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AMERICAN BLACKSMITH AUTO & TRACTOR SHOP

VOLUME 20
NUMBER 1

BUFFALO, N. Y., OCTOBER, 1920

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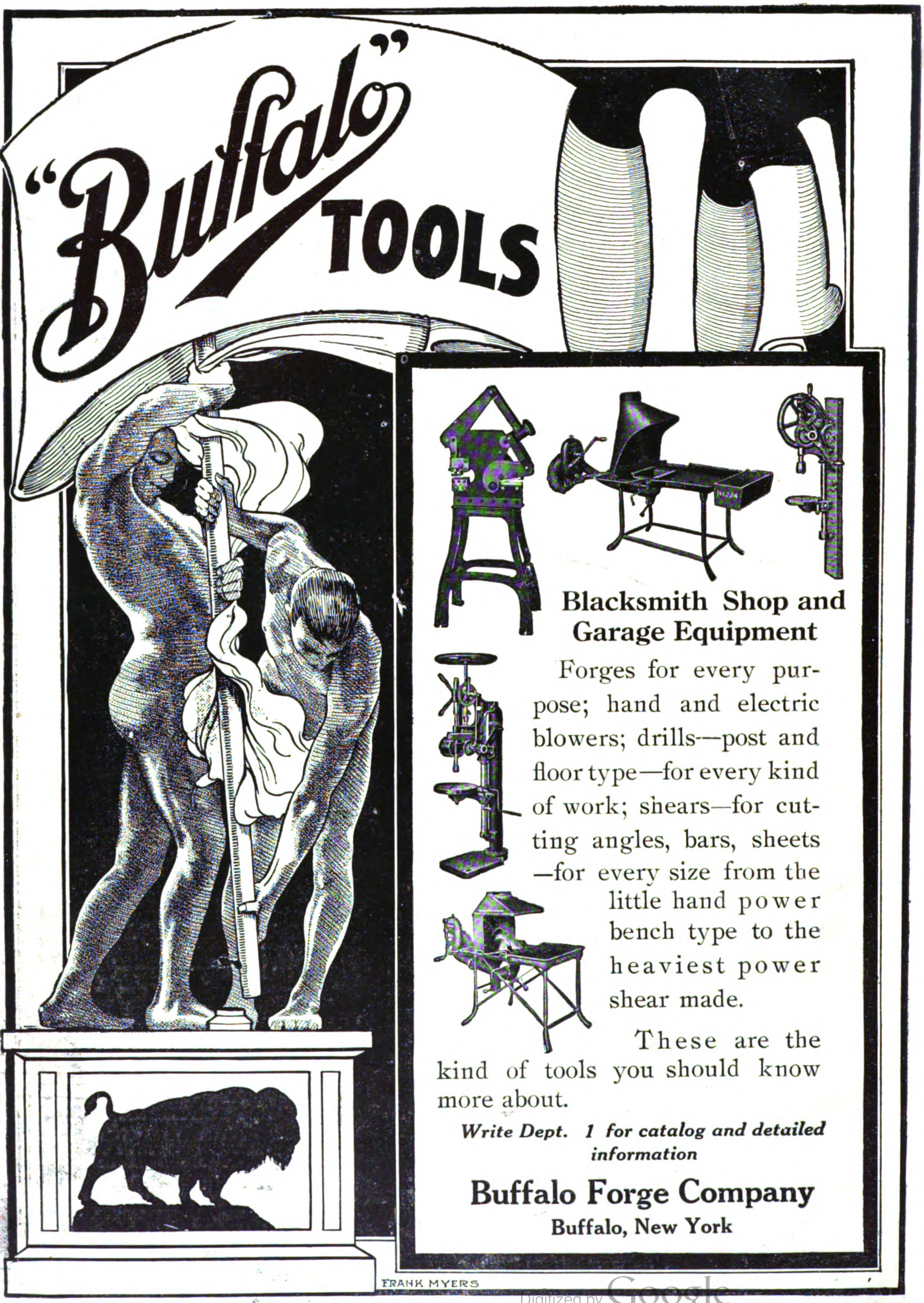
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AMERICAN BLACKSMITH AUTO & TRACTOR SHOP

VOLUME 20 OCTOBER, 1920 NUMBER 1

BUFFALO, N. Y., U. S. A.

WILLIAM F. WENDT, *President.* L. J. WISCHERATH, *Editor.*

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THE REDUCTION IN FORD PRICES

The decision of the Ford Motor Company to reduce the price on all of their products from 14 to 31 per cent. caused quite a sensation in automobile circles. Business and financial men regard the cut as more than a mere reduction in the price of flivvers. To many it indicates that the post-bellum prices are finally on the wane. That it will have a marked effect on prices in general seems to be the concensus of opinion, the extent, however, being problematical, none venturing a decided opinion. Many of the other manufacturers, while explaining that the reduction will cause the loss of thousands of dollars to second-hand car dealers, point out the fact that it will not have any decided effect on the prices of other cars, because, as they explain, the Ford is in a class by itself, and its selling price would not be considered by the buyers of higher priced cars.

Men in business and financial circles, however, are not so sure of this, some predicting that this will be the forerunner of a general price decline.

They feel that Ford has acted at the psychological moment. Merchants fear that this will encourage the public to wait for further price declines in other lines.

In announcing the decision of the company, Mr. Ford in a formal statement said:

"Now is the time to call a halt on War methods, war prices, war profiteering and war greed. It may be necessary for everybody to stand a little sacrifice, but it will be most profitable after all, because the sooner we get the business of the country back to a pre-war condition, progress, prosperity and contentment will occupy the attention of the people."

The announcement said that the reduction was made despite unfilled orders for 146,065 vehicles.

EMPOYERS WARNED TO CARRY COMPENSATION INSURANCE

"Employers who come under the Workman's Compensation Law are warned to carry compensation insurance to cover their employees. The failure to do so", said Bernard L. Shientag, Chief Counsel to the State Industrial Commission, "is a misdemeanor punishable by a fine up to one thousand dollars, by imprisonment up to one year, or by both fine and imprisonment." The Industrial Commission through its Counsel will proceed vigorously against any employer who continues to disregard this important law.

"A large number of awards to injured workmen and to widows and orphans cannot be collected" said Mr. Shientag, "because employers have neglected to carry compensation insurance and in many cases are financially unable themselves to make payment. These widows and orphans are condemned to a life of want and compelled to seek the aid of charity because employers have violated this law."

"It is not only a great injustice and social wrong, but it arouses a spirit of resentment and discontent in the hearts of these unforunate victims of industrial accidents, who cannot understand why the humane Workmen's Compensation Law, which they counted on for protection has completely failed them."

A FAIR DEAL IN CREDITS FOR THE AUTOMOTIVE INDUSTRY

Nothing could be more alien to the rightful purposes of the Federal Reserve Act or in sharper conflict with business wisdom and fair-play than a singling out of the automotive industry for drastic restrictions of credit. For the sake of the principle involved, as well as the vast practical interests at stake, it is greatly to be hoped that the Federal Reserve Board will in nowise countenance, much less recommend, any policy to this effect. A rumor is abroad, however, that the regional banks have received suggestions, if not explicit instructions, to cut automotive credits to the bone and marrow, leaving the development, indeed the very life, of this great province of industry and commerce helplessly crippled. That responsible heads of the nation's financial affairs should take such a position is almost unthinkable; certainly, it could find no support, but only condemnation, from the discerning rank and file.

The only conceivable justification for refusing needful credits to this or to any other sound and legitimate business, as long as funds therefore are available, would be to protect the essential against the non-essential and to check the extravagance which breeds inflation and dangerous instability. But assuredly no competent judge would assign motor vehicles and machines to that category. The most casual observer knows that motor trucks are as essential as railway cars, and that tractors are as functionally important as plow horses or farm wagons in the country's productive life. Nor is it measurably different with the passenger car, that indispensable means of modern travel and communication. Theoretically, of course, the doctor could revert to the dozing Dobbin or his ancestors, the commercial traveler to the dirge of the country "hack" and the farmer, who now saves priceless hours and gains all manner of advantages by his automobile, could go back to the Arcadian jog of ox-cart or mule. Theoretically, we say; but if in fact the automobile and its kindred machines were suddenly whisked out of our daily life and labor, what an aching hollowness there would be. What gaps in business and social currents. What failures to function and connect.

Years ago—a very grandsire's past, it seems, though really but a score or so of summers—the automobile was regarded as a luxury for the few. To-day it is a necessity for multitudes, a source of livelihood for two million American workers, the foremost promoter of good roads, the banisher of solitude and loneliness from unnumbered farmsteads, the bringer of rural health and freedom to families once pent in cities, the foundation of the world's second largest industry. There is scarcely a field of the country's productive interests that does not profit, one way or another, from the manufacture and sale of automotive machines.

To hamstring the credit sinews of a business with which the common interests are thus vitally bound up, merely because persons here and there are extravagant in buying automobiles, would be as unwise and unfair as to stop the grinding of grain because certain foolish damsels squander their pin money on cream tarts, or gluttons now and then gorge themselves on hot cakes. Let the prodigals be rebuked as severely as common sense and public conscience can apply the rod; but let not the rights of a great prosperity-breeding industry be trampled down in the process.

SUMMARY

October, 1920

WELDING A BROKEN FLY WHEEL

A description of the oxy-acteylene welding process as it was employed in repairing a cast iron fly wheel. It also includes general hints and suggestions for welding cylindrical cast iron bodies.

David Baxter .

THE welding of cast iron wheels forms one of the lines of work which the blacksmith who installs an oxy-acetylene welding outfit is occasionally called upon to do. Nearly every kind of machine has one or more wheels, and the various designs and sizes of wheels are numerous indeed. Any of them are liable to get broken, which means work for the welder. Every kind of broken wheel is a job in prospect for him.

Not only do the different types present different problems, but the location of the fracture in the same kinds of wheel presents different methods for the application of the welder's trade . Each wheel may have the fracture located in a different part, thus offering plenty of opportunity for the torch operator to exercise his skill and ingenuity. Some wheels have two or more fractures while others have but one; complications which tend to multiply, sometimes to simplify, the difficulties attending the welding process. Sometimes it is easier to weld a wheel with two cracks than it is to weld a wheel having but one. Sometimes just the opposite holds good; all depending upon the location of the cracks.

The welding of cast iron wheels might be said to be in a separate class of welding, since once the welder grasps the fundamental principles of handling this kind of work, he is soon able to repair broken wheels regardless of shape and size; regardless of the nature and location of the fracture, while on other classes of welding, he will find many other things with which he has to deal. The general shape of wheel castings puts them in a class distinctly by themselves, because casting design and size controls expansion and contraction, more or less. That is due to the general shape of wheels, these forces act along certain well defined lines, so that no matter where it is broken, the welder can closely approximate the amount and direction of expansion, and can, therefore, tell in advance what to do to take care of contraction; providing of course he has a fair understanding of the theory of heat reactions upon metals, particularly upon cast iron when cast in a cylindrical shaped body.

First, he must know that metal expands upon being heated and contracts upon cooling. In other words, it increases in dimensions as the heat is applied and goes back to nearly its original size as it cools. This swelling, so to speak, acts outward from the central point in all bodies of iron, or, in other words, the expansion is in every direction. To illustrate this, let us suppose we have a block of iron an inch or so square, or a perfectly round ball of iron an inch in diameter. Now, suppose we heat either one equally on all sides. As the heat increases, the diameter of the ball or block increases. Barring impurities in the metal, or other irregularities, every side of the square block will increase in length and width the same; and the diameter anywhere through the ball will have increased. We see from this, by expansion the walls of the two articles are pushed outward in all directions, so to speak. So, in turn if nothing interferes, the contraction will pull the walls inward along the same lines on which they expanded.

This sounds simple enough as it stands, but to apply this theory to cast iron wheels is not quite so easy. Here is where the difference in size and shape, and in the number and locations of the fractures effect the welding process. For instance, the crack may be located in such part of the wheel that the action of expansion is resisted or perhaps effectually stopped; or the design of the casting may serve to turn the expansion aside, or influence the contraction the same way; or the preheating may have been improperly applied, so that some part of it will resist the inward pull of contraction. In either case there will probably be an open crack or a warped casting, depending upon the power of the casting's resistance.

The preheating may have been in the wrong portion of the wheel, so that the action is directly against the heat of the welding. That is, the preheating may be located so it will close the crack while expanding other parts of the casting, when it is really desirable to open the crack. These complexities and several others must be taken into consideration and thoroughly understood before the welder can expect to look at a wheel and tell off hand, where and how much to preheat it.

It is not the purpose of this article to try to discuss all of the difficulties connected with the welding of any certain type of wheel. Nor is it possible to do so in a short article. It is quite difficult to cover all of the complexities of design and fracture location in the various sizes of wheels now in use.

Therefore, let us take one type of wheel with but one kind of fracture and follow it through the process of repairing. Let us see if we can

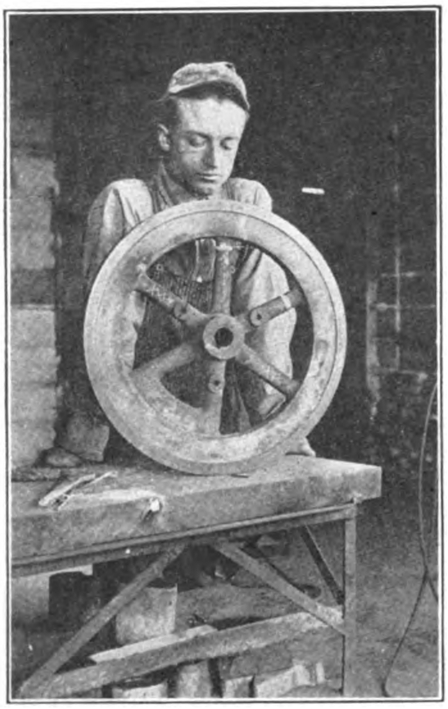


Figure 1. SHOWING THE LOCATION OF THE FRACTURE

apply to it, the theory of expansion as has been explained. In this, we must take for granted that the reader understands the fundamentals of torch practice, together with some knowledge of the characteristics of molten iron. We shall work in as much detail as space permits concerning the different operations in the repairing of this wheel, from the time it entered the shop to the repaired casting.

First, the job consisted of a gasoline engine fly wheel weighing about a hundred and fifty pounds. Two spokes were cracked as shown in Fig. 1. The extreme lightness of these spokes in comparison with the rim made this a job requiring considerable care in preheating and in cooling. The size of the wheel made but little difference in the manner of welding, because the same kind of wheel having the cracks located in the spokes like this one would have required the same general treatment regardless of size.

The first step of the repair process was to groove the cracks. This was done by cutting away enough metal on each side of both cracks to form a wide V-groove. Each groove was cut about half way through the spoke metal. Then the crack on the opposite side of each spoke was grooved in the same way. Thus making a groove on each side of the spoke; the two grooves meeting in the center of the spokes. This called for a weld on each side of both spokes, but more than made up for the extra time required because it permitted a better-looking and a stronger weld. The worst trouble being that the double groove required a turning of the job in the preheater with a consequent chance for loss of expansion.

After grooving and cleaning, the fly wheel was arranged for preheating as shown in two of the photos accompanying this article. The preheating was perhaps the most important part of the repair process, since the success of the welding depended upon it. The wheel was small enough to heat all over, but this would be a waste of time, since a better effect could be had by localizing the heat; or in other words, by confining the preheating to one portion of the casting.

Therefore, the wheel was arranged for preheating as is shown in Fig. 2. It was placed upon a bed of firebrick arranged on top of the leveling table. The bricks were so placed as to confine the heat of the oil burner to one portion of the heavy rim; at the same time preventing the spokes from heating.

The oil burner was arranged to spread its flame around a portion of the rim located between and including the two broken spokes. Bricks were placed between the flame and the hub of the wheel to prevent it from getting hot. Scrap asbestos paper was stuffed in the cracks to further retard radiation. After the heating was started, the heat was further confined by placing wet rags on the spokes next to the hub and on that part of the rim outside the brick enclosure.

As soon as the preheating device was ready, the oil burner was lighted and set as shown in the picture. While it was burning, the welder gave his attention to keeping the heat from being conducted to other parts of the wheel, while the enclosed portion heated. During this operation the oil burner and brick oven were covered with strips of asbestos paper to help confine and concentrate the heat; this also helped to protect the torch operator from the discomforts of the preheater.

As the heating progressed, the theory of expansion as previously explained, commenced to act. When the enclosed section of the rim commenced to heat, it started to expand. As it expanded, the heated portion of the rim endeavored to stretch, or gain in length as well as in size; but the rigidity of the adjoining parts of the rim prevented much endwise expansion. The natural thing for the heated portion then was to warp or bulge outward, being prevented from expanding to its fullest extent the rim section bulged outward, away from the spokes. This was a natural action, since the arched shape of the rim prevented it from warping inward. In other words, the heated section of the rim tried to grow in length, but was prevented by the resistance of the cooler portions of the wheel rim. Failing in its efforts to gain in length the rim was forced outward; and in so doing pulled the short ends of the broken spokes out with it; as the rim expanded, it opened the grooved cracks in the two spokes.

This opening of the cracks was just what was wanted; just the reason why the rim was heated. The

Figure 2. THE ARRANGEMENT FOR CONFINING THE HEAT TO ONE SECTION OF THE RIM

opened cracks provided plenty of play for the expansion and contraction of the weld metal. Perhaps it is better to say the opened cracks provided freedom of action to the shrinkage or contraction of the weld metal, since the weld metal is practically fully expanded when added to the groove, and, therefore, has but one movement; that is contraction. This again brings out the reason for preheating. The job was expanded by preheating so the fully expanded weld metal would not pull away from the adjoining casting metal when the weld cooled as would have been the case if the cracks were not opened. It was desired to have the rim contract in unison with the weld when both cooled. The contraction of the rim was to follow the contraction of the welds inward as both cooled.

Perhaps a little stronger statement would make it clearer to some. The contracting rim squeezed the weld metal inward as both cooled. It is readily seen that there could be no contraction cracks through a procedure like this. If the filler metal is fully expanded when it is added to the weld, and the rim starts to squeeze inward as the weld cools, then the weld cannot contract away from it, and crack the spokes again, providing of course the preheating is properly done.

Now, the rim should not be expanded too much, as it would then tend to warp the spokes as it contracted. The rim must shrink to very near its original curve or strains are set up in some part of the wheel, which are likely to cause a fracture when conditions are just right.

Estimating the correct amount to expand the rim is a rather delicate matter; one for which it is hard to give any fixed rule. Experience will probably teach better than any rules because the structure of the iron has a bearing on the amount of expansion.

A rule that works out pretty well is one that the foundrymen use. Cast iron shrinks approximately an eighth of an inch per foot. In our case, it is the shrinkage of the weld that we want to measure. The weld is so small however, that the shrinkage, based on an eighth of an inch per foot, would be almost unmeasurable. The actual weld or the melted part of the spokes, would in all probability not exceed one inch; thus it is readily seen that to attempt to measure the expansion and contraction by the foundry rule would require some pretty fine work. Much too fine for every-day use.

The heat of the weld is not confined to this one inch; it is conducted to several inches on each side of the weld to make this part of the spoke red hot. These red hot portions are almost fully expanded. At least they may be considered so in relation to the rim expansion. Thus we have about half a foot by which to gauge the expansion of the rim. In other words, the rim is expanded until the cracks have opened 1/32 of an inch or more.

The best way to tell when this expansion is established is by watching the grooved cracks, instead of attempting to heat the rim to a certain degree of redness. Roughly speaking, however, the cracks ought to be open about right when the rim has reached a dull

Figure 3. THE ASBESTOS COVERING TO RETAIN THE HEAT

red stage. Watching the grooved cracks is easier, since it is sometimes difficult to see the proper condition of the heated rim, especially in daylight.

With the idea in mind that he wanted to open the cracks enough so the cooling weld would not pull the spokes apart when it cooled, the operator lighted the oil burner, and placed it so the flames would envelope a section of the rim as stated above. The fire bricks helped to deflect the heat around the rim section. Thus the preheating was carried on until the rim was sufficiently hot to expand both grooves about the amount previously stated. A sketch accompanying this article should make clear the location and extent of the preheating and also the effects of expansion. The drawing is exaggerated a little for the purpose of making it clearer.

The spreading of the grooved cracks was observed through openings made in the asbestos covering. As soon as the crack had spread a little more than a thirty-second of an inch, the welding flame was applied to the end of one groove. A small size cast iron filler rod was used. With the tip of the flame's white cone barely licking the groove, the torch was revolved in gradually decreasing circles over about half an inch of the fracture. As the groove turned red the flame was concentrated in one spot at the end of it, and the welding rod was brought in contact with the flame. The flame was held until a portion of the groove bottom melted and flowed together. At almost the same time, the end of the filler rod was melted into the molten groove. As this was accomplished the flame was gradually moved to another part of the groove bottom, melting and flowing it together, and following it with a bit of filler metal. The whole groove bottom was thus covered with bits of filler metal. Not so much attention was paid to getting these added bits smooth and nicely arranged; the main effort being to make the work continuous, and see that the sides as well as the bottom of the groove were in a molten condition when the filler was added. It is also important to see that the filling operation was continuous; that there was no misrun portions. Then, when the entire length of the groove was treated, the flame and filler were worked back over the weld to finish filling the groove. About the same torch and filler manipulation was employed in placing this last layer of new metal.

This layer was also made to form a slight surplus of filler metal over and above the level of the spoke. Each bit of metal added was thoroughly soaked into the preceding layer. The welding flame was played over the surplus to melt and settle it into one mass, especially along the edges of the weld. The flame was also employed to blow the metal smooth.

A strictly neutral flame of less than medium size was used in connection with a soft silicon-iron rod three-sixteenths of an inch in diameter. A flux powder made for use on cast iron welds was applied at frequent intervals. These factors being the same on the four welds.

As soon as the top groove of the

first spoke was completely welded, it was immediately covered with asbestos to hold up the expansion by confining the heat. Then the second spoke was welded in the same manner as the first. When the second weld was finished, the asbestos paper was immediately removed and the whole wheel quickly turned over in the preheater. This was done as rapidly as possible and the casting was immediately covered again with the asbestos to prevent loss of heat as much as possible.

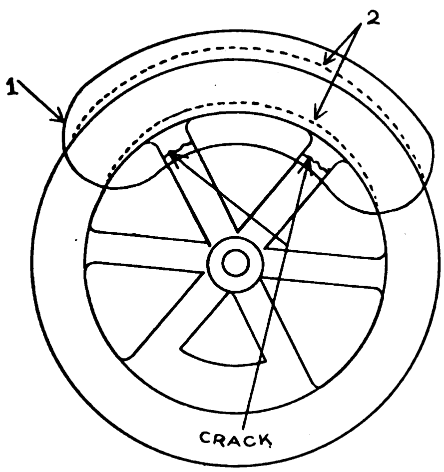
When the wheel had been turned and covered, the oil burner was allowed to burn beneath the rim a few minutes before starting to weld. This was to allow the interior of the brick enclosure to heat again. Devices used to prevent conduction of heat to other parts of the wheel were also replaced.

Next, the grooves were welded one after another, in much the same manner as the first time. Care was necessary in reopening the bottom of the groove, where the first welds had seeped through. This roughness was melted and puddled level before adding new metal. The new metal was placed in two layers carefully soaked together. In a groove as small as this, however, the entire length may be filled in one layer if desired, only it is essential to be more careful about melting the sloping sides of the groove before adding the filler; and, as with the first weld, the surplus metal should be soaked down to conform to the shape of the spoke.

After both grooves were filled and blown smooth, they were covered with asbestos and allowed to heat a few minutes before turning off the preheater. The casting was allowed to remain in the fire brick enclosure under cover of the asbestos until nearly cold, to cause the contraction to act slowly. The heat of the rim was thus conducted to the spoke welds, and radiated to the air space about them, preventing them from cooling before the rim began to contract.

If the welder understands his business, he may uncover the outside edge of the rim and force it to cool faster while holding back the contraction of the spoke welds, so the two will act in unison. The heavy weight of the rim causes it to contract so slowly that it may not press inward, upon the contracting weld fast enough. But, if he wants to assist this cooling, he must use good judgment and keep the action of the cooling casting in mind. The cap rim should squeeze inward upon the shrinkage of the welds.

From the foregoing suggestions the blacksmith should be able to tell how to weld other types of wheels with their fractures differently situated. He has only to preheat to open the crack and cool to close it. The weld is not allowed to pull against the wheel anywhere; nor should the preheating be arranged so it may pull upon fragile parts of the wheels.



1. SHOWS THE LOCATION OF PRE-HEATING
2. DOTTED LINE INDICATES THE DIRECTION OF EXPANSION

SELECTING PROPER TRACTOR PLOWS

Strange though it may sound, it appears as though but comparatively few farmers, planters, and farm managers display a thorough knowledge of the proper plows to select for tractor plowing when they purchase, and, as a result, when their tractor is unable to render first class plowing with the poorly selected plows, the farmer immediately springs up and runs down the tractor.

Ten times out of eleven the unsatisfactory experiences with tractors in plowing comes from the use of the wrong plows. Two examples, taken from actual experiences of Southern rice growers, will adequately illustrate the importance of properly choosing the correct plows, and the plows suited best to the soil being turned over. In heavy, stiff soil a tractor was making an absolute failure in plowing. It was pulling a two-bottom gang plow, each plow cutting twelve inches, or a total of twenty-four inches. The tractor often stalled and the plows frequently were out of the ground. A plow expert was called and after making his inspection he changed the plows to a gang, having three ten-inch plows. The tractor pulled these easily and the soil was excellently prepared.

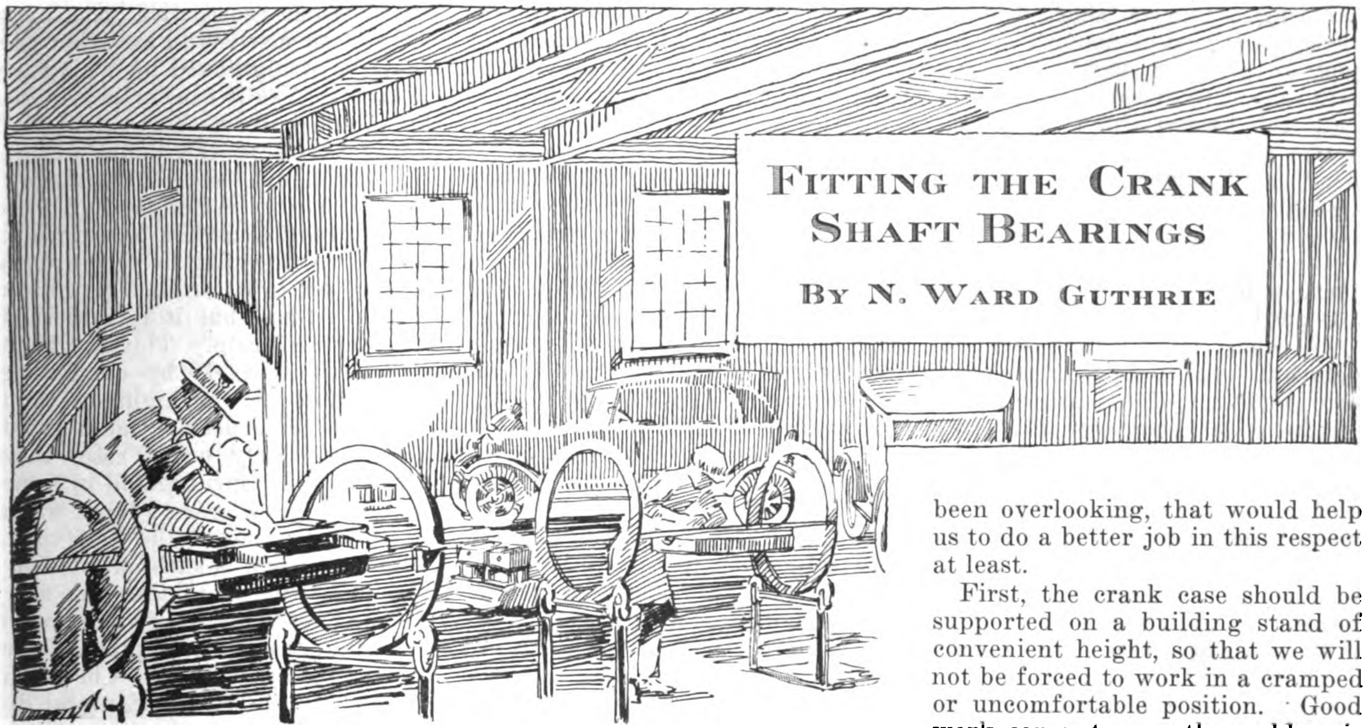
A tractor could not develop sufficient power to pull a gang plow in heavy buck-shot land. The plows were the regular mold board plows. The planter on whose land the tractor was trying to plow rejected the tractor and said it was a detriment to him. A plow expert heard of the trouble, examined and inspected the work and recommended the use of the same number and size plows, but the substitution of flat mould boards for the solid ones. The change was made and the tractor easily did its work; and the planter immediately purchased the outfit he at first didn't understand.

It is such instances as these that cause the tractor to receive so many inconsiderate slurs from many farmers, and, as previously stated, ten times out of eleven the farmer himself is to blame; and the sooner he learns the plows best fitted to his work the easier the tractor will do his work.

HARDENING SMALL DRILLS

Hardening and tempering small taps and drills requires considerable care and experience if perfect work is to be obtained. When undertaking the work the taps and drills are held with the spiral or thread immersed in lead which has been brought to the melting point in an iron or earthenware crucible. Pieces of very small diameter should be left in the molten metal for about 60 seconds. They should then be withdrawn and plunged in cold water. If the bath be of the correct temperature no lead will adhere to the work when they are removed.

After chilling the tools should be cleaned and tempered. The most convenient way is to lay them on a sheet of old iron held over a charcoal or gas fire. The tray should be rocked a little during the process in order that the pieces may be heated uniformly. When they attain a dark straw or gold color they should be again plunged in water. It is held that by the above treatment the degree of heat is strictly limited, and it is impossible to burn the edges as with an open fire.



Fitting the Crank Shaft Bearings

By N. Ward Guthrie

PERHAPS no part of the entire overhaul job is more important than the proper fitting of the main engine bearings. This is fairly safe to say, for the reason, that many of the other details, if not properly attended to when the motor was overhauled, may be adjusted with but little work after the motor has been placed in the car. Not so, however, with the main engine bearings. They not only must be fitted properly; but they must also be aligned when the motor is down, otherwise it is virtually impossible to correct them afterwards.

To be certain, a loose bearing may be adjusted, after the motor has been assembled, merely by removing the crank case; that is at least, most of the motors in present day use with few exceptions, have the main bearing accessible after the crank case has been removed. There is one objection to a procedure of this nature, that is, while the bearings may be adjusted very satisfactorily, very often, the contributing cause for the bearing having become loose, can not be removed, and the result is that in a very short time the same old trouble is again apparent.

There are several very important details in fitting the main bearings, aside from having the bearing caps fit snugly, that either make the job a success or a failure. These details are often overlooked or neglected by the mechanic. Such conditions as sprung shafts, shaft journals that are out of round, tapered or scored, and bearings that do not align properly, are some of the major contributing factors to bearing failures. Then too, a goodly number of these failures may be traced back to the mechanic, who will invariably set up the bearing caps so tightly, that it is next to impossible to turn the motor over, after the repair has been completed. In many of those instances, one may see the self same man, lamenting that a pound has developed in one or more of the bearings, in spite of the fact, as he says, that all of the bearings were tightened up. So they were—too tight, and when the motor was started, they became so hot that they just naturally burned out some of the babbitt to relieve themselves.

All of us are more or less familiar with the process in general, yet there are a number of details which have escaped our attention, or which we have regarded as being so unimportant as to merit little consideration; but which, nevertheless, have a most decided influence on the successful performance of the bearing. While it may bore some of the more experienced men to repeat some of these instructions, many of us may gain some helpful suggestions by following the process through from start to finish, and see if there are not some details, which we have been overlooking, that would help us to do a better job in this respect at least.

First, the crank case should be supported on a building stand of convenient height, so that we will not be forced to work in a cramped or uncomfortable position. Good work can not, or rather seldom is done, where it gives the workman a backache to do it. The bearing caps should all be marked, so that they can be returned to their respective places when needed; then they are removed, and thoroughly cleaned. Next, see that the timing gears are marked, so that no time will be wasted in retiming the motor when it is set up. The crank shaft is then removed, thoroughly cleaned and then inspected. Let us lay emphasis on the word inspected. All the bearings should be measured with a pair of micrometers to see that they are not out of round in excess of .0005" per inch diameter of the bearing; if they are, have them trued up.

There are a number of devices on the market for this purpose, and they work very nicely too, but there is one objection to their use on the line bearings of the crank shaft, that is if they are not carefully handled, they are apt to leave the bearings slightly out of alignment. Alignment is a very important detail, as we all know, so even though the bearings are trued up perfectly round, if they are thrown out of line, we have accomplished nothing, but really have made matters worse. In this condition, the shaft is just as ruinous, perhaps even more so, than if it were sprung, because in reality we have made a miniature crank shaft from the line bearings.

Next, the bearings should be measured with micrometers to see that they are not tapered. There is always excessive wear on a bearing carrying a tapered shaft, because there is a certain amount of end play in the crank shaft. The bearings naturally wear to accommodate the largest diameter of the shaft, and when the shaft slides back and forth permitting the smaller part of the shaft to be supported by the bearing, then it fits perhaps loosely enough so that there will be a slight knock; not perceptible at first, but it gradually becomes more and more pronounced, until there is unquestionable evidence of a loose bearing. Where the taper is over .001″, as a matter of precaution, it would be well to have the shaft trued up.

Now, we come to the most important detail of all; the one that

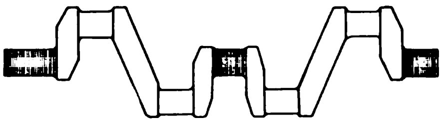


FIG. 1

is responsible for more bearing failures than all the others combined; it is our old enemy the sprung shaft. There are a number of reasons or causes for shafts becoming sprung. Improper alignment of the bearings is one, bearings that fitted so tightly that the use of acetylene was necessary to start the motor when it was tested and sudden and excessive strains are some of the most prominent causes. The sprung shaft must be detected, taken out and corrected or else a new one substituted, if good service is to be expected from the motor. There are a number of ways of checking it up to detect this condition. One is to place it between centers, revolve the shaft and place an indicator while so doing on the various bearings. One large manufacturer in instructions issued to their service departments, says, that if the main bearing does not run out in excess of .006″ the shaft can be successfully used. That may be true—at least let us hope it is. Perhaps what he meant to have said, had space permitted, was that it might be used—used long enough to have the car driven several hundred miles, and then when the inevitable bearing knock developed, it could be pawned off on the owner because he "let the oil get low" or didn't use the prescribed kind of inner tubes, or any other reason why. For good uninterrupted service the shaft must be straight, absolutely so. There is no objection to testing shafts between centers, aside from the fact that a majority of the smaller establishments do not have the necessary equipment, but on the other hand the shaft may be tested quite as accurately in other ways, and then too, it frequently occurs that the centers on the shaft are mutilated, and where this condition exists, naturally the shaft will not run true, regardless of whether it is straight or not. So when testing shafts between centers, be sure that they are not mutilated, lest you condemn a shaft which is straight and serviceable, or vice versa.

The shaft may be accurately tested right on the bearings themselves, without any equipment whatsoever. Clean the upper bearing halves, that is, the one in the upper half of the crank case, blue all the bearings on the shaft, lightly with prussian blue, and then lay the shaft on the bearings. Turn the shaft over several times without applying any pressure to it, and then observe what effect that turning had on the blue of the shaft. If they are all evenly marked, all the way around the shaft and on all the bearings, the shaft is straight. If the front and center bearings are marked and the center bearing is marked only on one side, the shaft is sprung. Figure 1 shows the appearance of the marking on a straight shaft, while Figure 2 illustrates the appearance of one which is sprung. This is just as positive evidence as though it were shown by an indicator, the only difference being that the latter shows the extent to which the shaft runs out, while the former merely shows that the condition exists. In severe cases, however, the shaft may be actually rocked on the center bearing, merely by turning the shaft so that the marked part of the center shaft bearing will face or rest on the bearing in which it runs. In that position, it is often possible to tip the shaft back and forth by tapping it alternately on one end and then the other. Where no marks appear on the shaft's center bearing, it is the result of the center bearing in the crank case being low. After the front and rear bearing have been lowered by slight scraping, the center bearing will engage the shaft properly. The same thing is applicable to the front and rear bearings. Where either fail to touch the shaft, it is the result of the other two being too high, and thus preventing any contact.

Where we have discovered by the foregoing, that we have a sprung shaft, some corrective measures suggest themselves to us. Can the shaft be straightened by springing it back? Yes it can, or nearly so, but—but will it stay straight? There is where the doubt arises. No it will not—not in the majority of cases. After having been straightened and then placed back in service, the shaft is very apt to spring back to its original condition the first time that it is subjected to a severe strain. This has been shown conclusively by examining shafts that were straightened and then placed in service for a short time. In nearly every case, they were as badly sprung, and in some instances even worse than when they were removed the first time. This conclusion is substantiated by a simple experiment that you may try in your own shop, if you happen to have a straightening press. Take a sprung shaft and place it between centers, locate the position and direction of the sprung portion. Then place the shaft under the press and notice how far in the opposite direction the shaft will have to be bent in order to straigten it. In some cases, it will have to be pressed an inch or more to have any effect. When the shaft is straight, or nearly so, turn it over so that the pressure may be applied from the reverse direction, and notice how much pressure it will take to bend it back to its original sprung shape. You may be surprised to find that a quarter or less of that amount will usually do the trick.

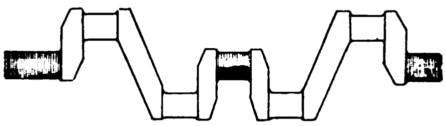


FIG. 2

So it would seem from the foregoing, that it is pretty risky business to use straigtened shafts, at least shafts that have been straightened by bending them back to some semblance of their former shape. There seems to be but one satisfactory way of straightening crank shafts. It is to place them on a crank grinder and regrind the line bearings to alignment. Few shops have sufficient work to justify the installation of such equipment, and since this operation necessitates the use of new undersized bearings, it is profitable to attempt the repair only on large and expensive shafts. It will be cheaper to use new shafts on light four cylinder motors, as they are comparatively inexpensive.

Sometimes the question arises as to whether a shaft which is sprung can not be successfully used without being straigtened and the argument advanced in its favor usually runs something like this, "why the bearings will hold it in place." So they will—for a little while, but while they are attempting to do it, let us see what happens. Every time the shaft revolves, they attempt to spring it back to alignment. The shaft is subject to a constant bending motion, which is very slight to be sure, but which, nevertheless, is apt to cause crystalization, while the bearings at the same time are subject to excessive wear. One of two things are bound to happen. Either the shaft will break, or else the bearings will succumb to the strain, loosen up, then the shaft will further aggravate matters by whipping and pounding out more of the babbitt, and if our nerves do manage to stand the racket, provided nothing worse happens, we are at least encouraging the police to order us off the street for creating unnecessary noises.

So we are reluctantly forced to admit, that a sprung shaft is a bad investment from any angle, and is more or less apt to keep us "dabbling in oil" until we get rid of it. With that point settled, let us consider a few pointers in fitting the bearings on a shaft which to our relief, we have discovered is straight. Blue the shaft and lay it on the bearings. Revolve it several times, pressing it down at the same time, then remove it and see what the results are. If the bearings line up, and show a good bearing area, are smooth and are not burned, for the love of Mike, let them alone. Forget that you own a bearing scraper. That's going to be pretty hard on some of the habitual whittlers, but let's hope that we get caught up with our whittling so that we will be able to let bearings alone that do not need it. As many good bearings are spoiled through the improper use of the scraper, as there are bad bearings that are improved through its use. A smooth, semi-hard surface has been imparted to the bearing through wear, and when this surface has been removed through scraping, what remains instead, is a soft surface composed of minute high spots, which will wear down as soon as the motor has been run for a few moments. Then there is always the possibility of the bearing being loose, and I guess we have said enough about loose bearings to condemn them for all time to come.

This is the very reason why the method of reaming and then "burning in" the bearings has become so popular. It imparts that hard, long-wearing surface that is so frequently destroyed by the thoughtless scraper. Another thing which often misleads the mechanic is that when the shaft is blued and then laid on the bearings, they do not show blue at the bottom when the shaft is removed. That seems to be the only fault to find, otherwise they seem to be perfect, yet the mechanic may think they need "just a little touching up" and then proceed forthwith to ruin, what, in many cases, is a set of good bearings. It occurs frequently, that the bearings are touched by the shaft only at the upper edge of the bearing. A little pressure is all that is needed to bring them into perfect contact.

In cases where one or more of the bearings are low, the rest will have to be scraped down so that all the bearings will align properly. In doing this one must be careful lest he lowers the shaft sufficiently, so that the timing gears will bottom. Before attempting any scraping, it is a good practice to see that there is enough clearance between the teeth of the gears to allow them to be meshed a little closer. Another suggestion where a condition like this is met, is to avoid trying to raise the low bearing by removing it from the case and then inserting a thin shim underneath it. That is a very poor practice, because in the first place, when the bearing is replaced it is pinched and will not conform to the radius of the shaft, and secondly, bearings that are thus shimed up are not solid. There is a decided tendency to spring up and down. When the shaft is blued and laid on it, it will show a good bearing surface, yet when it is subjected to the strain of actual working conditions it will be apt to move away slightly and thus be out of alignment. The same is true where new bearings are fitted into the case. First, they should be blued on the outside and fitted to the case, otherwise they will always be more or less springy, moving away in actual service, then we have our old bugbear, the loose bearing with us again.

The same instructions which are used in fitting other bearings may be applied to the caps—don't do any scraping unless conditions actually demand it, and then remember it isn't a whittling contest. Every time you scrape below the surface actually needed, all the rest of the bearing will have to be scraped down to meet it. The scraping process is understood by every mechanic that has done any overhaul work, and the selection of the tools is largely a matter of

SAFETY POST HELPS FRENCH HORSESHOERS

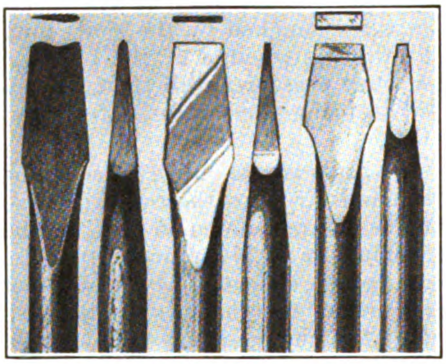
French army farriers are firm believers in safety first when it comes to shoeing fractious and high-mettled young horses. The animal to be shod is manoeuvred around to a convenient position where one of the hind legs can be securely fastened to a stout wooden post. After the leg is once in position, then the work of fitting and placing the shoe can be accomplished in perfect safety. The extensive use of mules for army transport work makes this method of procedure highly desirable.

individiual taste or opinion. The idea being, of course, to scrape away the high spots until a good smooth even surface is obtained.

Now comes the manner of fitting the caps. The caps should fit snugly and should bear on the crank case, not on the shaft which they are supporting. We say that they should fit snugly, that is, when one of the bearing caps is tightened down, one should be able to turn the crank shaft by taking hold of the crank throws—if it is any tighter, better loosen it up. When all the bearing caps are drawn down, one should be able to turn the crank shaft over without using a leverage greater than half of the diameter of the flywheel.

There is another important condition, that is end play. Do not forget that end play in the crank shaft is desirable, that it is a defect only where it is excessive. There should be a certain amount. It assists lubrication, and if all taken up by fitting oversized bearing caps, to take up the thrust, the lubrication of these bearings where the splash system of lubrication is used, may be impaired. In all probability they are apt to burn part of the babbitt away in an effort to relieve themselves, then you will have some end play that will cause trouble. End play not in excess of .010″ on small motors and increasing with the size of the motor is not excessive and should not be reduced below that point.

Before we bury the hammer, let us try to shatter the sad delusion under which so many mechanics labor, in regard to the practice of tightening up motors, so that when they are assembled, one has to prime them with a shot of TNT in order to have an explosion of sufficient force to carry them over to the next charge. It is a ridiculous sight to see three or four men at the end of a rope attached to the starting crank, trying to assist the man who is cranking the motor, while still another is feeding acetylene into the intake manifold, so that the explosive charge will carry the motor over . Such procedures are not only time wasters, and altogether unnecessary, but they are in no way conducive to getting a good motor, if it ever does succeed in limbering up. Ten chances to one the bearings have been set so tightly that when the motor is finally started, they will get so hot that part of the babbitt will be melted away. Yet some of the garrulous mechanics will blithely tell you, that an overhauled motor has to be set tight so that when they are worn in they will not be sloppy. On the contrary what really does happen instead of the bearing wearing off the little high spots, is that it gets so hot that it actually burns away part of the bearing. Not enough to manifest itself in the form of a knock at the start, to be sure, but you won't have to wait long for the symptoms to develop. The writer has had charge of considerable engine repair work, and at one particular place it was the custom to reject and return to the mechanic, an overhauled motor that could not be turned over with the starting crank with a reasonable amount of effort. It was a very good practice too, because after the mechanic got several stiff motors returned to him, he soon found that he was out looking for another job. At least in the next place he worked, the stiff motor nuisance was abated as far as he was concerned.



THE DAMAGED SCREW DRIVER IS A POOR TOOL

Another suggestion in regard to fitting bearing caps on motors employing the pressure feed system of lubrication: the caps should be fitted so that they entirely enclose the crank shaft. No shims should be used between the caps and the crank case, for the reason that very often these shims do not go up to the shaft, thereby leaving a place for the oil to escape, diminishing the pressure on the line from that point on and in many cases depriving the parts further along the line from getting the requisite amount of oil.

Reaming the main engine bearings and then running them in, or as some call it "burning them in", is no doubt the most successful manner in the long run; not that just as good bearings may not be had through scraping, but it is quicker, more accurate, and leaves a bearing that is better aligned and one which will unquestionably wear longer. The process has become so popular, that many manufacturers of garage equipment have special machines for handling some of the more popular light car motors. Where this system is used there are a few suggestions that help make the job a better one.

If one has any odds and ends of machinery around the shop, he can make an improvised "running in" stand that will give excellent results, and it will be well worth the trouble to make it. Any device that will turn the crank shaft several hundred revolutions per minute will answer the purpose, but it should be borne in mind when designing the machine, that no loads of any kind should be placed on the crank shaft. That point may be illustrated by assuming that a pulley would be fastened to the end of the crank shaft, and the shaft revolved by means of a belt over this pulley. It is obvious that the strain and weight of the belt would have a decided tendency to wear the bearings, that were being "run in," out of alignment, particularly the one next to the pulley. A better practice would be to support the pulley on an independent shaft and turn the crank shaft by means of a forked connection or by a universal joint.

In reaming preparatory to "burning in", the bearings should be reamed .001″ to .0015″ per inch diameter larger than the size of the shaft they carry. After the reaming, all the oil grooves should be cut and the ends of the bearings relieved to accommodate the radii of the shaft. Then the edges of the crank case bearings and the bearing caps should be chamferred where they meet, so that the metal will have a place in which to pile up when the bearings are run in. The shaft is put in place, the bearing caps applied and then as the shaft is revolved, the bearing caps are all drawn down evenly and run in together, otherwise if one is run in, then the next one and so on, it is not improbable that trouble will be experienced from the bearing being out of alignment. The bearings have to run until they are fairly hot, that is, so that when the oil is applied they will smoke freely, but at the same time care must be used not to carry it to the extreme and completely melt out part of the babbitt. A hard smooth surface should be imparted, and when the "running in" process is properly completed the caps should be adjusted, then drawn down just as tight as possible and allowed to run that way until there is no longer any tendency to heat.

SCREW DRIVERS

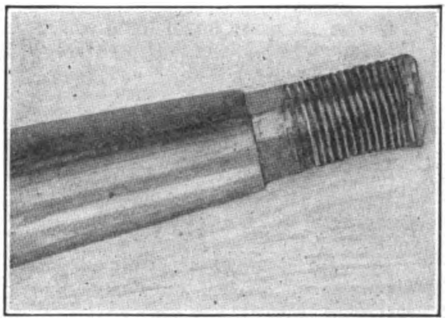
The screw driver is probably the most abused tool in a repairman's kit . It is used for a number of things for which it was never intended. The edge is destroyed, and it will not only mutilate the heads of screws to which it is applied but often slips off and damages the adjoining material. When properly ground the tool is much more efficient and will remove the screw without marring it, and with less danger of injuring the user. Screw drivers that are subjected to constant use become worn as shown in the extreme left hand side of the illustration. The screw driver should be hollow ground as shown in the center figure of the cut or with square edges as shown to the extreme right.

USING THE RIGHT TOOL IN THE RIGHT PLACE

The hammer and cold chisel mechanic always gets in wrong sooner or later, no matter whether he is using a screw driver in place of a cold chisel; or a cold chisel in place of the proper wrench. In this particular instance the effect is quite apparent. The mechanic thought he would save a little time in removing a rear wheel from the axle by resorting to the strong arm method assisted by a good heavy hammer, instead of using a wheel puller. The result is self-evident. He got the wheel off, but the time he saved and a whole lot more will be used in replacing the damaged axle. You can't drive a nail with a sponge no matter how hard you soak it, so why not try using the proper tools?

LUBRICATION OF BEARINGS

The function of lubricants in bearings is to separate the surfaces by a film so that metallic contact does not occur. If such a separation does take place the friction resulting will follow the laws for fluids. It has been well established by Tower that under conditions of perfect lubrication the journal is actually fluid borne, and in this case the laws of fluid friction may be applied. He showed that when a bearing is plentifully supplied with lubricants the friction depends very little on the load or the character of the surfaces, but is dependent on the extent of the surfaces, the velocity and the character of the lubricant. Tower's experiments were made with the load and bearing above a journal, the lower part of which was immersed in a bath of oil. He found that the journal carried the oil between the surfaces and formed a film between them. One of the most interesting points of his experiments was noted quite accidentally. In the course of his work he had occasion to drill an oil hole at the top of the bearing and found that the oil flowed freely from it. He attached a pressure gauge at this point and determined that a pressure of 200 lb. per square inch was developed, although his load was only 100 lb. per square inch of projected area. Later experiments showed that the pressure of the film at the top was greatly in excess of that at the sides and that it was greater on the discharge side than on the entering side. The thickness of the film has been determined as between 0.0013 and 0.0029 in. Mark Meredith.



A BATTERED AXLE—THE RESULT OF NOT USING THE PROPER TOOLS

THE IGNITION OF GASOLINE BY STATIC ELECTRICITY

There are innumerable instances of fires due to ignorance on the part of men handling gasoline. Beside the self-evident hazard of tobacco sparks, open flames and sparks due to opening electrical switches or those caused by defective wiring, there is danger due to the generation of static electricity by the flow of gasoline. Every mechanic knows that electricity may be produced by rubbing two substances together, as for example, the sparks which jump from a running belt to one's hands in cold weather. In the same way, static electricity is generated by the friction between the moving gasoline and its container. If some means are not provided to conduct this electricity away from the container, it will build up until there is a sufficient amount to jump a small gap, causing a spark which will ignite gasoline. By following rules given by the National Board of Fire Underwriters, fires due to the generation of static electricity, when pouring gasoline, may be avoided.

Never use a hose except of metal or metal lined, making it of the non-static type, which should be in metallic contact with the supply tank. The nozzle should also be in metallic contact with the can or tank which is being filled.

Never use anything except an unpainted metal funnel.

In pouring from an open mouthed can be sure and rest the can on the funnel.

Never hold a chamois skin away from the funnel, but allow it to rest on it.

Never allow gasoline to fall any distance to a receptacle from a valve or nozzle above it. Gasoline passing through the air generates static electricity.

In filling tank wagons, if the funnel is suspended from the filling tank allowance must be made for the lowering of the tank because of the settling of the springs.

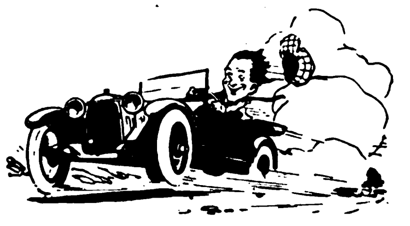
TO TEMPER A CHISEL

Heat the chisel about 1½ in. up from the cutting edge, to a dark cherry red, then cool the edge in water and rub it with an emery stick or a whetstone. Let the heat run down to dark straw color, then cool the edge again and brighten as before. Let the heat draw to the color of pigeon blue, then cool the entire chisel. Chisels tempered this way will stand much better than those tempered in the ordinary way.

In May, 1920, the U. S. exported motor vehicles and parts totaling $29,763,034. Rubber imported during the same period was valued at $20,104,383.

When a man boasts of his speed at a job, take a look at the quality of the work.

High Spots



LEGALLY SPEAKING

If a man were to give another an orange he would simply say: "I give you this orange." But when the transaction is intrusted to a lawyer to put in writing, he adopts this form: "I hereby give and convey to you, all and singular, my estate and interests, right, title, claim and advantages of and in said orange, together with all its rind, juice, pulp and pips, and all rights and advantages therein, with power to bite, cut, suck and otherwise eat the same or give the same away with or without the rind, skin, juice, pulp or pits, anything hereinbefore or hereinafter or in any other deed or deeds, instrument or instruments of whatever nature or kind whatsoever to the contrary in any wise notwithstanding"

THE HYPNOTIC BUGLER

Two darkies in a negro regiment were boasting about their company buglers.

"G'long wit' you, boy," said one; "you ain't got no booglers. We is got the boogler, and when 'at boy wraps his off lip around that horn and blows pay-call it sounds jes' like that um Boston simphony band playin' 'The Rosary.'"

"Yeh, I hearn you, replied the other. "Talk up, boy; talk up. Yo' is wadin' deep into trouble."

"—An' when he sounds 'at tapoo the angile Gabri'el hisself is lendin' a ear, boy. A ear is what I says."

"Well, if yo' likes musik they is all right, but if you' is yearnin' fo' food yo' wants a boogler with an hypnotic note like we is got. Boy, when Ah hears ole Custard-Mouth Jones discharge his blast Ah looks at mah beans and Ah says, 'Strawberrehs, behave yo'selves! Yo' is crowdin' the whip cream out o' mah dish.'"—American Legion Weekly.

Work is the richest of all gold mines. It yields infinitely more than money when tackled in the right spirit.—Forbes Magazine.

REAL DISTINCTION

Dibbins was dining with some people who were proud of the recent elevation of a member of the family to the House of Lords.

"This," said his hostess, "makes the second of my husband's family in the peerage. Have you any relation in the House of Lords?"

"No!" said Dibbins, "but I've two maiden aunts in the Kingdom of Heaven."—London Tit-Bits.

Sub Editor—"A correspondent wishes to know why they whitewash the inside of a hen-house."

Editor—"Tell him it's to keep the hens from picking the grain out of the wood."—Boston Transcript.

"You say you were held up by a footpad with a revolver this morning. At what time?"

"Five minutes to one."

"How can you fix the time so precisely?"

"Because I could see the church clock, and I noticed the hands were in the same position as mine."—London Tit-Bits.

Counsel—"After all my client is only charged with simple theft."

Prisoner—"Simple! I'd like to see you do it."—London Opinion.

"Among the memorable dates in history," wrote a boy, "was Anthony's date with Cleopatra."—Case Eagle.

Judge—"Now, I don't expect to see you here again, Rufus."

Rufus—"Not see me here again, Mr. Judge? Why, yo' all ain't a-going to resign yo' job, is you, judge?"—Searchlights.

HANDBOOK FOR MOTORISTS

Radiator: The large, flat thing on the front of the car (just back of the license plate) resembling a bee's boarding-house, and which generally ought to contain water when it doesn't.

Motor: A phlegmatic-looking mass between the radiator and the clutch, which is rather set in its habits and dislikes being worried with theories and pliers.

Clutch. The big, round thing under the footboard that should be put to sleep before you exercise the gear-shift.

Driving-shaft: A piece of steel whose temper is not proof against arguments with the reverse on the down grade.

Gears: A pesty lot of little wheels that must be quickly humored when they grind their teeth.

Manifold: A large pipe on the motor against which the tinkering motorists rests his head—just before he stops tinkering.

Carburetor: The thing that mixes the gasoline and air in proper proportion before you try to fill it with cylinder oil.

Differential: Quite a mysterious arrangement packed into a round sort of a thing on the back axle by a genius who is never about when you try to put it back again.

Magneto: Quite a cute little machine that has something to do with electricity if you only let it alone.

Valves: Sort of a trap door invention with springs that are decidely tricky and really belong in the recoil action of a canon.

Drip-pan. The place where you hunt for your favorite cotter pin.

Gasoline tank: A tin box near the back of the car (near the tail light) that you remember and find empty after you have gone and lost half of your car in the dust.—Charles Elkins, Jr., in Judge.

THE LAST TRIUMP

A colored dough-boy who had hit Paris on AWOL and supplied himself generously with the vin sisters, mingled with stronger waters, woke suddenly in a still befuddled condition in the great urban cemetery of Pere al Chaise, whither his uncertain steps had taken him. To make it worse, there was an air raid going on.

The brother looked around him out of half closed eyes. On every side stretched long rows of white monuments. Sirens shrilled from the city streets. Dazzling beams of white light stabbed the heavens. There could be but one conclusion.

Hastily searching his pockets, he drew forth his remaining possessions—a bottle of vin blanc, a pack of greasy cards, a much-worn pair of ivories—and hurled them from him.

"Git gone away f'um me, evidence," he muttered. "Now, come on, Mistuh Gabriel, I'se ready."—The American Legion Weekly.

McMIV, OF LONDON

Two Highlands stood looking at the imposing facade of a building in Westminister. The cornerstone bore the date in Roman characters, "MCMIV."

"Luke, a' thot, Angus," said one. "Ah've never heard th' name McMiv befure, but thear's a Scotsman who's got his name on one of th' finest buildings in London. Ye can't keep 'em down, can ye?"—London Tit-its.

If love is blind it's a wonder he ever hits the mark.

Bobbie—"My father must have been up to all sorts of mischief when he was a boy."

Johnny—"Why?"

Bobbie—"Cos he knows 'xactly what questions to ask me when he wants to know what I've been doing."—Cleveland News.

First Constable—"Did yer get that feller's number?"

Second Constable—"No, he was too goldderned fast for me. "Thet was a perty pert-lookin' gal in the back seat, wasn't it?"

First Constable—"She shure was!"—Hum Bub.

Time will heal our wounds, but the heel of oppression is more active.

The operation of cutting out booze may be performed without anaesthetics.

It doesn't pay to tell tales. The banks have a monopoly on paying-tellers.

You never can tell. Many a man has lots of go to him without any staying qaulities.

Misery loves company. The fellow who hates to be alone wouldn't even take a tumble to himself.

Wigg—"Guzzler's conservation is pretty thin, isn't it Wagg—"Yes, for a man whose speech is so thick."

The average man is more scarce than you would think. Most men are either better or worse than they seem to be.

It's a dangerous thing to ask an old maid to take a chance in a lottery. She might construe it into a proposal of marriage.

"Beauty is only skin deep," quoted the Wise Guy. "But many a woman is deeper than she looks," added the Simple Mug.

The Cynical Bachelor observes that the monotony of married life doesn't begin till a woman has completely tamed her husband.

Every day one loses more faith in his fellowman. For instance, here is one who has married a woman trombonist, without a court order.

Ambition is the guy that puts the try in triumph.

Nell—"Her wedding gown came from Paris." Belle—"But her divorce suit is being made in America."

Benton's Recipes

THE PRESERVATION OF ORNAMENTS

The automobile painter frequently finds, in light repainting of the car, that it is necessary to preserve the monograms and other ornaments. First coat over the ornament with a mixture of thin glue and gilder's whiting. This will dry rapidly and need not delay other operations. Some painters use ordinary trimmer's paste, but the glue and whiting are to be preferred. Subsequent paint coats, including color and varnish-color, go over all. When the coats containing color are in place, which will be when the last coat of varnish-color is applied, rub with water and pulverized pumice stone, which process will soften up the glue and presently serve to remove everything from over the ornaments.

The ensuing depression may then be washed and cleaned, and coated in with quick-rubbed varnish, later rubbed, and coated with rubbing varnish applied in connection with the process of varnishing the entire body of the car.

In the event of work requiring several coats of paint, color, and varnish-color, it will no doubt be necessary to apply a couple of coats of rubbing varnish to the depressed surface containing the ornaments. It is all important that these be fully level with the surrounding surface before applying the finishing varnish.

For Etching on Hardened Steel—First heat an iron or an old pillar file with a smooth side, and with it spread a thin, even coat of beeswax over the brightened surface to be etched. With a sharp lead pencil, which is very much preferable to a scriber, write or mark as wanted through the wax so as to be sure to strike the steel surface. Then daub on with a stick some etching acid made as follows: 3 parts nitric acid; 1 part muriatic acid. If a lead pencil has been used the acid will begin to bubble immediately. Two or three minutes of the bubbling or foaming will be sufficient for marking, then soak up the acid with a small piece of blotting paper and remove the beeswax with a piece of waste wet with benzine, and if the piece be made small enough dip it into a saturated solution of sal soda, or if the piece be large swab over it with a piece of waste. This neutralizes the remaining acid and prevents rusting, which oil will not do.

New Compound for Blackening Metals—For imparting a lasting black coating of mat luster to parts made of any of the reddish varieties of brass, to copper, gun metal and most bronzes, among which phosphor to bronze and metal and most bronzes, among which phosphor bronze and manganese bronze. Dissolve 5 kilograms of caustic hydrate of soda in 100 liters of water, bringing the mixture gradually to the boiling point of water, and then to add 1 kilogram of powdered persulphate of potash. The article is suspended in the hot solution for 7 to 10 minutes, is then rinsed in clean water and dried in sawdust.

In the case of aluminum-bronze or kindred light bronzes, the lye must be concentrated; that is, 10 kilograms of caustic hydrate of soda must be dissolved in 10 liters of water and 1 kilogram of persulphate of potash is added to this smaller quantity.

THE FIRST AUTOMOBILE TO CARRY MAIL ACROSS THE CONTINENT

San Francisco Post Office officials receive the first consignment of United States mail carried from New York to the Pacific Coast metropolis by automobile. This car left New York at 12:01 A. M., August 6, and arrived in San Francisco 4 days, 19 hours and 17 minutes later. Three different Essex cars beat the fastest previous time between the two coasts during this demonstration of the ability of the motor car in fast, long-distance mail service. The former record, made in 1916 by a Hudson Super-Six, was 5 days, 3 hrs. and 31 minutes. The Hudson record for the round trip, San Francisco-New York, still stands.

Tempering Tool Steel — The following gives the temperature in degrees Fahrenheit necessary to produce the required color, when tempering hardened steel: Lathe, shaper and planer tools, 430 degrees, very light straw color; 450 degrees, light straw color. Taps and dies, 470 degrees, dark straw color; 490 degrees, very dark straw color. Chisels, 500 degrees, brownish yellow; 520 yellow tinged with purple; 530 degrees, light purple. Springs, etc., 550 degrees, dark purple; 570 degrees, dark blue.

Proportional parts of lead to one pound of pure block tin which when melted will have the temperature in degres Fahrenheit necessary to produce the requird color on hardened steel, by simple immersion, are given below:

Color	Temperature degrees	Pounds of lead to one of tin
Very light straw color	430	1.750 to 1
Light straw color	450	2.125 to 1
Dark straw color	470	2.500 to 1
Very dark straw color	490	3.500 to 1
Brownish yellow	500	4.750 to 1
Light purple	530	7.500 to 1
Dark purple	550	12.000 to 1
Dark blue	570	25.000 to 1

To Remove Steel Chips from Jigs and the like—It if often very desirable to remove chips of steel from jigs and the like each time a new piece is inserted. An easy way to do this is to put a pound of caustic soda in a gallon of water and dip the jig in every time it is desired to remove the chips.

To Scale Cast Iron—To remove the scale from cast iron use a solution of 1 part vitriol and 2 parts water; after mixing, apply to the scale with a cloth rolled in the form of a brush, using enough to wet the surface well. After 8 or 10 hours wash off with water, when the hard scaly surface will be completely removed.

To Produce a Mat Surface on Steel—To make a non-reflecting or mat surface on small steel articles such as screws, small steel stampings, etc., which at the same time shall be perfectly rust-proof, proceed as follows: Mix 2 ounces of powdered tartar with 20 ounces of water. Put the articles to be treated into this mixture in an earthen pot, and boil until they become yellow. Then place the articles in a tray with a solution of sulphate of copper (blue vitriol); take out when copperized and put in a tray with sulphur-ammoniac. When black, take out and rinse off with water. After the rinsing has been done carefully, mix a quantity of clean, very dry, beechwood sawdust with sufficient sweet oil, to render it slightly oily. Then thoroughly mix and rub in some powdered graphite, but only enough graphite should be added to give the whole a blackish appearance. Throw into the sawdust the steel parts to be blackened but not more at a time than about 1-3 of the quanity of the mixture. Put the whole in a small coffee-roaster such as is used in private houses, and after shaking well, roast the contents over a gentle flame, in constant motion, until the sawdust is burned to charcoal. The parts are then ready to be taken out and cooled. The roaster should be tightly closed during the roasting operation.

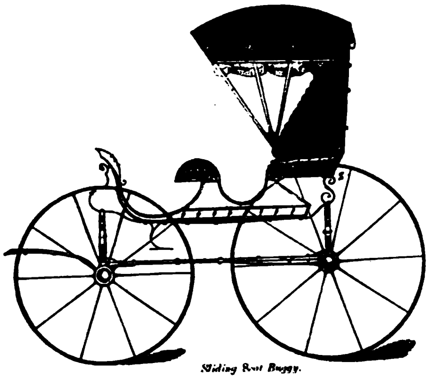
It is not necessary to lacquer the parts as the color put on in this manner will not wear off by ordinary handling. The parts will have a nice mat surface suitable for articles used in photographic manufacture and art goods. The formula used was a secret for many years and was successfully used by the inventor.

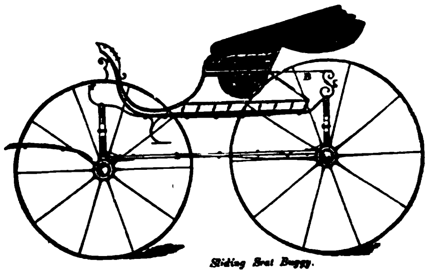
SALADEE'S MAGAZINE

A PAGE FROM YESTERDAY

The retrospective view of those things which were commonly associated with our every day life, after a few years become as interestingly strange as are the prospective views of the future. The fanciful imaginations of one generation become the realities of the next. The transition from the hay burner to the gas burner has come about so quickly and so completely, that not only have the earlier forms of transportation been nearly effaced from our memory; but we are actually tempted to ask ourselves if such strange looking vehicles really were used. Yet 65 years ago, when silk hats, frock coats and hoop skirts were the height of affluence, these vehicles were the last word in stylish carriage design. Today a dozing dobbin hitched to one of these rigs would attract as much attention on our city streets as some fair damsel would, if attired in one of the huge skirts of our grandmother's time. It should be a pleasant retrospection to our older readers, who can recall some of these models, to see how things have changed since the advent of the automobile, and to wonder if the cars we are using today will not look equally as strange three quarters of a century hence.

—The Editor.


Sliding Seat Buggy.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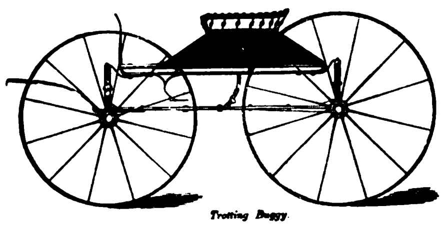
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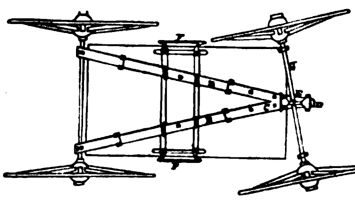
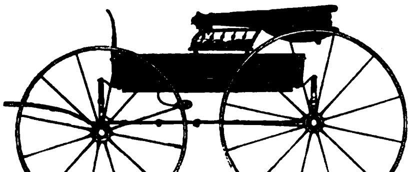
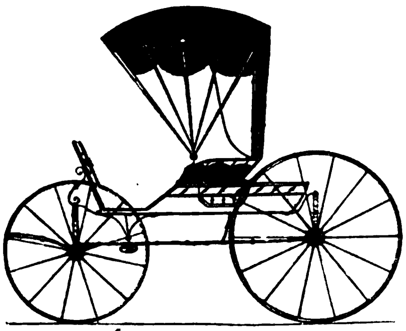


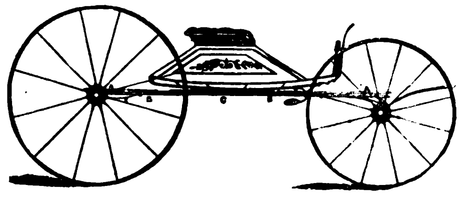

Fig. 9


New York Buggy


Sliding Seat Phaeton.

J. S. McClelland's Self-Adjusting Spring Coupling

Patented August 8, 1854.



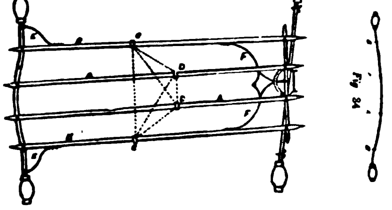
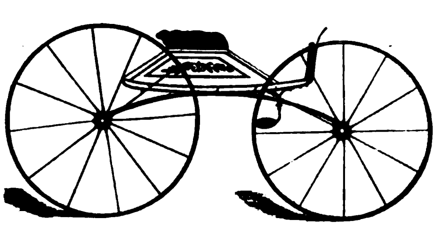
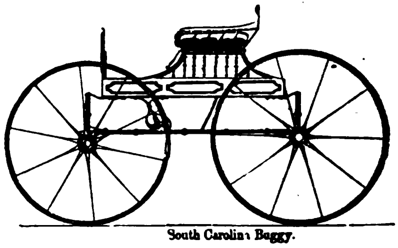
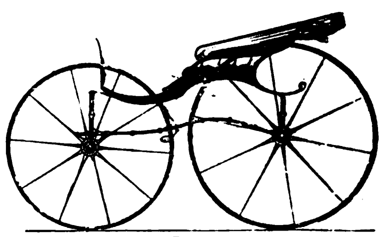
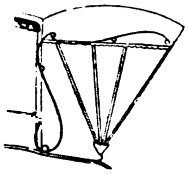


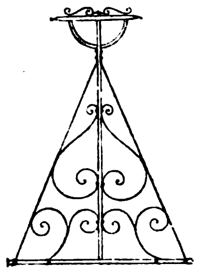
Fig. 34

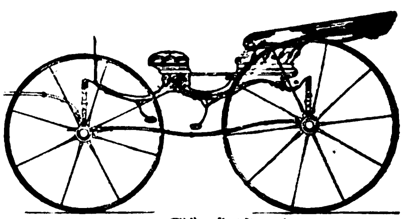


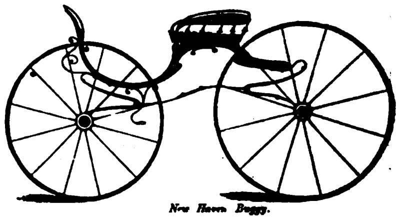

South Carolina Buggy.

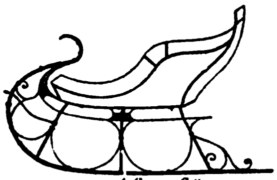

Boston Phaeton.

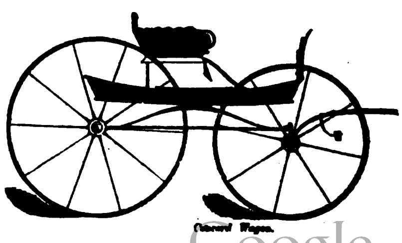


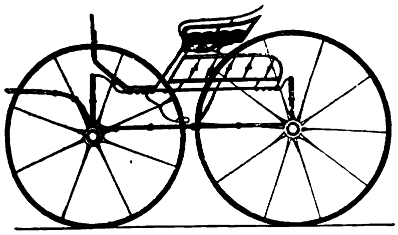



Sliding Seat Barouche.

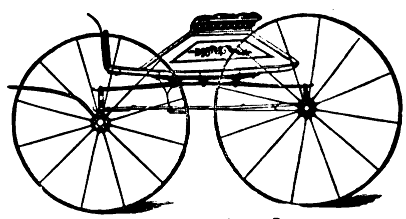

New Haven Buggy.


A Common Cutter.

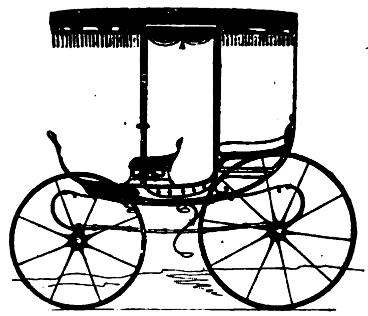

Concord Wagon.



Trotting Buggy.

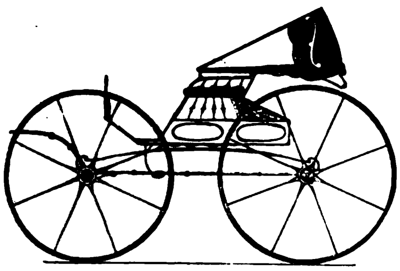


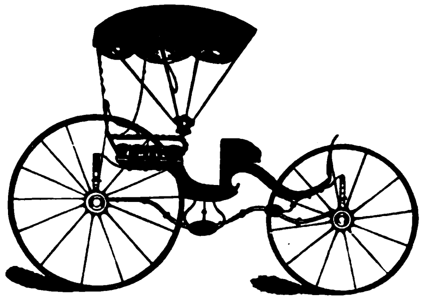
Stratton's New York Trotting Buggy



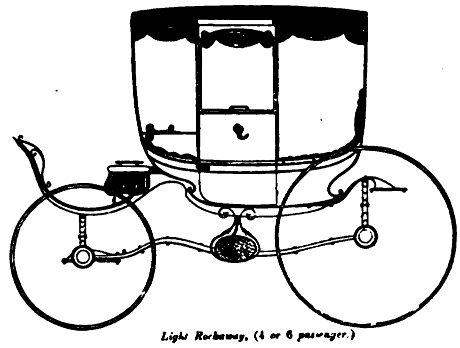
SALADEE'S MAGAZINE

NEW YORK, APRIL, 1855.

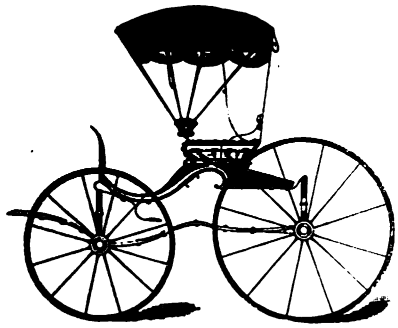


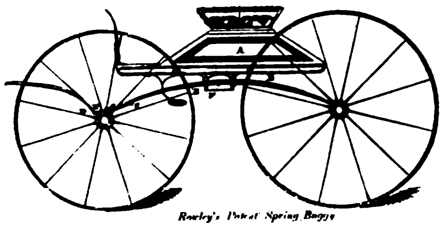


Sliding Seat Calash.

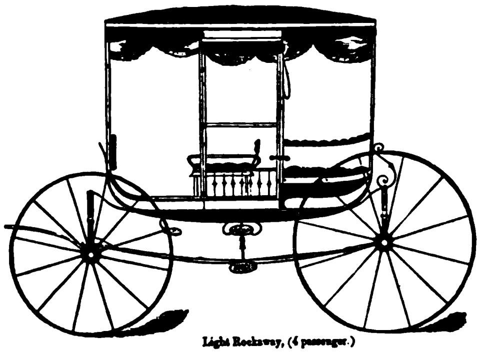


Light Rockaway, (4 or 6 passenger.)

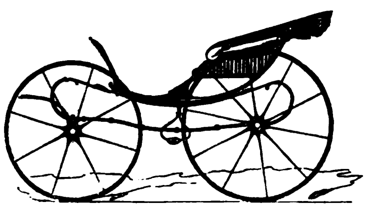


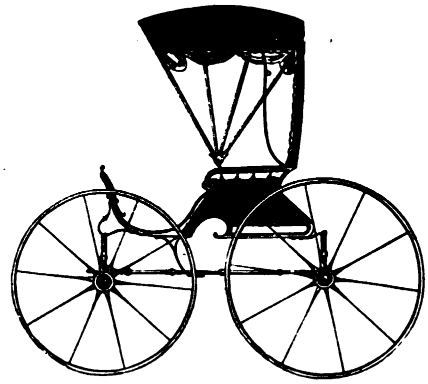


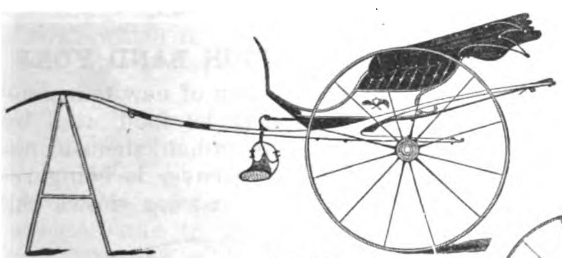
Rowley's Patent Spring Buggy



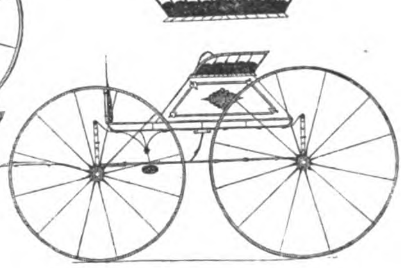
Light Rockaway, (4 passenger.)

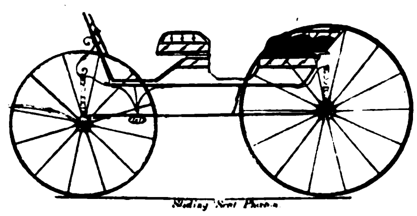




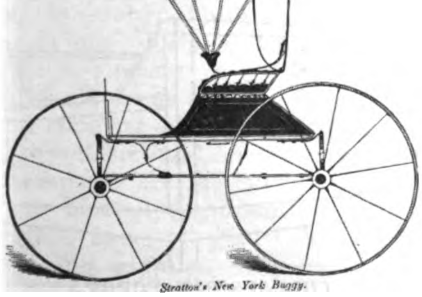


Boston Chaise.

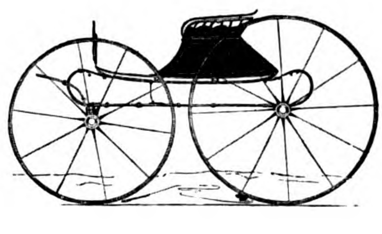


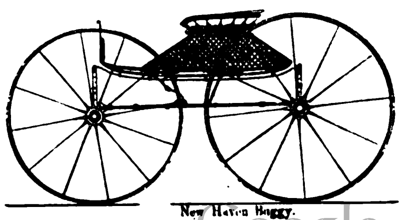


Sliding Seat Phaeton



Stratton's New York Buggy.



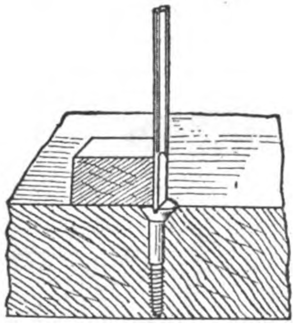


New Haven Buggy.

Helpful Shop Suggestions

REMOVING A DAMAGED WOOD SCREW

Where a screw has one side of the head broken away, it is a very difficult matter by the ordinary

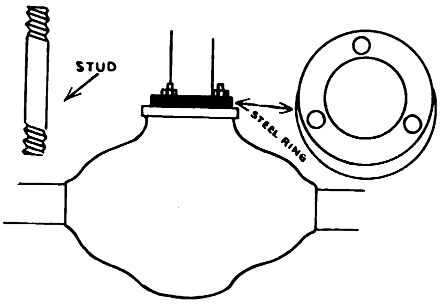


REMOVING BROKEN WOOD SCREWS

means to remove it without damaging the wood. It is very easy to get the screw out by following the plan shown in the accompanying illustration. The screw-driver is placed against the side of the head which is still intact, and a small block of wood is pressed firmly against the side of the screw-driver. As the screw-driver is turned the block is moved around with it and the pressure maintained. It will be found that the screw comes out with very little trouble.

DRIVE SHAFT HOUSING REPAIR

A simple expedient that will greatly lessen the possibility of a housing tube from breaking off at the transmission is shown in the accompanying illustration. A steel ring ½″ or more in thickness is forged so that it will slip snugly over the housing tube and jam against the flange on the end of the tube. The old studs are removed

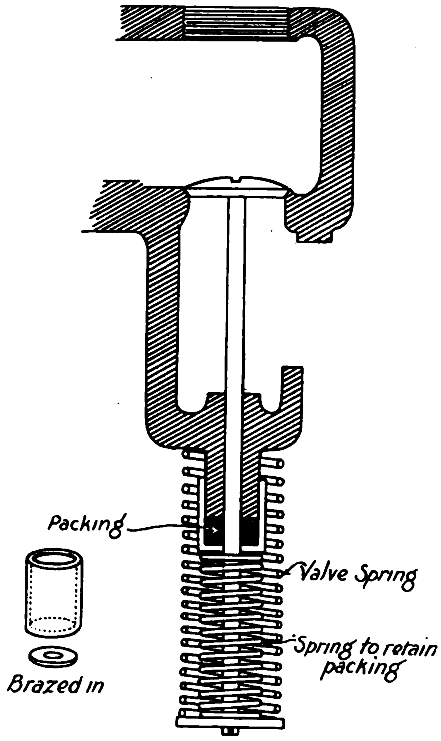


STRENGTHENING THE DRIVE SHAFT HOUSING

and longer ones made so that the ring can be held tightly against the end of the tube. In this position it will support part of the strain and load to which the tube is ordinarily subjected. This method can be used only where one end of the tube is plain so that the ring may be slid into place.

LEAKY VALVE-STEM GUIDES

THERE are always many new wrinkles to learn about the tractor engine, and recently while visiting a farmer who had used his tractor many seasons I

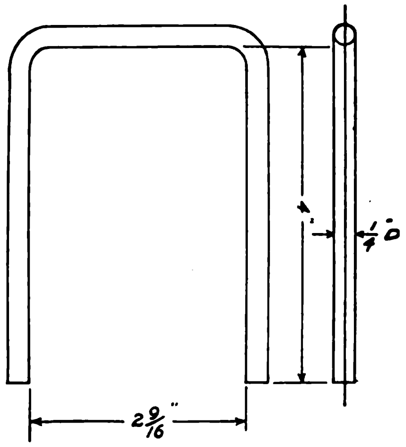


TEMPORARY REPAIR FOR WORN VALVE GUIDES

picked up this unique wrinkle which he had devised to cure some troublesome leaky, worn valve guides.

It so happened that he had been having considerable trouble with the engine missing when working the tractor in gang plowing at slow speed, and after a considerable lot of tinkering with the carburetor with no results, he came to the conclusion that air was being drawn in somewhere and weakening the mixture. An inspection of the intake manifold gaskets and joints showed that they were all O. K. It was decided to have a look at the valves, and luckily while inspecting them he noticed that the stems were quite loose in the guides, and it dawned on him that here was the place that the piston could be sucking in air.

The valve-stem guide holes had become worn considerably, and as



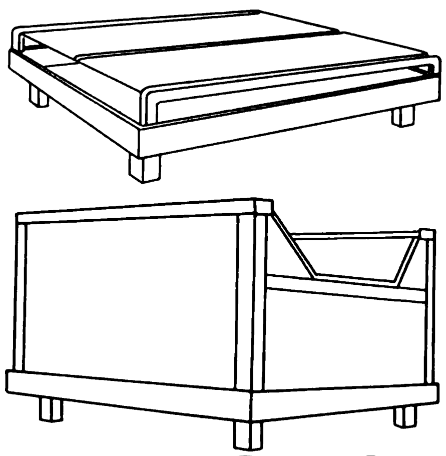
TRANSMISSION BAND YOKE

no bushings had been fitted he had to improvise some way to correct the trouble. This he did as shown in the accompanying diagram. Steel thimbles were made to fit round the lower end of the cast-iron valve-stem guides. They were made of brass pipe and the bottom discs brazed into one end.

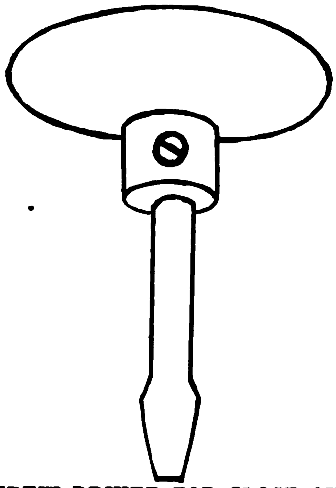
This packing gland was put on the stem and then packed with asbestos wicking and graphite and some small springs made that slipped on the stem inside the regular valve-spring. This spring forced up the packing gland and packing, and very successfully closed the opening round the stem. The trouble was cured. An occasional renewal of the packing is all that has been needed for the past year.

TRANSMISSION BAND YOKE

The installation of new transmission bands may be facilitated by making a yoke to hold them in position while the cover is being replaced. The drawing shows the



COLLAPSIBLE FORGE



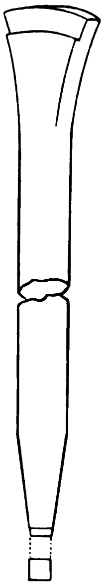
A SCREW DRIVER FOR CLOSE QUARTERS

necessary dimensions. A piece of 1/4" round bar stock is used. The bands are held and the yoke slipped behind the ears. After the cover is replaced, the yoke is easily withdrawn. This is not only quicker than tying them together with string or wire, but the possibility of dropping part of the string or wire into the crank case is entirely obviated.

NEW COLLAPSIBLE FORGE

A Texas firm have developed a new collapsible or "break-down" forge that is coming into extensive use in the south-western oil fields. The forge is designed for oil field tool workers, who find portable equipment very desirable owing to its compactness and the ease with which it can be set up whenever needed.

The new forge is being built on a production basis in the shops of this company as a side issue to its regular business. The entire manufacturing operation which consists simply of cutting metal sheets to pattern and welding of the joints, is done with oxy-acetylene flame, and the equipment required is almost as simple and compact as the forge itself. Besides material and operators the only requisites are the cutting and welding blow-pipes, dissolved acetylene and oxygen, the gases being supplied in portable cylinders.



HANDY VALVE GRINDING TOOL

A HANDY SCREW DRIVER

A handy screw driver for getting into close quarters, especially where medium sized screws are to be removed can be made from a door knob and a short screw driver bit. File the shank of the bit down so that it will fit the hole in the knob snugly and then pin it in place.—Philip Baker.

AN EASILY MADE VALVE GRINDING TOOL

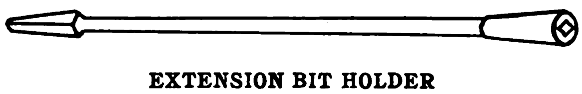
An inexpensive valve grinding tool which answers the purpose very nicely and one that can be made very easily is shown in the accompanying cut. A piece of steel 14 or 16 inches long, or in fact any length that will suit the individual need, is used. One end is forged with a tapered shank to fit the brace while the other end is flattened out, something after the fashion of a cold chisel. This end is finished with a radius so that when the brace is accidentally tilted either one way or the other, the blade will not be so apt to slip out of the slot in the valve. A recess is cut on both sides of the end that fits into the valve slot. This further facilitates keeping the blade in the slot.

E. D. Pendleton.

EXTENSION BIT HOLDER

This is a very useful tool around any repair shop, especially where any drilling has to be done in places that are hard to reach. It may be made from a regular extension bit holder, merely by welding another piece of steel in the center, or the whole thing may be made up from a piece of raw material. One of 36" seems to be the most useful, although that dimension may be left to the requirements of the individual.

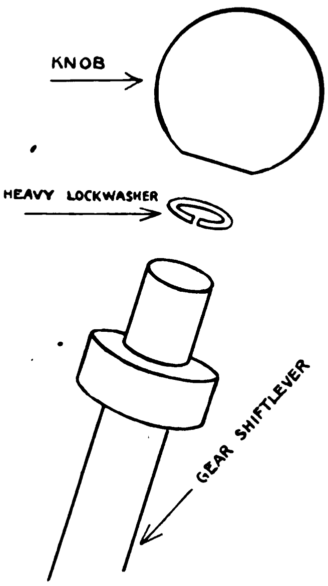
When it comes right down to the anatomy, ailments and cure-alls of a motor, there is a whole lot of difference between thinking what you know about them and knowing what you think.



EXTENSION BIT HOLDER

TIGHTENING THE KNOB ON THE GEAR SHIFT LEVER

Looseness in the knob of the gear shift lever with its attendant rattles is an annoyance to every driver. It is a condition that is so easily remedied that there seems hardly any excuse for it being tolerated. Removing the knob and inserting the proper sized lock washer in the hole will not only stop the rattle but will prevent the knob from working loose. If the play cannot be taken up with one washer, use two lock washers with a plain washer between them.



TIGHTENING THE GEAR SHIFT LEVER KNOB

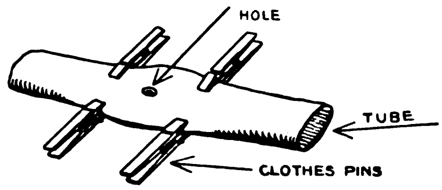
HOLDING THE INNER TUBE WHILE PATCHING IT

The difficulty of having the tube curl up while applying a patch is an annoyance that most of us have experienced. It can be very easily overcome easily by fastening several clothespins on the tube to hold it flat.

WHO IS NEXT?

Twenty-three persons are accidentally injured every minute.

Thirteen hundred and eighty accidentally injured every hour.



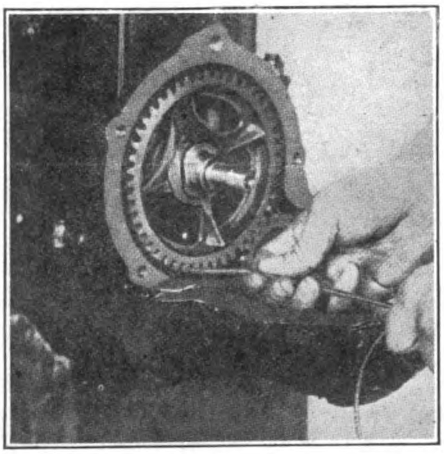
HOLDING THE INNER TUBE

BENDING LIGHT TUBING

Bending light tubing requires considerable care. Where small tubing is to be shaped, take a close spiral spring that will make a neat, sliding fit in the tube, and anneal it at the part that is to be bent. Take a piece of hard wood and make a form about which the tube is to be shaped. To remove the spring after the bending process, twist it in the direction in which it was wound. This will serve to close the spring slightly so that it can be taken out easily. This kink may be used on tubing up to .75 in. diameter.

CLEANING OUT THE OIL TUBE ON A FORD MOTOR

Occasionally the oil tube on a Ford motor will become clogged from a piece of dirt or foreign matter becoming lodged in the oil tube. The usual result is that the first two connecting rod bearings are burned out and sometimes the front main engine bearing is effected. Where any trouble has been experienced with these bearings, as a matter of precaution, it would be well to examine the oil tube to see that it is not stopped



THE TIMING GEAR COVER REMOVED SO THAT THE OIL TUBE MAY BE CLEANED WITH AN OLD SPRING SPEEDOMETER SHAFT

up. This can be done without pulling the motor down.

An old coil spring type speedometer shaft may be used to good advantage in cleaning out this tube. In fact a device made especially for the purpose would not work any better. By removing the radiator and the cylinder front end cover, the wire shaft may be easily run through the tube. This operation will remove any dirt or sediment that has accumulated in it. On cars using spiral timing gears a little care will have to be exercised in lining the gears so that the hole will be accessible. It is a good plan to drain the crank case and wash it out with kerosene after this operation.

Drill Sizes for Various Taps

For taps ¼ to 2 inches when a full thread is to be tapped in a hole. The sizes given are practically correct.

The following table, shows the different sizes of drills that should be used when a full thread is to be tapped in a hole. The sizes given are practically correct.

This table also indicates the proper holes for nuts, a matter which is frequently disregarded.

Diam. of Tap.	No. Threads to inch.			Drill for V Drill			Drill for U. S. S. Thread
1/4	16	18	20	5/32	5/32	11/64	3/16
9/32	16	18	20	3/16	13/64	13/64	
5/16	16	18		7/32	15/64		1/4
11/32	16	18		1/4	17/64		
3/8	14	16	18	1/4	9/32	9/32	9/32
13/32	14	16	18	19/64	21/64	21/64	
7/16	14	16		21/64	11/32		11/32
15/32	14	16		23/64	3/8		
1/2	12	13	14	3/8	25/64	25/64	11/32
17/32	12	13	14	13/32	27/64	27/64	
9/16	12	14		7/16	29/64		7/16
19/32	12	14		15/32	31/64		
5/8	10	11	12	15/32	1/2	1/2	1/2
21/32	10	11	12	1/2	17/32	17/32	
11/16	11	12		9/16	9/16		
23/32	11	12		19/32	19/32		
3/4	10	11	12	19/32	5/8	5/8	5/8
25/32	10	11	12	5/8	21/32	21/32	
13/15	10			21/32			
27/32	10			11/16			
7/8	9	10		45/64	23/32		23/32
29/32	9	10		47/64	3/4		
15/16	9			49/64			
31/32	9			51/64			
1	8			13/16			27/32
1 1/32	8			53/64			
1 1/8	7	8		29/32	15/16		15/16
1 5/32	7	8		15/16	31/32		
1 1/4	7			1 1/32			1 1/16
1 9/32	7			1 1/16			
1 3/8	6			1 1/8			1 5/32
1 13/32	6			1 5/32			
1 1/2	6			1 15/64			1 9 32
1 17/32	6			1 9/32			
1 21/32	5	5 1/2		1 5/16	1 11/32		
1 5/8	5	5 1/2		1 9/32	1 5/16		1 3/8
1 3/4	5			1 13/32			1 1/2
1 25/32	5			1 7/16			
1 7/8	4 1/2	5		1 17/32	1 17/32		1 5/8
1 29/32	4 1/2	5			1 9/16	1 9/16	
1 29/32	4 1/2	5		1 9/16	1 9/16		
2	4 1/2			1 21/32			1 23/32

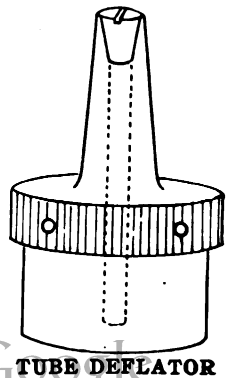
INNER TUBE DEFLATER

An easier way of deflating a tire than removing the valve lining, and a quicker way than holding the plunger until the air has escaped, is to make a simple deflater as shown in the drawing. An old valve cap is used for the purpose. The rubber is removed, and several 1/16″ holes are drilled as indicated. A small wood screw, the end of which has been filed flat, is turned down through the top so that it nearly reaches the end of the cap. By screwing this cap onto the tube, the air will be released .

Someone has said that the man who is in advance of his times is usually the butt of stone-throwing on the part of people who do not understand and appreciate him. And that the leader is the man who can take these stones and the mud thrown at him and build a monument out of them. So do not take it to heart too seriously if everybody doesn't appreciate what you are honestly trying to do. Have a vision of something worth while, and try to bring it to actual pass. If you do, you will never complain that life is monotonous or that the years drag.

It is said that the automobile tire business in the United States will reach a total of $1,200,000,000 in 1920, which sum amounts to more than all the gold in circulation in this country and almost doubles the value of the output of petroleum. Less than twenty-five years ago the law forbade the driving of an automobile on any public highway.

Thirty per cent.of the population of the United States live in electrically lighted houses, it has been estimated.



TUBE DEFLATOR

THREE LATHE KINKS

Two Small Drivers.—Fig. 1 is a miniature driver, designed to afford the least diameter and amount of projection, for the function of driving small work between centers. It is less in the way than the standard catch-plate, hence is more convenient in dealing with slender pieces. The size is made only just sufficient to afford enough metal round the threads and round the driver pin. The latter is regulated by screwing it in or out to suit the position of the carrier on the work.

The driver illustrated in Fig. 2 is intended for bolt driving, a function usually performed by a slotted plate bolted to the catch-plate, and remaining in position, the only effort of chucking being that of slipping the bolt on to the center. This avoids the need of screwing on a carrier and removing it for each piece. The small driver shown gives similar advantages, but provides also an adjustment for various widths of heads. The two little angle-plates are slotted out so that they can be advanced towards or receded from the center, as desired. The plates should preferably be slightly recessed into the catch-plate, sliding in grooves, so that the thrust of driving is relieved from the screws to a considerable degree.

Method of Finding Center Height.—A rough-and-ready method of finding the center height of a piece of work in the lathe to set the tool to, is that shown by Fig. 3. Apply a square as shown, standing the stock on the bed, and bringing the blade into contact with the periphery of the work. The point where the two touch will be the height to which the tool may be then adjusted. The hint is useful in cases where a slide-rest height-gauge cannot be conveniently applied, and for the American type of tool-post.

Screw Center Fitting for Chuck.—For a piece of wood-turning of short duration, the fitting illustrated by Fig. 4 is useful, the object being to avoid removing the self-centering chuck in order to substitute a screw center in the mandrel. A piece of iron or brass is turned to the shape shown, the flange serving the double purpose of a face for the wood to screw up against and of a shoulder to come against the face of the chuck jaws. Into the drilled hole a piece of screw is sweated. To use, its merely necessary to grip the chuck jaws on the body, when the appliance is ready.

Hints for the Service Man

By Curtis Allison

WHEN overhauling a car which has seen considerable service, inspect the frame to see whether it sags in the middle. Various mechanical difficulties are occasionally traced to sagging frames, the more common trouble being difficulty in clutch shifting. The best way to remedy a sagging frame is to fit a truss rod, with a turn-buckle, under the portion of the frame which sags.

"My clutch spins," remarks an excited autoist. "What's the matter with the blame thing?"

Clutch spinning is frequently due to excessive friction in the spring thrust bearing. Sometimes faulty alignment of the flywheel and clutch cone prevent the engaging surfaces from entirely clearing each other. A bent clutch shaft may also cause the difficulty.

"My clutch doesn't take hold properly."

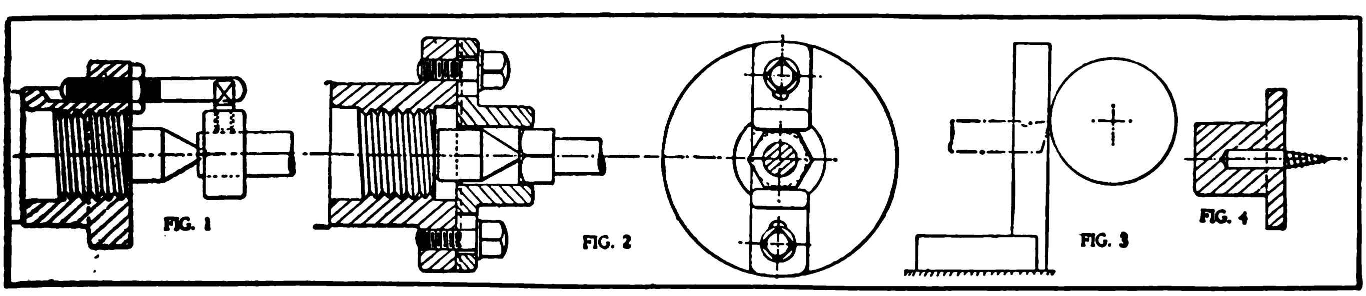
High-grade glycerine, applied to the leather facing of cone clutches, will give the proper "take hold" which is sometimes lacking. When a clutch is "fierce" in taking hold, mix a little graphite to the glycerine before applying.

"My radiator has an annoying leak. It's a small leak, which I am unable to locate."

Little leaks are often hard to locate. Empty the radiator completely, then blow smoke into it through a blow pipe. This plan "shows up" the smallest leak immediately. If the leak is located where common soldering cannot be done successfully, try placing a little soft solder on the end of a wire; this will enable you to reach out of the way places.

When overhauling a car, do not replace rubber hose connections unless they are in good condition. The average rubber hose connection deteriorates after a season's use. If an auto owner asks why new connections are necessary, when the old ones look all right, tell him that the inside layer of fabric occasionally separates from the rest, impeding the circulation of water without the defect being discernible from the outside. Kinks should be avoided in rubber hose connections. See that the clamp fasteners are in good condition, and are properly secured. Where the rubber hose connections has bends in it, it is advisable to reinforce it with a coil brass spring which fits snugly inside. This will prevent flattening at the bend, eliminating cracks which eventually cause leaking.

"My engine misfires; my plugs must be all right because I cannot



Three Lathe Kinks. Fig. 1.—Small Driver for Slender Work. Fig. 2.—Adjustable Bolt-driver. Fig. 3.—Method of Finding Center Height. Fig. 4.—Screw Center Fitting for Chuck.

locate short circuiting at the spark gap."

Short circuiting of a spark plug which causes misfires is seldom at the spark gap. Greasy surfaces of the porcelain collect and retain materials which enable the current to avoid the gap, checking the "spark jump" which is necessary to ignition. Proper action will be resumed when the porcelain is thoroughly cleaned.

When caring for motor trucks give particular attention to the bearings. When taking up bearings in a motor truck, it is necessary, in making the final adjustment, that the strain of the bolts shall not come on the journal, but on the facings of the bearing shims.

"I want to see whether you know how to put on cord tires," remarks the truck owner as he seats himself where he will have a good view.

First of all see whether the truck is equipped with the later types of rims which are made with valve stem slots to facilitate application of tire tube. Allow the tire to drop down evenly until valve stem is reached. Press valve stem down sideways and toward the end of the flap. Hold stem in position, taking care that when tire slips down the rest of the way the valve stem doesn't catch in locking groove. It is best to put a valve cap on the stem to protect the threads during this operation.

"Why does my motor heat so quickly, if I retard the spark a little too much?"

Because the explosion takes place when a maximum of the cylinder wall is uncovered, instead of the minimum as is the case when ignition happens at upper dead center, piston being at top of its stroke.

"This tar and refuse oil must be removed from the car body before the varnish is ruined," growls a portly citizen. "See that you don't scratch the finish while doing the cleaning."

Get some butter (packing stock will do) and lay it over the greasy spots, allowing it to stand for three-quarters of an hour. It will soften the grease, and the mixture can be wiped off smoothly with a piece of soft rag.

When grinding valves, do not pass up a valve until it has nicely polished circle all around it. When a valve is properly ground, the polished circle will be plainly visible after the compound is removed. Wipe each valve with a cloth dampened in gasoline to insure removal of all foreign material. Replace springs, then check up that there is approximately from .005" to .010" clearance, depending on the type of motor, between valve stem and push rod when cam is at its lowest point. Make certain that this clearance is correct, otherwise you will have another overhauling job at an early date. When clearance is too small, the valve will not seat properly, causing a loss of compression and power. When the clearance is too wide, the engine will be noisy; the valve will be slightly out of time.

"How does carbon accumulate?" asks the car owner. "You service men are always talking about the necessity of keeping auto and tractor motors free of carbon. Why does carbon lower the efficiency of a motor?"

Carbon is certain to form to a certain extent in the combustion chamber of a gas engine but its formation can be checked. Low quality fuel is one cause of its formation. Oil coming up past the piston rings is another common cause. The principal manner in which carbon lowers a motor's efficiency, is the heating of the carbon in combustion chamber to a point where it ignites the gas prematurely, or the explosion of the mixture before the proper time of the spark. A service man can do his patrons no greater service than by encouraging them to have carbon removed from their motors at regular intervals.

It is to the service man's interests to replace worn or broken piston rings, with new rings of high quality. There are certain factors which determine whether or not a piston ring is satisfactory. It must maintain sufficient pressure on every part of the cylinder wall and prevent gas blowing past. It must fit the cylinder walls exactly, when heated to the temperature obtained when working. Pressure on the cylinder must be well below that which will squeeze out the oil film, otherwise ring is certain to score and cut cylinder wall. The ring must have sufficient elasticity to cause it to follow up, as wear takes place. The slot in the ring should be almost closed when the engine is heated up, otherwise there will be a gas leakage during compression and explosion.

Ignition trouble is the main cause of failure to start. Insulation should be guarded against such "foes" as oil, rubbed places and breaks.

"My car ran fine when I left home, but about half a mile out of town it began to run unevenly and finally stopped dead."

Look for water in carburetor. Other probable causes of trouble are weak battery; leak in water jacket which admits water into combustion chamber; loose wiring connections; heated bearings and seizing of piston in cylinders owing to inadequate cooling or insufficient lubricating oil.

The service man can be of great assistance to his patrons by advising them to use the right kind of lubricating oil. As motors differ, and accordingly demand different oils, the service man, owing to his familiarity with different motors can usually recommend the right lubricant for a particular motor. The proper lubricant is necessary to assure the maximum power development, smooth operation and long life of a motor.

Whenever insufficient oil is supplied to cylinder or moving parts, excessive heat quickly generates from the friction, causing destructive wear. When you are asked to overhaul a motor which is seriously harmed because of insufficient lubrication, tell the owner just how the trouble was caused, so he may avoid such mishaps in the future. More gas engines are ruined through insufficient or faulty lubrication than from all other causes combined. Lubrication is the life of the motor Warn your patrons not to experiment with "cheap" or "cut price" lubricants.

POINTS ON PLOW WORK

Welding a plow point, make the point fit the plow share; then heat both plow share and point and when they are a good red remove from the fire and put a small piece of welding plate between the parts where the lap occurs. Then with a pair of tongs, squeeze the parts together and they are ready to make a weld. In this way there is no slipping of the plow point and it can be turned in the fire, making a very nice job and from ten to fifteen minutes is saved on each job. Sometimes a little trouble is experienced in getting the first heat so that the point will not slip off in the fire. Special tongs are an advantage where much work of this character is done.

Hardening soft center shares and shovels is a common job. For plow work take a piece of 1½ by ½ inch

(Continued on page 22)

Hal Lets His Light Shine

By D. G. Baird

DON'T it beat all what peculiar notions some folks gets into their beans? W'y som'uh them even gets a idea ever so often that ordinary human bein's like me and you, what's commonly known as The Public, has such wonderful vision we can see right through wood or glass that's coated with from one to half a dozen inches'uh grease and smoke and carbon and real estate and the like.

I reckon it must be on account'uh their lookin' through wood and dirt and the like all the time theirselves—seein' as how they're wood from the neck up—or maybe they get a message from the squege board or somethin'. Anyhow they sure do get them kinda wheels in their domes, as I can prove in a jiffy or two.

As to the first proof, I might sight no less a authority than the Good Book itself where we're told that even in them days there was a lot'uh birds what didn't know no better'n to stick a candle under a bushel basket and expect it to give light so's the welders could see without wearin' them funny spectacles what they're always sportin' around. Yep, and the great Teacher had to tell 'em that the right and proper place for their flambeaus was in the patented holders what 'uz made for the purpose, so's the light repair men and the rest could see how to fit a half-inch bolt into a three-inch hole.

As to all my other proofs, I'll just sight the case'uv a modern workman and well-known veterinary to the steedless carriage, Hal Jayne. And inasmuch as there's never been no chronicle'uv Hal's career chronicled that I could refer you to, I'll just proceed forthwith to chronicle the same.

Hal had a fine location and a bang-up shop—all brick and cement floor and pits and all—and he'uz doin' a nice business for a time. Yep, it'uz a pleasant day for yours truly when he breezed along the highway and stopped in for a social chat and a nice order from Hal.

But times change sometimes and they changed durin' Hal's time. One'uh the changes that'us made was a change from one shop in Hillsdale, which was Hal's to five shops in the same hamlet, four of which wasn't Hal's. Another change was a change from a few little accessories, what'uz carried as a kinda side line in Hal's shop, to two regular accessory stores and a lot o' hardware stores and drug stores and the like that'uz carryin' the same. And the third change was that friend Hal begun to lose his buoyant buoyancy and look somewhat worried-like and to develope a alarmin' tendency to shut down on his buyin' and all.

"Tain't no use to try to buck the game no longer," Hal says when I make careful inquiries into the why and the wherefore-uv the crepe-hangin'. "There's just too much competition. There ain't room in a small town like this for five garages and two accessory stores, so I guess I'll sell out and buy a little farm and settle down to take it easy. I'm gettin' purty old anyhow and—"

But I never could stand to hear a able-bodied man under the century mark talk about gettin' old and retirin' to the farm—I know too much about farmin'!—so I proceed to cut friend Hal off right short and get right down to business.

"Now just looka here, you candidate for the poor house," says I real cheerful, "the only trouble I see with you is that your liver's outa order and your shop as well as your system needs a general cleanin' and renovatin' and a little new pep injected into it to make the wheels go round a little smoother."

With this bit'uh sage council I get up and start to take a look 'round about to see just what condition things're in, and I ain't took but two steps when I—well, it wasn't very dignified nor becomin', so I'll just say that I picked myself up and tried to dust the dirt and cylinder oil and a few other ingredients off'n my new palm beach suit and assure friend Hal that I wasn't fatally injured and it'uz all right and all.

"Hal," says I when I regain my exposure, "do my eyes deceive me or do I see a kinda opaque light through this here supposed-to-be brick wall here?"

"I dunno what kinda light you're referrin' to," says Hal real uneasy, "but if you'd a fell an inch forther toward the front you'd a gone through that twelve-foot glass window. I've been layin' off to take them old anti-skid chains outa there 'cause they ain't doin' no good anyhow, but I just haven't got around to it. Folks don't buy chains or nothin' else from me any more—they go to them accessory stores."

Well, sir, the solution'uv the whole bafflin' problem just reveals itself to me right then and there.

"You say there's a twelve-foot glass window in this front wall here?" I asks real excited.

"Sure! don't you see it? There's another one just like it over on the other side of the entrance, too. This was some shop when—"

But I'm not listenin' to what the shop used to be. What I'm interested in is what the shop's **gonna** be, and before Hal's finished his sentence I'm half way down the room lookin' for the colored gent what Hal keeps around to wash cars.

Hal comes tagin' along after me and when we find the aforementioned colored gent busy shootin' craps with the battery man I bust up the game real unceremonious and tell him to run down town and get a few sticks'uh dynamite and a pick and shovel and a gallon'uh lye and to borrow the hose from the fire department and hustle back and get to work cleanin' them twelve-foot windows.

Then I round up the rest'uh the force and make them get busy inside cleanin' out the old chains what caused my downfall and was indirectly responsible for savin' Hal from bankruptcy, and have 'em scrub the floor and walls'uv the windows and polish things up like Christmas or the Fourth'uh July.

While they're doin' all that I'm rumagin' around in Hal's old run down stock'uv accessories and pickin' out the neatest and best looking goods and determinin' my plans for the future.

I see Hal's some mystified by it all, so I proceed to elucidate as I go on with the good work. "No, Hal," says I real kindly, "the human eye can't see through glass coated with a twelve-inch plate'uh smoke and grease. I'm willin' to forgive yuh for pretty near givin' my wife the pleasure'uh collectin' my insurance, but you'll never forgive yourself for lettin' your business go to the bow wows like this after you've seen the difference a few little changes'll make.

"What yuh been gettin' for this cord tire?" I go on as I see he's got about ten or twelve piled over in the corner? He says a little over thirty plunks, and I proceed to roll 'em out. "Now," I go on, "we're gonna put on a little special sale of this here junk that you've got on hand and I'll see that you've got a supply'uh fresh goods by the end'uh the week. This will all be gone before that time, and you'll have a clean stock to go with your clean windows."

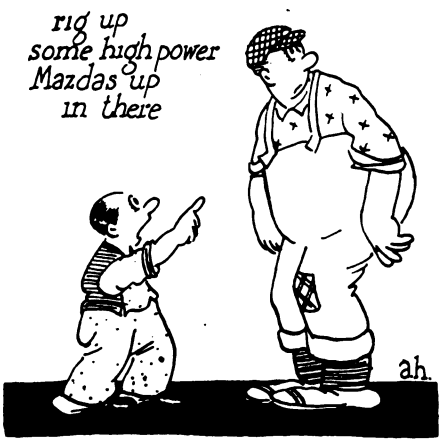
With that I make him get busy markin' price tags at a reduction'uv about 25% to 40% on the lot and I arrange a window display'uv tires, wheels, tubes, jacks, pumps, and related articles. Hal hesitates a little at first, but he's anxious to get rid'uh his old stock what he ain't been sellin' none of for months, so he lets me cut prices all I want.

Well, sir, we get them windows cleaned up so's passin' motorists can see right through 'em and see the goods and the price tags on 'em whats in the windows, and before we're through puttin' the goods in we've sold two tires and a jack and three innner tubes and some more things that I've forgot.

In between sales I'm givin' Hal a few pointers on display.

"Hal," says I, "don't ever again be guilty'uv hidin' your light under a bushel or behind dirty windows with nothin' in 'em. Let your light shine! And the way to let it shine is to have attractive show windows kept nice and clean and filled with nice clean stock at attractive prices. Let folks know you've got goods for sale! When it comes to sellin' accessories your windows're the best salesmen and the best ads you've got.

"You can make your windows work eighteen hours a day, every day in the year, and they won't strike for shorter hours nor higher wages—they're free! They can be made to work at night as well as



day. Rig some high-power Mazdas up in there and they'll do the job. There's folks goin' by here in cars all day long and till two or three o'clock in the mornin'. Let 'em know you're doin' business. Get a little opulence into the appearance'uh things around here and the first thing you know you'll be opulent!

"When your new goods come, you make it a rule to keep your windows clean and to always display clean, attractive goods. Folks don't like to buy dirty, greasy accessories no more'n they do other dirty things.

Display things that go together; like tires, tubes, patches, cement, pumps, jacks, chains, wheels. Display them for one week. Then next week change your show to some other line—say to oil, grease, waste and that kinda stuff. The next week you can show bulbs in assorted sizes, lenses of different makes, and other goods in that particular line.

Always make your display a unit—don't just cram the window full'uv a lot'uh junk 'cause you've got it and don't know what else to do with it. A miscellaneous show like that loses all its force'uv suggestion. Let the folks see your stuff and it'll sell itself by the very sight'uh the merchandise.

And don't forget to put price tags on your goods, marked in plain figures so's he who rides may read. Folks wanta know what things cost and it may be they'll see you're sellin' a little cheaper than their city dealer and'll buy from you instead'uh him.

"The folks what stop in for gas or air or repairs'll buy accessories, and the folks what buy accessories'll stop for repairs and gas and oil and the like. Garages and accessories just naturally go together.

"You roll up your sleeves and get into the game and you'll be forgettin' there's four other shops and two accessory stores in this here burg."

And do you know what Hal said back to me? Huh?

He said real spunky-like: "Who said there was any other shops or accessory stores in this here village! B'lieve me, as far's I'm concerned there ain't another shop on the North American continent! Put 'er there,pal!"

POINTS ON PLOW WORK

(*Continued from page* 20)

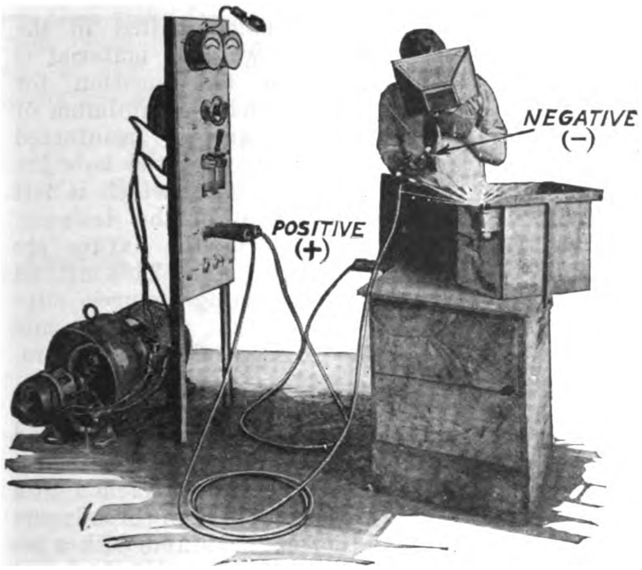
wagon tire and bolt it to the back of the share. Then heat to a cherry red and sprinkle while on the fire with pulverized potassium cyanide, being careful not to inhale any of the fumes. Then plunge into the tub edge first. The tire iron on the back of the share prevents warping. Leave in the tub until cool and polish.

For cultivator shovels heat to a cherry red and sprinkle with cyanide all over the face, as above. Then cool the cutting edge of each shovel slightly for about ⅜ of an inch from the edge and then plunge in the tub.

VANADIUM AS AN ALLOY

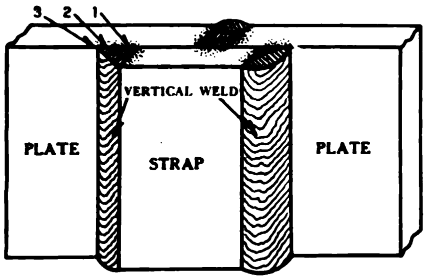
Vanadium has become one of the vital factors in the steel trade, entering into the manufacture of automobiles very extensively. Four pounds of vanadium added to a ton of steel results in an increase of 45 per cent. in its strength and at the same time produces an alloy steel which has satisfactory machining qualities.

Nomenclatures Used in Electric Arc Welding



IN order to aid in the standarization of various types of joints and welding operations, the nomentclatures or symbols prepared by the Welding Committee

STRAP WELD, REINFORCED, COMPOSITE OF THREE LAYERS, VERTICAL, STRAIGHT.

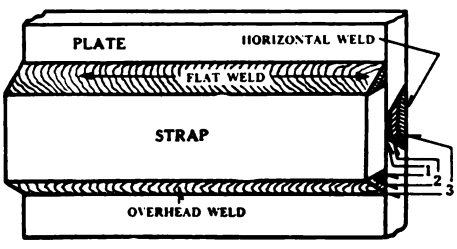


of the Emergency Fleet Corporation are given for the information and guidance of those doing electric arc welding. It is suggested, that general use be made of it in the industrial world, so that all may speak of the same welding term without confusion or misunderstanding whether in the field or shop. Some of the most important nomenclatures are given as follows. The simpler forms having appeared in a previous issue.

Strap weld reinforced, composite of three layers, vertical and straight. This sketch and symbol shows a strap holding two plates together, setting vertically, with the welding material applied in no less than three layers at each edge of the strap, as well as between the plate with a reinforced, composite finish, so as to make the weld absolutely air, water or oil tight, and to attain the maximum tensile strength. The edges of the plates are left in a natural or sheared finish. This type of weld is used for most particular work where maximum strains are to be sustained.

Strap weld, flush, strength of three layers, horizontal, flat and overhead, double bevel. This illustration shows a strap holding two plates together horizontally welded as a strength member with a maximum of three layers and a flush finish. Inasmuch as the straps necessitate the welding of the plates from one side only, both edges of are beveled to an angle, the degree of which are left to the discretion of the designer. The edges of the strap are left in a natural or sheared state, and the maximum strength is attained by the mode of applying the welding material, and through the welded sectional area per square inch exceeding the sectional area of the surrounding material.

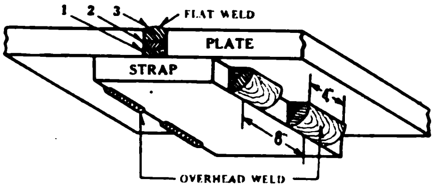
STRAP WELD, FLUSH, STRENGTH OF 3 LAYERS, HORIZONTAL, FLAT AND, OVERHEAD, DOUBLE BEVEL



Strap, tack, overhead, 8″ center to center, 4″ long, butt, reinforced composite of three layers, flat, straight. This symbol represents two plates butted together and welded flat, with a composite weld of not less than three layers, and a reinforced finish. A strap is attached by means of overhead tacking, the tacks being four inches long and spaced eight inches from center to center. In this case, the welding of the plates of maximum strength and water, air or oil tight, but the tacking is either for the purpose of holding the straps in place until it may be continuously welded, or because strength is not essential. All the edges are left in their natural or sheared state.

Butt weld, concave, caulking of two layers, flat, straight: The symbol shown shows a butt weld

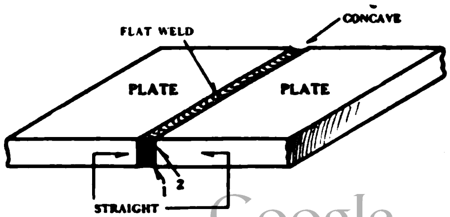
STRAP, TACK, OVERHEAD.
8″ CENTER TO CENTER
4″ LONG, BUTT, REINFORCED
COMPOSITE OF 3 LAYERS,
FLAT, STRAIGHT.



symbol shown shows a butt welding material finished concaved and applied in a minimum of two layers to take the place of caulking. The edges of the plate are left in a natural shear cut finish. This symbol is quite frequently used for deck plating or any other place where strength is not essential, but where the material must be air, oil or water tight.

Butt weld, reinforced, strength of three layer, vertical, double vee: This symbol is used where the edges of two plates are vertically butted together and welded as a strength member. The edges of adjoining plate are finished with a "double vee" and the minimum of three layers of welding material applied from each side, finished with a convex surface, thereby making the sectional area per square inch of the weld, greater than that of the plates. This will be a conventional symbol for shell plating or any other member requiring a maximum tensile strength, where the welding can

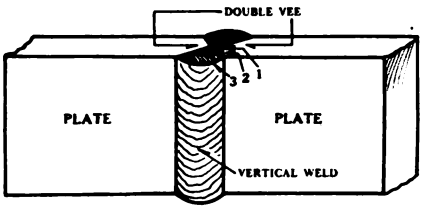
BUTT WELD, CONCAVE, CAULKING OF 2 LAYERS, FLAT, STRAIGHT.



be done from both sides of the work.

Butt weld, flush, composite of three layers, flat, double bevel; That symbol shows two plates butted

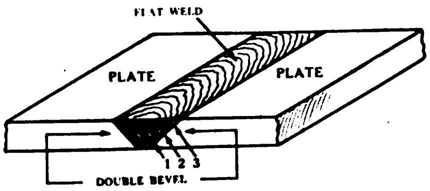
BUTT WELD, REINFORCED STRENGTH OF 3 LAYERS, VERTICAL, DOUBLE VEE.



together in a flat position, where the welding can be applied from the top surface. It shows a weld required where both strength and water tightness are to be considered. The welding material is applied in a minimum of three layers and is finished flush with the level of the plates. Both edges of the adjoining plates are beveled to an angle, the degrees of which are left to the discretion of the designer, and should be used when it is impossible to weld from both sides of the work.

Lap weld, concave, caulking of

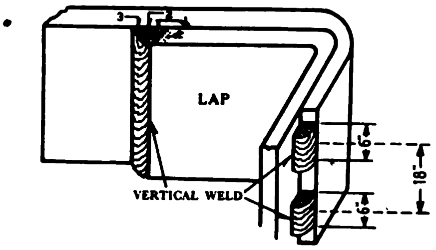
BUTT WELD, FLUSH, COMPOSITE OF 3 LAYERS. FLAT, DOUBLE BEVEL.



two layers, overhead and flat, straight: The sketch shows the edge of two plates lapping each other with the welding material applied in not less than two layers at each edge, with a concave caulking finish, so applied, as to make the welded seams absolutely air, oil or water tight. The edges of the plates themselves are left in either a natural or sheared finish. Conditions of this kind will often occur around the balkhead door frames, where maximum stregnth is not absolutely essential.

Lap weld, reinforced, strength of three layers and tacking, 18″ center to center, 6″ long, vertical, straight: The illustration herein shown, is somewhat exaggerated as regards the bending of the plates but it is shown this way only to illustrate fully the tack and continuous weld. It shows the edges of the plate lapped with one edge welded with a continuous weld of a maximum of three layers with a reinforced finish thereby giving a maximum tensile strength to the weld, and the other edges of the plate, tack welded. The tacks are 6″ long with a space of 12″ betwen the welds or 18″ from center to center of the welds. In both cases, the edges of the plates

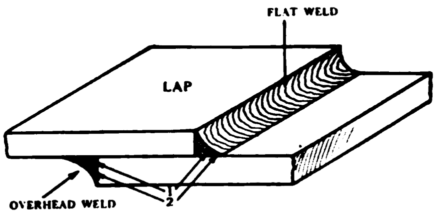
LAP WELD, REINFORCED, STRENGTH OF 3 LAYERS AND TACKING, 18″ CENTER TO CENTER, 6″ LONG, VERTICAL, STRAIGHT.



are left in a natural or sheared state.

Plug and lap weld, strength of three layers, flush, flat, overheat, horizontal: The sketch shows a condition exaggerated, which is apt to occur in side plating where the plates are held in position with bolts for the purpose of alignment before being welded. The edges are to be welded with a minimum of three layers of welding material for a strength weld and finished flush, and after the bolts are removed, the holes thus formed are to be filled with welding material in a manner prescribed for strength welding. The edges are to be left in a natural or sheared state, which is customary in most cases of lapped welding.

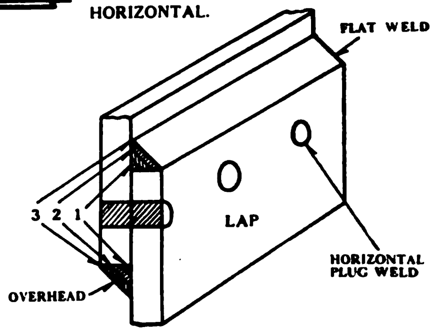
LAP WELD, CONCAVE, CAULKING OF 2 LAYERS, OVERHEAD AND FLAT. STRAIGHT.



Plug and fillet weld, reinforced, strength of three layers, flat, single bevel and straight. The adjoining sketch shows a pad eye attached to a plate by means of a fillet weld around the edge of of the fixture and further strengthened by means of plug welds in countersunk holes drilled in the fixture. The welding material is applied in a flat position for strength weld with a minimum of three layers and a reinforced finish. The edges of the hole are beveled to an angle, which is left to the judgment of the designer, but the edges of the fixture are left in a natural state. This method is used in fastening fixtures, clips or accessories that would be subjected to excessive strains or vibrations.

Fillet weld, reinforced, composite of three layers, flat, vertical and overhead, straight: This illustration shows a fixture attached to a plate with not less than three layers of welding material and with a reinforced finish. The fixture being placed vertically, necessitates a combination of flat, vertical and

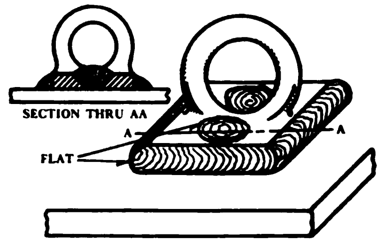
PLUG AND LAP WELD, STRENGTH OF 3 LAYERS FLUSH, FLAT, OVERHEAD, HORIZONTAL.



overhead welding in the course of its erection. Although a fixture of this kind should never be required to be water tight, the composite symbols is simply as a possibility of a combination.

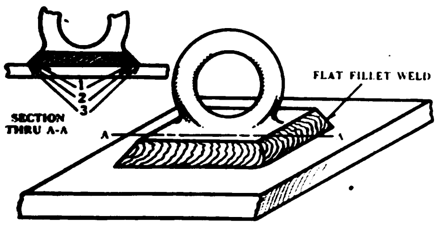
Tee weld, flush, strength of three layers, flat, single vee: The adjoining sketch illustrates the edge of a plate welded to the face of another plate as in the case of the bottom of a transversed bulkhead being welded against the deck plating. To obtain a maxi-

PLUG AND FILLET WELD, REINFORCED, STRENGTH OF 3 LAYERS, FLAT, SINGLE BEVEL AND STRAIGHT.



mum tensile strength at the joint, the edge of the plate is cut to a "single vee" and welded on both sides with a strength weld of not less than three layers, and finished flush. This should be a convenient way of fastening the intercostals to the keelsons. In this particular

FILLET WELD, FLUSH,
STRENGTH OF 3 LAYERS
FLAT, STRAIGHT.

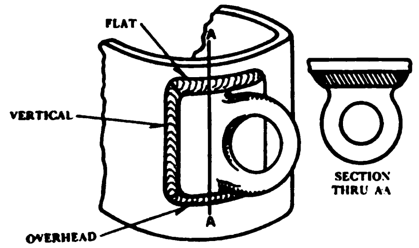


case the welding is done in a flat position.

Tee weld, reinforced, strength of three layers, vertical, single vee. This symbol shows another case of the tee weld with the seam setting in a vertical position, and the welding material applied from both sides of the work. The edge of the plate is finished with a "single vee" and a minimum of three layers of welding material applied from each side, finished with a convex surface, thereby making the sectional area, per square inch of the weld, greater than that of the plate, allowing for a maximum tensile strength in the weld.

Strap and tee weld, flat, reinforced, tack, 12″ center to center, 6″ long, single bevel, overhead, strength of three layers, flat: The illustration herein shown, represents an example of the possible combination of symbols. An angle

FILLET WELD, REINFORCED,
COMPOSITE OF 3 LAYERS,
FLAT, VERTICAL AND
OVERHEAD, STRAIGHT.

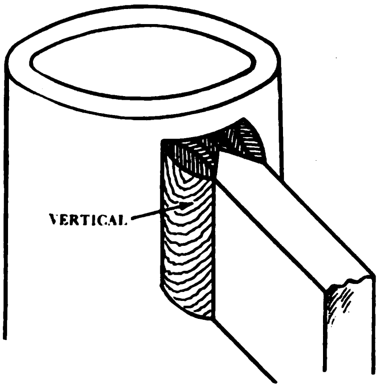


iron is tack weld to the plate in the form of a strap or stiffener, though in actual practice this might never occur. The tacks are spaced 12″ from center to center, and are 6″ long, and applied in a flat position, with a reinforced finish. As the strap prevents welding the plate from both sides, the edge of the plate is bevelled and the welding material applied for strength in not less than three layers in an overhead position and finished flush. Note that in specifying tack welds, it is essential to give the space from center to center of the weld, and the length of the weld by the use of figures representing inches placed either side of the circumscribing symbol of the combination.

RUBBING ROUGHSTUFF

As a rule the good roughstuff rubber does not get the credit which is his due. In the production of surpassing finish he plays a large part. Really high-class rubbers have a natural aptitude for the work. Supplement this with experience and you have the finished mechanic. One of the best roughstuffs and varnish rubbers the writer ever worked with was simply a specialist, having no knowl-

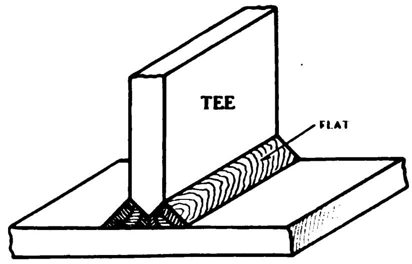
TEE WELD, REINFORCED,
STRENGTH OF 3 LAYERS,
VERTICAL, SINGLE VEE.



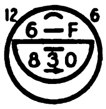
edge of the other branches of the trade. He came from the country, with the average countryman's enthusiasm for hard work, and the amount of roughstuff, or varnish, he could rub in a day, and the very fine surface he could develop, was a revelation.

The beginner, first of all, will find it necessary to choose and care for properly a good rubbing "kit"—pail, sponges, rubbing stones, etc. The sponges will need to be medium sized fleece wool sponges. These carry the maximum quantity of water and will on the whole last longer. A couple of good galvanized pails, 12-quart capacity, will be needed. A common hand saw, also a flat 1-inch mill file will be in order. The lava pumice stone is scarcely ever used now, the artificial rubbing stone, a composition product, made in various degrees of fineness, having succeeded it. These various qualities of fineness are suited to practically all grades of work. Carriage, wagon and automobile work rarely ever needs more than two kinds—medium fine and fine. Cut these, in size of block, to suit the size of surface. A big, thick, unwieldly block of stone requires extra effort to hold it firmly

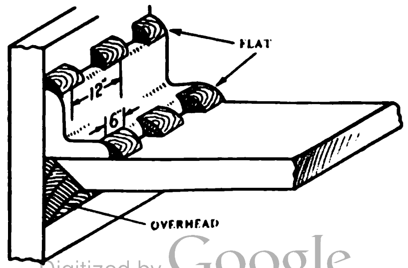
TEE WELD, FLUSH,
STRENGTH OF 3 LAYERS,
FLAT, SINGLE VEE.



to the surface without rolling and wobbling about, and even then it is likely to get away from the operator and scratch the surface. On account of its greater cutting surface, and the larger amount of work that can be done with it, the larger stone, up to a certain size, is the most economical, but the stone should under no circumstances be larger than can be conveniently handled. Provide a bench within reach of the rubbing position, and on this carry an assortment of various sizes and shapes of stone. Then on different shaped surfaces, odd corners, and around surface ornaments, use the stone shaped precisely for the work. A barrel two-thirds full of water had best be kept within reach. Rub around moldings, surface ornaments, and edge of panels first. The main surface is always the easiest to reach. Rub this main surface, as far as possible with straight arm movements out from the shoulder and return. Use plenty of water so that a good rubbing contact is always had, and to prevent gumming of the filler and gouging the surface. Working the head counts for as much as working the muscles in rubbing roughstuff.



STRAP AND TEE WELD,
FLAT, REINFORCED, TACK,
12″ CENTER TO CENTER,
6″ LONG, SINGLE BEVEL,
OVERHEAD, STRENGTH OF
3 LAYERS, FLUSH.



THE LOGICAL TRACTOR AGENT —THE BLACKSMITH

By Ed. Henry

SOME people would have us believe that there is quite a controversy raging regarding the exclusive motor car dealer and the implement dealer, as to who is or will be the most logical agent for the tractor. Some writers claiming the motor car dealer has already preempted one-half of the business in which the implement dealer was seemingly intrenched at the beginning. Recently at a convention of implement dealers regret was voiced that the impression had gotten abroad that there was such a quarrel between the two classes of dealers, the convention asserting there was no such harsh feeling.

Whether there is such harsh feeling or not, in deciding who is the most logical man to handle the tractor, the blacksmith seems to have been absent from their calculations; yet he is undoubtedly the best fitted to handle the tractor from more angles than one, as can be readily proven and as tractor manufacturers will in time find out. Selling tractors cannot be successfully confined to one year: it must be a growing business. It is not so much a matter of selling the first machine as it is a matter of keeping that machine in good running condition and ready to give a satisfactory working performance day in and day out. And who can be better fitted to do this than an energetic progressive blacksmith who naturally and thoroughly understands machinery of all sorts and the knoweldge required to keep it in running order? Your automobile dealer may be a better or more persuasive salesman, but he knows little of the farmer's working problems, which the blacksmith has intimate knowledge of because he has perhaps shod his horses or mules and helped keep his farm implements in repair for years.

He knows how much horse and man-power he employs or could employ profitably the year around, therefore, he is in position to help him select the size and type of tractor that will fit his needs and do his work satisfactorily and most economically. He is not likely to sell him a machine that is too small to do the work because the farmer thinks he can save by buying a lower-priced smaller machine. Knowing conditions the blacksmith would not do that, he'd rather lose the sale than sell the machine he knew could not do the work expected of it and hence could not give satisfaction. Though another man, less practical or well-informed, would close the sale and take his chances. Then perhaps, both he and the manufacturer would lose in the end through having a dissatisfied owner.

Nor would the average blacksmith be guilty of persuading him to buy a big expensive over-size machine simply to get the increased commission the sale of the larger and higher priced tractor would give him. He would know better than to unload such a white elephant onto any farmer, because familiar from past experience with his power needs, he knows such a machine would prove too cumbersome and expensive to operate hence even more unsatisfactory in the end than the too small size. One machine would be too small for the tasks expected of it but it would be easier and more economical to give it added help than to pay the constant expense an over-size machine would entail. Instead of reducing the farmer's power costs it would increase them. This naturally would be a constant source of irritation and dissatisfaction, no credit or help to the tractor's reputation nor to the agent's business.

On the other hand the average implement dealer knows farming conditions and problems pretty thoroughly, but as a rule he is not so familiar with this new iron gasoline-consuming horse and its problems. He is familiar with horse-drawn implements but does not always realize that these have to be converted or changed to meet the new requirements. A tireless inexhaustible horse that must have a full equipment of machinery to keep it busy is a new problem to him, though it may not be to the blacksmith who is familiar with all sorts of machine economy. Many blacksmiths are already implement dealers hence a tractor agency will fit in nicely with their other business.

As said before, selling the tractor itself is only the begining. It is the service given afterward that will make the agency a success or failure, and who can be better fitted to give really helpful first-class service than the average blacksmith and his shop?

The blacksmith's business for year has consisted principally of rendering service. During the rush of the busy planting or harvesting season he is called upon and has been frequently compelled to work almost day and night repairing and servicing tools and implements in order that his farmer patrons may be enabled to get their crops into the ground in due time and again to get them off at the proper time during the busy harvesting season.

He has learned the supreme value of prompt efficient service and is prepared and in position to give it. How often a customer has come to him with a broken or worn cultivator or implement part saying an immediate repair or replacement was necessary or he was likely to lose much of his prospective crop. Perhaps he had been to his implement dealer previously only to find that because of the increased and unforeseen demand for that part at that particular season of the year he had just given another customer the last he had in stock, nor can he give the farmer any assurance of how soon a new part can be obtained from the manufacturer. Perhaps the blacksmith handles the implement in question and is out of parts for the aforesaid reason. Under these circumstances, what does the average blacksmith do at the earnest solicitation of his customers? He goes immediately to work and either makes a new part or repairs the old, sending his customer rejoicing on his way, happy in the knowledge that he has been saved from a threatened loss. Would that be possible to the dealer in any other line unless he constantly employs a capable blacksmith?

It is practically the same with the tractor, to give satisfaction it must be kept running, performing the tasks imposed on it satisfactorily and economically. And few understand this better or are in a better position to give this service than blacksmiths. Should the tractor balk or break down during the busy season, the farmer demands that it be repaired or adjusted immediately for the same reason that he demands quick repairs of the implement maker.

Blacksmiths are prepared to do just that as they have all the farmer's other repair and service work of this kind. He is also, as a rule, located close at hand, easily reached because he is not in some distant city or town as is often the case with others.

Queries-Answers-Notes

THIS department is the meeting place where you are free to ask for information, answer questions, discuss shop matters and business conditions and any other notes you feel would be of interest to a fellow mechanic. Make use of this Department as often as desired.

Shoeing Foundered Horses:—Some of the questions of Mr. O. N. Benninger, concerning the shoeing of foundered horses, are very aptly answered by our Canadian contemporary.

"The causes for this trouble are commonly concussion, over-exertion, exhaustion, drinking cold water when the animal is heated, over-eating and improper feed.

In laminitis, the symptoms, if in both feet, are excessive lameness. The animal moves with great difficulty, especially when starting, and appears as if the entire body were in a state of cramp; he stands with the hind legs drawn under the belly and forefeet advanced, in order to relieve the painful feet of as much weight as possible. Occasionally he may be seen to sway backward, raising the toes and throwing the weight for a moment upon the heels of the front feet, and then resuming the original position. If compelled to move, he raises the feet laboriously, not because the muscles are sore, as is sometimes supposed, but because if all four feet are not on the ground at the same time to bear the weight of the body his suffering is increased. He will often groan with pain and the sweat will break out over the body. To diagnose a case quickly the best method is to push the horse backward, when, if affected, he will elevate the toes and throw his weight upon his heels.

In some instances the animal will lie down on his side with his legs stretched out, for hours at a time, evidently feeling great relief in this position; in other cases, particularly during the early period of the disease, he will stand persistently.

Treating the Disease

Remove the shoes from the affected feet, stand the horse in hot water for several hours each day, or what is equally good and perhaps safer, apply hot flaxseed poultices, changing them every hour as they become cold. After two or three days of this treatment, change to cold water, which can be applied either in the form of a foot bath or by standing the animal in a running stream for five or six hours at a time. As soon as the pain has diminished moderate exercise is beneficial. This may be gradually increased until the animal shows no further signs of trouble. If, after five or six days, pronounced symptoms of recovery are not evident, apply a stiff blister of cantharides around the coronet repeating the blister if necessary. In addition to the local treatment nitrate of potash (saltpetre)) in doses of 2 to 4 ounces may be given three times a day.

After treatment use a bar shoe, well rolled at the toe and with thin heels. Use no toe clips. Concave the upper web to remove sole pressure.

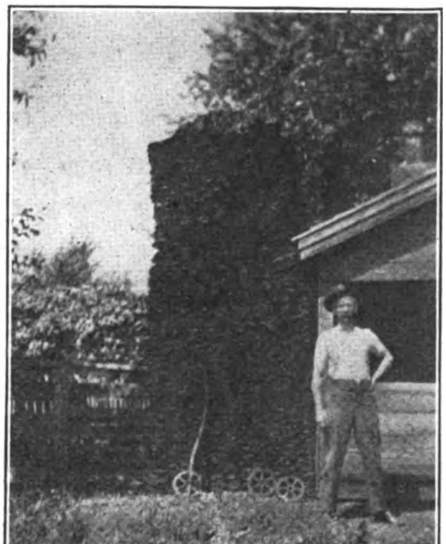
Chronic laminitis is permanent laminitis resulting from one or more attacks of the acute form of the disease. In the chronic form there is always inflammation, sometimes more, sometimes less, but never as severe as in the acute form. This varying inflammation affects the adjoining sensitive structures and interferes with their continuous regular secretions. The coronary band becomes affected and consequently the growth of horn is not steady. This is shown by the growth rings on the outer surface of the wall."

Which Would You Do?—Pardon the liberty I take in writing you. I am in the blacksmith business for myself and am thinking of building an addition to my shop to be used for a garage, as I have a splendid location for it. I have not had a great deal of experience in automobile work, and I am wondering whether I should go in partnership with a man, or hire him on a percentage basis. If you would give me some advice, I would certainly appreciate it very much. I am doing this on account of the lack of blacksmith work. Because the location is good. I feel that it would improve my business.

A. R., Wisconsin.

Editor's Note:—If you have a good location, we believe the idea of expanding your business to take in automobile work to be an excellent idea, and it certainly should increase your revenue. The automobile industry has grown to be the third largest in the Country, and, it is a fact not generally known, that the farmers own and operate more motor vehicles than all the industrial and commercial enterprises combined. The farmer is going to use more and more trucks and tractors to combat the shortage of help, and also to extend his scope of operation, by supplementing with the tractor, that work which has already been well done by the horse. Some would have us believe that the tractor is going to supplant the horse entirely; but since both have their advantages and disadvantages, this version seems lacking the happy medium of a working average. What we will have is a combination of both. So it would seem only logical to assume that the blacksmith and repair-man, particularly in the rural district, will profit from the resulting repair work, when he is properly equipped to handle it.

Some careful thought should be given to the selection of a partner, because it not only involves his mechanical ability, but is also a proposition in which your finances are vitally concerned. Remember in selecting a partner, that you can be held liable for his action in reference to your business, regardless of the fact, that they may have occurred without either your knowledge or consent. Unless you are well acquainted with the party, we believe it would better serve your interests to engage him either on a salary or on a commission basis. In that way you would preclude any possibility of laying yourself liable for any bill, contracts or other arrangements that he might contract for in the firm's name. Then too, if you found his service unsatisfactory, you could dispense with them without litigation.



14 TONS OF HORSESHOES

Mr Stewart of New Jersey has shod a few horses. If you don't believe it, look at the evidence in the picture. In his letter he says: "Here is a picture of myself and a 14 ton stack of old horseshoes which are but part of those that accumulated during the 39 years that I have spent behind the anvil."

NEBRASKA BLACKSMITHS TO MEET

The men who compose the Nebraska Blacksmiths, Horseshoers, and Wheelwrights Association will have their annual meet at York, Nebraska on Wednesday and Thursday, Oct. 20th and 21st. Items of interest will be debated, and this annual get-to-gether will be for the advancement of all. York is ready with a big welcome. Smiths of Nebraska remember the date and place—Oct. 20th and 21st at York.

Those County Officials:—I have delayed writing to you, because I have waited to see if any other blacksmith would answer the letter of C. C. Schmidt of Iowa, regarding his inquiry as to what constituted a profiteering charge. Now, I find that the letter has been so well answered that it seems useless, almost, to add anything to what has already been said. If he had asked how to do the work it, would have been an easy matter for the Editor to have answered him in the same issue, yet when it comes to inquiring about charging for the work, the blacksmith is at a loss to explain himself. I had an answer for Mr. Schmidt, but brother E. D. Pendleton of Ohio answered his letter so thoroughly, that I will make no further comment. I only hope that Mr. Schmidt will read those letters to that County Official so that he will see what other blacksmiths think about profiteering, as he charges. A County Official seldom if ever makes any complaint on bills for painting or carpenter work. They can charge any price, it would seem, and there will be no kick; but watch your step Mr. Blacksmith when you submit your bill. I have many experiences similar to those of Mr. Schmidt and know just what to expect. A dollar looks just as big to a customer in a blacksmith shop as it ever did. There has been comparatively little decrease in its purchasing power. The truth of the matter is that blacksmiths as a whole do not know how to profiteer. Their ignorance in that respect is to be regretted. The average smith knows how long it will take to do a certain job; but they do not seem to know what should be a fair charge for their work. They will stand on a street corner and tell just how much work they have done that particular day; but just ask them what they have actually cleared on their work, then you will have them up a tree. I have had blacksmiths tell me that they have cleared $60.00 in a day. They would let their customers in on the same information, which of course is a bad business policy. That seems like a big profit for a day's work, and it is to be sure. It is the exception rather than the rule. If they would have kept track of all their bad days, their overhead expenses and other items which reduce the net earning and taken a working average instead, they would have been astonished to find that in all probability they would have made only laborer's wages.

It is a strange thing to me to see blacksmiths working all their lives at a trade as old as this one is, and not one out of ten know how to set a price on their repair work. The automobile is educating the younger men how to charge for their work; but there seems to be no hope for the older blacksmiths. The old saying that you can't teach old dogs new tricks fits here very well indeed. I want to thank the Editor, for he is trying to help us old blacksmiths out of the rut. I hope that more blacksmiths will write to their trade paper so that we can keep posted on prices and general conditions.

A Reader from Ohio.

More on Removing Broken Cap Screws:—In a recent issue of the American Blacksmith, I read the inquiry of Mr. E. A. Neuman, who wishes to know the best means of removing broken cap screws. I have had quite a lot of experience with that line of work, and will gladly tell how I do it. First, I make an old fashioned diamond shaped drill, then file the cutting edge so that it will cut left handed. The shank is made so that it will fit a brace. Next, a hole is drilled in the center of the broken cap screw. The left hand diamond drill is placed in a good strong brace, then start drilling into the hole in a left hand direction. When the drill gets down where it can get a good hold, nine times out of ten, the cap screw will back out. However, if it is so tight that this method will not move it, then take a blow torch and heat the metal around the screw, being careful to keep the heat away from the screw. This will expand the metal sufficiently so that little difficulty will be experienced in getting the screw out.

Louis Keisser, Illinois.

Remagnetizing Ford Magnets:—I am going to ask for a little help. Can I charge the magnets of a Ford magneto with a 110 volt direct current without disassembling the magneto? If I can, I wish you would supply me with the details, telling me exactly what I need and how to use same. I am afraid to go ahead without the advise of older and wiser heads. Any advise that you give me will be appreciated, and if there is any charge for the service, I will most gladly pay it.

I. W. S., Kansas.

Editor's Note:—The usual method and probably the better method is to replace the magnets with new ones. The Ford Motor Company do not advise attempting to remagnetize these magnets, presumably because there is always a possibility of completely demagnetizing the magnets rather than magnetizing them, if the connections and the current is not properly used, or if the fly wheel is not stopped in exactly the right position. A 110 volt current may be used for the purpose, but it will be necessary to reduce the voltage to approximately 30 volt by the addition of the proper amount of resistance to the line. This may be accomplished in several different ways. A 3 ohms resistance coil cut in on the negative side of the line will reduce the current sufficiently. The coil may be made of 13 ft. of No. 16 nichrome wire, or 8 ft. of No. 18 may be used. If German silver wire is used 35 ft. of No. 16 or 22 ft. of No. 18 will produce the desired results.

Perhaps the safer way of getting the desired resistance would be to employ a bank of lamps, using 28, 32 C. P. carbon filament lamp connected in series multiple. 4 banks of 7 lamps each are formed by connecting these lamps in parallel. These 4 banks are then connected in series. This resistance is connected in on the negative side of the line and the line is then connected, or rather grounded to the frame of the car. The other side of the line, the positive side, is connected to the magneto terminal after all the other wires have been removed from it.

When the current is run through the field coil each one of the spools produce a magnetic field, alternately north and south around the entire coil. Now to magnetize a magnet, it is necessary to bring the north pole of the magnet into the opposite field, that is the south pole. Where the polarity is similar the magnet is demagnetized. Thus it becomes apparent that it is highly important that the fly wheel be stopped in exactly the right position. This is done with a limited degree of accuracy by placing a compass on the transmission cover about 1" from and to the left of the magneto terminal, then by turning the engine over slowly until the needle of the instrument is parallel with the engine, and the north pole end of the needle pointing at the engine when in this position. Connect the wire from the positive side of the line to the magneto terminal. Next, connect a wire from the negative side and make and break the circuit by touching the wire to some metal part of the engine or the frame. Permanent connections should not be made, but instead only 30 or so momentary contacts should be made, which, it is claimed, will charge the magnets more satisfactorily.

By connecting 5, 6 volt batteries in series a suitable current may be obtained. The manner of connecting them to the magneto is identical with the method already described.

It is important that the positive side of the line should be connected to the magneto terminal. If there is any doubt as to the polarity, it can be readily determined by submerging them in a salt water solution. It will be observed that the bubbles will form around the negative wire.

Limits, Tolerance and Allowance:—I have gotten into a discussion over the words "limits," "tolerance" and allowance" as regarding the specifications given on a drawing. I would be very much obliged to you if you would define these three words and tell me just how they are applied or what they mean in reference to a working drawing.

F. L. Carter.

Editor's Note:—There is a close relationship existing between the word "limit" and the word "tolerance" and also between these words and the word "allowance." For this reason they are often used incorrectly. "Limit" is the permissible variation over or under the size given by the specification of the drawing. For example, it is impossible so as to speak, to make shafts of exact 1". Therefore, it is the practice in modern machine manufacturing to establish a limit on such work—the over limit being known as the plus limit and the under limit as the minus limit. Occasionally there is only one limit permitted, the oversize, we will say. Usually, there is a limit established both below and above the stated size.

"Tolerance" is the total of the under and over limit Thus if we had a piece of work that had an over limit of .001" and an under limit of .0005" then the tolerance would be .0015".

"Allowance should be used in referring to the space between running parts provided to give a certain fit for lubrication. This difference between the shaft and the hole depends, of course, on the character of the parts and the work they have to perform. "Allowance" varies from "tolerance" because it takes into account the tolerance on the hole as well as on the shaft and these two tolerances usually offset each other to some extent. For example if there is a plus limit of .0005" and a minus limit of .001" on a shaft and the hole into which this shaft is to fit has a plus or minus limit of .001" it may happen in many cases that a shaft carries the full .0005" plus limit may be assembled to fit a hole that is carrying the full .001" limit, which will reduce the allowance to the minimum. This situation is provided for in designing the machine. "Clearance" and "working clearance" are used commonly in place of allowance. The three words—"limit", "tolerance" and "allowance" have their meaning fixed and should not be confused.

Drawing The Temper on Small Drills:—If some of the boys want to know how to draw the temper on small twist drill and taps, and to do it evenly without using expensive furnaces, tell them to try the bake-oven in the range. I get good result there. W. S. Hathway, Manitoba.

KEEP YOUR GOGGLES ON

In case of employee who was not wearing protective goggles provided by employer and who was working in direct disobedience to posted order requiring employees to use safety device, California Industrial Accident Commission has ruled that employee's action in neglecting to wear the goggles was an act of serious and wilful misconduct, and since employer had enforced rule by reprimanding employees for violation of it, it was not necessary that he discharge offenders in order to claim that the rule was enforced; compensation reduced one-half.

Preparing Fine Oil for Delicate Machinery—Put small zinc and lead shavings in equal quantities into best olive oil, and place the oil in a cool place until it becomes colorless. This oil is the best obtainable for fine mechanism.

AMERICAN BLACKSMITH AUTO & TRACTOR SHOP

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WILLIAM F. WENDT, *President*. L. J. WISCHERATH, *Editor*.

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CHANGE IN MOTOR CAR SALES SITUATION FOLLOWED BY RETURNING NORMAL DEMAND

WHAT has happened to the motor car business? And why did it happen?

These are questions that everyone connected with the industry is asking himself, with few being able to supply a satisfactory answer.

All that the average man is certain of is that business suddenly, and unaccountably, took a slump. The change was so abrupt, so unexpected, and so utterly without precedent, that it gave rise to all kinds of wild rumors as to why it happened, and as to exactly what was happening. Here are some facts that may clear up a lot of misunderstanding about the peculiar business situation which now exists.

Just a few weeks ago it was impossible to obtain delivery of a car. This period had continued for so long that buyers, in their anxiety to get some kind of a car, would frequently place orders with several dealers, then accept the first car delivered, and cancel all other orders.

Almost the same thing was true about prospects. A man would go into one sales room to inquire about delivery, and then pass on to the next one until he had frequently been listed as a live prospect by from six to ten dealers. Of course he could not be a live prospect for more than one. Consequently all the other dealers had a man listed as a prospect who was not a prospect at all. This, as one can easily see, created a false situation because it led dealers to believe there was many times the car demand, more than actually existed.

Of course the time arrived when these men who had cars on order, and these live prospects, were able to get some one make of car. Accordingly any number of dealers suddenly found that the orders on their books were being cancelled right and left, and that their prospect records had become worthless almost over night.

This, of course meant a decided temporary drop in sales, and business had to be allowed a chance to recover. No business can have all its orders cancelled practically at one time, and keep on making sales as if nothing had happened. But there is a normal, steady demand for motor cars almost equal to the production attained this year, and this demand is bound to resume. In fact, the slowly increasing number of orders received each day indicates that business is starting to "come back" right now.

Here is an easily understood comparison. Sugar is scarce. Suppose everyone in your block were to order five pounds of sugar, from the grocer in your block, for delivery next week. Then suppose all these people also ordered five pounds from the grocer in the next block just to make sure that they would be able to get one of the orders filled. Now you can see that one of these grocers was bound to be disappointed. They would both have gone ahead and ordered from their wholesaler the amount of sugar that the retail orders called for. But the next week, when deliveries were made, they would find that they only had actual sale for one-half of the orders that they had taken. This would mean that they could not order any more sugar from their wholesaler, until they had disposed of what they had on hand. So the wholesaler temporarily suffered. But after the grocery had disposed of its extra supply, then the sale of sugar would continue just as it always had.

That is the situation in the automobile business.

Don't let anybody mislead you with wild stories about the whole industry going to the dogs. That is simply nonsense.

There isn't any question that things will stabilize soon. There is always a normal state of business. Too great a business, or too small a business is abnormal, and it cannot continue very long, because a normal business is the natural state of things.

A FEW FACTS FOR "KNOCKERS"

Occasionally you will hear a chronic pessimist declare that this country is going to destruction, that we are on the verge of a panic, or a revolution or some other imagined catastrophe. In order to quiet such "calamity howlers" a dose of cold, hard facts is prescribed.

John Fletcher, Vice-President of the Fort Dearborn Bank, recently handed a few figures on panics to Chicago's big business men at the meeting of the Association of Commerce: "There are people foolish enough to talk about the possibilities of panic. With but 5 per cent. of the earth's population, we have 24 per cent. of its agricultural production, 40 per cent. of the mineral production, and we manufacture 35 per cent. of its goods. Our natural wealth is above $225,000,000,060 while that of our nearest competitor, England, is but $80,000,000,000. With this, it is impossible for things to go wrong. The real trouble in this country today is that there is a premium on idleness. Our trade balance today is $5,000,000,000. We have purchased our foreign placed securities to the value of about $8,000,000,000. We have loaned our allies $9,000,000,000 or $10,000,000,000. Half of the gold in the world is in the United States, and the deposits in the banks of this country are billions more than the total in all the other banks of the world."

NOVEMBER, 1920

SUMMARY

TESTING WELDS†

By S. W. Miller, M. E.*

THE question of testing welds is one that has been considered more or less since welding was known, but especially during the past five years. Its importance has now become very great. There have been many failures in the past, many of them not having been explained and some of them having

Fig. 1. Flaky gun steel. Films of oxide or slag, which weaken the metal, and prevent it passing test.

been very expensive. As in all other developments, welding first received its principal impetus from the practical man. Of late, however, the tendency has been to investigate more carefully and more fully and by means not available to the ordinary welder. This means that scientists of all kinds have been called into consultation and that almost every conceivable method of test has been suggested in order to determine what methods and materials would make the best welds both from a standpoint of security, service and cost. While some of the methods employed at present are beyond the reach of the ordinary welding shop yet they are of great value and, in fact, necessary in order to determine correctly what has occurred during the welding operation and what results may be expected under given conditions. Serious criticism of most of the published results can be made because of their incompleteness in one or more respects and one of the things that the American Welding Society proposes to do is to put the testing of welds and welded structures on a firm and safe foundation.

The testing of metals, aside from welds, is quite well developed both in theory and practice. The usual test is the tensile that gives the tensile strength per square inch, the yield point or elastic limit in pounds per square inch, the elongation in per cent of the original gauge

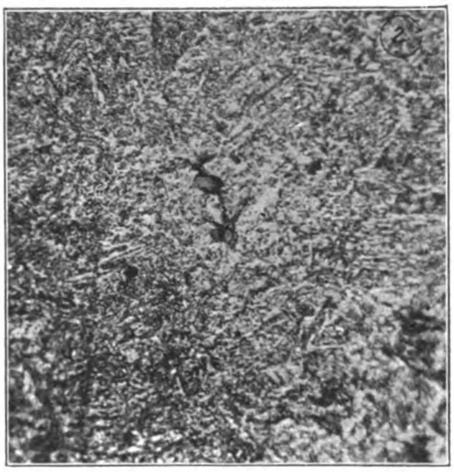


Fig. 2. Strained piece of gun steel showing rupture beginning at small defects, two small dots of manganese sulphide.

length and the reduction of area in per cent of the original section. Compression, torsion, shock and alternating stress tests are also used and the two latter are beginning to be used much more than they have in the past because it has been found that materials may give high results in the tensile test and yet be entirely unsuitable to resist service where shock or alternating stresses are met. Another of the common tests is bending to a certain radius either hot or cold and it has been found that it is a very valuable test of certain qualities.

Chemical analysis is another powerful method of investigation and many specifications have been made in which its use is vital.

The microscope has been found to be of tremendous help in the study of metals and in fact it is now a necessary instrument in all laboratories. Its principal function is to determine the extent and location of impurities in a metal, to decide whether the structure is proper for the purpose desired and to decide whether various heat treatments will give satisfactory results. While no one method of test shows everything desired to be known, the microscope is probably the most powerful single method of investigation in the case of metals, and in the study of welds it is particularly valuable because of the method of their formation. A weld is a casting and is subject to all the defects found in castings which are, however, exaggerated in the case of welds. It would be impossible in the time allowed to consider the defects in welds in all metals made by all welding processes and I, therefore, feel that it will be wise to confine my discussion to the welding of steel plates by the oxy-acetylene and metal electrode processes. Let us also consider that the welds we are to talk about are to be those in some important structure so that soundness and high quality are necessary. By soundness, I mean freedom from mechanical imperfections such as lack of fusion, the

Fig. 4. Armco iron strained. The curved lines are not cracks, but the edges of parts of the grains that have slipped past each other, so that the surface of each grain is stepped, as would be the top of a row of books that had slid past each other. In some grains there are two sets. They are called slip bands.

†A paper read before the September meeting of the Chicago Section of the American Welding Society.

**Mr. Miller is proprietor of the Rochester Welding Works, Rochester, N. Y., and is regarded as being one of America's foremost authorities on the subject of autogenous welding.*

Mr. Miller's paper serves to illustrate the splendid constructive work which is being done by the American Welding Society. The Chicago Section of the Society meets at 7:30 p. m. on the second Tuesday of each month, in the rooms of the Western Society of Engineers, Monadnock Bldg., Chicago. Visitors are welcome.

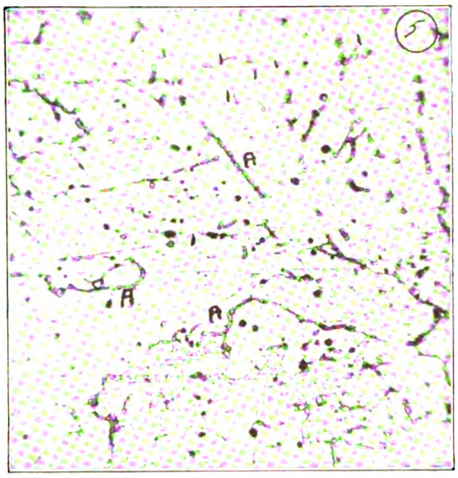


Fig. 5. A better oxy-acetylene weld than Fig. 6, but in the same material. Note the absence of iron nitride lines. The small dark dots are iron oxide, and they appear in all welds. The bands A at the grain boundaries are carbide of iron, or cementite, and contain all the carbon in the steel. There are more of them than in Fig. 6, showing more carbon present, and also that the metal was not as hot as in Fig. 6, because overheating burns out the carbon.

presence of films or other inclusions, gas pockets, slag, etc. It is not forgotten that welds of inferior quality may answer some purposes admirably and that if they do, there is no use in making better ones, but this is not the goal at which to aim for one who desires to make really good welds. The welding of steel is frequently considered as not being especially difficult, and it is also sometimes considered that steel is steel and that no different treatment is required in the case of different qualities and varieties of steel. This idea is much less common today than it was several years ago, but it is still too prevalent for the good of the art. It is not as well known as it should be that a comparatively small difference in the percentage of carbon in the material being welded makes a very great difference in the results of either a bend or tensile test. If the carbon is .12 per cent or less, the material is soft, ductile and yields readily to any strain that may be put on it. Such material is frequently used for tanks and because of its ductility and comparative freedom from damage by heating, is admirably suited for welding. Structural steel, bar steel and boiler plate contain about .15 per cent to .25 per cent carbon and have a tensile strength of about 60,000 lbs., while the soft low carbon material has only about 52,000 to 55,000. Ship plate is required to have a tensile strength of from 58,000 to 68,000 lbs. and in the heavier sections requires as high as .30 per cent carbon. It has been found by experience that the higher the carbon, the more difficult it is to get a satisfactory weld and the more danger there is of injuring the metal being welded. From a metallurgical point of view this is entirely natural and to be expected. It is also evident that a weld made with a given welding rod or electrode can have only a given strength. If this strength is greater than that of the material being welded, the test piece will always break outside of the weld. If, on the other hand, the weld is weaker than the material being welded, the rupture will always take place in the weld. An oxy-acetylene weld made with ordinary low carbon welding wire will have a tensile strength of about 52,000 lbs. This

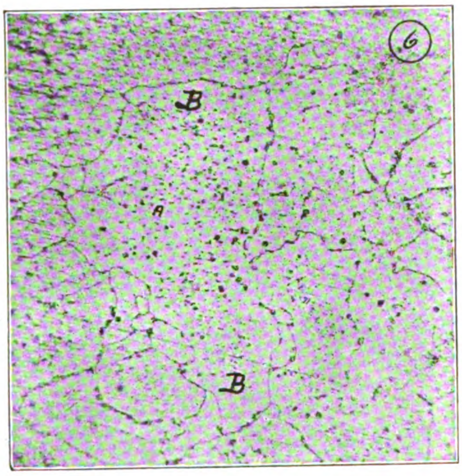


Fig. 6. A good looking oxy-acetylene weld, but made with too large a tip, as shown by the short straight lines in some of the grains, as above and below A, in the large grain B. These lines are iron nitride, and indicate absorption of both nitrogen and oxygen by the overheated metal.. The grain boundaries are the irregular curved lines.

is stronger than soft tank steel and weaker than the other materials mentioned. It is possible to get with alloy steel rods of proper composition, a tensile strength in an oxy-acetylene weld of about 50,000 lbs. Neither of these materials will weld boiler steel, boiler plate or ship plate, so that the rupture will occur outside the weld when the section of the weld is the same as the section of the piece, so that in making tests of welded pieces, it is necessary to know accurately the character of the material being welded, because if Welder Jones makes a weld in soft tank steel and Smith makes one in bar steel the first will break outside of the weld and the latter in the weld with a probable adverse criticism of Smith's work. The method of test to be applied in any given case depends largely on the use to which the welded piece is to be put. If it is to be used in a pressure vessel, I believe that not only should a tensile test be made but that an alternating stress test should be used because of the breathing of the tank due to changes of pressure. This latter test should also be applied where the welds is subjected to bending strain. There are no standards at present for weld tests but it is advisable, whenever possible, to follow those of the A. S. T. M. Inasmuch as a welded piece is not of uniform character, it is not possible to use the elongation and reduction of area as commonly measured. Where the break occurs in the weld, the elongation of the whole test piece tells very little about the quality of the weld and I have been in the habit of taking the elongation in each inch, two inches, etc., of the gauge length beginning at the center inch which includes the weld, and plotting these figures against the gauge length. Evidently, when the break is outside the weld, the various physical characteristics are those of the original material and not at all of the weld. The best test, in my opinion, to determine quickly the general character of a weld, is to grind it off level with the surface of the pieces and clamp it on an anvil; with the center of the weld level with the top of the anvil, the bottom of the V toward the anvil so that the top of the weld is stretched when the projecting end is struck with a sledge. The blow should not be too heavy and the number of blows and angle to which the piece bends before cracking are quite a good index of the value of the weld. It is true in this test, as in the tensile

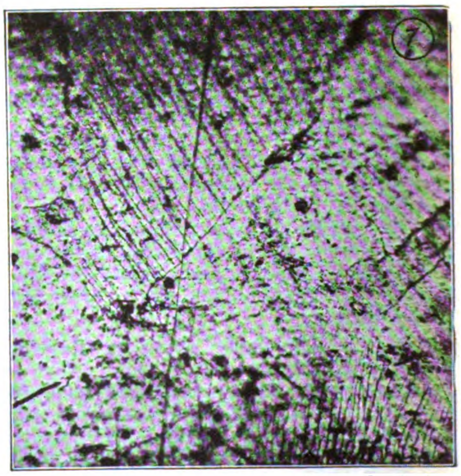


Fig. 7. Slip bands in good oxy-acetylene weld, stopping at grain boundaries.

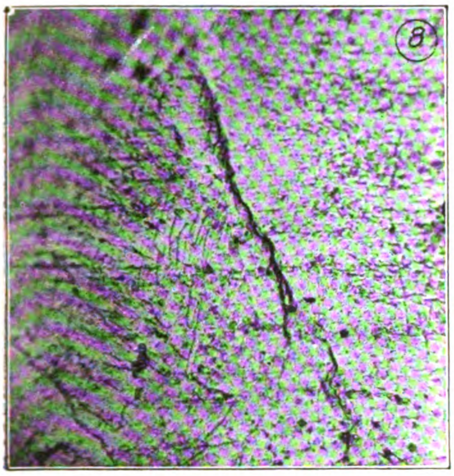


Fig. 8. Oxy-actylene weld showing heavy slipping at grain boundary. This is not a crack, but shows a weakness there.

tests, that the quality of the material being welded has a great influence on the results. Still material throwing more of the strain into the weld while soft ductile material will itself take considerable of the bend. In the case of defective welds, that is, those not fused along the V or which contain slag or other inclusions, this test will at once develop the defects. If a welded piece were to be used in a place where it might become red hot such as, for instance, in a locomotive fire box crown sheet, it would be entirely proper to test the weld at a good red heat and I believe that it would be of much interest to all of you, if you would test some of your welds by clamping them in a vise or on an anvil with the center of the weld about half an inch from the edge of the table or above the face of the anvil, heating them to a bright orange with the torch and then bending them as before with a sledge.

If such welds are made in half inch by two inch bar steel, a 90 degree single V being used, and they bend to a right angle without cracking on the outside, a welder may feel well satisfied with his work.

It is not my intention to tell you how to make good welds, but it may be well to state that there seems to be quite a definite relation between the thickness of metal, the size of tip and the size of the welding wire, in the case of gas welding, and between the thickness of metal, the diameter of the electrode, and the current used, in electric welding. It is also to be understood that electric welds, except possibly those made with covered electrodes, will not stand as much bending as oxy-acetylene welds.

In many cases, the defects in welds are easily visible to the naked eye when tested. In other cases, they are not, and while it would seem plausible that the visible ones are more dangerous, yet to my mind, the hidden danger due to the ones that are hard to see is a matter that must not be overlooked. For many years, the dangerous defects in steel rails have been those which were not visible, and which have usually been very small at the start. During the war, when the demand for gun steel was very heavy, flaky steel, so called, was the material that gave the Government the greatest cause for concern. In fact, those who are best posted on the metallurgy of steel are paying more and more atten-

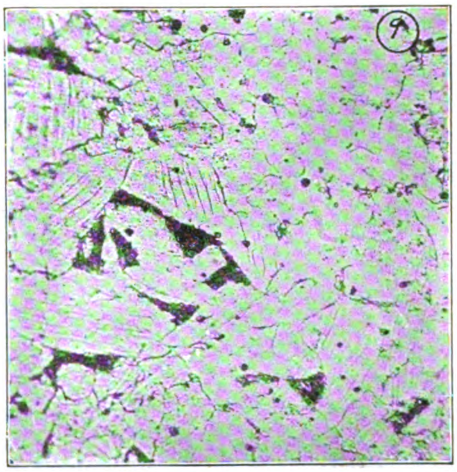


Fig. 9. Good oxy-acetylene weld made with rather high carbon steel, as shown by the pearlite grains A. Note presence of slip bands in all good welds, and their absence in bad ones.

tion to the minor defects, which heretofore have been considered but of little importance. This is equally true in a case of welds and in finding out what a welder can do, this is one of the things that should be examined most carefully. There has recently been developed a method for testing rails for these hidden defects which has been devised by Mr. A. M. Waring. It consists of deeply etching a polished surface of the material under test. For instance, a section of a weld might be cut out with a hack saw, machined or filed to a true surface, and polished on various grades of emery paper, ending up with 00 Manning. It is then placed in a warm solution of 25 per cent hydrochloric acid and water for from a half an hour to an hour. The acid will eat away the defects, making the edges of the material at them taper, so that rather large grooves and pits will be visible where the defects prior to the etching would be only microscopic. It is not really necessary to warm the acid altho it takes longer when it is cold. The bending test hot and cold, and the etching test, I consider to be of the greatest value in ordinary shop practice where it is desired to find out rapidly and quite accurately what the quality of work is being done by the different welders.

Some of the defects in welds are visible under the microscope but others are not visible until the weld is stained. A small bending machine that can be placed on the microscope stage is very useful, because after etching the piece can be bent and examined and see what the effect of the strain is. In the case of bare wire electric welds, the rupture, as far, as my experience goes, always occurs at the grain boundaries even where no defects are visible there with the highest powers of the microscope. Of course, where there are visible defects, the rupture takes place first at these. Where there are not defects, the distortion occurs by slipping in the grains as in normal steel. The causes of these defects are to my mind almost always oxides of one or another constituent of the metal, but usually of iron. There is no positive proof of this as yet but there are indirect proofs. An electric weld that will bend very little may be made much more ductile by heating in a reducing atmosphere at a low red heat for one or two hours indicating that the weakness at the grain boundaries has been removed. The reduc-

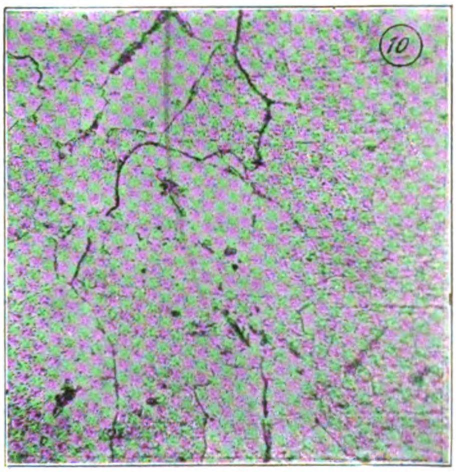


Fig. 10. Inter-granular cracks in strained oxy-acetylene weld.

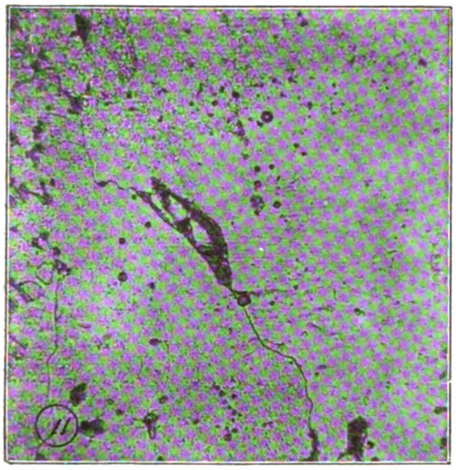


Fig. 11. Film of foreign matter, probably oxide, in oxy-acetylene weld.

ing atmosphere would seem to make it clear that the material at the grain boundaries was on oxide. Again, heating an electric weld in an oxidizing atmosphere makes it more brittle. The same treatment effects oxy-acetylene welds in the same way but in as much as they are normally not as brittle as electric welds, the improvement is not so noticeable.

These rough tests, while satisfactory for determining the general quality of the work, do not answer as a basis for design and more refined tests must be used as before referred to. I believe that the most important of these are the tensile and alternating stress tests. The tensile test can be made in any shop provided with the usual tensile testing machine. The alternating stress test is not as yet standardized even for unwelded material. I am inclined to believe that the machine devised by the Quasi-Arc Company is of considerable value although it does not give absolute results, that is, it does not give the amount of fibre stress to which the piece is subjected. During the war, the electric welding committee of the Emergency Fleet Corp. designed and built a machine for testing welds up to ¾-inch thick and 8-inch wide in which the fibre stress could be measured. The idea being to test large sections of welds. This machine has not yet been used. The ordinary machine for determining the resistance to alternating stress uses a rather small test piece about ⅜ by 2 inches in section which is vibrated back and forth at about a one-thousand alternations per minutes. Another machine that will give considerable information is that designed by Mr. F. M. Farmer of the Electrical Testing Laboratories in New York. The test piece is round and is rotated under load. In both these latter cases, the fibre stress can be accurately determined, and this being known, the number of alternations or revolutions is the measure of the resistance of the piece. The difficulty with these two methods of tests is that the pieces are very small so that a small defect may cause the piece to break long before a larger piece would, or before a full sized weld would show any evidence of strain.

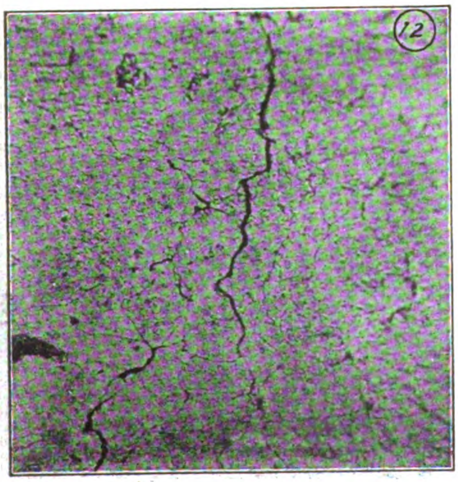


Fig. 12. Inter-granular cracks in strained oxy-acetylene weld. No defects visible before straining, showing that films were very thin.

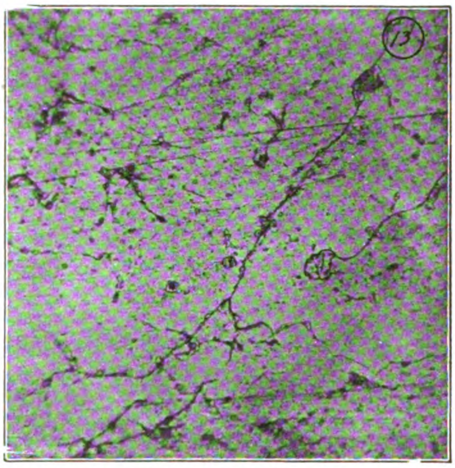


Fig. 13. Visible defects in oxy-acetylene weld before straining.

A great deal may be learned from the appearance of a weld. It is difficult to describe the appearance of good welds but after they have been seen a number of times, an inspector can readily say whether the operator knows what he is doing. In gas welding, I would not accept a ripple weld in heavy material nor one which was narrower than about 2½ times the thickness of the sheet, because I have never seen a weld having these appearances that was properly welded. The appearance of properly made electric welds has been described by Mr. Escholtz of the Westinghouse Company and has been published in several of the trade journals. The appearance in a gas weld of porosities on top, indicates that the metal has been overheated, and the same thing is true in an electric weld. Inasmuch as I believe that the serious defects in welds are caused by oxides, it would appear wise in the case of gas welding to use no larger tip than is necessary to produce thorough fusion. This means that the catalogue speeds of welding are impossible if good welds are desired. The same thing is true of electric welds. The reason is that at the high temperatures of the steel caused by too large a tip or too heavy a current, the metal becomes overheated, and in that condition combines more readily with the oxygen of the air or with any excess oxygen in the torch flame, and produces oxide which are

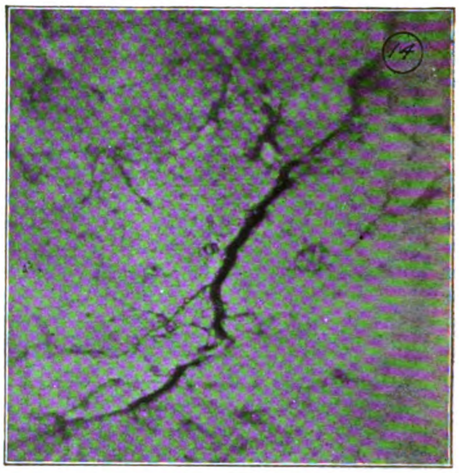
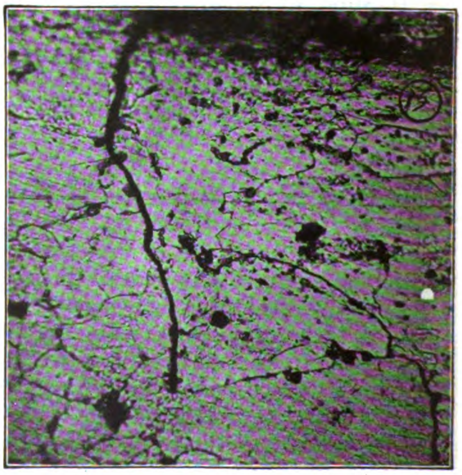


Fig. 14. The defects in an oxy-acetylene weld are more pronounced after straining.



Figs. 15 and 16. Are the same field, 16 being strained more than 15. Rupture is inter-granular. Note in 16 that upper part is lifted out of the lower.

readily dissolved by the melted metal. As the metal cools down, these oxides are rejected in large part and pass to the grain boundaries, as do other impurities, so that it is perfectly natural that material which has been seriously overheated should be more brittle and weaker than the material which has been properly melted. In conclusion, I have found in a number of cases that very great improvements in the quality of the work were made by using regularly the bending test above described and by carefully instructing the welders until they were able to make welds that would meet this test with unfailing regularity.

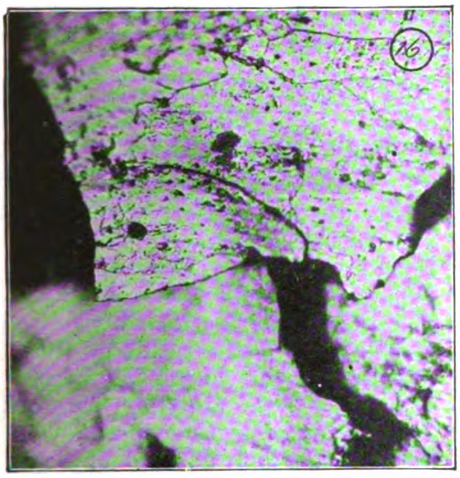


Figure 16

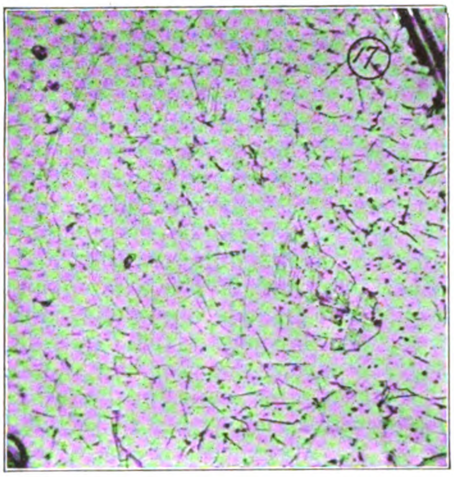


Fig. 17. Arc weld made probably with too long an arc, as there should not be so much iron nitride.

MAKING OUT THE ANNUAL FINANCIAL STATEMENT

By W. J. Bryan

NO man in business can afford to gauge his progress by guesswork. He must know accurately by actual figures the exact extent of his progress in dollars and cents at regular intervals. Unless he does this he has not a positive knowledge of the headway he is making and to attempt to guide a business in this hap-hazard manner is somewhat akin to attempting to guide a vessel without a compass. The Port of Success may eventually be reached but the chances are much against it. Even if it is reached, the journey will be a much longer and more difficult one than if the man at the helm was operating with that valuable accurate knowledge that he should have in his possession.

Every dealer should make out a financial statement at least once a year. No matter how large or small the business may be the same rule holds good. It is not essential that such a statement be for the calendar year. Some time between the opening of the year and the advent of the spring rush is an excellent time, but the important fact is to take it at the same time each year so that the resulting statement will be for approximately twelve months, so that comparisons from year to year may be made. This is one of the chief values of the financial statement. It allows the dealer to ascertain in actual money the extent of his progress, so that if it is not satisfactory an examination into the reason may be made. If such a statement is not available the dealer may go on unconscious of the fact that he is not making the money that he should. Sales cannot be taken as an accurate gauge of progress, especially in recent years when high prices have worked for larger sales but in many cases smaller profits. A good many dealers are inclined to think that as long as they are able to meet their obligations and have a little money in the bank that everything is alright. To have more money in the bank today than a year ago is no assurance that you have made money during the past year. It may be accounted for by reduced stock or in some other way. The only way is to make out a statement of assets and liabilities and compare the balance with that of a year ago.

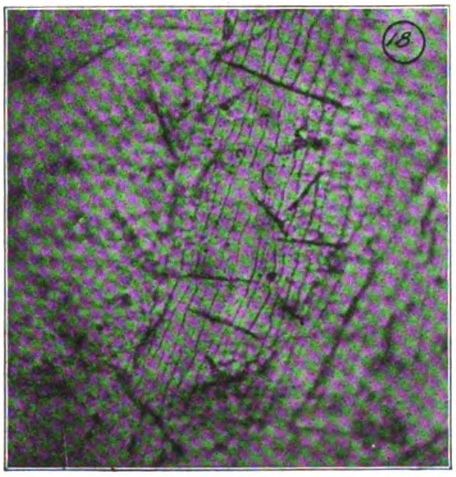


Fig. 18. Slip bands in arc weld. The heavier straight lines are iron nitride. These weaken the weld little, if any, because the slip bands usually stop at them, as at grain boundaries.

The biggest task in connection with the annual statement is that of taking stock. At least it is with the majority of dealers. It means an accurate listing of all stock on hand with every precaution taken to have it correct. The general rule is to price goods at the cost to replace them at the time of inventory. In most businesses there is bound to be a certain amount of stock that for some reason or other is not saleable at regular selling prices or which has deteriorated. One of the problems is to decide on a proper price to list such goods at. It is best to place it low enough. I always prefer to err on the safe side. Placing goods in the inventory at inflated prices is like going on a spree. It makes you feel alright at the time but there is the corresponding reaction "the morning after."

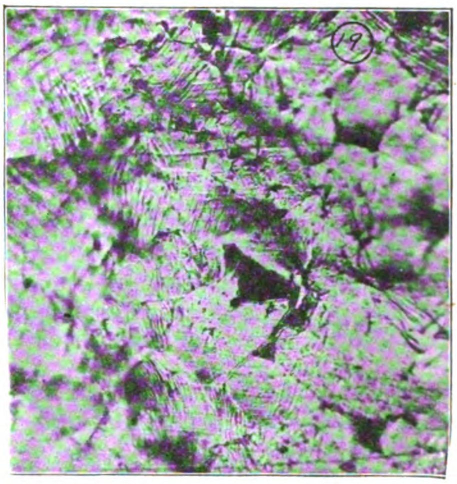


Fig. 19. Good part of arc weld heated red hot and slowly cooled. Distortion is by slipping as in normal steel. Large dark spot in center is iron nitride.

Loose leaf inventory sheets are available that help a good deal in stock taking. They can be bound together later. Some dealers take stock at both cost and selling figures. This is rather a good plan as from the resulting totals a pretty fair idea of the average profits in your business can be ascertained.

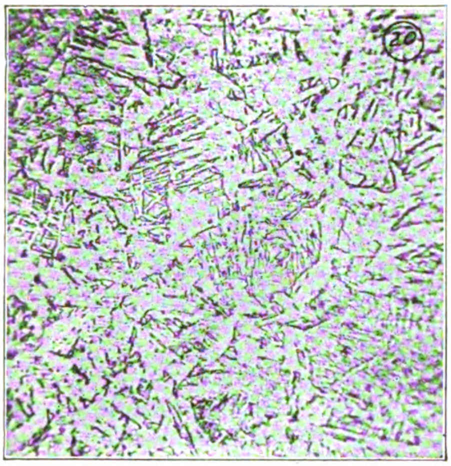


Fig. 20. Metallic arc weld heated red hot and quenched. No appearance of defects.

In order to make out a financial statement other particulars are required to be taken at the same time as stock is listed. These include book accounts, fixtures and equipment, cash on hand and in bank, notes receivable and payable as well as the amount due by the dealer for goods. Book accounts should be put in at their actual collectable value. Different methods are used in listing fixtures and equipment. Some dealers deduct a certain percentage of the cost each year for deterioration in equipment. The percentage of reduction is based on the life of the fixture or piece of

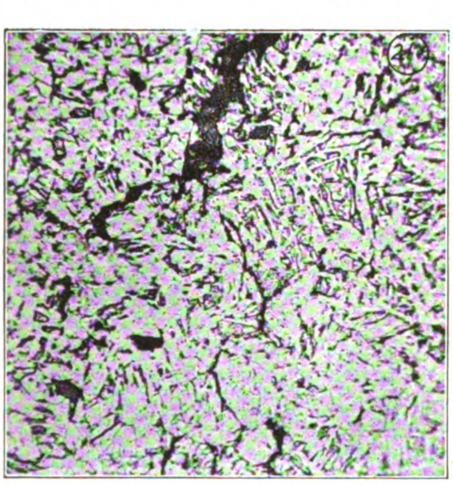


Fig. 21. Same weld as No. 20. There was no defect visible before strain. Ruptures are inter-granular.

equipment. For instance if the article has an estimated life of ten years, ten percent should be taken off each year. All dealers do not favor this plan, some arguing that a piece of equipment may be worth as much today as when purchased and that the dealer should use his own judgment in setting the price in the inventory. I would like to present my old suggestion again, however, that it is always best to err on the safe side.

With all the above information at hand the dealer is ready to prepare his actual financial statement. The resources will include amount of stock on hand, accounts on the books, fixtures and equipment, cash on hand and bills receivable. On the other side will be the amount due on stock, bills payable and other liabilities of the firm. This would also include any money put into the business from outside sources during the year.

If the dealer owns the building he occupies and wishes to include it in the statement, if there has been any advance in the value of

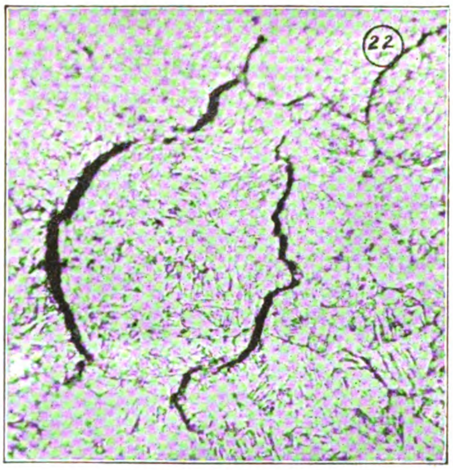


Fig. 22. Another view in weld No. 20. Ruptures are partly at a globule, the unbroken oxide film showing at the bottom, and partly where no defects showed.
where no defects showed.

the building during the year, the amount of the advance should be deducted from the net profits of the year, to show the exact amount of money made by the business itself. The advance in the building should have nothing whatever to do with the profits of the business. If, however, any improvements have been made in the building during the year, and the cost has been borne by the business, it is then only right that the advance in value as a result should be included in the net profits.

Let it be borne in mind that the majority of real successful business men make a practice of making out a financial statement each and every year. It is not meant to imply that the making out of a financial statement will make a dealer successful, but it has a tendency in that direction because it shows him that important thing—how much money he is actually making—or how much he is not making.

Sample Financial Statement—Illustrating article on "Making out the annual financial statement."

For Year Ending Dec. 1, 1920

Resources	
Amt. of Stock on Hand	$3000
Accounts on Books	1200
Fixtures and Equipment	1000
Cash in Bank	400
Cash on Hand	100
Notes—Bills Receivable	300
	$6000
Liabilities	
Amt. due on Stock	$1500
Drafts Signed—Not Due	500
Resources over Liabilities	4000
	$6000
Resources over Liabilities—This Year	$4000
Resources over Liabilities—Last Year	1900
Net Profit for Year	$2100

WHEN THE SPINLE BOLT THREADS ARE WORN

The repair-man often discovers in rebushing the spindle bolts on a Ford car, that the threads in the axle are entirely worn out, and that the hole is considerably out of round. This is the result of allowing the lock nut on the spindle bolt to become loose, and then running the car for some time in that condition. The bolt instead of being stationary moves around and consequently destroys the threads. Before installing the new bolt something has to be done with these threads. A simple but effective repair is to remove the axle, heat the threaded portion to a red heat, and then hammer the material together so that there will be sufficient stock to recut the threads. A ½" S. A. E. tap is then run through the hole, and the repair is complete.

E. B. Drury.

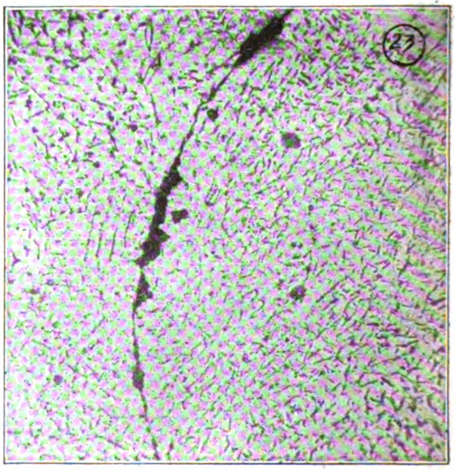


Fig. 23. Large defects in arc weld. Dark streak is oxide of iron.

PLYWOOD AND ITS USE IN AUTOMOBILE CONSTRCTION

It was not until the close of the war that the extent to which plywood was used in automobile construction was greatly increased, as there was always the danger of the separation of the glued plies when exposed to rain.

However, owing to the requirements of areoplanes these glues were perfected, and were able to stand eight hours of boiling or 10 days soaking in water without separation of the plies. With the disappearance of the objection to plywood, the demand for plywood roofs increased, and many makers use them exclusively in their closed cars. The reason it has not as yet been used for bodies is that it cannot be bent in double curvature, and the weight of the plywood wheel has prevented its use in this direction.

As regards plywood when compared with ordinary board wood as a non-homogeneous material; in all standard plywood construction, the grain of one ply crosses that of the adjacent plies at right angles, and consequently a marked increase in strength across the grain of a board is obtained. As regards its ability to withstand vibration, tests have been made and have shown that it could withstand vibration severe enough to cause weakening of the wood, and no parting in the glue joint was visible. In addition to strength, however, an automobile material must resist impact. Mark Meredith

REPAIRING BREAKS IN BABBITT

It often is desirable to join two pieces of babbitt together, especially in case of an other wise good bearing which has broken down the center, as they often do.

To join such pieces together is very easy, if you know how, so I will try to explain. I hardly think illustrations are necessary.

All that is needed is a good soldering outfit, a well tinned copper of rather large size, any good soldering acid or preparation that will work well on iron or steel, and some scraps of the same grade of babbitt as the parts to be joined.

To proceed, next place the parts together in their natural position, that is, the way they should be when finished, place under the break a properly shaped piece of wood with a layer of paper between it and the babbitt to keep the metal from dropping through, then apply some acid to the break and use the copper well heated to puddle the broken edges together, using the extra metal at hand to fill in and build up in a similar way as aluminum is worked in welding with the torch. When the one side is well built up turn over and treat same way from other side, and be sure the metal is worked and fused together clean through, and leave some surplus metal to be dressed off with a file and then scrape.

In working low grade babbitt it may be necessary to retin the copper often as such babbitt absorb the tin rather quickly. Parts repaired in this way will be as sound and as serviceable as though they had never been broken. Flaws or blow holes in bearings can be filled up in the same manner.

Otto A. Wagner.

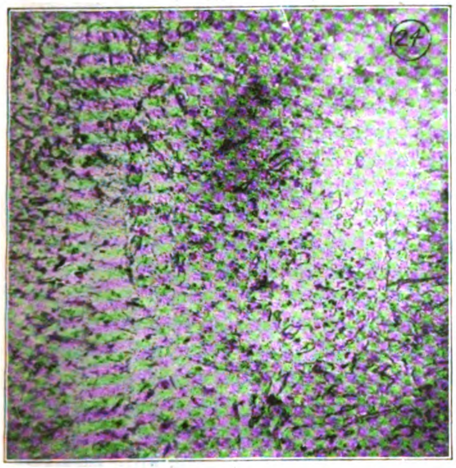


Figure 24
Fig. 24. Globule in arc weld about 1/300" diameter, surrounded by film of oxide about 1/800" thick. This is a weak spot in the weld, and such spots give first under strain.

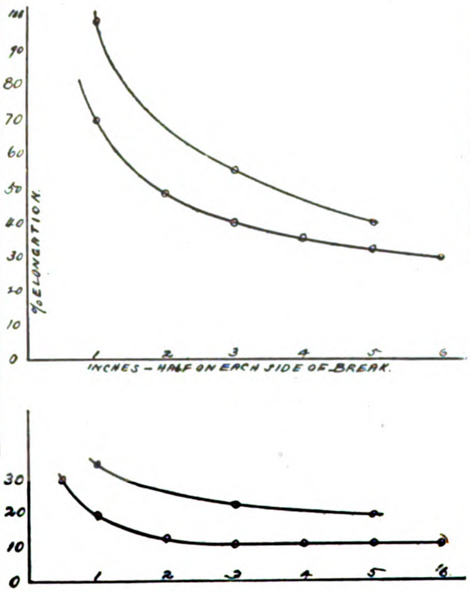


Figure 25
Fig. 25. The upper curves show the difference in elongations of two pieces of steel of the same tensile strength. The upper curve shows the more ductile piece. The lower curves show the elongations measured the same way, of welded test pieces of the same materials, the upper curve being in the more ductile material. So it is necessary to know all about the materials being welded before comparisons of welds can be fairly made.

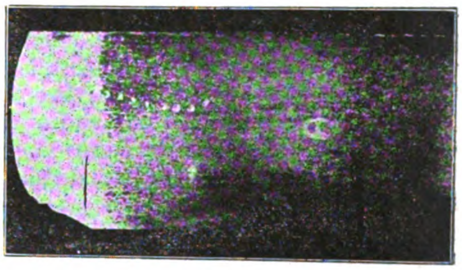


Figure 26a
Fig. 26A. Oxy-acetylene weld in .50 C shell steel made with Roebling o-a wire.
Fig. 26B. Oxy-acetylene weld in shell steel made with shell steel.
Fig. 27C. Arc weld in shell steel made with Roebling electric wire.
Fig. 26, A, B, and C. In all cases the black line shows the original surface, and the white parts contain very little carbon. The heat effect extends to D in each case. The decarbonization of the original material and the change in structure, even if the weld were sound, would be a defect in some cases. Note that even where .50 C steel is used for welding, there is not much carbon left in the weld. Also that the loss of carbon is greater with arc welding than with oxy-acetylene.

Figure 26b

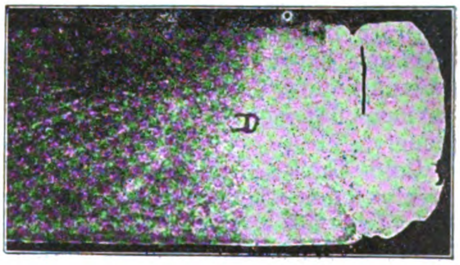
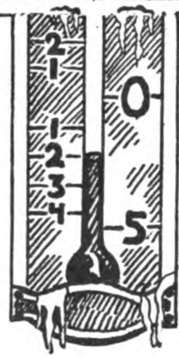


Figure 26c

Granted the horse affords one a much more poetic means of transportation than the automobile, still it is hard to realize it while swatting the flies from your neighbor's stable.

The United States with one-sixteenth of the world's population has five times as many motor vehicles as all the rest of the world.



BY N. WARD GUTHRIE

WITH the end of summer, autumn brings about a new set of conditions which demand special attention in the care of the automobile, truck and tractor. The special attention which these conditions demand during the months of cold weather is often overlooked or neglected. The only one detail that is regarded with any particular importance is filling the radiator with an anti-freezing solution. Ordinarily, the rest is trusted to luck.

The first difficulty which is experienced during the cold weather is that the oil and grease has a tendency to congeal, thus impairing the efficiency of the lubricating system, and in some instances actually clogging it. It is even more important to change the oil frequently during this period than it is during the summer, because the presence of water in the oil is particularly dangerous at this time. The water may lodge, either in the oil lines, or in the pump, freezing there and consequently entirely blocking the flow of oil. Perhaps, before it has had an opportunity of thawing out, some serious damage may have been done.

Cold thick oil does not flow freely and, therefore, does not lubricate the parts as thoroughly as in warmer weather. For that reason, that motor should not be raced as soon as it is started, after having stood in the cold for some time. The oil has congealed, particularly if it is of an inferior quality. If the motor is raced before the oil starts circulating properly excessive wear on some of the parts may result.

Much damage is done to automobile engines, as well as all other internal combustion engines, which are operated in the cold at this time of year. Because there is a decided tendency for this piston to seize in the cylinders. This is because in cold weather cylinders and wall jackets are slow in warming, while the rings and pistons get hot and expand with the first few explosions. Therefore, if the engine is run at a high rate of speed before the whole engine is warm, damage is apt to result, especially with comparatively new motors, where the clearance between the pistons and the cylinder walls is at the minimum. This condition is further aggravated by the fact that the oil has congealed and is slow in flowing properly. There is nothing to be gained by allowing the engine to race, while on the other hand there are some grave possibilities attached to the practice. There is no harm in allowing it to run at a moderate rate of speed, until it is warm, in fact, it is advisable to do so. Some drivers explain the reason for allowing the motor to race because they are afraid it will stop. If the choker is left pulled part way out for the first few minutes that the motor is run no difficulty from stopping will be experienced.

The proper oiling and care of the motor or tractor is even more essential at this time than during the summer, because of the added difficulty with which the lubricant flows. After a summer of strenuous driving, people are apt to grow lax in the care of their car. Their explanation is that they are soon going to lay the car up for the winter, or else have it overhauled. This attitude often means hard wear on the car, and bill which could have been prevented had they been more considerate.

In cold weather gasoline does not vaporize as readily as it does in warm weather, with the result that starting difficulties are more frequent. With the present grade of fuel, which is about as volatile as liquid glue and as flammable as hard coal, it is not to be wondered at that these troubles are experienced. Using the starter to spin a cold stiff motor for a minute or two until it starts, is very hard on the entire starting system particularly the battery. Where trouble is experienced in starting the motor on cold mornings, the motor should be primed. If the motor is not equipped with priming cocks, time in removing the spark plugs can be saved by spraying some gas into the intake manifold. Ether mixed with gasoline increases its flammability and makes an excellent mixture for priming, as it ignites much easier than the plain gasoline.

In extremely cold weather, or when low grade fuels are used, the motor often refuses to run until it is hot. In such cases acetylene may be used if available. A rubber tube connected to the gas cylinder, while the other end is inserted in the air intake of the carburetor, will usually do the trick, if the gas isn't turned on to far. In cases where the motor refuses to run after the introduction of acetylene gas, the spark plugs should be examined, as this gas has a decided tendency to short circuit them.

Perhaps it is the starting system that suffers the most during the cold weather. This is because considerably more current is used in starting, the lights are burned for longer periods, the runs are shorter, and the car is operated at a much lower rate of speed. Thus the battery doesn't have a chance to recuperate. The excessive current used in starting a cold stiff motor in some cases causes trouble, as drivers are prone to close the starting switch and hold it until the motor starts. Violent discharging long kept up, heats the battery, and if indulged in repeatedly is very apt to buckle the plates.

Another way to commit the sin of excessive discharging is to pretend that your gasoline car is an electric and run it on the starter instead of with the engine. Remember that the penalty of these abuses is shortened battery life.

Do not connect additional apparatus to the electrical system, particularly during the winter months. Such equipment as cigar lighters and warming pads put an added burden on an already overtaxed system. The surplus capacity of the system is large, but there is a limit to the amount of current which the generator can produce, especially under the adverse conditions enumerated. The same judgment and reason should be used in the operation of the lights on the car, as one uses in lighting his house or garage. When the car is running it is not necessary to burn all of the lights. The head and tail lights are all that are necessary, and when standing the side and tail lights will suffice.

Another danger in allowing a battery to discharge itself in cold weather is that it is apt to freeze. A frozen battery, as a rule, means a ruined battery, because freezing will seriously damage the battery vitals. You are familiar with the fact that water freezes at 32° F. The nearer a battery is to a discharged condition, the lower the gravity becomes, and the nearer the electrotrolyte approaches to becoming pure water, and the higher the freezing point. On the other hand, to freeze a fully charged battery requires a temperature at least 40° below zero Fahrenheit. If the electrical system is keeping the battery well charged, there is little likelihood of freezing in every day service. When the gravity gets as low as 1.150, the battery can hardly be counted on to maintain the lights and operate the starter. Good lights, then, indicate gravity of 1.150 or higher. Electrolyte of a gravity as low as 1.150 freezes at 10° F.

An idle battery slow self-discharges and the need of prevention of freezing is one reason for the insistence that to insure the longest battery life, you must charge at least one a month, particularly during the cold weather. When you store your battery for the winter, you can prevent freezing by keeping it where it will not be subjected to such extreme temperatures, but you must provide for the monthly charge to keep the plates in a healthy condition.

The care of the radiator through the cold weather is most important, as it is one of the most important parts as concerns the longevity of the engine. As the temperature of the combustion runs between 2,000 and 3,000 degrees F. and the greater portion of this heat is carried away through the cooling system, it is important that this system should be kept in good condition. There are more cases of over-heated motors in cold weather than at any other time. At first thought one would naturally think that the reverse of this condition existed, but it doesn't. Radiators frequently become frozen at the bottom, thus preventing circulation, and causing the motor to overheat before the obstruction is thawed out. Another common cause is the failure of drivers to raise the radiator cover, and to continue driving long after steam can be observed coming from the radiator. The other extreme is to allow to much of the radiator to be exposed, thereby lowering the operating temperature. It should be borne in mind that most efficient results are obtained when the motor is operated with a water temperature of around 170° degrees F.

WHO'S OUR FRIEND?
THERE'S A FREE SUBSCRIPTION FOR THE MAN WHO KNOWS

HE SENT US HIS PHOTO—BUT NO NAME

The circulating system should be filled with an anti-freezing solution as soon as the cold weather sets in. It is not safe to rely on draining the radiator when returning from a drive and filling it again when starting out. In extremely cold weather or when driving against a strong wind, the water may freeze even after circulation starts. Furthermore, where the tubular type of radiator is used, if one or more of the tubes have become clogged with dirt, the water will not drain out. Freezing generally results in a leaky radiator or cracked water jacket, necessitating costly repairs.

The ideal anti-freezing compound is, first, one that will prevent freezing of the radiator liquid without either injuring the engine or the radiator, second, that will not lose its non-freezing properties after continued use, and, third, that does not materially change the boiling point of the water when dissolved in it.

Kerosene has a lower freezing point and a higher boiling point than water, but the flammability of its vapor makes it dangerous to use, and its high and uncertain boiling point might lead to the serious overheating of the engine, or even to the melting of the solder in the radiator. It has marked solvent action on the rubber parts. These facts clearly indicate that kerosene should not be used as a non-freezing solution.

Most of the anti-freezing solutions sold under various trade names have a calcium chloride base. The calcium chloride exert a greater corrosive action than water on the water jacket of the engine and on the solder of the radiator. Tests have shown that calcium chloride solutions will completely remove solder from copper and brass. Since these are the materials used extensively in the construction of the radiators, the use of this solution is bound to have a most deleterious effect. Another troublesome effect from calcium chloride solutions is experienced if small leakes occur in the radiator, and the solution comes in contact with the spark plug and ignition wires, as short circuits are most liable to result. Calcium chloride compounds should be used with caution, if at all, on account of their corrosive action.

The alcohol solutions do not exert a greater corrosive action than water alone. Solutions made from either wood or denatured alcohol seem to be the most desirable anti-freezing solution to use. The table below shows the approximate temperatures at which the different alcohol solution freeze.

20% solution freezes at 15° above zero.

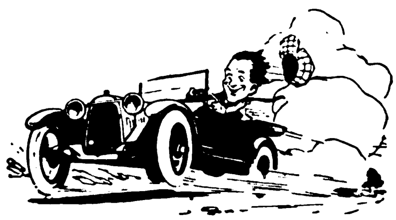
30% solution freezes at 8° below zero.

50% solution freezes at 15° below zero.

A solution composed of 60% water, 10% glycerine and 30%

(*Continued on Page* 47)

High Spots



The Essence of Tact—Following inspection the commanding officer of a negro regiment was making a speech to his men in which he warned them that, while courtesy is necessary at times, one should always use tact in one's relations with other people.

Talking together afterward, two of the colored soldiers were discussing the difference between courtesy and tact.

"Well," said one, "Ah can't 'splain the difference but Ah knows. Fo de wah Ah was a plumber and one day a lady calls me on de plone and sez, 'Hurry right down heah, the baft-tub done sprung a leak,' and down Ah rushes. Ah bust right in the front do' and up the back stairs into the baftroom. And, boy! there was a lady in the tub! And Ah jest speaks right up, sez Ah, 'Good mawnin,' SIR!" Now that there 'good mawnin'' was courtesy, but the 'sir' was tact."—Everybody's Magazine.

Triumphant Neutrality—Three Kentuckians were killed in a fight over a dog. The dog is alive because he ran away and hid. All of which proves that brains will triumph in the end.—Johnston Democrat.

What's the Hurry?—"My dear, I dreamed I saw a man running away with you last night."

"And what did you do? The usual stupid thing, I suppose?"

"No, I merely asked him why he was running!"—Cartoons Magazine.

Prejudiced—Y. M. C. A. Man (overseas) "Now, if you don't study French in a class, you'll speak the language the way a New York Dago speaks English. You don't want to do that, do you,"

Hardened Doughboy: "That's the way a foreign language ought to be spoke!" —Stanford Chaparral.

The Rural Correspondence School—Jed Hicksleigh—"Postmaster, he's the smartest feller hereabout—speaks six languages."

Travelling Salesman—"Learned them in college, I presume."

Jed Hicksleigh—"No, he jes' kinda got onta 'em readin' postal cards."—New York World.

The Popular Installment Plan—The congregation of a Southern church, being desirous of honoring their pastor, wrote to the dean of a certain faculty: "We want to get our beloved pastor a D. D. We enclose all the money we can raise at present. Be good enough to send one D. now. We hope to raise sufficient for the other D. by and by."—Toronto Globe.

Three little girls received each a silver spoon as a gift, and they were bragging about them.

"Mine," said one of them, "says 'From Papa' on it."

"That's nothing," said the second. "Mine says 'From your loving Papa'."

"Mine," said the third, with a superior air, "says 'Hotel Washington'."—Ladies Home Journal.

His Viewpoint—An American paterfamilias patiently followed for several weeks a wife and daughter who were more keen than he was about visiting Roman ruins. At last he rebelled and laid down this rule—

"I'll go with you to see any buildings that still have roofs on 'em, but as to the rest, I say, let bygones be bygones." —Windsor Magazine.

At a dinner in New York, James Montgomery Flagg, the clever artist, told this story to illustrate the influence of the artistic atmosphere:

"You can't escape the artistic atmosphere. Even my cook cannot escape it. She came into the studio today, and said: "About the potatoes for lunch, sir—will you have them in their jockets or in the nood?"—Truth Seeker.

A small boy came hurriedly down the street, and halted breathlessly in front of a stranger going in the same direction.

"Have you lost half a crown?" he asked with his hand in his pocket.

"Y-es, yes, I believe I have!" said the stranger, feeling in his pockets. "Have you found one?"

"Oh, no," said the small boy. "I just want to see how many have been lost to-day. Yours makes fifty-four."—London Tit-Bits.

Muleology—On mules we find two legs behind
And two we find before;
We stand behind before we find
What the two behind be for!
—Lafayette Lyre.

Father's Forte — Teacher: "Why are you late?"

Pupil: "Mother heard that a man had been arrested for stealing hens and beating two policemen, and she sent me to see whether it was father."—Klods Hans, Copenhagen.

Adding to the Prophets—"Who are those birds over there?" yelled the movie director.

"The twelve apostles," answered the camera man.

"Well, we ought to have at least eighteen."—The Siren.

Letting It Ride—Irish porter (who had been shifted from Killaloo to Ballyhooly): "Killaloo! Killaloo! Killaloo!"

Station master:—"This isn't Killoloo!" —it's Ballhooly."

Porter: "Well, phwat does it matter anyhow? Nobody's getting out."—London Opinion.

A Dark Thought—
Didje ever stop to think that the
White the bride always wear at a wedding,
Is supposed to be a symbol of joy?
Then please explain why the groom
Is always dressed in Black?
—Cornell Widow.

A Tactful Reproof—Mrs. Smythe de Willoughby: "Was the grocer's boy impudent again this morning, Clara, when you telephoned the order?"

Clara: "'E was, mum! But I didn't 'arf give 'im wot for. I sez, 'Who d'yer blinkin' well think you're a-talkin' to? I'm Mrs. Smythe der Willoughby'!"—Punch.

An Unpopular Part—A four-year-old Vancouver boy overheard his mother talking with an aunt about her family of three young sons.

"What a pity," exclaimed the aunt, "that one of them couldn't have been a girl!"

Every hair on the child's tow head rose in horrified resentment. With his feet wide apart and his face red he confronted the two women.

"Yes," he shrilled, "and who would 'a' been 'er? I wouldn't 'a' been 'er. Jack wouldn't 'a' been 'er. Harry wouldn't 'a' been 'er."—Saturday Evening Post.

Not Chivalry, but Caution—Entering the crowded street car the stout woman tried vainly to get her fare out of her pocket, which she had tightly buttoned as a precaution against pickpockets. For several moments she worked at the buttons, and then the man next to her said: "Allow me to pay your fare, madam."

"No, thank you," was the reply; and once more she began at the buttons on the pocket.

After a while the male passenger once more asked: "Won't you allow me to pay your fare, madam?"

"Certainly not," was the acrid reply. "I have my fare if I can get at it."

"I only suggested it, madam," was the quiet reply, "because you have already unbuttoned my suspenders three times." —The London Royal.

EXPERT AT IT

"Private Johnson!" yelled the top kick on the returning transport as he discovered the recalcitrant lying on his bunk during the fire drill. "Didn't you hear me yell 'Everybody inside, out?"

"Yeah," groaned Private Johnson, from the depth of gloom, "but what difference does that make to me? I've been that way since the boat started."—American Legion Weekly.

ONE WORRY REMOVED

"Well, my dear, I've just had my life insured for five thousand dollars."

"Oh, how sweet of you? Now I sha'n't have to keep telling you to be careful every place you go."—The American Legion Weekly.

IT WORKED

A defendant in a case before a county court judge, when an adjournment took place, suggested that it would be a wise thing for him to present the judge, who was a sportsman, with a brace of wild duck. His solicitor replied with indignation that such a thing would absolutely ruin his chance of success. When the case ultimately came to be heard the judge manifested the utmost animosity against the plaintiff and dismissed his claim with ignominy. On coming out of court the defendant said triumphantly to his solicitor, "Them ducks I sent the judge did the business after all." "You don't mean," shouted the solicitor, "that after what I told you, you actually sent the ducks to the judge." "Oh, faith, I sent them all right," said the client, "but after what you told me, I sent them in the other fellow's name."—Nineteenth Century Review.

His honor (gazing at the prisoner)—What is he charged with?

Officer (newly appointed)—Oi don't know, yer honor, but I think it's whiskey.—Judge.

Mother—Johnny, if you eat any more, you'll burst.

Johnny—Well, pass the cake, mother, and get out of the way.—Judge.

Benton's Recipes

Etching Fluid for Steel—Nitric acid, 60 parts, water, 120 parts; alcohol, 200 parts, and copper nitrate, 8 parts. Keep in a bottle having glass stopper. To use the fluid, cover the surface to be marked with a thin even coat of wax and mark the lines with a machinist's scriber. Wrap a bit of clean waste around the end of the scriber or a stick, and dipping same in the fluid, apply it to the marked surface. In a few minutes the wax may be scraped off, when fine lines will appear where the scriber marked the wax. The drippings from a lighted wax candle can be used for the coating, and this may be evenly spread with a knife heated in the candle flame.

Etching Names on Bottles—First cover with a thin coat of wax, and then cut or scrape away the lettering, leaving the glass bare in these parts. Hydrofluoric acid is then applied, and this etches or the part of the glass bottle to be etched eats into the exposed glass, but not into the parts protected by the wax. The acid is dangerous stuff to handle, causing bad burns and sores where it touches the skin. Another plan is to use the following solutions mixed in equal proportions. The lettering can be written directly on the glass, which should be perfectly dry and clean) with a rubber point or even a quill pen: (1) Sodium fluoride 35 gr., potassium sulphate 7 gr., and distilled water 1 oz., (2) Zinc chloride 15 gr., hydrochloric acid 65 minims, and distilled water 1 oz. Only sufficient should be mixed for immediate use.

Paint Remover—To a bucketful of freshly-slaked limewash add 2 or 3 lb. of common washing soda and a pennyworth of rock ammonia. Apply liberally with a fibre brush, not a bristle one. For carved portions make the solution thicker by adding more lime, or sawdust. Wipe off the paint as it softens, and when removed (after several applications, if necessary) rinse off with plenty of clean water. If stain is to be applied, first brush over with common vinegar. For antique furniture perhaps the following would be more suitable: Make an emulsion of two parts of ammonia and one pare of turpentine, well shaken together. This preparation softens the paint very speedily, so that it can quickly be rubbed off. Old paint may be removed by wetting it with naphtha. If one application is not enough, repeat 'till the paint is disolved. Keep the naphtha from a naked light.

Belt Dressing—The following mixture answers the purpose of a good belt dressing as well as an excellent anti-slip medium for hard-working leather driving belts: Russian tallow, 1 ounce; best lard oil, 2 ounces; Venice turpentine, 16 ounce. This dressing is good to use on the belts of belt-driven motor cycles.

Cement for Steam-Pipe Joint—A good cement for use in making steam-pipe joints is made in the following manner. Grind and wash in clean cold water 15 parts of chalk and 50 parts of graphite. Mix the two together thoroughly and allow to dry. When dry regrind to a fine powder, to which add 20 parts of ground litharge and mix to a stiff paste with 15 parts of boiled linseed oil. The preparation may be set aside for future use, as it will remain plastic for a long time if placed in a cool place. It is applied to the joint packing as any ordinary cement and will be found to last a very long time.

Rust Joint—Mix 10 parts of iron filings 3 parts chloride of lime with enough water to make a paste. Apply this mixture to the joint, bolt firmly together and in twelve hours it will be set so that the iron will break sooner than the cement.

Cleaning the Polished Parts of Machinery—Stains of every description, such as may result from dried oil, etc., may be easily and effectively removed by the application of alcohol.

Thread Cleaner for Chucks and Face-plates—The practice of cleaning out the threads on chuck and other faceplates every time they are screwed on the spindle is very necessary to maintain the accuracy of the chuck and should therefore not be neglected, especially by apprentices. The only instrument necessary is a piece of 3-16-inch drill rod bent into the shape of a safety pin and having its two ends bent.

Cement for Steam and Water Pipes—A good cement for joints on steam or water pipes is made as follows: 10 pounds fine yellow ochre; 4 pounds ground litharge; 4 pounds paris white (whiting), and ½ pound of hemp cut up fine. Mix together thoroughly with linseed oil to about the consistency of putty.

Paste Metal Polish—A paste metal polish that is good for any smooth surface, whether hot or cold, can be obtained from the following ingredients, which will make about 20 pounds of the polish: 2 ounces of spermaceti, 4 ounces of cake tallow, 10 star candles, 2½ pints of raw linseed oil, 2½ pints of kerosene, and 5 pounds of tripoli powder. Procure a crock that will hold 3 or 4 gallons. Put in the tallow, spermaceti and candles, and melt over a slow fire. Then add the linseed oil and kerosene, and stir well. While this mixture is still warm, remove from the fire, and add the tripoli powder very slowly while constantly stirring the mixture. When all the powder has been added, allow to cool. To use, apply with a soft cloth, and after drying, remove the remnant and rub the surface with a piece of soft flannel.

To Fasten Rubber to Wood—Make a cement by macerating virgin gum rubber, or as pure rubber as can be had, cut in small pieces, in just enough naphtha or gasoline to cover it. Let it stand in a very tightly corked or sealed jar for fourteen days, or a sufficient time to become dissolved, shaking the mixture daily.

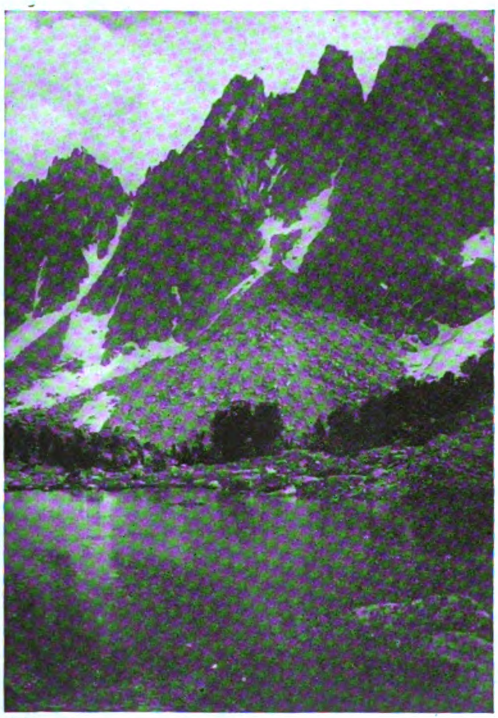
Another cement is made by dissolving pulverized gum shellac, 1 ounce, in 9½ ounces of strong ammonia. This of course must be kept tightly corked. It will not be as elastic as the first preparation.

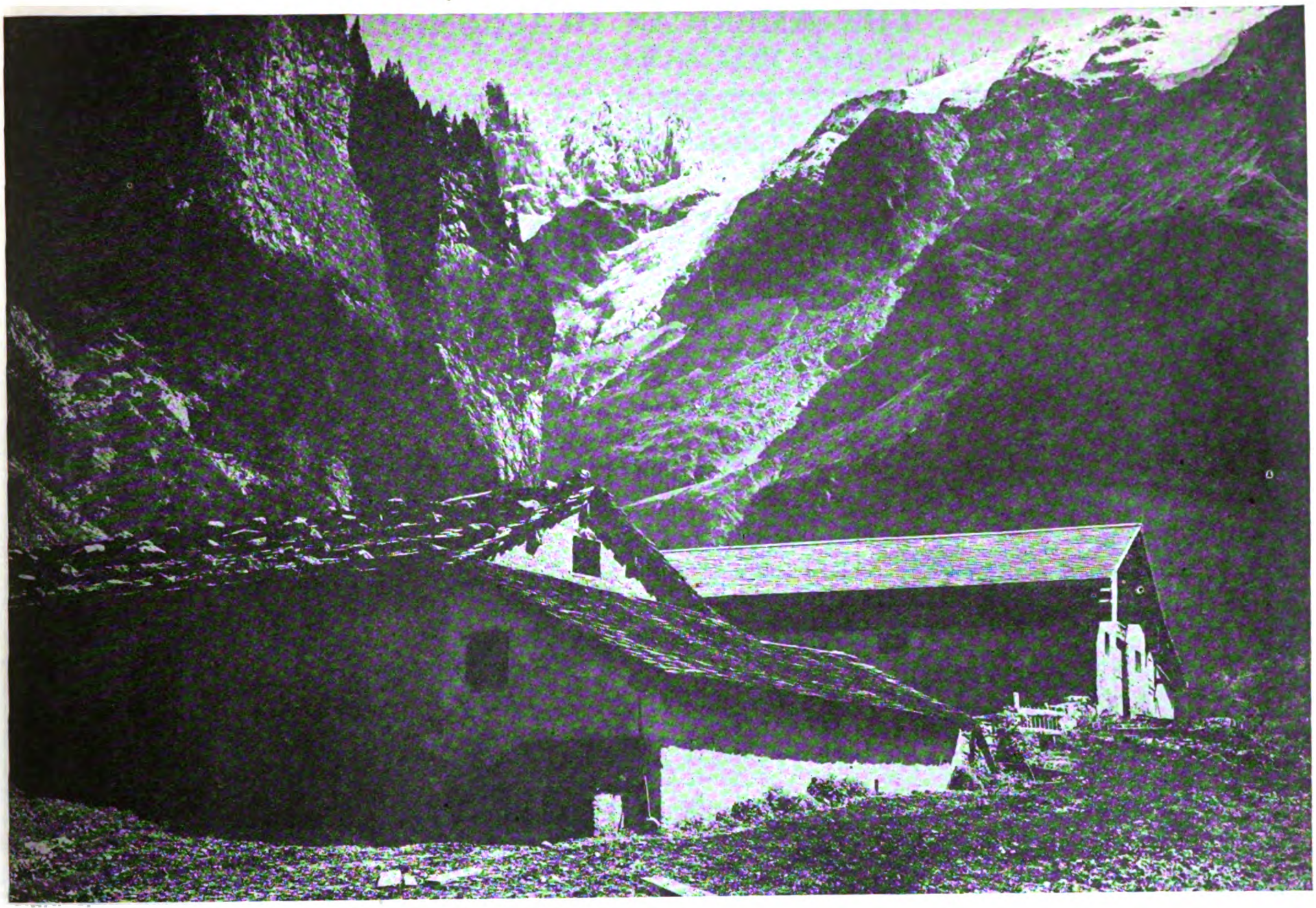
To Prepare Tripoli or Emery Cake—Tripoli, emery cake and crocus are all made in practically the same manner, the change being made in the composition being more greasy. Melt tallow and paraffine wax or beeswax together. Beeswax is by far the best, but the cost of the same has led to the use of paraffine which in many cases will work equally as well. After the tallow and wax are thoroughly melted, add tripoli or emery, whichever is to be made, a little at a time and stir in well, until it is as thick as is possible to make it; then pour out into a large tin, or better still into the moulds made for the purpose, and allow to cool.

ANTI-SKID CHAINS FOR THE HORSES TOO

THE HORSES AID SOCIETY OF NEW YORK JUDGES THE MERITS OF NON-SLIPPING ATTACHMENTS FOR HORSES. THE PHOTO SHOWS ONE OF THE TYPES OF NON-SKID CHAIN SUBMITTED BY A CONNECTICUT INVENTOR

Scenes in





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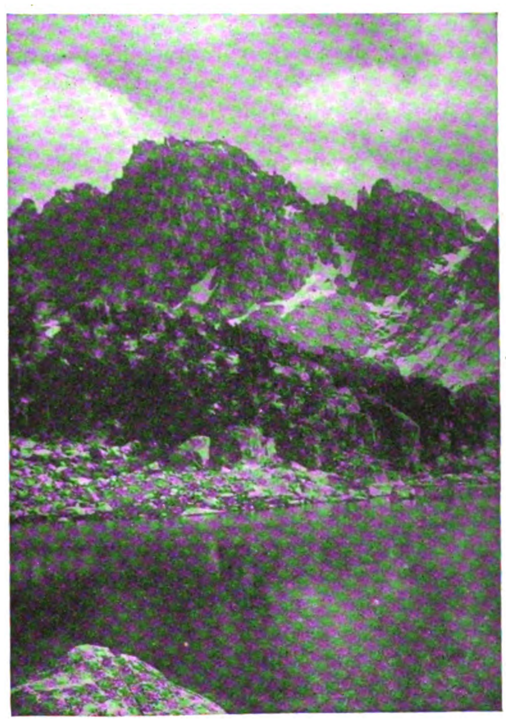
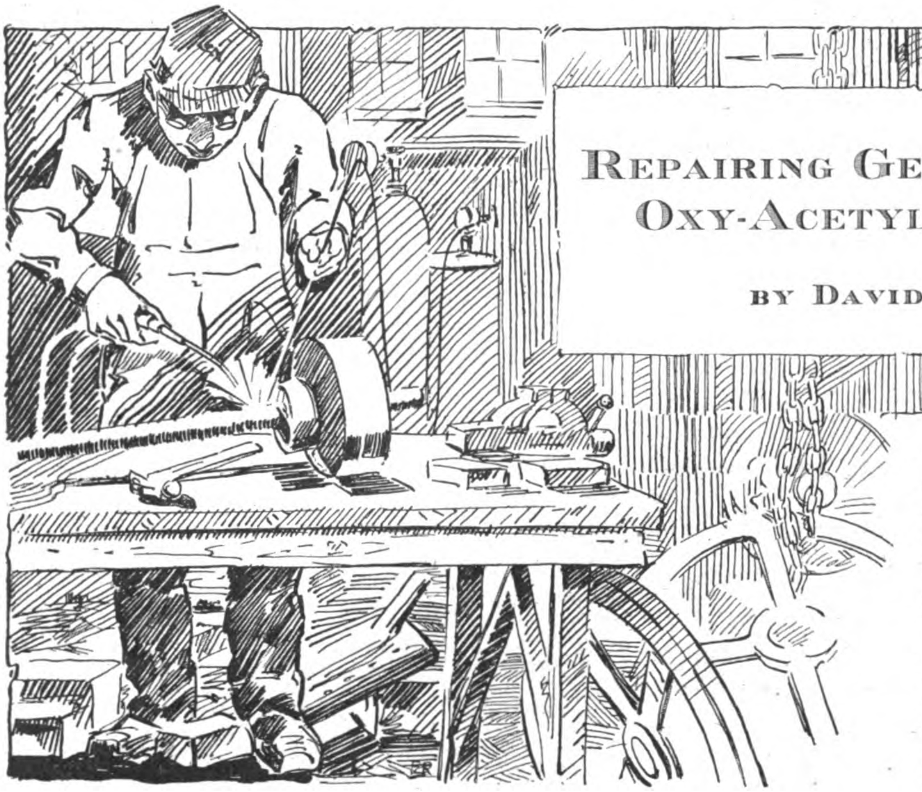


Repairing Gears with the Oxy-Acetylene Flame

By David Baxter



THE blacksmith who is not equipped to do oxy-acetylene welding in connection with his other repair work is undoubtedly missing a lot of nice profits. Not only because he is unprepared to do the welding; but because there are many repairs that can be satisfactorily made only with the torch. The torch method is the only way in which many things can be mended, and if the smithing shop equipment does not include a welding outfit, these jobs must all be passed up. Some of them may be big jobs, involving considerable profit, and requiring skilled experience together with special apparatus and high power torches. But the usual run of work, the kind wherein the steady substantial profit lies, may be handled by the average mechanic, who understands the fundamentals of welding, and is provided with a fair size outfit.

It is not essential that the smithy should know a great deal about welding in order to be able to do a lot of the smaller classes of work. Of course, the more he knows, and the more experience he has had, the better it will be. If he knows how to regulate and operate the torch and possesses a fair understanding of the actions and reactions of metal when heat is applied; the principles of expansion and contraction, there is no reason why he should turn away these nice profits. A fair size oxy-acetylene welding outfit usually brings a lot or other work besides the mere welding of broken articles.

Among the many small jobs that will come to the torch-welding blacksmith is the building up of worn teeth and the repairing of broken teeth on gears, especially cast iron gears. Before the advent of the welding torch, some blacksmiths made a sort of makeshift repair on broken gear teeth by doweling new ones in place, but when it came to mending a gear with a third or more of the teeth mashed, they simply gave it up as an impossible job; the cost of doweling on a full set of new teeth would have been several times that of a whole new gear. Now, however, one or a dozen mashed teeth may be built up quickly and easily with a fair cost to the customer and a reasonable profit to the welder.

There are numerous kinds and types of gears, and the damage to be repaired on them is just as varied. So much so that it is quite out of the question to attempt to tell how to repair them all. In fact, it is impracticable to try to tell how to weld more than one class of gears in one article because of a lack of space, and because too many descriptions would cause confusion.

Therefore, I have chosen a small cast iron gear with several broken teeth as an example to illustrate one method of welding broken teeth. This, together with a detailed description of another method of repairing the same gear should prove interesting and beneficial to welders in general, and to beginners in particular, in as much as it shows what may be done in the repairing of other gears. The method illustrated here is what may be termed welding the teeth "en bloc"; welding several teeth in one mass. The other method consists of building up the teeth separately, or one at a time. The first is probably the easier to actually place and fuse the metals, since it does not require as much skill; while the second method requires a steady hand to manipulate the flame and filler rod, as well as a clear understanding of the action of melted metal under the pressure of the welding flame. In the mass method, the welder must be more careful about producing a solid weld since a spongy or porous spot may ruin the whole thing when the new teeth are cut or filed out. In the single tooth method the welder can build up each tooth so near the correct size but very little grinding or filing is needed; if the operator is clever, he may utilize the pressure of the welding flame to blow or brush the molten metal into almost any desired shape. In fact, he may give the new teeth almost their original shape with the flame pressure. But there is also danger of porous spots in the single tooth method, if the flame and filler are not handled right; however, there is less danger and more opportunity to tell just when the porous spots start to form.

In both methods, the welder must endeavor to keep the metal soft, else the new teeth cannot be filed to exact shape. However, if the shop is equipped with the proper grinding facilities the hard teeth may be ground smooth providing they are not too small. And if the shop possesses a milling machine the teeth may be milled out of the block. But many shops are not so fully equipped so it is probably better to depend more upon hand methods; several of which will be described as we go along.

I have discussed both methods of gear teeth welding to some length mainly for the purpose of allowing each individual torch operator to choose the one he thinks best. For it is in reality more a matter of personal choice than anything, except for two important factors. If the teeth are small and deep it is very difficult to weld them one at a time, especially for the novice; therefore, it is probably better to advise the welding of fine teeth "en bloc." If the teeth are medium to large, it is no doubt better to employ the single tooth method since it saves an immense lot of time in cutting and filing. These two conditions are about the only things that need be considered in the choice of methods, unless the welder's skill and experience has to be counted. Even then we may practice on discarded gears for a while before tackling a job of building up broken or worn teeth.

But let us see just how each method is executed in detail, and then permit the welder to choose for himself; taking first the gear illustrated in the accompanying photographs as a typical instance of "en bloc" welding. This is a cast iron gear such as is commonly found on farm or other machinery. The new teeth need not be absolutely accurate, nor are they hardened or otherwise treated to give wear-resisting qualities. The metal is the usual grade of gray iron. In fact, it is just such a gear as is liable to come to any blacksmith welder for repairing any time. Several of the teeth are broken, some partially and some to the base. The broken teeth are in a group, thus making it adaptable to any method of welding.

First, the grease and rust that usually clings to such gears is entirely removed from the vicinity of the broken teeth. The broken teeth and several adjoining ones are thoroughly cleaned. This is accomplishd either by scrubbing with gasoline, or by burning the stuff to a cinder with the welding flame and then scratching it all off with a wire hand brush. This cleaning eliminates danger of foreign matter being absorbed by the melting weld to form pin holes or hard spots in the tooth metal. Bits of rust that come in contact with the molten weld sometimes change to gas and leave pin holes in their attempts to escape from the melted metal. Or the foreign matter may lodge in the weld to form a dirty spot. Therefore, it is safer to remove all matter from the vicinity of the weld before applying the filler metal.

The next step is to preheat the casting. This is not absolutely essential to a good weld, but it is safer and will hasten the melting process. It is quite natural that the filler metal will fuse easier and faster, if the casting is red hot than

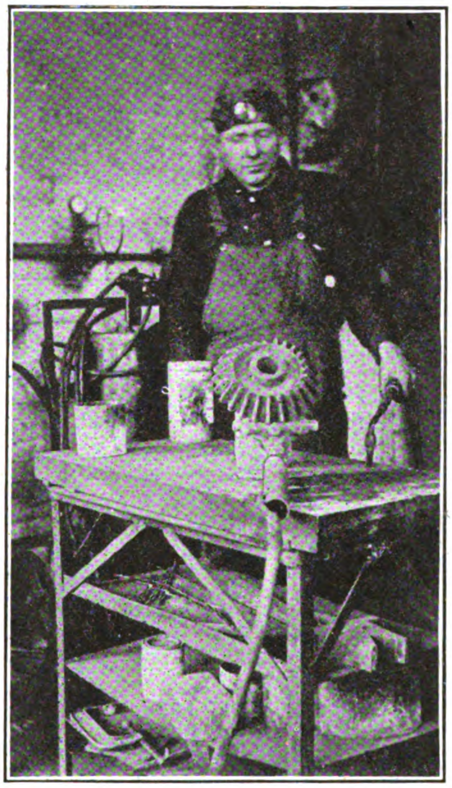


FIGURE 1. THE PREHEATING ARRANGEMENT

it will if the casting is cold, because the casting has already gone a long ways toward melting. Besides saving time the preheating saves welding gas, because the heated casting will not draw as much heat away from the weld, thereby permitting the use of a smaller torch which consumes less gas. The preheating also expands or spreads apart the grain structure of the casting thus permitting the filler metal to more thoroughly knit into the casting metal. There is less danger of strains being set up due to inequalities in expansion and contraction. There is little danger of this particular gear being cracked by contraction so that the preheating was chiefly for the reasons mentioned above.

The preheating is accomplished the handiest with a gas burner such as is shown in the illustration. The burner is placed beneath the gear so that its flames will envelope the whole casting. An air pressure oil burner may be substituted for the gas burner in much the same arrangement; or a charcoal fire may be used if properly prepared to prevent burning the lower teeth. In either method, the gear is tilted to bring the broken teeth level and horizontal. This makes it easier to manage the molten metal, since there is less tendency to run or pile up on the lower side of the weld. The metal may be added in even layers. In tilting, the gear is securely wedged so it does not slip or roll; which usually occurs just at a critical moment, when it does happen. The devices used for this may be anything that is handy, such as pieces of fire brick. The preheating position and arrangement is shown in Fig. 1 of the illustrations.

In addition to the preheating devices shown in this picture a covering of asbestos paper is draped over the gear and gas burner. This is for the double purpose of closely confining the heat and affording protection to the torch operator while working over the red hot casting. Thus, by enclosing the heat, it hastens the process and keeps an even temperature. The welding is accomplished through an opening made in the paper directly over the broken teeth, as is shown in Fig. 2.

The torch employed is a little less than medium size, that is, the torch is fitted with a tip below medium size, which furnishes a flame of sufficient power to fuse the metals and still without difficulty of confining the flame. A higher power flame causes the metal to wash around too much, making it difficult to control. This is not so particular in block welding since only the ends of the teeth need to be shaped. But if only a higher pressure flame is available greater care must be exercised in its manipulation, because there is also danger of burning the metal and thus destroying the life of it.

The selection and manipulation of the filler rod is also a particular part of gear welding. Some slight variations may be made. A rod a trifle too small or a trifle too large may be employed, if properly manipulated in connection with a correct handling of the flame. The operator must use some judgment in determining just how much of the rod should be melted to fill a molten portion of the weld; also, he must constantly change the position of the rod to meet the requirements of the molten weld. In short, he must be always more on the alert when employing a filler rod not just the correct size for the weld.

A cast iron flux powder is employed at frequent intervals, during the welding, by dipping the heated end of the filler into a pot of it, and quickly returning it to the weld. This flux is for the purpose of cleaning the metal, and to form a coating over it to protect it from the oxidizing actions of the air, and also from the oxygen of the flame. However, there is such a thing as too much flux; a condition which the operator will probably learn only through practice.

In the actual placing of the block metal, the welder may start at any part of the broken section, although a corner of one of the adjoining good teeth is probably the best, since the metal is to be added in layers, so to speak. These layers should be uniform to prevent disconnected spots.

Let us suppose that the welding is started at the corner of one good tooth. The flame is held close to it and played back and forth across one end of this corner until it shows indications of becoming fluid, when the filler rod is brought in contact with the flame and later in touch with the melting weld. The tip of the white cone of flame is played over the melting spot long enough to permit the heat to soak into the casting, thereby melting it to a depth of perhaps a quarter of an inch before new metal is fed into it. It is a great fault of many welders that they do not melt deep enough before adding filler metal; in effect, they merely melt a thin skin of the casting and then melt the filler on top of it. This procedure forms what is termed an adhesion; the new metal merely sticks to the surface of the old.

But the deep melting should be comparatively slow melting for if the operator tries to hurry by plunging the white cone into the molten metal he will oxidize it, or carbonize it, or perhaps both. In either event he will produce a dirty, brittle weld, which will show up badly when the new teeth are cut.

As soon as the first pool of metal is melted deep enough, the heated end of the filler rod is immersed in it. Enough filler is fed into the pool to raise the level about a quarter of an inch. At the same time, the flame is working toward another portion of the corner, forming a new pool, or rather lengthening the first one. This is formed and filled like the other. The process is repeated the full length of the tooth to form a fillet of new metal all along the corner. Then the flame and filler are worked in unison back across the face of the broken section to add another strip of filler metal beside the first. As each pool is melted and elongated, it is also widened to overlap and soak into the preceding one. Thus a layer of new metal is fused to the entire surface of the broken tooth section. In doing this, the short portions of missing teeth are melted down to form that part of the layer; the filler metal is not added in these portions.

FIG. 2. COVERING THE GEAR TO CONFINE THE HEAT

If preferable, the short portions of broken teeth may be completely knocked off with a hammer and chisel before preheating the casting. In most instances, it is probably better to do this, since the welder is then more certain to get uniform layers on the first weld. This is of course recommended only for "en bloc" welding; for building up teeth one at a time, it is better to leave as much of the old tooth as possible.

On top of the first layer, another layer about the same thickness is then added. This second layer is made by the same manner of soaking and pooling the filler. The pools are layed in strips or rows back and forth across the first layer. When the second layer is complete, the flame is pointed down on the ends of the weld to blow them square and smooth, at the same time dabbling here and there to fill any hollow spots.

The solid section is then finished, a layer at a time, after the manner described; always being careful to soak each one together. The last layer is filled a little above the level of the original teeth, so they may be machined to accurate size. The ends of the block are made a little thicker than necessary, too. This is to furnish machining stock. Now the preheater flame may be turned off, and the gear allowed to cool, until cold enough to handle, when it is ready for cutting the new teeth.

During the process of welding, the flame is kept almost constantly in motion, swinging from one portion to another as needed, raising and lowering according to whether the melting is too slow or too fast. The filler is also given a slight twisting motion to assist in mixing and cleaning. It is constantly in touch with the molten metal except when applying the flux. The filler is fed directly into the bath and never allowed to drip; the surface of the weld is raised by feeding the filler beneath it. A constant watch is kept to prevent oxide from being trapped in the congealing weld.

As soon as the gear is cold enough to handle, the next step in the repairing process is to cut out and shape the new teeth. There is but one way of accurately cutting new teeth on a bevel gear. Where accuracy is required, the blank is placed on a bevel gear cutter. Even the milling methods which are employed advantageously on spur gears are useless on bevel gears, because the tooth thickness is not the same over its entire length. However, since cast iron gears are not used where great accuracy or smooth running is essential, these repair teeth may be cut by hand. Good working results will be obtained, where reasonable care is used in blanking them out. By hand this is done as follows: first, the gear is taken to the emery wheel where the surplus metal is ground off of the ends of the teeth, and most of the surplus is ground off the face too; a very thin portion is left for filing to accurate size. Fig. 3 shows the gear with the "en bloc" method of welding completely welded ready for grinding.

After grinding the gear is fastened in a vise in such way as will hold the tooth block horizontal. Both sides of each tooth are then cut with a fine metal saw. This sawing is done straight down flush with the bottom of the teeth, no attempt being made to shape or pitch the teeth. The shaping is done afterwards with files. The sawing is mostly to help in removing the metal from between the teeth; of course it is to be carefully and accurately done.

The metal is removed between the saw cuts by chiseling it off in thin layers with a narrow chisel and light hammer. Great care is essential in this since one little slip of the chisel may ruin the whole job by breaking a new tooth. Each thin layer of metal is removed entirely before starting another layer. The last layer is finished with the edge of a fine file. All of the new teeth are then trued up with files and the gear is ready for service again.

Now the other method of repairing gear teeth with the torch is practically the same in most parts. The cleaning of the same as is also the arrangements for preheating. The condition and extent of preheating are practically the same as is also the reason for so doing. The cooling, filing, etc., are similar.

The chief difference between the "en bloc" and the single tooth methods lies in the manipulation of the flame and filler, and in the size of each. As a rule the flame is smaller for a gear about the size of the one illustrated. This is because the larger flame would melt the metal too fluid, and too much of it, unless very expertly handled.

Ordinarily a larger filler rod would furnish more metal than could be properly applied to the teeth. To eliminate a lot of filing and fitting the new metal must be added in portions just right to be puddled and blown smooth with the flame. When attempting to melt from a too large rod, the natural result is to overheat the gear metal, or the filler previously added, thus causing it to spread out and deform the shape of the new teeth. When the filler does melt, the quantity is usually too large, and consequently drips down the sides of the tooth. On the other hand too small a rod may give the opposite results. It is a difficult matter to define any set rule by which the novice may know the correct size filler rod or the correct tip for different jobs. This is somewhat due to the variation in the different makes of torches, and a great deal due to the difference in skill of the operators. Experiments will no doubt do more to help the operator in choosing proper sizes.

In building up a single tooth, the flame is revolved over a spot near the end of it, until the metal starts to melt, then the flame is confined as near the exact area as is possible. When this is melted a bit of filler rod is worked around over it until this is melted on top of and joining the tooth metal. Then the flame and filler are gradually work-

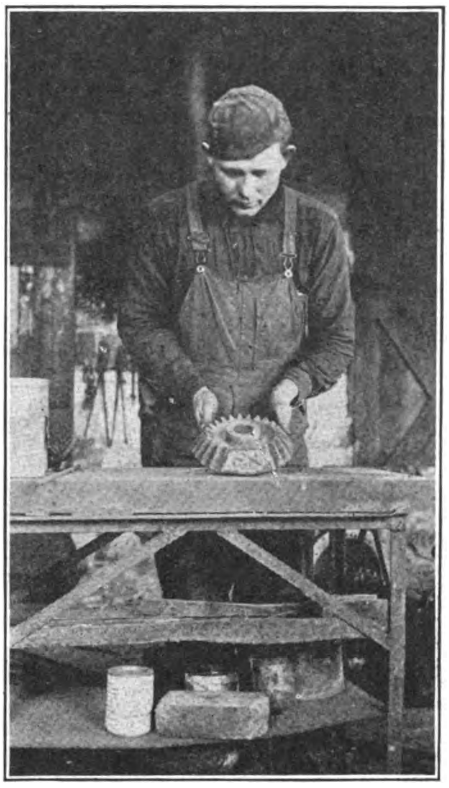


FIG. 3. THE BROKEN TEETH WELDED "EN BLOCK".

ed along the tooth to melt and add another bit of filler. The second addition being but a continuation of the first; so on the full length of the tooth.

It is better not to build the tooth its full height from the start, but to build it up in layers. Sometimes three or four layers are necessary. When the tooth is about two-thirds complete the flame and filler rod are used to smooth and shape it. The flame is turned at an angle to blow along the rough spots or little ridges that may have dripped over the sides of the tooth. The rod is used to scrape aside these ridges as they melt. Sometimes the welder may leave the smoothing go until the teeth are all welded and then turn the gear to bring the teeth vertical when the rough projections are blown straight down along the tooth.

In welding the teeth are gradually drawn in at the top as the height of the teeth grows, by reducing the amount of filler added, and by a faster movement of the flame. The flame is advanced until the metal reaches the stage where it just fuses right, then it is drawn quickly back a little to permit the added metal to set. Then it is once more advanced and retarded alternately the full length of the tooth. The broken teeth are welded one after the other as rapidly as possible. And each one is completely finished before starting another. When all are completely welded the gear is cooled and the teeth are filed to fit.

During both processes a strictly neutral welding flame is employed. It is regulated thus at the start and maintained during the entire procedure.

CASE HARDENING

This is a substitute for tempering, and is used on metals that cannot be tempered or hardened in any other way. There are several ways and means of doing this work. Heat your article to be case-hardened to a bright red; sprinkle over powdered rosin till thoroughly coated and plunge into clear water. This works fine on any wrought iron work. For cast iron use prussiated potash or common lye, or even the muriate of potash is good. Use same method as with wrought iron.

Another method for hardening cast iron, is to pulverize and mix together equal weights of saltpetre, prussiate of potash and ½ ounce sal-ammoniac. Heat the cast iron pieces till red hot, roll them in the powder, and then plunge them into the liquid.

(Continued from page 39)

alcohol is very often used, its freezing point being 8° below zero. Although glycerine tends to retard evaporation, the alcohol will evaporate much faster than the water. The solution will become weak and ineffective unless more alcohol is added from time to time.

RADIATOR REPAIRING

SOON the freezing weather will be with us, and when it does come, it will bring along with it a good deal of radiator repair work. This work is not all going to be the result of frozen, and consequently broken radiators. It is a little early in the season for the bad "freeze up jobs." But when the cold weather does arrive, anti-freezing solutions will have to be used. They are valuable, therefore, that the annoying leak that has been tolerated all summer will have to be repaired. Obviously, the motorist will be very prompt in attending to it before he buys many gallons of alcohol at its present price. Since most of the jobs can be successfully repaired merely by a little soldering, there is a golden opportunity for the progressive repair-man.

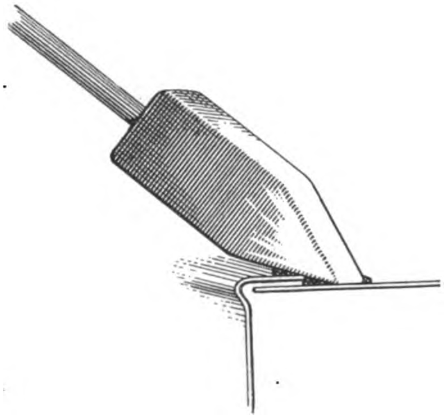


FIG. 1. THE WRONG METHOD OF USING THE SOLDERING IRON

It has been the practice in the past to send demaged or leaky radiators to men who specialized in that particular line of work. There is no good reason for this, as the repairs, with few exceptions may be made by any good mechanic after a little practice. The necessary equipment is decidedly inexpensive compared with the returns, while the improvement in the service you may render to your customer will be invaluable to your business.

Before going into the details about the repairs of radiators, a little information on the process of soldering will not be altogether out of order. The first thing to be considered is the solder. There are several kinds used in building up the radiator, but in repairing only one kind need be used. What is commonly known as half and half, or 50-50 answers the purpose very nicely.

The second consideration is the soldering iron. It should be heavy enough to convey heat to the work, and should be tapered to give a flat point for getting into the corners. The care of the iron is most important, as it is impossible to do good work with a dirty or improperly tinned iron, because the solder will not draw properly. When the iron becomes so dirty that it cannot be cleaned on a sal ammoniac block, it should be heated and hammered out to remove any low spots, and then the surface is polished after filing, because the smoother it is the better it will work, and the longer the tinning will last. Be careful to file the surface square and flat, bearing in mind that the more surface of the soldering iron that comes in contact with the part to be soldered, the quicker the part will be heated. In filing, remember that using the file carelessly will not only leave the surface rough, but it is apt to leave low spots, particularly where the file is used with a swinging motion. After the surfaces have been properly dressed, chamfer the edges slightly.

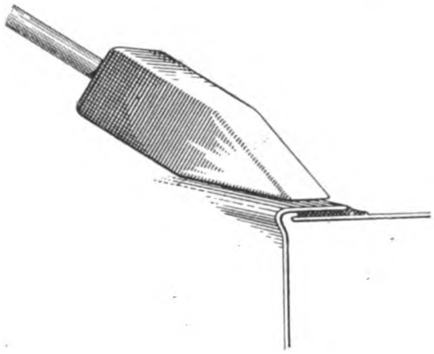


FIG. 2. THE RIGHT METHOD

Now, the next operation is to tin the iron. Heating the iron and then dipping it into the acid, after which rubbing it on a block of sal ammoniac, and at the same time holding a bar of solder on the point will produce the desired results. A good job of soldering can only be done with a clean, properly tinned iron, so that the time spent in this connection will repay the mechanic by giving him a better and more dependable job.

Solder oxidizes readily in heat, therefore, the iron should never be allowed to get red hot. It will result in burning off the tin, and as a rule leave the iron so badly pitted, that it will be necessary to reface it. Everytime the iron is withdrawn from the fire, it should be dipped for an instant into solution of sal ammoniac and water. This will leave the point clean and bright which will allow the solder to flow much more readily.

The acid used in soldering work of this kind is commercial muriatic acid cut with zinc. By cut is meant that zinc is placed in the acid and allowed to remain there until all boiling action has ceased. This acid is used both in cleaning the surface, and as a flux in soldering. It should never be kept in anything except a glass bottle or a stone crock, as it will corrode metal, and in so doing becomes dirty as well as losing its strength.

Now, let us consider a few of the fundamentals of soldering, making sure that we have the idea clearly in mind, before attempting any work on the radiator. The first thing to do is to thoroughly clean the surface to be solder. Any dirt that is left on the surface has a tendency to spread when the acid and latter the heat is applied, and thus getting into the work prevents a good joint. To clean the surface, heat it with the torch, and then rub the heated surface with acid on the acid brush. When all the dirt is loose, take the radiator to the test tank and wash it carefully with a scrubbing brush and water.

It is positively essential to have

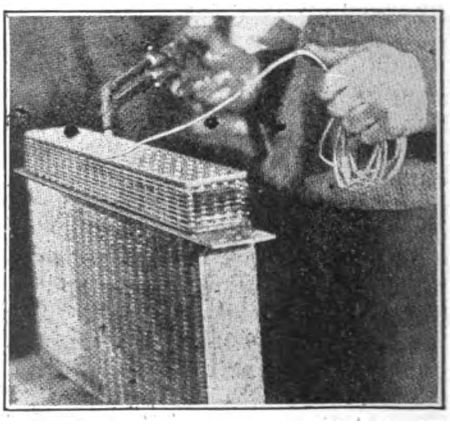


FIG. 3. RESETTING THE TUBES IN NEW SOLDER

a clean surface in order to run a seam of solder. The operator will save himself time and trouble as well as solder by putting in a little extra time in properly preparing these surfaces.

Now then for a few suggestions about soldering. Fit the two surfaces together. The closer they are together, the easier it will be to solder them, and the less solder that will be required to run a tight joint. The object of soldering is to hold the surfaces together, and not to build up a wall of solder at the edge. The first thing to remember is that solder flows only on well heated surfaces. Secondly, it will not flow up hill. Figure 1 of the accompanying illustrations shows the improper method of applying the iron. Here the iron is cocked against the edge of one surface. In the first place the solder does not flow between the surface as shown in the figure. In the second place, it requires a greater length of time to run the seam. Figure 2 shows the method used in good practice. Here the iron is held flat against the upper surface, transmitting the heat from the heel of the iron to the two surfaces, hence drawing the solder between them, making a strong joint with the least amount of solder and in the shortest space or time. Always draw the iron so that the heel heats the metal before the point arrives. The point gives a good clean draw to the solder after the heel has warmed the surface and flowed the seam.

When a torch is used on the larger parts of the work instead of the soldering iron, always solder in the direction of the flow of the flame as shown in figure 3. There are several reasons for this. First, it preheats the surface, saving time in soldering and secondly, it gives the solder a chance to cool after it has flowed into place. Do not be afraid to use plenty of acid. Acid applied after the soldering operation is started, while necessary in some cases, is never as good as enough put on in the first place. The acid should be used both when soldering with the torch and with the iron. The iron is used to best advantage in soldering two parallel surfaces, upon one of which the iron may rest. In all other cases the torch is most advantageous. For removing soldered parts, a torch with a flood flame is usually used.

The equipment necessary for repairing radiators, while rather extensive, is not so costly as it would appear. Most of the work of installation may be done by the average repair-man, and a number of the tools may be made by him in his spare time. The main expense is the bench and test tank. The bench and frame may be built by the mechanic, and the tank and covering of the bench may be installed by a tinsmith, if the mechanic feels himself incompetent, although one should have little difficulty in taking care of this detail too. Figure 4 shows a good arrangement of bench and test tank, and gives the necessary dimensions. This is the style of bench approved by the Ford Motor Company for use in repairing their radiators, as are the other illustrations. While intended of course to meet the needs of their particular product, nevertheless, it can be used very conveniently for other radiator with but slight variations. The work bench should be covered with tin and the test tank should

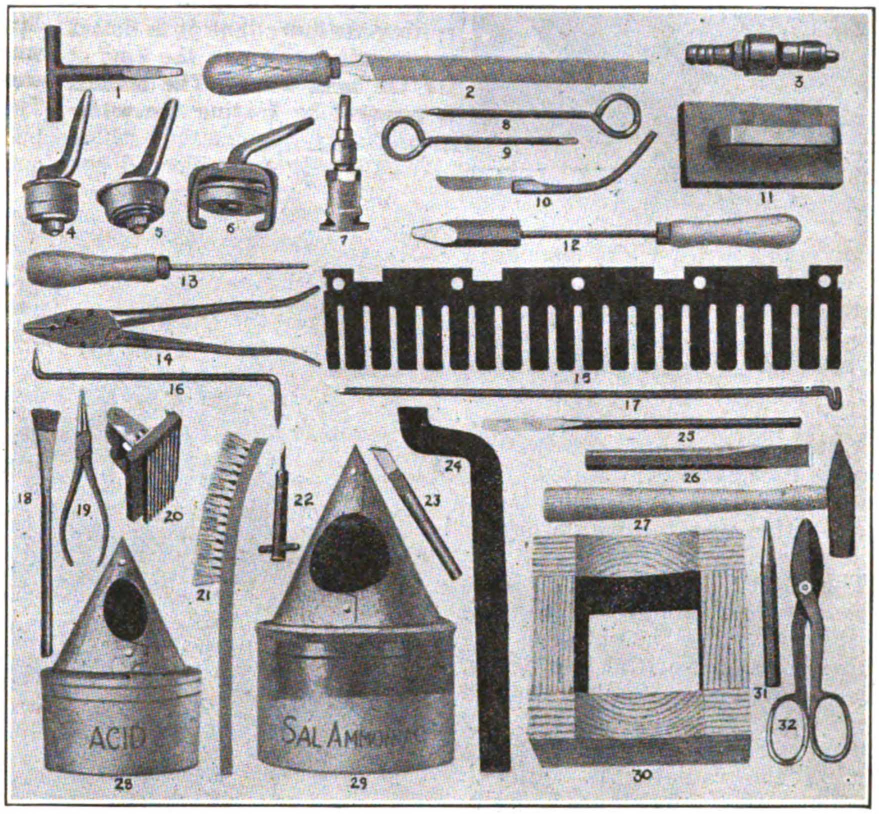


FIG. 5. TOOLS USED IN RADIATOR REPAIRING

1 Dent Puller or Tube Holder. Can be made by a repairman if a forge is available
2 12″ Mile File
(Tools, 3 to 7 inclusive used in testing the radiator)
3 Outlet Air Connection, to which the hose is attached
4 Outlet Test Plug
5 Inlet Test Plug
6 Filler Flange Plug
7 Inlet Air Connection. Screws into petcock hole in the radiator
8 Stretch-All. Made from 3/16″ to 1/4″ stock
9 Dent Puller. Made from 3/16″ to 1/4″ stock
10 Hacksaw for cutting tubes. Made by soldering a piece of tube to a broken blade
11 Weight for holding overflow tube down while soldering
12 Soldering Iron
13 1/4″ Rat Tail File
14 10″ Square Nose Pliers
15 Fin Spacer. Drill and saw out a piece of sheet metal 3/16″ thick to fit by the tubes
16 Tube Spreader, Right Angle made of 3/16″ to 1/4″ stock
17 Tube Cleaner 1/8″ stock. Fin Spreader 1/4″ stock for holes in fin
18 Acid Brush. Made by inserting horsehair into a copper tube, flattening the tube and trimming the rough ends of the hair
19 Weaver's Pliers
20 Fin Comb
21 Fibre Brush
22 Tube Regulator
23 Tube Cutter. Made from broken hacksaw blade with a tube handle. Fill handle with solder
24 Rivet Bucker
25 Fin and Header Bar. Made of 1/2 stock and flattened on the end
26 Cold Chisel
27 Small Tinner's Hammer
28 Acid Jar
29 Sal Ammoniac Jar
30 Radiator Block 8″ square, 4″ deep, made of wood with radius to fit 1917 radiator top tank
31 3/16″ Punch
32 8 Shears

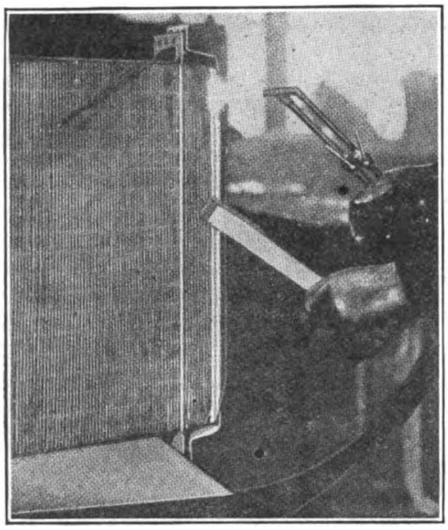


FIG. 7. REMOVING THE LOWER TANK

be given a coat of white enamel to prevent the acid from attacking the metal. The table top should be as flat as possible, and no dirt should be allowed to accumulate on it, as the core of any radiator is easily thrown out of square when it is hot. The steam pipe running to the test tank is for heating the water. The water may be heated in any manner, or the operator may work in cold water if he prefers.

The hose covered strap irons shown at the left may be set at the most convenient height for the man who is to work at the bench. The radiator may be supported on these brackets as shown, or at any convenient angle. The shelf for inverting the radiator is optional. The block shown in Figure 5, designated as number 30, may be used in place of it. The shelf will, however, prove a worthy addition to the bench. The air line leading to the front of the bench and designated as air supply, is used in testing the repaired radiator, a pressure of from 8 to 10 pounds is the most satisfactory.

Figure 5 shows the tools used in radiator repairing. They will be referred to throughout this article as the need for them arises. Since there are many more Fords in operation than any other individual make, let us take for example the repair of these radiators in detail and it will be found that the basic principles are applicable to most of the other makes which are of the fin tubular construction.

Figure 6 shows a relative assembly of the 1916 and 1917 Ford radiators. It brings out clearly the relative position of their parts, and also states the method of attaching them. This should prove useful in the study of making radiator repairs.

In disassembling the radiator for any extensive repairs to the core or tubes the first operation is the removal of the bottom tank. The operation is the same on both styles of radiator.

The bottom tank as considered here will include the tank reinforcements, and the outlet connections. The first thing to do in removing the lower tank is to detach the overflow pipe and the conduit for the light wires. The conduit is removed by heating the solder and lifting it from the tank. The overflow pipe need only be loosened from the lower tank and core and bent out of the way. Next, detach the reinforcement from the radiator support. On the later radiators, this support and reinforcement are spot welded. The weld may be broken by driving a cold chisel between the reinforcement and the support. If it is found that the reinforcement are soldered together, melt the solder with a torch or iron and bend the reinforcement far enough away to keep it from seizing. Next heat the surface of the reinforcement attached to the lower tank, brush off the solder and swing it out of the way. In the same way detach the other reinforcements.

Now the radiator should be placed on its side as shown in Figure 7. With a torch the heat

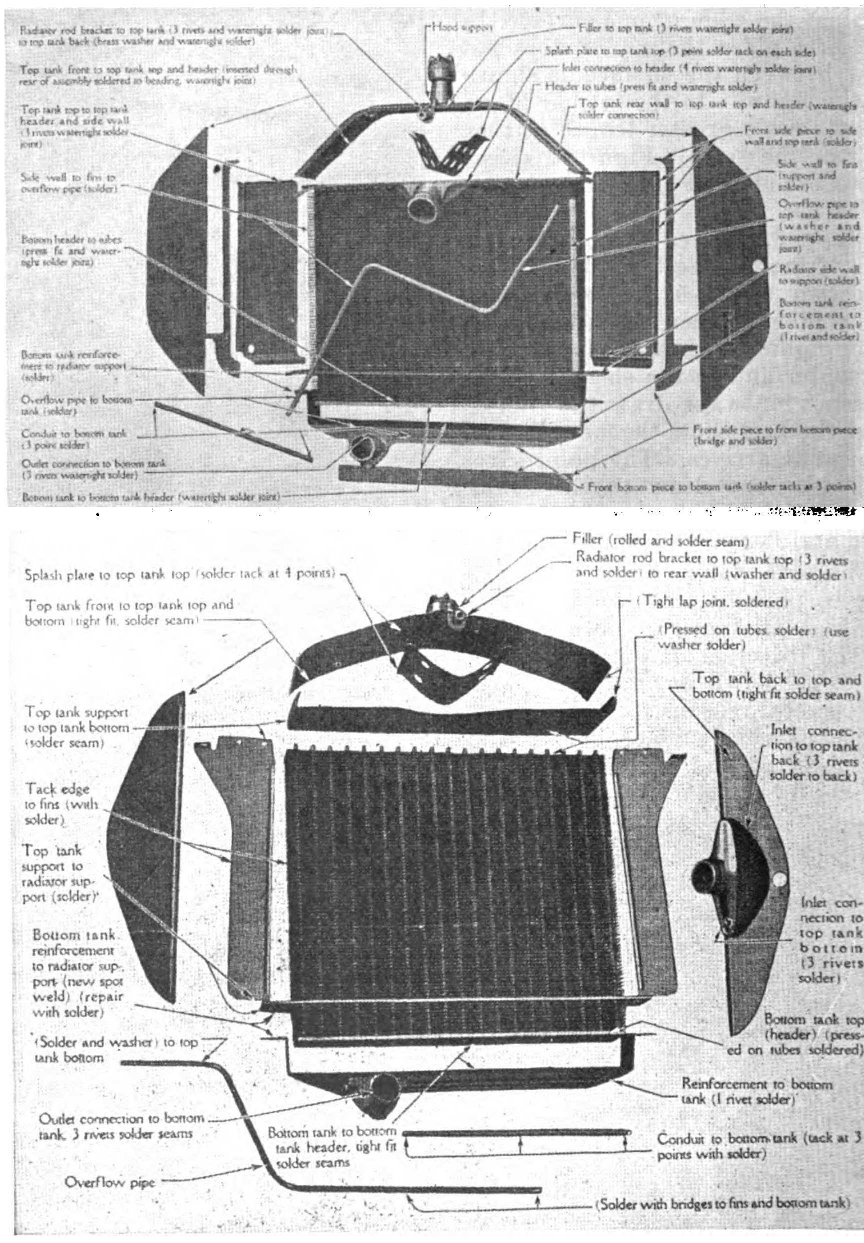


FIG. 6. THE PARTS OF A NEW AND OLD STYLE FORD RADIATOR AND THE MANNER OF ATTACHING THEM

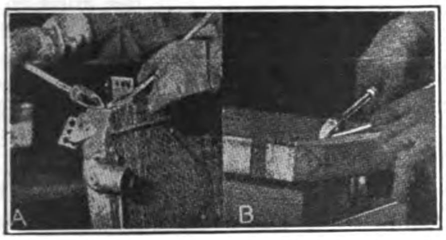


FIG. 8. REPLACING THE LOWER TANK

is applied to the side seam. With a brush remove the heated solder as it flows from the joint. This operation should be repeated on all four seams. When the joint shows that most of the solder has been removed, heat the entire tank sufficient to melt the solder by moving the torch rapidly all over it. Grasp the outlet connection with a pair of pliers and remove the tank, at the same time applying heat to any point that may be sticking.

While at this particular point let us reverse the operation and see how the tank is replaced, after the repairs which necessitated its removal, are completed. Removing the tank disturbes the solder around the tubes in the header. It is, therefore, advisable to heat the inside of the header, brush off the old solder and reset the tube in new solder before replacing the tank. Figure 3 shows how this is done.

In replacing the lower tank, see that it fits the header as closely as possible. Stand the radiator bottom side up as shown in Figure 4, using the shelf of the repair bench for the purpose. Flare the edge of the header out a little and spread the tank to fit it. It is usually necessary to tap the corners of the tank in a little. Clean the surface to be soldered with heat and acid, and insert the tank into the header, tapping it down with the flat of the hammer. Tack the corners of the tank to the header with a little solder on the iron. Use the hammer to tap the edges of the header into contact with the tank, then everything is ready for the soldering operation.

First, solder the ends, drawing the solder around the corners about ½ to ¾ inches. The radiator should be stood on its side for this operation. The process is shown in Figure 8 A. Next, solder the faces. The radiator should be laid back on its face when running the seam on the back. When running the front seam it should be supported on block 30, shown in Fig. 5.

The operation is shown in Figure 8-B. When soldering around the outlet, a little time and care is necessary to make a good joint. This is because the cold heavy metal is apt to resist the soldering at first. It is a good idea to run all around the outlet with the iron to insure a tight joint.

Next, stand the radiator bottom side up on the shelf, shown in Figure 4, swing the reinforcement into place and solder it to the support, then solder it to the tank. Take the necessary time to insure a strong joint, by flowing the solder well under the reinforcement. This operation may be performed immediately after the seam is run on the ends. The advantage of doing it at this time is that it holds the tank in position while soldering. The disadvantage is that in soldering the face, the end seams may open up, in which case, the reinforcement must be removed and the seam redrawn. Except in resetting the tubes, the soldering iron is used in all soldering operations when replacing the bottom tank.

With this operation completed, we may go into a little more of the details. Let us consider the spreader used in holding the tube in position and also forming part of the tank. To remove the bottom header, obviously it is necessary to remove the bottom tank. The header is removed by heating it and brushing off the solder around the tubes. Then heat the header by moving the torch over it rapidly and drive it off by inserting bar 25 shown in Figure 5 between the header and the fin. The operation is shown in Figure 9.

In replacing the header the operation is reversed. The radiator is set bottom side up on the shelf shown in Figure 4. Heat all the tubes and brush off the excess solder, and clean any tubes that are dirty, using heat and acid. Place the new header in position if a new one is to be installed, being sure

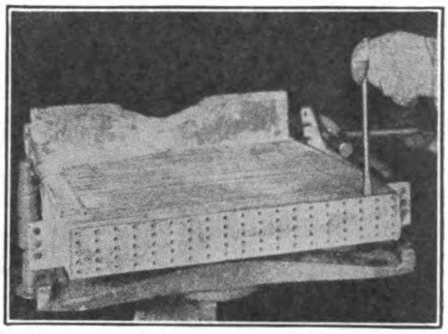


FIG. 9. REMOVING THE BOTTOM HEADER

that all the tubes are entering the holes, then tap it into position with a hammer. The header should be located about 1 15/16" from the radiator support. Wipe the tubes and header with acid. Hold the torch in the right hand, start at the right hand side of the radiator, as you face it and flow the solder around the tube to set them. This operation is shown in Figure 3.

Next, comes the removal of the rear wall of the radiator. We will take for example the 1917 type. In removing this part, it should be remembered that there are three rivets which hold the water inlet connection to the top tank header.

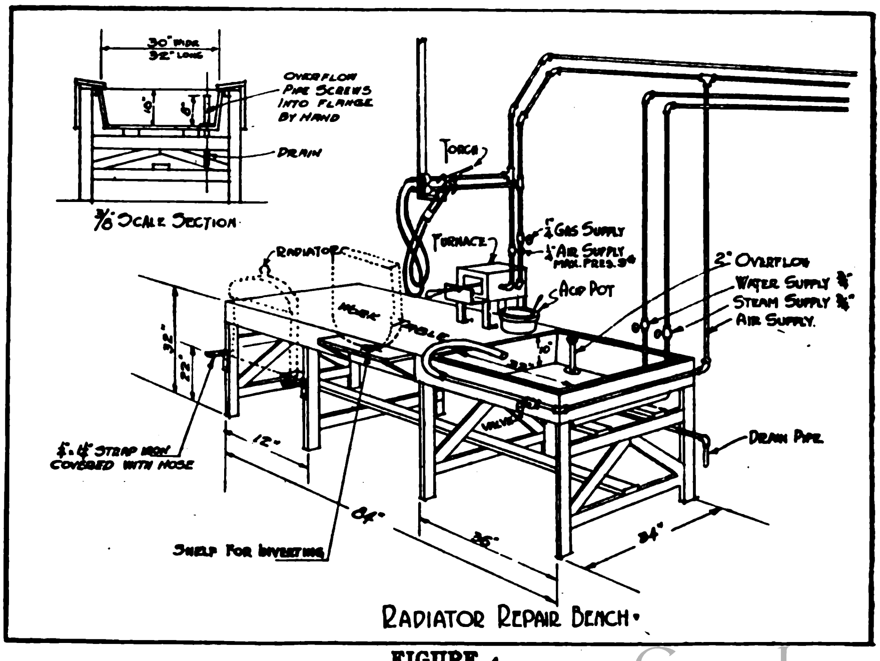


FIGURE 4

The rear wall is removed with this inlet assembled to it. With a chisel, shear the heads of the rivets which hold the inlet connection to the header. Heat the washer which holds the rear wall to the radiator rod support and remove it. Clean the solder by applying heat and brushing it off in the manner described in removing the bottom tank, then drive the top of the rear wall off of the tank to allow enough

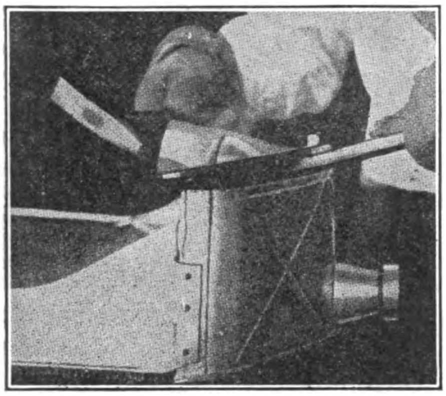


FIG. 10. PEENING THE RIVETS ON THE UPPER TANK

room to insert the rivet-buckler, indicated as 24 in Figure 5.

Next, heat the water inlet connection at the point where it is soldered to the top header and drive out the rivets, inserting the rivet bucker through the opening already made. It should buck the edge of the top header, near the rivet that is being driven out. When the three rivets have been removed, use the flood flame to heat the lower seam and water connection, then pull the rear wall off by grasping the water connection with a pair of pliers.

In replacing the rear wall of the 1917 radiator, first heat and brush off all the excess solder, both from the walls and the relative edges of the top tank assembly. Tap out the edges of the tanks so that they will fit the wall snugly. Insert three new rivets in the header and tack them in place with a touch of solder, on the side of the tank. Fit the inlet connections onto the rivets. If the holes in the connection are too small for the rivets, clean them out with the drift, shown as number 8 in Figure 5. Insert the rivet-bucker through the opposite side. This operation is shown in Figure 10. Now peen the rivets. Fit the walls to the assembly and tack it to the ends of the header and at two or three places on the top tank top.

Solder the washer in place around the radiator rod support. If there is too great an opening at any point in the joint solder the dent puller, 1 or 9 shown in Figure 5, to the top near the rear wall. The method is shown in Figure 11. With this as a hand hold, hold the top up to the flange of the rear wall, closing the opening while you tack it with solder at the center of the gap. Run the solder seam with an iron and bar of solder. It is good practice to clean the old seam between the top and inlet connection and while soldering, run this seam over again. It will save time in testing the radiator.

(To be continued in the next issue)

WHEN THE BLACKSMITH MAKES SPRINGS

Merle E. Morgan

Making the main plate of an automobile spring is the most important part of the entire spring making process. Many smiths who are not overly familiar with that class of work make a serious mistake when laying out the main plate by cutting it too short; thus not allowing in sufficient stock to turn the eyes properly. It is always better to be on the safe side and allow a little too much stock if anything, as it is always easier to cut a piece off than to weld some on.

The first operation is to turn the eye which fastens on the rigid end of the chassis at the front of the car. After turning the eye, give the leaf the proper arch over its entire length. Put this leaf in place, that is, fasten it to the front hanger by means of the eye, and then mark the location of the center or tie bolt. This is very important as the position of the axle is located by this measurement. When the spring is finished, if the back end is found to vary slightly it does matter a great deal, because the swing spring shackle will take up the difference, whereas with the front end, it fastens to the end of the chassis frame and then holds the

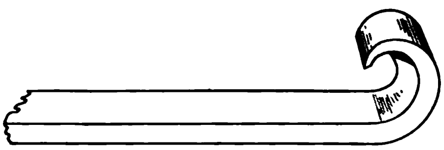


FIG. 1. THE FIRST BEND

axle true, it is important that this space should be reasonably correct.

Another common mistake is neglecting to draw out the ends thin or sharp enough. A plate 5/16" thick should have a bevel at least 1" long and should be hollowed slightly, something after the fashion of a razor blade. It should be square at the end when finished.

The next operation is making the bend for the eyes. This is where

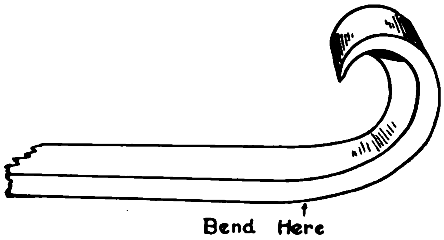


FIG. 2. THE SECOND BEND

most smiths could improve their methods. A decidely incorrect practice is to start the bend back from the end and then work out towards the end. The better way is to start the bend right at the end or point and then work back towards the center of the leaf. Make a short bend much smaller, if possible, than the size of the finished eye. This is shown in Figure 1. With this operation finished, reheat the leaf directly back of this bend and bend the leaf as shown in

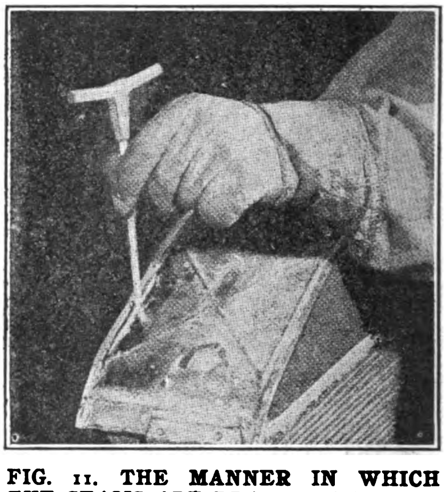


FIG. 11. THE MANNER IN WHICH THE SEAMS ARE DRAWN TOGETHER

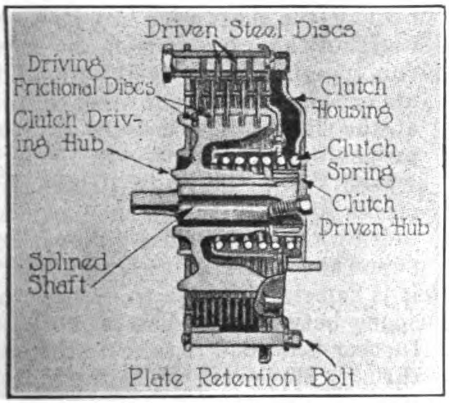
Figure 2. Now the leaf should be laid on the anvil, then hammer straight down on the first bend, this will close the eye. When the eye is worked down so that it is slightly smaller than the finished eye should be, being sure that the thin edge of the leaf is kept will under the bend, then drive a drift of the proper size into the eyes so that the opening will be the right dimension.

Don't be satisfied merely to stand still—keep moving forward.

HELPFUL SHOP SUGGESTIONS.

THE PROPER CARE OF THE DRY-DISC CLUTCH

The multiple and single plate disc clutch as used in the modern car, is not as difficult to adjust and care for as it would seem to the uninitiated. The disc clutch is a piece of mechanism of unusual qualities: Simple, easy to operate and lasting. In view of the severe work which it has to perform, and the excellent manner in which it does it, with comparatively no attention whatsoever, it becomes a unit of almost 100 per cent perfection. There are times, however,



SECTIONAL VIEW OF THE MULTIPLE DISC CLUTCH

when one of these clutches, after a period, will begin to slip. This condition usually developes after the first two or three months' service, if at all.

The clutch of the dry disc type is made up of a number of dry discs arranged alternately with a steel plate against one fabric-lined. The edges of the fabric-lined plate have a series of teeth cut around the outer circumference which mesh with the corresponding grooves in the outer drum. The steel discs have keyways cut in the edges of the hole in the disc which engage with keys in the internal drum. When the clutch is engaged, these discs are firmly compressed by two springs acting against the compressor plate.

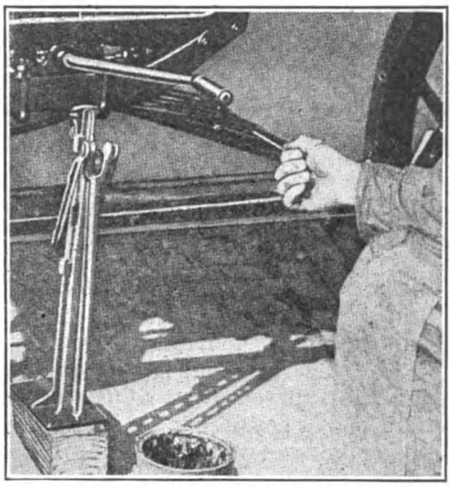
The height of the total number of discs piled one on top of the other, and arranged the same as in the clutch, should equal or be slightly in excess of the distance from the shoulder to the edge of the internal clutch drum. When the car is new the lined-discs frequently have high spot on them, but after a few hundred miles' running, they will be worn down, resulting in a reduction of the thickness of the disc assembly. When the reduction is sufficient to make the measurement of the disc assembly less than the distance from the shoulder to the edge of the drum, then the compressor plate will be against the edge of the drum instead of the discs, resulting in a slipping clutch. To correct this condition, the only thing necessary to do is to add to the disc assembly to increase its thickness. This can be done by installing one extra steel disc, and the best place to put it is against the shoulder of the drum. One disc is usually sufficient to make up the required amount. Do not put to many discs in, as there would be a possibility of the clutch not releasing properly. Very often, when one of these clutches start to slip, the operator will pour on gasoline or tighten the springs. This usually does not help much as, in most cases, slipping is caused from the reason given.

Slipping of the clutch is also caused from improper pedal adjustment. The clutch pedal, at all times, should have a slight amount of play so that there may be no doubt that the clutch is being held out by the pedal stop.

Do not pour oil into the clutch housing as it will damage the lining by making it too soft. The thrust bearing should be kept well lubricated.

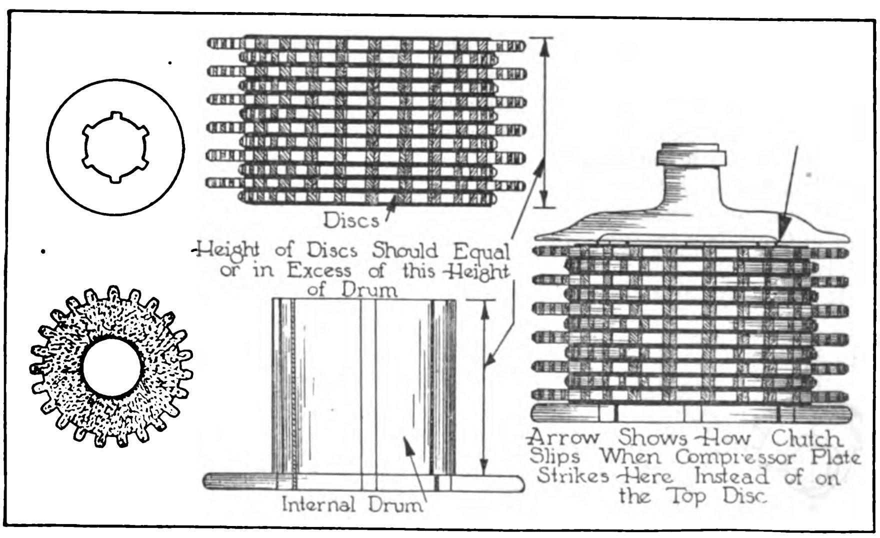
LUBRICATING THE SPRINGS

Here is the way to save time and work in graphiting the springs of the car. Jack the weight of the car off the springs and insert a



WELL LUBRICATED SPRINGS NOT ONLY WORK BETTER; BUT ARE LESS APT TO BREAK

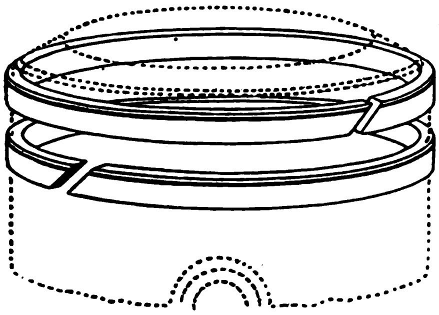
paste made of oil and graphite between the leaves of the springs, with a piece of a hack saw blade. Jacking up the car relieves the weight from the springs, the leaves of which may be easily separated by driving a thin cold chisel or an old screw driver blade between them. The accompanying illustrations shows the operation being performed on the front springs. The rear springs may be treated in the same manner.



THE PARTS OF THE MULTIPLE DISC CLUTCH. THE OCCASIONAL CAUSE OF SLIPPING IS CLEARLY SHOWN

FORD PISTON RINGS

The Ford piston rings are now machined with a groove near the edge. This groove should be towards the top when installed on



THE CORRECT INSTALLATION OF THE NEW FORD RING

the piston. The accompanying cut illustrates the proper installation. This method of marking supersedes the Ford script, and as the groove and the taper are cut at the same time, any possibility of marking the ring incorrectly is eliminated.

GENERATOR BRUSHES

A great deal of the generator and starter trouble is traced directly to the brushes. Where trouble with either of the instruments is experienced, the following information will help the mechanic in determining whether or not the trouble can be readily corrected, and in many cases avoiding the delay of sending the part back to the factory, only to find that merely the brushes were at fault. The brushes should seat all the way across the commutator. The proper position is shown in Fig. 1 and indicated as A. Generators with brushes seated as shown in B and C of the same figure will not obtain the full charging rate and have a decided tendency to run hot. A generator with improperly seated brushes cut in late, causing the repair-man or owner to believe that the cut-out is not functioning properly.

It is very important that the

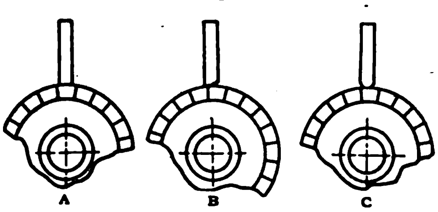


FIG. 1. THE RIGHT AND WRONG WAY OF SETTING GENERATOR BRUSHES

third brush be set correctly and propertly tightened to the holder. See that the holder is set so that the brush lies parallel to the segement as shown in A of Figure 2; instead of across the segement as shown by B of the same figure. This latter condition is brought about when the holder has become bent, or when there is some obstruction under the fibre insulator, or when the insulator itself is damaged.

TOOLS FOR REMOVING THE HEADLAMP DOORS

Headlamp doors are easily removed with the tool shown herewith. The dimension shown fit the Ford head lamp and should be varied for other lamps. The tool is made from a strip of flat iron 36½″ long ¾″ wide and ⅛″ thick. It is bent into the shape illustrated. At the 4 points indicated by the arrows, holes ⅜″ in diameter are drilled 4″ apart. The door is removed by clamping the device snugly around the rim with the

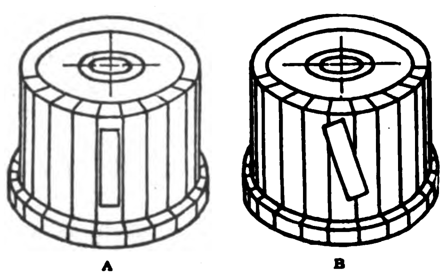
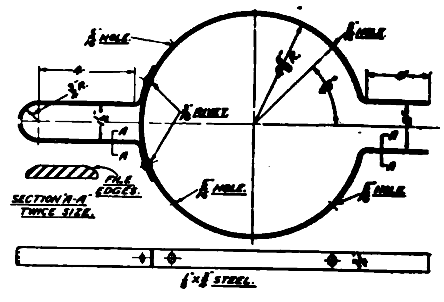


FIG. 2. THE BRUSH SHOULD BE PARALLEL TO THE SEGEMENT

four rivets in the rim of the door engaged in the four holes of the tool, forcing inward on the two handles and turning to the left.

AN OLD PISTON MAKES A HANDY BENCH GRINDER

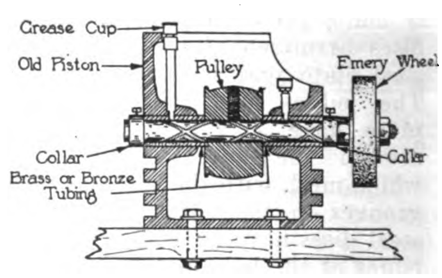
The discarded piston has a number of useful purposes around the shop. It may be used for a lapping tool merely by sawing it in half, lengthwise, and then holding the two parts against the cylinder wall by means of a spring on the inside. When it is sawed off slightly below the wrist pin bushings, it makes an excellent pot in which the welder may keep his flux. A more ingenious use still, is to use it for an emery wheel stand. It can be converted with but little effort and small expense. For small wheels and light work, it answers the purpose admirably, because the piston



IT'S EASY TO REMOVE HEAD LAMP DOORS WITH THIS TOOL

being fairly rigid, little trouble is experienced from vibration when it is bolted down securely.

In those pistons which are provided with wrist pin bushings, it is only necessary to make a shaft that will fit them, while in the case of the other piston, that is, those in which the wrist pin is fastened into the piston, it may be necessary to provide the shaft with bronze bearings. Although cast iron and steel run together fairly well at moderate speeds, they do not work so well at the high rate necessary for the proper operation of an emery wheel. The shaft is driven by means of a pulley fastened rigidly to it by a set screw. The pulley is between the two bearings, and where it is sufficiently wide to occupy the space between the bosses, nothing further is needed to take up the end thrust. However, where the pulley is too narrow for this purpose, a collar at both ends of the shaft, held there by means of a set screw will answer the purpose. The drawing shows these details. Two grease cups provide means of lubricating the bearings. The side of the piston nearest the wheel may be cut so that the wheel is more accessible.

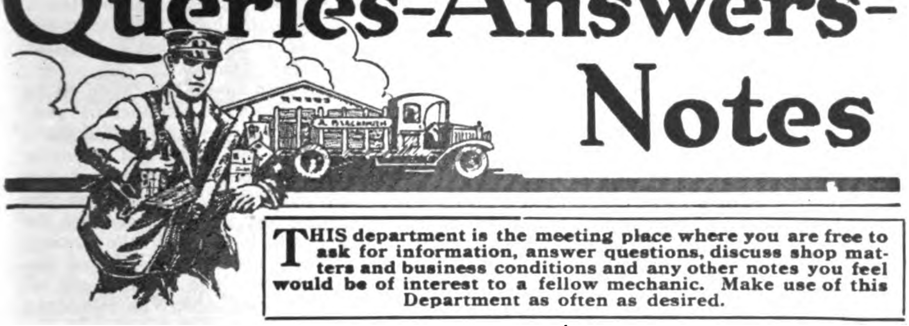


AN OLD PISTON MAKES A HANDY EMERY WHEEL STAND

According to the Bureau of Crop Estimates, on June 1, 1920, there were 3,500 tractors in use on the farms of Virginia.

502,667 short tons of pig iron were produced in Canada during the first half of 1920, states Commerce Reports.

Queries-Answers-Notes



THIS department is the meeting place where you are free to ask for information, answer questions, discuss shop matters and business conditions and any other notes you feel would be of interest to a fellow mechanic. Make use of this Department as often as desired.

Prices in the Western States—At the present time prices in the Western States are higher than in the majority of areas. A recent price list issued in Oregon quotes the following on various lines: Plowshares, sharpened 12-inch, 50c; 14-inch, 60c; 16-inch, 75c and 18-inch, $1.00. Plow pointing is $1.75. Setting axles costs $2.00 and up; welding and setting from $2.50 to $6.00. Setting wagon tires, 2-inch, per set, $6.00; 3-inch, $8.00. New steel tires, 1¼x5-16, are $17.60 per set; 1⅝x½ are $24.20; 1¾x⅝, $37.40; 3x½, $45.00. Stubs, each, vary from $4.00 for 1-inch size to $6.00 for the 1½-inch.

Shoeing, sizes 3 and 4, are $3.50 a set; 5 and 6, $4.00; 7 and 8, $5.00. Two rubber pads, No. 5 and up are $3.00. Bar shoes up to No. 4 are $1.25 each; size 5 and larger, $1.75. Resetting, sizes 0, 1 and 2 are $2.00 per set; sizes 3, 4, and 5, $2.50 and sizes 6, 7 and 8, $3.00 per set.

Shops in Chicago—The new prices in Chicago appear to meet with no opposition from the customers of the trade in that city. Evidently horse-owners consider that $5.00 is not too much for a set of shoes. The new price list in Chicago has been issued. It shows that the Local in that city covers 255 shops and has 300 members. There are 45 shops in Chicago with two or more partners.

Comparisons With the Past—We often hear men talk of the "good old days" but it is a safe bet that they are not horseshoers. Few men in the trade would want to go back to the conditions under which they worked 20 years ago—or the prices. In 1900, reports from 17 cities in the U. S. and Canada, giving the shoeing prices for fire department work, showed that the top price was paid in New York at $3.50, the low figure in Hamilton, Ont., $1.50. In New York at the time it was the custom to remove and replace one shoe before the second shoe was touched. The average price for all 17 cities was $2.30.

Making Butcher Knives—Do you suppose that some smith could tell me how to temper a butcher knife made from a file or any suitable steel.

R. H. Morris, Nebraska.

Editor's Note—We do not believe that you would be satisfied with a knife made from an old file, because knives made from this material are usually stiff, have no spring, break very easily and are not inclined to hold their cutting edge. This is because the steel used in files is high in carbon, containing as high as 1.40% while the ideal steel from butcher knives seldom runs over .80%. Thus the knife made from file stock possess all the qualities exactly opposite those which it should have.

In hardening a knife of the proper material, arrange the fire so that as much of the blade can be heated at once as is possible. Now put that knife in the fire with the cutting edge down, and move the knife back and forth so that it will heat evenly over the entire length. When it reaches a dull red, plunge it into the hardening bath lengthwise with the cutting edge down. Next, polish or brighten one side of the blade. To draw the temper place the flat side over the fire, holding the knife slightly above the hot coals and moving it so that it will heat evenly: draw to a pale blue, but before cooling place the blade on the anvil and straighten it by striking it the proper place, then cool, and it is ready for the grindstone.

THE INTERIOR OF MR. SNYDER'S SHOP SHOWING A "HOME MADE" POWER HAMMER

Changes From Blacksmithing to Automobile Blacksmithing:—Mr. F. L. Snyder of Albany, Oregon has changed from general blacksmithing and horseshoeing to oxy-acetylene welding and automobile spring work. He reports, that he is well pleased with the change, particularly after figuring his profits at the end of the year. In the earlier part of his life, he worked with his father in one of the small plow factories, many of which are scattered through the Mississippi valley. This training, under one of the mechanics of the old school, has proved most beneficial, as it afforded excellent experience in the handling of steel, which especially fitted him for automobile spring work and oxy-acetylene welding.

Although Mr. Snyder has been interested in mechanics all his life; probably it was the demand for a satisfactory method of welding cast iron, which came through the introduction of the automobile, that offered the greatest stimulus to his experimental work. Along about 1905, he started some extensive experiments along that particular line, keeping in touch at the same time with the latest developments, so that for years back, he has been turning out welding jobs, as nearly mechanically correct as it is possible to make them. No job is apparently too intricate for him. His success in the field of spring work is notable as well, for the "Snyder Spring" is widely known through his locality.

His efforts have always been to make the job stronger after it was repaired, than before, to use his words: "It broke before, and if it is not made stronger this time, it will break again." The idea he follows is to make the casting stronger by re-inforcing it, or in the case of a spring to make a better fit of the leaves, and to see that the temper is correct for the best possible results.

His mechanical qualifications are not confined alone to being a good mechanic; he is somewhat of an inventor as well, for he has designed and made most of his tools, punches, shears, forming devices and also the power hammer shown in the accompanying photograph. These tools are not mere makeshifts, but are of design and construction which compare most favorably with the most advanced ideas.

W. S. Richards, Albany, Oregon.

Shoeing Foundered Horses:—In your last issue of the American Blacksmith, Auto & Tractor Shop, Mr. O. N. Benninger asks about shoeing foundered horses.

Now I have had a few cases to handle in my career as an Army Horseshoer, and do not believe that a plate put on a foot will push the bulge on the sole, caused by founder, back. On the contrary, it will aggravate the trouble as it is bound to create inflammation in the sensitive sole.

The way I have always achieved the best results is by putting the horse with foundered feet in slings.

I have used leather boots with a heavy packing of oakum, and the horse was slung only so high as to let him use his own judgment. That is, he may put all his weight on his feet or simply rest his whole body on the slings.

In my 30 years in the Army, I have in every serious case removed the entire sole as soon as puss formed between the horny and the sensitive sole. After the removing of the horny sole, a man has a chance to heal the diseased parts and grow a new bottom.

After the horse has a new horny sole, and it should still show a inclination to bulge, I then put on a shoe with screw-calks and fasten a plate with those calks under the shoe on the ground surface. The plate is slightly hollowed towards the ground and away from the foot. This enables me to pack the foot with oakum and some good hoofdressing, of which there are several on the market.

The horse should now be worked a little, not too much, as otherwise the trouble may re-occur. One thing should be kept in mind and that is the horse should be kept in an absolutely dry stall and should be worked only in dry weather. Another good trick I have found is by putting a good effective blister around the cornette while treating the case. This will stimulate the walls of the hoof to grow quicker and stronger and so resist the outward spread of the wall which again will have a tendency to rather bulge the sole upwards.

Of course, this all is very laborious, but it is effective. But then a foundered horse should not be worked and should have the best care as otherwise a real and permanent cure is impossible.

It may always be seen by the brittle and broken up feet that a foundered horse was neglected or worked too soon.

Frank Wenke,
Post-Blacksmith, Fort Logan, Colorado.

Moth Balls in the Gas Tank—Recently, I bought a small stock of tablets which were supposed to greatly increase the mileage on gasoline. This was the salesman's version, which he supported with numerous testimonials. After a thorough test, I find no perceptible difference in the mileage but the car seems to start harder. To all appearance they are nothing more than moth balls. Naturally, I've grown rather skeptical as to their merits, and before recommending them, I would appreciate a few suggestions or comments from the Editor. Do there preparations really increase the mileage? Do they do any harm to the engine? Would you recommend their use?

Jules Dexereaux, Quebec.

Editor's Note—Recently we have had a number of inquries, regarding the efficacy of various "colored moth ball" to increase gasoline mileage when dropped into the gas tank. Chemical analysis show them to be a fraud upon the public, and prove that they do not have the slightest effect upon the efficiency of the gasoline. We do not know that they do any particular harm to the engine, but since they do not improve its operating efficiency, and have a decided tendency to making starting harder, we would not recommend their use under any circumstances.

An article recently appearing in Associated Advertising, aptly answers the question. It says in part as follows:

"Persons throughout the United States, the National Vigilance Committee reports, are selling ordinary preparations of naphthalene (which is the preparation used in making the ordinary moth ball of commerce) as a product guaranteed to increase the efficiency of gasoline in motor car operation to an extravagant degree, to remove carbon from cylinders and to eliminate most motor troubles.

Distributors of these products advertise that their use will increase the efficiency of gasoline 15 to 100 per cent, and that power equal to that obtained from a gallon of gasoline can be obtained at a cost of only 2 to 5 cents.

These products are marketed by advertising in newspapers and periodicals, by literature sent through the United States mails and by the personal solicitation of agents.

These products are sold in liquid, powder or tablet form, usually the latter. A small package of 100 tablets retails at $1.00. It is advertised as a substance which:

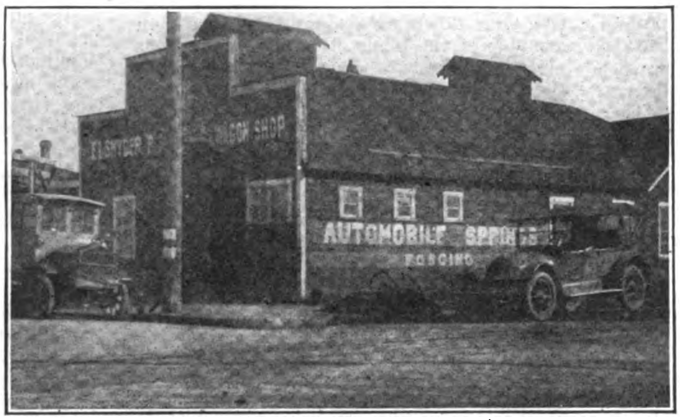
Eliminates carbon
Banishes ignition trouble
Prevents backfiring
Gives a quick pickup
Eliminates skipping and missing
Prevents overheating of the motor
Increases gasoline efficiency anywhere from 15 to 100 per cent.

These claims vary somewhat according to the brazenness of the advertiser, but the foregoing are typical.

Pseudo-scientific explanations are given for the benefit of the gullible who like to know all about the things they buy.

They learn something that certainly was never dreamed of in any philosophy so far studied if they digest this:

"NITRO-LENE is a chemical discovery that attacks and SOFTENS THE SKIN or covering on the globules of Gasoline, CAUSING them to DISSOLVE the MIXTURE QUICKLY, and releasing the imprisoned gas, thus becoming more EXPLOSIVE and MORE POWERFUL giving a FASTER and more even COMBUSTION."



THE SHOP OF A BLACKSMITH WHO SUCCESSFULLY INCLUDED AUTOMOBILE WORK ALONG WITH BLACKSMITHING

This is a fair sample of the 'reason why' copy put out by the advertisers in question. The usual guarantee goes with it. This is safe enough as the majority of people will not trouble to demand money back when the amount involved is only a dollar. Also there are positive statements, sometimes in the form of a chemist's report, to the effect that the preparaion is harmless to the machinery.

We have not yet seen any chemist's report in any of this advertising that includes a statement of the efficiency of the product.

The reason we do not know who and how many are now selling these miraculous marvels is because the advertisers not only sell the stuff but will part with the formula to any one who cares to go into the business himself, provided they get their price for it. You pay $15 or whatever the price may be, to find out how easily people may be gulled and then you coin a high sounding name, invest in a quart or two of moth balls and enter the industry. The profits are figured by the advertisers as being from 700 to 900 per cent, which is fairly attractive.

Each of these advertisers is careful to call attention to the fact that there is no camphor in the stuff. This is quite true. Camphor is an expensive drug and, though many people think it is, is not a constituent of moth balls. Naphthalene is cheap and most people do not know that it is what moth balls are usually made of. Thus the disclaimer serves a useful purpose: it makes people think these things, though they smell so much like them, are not moth balls without exactly stating as much.

The infallible testimonial is relied on to establish the claims to wonderful performance. Many people write and state that their mileage per gallon of gasoline is greatly increased and we have no doubt that it is, in most cases. But not by the Gasoline Economizer. It is increased by the directions which go with the Economizer. These are always careful and explicit and deal with the adjustment of the carburetor in such a way as to reduce the proportion of gasoline to air in the vapor, and, incidentally, increase by just so much the mileage per gallon of gasoline. That is, it is the adjustment of the carburetor which produces the results and not the wonderful tablets at all.

Chemical analysis has shown that these "economizers" are composed of naphthalene and of nothing else, though they are generally colored or disguised in some way. Napththalene has no effect whatever, in the quantity advised, on the efficiency or performance of gasoline. The United States Bureau of Standards has tested products such as these and has this to say of them:

"The natural conclusion from the tests so far performed is that nearly, if not quite all, the seeming improvement in engine operation when these 'elixirs,' etc., are added to the gasoline is due to the reduction in the proportion of gasoline used, caused by readjustment in the carburetor, which is nearly always recommended to be made when the new fuel 'dope' is added. It is of course a well known fact that may engines, particularly automobile engines, are habitually operated on too rich a mixture, mainly for the sake of ease of starting and satisfactory operation when first started, and that the reduction in the proportion of gasoline to air will often produce all the desirable results claimed for these 'tonics,' etc., without the addition of any foreign material whatever.'

This appears to be sufficient explanation of the testimonials received.

A pound of naphthalene in the shape of moth balls at retail costs about 35 cents. A pound of naphthalene purchased under the name of one of these "economizers" will cost about $2, which might well lead one to ask wherein the economy really lies. By buying flake naphthalene at about seven and one-half cents a pound the real economy is even more strikingly illustrated.

The Bureau of Standards has a parting word to say of the fraudulent claim that these preparations will increase the power and efficiency of gasoline:

'Very conclusive tests of a number of materials have shown that there is no measurable difference between the power produced by gasoline with, and the same gasoline without, the added material.'

It seems fairly evident that all publications which desire to protect their readers from this sort of mean and petty exploitation should exclude these advertisers, under whatever name they may seek admittance from their columns."

AMERICAN BLACKSMITH AUTO & TRACTOR SHOP

VOLUME 20 | **DECEMBER, 1920** | **NUMBER 3**

BUFFALO, N. Y., U. S. A.

WILLIAM F. WENDT, *President.* L. J. WISCHERATH, *Editor.*

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For $1.00 per year, payable in advance, The American Blacksmith, Auto & Tractor Shop will be sent, postage prepaid to any postoffice in the United States. To Canada, $1.25; to other countries, 6 shillings. Reduced rates to clubs of five or more on application.

Remittances may be made by money order, express order or checks payable to the American Blacksmith Company. We will also accept uncancelled postage stamps or currency, but for safety these should be sent by registered mail.

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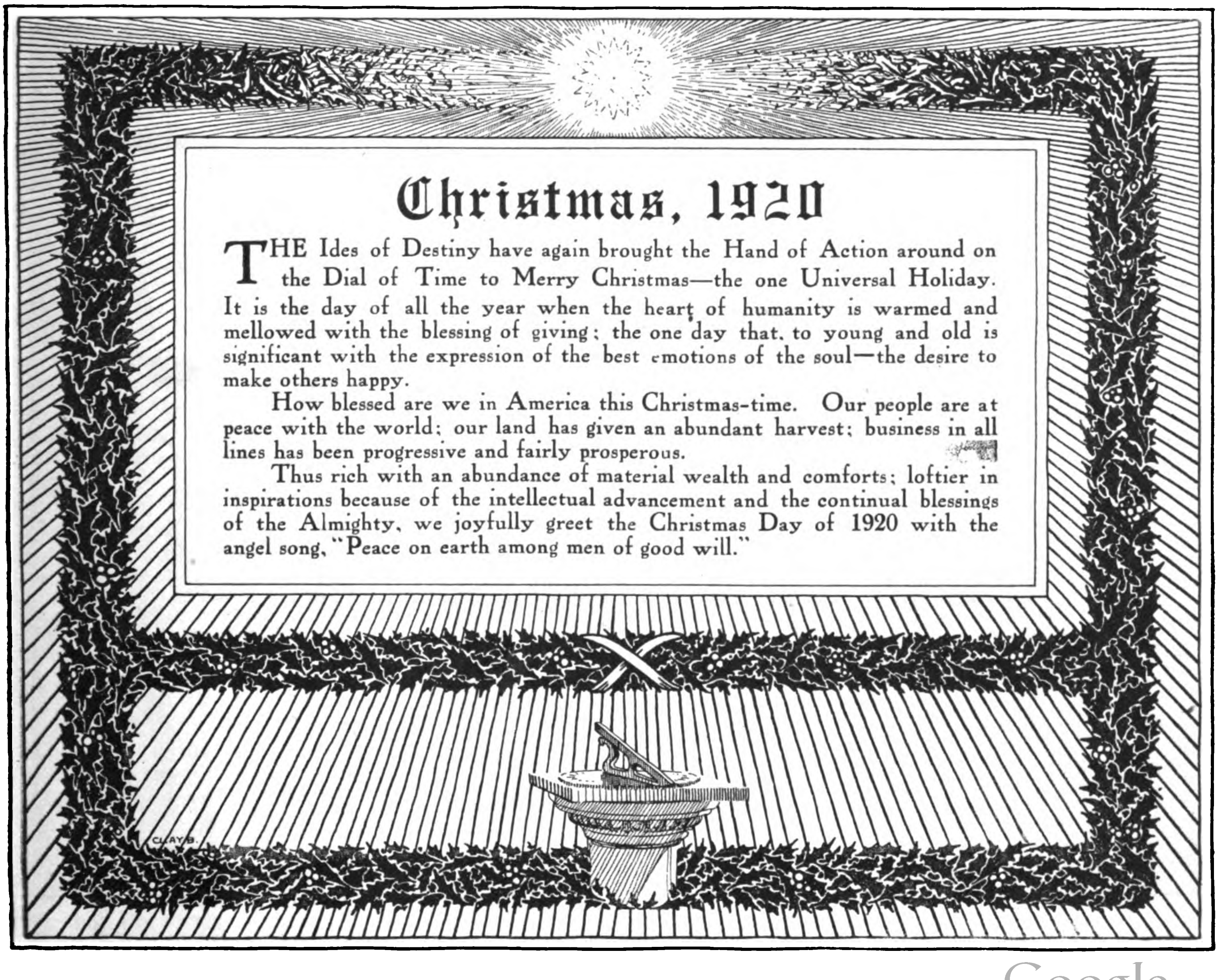


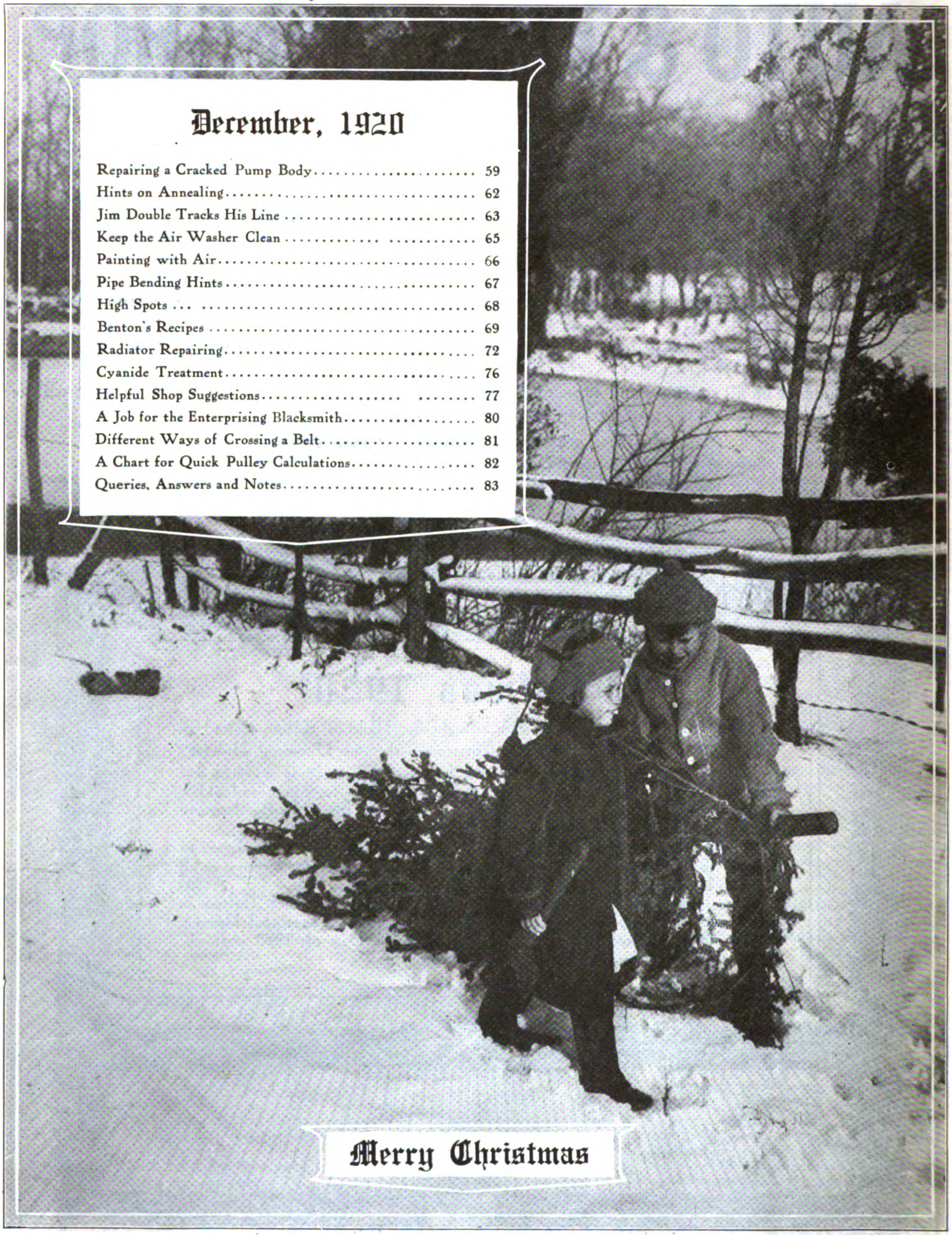
Christmas, 1920

THE Ides of Destiny have again brought the Hand of Action around on the Dial of Time to Merry Christmas—the one Universal Holiday. It is the day of all the year when the heart of humanity is warmed and mellowed with the blessing of giving; the one day that, to young and old is significant with the expression of the best emotions of the soul—the desire to make others happy.

How blessed are we in America this Christmas-time. Our people are at peace with the world; our land has given an abundant harvest; business in all lines has been progressive and fairly prosperous.

Thus rich with an abundance of material wealth and comforts; loftier in inspirations because of the intellectual advancement and the continual blessings of the Almighty, we joyfully greet the Christmas Day of 1920 with the angel song, "Peace on earth among men of good will."

December, 1920



REPAIRING A CRACKED PUMP BODY

A detailed description of the manner in which these parts are reclaimed by the oxy-acetylene flame, at a saving to the owner and a profit to the repair-man.

David Baxter

IN my articles on the subject of oxy-acetylene welding I have in the past dealt almost entirely with the repairing of autos, tractors and farm machinery, since these are primarily the blacksmiths line of work. But it is a well known fact that the average smithy is supposed to be able to do any and all kinds of repairing, from an Ingersoll watch to a locomotive. In fact, he is sometimes called upon to do that very thing—repair an Ingersoll.

Especially, the village smith is popularly thought of as a cure all for all the ills of everything made of metal; and it is to him that I believe this magazine holds its greatest appeal. The blacksmith in the larger cities and factory departments is essentially a speciality man.

Therefore, I believe it is well to treat some of the more plebian classes of work in an article now and then, and by the way, lots of these small fry jobs require some judgment and a certain degree of mechanical ability. Many of them are not so easy to do as they look. Unless the smithy has had considerable experience with all kinds of metal he is liable to be taken in by some of these "tinkering jobs."

Take for instance the common cast iron force pump such as is illustrated in the accompanying photographs. Here is a job of welding that looks simple enough, and is one that any torch operating blacksmith is liable to be called upon to do most any time; not only once, but many times perhaps, because these pumps are always being broken.

It looks like a matter of merely melting the crack full of new metal, and then turning it over to the customer. But when this simple procedure is tried, it is found that a new crack is formed near the weld, or the old one is opened again, about as fast as the welding can be done. After this happens once or twice the welder begins to realize that he must be about as careful with this kind of a job, as he would with a tractor or automobile job, if he wants the weld to be all that the name implies. He eventually finds the job to be a study in expansion and contraction just the same as a six cylinder block, only in a more modest way; and that he must handle it accordingly.

As I say, I believe an article now and then on some of the cheaper classes of welding will be appreciated by the blacksmith welders. Therefore, let us take the town pump as a good example of a little job with a hidden "kick" and follow the repairing of it through the process, a step at a time.

In this particular instance, the break occurred in the lower part of the force chamber, in the form of a crack three or four inches long. The fundamentals would have been the same, if the crack had been located in any part of the body of the pump, either above or below the location indicated in Figure 1. The reaction of the heat caused by the melting weld would have to be controlled or forestalled just the same.

But let us start at the time when the cracked pump entered the shop, and see just what was done to insure a satisfactory weld; going somewhat into detail for the benefit of the novice in the art of torch welding. First: the damage to be repaired consisted of a crack several inches long in the bowl of the pump and located as stated above.

This picture also shows the first step in the process of repairing, which consists of grooving the crack, or in other words, of cutting enough metal out of the crack to form a V-shaped groove the full length of it. There is danger of lengthening the crack, when a hammer and chisel are used. This risk is not great however, if the mechanic is careful and doesn't work too rapidly.

The iron was cut away from each edge of the crack, until a groove was formed about twice as wide at the top as the thickness of the pump bowl, and sloping to the full depth of the crack. When finished, the V-groove formed an angle of approximately 90 degrees. This was for the purpose of enabling the torch operator to weld the full thickness of the metal without having to melt it out. To enable him to make the casting metal and the new metal one piece, which should be the object of all welds since the parts are not to be merely stuck together with filler metal, but are to be one homogeneous mass.

The groove was cut past each end of the crack and gradually sloped to the surface of the bowl. This insured the welding of the whole crack and made the welding of the ends simpler. By gradually drawing the weld to the surface of the casting, the operator could easily eliminate any abrupt portions.

After grooving, the job was

otherwise prepared for welding by cleaning along each side of the groove with a file to prevent any rust or paint from interfering with the melting weld. The vicinity of the groove was lightly tapped all over to jar loose any corrosive scale or rust that might be adhering to the inner side of the break, or which might float through and cause trouble when the weld melted.

The pump was then taken to the welding table where arrangements were made for preheating. The horizontal preheating and welding position of the pump is shown in Figure 1. Fire bricks were used to raise the pump high enough above the table to permit a gas burner to be inserted beneath the bowl, directly below and opposite the fracture, the groove being upward and approximately horizontal; a position maintained during the welding process.

The gas burner used for preheating was a portable home-made device consisting of a common star-shaped stove burner welded to a section of gas pipe, to which a hose was connected. With this arrangement, the operator was able to confine and concentrate the heat nearly at will; an essential item on many small jobs as a great saving of time and fuel is thereby effected. No preheating fuel is wasted and only just enough is utilized to bring the casting to the correct stage of heat.

After arrangements were made as indicated in Figure 1, the ball of the pump was walled in with loosely laid fire brick, enclosing both the casting and the gas burner. Then several pieces of asbestos paper were spread over the top to further confine the heat. It is scarcely necessary to call attention to the fact that only the large or ball part of the pump was preheated as it is clearly shown in the photograph. To accomplish this and to conserve the heat were the main reasons for the fire brick enclosure.

Outside of a correct manipulation of the welding flame, the preheating was the principal requirement in the process of repairing this pump. The gas burner was lighted and allowed to burn slowly at first, then hotter as the casting absorbed the heat. This heat was permitted to reach the dull red stage before the welding flame was applied. This rising temperature caused the metal of the pump bowl to slowly expand, thus tending to open the grooved crack. Had the crack been free at both ends, it would have spread apart perhaps a sixteenth of an inch at this temperature. As it was solid at the ends the crack could only strain upward and outward under the stress of expansion. But this was all that was needed, since it sufficed to furnish plenty of play for the subsequent reactions upon cooling. In other words, when the heat of the weld subsided and the bowl started to contract, the contraction of the bowl could follow the contraction of the weld inward, and thus prevent cracking.

FIGURE 1, SHOWS THE LOCATION AND EXTENT OF THE DAMAGE AND ALSO THE ARRANGEMENT FOR PREHEATING

The flame of the gas burner was increased until it almost entirely enveloped the ball of the pump, and being confined within the brick wall and beneath the asbestos covering, but little of it escaped through conduction to the exposed portions of the pump. Therefore only the parts directly effected by the heat were fully expanded. The rest of the expansion being gradually dissipated through the near portions of the bowl. Thus any sudden strain caused by the application of the welding flame and its intense heat was eliminated. When the weld was finished the whole thing, pump bowl and weld, was practically fully expanded. If cooled properly it could not crack since the contraction of the whole thing would act as if there had been no welding done. In other words the outside diameter of the ball could shrink with nothing to retard the action.

The blacksmith who does not possess natural gas for a preheating agency can readily substitute a charcoal fire on such jobs as this pump. All that is necessary is to place a grating or flat iron bars across the fire bricks under the pump, upon which a charcoal fire is kindled and heaped up around the ball. Draught to this fire is regulated by opening or closing the cracks between the lower bricks. The charcoal fire is a little slower in heating but will produce a melting heat that is liable to ruin the casting if it isn't watched.

As a further substitute for gas preheating, an air pressure oil burner is good since the flame of it can be directed and controlled quite readily. After the job reaches the proper stage of heat, it can be held there long enough to do the welding. Or the smithy may heat the job over the forge, if he is careful to raise the casting high enough to prevent the fire from coming in actual contact with the metal.

But to revert again to the job at hand: as soon as the ball of the pump had reached a red heat all over, the welding flame was applied to one end of the groove through an opening in the asbestos covering. This part of the process is shown in Figure 2. Only enough of the casting was uncovered to expose the grooved crack. This was to prevent any loss of heat and the resultant decrease in expansion. The expansion was held at the maximum during the welding process.

A medium size flame was employed in connection with a soft cast iron filler rod three-sixteenths of an inch in diameter. The flame at the start was held close to one end of the groove revolving in circles about an inch in diameter. As the metal started to turn bright red, the circles were decreased in size until the flame was revolving in circles that only covered the sloping sides of the groove. When the groove started to melt the filler rod was placed in touch with it in the path of the flame. Then the groove and rod were melted together in one deposit upon the casting. The rod being twisted slightly and fed into the melting groove to fill that portion of it. As fast as the groove started to melt, the filler mixed into it. But at no time was the filler melted until the groove was ready for it. This was accomplished by clever manipulation of the flame as it covered both the melting filler and that portion of the groove being filled.

The filler rod was constantly in the bath of molten metal except when applying a cast iron flux powder. Then the fluxed end of the rod was quickly returned from the flux pot to the weld. At no time was the melting filler permitted to drip onto the weld, but was fed in by pushing beneath the surface of the weld.

The sloping walls of the groove were melted and flowed to the bottom as they mixed with the filler rod. Care was taken to see that the sides as well as the bottom of the groove were melted before flowing in the filler, or as it was flowed in. This is a very particular part of the welding where the groove is wide and deep. It is easily accomplished on grooves like that of the pump job which were only about a quarter of an inch deep.

When bits of slag apeared in the melting weld they were worked to the surface and floated to the edge of the weld with the flame presure, or were scraped aside with the filler rod. The purpose of the flux was to cause the slag to become more fluid and, therefore, make it easier to float. The flux was applied liberally during the process, serving also to form a covering for the melting weld to prevent oxygen of the atmosphere, or that of the flame, from attacking the molten iron.

The groove was melted and mixed full in a series of connected portions. However, each bit of it was but a continuation of the previous one. And each portion was in reality a part of the casting along the sides of the groove. At the last end of the weld the flame application was relaxed a little as the weld worked up the sloping part of the groove. That is, the melting was not so heavy nor was so much filler applied. In other words, no effort was made to melt the full thickness of the pump metal but merely the full depth of the groove.

As each inch or so of the welding progressed the flame was played back along the edges of the weld to insure a perfect connection between the filler and the casing. Literally speaking this was acomplished by allowing the heat of the welding flame to soak into the iron until it became fluid. When the strip or casting along the edge of the weld had all been made fluid again, it was fairly certain there could be no disconnected spots, because the metals would flow together under the mixing influence of the flame pressure. At times during this process, the flame was sprayed diagonally across the surface of the weld to wash any floating impurities to the edge of the weld where they could be scraped off. This spraying action tended to smooth the face of the weld. This operation must be used rather sparingly as there is danger of hardening the weld or causing it to be porous and brittle, as will

FIGURE 2 SHOWS HOW THE PART WAS COVERED WITH ASBESTOS TO RETAIN THE HEAT

frequently happen if the flame is held too close, or is too ardently applied. This washing action, which is sometimes called hot-finishing, should be rapidly and deftly accomplished without hesitating long over any part of the weld. The filler is not utilized in this hot finishing, except when a bit of oxide will not float to the surface. Then the filler rod is used to pick the stubborn bit of dross out of the molten metal.

When the last portion of the groove had been filled and hot finished, the covering of asbestos was replaced over the weld. Then several sheets of asbestos paper were wrapped around and over the preheater to prevent rapid radiation. The gas was allowed to burn several minutes after covering the job to bring up any accidental loss of expansion. The theory being to have the whole pump ball, weld and all, red hot or more before letting it commence to cool.

Then the gas was extinguished and the casting permitted to cool as slowly as the covering required. The covering and brick work caused the radiation of heat from the casting to proceed slowly, thereby causing the contraction to act evenly throughout the whole thing. In effect, the contraction or shrinkage of the ball followed the contraction of the cooling weld inward. We might say, the pincer-like closing of the crack squeezed inward in unison with the shrinking weld.

The pump was allowed to remain in the brick furnace until cold enough that it could be handled without burning the hands. However, it was not absolutely necessary to do this if the space occupied on the table is needed for another job. When the ball had been reheated, just previous to shutting off the gas, it could have been quickly swadded in heavy asbestos paper and placed to one side and allowed to cool. But this operation should be rapidly and deftly performed in order to prevent loss of any heat and expansion. There should be several thickness of asbestos around the casting when moving it.

The last step in the process of repairing the pump consisted of grinding the weld smooth to give it a finished appearance, which counts for a great deal with most customers. To the layman the appearance of an average oxy-acetylene weld seems to be quite a blotchy affair. Therefore, it is always a good proposition, in fact a profitable investment to grind and otherwise clean up a weld. The customer is better satisfied and he is bound to tell other of his satisfaction, just as he is bound to tell others when he is not satisfied. At least, he does not think he has been swindled by a defective job.

Now, in closing let me say that the pump is but one of the many jobs the blacksmith can do, if he is equipped with an oxy-acetylene welding torch. In fact, there are many such jobs that can be done by no other method, and there is a neat profit in making repairs

HINTS ON ANNEALING

STEEL to be used in parts which are subject to stress must be prepared for ready response to the heat treating operation required to bring out its physical properties. Steel hammered and rolled in the mill, and later forged in the blacksmith shop, is left hard and brittle and is not susceptible to the hardening process.

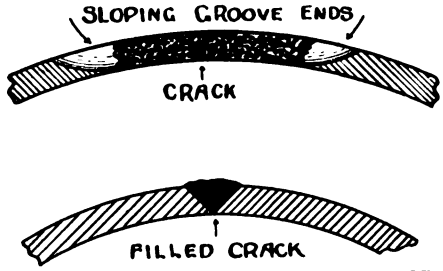


FIGURE 3. A SECTIONAL VIEW OF THE DAMAGED PORTION, SHOWING HOW THE CRACK WAS GROOVED AND LATER FILLED

This condition is overcome by annealing, which removes the hardness by careful, uniform heating and slow cooling. The operation restores the steel to a state of softness and ductility, absolutely necessary for the satisfactory machining of blank stock and the heat treatment of tools, die and machine parts.

"Anneal" generally means "to soften." In the case of glass this is brought about by heating and then slow cooling, which renders the glass less brittle. The same idea applies to steel hardened by hammering or rolling, or brittle through strains set up in the steel by stamping, punching or drawing operations.

The steel if heated to its critical temperature and allowed to cool slowly, tends to recover its malleability. The treatment brings it to its softest state, preparing it for further operations.

Annealing to remedy structure should always be carried out before the machining operations are started. Annealing before quenching or drawing minimizes the possibility of warping and shrinking. When heavy machine operations are performed a light anneal is helpful before hardening to avoid warping. The finishing machine operation should be performed after this light anneal.

A satisfactory manner of annealing carbon steel, is to pack the pieces in a cast iron box, between layers of charcoal, so that the pieces do not touch one another or the sides of the container. Leave one-half inch between the steel and the walls of the box. Secure the cover tightly, place in the furnace and bring to the proper heat, according to the carbon content of the steel, making sure that all parts are thoroughly heated. This method tends to slightly carburize the steel, which is a material help in machining and subsequent heat treating operations.

The time required depends on the size and quality of the stock and the pieces. A piece of high grade tool steel an inch in diamter, for instance, should remain at a temperature of 1475° to 1600° F., depending on the carbon content of the steel, for from one hour after the box is thoroughly heated through, with a proportionately longer time for larger pieces. Let the box remain in the furnace and cool with it. Cool slowly and do not remove from the box until the box and the contents are perfectly cold.

Instead of charcoal, fire clay, charred bone or leather, slaked lime, refractory earth and sand are also used for packing.

There is a new method now being used for annealing carbon steel without packing, which is claimed to work very satsfactorily. Place the work in the furnace cold without packing, and heat to 1480°. When the stock has reached this temperature remove it and place in another furnace which has been previously heated to 1290°F. After the work has received a thorough heating at this temperature, shut off the burners entirely and allow to cool.

It is claimed that steel annealed in this manner is soft enough for the most practical work, and excellent results are obtained in the hardening operations.

The best temperature for carbon steel annealing is from 1300° to 1750° F. This is known as the refining heat, giving the finest grains when hardened. The heat varies with the carbon content, as follows:

Carbon Content	Temperature	Color
1.5%	1300°F.	Dark Orange.
1.0%	1500°F.	Medium Orange
0.5%	1750°F.	Bright Orange

High speed steel can be annealed very nicely by heating thoroughly to about 1600°F. and cooling slowly the same as carbon steels.

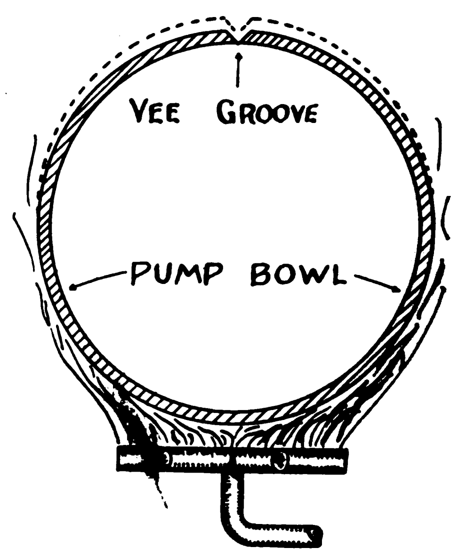
A short method is recommended: Heat slowly until it passes the transformation point, approximately 1600°F. hold at this heat, but no hotter according to the size of the piece, then bury in asbestos, ashes or slaked lime to cool.

Here is another process which is claimed to be very successful: Place in a furnace heated to about 750°F., raise this temperature slowly to 1600°F., then shut off the heat, letting the furnace cool to 1300°F., but not lower. Reheat to 1300°F., holding at that temperature for 30 minutes. Then remove from the furnace to air cool. This whole operation is said not to take

(Continued from page 61)

similar to this pump job, which is not to be sneered at even if the smithy would prefer to work on autos and tractors.

In connection with the many little jobs similar to this pump job, let me say that the fundamentals of the process are the same. The factors of expansion and contraction are controlled by the welder. In further explanation of which I have used a drawing in connection with this article. I believe it is self-explanatory and to need no comment. It is my aim to illustrate the workings of expansion and contraction in relation to cylindrical articles.



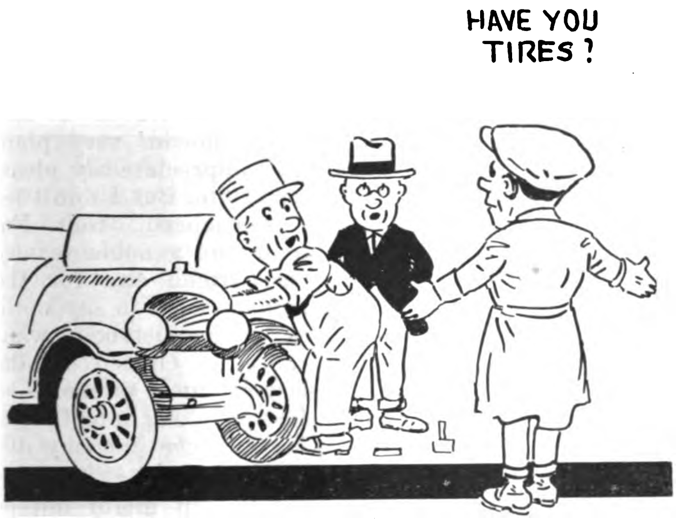
A CROSS-SECTION VIEW OF THE PUMP BODY. THE DOTTED LINE SHOWS, IN AN EXAGGERATED MANNER, THE EFFECT OF PRE-HEATING over an hour for a piece inch square.

There are a few vital points to remember when annealing steel. They may be briefly summarized, as follows:

Do not heat too long. Heat only long enough to penetrate—then turn off the heat immediately.

Do not overheat.

Heat slowly and cool slowly.



The slower the heat the greater the success.

Uniform, even heating is essential for the best results.

To anneal brass, copper and other non-ferrous metal, the heating required is not nearly so high. In the case of brass, the temperature required is about only one-half to one-third of that necessary for carbon steel.

For aluminum a very low and even temperature should be maintained, it should be remembered that aluminum melts at about 1217°F., and it is very easy for the inexperienced operator to permit the fusing of the metals. Heat slowly and evenly to the proper temperature, then allow to cool slowly. More accurate results are obtained if the material is left in the furnace to cool.

In some work such as stamping and drawing, the metal should be kept at an extremely low temperature. Very thin sheets or wire can often be annealed sufficiently in hot oil.

Uniformity in annealing operations depends almost entirely on the accuracy of the furnace used. The temperature should be brought slowly and evenly to the required point, held as long as necessary, and the cooling must also be done slowly and evenly.

JIM DOUBLE TRACKS HIS LINE

By D. G. BAIRD

SAY, did you ever go into a clothin' store to buy a pair of kicks and have the enterprisin' merchant tell you he didn't handle foot adornments because there was a shoe store two blocks up the street? I'll bet you didn't! If you had you'd a made it unanimous to send him along to the bug house, wouldn't you?

Well friends, just lend me your ears and I'll whisper a dark secret to you. There's actually some garage men what don't handle accessories! Can you beat it? And the reason they most usually give is that there's a accessory shop a coupla blocks up or down the street or else they've got a notion that the line don't pay.

Talk about opportunity knockin' at the door! Say, the old sport 'ud have to use a sledge hammer on the portals 'uv some garages to announce his arrival and chances are ten to one they wouldn't know then there'd been a visitor. "Nobody home" his nibs would grumble and amble down the street.

Yes sir, there was my erstwhile friend and sometime boon companion, Jim Calloway, what was a bad offender in them respects. Jim just had a idea that all he could take care of at a reasonable profit to hisself and company was a straight line 'uv garage work and storage and the like, and when it come to side lines he was willin' to let the world know he was runnin' on the main line all the way.

All'uh which woulda been well and good for some bird what didn't wanta help out his Uncle Samuel by contributin' a respectable-sized income tax, but I soon demonstrated to friend James that the gent what's interested in servin' the public and collectin' gratitude and coin 'uv the realm in return therefore will find that a double-track line carries a lot more traffic.

"Jim," says I among other interestin' things, "how's the accessories goin' these days?"

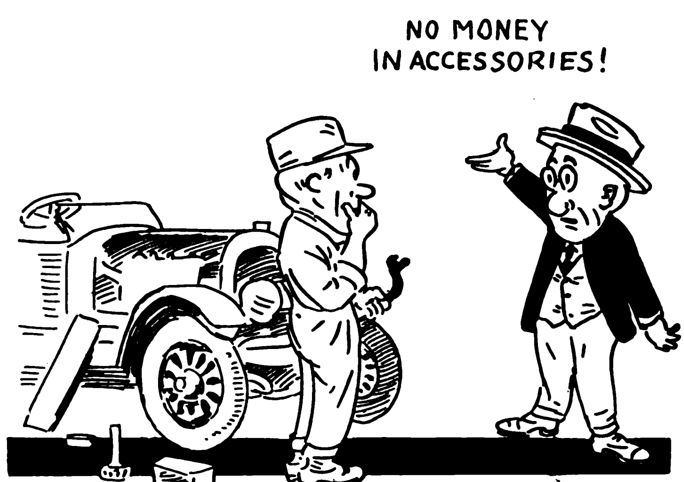
"W'y pretty good, I think," says Jim real innocent. "I haven't talked with the Perkinses lately, but I believe they're doing a nice business."

"The Perkinses?" Says I in a mystified way. "I wasn't referrin' to no Perkinses so far's I can remember—I was inquirin' after the health of the business of one James Calloway by name."

"Me?" Says Jim some surprised. "W'y I don't handle accessories. The Perkinses 're the only ones who handle that line in Hemphill. Just a straight repair business and fillin' station is enough for me these days. Got all I can take care of at that."

"Is that so? What's the trouble—bank in Hemphill shut down on big deposits?"

"Well, they haven't refused any that I've offered them so far, but I've never seen fit to branch off onto side lines. Besides, the Perkinses have got a full line of ac-



cessories just a block and a-half up the street, so I don't see that there's any particular need for anybody else to go into the line in a small village like this."

"Not wishin' to change the subject, Jim," says I real soothin'ly, "but have you been examined by the Doctor lately?"

"Me been examined?" says James lookin' somewhat peculiar. "W'y no, not lately. What 'ud I wanta be examined for? I haven't been sick a day—except for a little cold winter-before-last — in five years."

"That's fine. Don't have any funny feelin' in your head, do you? Or any peculiar notions at times?"

"Say! What do you think you're driving at any way?" Jim wants to know.

"Oh, that's all right, James," I says still bein' real solicitous in my tone, "I just wondered whether you was enjoyin' the full use 'uv your faculties in your old age. You see, a gent in your line what gets an idea that there ain't no use for him to handle accompaniments for gas wagons and automobiles is likely to arouse the curiosity of his friends as to the state 'uv his mental health."

"Huh!" says James s'if he don't appreciate my candid remarks. I guess I ain't got as many wheels in my dome as some that pretends to be business specialists. There ain't no money in a small line of accessories in the first place, and in the second place I've already told you there's a business just a couple of blocks up the street that's carrying a full line, so why in the world should I go dabbling with a little stock in competition with them?"

"No money in accessories! W'y you bloomin' mechanic there's about 35% profit—how much more do you want? And as for there bein' a store up the street that handles 'em, whadda you care if there's a dozen! When a customer comes into your shop and wants some repairin' done, he's more'n likely to want some kinda accessory too, ain't he? And a lot'uh times he wants something that's worth real money, don't he? W'y all you gotta do's—"

But just here Fate smiles real sweet and a gent what's havin' a spring repaired in a Packard Twin-Six steps up real business-like and says:

"Pardon me, gentlemen, (meanin' me too, o' course), but do you have tires?"

"Tires?" says Jim turnin' a beautiful purple, "no sir, we don't handle 'em. You can get 'em at Perkinses just a block and a-half up the street. We only have a straight repair business here. We always—"

But the gent wasn't listenin'. All he wanted to know was whether he could get rubber goods in return for paper goods—the long-green kind—and when he found he couldn't he turned around and left us real unceremonious.

I hate to take advantage 'uv a friend when he's down, but I see it's for the good 'uv all concerned, so I digs out a pencil and do a little mathematics.

"Now, you business giant you," says I, "I figger that the profit on that there one Packard tire what you just now didn't sell would amount to just about three times the price 'uv that little repair job you're doin' on the cart and would cost you about one-fifth the labor. With a little—"

But Jim snaps out real uncomplimentary-like: "Aw! go to blazes!" interruptin' me without beggin' my pardon, so I ignore his ill manners and go right on with my elucidation.

"Now," I continues s'if nothin' had happened to break my chain 'uv thought, "Let's surmise a little—in other words, let us conjecture what might happen, occur, eventuate, or befall in the ordinary course of human events and business competition.

"Just suppose, f'rinstance, that another garage should—"

"I beg your pardon again," says the gent what had wanted the rubber ring for his steed, "but I suppose you keep small articles such as lenses and bulbs, do you not? I might make that there tire do till I get over to Maxwell—I'm in an awful hurry—but it's going to be dark before I get there and one of my lights is broken."

"No sir," says Jim lookin' like he could eat a left-handed monkey wrench, "we don't handle any accessories at all. I'll be glad to send a man up to the accessory shop and get such things as you need—"

"Oh never mind!" the gent snaps and walks off again.

Well, Jim turns around and walks off too, showin' very plain that he don't appreciate my pleasant companionship. But I don't let on a-tall, rememberin' that I'm doin' a favor and a noble service both for my friend and for the human race—to say nothin' of the customers what can't be classed in the last group of animals—so I stroll along into the office and continue my discourse.

"Now it might not be advisable for you to put in a complete stock 'uv auxiliaries, James," I goes on s'if I hadn't been rudely interrupted, "but certainly it 'ud be to your advantage and to the advantage of the bank 'uv Hemphill and to the travellin' public 'uv the United States of America for you to put in a nice stock 'uv—"

"I thought you were conjecturing what might happen if another garage was to start up in Hemphill," James interrupts somewhat s'if he thinks I'm wanderin' in my oration.

"Exactly," I replies without hesitation or one-step. "As I was sayin', it would certainly be a brilliant idea for you to lay in a nice line 'uv the more common things such as spark plugs, anti-skid chains, jacks, bumpers, lenses, bulbs in assorted sizes, tires, tubes and valve caps, grease guns, grease cups, soap and grease remover, fire extinguishers, cotter pins, lock washers, waste in small packages, and the like for the service 'uv your trade, 'cause if some other garage should happen to start up in this here burg you'd pretty soon learn that when a motomaniac drifts into a shop for repairs he's usually willin' and anxious to spend money for the usual accompaniments.''

Jim gets up and hikes back toward the rear 'uv the garage without sayin' "excuse me,'' but I can walk as fast as the next one and I'm right with him all the way.

"O' course you don't wanta try to put the Perkinses outa business,'' I continues as we hustle along gettin' faster and faster in our gait as we pass out the back door and start up the alley, "but you'll find that a modest outfit such as 'Ive described 'll be worth real money.

"There was a friend 'uv mine over Mink's Point what put in a outfit about like that last spring and durin' the summer their weekend sales sometimes run as high as a millinium. Now if you'd—''

"Say, I'm runnin' outa gas! Where'n sam hill 're you headed for anyhow?''

And Jim don't slow up a-tall—just looks back over his shoulder to see how far behind I'm gettin' and kinda grins like my old friend that he is and says:

"I'm going up to Perkinses to see if he'll let me have a small stock of accessories to last me till I can get a lot shipped from the jobber. Come on along—I want you to help me pick out what I need most.''

GOOD BLACKSMITHING COAL

Good blacksmithing coal, like any coal in fact, is very hard to get at present. There are certain qualities which blacksmith coal should possess to give best results. They are enumerated briefly as follows:

First, the coal must be of a high coking nature, clean and free as possible from impurities, such as slate, fire clay and mother earth.

Sulphur is the most difficult constituent with which to contend. The fuel, therefore, should be low in sulphur as possible, on account of the fact that where sulphur comes in contact between the two portions to be welded, pitting will be caused and a poor weld will result.

The percentage of ash in the fuel also should be taken into careful consideration, not so much that it intereferes directly with the welding, but from the fact that it clogs the tyres of the forge and causes intermittent drafts at times when a constant draft is essential. Such action will naturally result in irregular heats and thereby decrease the efficiency of the furnace.

KEEP THE AIR WASHER CLEAN

The accompanying cut shows the amount of dirt that was taken from the air washer of a tractor after a few hours work in a dusty field. If the air washer had not been working properly this dirt would have passed through the combustion chamber and a considerable portion of it would have clung to the pistons and the cylinder walls, and some of it would have worked down the valve stems and guides. The result, of course, would be shortened tractor life and higher operating expense.

THIS IS WHY THE AIR WASHER PROLONGS THE LIFE OF YOUR ENGINE. THE DIRT WHICH IS COLLECTED IN A FEW HOURS

One driver to save the trouble of cleaning the air washer, when in the field, tried a novel labor saving short cut, as he thought. It was a short cut—he's short several dollars to pay the resulting repair bill. It worked so well, like many "cure alls'', that he continued to operate this way for a time, but as a result of his lax methods the cylinder block and all the bearing in the engine had to be replaced. The air washer, as every other part of the tractor, is put on for a definite purpose, and it is the owner's duty to see that it is functioning properly at all times.

PUTTING THE TRACTOR AWAY

One of the leading tractor manufacturers gives the following suggestions for laying away the tractor when it is not to be used again for a while. If they are followed out, the tractor will not only be kept in better condition, but it will also run much better when put into service.

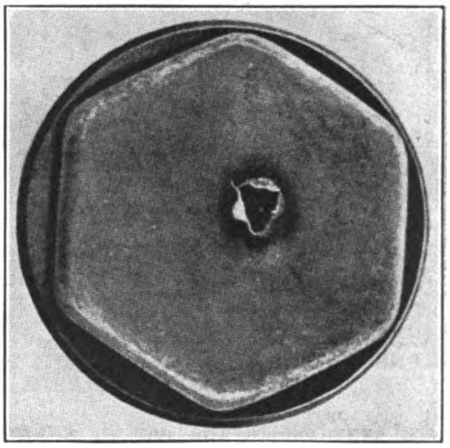
"When stopping the tractor on its last run, pour a pint or more of oil into each priming cup and then shut the motor down immediately afterward. This oil will be drawn into the cylinders and will coat the valves and valve stems with an oil film which will protect them from rust.

"In putting away a tractor, it should be looked over very carefully to see that all parts of the cooling system are drained thoroughly. If the tractor sits high at one end, water may lodge in certain places, and if freezing does no damage, it will rust the parts and in time cause trouble.

"The user of a tractor will find it a paying proposition to house the tractor at all times when not in service. However, if it is not housed there should be something placed over the stack of the radiator which will prevent snow and rain getting in and a tarpaulin or canvas large enough to cover the motor complete should be used, as the motor should not stand out and take the weather.

"The fuel tanks should be drained and protected so that it will be impossible for water to get into them. If the last time the tanks are filled with fuel, a pint of cylinder oil to each five gallons of fuel is put in to the fuel tanks, it will leave an oil film on the inside of the tanks which will be very beneficial in prolonging the life of the same.

"Also in putting away a tractor the user should make a note of all parts that will be needed to put on the tractor when it is put into service again in the spring.''



THE OPERATOR PUNCHED THIS HOLE THROUGH THE AIR WASHER TO SAVE TIME INSTEAD OF CLEANING IT. THE EXPERIMENT WORKED FINE—BUT FOR THE FACT THAT THE DIRT RUINED THE ENGINE

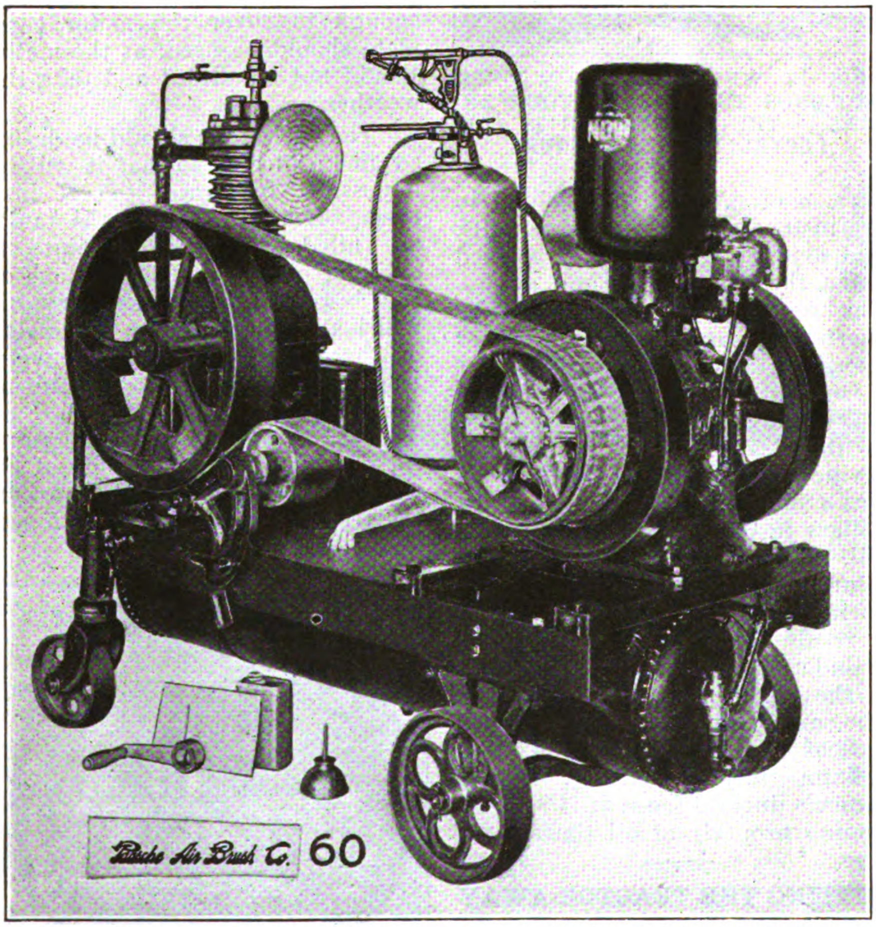
PAINTING WITH AIR

THERE is or seems to be, an impression among a considerable number of automobile painters, and some of their customers as well, that no painting job can be properly done unless all coats have been applied with a brush, the same as work of this kind has been done since Ann's first birthday.

Imagine what would happen if Henry Ford or John Overland painted all their cars by hand—there would be no flivver-a-minute—it couldn't be done. Therefore, if for no other reason than economy and speed of production, the automobile manufacturer applies the various coats of filler, color coat and varnish to the car in a fine spray by what is commonly referred to as an "air brush."

The equipment for spray finishing is simple; it consists of an air compressor, air tank, and the necessary piping to conduct the air to the air brush. If an air line is already installed the need of an air compressor is automatically eliminated. For all-around work an air pressure of from 75 to 80 lbs., should be obtainable, as the heavier the liquid to be applied the more air pressure will be required.

An air brush will apply liquids of practically any consistency from water to heavy asphaltum varnish, and do it with a smoothness and absence of brush marks and runs that is impossible by any other method. All of the various coats of paint and varnish that go toward making a first class job can be applied in a fraction of the time and effort that brush work requires.



ONE OF THE MORE ELABORATE PORTABLE OUTFITS FOR BLOWING ON THE PAINT INSTEAD OF BRUSHING IT ON

The air brush equipment is comparatively inexpensive, aside from the compressor and the engine or motor required to operate it. There is a model made for every conceivable kind of work from coloring the artificial flowers your wife wears on her hat to painting the outside of a skyscraper—or blacksmith shop.

Some of the instruments have the paint fed to them by gravity from a bucket suspended from the ceiling; others suck the paint or varnish directly from the barrel and some are equipped with detachable jars of glass or metal, which can be substituted for others, making it possible for the operator to use the same instrument for the application of any number of colors or materials.

Wastage of paint is reduced to a minimum and it is blown over the surface in broad, even streaks that do not run—further, but a single coat is required where two are generally required if it is applied with a brush. Spray-applied finishes are not inferior to hand-painted coats, the popular predjudice notwithstanding. In fact a spray coated job is actually superior owing to the uniformity of the coats and to the fact that the paint is blown into every crack and crevice and without the necessity of "dabbing" to them up.

This article on the air brush is not intended to induce the casual automobile body painter interested in equipping his shop with an equipment of this sort as he would not handle enough work to justify it. However, for the person or firm that does a large volume of business, the air brush will not only effect a marked and welcome reduction in labor costs, but the work will be better and more of it can be handled, merely to mention a few of the most conspicuous advantages and economies. J. S. Hagans.

PREPARING PLOWS FOR FIELD WORK

In removing varnish and paint from bases, rolling coulters and jointers, do not use lye. The best results are obtained with a varnish remover. Where lye is used for this purpose, these parts are frequently pitted, thus making it impossible for plows to "scour up" properly.

In starting in cold weather, the spark plugs are often damp, caused by condensation of the moisture in the air. They should be thoroughly cleaned and dried to overcome this trouble. Laying them on a piece of metal or a board covered with asbestos and then playing the flame of a gasoline torch around them proves an effective remedy.

PIPE BENDING HINTS

After fifteen years of experience with work involving pipe bending it occurs to me that the following precautionary remarks may be of value or interest:

In bending large pipe fill with DRY sand and plug the ends. Heat to a red heat in localities to be bent and bend. Be sure that the sand is DRY. Where bends are slight it is often unnecessary to use sand or rosin. The object of sand or rosin is simply to keep the sides of the pipe from collapsing, or, to prevent reduction of flow area. If wet sand is used, and if the ends are plugged, the pipe may burst when heated, due to the steam pressure generated.

Rosin, also, is good. But there is a "right way" and possibly several wrong ways to use it. An example of a wrong way was recently brought to my attention where the "mechanic" filled the pipe with rosin, plugged the ends and heated the pipe at the place where he wanted to bend it. He watched for a "red heat" just as he would had he filled the pipe with sand. The result was—a violent explosion.

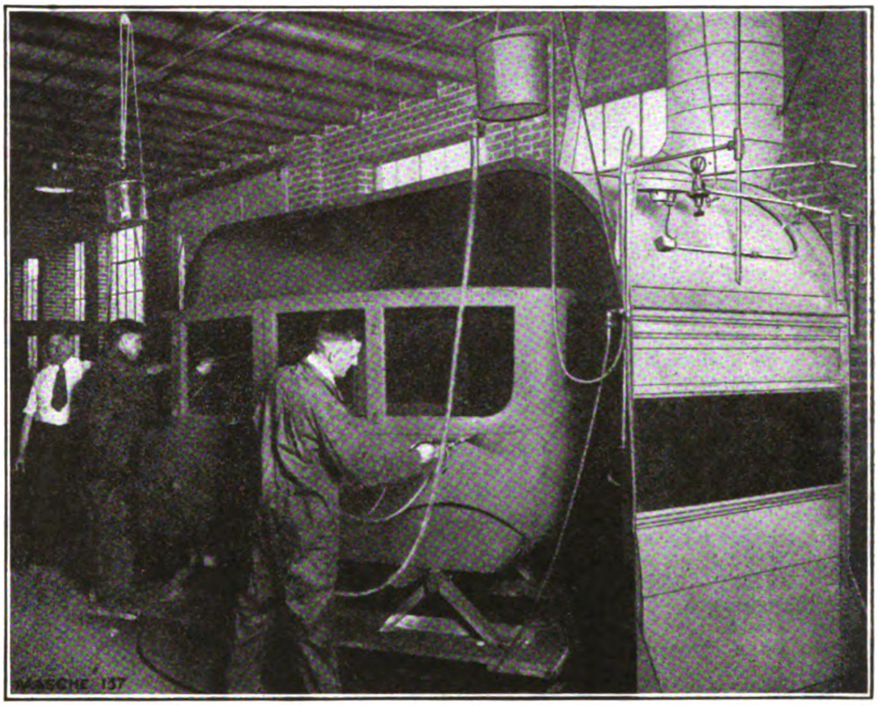
The way to use rosin is to pour it into the pipe and allow it to cool and harden. As soon as the rosin is hard, bend the pipe COLD. Don't heat it. Then, after the pipe is bent, heat the pipe all over sufficiently to melt and remove the rosin.

There are many excellent mechanical devices on the market for bending pipe. To bend large, stiff pipe slightly, and inexpensively, there is nothing handier or more efficient, in my judgment, than a hydraulic pipe bender driven by a hand pump.

NEW MIRACLES OF STEEL BROUGHT ABOUT BY THE AUTOMOBILE

Writers of historical fiction perpetuated the notion that the art of the old armorer has perished. And yet in cars sold for only a few hundred dollars axles and crankshatfs are to be found infinitely superior in texture to the weapons of famous swordsmiths. The tales of supple yet tough blades that could be bent into circles without snapping are eclipsed in the less artfully phrased reports of tests conducted with crankshaft steel in the metallurgical laboratory of any large automobile factory. Could the old swords be twisted through six complete turns before they broke? An axle-shaft can be so twisted. What was the tensile strength of the mace that Godfrey of Bouillon or Richard the Lion Heart wielded? How far, in other words, could it have been stretched lengthwise before it parted? No one knows. But the automobile metallurgist is sure that it was not the equal in that respect of a modern valve-stem—a slim little member that can be extended half its length in a testing-machine before it snaps in two.

As soon as the metallurgist discovered that the properties of steel could be subtly changed by the addition of very small quantities of such elements as chromium, carbon, manganese, nickel, tungsten, or vanadium—as soon, in other words, as the problem of making the automobile durable and safe had been solved by research—the designer ventured to consider the economics of motoring. Heavy automobiles endure, but they consume much fuel, and they wear out expensive tires very rapidly. Light automobiles are more cheaply maintained. And so new demands were made on the laboratory in the effort to save weight without sacrificing strength or safety. Is a gear required with teeth on the outside as hard as tool-steel and yet with a core that shall be soft and tough, a gear that shall not weigh more than a given number of ounces? The metallurgist is asked not only to discover the formula for a steel out of which a part can be made and which must be examined with the microscope to detect the wear to which it has been subjected after having run ten thousand miles, but also to indicate the methods that must be followed by the furnacemen in heating the metal. Without the laboratory the designer would be helpless. There would be little progress from year to year.

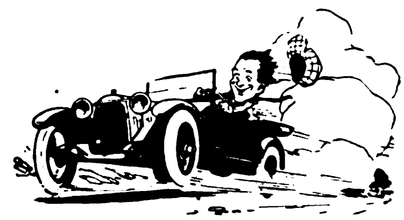


THE WAY THAT SMOOTH LUSTROUS FINISH IS PUT ON IN THE FACTORY WHERE QUALITY AND PRODUCTION IS THE SLOGAN

A NEW ALLOY FOR AUTOMOBILE PISTONS

An alloy containing 90% magnesium, and which weighs less than 70% as much as aluminum or aluminum alloys has been developed by a Michigan concern. It has a tensile strength of about 25,000 per square inch, which may be doubled by forging and heat treating. Its principle use so far has been for pistons for automotive engines. Unlike aluminum, the new alloy, when subjected to the temperature reached in an automotive internal combustion engine, acquires not appreciable permanent growth or set. The alloy is readily machined and the pistons made from it do not score cast-iron cylinders.

High Spots



"I'll bet that new recruit was only a bookkeeper in civil life in spite of all his talk about giving up a career to join the army," volunteered the drill sergeant.

"What makes you think that?" asked the corporal.

"Why, every time I give the order 'At Ease' he tries to put his rifle behind his ear!'

"My poor man," exclaimed the charitable old woman who was visiting the wounded soldiers, "and so you were hit by a shell. Did it explode?"

"No, ma'am," answered the suffering one, "it crept up behind me an' bit me."

THE CAMAGUEY SCOTSMAN

Lady Bountiful was walking down the street one day and passed Sandy, who did not notice her. "Sandy," said she indignantly, "you might at least raise your hat to me!" "Ah'm sorra, ma'am," apologized Sandy, "but ma' puir wife hae been dead only twa weeks, an' Ah'm nae lookin' at th' weemin yet."

HUBBY GETS FUNNY

Mrs. San Lazaro—"I see that, on account of the leather shortage, they are going to make shoes out of all kinds of skins. I wonder if they will use orange and banana skins?"

Mr. San Lazaro—"No, my dear, they will use those for slippers."

TROPICAL LASSITUDE

O'Neill—"I threw a kiss at that pretty girl we met the other night.

Kilgore—"Was she mad?"

O'Neill—"Not exactly. But she said I was the laziest man she'd met in Cuba."

A WOMAN'S CAPES

Cape of Good Hope—Sweet Sixteen.
Cape Flattery—Twenty.
Cape Look Out—Twenty-Five.
Cape Fear—Thirty.
Cape Farewell—Forty.

—The Log.

A wife is like an aeroplane,
She costs a lot of cash,
And if you lose control of her
There'll be an awful smash

Could Live it Down—Said an Irishman to his friend, "I'd have ye know, Pat, that I've got a fine boy baby, an' me neighbors say he's the picter of meself."

"Well, Murphy, what's the harm if he do resemble ye, providin' the child is healthy?"—Personality.

The Retort Courteous—"Why didn't you put my luggage in as I asked you?" angrily demanded a passenger of a porter as his train was moving on. "I did," shouted back the porter; "yer luggage has more sense than yourself, Ye're in th' wrong train."—Tit Bits.

All in the Good Book—Bishop Hoss said at a Nashville picnic:

"The religious knowledge of too many adults resembles, I am afraid, the religious knowledge of little Eve.

"'So you attend Sunday-school regularly?' the minister said to little Eve.

"'Oh, yes sir.'

"'And you know your Bible?'

"'Oh, yes sir.'

"'Could you perhaps tell me something that is in it?'

"'I could tell you everything that's in it.'

"'Indeed,' And the minister smiled. 'Do tell me, then.'

"'Sister's beau's photo is in it,' said little Eve, promptly, 'and ma's recipe for vanishin' cream is in it, and a lock of my hair cut off when I was a baby is in it, and the ticket for pa's watch is in it.'"—Los Angeles Times.

A Known Knave.—The architect remarked to a lady that he had been to see the great nave in the new church. The lady replied:

"Don't mention names; I know the man to whom you refer."—The Bystander.

THE SINS OF OMISSION

For the want of grease the bearings ran dry
For the want of bearings the motor stopped
For the want of a motor the service was bad
For the want of service the patrons got mad
For the want of patrons the business has ceased
All because the bearings weren't greased.

—*Motor World.*

They Bought Theirs Early—Ford's announcement of a return to pre-war prices will make some men angry enough to start a new war.—Toronto Globe.

Wonder Why?—There isn't a man in this town who could be trusted to run the weather for a week.—Frederickton, N. B. Mail.

The Test.—You can form a more accurate judgment of a man by observing his wife's clothes than his own.—Kitchener Ont. Record.

Optimism.—The champ optimist of the world is one who will sit in a poker game with his wife, her sister and her father.—Calgary Albertan.

A Novel Conception.—Henry Ford appears to have decided that the only way to put down prices is to put them down. Perhaps this is as good a theory as any. Others might take the hint.—Manitoba Free Press.

St. Peter (to applicant)—So, you are a millionaire, Hold this needle while I get a camel!—Karikaturen.

The Ever-Ready Flivver.—"Wanted—Married man to milk and drive flivver," reads an adv. in an exchange. There's no chance of the price of cars coming down if they're getting as versatile as this.—Welland, Ont., People's Press.

Barbed—"What do you mean by keeping me standing on the corner like an idiot?" demanded an angry husband, whose wife had kept him waiting to go shopping with her.

"Now, really, dear," she replied sweetly, "I can't help the way you stand."—Boston Transcript.

Restaurant Psychology—"With eggs 80 cents a dozen, how is it that you can offer two fried for ten cents?"

"Because," answered the manager, "nearly everybody that comes in brings up that question and then orders something else, just as you will do."

And he did.—Boston Transcript.

Back Talk.—The profiteer was dressing the other evening for the opera when his wife stalked into his dressing room.

"Here you are," she hissed, " a war profiteer getting 300 per cent. dividends, and I've got only one decent dress."

He turned and looked her up and down, then he said:

"Well, I wish to goodness you'd wear it."—Toledo Blade.

Not So Bad—A returned vacationist tells us that he was fishing in a pond one day when a country boy who had been watching him from a distance approached him and asked, "How many fish yer got, mister?"

"None yet," he was told.

"Well, yer aint doin' so bad," said the youngster. "I know a feller what fished here for two weeks an' he didn't get any more than you got in half an hour."—Boston Transcript.

Poor Willie Was Hungry — Little Willie had been told that he must always wait patiently till he was served at meals, and not to cry across the table or grab for his food.

One day while dining at a neighbor's with his mother, the little fellow was accidentally overlooked. He was very patient for a time, but at last he could bear the strain no longer of seeing everybody feeding but himself. So, leaning quietly across to his mother, he said in a loud whisper:

"Mother, do little boys who starve to death go to heaven."—Punch.

Tests—The late Ambassador Walter Hines Page was formerly editor of The World's Work and, like all editors, was obliged to refuse a great many stories. A lady once wrote him:

"Sir: You sent back last week a story of mine. I know that you did not read the story, for as a test I had pasted together pages 18, 19 and 20, and the story came back with these pages still pasted; and so I know you are a fraud and turn down stories without reading same."

Mr. Page wrote back:

"Madame! At breakfast when I open an egg I don't have to eat the whole egg to discover it is bad."—Writer's Monthly.

Some people go to extremes. Occasionally you meet a man who has a level head and is also flat-footed.

Winter is a gay old bird. Nothing pleases him more than to flirt with spring and linger in her virgin lap.

When disaster comes the world is equally divided between those who say "I told you so," and those who exclaim, "Who would have thought it?"

Lives of great men all remind us,
As biographers wax fat,
And book agents seek to find us,
They've more lives than a cat.

Benton's Recipes

To Finish Wooden Handles, Gun Stocks, Etc.—The wooden parts of tools, the fore-arms and stocks of guns, etc., are often made to have a fine appearance by French polishing, but this finish adds little or nothing to their durability. A much better finish is to soak the wood in linseed oil for a week and then rub it with an oil-soaked cloth a few minutes every day for a week or two longer. This solidifies and preserves the work.

Filling Surface Cavities—To fill a deep surface cavity prepare the pigment as follows: One part keg lead; two parts best bolted whiting. Mix to a stiff paste in equal parts of thick varnish and raw linseed oil. Add a few drops of coach japan to insure correct drying. Then add to the mixture enough dry white lead to give the putty the right consistency to work nicely in the hands. Apply this pigment smooth enough to obviate sand-papering.

To soften a brush that has become hard and unfit to use, take a quantity of the refuse of pine or coal tar and confine in a container of proper size. Immerse the diseased brush well above the bristles in this medium for a few days, at the end of which the stock will be found, as a rule, workable and quite fit for many uses. This coal tar product should be kept in an air-tight container to prevent evaporation.

Lubricant for Highspeed Bearings.—To prevent heating and sticking of bearings on heavy machine tools due to running continuously at high speeds fill an oil can with a good spring bottom about one-eight full of Dixon's flake graphite, and the remainder with kerosene oil. As soon as the bearing shows the slightest indication of heating or sticking, this mixture should be forcibly squirted through the oil hole until it flows out between the shaft and bearing, when a small quantity of thin machine oil may be applied.

To clean glass, use one part water and two parts denatured alcohol. Polish with a soft cloth and tissue paper.

Anti-Freezing Solution—A solution for water jackets on gas engines that will not freeze at any temperature above 20 degrees below zero may be made by combining 100 parts of water by weight with 75 parts of carbonate potash and 50 parts of glycerine. This solution is non-corrosive and will remain perfectly liquid at all temperatures above its congealing point .

To Blacken Articles Which Are Not Soldered—Heat the article to a low heat and dip into a solution of nitrate of copper, made by dissolving copper in nitric acid. Then heat the piece dipped over a spirit lamp or Bunsen burner until from greenish color it finally turns black.

Uses of Rub Lead—Despite the agitation directed against the use of white lead, carriage and automobile painters find it an indispensable material. You simply cannot get away from the fact that in the development of fine work white lead possesses a surpassing filling and surfacing-up property. For both body and running part work it is a superior facing up material.

Rub lead, which many years ago constituted a leading gear and wheel filling up material—the last word, in fact, in this class of work—continues to be used in not a few of the very best shops of this country. Make this rub lead as follows: Mix dry white lead to a mill grinding consistency in three parts raw linseed oil and one part brown coach japan. For a dark lead color add a little lamp-black. Indeed, shade or tone the color in the direction of the final field color.

Run through the paint mill and then add more oil and japan in the proportions above stated until a medium stiff brush-consistency is reached. Then apply with a moderately stiff brush. Let the lead set up for a matter of from 15 to 20 minutes before rubbing out, or until it reaches a condition to rub in and face up clean and smooth under the palm of the hand or under a tight fitting glove, the latter being mostly used by rub lead workmen.

Rub lead requires a little longer time to dry than ordinary lead coats, but a properly conditioned rub lead will produce a surface which ordinary lead coats cannot possibly duplicate.

In Hardening Plow-Shares:—If the share is of soft center steel, proced as follows: First, heat the whole point to a very low red heat; then turn the share face down with the heel over the fire, and the point in such a position that it is about 2 inches higher than the heel. This will draw the fire from the heel along towards the point, and the whole length of the share will be heated almost in one heat. Be sure to get an even heat for it will warp or crack if it is unevenly heated. When the share has a moderate red heat, take it out and you will notice that it is sprung up along the edge. The share is now sprung down. This is the general rule but there may be exceptions.

In either case, set it right—though you cannot with any success set it by a table or leveling block as this will cool off the edge and it must be either over or under the square a little. So, use your eye and set the share with the hammer over the anvil. This done, hold the share over the fire until it is a low red heat—like before—and plunge it into a tub of hardening compound. This can be purchased—or, sprinkle the share with prussiate of potash and plunge it into a barrel of salt water.

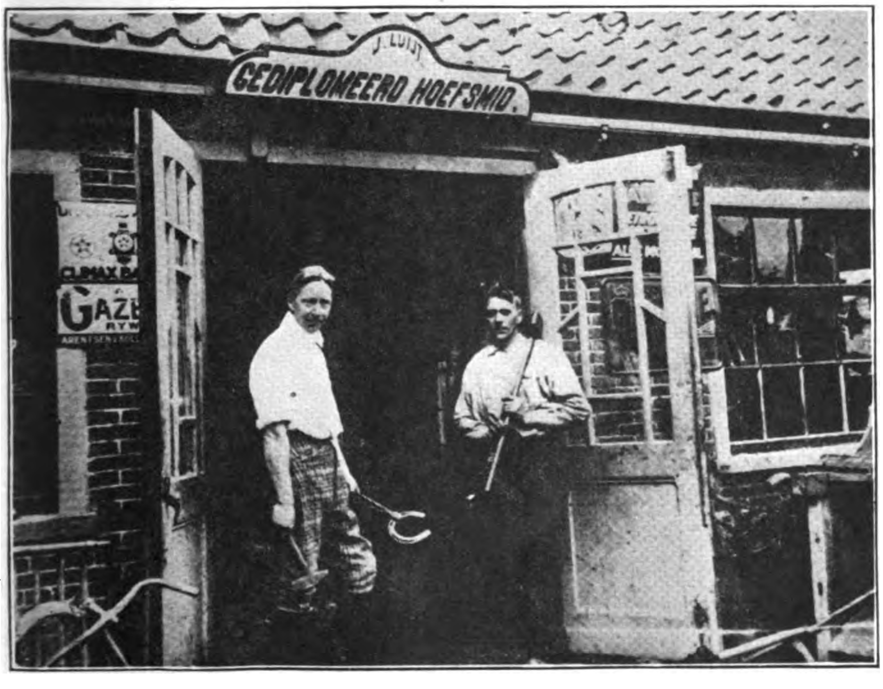
The share generally warps more out of shape in heating, but will also warp in cooling if the heat has been too high. Poor scouring may come from the lay and moldboard being too soft and thus not taking a good polish or it may be full or rough hammer marks.

For Hardening Toe-Calks:—A Minnesota smith has a little "kink" that he employs at the request of some of his customers who are willing to pay for the extra time and work.

Small pieces of cast iron are placed on the calk after it has been welded to the shoe and with borax as a flux these small cast iron pieces are melted or brazed onto the calk. When removed from the fire the calk is dipped in water which makes it exceedingly hard and also keeps an edge longer than the ordinary method.

Use of Turpentine for Wounds—The machinist often cuts or bruises his hands and by having a small bottle of turpentine handy he can at once bathe the injured part, which will relieve the soreness and perhaps protect it from blood poisoning.

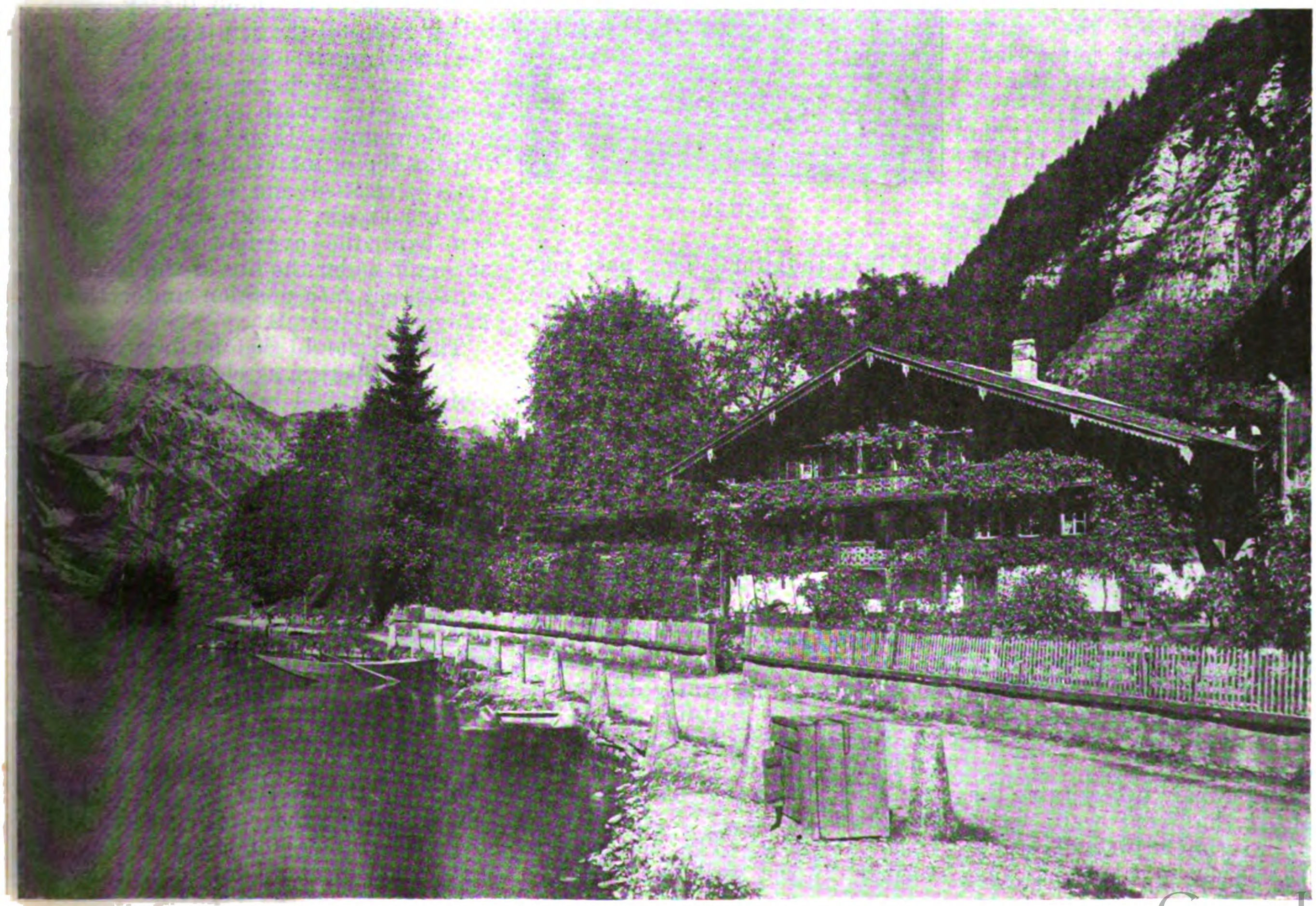
"CLOWN PRINCE WILLIE" IS AN IRON BURNER NOW.



The blacksmith profession has a new member in no less a personage than Fredrick Wilhelm Hohenzollern, erstwhile Crown Prince of Germany. The trade hasn't enjoyed any particular elation through the patronage of its latest devotee, and on the other hand, it may afford some of us an excuse to quit and "take in piano tuning." Ex-Crown Prince Willie, who is shown at the left with his first completed horseshoe, isn't doing it because he has to; but just to wile the time away while in Holland.

Among the Alpine Villag

e'f Picturesque Switzerland



RADIATOR REPAIRING

THE article on radiator repairing, which appeared in the preceding issue, concluded with instructions for replacing the rear wall of the 1917 radiator. The next step to be considered is the removal of the rear wall of the

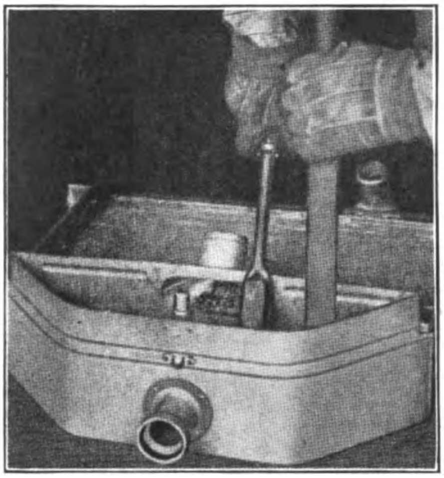


FIGURE 12

1916 radiator. The top tank assembly on this model fits inside the rear wall. The rear wall is removed in the same manner as is the 1917, excepting the work around the water inlet connection. On this radiator, the connection is fastened to the header only.

In replacing the rear wall of this style radiator, fit the tank to the wall as described in replacing the 1917 rear wall. Greater care must be taken in fitting, because the offsets and the difference in the thickness in the metal make the 1916 hard to draw out. An in the 1917, it is good practice to run the seam all the way around the outlet connection.

In removing the front wall of the 1917 radiator, the top tank is so constructed that the front wall slips over the top and header assembly, and is fastened to it by a water tight solder seam. To remove the front wall, it is only necessary to heat the seam, brush off the excess solder and tap the wall off with the back of the brush or a hammer. This wall is replaced and fitted into position in the same manner as the rear wall of the 1916 radiator.

When the repair necessitates the removal of the front wall, when working on the 1916 radiator, it should be borne in mind that this wall is held in place by the beading of the top and header. It is, therefore, necessary to remove the rear wall as described in removing the rear wall of the 1916 model. Heat the splash plate where it is soldered to the header and let it drop down. Disconnect the overflow from the lower tank and core. Heat the header at the point where the overflow pipe enters the tank. Keep turning the tube so that it will not set again at this point, and then draw it out. Heat the beading around the edge of the front wall and push it out through the opening left by the rear wall.

In replacing the front wall, it should be tacked in place and a paste made of chalk and water should be wiped on the front face at the joint to keep the solder from flowing over it. Lay the radiator on its face, wipe the acid on the inside and solder the joint with an iron, holding the wall in position with a file. This operation is shown in figure 12.

The next step to be considered is the removal of the top tank of

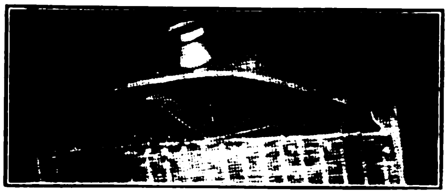


FIGURE 13

the 1917 radiator. This part may be removed in two ways. It may be removed with one of the walls in place, or both walls may be removed. This first is the quicker method, and in case the front wall is left assembled to the header, there is less likelihood of disturbing the tubes. The second method is used when the top is to be saved. To remove the top by the first method, remove the front and rear wall as previously described. Cut through the top with a hack saw about one inch above the top and header joint, stopping at the flange of the remaining wall. Figure 13 illustrates this feature. Heat the joint between the top and the wall and brush off the solder as it flows out. Hit the top a sharp blow at the corners, using a hammer to break it loose. The corners are formed by the wall and the cuts. The top may then be brought to heat and removed by pulling it away from the wall and then raising it off of the overflow pipe. As will be noted, it will be necessary to remove the overflow pipe when this method is used. The two pieces of the top remaining attached to the header may now be removed by flowing out the solder and then drawing them out with a pair of pliers.

With the other method, it is necessary to remove both walls, as previously described. The overflow pipe is detached from the core and the bottom tank, and then heated at the point where it enters the header and drawn out through the bottom of the tank. Care must be taken not to force the tube, as it is very brittle when hot.

The joints between the top and header are then heated and brushed, the radiator is placed with the top tank over the edge of the bench while the seam are to heat, the top is driven off as shown in figure 14.

In replacing the top tank, there are likewise two methods, the first of which is to brush off the excess solder from all the joints and bend the lips of the header out a little so as to insure room for those of the top. Set the splash plate over the overflow pipe. If the one on the top header is intact, it may be removed, cleaned and used in making the repair. Next, fit the new top over the overflow pipe and spring it under the lips of the header, force it into position under the flanges of the wall.

The top should then be drawn up to fit the flanges as closely as possible and tacked to it with a little

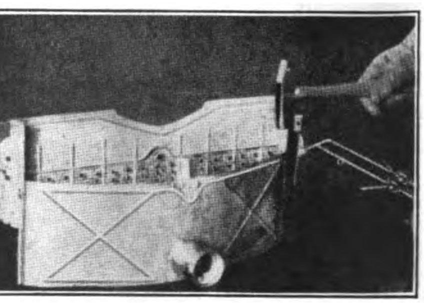


FIGURE 14

solder on the iron at two or three points. Hold the rivet bucker or some other piece of metal against the inside of the joint formed by the header and the top, and flatten the joint with a hammer as shown in figure 15. The opposite side should be flattened in the same way, then the top is ready to be soldered.

Wipe the three joints with clean

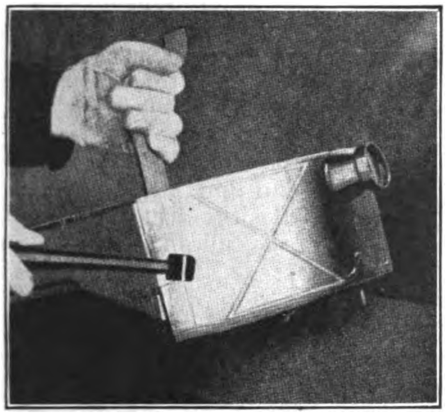


FIGURE 15

acid and flow water tight solder seams with the iron and bar solder. When the top is securely fastened to the wall and header, lay the radiator on the bench with the exposed side of the tank up. Set the splash plate in position and tack it to the top with solder at three points on each side of the plate. The tank is now ready for the last wall, which may be assembled as already explained.

The second method of removing the top allows the old top to be used in the repaired assembly, as when removing the top header. Open the lips, by inserting the weaver's pliers or the cold chisel behind them, to insure a close fit to the header. Clean the edge of the header and open the lips. Insert the top tank and force it down until it lines up with the front edge of the header.

Pull the top into close contact with the header and tack it at the turns with as little solder as possible. Turn the radiator over, draw up and tack the other side, insert the bar and flatten the joints as previously described. Wipe the joint with clean acid and run watertight seams with the iron and bar solder. The overflow pipe is next placed in position and soldered to the core, lower tank and header. The rear wall is now assembled, as already described. Before replacing the front wall, it is usually necessary to reset the tubes. To rest the tubes, clean them by squirting acid around the tubes and heating it. This operation is shown in figure 16. When the dirt has ben boiled loose, the radiator is taken to the test tank where the dirt is removed with water and fibre brush. The radiator is then set up on the rack and the solder is flowed around the tubes in much the same manner as the bottom header is reset.

Because the top tank assembly, already in position, confines the heat, care must be taken not to melt the seams already run. Some repairmen lay clothes soaked in water over the tank to help keep it cool. When the tubes have been properly set, the front wall may be assembled. This operation has already been described.

The top tank of the 1916 radiator is riveted to the header on each side with three rivets. To remove the top, it is necessary to remove the front and rear walls. Next, cut the top tank about one inch from its connection to the top header. This may be done with a hack saw, or with the torch by burning the header and then breaking it off with a hammer. The part remaining attached to the header is removed in pieces with the pliers, the solder first being brought to the melting point with the torch. This method is illustrated in figure 17. When the pieces are removed, brush off

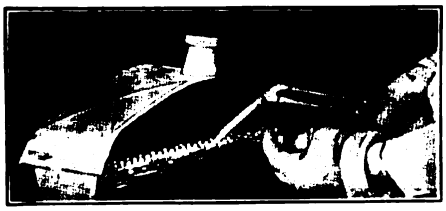


FIGURE 16

the excess solder, cut the heads off of the rivets and drive them out.

In replacing this part, see that the excess solder has been removed from the header at the point where the top is to be fitted. Bend the flaps on the back of the header out of the way, and slide the top into place from the rear of the radiator. When it is in place, line it up with the front edges of the header and tack it with solder on the outside. With the hammer and bar 4, shown in figure 5, flatten the break as close to the header as possible and insert the rivets with the rivet sticker. Coat the outside surface of the joint with chalk and water and wipe the inside with acid. Place the radiator in an upright position on the radiator rack and flow a heavy seam of solder between the top and header. The tank is now ready for the front wall. When the front wall is in place, clean the tubes and reset them with tne torch and wire solder. The flap at the rear of the header is bent to fit the top, after the front wall has been put in place, and is soldered at the same time to the rear wall.

The overflow pipe may be removed from either style of radiator by detaching it from the core and lower tank, melting the solder setting in the header, and withdrawing the pipe. Because of the double curve in the pipe, it is necessary to exercise a litle care in withdrawing it. First, draw it out until it binds. Turn it over to the other side of the radiator and withdraw it a little further. Now, turn back to the first position and it may be withdrawn completely. As it is practically impossible to get all of the solder out of the setting, it is necessary to keep it hot with the torch during the operation of withdrawing. The pipe is very brittle when hot, and unless the repairman is very careful, it will be broken. Should it be broken the top part may be withdrawn through the filler.

In replacing the overflow pipe, the following instructions are applicable. In the 1917 radiator, the overflow pipe is assembled with a washer on the inside of the header. This washer usually drops out when removing the pipe. It is not necessary to replace it, unless one of the walls be removed; in this case, it is good practice to solder it back. If the hole is too small for the pipe, clean it out with a rat tail file. Insert the pipe and push it into position, reversing the action described in removing the pipe. By watching through the filler, it is a simple matter to locate the hole in

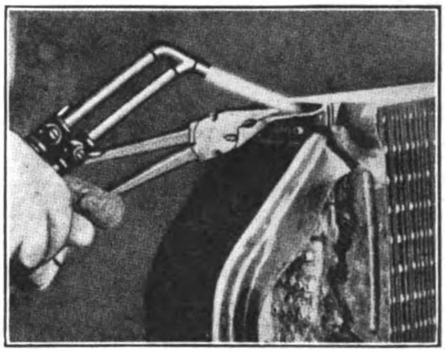


FIGURE 17

the splash plate through which the overflow pipe extends. When in position, solder it to the header and then to the core and the lower tank.

To remove the top header of the

1917 radiator, it is first necessary to remove the rear wall, front wall and top. These operations have already been described. The radiator is then stood on the edge while the solder is removed from the tubes. The radiator is then laid over on its back with the header sticking over the edge of the bench.

FIGURE 18

The top tank supports are loosened from the header by brushing the hot solder from them, and bending them out of the way. Next, the header bar, shown as No. 25 in figure 5, is inserted between the tubes and behind the header, which when thoroughly heated, is driven off in the same manner as the lower header.

To replace the top header of the 1917 radiator, proceed as follows: Before placing the top header in position, heat the supports, brush off the excess solder, and bend them back to their approximate position. The tubes should next be inspected to see that they are clean, properly formed and in line for the holes in the header. Fit the header into position and tap it with the the hammer until it rests on the top tank supports; solder the header to the supports and line the header up with those two points. Stand the radiator upright on the rack, wipe the tubes and header with acid and flow the solder around the tubes, using the torch and wire solder. When the tubes have been properly set, proceed to assemble the remainder of the tank. Details of the necessary operations have already been given.

In removing the top header of the 1916 radiator, it is necessary to remove the top tank, rear and front walls. Heat the solder which holds the header to the supports and pull the header off the rivets with a pair of pliers.

In replacing the top header of the 1916 radiator; the top of the new tank is first asembled to the front wall and tacked to it at several points with solder. Next, spring the top into the new header and insert the rivets with the rivet sticker. The rivets should be held in place with a touch of solder on the head. Cut a piece of wire solder to the length of the header and tack it into position along the joint of the front wall and the header. Remove the rivets from the side of the wall and having brushed off the old solder, straighten the breaks so that the header will set squarely on them. Set the core with the lower tank on the repair rack, and then set the top tank assembly in position on the tubes and side walls. Sweat the joint around the rivets with the iron and bar solder. As very little solder follows through to the inside wall, it is necessary in all cases to stand the radiator on its side and flow the solder into the joint, as shown in figure 18.

The radiator may now be laid on its face and the front wall soldered as explained earlier in the article. Stand the radiator upright on the rack, wipe the header and tubes with acid and flow the solder around the tubes, using the torch and wire solder. Washer solder may be used in this operation, but unless a large amount of header work is done, it would hardly pay to carry it in stock. When the tubes have been properly set, flow some extra solder around the corners formed by the front wall, top and header. Attach the splash plate after which the radiator is ready for test.

The core of the 1916 radiator is changed by removing the bottom tank and then assembling the new core. The rear wall and overflow pipe are next removed and the solder is flowed away from the tubes of the top header. The side walls and front pieces are detached from the support and the core and this assembly is drawn off. The core is then fitted to the top tank and side wall assembly, the tubes being in position in the top header. Force the header down until the side walls rest on the radiator support. The radiator is then inverted on the rack and the side walls are soldered to the support as shown in figure 19. When the solder on the support has set, clean the tubes and header and solder the tubes to the header. The side wall and front member are then attached to the lower tank, front and rear of the core, as indicated in the assembly drawing, figure 6, appearing in the preceding issue. The overflow pipe and rear wall are then soldered into position and the radiator is ready to be tested.

In changing the core of the 1917 radiator, remove the lower tank, the front wall of the top tank and the overflow pipe. The top tank may now be removed assembled by brushing the solder from it in the same manner as removing the top header. Finally, remove the top tank supports. Assemble the bottom header and tank, as previously explained. Position the top tank assembly on the tubes using the top tank support as height gauges. Position the top tank supports against the back edge of the fins and the top tank header, and solder them to the header. This is illustrated in figure 20. Draw down the head until the top tank supports rest on the radiator support and solder them together. The tubes should be cleaned and resoldered. Replace the overflow pipe, attach the front wall and then the radiator is ready to be tested.

Repairing a broken tube is a job the repairman is frequently called on to do. When the tube is broken in the core near one of the headers, the radiator should be removed from the car and taken to the repair bench. Use a pair of 8 inch shears to cut the fins along the tube and bend them back as shown in figure 21. Cut the tube a little above the rupture with a saw made from a broken hack saw blade. Grasp the section with a pair of pliers, and having heated the header warm enough to allow the solder to run thin, draw it out. Next, warm up the end of the tube and

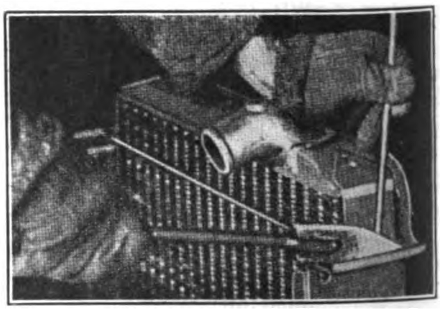


FIGURE 19

clean it with acid until there is no dirt at the end, either on the inside or the outside. In the same way, clean around the hole in the header. Examine the hole and the tube to see that there is no excess solder to interfere with the insertion of the new section. If there is, heat and brush it off or file it out with a ¼ inch rat tail file. Next, cut a section of tube about 3/16" longer than the gap to be filled. File the end of the tube tapered so that they will enter the header and the end of the tube in the core. Next, take a drift of suitable size and drive it into the end of the tube to be repaired, and also into the header to give the necessary clearance for the new section. Dip the tube holder into the acid and solder it to the new section. Enter the tube into the header and hammer it if necessary, striking on the holder. This operation is shown in figure 21. Never strike on the section of the tube. Next, insert the free end into the tube, forcing it well in by hammering on the holder. Wipe the joints with acid, and while heating with

FIGURE 20

a torch, apply wire solder. The radiator should lie flat for soldering tube to tube, but may be stood on end to solder the tube into the header.

Bend the fins back into place with the flat-nosed pliers, and solder them to the tube with the torch and wire solder. If the repairs were made on the front of the radiator, the fins should be supported by a strip cut from the edge of extra fins, to hold the edges of the cut fins together. If it is necessary to remove a large section of the fins, or to cut to the second or third layer of tubes, it is best to cut away the fins and insert a patch. The patch straddles the tube, and is tacked down by soldering with the iron and the bar solder. The patch should be made to overlap the end of the fins and the edge should be turned down over the edge of the remaining parts of the original fins. No support is necessary when the patch is used.

If there is a leak between a number of the tubes and the header, it is best repaired by exposing the inside of the header, cleaning the surface and flowing new solder around all of the tubes, as described in replacing the bottom tank. If there are a number of tubes badly damaged, it will pay to remove the lower tank and one wall of the top tank and insert new tubes the entire length. Remove the lower tank and wall. These operations have all been explained. Then heat the header around the tubes to be removed and brush off the solder. Repeat this operation on the other header. Now heat the fins the entire length of the tube and draw the tube out through the bottom header, using the square nose pliers for the purpose. Clean the surface carefully and insert the new tubes. Solder them by flowing solder on the inside of the header with the torch and wire solder and heat the fins along the tubes to tack them in place. There is an excess of solder on the tubes, and in most cases this is sufficient for tacking the fins, if the fin surfaces have been properly cleaned. If the fins are not tacked properly, add a little more solder while applying the torch.

If there are one or more tubes broken near the center of the core, they may be repaired by cutting the injured tubes above and below the rupture, and after cleaning properly, inserting a new section by entering it into one of the parts of the tube and then into the other in much the same manner as described for inserting a new section for a damaged tube.

If there are a number of tubes broken or damaged near the lower header, it is advisable to expose the lower header, cut the tubes above the rupture and draw them out through the header in much the same manner as described in inserting and entering new tubes. The tubes may be spread with a long drift, inserted through the holes in the header and thereby not damaging the fins. The new section is inserted through the header and driven into place. When the tube is in position to cut it off at the header, drive the spreader into the opening, so as to completely fill the hole in the header. Solder the tube connection with a torch and wire solder, after having cleaned them properly with acid.

When it is necessary to clean the radiator tubes, this operation can be performed most advantageously by removing the bottom tank and forcing the tube cleaner through each tube. That tool is shown in Figure 5 and is indicated as No. 17. If any of the tubes are clogged to such an extent as to not allow a passage, even after tapping the cleaner with a hammer, the tube should be replaced.

When this operation has been completed, the radiator should be flushed out with water, after which the lower tank may be replaced. The radiator should, by all means, be tested before it is replaced on the car.

Not infrequently the radiator supports become loose or broken, and of course, have to be replaced. The old radiator support is replaced by removing the lower tank and lower header, after which the fins below the support are heated and driven off, one at a time, with a bar, in much the same manner as the lower header is removed. In a like manner, drive off the support and the first fin above it. Invert the radiator on the rack and lay the fin spacer on the last fin. Put on a new fin, the bell end of the taper in the hole extending down, drive on the new radiator support and add one more fin. Solder these parts to the tubes with wire solder and the torch. Next, set the fin spacer on top of this assembly and place the next fin in position, all the fins starting on the tube from the bell end of the taper in the

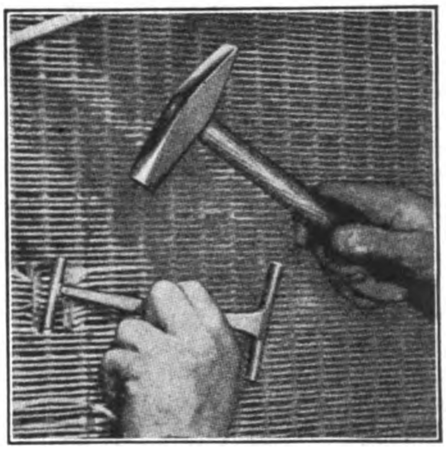


FIGURE 21

holes. Move the spacer into positions for the next fin and continue to add fins until the requisite number are in position. They should then be tacked to the tubes with the solder and the torch. When they have been properly secured, replace the lower header and the tank.

The last operation, but not by any means the least important is testing the radiator after the repair has been completed. It is taken to the test tank. The hose connection, filler and overflow pipe are plugged to prevent leakage, and an air hose is attached to the drain cock hole or to one of the hose connection plugs. The radiator is then submerged and a pressure of 8 to 10 pounds of air let into it. No air should escape from any part of the radiator. If there is a leak, note the spot from which the air is coming. Remove the radiator, let out the air and flow a little wire solder into the hole with the torch.

Before delivering the repaired radiator to the customer, it not only should be in good condition as far as the repair work is concerned, but it should be touched up so as to give a neat appearance. The customer's impression is often largely based on the exterior appearance, and what otherwise might have been an excellent job is spoiled by its sloppy appearance. If the tubes have been repaired, no excess solder should be left sticking to the tubes or fins. The fins should be lined up with the weaver's pliers and straightened out with the comb, as shown in Figure 22. The face of the fins should be given a coat of lamp black and turpentine.

When repairing a 1916 radiator, all the solder should be scraped from the exposed surfaces, and these surfaces should be polished on a cloth wheel dressed with tripoli. Remember that the wheel heats the metal, therefore, do not polish too long in one place as it is apt to melt the solder. If no wheel is available the spot may be cleaned with some metal polish.

The general appearance of the radiator is greatly improved by removing as many of the small dents as possible. This can be done without disassembling the radiator. If the filler has been driven into the tank, it is possible to pull it out by soldering the dent puller to the filler cap, and, having screwed the cap into the filler, pound up on the dent puller. If there is a dent in the tank, solder the dent puller into the center of the dent and draw it up in the same manner. Larger dent may be drawn out by removing the part of that assembly and reshaping it on the bench. The repairman may judge the advisability of reforming the part, and if he considers the dent bad enough, he should replace the damaged part.

CYANIDE TREATMENT

The use of cyanide of potassium for the heat treatment or carbonizing of embossing dies, engraving plates, small steel parts for typewriters, guns and etc., and in general for a wide range of articles requiring a hard wearing surface without great depth of case, has so many advantages that it is rapidly superseding other methods of carbonizing and of heat treating along certain lines.

Cyanide of potassium is now commercially handled in crystal form. These crystals are melted in the pot of the furnace and the molten bath is heated to a temperature of about 1450°F., at which temperature the best results are obtained.

Small articles to be treated in cyanide are suspended in this molten bath, usually in wire baskets; larger articles are hung from the side of the pot by means of wire hooks. It is important that the parts or articles to be treated do not touch the side of the pot, or the bottom of it.

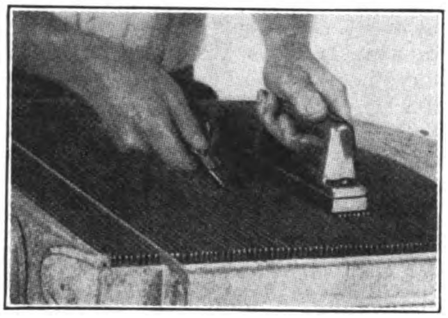


FIGURE 22

Ordinary cyanide treatment involves leaving the parts immersed in the molten bath from two to thirty minutes. After the part has been taken from the cyanide bath, they are quenched in oil or water, preferably oil.

In addition to giving the articles treated a uniform skin of very hard casing, the cyanide treatment can be made to leave on the surfaces of the articles treated, a very attractive mottled effect.

As cyanide of potassium is a deadly poison, such furnaces or other receptacles in which the cyanide treatment is conducted should be supplied with hoods for carrying off the fumes through flues to the outside air.

SAVING IN BELT TRANSMISSION

At a foremen's meeting recently, one of the questions discussed was, "Why do we lose so much time in getting the full production from a machine with a new belt?"

One man asked, "Has it anything to do with the way the belt hugs the pulley?" The reply came quickly from two or three, "The trouble is that the belt was not properly stretched before it was put in place."

Finally, the manager said, "Well, let us take this up as we did the other power problems. We will get the engineering department to take full charge of all the belts that are put on new in two or three rooms for the next two weeks, and then hear their report."

When the tests were made, and the report read, the following facts were brought out:

First: All the belts, even those as narrow as 1¼ inch, showed the least trouble when stretched on the floor before being measured for the length required. This was done by securing the ends of the belt by nails at one end, the other being put in the regular clamps and drawn up a little every day before cutting to length.

Second: All the belts of whatever width that were used showed a loss in power when they were put together, either with lacing or any style of belt hook. Those that were cemented, with no extra thickness at the joint, showed regular transmission, no lost motion on machine or shaft and the production very soon after the new belt was put on the machine came up to full production.

The tests showed such favorable results that the following rules were adopted after the points had been thoroughly discussed:—

Rule 1. All belts shall be given out only in lengths required for applying to the drive, and only after same have been subjected to a regular process of stretching, the belt being secured to the floor at one end and the clamps applied to the other, the amount taken up being determined by tests on the exact width of the belt being kept, one inch not being reduced by the pull to three-quarters and so forth.

Rule 2. Any roll of belting, so stretched, that showed uneven width, shall be laid to one side, and shown to the purchasing agency, to be taken up with the firm that supplied the belting.

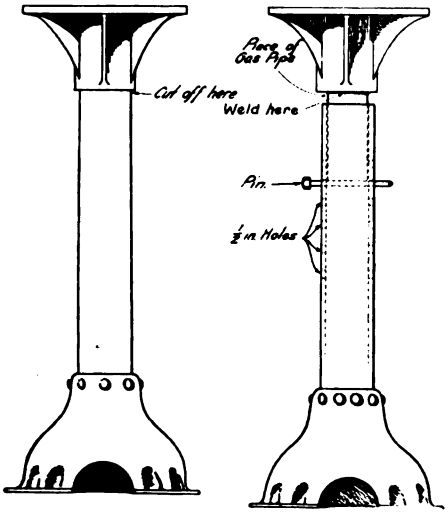
Rule 3. No lacing, unless necessary to avoid stoppage, shall be used in any case, unless the belt is narrower than one inch.

Mark Meredith.

HELPFUL SHOP SUGGESTIONS.

A HANDY CAR SUPPORT

A pair of car supports that will be found very handy around the repair shop, and which work out much more satisfactory than blocking can be made at practically no



A SERVICEABLE CAR SUPPORT MADE FROM OLD REAR AXLE HOUSINGS

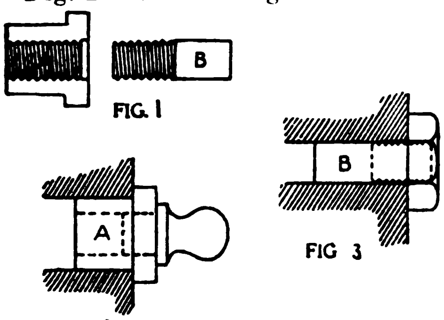
expense from a pair of Ford rear axle housings.

The outer flange of the housing is cut off as indicated in the drawing. The projections on this flange over which the felt washer retainer is slipped is cut off so that the top of the flange will be flat. This flange is then welded to a piece of pipe which will slide in the other part of the housing. Several ½″ holes are drilled at intervals, then by means of a pin placed in these holes, any desired height may be obtained.

If desired, part of the tubing may be cut away, thus lowering the overall height of the support.

CHUCKS FOR HOLDING SCREWS AND NUTS BY THE THREADS

Fig. 1 shows in longitudinal section, a complete appliance which consists of two parts, male B and female A, each of which is stamped with its diameter and number of threads per inch. For facing a screw head, or the like, the female part A is used, being held in a self-centering chuck. The job is then run into it, as shown in Fig. 2, and at once faced or turned as required with a slide-rest or hand tool. Withdrawal after finishing offers no difficulity, as even if a smooth cylindrical head or a polished knob has to be dealt with, it can be gripped without damage by placing a piece of leather between it and the gas pliers or other gripping tool.



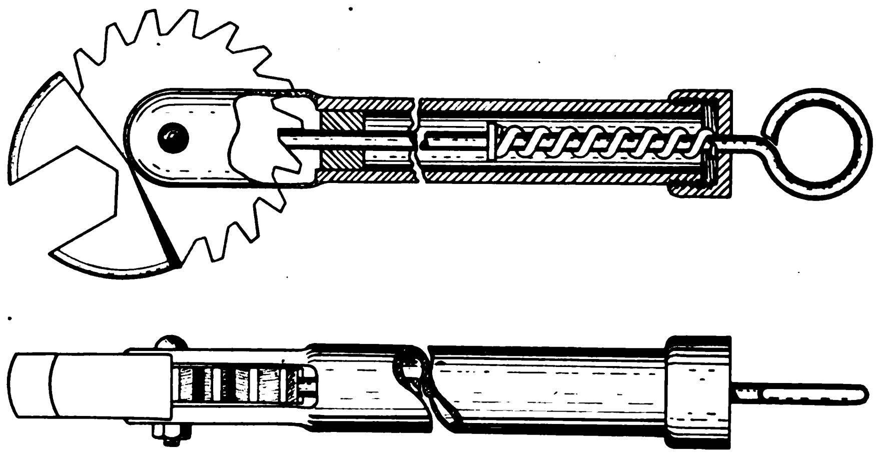
CHUCK FOR HOLDING SHORT SCREWS AND STUDS. IT DOESN'T MAR THE THREADS

If the job is a nut that requires facing or the like, the male part of the appliance is employed and held in the self-centering chuck (as shown in Fig 3), so that the amount of its thread projecting is rather less than the thickness of the nut. In this case the opening of the chuck jaws relieves the pressure on the nut, and no tool is required for its withdrawal. The external dimensions of the appliance are of no importance, and any available stock of round steel (or brass) rods can be used for their manufacture. The plain part of the male portion should be a shade full of outside diameter of thread. Work.

AN OPEN END RATCHET WRENCH

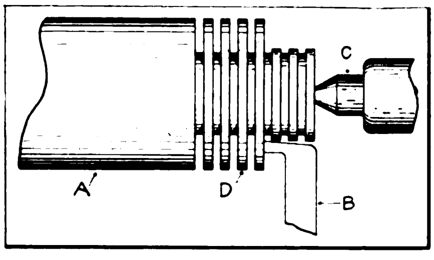
A wrench of rather unusual design, which incorporates with the open-end wrench, the ratchet principle, so successfully used in socket and spanner wrenches, is shown in the accompanying drawing. The jaws, which are forged from tool steel, are made in several sizes to fit the standard size nuts most commonly used. These jaws are readily removed from the handle merely by removing the nut and bolt which hold these parts together. The handle is made from a suitable sized piece of pipe with a standard cap at the end. The ratchet effect is accomplished by means of a rod which acts as a pawl, engaging the teeth in the jaw. The rod is held in contact with these teeth by means of spring located directly under the cap. The rod is strengthened at the point where it engages the teeth by means of a bushing of proper dimensions brazed to the inside of the pipe as near the ratchet as possible. A hole slightly larger that the size of the rod is drilled directly through the center of it, and the rod passes through this hole.

Chas. Chism.



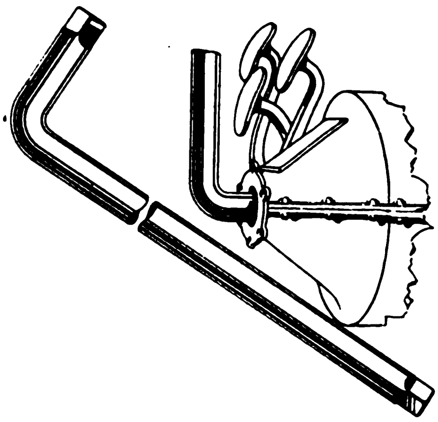
THIS OPEN END RATCHET WRENCH HAS MANY USEFUL PURPOSES

MAKING WASHERS OF ACCURATE SIZE



MANNER OF CHUCKING THE STOCK TO TURN OUT WASHERS

Washers of accurate size can be conveniently and quickly made by chucking a piece of material in the lathe. It is then turned to a size corresponding to the outside diameter of the washer as shown by A. A cutting-off tool is placed in the tool holder, and is used to cut the bar to give the desired thickness to the washers. This is shown at D. The boring tool B is then placed in the tool holder, and used to cut off the washer with the proper inside diameter. After each ring is cut, the carriage is run back, and



A HANDY LEVER FOR TURNING OVER A TIGHT OVERHAULED MOTOR

the washer is permited to drop over the center C.

WHEN OVERHAULING THE FORD MOTOR

When overhauling the Ford motor, the mechanic frequently has considerable trouble in turning the motor over in order to insert the pistons and perform other operations. The crank case being removed, it is impossible to use the starting crank for this purpose. It is difficult to turn the motor over by grasping the fly wheel and besides ones fingers are often skinned or badly pinched when they come in contact with the stationary field coils. This condition often prompts the mechanic to turn the motor over by inserting a large screw driver between the magnets, thus using the driver as a lever. This ofen results in a broken or cracked magnet. Should such a break escape detection, it is bound to tear things up in general, if it works loose when the motor is placed in operation.

The safest and most convenient way is to make a lever for the purpose of turning the motor over. An old drive shaft answers the purpose admirably. Make a short bend near the square end. This square end will fit the hole in the end of the driving plate and the motor can be turned over with comparative ease.

If the other end of the lever is forged square so that it will also fit the hole in the driving plate, it will be found that the motor can be lifted a great deal easier by this means than any other, where a hoist is not available. The universal ball cap should be bolted in place to avoid any possibility of springing the driving plate. This tool will also be found very handy in lifting the motor block with the transmission assembled off of the crank case or onto it.

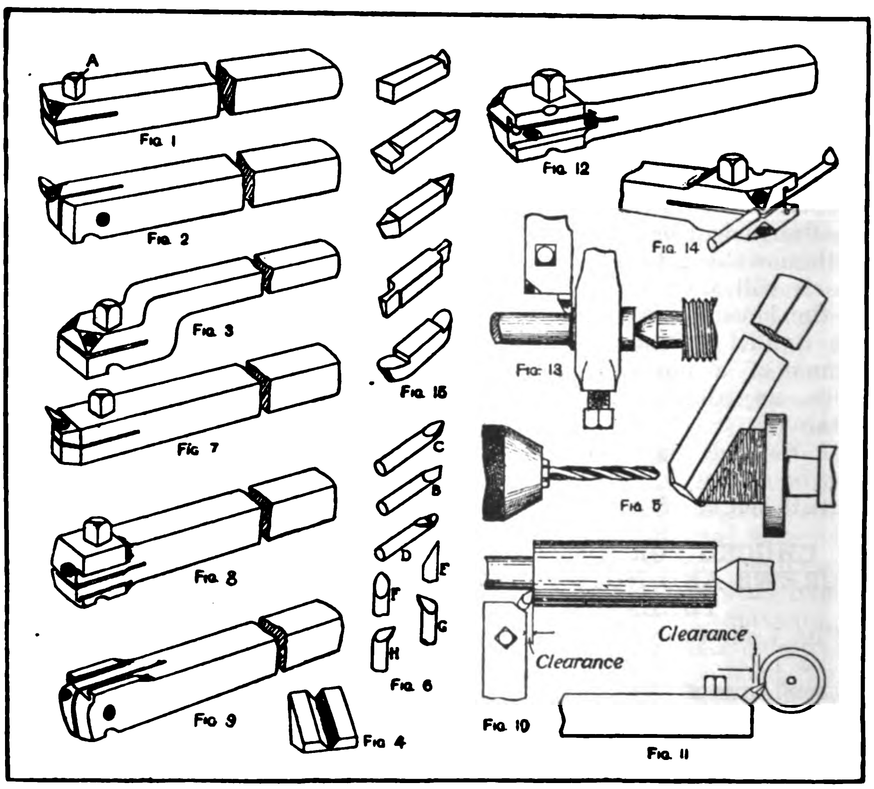
SIMPLE LATHE CUTTER BARS

The cutter bars here described are very simple to make, and are amply strong for the size of bit they take. They are made to take round cutters by filing out the holes; square or rectangular can be used with equal facility.

The right and left bar Fig. 1, are made to take 7/32 in. cutters. The bar is of cast steel 5/8 in. square, which when in position is somewhat below the height of the lathe center for which it was made. It will be seen that if the bar is turned over as in Fig. 2 it acts as a right-hand facing tool.

For lathes where there is little difference in height between the top of the tool-slide and the tool center, a dropped head tool (Fig. 3) should be used. As will be seen, the hole that holds the cutters is drilled at 45° from corner to corner, and is also set back as shown, one of the corners being filed away. Whether drilled on the lathe or drilling machine, an angle piece of hard wood is shaped as in Fig. 4. The bar is placed in the vee-slot, and the wood put against the pad center to throw the bar at the correct angle for drilling see Fig. 5. The clamping screw A (Fig. 1) is turned from 5/16 in. cast steel to fit the hole, drilled half way 11/16 in., and then drilled ¼ in. the other half and tapped 5/16 in. Sawing the slit shown completes the bar. Owing to the cutter hole crossing the saw slit at the angle shown, a good grip is obtained with the clamping screw.

The cutters are shown by Fig. 6, B right and C left. Round-edged cutter bits D can be easily formed.



SIMPLE LATHE CUTTER-BARS.

Fig. 1—Left-hand Cutter-bar. Fig. 2.—Bar for Right-hand Cutters. Fig. 3.—Right-hand and Left-hand Cutter-bar. Fig. 4.—Veed Angle-piece for Backing Bars for Drilling. Fig. 5—Method of Drilling Oblique Holes. Fig. 6.—Cutters for Bars. Fig. 7—Front Sliding Cutter-bar. Fig. 8.—Heavy Pattern Round and Flat Bit-holder in Left-hand Position. Fig. 9.—Same Bar in Right-hand Position. Fig. 10—Side Clearance between Bar and Work. Fig. 11.—Front Clearance between Bar End and Work. Fig. 12.—Combination Cutter-bar for Round, Flat and Square Bits. Fig. 13.—Same tool working close to Corner. Fig. 14.—Combination Bar carrying Boring-bit. Fig. 15—Square Cutter-bits for Combination Bar.

To make the bits, round cast-steel rod is sawed at an angle to leave an edge shown at E, this edge being filed off as at F and the cutting edge formed. It will be seen that cutting at a long angle saves a lot of grinding. After hardening and tempering, the bits are finished off on a smooth stone. Screw-cutting bits right and left are shown at G and H.

Practically any shape of cutting edge can be formed by trying the blank piece of steel in the holder, and with the holder secured in position in the tool slide, note the position the cutting edge should take. After filing this and making allowance for clearance and rake, form the adjacent semi-cutting edge. With bits of this description, clearance and rake can be adjusted slightly by turning the bit in the holder.

In designing cutter bars of this description due regard must be paid to the height of the lathe centers, so that when in position there is sufficient side and front clearance for the tool end (see Figs. 10 and 11, which are plan and elevation). An all-round cutter bar made on the same principle as the others is shown by Fig. 12, and D in the photograph. This tool will hold round, square, or flat bits, left and right facing cutters to work close to a shoulder either way, and will also face or square a shouldered end working close to the carrier (see Fig. 13). It takes 3/8-in. square bits, and in addition will hold a 1/4-in. boring bit as shown in Fig. 14 perfectly rigid. It is quite a universal tool. Flats are first filed to start the right-hand and left-hand oblique holes. When these are drilled, the bar is mounted in the lathe and the hole for the boring bar drilled, the slot for the flat and square cutters being then drilled out and the 5/16-in. hole drilled out for the 3/8-in. clamping-screw. The hole for the latter is enlarged halfway for 13/32 in. to allow the screw being clear when tightening up. The slit is afterwards cut 5/8 in. beyond the screw-hole. This does not unduly weaken the bar, and enables the screw to bend the ends of the bar with the least trouble. A selection of cutter bits to suit the bars is shown in the second photographic reproduction.

The square bits (Fig. 15) are held horizontally, and consequently have the rake filed off the top side, the other side and ends being filed away for clearance.

THE VALUE OF CHROMIUM

Chromium is a metal which when alloyed with steel gives to it hardness and toughness that make it useful in the manufacture of automobile steels; armor plate; armor-piercing projectiles; the shoes and dies of stam mills, and tires for rolls used in crushing ores; tool steels; and in other steels to which it is desired to give hardness and toughness.

The proportion of a countersunk bolt head should be such that the diameter at the upper end of the conical head is equal to twice the diameter of the bolt. The links of the conical head should be five eighths of the diameter of the bolt.

A worn broom can be used handily for cleaning corners by cutting to a sharp point at one side.

FASTENING THE ANVIL

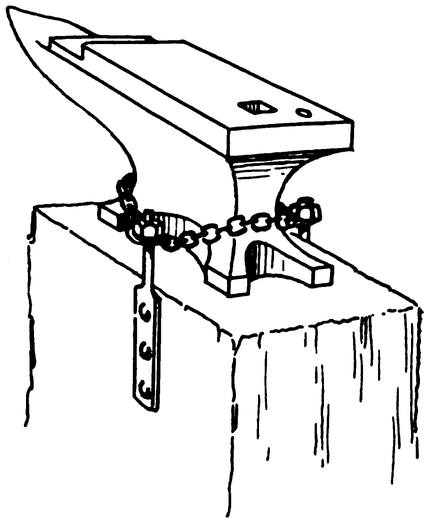
A convenient way of fastening the anvil so as to hold it rigidly to the block and still allow it to be readily moved to any desired position with but little effort, is shown in the accompanying illustration. A chain is passed around the base of the anvil. It is drawn tight by means of the two nuts as shown in the drawing.

FASTENING SLEDGE HANDLES

Usually hammer heads and sledges are fastened to their handles in a safe manner when the tools are new After use, however, if the same implements are examined, as many different modifications of the original fastening are found as there are tools. Many of the makeshift fastenings are dangerous.

One manufacturer has worked out a uniform method of fastening sledge handles. He believes that there is a great advantage in having them all fixed on in a uniform manner. For this reason the handles are all fastened by one man, to insure their being done the same way.

When a sledge comes to this man to have the head put on firmly he takes a fine hacksaw blade and slots the part of the handle entering the sledge once lengthwise and twice crosswise. He then dips the handle into boiling rosin before fastening it into the sledge. This done, the handle is inserted into the sledge eye and the three wedges are driven home.



THE ANVIL WON'T MOVE IF IT'S FASTENED THIS WAY

It has been found that this is one of the best ways to insure against accidents from sledge-hammer heads flying off. There is doubtless something, too, in having the repair work done by one man who is thoroughly familiar with it. If tools of this kind in a factory are fastened in a uniform way, the workman becomes accustomed to their appearance when in safe condition.

Thus, he is more apt to recognize a dangerous condition and so avoid disastrous results.

Mark Meredith.

MELTING POINTS OF METALS

	Degrees F.
Zinc	786
Lead	621
Aluminum (pure)	1217
Silver	1760
Iron, cast	1920
Copper	1981
Steel, mild	2550
Nickel	2646
Chromium	2939
Vanadium	3128
Tungsten	6152

Statistics show that one person in the U. S. is killed by an automobile every 35 minutes. This is three times the fatalities caused by all the accidents in factories, mines, railroads, and other industries in America.

7,990,000 motor cars and trucks are now in service on the highways of the United States.

A JOB FOR THE ENTERPRISING BLACKSMITH

In certain parts of the country much of the farmers' income is derived from growing onion sets for the market and these must be delivered clean and in good condition. Removing the dirt and loose hulls from the sets can only be done by sifting and this operation, if conducted by hand, is a laborious and back-breaking labor, particularly when several thousand bushel of the bulbs must be thus prepared. The time consumed in sifting even a moderate quantity of sets is also an item that must be considered, particularly if the product is to be sold at a close margin.

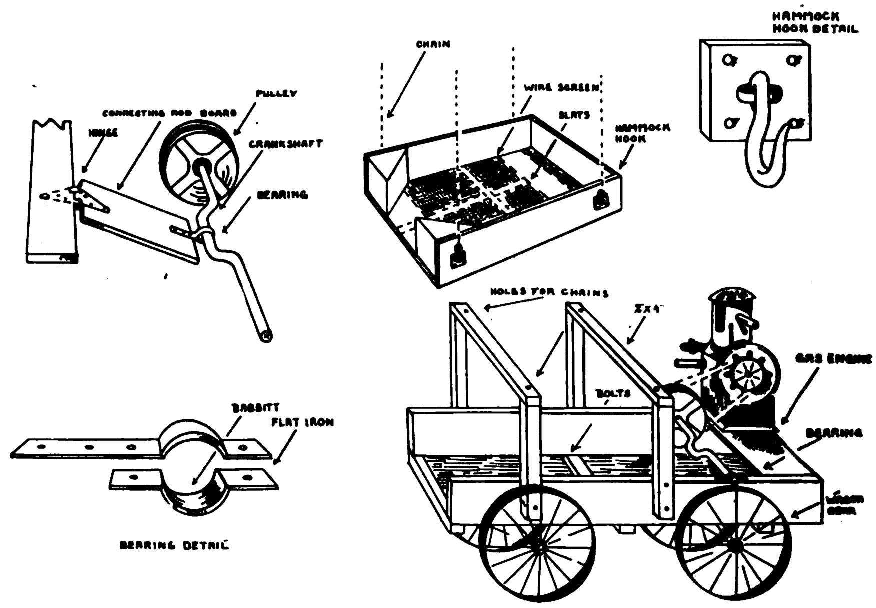
The illustration shows a mechanical shaker which is in use on an Illinois farm. The device is mounted on a wagon gear, for easy transportation to any part of the farm. A bottomless box, suitably cross-braced, and open at the rear is fitted to the gear; the front end of the box is provided with a platform on which the small gas engine used to operate the shaker is mounted; the box is also provided with supports and cross-braces of 2 by 4 in. material from which the shaker, or sieve, is suspended.

The shaker or sieve consists of another box, about 6 in. deep, which fits inside the wagon box, with plenty of room at the sides so that it can swing freely. Lengthwise and crosswise slats of 1/2 in. strips are provided to prevent the netting bottom from sagging. The netting used has a mesh about 5/16 or 3/8 in. square. A hammock hook is screwed into each corner of the shaker, as shown, and the rear end is partially closed so as to retard the flow of sets into the pile and insure thorough cleaning. Well toward the front end of the shaker, a substantial cross brake, as at "A" is fitted.

One end of a heavy strap hinge is bolted to this piece and the other is bolted to one end of a wooden connecting rod. The opposite end of the connecting rod is attached to the crank shaft by a simple babbitted bearing, as shown in the detail drawing. The crankshaft is formed from a suitable length of 1¼ in. round stock and care should be observed to form the throw so that it will be parallel with the ends or difficulty in fitting the bearings will be experienced. The shaft is fitted with a pulley and set in place on bearings bolted to the sides of the wagon box, as indicated.

One inch holes are drilled in the horizontal braces over the wagon box as shown and the shaker is suspended from them by means of a chain, the height of the shaker being easily regulated by inserting a pin through the chain links.

In use, the shaker is inclined so that the lowest point is at the rear. The onion sets, or other crop to be cleaned are dumped into the shaker at the upper end from where it is gradually be shaken down and out of the lower end, all or most of the dirt having shaken through to the ground underneath.



Such a shaker or cleaner is made without much trouble or expense and as practically every part, with the exception of the crankshaft, is to be obtained from any well-stocked hardware store, and as almost any blacksmith can turn out a satisfactory crankshaft it is possible that blacksmiths can "cash in" on this idea. The total cost of set, exclusive of the engine, did not exceed $20 and the builder would not do without it.

SUGGESTIONS FOR OLD CHIMNEYS

1. A chimney in any existing building that becomes too hot to hold the hand against comfortably is dangerous if there is woodwork touching it. Have it carefully inspected by a reliable mason, and apply the protection prescribed by this Ordinance as far as is possible.

2. Where soft coal is used it is often necessary to rebuild chimney tops every few years, and all unlined chimneys irrespective of fuel used, are very liable to become defective through disintegration of the mortar joints. In order to ascertain if chimneys need rebuilding, climb to the top and look inside. An electric torch or a lantern let down on a string is an aid in detecting defects. If mortar has begun to fall out from between the bricks it will soon do so all the way through the wall. Take an ice pick or other sharp implement and try to push it through the mortar; if you can do so, rebuild at once as follows:

Tear the chimney down to a point at least 18 inches below the roof, get fire clay flue lining of the same size as the inside measurement of the chimney, set it in the top of the flue and build up with good brick and Portland cement mortar. This will make a solid chimney through the roof where there is greatest danger, and is the best that can be done unless the flue portion of the chimney is completely torn down and rebuilt. Preserve a clear space of at least 1 inch between the woodwork of the roof and the chimney wall, and connect the chimney with the roof by metal flashings. Build the chimney at least two feet above the peak of the roof.

While we are learning more every day how to prevent fires and to put them out quickly when they do get started, the annual fire loss in the United States, according to the underwriters, exceeds $300,000,000 in property and 20,000 lives.

DIFFERENT WAYS OF CROSSING A BELT

One of our readers, when installing a new belt in his shop had considerable trouble in crossing it.

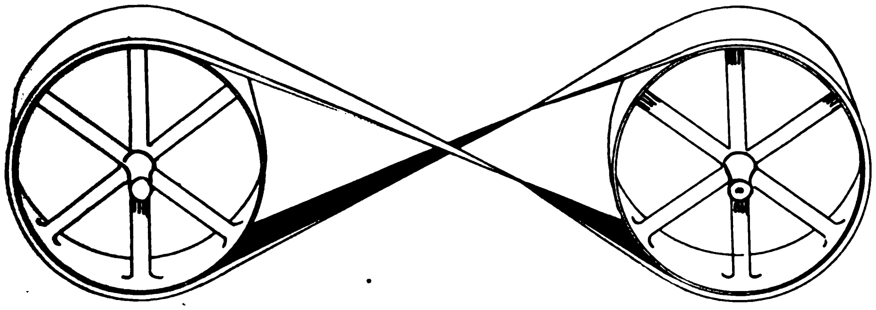


FIGURE 1. THE BELT CROSSED FACE TO FACE

This opened his eyes to the fact, that while the crossing of belts is an old chestnut, few mechanics are aware of the proper way of crossing belts under certain conditions. The solution of his particular problem will be of interest, we believe, to any one who uses crossed belts among his shop equipment.

In this case the belt was crossed, as is generally done in most shops, by one twist as shown in Figure 1. The result of this method of crossing was that the belt continually crowded off of the driven pulley when the machine was started.

FIGURE 2. HERE THE BELT IS AGAIN CROSSED FACE TO FACE ONLY THE TWIST IS THE REVERSE OF FIGURE 1

After several unsuccessful attempts were made to keep the belt on the pulleys, a belt man was

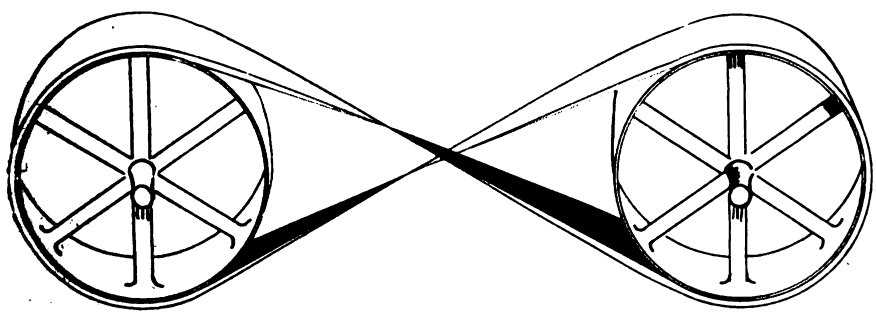


FIGURE 3. THE BELT IS CROSSED BACK TO BACK

called to remedy the trouble. He could not diagnose the trouble though he attempted to remedy it by crossing the belts in the reverse twist as shown in Figure 2. This merely resulted in the belt crowding off of the pulley on the opposite side.

This started a debate on the question; theories and suggestions were advanced. It was suggested that the shafts were not in line, and a great many other conditions were alleged to exist, and later it was found that they had no bearing whatsoever on the case. A master mechanic w. . called in from a nearby plant, but could offer no remedy, arguing that there were but two ways of crossing a belt.

If one watches a belt in operation, which was crossed as this one was, he will notice that there is tendency of the driving side of the belt to flatten out and push the slack side of the belt to one side, often crowding it off of the pulleys. In some cases conditions are better than in others, due to the pulleys being wider than the belts and also when there is a greater distance between the pulleys.

After watching the belt for a time it was suggested that the belt be crossed so as to bring it back to back at the place of crossing instead of face to face as was the existing condition when the belts were crossed by the former method. This method is illustrated in Figure 3.

This was done and was found to remedy the condition. It also brought to light the fact that there are four ways of crossing a belt. Figures 1 and 2 show the manner in which belts are most commonly crossed. It will be observed that they are running face to face at the point of crossing. In the drawings which accompany this article, the inside of the belt, that is the part which comes in contact with the pulley, have been blackened so that the inside of the belt may be readily distinguished from the outside, and it also enables the crossing of the belts to be shown more clearly.

In Figures 3 and 4 it will be observed that the belts are running back to back at the place where they cross. This method prevents the dressed side of the belt from coming in contact at this point, thus giving greater efficiency, it is claimed.

The easiest way of arranging the belts so that it will run back to back is to open the belt at the point where it is laced or held together; give one of the ends two complete

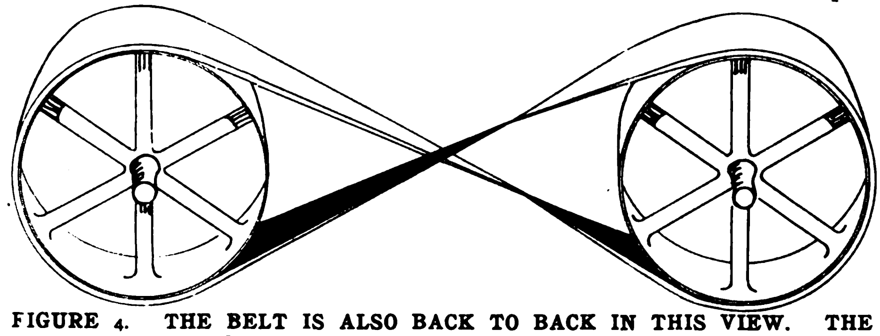


FIGURE 4. THE BELT IS ALSO BACK TO BACK IN THIS VIEW. THE TWIST IS THE REVERSE OF FIGURE 3

A CHART FOR QUICK PULLEY CALCULATIONS

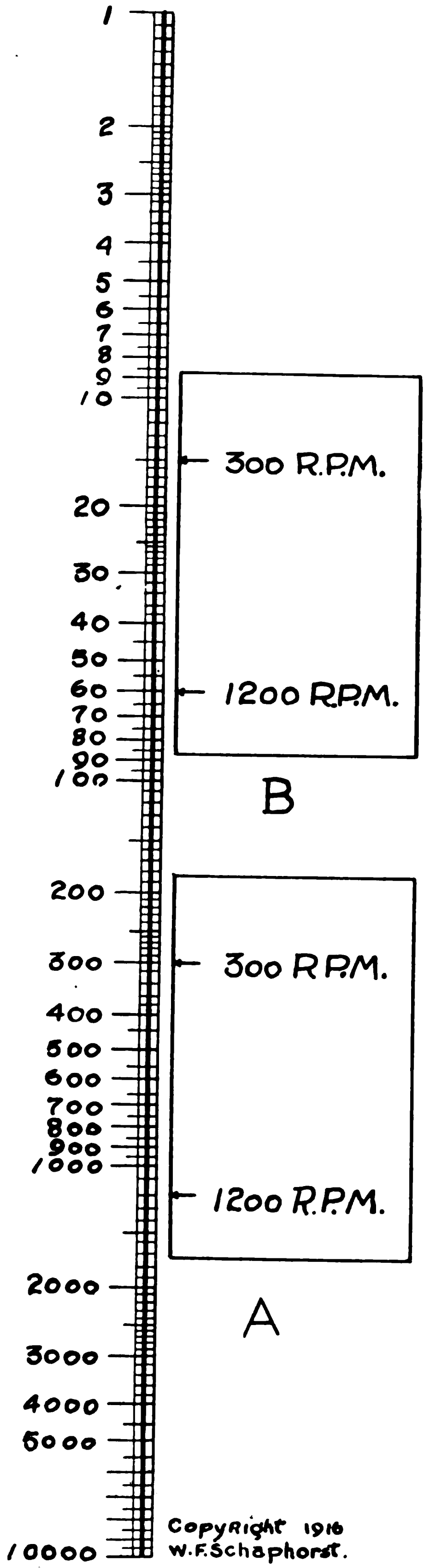
The accompanying chart does away with formulas for making pulley calculations. It will be found to be extremely simple.

For example: Suppose a motor is running at 1,200 R. P. M., and it is to be used to drive a line shaft at 300 R. P. M. What size must the pulleys be? On the slip of paper in position A on the chart, make marks opposite the 300 and 1,200 as shown; now slide the paper up where you want it. Position B now shows that the pulleys 15 inches and 60 inches in diameter will do the work very nicely. If these diameters are considered unsuitable, just shove the paper either up or down and select the sizes best suited to your particular needs. No matter where the slip is placed, the ratio is always correct—no figuring is necessary.

This chart also lends itself readily to the solution of such problems —knowing the pulley diameters and the speed of one pulley; what is the speed of the other pulley? For example: suppose we have a line shaft running at 200 R. P. M. The pulley on this shaft is 15 inches in diameter, the counter shaft pulley is 12 inches in diameter. The problem is, what is the speed of the counter shaft pulley? In using the chart, we mark our paper at 15 inches and at 12 inches, move the slip of paper down on the chart until the mark at 12 is in line with the mark at 200 on the chart, and we find that the mark made at 15 indicates the speed of the counter shaft pulley is 250 R. P. M.

Now, supposing we want this counter shaft pulley traveling at 250 R. P. M., with a diameter of 12 inches to operate a machine pulley of 8 inches. What will be the speed of the machine pulley? As we did in the previous example, we make marks on a sheet of paper at 8 and 12 on the chart, move the paper down until the 8 mark corresponds with the 250 mark on the chart, then we find that the 12 mark indicates that the speed of the machine pulley will be 375 R. P. M.

Now, supposing that we have a



12 inch counter shaft pulley traveling at 250 R. P. M., and desire our machine pulley to travel at 300 R. P. M., what will be the size of the machine pulley? Again we take a slip of paper, mark on it at 250 and 300 as per the chart, move it up on the chart until the 300 mark is opposite the 12, then we find that the 250 mark indicates that our machine pulley must be approximately 10 inches in diameter.

Now, suppose we take another example, supposing that we have received a new machine with a 10 inch pulley, which has to travel at 300 R. P. M., and our shaft speed is 200 R. P. M. The question is, what size must the shaft pulley be? We again take a slip of paper and make marks on it at 200 and 300 as per the chart, move the slip up until the 200 mark is opposite to 10 on the chart, and we find that the 300 mark indicates that the size of the shaft pulley must be 15 inches.

This chart will save the practical smith and power equipped shop owner considerable time and trouble in figuring what to some craftsmen is a complicated calculation—the size and speed of shafts and pulleys.

(Continued from page 81)

twists and then joint the ends, when the belt is placed over the pulleys, it will be observed that the belt will be running back to back. Figure 4 is merely the reverse of Figure 3, that is, when joining the ends, the one was twisted in the opposit direction to the way it was done in Figure 3.

NEW STARTING DEVICE AND FUEL ECONOMIZER

This device which has recently been patented in England consists of a brass cylindrical tank containing gasoline and attached to the dashboard.

On the top of the tank is a standard supporting a short tube, one end of which varies a sliding sleeve and is controlled by a bridle and short handle, while the other end is provided with a union from which a pipe is lead to the intake manifold of the engine. The tank outlet consists of an elbow pipe fitted with cock, the free end of which terminates in a fine orifice. This end of the cock is placed in line with and opposite the sliding sleeve to enable the latter to slide over it. The arrangement closely resembles a carburetor and choke tube, and under suction from the engine acts as such, the sliding sleeve regulating the admission of air. When starting with a cold motor, the cock is opened, and the air intake closed down, the suction of the engine then induces a fine spray of gasoline to issue from the jet and, when mixed with the air, provides a rich mixture for starting. Once the engine is running, the cock is shut off and the engine then runs on gas supplied by the main carburetor. Mark Meredith.

Queries-Answers-Notes

THIS department is the meeting place where you are free to ask for information, answer questions, discuss shop matters and business conditions and any other notes you feel would be of interest to a fellow mechanic. Make use of this Department as often as desired.

Shoeing Foundered Horses:—I noticed the inquiry of Mr. O. N. Benninger of Pennsylvania in a late issue of the American Blacksmith, regarding the manner of shoeing foundered horses. I will give you the benefit of my experiences on the subject, as I have encountered a number of cases of badly foundered feet.

I take a heavy shoe and make a bar shoe of it, and then take a round faced hammer and draw the inside edge, next to the foot, down to a feather edge, making the shoe flat on the bottom, or rather next to the ground. Next, weld on the toe calks and two heel calks, or rather toe calks at the heels set lengthwise, as they wear longer, because a foundered horse treads heavier on the heel calks. I am of the opinion that it is better not to use any toe calks or side clips as they injure the outside wall, and you have got to have all that it is possible to keep. In fitting the shoe, just take off enough of the outside wall to get a good bearing and then nail on the shoe. If there are not enough nail holes to hold the shoe tight for a month, I have found it good practice to make more. I shod a horse that was the worst I had ever seen and kept him on the road for years until he finally died a natural death.

Ralph H. Keeney, Plateau City, Colo.

The Object of Tempered Steel:—Recently, we have received a number of inquiries from readers, requesting an explanation of why the final hardening of a piece of steel is referred to as "drawing the temper" others point out that some of the text books refer to tempering, as a softening process. The point is misleading, insomuch as most of us understand "Tempering" as meaning to harden the object, rather than to soften it. An explanation on the subject will set most of us right.

We found in examining a number of books and articles on the tempering of steel, that almost invariably, the authors stated that the object of tempering was to soften the steel. They said that when the steel had been heated to the required hardening temperature and then quenched, that it became too hard, and that, therefore, it was necessary to draw the temper in order to soften the steel, so that it could be used for the purpose for which it was intended. In a certain sense this is an erroneous statement, which seems to be accepted by the majority of mechanics, because they fail to distinguish between hardness and britleness—two entirely different qualities. Hardened steel is tempered in order to make it less brittle, but unfortunately the tempering process also makes the steel softer to some extent. If it were possible to temper steel so as to produce greater toughness and at the same time retain the extreme hardness, the ideal condition would be obtained. That hardness and brittleness are not necessarily synonymous may be seen in the case of cast iron, which is very brittle but not very hard. On the other hand there are some alloy steel which may be made very hard and at the same time very tough. The object of tempering steel is to reduce the brittleness; the hardness at the same time is reduced to a certain extent, but this unfortunate condition can not be avoided.

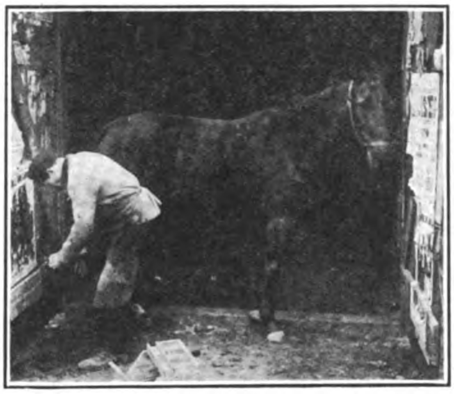
Cutting Down Rims:—Well, here I am again for more information. Here's my story: I have a Buick car and want to doll it up. I have 5, 34" x 3½" Baker rims, which I want to cut down to 32" x 3½" in order to use a 33" x 4" tire on them. Do you think I can bend the rims on a common tire bender? I will have to cut out 5¼" to get the proper size.

Also, will a 34" x 4½" tire fit a 33" x 4" rim? I have a job in sight to cut a car down to that size. It is for another garage man in this town and he is of the opinion that it won't work on that size. I contend that it will. Who is right?

T. W. K., Illinois.

Editor's Note:—It is possible to cut the Baker rims described above to the size mentioned and also to use a 33" x 4" tire on them. It is difficult job, however, to bend them evenly as the material is usually extremely tough. We believe, that it in the long run, it would be cheaper buy rims of the proper dimensions. A 34" x 4½" will fit a 33" x 4 rim. That sized tire is the standard over-size for the rim mentioned.

WHO'LL IDENTIFY THIS SON OF VULCAN



In last month's issue, we printed the picture of an "unknown friend". A free subscription was offered for his identity. To our surprise, we found that he was "positively identified" as no less than 28 different people. Another man has favored us with his photo; but like the other, gave no name. Our curiosity has been aroused. Is this another "Dr. Jekyll and Mr. Hyde" affair; are our eyes playing tricks on us when we see only one man in the picture or how many men is he? The offer still holds good.

An Interesting Letter From South Dakota:—Last Fall, I was discharged from the Army and shortly afterwards started a blacksmith shop out here. In March, we organized the Rosebud Blacksmiths Association, of which I was elected Secretary and Treasurer. Here is a list of the prices upon which we agreed and which are now in force in this locality.

It occurred to me, that it might be of interest to some of the other smiths to see what kind of a mobile blacksmith and harness shop we used "over there", so I am sending you a photograph of it. As you will see, it is decidedly an improvised affair which three pals and myself rigged up from an old wrecked French soup cart. The old hack did some great service and we took it right along with us clear up to the Rhine. 1, Eng. G. A. Taylor; 2, Horseshoer Clell Frung; 3, Saddler, Edward E. McMurray; 4, Horseshoer Martin O'Grue.

G. A. Taylor, Colome, South Dakota.

PRICES IN SOUTH DAKOTA

Horseshoeing	
Per span, new only, steel plugged 0x5	$10.00
Per span, new only, steel plugged 6x7	12.00
Per span, new Never Slips, 0x5	10.00
Per span, new Never Slips, 6x7	12.00
Per span, new common, 0x5	8.00
Per span, new common, 6x7	10.00
Per span, resetting	5.00
Never Slip calks, put in shoes, each	.10
Bar shoes, new, each	1.50
Bar shoes, reset, each	1.00
Vicious horses, per hour extra time	1.50
Stallion breeding, set 4, new	10.00
Stallion breeding, set 4, reset	8.00
Pulling or trimming, per head	.50
Plow Work	
New shares, No. 1, 12-inch	6.50
New shares, No. 1, 14-inch	7.00
New shares, No. 1, 16-inch	7.50
New shares, No. 1, 18-inch	8.00
Pointing and sharpening, all sizes	2.00
Sharpening, all sizes	.75
Polishing, all sizes	.25
Hardening, all sizes	.50
Polishing mouldboard	$1.50 to 5.00
New lister shares at market price.	
Lister shares pointed and sharpened	2.50
Lister shares sharpened	1.00
Lister shares hardened	.50
Lister shares polished	.25
Polishing lister mouldboard	$1.50 to 5.00
Cultivator shovels, new, at market price.	
Cultivator shovels pointed, set of 4	4.00
Cultivator shovels pointed set of 6	4.50
Cultivator shovels sharpened, set of 4	1.50
Cultivator shovels sharpened, set of 6	1.75
Cultivator shovels hardened, set of 4	2.00
Cultivator shovels hardened, set of 6	2.25
Setting plow beam	2.50
Plow round	1.75
Plow handle, straight	1.75
Plow handle, bent	2.00
New land side	3.00
Sharpening discs, per disc	.40 to .50
Sharpening disc plow, per disc	1.50
Sharpening road plow	1.50
Sharpening and pointing road plow	3.50
Sharpening road grader blades, per foot	1.00

Wagon Iron Work

New bolster end iron	.50
New bolster stake iron	1.25
One pair of bolster plates	3.00
One sand board plate	2.50
Four wagon tires 1½-inch, set cold	4.00
Four wagon tires, 1½-inch set hot	5.00
Four wagon tires, 1½-inch, set with bolts	6.00
Four wagon tires set, 3-inch	9.00
Four wagon tires set, 4-inch	11.00
One set-new 3-inch tires	25.00
One set new 1½-inch tires	18.00
New rub iron, put on	1.00
New hammer strap	.75
New pole cap	1.00
New wagon wrench	.75
New hub bands, each	.75
King bolt	1.00
Queen bolt	.75
New brake shoes, each	.50
Box trap irons, each	.75
Skeins, 3¼x10 and 3x9, per set D. V., for labor in addition to cost	$8.00 to 10.00
One new skein, 3¼-inch, put on	$3.00 to $5.50
Top box irons, per box	6.00
Box rods, put in,	.75
Single-tree center clips	50c to .75
Single-tree hooks,	35c to .50
New neck-yoke center	1.00
New neck-yoke ferrule and rings	.50
Seat hooks, 50c each, set of 4	1.50

Wagon Wood Work

New bolster:	
Front	6.00
Rear	7.00
Bolster stakes:	
Front, each	1.50
Rear, each	2.00
New rims, 1¾ inch	6.00
New half rims, 1¾-inch	3.25
New rims, 3-inch	10.00
New half rim, 3-inch	5.50
New rim, 4-inch	12.00
New half rim, 4-inch	7.00
Wagon fellies, 1¾-inch	.75
Wagon spokes, each	.75
Wagon spokes, wheel filled, each	.50
Wagon tongues, put in	8.50
Tongue hawns, per pair	5.00
Tongue hawns, each	3.00
Front Hawns, per pair	6.00
Front hawns, each	3.75
Front hawn cross bar	2.00
Rear hawns, each .. $3.00, per pair	5.00
Front hawns, bent	10.00
Axle, 3½-inch	12.00
Sand Board	$5.00 to $6.00
Box bottom cross bars, each	2.00
Wheeles cut down and setting old tires, per set	$25.00 to $40.00

Buggy Iron Hork

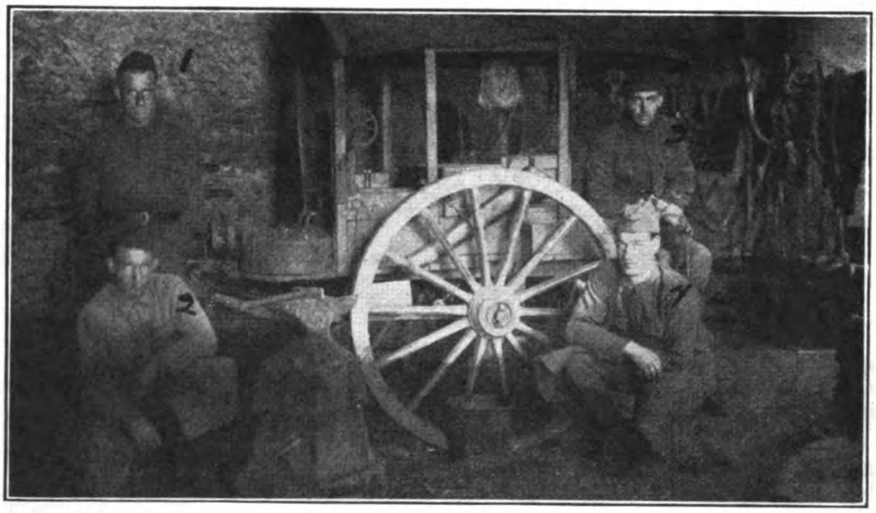
Stubs, 1⅛-inch, for labor	10.00
Axle, set	2.50
Four buggy tires set, hot	6.00
Shaft iron welded	.75
Shaft shackle	1.00
Shaft eye	1.00
Pole brace welded	1.00
Pole circle welded	1.00
Pole eye	1.00
New T hammer strap	1.75
New hammer strap	.75
Axle clips, each	.50
Steel bow socket	1.50
Single-tree clevis	.50
Single-tree hook	.25
Whip Socket, put on	1.00
Bow rivet	.25
Buggy boxing in new wheel	1.50
Buggy boxing in old wheel .. 50c to	$1.00

Buggy Wood Work

Buggy pole	$9.00 to $10.00
Pole circle	2.50
Patent spokes, single	.75
Patent spokes, wheel filled	.50
Buggy rim, 1-inch	4.00
Wheels cut down and tires set	20.00
Reach, single	2.50
Reaches, per pair	4.00
Head block	2.50
Spring wagon box, without seat	20.00

Mower Work

Welding sickle	1.00
Welding on new end	1.25
Filling sickle for work,	1.00
Filling guards for work, per foot 25c or per hour	1.25
Sickle head put on, for work	.50
Sickle heads at market price.	



THE UNIQUE MOBILE BLACKSMITH AND HARNESS SHOP BUILT AND USED "OVER THERE" BY MR. TAYLOR AND HIS COMPANIONS

Auto Work, Detached

Set tires $2.00 and up	
Spring welding, main leaf only	1.50
Other leaves, each	1.25
Three or more leaves in same spring each	1.00
Straightening auto axle.. $1.00 to	$3.00
All repair work, man only, per hour	1.25
Work with fire or machine, per hour	1.50

Oxy-acetylene welding based on half price of new parts. First class workmanship at above price. New material not warranted. Not responsible for unavoidable breakages.

Terms Cash.

Work requiring new stock subject to market changes.

Filler for Crank Shafts:—I have several crank shafts on which the connecting rod bearings have been damaged. Would it be possible to build up these worn journals with oxy-acetylene flame? If so what kind of filler should be used?

Editor's Note:—There is no reason why this can not be successfully done. The filler used for that purpose is usually a form of nickel steel. It should be purchased expressly for that particular purpose. A suitable quality rod may be purchased from any reliable manufacturer. Merely explain your needs to him.

Hardening Plow Points and Tempering Hammers:—I would like to ask some information on pointing plows. After they are hardened they seem to be too soft as they wear rapidly. What can I do to make them last longer? I would also like to know the correct way to temper a hammer.

Editor's Note:—Good results in pointing plow is obtained by the following method: Heat the share on the edge so as not to spring it. Have a box 2 feet square and 2 inches deep, filled with wet sand. After the share has been sharpened and straightened, heat the edge of the share and press it into the wet sand, and let it cool. The success of this or any other tempering or hardening operation is dependent, of course, upon the amount of carbon which the steel contains. Sometimes the carbon content is so low that it is virtually imposible to harden it. That may be the trouble in your case. In event that other methods fail, you might try hardening the surface with cyanide of potassium; but remember that the fumes of this chemical are very dangerous.

In hardening a hammer the first thing to do is to clean the fire, getting the cinders out of it, and then have plenty of charred coal. Heat the surface of the hammer slowly until it is a dull red, turning around and watching it to see that it heats evenly. When at the proper heat plunge into the hardening bath, and hold there until it is entirely cool. When cool polish with emery cloth so that the color may be watched. Now set it in the fire face up, and watch the color as it comes up, raising it out of the fire occasionally to see how hot the peen is getting. When the face is at the proper heat plunge it into the cooling bath. The face should be drawn to a blue bordering on a purple, of course the color depends on the amount of carbon which the steel contains. The above color works very satisfactorily for steels having .80% carbon. If th carbon content is less the hammer will have to be tempered at a slightly higher temperature, and at a lower temperature if the carbon content is higher than that amount.

Can a Pacing Horse Be Made to Trot?—I have been a reader of your paper for some time and find it has been a great help to me. I would like to ask several questions through your columns. Can a natural pacing horse be shod so that he will trot. If so, how?

Can the main shape at a cane mill roller which has broken loose from the roller, that is the shaft, turn and the roller stay still? Can they be made so the roller will turn when the mill is at work?

R. Elmo Harris, Tennessee.

AMERICAN BLACKSMITH AUTO & TRACTOR SHOP

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WILLIAM F. WENDT, *President*. L. J. WISCHERATH, *Editor*.

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FOR THE FUTURE

A day or two before the Wright brothers soared over Dayton in their first heavier than air machines, some long haired scientist writing for a scientific journal proved conclusively that the weight of fuel alone would make the flying machine a practical impossibility.

Someone, several prominent pessimists in fact, are ready to-day to argue that the automobile business has reached the saturation point. They, too, have "figures to prove it."

It has been said for instance that no family with an income of less than $5,000 a year can afford to own and operate an automobile.

In the face of that statement we submit the following culled from the Literary Digest.

"Records to-day show that over half of the more than 7,000,000 registered cars in the United States must be located with families or individuals whose estimated cash incomes are $2,000 or less.

This fact throws some light on the possibilities for future sales, and goes a long way to lessen the fear of that bugaboo of the industry, "the saturation point," the time when production will overtake the ability of the buying public to absorb as many machines as are produced.

Forbes magazines states that there are in this country 9,330,000 families with incomes from $1,000 to $4,000 a year, who do not own a car. Against this figure there are 6,670,000 families similarly situated who do own cars.

Still some other heartening figures quoted from Mr. John Fletcher, Vice President of the Fort Dearborn Bank of Chicago show America's position among the world powers from an industrial and financial standpoint.

The 100,000,000 people in the United States constitute 5% of the earth's population.

These 5% are responsible for 24% of the world's agricultural production, 40% of the mineral production and manufacture more than 35% of its goods.

The national wealth of the United States is more than $225,000,000,000. Our nearest competitor, England, has about $80,000,000,000. The trade balance with the rest of the world is in our favor to the tune of $5,000,000,000.

Repurchases of our securities placed abroad amounts to about $8,000,000,000. We have loaned to our allies between $9,000,000,000 and $10,000,000,000.

Half of the gold in the world is in the United States, and the deposits in the banks of this country are billions more than the totals in all the other banks in the universe.

Things may look a little dull to you and me right now. Fundamentally though, conditions are right. A day, or a week, or a month, after the speed of a few months ago may seem a long time to wait. Business is bound to come back however sooner rather than later. The signs all say it.

SELF-ACQUIRED KNOWLEDGE

A successful business man in New York retired recently. He had worked his way to the top of the ranks of the great national business organization which he had served for forty years. The city editors, smelling stories, set their reporters on his trail. They figured that he would have something to say about the secret of success, advice to young men, how to become rich, etc.

Now, this thing happens probably ten times a day every day in the year. Somewhere in this country of 100,000,000 people, reporters are forever prying "the secret of success" from some big man who has made good and is laying down the reins. Ninety-nine out of a hundred times the reporters get for their pains a column-ful of generalities, mixed with platitudes and maxims. Only the hundreth man says the specific thing, only the hundreth makes the pointed observation from the much desired new angle. Such a man was our retiring New Yorker.

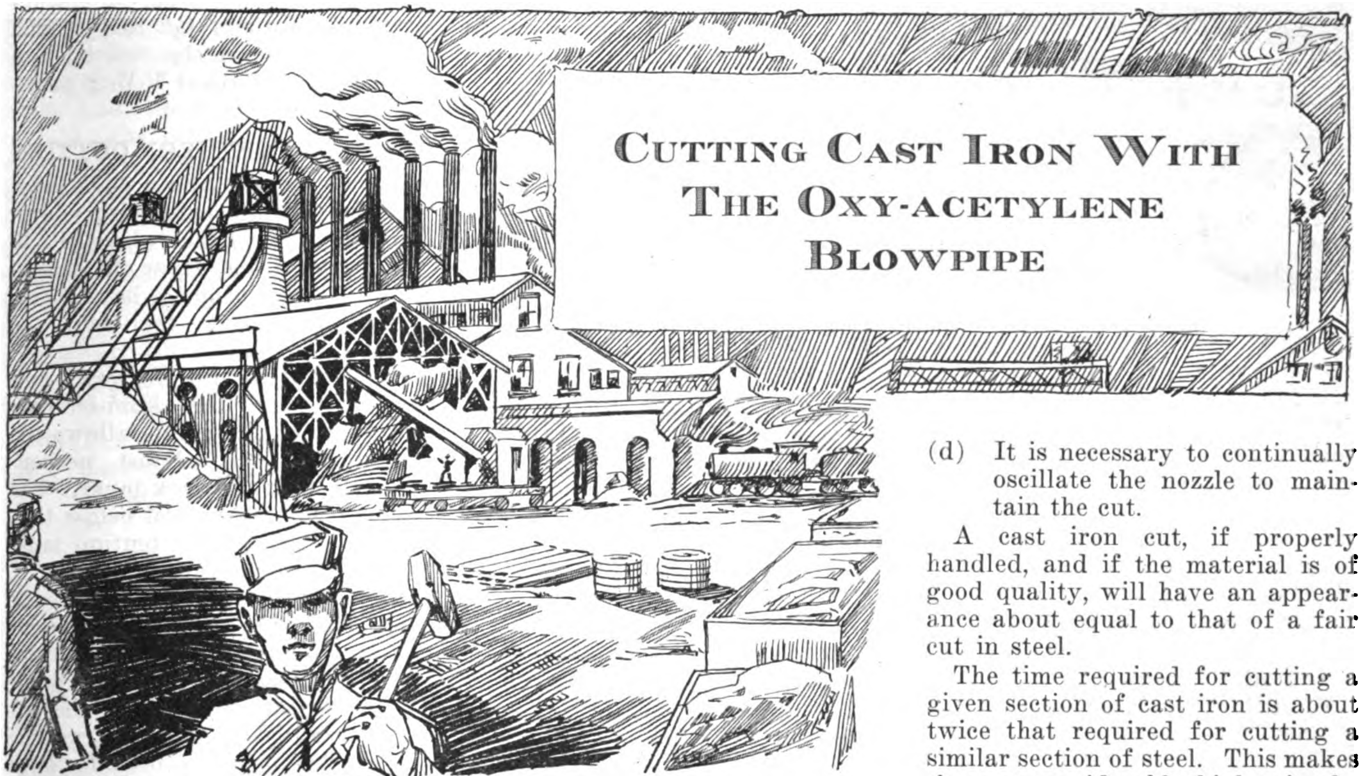
"If the average young man in business only realized it," said he, "an infinite amount depends upon the way he assembles information about his own particular line outside of working hours. Few bosses are apt to suggest this to him. He must do it on his own responsibility. He cannot even be certain of an immediate dollars and cents return upon the effort. It must be absorbed at the risk of the man who is ambitious. But he will learn in the long run that it is the self-acquired knowledge that enables a man to get ahead.

"The successful business man buys his self-acquired knowledge at something of a cost, I'll grant you. He pays for it—pays an evening's rooting at the trade journals here, and an evening's listening to the technical lecture there. He pays a ball-game's span of sharp analysis one week, and a night's study, another. He pays in the coin of extra, unrequired effort. But—as surely as he pays, he receives value therefor. Believe me, self-gathered knowledge of your business is precious stuff."

Disabled Car Owners' Rights—That the disabled car, unable to proceed upon its way, is as much a responsibility to drivers of other cars as though its owner were driving it, has been ruled in several of the Eastern States. These courts hold that though an owner be compelled to leave a car that has broken down, other motorists must look out for it and are as responsible for any damage they inflict as they are for damage to other property that adjoins the highway.—Motor Life.

SUMMARY, January, 1921

WHERE FROST IS KING



Cutting Cast Iron With The Oxy-acetylene Blowpipe

INSOFAR as their experience has been given to the public, the findings of the investigators in the field of cast iron cutting agree in indicating that, where pressure blowpipes are employed, some supplementary or specially designed mechanical part is essential. In one instance it is an attachment for preheating the oxygen; in another, a specially constructed tip.

The experience of the Oxweld Acetylene Company, of Newark, N. J., and Chicago, seems to have demonstrated quite conclusively that general service cutting blowpipes of the injector type require no special attachments whatever, no alteration of the stock torch being necessary because of the solid stream cutting jet and the long preheating jets, which converge toward and are drawn down into the cutting by the cutting jet, thus intensifying the temperature to a point where a special device for preheating the oxygen or a special tip is not necessarry to propagate the cut. No special equipment whatever is required in this type of blowpipe.

Apparently the reason pressure blowpipes have not accomplished this work, excepting where specially designed for it, is that it has been impossible to adjust general service blowpipes of that type to give strong flames carrying the necessary excess of acetylene.

With some pressure blowpipes fiairly good flames have been obtained, and with them it might be possible for a very skilled operator to gradually obtain a cut thru the metal, but undoubtedly the operator would take a long time and a real cut would not be obtained.

The Oxweld blowpipe was not originally designed with a view to cutting cast iron, but, after exhaustive experiments, a method of operating the torch in cast iron cutting was developed, and it can be mastered by the average operator almost as easily as the method employed for the cutting of steel. There is, however, a decided difference in respect to procedure. In practice, cast iron cutting differs from steel cutting in that:

(a) It is necessary to use heating flames having an excess of acetylene.

(b) It is necessary to hold the blowpipe nozzle farther away from the metal.

(c) It is necessary to preheat for a longer period for cast iron than for steel, since the cast iron must be almost molten before the cutting reaction will start. Steel ignites at a temperature well below its melting point.

(d) It is necessary to continually oscillate the nozzle to maintain the cut.

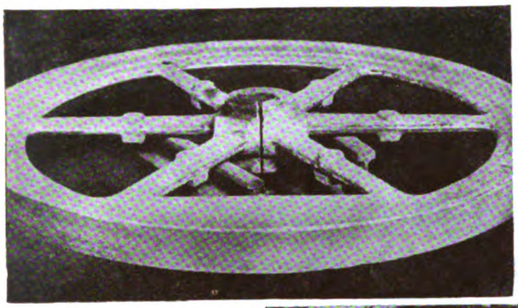
A cast iron cut, if properly handled, and if the material is of good quality, will have an appearance about equal to that of a fair cut in steel.

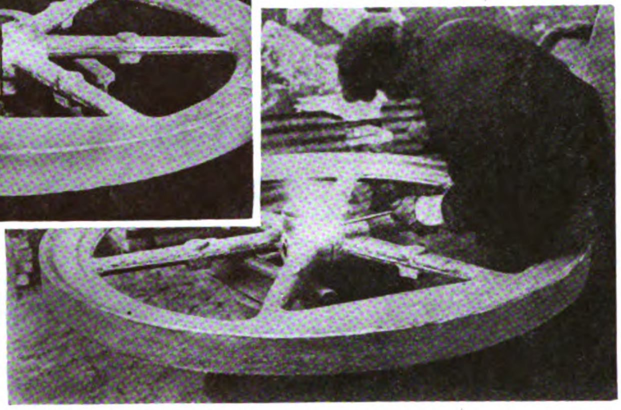
The time required for cutting a given section of cast iron is about twice that required for cutting a similar section of steel. This makes the cost considerably higher in the instance of cast iron and tends to restrict its applications in many places where one might suppose it would be generally useful. For example, the inexpensive methods employed for removing risers from castings in iron foundries preclude the use of oxy-acetylene as an economical means of performing this class of work. Further, the cutting off of risers from chilled iron castings is usually not practical because the surfaces cut are likely to crack or check, due to local heating.

The use of cast iron cutting is already being appreciated in the steel mills, where it was introduced more than a year ago. In those plants its demonstration was received enthusiastically, and cast iron cutting has since been used daily in that and other industries for removing broken machinery parts such as pinions, gears, flywheels, housings, etc. The removal of such parts by old methods usually required several days because of frozen shafts, bolts and the like. With the cutting blowpipe the broken part, and sometimes parts adjacent to it, are cut quickly, the parts removed, repaired, or new parts installed, all within a few hours.

Instructions for Cutting Cast Iron

The blowpipe manipulations for cutting good grades of cast iron





TOP—FLY WHEEL SLOT CUT OUT, LEAVING CLEAN, SOUND, EASILY MACHINED METAL. BOTTOM—CUTTING SLAG AND BROKEN CORE OUT OF CAST IRON FLY WHEEL SLOT

and for cutting poor grades of cast iron are quite different and are both described below. Although there is a difference in the manipulation of the blowpipe, the oxygen pressures used and the adjustment of the flame are the same for both grades of metal.

Methods for cutting good grades of Cast Iron.

(1) Adjust oxygen cutting regulator to give the correct pressure as shown in the Cast Iron Cutting Chart for the work to be done, having the blowpipe cutting valve open. Then close cutting valve.

(2) Open oxygen valve one-half turn and acetylene valve fully and light blowpipe. Open cutting valve and adjust acetylene valve to give flames having an excess of acetylene the length shown in the cutting chart. Then close cutting valve.

(3) Hold blowpipe so that the nozzle points **backward** at an angle of 45 deg., with the inner cones (not the excess cones) ⅛″ to ¼″ above the surface, give the nozzle a swinging motion describing semi-circles over the end of the line of cutting and heat a semi-circular area about ½″ to ¾″ diameter to a bright cherry.

(4) Move nozzle just off the heated edge, open cutting valve quickly and move nozzle (at 45 deg.) forward along the line of the cut with the same swinging motion.

(5) While advancing the nozzle gradually straighten it up so that it is about 75 deg. pointing **backward** when at the inner edge of the previously heated semi-circular area.

(6) Advance nozzle about ¼″ to burn off the molten surface, then quickly move it backward to burn thru the comparatively dark layer and lower section, then hold it steady for a moment to heat the upper surface.

This movement can be best practiced by counting as follows: 1 forward, 2 back, 3 hold; 1 forward, 2 back, 3 hold, etc., etc.

(7) Continue moving nozzle in this manner at the rate of about one complete cycle per second.

(8) When the far edge is reached, carry nozzle over the edge and across the other surface, holding it at about the angle of the lag, and cut thru the lag section.

Method for Cutting Poor Grades of Cast Iron

Follow the directions given for cutting good grade grey iron, except that instead of using the peculiar motion explained, advance the nozzle slowly, describing semi-circles from about ¼″ to ½″ wide across the line of the cut, holding the blowpipe at about 75 deg. pointing backward.

NOTES ON CAST IRON CUTTING

In cutting cast iron a dark layer will be found extending down from the top surface about 1″ to 1½″. Below that layer the material will be bright, having an appearance about the same as steel.

Be sure that the forward and backward, or the semi-circular movement of the nozzle allows the blowpipe to cut almost perpendicularly thru the dark layer. The lag must not start until below that section. Particular attention must be paid to this condition.

If cut is lost, move nozzle back along one edge of the kerf about ½″ and describe semi-circles lapping that edge and that point where the cut stopped. If the cut is not readily resumed, carry the semi-circles over to include both edges of the cut and the point where the cut stopped.

Always wear heavy asbestos gloves and suitable clothing to protect the body, face and head, because cast iron cutting is a very much hotter operation than steel cutting.

Always make sure of ample protection from the heat before starting so that it will not be necessary to stop the cutting operation to take shelter or provide further protection.

There has been no more interesting recent development in the oxy-acetylene field of research than the successful application of oxygen to the cutting of cast iron. Curiously enough

LEFT—CAST IRON MELTING POT WEIGHING 16 TONS BEING CUT WITH THE OXY-ACETYLENE BLOWPIPE. RIGHT—ANOTHER VIEW SHOWING THE CUTTING IN PROGRESS. THE DIAMETER OF THE POT WAS 12 FEET this old enigma of the industry appears to have been solved contemporaneously, if not concurrently, by separate investigators and in entirely different ways. At the present stage of development cast iron cutting may be accepted as an established fact, but not as a concluded study, and the future may be looked to with every confidence that it will yield much of interest and value in the general direction of increased economy and practical utility of the process.

Cast Iron Cutting Chart

Size of Nozzle	Thickness of Metal in.	Oxygen Pressure lb. sq. in.	Length of Excess Acetylene in.
	½	45	
	¾	50	
	1	55	
No. 3....	1¼	60...	1 to 1½
	1½	65	
	1¾	75	
	3	85	
	4	95	
	5	105	
No. 4....	6	115....	1 to
	8	125	
	10	155	
	12	175	

MAKING SOCKET WRENCHES

It is comparatively easy to make a set of socket wrenches for the average size nuts.

Secure a piece of seamless pipe or tubing just large enough to go over the nut. For example, if a ¾-inch square nut is to be removed, the wrench must be made from tubing having at least ¾-inch inside diameter. The end of the tube, when heated to a red heat is placed over the nut and then hammered down on each face, so that the tube end is hammered down and shaped to fit the nut at the same time. If a deeper wrench is desired, a piece of hexagon or square rod of the proper size may be used as a mandrel to form the required length of socket. Seamless steel tubing is the best material to use and after the wrench is made it may be well to case-harden the formed end. The tube is cut to any desired length, six inches being the average for ordinary work and a ¼-inch or 5/16-inch hole is drilled ½-inch from the top end of the pipe through which a short piece of iron or steel rod of the proper size may be inserted as a handle. This handle can be used for all the sizes you make.

WHY PICK ON ACETYLENE?

THERE is no commercial product that is more frequently misrepresented in the news columns of daily papers than acetylene. The average reporter seems to have a special weakness for the word, as if there were a general term applicable to it, if not actually essential to, a proper denomination of all mysterious, or not definitely identified explosions found upon searching inquiry to be, in a majority of instances, entirely without foundation.

The big evident fact in each case is that there has been an explosion from some cause not definitely known. Explosions as a rule occur in industrial plants. Industrial plants almost without exception, employ oxy-acetylene welding and cutting in some parts of their plant. The cub reporter, hungry for sensation, and without technical knowledge, will, if not restrained, miseducate the public mind to the idea that acetylene is a very tricky gas that keeps one eye open all the time awaiting its chance to blow up and kill somebody. That notion grew out of the publicity given to explosions of acetylene in the early days of the industry before the development of present-day safeguards for the generation and compression of acetylene. Because the industry was new these explosions attracted much wider interest than was the case in even more disastrous explosions of boilers, for example. Acetylene piqued the imagination

TOP LEFT—CUTTING CAST IRON WITH THE CUTTING BLOWPIPE. TOP RIGHT—SIXTEEN TON CAST IRON MELTING POT CUT IN TWO IN TWO HOURS AND THIRTY-FIVE MINUTES. THE POT WAS TWELVE FEET IN DIAMETER WITH A FLANGE ONE FOOT WIDE. BOTTOM—THE FLANGE WAS THREE INCHES THICK AND THE WALLS INCREASED IN THICKNESS TO FIVE INCHES AT THE BOTTOM. THE CUT WAS SEVENTEEN FEET LONG

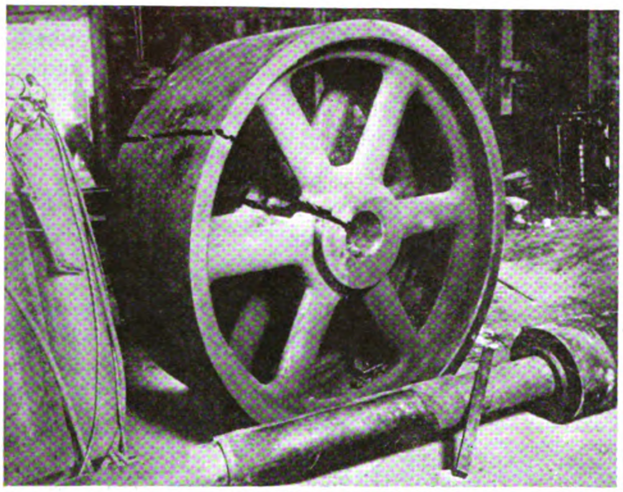
Every little while one reads of acetylene explosions or the explosions of acetylene torches, and when the reported cases are authoritatively investigated, as they always are, it is discovered that in nearly every instance the explosion was not an acetylene or an acetylene torch explosion at all. Sometimes, by way of injecting a little variety, it might appear, the cause of an accident of the kind is given as an oxygen explosion. These reports do not occur so frequently as the ones attributing explosions to acetylene, but like them, they are

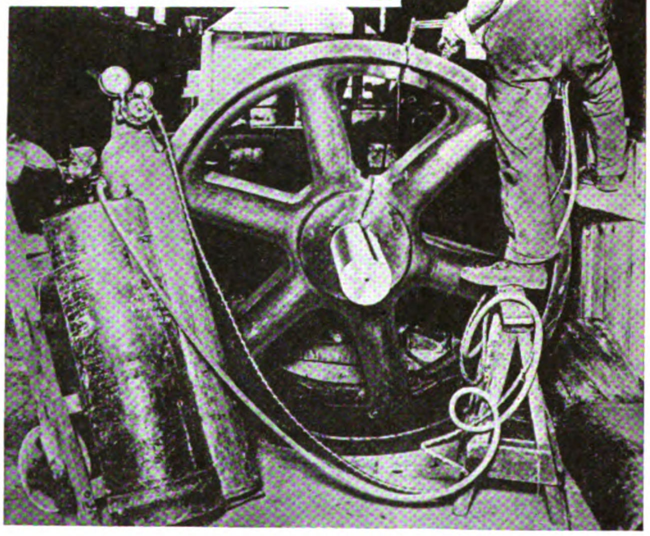
—and it still does. It makes good "copy."

Getting back to explosions of unsolved origin, what is more natural than for the sleuths of the press—for every reporter is a detective at heart—to yield to the ever-assertive weakness of their guild for sensation and word effects and gratuitously hang the responsibility cn acetylene — or oxygen? Our newspaper scribes, given to the artful scrambling of fact and imagination—and scant time for matururing either—should not be expected to be immune to temptations of this sort. But why can't some other highfaluten gas be made the goat? Why pick on acetylene? There are plenty of other gases with polysyllable names and with explosive kicks to meet the most exacting requirements—sly gases that occasionally land punches like a Dempsey or Carpentier, or like a charge of TNT, wrecking building and vivisecting men regardless. Acetylene and oxygen have been blamed for a heap of sudden freaks of these culprits, but it would make too long a story to cite particular cases.

There may be no adequate way of educating the newspapers. It has been tried, and the principal offenders appear to be too busy to learn, or perhaps they just don't want to learn. Anyway, they go on repeating misrepresentations of acetylene and oxygen in connection with explosions, and very likely they will continue to do so. After all, the practical thing is to reduce the number of explosions, from whatever cause, if that be possible—and it ought to be. Of course, the first essential is to understand the causes of explosions. It is a large subject on which too much can not possibly be written, if true. The subject is too big for anything but a hint in this short article, but if the hint here given is acted upon there is little question that some of the miscalled acetylene explosions will be prevented.

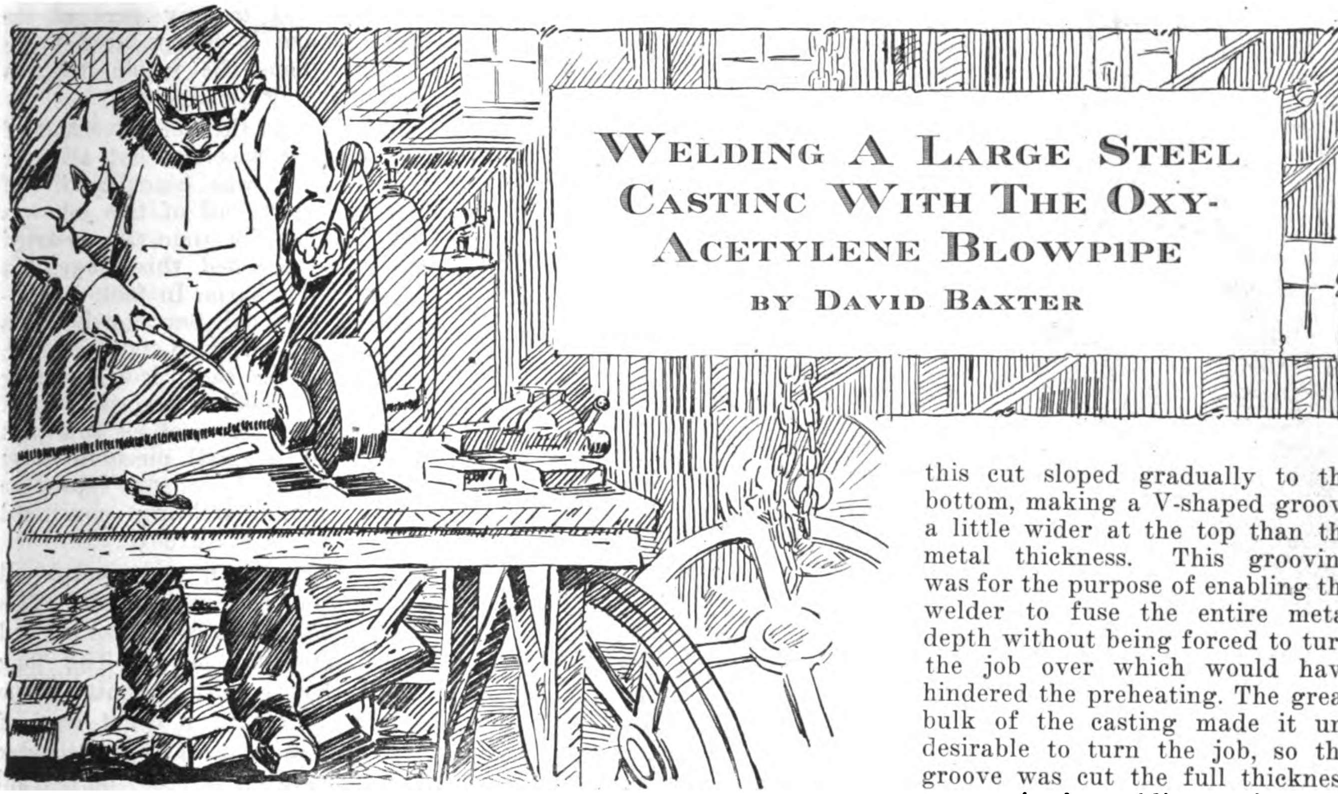
One does not read much of the danger of air and water as explosive agents. Of course when a boiler explodes the water has been converted into steam. But just simple, every day **aqua pura,** the kind that comes from the well or the bathroom faucet is explosive under certain conditions. And so is air explosive under the same conditions. Unfortunately those conditions obtain under circumstances in which they are not always apparent. They, the conditions, are: confinement and application of heat in sufficient degree for the expansion to burst the confining walls. Some of the circumstances in which these conditions are not apparent are evidenced from time to time in "acetylene explosions" where no acetylene is used and in "acetylene explosions" in which, though used for heating, acetylene did not explode. An example of an explosions of this kind in which acetylene was not used at all, was the explosion recently in a New York welding shop where, because oxy-acetylene apparatus was a part of the plant equipment, the news-sleuths deduced another "acetylene explosion". It was not reported in one, but in all of the New York City dailies as an explosion of acetylene. The facts were these: An automobile tubular drive shaft was placed in the fire of an ordinary blacksmith's forge for heating preparatory to straightening the tube. Unknown to the workmen, the tube contained confined air. Had there been so much as a pinhole the expanding air might have escaped without violence. It would have been a very simple matter to tap the tube with a drill. This precaution was not taken merely because the air inclusion was not obvious. The result was an explosion that sent several workmen to the hospital to be treated for burns sustained from the flying embers from the forge. No damage was done to the shop, but the force of bursting tube and released air was sufficient to endanger the lives of the workmen.





THE UPPER VIEW SHOWS A SHAFT WHICH HAS BEEN REMOVED IN PERFECT CONDITION. THE LOWER VIEW SHOWS THE CAST IRON PULLEY BEING CUT WITH THE OXY-ACETYLENE IN ORDER TO REMOVE THE FROZEN SHAFT

Quite similarly the other day a workman engaged in welding a hollow metal ball some three inches in diameter, did not know that the ball was filled with water. Why it was so filled is still a mystery. But the water expanded under the heat of the welder's flame, bursting the shell of the ball and exploding like a bomb. Fortunately the workman was not killed, and was thus permitted to learn by experience what all the rules of caution ever put into print could not teach him so thoroughly. It is safe to wager he will never again "take a chance" welding any hollow metal without first tapping it to vent whatever it contains. This also was served up to



Welding A Large Steel Casting With The Oxy-Acetylene Blowpipe

BY DAVID BAXTER

SINCE the advent of the oxy-acetylene torch the American blacksmith plays second fiddle to no one when it comes to doing all kinds of repairing of metal articles. He is no longer limited to minor jobs, tinkering as it is sometimes called; but is able to do the heavy work with the best of them. No jobs too small; none to big for the modern blacksmith.

The article this month concerns the repairing of a heavy casting; one of the big jobs that come to the smithy nowadays. Let us see what the difficulties were and how they were overcome.

This job was a heavy steel casting, the comparative size of which is shown in the accompanying illustrations. These pictures also give some idea of the weight of the casting; and also indicate the location of the fracture to be welded, which consisted of a crack over two feet long through three inchs of metal. The whole casting weighed approximately a ton and was made of cast steel. Its bulky sections and great weight made it a quite difficult job.

First, because it was hard to handle and, secondly, because it was difficult to preheat accurately; this was on account of the heavy sections drawing the heat away from the weld too rapidly. Then, too, the nature of the metal presented obstacles not at all easy to surmount; cast steel has some peculiarities all its own when it comes to welding. But, let us take up these difficulties as they were met during the welding process and see just what was done in each instance.

Now, like nearly all other welding jobs, a certain amount of preparation was made in order to facilitate the welding process. Nearly all castings oven an eighth of an inch thick should have a groove cut or ground in the crack its full length. Therefore, the fracture in this casting was grooved to its full depth, which formed the first step in preparing the job for welding. The metal was cut away from both sides of the crack the full thickness of the casting. The walls of this cut sloped gradually to the bottom, making a V-shaped groove a little wider at the top than the metal thickness. This grooving was for the purpose of enabling the welder to fuse the entire metal depth without being forced to turn the job over which would have hindered the preheating. The great bulk of the casting made it undesirable to turn the job, so the groove was cut the full thickness to permit the welding to be done from one side. The groove also permitted a well fused weld from top to bottom. In fact it would be almost impossible to make a good weld of this nature without grooving the full depth. Since the casting belonged to a pressure machine it was necessary for the weld to be perfectly connected from top to bottom. Without grooving it would have been extremely difficult for the welder to be certain he had fused all portions of the weld.

The crack was cut out with the oxy-acetylene cutting torch, this was the handiest, quickest and cheapest way to do it, since it would have required hours of heavy slugging to cut out the groove metal with a sledge and chisel. But by employing the cutting torch the operation was shortened to less than half an hour, with no labor to speak of.

Fig. 1 shows the cutting process in operation. It will be seen that the oxidized metal is blown entirely through the cut in the casting. First, the torch was lighted and regulated in the usual manner for welding. The tip of this flame was applied to one end of the crack until it started to melt. Then the high pressure oxygen was turned on. This oxygen caused the molten metal to turn to oxide immediately. Then by flirting the flame sidewise

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(*Continued from page* 90)

newspaper readers as an oxy-acetylene explosion. Of source it was nothing of the kind; but by the time the facts were ascertained the story had ceased to be news, so it goes unretracted as just another of those acetylene explosions!

A little knowledge, a little horse sense and the caution these beget ought to go a long way toward eliminating the types of accidental explosion just noted.

FIGURE 1. GROOVING THE CRACK WITH THE CUTTING TORCH

and assisting it with a filler rod a hole was soon eaten through the steel after which it was easy sailing, for the flame was moved along the crack as fast as the steel was turned to oxide and blown away from the casting. The flame was held at an angle to cut the proper slope for the groove. Down one side of the crack, around the end and back the other side the metal was burned up and forced through the casting. A wedge shape piece of metal was thus severed from both sides of the crack. In the second of the photographs the welder is shown holding the cut out portions.

Fig. 2 also shows the location and extent of the grooving. Notice the comparatively smooth appearance of the sloping wall of the groove. If proper pressure and torch manipulation are employed, the groove may be made as clean as though cut out with a chisel. The action of the cutting flame is too rapid for the heat to spread enough to injure the quality of the steel. It will be seen in these two pictures that the job was handled with chain blocks for which a makeshift derrick was attached to the sides of the shop door and to the roof.

After the cutting was completed, the bits of slag and roughness were knocked off with a hammer and chisel. Then the job was ready for preheating. This was accomplished with a charcoal and coke fire, kindled with wood and kept burning with an air hose. The casting was arranged out of doors, upon some pieces of pipe to hold it above the ground a few inches, so that the fire could get all the air possible from below. The groove was upward and the casting rested upon the ring section. Thus the heat could be applied to both the inside and outside of the ring. To increase the draught a crude hood and chimney were suspended over the casting. Pieces of sheet iron were placed around the casting to confine the heat. These and the chimney were arranged after the fire was burning briskly. They were so arranged that the fire could be attended to from any point.

Fig. 3 shows the preheating device, a crude appearing; but cheap and serviceable affair. Notice in this picture the long filler rods which the welder is holding. Each consists of three ordinary rods welded together and is for the purpose of permitting the torch operator to save himself much discomfort from the intense heat. By using long rods he is permitted to stand erect and some distance from the fire.

A brick wall around the job would probably have been better, except that the sheet iron could be readily pulled aside at any part when necessary to replenish the fuel the half of the casting containing the crack had to be gotten red hot and kept that way throughout the welding, so it was essential to be able to look after the fire easily.

The preheating was not for the purpose of expanding the job to keep it from cracking as is the case with other metals. The cast steel was in practically no danger from this source. The purpose of the preheating was to make it easy to melt the groove, and to make it easier to keep it molten. If the job had been welded without preheating the thick parts of it would have conducted the heat of the torch flame away so fast that but little of it could have been utilized to melt the groove and filler metals. In fact, the largest size torch in use could scarcely handle the job unless it was heated previous to applying the welding flame.

This preheating required several hours time and constant attention before the casting was hot enough to start welding. The fire was forced all that was possible without endangering the steel with overheating. The force draught was applied to any part of the fire in turn if it appeared to be dying. Thus the whole fire was kept burning evenly.

As soon as the defective half of the casting was red hot all over the welding was commenced. Of course, nearly all of the job was red hot by the time the grooved part had reached this stage, but this did not harm. In fact, it helped the grooved part to hold its heat. When ready to start welding, a part of the sheet iron covering was moved aside to expose part of the groove. As fast as this part was filled, a small piece of sheet iron was placed over it to retain the heat while welding continued farther along the groove.

A large torch was employed throughout the entire job. This was fitted with a large size tip and long extension head. The long torch thus formed permitted the welder to escape a great deal of the intense heat of the preheater and also the weld. To further aid in this a sheet iron shield was arranged between the operator and the preheater. The erect posture permitted by the long filler rods afforded the operator an opportunity to shift positions at will to obtain a little relief during the tiresome effort required on such long jobs.

FIGURE 2. THE GROOVED CRACK AND THE METAL WHICH WAS CUT OUT OF IT

The torch was lighted and regulated so the flame carried equal parts of oxygen and acetylene; which formed what is termed the neutral welding flame; a safe one to use on cast steel work as it is easily oxidized if an excess of oxygen is used. However, an expert welder often uses a slight excess of oxygen, since it tends to increase the melting power of the flame; and aims to counteract the oxidizing tendency by the way he manipulates it. That is, he works rapidly and holds the flame in certain positions, according to the rapidity of the melting. He is able to know instantly when he is forcing the melting too much and quickly switches the flame to allow the molten metal to recover. On the other hand he can not use a flame having an excess of acetylene because it will not supply heat sufficient to keep the weld and filler molten. With these two dangers in mind, this operator used a large neutral flame. He was also careful to see that it did not vary under the effects of the intense heat reflected upon the torch.

The neutral flame was then brought in contact with the bottom of one end of the groove. Here it was played back and forth across the groove bottom to cause an inch or so of it to melt. During this interval a filler rod was brought in touch with the heated groove. As soon as the first part of the groove started to melt the filler was placed in contact with it to help knit the melting sides together, adding an inch or so of the rod to the weld. The rod was given a twisting, turning, motion to bring the edges of the groove bottom together faster. The lower part of the sloping sides of the groove were melted down to join at the bottom with a quantity of the filler rod.

An inch or so of the groove bottom was filled in this manner before attempting to fill the upper part of the groove. Then the flame was worked back to the starting point. Here it was revolved in circles about an inch in diameter until the metal became fluid, when the circles were increased and the filler brought into the fluid metal. From then on the operation consisted of keeping the flame in motion and feeding in new metal. As fast as the groove sides melted and slid down, the filler was melted into the mass. Instead of building a layer of metal straight up, it was sloped back up the end of the groove and gradually worked to the surface of the casting. Thus a sloping layer was added to the end of the groove; always being careful that the walls of the groove were molten.

FIGURE 3. THE PREHEATING ARRANGEMENT

When the first sloping layer was complete, the flame was moved to the bottom of the groove and worked upward again to apply another layer against the first one. The same care being taken to see that the walls as well as the first layer of metal was fluid when the filler was added. The flame was shifted quickly from one part of the weld to another, in order to keep the whole mass fluid. The rod was kept in motion too, shifting from one side to the other in order to keep the layer evenly distributed. Thus, the first section of the groove was filled in sloping layers, thoroughly soaked into each other to form one solid mass.

When this first couple of inches was filled, the flame was transferred to the bottom of the groove, where the first operation of melting and joining the bottom edges was repeated. This new section was made about like the first one; as were each succeeding section, except that at times it was necessary to slow down the work in order to adjust the flame, or fix the preheater. When this was necessary some of the heat was lost of course, and it was necessary to handle a shorter part of the groove until things were again going well.

After the second section of the groove bottom was thoroughly fused, it was filled with sloping layers the same as the first portion. Then the flame was again shifted to treat another section of the bottom, and to fill it with new metal. Thus the entire length of the groove was made up of divisions of sloping layers. All except the last few inches of the crack, where the process was reversed. That is the weld was made backward by filling the last end of the groove before bringing forward the layer sections. This end was filled like the first and extended out to meet the last of the layer sections. Thus the last part of the weld to be made was the shape of an inverted pyramid. This was built up from the bottom in flat layers that widened as the welding approached the surface of the casting.

It was easier to finish the weld this way than to go on to the end in layer sections as was done at the start since there was no chance for hidden weak spots due to any steep parts of the groove not being thoroughly fused. The welder had a better opportunity to watch the progress of the melting, and to be sure that the side walls as well as the bottom were all fluid when the fluid filler was added.

During the whole process, it was the constant endeavor of the torch operator to keep the casting metal deeply melted. The heat of the flame was allowed to play over every spot until the metal was melted at least a quarter of an inch deep. To do this of course caused some danger of burning the steel by holding the flame too close. Most of this danger was eliminated, however, by keeping the torch in motion.

The adding of the filler metal was a particular part of the work. At no time was more filler added than the molten weld could assimilate, and it was not permitted to drip into the weld, but was literally pushed into the molten bath by keeping the rod in contact with it. Sometimes it was necessary to play the flame up and down the end of the rod to make it melt fast enough, but ordinarily the flame merely crossed the end of the rod.

Little attention was paid to the surface part of the weld, while it was being made. This was re-finished after the whole groove was filled. But the grooved portion was considerably wider at the top when the weld was finished than at first, due to the melting down of the sloping walls to help make the bath into one mass; also to make certain the surface part of each layer was thoroughly mixed along the edges of the groove. Here in particular was the soaking process of applying the heat employed. These edges were melted deep and a surplus of filler was piled up along the weld and also over it. After the entire weld was completed, the flame was worked back over this surplus to level it, and to make sure there was no disconnected portions. The flame was played around over each part of the surplus metal until the heat soaked into it enough to cause it to settle in a fluid pool. Where the edges of the weld joined the casting metal, the operator was doubly careful to soak it thoroughly.

The force or pressure of the welding flame was utilized to blow or brush the molten metal here and there as needed to fill the low spots and to reduce the rough or high spots. By being careful about this re-melting the operator saved a lot of labor which would have been required to dress the finished weld; by using the flame power to smoothen the molten metal a lot of machining was eliminated.

Now to sum up the whole job it might be said that there was nothing to it except to keep it hot with the preheater and keep the torch flame working constantly. Although it was a hot and extremely tedious job, the only way to insure success was to keep everlastingly at it.

PREHEATING CAST IRON

Preheating cast iron should be done slowly but thoroughly. There is great danger of warping or cracking a thin iron casting by improper preheating in an open fire. It is advisable, whenever possible, to interpose a steel sheet between the part to be preheated and the direct flame. The time required for heating will be increased, it is true, but the danger of excessive unequal expansion and overheating will be eliminated. The top of a stove is an ideal place for preheating small parts. The heat obtained with a hot fire is sufficient for all general preheating requirements, and there is no danger of overheating.

Heat Treatment for High Speed Steel

HIGH speed steel is an expression very commonly heard in the shop of today, and is generally applied to a piece of steel which gives service rather than to the specific type of steel which it signifies.

High speed steel is a tungsten steel, which possesses the distinctive quality of red hardness, being able to retain a cutting edge while

FIGURE 4. STARTING THE WELD

heated to a temperature which would ruin the best carbon steel tools. Such properties are obtained only by a correlation of suitable chemical compositions and proper heat treatment.

The components of high speed steel are confined within fairly close limits. The average analysis of 5 American-made high speed steels gave:

Carbon	.67%
Tungsten	16.78%
Manganese	.28%
Silicon	.21%
Chromium	4.26%
Vanadium	.86%

Before any machining or forming operation are carried out on high speed steel, it should be annealed, and this is best accomplished by a thorough "soaking" at 1600°F., followed by a very slow cooling, either in the furnace or by burying in ashes, asbestos or a similar poor conductor of heat.

The principle involved in hardening high speed steel is, indeed difficult to explain without using somewhat of a technical description. The aim in hardening high speed steel is to obtain an austenitic or polyhedral structure free from the particles of carbide which are characteristic of annealed high speed steel. In order to accomplish the solution of this carbide, there must be a temperature of at least 2275° F., for most steels. Pieces heated to 2000° or 2150°F., and quenched do not accomplish this result unless held at those temperatures 30 to 45 minutes or more. To heat a piece of high speed steel to 2300°F., and to hold it there for any length of time would produce a worthless tool. The first rule in treating high speed steel is that the high temperature should be used only as long as is necessary to heat the steel through.

When pre-heating and hardening, better results are obtained, and the danger of cracking or checking are minimized, if the parts or material to be hardened is first preheated in an oven furnace to a temperature of 1600° to 1700° F., and immediately removed to the high speed steel furnace, which is heated to a temperature of from 2250° to 2275° F., keeping it at this temperature until the work is thoroughly heated through.

Small tools, tool holder, bits and similar articles should be hardened all over. Turning tools and all larger tools where the design permits, will give better result if hardened only at the cutting edge.

The quenching, like the heating or any of the other operations is highly important for uniform and dependable results. The pieces should be quenched in oil, free from water, until the oil ceases to flash on the surface of the piece. Keep the tool or part in motion until thoroughly cooled. The oil for quenching high speed steel should be carefully selected, as considerable trouble is often experienced through the use of unsuitable oils. The oil should be selected to give a uniform quenching speed, not oxidizing or thickening with repeated use, or producing gaseous vapors at low temperatures.

After the tools are immersed in oil, quickly place the tool before the furnace door and allow the oil on the tool to catch fire, repeating the operation several times. This relieves the strains on the outer edges caused by the quenching operation.

A lead bath is sometimes used in place of oil for quenching. Preheat and heat to 2275° as directed and immerse in the lead bath at a temperature of 1100° F. Tools cool more rapidly in this method than in oil, and are harder.

When the nature of the tool will permit, they may be removed from the furnace and placed in a dry air blast. A very heavy scale will form when this treatment is used, but as the tool cools to the point where the red is disappearing, this scale will shed, leaving the surface gray and fairly smooth. If the part is then reheated or drawn at 1100° F., the tool will be as hard as if cooled in any other way.

Tempering in oil is the usual procedure. 400° to 650° F., is the average range of temperature, the latter being for dies subject to constant shock. Medium sized drills quenched at about 2260° F., and drawn in oil at 480 F., for half an hour give excellent results. Tool holder bits should be quenched at 2300° F., and drawn at about 1100° F. Many favor a higher temperature, using up to 900° with successful results. The temperature best suited can be learned through experiments.

The lead pot is also used in tempering. Heat to the melting point and take the chill out of the cutters before placing in the pot. While the heat is rising push the tool down into the lead. When a temperature of 1100° F., is reached, hold the tool down under the lead from one to three-minutes according to size; remove and allow to cool in the air.

If a lead pot is not available, use a gas or oil furnace, and bring tool up slowly to 1100° F. Tempering or drawing a 1100° F., has been shown to increase the durability of the tool 40% or more, and adds strength and elasticity which practically eliminates the breakage danger.

The proper heat treatment of high speed steel requires furnaces with minimum heat radiation; a thorough penetration of the work, with no danger of it being touched with the flame; a fuel supply giving constant and even heat; a temperature control permitting the necessary degree of heat to be reached steadily and maintained accurately throughout.

HOW TO MAKE PIPE BUSHINGS OUT OF STANDARD PIPE

It is a good thing to know that bushings can be made out of standard pipe. Many pipe fitters don't know that it can de done. Or, if they know that it can be done they don't know the correct size of drill to use for tapping. I have always known that it can be done and have occasionally made bushings out of pipe, but each time I found it necessary to first look into my handbook for the drill size to use and that is so much trouble that it is frequently easier to go to the store and buy a new bushing. Recently, though, it has been very difficult to buy bushings in stores on account of shortage of all pipe fittings, hence I feel that the following information should be of much value. I have collected all of the data together for all bushings that can be made out of ordinary sizes of extra heavy and double extra heavy piping.

To bush from 1/4" to 1/8", for example, get a piece of 1/4" extra heavy pipe sufficiently long for cutting the outside thread. Then cut the end off to the desired length, drill or ream with a 21/64" drill (diameter of drill 0.328") and then tap with a 1/8" pipe tap. That's all there is to it.

The table enclosed tells the complete story for all ordinary sizes: Note that in one case, 3/8" to 1/4", the internal diameter of 3/8" extra heavy pipe is such that no drilling is necessary.

Also note that in bushing from 1/2" to 3/8" either extra heavy or double extra heavy piping can be used.

1/4" to 1/8"	.. 1/4"	Extra Heavy..........	21/64"	Drill=0.328"
3/8" to 1/4"	.. 3/8"	Extra Heavy..........	None	
1/2" to 1/8"	.. 1/2"	Double Extra Heavy..	21/64"	Drill=0.328"
1/2" to 1/4"	.. 1/2"	Double Extra Heavy..	27/64"	Drill=0.422"
1/2" to 3/8"	.. 1/2"	Double Extra Heavy..	9/16"	Drill=0.562"
1/2" to 3/8"	.. 1/2"	Extra Heavy..........	9/16"	Drill=0.562"
3/4" to 3/8"	.. 3/4"	Double Extra Heavy..	9/16"	Drill=0.562"
3/4" to 1/2"	.. 3/4"	Double Extra Heavy..	11/16"	Drill=0.688"
1 " to 3/4"	..1 "	Double Extra Heavy..	29/32"	Drill=0.907"
1 1/4" to 1 "	..1 1/4"	Double Extra Heavy..	1- 1/8 "	Drill=1.125"
1 1/2" to 1 "	..1 1/2"	Double Extra Heavy..	1- 1/8 "	Drill=1.125"
1 1/2" to 1 1/4"	..1 1/2"	Double Extra Heavy..	1-15/32"	Drill=1.468"
2 " to 1 1/2"	..2 "	Double Extra Heavy..	1-23/32"	Drill=1.72 "
2 1/2" to 2 "	..2 1/2"	Double Extra Heavy..	2- 3/16"	Drill=2.187"
3 " to 2 1/2"	..3 "	Double Extra Heavy..	2- 9/16"	Drill=2.562"
3 1/2" to 3 "	..3 1/2"	Double Extra Heavy..	3- 3/16"	Drill=3.187"
4 " to 3 1/2"	..4 "	Double Extra Heavy..	3-11/16"	Drill=3.688"
4 1/2" to 4 "	..4 1/2"	Double Extra Heavy..	4- 3/16"	Drill=4.187"

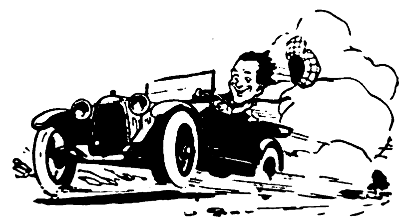
USEFUL INFORMATION

The specific gravity of steel is about 7.85; of gray iron 7.22 and of white iron 7.65. High speed steels, however, owing to the percentage of metallic alloys present, are denser than ordinary steels. This increased density is not, of course, constant, but in general, high speed steels may be considered showing specific gravities 15% in excess of tool steel.

The weight of one cubic foot of steel is approximately 490 pounds.

The weight of one cubic inch of steel is practically .285 pounds, and knowing the cubic inches in any bar or piece, its weight can be obtained by multiplying by this decimal. In ordinary practice, however, it is customary to multiply by the decimal .3, as most commercial steel is finished "full" to the dimensions specified. For the weight of wrought iron, multiply by the decimal .28, and for cast iron by .26, the results of which calculations will be sufficiently accurate for all ordinary purposes.

High Spots



Old and New Models.—"Happiness," said Jud Tunkins, "has to be cranked up, but trouble always has a self-starter."—Washington Star.

More Profitable.—"The Bolshevists," says a gossip writer, "do not always rob Peter to pay Paul." No, they sometimes just rob Peter.—Punch.

Useless.—We saw the meanest man yesterday. He gave his little nephew a nickel and told him to take it and go "buy something."—Kansas City Star.

Times Have Changed.—Remember the long ago when the little girl looked forward to young ladyhood and the time for putting on long skirts.—Nashville Banner.

No Real Sacrifice.—"I want to ask for your daughter's hand," said the suitor to her father.

"All right, boy. Go to it. Take the hand that is always in my pocket."—Ladies Home Journal.

Trend of the Times.—"It's got so these days that a man can hardly wed unless he can show the girl two licenses."

"Two license?"

"Yes, marriage and automobile."—Boston Transcript.

Keeping It in Its Place.—Proud Aunt—"We all think the baby has got its mother's nose.

Neighbor (coldly)—"I'm glad to hear it: Then she can't go about any more poking it into other people's business."—Punch.

Cause and Effect.—Magistrate—"Do you mean to say that such a physical wreck as your husband gave you that black eye?"

Plaintiff—"Your Washup, 'e wasn't a physical wreck until ' gave me the black eye."—London Opinion.

Pleasant For Father.—"Are caterpillars good to eat?" asked Tommy at the dinner table. "No," said his father. "What makes you ask a question like that while we are eating?" "You had one on your lettuce, but it is gone now," replied the little son.—Pittsburgh Post.

Crime and Cocaine.—William J. Burns, the famous detective, was displeased with the work of one of his squad last month, and, accordingly, as a kind of hint, presented the man with a copy of "Sherlock Holmes."

"I guess this means, Mr. Burns," the man sneered—"I guess this means I'd make a great detective if I took enough 'coke.'"

Mr. Burns shook his head sadly.

"George," he said, "there aint that much coke."—Detroit Free Press.

Careless.—The foreman rushed into his employer's office in a state of intense excitement.

"Please, sir," he gasped, "one of the new houses has fallen down in the night."

"What?" roared the builder. "You mean to tell me that one of my new well-built, desirable villa residences has come to grief? How the dickens did that happen?"

"Well, sir," explained the foreman, "as far as I can make out there was a little mistake. Unfortunately, the men took down the scaffolding before they had put up the wall-paper."—Windsor Magazine.

SOME OF THE LATEST SONG HITS:

"I'm going back to my Moonshine Nell. I love her still."

AMUSING AUTOMOBILE ACTUALITIES

"Say, old man, is my tire flat?" "Well, it's a little flat at the bottom, but the rest of it is all right."—Judge.

"Papa, what do you call a man who runs an automobile?"

"It depends on how near he comes to hitting me."—Houston Post.

ANSWERS BY WOMEN APPLICANTS FOR AUTO DRIVING LICENSES:

"If your brakes don't work going down hill what would you do?"

"Jump out and put a stone under the wheel."

"If your engine stalls on the car track what would you do?"

"Phone my husband to come fix it."—New York Evening Mail.

There is one automobile to every 16 people in the United States. The population may, therefore, be roughly proportioned as six riders to 10 dodgers.—Syracuse Post Standard.

"Have you got any of the bomb throwers yet?"

Policeman: "No, but I captured three automobilists who turned to the right instead of the left."—Brooklyn Standard Union.

Here lies the body of Jim Lake,
Tread softly all who pass;
He thought his foot was on the brake,
But it was on the gas.
—Jack Canuck.

A small boy who often goes riding in a motor car, is a great believer in prayer. The other day the car got stuck, and Bobbie prayed, "Oh, Lord please help us out: these is only a woman chauffeur present."—Capper's.

"You must have been walking carelessly," said the lady whose car had run down a man. "I'm very careful. I've been driving seven years."—Man. "That's nothing I've been walking for fifty-four years."—Erie Dispatch.

"Have you a little fairy in your home?"

"No, but I have a little miss in my engine." — Philadelphia Retail Public Ledger.

JUST LIKE OUR BOSS

"What is that stuff you are going to give my husband?" asked the agitated wife.

"An anaesthetic," replied the Doctor, "after he has taken it he won't know anything."

"Then don't give it to him" she exclaimed. "He don't need it."

IN THE GOOD OLD DAYS

The Policeman—"Man, you can't open that door with a cigar."

The Pickled One—"With a cigar? Gosh! I must have smoked the key."

IT SOUNDS BETTER

Why do you object to the League of Nations?"

"On musical grounds. After singing my "Country 'tis of Thee, all these years, I don't want the mental effort of changing to "Our Countries, 'tis of Those."—Washington Star.

HEALTH HINT—DON'T ASK THE EDITOR

Dear Editor: How can I tell when the water is of the right temperature to bathe baby? —Mrs. Eric Adams.

Ans. If the child turns red and screams, it is too hot. If he turns blue and shivers, it is too cold—Editor.

ON THE TIP OF THE TONGUE

Getting it in the neck is always an amusing thing, provided it isn't our neck.

Experience is a mighty good school, but there are no vacations or holidays.

When a man discovers that he has no balance in the bank he naturally feels upset about it.

You can rob Peter to pay Paul, but that doesn't prevent him from borrowing it back again.

A man derives almost as much pleasure from keeping a secret as a woman does telling one.

Some people are so constituted that if they should be struck by a train of thought they would sue for damages.

"It doesn't make any difference whether a woman marries for love or for money," observes the Cynical Bachelor, "she earns every penny of it."

"Put your best foot forward," advised the Wise Guy. "But don't lose sight of the fact that two feet are better than one," amended the Simple Mug.

Muggins—"I saw an old-fashioned melodrama last night in which only three of the characters were left alive when the curtain fell." Buggins—"Was the author one of them?"

Henpeckke—"My wife and I spent the weed-end with Mr. and Mrs. Gnaggs." Wigway—"Did they make you feel at home." Henpeckke—"Sure they did. They scrapped like the deuce all the time we were there."

GETTING A LIGHT

"The Indians used to smoke a pipe of peace."

"They never could have remained peaceful if they had been compelled to depend on these modern matches to light the pipe."—Washington Star.

The Lord will provide. Even with a shortage of coal the prohibition amendment would make lots of people hot.

In France some American negroes were sitting beside the road, away behind the battle lines, watching troops moving forward to the front. These Negroes were commenting on the names of the regiments which marched by. (Many of the regiments raised in England were named for the counties in which they were recruited, as "Kentish Rifles," "Northumberland Lancers," "Third Yorkshire Infantry," and so forth.) As these British troops marched by, one of the Negroes took delight in calling out the name or number of the regiment. Suddenly down the road came a regiment of Highlanders in kilts. The Negroes had never before seen a "'kiltie' regiment," and one of them cried: "My! My! Look dere, Sam, what am dat. Dey is too big for women and dey cain't be men 'cause dey is wearing skirts; what do you-all s'pose del is?"

"Why," said Sam, "dey is dat Middlesex regiment."

Benton's Recipes

Self-Lubricating Bearings—In hard gun metal bushes, bored a good fit to shaft and split, drill four holes per square inch of surface, each 1/4 inch diameter by 1/4 inch deep. The holes are to be flat at the bottom and to be spaced zigzag, so that one row of holes is between the holes in the opposite side thus: : : : : . Fill the holes with a compound prepared as follows: Melt 1 pound solid paraffine and add 2 ounces of litharge, dissolved isinglass and sulphur; add further 2 pounds of fine plumbago and mix thoroughly.

Cement for Cast Iron—To make a cement for cast iron take 16 ounces cast-iron borings; 2 ounces, sal-ammoniac; and 1 ounce, sulphur. Mix well and keep dry. When ready to use take one part of this powder to 20 parts of cast iron borings and mix thoroughly into a stiff paste, adding a little water.

Cooling Compound for Necks or Rolls and Shafts—Dissolve 2 1/4 pounds of lead acetate in 14 pounds hot tallow and add 2 1/4 pounds black atimony. Stir the ingredients constantly until cold.

Soldering Alloys—The following soldering alloys can be recommended:

For copper with copper: Copper, 55; zinc, 40; tin, 5.

For copper with iron: Copper, 80; zinc, 16; tin, 4.

For brass: Copper, 45; zinc, 50; tin, 5.

For lead: Lead, 67; tin, 33.

Cement for Joining Metals to Wood—Dissolve in boiling water 2 1/4 pounds glue, 2 ounces gum ammaniac and drop by drop 2 ounces of sulphuric acid.

Chilling Cast Iron—Mix together 1/2 pint of oil or vitriol, 2 ounces of saltpeter, and 3 gallons of clean water. Heat the casting, and plunge it in this solution, keeping it there until cold.

Cement for Fastening Emery to Wood—Melt and mix equal parts of shellac, white rosin and carbolic acid in crystals. Add the acid after the other two ingredients are melted.

Gluing Leather, Cloth, and the Like to Metal Surfaces—When undertaking to glue leather, cloth, labels, etc., on metal, it may be difficult to get the articles to stick. Where it is possible to completely wrap the metal, the following is a good plan:

Cut a piece of print or newspaper, wide enough to go a little more than twice around the metal. Paste this up, allow it to soak a moment, then wrap it tightly around the metal, pasted side in. In drying, the paper contracts and pulls itself so tight as to form almost a part of the metal itself, which is then ready for use. If this plan is not practicable, try this:

To 3 parts liquid glue add 1 part glycerin. Glue up the leather, cloth or labels with this preparation and apply directly to the metal. The glycerine prevents the glue from becoming perfectly dry by absorption or evaporation, holding the labels, etc., to the metal by capillary attraction.

Milling Cutter Lubricant—An excellent lubricant for milling cutters can be made by mixing together and boiling for about a half hour one-quarter pound sal soda, one-half pint lard oil, one-half pint soft soap and enough water to make 10 quarts.

When a cone clutch spins, that is, when it continues to rotate for some time after being disengaged, the trouble may be remedied by adjustment in many cases. Roughness of the leather may be the cause. A thin coating of neatsfoot oil or dressing with Fuller's earth usually stops the trouble. In a disc clutch running in oil, thinner oil sometimes helps. It usually is a sign of gummed discs when the trouble occurs in a dry disc clutch.

Etching Iron and Steel—To establish ownership of their tools many mechanics inscribe their name on them. Instead of using a stamp for the purpose, it is the better plan to place the name on the tool by etching process by using a solution made of one ounce of muriatic acid and a half ounce of nitric acid. Cover the place to be marked with melted beeswax and make the desired marking through the wax to the metal with a sharp pointed instrument. Shake the solution well and apply it to the indented letters with the end of a feather. Allow the acid to remain until it has eaten into the metal to the desired depth. The action of the acid can then be neutralized by sprinkling water over the part.

Case Hardening Hint—When case hardening a wheel or other component of a piece of work and it is desired to leave one portion soft, so that it can be machined, the following sugguestion may prove helpful; Before placing the work in the furnace, the part desired to be kept soft should be covered with a layer of old fire clay. After the heating process do not remove the fire clay, but allow it to remain in position until the work has become cool.

Hardening Small Parts—To skin harden small cast parts, such as gears, etc., make them red hot and dip them in a melted solution of ferro-cyanide of potassium. After immersion, withdraw them from the solution and cool them off. The cyanide should be melted in an iron or earthenware pot.

To make canvas water proof wash it in in a solution of dissolved soft soap and a small portion of sulphate of iron. When the canvas is dry coat with linseed oil. The soap prevents the oil from becoming hard.

If you place a piece of cloth under the point of a drill and drill through it you will be able to make quite a large hole at the first attempt without the drill slipping or chattering. This practise can be beneficially adapted for countersinking work when a clean finish is desired.

If you want to obtain a black finish on aluminum first polish it with a fine emery cloth, coat with a thin layer of olive oil and heat slowly over an alcohol flame. The heat causes the metal to turn brown and then black, depending, of course, on the degree of heat. To obtain a uniform color repeat the process. When the desired tone has been achieved, polish with a soft leather or a woolen cloth.

When Grinding Copper—Do not forget that copper attempted to be ground on a carborundum wheel always clogs. You can avoid this by rubbing a little tallow on the copper. This will not interfere with the cutting of the wheel.

Cutting Tubing—A hacksaw used for cutting brass tubing, or thin, hard brass sheets, very quickly loses its usefulness and its teeth. Two hack saws set side by side in the frame with their teeth pointing in opposite directions, will usually overcome this difficulty and give a cleaner, though a wider cut.

A TRAVELLING SMITH OF AUSTRIA

The smith of southern Austria hasn't had the advantages enjoyed by the village smith whose praises were sung by Longfellow. Nor do the children coming home from school watch him pound the hot iron into shoes, because this smith has the wander-lust. His place of business is here now and within an hour he has moved on.


ST. ANDREWS AMBULANCE ASSOCIATION
Typical Example of Red-Cross Ambulance.
RENO Chassis.
Motor-buses which run from
Edinburgh to the Forth Bridge.
C 7114
Four-Seater:
TALBOT
Auxiliary
Ambulance
HALLEY - 37-seat Auto-bus
Covered with a Seldon body.

The Motor Car Industry in England

By JOHN Y. DUNLOP

IN the earlier stages of the history of the English motor car industry there was a great deal of prejudice against the English make of cars solely by reason of the great advantages which Germany and France had gained by forcing matters through propaganda and sales promotion work as compared with the slow beginning in England.

The first effective check which was placed on their inroads into the British industry or rather the first change in matters was brought about through the success of the Hapier Car in winning the Gordon Bennett International Race in 1902.

The English view of the motor industry in their country is clearly analyzed in this article. It was written by an Englishman who is thoroughly familiar with the conditions in his country. His observations should be of interest to all who are connected with the automotive industry, and particularly those calamity howlers who would have us believe that the industry in this country has all gone to smash. The industry over there is beset with the same pitfalls and troubles that it is here—only worse. We aren't really as bad off as we think we are.—The Editor.

From that time on it was possible to slowly, but surely convince the motor users of England that Britain had rendered a satisfactory account of itself in this branch of engineering, as well as others.

The British cars of those days were not really home made cars so to speak, as we found them in the pre-war days. One of the best known makes of British motors were equipped with a German make of crankshaft, while a number of other makes of British cars had engine castings and forgings made in the Scandinavian countries.

Of course, the general trend of those days was eventually towards an entirely home-made car, with the exception perhaps that some makers had to go abroad for their springs. The French excelled particularly in that line, as they had gone more carefully into the problem of selecting suitable steel long before Britain had given serious thought to the matter.

In this way we entered the war dependent on the German magneto and other Bosche products; but the campaign made us all realize the importance of being able to depend on our own resources, with the result that we learned a great deal in commercial and quantity production, and also of selecting precisely the right material for manufacturing the various parts.

About that time Britain learned to produce practically every requisite for a motor vehicle, then came our labor troubles with the result, that in self-defence and in justice to our patrons, we were compelled to again send abroad for many parts, which labor troubles not only made scarce, but too expensive.

Most of the countries are well aware of the disasterous effect the moulders' strike all over England had on the British production program, and to the disappointment which it caused to the prospective vehicle owners, while on the other hand little attention was given by these people to the financial and managerial difficulties, which had to be overcome. These conditions were further aggravated by the scarcity of raw materials and many firms were able to continue operations only through the rapid establishment of works in Belgium, by British capital. These plants produced the necessary castings.

The effect of this condition was twofold, while it helped out the British manufacturer, it also enabled Belgium to resume its industrial activities more rapidly and more profitably than would otherwise have been possible, and at the same time, we were given castings of better quality and at a lower price than could have been produced in our own country. The result of this attitude of British labor, which compelled our manufacturers to acquire a controlling interest in works abroad, is that now a large amount of our own castings are coming from these countries, and I suppose will continue to come instead of being made in our own country.

Moreover, today there is every indication that trouble is brewing in certain branches of the industry in connection with cylinder casting. Due, I understand to the prolongation of the moulders' strike, which has lead to the diversion of skilled labor to other countries. It is not so much that there is difficulty in getting cylinders, as in the fact that those which have been supplied are largely defective and consequently have to be rejected. These conditions are having a telling effect on the output of cars, because in some of these home-made castings, the defects are so difficult to discern that it is only after the engine has been built and placed in operation that the trouble really developes. Much of this is no doubt due to the replacement of skilled labor by men less familiar with the work.

No doubt other countries have much the same trouble, but some of them seem to get over them more easily than we do. The whole question looks to me as though these conditions have been brought about, because skilled labor was not renumerated to the extent it should have been. There is no reason why, if a man is a specialist in certain productions and operations, and can produce work which is highly profitable to his employer why he should not be paid accordingly and proportionately to his ability.

Unfortunately, British labor is directly opposed to such procedure. The labor unions will not allow this excess amount of labor (as they call it) to be done by any of their members, with the result that there is a great need of increased production, and final output suffers along all lines.

Many English builders of motor vehicles are now not nearly as particular as heretofore in demanding that every part of the British car should be made in their own country. Their time is occupied largely in finding a place where that particular part of the mechanism, which they cannot produce profitably, can be made at a price to enable its use.

In this way, some of the British cars are having all, or nearly all of the principal parts of the rear axles supplied directly from American factories. British builders realize that they are better supplied there than we are in our own workshops. The British buyer is satisfied that he gets a better and cheaper job, and the English engineer is confident that the job will be made precisely to his specification. All this goes to show that many British cars are either more or less American cars in a certain sense, and in many cases complete unit assemblies, such as transmissions and rear axles rest in British chassis. We must be consoled of course, by the thought that it is going to take us a long time before we can expect to be abreast of the Americans, either as automobile users or motor builders. In Britain at the present time, only one person in 180 owns a motor vehicle, and for economic reasons there doesn't seem to be any hope that that proportion will be materially changed for some time to come.

At the present time in spite of labor troubles, the supply of cars is rapidly catching up with the demand, and it is possible in many cases to make immediate purchase from agents, because the lessened demand has offset the shrink in production.

Of course the supply has a long way to go before it will reach the saturation point, and probably as these conditions more nearly approach normal, it will be the importers who will first be able to appreciate the change. The demand for vehicles might be greatly increased in England now, even in the face of such adverse conditions, but the price of fuel makes their operation for pleasure purposes almost prohibitive. Today, the price of even second quality petrol (gasoline) is over 96c per gallon.

Even by making liberal allowances for the increased cost of production, raises in freight rates, and the decline in the value of money, the English motorist is confronted with a raise of 750% in the price of fuel within the last few years. Oil prices in England have long left the lower slopes of economic value, and have risen to the dizzy heights of scarcity demands, and there seems to be no summit to reached, save that fixed by competitors of other fuels.

After the eternal order of things the burden of course, falls on the ultimate consumer. The commercial vehicle owner has to pass on to his hire any increased operating expense whether it be an increase in driver's wages, a reduction in working hours or an increase in the cost of fuel.

Just what effect this is going to have on the motor car industry is indeed speculative, and these difficulties it might be added have arisen at a most inopportune time, particularly for the commercial vehicle industry, as we were just recovering from a slump. The raising of the railway rates had diverted considerable of the short-haul loads from the railroads to the motor truck, but the increased cost of truck haulage has again diverted a great deal of this traffic back to the railroads. The only remedy we see in this connection is home-produced fuel, but when the English oil fields will be developed to such an extent is indeed a remote, difficult question to answer.

TRACTOR PRODUCTION IN THE UNITED STATES

In an investigation made by the Bureau of Public Roads, United States Department of Agriculture, of the production of tractors in the United States during 1919, reports from 80 manufacturers show that they manufactured a total of 164,590 tractors during the year.

The reports also gave the number sold in the United States and for export, and the number on hand, in transit, in branch houses, and in the hands of dealers unsold on December 31, 1919. Five of these manufacturers built only tractors of six-belt horsepower and less. In all, reports were received from 156 companies but only 80 had manufactured machines during the year. It is believed that the total number of machines manufactured by these 80 firms represents at least 95 per cent of the total tractor production in the country during the year. The number of tractors of different sizes built by these companies during the year 1919 is as follows:

Makers' rating belt horsepower	Number of tractors built
6 and less	3,760
9, 10, and 12	1,991
16 and 18	22,012
20 and 22	94,653
24, 25, and 26	15,546
27, 28, 30, and 32	17,597
35 and 36	2,453
40, 45, and 50	1,954
60 and over	1,624
Not given	3,000
	164,590

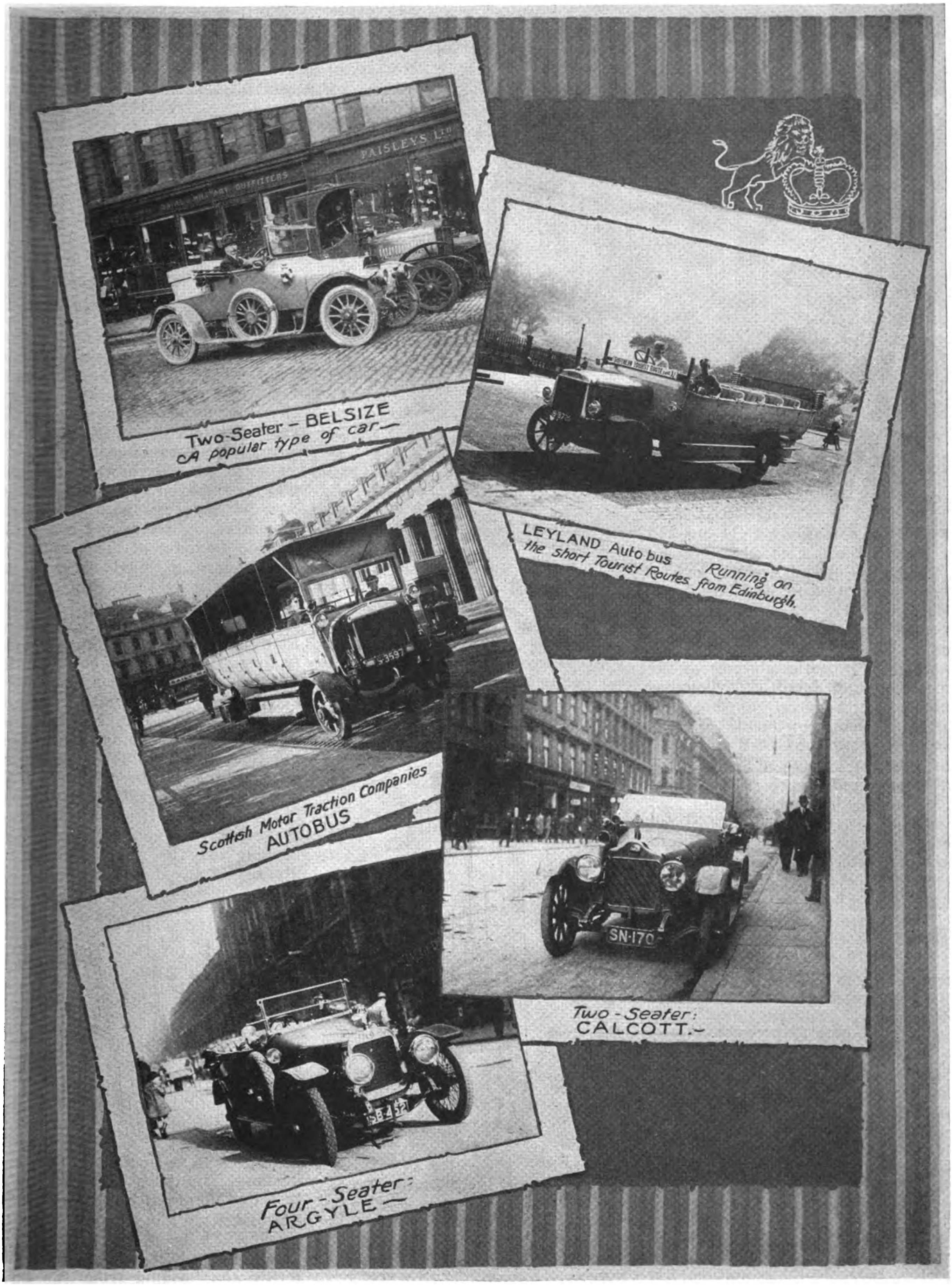
THE CLASSIFICATION OF STEEL

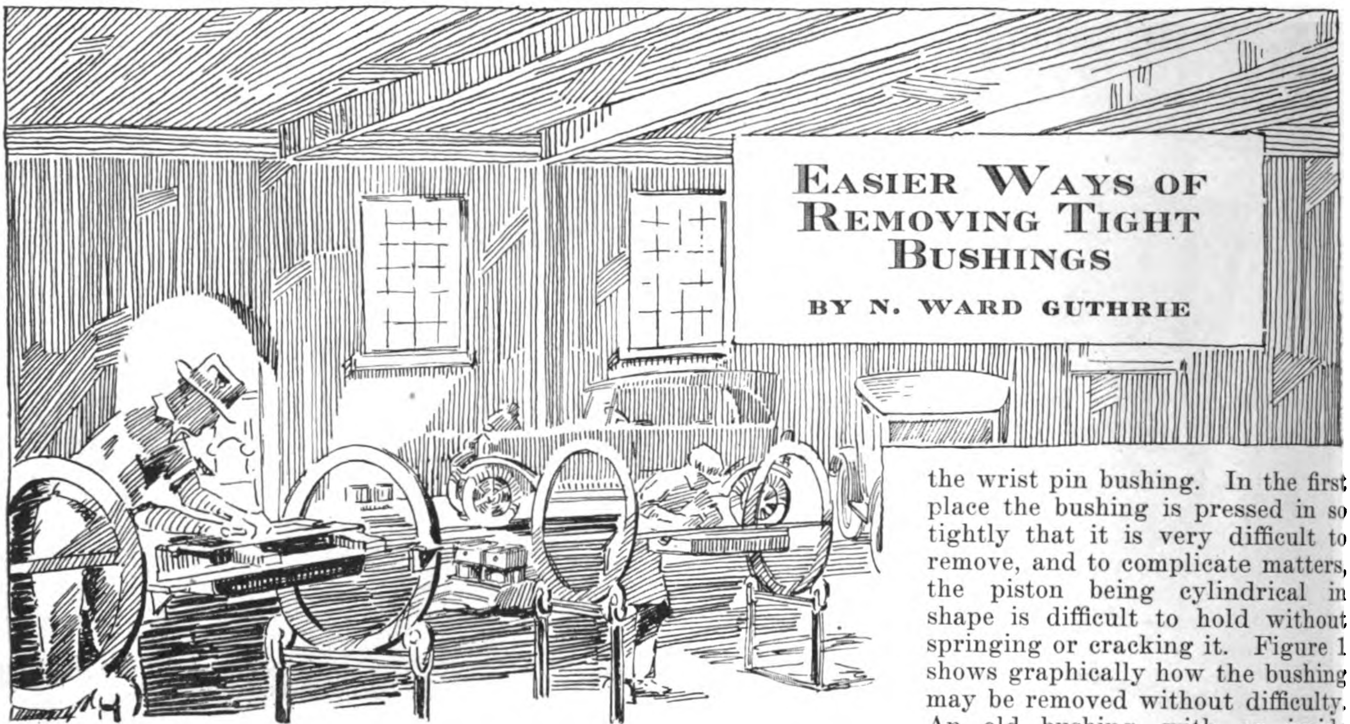
The varieties of steel and iron may be classified in four different ways: (1) by the presence or absence of slag; (2) by carbon content; (3) as carbon or alloy steels; (4) by the method of manufacture. In the carbon variety there are three classes: (1) soft or low carbon steel and wrought iron (for soft steel contains no slag while wrought iron does) with less than .3 per cent. of carbon. Both are soft, ductile and have little hardening properties, but are stronger than cast iron; (2) medium and high carbon, or half-hard and hard steels, containing 0.3 to 2 per cent. of carbon; harder, less ductile and stronger than low carbon steels, and with marked hardening power; (3) cast iron, containing more than 2 per cent. carbon, weaker and less ductile than the two former classes, with part of the carbon present as graphite.

The uses of the varieties are, roughly, as follows: Low carbon or mild steel, .0.5 to .3 per cent. carbon. Used for wire, sheets, boiler and ship-plates and structural steel. Medium carbon steel, .3 to .8 carbon. Used for axles, shafting, tires, rails, etc. Requires hardening and tempering, and is used for spring work to a certain extent. High carbon steel, unhardened, contains from .8 to 2.0 per cent. carbon. Can be hardened or tempered. Used for springs and cut ting tools.

The following is a summary of the reports received from the manufacturers for the years 1916 to 1919 inclusive:

	1916	1917	1918	1919
Number manufactured	29,670	62,742	132,697	164,590
Number sold in the U. S.	27,188	49,504	96,470	136,162
Number sold for export	.....	14,854	36,351	19,693
Number on hand Dec. 31.	.....	15,525	15,401	27,740


Two-Seater - BELSIZE
A popular type of car
LEYLAND Auto bus Running on
the short Tourist Routes from Edinburgh.
Scottish Motor Traction Companies
AUTOBUS
Two-Seater:
CALCOTT.
Four-Seater:
ARGYLE
SN-170



Easier Ways of Removing Tight Bushings

BY N. WARD GUTHRIE

THE removal of a tight bushing is indeed a rather annoying job, especially when one is not equipped with special tools for the purpose. The hundred and one kind of special devices, as well as an arbor press, are not always at hand. It is the absence of the right kind of facilities which has made the removal of bushings about as popular a mental irritant as fitting stove pipes. We have all had the opportunity of seeing some of our friends in the shop struggling over a stubborn bushing, trying to get it out by the old fashioned punch-hammer and profanity method. After the atmosphere cleared up sufficiently so that the blue haze could be penetrated by the curious gaze of a more composed person, it was an amusing sight after all. Tools strewn around the floor, fingers skinned and a delightful saw edge on the mechanic's disposition. You've done it—so have I—puffed and sweated over a stubborn bushing, then after we had damaged the part more perhaps than the bushing, and were on the verge of throwing the whole thing away, fate seemed to intervene, and to our relief the part came out.

It is merely another case of misapplied energy. There are a number of half nelson's, so to speak, to which old man bushing simply can resist. Both shoulders and one hip are on the mat in less time than it takes to tell about it. To be sure these little hints, which are enumerated herewith are not recommended as being paramount to specially designed tools for the purpose; but they will do the trick nevertheless, and do it in a way which leaves one in a much more companionable frame of mind.

Perhaps the worst offender of the entire group is our old enemy the wrist pin bushing. In the first place the bushing is pressed in so tightly that it is very difficult to remove, and to complicate matters, the piston being cylindrical in shape is difficult to hold without springing or cracking it. Figure 1 shows graphically how the bushing may be removed without difficulty. An old bushing, with an inside diameter slightly larger than the outside diameter of the bushing to be removed, is filed concave, so that it will rest steadily against the outside of the piston. Another bushing slightly smaller in diameter than the wrist pin bushing is placed against the opposite end of the bushing to be removed. Washers are placed over the ends of both of these bushings. Then by means of a bolt, the two bushings are drawn together, and in so doing the wrist pin bushing is forced out. The whole arrangement is clearly shown in the drawing. It will be observed that where this method is used, the bushing may be removed without practically any danger of damaged to the piston or injury to the bushing.

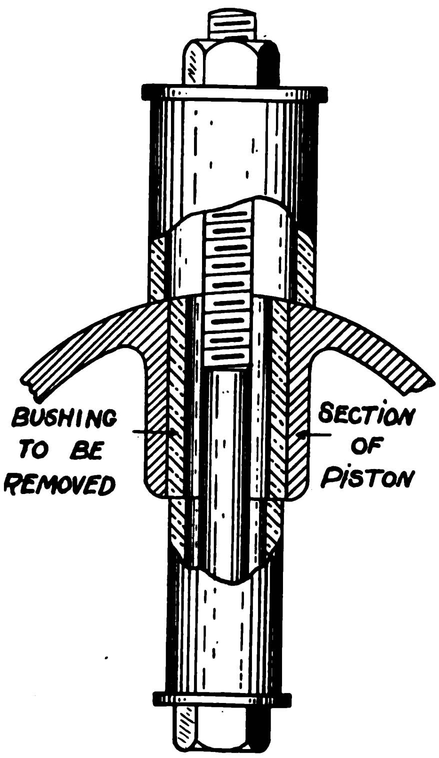


FIGURE 1. PRESSING THE WRIST PIN BUSHING OUT OF THE PISTON

In replacing the bushing, the operation is reversed, that is, the bushing is drawn into place by means of the bolt. Figure 2 shows the general arrangement. The same bushing which was used on the outside of the piston in withdrawing the bushing, is again placed in the same position. The new bushing is entered from the inside of the piston. In most cases there is ample clearance between the bosses to accommodate the new bushing. In those cases where it is found impractical to enter the bushing from the inside, a heavy washer may be placed against the inside of the boss, and then by entering the bushing from the outside, it may be drawn in against the washer. The same is true in drawing bushings where the distance between the bosses does not permit the use of a bushing to push the wrist pin bushing out. Then a heavy washer may be used against the end of the bushing to be removed and then it may be pulled out in the customary manner. Such an arrangement is shown in figure 4 where the manner of removing a cam shaft bushing is shown. Wherever space permits, it is better to use the bushing instead of the washer as there is less likelihood of mutilating the part holding the bushing when the latter is drawn out.

Wrist pin bushings which are located in the connecting rod instead of the piston are much more easily handled, as there is less likelihood of damaging the connecting rod than there is of the piston, however, these conditions do not warrant the use of the strong arm, cold chisel and hammer methods. The bushings can be much more satisfactorily removed by utilizing

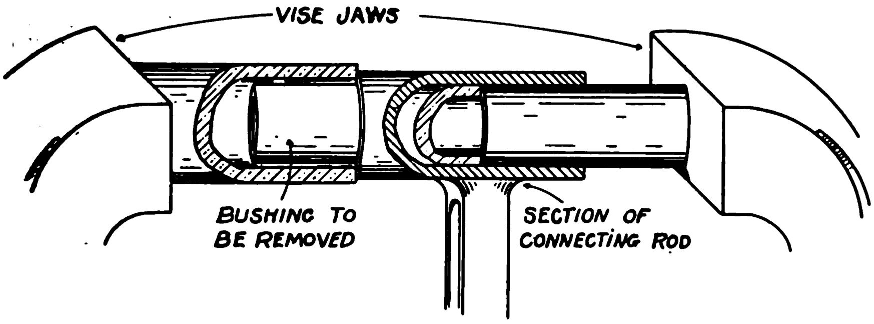


FIGURE 3. USING THE VISE TO PRESS THE WRIST PIN BUSHING OUT OF THE CONNECTING ROD

the jaws of the vise. Figure 3 shows so plainly how it is done, that a detailed explanation seems unnecessary. The bushing is replaced in about the same manner. The only difference being that it is squeezed in by the pressure of the jaws instead of being pressed out.

Some mechanics in order to correct slight wear in wrist pin bushings withdraw them, tin the entire outside surface and then press them back into place. The increased size of the outside diameter, causes it to shrink to a certain extent when it is again pressed into place. The advisability of such procedures are highly questionable, since the bushing is merely shrunk at or near the edges. These high spots soon wear down and then there is as much play in the bushing as before the repair was attempted. In emergencies such work might be tolerated, but it should not be encouraged. Wherever possible, bushings, that show signs of having worn so that they loosely fit their shaft, should be replaced with new ones, and then reamed accurately to size.

It might be slightly irrelevant while discussing the removal of bushings to branch off and speak of reaming them; but this little suggestion fits in so nicely that it should not be overlooked. In reaming the bushing, after it has been replaced, a straight flute reamer should not be used, if possible to avoid it; especially on wrist pin bushings, because it is virtually impossible to ream a perfectly round hole with a straight flute reamer. An inspection of the reamed hole after the use of such a reamer, will disclose, if the pin is blued, that the hole has a number of high ridges running through its entire length. Much better results can be obtained where spiral reamers are used for this purpose.

Another difficult bushing to remove is on those motors having bronze cam shaft bushings. The crank case being aluminum, and invariably the bushing is most inaccessibly located. It is a mean task to drive it out, and further more an attempt to do so usually results

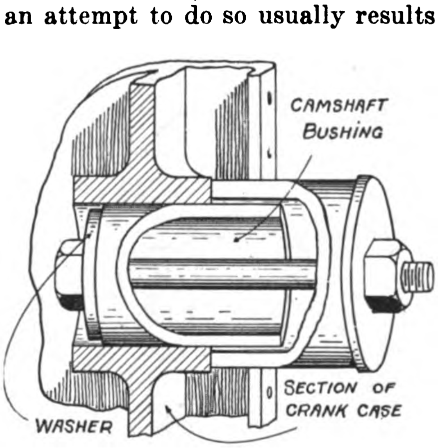


FIGURE 4. WITHDRAWING A CAM SHAFT BUSHING

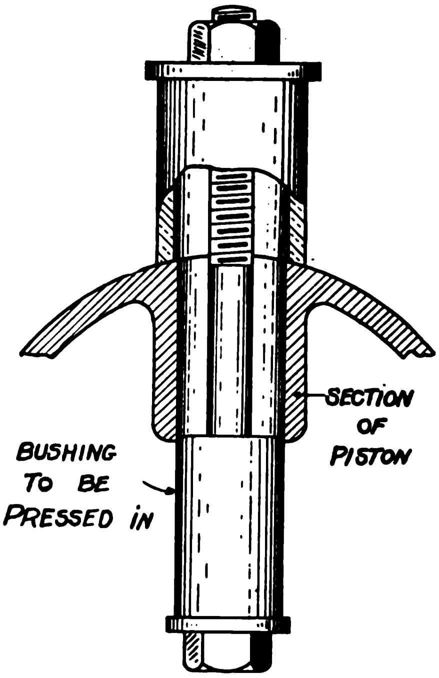


FIGURE 2. PRESSING THE NEW WRIST PIN BUSHING INTO THE PISTON

in the tool slipping off of the end of the bushing and badly mutilating the soft aluminum case. Figure 4 shows how it can be done very easily. The principle involved is identical with that used in removing the wrist pin bushings, except that the large bushing at the outside is square at the edge instead of being concave. The new bushing is replaced in about the same manner as the other one was removed, that is, the only difference is that the operation is reversed.

Bushings in the spindle body are often quite a problem to remove. Being arranged end to end, and setting as they do either in a complete or partial recess; it is not only impossible to get behind them and draw them out, but it is equally difficult to use a punch from the opposite end. Using a cold chisel under the shoulder or flange of the bushing as a rule only results in breaking off the flange and leaving the bushing still firmly imbedded in the body. Figure 5 shows a kink which greatly facilitates their removal, and where it is used little difficulty is experienced.

A hack saw blade is shoved through the hole in the bushing. It is then connected to the frame. The bushings are cut through to the spindle body. After this is done, it will be found that they can be very easily removed, either by driving against the edge of the flange with a cold chisel or by using a punch on the ends. The same methods may be used on other bushings which are sometimes hard to get out, such as steering arm connecting rod bushings.

It is always better when replacing the new bushings to press them in, than to attempt to drive them. In this case, however, the part is usually to long to be accommodated in the ordinary vise, so that the bushings may be driven in; but it should be done carefully.

Some mechanics attempt to take up the play in worn spindle bushings, by wrapping a piece of sheet metal around them after they have been removed by the foregoing method. The cut in the bushing permits it to shrink sufficiently when it is pressed back into the body, so that it will fit the bolt snugly; but bushings installed in this manner seldom hold tightly in the body. In most cases they soon work loose thus making the improvement very short lived.

Bushings are comparatively cheap when compared with the cost of time that it takes to install them. The cost of that time should not be wasted by making a worthless, makeshift repair.

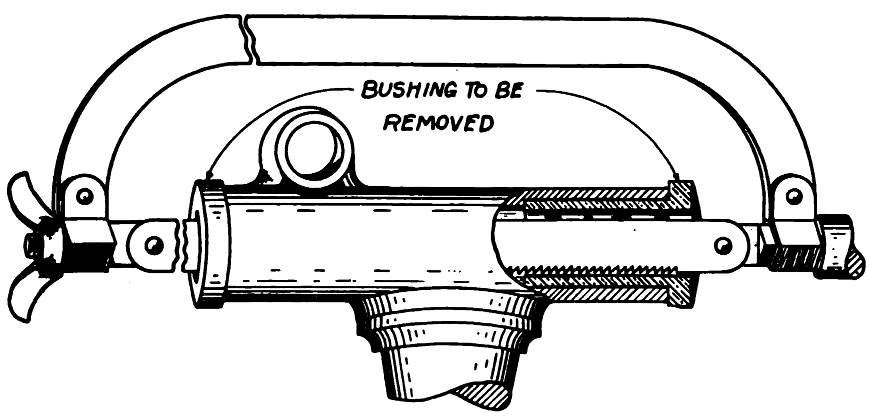


FIGURE 5. THE MANNER OF SAWING A SLOT IN THE BUSHINGS SO THAT THEY MAY BE MORE EASILY REMOVED

Ever notice how much more noise a little loose change can make than a wad of greenbacks? Same with automobiles.

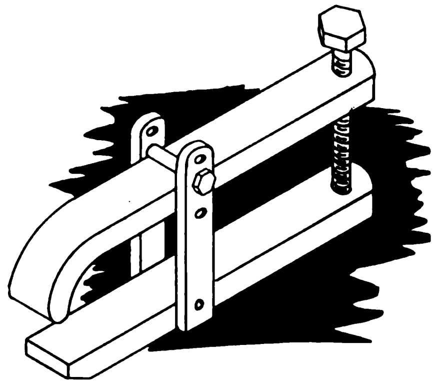
The man who isn't a producer is a parasite, and society has no use for parasites. Produce goods or service or both, or get off the map!

TIME SAVERS FOR THE SHOP

By Chas. H. Willey

NOVEL CLAMP

The clamp shown in the sketch is one that combines the useful features of both a C clamp and a



AN EASILY MADE CLAMP THAT HAS A NUMBER OF USEFUL PURPOSES AROUND THE SHOP

parallel clamp and is far simpler and easier to make than either of those two clamps. The writer designed, made and used these clamps in the shop with great satisfaction. The sketch shows its construction. One should use a good grade of machine steel and make them of a size to suit the needs of the shop.

OIL CAN STAND

In a shop operated by a gas engine, the idea for an oil can stand was picked up. It stood near the engine. The support was made of $1\frac{1}{2}$ inch pipe cast into a concrete or cement base, the form for which was made out of an old wooden bucket. The detail of the manner in which the pipe was secured to the pan is shown in the sketch. The oil cans, the can filler, etc., used for the engine and shop machinery were kept in readiness on this handy movable stand.

BENCH CUTTER

It is handy to have a small sheet metal cutter on the work bench. Such a tool can be quickly and easily made from a couple of large size old files, or if preferred, from tool steel bar as shown in the sketch, the lower jaw being secured flush with the bench edge top as shown in the sketch.

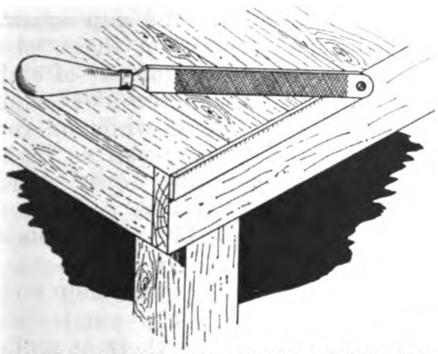
A HANDY DRILLING BLOCK

The damage usually done to U shaped articles on account of the pressure of the drill crushing the side together, when drilling them; can be avoided if a part of an old crank shaft is used for a drilling block. A crank shaft on which the sides of the throws are parallel has to be selected. The accompanying cut shows how the kink works out in practice.

A HANDY STAND FOR THE OIL CANS

PATCH FOR LEAKY PIPE

A man came in the other day and wanted a couple of pieces of sheet iron bent up in a hurry to fit an inch and a half pipe which had split and was spilling water all over the works. As we had some of the next size, (2 inch) pipe, we immediately made him a durable patch, as shown in the sketches by splitting a couple of pieces of this and bending them as indicated in the dotted lines.



HANDY TRIMMER MADE FROM OLD FILES

WRENCH EXTENSION

A rather novel way of providing extra leverage for double end wrenches is that shown herewith in the sketch. A piece of bar steel of right length is used, and to its end a nut is welded or riveted, the nut to fit the wrench. The tool is used as illustrated.

HANDY LATHE TOOL HOLDER

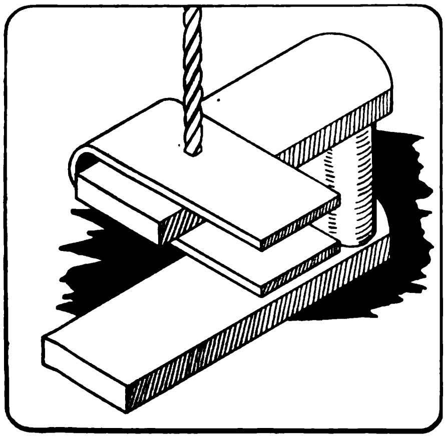
Having some spare time recently I milled up a rather unique tool holder that holds round boring tools made of drill rod and regular square tool bits. It has two size Vee slots for holding the round tool steel of different size boring or threading tools. The clamp swings to either side of the tool.

This tool should be of tool steel and hardened and tempered. The sketch makes the idea plain to those who would care to make one.

EASY, IF YOU KNOW HOW

By Bill Gumm

"Say boss, what'll I do with



PART OF AN OLD CRANK SHAFT BEING USED FOR A DRILLING BLOCK

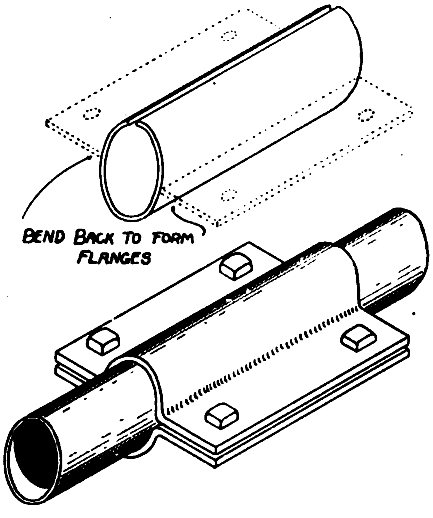
this?" asked a helper of the manager of the Leader Garage. holding up for his inspection an inner tube having a blowout several inches long.

"Why vulcanize it, of course," replied the manager in a surprised tone. "Don't you know how to do it?" he asked.

"Yes, I do," replied the helper evidently hurt that his employer should think him so ignorant, "I'd do if I have the stuff," he added, but we haven't any gum cured on one side to use inside so the patch won't stick the tube together."

"And don't you know what to do in a case like that?" asked the manager, "Well, I'll show you. Bring me the raw gum, cement and tools," he ordered.

The helper brought them and



AN EMERGENCY PATCH FOR A LEAKY PIPE

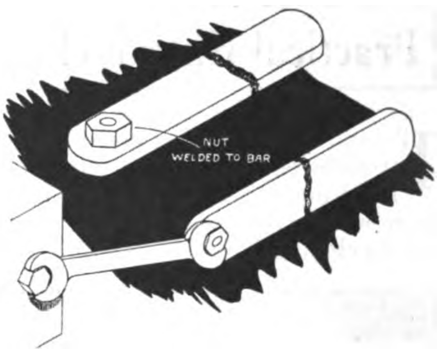
was set to work cleaning thoroughly the torn tube with gasoline. That finished, the manager measured the hole and then cut a piece of raw gum large enough to cover the hole extending at least half an inch on all sides. From this he carefully removed the cloth backing. This backing he gave a heavy coat of vulcanizing cement and allowed it to dry. After it was dry it was slipped into place in the hole in the tube where it made a good substitute for the gum cured on one side most generally used for such work.

The helper, an interested onlooker, laughed at the manager's cleverness. "Say boss," he exclaimed, "that's a good idea."

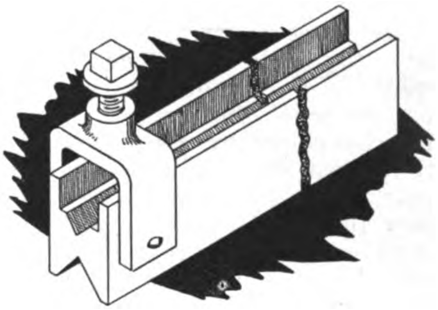
The manager continuing his task, simply smiled. Holding the cement-coated cloth firmly in position, he cemented the cut thoroughly inside and out, using care that no cement got beyond the limits of the cloth inside the tube. The cement was allowed to dry and then the hole was filled with raw gum. The manager then took the piece of gum from which he had removed the cloth backing for use inside the tube. This entirely covered the repair and was rolled carefully into place. Then handling the finished job to his grinning helper, the manager ordered. "There now, vulcanize it, but be careful not to burn it."

"And how are you going to get that piece of cloth out?" I asked.

"We leave it in," he smiled, "It never does any harm."



OPEN END WRENCH EXTENSION



A LATHE TOOL HOLDER THAT WILL HOLD ROUND OR SQUARE TOOLS

FINISHING THE VEHICLE

In touching up vehicle parts after repair, if any dust or grit should adhere to the varnished sufaces, it must be sanded out before applying succeeding coats of varnish. If this is not done the specks may come out when rubbing, leaving small pits or pin-holes. Never varnish a surface before it has been dusted. If you do you may be troubled with pin-holes through the dust pulling out when rubbing.

Practical Hints on Repairing the Ford Magneto

It is infrequent indeed that trouble is experienced with the Ford magneto. On the whole it is a wonderfully dependable piece of mechanism; but like all other

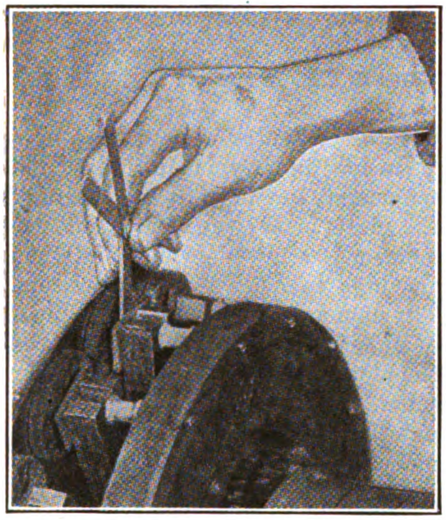


FIGURE 1. MEASURING THE DISTANCE BETWEEN THE MAGNETS AND THE COIL SUPPORT

kinds of mechanism, it occasionally goes wrong. In ordinary practice, or rather in the vast majority of cases, when it fails to deliver the necessary current, the trouble may be located in the magneto terminal, and is not, so to speak, a failure of the magneto, but rather the direct result of some foreign matter having gotten into the oil and short circuited the current. The average mechanic is not only thoroughly familiar with the symptoms of such a case but is well versed in the corrective measures necessary.

In those rare cases, however, when the trouble is more deeply seated, that is, when it is in the magneto itself, he is not quite so sure of himself. In most cases the trouble is caused by a short circuit in the coils, either because the insulation has been broken off some place, or because some foreign matter has worked in behind the coil where it can not be detected by a visual inspection. New coils are installed in a number of these cases, where in reality a simple repair to the old coil would make it just as serviceable as the new one. But we are sort of getting ahead of our story. It would be better, perhaps, to start in at the beginning and follow the whole operation all of the way through.

We will begin with the magnets and see if we can learn something of their good points as well as their weaknesses. Contrary to general opinion, the use of the magneto does not weaken the magnets perceptibly, even after long and protracted use. It is almost impossible for the magnets to lose their strength unless acted upon by some outside force, such as the current from the storage battery. This might occur in a number of ways, either by mixing the wires on the terminal post or by not properly insulating the battery wire on the block.

Magnets are not infrequently discharged, or rather demagnetized, through an attempt to recharge them by connecting a direct current to the magneto terminal. There are a number of devices made especially for the purpose; but in the hands of an inexperienced operator they often do irrepairable

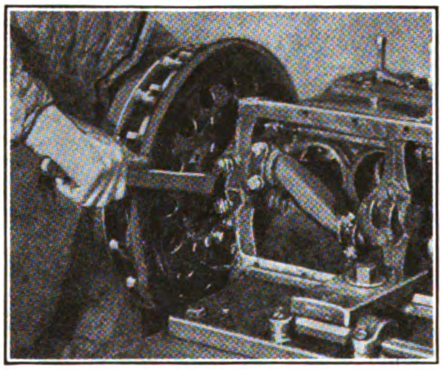


FIGURE 2. REMOVING THE CAP SCREWS WHICH HOLD THE TRANSMISSION TO THE CRANK SHAFT

damage, and even when properly handled the results are more or less apt to be uncertain.

Unfortunately the magneto is inaccessible. When trouble has been located in it, it is necessary to remove the engine and disconnect the transmission. Before taking off the transmission, try the crank shaft for end play. This is frequently a contributing cause of trouble. Force the transmission as close to the engine block as possible by pressing against it and turn it about a quarter of a turn one way and then the other. After measuring the gap between the core of the coils and the face of the magnet clamp, as shown in figure 1 of the accompany illustrations, pull the transmission away from the block and measure the gap again. The difference between these two measurements is the amount of end play. On a new motor .004″ end play may be allowed while on repaired motors it may run as high as .008″ to slightly over that amount.

End play up to .15″, while detrimental to a smooth running motor, should not cause a weak magneto, nor should it do it any particular harm, provided that there is sufficient clearance between the magnets and the coils so that the two do not come in contact when the fly wheel is shoved forward. It is good practice wherever the end play is in excess of .008″ to fit a new oversized rear bearing cap on the crank shaft. By dressing it down, the desired amount of end play may be obtained. To measure the gap a set of feelers should be used. They consist of a number of thin blades with their thickness stamped on in thousandths of an inch. They may be purchased at nearly any hardware store. A set of feelers should be in every repairman's kit.

The transmission is removed by taking out the 4 bolts or cap screws which hold it to the crank shaft. Figure 2 shows the repairman in the act of removing these cap screws with the special wrench for that purpose. When the cap screws have been removed grasp the transmission firmly and pull it out from the crankshaft. It is usually advisable to support the transmission against the body during the time that the last screw is being removed as the weight of the

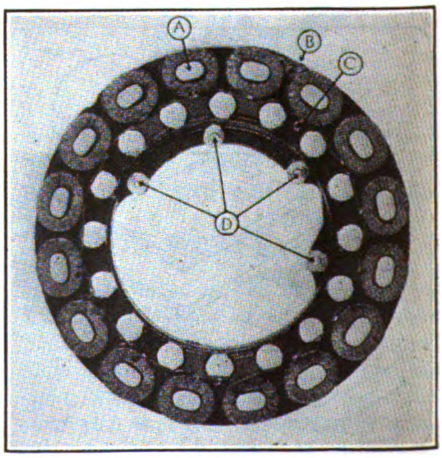


FIGURE 3. THE COIL SUPPORT ASSEMBLY

overhanging transmission is sufficient to pull it off of the crankshaft and permit it to fall to the floor, with possible damage. The magnets are now exposed for examination and test. The coils support assembly is carefully inspected before leaving the factory and meter readings are taken while the motor is running on the block test. Any short circuits, therefore, would be caused by a blow or burned out insulation, either of which could be detected by a visual inspection.

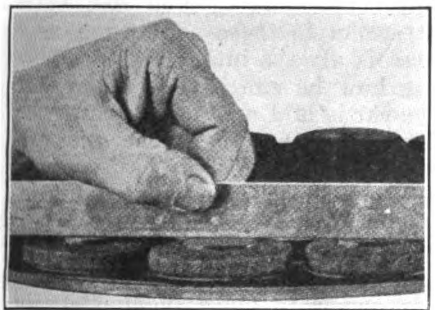


FIGURE 4. CHECKING UP THE FACES OF THE COIL CORES WITH A STRAIGHT EDGE

Examine the coils support assembly for broken or burned insulation, repair or replace if necessary. If the insulation is broken and the coils is badly damaged, the cheapest and the quickest way is to replace the coil support assembly with a new one. If the insulation has been broken; but leaving the coil in good condition, it may be fastened back. Clean the damaged coil with gasoline. When dry coat it with shellac and press the end of the damaged tape back into position, holding them until they stick. If the insulation is badly damaged and it seems uncertain that this remedy will prove effective, then the connections on both sides of the coils should be disconnected by melting the solder, and the coil may be pried off of the core. Rewrap with new tape over the damaged portion, clean the core thoroughly with gasoline, then shellac both the core and the coil and press the coil back into position and resolder the connections. Care should be taken that the coil is replaced in the same position.

Some cases of grounds, or as it is some times referred to, short circuit, may be detected by a visual inspection, as when a cotter pin or other piece of metal is jammed under a coil or when the connection between the two coils is touching the support. There are some cases, however, which can not be detected by a visual inspection. These may be found by testing with a lamp. When using a test lamp care should be taken to prevent the exposed ends of the wires from touching any part of the building that is a conductor as the flash resulting therefrom might injure the operator. If the regular lighting circuit is not available for testing purpose, the battery in the car may be used with a lamp of proper voltage. The former however is much more satisfactory as sometimes there are defective conditions which the later will not or rather are not so apt to disclose.

To use the light test, break the connecting C shown in figure 3, by heating it with a soldering iron. Bend the loose ends of the wires away from the support. The coil support should be set on a dry board or other non-conductor to prevent grounding one of the wires in the building. Hold the exposed end of the wire against the contact B, while the other is held against some exposed metal part of the support, such as the face of the core or the spot face surfaces around the cap screw holes indicated as D in figure 3. If the lamp lights there is a ground. It is possible to repair a grounded coil, but repaired coils are often troublesome afterwards. The operator may use his own judgment but in the majority of cases it will be found more profitable to put on a new coil support.

Should he decide to repair the grounded coil, proceed as follows: break the connections between the coils directly opposite the contact. See figure 3. This connection, the same as all other solder connections, should be broken with a soldering iron. The coils have now been divided into two parts, try the light as before, if it does not light, the half connected to the contact is all right. Break the center connection on the other side, and using the end of the coil wire in place of the contact try for the ground. Break the connection in section or sections which show light, and try each individual coil. The coils which show a light are grounded. Force a cold chisel or screw driver under the grounded coil and raise it from a 1/16 to an 1/8 of an inch. Clean under the coil with a piece of string, wash it out with gasoline. Run shellac under the coil and tap it back into place. Try it with the lamp. If it shows no light solder back the connection except the grounded C and try the light as was done in the first place. Finally solder the ends of the coil as C. Cover any spots on the coil, connecting wires, or support, which may have been bared, using shellac or oil proof varnish.

Both repaired or new coil support assemblies should be carefully inspected before being assembled to the engine block. The insulation should be in good condition and thoroughly impregnated with shellac or oil proof varnish. The surfaces of the cores A should be cleaned to the metal and all should lie in the same plane. To prove this lay the support face down on the surface plate, tapping around on the back to note whether or not the assembly lies flat or if it rocks. If no surface plate is available, run a straight edge accross three cores at a time to note high or low cores. This operation is shown in figure 4.

It is important that the spot face surface around the bolt holes be clean to ensure a good electrical contact with the cylinder block. The back of the coil supports should be parallel to the face of the core. To prove this lay it on a surface plate or place a straight edge across the core, and measure down to the back of the four bolt holes, as shown in figure 5. A new support should be within a few thousandths of an inch while an old support that its not out over one sixty-fourth may be shimmed into place.

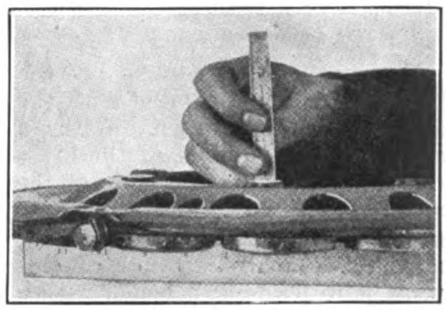


FIGURE 5. CHECKING UP THE COIL SUPPORT TO SEE THAT THE FRONT AND BACK ARE PARALLEL

If nothing can be found to indicate trouble with the coils then the magnets must be at fault. If the magneto has caused trouble since the last time the motor was overhauled, take an old magnet and try each magnet at the end, as shown in figure 6. If the test magnet is held with the same side up each time, you will find that one magnet will stick and the next one will not and, etc. When there are two magnets in rotation which do not stick or two which do stick, it is because the magnets are not properly set. Remove and reset them as described below.

When the magnets are weak, it is better to replace them with a new set than to charge the old one as they should be aged and drawn to a certain test reading to give the best results. Hower, an improvement is obtained, to be sure, by recharging them.

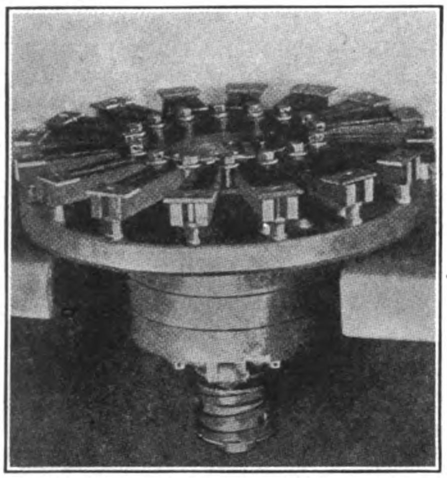


FIGURE 7. A RECESS CUT IN BENCH IS HANDY WHEN WORKING ON MAGNETS

To remove the magnets lay the transmission on the table with the magnets facing down. With a chisel cut the ends off of the brass screws which hold the ends of the magnet. The transmission should now be turned over to remove the magnets. If any amount of this work is to be done, a bench with a recess cut out to accommodate the transmission drums, will be found very useful for this operation. This is shown in figure 7. Now remove the clamp screws, clamps, cap screw and washers. The old magnets may be taken from the fly wheel and removed far enough from the work to insure that they will not be mixed with the new ones.

The new magnets come on a board. Unless disturbed they are set in their relative proper position, which they will occupy on the fly wheel. They should be free. If two or more magnets stick together they must be turned over to have their relative position changed. It is very important to have them placed properly as misplaced magnets result in a weak magneto.

CARE OF THE STORAGE BATTERY DURING COLD WEATHER

By N. Ward Guthrie.

EVERY motorist is familiar with the fact that the storage battery in his car requires periodical attention throughout the entire year. During the winter months a stricter observance of the rule of proper attention are necessary as cold weather, harder starting, thick oil and poorer carburetion soon drain the battery of its reserve power. Frequently, it is necessary to step on the starter switch three or four times before the engine starts running, with the result that three or four times as much energy is taken from the battery as is ordinarily required in warmer weather.

Another reason why the battery should receive special attention during this time is that short rides, the increased use of lights, driving at a lower rate of speed; long periods of idleness between runs all of which have a tendency to use more power than the generator produces. The lights grow dim and the next warning the driver receives is when he steps on the starter switch and only a feeble effort that merely brings the engine up against compression is apparent—the battery is discharged.

The little black mystery box, which has worked so faithfully all summer is now in grave danger, because besides the usual bad effect on the vitals of battery in allowing it to stay in a discharged condition, it is apt to freeze if subjected to severe weather. A frozen battery usually means a ruined battery—ruined beyond all possibilities of being repaired.

Freezing is the result of the gravity of the electrolyte becoming low. The plates have absorbed nearly all the acid and what really remains is nothing more than distilled water. This water freezes, expands and cracks the grids. The active material in the plates is softened and eventually drops out, settling to the bottom of the jars. If the plates were not completely ruined by freezing the internal short circuit formed by the material at the bottom of the jars will soon complete the work of destruction. At no time, particularly in the winter should the specific gravity of the electrolyte be allowed to drop below 1280. The following table shows the temperature at which the electrolyte of various gravities will freeze.

1280 (Full charge)	98 Below zero
1260 (Three fourth charged	60 Below zero
1225 (One half charged)	38 Below zero
1170 (One fourth charged...	5 Above zero
1150 (Discharged)	13 Above zero

If the car is to be laid up for any length of time it is just as important that the battery should be stored or be properly taken care of, as it is that the car should be jacked up. Your customers will appreciate having you call their attention to these conditions, as a man is always interested in knowing how he can save a dollar. If the car is laid up for the winter, or for a few months there are two methods by which the battery may be stored; either wet or dry storage.

If the car is to be laid up for six or eight months perhaps the better method of the two is to advise the car owner to place the battery in dry storage. There are two reasons for this. First, it is fully charged to bring it up to the proper gravity, then the battery is entirely disassembled. The plates are washed thoroughly and then stored in a dark dry place. This removes any possibility of the plates deteriorating. It not only means that all chemical action of the battery has been stopped, but all drains on the life of the battery have been removed. It also affords an opportunity of thoroughly inspecting the battery plates to determine their actual condition. The cost is not more than the expense of having the battery re-insulated, which is usually necessary after a year's service.

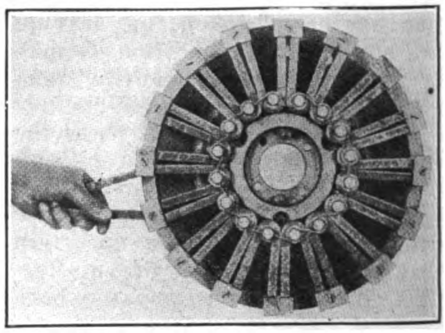


FIGURE 6. TESTING THE MAGNETS WITH ANOTHER MAGNET TO SEE THAT THEY ARE ARRANGED PROPERLY

Wet storage means that the battery is kept in a place where it will not freeze, and where it can be given a light charge every three or four weeks. This is the more advisable method where the battery is to be laid up for only two or three months.

HANK SCRAPS SOME SCRAPS

BY D. G. BAIRD

TALK about the boobs what usta think that they could find a way to turn base metals into gold, and the nuts what tried to invent petrified motion, and the gay old birds what strolled around lookin' for a fountain of youth, and the statistician what christened a certain well-known temperance beverage, and all — say; these sports was shinin' lights in the intellectual line compared to the gink what gets a hunch he can build up a lucrative trade in accessories by sellin' scrap iron and chewin' gum under such a appellation just because it's cheaper and folks'll buy anything that's supposed to be a bargain.

"HANK WAS ONE OF THOSE BRILLIANT YOUNG SALESMEN."

Do I know whereof I speak? I'll say I do! Didn't my esrstwhile side-kick, Hank Henderson, get just such a ailment? But maybe you hadn't heard about Hank.

You see, Hank was one o' these here brilliant young salesmen what get a idea their bosses don't know the first principle's of the fine art 'uv layin' theirselves liable to a high income tax or enticing' the populace of the village to drive a few blocks outa their way for the sole purpose of investin' in a goodly proportion of their stock and all, and the only thing to do under the circumstances is to set up a establishment 'uv his own and proceed at once to corner the trade in his line and become a philanthropist.

Well, anyhow when I happen down to Cartersville awhile back I find Hank all set up in business for hisself and tryin' to imitate a drug store by hangin' out a cutrate sign. He's got a garage and a lot o' tinware and other junk strewed promisciously around the joint what he's sellin' under the psedonymn 'uv accessories.

And it seems he's sellin' it too, 'cause he's got a coupla clerks hired and they're busy waitin' on customers and Hank hisself ain't no more'n give me a fraternal greeting than he hasta excuse hisself and pitch in and help 'em out, about three seconds later I'm implicated in the merry game myself.

It all come about this away. All the force is busy waitin' on folks when another gent comes in real brisk and steps right up to me 'sif he means business and wants to know if we've got a good tire for sale.

Now I'm some authority on accessories myself, and seein' as how I know the trade and the prices and the goods and Hank and all, and I'm wantin' to be of service to my friend and to the customer what shows he's in a hurry, I let it be known forthwith that money'll buy anything in the shop.

"A good tire?" says I real pleasant, "I'll say we have! We've got the only genuine 18 carat, all-wool-and-a-yard-wide tire that never tires! Ever hear 'uv the Roll-Along tire?" I continues as I stroll over to the ring case. "When it comes to—

"Have yuh got the **Roll-Along?**" he puts in real eager. "That's exactly what I wanted, but I didn't think I could get it in this here burg. I'uz beginnin' to think you folks didn't handle nothin' but cheap goods."

But in the meantime I'm beginnin' to feel sick clear down to my boots. There ain't nary a Roll-Along hoop to be found in the whole lot. And then the Roll-Along customer gets around where he can see all the imitation rubber and he grunts real disgusted-like: "Humph! you ain't got no **Roll-Alongs in that** bunch."

"Well no," says I real feeble, 'cause I'm gettin' sicker and sicker as the facts rise up and smite me amidships, "We don't seem to have any left. But we'll have 'em in in a few days—Pardon me, here's the proprietor, he can tell you just when the new lot'll be in. Or maybe he's got some stored away."

"Roll-Alongs?" says Hank real cheerful, "nope, we don't carry them. Here's a good tire though that'll give you excellent service and it costs only about half as much as a Roll-Along or any of those highly advertised tires."

The gent don't wanta buy it, but it sems he's gotta have a tire pronto if not sooner, and Hank bein' a good talker he's soon abstracted a bunch 'uh coin from his victim and give him the counterfeit goods.

Well the customer goes on his way lookin' real grumpy and Hank trips blithesomely up to me lookin' just otherwise and says, says he: "Some busy little establishment, eh? We're selling goods, I'll tell you. Give the folks bargains is what I always contended, even when I was working for old man Quality-counts. But he couldn't see it that way. He was out of date, though, anyway. Didn't know the first principles of modern merchandising. Here I give them what they—"

"WHAT DO YOU THINK THIS IS A GAMBLING JOINT?"

"Pardon me, Hank," I interrupt real polite, "but I presume you've got everything fixed all right so's there ain't no danger 'uv the place bein' raided?"

"Place being raided?" Hank parrots in a mystified tone.

"Sure. Pinched, run in, thrown into the town hoose gow—you gets me? I wanta make the 4:20 this afternoon's why I asked. If there's and danger—"

"Say! What do you think this place is—a gambling joint or a blind pig or something? What do you mean by being afraid of getting raided in a place like this?"

"Well, you know there's a law against obtainin' money under false pretenses and practicin' deception in business and—"

"And do you mean to insinuate that this isn't an honest and aboveboard business I am conducting here? I'll have you understand the very principle of this store is the square deal for everybody!"

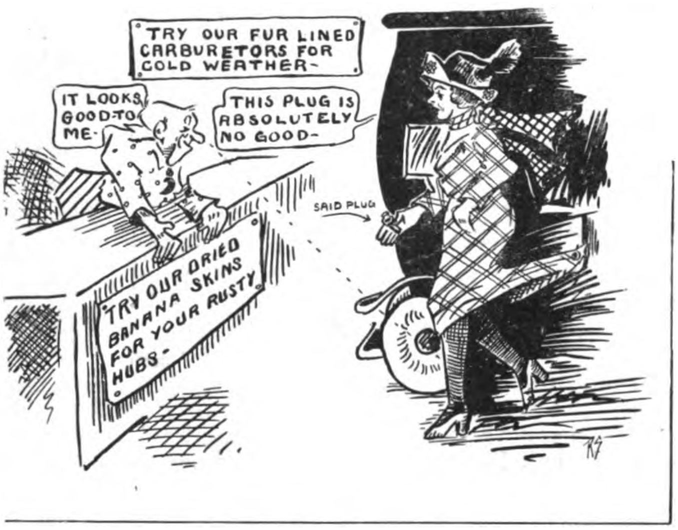
"Oh, sure! You're the dealer and ain't supposed to know anything about the goods you sell, but if that there piece of calico you just sold under the title 'uv a tire blows out or happens to get wet and fall to pieces before the gets gets three miles from here, he'll probably be somewhat peeved and get a mistaken notion that you—

"That tire's not going to blow out nor fall to pieces before he gets several hundred miles from here," Hank breaks in rather rude. "Furthermore he knew it was a cheap tire when he bought it and if it doesn't last quite as long as the kind he inquired for he'll remember it only cost about half as much and he'll come right back here and buy another one just like it. And as for knowing my goods, I guess I know about as much about the accessory line as some who do a lot more boasting than I do.

"What folks want these days of high prices is something that doesn't take the whole month's pay check to pay for. I'm not selling the highly-advertised goods, 'tis true, but I'm giving the people of this town good honest stuff for an honest price and they're buying it."

"I see. And I suppose they'll be so filled with gratitude for your altruism and magnanimity they'll rush home and spread the glad tidin's all around and the next thing I hear from you you'll be forcin' Woolworth outa business."

Hank is just about to make some impolite remarks by way of rejoinder when a lady steps in with a package under her arm and heads right for him. And she ain't slow about revealin' the secret contents 'uv the package. It's a spark plug what she's bought from Hank about two days before and what's already on the blink. She's on a high horse about it and wants her money back or a plug what won't quit pluggin' before Monday mornin' bright and early. But Hank can't see the advantage 'uv rerundin' money on goods what ain't



"THIS PLUG THAT I BOUGHT HERE YESTERDAY IS NO GOOD."

in no wise guaranteed by the manufacturers, 'cause if he does he'll just be out that much hisself.

But I see he's in for a early business suicide if he don't get help forthwith, so I step up in my best manner and take charge 'uv the situation.

"Beg pardon, Miss," says I real genteel-like, "but what did you wish to purchase?"

"I didn't wish to purchase anything!" she snaps out. "And I'll never want to buy anything here again if you don't make good this spark plug I bought here less than a week ago and that is already burned out or broken or something."

"W'y certainly!" I says real enthusiastic. "We'll gladly refund your money or give you another plug in exchange. When there's any complaint to offer about our goods—"

"Excuse me, Mr. Egotson," Hank puts in, but I gently push him into a corner and get between him and the haughty dame."

She wants her money back 'cause she's made up her mind to get a plug like her neighbor's got the next time she goes into the city, so I stroll over to the strong box and ring up "nothin' doin'" and refund the purchase price with a winnin' smile and she goes out somewhat calmer.

But Hank don't seem to agree with me in my notions 'uv merchandisin' and begins to make uncomplimentary remarks. But he don't have time to remark at any great length. He's just gettin' started on a splendid effort to exhaust the dictionary of unbecomin' names to call me when a motomaniac rushes in real mad and shoves a pump under Hank's nose and demands his money back.

It seems that the traffic-law goat has only had the pump about a week and he's come forty miles outa his way to tell Hank the instrument wouldn't pump up a child's balloon like a first class tire pump oughta do.

Hank sees he's gonna have to give this bird his money back or go to court and complain of assault and battery, so he forks over the jack and the gent goes out somewhat mollified.

I see it's a bad situation, so I set in to show Hank the error of his ways as is becomin' a friend what's got first class goods for sale.

"Now I guess you're begininin' to see what kinda goods the public wants, ain't yuh?" says I real mild.

But Hank invites me to take a trip to the nether regions. I appreciate the situation, howsomeever, and as I ain't got time to take the little spin he suggets I follow him into the back room and continue my sage counsil instead.

"Yuh can just take it from a old timer, son," I goes on, "that this here bunch 'uv humanity commonly known as the rude and sometimes uncultured public wants all it can get for its dough. It don't care so much what a thing costs just so it's worth the coin. But it'll sure rise up and put yuh on the toboggan if you sell it somethin' that's cheap but ain't worth even the bargain price.

"You've been sellin' a lot'uh your scrap, no doubt, but that's because the folks didn't know what they was buyin'. You've been in business now just about long enough for them to start in on you, and from the general appearance 'uh things as I've seen 'en the last few minits, they've already started."

But Hank seems to be peeved over something or other, and when he begins to talk about disfigurin' my fair countenance I desert him to his fate and seek more congenial company.

Well sir, just about 4:20 I'm waitin' for the accomodation to accomodate me over to Bixby, the next station on my route, and my meditatin' on the ways of fate and garage men, when Hank dashes up all outa breath and lookin' like he ain't slept none for a week.

And would you believe it? As I step on the movin' train, he yells at me: "Hey! You send me a full stock of accessories by fast express."

I'm partly human, and I can't help grinnin' a little as I ask innocent-like: "What's the idea, Hank —thinkin' of goin' into the accessory line?"

And as the train picks up speed I just catch somethin' about d— scrap and a dollar sale tomorrow.

YOUNG WOMAN MAKES TRANSCONTINENTAL TRIP ON HORSEBACK

Miss Wilhelmine O. Lempie feels that she can make some claims to being an authority on American roads, for she has just completed a trip on horseback from St. Albans, Vermont, on through to San Francisco. "Salem," her 10-year-old horse, is a thoroughbred Morgan and was in the pink of condition at the end of the long transcontinental trip. He tipped the scales at 770 pounds at the end of the journey. Miss Lempie had in her equipment a national guard pup tent and an English army saddle. The entire load that her horse carried weighed about 210 pounds. She took her time leisurely, although on several occasions she made 50 miles a day. One pair of shoes lasted "Salem" from Collins, New York, to a small town in North Dakota. At Reno, Miss Lempie had Blacksmith Corbett put an entire new set on "Salem" to take him safely over the Sierra Mountains. Miss Lempie enjoyed perfect health on the trip. She was perfectly able to care for herself and in case of an argument she had an automatic to use. Her aim is good. To keep in practice she bowled over some jack rabbits and coyotes en route.

Frederick Hall.

INCORPORATION—ITS ADVANTAGES AND DISADVANTAGES

Ralph H. Butz

It is a matter of common knowledge that the tendency at the present time is to conduct business under corporate ownership, rather than as a partnership or under individual ownership. The reason for this tendency is readily understood by those who are familiar with methods of business administration under both corporate and individual ownership.

MISS LEMPIE AND SALEM AT CORBETT'S BLACKSMITH SHOP, RENO, NEVADA

The three most desirable features in the conduct of a business are: (1) Limited liability of the members of a business: (2) the right of perpetual succession; (3) the facility of assembling large amounts of capital in the hands of a single entity.

The first two of these features are not to be obtained except as a part of the corporate organization, and the third feature is very rarely obtained by the individual or partnership.

Limited Liability—Stockholders have, in most states, no liability beyond what is known as the subscription liability. If a stockholder subscribes for shares of the corporation's stock and does not pay the amount of his subscription in full, the creditors of the corporation can usually compel payment of the unpaid balance, in case the corporation become insolvent. Or if a corporation accepts subscriptions for stock at less than par, corporate creditors can usually collect the difference to render the stock full-paid.

A corporation and its stockholders are distinct persons or parties. If a man owns one share or all the stock of the corporation, he is not the corporation. Many business men have an idea that because they own all or most of the capital stock of their corporation, they are the corporation. They are not. They are so distinct that, if they loan money to the corporation, they become creditors with the right to sue the corporation. If they were the corporation itself, they could hardly sue themselves.

In the case of individual ownership or a partnership there is no limited liability. A partnership is merely a number of individuals, each one of whom represents the partnership fully, may make contracts for it without consulting the other partners, and can bind it by his action. This is so despite the fact that all the partners are held equally liable, and may even be opposed to the action of the one partner. A partner cannot contract with his partnership, bring suit against it or be sued by it.

An individual in business is liable for all his business debts, even though his private fortune may be required to liquidate his indebtedness. On the other hand, if he incorporates his business and takes in payment shares of stock in the corporation to the value of his stock of merchandise and other property, he then controls the affairs of the corporation, holding full-paid stock, and he is not liable for the debts of the corporation should it become insolvent.

It must be understood, however, that an officer or director of a corporation may become liable for the debts of the corporation if he specifically states that he will assume such liability for the corporation.

Perpetual Succession—A partnership is necessarily dissolved if a parner dies, no matter how much embarrassment or loss this may cause the remaining partners. If an individual dies it is sometimes possible for his heirs to arrange to continue the business, but very frequently it is not. A partnership may be dissolved at any time, at the will of any partner.

A corporation, on the contrary,

is not disrupted if one of the stockholders or officers dies, becomes insolvent, or sells his stock. The stock will merely be transferred to another person, and without necessarily affecting the business of the corporation. A corporation continues for the term of its existence, regardless of the ebb and flow of the fortunes of its stockholders, or how many times the stock of the corporation may change ownership.

Assemblage of Capital—The comparative ease with which large amounts of capital may be obtained designates the corporate organization as the logical form for business enterprises whose aim is to expand to the greatest posible extent. The individual or partnership has very limited means of obtaining capital for expansion, while the corporation may issue stocks, bonds, and other forms of securities, thus securing capital for expansion, while the corporation may issue stocks, bonds, and other forms of securities, thus securing capital with greater ease than is possible for other business organization.

Corporate Powers—An individual or partnership may do anything and transact busines of any nature not expressly forbidden under the law. A corporation, however, may do only those things for which it was organized and which it is permitted to do under its charter.

The special powers of a corporation are mentioned in the charter, and include the purpose for which it was formed. In addition to the special powers granted by the charter, a corporation also has general powers, and these include the right to do all things necessary to conduct the business for which the corporation was organized.

A corporation might be organized for the purpose of conducting a retail business only. It would be beyond the powers of such a corporation to engage in a manufacturing business, and should it do so the charter might be forfeited, or it might be restrained from continuing the part of the business for which it had no authority. However, a charter may be amended, a corporation may thus obtain powers which it did not possess originally.

WORKSHOP ARITHMETIC

IN calculating the length of a rod of any section, two important points have to be borne in mind. First, that the inner edge of the bend is in compression, and second, that the outer edge is in tension.

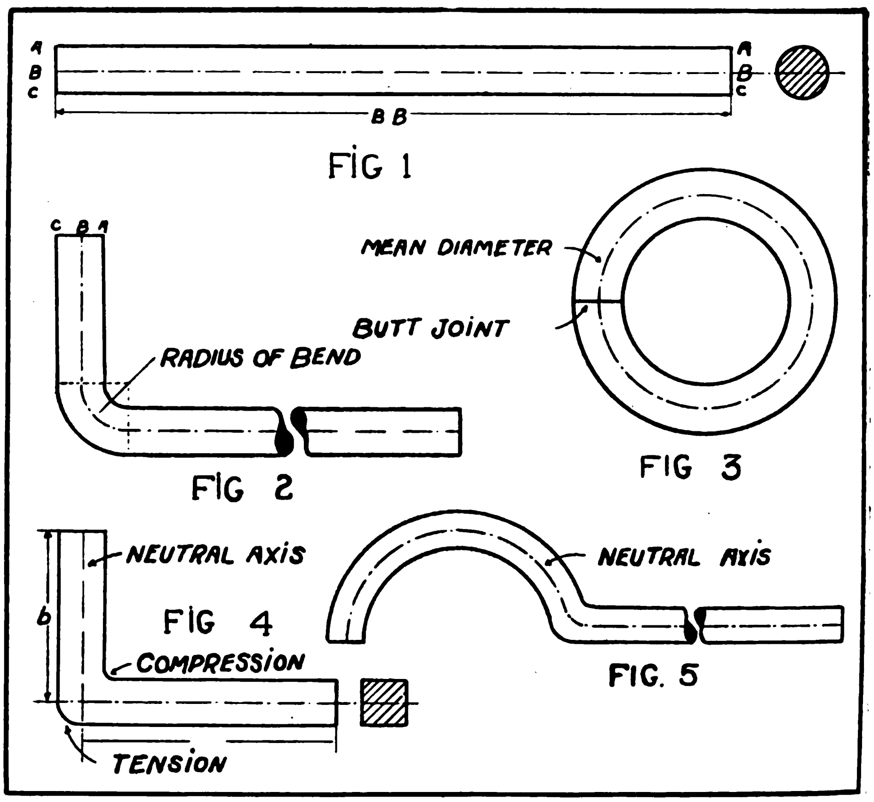
In order properly to understand the principle involved, it will be in order to investigate what takes place when a length of rod is bent. Assume that a rod (Fig. 1.) is either round or square; the measurements A A, B B, and C C will all be equal. Now bend it to the shape shown in Fig. 2, and measure the lines A A, B B, and C C. A A will be found to measure less than it was at A A in Fig. 1, and C C will be longer than it was previously. But the center line B B will measure exactly the same as it did when in its straight form. It will therefore be followed that the bend causes a contraction along the inner edge, and an expansion or lengthening on the outer edge; but the center line or neutral axis may be regarded as a zone unaffected by change of form.

Therefore to find the length of a rod of material which will assume the form given by Fig. 2 when bent (the rule holds true for other shapes as well) to some given dimensions, two methods may be resorted to—to draw the shape and measure the central line, or to calculate it. The letter may be effected by assuming that the radius of the bend x 0 is 2in.; then the length of the dotted line x i will be one-quarter of the circumference of a circle of that radius. The circumference of a circle is 3-1/7 x diameter, and the length of the arc will therefore be $\frac{4x3\text{-}1/7}{4} = 3\text{-}1/7$ Adding the lengths Bx and By gives the required length of the rod.

Similarly the same contraction and expansion takes place when bending rings; so to determine the length of rod required to form a ring or given outside diameter, the mean diameter is found. This is effected by adding the inner and outer diameters, dividing by 2, and multiplying the result by 3-1/7, or 3.14. The inner diameter is found by substracting twice the diameter of the rod from the outside diameter (see Fig. 3).

The same rule applies with square-section rod, except that distortion is more pronounced on the outside of the bend; it is impossible to bend a square corner on the outside of the bend. Fig. 4 will make this clear, a and b being the two dimensions that should be added to obtain the length of the rod.

Fig. 5 shows another bent shape applying these principles; half the mean circumference should be calculated, and the mean length of the straight portion should be added.



THIS department is the meeting place where you are free to ask for information, answer questions, discuss shop matters and business conditions and any other notes you feel would be of interest to a fellow mechanic. Make use of this Department as often as desired.

In Kansas:—It is interesting to read of the experiences of the different smith throughout the country. I noticed in a recent issue the comment of Mr. Lowe of New York. He complains that he can not hire help, and still he is putting on shoes for 50c. Perhaps that is just the trouble. He doesn't charge enough so that he can pay a man an attractive wage. Help is plentiful out here, and we all pay a good living wage. I pay $1.00 an hour, and this is what I charge for shoeing: No. 1 to 4, flat or calked, $1.00 per shoe; No. 5, $1.10; No. 6, $1.25; old shoes reset, 75c per shoe; Removing old shoes to let horses go bare foot, 25c per shoe. I might add, that my shop is always full of work every day.

There is plenty of room for more shops in the small towns out here, as it is, men bring work for a distance of 20 miles. This is a wheat farming district, and I have a never ending stream of farm machinery to repair. I came here from Canada, bought a lot and built a shop. I am more than pleased with the conditions out here, as there is plenty of work and it's all cash.

Roy Butts, Colby, Kansas.

Polishing Carving Knives:—Will you please tell me how to polish carving knives, as I find it slow work by hand, after grinding. I have made some hunting knives which take lot of time to finish after they have been forged out to shape.

Editor's Note:—The polishing of knives by hand is a slow and tedious process no matter what kind of material is used. However, where a buffer is used it can be accomplished very quickly.

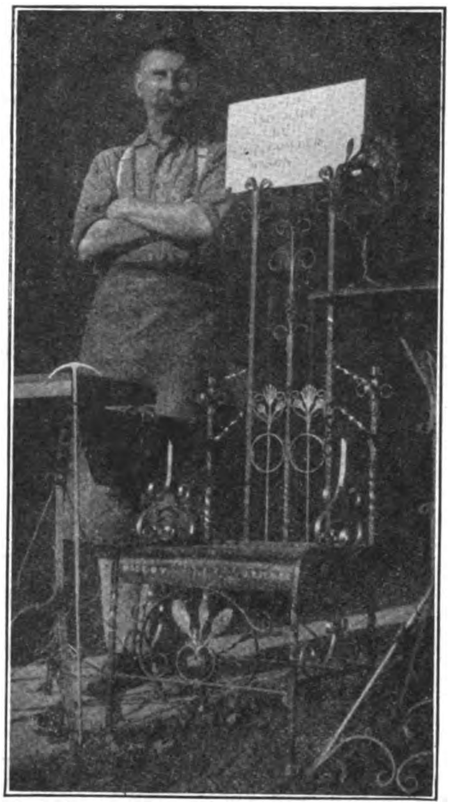
The usual manner is to rough grind the knife, after which it is placed on a buffer charged either with coarse rouge or tripoli, and then changed to a wheel with a finer grade of that material. The length of time and the fineness of the rouge determines the degree of the final polish.

Where the work is done by hand, because a buffer is not available, the deep scratches from the rough grinding are removed with emery cloth. First a medium grade, and then finished off with a finer grade, after which the final polishing is done with either a leather pad or soft wood block charged with either tripoli or rouge.

Information on Making a Spring Heating Furnace Wanted:—Would some smith kindly give me some information on making a coke burning spring heating furnace. I would appreciate some suggestions as to the general construction as well as the material necessary.

E. J. Kauft, Minnesota.

Favors Giving Up Horseshoeing:—Dear Editor:—I am writing this letter to you on Armistice day, while I'm lying in bed from a kick on the knee, which I received about ten days ago, while shoeing a bad horse. I will try and answer, and give my best advice to our brother A. R. of Wisconsin. If he has the splendid location which he claims to have, I would advise him to go into the automobile business on a big scale. Be an agent; sell all kinds of parts; accessories, oil, tires and etc.



MR. FOWLER, OF MASON, MICHIGAN. THE CUT ALSO SHOWS SOME OF THE ORNAMENTAL FORGING WHICH HE DOES

It has been my experience that, that would be a better procedure than to try and combine automobile work with blacksmith, because I have often noticed that where the two are attempted, one or the other is bound to be slighted, and as a result usually ends in a failure for both.

These small, one-horse garages are a failure, at least, they have been in my locality. There is one close to my shop, and in the last two years there have been five different parties in it. Now it is closed. They were all good mechanics too; but they didn't branch out far enough.

I'm not trying to discourage you, nor do I think that you will have a similar experience, I'm merely stating what I have observed, and it should be remembered that this may have been on account of local conditions which may be entirely different in your vicinity.

The blacksmiths have always been underpaid, largely because they do not demand a reasonable return the same as other tradesmen. If you are not making at least $7.75 a day for 8 hours work at blacksmithing, you are not doing justice to yourself or family. Every blacksmith working in the mines in our neighborhood is getting that amount, and they don't have any overhead expense to worry about either. Several blacksmiths from here have closed their shops and gone to the mines.

If you decide not to go into the auto field, I would advise you to enlarge your shop and install an oxy-acetylene welding outfit. It works in with blacksmithing in good style. I know of several blacksmiths who get work of that kind where other welders would not, because people naturally have more confidence in blacksmiths making welds for they have always associated them with that kind of work.

By all means, I would take in some kind of a side line to make an easy dollar once in while, rather than run a chance of being kicked and perhaps crippled for life.

I am acquainted with a brother G. Colson who took in plumbing for a side line. Finally he quit horseshoeing all together. At first he did nothing but gas fitting and putting in gas stoves. He finally spread out and did other work, until now he does all kinds of plumbing. Recently he completed a $2,300 job with the help of a young plumber whom he got to work for him. Mr. Colson says it's the easiest money he ever made.

Moral: There is an opportunity waiting for you right in your own neighborhood if you'll only look around for it, and then go after it. Perhaps it is the epochal auto and tractor, maybe there are opportunities in the blacksmithing field if you will enlarge your shop so that you can handle them; or perhaps it may be plumbing—at any rate your the man who will have to make the decision.

Charles Chism, Ohio.

More on Tempering Knives.—In the last issue of your journal, I see that a brother smith wants to know how to temper butcher knives. This is the way I do it: Get a piece of pipe sufficiently large in diameter to take in the knife. Fill it with lead. But before that I heat one end of the pipe, flatten it, and weld it so that it won't leak. Then I place it in the fire with the open end up. When the lead is melted I place the knife in it. When it reaches a red heat withdraw it and quench in a salt water bath. Now place a large piece of iron in the forge and heat it to a bright red. Remove the heated iron from the forge and lay it on the anvil. Take the knife which has been previously covered with tallow and hold it over the hot iron, keeping it constantly in motion until it shows a straw yellow, then drop it in linseed oil. By using lead the knife is heated equally over its entire surface.

But that is not all there is to making a knife and having it give good service. It must be handled correctly through the entire forging operation. I hope this will help the brother out. I am also sending you a photograph of myself and some of the ornamental forging that I do.

J. T. Fowler, Michigan.

You Can Blame This on Mr. Volstead, Too:—Would you please give me a recipe to take paint off a beer sign, and also one to take the coating off a mirror glass, as I wish to use the glass in my windshield?

Chas. B. Guyer, Pennsylvania.

Editor's Note:—Muriatic acid applied full strength to the back of the mirror will remove the silver. The acid should be applied with a swab or with some rags tied on a stick, care being taken that it does not touch the hands or clothing.

The paint also may be removed from the beer sign in the same way, if it is painted on glass. If it is painted on metal, a strong solution of lye and water or else some standard paint remover, should be used, as the acid will attack the metal.

Sometimes the silvering on the mirror may be wiped off in a few minutes after the application of the acid, while in other cases the acid will have to be allowed to soak for several hours.

Tempering Knives:—In your last issue I note a request from A. H. Morris, Nebraska, for information regarding the tempering of a knife. Permit me to inform him that the knife should be slowly heated and allowed to cool slowly in lime. This will relieve all forging strains.

Before hardening the knife, a piece of thin paper should be spread completely over the top of the cooling bath, and then the knife should be plunged edge downward into the water, care being taken to carry the paper along with it, without cutting or tearing it. The paper is placed there for the purpose of exactly equalizing the volume of water on each side of the cooling blade. Before heating the knife it will also be advisable to smear its entire surface with common chalk.

I obtained this information many years ago from a Sheffield cutler, who was a past-master in this kind of work. I have found that it gives excellent results, not only on knives, but on articles which have a tendency to bend or warp when they are hardened. The vessel containing the hardening bath should be round if possible.

F. J. Flatman, New York.

Cementing Patches on Heavy Tarpaulin.—Please give recipe for cementing patches on heavy tarpaulin.

F. M. B., West Virginia.

Editor's Note:—It has been our experience that patches cemented on tarpaulin do not prove as serviceable as those which are sewed on because of the rough usage which these coverings receive.

We would suggest, therefore, that a patch of similar or suitable material be sewed firmly in place with waxed thread and then the patch should be treated with a water-proofing solution.

The following is a formula from Henley which is reputed to give good results:

I. "The canvas is coated with a mixture of the three solutions named below: 1. Gelatin, 50 parts, by weight, boiled in 3,000 parts of water free from lime. 2. Alum, 100 parts, dissolved in 3,000 parts of water. 3. Soda soap dissolved in 2,000 parts of water.

II.—Prepare a zinc soap by entirely dissolving 56 parts of soft soap in 125 to 150 parts of water. To the boiling liquid add, with constant stirring, 28 to 33 parts of zinc vitriol (white vitriol). The zinc soap floats on top and forms, after cooling a hard white mass, which is taken out. In order to clean it of any mixed carbonic alkali, it must be remelted in boiling fresh water. Next place 232.5 parts of raw linseed oil (free from mucus) in a kettle with 2.5 parts of best potash and 5 parts of water. This mass is boiled until it has become white and opaque and forms a liquid, soap-like compound. Now, add a sugar of lead, 1.25 parts; litharge, 1 part; red lead, 2 parts and brown rosin 10.5 parts. The whole is boiled together about one hour, the temperature not being allowed to exceed 212°F., and stirring well from time to time. After this add 15 parts of zinc soap and stir the whole until the metal soap has combined with the oil, the temperature not exceeding 212°F. When the mixture is complete, add a solution of caoutchouc 1.2 parts, and oil of turpentine, 8.56 parts, which must be well incorporated by stirring. The material is first coated on one side by means of a brush with this composition, which must have a temperature of 158°F. Thereupon hang it up to dry, then apply a second layer of composition possessing the same temperature, which is likewise allowed to dry. The fiber is now filled out, so that the canvass is waterproof."

What Would You Do?—I used to be a reader of the American Blacksmith, but the war and other conditions prevented me reading it further. I want to change locations. I have a good set of machines and tools. I want to sell or carry them to another place. I thought that you may help me to find one. Several years ago, I noticed something in your journal about South Africa. I would like to know about conditions there, South America and Hawaiian Islands.

The boll weevil and the panics are making the blackest future here since the Civil war.

J. T. Compton, Alabama.

Soldering Solution.—In the August number of Benton's Recipes is given a recipe which reads as follows: "Soldering solution that will not rust the work. A soldering solution that will not rust or blacken the work is made from 6 ounces of alcohol; 2 ounces of glycerine, 1 ounce of zinc."

I would be pleased to know if that is alcohol for medicinal purposes or wood alcohol?

Editor's Note:—Either grain, denatured or wood alcohol will give satisfactory results. On referring to the recipe in question it will be noticed that "zinc oxide" instead of "zinc" is prescribed. Zinc being a metal is not soluble in either alcohol, glycerine or a combination of both.

We believe that even better results may be obtained if a quantity of zinc chloride is substituted in place of the zinc oxide. This can be made by dissolving zinc in commercial muriatic acid until all bubbling action ceases. After it has settled it should either be poured off carefully or else strained. This is the solution ordinarily used in soldering. The addition of the glycerine and alcohol will, to a certain extent, counteract its rusting tendencies, a quality which is decidedly objectional in many kinds of work.

Bending Copper Piping—Bending copper piping is not so difficult a task as at first appears. For large pipes a core of sand, resin or lead may be necessary, but in small pipes, such as oil piping, a piece of wire cable can be twisted into the pipe, as this will save considerable time. The secret of bending copper pipe is to keep the metal soft, and whenever bending or hammering has hardened it, it should be heated to a red heat and then quenched in cold water so as to soften the copper. It is best not to cut the pipe to the exact length until the bending is completed, for the extra leverage of a long pipe makes the work much easier. In handling short piping a piece of gas pipe can be used as a lever, slipping it over the end of the tubing.

Drilling Hard Steel—The following preparation will aid in the drilling of hard steel used in automobile construction. Mix one part spirits of camphor with four parts of turpentine. After the mixture has been applied to the part to be drilled and allowed to dry an ordinary drill may be used.

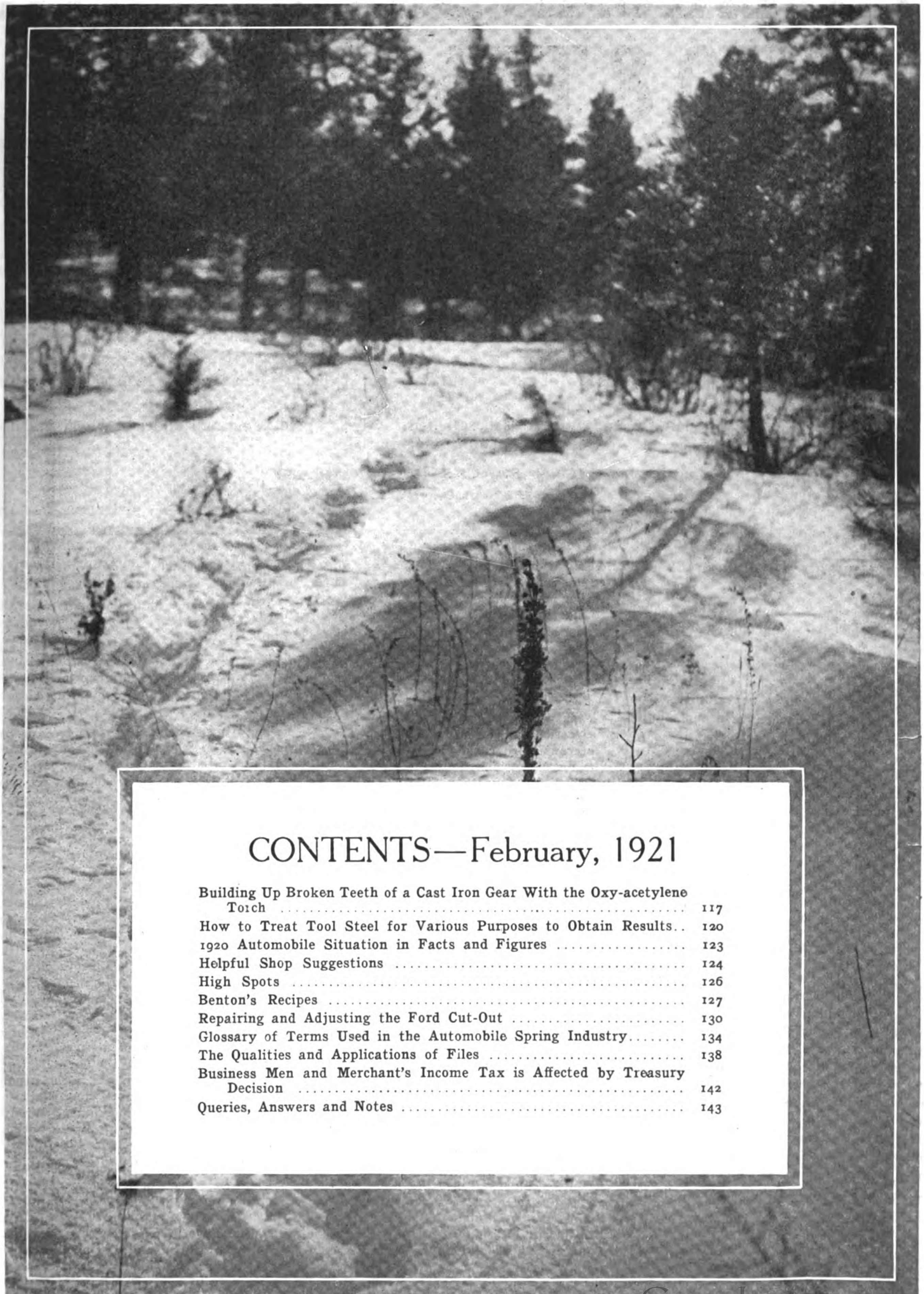
Get Tractor Ready for Spring

During the Winter months we have been getting some of the older tractors into our place and overhauling them, putting them in shape to start out next Spring.

We find that any owner who has plowed and prepared ground that equals a thousand or more acres is very willing to pay a reasonable sum for the thorough overhauling of his tractor. This keeps our tractor men busy on profitable work through the Winter months, and our customers very well pleased. The proof is the fact that we have duplicate orders coming to us, and are selling new customers right through the Winter months.

This policy is especially satisfactory because of the fact that some of the other tractor dealers in Harrisburg have waited to provide service until it was wanted, whereas, we had service *waiting for the customer when he wanted it.—Harrisburg Auto Co.*

HERE IS THE TIMELY SUGGESTION USED BY A WESTERN CONCERN. A SIMILAR CARD MAILED TO YOUR CUSTOMERS SHOULD BRING IN WORK THAT WILL KEEP YOU BUSY DURING THE MONTHS WHEN BUSINESS IS USUALLY DULL



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AMERICAN BLACKSMITH AUTO & TRACTOR SHOP

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BUFFALO, N. Y., U. S. A.

WILLIAM F. WENDT, *President.* L. J. WISCHERATH, *Editor.*

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BUFFALO, N. Y.

Cable Address: "Blacksmith, Buffalo"

—"THE WHOLE WORLD BACK TO WORK"—

Business undertaken now is on a sound deflated instead of an unsound inflated basis. Merely the return to real values from those born of pessimistic feeling will work a rapid change for the better. The times bristle with opportunities for enterprise. We have a vast opportunity in making up for the work that has been long left undone, as well as in the performance of the profitable current tasks that await us. These tremenduous works will require labor, capital, brains and materials in ever-increasing volume. We have scarcely scratched the resources of our own country as yet and there are limitless fields in foreign lands for our enterprise and our capital. The world is ours in a wealth-making sense.

Let us look courageously at facts as they are, let us cast off the blindfold of pessimism, let us set our house in order, let us cut the Gordian knot of the German reparations impasse and set the whole world back to work, realize peace in the fullest measure, face the future with American dauntlessness and look with confidence for the certain dawn of a great and enduring industrial renaissance, always bearing in mind the predominating fact that the economic, political and social elements are so interwoven that one cannot survive without the others.

—Bernard Baruch in the New York Times.

THE SOLDIERS' BONUS

It has never been our editorial policy to become embroiled in any political discussions of the day. This departure might occur to the casual observer as being rather out of place in a magazine devoted to mechanical subjects. Since many of our readers are ex-service men the question is not as irrelevant as it would at first appear, and especially in view of the matter being proposed to Congress.

Secretary of the Treasury Houston pleads with Congress not to consider any proposed plan of providing World War Veterans with cash. He even says that the mere consideration of such a plan is responsible for the fall in price of Liberty Bonds. Without attempting a lengthy essay on economics, we would suggest that Secretary Houston take into consideration the following facts, and incorporate in his next public speech a comprehensive explanation that an ex-soldier can understand. It is not enough to say, "It can't be done,"—for his explanation is addressed to a lot of men who have been taught to think that what is right can be done.

In the first place, the United States Government made a serious mistake when it drafted one young man to pack a gun, and another to pack a hammer—commanding the one with the gun to forget home and business—and to fight for love of Country at one dollar a day, while it pleaded with the man with the hammer to drive rivets for love of Country at eight dollars a day.

If love of Country is sufficient compensation for the soldier—it is also sufficient compensation for the banker, riveter, farmer and average citizen. Why didn't the Government make it everybody's war and put us all on a "Love of Country" plus one dollar a day basis during the crisis?

The farmer raised wheat for the "Love of Country," plus a guaranteed profit.

The railroads hauled freight for the "Love of Country," plus a guaranteed profit.

Manufacturing plants turned their machinery over to the Government for the Love of Country, plus a guaranteed profit.

The Government has found cash for each single "Love of Country" worker in the United States. Secretary Houston saw to it that the Railroads got six hundred million dollars. Every large corporation or contractor that was even slightly inconvenienced by the war has been compensated.

Yet every individual, save the wives and mothers of soldiers, who stayed in America and worked for the "Love of Country plus enormous war profits," fared better during the war than many ever did before or ever will again. The soldier who fought for "Love of Country" risked his life—went through a virtual hell—caused grief and worry to his loved ones—lost out in business and trade—yet of all those who worked for Uncle Sam "For Love of Country," the soldier alone has been told to go to .... Of all the Great Nations in the World War America alone cannot find means to compensate the soldier for the economic handicap he suffered through the war. But never a murmur about the millions handed to the "Love of Country" corporations and war profiteers.

There is only one way to interpret Secretary Houston's remarks. He admits that "Love of Country" workers should be given a huge bonus, but explains that the corporations and war profiteers got it all before the soldiers got a chance.

Building Up the Broken Teeth of a Cast Iron Gear with the Oxy-Acetylene Torch

By DAVID BAXTER

A few months back we discussed in this department the welding of broken and worn gears such as often come to the blacksmith or repair shop. But the method described at that time concerned in the main the welding of bevel gears, by what is termed the "en bloc" process, where several teeth adjoining each other are broken and are welded in one mass, to be cut into separate teeth afterward. This method is no doubt the easier for the welder; but it causes quite a bit of machine work when the weld is finished. The advantage lies mainly, however, in the welding of small teeth such as are difficult to build up one at a time with the torch. Fine teeth require more skill with the torch and a steadier hand when welded one at a time so that the welder can often weld them in one block and still save time.

But the larger teeth should always be welded one at a time because there is too much labor attached to the process of cutting them from the solid block. If the welder is careful, and is at all adept in handling the flame, he can build up single teeth which will need no machining afterward unless the gear happens to be a cut gear where the teeth have to mesh perfectly and run with a minimum of noise.

Now, in view of the fact that there is quite a difference between the "en bloc" process and the single tooth method, it is no doubt well to cover the latter in a special article. Each welder will then be able to choose the method best suited to the job at hand. Therefore, let us take the gear illustrated in the accompanying photos and see how this welder built up the new teeth one at a time. Let us understand if we can the various means he employed to overcome the obstacles in every step of the process.

First, the gear was of cast iron, weighing approximately a hundred pounds. The web was solid except for three small holes near the shaft hole; a fact which would have eliminated danger of contraction cracks even if it had been necessary to preheat that portion of the wheel containing the broken teeth. Had the wheel been made with spokes there would have been some danger of cracking, particularly if the welder was a novice and worked slowly. However, the average torch operator may entirely disregard the factors of expansion and contraction when welding a damaged wheel like this one.

The teeth were approximately an inch high by five-eights thick at the root and two inches long; four of them were entirely missing, being broken off flush with the base of the other teeth. These facts have some bearing on the process of welding; but are stated more to give the reader a clearer idea of the necessary amount and nature of the welding. However, the pictures should furnish a good comparison as to size.

After inspecting the job and taking in the details of the damage, the welder then proceeded to prepare the wheel for welding. The preparations were few and simple when compared with other welding jobs. First, the welder examined the broken base of the teeth to see that no dirt or grease clung to the fractured metal. Then he scraped the gear metal bare and clean on each side of a broken tooth after first burning the grease and dirt to a cinder with the torch flame. This removal of all foreign matter from the vicinity of the broken teeth was a precautionary measure to prevent any of it from getting into the melting weld to cause trouble in fusing and mixing the metals. After which the wheel was suspended on a round bar of iron as indicated in Figure 1. The arrangement being for the purpose of permitting the operator to bring the teeth upward one at a time so each weld could be made in a horizontal position. He had merely to turn the wheel as each weld was finished to bring another tooth horizontal. This simple device completed the preparation of the wheel for welding.

The horizontal position of each weld made the building up of the molten metal more easily accomplished, because there was less tendency of the metal to run. If the broken portion of the tooth is not level while welding, the molten metal naturally runs to one side and makes it harder to build the tooth up straight. Of course, a wheel like this can be stood on the floor and welded, but it is a more tiresome job and being an uncomfortable position, it tires the operator, causing his hands to become unsteady. To place it on edge upon the welding table also has the same effect. These form the principal reasons for the bar arangement. The wheel is raised about the right height for a convenient welding position and steady hand, so essential to gear tooth welding.

In relation to the need for preheating to care for expansion and contraction, it is scarcely necessary to say that this job was not heated previous to welding, first, because the welded teeth were free to expand in all directions during the melting and just as free to contract as they cooled. Being located on the outer edge of the casting there was nothing to retard the contraction; also the filler metal was fully expanded when added to the teeth. As this fully expanded metal cooled, it could contract or shrink in size without pulling upon any part of the wheel, except where it joined the casting. Quite naturally this junction held the tooth so its contraction acted toward the center and therefore could not pull the wheel metal. The teeth literally shrunk toward the wheel. From this we see why it was useless to preheat the job.

However, it is often well to heat some straight gears before welding but this must be properly managed, and is for the purpose of assisting the welding by having the gear metal red hot when the torch flame is applied. If one attempts to build up teeth on a heavy gear without preheating, he will find that the heat of the torch flame is drawn away from the weld by the cold metal, through conduction, to cause trouble in joining the filler metal to the wheel metal. Therefore, the heavy wheel is heated, because red hot metal will melt easier and faster as the weld is executed. It is now probably obvious that this

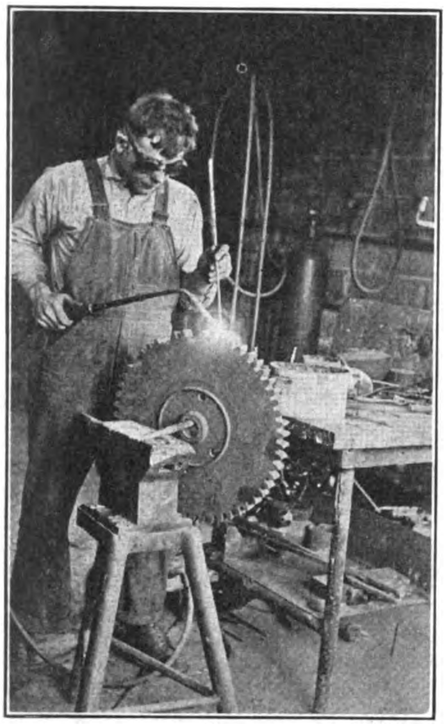


Fig. 1. BUILDING UP THE NEW TOOTH

particular wheel was too small to heat with any intention to hasten the welding process. The teeth were small enough to complete before conduction acted to any extent.

After preparing and arranging the wheel as described above, the next thing the operator did was to select the proper torch and tip with which to weld the job. In this he realized that a small flame would not supply enough heat to keep the weld molten and still provide for conduction. Also that a large flame would be too powerful and therefore result in a burned weld, or at least trouble in controlling the molten metal. So he selected a little below medium size long tip, fitted it to the torch after seeing that it was in good condition; that is inlet and outlet had not been dented or otherwise damaged; also that it was not partially clogged. Exact sizes are not given here on account of a variation in the different makes of torches.

A wide-mouth flux pot was placed upon the table near the wheel. Several filler rods were handily arranged. The flux was a patent powder made purposely for cast iron work and intended to protect the molten metal from the oxide, and also to make the metal more fluid, so it would cast off the slag easier. The filler metal consisted of round cast iron rods a quarter inch in diameter soft high silicon gray iron.

The choosing of the rods was something similiar to the choice of welding torch. A large rod, say five-sixteenths or three-eights of an inch in diameter would have furnished more metal than the weld could assimilate, at the same time drawing heat from the weld. A small rod would have endangered the filler metal with burning or made a poor weld in an effort to keep the wheel melted fast enough to receive the rapid flow of filler metal. After making the proper selection of torch and filler, the welder kept these facts in mind as he applied the flame to the first broken tooth.

The flame employed at the start and maintained during the entire process was what is known as the neutral working flame. It was composed of equal proportions of acetylene and oxygen. It produced a white blunt pencil of flame about three-eights of an inch long. This flame was tested from time to time by opening the torch valves a little and then closing them again as the flame shortened and grew blunt.

The neutral flame is attained by first opening the acetylene valve a little and then applying the lighter; not applying the light and then opening the valve. When acetylene ignites the pressure is increased until it forms a long yellow flame without smoke. Then the oxygen is gradually turned on until the long blue tongue of flame replace the yellow. Both valves are then closed a little at a time in turn until the flame becomes a blunt white cone.

It was this blunt cone that the operator brought in contact with one end of a missing tooth space. It was revolved in circles here until the gear metal reddened and then it was concentrated in smaller circles that covered only the broken face of the tooth. When this spot started to whiten, the end of the filler rod was brought close to the flame. As the gear metal commenced to melt the rod was brought closer to the white flame. All the time the flame was revolved and the filler was given a slight twisting movement. When the first half an inch of the broken tooth was melted and ready to receive the filler metal, the end of the rod was melting, ready to be deposited. Half an inch or more of the rod was added to the melting weld, manipulating the flame and rod so as to spread the filler out in a layer over the weld. And almost imperceptibly working the flame and filler to another portion of the broken tooth, where the filling process was repeated, with the flame and filler again moving gradually onward.

Thus the full length of the broken face was covered with a layer of filler metal probably an eight of an inch thick. The progress across the tooth was not so rapid, however, but what the heat was given opportunity to soak into the wheel metal, in order that it might fuse deeply and thus form a homogeneous bond with the gear. At no time was the filler permitted to drip into the weld, but it was literally pushed in; always in contact with the wheel except when applying the flux. This was done by dipping the heated end of the rod in the flux powder and quickly returning a bit of it to the weld,

Fig. 2. THE REPAIRED TEETH IN DIFFERENT STAGES OF THE OPERATION

where it melted and spread over the molten metal. An application of the flux was made at frequent intervals while depositing the layer of filler metal.

At the end of the first layer, the welder stepped to the other side of the wheel and melted another layer back across the first one in practically the same manner; a little more careful perhaps along the edges to see that the tooth was coming up squarely. Then he doubled back along the tooth again to place a third layer, after moving to the other side of the wheel once more. This time he had to be more deft and very careful in depositing the filler as he had now about half the tooth built and had to start shaping it. The melting filler was guided by both the flame pressure and the molten rod, so that the tooth was erected with very little roughness on its sides. The ends too were shaped by scraping and patting with the filler in conjunction with the force of the flame.

After the third layer, the succeeding ones were gradually drawn in to conform to the original shape of the tooth. This required considerable skill and a steady hand. However, the welder soon learns by practice to put the molten metal just about where he wants it. The flame is advanced or retarded as the condition of the melting warrants. The filler is also crowded or held back according to the rate of the melting. These things come easy with actual practice.

The last narrow layer was added along the top of the tooth with enough excess filler to provide a surplus for machining stock. Then the wheel was revolved to bring another tooth upward, where the process just described was repeated identical with the first tooth weld. And as each tooth was finished the wheel was turned and the welding repeated until all had been treated alike. Figure 2 shows two teeth completely welded and the third half done. The fourth tooth is ready for welding.

If the welder is reasonably skillful, and is careful, the teeth will need but little filing. If the shop possesses a thin emery wheel the roughness of the finished weld may be ground to almost exact size and shape on the emery wheel; unless the teeth have to mesh closely. In which event they should be finished with a file.

Another device that is employed quite successfully by some welders is shown in Fig. 3. This is what is termed a "hot finishing" process and consists of striking the molten metal off smooth with a flat file. The wheel is placed upon one side on the levelling plate as near perpendicular as possible in position of the teeth. Then the welding flame is directed downward along the sides of a tooth. The high places and rough spots are re-melted and blown downward. As soon as these projections are melting they are wiped off quickly by a downward movement of the flat file. The file must strike flat and not dig into the metal; it should barely scrape the surface to carry with it the roughness. The re-melting and striking is repeated until the tooth is smooth and fairly well shaped; a process that requires some practice to obtain proficiency. The novice had better practice upon some old castings before attempting to finish a custom job. As he grasps the idea, however, he can soon learn to save lots of time by the "striking" method.

The face and ends of the teeth are also finished in this manner. Nor is it absolutely essential to always strike downward; the re-melted metal may be removed with a sidewise motion just as easily after the welder becomes proficient.

When all of the teeth have been "hot finished" the gear was allowed to cool before measuring and filing the teeth, at which point comes the real test of the weld. If it is too hard to file the weld has been improperly made in some part of the process. Which brings out the fact that the filler should be applied without oxidizing or carbonizing. A hard tooth is a brittle one and will not stand much strain. If the filler is soft but the flame carries a little too much acetylene, it will be hardened in the melting. Also an excess of oxygen is liable to cause a brittle porous weld. And, also, a too ardent application of the flame causes poor teeth. If it is held too closely to the metal or is held motionless too long in one place the weld will be spotted with hard portions or burned to sponginess.

Also, if the filler has not been thoroughly "soaked" into the metal below it, section of the new tooth may peel loose; they have not been welded but merely adhered. These mis-connected portions are liable to break loose when the wheel is in service.

All of which goes to prove that a mere skillful placing of the new teeth does not mean a good job. So the welder must keep his mind on all parts of the process if he expects to produce serviceable teeth on straight gears by the single tooth method of welding with an oxy-acetylene torch.

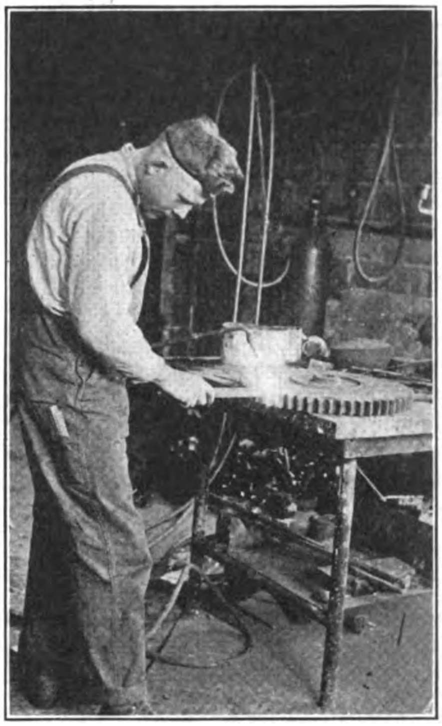


Fig. 3. THE NEW TEETH ARE "STRUCK" SMOOTH WITH A FLAT FILE

Defects in steel wire, rods, rails, cables, and strips may now be discovered by the use of the "defectoscope" — a new apparatus which has been invented for the magnetic testing of steel.

Only 70,000 dwelling houses were built in th U. S. in 1919 although a million couples set up housekeeping that year.

West Virginia is the largest producer of natural gas. One company in that state has more than 3,400 gas wells.

Exports of corn syrup and corn sugar—by-products of corn—aggregated 255,617,709 pounds, valued at $15,139,944, in 1919.

Cloth made from wood is slowly finding its way into American markets.

How to Treat Tool Steel for Various Purposes to Obtain Results

By J. C. SCOTT

IT is well known to any one at all familiar with machine-shop practice that to get the best results with any brand of tool-steel implies knowledge of the right way to treat it and care in treating it. When this involves, as is often the case, five or six different and distinct operations, there can be no fair test of the steel unless every one of these operations is properly conducted. However, in many cases it is a fact that because one or two of them are successful the test is considered a fair one and the steel is condemned because of failure in some other equally important operation.

Consider the case of a steel die. The different operations employed in making a die result in leaving strains which should be removed by subsequent treatment; however, in many cases the hardening process is expected to remove all of the strains and at the same time produce a fundamental change in the mechanical condition of the steel—and that too in a poor fire, subject to direct contact with the blast, and with very careless handling. It is too much to ask of a piece of steel that it conform itself to half a dozen conflicting conditions at one time; yet if the unequal strains cause it to burst in cooling it is said that the fault **must be in the steel.** Printed instructions issued by many manufacturers are useless to the average machinist or blacksmith; first, because they imply the possession of an equipment which is beyond his reach, second, because they deal mainly and at great length with the necessities of their own product, thirdly, because while they tell him the object to be attained, they do not tell him how to reach it.

What the machinist needs is a few simple, practical rules that can be applied to any make or kind of bath-hardening steel and can be carried out in any ordinary shop.

As an illustration we will take the matter of forging dies:

In the first place, the material is forged to the shape wanted, which results in what are designated by the mill as "hammer strains."

In the second place, to facilitate the machining of this material readily, it is annealed, putting in what are commonly called "annealing strains," for the reason that the different pieces vary materially in thickness, and consequently the average annealing does not affect the steel uniformly—the more so because the hammer strains interfere to some extent with getting the piece entirely ductile.

In the third place, the operator will proceed to machine this die, generally taking a small amount off the ends, sides and bottom, but sinking in the face of same, possibly, a very deep and intricate shape, for the purpose of forming a drop forging. This, it can be readily seen, causes what are called "mechanical" or "machining" strains.

Ordinarily this die is now considered finished, and is put into the furnace and brought up to what is considered by the operator the proper heat for tempering, with the result that two out of five of the dies will burst in consequence of the conflicting strains above mentioned.

To prevent this, as soon as the die is machined it should be heated up to a fair cherry red throughout and laid in a dry place to cool. This operation will relieve all the strains which have been put in either in forging, annealing or machining, and the operator will find that the die then will take the heat more readily and more uniformly and will harden much more successfully, there being scarcely any risk whatever of its bursting, cracking or chipping off in his hands, if carefully handled.

After the operator has thus relieved the strains, the hardening process should be as follows: Heat the die to a fair red throughout, being careful that the corners have not been heated up too rapidly and that the heat has penetrated to the center. The die should be left in the fire until it assumes a uniform color which is known as the critical point, at which period it should be put into the water on tongs and kept immersed and moving until the operator feels, as old workmen say, that the steel "has just quit fussing." He should have some oil ready at this time so that he can immediately remove the die from the water and finish the cooling in oil.

If these directions are followed carefully, there is no reason why the operator should burst a die in a lifetime. The one vital essential in hardening is to know when the critical period is reached.

The foregoing paragraphs on handling die-blocks are applicable to dies for hot work, generally averaging from .60 to .70 carbon, and if the operator uses a pyrometer the heat should be from 1350 degrees F. to 1450 degrees F. For trimming and stamping dies the steel will be of a higher carbon, for the reason that it will be necessary to have a harder and firmer edge than will stand up on the cold work. The steel generally furnished is from 1.10 to 1.20 carbon and should not be heated above 1350 degrees F., which is a dark red. In the hardening, the same treatment applies as to dies for hot work.

For taps, reamers and cutting tools generally, the steel should be not less than 1.20 to 1.30 carbon, heated at about 1350 degrees F. and the temper drawn to 425 or 450 degrees F. in oil.

For tools for turning or cutting hard chilled rolls or extremely hard material, the carbon is increased proportionally up to 1.65 carbon for the hardest. The extremely high carbon steels, while they carry a greater degree of hardness, are more easily ruined in the heating than the lower carbons; although when handled properly they will give better results.

The operator will please note that the only difference between a a poor steel and a good steel is the strength in one more than in the other to **carry up the hardness,** whether same is artificial or normal.

To illustrate what we mean by this, note that 212 degrees F. boils water 375 degrees F. ordinarily relieves the steel from all strain; 425 degrees F. is commonly called a straw color; 450 degrees F. a copper color; and 550 degrees F. indicates the lowest temper at which it ordinarily is possible to leave any noticeable degree of artificial hardness. This is designated as a spring of flash temper. It is called a flash temper for the reason that if you are drawing the temper of tools in oil, by the time you get up to 550 degrees F. both the oil in which you are drawing and the article to be drawn are at so high a heat that almost immediately after the article is taken from the oil, thoroughly drawn, the surplus oil on the surface evaporates or dries up.

Now you will readily see from the above that if you buy a cheap steel—and are therefore, compelled to draw the temper down to the lowest point at which you leave any of its artificial hardness in order to enable the tool to do the work without chipping or crumbling—the result will be that the amount of work you can turn out with this tool will be reduced very materially. On the other hand, if you have a better steel, made out of better stock, and by people who thoroughly understand the making of a first-class carbon steel, this steel after being made into a tool can simply be drawn just beyond the point that naturally takes the strain off, leaving the greatest possible degree of hardness that can be put into it.

This grade of steel will not only stand up longer than a cheaper grade but will do so much more work per hour that it will pay both for the difference in the price of the two steels and the cost of making the best tool. Thus you will readily see that it would be false economy to have the cheap toolsteel at any price; not only for the reason above stated, but also from the fact that it costs you just as much time, trouble and expense to make a tool out of poor steel as it would out of a first-class article. Where the operator has not the oil handy to use to handle the steel as above, he, of course, can use the different colors as above mentioned to draw to.

We quite often hear it said by purchasing agents, superintendents and blacksmiths—and it does not make much difference whether they are getting good, bad or indifferent results in their work—that they do not care to change steel, for the reason that they are more thoroughly acquainted with the steel they are using. We believe that a man ought to be **contented**; but as there have been so many improvements, not only in steel, but in the uses of steel, we do not believe that he ought to be **satisfied.** He should always strive to get the best possible results, for results are what the manufacturers, who have to consider not only superintendents, but other men employed, are after.

This notion of the advantage of sticking to the same brand because you are familiar with it is greatly exaggerated. As an illustration of this let us take the common assertion that you must know the carbon contents of a piece of steel in order to get results.

It is not necessary for the operator to know anything about what carbon is in a piece of steel to get good results. This may seem a strange assertion to make and will not be believed by a great many; but if the operator will simply try the following directions we believe he will in the future admit that he can handle any piece of steel of the carbon quality, regardless of whether it has .60 carbon or 1.60 carbon, whether the grade of steel is new to him or not.

In the first place, he must distinctly understand the decalescent, critical and the recalescent points. To explain what we mean by this: steel whether .60 carbon or 1.60 carbon, if handled carefully, can be safely heated to a dark cherry red throughout, and while we do not believe in roasting steel, we believe in giving it ample time to come up to that point without forcing. Then, if the operator will pay strict attention and increase his heat a trifle, as the heat reaches a certain point, he will notice that the steel is apparently cooled off. He is liable to think that possibly the air is striking it, but the phenomenon is really caused by the fact that thus far the heat has been penetrating slowly through the outsides of the article, and at this point, known as the "decalescent point," it has struck in toward the center, leaving the outside heated in spots or uneven.

This is caused by the difference of density in the steel, and from other causes, and should be watched very carefully until the article to be hardened assumes the same color throughout, which should be not over 1450 degrees F. for the mild steel and from 1300 to 1350 degrees F. for the highest carbon steel. The point at which the steel thus returns to uniform heat is the "critical point," and if the steel is not immediately quenched it will reach the recalescent point and will soon begin to oxidize or "burn." and be ruined for all practical purposes.

As carbon steels of exactly the same carbon will vary 50 to 100 degrees F. in the heat at which they should be hardened to get the fine flint-like grain that gives the best possible results, the watchfulness and skill of the man in charge of the steel at the critical period are of the greatest importance.

Even though you have a pyrometer on the furnace, it is not safe to rely upon it, for the heat will always be greater than shown by the instrument. One reason for this is the fact that the temperature increases in the steel at the rate of three to one after the striking in of heat, or decalescent stage. Another reason is that the steel is generally heated more rapidly than the furnace lining, owing to its being in position to absorb not only the direct heat of the fire but the reflection from the walls.

The only sure way to get results, therefore, is as follows:

First—Handle the steel carefully, and give it time to come to a dark cherry red without forcing;

Second—Increase the heat slightly and watch for the appearance of the decalescent stage;

Third—Quench immediately after the steel has reached the critical point, and before the recalescent period is reached.

To get the best results, steel must always be hardened on what is called an "up heat" instead of being overheated and then held in the air until the operator **thinks** it is time to quench it. It is much better, having overheated the steel, to lay it down, allow it to cool considerably below the point at which it will harden, and then bring the heat up to the proper point again. This will not do the work as well as if it had been handled right in the first place, but will give much better results than to quench in water **when the heat of the steel is going down.**

If tested after hardening, with a file—assuming that both have been drawn to the same point to toughen or temper—there will be no noticeable difference as to the hardness between a piece hardened properly and one that has been overheated; in fact, one would be inclined to think that the piece which had passed the last point or the danger point, was the harder. If tested with a scelerocope, however, which is the only way to determine the beneficial hardness, you will find that the properly-hardened piece will possibly go from 80 to

105 hard, depending on the amount of carbon, while the piece which has been a trifle overheated, or gone past the critical point, will not be over 70 hard for high carbon and less for low carbon. While to all appearances, if tested with a file as stated above, it would be hard enough to withstand any use that it could be put to, the steel has a granular open appearance, will crumble, and is almost devoid of strength, for the simple reason that it was ruined in the hardening. After this has been done no amount of drawing the temper or letting down of the hardness would bring the quality back. When a piece of steel or die block has been impaired just in proportion to the amount of abuse it has received and if much overheated it is no better than a piece of slag.

High carbon steels when hardened acquire properties diametrically opposed to those found in low carbon steels. Both may harden equally high under favorable conditions, but assuming that both are equally hard in the sections actually hardened outright the strength increases with the increase of carbon up to about 1.65. The strength of the partially hardened sections, as the inside of large dies, etc., decreases with the decrease of carbon, the maximum carbon generally used in forging dies being approximately .60 to .70. All carbon steels lose about 50% of their strength when overheated.

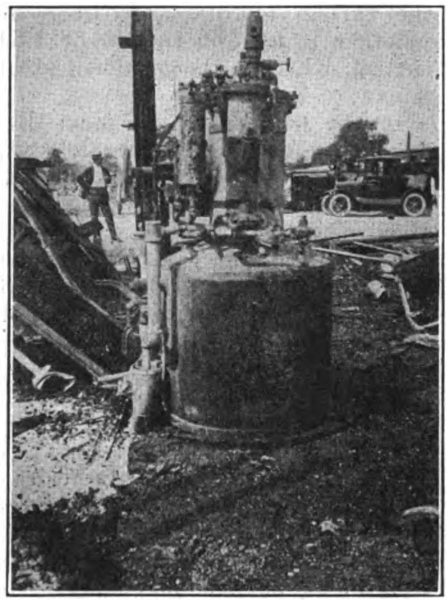
Steel containing less than .40 carbon will fail to harden, and is classed as machinery steel. With .60 carbon it will harden sufficiently for all dies for hot work and work similar to hot work. It is advisable, however, to increase the carbon at least 5 points to make allowance for loss in heating and annealing.

Carbon steels having originally barely enough carbon to harden under favorable conditions will lose enough carbon in treatment to make them fail to harden at all, or to harden in spots. Therefore, if a uniform and clean hardening is desired on a finished surface, there must be either enough carbon in the steel to make up for the loss in heating or it must be packed and heated in a case hardening box, which adds to rather than subtracts from the carbon on the surface. If a case hardening box is used, the article to be hardened should be packed in a mixture of three-fifths charcoal and two-fifths crushed bone.

ACETYLENE GENERATOR STAND UP UNDER REMARKABLE ABUSE

The wisdom of the fire underwriters in cautioning the public against any other than approved types of acetylene generators was again demonstrated in a shop fire at Houston, Texas, in the plant of Horton & Horton.

The fire started in an adjoining shop and worked its way to the welding department, where everything but the generator, of the 50 lb. pressure type was an utter loss. The fire was so intense that it melted all of the brass parts and des-



THE ACETYLENE GENERATOR WHICH WITHSTOOD THE HEAT OF THE FIRE THAT DESTROYED THE BUILDING

troyed all piping, filter, regulators, etc., in fact ruining everything above the waterlines in the equipment. The dark belts in the illustration indicate the water-protected areas in the generator and back-pressure value. The generator was fully charged at the time of the fire and had been in use just previously. When reached by the flames it was carrying a full head of gas. The excessive heat weakened the spring in the pop valve, after which the vent remained open, the gas igniting and flaring out in a flame several feet in length, but the water seal prevented the fire from flashing back into the generating chamber. Spectators stood back at a respectful distance, fearing an explosion momentarily, but apparently there was no danger.

Authorities on acetylene generation declare that only the safety features characterizing approved apparatus prevented a disastrous explosion. This generator was, or is—for it is back in commission now—one of the Oxweld pressure type, which is one of those that has the formed approval of the underwriters' board.

YOU CAN BLAME THIS ON 'EM TOO

A few months before the Armistice was signed, a Hamburg liner owned and operated by a German Agency, was interned at an American port and taken over by the United States Government for war service.

The lack of reluctance on the part of the ship's officers when leaving the ship at once aroused suspicion and served to intensify the inspection given interned ships. Preliminary investigation failed to justify our officers' belief that the vital parts of the ship had been tampered with; however, after days and weeks of examination, during which time not an inch of the ship was overlooked, it was found that every ninth or tenth rivet on the ship's boiler had been removed and wooden pegs substituted. These wooden pegs were the same shape as the steel rivets and had been painted to match. Only by tapping and noting the unmetallic sound were they discovered. Experts said at the time that the boilers might have held for several hours before bursting. No doubt the Germans planned to allow the ship to get well out to sea before their labor would bear fruit.

However that may be, the point is forcibly brought out that ship rivets, whether in the boiler or hull plates, are the most vital parts of its construction. If of improper chemical analysis or driven while at the wrong temperature, immeasurable trouble and delay is bound to result.

At the Hog Island ship yards, several years ago, in order to speed construction, premiums were given the workmen on the number of rivets driven; needless to say it had a marked effect, but upon final inspection hundreds of rivets were condemned and consequently had to be removed, causing great delay and expense, condemned for the most part, however, because they were improperly heated and driven.

1920 AUTOMOBILE SITUATION IN FACTS AND FIGURES

The pessimists' old bugbear, "the saturation point," which has been paraded and flaunted so much of late when ever the automobile industry has been mentioned, has suffered a complete knockout by figures recently complied, regarding the number of cars registered in this Country last year. The decent burial to which these depressing rumors have long been entitled, will be quietly conducted, we presume, by the association of gloom spreaders.

Cars and Trucks in the United States, December 31, 1920

New York	651,796
Ohio	616,800
Pennsylvania	570,164
California	568,892
Illinois	568,759
Iowa	437,300
Texas	427,634
Michigan	412,717
Indiana	332,707
Massachusetts	304,631
Missouri	295,817
Wisconsin	293,298
Kansas	265,396
New Jersey	226,459
Nebraska	223,000
Oklahoma	204,300
Washington	175,000
Georgia	144,422
N. Carolina	140,860
Virginia	134,000
Colorado	128,951
S. Dakota	122,000
Connecticut	119,134
Kentucky	112,685
Maryland	105,000
Oregon	103,790
Tennessee	101,852
S. Carolina	92,818
N. Dakota	90,840
West Virginia	78,862
Alabama	74,637
Louisiana	66,000
Minnesota	64,312
Mississippi	64,000
Maine	62,907
Montana	60,646
Arkansas	59,082
Florida	57,000
Idaho	50,750
Rhode Island	50,375
Utah	42,604
New Hampshire	34,680
Arizona	34,559
Vermont	31,625
D. of C.	25,688
Wyoming	23,926
New Mexico	22,109
Delaware	18,300
Nevada	10,464
Total	8,903,548

The huge climb in registeration figures of cars and trucks in this country last year, fail to show signs of general business depression. 8,903,548 cars and trucks were registered in the year 1920. This is a net gain over the preceding year of approximately 21 percent, and gives a proportion of approximately one car to every twelfth person.

Estimates made in the early part of the year placed the number of cars to be registered in that year at over eight million; but none believed that the number would come so close to reaching nine million. It seems that the most conservative estimates have been exceeded by nearly three hundred thousand.

New York, as usual takes the first place, through a spurt made in the last six months, leaving Ohio a close second; while Pennsylvania pushes California out of third place.

Another interesting detail in the itemized list of increases is the case of West Virginia with an increase of 57 per cent.

The Department of Agriculture has not given out the number of tractors which were placed in operation during the last year. When the foregoing is supplemented with that information, it will be doubly interesting particularly to the dealers and repair men in the rural districts.

Certainly these figures look encouraging to the men who sell the service and material which is going to keep these cars running, and it should look encouraging to the men who contemplate it. Doesn't it look as though there is an opportunity in your locality to increase your present income by the addition of suitable lines, or if there isn't as you may think, perhaps opportunity is waiting around the corner, or you may be living in another "West Virginia?"

The present production of oxygen in the U. S. is about 3,000,000 cubic feet, or approximately 130 tons per day. It has been estimated that ninety-five per cent of this amount is used in torches for cutting and welding purposes.

The packing and crating business of the nation used one-eight of all the timber cut in the United States in 1919. In 1918, 4,500,000,000 board feet were used for this purpose—an amount five times greater than that used by all American furniture makers and twenty-five times as much as the shipbuilders.

Americans should not suffer from the cold, for one-half of the world's coal reserves are located in the U. S.

Gain in Registration 1919—1920

Ohio	105,769
Texas	96,324
California	91,442
Illinois	90,321
Pennsylvania	88,047
Michigan	86,904
New York	80,134
Iowa	73,443
Oklahoma	59,800
Massachusetts	57,448
Wisconsin	56,317
Indiana	55,452
Missouri	51,454
Virginia	39,880
Kansas	37,644
New Jersey	35,586
N. Carolina	31,843
Nebraska	31,000
W. Virginia	28,659
Washington	26,225
Colorado	24,086
S. Carolina	22,675
Kentucky	22,044
Tennessee	21,430
Oregon	20,458
Mississippi	18,970
S. Dakota	17,372
Georgia	17,096
Alabama	15,739
Louisiana	15,000
Arkansas	9,632
Connecticut	9,483
Maine	9,482
Maryland	9,366
Idaho	8,530
N. Dakota	7,955
Utah	7,368
Minnesota	7,260
Arizona	5,580
Rhode Island	5,542
Vermont	4,818
New Mexico	4,032
New Hampshire	3,055
Wyoming	2,555
Dist. of Columbia	2,345
Delaware	2,148
Florida	1,600
Montana	1,321
Nevada	1,159
	1,521,911

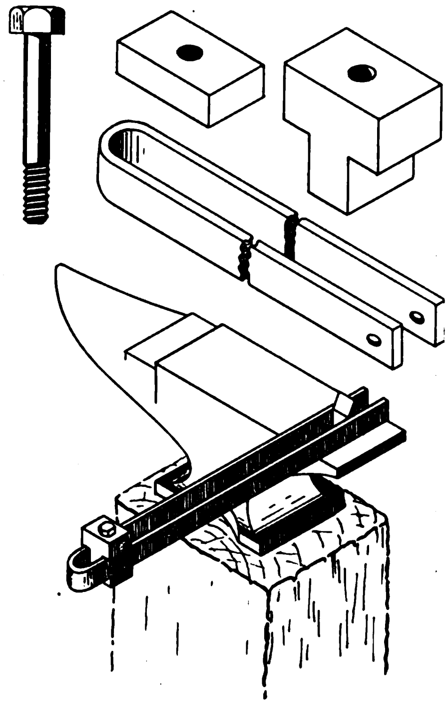
It will be interesting to know that at the prices of 1914, our mines, forests, farms and fishries produced in the aggregate about \$22,500,000,000 worth of goods. At the prices of 1919, however, their production was valued at \$53,700,000,000, an increase of \$31,200,000,000.

HELPFUL SHOP SUGGESTIONS

CHAS. H. WILLEY

ANVIL GAUGE

Where a blacksmith has any amount of rods or bars, etc., to cut off on the anvil hot chisel, some sort of an adjustable gauge will make the work easier. I recently



noted such a device and have made a few sketches of it which are shown here.

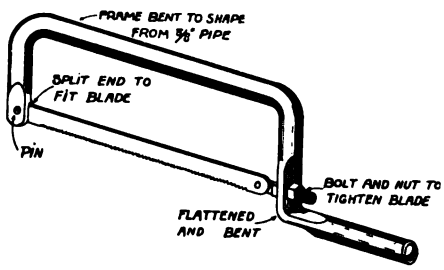
The chisel is of special height and construction and to it is attached the gauge track made of a piece of light band iron as shown. A stop with a bolt and strap complete the device.

HOME MADE HACK SAW

One or more extra hack saws around the shop are welcome tools, and when one can make the frames for a pretty good sort of a hack saw so easily from small size pipe, there seems to be no good reason that we cannot have a couple laying around handy. The sketch shows how the frame is made.

EFFICIENT SHOP PRESS

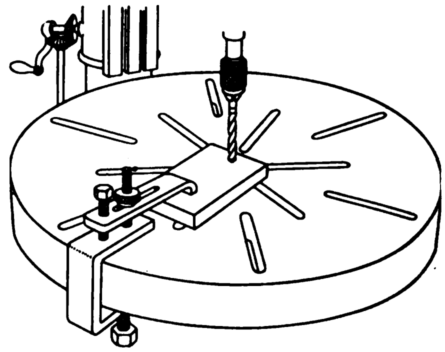
It is within the ability of the shop mechanic to make a lever type of press that will make the work of pressing on or off engine fly wheels, pulleys, gears, bushings. etc., that are met with in the course of general overhaul and repair work to the various equipment, easier. Such a press as that shown here in the sketch is very efficient, cheap, and easy to make. It was designed and made by the writer for such work. It consists of a part of a length of railroad track. A strong back made of a portion of an old wagon axle. The housings and hanger are made from ½x4 inch flat bar stock which are easily formed to the required shape shown. The press is mounted on a specially strong built bench and a screw jack used under the end of the lever. Blocking may be used under the bench where the jack sets, and blocks of suitable length are used to support the work under the end of the press lever. Those who have a need for such a tool can construct one for themselves with the aid of the sketch.



HANDY DRILL PRESS CLAMP

Save your fingers and broken drills by making a handy drill press table clamp for holding your work. Such a clamp can be very easily constructed from a few odd bits of scrap stock. I designed and made the clamp shown in the sketches and found it extremely handy. It is adjustable for various heights and can be moved in and out and swung in a arc.

These features make it a handy affair that will be appreciated and anyone who would care to make the device could obtain from the sketch all the details of its construction.

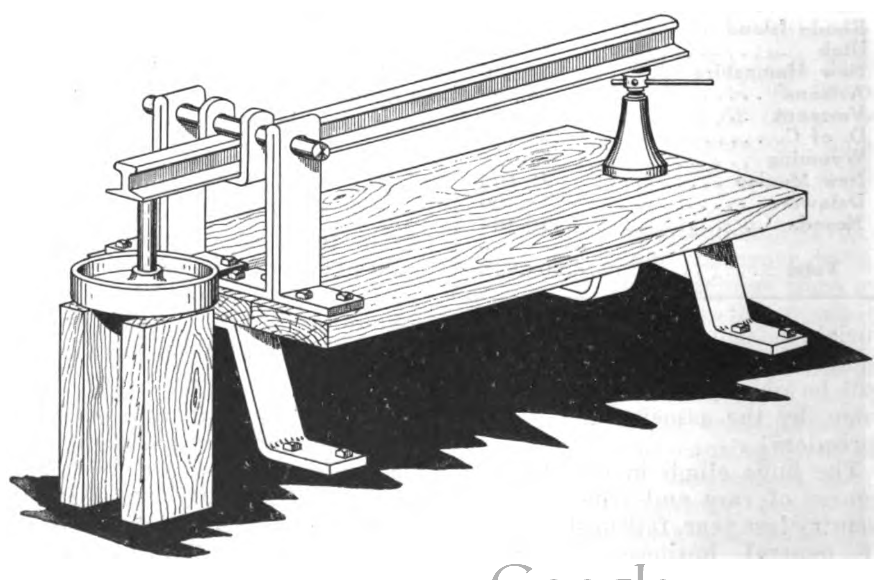


SPECIAL STUD WRENCH

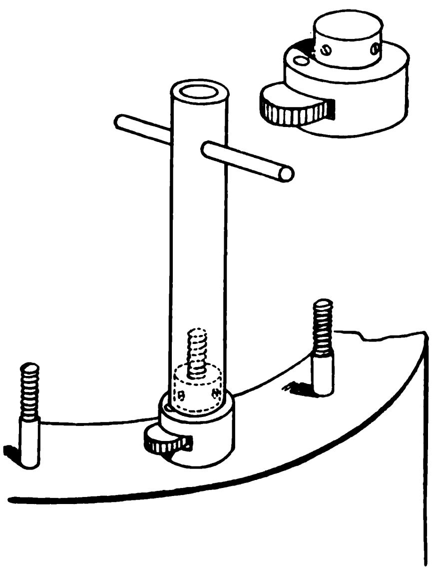
For removing or installing extra long studs in cylinder heads, etc. I hit upon the scheme of making a Tee handle eccentric stud wrench, from a bit of steel tubing and a special turned up wrench, as shown at A in the sketch. This is secured to the inside of the pipe by two screws. The sketch shows the tool and its use.

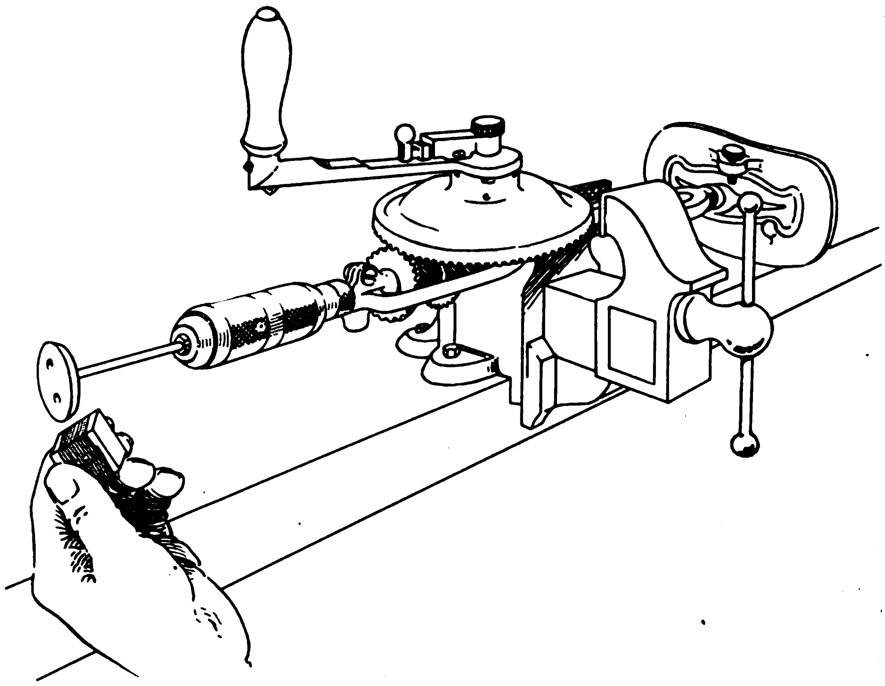
CLEANING VALVE SEATS

By the simple method shown in the sketch, that of putting the engine valve by its stem into a breast drill chuck and holding the breast drill in the vise and revolving the valve. While revolving it hold a small square block covered with fine emery cloth against the seat as indicated. This will smooth off



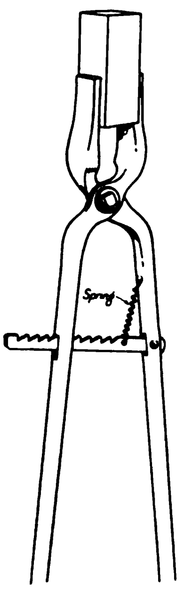
the seat and remove the small bits. By cleaning a set of valves in this manner it becomes much easier to grind them to a perfect seat.





CLAMPING TONGS

The sketch shows how to make a pair of clamping tongs for holding work securely while working it under the hammer. The tong jaws are made in the regular style, but the handles are cut short and forged round to fit into pieces of pipe, as shown in the sketch. A slot is made in the pipes and a toothed lever is used as indicated with a spring to pull it into place. The action is obvious to any mechanic or blacksmith who would care to make such a tool.



EYE BENDING DEVICE

For making eyes in rods of small size, one can use such a home made tool as that shown in the self explanatory sketches to advantage. The tool is easy to make, being simply two lengths of flat bar stock with three suitable size pins. The size of the center or hinge pin will depend on the size of the eye wanted and if desired there should be different size pins. One can improve the idea when using it.

ANNEALING WITHOUT TARNISHING

A method of protecting polished metals which have to undergo annealing from the tarnishing which occurs under ordinary treatment has been patented by H. Schultz, Charlottenburg, Germany.

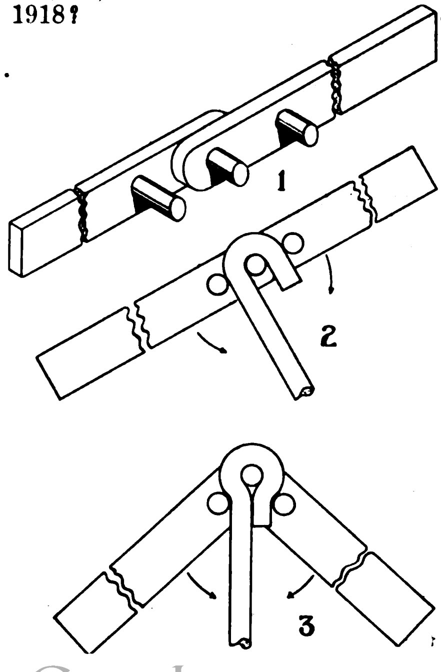
In this process a solution of boric oxide is used, completely excluding atmospheric oxygen, although it is applied only as a very thin film over the articles to be annealed. It melts at a temperature varying between 550° and 650° C. (1022° to 1202° F.), according to its composition, and acts as a protection so long as it remains solid. Steel, for instance, remains bright when heated to the melting point of the composition, and no coloration takes place when it is tempered.

In the molten or semi-molten condition, it forms a perfectly gas-tight cover around the article, even when heated to the highest temperature used in practice. The coating is perfectly fireproof, does not evaporate, and dissolves any oxidized matter on the surface of the heated metal. The coating can be applied either as a powder, sprinkled or dusted over the surface of the objects to be annealed, or as a liquid. It is soluble in water and methylated spirit, and the work to be annealed is simply dipped in the solution and allowed to dry. The coating peels off on cooling, or it may be dissolved in warm water.

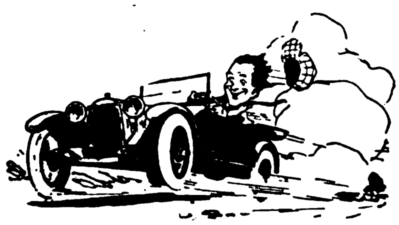
TO FILE CAST IRON

Frequently it is necessary to file a piece of cast iron that has been subjected to friction and has acquired a glaze or skin. The best way to get through this skin is to use the edges of an old file. If a new file is used on this sort of surface it may be ruined.

Perhaps you helped the Bureau of Internal Revenue to raise $1,127,721,835 from income taxes in 1918?



High Spots



PICTORIAL ANCESTRY

An Englishman, fond of boasting of his ancestry, was visiting a Boston man, when he took a coin from his pocket and, pointing to the head engraved upon it, he said: "My great-great-grandfather was made a Lord by the king whose portrait appears on this shilling!"

"What a coincidence." said the Yankee, who at once produced another coin.

"My great-great-grandfather was made an angel by the Indian whose picture you see on this cent."

AN AWAKENING

The discharged soldier hastened gladly home to see his wife. He found her polishing the kitchen stove, and slipped quietly up and put his arms around her.

"Two quarts of milk and a pint of cream tomorrow," she said without looking up.

PRINTED FACTS

At the wedding reception the young man remarked: "Wasn't it annoying the way that baby cried during the whole ceremony?"

"It was simply dreadful," replied the prim little maid of honor; "and when I get married I'm going to have engraved right in the corner of the invitations: "No babies expected."

IN LINE

An experience meeting of gratitude for blessing bestowed was being held, and the meeting had been "thrown open to any present."

One after another rose and spoke of peace and contentment, under circumstances that seemed impossible, judged from a worldy standpoint. Some said they were thankful for things they had missed, and at last an old lady arose, pushed back her sunbonnet and, with a beaming countenance, triumphantly exclaimed: "Well, Brother Mose, I ain't got but two teeth, but thank God they hit!"

HIS SECOND THOUGHT

Pa (roaring with rage): "Who told you to put that paper on the wall?"

Decorator: "Your wife, sir."

Pa (subsiding): "Pretty, isn't it?"

GRANDPA'S DILEMMA

"To what do you attribute your great age?" asked the city visitor to Grandpa Eben Hoskins.

"I can't say yit," answered Grandpa cautiously. "They's several patent medicine fellers dickerin' with me."

WOULD BE WASTED

Hewitt—I shave myself.

Doitt—I don't blame you for not spending money on a face like that.—Houston Post.

PICKED TOO SOON

Mrs. Newlywed went to the grocery store to do her morning marketing. She was determined that the grocer should not take advantage of her youth and inexperience.

"These eggs are dreadfully small," she criticised.

"I know it," he answered. "But that's the kind the farmer brings me. They are just fresh from the country this morning."

"Yes," said the bride, "and that's the trouble with those farmers. They are so anxious to get their eggs sold that they take them off the nest too soon."—Cleveland Plain Dealer.

RATHER EMBARRASSING

A young Californian often visited a leading Santa Barbara hotel because of its excellent honey.

When the young man got married the wedding trip included this hotel, so that the bride might taste this ambrosial spread.

But the first morning there was no honey on the breakfast-table. The bridegroom frowned. He called the old familiar waiter.

"Where's my honey?" he demanded.

The waiter hesitated, looked awkwardly at the bride, then he stammered: "Er—Mamie don't work here no more, sir."—

COURTESY

"If I possessed a shop or store,
I'd drive the grouches off my floor.
I'd never let some gloomy guy
Offend the folks who came to buy;
I'd never keep a boy or clerk
With mental toothache at his work,
or let a man who draws my pay
Drive customers of mine away."

"I'd treat the man who takes my time
And spends a nickel or a dime
With courtesy and make him feel
That I was pleased to close the deal,
Because to-morrow, who can tell?
He may want stuff I have to sell
And in that case then glad he'll be
To spend his dollars all with me."

"The reason people pass one door
To patronize another store
Is not because the busier place
Has better silks or gloves or lace,
Or cheaper prices, but it lies
In pleasant words and smiling eyes;
The only difference, I believe,
Is in the treatment folks receive."

"It is good business to be fair
To keep a bright and cheerful air
About the place and not to show
Your customers how much you know;
Whatever any patron did
I'd try to keep my temper hid.
And never let him spread along
The word that I had done him wrong."

RAILROAD PRONUNCIATION

The conductor and a brakeman on a Montana railroad differ as to the proper pronunciation of the Eurelia. Passengers are often startled upon arrival at this station to hear the conductor yell: "You're a liar! You're a liar!" Then from the brakeman at the other end comes the cry: "You really are- You really are!"—Boston Transcript.

THE MEAN THING

Revengeful Maud.—"Ferdie jilted Maud and married another girl but Maud had her revenge."

"How?"

"She sent the bride a book to read on their honeymoon—Stevenson's "Travels with a Donkey."—Boston Transcript.

A BOLD HUNTER

Lecturer (in a loud voice): "I venture to assert there isn't a man in this audience who has ever done anything to prevent the destruction of our vast forests."

Man in Audience (timidly): "I've shot woodpeckers."

EASY

Young Housewife—What makes the milk so blue lately?

Milkman—The milk's as good as ever, ma'am, but we just turned the cows into a blue grass pasture.

LOVE THY NEIGHBOR!

The chap next door who, when you retire, is out making wheezy and futile attempts to start his automobile, and, when you are trying next morning to make up the lost winks, is playing a lively record on his lawnmower, is the kind of neighbor who causes the Third Commandment to seem like a visionary and impractical idea.—Boston Globe.

Without looking it up, what is the Third Commandment?

PASSENGERS' PASTIME

Chief Clerk on the Interburban—"Another farmer is suing us account of his cow."

General Manager—"One of our trains killed it, I suppose?"

Chief Clerk—"Not this time. He complains that the passengers lean out of the windows and milk his cow as the trains go by."—Successful farming.

CONFUSING

A tipsy man approached a policeman and asked:

"Would you kindly tell me which is the other side of this street?"

"Why over there, of course," said the policeman.

"That's funny," muttered the tipsy one. "I've just been over there and they told me it was this side."

From London Tit-Bits.

WHERE WERE THE LIGHTS

He—"We are now coming to a tunnel. Are you not scared?"

She—"Not a bit, if you take the cigar out of your mouth."

SHOOTING STARS

An Irishman engaged in cleaning an observatory, once noticed an astronomer looking through a telescope. A few moments later, seeing a star fall, the son of Erin was heard to remark:

"Begorra, that chap's a crack shot!"

A CERTAINTY

Heck—"If I ever marry I'll rule the roost or know why."

Peck—"You'll know why, all right."

SMITH FAMILY ACCOUNTED FOR

A Chicago school girl, in her history examination, answered that Jamestown, Virginia, was settled in 1607 and there were 120 deaths and 72 births the first year, "due to the efforts of Capt. John Smith."

HIS ACT

History Teacher—"What was the Sherman Act?"

Bright Pupil—"Marching through Georgia."

Benton's Recipes

Renewing Old Files—Many old files can be cleaned and the cutting value partially restored, by first boiling them for at least forty-five minutes in water to which has been added one-fourth pound of saleratus for every quart of water used. Then the files should be washed in clean water and dried. After this is done, place the file on end in a solution consisting of one-fourth pound of sulphuric acid to each quart of water used. After remaining in this solution, which must completely cover them for at least twelve hours, they must be washed again in clean water and dried quickly. Use some light oil to prevent rusting.

You can obtain a fine grade of light oil by allowing several strips of sheet lead to remain in a quantity of olive oil for three or four weeks, keeping it in the sunlight as much as possible. The light oil will rise to top and can be drained off.

Grinding Aluminum—If an aluminum casting is ground on an ordinary emery wheel, the soft metal is apt to clog the abrasive material and impair its cutting efficiency. To avoid this condition, apply paraffine wax to the cutting surface of the wheel. This material will not effect its efficiency and can easily be removed when desired by applying heat.

Brass Polish—A suitable polish for brass parts can be made of three ounces of powdered rotten stone, two ounces of pumice stone, four ounces oxalic acid and two quarts of rain water. Mix thoroughly and allow to stand for several days, after which it is ready for use. Shake well before applying and polish with a dry woolen cloth of chamois skin.

Aluminum Solder—An aluminum solder may be prepared from 50.03 parts zinc, 47.99 parts tin, 1.76 parts aluminum and .22 parts phosphorus. Add the phosphorus to the other materials in the following manner: Screw a cap on one end of a 12-inch length of one-inch gas piping. A tin plug may be utilized to close the other opening. Dry the phosphorus between blotting paper and expose to the air as little as possible.

To Neutralize Battery Acid—A certain percentage of sulphuric acid is used in making electrolyte for a storage battery. When handling sulphuric acid a little of this fluid spilled on the operators clothes or the fittings of the car will quickly cause holes to appear. To neutralize the effect of the acid, there is nothing better than strong ammonia when applied promptly. Ammonia mixed with vaseline forms a good preventive of corrosion when rubbed on battery terminals.

Keeping Windows Transparent—To restore the transparency of automobile curtain windows, use the following:

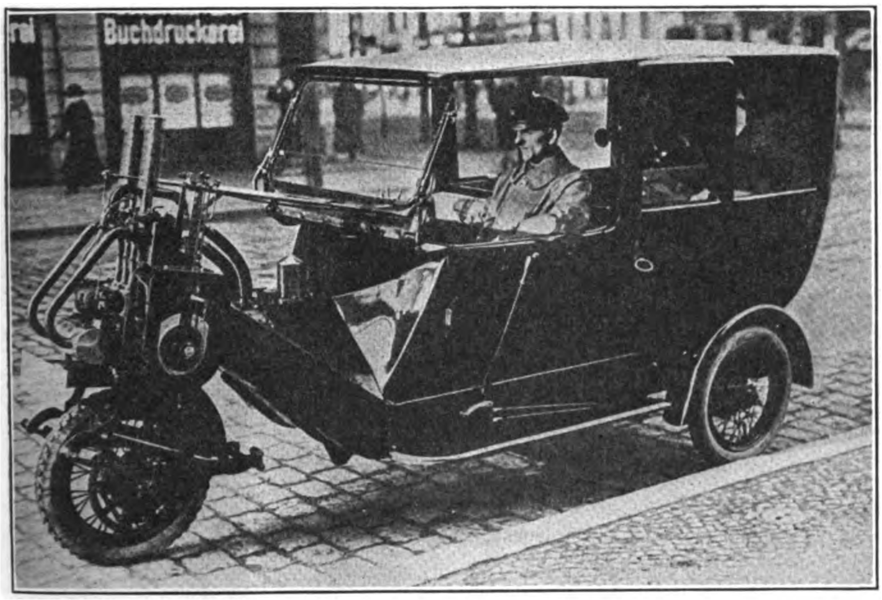
Acetone, U. S. P.	4 oz.
Alcohol	2 oz.
Flexible Collidion	2 oz.

Make a half pint of fluid.

Keeping Water System Clean—A good way to keep the water system clean is to put a box of baking powder in the radiator and leave it in the car a couple of days. When the water gets hot it will boil all the rust and dirt out. Let the water out when it is warm.

Leather and Iron Cement—To face a cast iron pulley with leather, apply acetic acid to the pulley with a brush. The action of the acid roughens the surface by rusting. When dry apply a cement composed of one pound fish glue and half pound common glue, melted in a mixture of alcohol and water. Place the leather on the pulley and dry under pressure.

A THREE-WHEELED TAXI WHICH RECENTLY MADE ITS APPEARANCE IN BERLIN



Owing to the scarcity of material an ingenious inventor of Berlin developed a three-wheeled taxi, which it is claimed can be handled very easily. The two cylinder air cooled motor is mounted directly over the front wheel. The machine is reputed to go thirty miles on a gallon of gasoline and to be able to make forty-five miles an hour.

Bent copper wire can easily be straightened by gripping one end in a vise and the other end in a pair of pliers. The operation consists of simply drawing the wire taut with a jerk. Hammering has a tendency to flatten it.

Cleaning The Hands—A repair man in Massachusetts advises that the appearance of a mechanic's hands can be much improved by cleaning them in the following manner: Rub ordinary soap well into the pores of the skin and with the aid of a little gasoline, form a lather by rubbing the hands together. The hands can then be washed in the ordinary manner. A brush with stiff bristles will greatly aid the cleansing operation.

Body Polish—A good and inexpensive polish for brightening enameled body parts can be made by mixing three ounces of citronella, one pint of kerosene, one gallon of turpentine and 1½ ounces of oil of cedar. Apply the mixture with a soft cloth and then rub well with another dry soft cloth. The more rubbing afforded the parts the greater will be the lustre.

Mixture for Hardening Springs:—The following oil bath mixture gives excellent results for hardening spiral springs: Two gallons best whale oil, 2 pounds Russian tallow, and ½ pound rosin. Boil the tallow and the rosin together until dissolved; add the whale oil and stir up well, and then it is ready for use.

Solder, Aluminum. — Aluminum 30 parts, copper 20 parts and pure zinc 50 parts.

Aluminum 20 parts, copper 15 parts and pure zinc 65 parts.

Aluminum 9 parts, copper 6 parts and pure zinc 85 parts.

Aluminum 12 parts, copper 8 parts and pure zinc 80 parts.

Tin 95 parts and lead 5 parts.

Tin 97.5 parts and nickel 2.5 parts.

Tin 95 parts and pure zinc 5 parts.

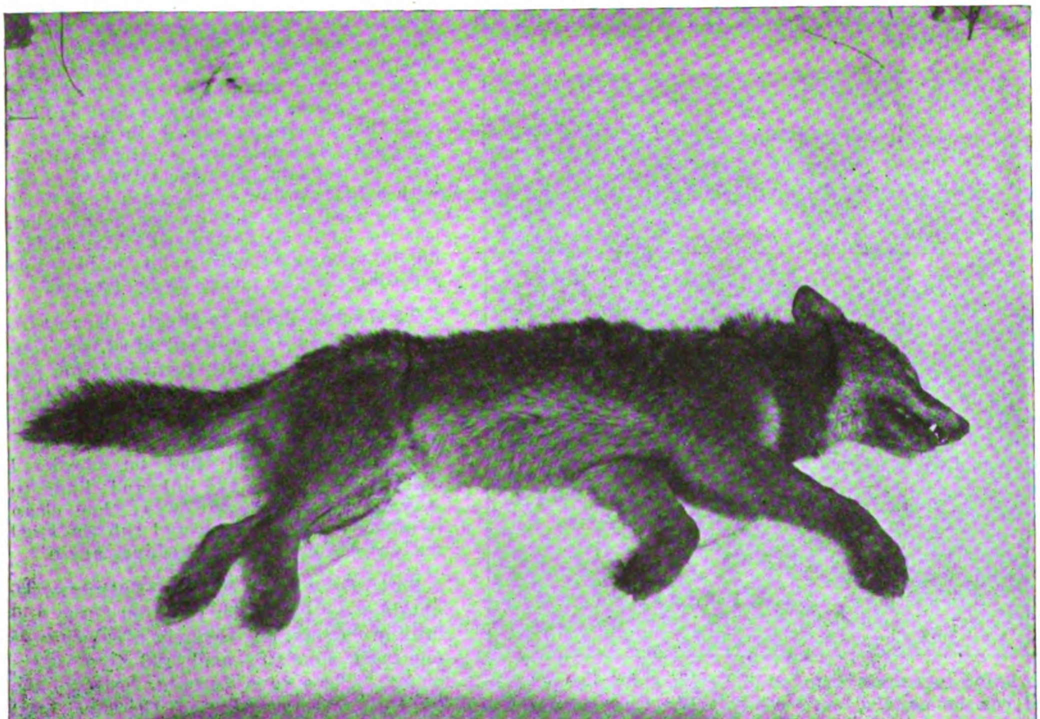
In soldering aluminum, it is well previously to tin the parts to be joined. This is done with a mixture of aluminum and tin applied with a soldering-bit made of pure aluminum. For preparing copper solders, the copper is first melted and the aluminum added in successive portions. The mixture is stirred with a piece of iron and the zinc is added along with a little tallow. Too much heat must not be used after the zinc has been added, lest the latter be volatilized. The soldering may be done with a bit or blowpipe according to the pieces to be treated.

To Restore Polish to Steel:—To restore the brightness of polished steel, or iron, that has become badly tarnished but not badly rusted, apply ammonia soapsuds with a stiff brush, wash off with clean water, and dry by heat. Coat liberally with olive oil, and dust on powdered quicklime. Allow the oil and lime to stay on for about two days; then clean it off with a stiff brush and rub the steel with a soft cloth until it shines again.

Soft Gray on Milling Cutters:—To obtain a soft grayish color on form and milling cutters, dip them in a solution of one part muriatic acid and four parts water. Place in a furnace, heat to the hardening temperature of the steel, and quench in a high-grade soluble quenching oil.

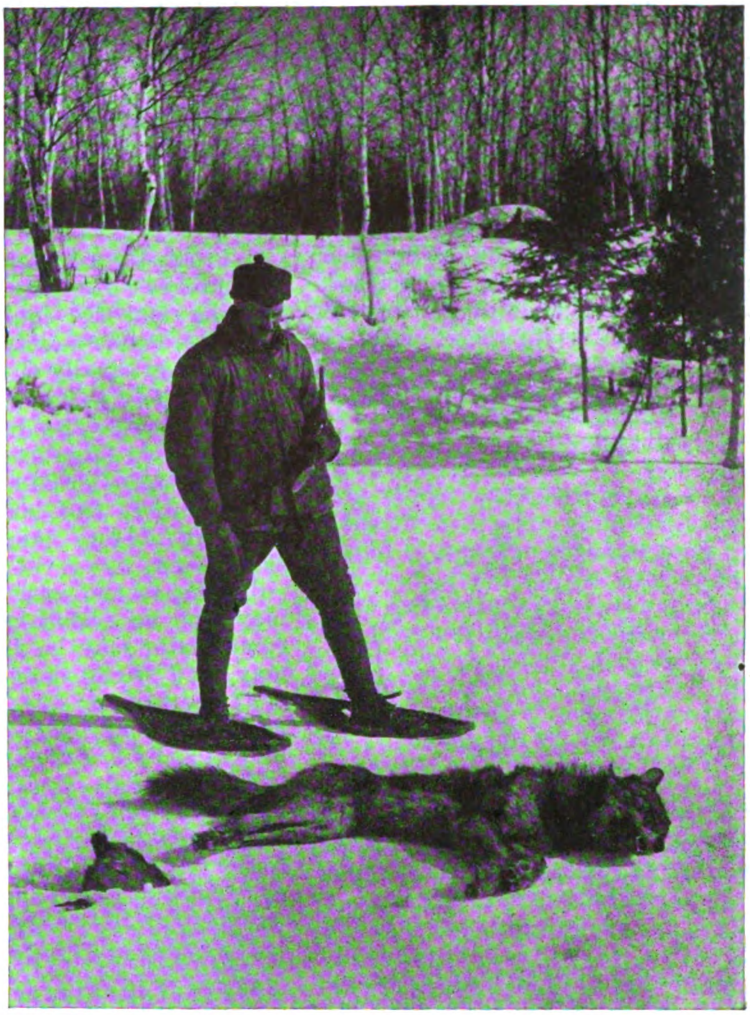
HUNTING THE TIMBER

FISHING T



NORTHERN CANADA

THE ICE



Repairing and Adjusting the Ford Cut-Out

INDICATIONS of trouble in the cut-out are, generally speaking, indications of trouble in other parts. As the cut-out is enclosed, it has small chance of getting out of order unless tampered with or

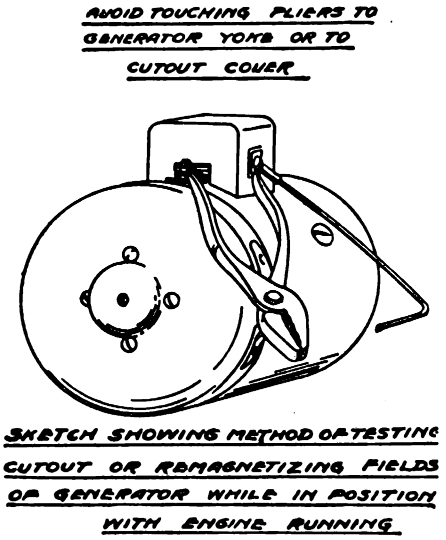


FIGURE 1

affected by defective operation of some other part of the charging circuit. The cut-out is affected by the following:

1. Open circuit between the cut-out and ground through the battery, continued operation under these conditions will burn out the voltage and series coil.

2. Running with a dirty commutator or at speeds which cause the current to cut in and out, will pit the points and eventually cause them to stick.

3. If the base is sprung in assembling the cut-out to the generator, the adjustment will be thrown out. It is very important, therefore, to fit them properly, bending the arms to position in a vise or with a pair of pliers.

Cut-out troubles are indicated on the ammeter in four ways;

1. The meter registers no charge when the engine is running at a fair rate of speed, lights off and the ignition on the magneto.

2. Too high a rate of speed must be obtained before a charge is registered, lights being off and the ignition on the magneto. In this case the meter will jump from 0 to 8 or 10 amperes charge.

3. The meter registers a discharge when the engine is stopped and the lights are off.

4. Ammeter registers more than 4 amperes discharge no lights burning and the ignition on the magneto, before points open as the engine is gradually slowed down.

Remember that in the first case the trouble may be due to a dirty commutator, loose connections or short or open circuits in the field or armature, and make tests accordingly before tampering with the cut-out.

In the second case the brushes may not be seated properly, the commutator may be dirty or there may be a slight short in the field or armature, or the third brush may be set improperly as would be indicated by a low charging rate.

In the third case there may be a short circuit between the ammeter and the switch. Besides the foregoing, it is always well to remember that the ammeter may be wrong.

Testing The Cut-Out

Figure 1 shows a method of testing the cut-out when the generator is assembled in the car and the engine is runing. As stated in the caption, care should be exercised that the pliers do not touch any other metal part other than the contact. This test is used when the ammeter does not register either way with the engine running at a fair rate of speed, lights off and the ignition on the magneto. With the pliers in the position shown, the ammeter will indicate as follows:

1. Full discharge, cut-out is probably alright, generator is not functioning properly because of internal trouble. Remove dust cover to examine pig tail, terminal or insulated brush for ground.

2. Slight discharge indicates that the cut-out is probably OK but the generator is not functioning properly because of a dirty commutator, brushes not seated properly, open or short circuits.

3. Neither charge or discharge indicates an open circuit between the cut-out and the batteries or in the generator. The possibility of it being in the generator may be eliminated if a good live spark results when the generator terminal is shorted to the housing.

4. Proper charge indicates that the system, other than the cut-out and its two connections, is OK. If when the pliers are removed, the ammeter returns to and remains at O, tighten the cut-out to the generator terminal and the ammeter wire connection. This failing, remove the cut-out terminal carefully, as it may be repaired if not damaged by careless handling. Besides tracing, this practice will often correct the trouble by burning the dirt from under the brushes, blowing a slightly charged circuit, or charging a demagnetized field.

There are several styles of cut-outs in use, and the method of securing the cover varies in each case. The dash type is secured by the "dents' in the cover fitting it corresponding dents in the base. The cover is removed by inserting a screw driver between the cover and the base first on one side and then the other, as shown in figure 3.

The large generator type is secured by two punch marks just above the arms by which the base is secured to the generator. This

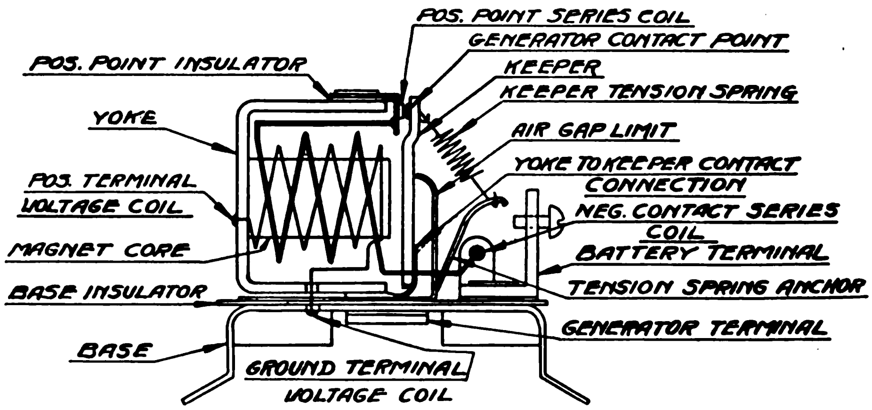


Fig. 2. WIRING DIAGRAM OF THE CUT-OUT

cover may usually be removed by a steady raising the generator terminal and first. The latest type

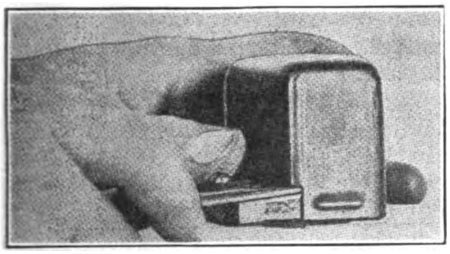


Fig. 3. REMOVING THE COVER FROM THE CUT-OUT WITH A SCREW DRIVER

of this cut-out is secured with a bar through the end of which the seal is made. Cut off one side of the seal and push it out. The bar may then be withdrawn from the opposite side. Figure 4 shows this operation. This frees the cover which then may be lifted off. In some cases it is necessary to relieve it slightly at the terminal with a screw driver.

There are two cut-out with metal finish covers. These covers are secured to the base with screws. In one there is only a single screw: in the other the screw to the right through which the seal wire passes is the one to remove.

While a test stand is much more convenient, it is possible to adjust a cut-out on the generator. One advantage in so doing is that the adjustment remains permanent, or in other words, it not disturbed in assembling it to the generator.

We will now consider the repairs necessary on a cut-out. They may be summarized as follows:

1. Mechanical; such as loose rivets, armature spring out of place, broken parts, points burned out or sticking. In each of the above cases the cut-out should be changed. The screws which hold the cut-out to the base may be loose, vibration would open the coils by crystalization or wear the fibre, allowing the screws to ground against the base.

2. Adjustment; not sufficient clearance between the armature and the core when the points touch. Too much gap when the points are apart. Too much or too little tension on the tension spring. Points dirty. All of these may be corrected unless the core is loose or the points are worn so that they cannot be brought together before the armature and the core meet, in which case the cut-out would have to be changed.

3. Electrical: Such as short circuit in the voltage coil, short circuit in the service coil, or an open circuit in the service coil. With the exception of the times when these troubles are internal, it is possible to repair electrical trouble.

The equipment necessary to repair and adjust the cut-out is as follows:

One direct current ammeter reading both ways from 0 to 20.
One small screw driver.
One small goose-bill pliers.
One small soldering iron.

The solder may be 50-50 such as used in radiator repair work, but instead of acid a non-conducting neutral paste should be used as flux.

Meter Remains at 0.

We will not suppose that by the process of elimination that the

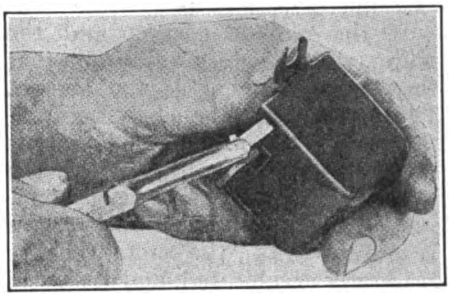


Fig. 4. WITHDRAWING THE BAR FROM THE LATER TYPE OF CUT-OUT SO THAT THE COVER MAY BE REMOVED

trouble has been located as being in the cut-out, and that the indications are the same as those previously described for locating trouble in the cut-out. Since no current is registered, it is evident that the circuit in the service coil remains open. The trouble may be due to:

1. Dirty contact points.
2. Open circuit in the series coil.
3. Short circuit in the series coil.
4. Open circuit in the voltage coil.
5. Short circuit in the voltage coil.
6. Too great a gap between the armature and the core.
7. Armature striking core or other part before points come together.

To determine the type of trouble remove the cut-out from the generator, leaving the ammeter wire attached. Connect the voltmeter to the terminal post as shown in Figure 5. Start the engine and set it at such a speed that the meter registers 9 volts. With the voltmeter still in place, set the cut-out on the generator, the base bracket held firmly against one of its screws and the arm making contact with the terminal. Look at the meter and see if the voltage has dropped from ½ to 1 volt. If not the voltage coil is open. Repeat the test to make sure that you are reading the meter properly.

If an open voltage coil is indicated see that the terminal wires are properly soldered. One of these wires is secured to the base so that it is in connection with the ground (generator yoke), the other wire is soldered to the core yoke which connects it with the generator terminal. The circuit in this coil is always closed, and a small amount of current, ½ ampere, is passing through it even after the service coil cuts in. If either of these connections is broken, solder the wire back in place, using very little of the paste and taking care not to get any of the solder between the coils and the base, or the core yoke, where it is likely to cause a ground or short circuit. When soldering to the core yoke be sure that a flat joint is made, or it may touch the cover, causing a ground.

Shorted Voltage Coil

If the voltmeter turns to 0, or registers an appreciable drop, of say more than one volt, it indicates a short circuit in or before the voltage coil. Such a condition is caused generally by running the car with the charging circuit open. Whenever it is necessary to operate the car with the charging circuit open,

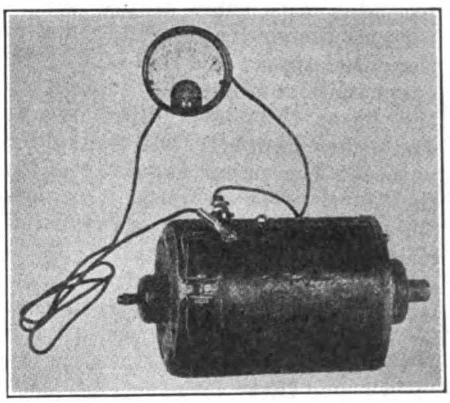


Fig. 5. THE MANNER OF CONNECTING THE AMMETER TO THE GENERATOR TO DETERMINE THE KIND OF TROUBLE

such as when the battery has been removed the generator should be grounded as shown in Figure 7. The wire used is a double strand of shipping tag wire, and the connec-

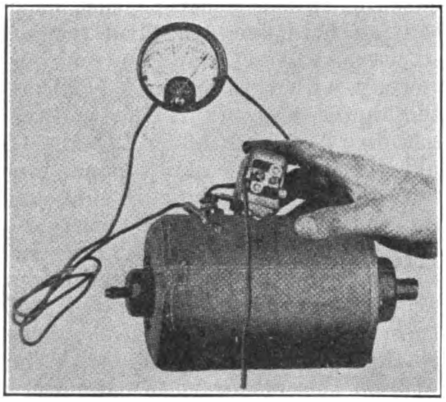


Fig. 6 THE TEST IS CONTINUED BY HOLDING THE CUT-OUT ON THE GENERATOR WHILE THE VOLTMETER IS STILL ATTACHED

tion is made from the generator terminal to one of the brush end bracket screws. The practice of shorting the generator through the cut-out points may cause many other troubles in the generator. Not infrequently such practice burns away the insulation. Wherever the cut-out has been damaged through such operating conditions, it should be replaced with a new one.

In some cases the terminal wire leading to the base makes contact with the magnet yoke, unsolder the wire and slide a tube, made by rolling up a piece of paper, over the wire, after which resolder the wire to the base.

Another instance of short circuit occurs when one of the screws on the under side of the base works loose, or is sufficiently long to touch the yoke. If the cover is not provided with some proper insulator and the soldered connections to the core support is a little high, the cover will conduct the current to the base, thus grounding it. It sometimes happens that the solder will cut the paper insulator. On the black cover cut-outs, it is possible to jam the cover down sufficiently to cause a ground. This is shown in Figure 8, A and B. Lastly, the short circuit may be caused by a loose or foreign part in the assembly.

Dirty Points

Dirty or pitted points may be detected by a visual inspection. They may be cleaned or smoothed down with a piece of fine sand paper or with one of the files used on the coil unit points. If sand paper is used, it is advisable to purchase sand paper that is sanded on both sides. After cleaning the point hold the keeper (armature) down to see that the point makes a good contact and that the keeper is not touching the yoke, core or coil. There should be between 1/64 and 1/32 of an inch clearance.

The cut-out should also be inspected to see that the keeper is not sticking. This condition is found by holding the keeper down and inspecting as stated above.

Too Great a Gap Between the Keeper and Core

If there is too great a gap between the keeper and the core, the keeper will not be drawn down until the voltage has built up beyond the normal pressure of between 7 and 9 volts. If the gap is too great the cut-out will not function at all. Ordinarily the gap between the points when open should be from 1/64 to 1/32 of an inch.

If the gap is correct and the points will not close, it may be that the tension spring is too strong. The tension is relieved by bending the anchor upward or on the other type by pressing down on the spring. The cut-out should be so adjusted that it will cut in at between 7 and 9 volts; the engine being gradually accelerated, and it should cut out before the hand on the ammeter goes below 4 amperes discharge; the engine being gradually retarded. If it is impossible to obtain the above adjustment the trouble probably lies in the coil or magnet and the cut-out should be replaced with a new one.

Open Circuits in the Series Coil

An open circuit in the series coil is detected by holding the points together while the cut-out is in place on the generator. If the engine is not running, the ammeter should show 18 to 20 amperes discharge until they are pulled apart or the cut-out is removed. It is important to do this as soon as the test has been made to prevent the battery discharging. If no discharge is registered the coil is open. If the opening occurs at either end of the coil, the ends may be tacked down with a little solder. If the opening is at other than these points, the cut-out must be replaced with a new one.

Short Circuit in the Series Coil

If the series coil is short circuited the hand of the ammeter will remain at 0, or will jump back and forth as it would if the commutator were dirty or the brushes not seated properly. This condition will be accompanied by arcing at the points. With the engine running at a fair rate of speed hold the points closed and see if the meter reading is steady, indicating that the generator is OK. If it is the coils that are shorted, the cut-out should be replaced with a new one.

Meter Reads Discharge After the Engine Has Stopped

This condition is caused by:

1. Ground in the series coil.
2. Points remaining closed.
3. Points sticking.
4. Keeper remaining down.

Ground Circuit in the Series Coil

A ground in the series coil may be detected by the ammeter showing a discharge when the points are open. Examine the leads to see that they are not touching the base, yoke or cover. If they are, move them away and cover any bare spots with shellac. Replace the cover and repeat the test. On the black covered cut-out a ground may occur by the cover being forced down too far as shown in Figure 8 A. It should be so placed that the fibre boss fits into the opening in the cover as shown in Figure 8B.

Grounds also occur where the fibre insulation between the battery terminal base or cover permits the terminal, its screw or rivet to touch the base or cover. It is sometimes possible to correct this condition by moving the terminal a little or installing a new fish plate.

Points Remain Closed

The points may remain closed

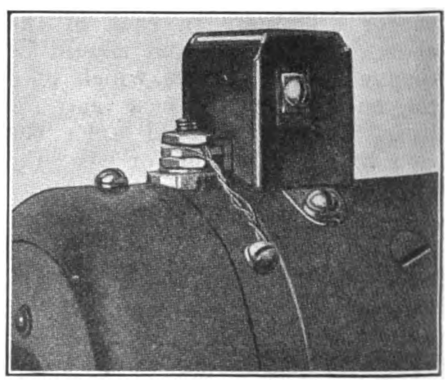


Fig. 7. THE MANNER OF GROUNDING THE GENERATOR

either because the points are sticking due to a fused or pitted condition or the keeper may not be moving away due to a weak tension spring or its touching the core and yoke. This condition is indicated by a discharge when the engine is running slowly or stopped, the meter reading a normal change

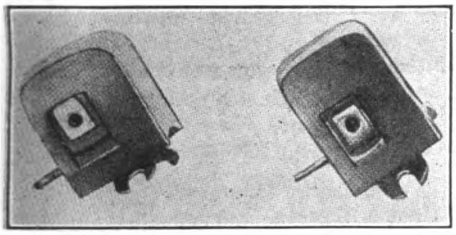


Fig. 8. A & B. THE FIGURE TO THE LEFT SHOWS HOW THE CUT-OUT IS GROUNDED BY FORCING THE COVER DOWN TOO FAR

when the engine is running at a fair rate of speed.

First remove the cover and examine the points to see that they are not sticking or that they are not pitted. If they are badly fused together the cut-out should be replaced with a new one. If the points are not too badly pitted, they may be dressed down with a piece of fine sand paper or a coil unit point file. The cut-out should then be readjusted as has been previously explained.

Generator Tests

The following tests and determinations may be made with one of the ammeters which are sold as standard equipment with the Ford starting and lighting system. The standard 6 volt battery, preferably one which has been in use is used and the connections are made as shown in Figure 9.

The correct reading is from 2 to 4 amperes, the generator running at a slow, steady speed, and with no arcing at the brushes. A heavy discharge, the hands going beyond the limits of the instrument indicates trouble in the head, such as a third brush not seated, fields open probably at the third brush or ground connection, third or positive brush holder or pig tail shorted. To prove an open field, raise the third brush and connect A to it. If open no reading will be shown on the ammeter.

No reading on the ammeter indicates dirty commutator or brushes not seated one is due to the brushes sticking in the holders, worn too short to make proper contact or spring out of shape so that it presses against the holder. Ammeter fluctuating between 18 and 20 indicates short circuit in the armature. Ammeter reading 6 with a higher RPM indicates a shorted field. If the ammeter is normal but there is a decided flash at one point on the commutator, an open armature is indicated. Turn the armature over by hand, one segement at a time; if there is a point where the armature will not start to rotate, that coil is open.

WHEN HANDLING GASOLINE

We wish it were possible to bring about, in some way, a more general appreciation of the hazards that are involved in the handling of gasoline, and to cause every person who uses it to exercise the utmost care when doing so. We cannot estimate the amount of suffering or the number of deaths caused by the improper handling of gasoline, but we know that the total is large, because nearly every daily newspaper contains one or more accounts of accidents resulting from the careless use of this exceedingly flammable and dangerously explosive liquid.

These remarks are inspired by a recent unusual case which resulted fatally, and which can only be ascribed to thoughtlessness because there is no evidence to indicate that there was any harmful intent on the part of the person who was the immediate cause of the accident. Neither can ignorance be pleaded, because the responsible person is a man of intelligence,—a police officer,—who, it seems to us, could not fail to know of the dangerous properties of gasoline.

The story of the distressing affair is as follows: A policeman was sent to a store to procure five gallons of oil for use in connection with various machines used by the police department, and waited in the workshop at the store while the oil was being drawn. A young man in the shop was working on a motorcycle, and accidentally overturned a basin of gasoline on his trousers. He feared that the gasoline would blister his skin, and endeavored to dry his clothes. It is said that the policeman told him, apparently in a joking manner, to "burn it off," and at the same time lighted a match. Somehow or other the young man's clothing became ignited, and he was almost immediately enveloped in flames. The policeman made frantic efforts to extinguish the fire, and someone else threw water over the victim. At length a blanket was procured and was used for smothering the fire. The boy was taken to a hospital in the police ambulance, and every effort was made to save his life. This was found to be impossible, however, and he died a few hours later.

This is only one item in a long list of cases in which death or serious injury has resulted from attempted practical jokes. "Blowing-up" persons with compressed air has frequently caused death. Innocent-looking, charged electric wires have been left about for unsuspecting persons to grasp, with the intention of "having sport" with fellow workmen,—but unforeseen circumstances or conditions have changed the fun into funerals. "Goosing," and rough horseplay of other kinds, cause many deaths every year.

"Think before you act" is a good motto for everybody, and particularly for those who have a fondness for alleged "practical jokes." Many lives would be saved if this motto were universally followed, and many a person would be spared a lifetime of remorse resulting from the unexpected outcome of a thoughtless act.

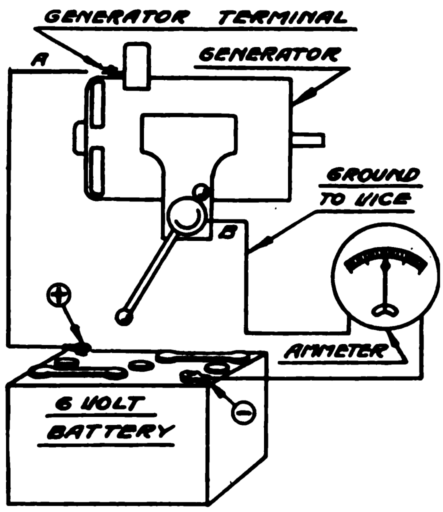


Fig. 9. A SIMPLE TEST FOR THE GENERATOR WHICH REQUIRES NO SPECIAL EQUIPMENT

For a thorough job of brazing, immerse the work in a saturated solution of borax and hot water. While heating, apply powdered borax freely.

25% of all accidents in industrial plants are caused by poor light.

Glossary of Terms Used in the Automobile Leaf Spring Industry

Alinement-Alignment. The means of keeping the leaves of a spring from moving transversely. This is accomplished in one of several ways, notably, by use of lips on side of each plate, by ribs, slot and bead, saw and bead and partly by rebound clips or beetle rivets. The last method is not common.

Alloy Steel. Any steel which owes its properties chiefly to the presence of an element, or several elements, other than carbon.

Amplitude. The arc traversed by an oscillating body.

Anneal. Heating a piece of steel to a low red heat and cooling it slowly. This reheating also relieves stresses in the metal, and breaks up the coarse structure and brittleness.

Anti-fatigue. A term applied to a material, as steel, which will withstand a large number of applications of load without destruction. Such steel is said to possess great **Dynamic Resistance.** The term is comparative.

Applied Load. The application of a load, continuously, or in steps, but without releasing of such load at any time during the test; dimensions measured under conditions are known as "applied load test" dimensions.

Arch. A distance measured on a semi-elliptic spring from a line drawn through the center of the spring eyes to the top of the master leaf, or to the bottom of the short plate. The height of the arc from the chord. The term **Set** has been used in an analogous way to indicate the distance measured to the **Top** of the master leaf. This term **(Set)** is now used, however, to express a distance measured between successive plates of a spring when they are free and not bolted or clamped, but with their points just contacting each neighboring plate.

Synonyms—Camber, compass, height, opening, in dimension, out dimension.

The opening of a spring and the **In Dimension** refer to the height of a semi-elliptic, measured from a line drawn through the spring eyes to the top of the master leaf.

The **Out Dimension** is the height measured from a line passing through the center of spring eyes to the outside of the short plate on the spring.

Auxiliary Spring. A separate spring, although sometimes combined with the regular spring, and so disposed as to come into action automatically when a certain predetermined load has caused the main springs to deflect. The auxiliary springs may be either of the plate, or coil type. They may also be composed of a single leaf, a plurality of leaves or, commonly, of a semi-elliptic spring having plain ends; they are frequently used on heavy vehicles. When such springs are used to prevent large deflections of the main springs of heavy vehicles, they are called **Bumper Springs.**

Synonyms—Buffer springs, jack springs, helper springs, check springs, overload springs, supplementary springs. The last term has recently come into use, being more frequently applied to a coil or spiral spring designed to act with and increase the deflection of the total suspension.

Back. The main plate or longest plate of a spring, which most frequently has its ends turned over on itself, making the eyes.

Synonymns—Master leaf, main plate.

Band. A ribbon of steel, usually from 3/8" to 1/2" thick, formed into a hollow box section, having the ends welded. It is shrunk on the spring to keep the plates together and forms a flat seat for the spring; only used on very heavy springs. The portion of the band which rests on the spring seat is called the **Butt,** or **Head** of the band, while the upper is called the **Strap** of the band.

Barrel-Shackle or (Shackel). A swiveling, or universalling type of shackle, used to connect the transverse spring to the side springs of a three-quarter platform suspension; also used to connect any two springs lying at 90° to each other and in in different planes.

Bead. An indention in the leaf of a spring which raises a portion of the metal on one side and depresses it on the other. The successive beads usually "nest" in one another and are used in place of the center bolt to prevent transverse motion of the spring and the separate leaves relative to the axle; also used in saw and bead construction for alignment.

Synonyms—Nib, teat, projections, dowels, depressions.

Beetle Rivets. A special form of rivet used to rigidly connect the master leaf and long plate, in a transverse direction, but free to slide in a longitudinal one.

Berlin Head. A head forged on or welded to the end of the master leaf in such a manner that a line drawn through the center of the head passes through and coincides with the center thickness of the master leaf.

Synonym—English head.

Berlin Eye. An eye of a spring plate so formed that a line passing through the center of thickness of the master leaf passes through the center of the eye.

Black Finish. When the more flocculent scale is removed by any one of several methods, there still remains a darkened oxidized surface on the plates, hence the term. Heavy springs are usually finished in this manner.

Body Springs. A term used to describe the long semi-elliptic springs extending from front to rear axle and supporting the body and mechanism. The term is now used by some in a more general sense to describe the plate springs used to suspend the chassis, hence they are sometimes also called **Chassis Springs.**

Synonym—Side springs.

Bolt. The word is seldom used alone, but is compounded with such terms as: **Center,** meaning that such bolts are used to clamp the leaves together; **End,** when used in the eye of the spring; **Shackle,** when placed through shackle and eyes; **Eye, Spring, Oil Cup, Grease Cup, Self-lubricating.** The last terms are applied to a shackle, or eye, bolt having a grease cup and cap at one end to feed either grease or other lubricant to the spring bushings.

Bolted Rebound Clip. A clip, bolted and riveted to a spring and used to prevent the plates from parting with each other when the load is suddenly removed from the spring; for example, as in a violent rebound. The clips are, usually, riveted to one plate and their free ends are connected by a bolt and nut. When a tube of brass or steel is placed over the bolt in a manner so as to act as a spacer to prevent the clip stock from pinching the sides of the plates this tube is specified by adding to the above term "and tube."

Box Eye. An eye formed on the end of a plate spring producing an opening which is substantially rectangular in shape.
Synonyms—Loop end, box end.

Box Clip. A U shaped piece of steel having its free ends threaded; used to clamp the spring to its seat; usually made of very low carbon steel, but should be made of nickel steel.
Synonyms—Saddle clips, spring clip, seat clip.

Bright Finish. When spring plates are ground so as to leave the surface bright and without scale.

Buffer Spring, (See Auxiliary.) The term buffer is also distorted sometimes to the word "bumper." The word bumper when used alone refers to a rubber cushioning device used to prevent the striking of such adjacent parts as frame and axles.

Bushing. A hollow cylinder of metal made of steel or bronze and used to line the eye of a spring to prevent wear on the bolt and eye.
Synonyms—Sleeve, tube, lining.

Butt End.—See Band.

Butt of Spring.—The thickest portion of the spring; the central portion of a spring where the leaves have not been thinned down by tapering or drawing.

Button Head. A head forged on the end of the master leaf and circular in section. The upper surface of the master leaf is tangent to the outer portion of the head.

Camber. See Arch.

Cantilever Spring. Another name for a quarter elliptic spring. when the thickest portion or butt is fixed to a bracket it is called **a fixed cantilever spring;** when the spring is a semi-elliptic spring and so arranged that the center, or butt portion, is allowed to swing on the frame or a bracket on the car and one end is shackled or otherwise attached to the frame while the free end is on the axle, then the spring is called a **Floating Cantilever Spring.** When one end of a spring has a scroll end, but in other respects complies with the general description of the floating cantilever spring it is then called a **Floating Cantilever Scroll Spring.**

Capacity. The number of pounds required to deflect a spring, or combination of springs, one inch.
Synonyms—Stiffness, scale.
The word capacity had been used to indicate the total load a spring, or system of springs, can carry safely without taking a set. In this sense it is but rarely used in the automobile spring industry. In the railroad leaf spring industry the term capacity is used to designate the load the springs are designed to carry.

Cee Spring. Used in England to denote a scroll spring. The name C spring is still used in the horse-drawn vehicle spring industry to describe a large multiple plate scroll closely resembling the letter "C." The true C spring has been used by some foreign automobile makers for town car suspensions and electric pleasure vehicles.

Center Bolt. A bolt used to clamp the leaves of a spring at the butt of the spring.

Check Springs. See Auxiliary.

Clearance. The vertical height between the two most adjacent members in a car when loaded which are liable to strike each other. A dimension effecting the design of springs with reference to their flexibility and deflection.
Colloquialism—Jam space.

Clevis Shackle. A link which is approximately U shaped and so arranged that a pin or bolt can be placed through the free ends connecting the spring thereto. The lower end of the shackle is attached to the vehicle by means of another bolt. A **Loose Clevis Shackle, or** universal shackle, is used in large three-quarter platform springs to join the sides and transverse member.

Clip Rivet. A rivet used to firmly connect the rebound clips to the tapered end of the plates.

Compass. See Arch.

Concave Steel. The cross section of spring plate steel is not rectangular, but is slightly concave at the middle; the section is rolled concave, hence the name. In the earlier days of the spring industry the plates were made by hammering and this operation of concaving the steel was called "middling," and the steel was said to have been "middled."

Constant. A dimension in a three-quarter elliptic spring measured from the center of the end eye of the lower half elliptic to the under portion of the master leaf of the quarter elliptic. A term applied by Mr. William H. Tuthill.

Cross Spring. The semi-elliptic spring of a platform suspension which connects the rear ends of the side springs.

Curvature. A term applied to the shape of a spring and describing its approach to circular shape.

Dead. When any two or more leaves of a spring placed together and not clamped are found to contact along their entire length they are said to be dead. (See Nip.)

Dead Load. A load resting on a spring which does not change with time or use. The weight of the body, chassis and equipment produce the dead load resting on the springs.
Synonym—Static Load.

Deflection. The distance a given point on a spring moves away from another and fixed point on same; usually, the perpendicular distance traversed by a point in the center of the eye relative to a fixed point at the top of the master leaf. A displacement of one part with reference to another. A distortion.
Synonyms—Travel, Bending.

Dimension. Specific lengths, widths and thickness or heights of a spring.

Distortion. Generally applied to the effect produced by the unintentional displacement of the plane of plate, as, for example, in the heat treatment of spring steel when the plates may warp. Unintentional deflections produced by extraneous forces.

Double Scroll. When a scroll is formed at each end of a plate as in a double scroll full elliptic spring. A **French Double Scroll** is a full elliptic having a single scroll on each spring element.

Double Sweep. A reversal of curvature in a spring usually near the ends or eyes. Contra-curvature.

Synonyms—Reverse Sweep, Reverse Curvature, Double Compass (English).

Dowels. Sometimes applied to a beaded leaf. (More recent usage.) A doweled spring is one whose short plate is so designed that it has a pin or dowel riveted through a hole made for the purpose and into which doweled and countersunk head the next beaded plate is inserted.

Draw. The operation of tapering the leaves of a spring to produce points.

Synonyms—Taper, Scarf, Point. When used with reference to treatments the word draw is synonymous with **Tempering** or **Drawing Down.**

Drawn Eye. An eye of a plate spring the leaf of which before being rolled into an eye has been tapered. This is sometimes resorted to in order to maintain an overall diameter to a specified dimension.

Drilled Eye. An eye of a spring whose internal diameter has been finished by drilling to specified size.

Drop. The vertical distance which one end of a spring is lower than the other. Front springs generally have a drop.

Ear. A term used, though not extensively, to describe the eye of a spring.

Egg Shape. Applied to describe the shape of the points of leaves.

Elastic. The property possessed by most materials of returning to their original form after they have been subjected to a deformation.

Elastic Limit. When a load is applied to a substance a deformation, or strain, results; within certain limits, the resulting strain is directly proportional to the stress; the point at which this proportionality ceases is called the elastic limit. When the elastic limit is exceeded the material does not return to its original dimensions and is said to have taken a permanent set.

Elastic Elongation. The elongation of a material, within the elastic limit, due to stresses operating within that limit. For good steels the elastic elongation may go as high as 75/10,000 of their length. (See Modulus of Elasticity).

Elastic Shackle. A term more commonly used by French writers, applying to any highly flexible medium interposed between two elements of a spring and taking the place of the rigid links or shackles.

Synonym — Supplementary Springs.

Element. In chemistry, used to denote a material which cannot be reduced to a simpler form—such as Gold, Silver, Carbon, Silcon, etc. In spring manufacture it is applied to a portion of a spring system which is in itself a completed unit; thus, a three-quarter elliptic spring contains two elements composing the spring, the semi-elliptic element and the quarter elliptic element. In a three-quarter platform we have three elements, the two side elements, and the transverse, or cross element.

Elliptic. A term applied to a spring having the general shape of an ellipse. The word elliptic refers in general to a full elliptic spring. The modifications are usually designated as follows: **Full Elliptic, Semi-Elliptic,** or **Half Elliptic, etc.**

Scroll Elliptic. An elliptic spring having a scroll at one end, this may be a three-quarter or a full elliptic type, single or double scroll type, quarter elliptic, or any other variety to suit specific cases.

End. The eye or other portion most remote from the center or butt of the spring. When the end having the eye is referred to it is designated as the eye end; also, when a spring is offset or eccentrated we have two ends, known as **long end** and **short end** or, when referring to their relation with reference to the car, or vehicle, we speak of them as **front end** and **rear end.** The eye end is sometimes spoken of as the **pin end;** this term is becoming obsolete in the automobile spring industry. When the end of a spring is flat and has no eye or, is very slightly curved, the curvature being reversed from the general direction of curvature of the main plate, the end is then called a **plain end.** If the reversed curature is very pronounced and has no eye it is called a curved plain end; and when, as is sometimes the case, the eye of a spring may be drilled and tapped for a grease cup, it is called the **tapped end.** When the master leaf is rolled so as to leave a substantially rectangular opening or eye, it is called a **loop end** or **box end.** The leaves may, for one reason or other, be tapered at the end; we then have a **tapered end.** There are other designations for ends, but they are so numerous and but little used that they are left out of consideration here.

Endurance. Applied in the usual lay sense to materials that withstand considerable use before destruction.

English Eye. See Berlin Eye.

Eccentrate. Eccentric, not central. A spring whose center bolt, or butt center is not in the geometric center of length of the spring; this term is best suited to describe this condition and we urgently request its use instead of the present.

Synonyms—Offset, Out of Center.

Eyes. An annular hole in the master leaf of a spring made by rolling the leaf back on itself. A pin or shackle bolt is used to connect the spring through the eye to its attached member on the car.

The eye of a spring may be turned "**up**" or "**down**" or it may partake of the nature of both and is then called a "**Berlin**" **Eye,** or an "**English**" **Eye.** When eyes are finished by having a bushing inserted, we have a "**Bushed**" **Eye. Reamed, Drilled, Solid, Welded** are explanatory or each type.

When the outermost portion of the spring eye is "**finished**" to an "exact" width we have a "**Milled**" **Eye.** Then we have a **Swedged, Wrapped, Forged Rolled** and **Taper Rolled Eye.**

Filister Head. Refers to shape of the head of the center bolt clamping the spring leaves.

Finish. Used in conjunction with other words describing the surface or method used to clean the plates of flocculent scale. Thus we have, **Bright Finish,**

Half Bright, Black, Grindstone, Polished Top, Buff, etc.

Flash. Many spring makers to-day and, especially those of old, practised a method of annealing the spring plates by inserting them in an oven and waiting until their greasy surface became hot enough to flash off the oil hence, the term applies to an ancient practice which has been superseded by pyrometers and more exact methods. "Flashed Springs" are still common.

Flat Top. The portion of a quarter elliptic spring element whose length is flat to permit of its being clamped to a flat seat or bracket. The amount of flat top (length) is of great importance to the spring designer and the car constructor. Should be specified on drawings.

Flexibility. The deflection of a spring in inches per 100 pound load placed at its "center." For quarter elliptic springs it is the deflection in inches per 50 pounds placed at the eye end of the element. In three-quarter platform springs, the flexibility is the deflection, in inches per 200 pounds, placed on the entire system.

Floating Cantilever. See Cantilever.

Floating Upper Elliptic. Another term for a floating cantilever spring when used in conjunction with a semi-elliptic element at the bottom.

Floating Upper Scroll Elliptic. The same as a floating upper elliptic, except that one end has a scroll.

Forged Eyes. See Eyes.

Fracture. A noun used to desinate the broken ends of a piece of material. The physical aspects of a fracture are usually stated thus: Crystalline, Granular, Radial, etc.

Front End. See End.

Grading. Making the thicknesses of steel used in a spring element variable. The more graded the spring the better, but there are limits.

Grasshopper. A term nearly obsolete, used to describe a semi-elliptic spring.

Grindstone Finish. A colloquialism used by a few spring manufacters. (See Finish.)

Half Bright. The "finish" of the spring leaves. (See Finish.)

Half Elliptic. See Elliptic.

Hanger. A misnomer for shackle—more often used to describe the brackets or appliances used to connect the shackle with chassis.

Head. The head of a spring is usually a wrought iron forging having a variety of shapes which are forged, or welded, to the master leaf. (See Berlin Head, etc.)

Heat Treatment. A process, or several processes, of subjecting the materials used in making springs to definite temperatures or, otherwise acting on these materials through heating and cooling to refine and improve their strength and endurance; essentially, a careful and precise heating and cooling process subject to many alterations that endows any given material with the best dynamic properties. The older spring makers knew little of the scientific aspects of heat treatment.

Height. See Camber, Arch, etc.

Helical Spring. A helical spring is one which is wound on a cylindrical surface and the separate turns advance like the thread of a screw. These springs may be made of either square, round, rectangular or, indeed, any special section of bar.

Helper. See Auxiliary.

In to Out (Dimension). The upper surface of the master leaf is known as the inner and the lower surface of the short plate is known as the outer surface of a spring. In a three-quarter elliptic, where the master leaf in the quarter element is set on a perch, or pad, and the half elliptic has its short plate on a perch it is essential that the combined heights of springs be given "from pad to pad." This gives the "in to out" dimension of the spring. It is never used as descriptive of a dimension of a single spring, but always applies to a combination of elementary portions. (See Text.)

In Dimension. See Camber or Height. The Height measured vertically from center of eyes (or from the end of plain end spring) to top of master leaf.

Inertia. The inherent property possessed by a substance of resisting change of state. That is, if at rest, it tends to continue at rest and when in motion it tends to a continuation of this state, unless other forces compel alteration of this state.

Isochronous. To swing over different lengths of arcs in equal times; to travel over unequal lengths in equal times.

Jack Spring. See Auxiliary. The term Jack without the apellation (of the term spring) was used formerly to describe a small windlass, or apparatus, used to change the height of a body on horse-drawn vehicles.

Jam Space. A colloquialism meaning the same as Clearance, which see.

Laminated. In the early history of the carriage and railroad spring industry the springs were always designated as Laminated Springs; the term is still used in place of leaf. It has no other meaning than that of ordinary usage which designates a thin plate or sheet.

Lap. The distance that one plate in a spring extends over another plate at either end; it is the length of this extension.

Lapped End. When the end of a leaf, usually the master leaf, is sharply bent back on itself to form a bearing surface, it is then called a **Lapped End.** In England it is called a **Slape End.**

Leaf Spring. A spring composed of a plurality of thin sections of materials in the form of narrow and comparatively long plates, or sheets, usually of steel.

Leaves. The separate plate comprising a leaf spring.

Left Hand Spring. A spring placed on the left hand side of a vehicle; this may be either front or rear and is so designated.

Length. The length of a spring is understood to be the projected length measured between the centers of the eyes of the spring; in a semi-elliptic spring it is the chord of the arc; that is sometimes also called the **projected length.** The actual length of the arc is called the **developed length** or, in shop parlance, owing to it being a length that the plates must be cut to, it is known as the **cutting length.** The cutting length is the actual length of the plates.

(To be continued)

The Qualities and Applications of Files

Some of the Practical Points about Files which make all the difference to their successful use

MARK MEREDITH

THE old-time fitter's test of filling up a 1 in. cube of metal, all the faces of which require to be true planes, all angles absolutely 90 deg., all relating dimensions in perfect agreement, is to-day as much a criterion of expert fitness as ever it was. But although this test has lost much of its importance as a qualifying factor of a mechanic's all-round skill, owing chiefly to the development of machine tool practice, the file still holds premier position among hand-operated tools.

It is however, a little known fact that to-day most so called "flat" files are not really flat, but slightly convex; the reason for which it may not be amiss to explain. Ninety per cent. of the uses to which a file is put is to produce a perfectly flat surface, the width of which seldom exceeds from one-sixth to one-eighth the effective length of the file. This being so it it might very reasonably be thought that a file should possess a perfectly true and straight surface. But facts are against this. It is now held by file makers, and supported by experienced file users, that all "flat" files should have a certain amount of face convexity, because then if permitted a greater control of the file from point to heel; it presents fewer cutting points to the work, with a given downward pressure, than does the straight-faced file"; hence its bite is correspondingly increased, and truer, quicker and better results are obtained.

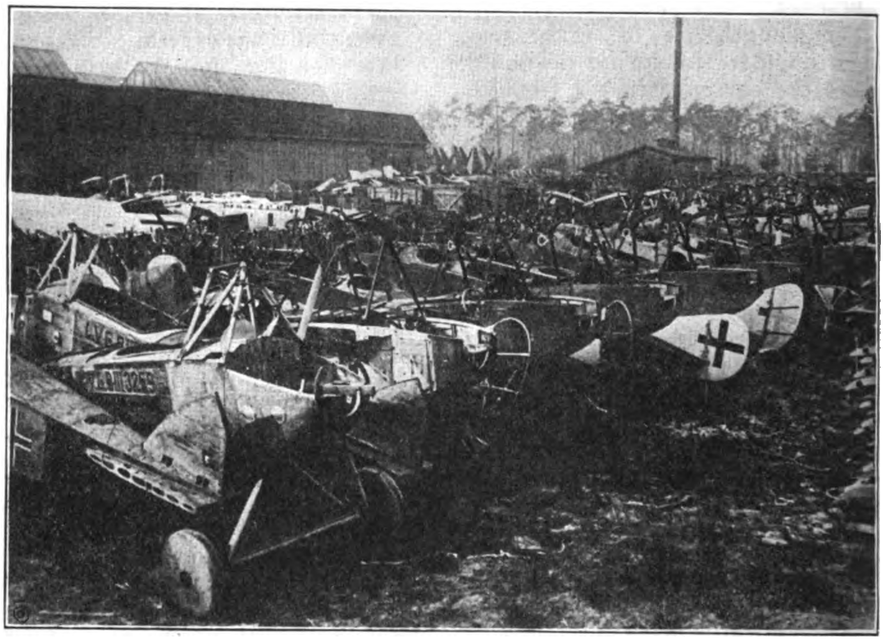
Take, for instance example, the application of a file on broad work, such as steam engine valves, wide bearing caps, tables presses, stereotype plates, and so on, the balance of suitable would seriously limit the usefullness of a file when it is desired to operate on a centrally situated high place, as indicated by straight-edge surface plate.

More files are probably, discarded as a result of these than because of honest wear. Whenever possible it is better to "break a file on gunmetal, copper, or brass, before putting it to work on mild steel or cast iron. A new rough, or bastard, file should never, if it can be helped, be put direct upon tool steel. The reason for this is that the succession of tiny, almost dead-hard teeth of a file are, when new, too keen to withstand the ordinary thrust imposed upon it; the extreme sharpness inducing a digging-in effect, which tends to sever the points. Its preliminary use on the softer metals dulls slightly the sharpness of these keen points, without actually detracting from their shearing qualities when subsequently used on the harder range of metals.

If, however a new file must be put straight on, say, tool steel an excellent plan to adopt in order to preserve the teeth is the old practice of "letting it down". This is done by dipping the file into vegatable oil, letting it drain, then passing it backwards and forwards in a horizontal position through an open, clear fire, until the oil ignites, then immediately quenching of the cold water.

Files that are wholly to be used on brass, or indeed for any of the non-ferrous order of metals, are usuall differently cut from those that are employed on iron and steel, the teeth being given a rake and angle more suitable material. When filing very narrow surfaces, new files, particularly those that are double cut, are very liable to have their teeth sheared off, as the strain comes wholly upon a few teeth, hence it is better to employ a broken-in file for this purpose. Neither is it advisable to put a new file direct upon an unmachined cast-iron surface. The hard skin and burnt-in sand should first be removed by grinding, that unless the castings have been pickled; but even then a half-worn-out file should be first employed to get down to clean metal.

THE GRAVEYARD OF GERMANY'S AIR FLEET



Thousands of German War Planes are being destroyed at Johannisthal in accordance with the terms of the Peace Treaty. The photo shows some of the machines from which the motors have been removed.

Oil may be used on a file to good advantage when engaged upon narrow, fibrous metals of a tough nature. Or in the finishing of wrought iron or steel a little oil applied to the face of the file, then a rub down with a lump of chalk, will assist materially in producing a fine finish, and reduce the tendency to pin and scratch.

In a general way the types of file in common use are the bastard, the second-cut, and the smooth file, the distinguishing point about them being not so much in shape or length or thickness, but in degrees of tooth formation and tooth coarseness. Thus the first named is, more or less, a general service file, being used upon the coarser, heavier classes of work and when a fair amount of metal needs to be removed.

The second cut file is rather differently cut than a bastard. The first cutting is not very deeply indented, the second, or cross-cutting, is, however, much heavier, and slightly coarser, with the result that a much better cutting action is given it. While a second-cut file is not usually considered to be so free cutting as a bastard, many users prefer using the former, contending that as much work can actually be accomplished by it as with a bastard with less muscular exertion.

The smooth file is essentially a finishing tool, used only for imparting to the work a smooth surface, to remove the marks left from previous filing, or for polishing rotating work in the lathe. Very little pressure should be brought to bear on the smooth file, and it should not be put direct on rough surfaces; the reason for this is apparent. This class of file may have anything from 60 to 120 teeth to the inch, and not very deeply cut, therefore if used on rough surfaces, or otherwise mishandled the teeth, will in all probability be ripped out, and the file will be ruined.

A thoroughly good made file is always the most profitable investment. Don't expect to get as effective service from a cheap file as from a more costly article; the secret of good service is best quality steel and careful cutting. Don't expect a workman to do special jobs with ordinary files; generally there is a special made and obtainable for every special job. Failure in this respect often brings down unjust condemnation upon the file or the file maker. Don't fit a good file with an illshaped or badly fitting handle. Fit the tang of the file well into it, not at any angle, but in a true axial line with the file. If necessary drill the handle down and burn the hole out with the tang of an old file similar in shape and size.

TO REPAIR BROKEN INSULATION

Very often the insulation on ignition wires gets broken and peels off, leaving the wires bare in certain spots. Usually such wires are patched with tape, but many times this does not want to stick, and if the exposed places cannot be covered in some other way the wires are useless. Removing the wires and putting in new ones is frequently inconvenient, and usually unnecessary, for most wires can be patched in the following manner. Take a thread long enough to cover the spot, dip it in shellac, and wind tightly around the exposed wire. The thread should not be too fine, and should be wound layer on layer till the repair is a little thicker than the insulation. See that the thread joins the insulation closely so there will be no openings to the wire, and after the patch has dried for a few minutes, cover it with a coat of shellac. This will serve as an outside protection, and will make the patch both oil-tight and water-tight. A repair made as described will give entire satisfaction for a long time.

Charles Olive.

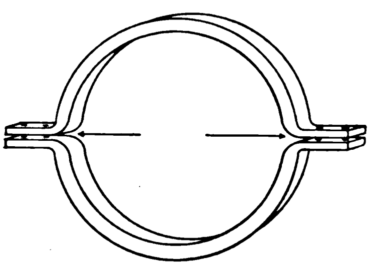


Fig. 1. REPAIR BANDS MADE IN THIS MANNER FOR CRACKED PIPES USUALLY LEAK AT THE JOINTS

REPAIR BANDS FOR CRACKED PIPES

Like everything else there is a right and wrong way of making the simple straps or bands that are used in repairing cracked pipes, cylinders or any round object. Very often the best results are not obtained because the part is not made correctly. Figure 1 shows how these straps are usually made. It will be observed that the corners are not square and do not meet properly. Figure 2 shows a much better design. The corners meet squarely and the whole arrangement conforms to the pipe better, particularly at the joints. The sketch at the bottom of Figure 2 shows the flat pattern of the stock to be used. The stock should be worked out, as shown in the drawing and care should be taken to get the corners square before bending the stock to its semi-circular shape.

Arthur R. Jones, U. S. N.

SLITS AND CRACKS IN TIRES ARE SIGNS OF OLD AGE

When numerous small slits and cracks appear in a tire, it is a sign of the approach of old age. A strange thing about auto casings in this respect in their similarity to men and women. While they don't get grey haired, they do become wrinkled and cracked, often chalky white in appearance.

The fabric in an old tire gradually becomes brittle and hard so that it breaks. Like the bones of old people, it is difficult to knit. The tire surgeon's work increases in difficulty with the age of the casing.

Like individuals, those whose strength is conserved do not so readily show their age. The best way to preserve their usefulness is to take care of them.

To hide the effects of age and wear, motorists frequently "doll them up," painting the side walls and washing with cleaning solutions. Others pay no attention to their appearance and permit them to go shabby.

USE CURRENT SPARINGLY IN WINTER

Do not connect additional apparatus, such as electrical horns, cigar lighter, etc., to the system without taking the matter up with the factory. The surplus capacity of the system is large but there is a limit to the amount of current which the generator can produce. Use the the same judgment and reason in the operation of the electric lights on a car as you do those in your home or garage. When a car is running it is not necessary to burn all the lights, the two heads and the tail are all that are required or that are of any service. When the car is standing at night, use the side and tail lights only.

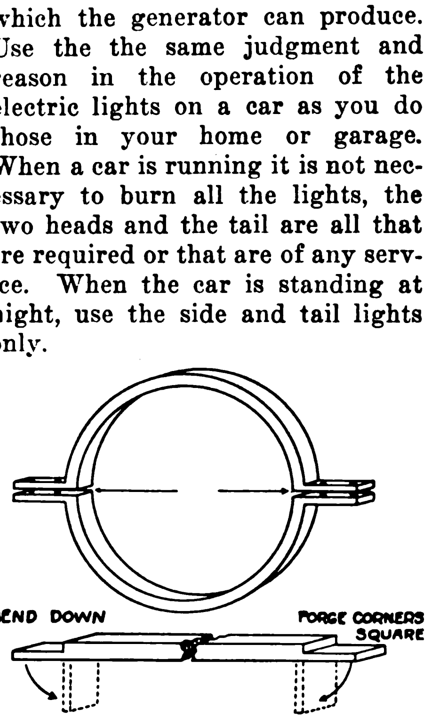


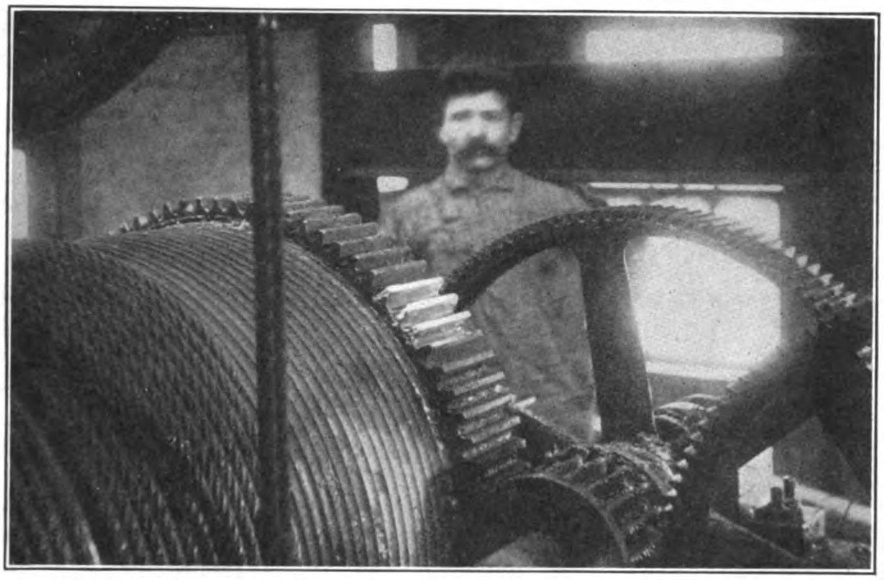
Fig. 2. PROPERLY MADE BANDS ARE SQUARE AT THE CORNER. THE LOWER DRAWING SHOWS THE FLAT PATTERN

OXY-ACETYLENE ENDS TIE-UP IN NEW YORK GARAGE

Due to a break recently in the drum gears of a large elevator, the cars on the upper floor of a five story New York garage were marooned from Saturday afternoon until Tuesday noon. The break occurred at an hour when the floors were partially emptied, and suspension of elevator operation not only tied up the cars above but so crowded the ground floor that dozens of motor cars had to be parked on the street at night.

Not until it was found that replacement of the broken gears would be impracticable, owing both to delay and excessive cost, was an oxy-acetylene welder called in. An outfit was set up and work started at 1. P. M. Monday. The welds were completed by 8. P. M. the same day and were left to cool overnight. By noon Tuesday the teeth were finished off with a file and the elevator was at once put back into service, releasing 115 cars that had been tied up since the preceding Saturday afternoon.

The cost of the repair was nominal compared to the price of a new drum, which would have cost $600.00, and the time was as nothing to six months delivery, which was the best the factory would guarantee. Still, for one memorable Sunday some of Gotham's most enthusiastic motorists were given a taste of what Blue Laws in Manhattan would mean to them.



Drum of Elevator Hoist showing Gear Teeth repaired by Oxy-acetylene Welding. The repaired teeth show white in the picture. Broken teeth in the small drive gear were also welded, but they do not show owing to the position of the two gears as meshed when the photograph was taken.

INTERESTING ENGLISH COMMENT OF WELDING

Recent favorable comment on welding by the ENGINEER, England's ultra-conservative engineering journal, are of special interest to American manufacturers at this time, when there is so marked a tendency in this country to adopt this process of jointing structures. The oxy-acetylene industry is much older in Great Britain than here, and it is reassuring to observe that welding applications in England coincide with advanced American practice.

"There can be no doubt about the attractiveness of welding as a means of making joints in most metal structures," says the ENGINEER. "Its advantages are so obvious and appear to be so great. First and foremost is the advantage of cheapness and convenience... Welding can be carried out not only with much less labor, but with much greater speed and convenience than by the old method of making joints, By comparison, riveting, involving as it does, the drilling or punching of holes in accurately determined positions, followed by the insertion of the rivets themselves, is a clumsy and costly operation. From the point of view of the strength of the resulting joint, also, riveting is far from satisfactory. Only by great care in design and construction can a strength approaching as much as 70 per cent. of the original bar be obtained, and in most joints the strength is very much less. Further, there are many cases where broken parts can be rejoined by welding, while riveting is out of the question and other methods are impracticable. It is small wonder, then, that this method of jointing structures by autogenous fusion is finding ever wider and wider application."

INDUSTRIAL GASES, another authoritative English publication, observes: "In welding, more than in most trades, aptitude and experience are required to produce the expert welder...The expert welder must be trained to deal with all sorts and conditions of metal and their welding fluxes. He should be a fair metallurgist and chemist, with some knowledge of the strength of material and the strains liable to be set up in structures through the welding repairs he has to carry out. Above all, he must know how to weld without creating internal strains, or the best way to disperse such strains after the weld has been effected."

American welding engineers will not entirely agree with the English editor in his belief that the expert welder "should be a fair metallurgist and chemist." However desirable a technical knowledge of metallurgy and chemistry of a "fair" order may be in a supervisor of welding, it does not in practice exist as the sine qua non of the expert operator, who may do very well with a general conception of expansion and contraction and methods of preheating, torch manipulation and after cooling or annealing. Expert welders employ various ways of handling the torch, generally adopting styles the operators individually prefer. It is not essential that supervisors of welding be themselves expert in manipulation of the torch in order to competently pass on the quality of welds. In fact, wherever there exists a tendency to impose individual ideas as to particular modes of torch manipulation the results may often prove disappointing. Supervision of welding is very important and is a necessary step to secure better work, but the requisite qualifications of supervisors and welders should not be confused. The supervisor is the officer who directs and inspects; the operator the subordinate who executes. The wise officer will always respect the competent workman's individual slants so long as he produces good welds and will not hamper him with needless interference or demand of his engineering knowledge that would render his own technical education superfluous.

The editor of INDUSTRIAL GASES sees the greatest good to the welding industry in the large number of welding schools that are now teaching the process in England and America, and urges welders to take advantage of instruction courses.

No one can doubt the importance of the welding school as a factor in producing the competent welder, and in this connection it is worthy of observation that manufacturers of equipment in this country were among the first to realize the need for technical as well as manual instruction, as is evidenced by the leading manufacturers of welding apparatus. Some of these have gone a step further in maintaining for the benefit of customers engineering departments that deal with the problems of individual users, in many instances going to expense far in excess of any immediate return that could be expected. Another engineering resource of American users of welding, intended especially to aid manufacturers and industrial engineers in correct applications of welding and in solving difficult or unusual technical problems, is the Development Department of the Linde Air Products Company, the world's largest producers of oxygen.

With these engineering resources at their command, American welders and manufacturers may well feel that they are treading on safe ground in determining where and how oxy-acetylene welding may be advantageously employed.

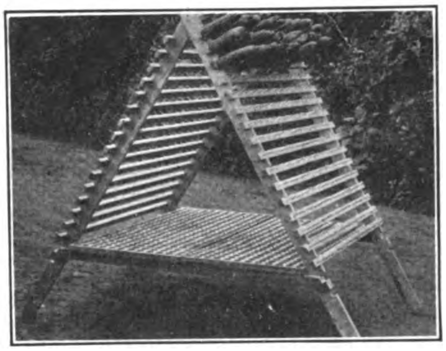
HELPING THE FARMER SOLVE HIS PROBLEMS

The blacksmith finds the farmers often making unique demands upon his mechanical ability. Some labor-saving device on the farm, some new mechanical solution of a familiar farm problem comes to some particular farmer. He has not the knowledge or the skill to make the device himself and so he brings his idea to his time-honored helper, the blacksmith and asks him to put his idea into substantial form.

An Iowa blacksmith recently built the seed corn tester shown in the picture, for a farmer of his vicinity. Many have seen it and declare it the best contrivance they have seen for testing seed corn.

The device not only holds the seed corn but provides for germination on the same frame. The arrangement makes testing almost mistake-proof. The base of the frame is made of sheet iron provided with rows of tiny pockets closely set together. The frame itself which is of wood has rows of nails on the cross pieces as the photograph shows. Each nail is numbered. There are just as many of the pockets as there are of the nails and they are numbered in the same way as the nails.

When the time comes to test the seed corn, the matter is simply and easily handled. The kernels from each ear are placed in the pockets, the corn from ear No. 1 going into Pocket No. 1, two into two and so on. When germination has been accomplished by covering the sheet iron with a wet cloth, the kernels which are good and those which are not demonstrate at once which are the good and which are poor ears. If those in Pocket No. 1 have sprouted, ear No. 1 is known to be all right for planting and is kept. If germination has not taken place ear No. 1 is cast aside.



AN EASILY BUILT SEED CORN TESTER

GARAGE SERVICE AND REPAIR STUNTS FROM CANADA

By Ernest A. Dench

A SAFETY FIST SIGN

The Universal Garage, Medicine Hat, Alta., endeavor to reduce the number of car accidents by a red sign hung over the garage entrance. The sign bears the following warning:

"Safety First—Look out for our cars."

NO MORE LOANING OF GAUGES

Bowman Brothers, Ltd., Saskatoon, Sask., were forced to introduce a firm policy in regard to the loan of gauges on account of the losses arising in this connection. Motorists now wishing free air must get it on the premises, for a card advanced the reasons in a nutshell. The card was placed against a gauge in the show window:

"The management has requested the clerks not to loan gauges. In June we lost six gauges through loaning.

THE AIR IS FREE"

REPAIRS THAT ARE JUSTIFIED

The Tire Service Co., Saskatoon, devoted a trim to tires, in connection with which the following card was placed at the rear:

"Will it pay you to have that tire repaired?

That is part of our service. We are specialists in tire and tube repairing. Let us show you."

THE AUTO HOSPITAL

What catches the eye outside the garage at Smithers, B. C., run by O'Neill and Wall, is the following unique sign:

"SMITHERS HOSPITAL—

Now open—for the sick and the lame motor cars.

Try Drs. O'Neill and Walls' famous prescription."

GETTING MORE BATTERY REPAIR JOBS

Carnahan and McKnight, Verden, Man., realized that many car owners will not bring in their batteries to be repaired because they cannot afford to have their car tied up even for a short time. To induce such motorists to turn over their battery work, they offered to loan a battery free of charge while the other was being repaired.

REBUILT RADIATOR BETTER THAN NEW

The Central Repair Shop, Saskatoon, Sask., placed an auto radiator repaired by them in the window. The card backing up the exhibit was as follows: "Radiators rebuilt by us are better than most new ones."

BUSINESS MEN AND MERCHANT'S INCOME TAX IS AFFECTED BY TREASURY DECISION.

Recent Treasury decisions affect materially returns of income taxes which will be made by business men for the year 1920. Among the more important is the decision in relation to valuations of inventories, in accordance with which a taxpayer may, regardless of his past practice, adopt the basis of "cost or market which ever is lower", for his 1920 inventory. In his return the taxpayer must state that it represents a change from his former basis. Thereafter, changes can be made only after permission is obtained from the Commissioner of Internal Revenue.

In the case of a merchant "cost" means the invoice price less trade or other discounts excepting strictly cash discounts approximating a fair rate of interest, which may be deducted or not at the option of the taxpayers, providing a consistent course is followed. To the net invoice should be added the cost of transportation and other necessary charges incurred in acquiring possession of the goods.

In the case of a manufacturer "cost" means the cost of raw materials, and supplies, expenditures for labor and indirect costs incident to production, including a reasonable proportion of management expenses, but not including any cost of selling or securing return on capital.

"Market" means the current bid price prevailing at the date of the inventory for the particular merchandise. The burden of proof as to the correctness of the price rests upon the taxpayer in each case. Where no open market quotations are available, the taxpayer must use such evidence of a fair market price at the dates nearest the inventory as may be available, such as specific transactions, or compensation paid for cancellation of contracts or purchase commitments. Where, because of abnormal conditions the taxpayer has regularly sold such merchandise at prices lower than the market bid price, the inventory may be valued at such prices. The correctness of the prices will be determined by reference to the actual sales of the taxpayer for a reasonable period before and after the date of inventory. Prices which vary materially from the actual prices so ascertained will not be accepted as reflecting the market. In such instances, the penalties prescribed for filing false and fraudulent returns—a fine of not more than $10,000 or one year's imprisonment or both, together with the cost of prosecution and an added assessment of 50 per cent of the tax—may be asserted.

The value of each item in the inventory may be measured by cost or market, whichever is lower. An entire stock may not be inventoried at cost and also at market price, and the lower of the two inventories used. Inventories on whatever basis taken will be subject to investigation by the Commissioner of Internal Revenue, and the taxpayer must satisfy the Comissioner of the correctness of the prices adopted. He must be prepared to show both the cost and the market price of each article included in the inventory.

Business enterprises for the purposes of the income tax, may be divided into three classes; those engaged in making, those engaged in producing, and those engaged in trading. To these may be added another class which neither produce, make nor trade, but render what may be designated as business services, such as transportation, storage, livery and garage service, in which case the gross income would be the total amount received or earned.

In mercantile accounting the gross profit for a given period is obtained from a group of accounts known as trading accounts, consisting of inventory, purchases, sales, freight, returns, and allowances, and in certain cases discount and freight charges outward. Discount should be charged or credited to the distribution accounts of the business. Freight outward should be considered a selling expense.

There are three elements which enter into the cost of a manufactured product, cost of material, cost of labor, and manufacturing expenses, sometimes called overhead. The first and second elements go to make up the prime cost of manufacturing. Gross income in such business means total sales less the prime cost of goods sold. Treasury regulations provide that in determining gross income subtractions should not be made for depreciation, depletion, selling expenses, or losses, or for items not ordinarily used in computing the cost of goods sold.

The Revenue Act provides for the deduction of business expenses. Among the items to be treated as business expenses are material, labor, supplies and repairs in the case of a manufacturer, while a merchant would include his purchase of goods bought for resale. In either case the amount to be taken as a deduction for the year 1920 should be determined by taking into consideration the inventory at the beginning and end of the year. Other itmes that may be included as business expenses are reasonable compensation for the services of officials and employees, advertising, and other selling expenses, together with insurance premiums against fire, storm, theft, accident or other similar losses, and rental for the use of business property.

A taxpayer may deduct the necessary expenses paid in carrying on his business from his gross income from whatever source. In computing net income upon which the tax is assessed, a deduction for business expense or a disbursement or charge must have certain qualities in order to be allowed. It must relate to a trade, business, profession, or vocation, "carried on" by the taxpayer in which he has invested time and money for the purpose of a livelihood or profit. A business is being carried on by its owner, even though all its activities may be conducted by employees.

The deduction must be a "business expense" and not an "investment of capital". Amounts expended for the erection of new buildings, installation of machinery and the purchase of tools or implements of permanent value do not constitute business expenses, being merely a change in the form of capital and not a reduction of wealth. Expenditure for property which is used up in the course of the year may be deducted as a business expense.

Many representatives of business houses will be benefited by a recent Treasury decision relative to traveling expenses. Reasonable and necessary traveling expenses include railroad fares, and meals and lodging. A traveling man, working on a salary without reimbursement for traveling expenses, or employed on a commission basis with no expense allowance may deduct his expenses for railroad fare, and also his expenses for meals and lodging in an amount in excess of the ordinary cost for such living expenses when at home.

If he receives a salary and is repaid his actual traveling expenses, he must include as gross income an amount equal to the ordinary expenses for meals and lodging when at home, as such amount is held to be additional compensation to the taxpayer.

Numerous errors relative to claims for deductions for losses have been discovered in returns of prior years. To be allowed, deductions for losses must be confined to the following classes: Losses sustained in trade or business; losses sustained in transactions entered into for profit though not connected with a trade or business; losses sustained of property not connected with trade or business if arising from fires, shipwreck, storms, or other casualty, or from theft. To the extent any of the losses are compensated for by insurance or otherwise, they are not deductible.

A common loss of a person engaged in business is the destruction or theft of merchandise. A merchant who uses inventories to ascertain his profit should not make on his books entries for any of his stock in trade that is destroyed or stolen, for the reason that such loss will be reflected in his closing inventory. If his books are kept on a cash basis which properly shows his correct profits, he may deduct specifically the amount of his loss. In either event, if the merchant receives insurance for such losses he must include in his gross income the amount of such insurance.

Loss of cash by burglary or embezzlement may be deducted by an entry debiting profit and loss and crediting cash. The amount of such loss should be reduced by the amount of insurance covering it and by the reasonable value of any claim against the embezzler or his sureties which have an ascertainable value such as a claim against the surety company. A loss incurred through embezzlement is an allowable deduction from gross income only for the year in which the embezzlement occurred.

Bad debts form an important item in the returns of many business men. Claims for such deductions must have certain qualities. The debt must have been charged off within the year in which its worthlessness was discovered; the return must show evidence of the manner in which discovery was made; a statement should be made that the debtor has been discharged in bankruptcy or has disappeared leaving no trace, or that the ordinary means of collection have been exhausted.

Where the creditor continues to extend credit a debt may not be claimed as worthless. A debt may not be charged off or deducted in part, but must be wholly worthless before any part can be deducted, though it may be clearly worth less than the face amount. If a debt is forgiven, it cannot be deducted because it is then regarded as a gift.

The Revenue Act provides in relation to deductions that a reasonable allowance may be made for the exhaustion, wear and tear of business property. This applies to buildings and equipment, such as motor trucks, horses, delivery wagons, or machinery.

Return of individual income if the net income was $5,000 or less must be made on Form 1040A. If the individual net income exceeded $5,000 the return must be made on Form 1040. If the business is

Queries-Answers-Notes

THIS department is the meeting place where you are free to ask for information, answer questions, discuss shop matters and business conditions and any other notes you feel would be of interest to a fellow mechanic. Make use of this Department as often as desired.

Five Horse Hitch:—I am a Washington smith. I came here from Kansas several months ago, and have made good. I would like to join the Washington Blacksmiths Association but do not know where to go.

I wonder if any smiths could give a rough sketch for making a five horse hitch to work five horse abreast and not have to work one of them on the plowing? I would like to get it for the Spring work.

Money matters are rather tight here now, because wheat is our principal crop.

M. R. Hollingsworth,
Waverly, Washington.

Propeller for an Areo-Sled:—I would like to know if an automobile engine would be strong enough to drive a light sleigh by means of a propeller, and about what size propeller to make? I intend to make it out of white ash.

Wm. Robarge, Posen, Michigan.

Editor's Note:—There isn't any reason why an automobile engine equipped with a proper sized propeller should not drive a light sleigh. The writer has seen several such vehicles in operation, and in each case they were driven with seven H. P. motorcycle engines. With the additional power which is available with a larger engine there is no reason why a larger machine could not be built.

The question of designing a suitable sized propeller is by no means a small engineering feat, that is to produce one which will be highly efficient and not merely and overgrown fan, so to speak. The size is dependent of course on the power which the engine is capable of developing, the speed at which it travels and the weight of the vehicle to be moved. You have overlooked telling us, the size and weight of the engine you have in mind, and also the speed at which it is capable of running. It will be necessary, therefore, to confine ourselves to generalities.

The material from which the blade is to be made, should be given serious consideration. White ash is sometimes used, and gives fairly good results; but it is not to be recommened if mahogany or walnut is obtainable, because it is difficult to laminate it, or work it on account of its tendency to splinter. Spruce is successfully used to some extent in the manufacture of propeller to be used on engines of 60 H. P. or less. This wood has the advantage of being light and strong, as well as easy to glue, and climatic conditions do not affect it unduly.

We assume that you are familiar with the fact that all propellers are made from laminated stock. This works out in practice much more satisfactorily, than cutting the propeller out of a solid piece of timber, because there is less tendency for the blade to split, warp or draw out of shape.

The propellers used on the Curtiss J N models, in which a 90 H. P. engine, which drove the propeller at 1450 R. P. M. is used, are 48 inches from the center of the hub to the tip of the blade. The pitch of the blade varies gradually from and angle of approximately 22 degrees at point 18 inches from the hub, to approximately 11 degrees at the tip. The widest part of the blade is at a point 20 inches from the tip and at that point it is 8-5/8 inches wide. The thickness of the blade is approximately 4 inches at the hub and tapers gradually to 13/32 of an inch at the tip.

As was previously stated this propeller was designed for an engine of 90 H. P., and to revolve at 1450 R. P. M. Where either the speed or the capacity of the engines differs from that the specification will likewise have to be changed to suit the particular conditions. Where the speed of the motor is in excess of that stated the pitch of the propeller is lessened.

We assume that you are familiar with the streamline shape of the blade. The leading edge of the blade is the thicker and gradually tapers off to a thin edge at the trailing side. This is to lessen wind resistance of the propeller.

Sharpening Rock Drills:—I am taking the liberty of asking you to do me a favor. I am a blacksmith around the mines, and I am engaged in sharpening those big rock drills used in the tunnels. The rock is very hard, and I want to know if you could give me a recipe for tempering the drills or any information on the subject.

Thos. Loomis, Pennsylvania.

Editor's Note:—We would be better able to assist you if we knew definitely just what kind of material you were using in these drills, whether they are hand or machine drill and what kind of material they operate in.

As a rule rock drill for quarry work are made from crucible steel having a carbon content of around 1.10% but some authorities claim that steel as low as .75% may be successfully employed. These drills may be divided into two classes, namely, the hand drill and the cross or machine drill.

Besides the temper, it is highly important in the first place to have the cutting edge shaped properly. In the case of the hand drill the cutting edge should not be sharpened too bluntly, nor on the other hand should it be tapered too sharply. An angle of about 40% with the cutting edges slightly curved in as the end is approached works very nicely. The cutting edge should also be flarred out slightly so that the distance across the face of the cutting edge will be slightly greater than the diameter of the stock.

The real secret of success in making a good fast cutting hand drill is this: The drill must be properly hardened, but not very far back from the cutting edge, and it should have plenty of clearance on the corners of the bit. The cutting edge is formed by drawing down to a very short taper and should be gradually rounding towards the extreme cutting edge, instead of being perfectly straight. The cutting edge should also be slightly rounding. This angle, we will call it for the sake of convenience, should be approximately 45 degrees, that is tangent to the center of the face of the sides.

A great many drill sharpeners make a serious error in not giving their drills sufficient clearance at the corners and at the same time making the drill too blunt at the cutting edge. Others make the mistake of having the cutting face rounded off too much towards the corners. Miners call these bits with thick edges bull bit, because it will neither cut or break on account of its thickness. This shape of bit is made by driving back the steel with the hammer when sharpening. Ordinarily hand drills for rock work such as granite, require no temper to be drawn after hardening.

The machine drill which does its work by the aid of steam, is entirely different from the hand drill, the bit or cutting edge being in the shape of a cross. To make a machine drill the end is first upset according to the size of drill to be made, then split in from four sides with a thin hot chisel.

When forging or dressing the bit of a machine drill, make sure that the center of the bit is exactly in the center of the drill, so as not to have one part of the drill longer than the other, and have the bits perfectly square, and all the cutting edges exactly the same length; also have

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(Continued from page 142)

operated by a partnership a return must be made on Form 1065, even though the firm had no net income for the year.

Partnership as such are not subject to the income tax, but individual members are taxed on the distributive shares of net income from the business, whether distributed or not, and are required to include such shares in their individual return, even though they may not have been actually received. Similarly, if a business is incorporated a return must be made on Form 1120, regardless of its net income.

Forms for making corporation, partnership, and individual tax returns are now available at offices of collectors of internal revenue. Copies will be mailed by collectors to persons who filed these returns last year. Failure to receive a copy however, does not relieve a taxpayer of his obligation to file a return on time. The period for filing is from January 1 to March 15, 1921. This year as last the tax may be paid in full at the time of filing the return or in four equal installments due on or before March 15, June 15, September 15, and December 15. The return must be filed with the collector of internal revenue for the district in which the taxpayer resides, or has his principal place of business. Heavy penalties are provided by the revenue act for failure or willful refusal to file a return and pay the tax on time.

a good clearance on the corners. Although machine drills are used chiefly in mines, they are also used in quarries, but when making a machine drill for soft rock such as limestone, the bit should be made thinner and should have a longer bevel to form the cutting edge, than a drill which is to drill hard rock.

When hardening a machine drill heat the whole bit evenly, but not to exceed ¾ of an inch back from the cutting edge, then plunge into the hardening bath and cool off entirely. Drills to cut hard rock do not require any temper to be drawn, but a machine drill to drill soft rock should be drawn to a dark blue.

The main cause for drill breaking is due to over and uneven heating and also by having too long a heat when hardening, but a great many times the drills will break and although the broken fracture shows a very solid, fine close grain in the steel, a sure sign that the steel was properly hardened, so there must be some other cause. Many smiths will blame such cases as these on the machine operator when in reality they are to blame for not having made the drill the correct shape, by not giving the drill enough clearance on the corners.

It should be remembered that if a drill has not enough clearance and binds in the hole it is very easily broken, although it may be properly hardened. Another cause for drills breaking is, when drilling rock that has seems or cracks running through it, but this is a natural cause, and as rule cannot be avoided, although it may be partly overcome when drilling with a hand drill, by making the drill perfectly straight in the bit. When drilling holes 12 or 15 feet deep, the hole should always be started with a large drill, but as the hole is drilled deeper the drill will have to be made smaller and longer. A good rule to go by so as to regulate the size of the drill for deep drilling is to make the bit or cutting edge ⅛ of an inch smaller for every 2 feet in length of the drill. To explain it perhaps a little clearer, supposing a hole is to be drilled 16 feet in depth, the first drill or started will be 2¼ inches wide, while the last one which finishes the hole will be 1¼ inches wide.

The advisability of drawing the temper of the drill is depended of course on the nature of the work and the quality of steel which is being used. The smith should have but little trouble in telling whether his drills are inclined to be hard or whether they are too soft and then taking the necessary corrective steps.

One Way to Combat Price-Cutting:— Our competitor here inserted the following advertisement in the local paper:—

> "—**Notice**—The ——— garage will During the months of January and February overhaul Ford motors for $10, and Ford rear systems for $2.
>
> I have also cut 25 per cent in prices on overhaul jobs of any other make of car."

Now any sane man knows that one cannot make a living and pay other expenses at those prices.

Any one of the said "sane men" also knows that such a proposition would certainly appeal to the average "John Farmer", if there was nothing done to set him thinking.

We didn't cut to meet his prices:—

The first week the advertisement appeared we sent cards which was the last Week in December. Other cards have followed. Still others will go forward every week, thruout the two months named.

Already, we have had man after man tell us that ——— stop him and offered to "do that job" for some certain sum, and then remark that he was "afraid ——— was just a little too cheap".

Of course he gets some of them at those figures, but—I'd rather work for the fellows who are driving in to my place every day, knowing that the prices are just as high as they ever were, and coming in willing to pay liberally for what they're going to get than for the two or three "cheap skates" that he's enticed into his place by his price cutting.

Think it over Boys—we've got our prices now where we can make some money in the next year or two, and let's stay with 'em. Fred H. Correll, Ill.

Correll's Ford Service stands first, last and always for RELIABILITY. Correll's Customers know that this is true. **Their trust in Correll is the trust of experience.**

Why is it any way, when some fellow's trying to boost another shop, that he'll almost invariably say "His work is just as good as **Correll's**"? Who sets the standard for **Quality Work** in this vicinity?

It has always been our theory that one suffers far more from over-stating the facts with reference to his mechanical skill than from under-stating them. Exaggeration, you know, destroys confidence.

And when we tell you we're in a position to give you excellent service on FORD and Maxwell and Overland repairs, we can 'make good' on that statement.

This is the year for 'careful buying, and careful spending', and you'll appreciate the economy of patronizing, **The CORRELL SHOP**

Mr. Correll says it pays to call attention to the particular service you are rendering in your community. These are some of the cards that he sends out at regular intervals. Are you getting all the work you should, or, are you letting it drift elsewhere merely because people didn't know about your shop? Your work shouldn't be a secret. Give it publicity and it will grow.

Waterproof Glue—Glue can be prepared, by adding tannic acid, so that dampness or water does not dissolve it as it does the ordinary glue used by carriage and coach bodymakers.

Various sorts of glue require different quantities of tannic acid, which makes it difficult to prepare properly.

It is said to make glue insoluble in the hottest weather to add to the glue when in the liquid state, ready for use, a little potassium bichromate, and then to expose the glued parts to sunlight. The quantity of potassium bichromate varies, but is commonly equal to one-fifth of the quantity of glue used, but it is important that the thumb screws should not be removed until the glue is thoroughly dry.

As glue thus treated cannot be mixed again into a liquid state, it is perhaps better to glue as usual, without adding the potassium bichromate. When dry finish the edges and coat the pieces to prevent water from entering the glue joints.

Another method to make a waterproof glue is to place the glue in water and let it remain there until soft. Take it out before it has lost its original form, i. e., before it is dissolved. Add to this some hard boiled linseed oil, cook slowly and stir the mixture till it has become thoroughly assimilated. If too thick for glueing purposes then add more hard boiled linseed oil. Such glue is hard and strong when dry, and resists dampness and water. If the glue becomes thick from standing add more linseed oil for further use.

To glue soft woods and especially soft pine woods, exposed to moisture or water, "curd" cement is largely used by cabinet makers in Germany.

It is made of white cheese in a fresh state, without salt, and a little slacked lime in a wet state. The mixing is done as follows: Use a smooth board and spatula. Put the cheese and some of the lime on the board and mix same as mixing paint except that it is worked with the spatula on the board, adding only as much lime as needed to give a uniform medium thick, milky pulp. To test the consistency see whether threads will form when spatula is raised quickly from the mixed cement. Slightly heat the cement and joints to be cemented, which will give better results. It dries somewhat slower than the ordinary glue, but when thoroughly dry it will not dissolve in water.

Dusting for Molds for Brass Work—To produce light castings of brass and gunmetal with a clean face and fine skin, first dust the mold with pea meal and on top of same add a slight dust of plumbago; for heavy castings dust only with plumbago.

WHAT DO YOU CHARGE FOR HORSESHOEING AND BLACKSMITHING?

Brother Smith in the other State would like to know. Are you going to increase your charges? Have you thought of lowering them? Do some of your customers complain that they have to pay more than is charged in other States?

You would like to have some smith in another locality answer those questions, wouldn't you?—So would he. There is only one way to do it, and that's on a basis of mutual exchange. We want to help you have these questions answered, but we are going to need your help in doing it. All these price lists will be printed in the next issue. Can we count on yours?

AMERICAN BLACKSMITH AUTO & TRACTOR SHOP

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BUFFALO, N. Y., U. S. A.

WILLIAM F. WENDT, *President.* L. J. WISCHERATH, *Editor.*

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BUSINESS PROSPECTS OF THE FUTURE

The new year began with general business conditions throughout the country "poor but sound", says Archer Wall Douglas, chairman of the Committee on Statistics and Standards of the Chamber of Commerce of the United States in his semi-annual review of the business situation issued recently.

According to Mr. Douglas a determined and constructive effort is being exerted to bring about a change for the better by teamwork and cooperation. In the entire absence of any apprehension of a money panic he sees the most encouraging feature of the whole situation.

"How long the present situation will last is a subject of much speculation and inquiry," says Mr. Douglas. "The general though is that the winter months will be quiet and that as the Spring opens there will be an appreciable change for the better.

"In the cotton sections, there are those who feel that the first six months of the year will show a continuous monotony of dull business. In the industrial districts there is a general feeling that the situation will improve when prices of commodities reach a figure that will tempt the ultimate consumer to begin purchasing for other than his immediate wants. It is rather significant that some sales can be made at bargain figures but very few at moderate concessions. The answer apparently is, therefore, that when the deadjustment now in active operation has resulted in a sufficiently low level of prices for manufactured commodities, business for manufactured commodities, assume more normal proportions.

"We have the curious paradox in this country at this time of the greatest harvest ever gathered, and consequently the greatest amount of agricultural wealth, in quantity, that we have ever known, with the lack of the factor of ready translation into liquid capital; and in the midst of incredible plenty on every hand the countryside is still in sore distress. The farmer is particularly short of funds since he has marketed so small a portion of his crop, and as the country banks are already loaned up to their limit it is difficult, in fact almost impossible, for the merchants and farmers to obtain further credit. The farmer is most unwilling to sell his products at present low figures, and is not doing so, save under stress of necessity or because of pressure brought by merchants and banks to settle his accounts.

"From the viewpoint of the farmer, it may be said that he purchased his house and farm equipment last spring at the peak of high prices and paid for labor the largest wages within his memory. Now, before he has opportunity to dispose of products, the prices decline from forty to fifty per cent, until they reach figures which seem to him entirely unremunerative. In addition, as is always the case in periods of low prices, he finds that there is practically no market for some of his goods.

"Many merchants are engaged in collecting bills due rather than incurring new commitments, and consequently their buying is confined, after the example set by the farmer, largely to things of immediate need. Collections are naturally slow under these conditions. Merchants are revising drastically their credit systems under the stress of necessity, and in many cases the retailers in the country districts are confining themselves strictly to cash transactions.

STUDY YOUR TRACTOR TO AVOID TROUBLES

The best way to avoid tractor troubles, costly delays and repair bills is to know your tractor. One of the best ways to know your machine and how it operates is to make free use of the instruction book that comes with it. Most tractor concerns have very complete instruction books explaining the various parts of the machine, how each part operates, and how to care for it. These little books are furnished for the farmer's benefit and should be used. Always keep the book where it can be referred to. Do not leave it in the tool box where it will get dirty and greasy, torn or possibly lost.

Tractor troubles are due to many widely different and varying causes, and it would be utterly impossible to prescribe a panacea successful for all troubles. But the best insurance against trouble is a good understanding of the workings of the machine. The man who has least trouble with his tractor and who keeps it going longer than his neighbor, is the man who knows how each part of his tractor should work and how to quickly and intelligently locate and remedy troubles when they do occur.

MARCH, 1921—CONTENTS

Are You Equipped to Handle the Repair Work of Both?

BRASS WELDING

THE ARTICLE ALSO INCLUDES SUGGESTIONS FOR WELDING COPPER, BRONZE AND OTHER ALLOYS

DAVID BAXTER

THE title of this article might properly be welding of copper alloys, since in the average blacksmith shop, much of what is called or known as brass is in reality a bronze. And on the other hand much so called bronze is in reality nothing but brass. However, to the welder, both could be termed brass in so far as the actual welding is concerned. So, for the sake of simplicity let us refer to all copper alloy metals of this nature as brass. The flame regulation, the fusion, and the filling are practically the same whether the metal is common yellow brass, or bronze in the strictest sense of the word.

The chief difference in welding the different grades depends more upon the constituents other than copper, than it does upon the shape of the article to be welded. If the alloy contains a large percent of zinc, lead, or aluminum the flame manipulation should be more carefully managed; if so the flame should not be applied so ardently, nor should it be as large as it may be if the copper content is high. Although as a usual thing the operator should employ a flame at least a size larger for the same thickness of brass as for cast iron. If the job happens to be a cheap grade of brass, he can readily change the tip for a smaller one. The cheapest grades contain a large percent of zinc, which will burn out quite easily. This burning is indicated by an excessive amount of smoke arising from the weld. When the usual application of the welding flame is made and the smoke is excessive, the operator may be reasonably cerain he is employing a flame too large. It is also a very good indication that he is welding a cheap grade of brass.

It is difficult for the average mechanic to tell one grade of brass from another by the appearance or by the kind of casting, but he can soon learn to approximate the grade, closely, by its action under the welding flame. Of course, this action will depend upon the flame, and the way it is handled. Ordinarily, the tip of the white cone of flame should be held not closer than a quarter of an inch from the melting brass. The operator should not get impatient and try to force the melting by holding the white cone in direct contact with the metal after it starts to melt: even just before it starts to melt, as some authorities claim that brass absorbs oxygen when it reaches a bright stage. A sort of soaking heat will produce better results, even if it does take longer to make the weld; in effect the heat of the flame is allowed to soak into the brass. This is achieved by holding the flame back so the tip of the white cone doesn't touch the brass. The flame is played above the metal until it becomes fluid, with much less danger of injecting oxygen into the molten bath.

Another way to accomplish about the same result is to direct the flame across the melting metal instead of straight into it. At least the direction of the flame should be at an angle with the horizontal part of the weld. This lessens the danger of forcing oxygen into the molten metal, and eliminates most of the tendency of unintentional impatience on the part of the operator. However, an experienced welder does not adhere strictly to this method, but manipulates his flame according to the action of the melting brass. If it appears to melt too rapidly for the flow of filler metal, he shifts from a direct application to the angle position. If he needs to melt the casting a little faster, he uses the direct force of the flame; always with a thought of avoiding the oxidization of the zinc or other metals of low melting point. He may have to shift several times during one welding; often to shift constantly and rapidly. That is probably the best instruction that can be given, especially to the novice. The weld should be ready to receive the molten metal filler; the filler should be melted ready to be flowed into the weld.

Brass welding and steel welding are alike in many respects, so that the operator who has had experience on the latter should have no trouble learning to handle copper alloys. Like most steel welding, the brass jobs seldom need preheating in relation to expansion and contraction in so far as strains or cracks are concerned. And like steel, it is often economical to preheat brass jobs in order to cause them to melt faster and to retain the welding heat better. That is, a heavy brass job will fuse easier if it is heated previous to applying the welding flame. In fact, it is often necessary to heat an area around the weld, before melting any of it. The copper in the composition has a higher melting point; in fact twice as high as some of the alloy metals. It also is rapid conductor of heat. This combination increases the need for preheating. The flame heat will be carried away so rapidly as to cause difficulty in fusing the weld; which is aggravated by the higher melting point of the copper. If the operator is not careful, he is almost certain to burn out the zinc, before he can fuse the copper. Preheating a

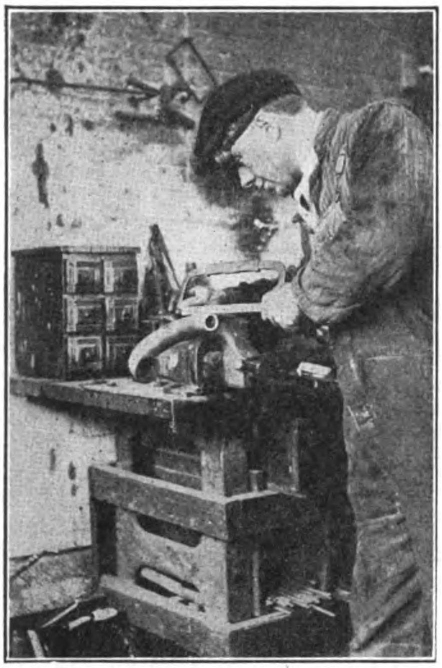

Fig. 1. SAWING A GROOVE IN THE CRACKED MANIFOLD

larger area of the casting around the weld with the welding flame will minimize these troubles. Or they may be overcome by heating the whole job, or a considerable portion of it, previous to welding; this to be done with an agency other than the welding flame in order to save welding gas.

The preheating in either case prevents the heat of the weld from being conducted to other parts of the job so fast that it will hinder fusion. Where the preheating is done with the welding torch, an area two or three inches around the weld should be brought to a red heat. This will prevent conduction, and at the same time facilitate the melting of the copper. But the welder should remember that it will not eliminate oxidization, only in so far as it requires a flame application of shorter duration.

Where the preheating is accomplished by other means than the torch flame, the operator must be careful about moving or striking the casting after it reaches the red stage because brass has but little strength when red hot. It is liable to sag and crack, or perhaps collapse of its own weight, or it may fall in pieces under a light blow or pressure. The job should be arranged for preheating so that no part of it is suspended. The welder should be careful about prying or moving the red hot job.

Parts of the procedure of repairing brass castings with the oxy-acetylene flame are the same as for cast iron, aluminum, or other metals. One of which is the chamferring of the broken parts, or the grooving of the cracks. Metal an eight of an inch or more in thickness should be grooved practically the full depth of the crack. Although some welders omit grooving on brass even a quarter of an inch thick, there is no question but what a better weld is made where the crack is grooved, because it lessens the danger of burning the metal, due to the fact that the welding time is decreased.

Brass welds should also be cleaned the same as other metals to prevent foreign matter from being trapped in the metal either in solid or gaseous state. These bits of slag or other impurities cause blow holes and porous spots and should therefore be eliminated in every possible way. Of course there are some jobs where they do no harm but it is better practice to avoid these results wherever possible.

Like cast iron and aluminum, brass welding is surer and easier if accompanied with liberal applicaions of flux powder. If anything, flux is more essential on brass, due to the greater danger of oxidization. A coating of melted flux tends to prevent the oxygen of the air from attacking the molten weld. It also wards off any excess or unused oxygen of the welding flame.

The choice of filler size is governed much the same as for iron. Although it is possible to utilize a larger filler rod on account of the larger body of molten metal in the weld. A Tobin bronze rod is the best all around filler rod, unless the job is light and thin; in which case a soft brass wire is alright. Manganese bronze is used on harder grades of brass castings.

The manipulation of the filler rod is about the same as for other metals. It is kept in touch with the molten weld except when being used to apply the flux. It is literally pushed into the bath and never allowed to drip. If everything goes rightly, the filler is fed into the melting groove in a constant flow; the rod being lowered as the flame advances. An inch or so of the rod is melted and settles into the groove as the flame is moved forward. A twisting or slight sawing movement helps to settle the new metal and mix it with the weld.

The flame adjustment to be safe should be the same on all metals upon which the novice works. This is the neutral welding flame composed of equal parts of oxygen and acetylene. Neither of these gases are in excess in the standard flame. However, an experienced torch operator can use a flame carrying a slight excess of acetylene when welding brass. He uses this flame to insure further against oxidizing, on the theory that all of the oxygen is certain to be consumed in the combustion of the flame. And, therefore, none of it can be injected into the melting weld. The excess acetylene flame is also not so hot. But the beginner will do well to use the neutral flame; not only

Fig. 2. THE "V" GROOVED CASTING

at the beginning, but throughout the enire welding process. In this connection, it may be well to mention the fact that this flame is more difficult to maintain after the welding tip has been used for some little time, and is more than likely worn or pitted. These defects cause the flame to vary while in use.

The manipulation of the flame is a trifle different on brass than on other metals; although fairly successful work is done with the same handling. The flame should be moved around slightly until the brass fuses, then it is immediately raised or drawn back a moment to prevent over-melting the brass. It is immediately advanced again to melt another section of the weld and deposit a quantity of filler; When this filler is fluid the flame is again drawn back. This procedure is repeated the entire length of the groove. In short the flame is lifted with the fusion or when the fusion is complete.

We have now touched upon most of the fundamental principles of brass welding in general, let us take a specific example of this work and see how the details were handled; discussing the different steps of the process as they applied to the particular job which is illustrated by the photos accompanying this article.

This job was a brass manifold casting. Such a job is liable to be brought to any blacksmith torch welder. The metal was approximately three-eighths of an inch thick in the vicinity of the crack, as indicated in Fig. 2. This picture also indicates the extent of the grooving, which formed the first step in the repair process.

The full length of the crack, almost its entire depth was grooved out. This was accomplished as indicated in Fig. 2. A V-shaped piece of brass was sawed out of the crack with a hack saw. This is probably the easiest and quickest way to handle such jobs. At the inner end of the crack the groove was made to slope gradually to the surface of the casting beyond the fracture; thus the welder made certain that no part of the weld would be poorly connected. That is the crack would be sure to be welded its full length.

Next, the metal for an inch on each side of the groove was wiped clean of all grease and corrosion. Then the job was ready for welding. To assist in this the casting was arranged in a V-block, so it would not rock or slip at a critical point in the welding, and yet be free to expand and contract. The V-block also braced the part to be heated so there would be no danger of collapsing should it chance to be overheated. Such arrangements are few and simple but effective.

Then a fairly large torch was lighted and regulated to the neutral condition. A three-eights tobin bronze filler rod was selected and a pot of fresh flux powder conveniently placed.

The flame was played back and forth along both sides of the V-groove until about two inches of the casting metal became red hot. Then the flame was concentrated upon the inner or closed end of the groove. Here it was revolved until the brass almost reached the melting point. The filler rod, which had been heated at the same time, was dipped in the flux to deposit a quantity upon the melting groove. The flame was then played upon the groove and rod to bring them to the molten stage as described above. As soon as the part of filler melted and started to sink into the groove the flame was lifted slightly and the rod was again dipped into the flux.

This fluxing and melting process was repeated the entire length of the groove, filling it over-full of molten bronze, carefully fused with the sides of the groove and smoothly rounded over on top. The flame force and the filler rod were used to guide the molten metal.

After welding the casting was permitted to cool as it remained in the V-block. In most brass jobs such as this it is not necessary to cover or bank for slow cooling. So this casting was allowed to cool in the open until cold enough to handle. After which it was filed smooth and replaced upon the engine.

TRIMMING THE HOOF

In hoof trimming some special points are noticeable. If the toes are turned out, the outer wall of a hoof will appear longer than the inner wall, if the hoof is viewed from a point in advance. Similarly, if the toes turn in, the inner wall will be the longer of the two. The horseshoer will do well, then, to note such conditions, and observe just how the true axis runs, before he begins trimming.

First, seek to imitate the effects produced by natural wear. This produces a flat foot of the form best suited to the conformation of the limb it terminates. It shortens and round the toe, lowering it to a greater extent than the heels; removes horn only from the anterior part of the sole, leaving the connection between walls and sole of full strength; round off the outer edge of the wall more than the inner, and spares the sole, frog and bars, which shed their superflous growth

Fig. 3. FILLING THE GROOVE

naturally. Natural wear gives to the foot the form best suited to the animal's action, and produces a perfectly flat bearing surface from the quarters to the heels.

ON VULCANIZING

In vulcanizing casings, which it is not always necessary to remove from the wheel, three layers of cement should be applied, each one being allowed to dry. The cut should be filled not quite level with the surface with scraps or rubber supplied for the purpose. If the hole is filled to full the rubber is likely to expand and run over the surface which has not been prepared, and this thin film will soon peel off. When fixing a sand pocket care must be taken to fill the hole where the sand found entrance which may be a foot away from the pocket as finally developed.

CEMENT FOR JOINING METALS AND WOOD

Melt rosin and stir in calcined plaster until reduced to a paste, to which add boiled oil in sufficient quantity to bring to the consistency of honey; apply warm. Or, melt rosin 180 parts and stir in burnt umber 30, calcined plaster 15, and boiled oil 8 parts.

The Effect of Expansion and Contraction in the Oxy Acetylene Weld

N. WARD GUTHRIE

THERE is a decided difference in the effect produced through expansion and contraction by the welds made with the oxy-acetylene blowpipe and those which are made in the smith's forge.

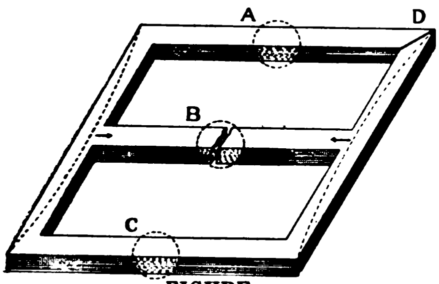

FIGURE 1

They have something in common 'tis true; but the entirely different nature of the work on which these different processes are used, is such, that in the latter case the result of expansion and contraction is generally immaterial. That is because the welds that are made in the forge, in the majority of cases, are merely the joining of two separate parts; being unattached to other parts, there is nothing to prevent expansion and contraction from acting freely, and being free to act no damage results from these forces. Thus they occur unnoticed. Unfortunately, the same cannot be said of the oxy-acetylene process. Here it is frequently necessary to joint parts of intricate design, which are held rigidly in a certain position by still other parts. The forces of expansion and contraction are not free to act as in the former case, because they occur in parts which are unable to move freely because of their fixed relation to the members to which they are attached. The heated weld insists that it shall have more room, while the parts supporting it are equally insistent that they remain just the way they are; so that it is evident that trouble is brewing. Unless these forces are understood, and some provision made to counteract or offset their effect, the repair is doomed to failure irrespectiv of how well the weld may have been made.

The principles of expansion and contraction are in themselves extremely simple. Being constant in their action, they are easily undersood and become only apparently complex when their action takes place in parts of intricate design. Even then after one gives a little thought to the matter, assisted by a fair knowledge of these forces, there is no reason why trouble should be experienced from this quarter.

First, let us regard the action of the metals themselves, when subjected to heat, and having seen what there actions are, we can readily apply it to the work itself. When metal is heated it expands; as it cools it contracts. Nothing particularly startling about that; in fact, any school boy has that information at his tongue's end. But

FIGURE 2

we will go just a step further and say there is another inflexible rule rule governing these forces. It is physically impossible to prevent the forces of contraction from working as the metal cools. But we can do this; we can pit one against the other, so to speak, by heating the article in different parts and thus offset the effect, and there are still other agencies which may be used.

But we are getting a little ahead of our story. Various metals conduct heat in varying degrees. Copper having the greatest conductiviy of all the metals that are encountered in welding; so along with expansion we must take into consideration the conductivity of the metal, or in other words, we must consider how much more of the part is going to become hot besides that section which is actually subjected to the direct heat. We must take this into consideration before we make any allowance for expansion and subsequent shrinkage. Since cold metal occupies a smaller space than hot metal, it necessarily follows that unless we recognize these factors, and plan to offset them by preheating, or other agencies, the result will be that the part will be distorted when it cools, and in some instances if the metal is brittle another break is likely to appear. Perhaps it will be in the weld itself or it might be near it or even in some distant part; the weakest part giving away to the forces of contraction.

The simplest example of all would be to use a diagram such as shown in figure 1. Let us suppose this bar of metal is broken. As the molten metal is added to the break during the welding, the two pieces are moved apart by expansion. As the weld cools, it contracts and draws the two parts together. Both ends being free to move, the parts are simply separated in the first instance and later as the weld cools, they are drawn together, because there is nothing to prevent their free movement. Thus expansion and contraction act unnoticed because there is no opportunity for them to register their effect. The same is true of those separate parts that the blacksmith welds in his forge.

Now, to carry our experiment a step further, we will select another bar of the same dimensions and material, which is also broken similarly; but this time we will select one that is the central cross bar of a frame as indicated by B in figure 2. Here the ends of the bar are rigidly attached to the sides of the frame. The frame is going to contest any attempted move on the part of the bar when it either expands or contracts. So we've got two abitrary parts. One says, I want more room to expand, and the other says, I'm going to stay right where I am. So we'll see what happens and how there whims are overcome.

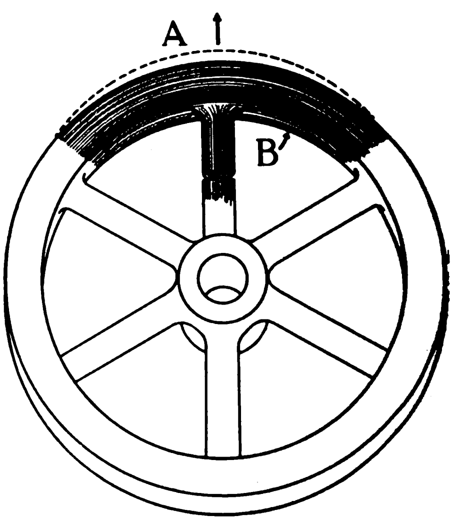

FIGURE 3

We have recognized the fact that metal, as it is heated, expands. For example; a steel bar 12 inches in length would increase approximately 1/8 of an inch in length in being heated from 100 degrees Fahrenheit to 2100 degrees Fahrenheit. Now, the bar which is rigidly enclosed in the frame is going to be heated, but in this case the results of expansion need not be feared, because the edges of the break on being heated to the fusing point will merely approach each other, the molten metal offering but little resistance to this expansion.

But, when the weld is completed, and the metal commences to cool, contraction starts to act. Now, the bar which was free to expand is not offered the same opportunity to contract because the two ends are rigidly held by the frame. The shrinking bar attempts to draw the sides together, as indicated by the dotted line. There are two possible results. Either the frame will be distorted or else it will break. If the metal is ductile in all probability it will merely distort itself, as shown by the dotted line; on the other hand if the metal is brittle, such as cast iron would be, then it is likely to break, depending on the alloy. Mild steel would probably bend; but irrespective of whether it bent or broke, it would be considered an unsuccessful weld, even though the weld itself was first class.

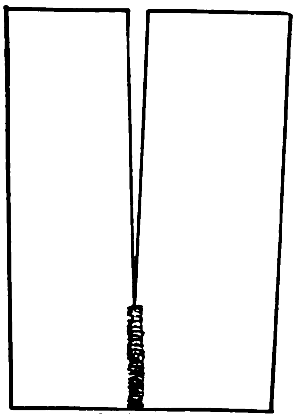

FIGURE 4

When an internal stress is produced by contraction, and it is greater than the tensile strength of the section to which it is confined, a fracture is bound to result Where the strain is not great, but still exists, the resistance of that particular section is reduced in proportion to the amount of internal strain which it is resisting. Thus a casting might appear to have been perfectly welded, and also as strong as before it was repaired, but the internal strains caused by the welding are apt to make it break the first time any strains are placed on it in service or otherwise.

Some metals are considerably more ductile than others, particularly mild steel. It may be hammered hot or cold with but little danger of causing a fracture. While this is a decidedly good feature in one way, it is a bad one in another, because it is an inducement to some welders to disregard the results of expansion and contraction. It should always be borne in mind, that while the part may not break as the direct result of expansion and contraction, we are likely to meet with failure because we have distorted the article, leaving a strain in the weld or in some other part of the welded article. The metal being ductile, it is not necessary in every case to preheat the part in order to offset expansion and contraction. Sometimes certain section may be bent, before they are welded, with a view to having contraction straigten them. Or we may localize the heat of the weld by applying wet clay or asbestos to the adjacent parts, thereby minimizing the effect of these forces. Sometimes it is absolutely necessary to resort to these methods, because it is impractical to preheat either on account of the size of the part or the location of the break. In all cases wherever possible it is better to preheat; but in any event, we must allow for expansion and contraction.

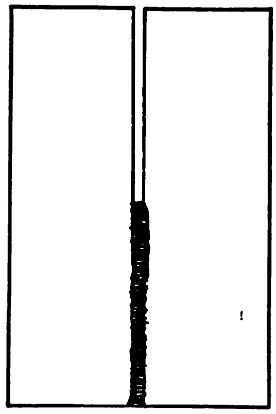

FIGURE 5

In the case of the frame which we were just discussing, there are several ways of overcoming the effect of contraction. The first and simplest of all is to preheat the entire part, thus it will be expanded equally, and in cooling it will draw together equally. In some case, as we have just mentioned, it is not practical to preheat the entire article, for that reason and also because it is more economical to preheat locally to produce the desired effect, other means can be found which give equally as dependable results. In this case, the other two bars may be heated at the places indicated as A and C. In expanding these two bars. the whole frame will be affected, and as they cool along with the weld, they will contract, allowing the center bar to come together without strain.

Suppose it were impossible to heat the frame at the places indicated. There would still be other means at the disposal of the welder. The edges of the break might be separated slightly by using a jack or wedges to spring the sides of the frames back in the opposite direction to that indicated by the dotted line. The weld should be quickly made, and after it is completed, the pressure should be gradually relieved and the welded parts allowed to come together without strain. This method is not to be advised, particularly in the case of the less ductile metals, as there is always danger of breaking the other parts, if slightly too much pressure is applied. However, in some cases it offers a practical solution. Still another way of getting around the forces of expansion and contraction, would be to cut the corners of the frame as shown at point D of figure 2. Then proceed with the weld in the broken bar. When it is completed, weld the frame where it was cut. The effect of expansion and contraction is least to be feared at this point. Thus, in some cases it is actually necessary to break a piece in order to repair it. This illustration shows the importance of giving thorough consideration to the preparation of the pieces, before the weld is started, as it is impossible to avoid the consequences once the weld is under way.

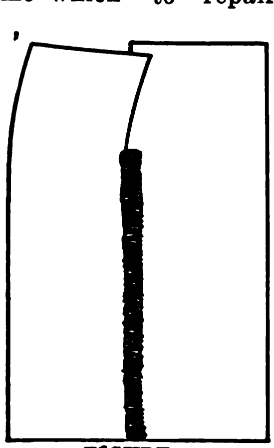

FIGURE 6

The facts to be borne strongly in mind and to understand thoroughly is that we cannot prevent expansion and contraction; that it will always take place and that it is utterly useless to attempt controlling it with the use of jigs, clamps, vices, angle irons or any other mechanical devices. We may offset their effect by preheating or by other means such as have been briefly outlined but not through the application of resistive force.

Breaks occuring in the spokes of flywheels are ones that the welder is often called on to repair. The welding in itself is comparatively simple, as cast iron can be welded without much difficulty, but cast iron is not elastic. Its tensile strength is low, so that it must be treated with more consideration in regard to expansion and contraction than any other metal. In figure 3, we have the drawing of a flywheel, requiring a repair to one of its broken spokes. If the spoke is welded without preparation, little

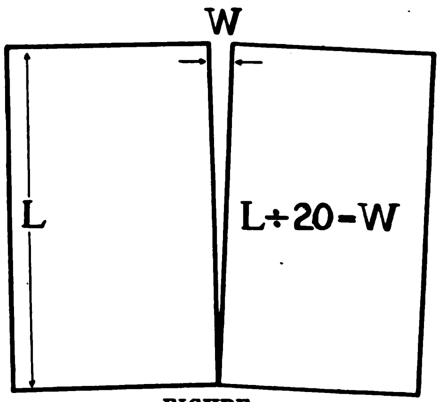

FIGURE 7

danger will be experienced from expansion, because as the edges of the break approach each other after the welding flame is applied, little resistance will be offered by the molten metal. The same as in the case of the frame. But as the weld cools, the rigid rim of the flywheel will prevent the spoke from contracting. In the frame there was an opportunity of distorting the sides, but here the rim is extremely rigid, so that it is almost a foregone conclusion that the spoke will break again. In this case there seems to be but one practical solution to prevent the result of this contraction; that is to preheat a section of the rim as indicated by the shaded portion B in figure 3. The effect of this preheating expands the rim. We have learned that when metals are heated, it is impossible to prevent them from expanding lengthwise, or in other words, growing in length, so that the heated portion bulges out slightly, as indicated by the dotted line A. This line is exaggerated to to be sure, but nevertheless, the rim actually bulges out and carries the portion of the spoke attached to it along with it. Thus the break is separated. The molten filler is added. As it cools, the rim is allowed to cool, and both contracting in unison, no strain is placed on the spoke, because the cooling rim literally pushes the break together. On the other hand, some judgment must be exercised regarding the extent to which the rim should be heated. It should not be heated to a point where it would be apt to press in on the cooling weld so hard that a deformation of the spoke would result. Practice alone developes the judgment for these cases.

Still in other cases, it is impractical to resort to the method just described, because there is a danger of cracking the rim or causing distortion. In such cases it is necessary to preheat the entire wheel applying the heat slowly and evenly.

The effect of expansion and contraction manifest themselves quite plainly when parallel welds in sheet metal are made. As a simple illustration of this phenomenon, we will refer to figures 4, 5 and 6. Here we have two sheets of metal to be welded with their straight edges together. The weld is started as shown in figure 4. The first effect that will be observed is that the edges of the plate opposite to the end where the welding was started, have been moved further apart. As the weld is continued, the effect shown in figure 5 is observed. The edges have now been drawn together parallel, or nearly so. Finally the end of the weld is approached, then we find that the plates have been drawn together to the extent that they are really overlapping each other. This effect is shown in figure 6.

There are two ways of overcoming the result of expansion and contraction in these cases. First, the plates should have been separate more at the one end than the other, before the weld was started.

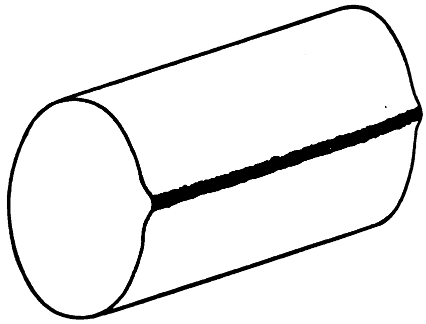

FIGURE 8

The widest part of the gap should have been the end away from where the welding was started while the plates should have been together at the point where the weld was commenced. The correct amount of divergence is determined by the thickness of the metal, and a fair working average is to allow one twentieth of the length of the weld. This is illustrated in figure 7. This proportion does not remain constant, however, but varies according to the speed with which the weld is executed. The faster the welding is done the lesser will be the divergence to be made.

Still another way is to spot weld the plates together at interval about a foot apart, and then proceed with the welding. This will prevent the plates from moving laterally, but often results in a deformation such as shown in figure 8. In most such cases, however, that plates can be easily brought back to their original position.

In welding cylindrical articles made from thin plate stock, it is possible to prevent the plates from

(*Continued on page* 161)

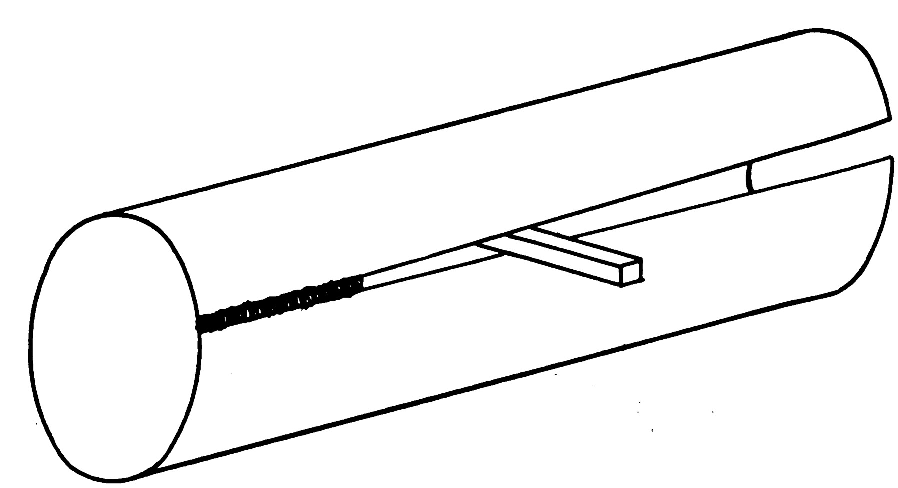

FIGURE 9

Repairing the Frame of a Large Press by the Thermit Process

ONE example of the many Thermit welding repairs constantly being made on housings, Crankshafts, Locomotive Frames and other heavy steel, wrought iron and cast iron sections, which would otherwise have to be relegated to the scrap heap, is shown by the accompanying illustrations of a Thermit repair recently made on the broken cast iron side frame of a Power Press for The Leonard Sheet Metal Works, Inc., Hoboken, N. Y. It may be interesting to note that about 500 Railroads in the U. S., are using Thermit for these purposes.

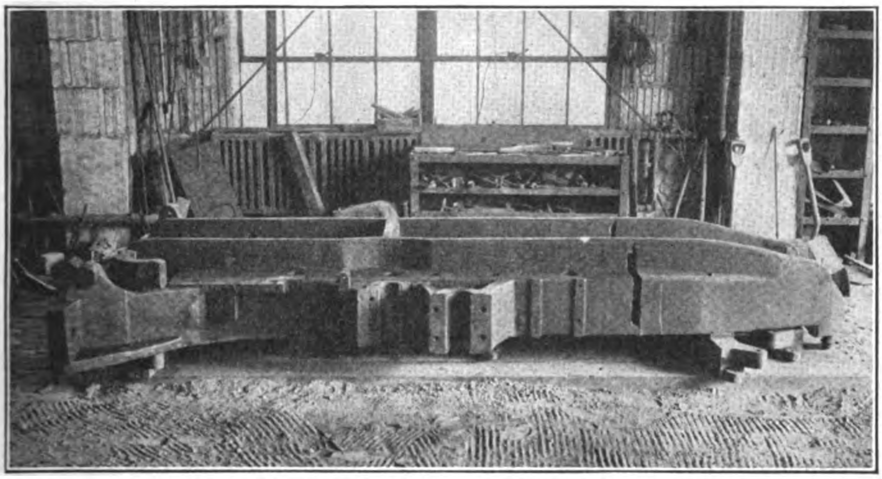

Fig. 1. THE FRACTURED SECTIONS LINED UP FOR WELDING

The Thermit Process is based on a chemical reaction between finely divided aluminum and iron oxide. Such a mixture can ignited when brought to a high temperature in one spot and the reaction when so started will continue throughout the rest of the mass, the result being that the aluminum combines with the oxygen of the iron oxide to form aluminum oxide, or slag, in a highly superheated molten state, while the iron is set free and is produced as liquid steel also highly super-heated. The temperature of this reaction is not measurable by any mechanical instrument, but it has been determined theoretically by metallurgists as approximately 5,000 degrees Fahr., or almost twice the temperature of ordinary liquid steel. It can readily be seen that if steel at this high temperature be poured around and between two iron or steel sections, which have been previously heated to red heat, that they will become dissolved and will amalgamate with the Thermit steel so that finally the entire mass will cool down to form a single homogeneous section.

In making the repair in question, the broken parts were lined up with each other in the position shown in Figure 1. A small gap was then cut out at the fracture by means of the Oxy-Acetylene torch, followlowing which the faces of the broken parts were carefully cleaned, so as to allow perfect fusion when the Thermit steel later flowed through the sections to be welded.

In addition to the space left between the two sections for allowing entrance of Thermit steel, an allowance for contraction was next made, setting the parts away from each other a sufficient amount, (about ¼ inch to make up for the contraction of the Thermit steel in cooling.)

The parts were now ready for the pattern which was made of yellow wax. This wax was placed in a pan and warmed until it became plastic, after which it was shaped around parts to be welded in the form of a collar. The opening between the ends was also filled with wax as shown in Figure 2.

A mold box was then built around the wax pattern and as shown in Figure 3, filled with molding material which included both backing material and facing material. The backing material consisted of a mixture of two-thirds sand and one-third fire clay. The facing material consisted of one part fire clay, one part ground fire brick and one part sand. This was used for the facing of the mold or the part which was to come in contact with the Thermit steel. This material was well riddled, mixed dry and then moistened with just enough water so that it would pack well.

This molding material was now rammed hard into the box.

A wooden gate pattern for the preheating opening was set at the lowest point of the wax pattern and laid out to the front of the mold box where the opening was provided for it.

The flame from a gasoline preheating torch was then directed into the mold shown in Figure 3. This served the threefold purpose of burning out the pattern wax so as to form space for the Thermit steel, drying out the mold and preheating the sections to be welded.

Finally, a charge of Thermit was ignited in a crucible suspended over the mold. Super-heated liquid steel, formed in about 35 seconds by the chemical reaction, was precipitated to the bottom of the crucible while the slag,—aluminum oxide, remained on top. At the completion of the reaction a tapping pin at the bottom of the crucible was tapped upwards, allowing the liquid steel to flow into the mold and fill up the welding space and fuse thoroughly with the parts to be welded.

In order to allow the weld to cool slowly the mold was not dismantled for several hours.

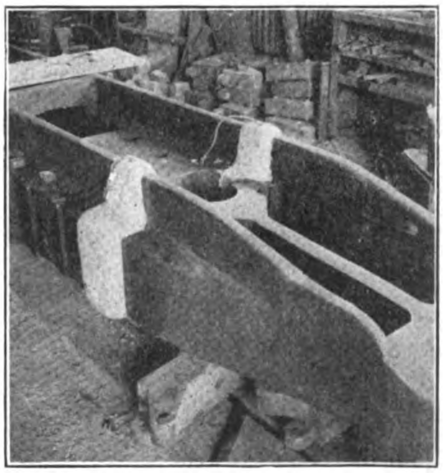

Fig. 2. THE YELLOW WAX PATTERN APPLIED TO THE FRACTURE

Fig. 5 shows the weld before removing the steel pouring gate and risers. The function of the riser is to hold a supply of steel which will remain liquid for a considerable

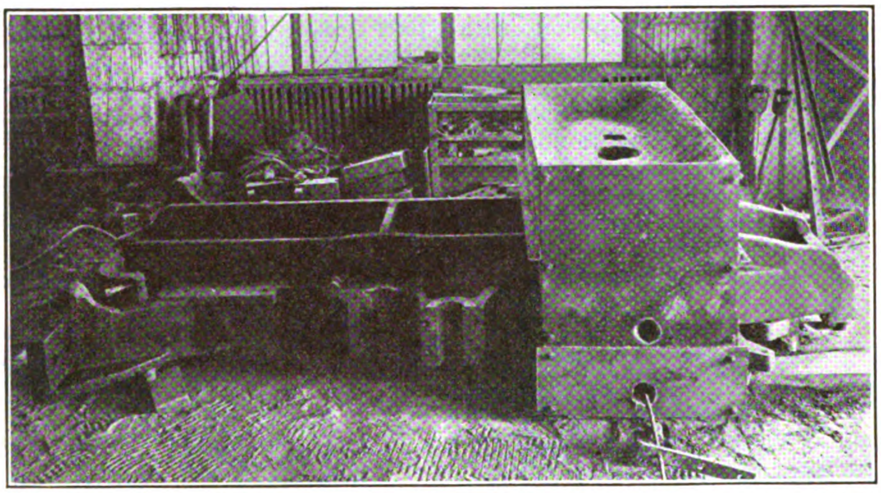

Fig. 3. THE MOLD BOX, AND PREHEATING TORCH IN PLACE READY TO PREHEAT THE MOLD

period of time and take care of all shrinkage, so that when a "pipe" is formed, due to shrinkage, this pipe will appear in the riser and not in the weld. Also the riser acts as a depository for loose sand or other foreign matter which may be washed into it by the Thermit steel in passing through the mold and prevents this material from clogging in the weld.

Figure 6 shows the welded frame replaced in operation.

The wonderful strides made in the manufacture and welding of steel and iron during the last decade are nothing short of marvelous, and we find them interesting—decidedly so, irrespective of whether they can be applied to our needs or not. While the Thermit process is particularly well adapted to the repair of large and heavy part, a class of work that is seldom brought to the smaller blacksmith shops, nevertheless, it serves as an excellent example of the progress made in the art of welding.

Title Does Not Pass Where Check is Dishonored

RALPH BUTZ

THE question often arises whether the title to merchandise passes to the buyer if the check given in payment is dishonored. If the merchandise is sold on credit and immediate payment is not one of the conditons of the sale, then title usually passes upon delivery to the buyer, although a check given in payment may be dishonored. But if the terms of the sale are cash, and the check is dishonored, the courts hold that title does not pass.

One authority holds that "If a sale is for cash, and the check of the buyer is taken, this will operate as no more than a conditonal payment, as well as a conditional delivery; and if upon due presentation of the check it is dishonored the vendor may retake possession of the goods. A check is accepted as a particular form of cash payment, and if dishonored the seller may resort to his original claim on the ground that there has been a defeasance of the condition on which it was taken.'

A case in point was recently reported in one of the higher courts. (190 Pac. 628). In this instance merchandise was sold under the arrangement that a check should be given at the time of delivery. The check was given by the buyer, as agreed, but was dishonored when presented for payment. The seller sought possession of the merchandise, but the buyer resisted on the ground that the terms of the sale specified that a check be given in payment, which was done, and that thereafter title remained in the buyer's name.

The court stated that if a seller agrees to accept a check or note as absolute payment for goods sold, then title to the goods will pass upon acceptance, irrespective of whether the paper is honored upon due presentation or not. But where the seller requests check upon delivery of the goods, it is apparent that the terms are the equivalent of payment on delivery. It is not a sale on credit, nor for the check as such, but delivery of the goods and payment for them are to be simultaneous.

The legal situation is no different from one where the terms of the sale are cash on delivery and a check is accepted by the seller. In such a case the acceptance of the check is no waiver of immediate payment; and, although delivery of the goods is made upon receipt of the check, title thereto does not pass as between the parties, unless, upon due presentation, the check is paid.

The court held: "While a delivery is perhaps the most significant fact as indicating an intention to transfer title, it is not conclusive, and, notwithstanding there has been a delivery, the property will not pass if it appears that the intention of the parties was that payment be a condition precedent to the passing of the property.

"The condition as to payment or security is one which may be waived by the seller, in which case

Fig. 4. THE THERMIT REACTION

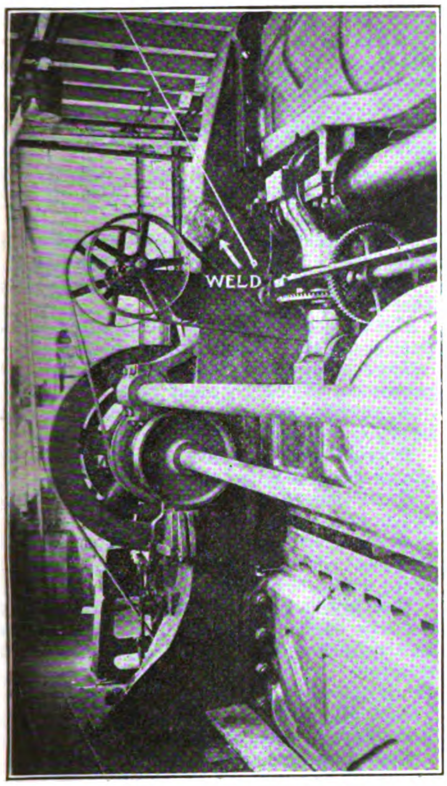

Fig. 6. THE FRAME REPLACED IN OPERATION AFTER BEING WELDED. THE ARROW INDICATES THE WELD

title to the goods sold will vest in the buyer although the condition has not been performed. Where the seller delivers the goods conditionally, and without any intention of waiving payment or security, the property does not pass; and in order to render the delivery conditional within the application of this rule it is not necessary that there should be any express declaration to that effect, but it is sufficient if it appears that such was the understanding of the parties, or that the delivery was made in the expectation of immediate payment, the question being primarily one of intention, as shown by all the facts and circumstances of the case. If the seller delivers on an understanding that he is to receive immediate payment or security he may reclaim the goods, or if he delivers on payment by check, and the check is dishonored, he may reclaim the property.''

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The business man who thinks much and acts accordingly is always a leader. A wise proverb declares that, ''It is for want of thinking that most men are undone.''

RED FOR OXYGEN: BLACK FOR ACETYLENE

Every once in a while there arises in our midst the genus-reformer who sees imminent need for upsetting established customs of one sort or another. Now it is the man who would reverse the order of color-marking oxygen and acetylene and regulators.

It seems advisable in the interest of safeguarding the oxy-acetylene industry to nip in the bud any suggestion along this line.

The necessity for adopting a general practice in the matter of standardizing the color markings of oxygen and acetylene hose and regulators was early appreciated, both by manufacturers of equipment and by the National Board of Fire Underwriters. The latter, in their Rules and Requirements (edition of 1910), dealt with the subject as related to hose in the following definite provision:

''In order to avoid confusion when attaching the hose to the connections a red colored hose should be used for oxygen and a black colored hose for acetylene.''

This recommendation was very generally adopted by manufacturers, not only in the color marking of hose, but also in the color marking of regulators, which were in every instance, if color-marked, painted red for oxygen and black for acetylene, to correspond to the color of the hose to be connected to them. This practice worked admirably and became as much a part of subconscious welding and cutting thought as one's A, B, Cs.

And now there is agitation in certain quarters to reverse the order, red being favored as a more natural color to indicate combustible gas! It is true that red is a common danger signal, but it is equally true that in the oxy-acetylene industry red has stood for oxygen ever since welding and cutting have been used to any appreciable extent in this country. It would seem unwise to unlearn now something that has become so fixed in thought-habit as has this old established practice; and all the more so considering the fact that the industries of the country have in service tens of thousands of welding and cutting units in which hose and regulators are color-marked with red for oxygen and with black for acetylene. The change proposed would surely result in confusion and possibly serious accidents by substituting a thought-effort in the place of automatic practice.

In line with this view of the matter is a resolution passed at the regular meeting of the Executive Board of the Compressed Gas Manufacturers' Association.

''RESOLVED: Whereas, although it would have been a good thing for the industries if red had been adopted as the color for combustible gases at the inception of the business, grave results might follow such adoption at this time and we therefore feel that it is desirable to go on record as against the change of colors now in general use.''

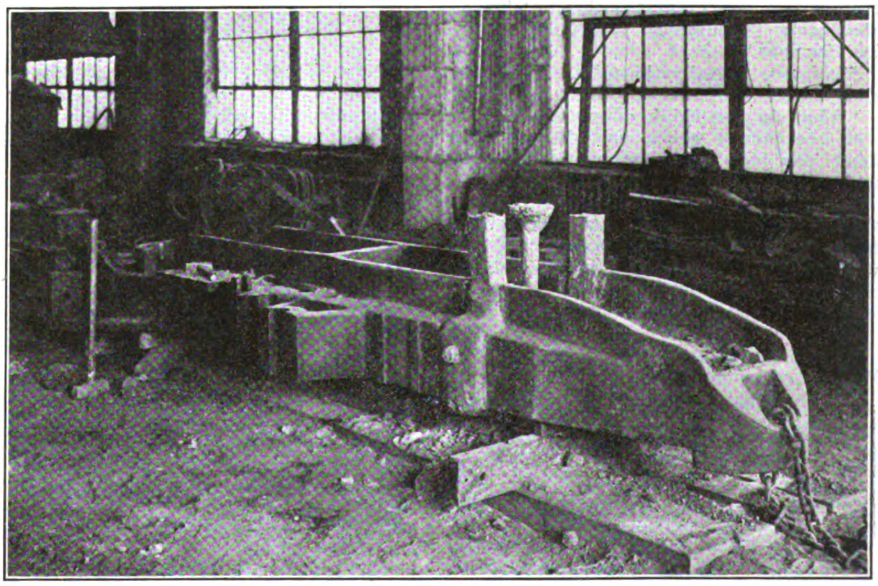
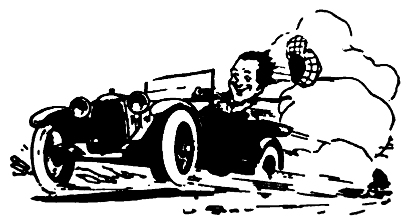


Fig. 5.—THE THERMIT WELD BEFORE REMOVING THE RISER AND POURING GATE

High Spots



CONSOLATION

"Good morning, Uncle Slewfoot! How is your rheumatism coming on?"

"Po'ly, sah; po'ly—and 'bleeged to yo', sah, for de 'terygation. But I has de blessed consolation of knowing a brudder dat's a heap wuss off dan I is. De Lawd has done blessed dat mizzable man wid de skiaticky an' de St. Vital's dance. De one keeps him jumpin', an' d tudder near-kills him when he moves."

HE SUCCCEEDED

It was a very hot day, and the fat salesman who wanted the twelve-twenty train got through the gate at just twelve-twenty-one. The ensuing handicap was watched with absorbed interest from both the train and the station platform. At its conclusion the breathless and perspiring knight of the road wearily took the back trail, and a vacant-faced "redcap" came out to relieve him of his grip.

"Mister," he inquired, "was you tryin' ter ketch dat Chicago train?"

"No, my son," replied the patient man. "No, I was merely chasing it out of the yard."

REAL AFFINITIES

"Are you sure your tastes and Robert's are congenial?" anxiously inquired the fond mother of the newly engaged daughter.

"Oh, yes, mamma," replied the joyous young thing, "we are both fond of Browning and lemon pie and motoring."

THE EXPLANATION

Diner (reading from the bill of fare): "Chicken, 75 cents; milk-fed chicken, one dollar. What is a milk-fed chicken?"

Waiter (perplexed but optimistic); Er—that probably means it has not been weaned, sir."

MEASURED MELODY

Concert Manager: "What, you want twelve dollars a night for playing! That's absolutely ridiculous. You must charge by the note."

Musician: "No, by the mile. I play the slide trombone."

"What do you think of my car?"

"I see you've got a good horn. Why don't you jack it up and run a new car under it?"—Boston Transcript.

A Flivver in Kankakee, Ill., broke the arms of four persons, who attempted to crank it, in less than a week. That's what comes of crossing a bicycle with a mule.—Utica Tribune.

"I just bought a Ford,"

"I got a Rolls-Royce."

"That's a good car too, isn't it?"—Bystander London.

We never saw a horse laugh. But when a horse sees a four-year-old flivver staggering up the street he has a right to laugh.—Cincinnati Enguirer.

Sign in village garage:

"AUTOMOBILES AND FORDS REPAIRED."—American Motorist.

The way large families are packed into small cars, some inventor ought to devise a folding child for parents who own flivvers.—Border Cities Star.

"On the road yesterday we saw a sign "SEA FOOD A SPECIATY."

"Well, what happened?"

"Our auto turned TURTLE."—Baltimore American.

FOR SALE:—Late model Ford Touring car, apply Herman's Tin Shop.—Watertown Standard.

Yes, you might call them "fright rates." Regina Post.

Not a Prodigal Job.—The prodigal son got the fatted calf, but it wasn't a prodigal farmer that "fatted" it.—London, Ont., Free Press.

"JUST KEEP ON, KEEPIN' ON"

If the day looks kinder gloomy
And your chances kinder slim;
If the situation's puzzlin',
And the prospects awful grim;
And the creditors keep pressin'
Till all hope is nearly gone,
Just bristle up and grit your teeth,
And keep on, keepin' on.

Fumin' never wins a fight,
And frettin' never pays:
There ain't no use in broodin'
In these pessimistic ways.
Smile just kinder cheerfully,
When hope is nearly gone,
And bristle up and grit your teeth,
And keep on, keepin' on.

There ain't no use of growlin',
And groumblin 'all the time,
When music's ringing everywhere,
And everything's a rhyme.
Just keep on smiling cheerfully,
If hope is nearly gone,
And bristle up and grit your teeth,
And keep on, keepin' on.

—Selected.

"Selling Things"

Envy.—Prisoners are to have two new suits a year. Here's where we throw a brick through a window.—Ottawa Journal.

No Charge.—Glory be. We were able to change the clocks the other day without having to pay the income or any other tax.—Brockville, Ont. Record.

A medical Corps Officer chanced upon a negro acquaintance of civil life one day in France.

"How do you like the army, Mose?" he asked.

"'S'all right so far, cap'n," replied the negro, "but Ah don' know how I'm going to like it when dem Germans shoots at me."

"Don't worry about that," replied the officer. "Al you have to do is zig-zag." And he demonstrated.

The next time the two met, the negro was in a hospital.

"What's the matter with you, Mose?" asked the officer.

"Ah ain't sure, cap'n, but Ah think I must have been ziggin' 'bout the time Ah oughta been zaggin'."—American Legion Weekly.

AT COMMAND

"I don't suppose you keep anything so civilized as dog biscuits in this one-horse, run-down jaytown, do you?" the tourist customer snarled.

"Oh, yes, stranger," the village merchant responded pleasantly. "Quite a few folks like you come through from the city, and we aim to have everything called for. Have 'em in a bag, or eat 'em here?"

Don't break your word—unless you can do it where a hyphen will fit in nicely.

Necessity knows no law, and it's the same with extravagance .

Hush money usually speaks for both parties in the transaction.

True friendship between women is a matter of doubt to most men.

A nutmeg may be great, but sooner or later it will meet a grater.

Providence takes care of some fools by giving them a wife to look after them.

Don't consider a task impossible because you are unable to perform it.

Soon there will be no sober second thought accompanied by a dark brown taste and a headache.

Railway corporations are not altogether soulless when they allow only 10 minutes for refreshments at the railway lunch counter.

If all the trees were cherry trees,
And all parents were unwise
Enough to present hatchets to
Each boy of George's size,
It would be tough on every one
Who is fond of cherry pies.

A man is usually able to conceal his middle name while he lives, but it always crops out on his tombstone.

It is some consolation to a man when a girl refuses him in a hesitating manner. It's the negative produced by the instantaneous process that hurts.

Don't pick quarrels before they are ripe.

Many a pretty shoe covers an ugly foot.

A word to the wise is sufficient—if it is the right word.

Less than a pint of whiskey may make a peck of trouble.

A political dark horse is a real nightmare to the rest of the bunch.

Most of the things people tell you are of no earthly benefit.

Learn to paddle your own canoe before offering to steer some other fellow's boat.

The financial failure of the girl's father has resulted in heart failure for many a young man.

If you would believe in the honesty and integrity of your friends, don't endorse their notes.

And it sometimes comes to pass that, after a man has made money, the money gets busy and unmakes the man.

The man who is aware of his ignorance knows a whole lot more than some people, and he stands a better chance of making good.

There is no good and sufficient reason why you should mind your own business if other people will pay your more for minding theirs.

When a husband and wife are of the same mind it is a pretty safe bet that the mind belongs to the wife.

Merit often turns up in unexpected places.

Wise is the man who has a cage ready for the bird in hand.

Corkscrews has sunk more people than cork jackets ever saved.

When you can get a horse at a bargain —drive the bargain.

The rolling stone reaches the foot of the hill in due time.

Benton's Recipes

Cement for Brass on Wood:—Sometimes screws or other fastenings of brass or iron are not feasible nor permissible, and a cement that holds the parts firmly together is very much needed. Such an adhesive is made as follows: Take same kind of glue as is used by carriage wood workers, and to every pound of glue in a dry state put in one fluid ounce of glycerine and one ounce of slacked lime. Boil the glue as usual, put in the glycerine and lime, stir well so that it mixes thoroughly. To this mixture of one pound of glue in a dry state add two thimblesfull of hard boiled linseed oil and again stir well while the glue is boiling. If too thick, thin with linseed oil rather than with glycerine.

Previous to spreading the glue, dip the brass in a weak solution of nitric acid (one part acid and 10 parts of water), which will roughen the surface of the metal and afford a better grip for the glue.

Warm the metal and the wood, force the two parts together same as wood workers do, by clamping them, and when dry the glue will hold the parts together. The addition of glycerine prevents the glue from shringing when drying.

Heat Treatment Oils:—The essential requirements of tempering oils are: Flash and fire tests high enough to avoid serious evaporation loss or to incur high fire risk; comparative freedom from decomposition; absence of acid or acid forming substances, which would have a materially corrosive action on metals at high temperature; a fairly high heat capacity; and enough capacity to permit rapid carrying away of the heat.

To Renew Polish on Tools: There are various ways to clean off rusty and soiled bright work on tools, etc., most of which involve the use of coal oil, gasoline or benzine, as the cleaning agents and some wax or heavy oil for polishing and preserving. One mixture recommended is 100 parts of petroleum to 2 parts of paraffin. Shave the paraffin fine and put it with the petroleum in a bottle and let it stand a couple of days, giving it a shake when ready to use and apply with a woolen rag or brush. Coat the tool and set aside until the next day and then rub well with a woolen rag. On badly rusted tools a second and third application may be necessary.

To Blacken Brass for Templet Work and Other Purposes:—The brass must be thoroughly cleaned, and then is heated slowly over a charcoal fire, care being taken not to allow the brass to touch the charcoal, or indeed not to allow any sparks from the charcoal to come in contact with the brass or it will cause red spots. As soon as the brass is slightly red, dip it into nitric acid and reheat, just short of red. Rub strongly with a stiff bristle brush and clean with a greasy cloth. This gives a fairly permanent dead black finish.

To Cover Iron Pulleys With Rubber—Thoroughly clean the surface of the pulley; if the pulley has just been turned in the lathe, so much the better. Give it a thorough wash in muriatic acid and let stand over night. In the morning give the iron and rubber a good coat of heavy yellow shellac varnish and apply the rubber and clamp. Let stand until thoroughly set.

Overcomes Lead Sticking in Heat Treatment:—Trouble is sometimes experienced by the lead sticking to the work. This can be avoided by diping the article in a solution of cyanide of potassium and water—about one pound of powdered cyanide to one gallon of boiling water. This should be used cold and the article permitted to dry before placing in the lead bath. The pieces should be left in the lead only long enough to heat them through. The pieces can be quenched in oil, water or brine, as preferred.

To clean a lead spot, it is advisable to add dry, common salt, and stir thoroughly with the molten lead. All dirt and foreign matter will rise to the surface, and can be skimmed off with ease.

Substitute for Cement on Grinder Disks—A good substitute in place of glue or emery cloth to the disks of grinders of these Gardner type is to heat or warm various kinds of cement for fastening the disk and apply a thin coating of beeswax; then put the emery cloth in place and allow to set or cool under pressure.

Cement for Belts—Mix 5 ounces bisulphite of carbon with ½ ounce spirts of turpentine, and enough gutta percha to make a paste. Thin the ends of the belt so that when they are joined the thickness at the joint is the same as thickness of the belt. If the belt ends are greasy, apply some blotting paper and a hot iron to free them from grease. Then apply some of the paste, and press the parts together, using screw clamps and two pieces of board of the same width as the belt. The cement will dry in a short time, when the clamps can be removed. I have cemented belts in this way at night, and in the morning they were as nicely joined as could be wished.

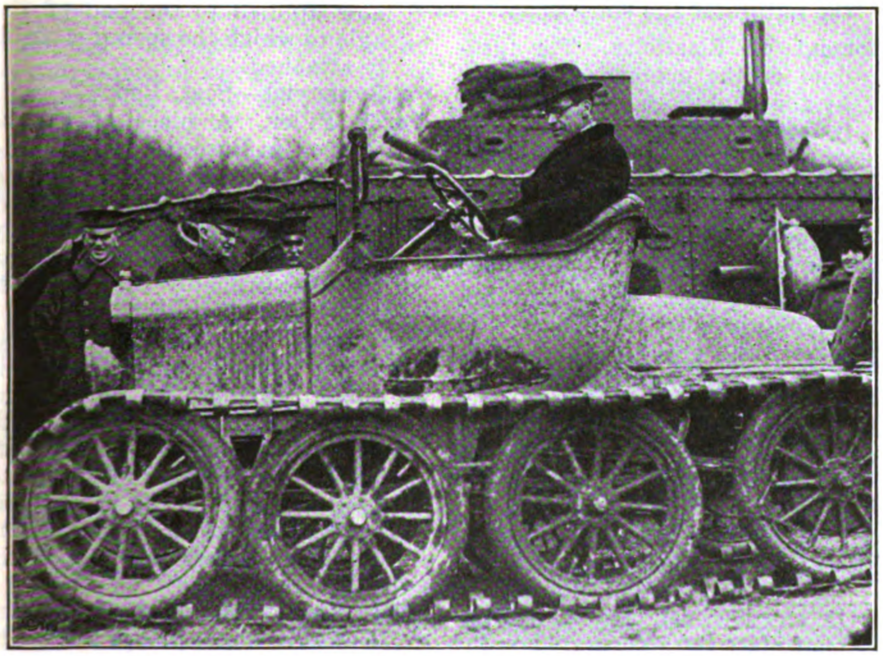
Copper Plating Cast Iron—In the process of covering cast iron with a coating of copper the pieces of cast iron are first placed in a bath made of 50 parts of hydrochloric acid, specific gravity 1.1, and one part of nitric acid; they are next immersed in a second bath comprised of 10 parts nitric acid and 10 parts chloride of copper dissolved in 80 parts of hydrochloric acid, specific gravity 1.1. The pieces are then rubbed with a woolen cloth and immersed again until the desired thickness of copper is deposited. To give a bronze appearance the copper surface is rubbed with a mixture of 4 parts sal ammoniac and one part each of oxalic acid and acetic acid dissolved in 30 parts of water.

Cement for Uniting Glass and Brass—It is often necessary, in electrical factories and repair shops, to cement small brass parts to glass. A good cement for this purpose is made from the following: 1 part caustic soda, 3 parts resin, 3 parts plaster of paris, 5 parts water. Boil all the constituents together until thoroughly mixed, and then allow to cool before using. The cement hardens in half an hour. If it is desired that it should not harden so quickly, substitute zinc white, lead, or slaked lime, for the plaster.

To Prevent Lead from Sticking to the Work—To prevent lead from sticking to work that has many small corners or grooves, when heated in a lead bath preparatory to hardening, mix lamp black with water or alcohol to the consistency of paint and apply with a brush. Be sure that the mixture is thoroughly dried out before the piece is dipped into the lead bath.

To Pickle Brass Castings—An excellent mixture to use for cleaning and brightening brass castings is as follows: Two parts, by measure, of nitric acid, and three parts of sulphuric acid. To each quart of the acid mixture made up, add one pint of common salt and stir until dissolved. The solution may be held in any suitable receptacle, say, of glazed earthenware. It is only necessary to provide a vessel large enough for the immersion of the largest piece to be dipped.

HERE'S ANOTHER USE FOR THE VERSATILE FLIVVER



Secretary of War Baker trying out an improvised Ford tractor at the test of army tractors, recently held near Washington. The tractor is built to run on eight wheels and is intended for use in the fields where the going is rough.

Glossary of Terms Used in the Automobile Leaf Spring Industry.

Life. A rather indefinite term used to describe the longevity of springs when doing work; the capability of exercising its natural functions. See Anti-fatigue and Endurance.

Lip. A projection on the edges of the leaf, made by forging, or drawing out the metal and then turning it up at right angles to the plate width. Used to prevent relative transverse motion of the plates.
Synonym—Lug (used instead of the word lip by English spring makers.)

Live Load. The actual load to be transferred by the vehicle aside from its own weight, as passengers, cargo, merchandise, etc. The load producing deflection in an endurance spring testing machine.
Synonyms—Paying Load, (In case of commercial Vehicle). Passengener load on passenger vehicles.

Load. The weight carried by a spring.

Long Plate. The plate next to the master leaf in a leaf spring.

Long End. In an eccentrated spring the longer "half" measured from the center of the center bolt, or center of butt, to the center of the eye of corresponding end.

Loose Shackle. A shackle made of links and not intergral with each other—sometimes, (though not properly) called a loose link shackle.

Loop End. A box eye on end of spring. See Box Eye.

Main Plate. The longest plate of a spring; the back, usually having eyes rolled, or forged, at its ends and through which the effort or load is applied to the spring.
Synonyms—Master Leaf, Back.

Manganese. A chemical element found in all spring steels.

Master Leaf. See Main Plate, Back.

Middled. A term formerly applied by English spring makers to substantially rectangular sections of steel which are slightly concave at the middle of the section.

Middling. The process of concaving spring steel by hammering it to concave shape. A term now nearly obsolete.

Modulus of Elasticity. Applied to designate the force that would be needed to stretch, or elongate, a material, if such were possible, to double its original length; a coefficient of stiffness. Thus: if a piece of steel were, say, ten inches long and one inch square in section, it would require a force of 28,000,000 pounds to stretch it to a length of twenty inches. It is true that no piece of steel can withstand such prodigious force but, the fact is interesting nevertheless and the knowledge of this is of great importance in the realm of mechanics. This value of 28,000,000 seems to be nearly constant for all spring steels and is, generally speaking, independent of their chemical composition.

Moment of Inertia. When applied to a plate of rectangular shape, as spring steel, it is a mathmatical expression of its width, multiplied by the thickness cubed, and the result divided by twelve. It is the measure of the body to resist forces acting thereon and is independent of the nature of the substance.

Moment of Elasticity. The product of the moment of Inertia by the modulus of elasticity; it represents the actual opposing, or resisting, force that a given material presents to change of shape within the elastic limit of the material.

Net Weight. The actual weight supported by a spring not including its own weight.

Neutral Axis. An imaginary axis through the center thickness of a plate where no tension or compression exists; it is an axis of shear. It is also the center of gravity of the section.

Nib. See Bead.

Nip. A term used, more particularly in England, to indicate the height between any two adjacent plates of a spring when the leaves are not clamped together but the points of each successive plates touch the preceding one. When any two successive plates have no nip they are said to be "dead."
Synonyms—Set, Pinch, Pull.

Offset. Not central, out of center, eccentrated.

Open Head. A head, or forging, welded to the end of the main leaf in such a way that, the upper face of the leaf is on a line tangent with the top of the head; it is distinguished from a button head by the absence of the circular boss which is the conspicuous portion of a button head. In an open head the stock between the ears extends to the point only on the outside circumference of the eye nearest the center of the spring.

Closed Open Head. This head is the same as an open head except that the stock between the ears extends to the end of the head.

Oval Head. The shape of a special bolt head used in the eyes of some full elliptic springs, which join the two elements together.

Overall... A dimension applied usually to the outside heights of full elliptic, three-quarter elliptic springs, and to the overall length of a spring measured to the outside portion of the eyes.

Peening. An act of striking plates with a round headed hammer to straighten them. A practice that should be deprecated

Perch. An expression formerly used for a separate bracket which the spring rested on, but now applied to the pad of the axle to which the spring is rigidly attached.
Synonyms—Seat, Pad.

Perch Filler. A piece of canvas steeped in linseed oil and white lead and placed on the perch to fill out the inequalities and permitting the spring to be firmly attached to an otherwise uneven surface; probably first suggested by R. D. Woodford.

Pin Head. A round pin attached to the master leaf by forging it solid, having its long axis parallel and usually in line with the center length of master leaf, which enables the end of this to go into a hole in the axle. This method of attachment prevents torsional stress on the main plate.

Plain End. The end of the master leaf is in some springs left without an eye and such ends are frequently straight or flat, although, in some instances, this end is given a slight reverse sweep.

Plate. A single leaf of a spring. Depending on their location, size, or function; the various plates are named: **Long Plate, Master Plate, Master Leaf, Short Plate, Rebound Plate, Auxiliary Plate,** etc.

Platform. A combination of four semi-elliptic springs, arranged so that two are on the sides and two are across the vehicle; also, any other combination, similarly disposed, with relation to the vehicle. When combinations, other than semi-elliptics, are used they receive special names of the type of spring to which they belong and the word platform is affixed; three-quarter platform, etc.

Points. The end of the spring leaves. These are forged or drawn into special shapes and receive names accordingly. Thus we have **Round, Oval, Egg Shape, French Square,** etc.

Polished Top. A style of finish in which the upper surfaces of the leaves (those visible to the eye when the spring is in place) are ground upon a grindstone and afterward polished upon a buffing wheel.

Pressure Block. A piece of metal or wood, shaped approximately to fit four to five inches of the short plate of the spring and used as a spring seat when applying a load in testing springs for their carrying capacities, etc.

Pumping. The act of loading and unloading a spring rapidly to loosen up scale or to "nest" the plates.

Pull. See Nip.

Radial Elliptic. A special arrangement of a full elliptic spring in which the lower half elliptic is longer and sometimes wider than the upper; one end of the upper element is attached by a bolt or shackle to the lower and the other end is attached by means of a shackle to an extra plate lying over the master leaf of the longer spring.

Rapping. The act of jarring, shaking, or tapping a spring so as to release the friction of the plates, thereby enabling the effects of friction to be noticed (or removed) in testing.

Rear Spring. Any spring used on the rear end of a vehicle.

Rebound Clip. A "U" shaped piece of steel rigidly attached to one plate and surrounding two or more plates and preventing their parting in the event of strong rebound, or, on the rapid removal of the load from a leaf spring. There are a variety of forms of rebound clips used.

Rebound Plates. A plate placed over the master leaf of a spring and so shaped that it carries a load only when the direction is, in sense, opposed to that of the main spring. This plate may be as long as the main plate, but is usually much shorter. Its utility in the respect mentioned is doubtful, but it possesses other features that are thought desirable.

Released Load. The various dimensions of a spring can be ascertained by applying given loads, in steps, and measuring successively their alteration; also a much greater load may be applied and by slowly releasing, in steps, the various dimensions can be obtained. The two methods do not give the same results, but the last method is sometimes used and is called the Released Load Method. When used in conjunction with the applied load method it enables us to ascertain the frictional work of the spring.

Rib. A long and narrow grooved projection thrown up by forcing out metal at the center of leaf point or end, and used to align plates.

Ribbed Spring. A spring whose plates are provided with ribs to align the plates.

Riding Quality. An indefinite term expressing a general but vague meaning referring to the softness of a suspension.

Right Hand. Referring to a spring placed on the right side of a vehicle. See Left Hand.

Round Head Rivet. A type of rivet having a round head and used to fasten the rebound clips to leaf points.

Rolled. The process of making steel plates, or leaves, or the points thereon by being passed through rollers. Also descriptive of making the eye of a spring.

Round Point. The shape of the end of a leaf on a spring. No precise description can be given to cover this term.

Saddle Clip. Sometimes, but incorrectly, applied to the rebound clip, but more frequently and appropriately applied to the box clip used to hold the spring to its seat.

Synonym—Box Clip.

Saw and Bead. A means of keeping the plates in alignment. A bead or projection is stamped on one plate and made to fit into a sawed slot in the adjacent plate.

Scale. This term is synonymous with the word capacity, which see.

Scarfing. The process of tapering plates to weld on eyes; the process of making points on plate ends.

Scragging. A term used by English spring makers to describe a bending test on steel for springs, or, a deflection test of a spring.

Scroll End. The end of a spring turned or bent around a form giving it a large curve, which is called a scroll. Sometimes called a "C" end, owing to the slight resemblance to this letter. The term "C spring" is applied by some to a scroll end, but this in incorrect.

Seat. A pad or bracket on which the spring rests.

Synonyms—Perch, Chair, Pad, Spring Rest.

Self-Lubricating Bolt. A bolt containing a reservoir for grease or oil; the lubricant flows through proper channels to the spring eye, or bushing, and, of necessity, lubricates both bolt and bushing automatically.

Self-lubricating Bushing. A bushing containing graphite fillers, which are supposed to perform the office of automatically lubricating both bushing and bolt.

Self-lubricating Shackle. A shackle so designed as to contain a well or reservoir, together with a proper arrangement of wicks to feed oil to the shackle bolts and spring eyes. Such are the F. J. M. or Miesse Shackles.

Semi-elliptic. A half elliptic spring, or, a spring having a shape which is approximately a half of an ellipse.

Set. Meaning the arch or camber of a spring or a plate; in this sense the term is not often used. The distance or "nip" in respective plates when free and unbolted or unbanded and the points of each leaf just contacting with the one above it;

a deformation or distortion which has become permanent, as in a piece of steel which has been stressed beyond its elastic limit. The set is then said to be permanent.

Shackle or Shackel. A clevis or a "U" shaped piece of material used to join a spring to its hangers.

Shape. Refers to the form or the contour of a spring when either free or loaded; also, the kind of points on a leaf.

Shock Absorbing. The capacity of a spring to yield to sudden blows and prevent their reaching the vehicle. Something that prevents rapid or large changes in acceleration by being interposed betwen the substance tending to undergo changes of acceleration and the force producing it.

Short Plate. The shortest plate in a leaf spring forming a unit with the series carrying the main load.

Side Spring. Any spring used on a vehicle and placed parallel to the vehicle length. Formerly this term applied to a long semi-elliptic spring extending from the front axle to the rear axle and called a **Body Spring.**

Silicon. A chemical element.

Slape End. A spring end having its master leaf folded back on itself for a distance of about 2″ to 5″ and forming a pad, or shoe, to slide on a casting provided for the purpose on the frame of the vehicle.

Sleeve. A bushing usually of metal. A tube. The term bushing is preferred.

Soft Spring. A term used to designate a spring having a high flexibility. It bears no relation to the quality of steel, for all steels are equally "soft" or "hard." See Modulus of Elasticity.

Spacer Clip Plate. A plate placed on the master leaf of the spring and used as a distance piece for the box clips.

Special Bead. A nib or projection in a plate made in accordance with some "special" design, the size of the bead not being a "standard" carried in stock.

Special Bolt. The term is clearly indicative.

Special Bolt Head. This is clearly indicative.

Specification. A concise and detailed description in writing, or a drawing showing the requirements of the purchaser.

Spiral Spring. A spiral spring is one which is wound around a fixed center and continually recedes from it like the hair spring of a watch; such springs have been recently used in conjunction with plate or leaf springs, both in this country and abroad.

Spoon End. An end on a spring (seldom used now) having a concave seat in which a swiveling member fits.

Spring Hanger (or Horn). A bracket-like piece, permanently attached to the frame by rivets or, other fastening and to which the springs are attached by shacles.

Spring Brackets. Used for the same purpose as a spring horn.

Spring Leaf Retainer. A longer term, meaning the same as a rebound clip. Probably called retainer for it, doubtless partly functions in the same way as a lip or slot and bead, saw and bead, etc.

Spring Stop. A rubber bumper that prevents the spring contacting with frame or other adjacent members.

Static Load. The load on a spring which does not alter, as frame body, etc.

Stiffness. The number of pounds required to deflect a spring, or a combination of spring elements made into a unit, one inch.

Synonyms—Capacity, Scale.

Strain. The stretch or elongation caused by a force or load acting on a piece of material. Every stress is accompanied by a strain. Hence, without a stress there can be no strain. Strains produced by forces acting within the material are known as internal strains.

Stress. That which produces a A force.

Stubbs Gauge. A gauge for measuring thickness used in the spring industry.

Supple. Pliable, yielding, flexible.

Supplementary Spring. An extra spring of any kind although generally of the nickel variety, connected with the plate spring and used to increase the total deflection of the spring system; sometimes used in the sense of auxiliary, helper, or jack springs. The application of this term is, for the present, at least, not precise and care should be exercised in its application; it is, indeed, used in two distinct and almost opposite senses.

Snubbing. The process of rolling whereby the thickness of the steel is reduced at a given location only. This distinguishes Snubbing from Taper Rolling, in which the thickness uniformly decreases throughout the length of the portion rolled.

Swedged. The operation of compressing a piece of a plate to contract it, as by rolling or otherwise working it.

Sweep. The radius of the curve to which a spring plate is shaped; a curved line; also means the arch, or camber, or compass. **True Sweep,** generated by being drawn from a single center. **Double Sweep, Reversed Sweep,** two curves drawn from opposite and even different centers, producing contra-flexure shapes. Also called **Double Compass. Varying Sweep,** having two or more loci for generating curves.

Synchronism. To be in phase with, to coincide with.

Taper. To thin down as by rolling, drawing or forging.

Teat. A nib or projection on a leaf of a specific size.

Teeter. A colloquialism, meaning to rock like a see-saw, more especially used to describe a transverse rolling or rocking, as is common in a three-quarter platform suspension using a flexible cross spring, or, where a stiffer spring is used and a high center of gravity maintained.

Synonym—Rolling. Rolling or teetering is noticeable where the side springs are narrow or where lateral stability is wanting.

Temper. To harden a piece of steel by heating to a high temperature, then quenching in a cold medium, as water, oil, etc.

Tensile Strength. The force, measured in pound units, required to disrupt a piece of material by being stretched or pulled apart. Tensile Strength is becoming to be understood as the force in pounds required to pull apart one square inch of material.

Tensioning. A term formerly applied to the act of putting a nip in plates by peening them. A practice rapidly becoming obsolete.

Test Height. The opening, camber, or in to out dimension of a spring when under a given test load.

Tobin Bronze. A material often

used for bushings in spring eyes and consisting substantially of 58.2% copper, 2.3% tin and 39.5% zinc.

Transverse Spring. A spring, usually of the semi-elliptic type, placed at right angles to the car length or parallel to the car width, and not used in conjunction with any other spring.

Treatment of Steel. Usually applied to abbreviate the term heat treatment, which see.

Torsional Strain. A strain produced by twisting, as the strain produced in a shaft transmitting power. Should be avoided in springs. Torsional strains are sometimes produced in three-quarter elliptic springs when the upper and lower elements are not parallel.

Synonym—Twisting strain.

True Sweep. See Sweep.

Tube Spacer. A brass or, sometimes, a steel tube used to space the rebound clips so that they do not bind or pinch the plates.

Twisting Strain. See torsion.

Uniform Strength. A spring so proportioned that the stress is everywhere the same; hence it is of uniform strength.

Universal Shackle. A shackle or, a combination of two shackles, allowing freedom of motion in two planes.

Underslung Spring. A spring fastened underneath the axle instead of on the top of same.

Vanadium Steel. A steel alloyed with the element vanadium. Also applied to a steel in which vanadium may have been used during its manufacture to divest it of objectional substances.

Warping. To twist out of intended shape, to distort, as by heating or rapid cooling.

Weight Capacity. The maximum weight a spring will carry without permanent set.

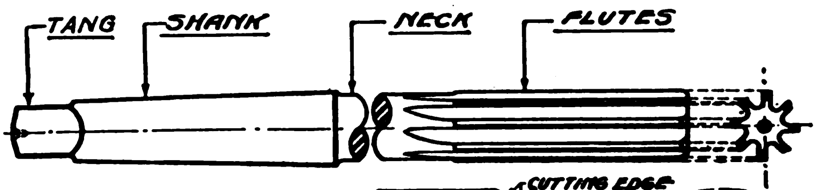
Wrapper. A leaf rolled over the outer portion of the spring eye.

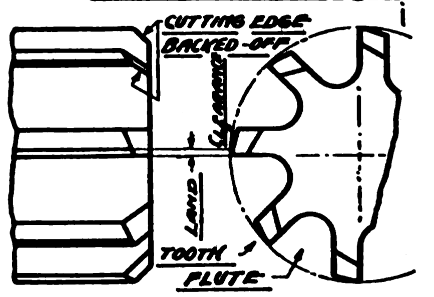
Wrought Shackle. A shackle made by a forging process from wrought iron.

Yield Point. In testing the strength of materials that point, at which, the rate of stretch suddenly increases rapidly. It is nearly, but not quite exactly, coincident with the "elastic limit." Practically the elastic limit is taken as the yield point.

TAKING CARE OF THE REAMER

Automoblie repair work has necessitated bringing into the blacksmith shop, tools that were not used extensively on its predecessor. The advent of the iron horse has introduced many machine tools into the repair shop, in order that certain repairs operations could be more successfully completed. Perhaps the most prominent of all is the reamer. Few of the repair tools are required to produce such accurate results, and few are, at





the same time, given such inconsiderate handling both in use and the manner in which they are stored.

The reamer is a very delicate tool, and is easily damaged by being struck with hard substances. If it is a long reamer, it may be easily bent out of line by careless handling when in use or by storing it on some uneven surface with some other object on top of it. Reamers, like all other tool steels are susceptible to rust, and only a small amount of rust on the land will cause the reamer to cut rough. By exercising a little care in using, storing and raising a reamer, its length of service may be considerably extended.

Each time a reamer is returned to stock after it has been used, it should be given a coat of oil to prevent it from rusting. It should be stored in a wooden case to prevent the possibility of any hard object striking the cutting edge. In the absence of a suitable wooden case, wrapping it in a rag will prove a useful expedient.

There are two styles of reamers, generally termed machine and hand reamers. Because the machine has the power to push the reamer through the work, and as longevity is an important consideration on production work, the machine reamer has a land between 1/64 and 1/32 of an inch wide, while the hand reamer has only .009" or less (slightly over 1/128 of an inch.) When the reamer begins to cut undersize, its life may be slightly extended by raising it. This is accomplshed by drawing a piece of hardened steel along the face of the tooth. Never stone a reamer on the outside diameter as this throws a burr into the flute, requiring the reamer to be refaced, an operation which requires skill and special machinery.

THE BEFORE AND AFTER RADIATOR

The Elm Auto Sheet Metal Works, Winnipeg, had a glass showcase outside their premises. The showcase contained a single auto radiator. Half of the radiator was left in its damaged condition, while the lower half was painted and fixed up like new. A card above the showcase announced:

"Before and After having treatment at the Radiator Hospital."

REBUILT RADIATOR BETTER THAN NEW

The Central Repair Shop, Saskatoon, Sask., placed an auto radiator repaired by them in the window. The card backing up the exhibit was as follows: "Radiators rebuilt by us are better than most new ones."

(Continued from page 152)

drawing together by making the same allowance as was made in the case of the flat plates and maintaining this space by means of a wedge that may be moved along as the welding progresses.

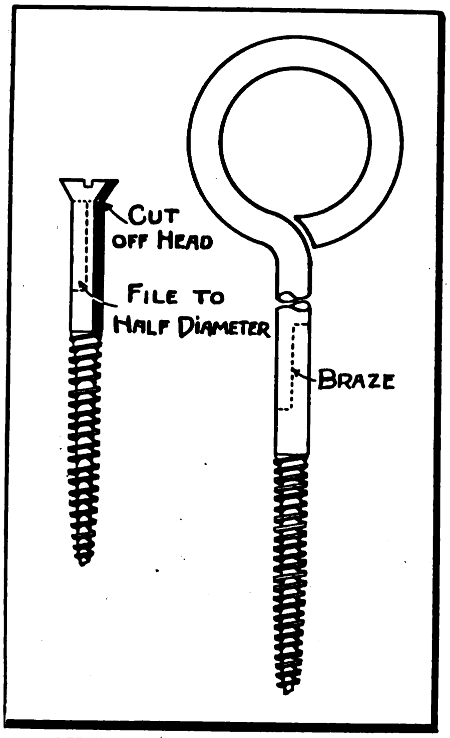
These few simple examples of the effect of expansion and contraction taken at random from the hundreds of similar problems that the welder will meet in the course of his work, will suffice to show that their action cannot be overcome by force, and that it is perfectly useless to attempt opposing them. The method is to avoid or limit their consequences.

Helpful Shop Suggestions

CHAS. H. WILLEY.

PACKING SCREW

A very easy way to make a serviceable packing removing screw is shown herewith in the sketch. Simply file a suitable size wood screw flat for half its diameter, and do the same to the end of a piece of small rod, then braze or solder the two together and you have a dandy screw for pulling out small packing.



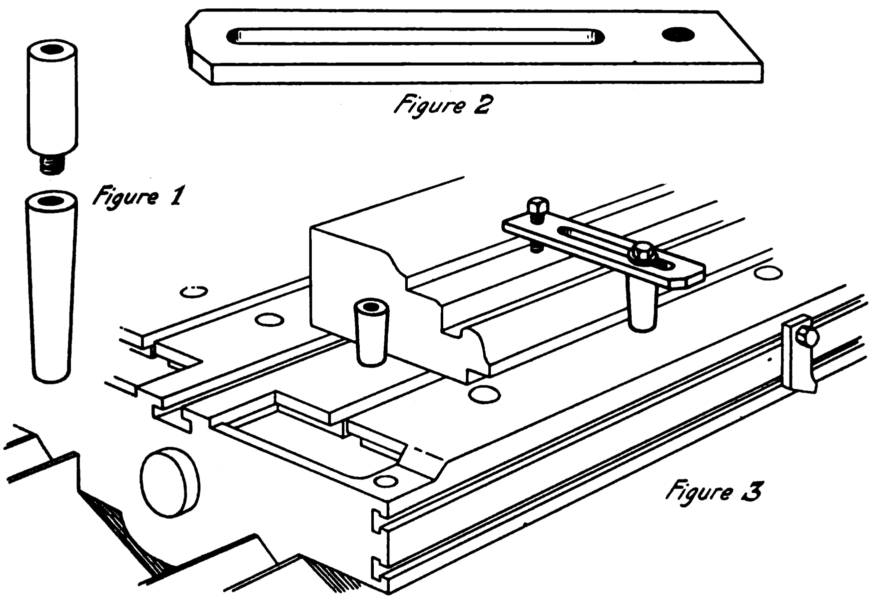
AN EASILY MADE PACKING EXTRACTOR

Chas. H. Willey.

PLANER STOP AND CLAMP

A rather novel sort of clamp and stop for planer use is shown in the sketch. It will appeal to mechanics operating such a machine.

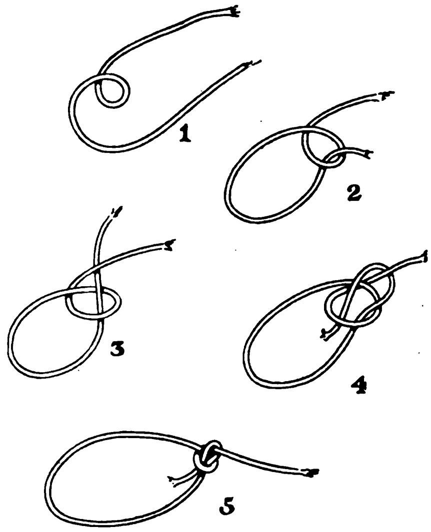
The stop is turned taper as shown in Fig. 1, so that it will fit tightly into the hole by a blow on top with a babbitt hammer. The large end is drilled and tapped to take a standard machine bolt. A strap such as shown in Fig. 2 is made to use the stop as a clamp, the strap being bolted to the top of the stop, and a set screw is used in the outer end for applying pressure to the work. The use of couplings such as shown in Fig. 3 make the clamp adjustable for height. The sketches make clear the use of the tool.



HANDY PLANER STOP AND CLAMP

NON-JAM KNOT

The bowline knot is the sailor's name for this non-jam knot and not one in a hundred land lubbers can tie a knot that will not jam so that it can be easily untied, yet almost every day there is a need of tying such a knot. I have sketched out the five steps in tying a bowline knot and if one will follow the steps shown with practice work, that is, take a piece of rope and go through the steps a few times, it will be very easy to learn how to tie the knot. This knot absolutely will not jam, no matter how tight the rope is pulled or if the rope gets wet.



A KNOT THAT WILL NOT SHIFT

BENCH DRILL WITH BREAST DRILL

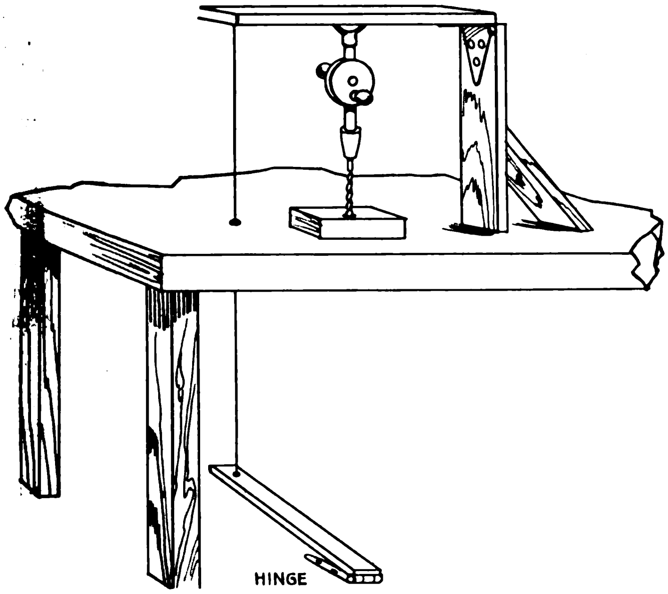
In spite of the fact that a shop may have one or two post or spindle drills, it sometimes is handy to be able to do a bit of drilling right at the bench when these drills are busy. The sketch shows a very simple idea of the way that a breast drill can be used with foot pressure. This scheme is specially handy for portable electric hand drills.

HOME MADE HOSE RACK

While passing near a roadside gas station the other day I noticed that the owner had made a hose rack out of a quarter of a barrel nailed to the wall. The idea is crude, yet worthy of note, for it saves the hose from kinks and abuse. The necessary material can be found around any shop. The sketch shows the idea.

HANDY PLATFORM FRAME

Where one has use for a platform around the inside of buildings, they could use the scheme shown in the sketch; that of utilizing old boiler tubes or lengths of pipe and large size machine bolts for the adjustable feet. The upper ends of the pipe are split and bent back to make flanges. The machine bolts are split and spread apart and secured to pieces of plank, as shown. The separate parts can be jacked tightly against the ceiling, as indicated, thus making a rigid platform. These same parts may be used as braces for other work.



AN IMPROVISED DRILL PRESS THAT SERVES MANY USEFUL PURPOSES

SCREW AND BOLT KINKS

Add these two kinks to your collection as they are worth remembering.

There comes a time when you want a thumb screw of a large or small size and none can be found, yet you have other screws of the correct size. The trouble can be remedied by cutting a slot in the screw head and making a butterfly to fit into it. Make the slot small and drive the wing into it, then solder.

Sometimes it is desired to lock a nut on to a bolt so that it cannot work off, yet there is no room for a cotter and it is not possible to spin the nut. It is then that the scheme of drilling and tapping a hole in the end of the bolt for a screw is used and a thin washer under the screw will keep the nut on.

A TIME-SAVING HINT

By Ed. Henry

"Confound it," growled the blacksmith's helper, rolling into the vulcanizing department an inflated tire mounted on its rim, "Here I have to take this tire off, fix it, put it back on the rim, and pump it up again. All that trouble just to vulcanize a small tread cut."

"Why not leave it on the rim?" asked an accessory salesman who happened to overhear his complaint.

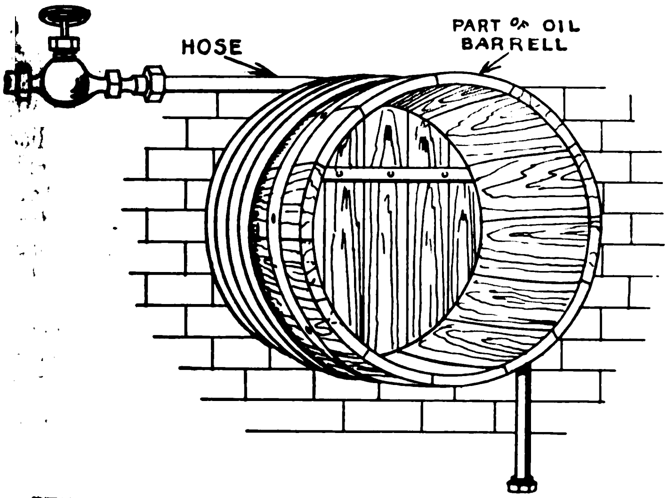
"How can you do that?" derided the helper.

"Clean out and fill the cut just as you always do, using quick repair gum, then clamp on one of those automatically-regulated small vulcanizers and light the heating element. Leave it on till cold and when you remove it you'll find a finished job. While you've saved yourself the time and trouble of removing and then replacing the tire on the rim."

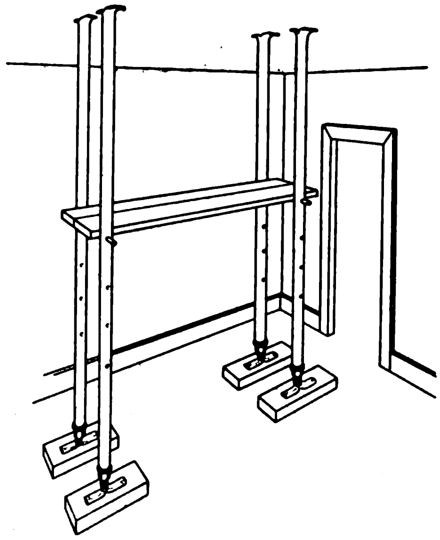
"Yes, try it," ordered the blacksmith who had been listening, and thus reassured the helper went to work.

The salesman could not await the completion of the job, but when he came around again the blacksmith thanked him for his time-saving hint, and showed his appreciation with an increased order.

To show up minute cracks in hardened pieces, apply oil, wipe off, and chalk the surface. The oil appears at the cracks, soaking through the chalk.



THE LIFE OF THE HOSE IS PROLONGED IF STORED PROPERLY

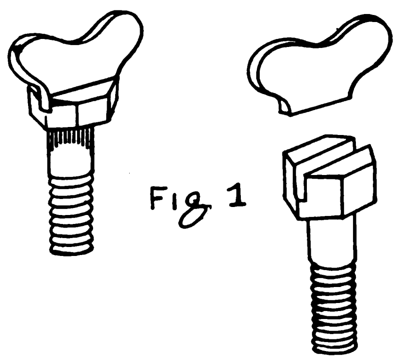


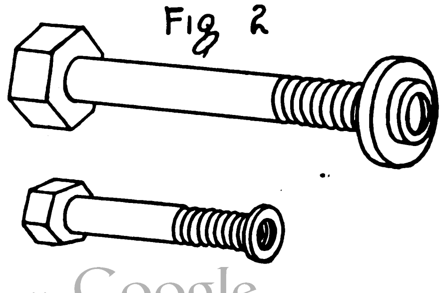
AN EASILY MADE AND DURABLE PLATFORM FRAME

The Bureau of Immigration reports that more than 5,000 immigrants are arriving at Ellis Island daily and that the number is restricted only by transportation facilities.

When you advertise don't make your copy all from the "you" and "I" angle if you would have it sincere. Blend the "you's" and the "I's" and the result will be more convincing from every standpoint.

The man who has no desire to do his work well is either in the wrong kind of work or else he is shiftless; in either case he is no help to the business.





Art Steps on the Soft Pedal

BY D. G. BAIRD

YEP, Mr. Dealer and Mr. Shopman sure is up against it when it comes to the ennoblin' virtue 'uv makin' collections, or to put it in plain American, of gatherin' in the jack what's rightfully due and belongin' to 'em for their heroic service in ministerin' to the ills 'uv the gasoline chariot and its older cousins, the mule-power vehicles and implements.

A good customer goes along deservin' the title I've just give him, f'rinstance, and he brings all his tinkerin' what he ain't able to do on Sundays hisself and all his accessory business to friend Shopman and Dealer and allus brings the necessary amount'uv kale along with him for a spell, and then one day he has a good neat job done on his old bus and when it's all finished and Mr. Shopman's wipin' the grease off'n his mits all ready to pocket the remuneration the gent says real confidential: "Just make a note'uv that, will yuh Oscar? I'm a little short'uv change today. I'll see yuh first'uv next week, sure."

Mr. Shopman don't like to make notes, seein' as how his fist is better suited to flourish a monkey wrench than a pen, but he's done the work and the gent's a good customer and all and he hates to say what he thinks about makin' notes 'cause he don't wanta hurt the gent's feelin's, so he grunts somethin' to hisself what sounds like "all right" but what's really "dammitall" and the sport gets into his lizzie and ambles along.

Mr. Shopman ain't able to do work on credit and he ain't intendin' to do the same, but first thing he knows he's got a lot'uv good honest American dollars owin' to him and them what owes the mazuma seems to have a lot'uv stickability when it comes to stickin' to the dough and they don't fork up on Monday of next week like they said they'd do.

Some bad situation, we'll say. Trouble is, besides needin' the money forthwith and immediately, Mr. Shopman's all upset 'cause he don't know just what he oughta do under the circumstances. He's afraid if he pushes them what owes him they'll quit doin' business with him, and he's afraid if he don't push 'em they'll put him outa business by not payin' their bills.

Mr. Shopman just don't know what to do till one day he hits his thumb with a sledge hammer instead'uv hittin' the bolt what he intended to hit and he says somethin' I ain't gonna repeat and marches into his office and sets down and writes his good customer what's become a bad customer a ugly letter and makes a lot'uv ugly remarks about folks what don't pay their honest debts real regular and if they don't pay him pronto, forthwith, and immediately if not sooner, he'll turn their account over to an attorney for collection. Adieu, good-bye and farewell to Mr. Good Customer and his bill. He won't trade no more a-tall with Mr. Shopman, and if he ever pays his bill it'll be because he's forced by due process'uv law.

All'uh which is gospel truth and Mr. Shopman knows it and he don't know what to do about it and that's just what we're gonna tell him in the next sixty-five dollars' worth'uv space. We know our counsel's good 'cause Art Steele tried it and it saved him from bein' buried in the potter's field when he croaks.

"I'LL SEE YUH FIRST OF NEXT WEEK SURE."

Yuh, see, I just happen to drop into Art's place'uv business one day when he's just finished readin' a ugly letter from his creditors sayin' they're tired'uv bein' creditors and won't he send a check by return mail, and he's got a bad case'uv indigestion and's been havin' a little friendly row with the wife and all, and he's real busy writin' insultin' letters to the bunch what owes him money and tellin' 'em right out plain he wants 'em to fork up and quit lyin' about it and all.

I look over one'uv the letters he's preparin' to send out to a lot'uv American citizens and I see it's time for action, so I don't beat around the bush none whatsoever but just come right out plain and meet the emergency.

"Art," says I real anxious, "have yuh got a 'For Rent' sign?"

Art says "Naw!!!" real pleasant and goes right on addressin' letters, but I come right back pressin' my advantage.

"How much yuh suppose it'ud cost to get a good big sign painted clear across the front'uv the shop, Art?" I inquire.

"How'n samhill do I know?" Art interrogates, and then he wakes up a minit and wants to know whose shop I'm talkin' about hangin' a vacation sign on and wherefore.

"W'y I'uz just wonderin' whether I'd be able to lend yuh enough to get such a announcement prepared and made suitably conspicuous when yuh begin to feel the effects'uv them there letters," I says, says I, "cause as sure's shootin' yuh ain't gonna have no occasion to occupy these here premises no longer thereafter."

"How'd you get that way?" Art hints. "These here dead-beats owe me money that I've worked hard for and that they've promised to pay long ago. I'm tired of having a lot of folks who are better off than I am forgetting to pay their honest debts, and I'm going to put a stop to it right now, that's all!"

"Oh, sure!" I come in, makin' it unanimous. "Go on and get the dough, Art, but I'm a little short'uv change myself just at the present hearin' and I won't be able to lend yuh none a -tall, so I'd suggest that yuh save up enough to get that there sign painted. Of course if yuh—"

"Aw, forget it!" Art interrupts without beggin' my pardon. "If you mean to insinuate that sending out a few frank collection letters is going to ruin my business, I'll have you understand these here four flushers who put on so much dog and don't pay their honest debts are going to shut up this here establishment anyhow if I don't make 'em come across right quick. I have to pay my bills when they come due or my creditors'll shut up the shop for me aud believe me these birds're gonna—"

"Pardon me, Artie, but I just want yuh to listen to what you're about to perpetrate on the self-respectin' inhabitants of this here village. What you reckon John Corbin's gonna say and think and do when he reads this here epistle:

"Dear Sir:

On June 12, 1920, we made repairs on your car totaling a cost of $23.75. Our business is strictly cash, but you asked us to wait for a few days for payment of this bill and as you had always been a good customer, we agreed to do so.

We've waited several months instead of a few days and you haven't paid the bill yet.

"WRITES A GOOD CUSTOMER THAT SOON BECOMES A BAD CUSTOMER."

Now when we extended you this courtesy, Mr. Corbin, we thought you were an honest man. We hope that you are not going to prove to us that we were mistaken in this.

If this account is not settled in full by the tenth of this month, we shall turn it over to our attorney for collection.

Hoping to receive a check from you by return mail, we remain

Very truly yours,"

What yuh reckon Mr. Corbin's gonna do, huh? He's gonna let yuh get all the lawyers yuh can hire and go to court and have a expensive law suit and he's gonna prosecute yuh for sendin' him such a dun and he's gonna tell all the folks in the county you're a crook and a insultin' rascal and some other things I'd better not mention, see?"

"But I guess I got a right—"

"Now just step on the soft pedal, friend Arthurus. We're gonna collect the coin and we're gonna keep Mr. Corbin in a good humor and we're gonna keep his trade and he's gonna tell folks you're a brick or a trump or somethin' else yuh don't deserve to be denominated.

"Ain't yuh been sendin' this here bird no statements'uv his account? Three, yuh say? Well, we're gonna send him somethin' else now. Let's see, how does this here sound?" And I begin to write somethin' like this, readin' it off as I push the quill:

"Dear Mr. Corbin:

Samuel Green, a gentleman of color, had been married just three weeks when he met Colonel Brown, the local judge, on the street of the village.

"Well, Sam, how's married life?" the Colonel asked patronizingly.

"Yassah, Cunnel, married life's all right, sah," Sam replied sheepishly. "On'y one thing wrong wif married life as I sees it, sah. That there wife uh mine, Cunnel, she's just allus askin' fer money. Ebry day it's the same old story: 'I wants a dime,' 'I wants a quatah,' 'I wants foh bits'—all de time wantin' money!"

"That's too bad, Sam. What does she do with all that money?"

"I dunno, sah, I ain't gi'n her none yit."

We're in the same fix as Sam's wife. Every few days, Mr. Corbin, we've been asking you for money, but you "ain't gi'n us none yit".

Seriously, though, we have actually notified you three times that your account is past due without being rewarded with a check.

You will find the amount due on the enclosed statement.

Cordially yours,"

Well, say! I got myself a job right there. I finish this here communication and look up and there's Art with a grin on his physlob. Sure he's grinnin'! He's all tickled about the nice way I've got'uv tellin' 'em what's what and that he wants the spondoolax and all and he wants me to go right on and write some more to follow the first one in case it don't bring home the bacon.

I'm always willin' to accommodate a friend for a sufficient amount'uv jack, so I go right on explainin' the mysteries'uv writin' collection letters and illustratin' the same.

"We'll use this here'un for the second letter," says I, "and we'll rig up another one to go out first, explainin' that probably the failure to come across has been a oversight.

Dear Mr. Corbin:

In the hurry and rush of modern business, one will overlook a little account occasionally. We are sometimes guilty ourselves and we suspect that is just why you have failed to settle that small bill that's been waiting for a few months.

We've sent you two or three statements already, but are enclosing another for your convenience in case the others have been mislaid.

Drop in and say "hello" occasionally.

"Now if that don't get 'em, try the funny one. Let 'em know yuh're expectin' the jack by come-back mail, but act like yuh know they're intendin' to pay pronto but 've just forgot it.

"After some 'uv 'em don't pay no attention to both'uv these we'll send 'em a third 'un somethin' like this here:

Dear Mr. Corbin:

Suppose you met a man who owed you a sum of money you wanted to collect and still retain his good will. You politely asked him for a check and he turned on his heel and walked away without a word.

A few days later you met him again and again you courteously requested payment and again he turned and walked away without a word.

The next time you met him you tried to show him from a different angle just why he should pay you, and again he refused to answer.

You would be good and mad, wouldn't you? Well, in a way you're him and we're you. We've notified you four different times of your unpaid account and, so to speak, you've turned on your heel without a word.

WRITING LETTERS TO SLOW PAY CUSTOMERS."

We're not mad, Mr. Corbin, but we do think that you should favor us with a check by return mail.

"If that'un don't bring him, he ain't worth keepin' as a customer, so we'll send him one more and this time we'll let him know just what's what. Let's see—.how'll this here do?

Dear Mr. Corbin:

If a man owed you a sum of money for an article you had sold him—a perfectly good article about which there has been no complaint whatever—and you had asked him half a dozen times to make a payment as per his agreement at the time of purchase, and still he utterly ignored your requests, what would you do?

We believe you would feel that your customer had been negligent beyond reason and would notify him that unless he paid up in full by a certain date you would feel justified in turning the account over to an attorney for collection.

Frankly, Mr. Corbin, that is the way we feel toward you. We regret very much that the time has come when further delay in the settlement of your account is not only unwarranted, but also unbusiness-like, and we shall have to insist that you attend to this matter within ten days from this date.

In case we fail to receive payment in full by this time, we shall turn the account over to our attorney for collection.

Very truly yours,

"When a customer hasta be sent all them letters and don't come across with the collateral, he ain't worth keepin' as a customer. The only thing to do then is to get a collection agency or a lawyer to take the case.

"But makin' collection epistles human and entertainin' will tickle the folks and save them the price 'uv admission to the show and they'll be able to pay your bill, see?"

And did Art see? Sure! I ain't had to lend him the coin to have that there sign painted yet.

CLEANING SPARK PLUGS

An excellent method of cleaning mica spark plugs or, in fact, any mica unit, is to wash them in a 10 per cent solution of acetic acid, which is an infallible solvent for grease and carbon deposits. The plugs should then be washed off with gasoline and finally dried by rubbing with a handful of waste or a cloth.

Any legitimate business in your line is worth while which adds to your profits without increasing your overhead expense.

You can never convince others unless you first convince yourself.

Zinc production in the United States in 1919 was 485,491 gross tons against 527,845 tons in 1918, according to a United States Geological Survey report.

A Talk on Tractor

BY CURTIS ALLISON

CARELESSNESS and neglect on the part of operators, result in rapid depreciation of tractors. The repair man is usually called on to remedy the difficulty. It is advisable for him to know the reasons why careless handling of a tractor, soon render the machine unfit for service. Dirt is one of the chief enemies of the tractor. It is such a common substance, and is present so often, that the operator is apt to minimize its possibilities for causing trouble. It usually happens that dirt and dust collect rapidly, and thickly, wherever there is oil and grease. Usually the presence of oil and grease indicates the presence of a bearing. It may happen that grease is accumulating rapidly because too much lubricant is used, or it may be that the oil is working out in a natural manner.

The accumulation of dirt and grease can seldom be prevented; but the undesirable accumulations can be removed before they have a chance to cause damage to any part of the machine. It is easy to determine what happens when proper cleaning of a tractor is neglected. It makes no difference whether the shafts moving in the bearings turn at fast or slow speed, the foreign matter will gradually work its way into the bearings, where it will commence the steady cutting and grinding which gradually ruins the bearing. Wear may be slight at first; but as the cutting of the metal surfaces progresses, a larger space forms, which admits still greater quantities of dirt. And eventually the tractor is classed as a "disabled machine" and is towed to the tractor shop for repair. A popular fallacy among some tractor operators is that an extra quantity of lubricant will prevent dirt from harming the bearings. It is true that plenty of oil will serve to cool the metal, and assist in checking cutting of the surfaces; but oil doesn't remove the dirt, which is the source of the trouble.

The tractor operator finds several places about a tractor where dirt gains access to important bearings. He should be encouraged to find such places on the particular tractor he is using, and adopt a method of cleaning which will check the harmful effects of dirt. Experienced engineers never allow their engines to become covered with dirt and grease. The expert engineer and a shining, smoothly-working engine are always classed together. Then why should the farm tractor be allowed to carry a grievious burden of dirt and grease? Simply because some farmers haven't yet awakened to the necessity of keeping tractors clean. The first thing the prospective operator of a tractor should learn is the necessity of removing dirt and grease at frequent intervals. This is easily accomplished by the use of clean waste, and muscular exertion. After a tractor is gotten in good shape, it can be cleaned in twenty or thirty minutes. A tractor should be thoroughly cleaned not less than once a day when it is in use. The average experienced tractor operator wears out more waste than wrenches, because he knows a clean tractor will usually work smoothly.

After a repair man has overhauled a tractor, and gotten it in condition for service, he should advise the owner of the necessity of keeping the machine clean.

A talk about tractors would be incomplete were mention not made of the growing popularity of the iron horse. There will be so many tractors in operation in the future, that repair men will have their hands full keeping the machines in good working order. Blacksmiths who are planning to devote time to tractor work will find all the business they can handle. The power farming era is here, and mechanics will profit accordingly. Contrary to some opinions, a tractor needs the occasional services of an experienced mechanic. The average farmer has neither time, equipment nor experience to do all his own overhauling and repairing. Well equipped tractor shops will be the Mecca of tractor owners.

Experiments show that a good tractor will increase the output per man on the farm. This fact is of particular interest to farmers during this era of scarce and high priced help. Thousands of acres of farm land requires deeper plowing than it has received in the past. On countless farms deeper plowing is required in order to turn up the virgin sub-soil and redeem the wornout upper soil. The fact that power farming reduces operating costs is of interest to farmers. A tractor costs practically nothing while standing idle, providing it is properly housed, while a work horse, when standing idle, consumes approximately 80 per cent of what he consumes when working at full capacity. The range of tractor activities on the farm is constantly increasing. More regular use of the tractor means a more steady business for the tractor shop owner. All indications point to a favorable future for tractor shops.

We will allow an experienced service man to explain his methods for handling this important job of overhauling. "The first thing I do," he explained, "is to drain all oil from the differential and transmission housings. I then thoroughly wash these places, including the gears, with kerosene, and watch closely for broken teeth, loose or badly worn parts. I replace any badly worn parts, and any gears which have cracked, or broken teeth. I examine all thrust bearings closely. The advantage of dismantling these parts is that various little defects may be located, which otherwise would be unobserved.

"I make a practice of giving special attention to the clutch. The clutch plays a part in regulating the amount of power transmitted from engine to belt pulley or drive wheels. A multiple disk, or a twin disk clutch usually are adjusted by varying the tension on one bolt or nut. An expanding shoe clutch must be adjusted on every shoe. Care must be exercised when working on a clutch of the expanding shoe type, not to cause an uneven pressure on the shaft which will cause excessive wear on the adjacent bearings. A clutch should be gotten in shape so it doesn't slip easily under a heavy load, and so it will release immediately when the lever is thrown out. I know from experience that proper clutch adjustment plays an important part in prolonging the life of a tractor, and permitting the operator to get satisfactory service. Occasionally proper clutch adjustment isn't easy to secure; but it is something to which a mechanic must attend.

"There is sometimes a tendency on the part of repair men to slight tractor frames when they are overhauling the machines. I believe this is a poor policy. The entire frame should be carefully inspected so any loose, or lost, bolts and rivets can be tightened or replaced.

"Judging from the experience I have had with tractors, the front axle member of the iron horse is frequently an abused part of the machine. The most common cause of rapid wear at this point is insufficient grease. My plan is to remove the front wheels of the tractor upon which I happen to be working, and to clean off all the old grease. I then wash the bearings with kerosene.

"If the pivot upon which the wheels are steered hasn't been greased properly, the grease in the oil grooves will be gummed up, and when the cup is screwed down no lubricant can pass the old, gummy grease. This is why steering sometimes becomes more and more difficult, wear is excessive, and the entire efficiency of the tractor is lowered. I clean off all the old grease, and inspect the pivot. If it is rusty, I remove the rust with kerosene.

"Re-assembling the front axle isn't difficult, providing care is taken to replace the roller bearings in the proper position. I apply fresh grease and oil, and see that the parts work smoothly."

A cheap grade of oil has more residue in it. and forms carbon much faster than good oil. In the mechanisms of the tractor there are many close fits, and highly polished wearing surfaces which demand proper and thorough lubrication. Under average working conditions, the oil should be replaced twice a week, when kerosene is used for fuel. Kerosene is condensed in the cylinders, and eventually leaks down past the piston rings into the oil reservoir, diluting the oil and impairing its lubricating qualities.

THE APPLICATION OF HEAT WHEN SOLDERING AND BRAZING

As the main difficulty in the process of soldering and brazing seems to be the proper application of the necessary heat, perhaps the following notes may be helpful to those who are somewhat backward in these useful arts.

A common cause of failure when attempting to solder heavy articles is the inability of the copper bit to transmit the required heat, and as the article to be soldered should be raised to the melting heat of solder before soldering can be affected, it will be apparent that an unduly large-size iron will be required for some jobs. This could be avoided by previously heating the heavier parts of the job in hand, or if two heavy pieces are to be soldered, then it is advisable to heat them both before using the iron.

For light tinware or any article having a running joint to be soldered, the bit should not be too hot, as in this condition difficulty will be experienced both in picking up and distributing the solder. It should be sufficiently hot to melt the solder and pick it up, and in this condition it can be slowly drawn along the joint in an unbroken line.

An easier method of soldering can be executed by means of the bunsen burner. This serviceable tool can be easily made from the burner of an incandescent fitting; in fact it is ready made. It is, however, not capable of raising the same intense, concentrated heat as the mouth blowpipe, and consequently in its ordinary form cannot be used for brazing. The blowlamp, whether petrol or paraffin, is far more powerful than the bunsen burner, and for big soldering jobs is a convenient heat raiser. It is, however, difficult to localize light heat, so that when soldering light articles to heavy ones it is better to raise the heat of the latter by means of the blowlamp, and allow the heat of the heavy part to sweat the parts together, particularly so where delicate parts have to be soldered on to heavy bodies, and owing to their special nature cannot be heated directly.

For concentrated, intense heat the gas blowpipe is about the limit that can be used for soft-soldering, as it is possible to reduce the flame to a pencil of intense heat that can raise to soldering heat a narrow line on sheet metal without affecting the adjacent parts.

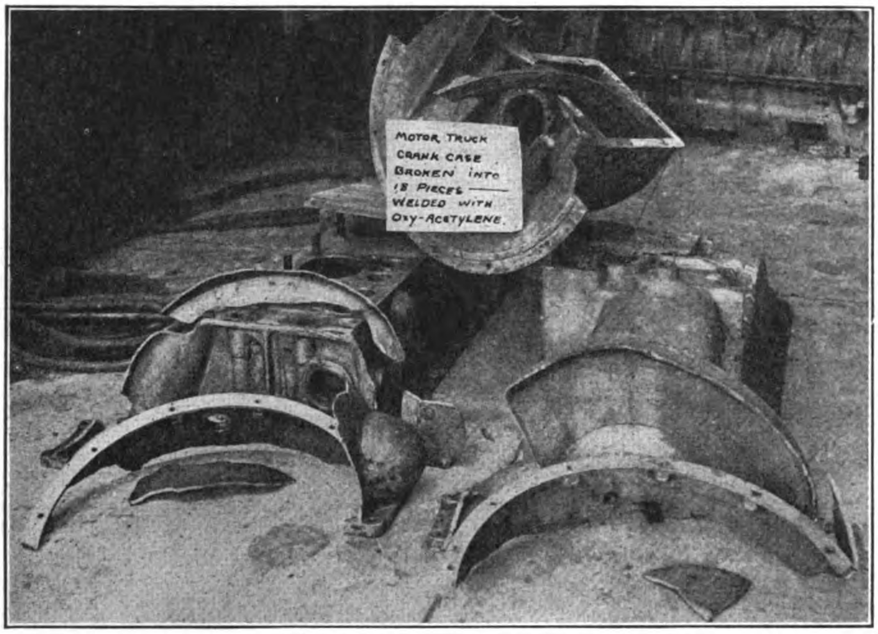
Brazing in its simplest form is somewhat analogous to soldering with the soldering-bit, such as when brazing band-saws by the heat of white-hot tongs. In this method the massive tongs are heated in a furnace or smith's fire to a heat well above the melting point of brass, and the parts to be brazed having been scarfed, fluxed with borax and a leaf of brass interposed in the joint, are clamped with the tongs until the brass leaf melts, when the tongs are withdrawn.

The brazing of band-saws can be achieved with the ordinary mouth blowpipe, provided the joint is well packed in charcoal and a fairly open tip is used, coupled with an experienced operator. This operation would, however, fail unless a blowpipe had been attained. The secret is to keep up a continuous blast, using a fairly large bunch of tapers and having the joint well embedded in charcoal. For heavier work the blowlamp is to be recommended, as it is fairly easy to start once the knack has been obtained.

There is little difficulty with the petrol blowlamp; it usually burns continuously without the least hitch. The paraffin blowlamp, however, especially when it has been burning for sometime, often gets choked, and constant recourse to the pricker must be had. There is no need to open the pressure tap, simply insert the pricker, which immediately puts out the lamp, which should be immediately relit. When the flame starts to taper off or comes in rushes, it is a sign that the nipple needs cleaning.

The article to be brazed should be well packed with a mixture of charcoal and coke unless the lamp is unduly powerful, when all coke can be used. This is the most essential part of the operation, and brazing on any but the smallest scale cannot be effected unless the heat is well conserved, constantly fair proficiency in the use of the drawing the coke round the work as it burns away.

It is very difficult to braze long, bulky, copper articles, even though they may be of fairly light section, owing to the heat being conducted rapidly away, so that in this metal it is necessary to prevent spreading of the heat by extending the covering of coke or charcoal, or using a more powerful, concentrated source of heat such as the gas blowpipe. This latter, in its simplest form, worked by the foot bellows is capable of generating a powerful flame more suitable for brazing than the blowlamp, owing to the facility with which it can be controlled. Being also more concentrated and intense there is less need of packing. If the blowpipe is fitted with a gas tap, it can be instantly varied to suit the flow of the spelter. In this way a vertical joint can be brazed by shutting off the gas immediately the spelter flows and leaving the air on to set the joint. For this reason it is also useful when brazing brass, as it is important to shut off the heat immediately the spelter melts.



THE BROKEN CRANK CASE BEFORE IT WAS REPAIRED

INTRICATE WELDING REPAIR HANDLED WITH GREAT SKILL

Repairing broken aluminum castings by welding is "particular" work, even when the breaks and the designs of the castings are comparatively simple. But aluminum castings are usually complex and, owing to inherent properties of the metal, the breaks are seldom what could reasonably be termed simple.

In Figure A—the motor base, crank case and gear case of a motor truck are shown in 18-separate pieces—about as complete a smash-up as one could wish to see. To reassemble this pot pourri of broken parts and weld them into their original form is an undertaking to tax the ingeunity and skill of the best of welders. To begin with a special set of jigs had to be devised, and during the welding far greater care was necessary to prevent distortion than would have been the case, for instance, were the parts of cast iron or steel.

Aluminum has a very low melting point (only 1215), has a relatively high coefficient of expansion, and a short fusing range. At a temperature just below fusing it becomes plastic and the parts have to be firmly held in place and supported. In a state of fusion the metal is very fluid and has a troublesome affinity for gases, especially atmospheric oxygen, which forms a refractory oxide that the welder must deftly remove or seriously impair the weld. Then there is the slow process of cooling necessary to anneal the jointures.

Figure B shows the repair in its completed form ready to be replaced and restored to service. This is one of the most involved and interesting aluminum casting repairs that has been noted in recent months. The work was done with the torch, of course, and it is suggestive of the great utility of the oxy-acetylene process in the automotive repair field.

HORSESHOER ALSO IS A COLLECTOR

In the mountains of Blair county, in the little town of Martinsburg, lives a man who has one of the most remarkable collections of autographs of notables in the state, if not in the country.

By profession he is a scientific horseshoer and sends little good-luck horseshoes out all over the world. The emblems of good luck are beautifully wrought with a delicacy that can be equaled by few other blacksmiths today. They are made at the large forge of the "village smithy" where the blacksmith shoes the farmers' horses. No small tools are used, for the maker of these fairy horseshoes, Charles

Gorsuch, is known among his craft as the "Master of the Forge."

From the time he was a stripling, Mr. Gorsuch has worked at the

THE TWO ORDINARY PINS SHOW THE COMPARATIVE SIZE OF THE MINATURE HORSESHOE

smith forge. His family were horseshoers for generations and the knowledge was handed down from father to son. The original Gorsuch arrived from England in 1662, and settled in the vicinity of Baltimore. Many of the descendents were blacksmiths of workers in iron.

Skilled mechanics who have examined these beautifully-forged little shoes say there is not another man living who could make a shoe with such exquisite skill.

Thomas F. Ryan, the money king of some years ago was Mr. Gorsuch's inspiration in his campaign of wishing the world good luck. Mr. Ryan had just risen into the limelight and Mr. Gorsuch had deep admiration for him, and one day he conceived the idea of hammering out one of the little shoes with which he had been amusing himself for some time past, and sending it to Mr. Ryan, asking for a photograph in return. An autographed picture and a letter of thanks were sent promply.

Encouraged by his success, Mr. Gorsuch grew adventurous and sent horseshoes to notables the world over, and had a collection of well over a thousand autographs.

One of Mr. Gorsuch's treasured possessions is a horseshoe that belonged to a race horse called Forforshire, who in her day was one of the most famous race horses in England. The horse belonged to Thomas R. Dewarr, a member of Parliament, and one of England's prominent statesman a number of years ago.

Mr. Dewarr's letter, after thanking Mr. Gorsuch for the little shoe, goes on to say:

"I will always keep this little token among my treasures, and when I see it, it will always remind me of one of my well-wishers among the large-hearted Americans whom it is my pleasure and privilege to know.

"May nothing ever separate the United States and Great Britain but the Atlantic, and may the golden chain of friendship which binds the two nations never lose a link."

Mr. Gorsuch has a personally autographed picture post card from Marshall Foch and the autographs of all the Allied Generals and the entire British War Ministry.

Mark Twain had his horseshoe mounted as a stickpin and wrote back that, "Now it has become beneficial as well as useful."

Millionaires had their vagaries in the presents they sent Mr. Gorsuch. H. C. Frick, the multi-millionaire and picture collector, sent him a large "Iron Workers Before King Solomon," with the steel magnate's autograph and best wishes in the corner.

John Astor, the great New York land owner, sent a souvenir book containing 400 views of New York. He neglected to pay the expressage, and remembering his oversight, he sent 50 cents in stamps to cover the expressage.

The autograph of the unfortunate Czar of Russia is not among Mr. Gorsuch's collection. Long before the war he sent the last of the Romanoffs a horseshoe and received a formal acknowledgement from Prince Killhoff, who was Nicholas' private adviser at the time.

"It gives me great pleasure to inform you," wrote the Prince, "that I had the honor to present to his Majesty the little horseshoe forged by yourself for this purpose. His Majesty graciously accepted the token of good luck and charged me to express to you his best thanks for the same."

Mr. Gorsuch had better luck with some of the other Russian nobility and received the signatures of men who were later to write history with their blood.

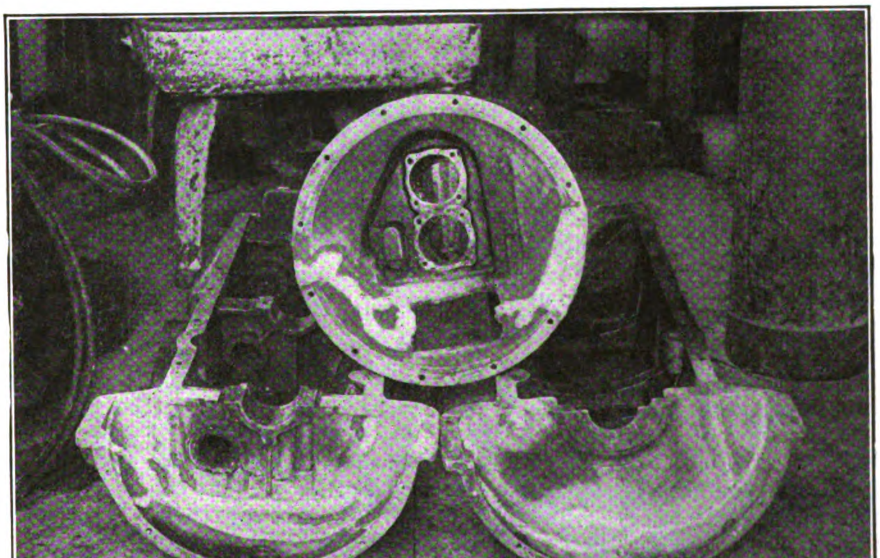
Mr. Gorsuch has lived all his life in the little town of Martinsburg, working daily at his forge, yet he has been in constant touch with the great men of the world.

He has never sold any of his valuable autographs or presents he has received, and his collection is said to be worth many thousands of dollars. He lives simply and continues to forge his fascinating little horseshoes.

You can never convince others unless you first convince yourself.

Zinc production in the United States in 1919 was 485,491 gross tons against 527,845 tons in 1918, according to a United States Geological Survey report.

It is often more expensive to do without a machine than to buy it.



THE PARTS SUCCESSFULLY JOINED TOGETHER BY THE OXY-ACETYLENE BLOWPIPE

Rebabbitting Cylinder Blocks and Running in the Crank Shaft

BECAUSE many dealers and repairmen are now doing their own rebabbitting on cylinder blocks, an article on the subject is not out of place.

The first operation is to remove all the old babbitt. This is easily accomplished by cutting out a strip at the bottom of the bearing as shown in figure 1, after which the two remaining pieces may be easily driven out of the anchor holes, and any babbitt that remains in these holes should be drilled out.

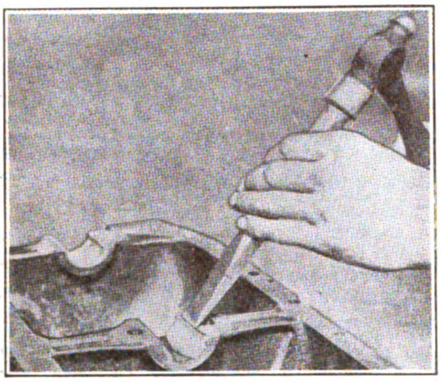


Fig. 1. CUTTING OUT THE OLD BABBITT

The success of pouring depends largely on the next operation, namely to provide a clean dry surface for the babbitt. Dirt and grit will work up in the hot metal, spoiling the boring tool or scoring the crank shaft. If oil or water is present, even in the smallest quantity, there will be blow holes in the babbitt. If it is present in large quantities, it will be impossible to pour the babbitt at all.

The babbitt is the most important consideration. As there are many different mixtures on the market, it doesn't pay to experiment with materials of questionable merits. It is advisable to use only babbitt that has been supplied by the manufacturer or one of his branches, because this babbitt has been especially selected for the purpose, and it is considerably harder than most of the ordinary run of babbitt, and it is the only kind that can be depended upon to "hold up." Any arrangement that will not pour this babitt satisfactorily should not be used.

The temperature of the metal is also very important. Perfect bearings can be poured only with metal between 800 and 840 degrees Fahrenheit. If not pyrometer is available, this temperature may be estimated by the appearance of the metal. At about 900 the pot and the metal turn red, and the metal "burns" coating rapidly when the scum is scraped off. When at the proper temperature, the metal appears like quick silver and tarnishes slowly when the scum is scraped off, the coat of tarnish showing all colors.

When too cold the metal acts sluggish and the tarnish takes on a dull appearance. Some mechanics check the temperature with a piece of soft pine. The stick should char immediately, but will not catch fire unless held in the metal for some time. The stick should be perfectly dry as the moisture would cause the metal to fly off endangering the operator.

The equipment for forming the bearings should be set up according to the instruction of the manufacturer and in nearly every case varies with the different equipment.

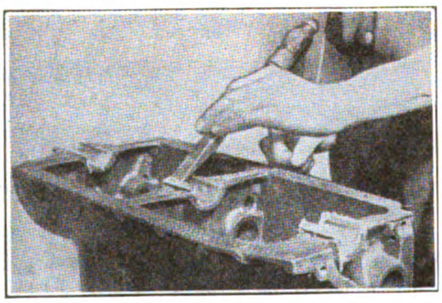


Fig. 2. CUTTING OFF THE SURPLUS BABBITT

If there are no plugs on the forming bar to fill the oil holes, it will be necessary to fill these with asbestos waste before pouring the bearing to prevent the babbitt from flowing through them. This waste together with the babbitt that covers it is later punched out.

While many equipment manufacturers advise heating the block and molding bar, equally good results are obtained by pouring into cold blocks, this success being due in a large measure to the cleaner condition of the parts. Heating with an open flame results in a deposit of carbon which interferes with the molten babbitt flowing evenly over the surface of the bearing.

While bringing the metal to heat, the ladle used in pouring the bearings should be in the same pot in order that it may be brought to the same temperature as the metal. When ready to pour, either two ladles or else a two lipped ladle should be filled with babbitt, pushing the scum back in order to provide the bearing only with clean metal. Sufficient babbitt to more than form the bearing should be poured. The bearings set quickly, so that the bar may be removed very shortly after the bearing has been poured.

The next operation is to cut off the "wing". The chisel should be introduced from the inside of the bearing as shown in Figure 2. The final operation in repairing the rough bearing is to peen them to conform to the cylinder block. In manufacturing the blocks, this is done with a special tool. It may, however, be done with a round bar. .010" larger than the bar used in pouring the bearings. The bar should be laid in the bearings and struck with a lead hammer.

The bearings are now ready to be line reamed. No particular instruction can be given, regarding this operation, because different machines are used for the purpose, and each are accompanied by the instruction of the maker, which should be rigidly followed. It might be well to add, that irrespective of what machine is used it is highly important that the finished surface of the bearings be the correct distance below the lower surface of the block, as there is no adjustment by which the center distance between the crank shaft and the cam shaft can be changed. It is equally important that the distance between these two shafts be the same at both ends.

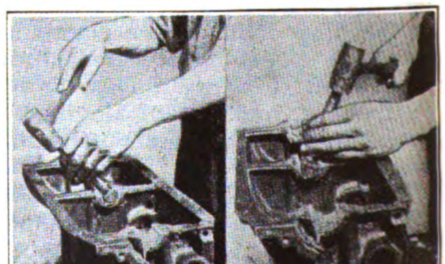


Fig. 3. PEENING THE BEARINGS AFTER POURING

If the caps are to be bored at the same time as the cylinder as is done in the factory and the branch-

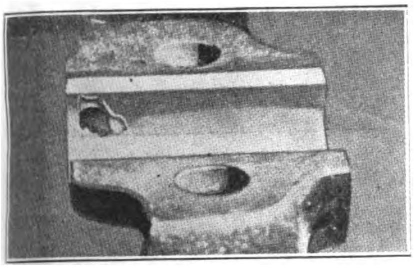


Fig. 4. THE BEARINGS SHOULD BE FREE FROM DEFECTS

es, temporary shims .012" thick are placed on each side of the cap before drawing down the bolt. These shims are later replaced by thinner ones when installing the crankshaft.

When the bearings have been bored the edges where the cap and the block meet should be dressed off at an angle of 45 degrees. The boring turns up a wire edge which should be removed with either a file or a bearing scraper. The surface on which the cap rests should be free from dirt, babbitt or bruises The ends of the bearings should be finished off at a 3/16" radius to clear the radius on the crank shaft. The tool reaming the bearing may be provided with a cutter for this purpose or this may be done with a bearing scraper, no special care necessary as this is not a working surface.

It is important that the bearings should have a smooth appearance and free from such defects and blow holes as shown in Figure 4.

The next operation is to clear the oil holes and to cut the oil grooves. The grooves are placed only in the center and rear bearings as shown in figure 5. If there is no arrangement on the bar to form these grooves, they should be cut out with a cape chisel as shown in figure 6.

The crank shaft should next be laid in the bearings the babbitt extending over the ends of the main bearings and cap should be dressed off with a mill file until the shaft fits well down into the bearings. New jobs should have about .004" end play.

It may be opportune to state at this point that all the play is taken up by the rear main bearing and its cap. The center and front bearings should have clearance to allow for the unequal expansion of the cylinder block and shaft.

The alignment of the bearings should be checked . The proper way to do this is with a test bar or a straight edge which will cover the three bearings at once. In using the bar lay down strips of thin cigarette paper on the bearings with one end protruding. Lay the bar in place and try to withdraw the paper. If the bearings are in line all papers will feel the weight of the bar.

The alignment of the bearings may be checked by the crank shaft which first should be tested to see that it is within the limits given in figure 7. The shaft is tried in the bearings by alternately tapping each end to detect a rock. This would indicate that the center bearing was high, but on the other hand if the center bearing should happen to be low it could not be detected in this manner.

An absolute test for determining whether the shaft is straight and a method that gives just as dependable results as centering and then testing with an indicator, is to blue

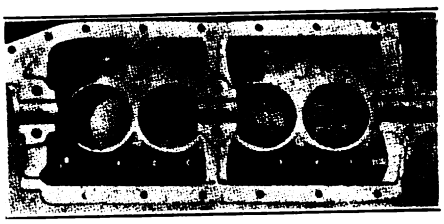


Fig. 5. OIL GROOVES SHOULD BE CUT IN THE CENTER AND REAR BEARING

the shaft lightly on all of the main bearings and then lay it in the bearings in the block, turning the shaft without applying any pressure to force it into the bearings. Turn the shaft over several times, and then observe the markings in the blue. If the bearings on the shaft are marked all the way around on all the bearings, it is a safe bet that the shaft is straight. If the front and center bearings are marked all the way around but the center bearing is marked on only one side, the shaft is sprung. The amount can be determined by applying an indicator to the bearing that is irregularly marked.

Still another way is to put a strip of thin paper in the bottom of each bearing. The shaft is then laid in place and by pulling on the paper, the fit of the shaft may be tested in all excepting the main rear bearing in which the end clearance may be sufficiently small to grip the paper giving a false impression.

After checking the shaft in one position it should be turned half way around and checked again. If found to be O. K. oil the bearings both on the shaft and the block and replace the shaft.

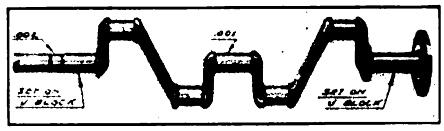


Fig. 7. THE CRANK SHAFT SHOULD CHECK TO THESE LIMITS

New or rebabbitted caps should be used in assembling the crank shaft and sufficient shims should be placed equally under each side to allow the bearing .006" rock; that is the bearing will be drawn down .002" to .003" for burning in. Ordinarily two or three shims should be placed under each side. The bolts should then be drawn down as tighly as possible without straining the threads.

The tightness of the bearings may be tested with the turning bar. Loosen two of the caps and try to turn the crank shaft over with the turning bar. The bearings should hold the shaft so that taking an 18" to 20" hold on the bar the repair man will be able to turn the shaft over. In the same way treat the other two bearings. With more than one bearing tight, the repair man should be unable to turn the shaft until after the block has been run in.

The next operation is to run in the shaft. This requires a running in stand. The speed varies with the different makes of stand, the strain on the stand and the driving unit being the main consideration.

The bearings should smoke freely and should be oiled while they are running in. If they do not smoke it indicates a loose fit, and some shims should be removed

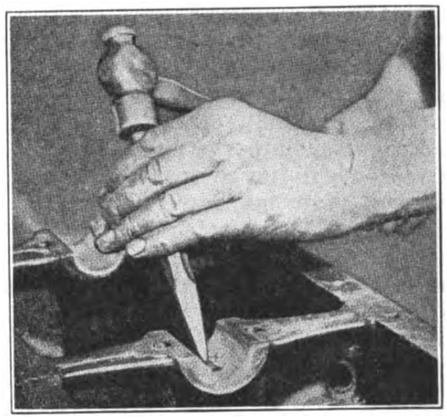


Fig. 6. CUTTING THE OIL GROOVES

from each side, the bearings should be tighten and run in again.

When sufficiently run in the shaft may be turned over by the hand wheel on the running stand or by means of a 20″ bar equipped with pins to fit the hole in the crank shaft flange. One should guard agains using this bar in the holes that are intended for the dowel.

THIS WORN WRIST PIN IS ANOTHER EXAMPLE OF WHAT RESULTS WHEN THE AIR WASHER IS NEGLECTED

When this condition is obtained the main rear bearing cap should be removed and inspected. There should be a bearing the entire length of the cap and covering at least 80% of the bearing surface If the cap does not meet these requirements, it should be rerun, taking out one or more shims from each side.

While it is not necessary for an experienced operator to remove the other caps, it is advisable for the beginner to do so on the first few blocks, so that he may be sure his work is correctly done.

THE IMPORTANCE OF KEEPING THE AIR WASHER CLEAN

Too much stress can not be laid on the importance of keeping the air washer clean and in good working order. That some operators of tractors are prone to disregard instructions of the tractor manufacturer in this respect, can not be denied. Their carelessness can be traced, very often, to the fact that they do not understand clearly the why and wherefors of the air washer. Several issues past contained an article which showed what the air washer did in the way of collecting dirt than otherwise would have gotten into the motor, and it also showed the picture of an air washer that has ben changed by the operator so that he would not be inconvenienced by cleaning it occasionally. Here we have some graphic evidence of the result of such negligence.

When the air washer is neglected, the wear on the pistons and rings is enormous as may be realized by looking at the picture which shows the effect on the piston and rings. The wear between the rings and their grooves is particularly noticeable. The greatest gap being between the top ring and its groove. It is not necessary to use a micrometer to detect the wear in the wrist pin. The photo tells the story much plainer than words.

While the owner must have been notified of the condition of his motor by the weak compression when cranking it, and the lack of power when it was in operation, and later by the slapping of the worn pistons and the knock from the wrist pins, still he ran his tractor until it was necessary to replace practically all of the engine parts. It really pays to attend to the air washer. Time saving dodges in neglecting this important device are direct short cuts to expensive repair bill.

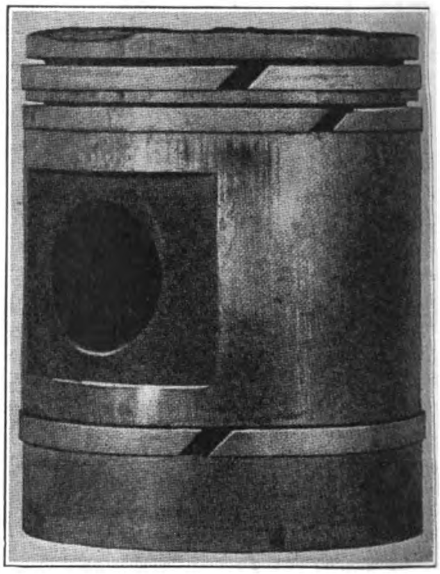
TRAILERS—A LINE FOR THE BLACKSMITH

During the past few years the trailer industry has grown to great proportions, and as the automobile increases in numbers in any one district, this line affords a profitable venture for the blacksmith and carriage repair man. In some cases the blacksmith may even construct trailers of a rough type, or, on the other hand, can sell the trailer models manufactured by the companies who specialize in this line. Practically every farmer who has a car is a prospect for a trailer. He can use it for transporting goods to and from town. He increases the efficiency of his car and also saves its body and upholstering, which are so often damaged by carrying loads from town to farm.

From a sales' standpoint, the most successful trailers are of sturdy construction and generally follow design worked out, through years of motor truck practice. Rolled or pressed steel frames, truck axles, truck steel frames, truck axles, truck springs, heavy artillery type wheels, and rubber tires are used.

Steel or iron draw-bars with special coupling devices to connect with the rear end of the truck or automobile are provided and are so connected with the steerng gear of the trailer that the front wheels of the trailer track with the rear wheels of the towing vehicle, thus avoiding the cutting short of corners on short turns. Semi-trailers having but two wheels are designed to be used with a "fifth wheel" mounted on the rear end of the motor truck chassis. This supports the front end of the trailer and acts as a combination of kingbolt and hinge, permitting the truck to turn under the front end of the semi-trailer and allowing the rear axle of the truck to rise and fall with relations to the front axle of the truck and the trailer axle. The trailer draw-bars and the semi-trailer fifth wheels are provided with springs to absorb the shocks of starting and stopping and the minor ones due to inequalities on the road surface.

Trailers are built in all capacities, for loads of a few hundred pounds up to ten tons or more, and for all sorts of purposes. The lighter, highspeed trailers for use with automobile runabouts and touring cars are made with ball bearings and equipped with rubber tires.



THE PISTON AND RINGS WERE ALSO RUINED FROM THE SAME CAUSE

An average of 129,903 pedestrians and 14,182 vehicles cross Fifth Avenue and 42d Street, New York, between 8.30 in the morning and 6:30 in the evening.

"The only thing agitators havent's asked for," says the Sedalia (Mo.) Capital, " is the shortening of the speaking day."

A process had been discovered for producing artificial wool from cotton waste. The new material is said to be an even better insulator against heat and cold than ordinary wool.

THIS department is the meeting place where you are free to ask for information, answer questions, discuss shop matters and business conditions and any other notes you feel would be of interest to a fellow mechanic. Make use of this Department as often as desired.

Making a Heater for the Car:—I wish you would advise me of the best way to make a home-made heater for automobiles; using either the exhaust gas or the hot water from the radiator. I don't remember just how they are made up. If you can give me a lift, it will be greatly appreciated.

O. S., Bittern Lake, Alberta.

Editor's Note:—There are several ways of making a heater for the car, using either the burnt gas from the exhaust or the water from the radiator. The first is the more feasible, because with the later there are a number of joints which have to be made water tight, and the car has to be operated for quite sometime before the water is hot, and further in cold weather if a considerable portion of the radiator is exposed, the water scarcely gets warm.

In using the exhaust gas there are several ways to proceed. The most commonly used home-made devices usually run the exhaust through a series of coil, installing the coil in a metal box protected by asbestos, and allowing the air to pass over these coil and then enter the car through a suitable opening in the floor boards.

There are several types of damper cutout which lend themselves readily to deflecting the exhaust from the exhaust pipe into these coil. The coil may be made by using ordinary pipe in connection with left-right return ells and threading the pipe correspondingly. Another way is to bend the coil from seemless steel tubing, by filling the tube with dry sand and plugging the ends, then bending it.

Another arrangement is to connect the exhaust up permanently to the coil, and then regulating the heat by means of a register on the floor of the car. One similar to those used in houses heated by hot air furnaces work very nicely.

In selecting the pipe, it should be borne in mind that pipe of ample size should be used so that there will not be any back pressure on the engine.

Taking the Burn Out of Steel:—Will you please tell me or help me find a recipe for taking the burn out of steel, such as files or plow points.

I once had a recipe so I could burn a file, crumble it up on the anvil, put it through my process, then weld the file back and make a cold chisel out of it.

S. D. H., Indiana.

Editor's Note:—It has been our experience that steel once burned has been ruined hopelessly, and that there is only one way of reclaiming it, namely, through the blast furnace. All of the authorities seem to agree on this point, and if you have been forunate enough in coming on to a process which will overcome this obstacle, it is indeed an inovation.

Rebabbitting a Ford Motor Block:—Will you please tell me how to rebabbitt a Ford motor block? I have tried to do it; but did not have very good success, as the babbitt would cool before it ran half way around the bearing.

R. W. Brown, New York.

Editor's Note—Considerable difficulty is usually experienced in rebabbitting a Ford motor block, if special equipment for this work is not used. This is due largely to the fact, that the babbitt cools before it flows entirely over the surface of the bearing, and secondly, because it is difficult to locate the mandrel accurately with relation to the distance from the cam shaft.

If you have any amount of this work to do, we would most certainly advise the use of special devices for the purpose; a number of which are now being sold on the market. Through their use the work is greatly facilitated and a much better job can be done. However, where but little of this work is undertaken, one would not be justified in going to the expense of such installation. On the other hand, it does not necessarily follow that a good serviceable job can not be done without their use.

The first consideration of importance is the mandrel. It should be from .020″ to 1/32″ smaller than the shaft, and should be centrally located in the bearings so that the shaft will be square to the wall of the cylinders and so that the proper distance between the crank shaft and the cam shaft will be obtained. This is imporant, otherwise the gears will either mesh too loosely or else they will bottom.

The difficulty of which you speak, namely, that of making the babbitt flow over the entire bearing can be overcome quite easily. First, the bearings should be cleaned thoroughly, then tinned, The bearing caps with the proper amount of shims below them are then bolted in place. Wet fire clay is then placed at one end of the bearings around the mandrel which has been previously inserted. Either asbestos or fire clay is placed in the oil holes so that the hot babbitt will not run out. This arrangement permits the block to be stood on end while the babbitt is being poured and is perhaps the most convenient position under these circumstances. Of course you understand that it will be necessary to hold the mandrel rigidly in position by what ever means you may choose. The bearings are then slowly heated with a large torch. This answers two purposes. It heats the bearings so that the babbitt will flow in evenly, and it also drys out the clay moulds.

Care should be taken not to direct the flame onto the surface of the bearings, because in so doing they are often covered with a black deposit which interferes with the babbitt sticking properly.

The babbitt should be heated as hot as possible without danger of burning it and then it should be poured into the bearings. Some care in regard to the quality of babbitt should be exercised as a metal which is soft will pound out very quickly after the motor has been placed in operation. The Ford Motor Company advise the use of a babbitt which they furnish to their agents because it is considerably harder and wears much better than the commercial run of that metal.

Welding a Circular Saw:—Could you tell me through your columns in the American Blacksmith, if a 30 inch circular wood saw, which is cracked can be welded with the Oxy-acetylene torch so that it will stand? The crack is about three inches long. I had another 30 inch circular wood saw, which was cracked inward from the cutting edge, a distance of about 1½ inches, so I cut off all the teeth and gummed in new ones below the crack, but some of the teeth seemed to case harden from the heat of gumming. I then drew out the hardness by heating the blade on top of a hot stove. I was then able to file the teeth and set them afer allowing it to cool slowly. Will this process stand?

Wm. P. Schrink.

Editor's Note:—It is not improbable that the teeth may have been hardened by the process of which you speak, and the method of annealing is in order with good practice. Perhaps it would have been better if the saw had been annealed in the first place. It is essential that the saw should be hardened in order that the teeth will hold their cutting edge.

In the factories this is done by heating the saw to a cherry red and then plunging it into an oily cooling bath. It is then reheated, but this time under pressure to prevent the saw from warping and then the temper is drawn to the desired degree of hardness. The color varies between a straw and blue depending on the quality of the steel from which the saw was made.

In regard to the advisability of welding the broken saw by the oxy-acetylene process Mr. Baxter says as follows:

"The difficulty in welding circular saws is not in the actual fusing of the metal, but in preventing them from warping or distorting. If the blade is cracked to the center or if the blade is broken in two, it is almost an impossibility to weld it without distortion. Or if a considerable portion of the blade is broken out the distortion due to the welding will make the blade worthless. However, as your blade is cracked only about three inches, it could be welded without warping, providing of course that you are a fairly rapid welder. The weld should be made rapidly and deftly and should be confined to a narrow line. To assist in this, the crack should be grooved by grinding on the square corner of an emery wheel.

As for the weld standing, there is no doubt about that if the welding is properly done. Broken teeth are welded in without any trouble, as are short cracks back of the teeth. So we can see no reason why a crack three inches long can not be satisfactorily welded if distortion is avoided. It might be well to start welding at the center of the crack and weld back to the end and then start again at the root of the tooth and weld to the start of the first weld. This often helps to prevent warping. Norway or Swedish iron filler seems to give as good results as anything. But the weld should be not over a quarter of an inch wide and made with all possible speed.

Making a Bolt Rack:—I have a bolt rack to make for 3/8″x2″ bolts and up to and including ¾″x12″, ranging one inch difference in length. If you have a cut of a suitable rack, I would certainly appreciate having you send it to me.

M. R. S.

Editor's Note:—By referring to Page 204 of the May, 1920 issue of the AMERICAN BLACKSMITH, an illustration and description of a bolt rack will be found there. Using this as a basic idea for your arrangement such variations to suit your particular needs could b easily made. For example: Instead of using light I beams to hold the bolts, 20 gauge sheet iron could be bent up in place of it by making it U shape. By closing one end the whole arrangement could be placed against the wall in a vertical position instead of suspending it under the bench, if you found it more convenient to use it that way.

Water Proof Glue:—I wish to ask how they fixed the glue that was used during the war, in fixing the gun stocks. They say it was water proof. I understand that they called it casein. How is casein fixed to give the best results? Please tell me as I have several musical instruments that I want to glue up.

Editor's Note:—Casein glue is made from milk and has the property of being insoluble in water. It was used largely during the war in airplane construction for glueing the laminated sections of the fuselage as well as the propellers—It is made by the Casein Manufacturing Co., 13 Park Row, New York City.

The glue comes in the form of a cream colored powder and is then mixed with cold water and applied to the points to be glued. Pressure is then applied and the part allowed to remain until thoroughly dry.

Favors Mr. Flatman's Method of Hardening Blades:—Have read with considerable interest, the short article printed in the January issue relative to the most satisfactory manner of hardening and tempering a knife blade, and wish to state that Mr. F. J. Flatman has presented to the readers of the AMERICAN BLACKSMITH the most reliable details in the process of heat treating, hardening and tempering a knife blade or similar shaped thin edged tool. The process he has described needs no comment further than to suggest that the same careful consideration be given to the forging and heat treatment of the blade as is given to the final detail of tempering. It is also suggested that the blade be rough ground to edge before hardening and tempering leaving plenty of material to be removed when grinding to the finished edge.

The methods that Mr. Fowler suggests maybe suitable if the knives are to be made from ordinary hoop iron, but the results obtained would be rather disheartening if tool steel above 60 carbon were used.

T. Guy Elliott, Pennsylvania.

Treatment for Thrush:—Please advise me what will cure sore feet among our mules and horses in Texas. We have no Veterinarian so we appeal to you with our trouble. The foot is affected thus: The frog is pitted under the surface with a white air bubble puss. When cut into as the disease advances, the cells become larger until the tough part of the frog is destroyed, and is replaced by what we call a proud flesh frog, which is very tender and somewhat larger than the old tough frog. The foot has a very bad odor. We have tried everything we can think of.

J. D. Hawkins, Texas.

Editor's Note:—The disease you describe is commonly known as "thrush". It is caused of infection and is most frequent among horses and mules that are kept in muddy yards or where the feet are kept moist from manure or from wet pastures.

The first thing is to trim away the horn thoroughly on both sides of the crack in the frog so that medicines can be applied directly to the infected tissues. After the part has been thoroughly cleaned out it should be filled with absorbent cotton saturated with a one-fourth of one percent solution of Chlorazene. Chlorazene is a new antiseptic that has been developed during the war. It is forty-five times as strong as carbolic acid and is non-poisonous. You can procure this from your druggist. The cotton should be moistened at least three times daily for two or three days, until all the infection in the part is thoroughly destroyed. The cotton and the bottom of the foot can be protected and kept clean by tying a piece of gunny-sack over the hoof. Care should be taken not to tie it too tight to interfere with the circulation.

After the part is thoroughly disinfected, Calomel can be dusted in once daily for two or three days and when the part is completely dried, thoroughly sterile and is beginning to heal, the cleft in the frog can be packed with oakum and pine-tar.

It is important in treating this disease that the treatment be thorough and that the animals be kept out of mud or filth of any kind.

Watch Oil Holes—Many owners are painting their cars at this time of the year and to these a word of warning must be given to watch out for small oil holes on the chassis, so they are not filled up with paint. This, of course, applies only to painting the chassis. For instance, there are oil holes in the caps of some radiator trunnions and if the owner is not careful they will be filled partially with paint, thus making it impossible for the oil to get to the bearing. Even though the hole might look open there may be just enough paint in it to prevent the oil from performing its function. All the small oil holes are there for a definite purpose, and many mysterious squeaks can be traced to one or more of them which either has been neglected or filled with paint. The holes always should be cleaned out before oiling, using a nail or small punch.

Never use too large an oil can when oiling these parts. Remember that oil on the outside of a bearing does no good whatever. Use a small can and put in two or three drops, as may be needed. A little oil applied at frequent intervals is better than a great quantity applied at long intervals.

How to Patch a Concrete Floor—When cement floor becomes worn, it is often necessary to patch it. Commonly a sand and cement motars is made, some cutting is done and the mortar is put in and scrubbed with a steel trowel until smooth. It is then covered up for a while. If the concrete under the patch is left dry, it soaks up the water of the mortar. As a result, the mortar does not set. If the room is dry or hot the surface of the patch dries out and for the same reason it does not set. If the concrete under the patch is dusty the patch does not adhere to the concrete. If the materials in the mortar are not suitable, naturally the patch wears badly, particularly as it is obviously located at a point of severe wear.

To proceed in the right way, cut down the worn place at least one-and-a-half inch. This cutting should be carried into the strong unbroken concrete and the edges should be cleanly undercut. The bottom of the cut should then be swept out, clean-blown out with compressed air or a pair of bellows, if available, then thoroughly wet and scrubbed with a broom. In this way, small loose particles of broken material which the chisel has driven into the surface are removed. A grout made of pure cement and water, about the consistency of thin cream, should be scrubbed into the pores with a broom or brush, both at the bottom and sides of the cut. Following this a stiffer grout, about the consistency of soft putty, should be thoroughly compressed and worked into the surface, which has already been spread with grout. Finally, before the grout is set a mortar made of one part cement to one part crushed stone or gravel, consisting of graded sizes from one-half inch down to the smallest, excluding dust, should be thoroughly mixed and put in place, then floated to a proper surface. Cover with wet bagging, wet sand, sawdust or other available material. All trucking should be kept off and the surface kept thoroughly wet for at least one week or ten days.

If a particularly hard surface is required, six-penny nails are sometimes mixed with the mortar and other nails stuck into the surface when the patch is finished. This will produce a surface which is extremely hard and durable.

A Gun-Metal Finish—To make an imitation gun-metal finish by electrical process take ¾ pound of the double nickel salts to a gallon, and dissolve in boiling water. After the solution has cooled, add ammonia until it is slightly alkalized, then add sulphuret cyanide of potassium, about ½ ounce to a gallon. If a darker finish is required add more sulphuret. This will work excellently on all metals and they will come from the solution with a very high luster. If the work has been buffed and dipped before plating, it will require no further finishing, and should then be lacquered. It should be run with a very mild current from three to four minutes.

Cement for Leather Belts—In an ordinary glue-pot soak over night a pound of fish glue in a pint of cold water. Then add one ounce of dry white lead. When the mixture has been again thoroughly stirred and is nearly cool, add one ounce of grain alcohol, and stir it well. Heat up the cement again when it is wanted for use. In the use of this cement care should be taken to have the laps freshly and smoothly cut, and as clean as possible. The cement should be evenly spread with a brush over both surfaces and the surfaces placed in contact as quickly possible, and on each side of the lapped belt should be placed a previously warmed board and the whole clamped together for an hour or two according to the width of the belt, its thickness and the amount of strain it will have to stand. This cement can be made in larger quantities by observing the same proportions, and when cool it may be cut into small pieces and kept in good condition in a fruit jar tightly closed. When it is wanted it will not be necessary to heat up more than is wanted for the job in hand.

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TWENTY-TWO PER CENT. INCREASE IN NUMBER OF MOTOR VEHICLES IN THE UNITED STATES IN 1920.

Over One Hundred Million Collected in Registration and License Fees for Motor Vehicles in Past year; Use Made of Revenues During Past Fourteen Years Has Changed Greatly.

A total of 9,211,295 motor cars, including commercial vehicles, were registered last year in the 48 States and District of Columbia, according to figures compiled by the Bureau of Public Roads of the United States Department of Agriculture in a study of revenue available for road-building purposes. There were also registered a total of 238,146 motorcycles. The registration and license fees, including those for chauffeurs, operators, and dealers, amounted to $102,034,106.26. As compared with 1919, the data for 1920 represent an increase of 22 per cent., or 1,645,849 motor cars. This increase alone lacks but 4 per cent. of being equal to the total registrations of the United States six years ago.

In 1920, in the State of New York alone, the number of motor cars registered, including commercial vehicles, exceeded the total cars registered in the whole of the United States in 1910. Furthermore, the revenues derived from registration in the State of New York in 1920 were about equal to the entire registration revenues of the United States for 1913.

The use made of the revenues has changed with the passing of years. In 1906 the total registrations were approximately 48,000 cars, paying a gross revenue of about $193,000. (Arizona in 1920 paid approximately this amount.) In 1906 the gross registration revenues were equal to less than three-tenths of 1 per cent. of the total rural road and bridge expenditures for that year.

The registration revenues in 1920 were equal to about 25 per cent. of the total rural road and bridge expenditures for the calendar year 1919. In 1906, practically none of the motor vehicles revenues was applied to road maintenance or construction, while in 1920, 96 per cent, or a total of $97,997,160.60, was used for this purpose. The remaining 4 per cent. not applied to road work was expended very largely for number plates and in carrying out the provisions of the motor vehicle registration laws in the several states. Of the total amount applied to road work 79 per cent., or $77,531,582.57, was expended under the control or supervision of the several State Highway Departments.

Increasing Amount Spent for Road Work.

For a number of years the general tendency toward devoting an ever-increasing portion of the motor-vehicle revenues to road work under the control and direct supervision of the State Highway Department has been very noticeable. Prior to 1912 only a very small portion of the motor vehicle registration was devoted to this purpose. In 1920, 76 per cent. of the revenue, or $77,531,582.57, was applied to road work under the direct supervision of the State Highway Departments and in addition $20,465,578.04 was applied to road work by counties or other local supervision but with little or no direct supervision from the State Highway Departments.

In most States the motor-vehicle revenues are devoted to maintenance and repair of the State roads or other improved highways. These States seem to have solved fairly well the difficult problem of securing funds for the maintenance of the more important roads under the ever-increasing traffic requirements. As both the traffic and the revenue increase with the number of cars, there apparently exists a possibility of so adjusting the registration rates as to keep pace with the ever-growing maintenance changes.

A number of the States having in general but a small mileage of improved roads have recently adopted the plan of capitalizing the motor-vehicle revenues and devoting these funds to road construction. The States doing this are Illinois, Maine, Minnesota, Missouri, Nevada, Utah and Wyoming In them bonds have been voted or issued for road construction, and the principal, in some instances also the interest, is to be paid entirely from the motor-vehicle revenue.

Limit Load of Motor Trucks

At the beginning of 1921 there were still seven States in which motor trucks were registered at the same rate as passenger cars, but in recent years there has been a very decided tendency in most States to increase the fees required for motor trucks over and above those required for passenger cars. This increase is usually based on the weight of the truck and its carrying capacity, its horse power, or a combination of these factors. The most general practice seems to be toward definitely limiting the maximum total road weight of the vehicle and basing the registration fee on the capacity of the truck. Some few States have adopted a scale of fees, which in actual practice serves to make the operation of very heavy trucks impracticable.

In Colorado, New Mexico and Oregon, in addition to the registration fees, a State tax on gasoline or other products used for the propulsion of motor vehicles is also levied. In some States motor cars are taxed as personal property in addition to the required registration fees. In Alabama, Delaware, Idaho, Iowa, Michigan, New Hampshire, New York, North Dakota, Oklahoma, Oregon, South Carolina, Pennsylvania, Tennessee and Vermont, the registration fees are in lieu of all personal property taxes.

SUMMARY—APRIL, 1921

Cutting Metal With the Oxy-Acetylene Torch

BY DAVID BAXTER

THE blacksmith who has not installed an oxy-acetylene welding outfit, will find he is slowly but surely being placed under a handicap that may require years to overcome. The smithy is essentially a repair man, and in this horseless age of machinery, he must be able to repair the modern machines the same as he did the horse-powered devices of a few years ago, or else pass into the tinker class. In a few words, he must realize that such machines as the modern tractor, or the modern grain thresher, or any of the machines now being invented and manufactured, for doing all manner work, from kitchen machinery to massive war machines, all are more or less constructed so that it is not possible to repair them by means other than one of the welding processes.

Then on the other hand, there is the blacksmith who owns a welding plant, but who is not yet using it to the fullest extent. In other words, he is using it solely for welding. Perhaps he doesn't know just what can be done with an oxy-acetylene outfit when it is completely equipped.

There are a dozen or more ways of using the oxy-acetylene torch besides merely the fusing together of severed parts or the welding of broken castings. Any one of which will prove to be a money maker; at least as a side line to keep the torch busy during slack spells. Fusion welding is readily conceded the most important work of the torch, but there are one or two other uses that run it a close race. Take for instance the cutting of metal. This is a very important use for the welding plant. So important in fact that the blacksmith who owns a welding outfit not equipped with a cutting torch is losing a portion of the profits of his investment.

Until quite recently it was thought that only steels and wrought irons could be cut with the oxy-acetylene torch, but some of the leading manufacturers and technical schools have been experimenting along the line of cutting cast iron with the flame. They now announce that it is feasible, in fact, entirely practical. The only thing now is to get the system on a commercial basis. However, this does not concern the average blacksmith so very much, so we will discuss at this time only the cutting of steels and wrought irons such as are found in the repair shops. Some steels are known as iron in some localities, while in others wrought iron is called steel. But the oxy-acetylene torch cuts either one with equal facility, so it is unnecessary to go into fine distinctions.

In regard to the actual cutting, the theory is the same for all makes of torches, although the mechanisms of the different torches vary. The individual operator must be guided by the instructions furnished by his particular manufacturer in order to obtain the best results. Each manufacturer should furnish tables and other printed instructions, which should be conveniently placed in the shop where the torch operator can refer to them at any time.

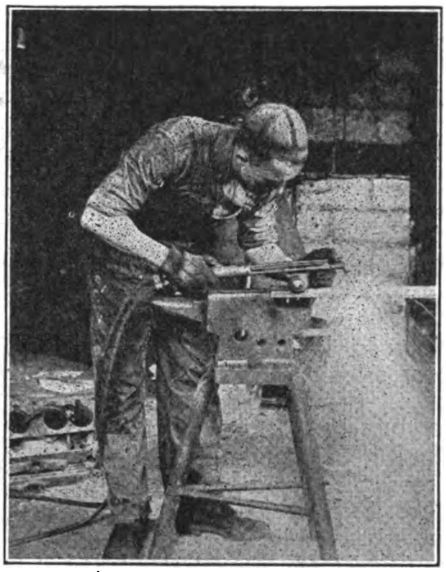


Fig. 1. A ROLLER GUIDE FACILITATES STRAIGHT CUTTING

Now, in consideration of the facts as given above, it will be seen that an article of the nature of this one must be more or less general in regards to the actual torch operation. In other words, we will take it for granted that the dealer knows his own cutting torch and regulators.

In the first place, the theory of cutting steel and wrought iron hinges upon oxidization; in fact depends upon it. That is, the metal is not cut in the strictest sense of the word, but is oxidized or burned. The steel literally furnishes its own fuel with which to burn itself up. The regularity and precision of this depends upon the flow of oxygen. Like any fire, the cutting operation must have oxygen. There can be too much oxygen or too little oxygen. The latter will stop the cutting while too much oxygen will blow the fire out. On the other hand, too little oxygen will cause a fire to burn poorly the same as it will cause a poor cutting operation. Between the two an irregular supply of oxygen will cause an irregular or intermittent burning of both the fire and the steel. From this it is readily seen that the cutting operation requires a steady supply of oxygen.

The explanation might be carried a little further: the size of the cut requires a certain amount of pressure of oxygen to keep it burning with a constant intensity. Thus the oxygen pressure is governed by the weight or thickness of the metal to be cut. If these things are right, then the speed of the cutting depends upon the constancy of the oxygen supply. In other words, the correct pressure of the oxygen must be maintained with relation to the oxidization, in order to produce a smooth, even cut. Not only that, but the cutting torch must be kept the same distance from the burning metal at all times. If it is not kept the same distance, the cut will be ragged and wider in some places than in others. There are other causes for irregularities in the cut, however; such as impurities in the metal; porous portions or poorly packed structure, adjoining different grades of metal; hidden rust cavities, etc. These things are quite beyond the control of the torch operator, so he should be ever watchful for them, to speed up or retard the flame accordingly.

Now, the above items have been given as hints in general, as there is more or less latitude in all cases except where the cut is to be very smooth and clean. That is, the operator doesn't always adhere strictly to a scientific application of the theory of cutting, in regards to pressure, movement and position of the flame. He usually approximates closely, because it is practically impossible to make a saw-like cut free hand. The human hand is not steady enough at all times to make a smooth cut. Some sort of

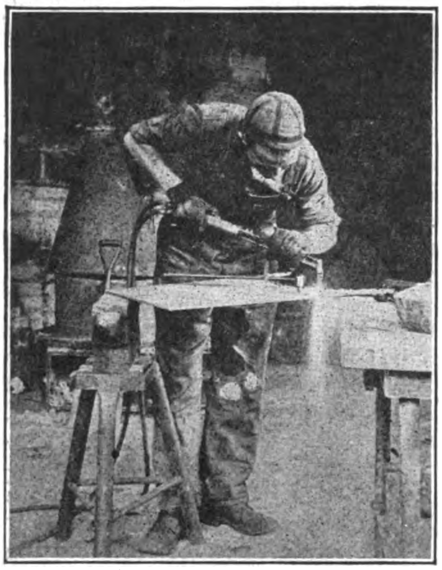


Fig. 2. USING THE ATTACHMENT THAT PERMITS ACCURATE CIRCLES TO BE CUT

machine or device for holding the flame rigid is essential if a cut is to be made which requires no machining or grinding afterward. Although a free hand cut can be made that compares very favorably with a cold shear or saw cut if the metal is new and the operator is skillful. This skill is acquired by practice, however, and the average blacksmith can soon learn to become adept in the art.

The theoretical rules governing the cutting of steel and iron might be condensed and worded as follows: The cutting flame should move forward, that is, in the direction of the line to be cut, at the same rate of speed at all times; it should not pause or waver. This speed is governed by the thickness of the metal. The operator refers to his table chart to set his regulator so the proper pressure will be furnished for this thickness. If this is right then the flame should be kept moving forward as fast as the metal is cut out. To move faster will clog the cut and cause a ragged spot; to move slower tends to the same effect.

When the pressure is correct and the forward speed is right both should be maintained. Then the next requirement is to keep the torch tip at certain height above the metal. This should also be constant. The flame should not be raised and lowered as this also causes uneven places in the cut. In some makes of torch, the tip rides upon the metal; in others it must be held the correct height by hand or by some mechanical device; in either event the tip is usually held very close to the metal. This is governed more by the width of the swath than anything else. Each operator should experiment to see which position cuts the narrowest swath. This is usually very close to the tip outlet and is, therefore, steadiest; farther away the flame flickers more and is harder to prevent ragged edges in the cut. The wider flame looses part of its cutting force besides making a wider cut.

The narrowest cut is the most economical, because less metal is wasted and because it is more rapidly executed. Then this is the proper height to hold the torch. But these and the other conditions are governed somewhat by the size of the cutting tip. The operator ought to have two torches, one for heavy duty and one for the lighter class of work.

As stated in the beginning of this article, the cutting is merely a high rate of oxidization. The steel is burned and blown away by the force of the flame. This action is accompanied by considerable pyrotechnic display, the oxidized metal is blown away in a perfect shower of sparks. Sometimes it falls in the shape of large drops of molten slag so that the operator should watch his hose to prevent danger of fire. Sometimes the slag piles up along the cut on the upper side. This is mostly due to the torch being held too high above the surface. Part of the flame force catches upon the edges of the cut and does not carry the slag through the cut.

It is not absolutely necessary for the oxide to be blown directly down from the flame, but it should be provided with a free exit. That is, the burned metal should not pile up and turn the force of the flame back. It may be blown to one side or diagonally out of the cut, or it may even be blown upward through the metal if it is not too thick and the force of the flame is sufficient to carry the oxide away as in cases where an overhead patch is cut out of a steam boiler.

Wherever conditions permit, like the cutting of boiler steel, the sheets should be raised above the floor, at least a few inches, to provide room for the escaping oxide. If the operator attempts to cut with the sheet flat upon the floor the oxide will soon pile up and make a sorry job of it. If he is able to cut at all the cut will be a ragged slot.

Before taking up any details of the cutting operations, it may be well to insert a few words of caution about the handling of oxygen under high pressure, such as is required for cutting. Oxygen will not burn, but is the greatest promoter of fire and will turn a small blaze into a conflagration in a few seconds. In regards to this, it is well to have an assistant posted near the oxygen cylinder so that in event of accident, he may instantly shut the pressure off at the tank. Cases are on record where the oxygen hose has blown loose at the torch connection and whipped around viciously before the tank valve could be closed. And there is the ever present danger of a bursting hose, when cutting very heavy steel. On the whole the operator can not be too careful when using the high pressure oxygen.

The cutting torch is probably the

Fig. 3. CUTTING HEAVY ANGLE IRON FREE-HANDED. NOTE THE REGULARITY OF THE FIRST CUT

most versatile tool ever invented. It can be used in place of a punch or drill press for making small holes in sheet metal, or as a saw for cutting heavy bars or billets of steel, or wrought iron. Then it can be used to cut out almost any special or irregular shaped article from solid sheet steel; from very thin or very thick metal. Then, it can be used for clipping rivets or bolt heads, and boring out the bolts or rivets. It can be used to make a straight cut a hundred feet or more in length, or it can be used to cut out a circle less than an inch in diameter. Very large circles are just as easy as the long straight cuts.

Fig. 4. SOME GOOD SAMPLE OF FREE-HAND CUTTING

In everyday free hand cutting, the torch is lighted and adjusted to burn with a neutral flame in the manner employed when welding. When doing this the high pressure oxygen is not used at all; just the ordinary welding pressure. The high pressure oxygen is fed to the flame by a separate valve for this purpose. This valve is not used during the lighting and adusting of the neutral flame. Nor is it turned on with the first application of the flame to the metal.

The neutral flame is applied to the point where it is desired to start the cutting. It is held close to the metal until the spot starts to melt. Then the high pressure valve is opened. This injects a stream of oxygen upon the heated metal, turning it almost instantly to oxide. In an instant it has eaten through the sheet of steel. Then the flame should immediately start to move in the direction of the cutting. The onward movement should be continuous and steady from then on to the end of the cut, where the oxygen valve is closed abruptly. The movement of the flame is timed to the oxidizing of the metal; as fast as the oxygen is blown through the sheet, the flame is moved forward to attack more of the metal, while a constant stream of sparks is falling.

This process is used on straight cutting, but is facilitated by bolting a roller to the lower pipe of the torch. This roller rests upon the sheet metal, thus enabling the operator to maintain the correct height of the flame; also to enable him to move the flame forward more easily, with an evener movement. Fig. 1 shows the cutting torch in operation on a straight cut; roller attached to the lower pipe. In lieu of this roller arrangement, a guide or foot is sometimes bolted to the head of the torch to steady it along the cut.

Fig. 2 shows an attachment used when cutting small circles. It is adjustable for circles up to four feet in diameter. This device consists of a radial arm bolted to the torch and extending downward to engage a sliding bar. This bar is adjustable and has an adjustable pivot or sliding point.

To manipulate the circle cutting attachment: a circle of the desired diameter is measured off on the sheet iron and a center punch mark is made in the exact center of the circle. Then the sliding arm and pivot are adjusted to fit the circle, bolted so they can not slip. When in operation the point of the pivot rides in the center punch mark and the whole thing, torch and all, swings around sidewise.

When setting the pivot the operator should know the width of the cut that his flame will cut, and should make allowances accordingly . If the circular piece to be cut out is to be accurate the inner edge of the swath should be the outer edge of the circle. Or the circle diameter should be measured so the center of the cut will be the outer edge of the circle. The adjustable arm of the device should be so arranged that the handle of the torch will be elevated as shown in Fig. 2. This will make the edge of the circular disc straight. If the handle of the torch is horizontal, the flame will strike the metal at an angle and the result will be a bevel cut.

To execute the cutting, the flame is lighted and adjusted neutral. Then the pivot is fitted to the center punch mark and held until a spot on the circle gets bright red, when the high pressure oxygen is turned on. As the burned metal blows through, the flame is gradually swung sidewise around the circle. These requirements hold good only for ordinary sheet steel, however. For thick metal it is often or usually necessary to drill a hole through the metal before starting to cut so the oxide will have a free exit.

When cutting thick metal, say half an inch or more thick, for straight cutting, the work should started diagonally at one end of the sheet. Very much like sawing a board. This will make a clean cut at the beginning; otherwise there is likely to be a large rough spot where the flame is first applied and burns through the metal.

In Fig. 3 is shown the cutting of a bar or angle iron without the aid of any guiding or steadying devices. In this, one hand is used to steady the torch and hold it the proper height above the sheet. This is all right where the edges of the cut are to be ground afterward on an emery wheel. The more proficient the operator grows with practice, however, the less grinding is needed. In Fig. 4 are shown several examples of free hand cutting. These are simple, too, but would require lots of time and labor if cut with a metal saw or with hammer and chisel. They are silent arguments for the addition of a cutting torch to the blacksmith's equipment, and assuring evidence for the smithy who is still hesitating about installing a gas welding and cutting outfit.

ANOTHER EXAMPLE OF THE THE WAY THE ROLLER GUIDE IS USED IN STRAIGHT CUTTING

Knocking should only be confined to the anvil. The other way doesn't pay any blacksmith.

Some men hate bookkeeping because it shows them what poor business heads they are.

Has your being in business improved you? Good! We are glad of it.

Has your being in business improved it? That's fine and dandy —the best ever.

Make a point to have a good hearty laugh at something genuinely humorous every day. It will help you to keep young and in sympathy with the spirit of the times.

Getting More and Better Work from the Circular Saw

THE points of teeth in the large circular rip saw, as well as in small saws, are the only portion of the saw which should come in contact with the timber. They

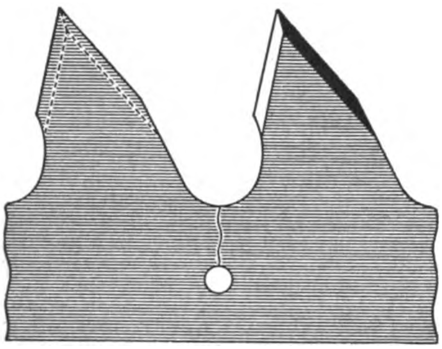


Figure 1

must be kept sharp by the use of a file or emery wheel, and set by springing or by swaging. They should be swaged and side-dressed so that the extreme point of the saw should be widest, and diminishing back from the point. A saw fitted full swage will stand up better in fast feed than if fitted spring set, but as there is more friction on

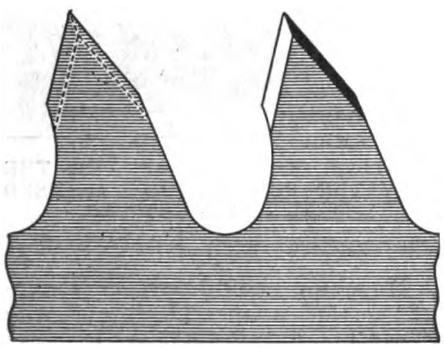


Figure 2

the edge on account of the points of the teeth being wider, it takes more power to drive the saw. However, for log sawing this style is more reliable.

As the swage wears more on the log side, and thus makes an unequal strain on the saw, it is a mistake to run the saw without swaging nearly every time it is filed. Where the timber is clean and free from grit, a saw may sometimes be run two or three times after being swaged before needing to be swaged again, and if carefully filed will do very good work.

Another contributing factor that prevents saws from doing the best possible work is caused by allowing them to run out of round. When this condition is detected, hold a piece of emery wheel squarely across the teeth, while the saw is in motion, thus reducing the most prominent teeth. When a saw has long and short teeth, it follows that the long teeth will have the most work to do, thus producing and unequal strain on the saw, which will have a tendency to cause the saw to deviate from its line, heat, and give bad results generally.

The cutting of a saw should be continuous, and to be so it should be perfectly round; otherwise, the best results cannot be obtained. On the same principle the tooth edge of a gang, mill or mulay saw should be perfectly straight.

The fitting of cut-off saws differs from the fitting of rip saws only in the shape of the teeth and the manner of fitting them. Large cut-off saws for cutting off large logs where power feed is used and rapid work is required, should have the pitch line from 4 to 8 inches in front of the center of the saw for soft wood. For hard wood a trifle more hook is preferable.

In heavy sawing where a very smooth cut is required, as in cutting off logs for pulp, there is more bevel required than for ordinary work, and the bevel should be about equally divided between the back and the front of the tooth. It is a mistake to try and run a large cut-off saw for heavy work, where a large amount of bevel is required, with all of the bevel on the front of the teeth. A very great bevel on the front of the tooth create a severe lateral strain. The teeth are thus spread apart as it were, and forced out of line into the side of the cut.

Where the teeth are extremely stout and short, as shown in cut No. 1, the strain is transmitted to the bottom of the gullets, and in many cases cracks at the rim are the result.

In a case of this kind the teeth should be gummed out deeper, as shown in figure 2, then the trouble will disappear. Where cracks appear in the place, as above referred to, not only should the teeth be gummed out in good shape, but a hole should be drilled at the bottom of the crack to prevent it from extending further into the plate. This is shown in figure 1.

For ordinary work the bevel should never extend to the bottom of the tooth. In fact, only the point of the tooth needs beveling. The remainder of the tooth and the throat should be dressed

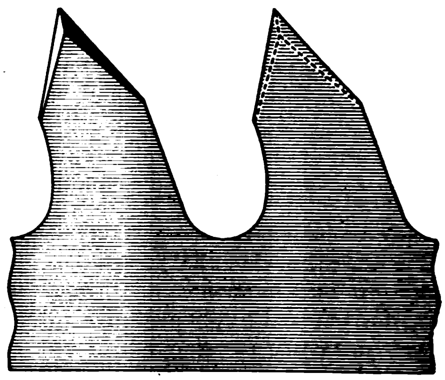


Figure 3

straight across, as shown in figure 2.

But there are cases, it is claimed, where a longer and wider bevel is required, for example, where saws are used for cutting up logs into shingle bolts. Cedar bark is tough and easily separates into strings instead of sawdust. These strings, it is said, often get pulled in between the teeth, and are carried around on the front of the tooth, often collecting in such quantities in the gullets as to cause much

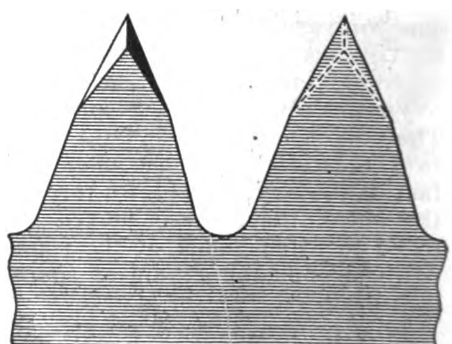


Figure 4

trouble with the working of the saw; whereas, if the face of the tooth had a longer bevel, the sharp

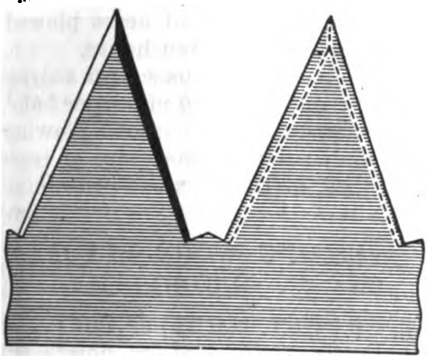


Figure 5

edge of the beveled tooth would, it is claimed by those who advocate this style of filing in such cases, cut the stringy fibre into small particles, and permit it to be properly discharged.

For heavy work, where a smooth cut is not necessary, a cut-off saw should be filed with the front of the teeth slightly beveled.

In the case of a tooth built on a line to about center—if the back of the point be nicely beveled, as shown in cut 3, it will be sufficiently sharp to cut off the fibre, and the square front will carry out the sawdust. This style of filing is preferable, for the reason that it prevents much of the lateral strain previously referred to, and the saw will run lighter, cut faster, and is less liable to crack than if run on fast feed with an extreme amount of bevel on the face of the tooth.

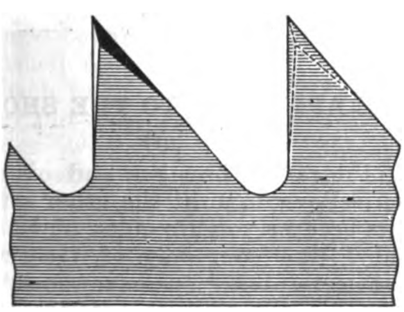


Figure 6

This is particularly the case where hard wood is sawed. Hard wood requires less bevel than soft wood. Figure 4 shows the proper way of filing a "V" tooth cut-off saw, while figure 5 shows the improper way of filing it.

Figure 6 and 7 represent a pitch to the center tooth, the first properly and the second improperly filed. The style of tooth and the manner of filing, as shown in cut No. 6, is used in light but comparatively rapid work in soft fibrous timber where fairly smooth work is desired. Where a smooth cut is desired, filing as shown in figure 8, gives better results. Cut No. 9 represents the same style, pitch to center, fitted for hard wood.

Cut-off saws with the front of the tooth under-cut 1, 2 and 10 are the best for general use. Cuts 1 and 2 are for heavy cutting with fast power feed, and the style shown in cut No. 10 for cordwood, or any kind of work where hand feed is used. If the teeth are kept in this shape, the saw will give better results, and will be far less liable to crack at the rim.

There are certain precautions to be observed when working in cold weather and sawing frozen timber.

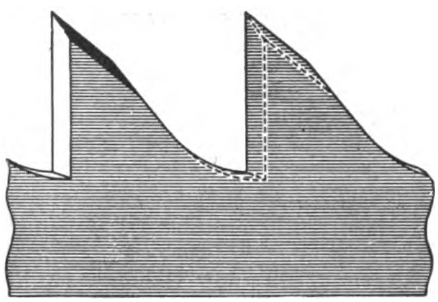


Figure 7

Frost effects steel, and a saw should never be used until the frost has been taken out of the plate. This can be done by prying over the end of the carriage with a piece of board, holding the end firmly against the edge of the saw and moving it along the saw. The friction, will in a few minutes, warm the saw and take out the frost. This will guard against the saw breaking or cracking from the frost being in the plate.

When sawing frozen timber, the saw should be run as closely as possible, with as narrow a set or swage as will clear the plate and prevent heating. As frozen timber cuts much cleaner, less set is required.

Do not have the set or swage extend as far into the body of the tooth as in summer sawing; the point being narrower requires less depth to support the corner. Keep good sharp corners; file the teeth perfectly square across, and line the saw straight with the carriage, and then frozen timber can be sawed as easily as any kind. Even better results are obtained when sawing frozen timber by fitting the saw as shown in figure 11 instead of fitting it as shown in figure 12. This is because a saw with sharp corners is less liable to dodge or run out in taking off a light slab. Saw fitting as shown in figure 12

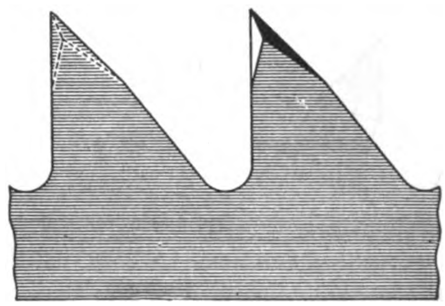


Figure 8

often give quite a great deal of trouble. The corners, being dull and rounding, do not take hold and enter the log as they should, but dodge out and lay over from the log, causing the saw to heat between the rim and center. The result is that it is liable to run into the log as much in the second cut as it ran out in the first cut, thus making wedge shaped lumber.

A word in regard to the practice of gumming saws will set most of us right on the subject, and dispell any doubt that we may have regarding the practice. When gumming with an emery wheel, the operation should be preformed by going over the saw several times. Doing too much work at one time will heat the saw at the gullet and stretch the saw so that after a few operations the saw will need hammering to restore it to its original tension. There is no excuse for crowding the emery wheel so as to

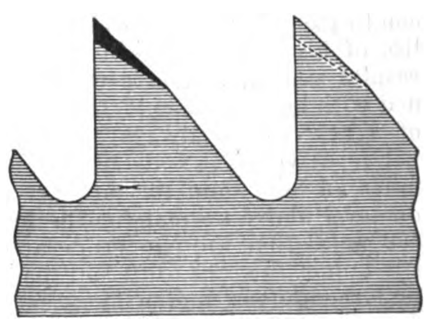


Figure 9

heat the saw to a blue, as this is sure to injure the saw where the emery wheel comes in contact with it, often glazing it so hard that a file will make no impression on it whatsoever. From these hard spots on the outer surface, small cracks begin, invisible at first to the eye, but gradually enlarging until they become dangerous fractures. Care should be taken to select the type of emery wheel that is suited to the work.

Hacking the wheel with a file or cold chisle will make it cut faster

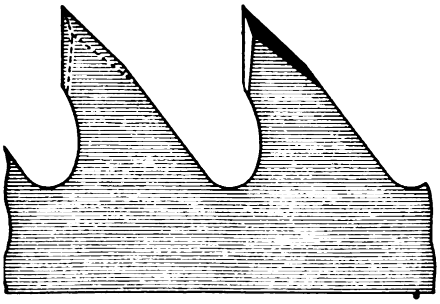


Figure 10

and prevent it from glazing, so that it is not so liable to heat the saw.

A good emery wheel dresser can be made from an iron bolt and some ½ inch or 5/8 inch washers This is far better than the hacking plan as it not only serves to rough up the wheel and remove the gum from it, but it can also be used for the purpose of rounding off the sharp edges of the wheel, which is made so by grindng more on the back edges of the teeth than at the bottom of the gullets. The edge of the emery wheel should always be round when used in gumming out the throats of the teeth and should always be of sufficient thickness to give a good, large, round gullet.

BREAKING IN THE TRACTOR

This spring there will be a number of new tractors in use on farms that have not used this equipment before. It may be well to call the new owner's attention to certain conditions that will prolong the life of his tractor, give him better results and make him better satisfied with his investment. The owner of a new car is always cautioned not to drive his car above 15 to 20 miles an hour, and to maintain an oil level above normal for the first 500 miles that the car is operated. By doing this the different parts find themselves, and a more satisfactory operating car is the result.

The same general rule applies to the tractor. A great deal of difficulty may be avoided in tractor operation by greater care in breaking in a new machine. This responsibility rests largely with the dealer, and it will pay him to make a thorough study of it in order to reduce the service cost later on, and more important still, to have a thoroughly satisfied customer.

In view of this fact, it is advisable for either the dealer or the new owner to allow the motor to run idle at from 600 to 800 R.P.M. for possibly three or four hours, before the tractor is actually put to work. The extra expense incurred by this operation is more than offset later on by a reduction in the number of service calls.

After delivery, the dealer should call on the owner once a week during the first month that the tractor is in service, giving such instructions as are necessary regarding its operation and making whatever adjustments that are required in order to keep the tractor in first class running order.

PLOWING SPEED AND ACREAGE DATA

1 Square mile equals 27,878,400 feet, or 640 acres.

1 Acre equals 27,878,400 square feet divided by 640, or 43,560 square feet.

1 Furrow, 28 inches wide and 1 foot long equals 2 1/3 square feet.

1 Acre of 28 inch furrows equals 43,560 square feet divided by

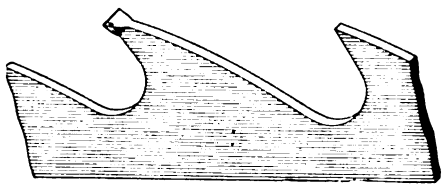


Figure 11

2 1/3, or 18,695 feet long, or about 3½ miles.

To find the number of feet of furrow plowed per minute, divide 5,280 (the number of feet in a mile) by 60 (the number of minutes in an hour) which gives 88; then multiply 88 x2¾ (the proper plowing speed for most tractors) and the quotient, 242, is the number of feet plowed per minute.

To find plowing time for one acre, divide 18,695 (the number of 28-inch furrows in one acre) by 242 (the number of feet of progress per minute) and the quotient, 78 9/10, is the number of minutes required to plow 1 acre.

To find the number of acres to be plowed in one day of ten hours, divide 600 (the number of minutes in a ten hour day) by 78 9/10 (the number of minutes required to plow one acre) and the quotient, 7 3/5, is the number of acres plowed in one day of ten hours.

The above data is based on a driving speed of 2¾ miles per hour, which is the correct plowing speed for the majority of tractors, including the Fordson.

HEATING WOOD BEFORE GLUING

In its Technical Notes the Forest Products Laboratory points out that in joints of small area, where the gluing is done in warm rooms in the absence of a draft and the wood itself is at room temperature, little is to be gained by preheating the wood. In fact, under such conditions, heating may be detrimental, since the glue will be kept thin and squeezes out when pressure is applied. However, when joints several inches each way are glued, pre-heating has a distinct advantage and unless heated, the joints develop their full strength only in spots. It has been found that joints of large size can be produced of uniform high strength if the wood is heated for from ten to fifteen minutes at from 120° to 130°F. just before gluing. The heat prevents the glue from chilling and keeps it liquid until pressure is applied. The rate of set is retarded, full joint strength being developed in ten hours in mahogany and more than twelve hours in red oak and maple, whereas cold-glued joints reach their full strength in less than eight hours.

THE APPROACH TO THE SHOP

F. L. Clark.

"I'd rather buy gas and oil of you fellows than at the other garages because you are quick about it and I like your way of treating customers, but you have such a blamed old mud hole out here in front most of the time that I won't drive through it.

The remark made not long ago in an automotive mechanic's shop in an eastern town was "just what we needed," as the two young fellows who operate the shop confessed later on. "We had been so busy and were thinking so much about running things right inside the shop that we hadn't realized we were neglecting the outside and losing money by it."

The two young men had learned auto repair work in a garage in the town. Had saved their money and one day when they found one of the garages in two was for sale bought it to use as a shop.

Determined to make good and run a place which would be first class in every way, soon after they made the purchase, one of the men went down to Kansas City and took a three months' course in auto mechanics. After completing, he came back home brim full of new ideas, and the two of them set to work to fix up a shop which would be thoroughly up-to-date and to keep it orderly.

They have been successful in this and also successful in attracting and holding a big slice of the repair work on cars, for they stuck close to their job and tried to be obliging and prompt.

But all this time, there was that mudhole. The shop was just around the corner from a paved street. There was about two hundred feet between the pavement and the door of the shop. They had an attractive sign extended from a post out at the edge of the pavement, so that the driver on the paving would not overlook them because they were a little off the street. Then they built a cement platform in front of the shop where customers were allowed to wash their cars. The water from this ran off, and made the road between the shop and the paving bad.

To cut the story short, the proprietors, after the customer had "bawled them out" about their mud hole, bought several loads of crushed rock and covered the approach to the shop with it. Then they put in a drain to carry off the water when cars were washed. Now, cars turn off the pavement and drive over a smooth little piece of macadamized road to the shop door and the gas tank which is beside it.

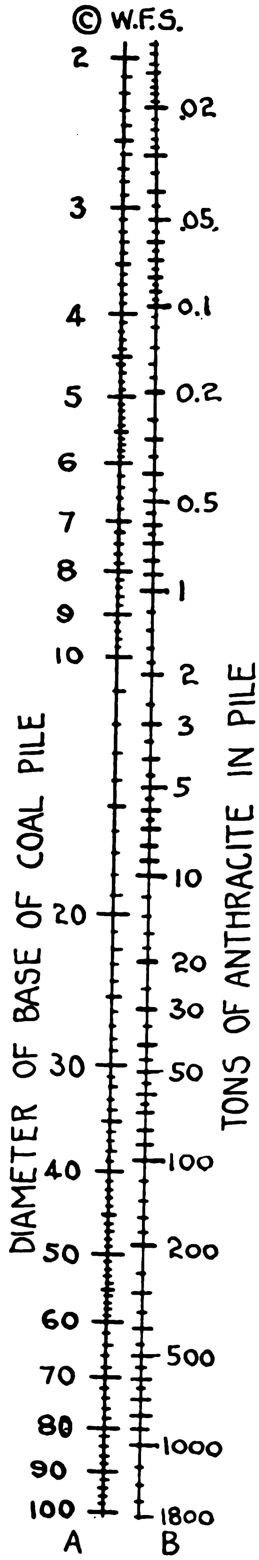
Are the proprietors selling more gas and oil and getting more trade because they have given attention to the kind of approach they have?

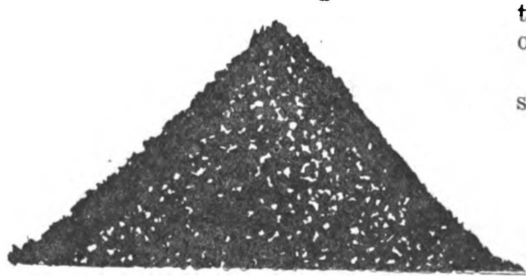
Well, you ask them, and see see what they say.

HOW MANY TONS IN A CONICAL PILE OF ANTHRACITE COAL?

(*Copyright* 1921, *W. L. Schaphorst*)

Because of the fact that when anthracite coal is piled loosely on the ground or on a floor it assumes a fairly definite angle of repose, we can easily develop a formula for computing the number of tons in a natural conical pile. The weight of anthracie per cubic feet is a fairly constant quantity also, which makes the development of the formula still easier.





Such a formula has been developed, but it involves squaring the diameter of the base of the pile and multiplying by a constant. To make the method as easy as possible the writer, therefore, constructed this chart, which gives the tonnage direct by simply glancing across from column A to column B.

For example, how many tons of anthracite coal in a conical pile whose base diameter is 30 feet?

Find the 30 in column A and glance across to column B and there's the answer—about 48 tons.

Inversely, the chart can be used to determine the size of plot needed for the storing of a given amount of anthracite coal.

For example, what size of plot will be needed for the storing of 200 tons of anthracite coal?

Find the 200 in column B and glance back to column A. The answer is—about 49 feet.

The range of the chart, it will be noted, is great enough to take care of most ordinary piles. It varies from 2 to 100 ft. in diameter. In a 100 ft. pile there would be about 1800 tons.

GETTING THE JOB DONE

By Ed. Henry

A motorist brought a blown-out inner tube into the Premium Blacksmith Shop to be vulcanized, asking the helper if he could have it again that evening. The helper told him he could and the motorist went away satisfied. He had hardly gotten outside when the helper came to the shop owner explaining in a worried tone, "I'm in a pretty fix. Here's a big blowout and when I promised that chap he could have it to-night, I forgot the big vulcanizer is out of order. What'll I do now?"

"Repair it with the small one."

"How can I? The vulcanizing plate on that is only about four inches, and this hole is at least ten inches long. Can't do anything bigger on that vulcanizer than four inches," explained the helper.

"Well then, do four inches at a time until you get the hole closed," ordered the blacksmith.

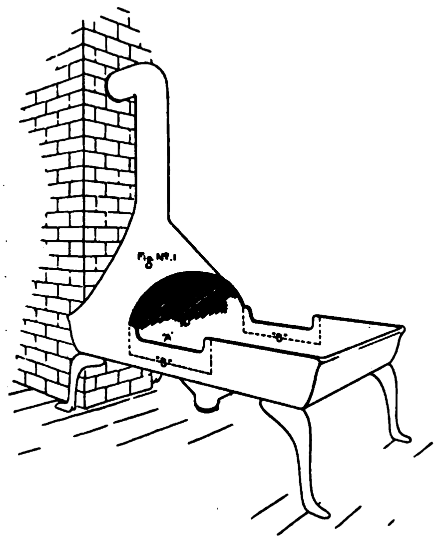
The helper understood, and though still dubious, went to work.

That night the motorist was pleased to find his tube repaired. Though it had taken him somewhat longer than it otherwise would, the helper had learned a successful tube repair can be made, even though it is not possible to vulcanize it all at once.

SHOP HINTS

AN IMPROVEMENT FOR THE CHIMNEY AND FORGE

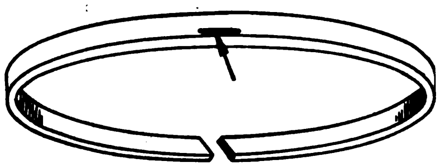
Like many other smiths, I have at times experienced considerable trouble with my forge not drawing



CUTTING THE SIDES OF THE FORGE MAKES THE FIRE MORE ACCESSIBLE

properly. We all know the annoyance that such conditions cause, and I have hit upon an idea which seems to correct this trouble. I believe that it will be of interest to other smiths, since it has worked out so satisfactorily for me.

There are a few conditions, however, that will interfere with the complete success of this arrangement; for example the chimney not



THE NEW FORD PISTON RING

being high enough. We all know that the higher the chimney is the better it will draw; but the height in this case isn't so vitally important, other than the chimney should be at least 3 feet higher than the comb of the roof. Another cause which causes poor draughts may be traced to the fact that in many shops a large heating stove is connected to the same chimney as the forge. Unless the flue is amply large to care for both, the draught of either or both fires may be effected.

A change in the hood of my forge, I find improves it considerably. By using an old water boiler, a reducer and a stove pipe "L" arranged as shown in the accompanying drawing, the whole story is explained. At a place on the boiler, as indicated by A in figure 2, a half circle 10 inches high was cut. Brick and cement are used to fasten the bottom of the boiler while the top may be fastened in the most convenient manner.

It has been my experience, that unless the factory-made hood is lined with brick it will soon rust out, and if it is lined with brick the opening is closed up sufficiently to seriously interfere with the draught. The boiler stunt seems to get around the difficulty very nicely.

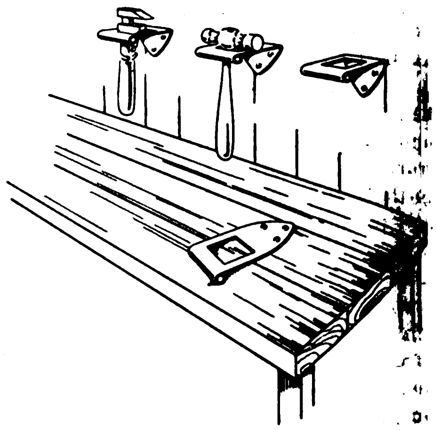
Another change that I have found which makes it considerably easier to handle certain classes of work in the forge, is to cut the sides down as indicated by the dotted line in figure 1. The advantage of this arrangement is that it permits long pieces of work, such as axles which have to be straightened, to be placed in the fire without having to build the fire up to meet the work. The results are that a smaller fire may be used, thus effecting a considerable saving in coal, which at the end of the year is quite an item. Secondly, the fire is nearer the tyres and accordingly is afforded a better draught. And last, but not least, the fire being smaller there is less smoke with which to contend.

If the cutting operation just mentioned should weaken the forge, it may be easily braced by using an additional leg made from a piece of ½" x 2" stock and fitted as shown by B in figure 2.

Merle Morgan.

CHANGE IN THE FORD PISTON RINGS

Another change has been made in the design of the Ford piston rings. They are now manufactured by a slightly different process, which it is claimed gives the ring greater wall tension. The present type of ring is marked as shown in the accompanying drawing. When assembling rings on the piston, the edge bearing the groove should be placed towards the top. In making motor repairs, it is advised that the new style of ring be placed in the two lower groove using one of the old style in the upper groove. In this way the stock of old rings may be consumed.



OLD BATTERY HANDLES MAKE HANDY TOOL HOLDERS

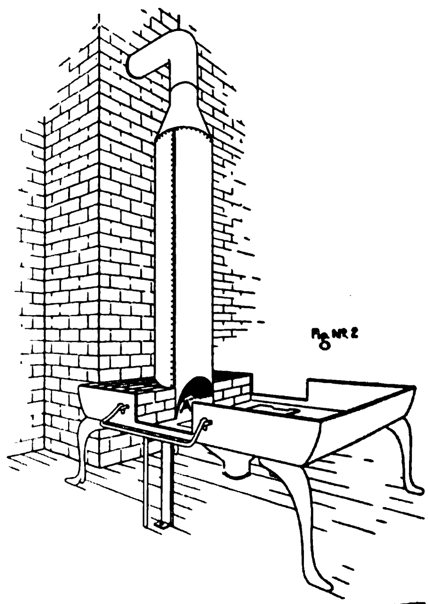
UNIQUE TOOL HOLDERS

One garage man of our town has made good use of all the handles taken off the discarded storage batteries left in his shop. The sketch shows the use. The handle is simply bent at right angles and screwed to the wall.

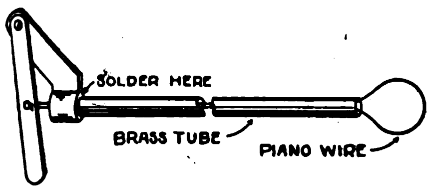
Chas. H. Willey.

A HANDY FISHING TOOL

A simple tool that will save considerable time in removing small pieces such as bolts or nuts, which



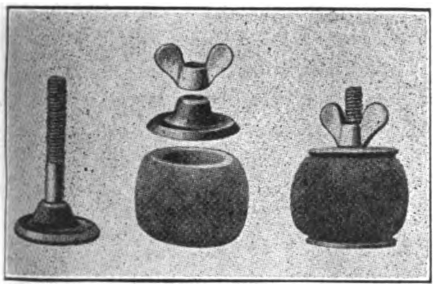
A BETTER FIRE AND LESS ARE THE ADVANTAGES OF THIS STACK



IT IS EASY TO FISH SMALL PIECES FROM INACCESSIBLE PLACES WITH A TOOL LIKE THIS

have fallen into inaccessible places and are difficult to reach, may be readily made from a piece of tubing of suitable length and diameter, and a piece of light piano wire.

The wire is doubled and passed through the tubing, protruding beyond the end in the form of a loop. The other end of the tube is fitted with a small lever with which to draw up the noose. It is relatively simple to work the noose over the object to be removed. The lever permits a firm hold to be made by the wire.



RADIATOR PLUG FOR REPAIR WORK

An old choker, such as is used on the Stromberg carburetor, lends itself readily to this purpose.

L. V. Pendleton.

AN IMPROVISED RADIATOR PLUG

In testing radiators after they have been repaired, it is necessary to plug the hose connections. While wooden plugs are often used successfully, nevertheless, their use is always attended with the possibility of damaging the radiator or the connection, because they have to be driven in so tightly in order that they will not leak. Further, when the test is completed, it is often difficult to remove them.

A radiator plug which works very nicely and avoids these troubles, is shown in the accompanying illustration. It is made from two scrap Ford valves and a solid rubber ball. The stem of one valve is cut off so that it is about 2½″ long and threaded to fit a wing nut. A 21/64″ hole is drilled through the center of the other valve head, so that it may be slipped over the stem of the first. The ball is cut flat on both ends, and a hole tapered at the end is cut through it. As the wing nut is tightened, the valve seats are forced into the taper, causing the ball to expand, thus filling the opening in which it was inserted.

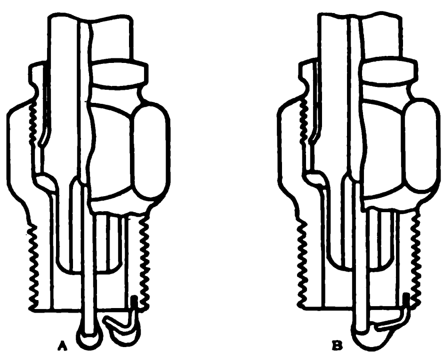
ADJUSTING THE SPARK PLUG GAPS

It is a natural human frailty to have a contempt for having any suggestion offered us regarding the simpler things that we encounter in our every day work, and still there are a number of hints that would help us to do those things better which we now believe are being done perfectly, according to our way.

A simple suggestion regarding the adjustment of the spark plugs gaps, at first thought would bring a sneer of contempt from most any mechanic and still there are but few of us who know that the peculiar little bend near the point was made that way for a definite purpose.

When adjusting the gap of a spark plug, it is not sufficient to have the correct distance, but it is also essential to have the points so bent as to obtain the greatest possible advantage of design.

With the point shown in the position of Figure B, the oil, which condenses on the body and core of the plug, runs down and closes the gap, thus rendering the plug inoperative. If the point is set properly as shown in Figure A, the oil flows away from the gap, preventing misfiring due to any accumulation at this point. Try this kink



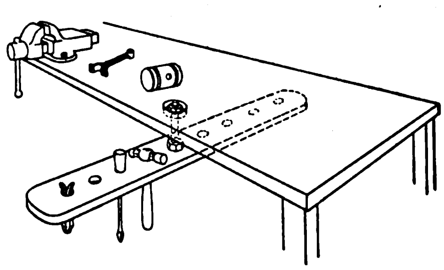
THE RIGHT AND WRONG WAY OF ADJUSTING SPARK PLUG GAPS

the next time you adjust some plugs and be convinced that they really work better.

BENCH TOOL RACK

Recently, I made a short trip to a village nearby and had to stop at the blacksmith shop. While talking with the smith who was working at the bench vise, he swung out from under the bench, a rack and took a tool from it. I examined the device and thought of how handy it was to be able to reach the needed tools so easily, each in its place, and yet all out of the way. I sketched the idea and send it along for the benefit of the other readers.

Chas. H. Willey.



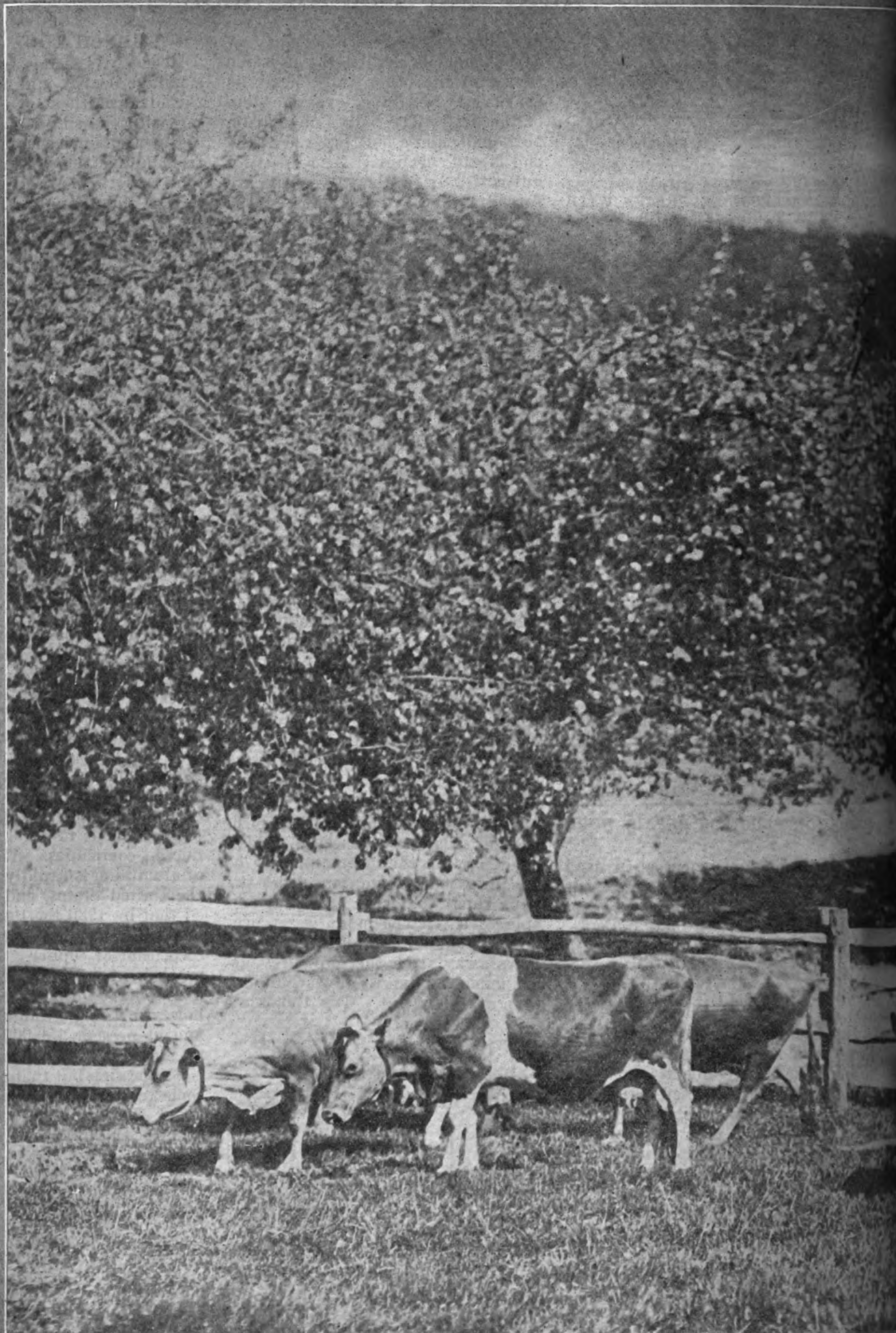
TOOLS ARE QUICKLY REACHED AND STILL OUT OF THE WAY

LIGHT ALLOYS

It is interesting to note that the majority of the light alloys in the United States are aluminum-copper, whereas abroad aluminum-zinc is more often found. This is said to be due to our lack of information regarding the aluminum-zinc series, and to supply the missing information, extensive research work has been undertaken on this class of materials by one of the large zinc-producing companies. The production of aluminum is rapidly increasing in the United States, and it is predicted that by 1930 the total production will equal, if indeed it does not exceed, that of copper. Aluminum as an element in die-casting has caused a number of difficulties, which are, however, being gradually overcome, and at present 150,000 castings can be made from a single die. There is no question but that aluminum has come to stay as an engineering material, the possibilites of which have by no means been exhausted.

In carburizing for colors, using cyanide, the work is often overheated. For a good mottled appearance a bare red heat is sufficient.

Inspection of holes drilled through a machined part is made effective by the use of a box with electric light inside.



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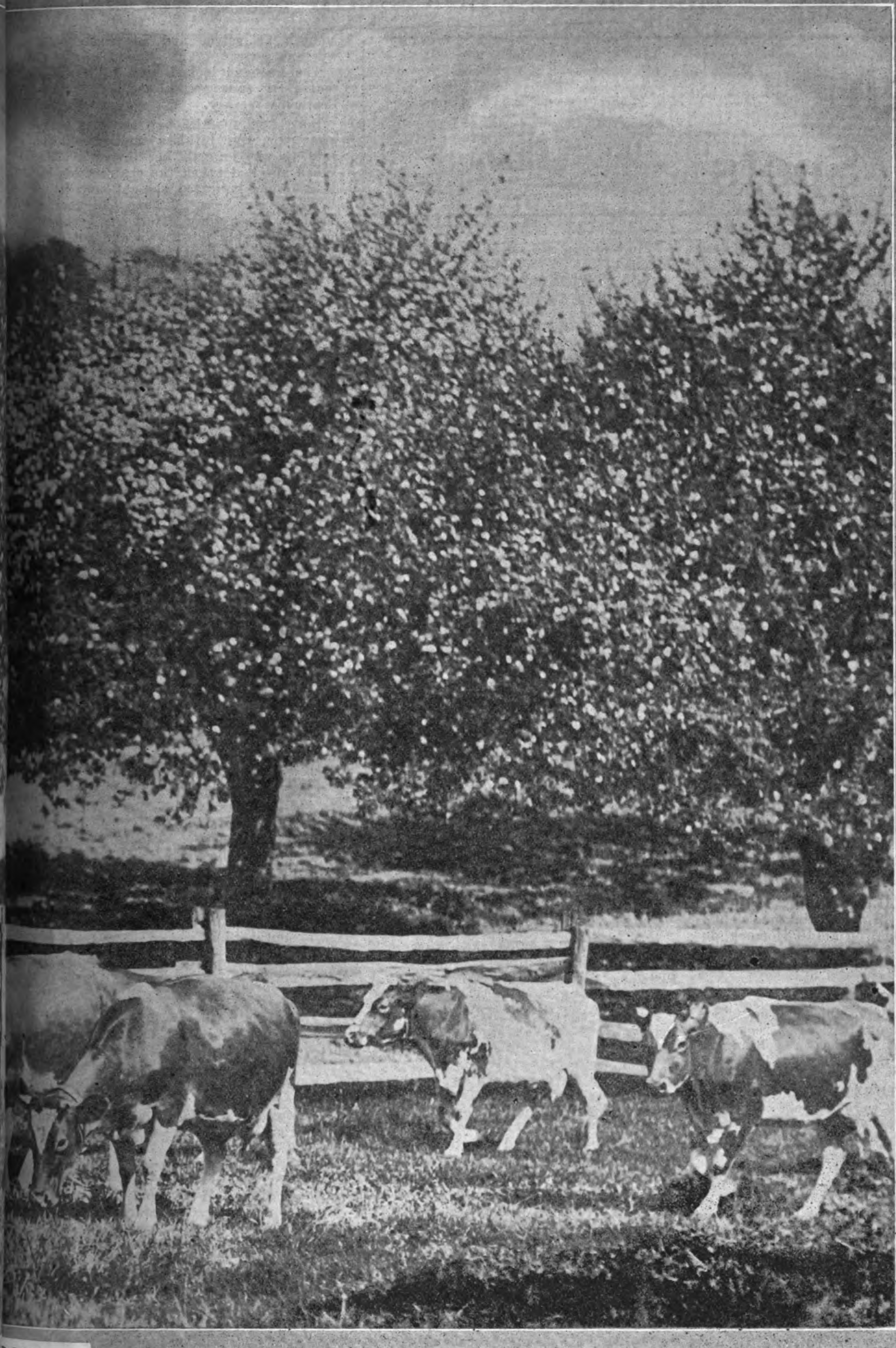
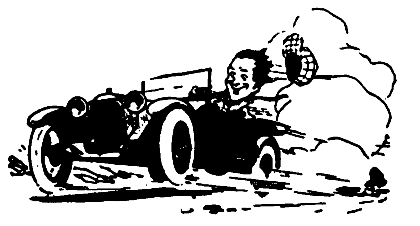


OME

High Spots



A CALLED BLUFF

A successful old lawyer tells the following story anent the beginning of his professional life: "I had just installed myself in my office," he said, "had put in a phone and had preened myself for the first client who might come along, when through the glass of my door I saw a shadow. Yes, it was doubtless some one to see me.

"Picture me, then grabbing the nice shiny receiver of my new phone and plunging into an imaginary conversation. It ran something like this:

"'Yes, Mr. S.,' I was saying as the stranger entered the office, 'I'll attend to that corporation matter for you. Mr. J. had me on the phone this morning and wanted me to settle a damage suit, but I had to put him off as I was too busy with other cases. But I'll manage to sandwich your case in between the others somehow. Yes. Yes. All right, good-by.'

"Being sure, then, that I had duly impressed my prospective client, I hung up the receiver and turned to him.

"'Excuse me, sir,' the man said, 'but I'm from the telephone company. I've come to connect your instrument.'"—N. Y. Globe.

Whenever Mary was a naughty little girl she was made to sit at a table by herself. One evening at dinner, when there were a number of guests present and Mary because of some act of disobedience was placed at her table, the guests and the family as well were surprised to hear a shrill voice pipe out: "Thou hast prepared a table before me in the presence of mine enemies."—The Country Gentleman.

APPLIED SCIENCE

Mrs. Wiggins: "I don't think one should ever punish a child on a full stomach, do you, doctor!"

Doctor Briggs: "No, ma'am; I turn him over."

HIS YEARN

"Ah, h'm!" said the able attorney. "So, naturally, you want justice?"

"I don't want no such a golrammed thing!" yelled the uncouth client. "I want damages!"

A NATURAL QUERY

The newlyweds were moving. The day was hot. The last van load of furniture had gone when they discovered that grandfather's old clock—a greatly prized wedding gift—had been left behind.

"Jack, you'll have to carry that. It's only three blocks."

Jack protested vigorously, but to no avail; so off he started. He stumbled along, the perspiration streaming from his face. He had to put down the clock and rest at frequent intervals. He had put it down for the tenth time when a pre-Volstead man came along. The latter wavered against the fence watched Jack mop his face, then sympathetically remarked:

"Shay, old scout, wouldn't you find it easier to carry a watch?"

"Jim's going to sue the company for damages."

"Why? What did they do to 'im?"

"They blew the quittin' buzzer whin 'e was carryin' a 'eavy piece of iron, and 'e dropped it on 'is foot."—Royal Magazine.

"And whom did you vote for, Miss Sophy?"

"Well, you see, the Republican was simply stunningly good-looking. But the Democrat had always been perfectly splendid to his family, so I marked both ballots, closed by eyes, shuffled them, put one in the box and tore up the other. Nothing could be fairer than that."—Life.

"Rastus, how is it you have given up going to church?" asked Pastor Brown.

"Well, sah," replied Rustus, "it's dis way. I likes ta take an active part, an' I used to pass de collection-basket, but dey's give de job to Brothah Green, who jest returned from ovah thai-ah."

"In recognition of his heroic service, I suppose?"

"No, sah. I reckon he got dat job in reco'nition o' his having lost one o' his hands."—Argonaut.

The depreciation of our currency today is nothing to be thought of in comparison with the slump in Confederate paper money after the Civil War. General Mulholland relates that shortly after Lee's surrender, he heard two Confederate soldiers bargaining over a very ordinary looking horse. "He'll do for my farm, John," said one. "I'll give you $20,000 for him."

"No," said the other.

"No", "Give you $50,000."

"Give you $100,000."

"Not much!" replied the owner. "I just paid $120,000 to have him shod."—Pittsburg Chronicle-Telegraph.

Just before the St. Mihiel show the Germans blew up an ammunition dump near a company of Yanks. It was reported that there was a large quantity of gas-shells in the dump, and as soon as the explosins began the Americans immediately made themselves scarce with great rapidity.

When the danger had passed all started drifting back with the exception of one man who did not appear till the next day.

"Well, where you been?" demanded the top kick, eying him coldly.

"Sergeant," replied the other earnestly, "I don't know where I been, but I give you my word I been all day gettin' back."—The American Legion Weekly.

Recommendations Didn't Appeal.—"What kind of meat have you this morning?" asked the haggard husband of the butcher.

"The best steak we ever had, sir," replied the butcher. "Here you are sir, as smooth as velvet and as tender as a woman's heart."

The husband looked up. "I'll take a pound of sausages, please," he said.—Pearson's Weekly.

Born Lucky.—Although she was somewhat pale, Mrs. Litnitzky smiled contentedly as she entered her lawyer's office. When she had taken the chair beside his desk he had indicated, she announced:

"Well, Mr. Moses, I have had another accident. Yesterday afternoon I slipped on the sidewalk downtown and got hurt. The doctor thinks I ought to get damages."

"Why, Mrs. Litnitzky," exclaimed the attorney, "isn't this the third accident within a month?"

"Yes," said she, proudly. "Ain't I lucky?"—Harper's Magazine.

Playing It Safe.—A certain banker, being bald-headed, was in the habit of wearing his hat continuously during business hours. Among his depositors was a carpenter who seemed very timorous concerning the safety of his money, and as this man was drawing out some one day, the banker said to him, "Look here, William, why don't you let your money stay in the bank?"

"Well," replied the carpenter, "I'm rather afraid. You see, sir" (here he glanced at the hat the banker was wearing), "you look as though you were always ready to start somewhere."—Tit-Bits.

Live Prices.—For three strenuous hours the auctioneer had tried to work his listeners up to the proper pitch of enthusiasm.

But either the weather or their lunch had disagreed with them, and they simply wouldn't be aroused. The sale was one of horses, and lot after lot went for very poor prices. At last a sad and sorry animal was led into the ring.

"Now, gentlemen," shouted the auctioneer, "what offers for this lot? Will somebody start the bidding?"

There was a pause. Then a voice came slowly from somewhere in the middle of the crowd.

"Two dollars!" it said.

"Gentlemen, gentlemen?" protested the auctioneer tearfully. "The horse is alive!"—Pittsburgh Sun.

Where is the woman now who can drive a man to drink?—Life.

"John, is it hot out to-day?"

"Oh, very, dear. You'll need your heaviest furs."—Judge.

Conductor (to passenger of Pullman)—"Excuse me, sir. Is this lady your wife?"

Passenger—"I don't know. It depends upon what State we are passing through."—Life.

Sartorial Foresight.—An economical housewife told her husband the other morning that she'd have to ask him for a dollar more a week on account of the high cost of living.

"I'll try and give you a half-dollar," he grumbled. "That's the best I can do. You're pretty extravagant, Amelia?"

"Me extravagant?" And Amelia laughed bitterly. "Well, James, I don't see how you can call a woman extravagant who has saved her wedding-dress for over 30 years on the chance that she may yet make a second marriage."—Detroit Free Press.

Benton's Recipes

To Harden Cast Iron:—Mix 2 pounds of concentrated sulphuric acid and 2 ounces of nitric acid with 2½ gallons of water. Immerse the article at a cherry-red heat in this mixture.

Welding Steel to Cast Iron:—This may be accomplishd by first shaping the steel so that it will correspond to the surface of the cast iron to which it is to be welded without forming a lap, then heating to a cherry-red, next applying borax to the surfaces to be united, and immediately heating the parts to a welding heat, after which a strong pressure applied without hammering will securely join the steel to the iron.

Hardening Compound to Make Wrought Iron Very Hard—Cut into small pieces 1 part by weight of cow or horse's hoof and 2 of old leather, and add ½ of common salt. These ingredients are placed in a heating-box together with the pieces to be hardened. The box is hermetically closed with clay and heated for 1 hour at a red heat, when the pieces are taken out and cooled in cold water.

Welding Cast Steel:—Take 64 parts of borax, 20 of sal-ammoniac, 10 of ferrocyanide of potassium, and 5 of rosin. The whole is boiled with the addition of some water, under constant stirring, until a homogeneous compound is formed, which is allowed to dry slowly in the same iron vessel in which it has been boiled. An analysis of a sample of this welding compound formed the basis for the composition of the following compound, which is highly recommended. The welding is accomplished at a light-yellow heat, or between that and a white heat, and as the quality of the steel is not in the least affected, it needs no further treatment. The compound is composed of 61 parts of borax, 17¼ of sal-ammoniac, 16¾ of ferrocyanide of potassium, and 5 of rosin. For welding steel less of the ferrocyanide may be used. The borax and sal-ammoniac are pulverized, mixed and gradually heated in a porcelain or iron vessel, until both melt in the water of crystallization of the first. A strong odor of ammonia is developed. The heating is continued, under constant stirring, until the odor of ammonia is scarcely perceptible, water being added from time to time to replace that lost by evaporation. The pulverized ferrocyanide and the rosin are then added, and the heating continued, under constant stirring, until a thick paste has been formed.

As soon as a weak odor of cyanide is perceptible the heating is interrupted, as otherwise the boric acid would exert a decomposing effect upon the ferrocyanide of potassium. The thick paste is spread upon a sheet- iron plate in a layer at the utmost ½ inch thick, and dried at a very moderate heat. To facilitate the drying, the paste is loosened and turned with a spatula, so that lumps are formed, which are stored away. When it is to be used a sufficient quantity of one of the lumps is pulverized and scattered upon the article to be welded, which has been heated to a light-red heat. It is then heated to a strong yellow heat and the welding accomplished in the usual manner.

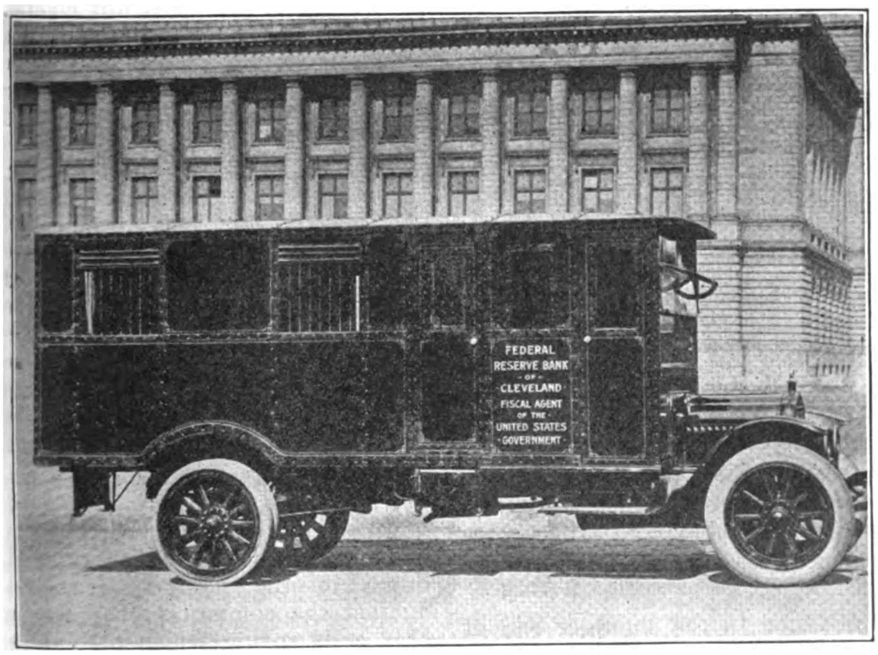
In the above compound, and manner of preparing it, boracic acid and common salt are formed from the borax and salammoniac, while ammonia escapes. The welding compound can therefore be directly prepared by mixing the following ingredients: 41.5 parts of boracic acid, 35 of pure, dry, common salt, 15.5 to 26.7 of ferrocyanide of potassium, 7.6 of rosin, and perhaps 3 to 5 of dry carbonate of sodium.

This mixture does excellent service, is in fact, as good as the above compound and far easier prepared. It has only the disadvantage of not remaining entirely unaltered if kept for any length of time, but gradually decomposes and assumes a color. But this, as the compound is so easily prepared, is a minor evil.

To Harden Files and Other Steel Instruments:—The files, etc., are first coated with a paste prepared by boiling glue and salt in yeast, and thickened by an addition of wood charcoal and graphite (black lead). Upon this coat is scattered a coarse powder consisting of a mixture horn, wood charcoal, and common salt. A solid crust is formed upon the files which protects them from a displacement of the cuts by the metal and conveys to them oxygen while being heated. For tempering, the files are brought into a lead bath. To prevent the oxidation of the lead on the surface a mixture of potash, soda, and tartar is scattered upon it. The files remain in the bath from 5 to 8 minutes, according to their thickness, and are then immersed in water.

To Harden Saws and Springs:—The following composition is highly recommended 4½ pounds of suet and 8¾ ounces of beeswax are boiled with 2¼ gallons of whale oil. This will serve for thin articles and most kinds of steel. For thicker pieces about 2¼ pounds of black rosin is added to the above compound, but it should be judiciously added, or the articles will become too hard and brittle. The usual way of proceeding is to heat the saws in long furnaces and then to immerse them horizontally and edgewise in a long trough containing the composition. Two troughs are generally used alternately. Part of the compound is wiped off with a piece of leather when the articles are removed from the trough. They are then heated one by one over a clear coke fire until the grease inflames; this is called "blazing off". When the saws are wanted to be rather hard, but little of the grease is burned off; when less, a large portion; and for a spring temper the whole is allowed to burn away. When the work is thick or irregularly thick and thin, as in some springs, a second and third application is burned off to insure equality of temper at all places.

BULLET-PROOF MOTOR MESSENGERS DISPLACING FOOTMEN IN SERVICE OF BANKS AND PUBLIC UTILITIES



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Sporadic cases of lives lost and payrolls stolen in the ambush by bandits of armed, but nevertheless practically defenseless messengers in a number of cities during recent weeks, have kindled a new interest in the lead taken in New York, Boston Chicago, Philadelphia, Cincinnati, and Cleveland by banks, public utilities and other companies having constant need to transfer money and other valuables. The lead they have taken lies in the direction of greater security and enhanced service, less loss of life and money, in the transportation of large sums through the thoroughfares of congested cities. Seeing an opportunity to render real service to industrial concerns, merchants and others by making a specialty of offering them safety and service in the transfer of payrolls and money, while protecting their own transactions by means of the same conveyance, more and more banks are purchasing armored motor trucks.

Generator Repairs and Adjustments

THERE are three distinct types of starting systems; the single unit, combined unit, and the two unit. The Ford starting and lighting system is of the two unit type, that is, starting the engine performed by a unit entirely separate from the one that generates the current. The system consists of the following: a generator, cut-out, ammeter or charging gauge, battery starting switch, Bendix drive, lamps, the light and ignition switch, together with the wires and terminal block.

The generator is of the series wound armature shunt field type. It is located on the right side of the engine attached to the gear case by means of three cap screws which extend through the case into the threaded holes in the brackets of the generator. A paper washer between the case and bracket prevents oil leaking by the joint. The spiral gear on the end of the armature shaft meshes with the large time gear, the relation being such as to give the armature a speed of one and a half times the speed of the crank shaft. The speed of the engine is such that for every two hundred revolutions, the car is driven at five miles an hour. Therefore, at the average driving speed of 20 miles per hour, the generator is running at 1200 revolutions a minute. The amount of current generated is controlled by the third brush. By its movemovement the field is distored to give the proper amount of current.

The generator is of the simplest possible construction. Figure 2 shows the parts in their relative assembling position.

The yoke is made of a piece of seamless tubing. It supports the coil and field poles and acts as a housing for the generator. The coils of the field wiring assembly are held in position by means of the field poles which are held to the frame by means of featherhead machine screws. When these screws have been drawn tight, a punch mark is made in the yoke, forcing metal into the slot of the screw, thus preventing it from working loose.

Before tightening the field poles, fish paper is placed between the coils and the yoke at the head end, thus providing insulation for the exposed ends of the coils. The terminal bolt extends through the slot in the yoke and is insulated from it by means of a fibre washer and a specially designed insulator, and the leads from the field coils are attached to the third and the ground brush holders.

Fastened to the shoulder end of the yoke by means of four screws is the brush and bracket. The purpose of this bracket is to support the brush holder support assembly and one end of the armature shaft. It also acts as part of the housing for the generator.

The brush holder support is held to the bracket by means of four screws which pass through the bracket and slots in the support screwing into the threaded holes of the clamp ring. The mortise in the support, under the clamping ring, has four slots cut into it. These slots allow it to be advanced or retarded sufficiently to obtain the correct setting of the external current brushes. The ground or negative (—) brush holder is riveted directly to the ring, while the positive (+) brush is riveted through two fibre pieces which insulate it from the ring.

The third or field brush holder is assembled to the ring; but insulated from it by two fibre strips in which a radial slot allows the holder to be advanced or retarded so that the brushes may be brought to bear at the proper point on the circumference of the commutator. The third brush holder is not riveted, but is held in position by means of a lug and threaded post, which pass through the slot. A clamp nut and lock washer on the stud secure the holder and the support. The nut is tightened, when the mechanic has found the proper position of the brush, as will be explained later on.

The brushes which are of the carbon type, are self-lubricating, and never should be oiled. The brushes which are also free to work up and down in the holders, are held against the commutator by means of a coils spring which fits into a slot in the post of the holder. When the spring has been properly positioned in the slot, the end of the post is pinched together, closing the slot, thus preventing it from slipping out. The current that is collected by the brush is carried away by a wire pigtail, one end of which is set into the brush either with solder or with a screw, while the

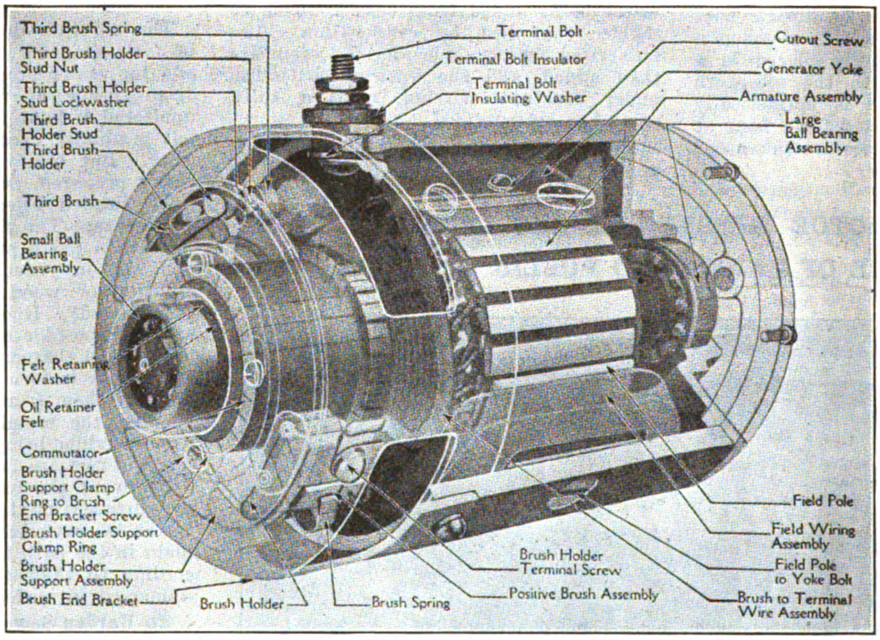


Fig 1. A PHANTOM VIEW OF THE FORD GENERATOR

other end is secured to a lug which is clamped to the holder by means of a screw.

The armature is supported by two ball bearings. These assemblies are pressed onto the shaft of

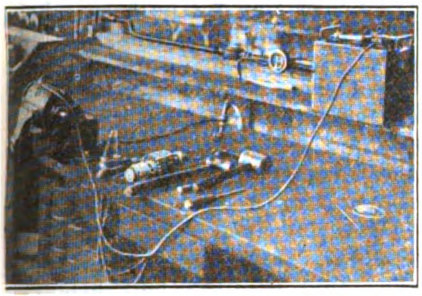


Fig. 3. A CONVENIENTLY ARRANGED GENERATOR REPAIR BENCH

the armature and are a slip fit into the bracket. The commutator is pressed onto the shaft. The wires from the coils are driven into the slots of the segement (two in each one) and are set in solder.

There is a specially designed steel washer, working on the centrifugal principle, on the gear side of the front bearing, which prevents an excess of oil from working through the gear case through to the commutator. The rear bearing is lubricated by a small oiler in the brush bracket. The front bearing is lubricated by the vapor from the time gears.

The front bracket which is attached to the frame yoke by six screws, acts as a support for the front bearing of the armature shaft, as part of the housing for the generator, and is also that part of the assembly which is held to the gear case.

The driven gear is held to the shaft by means of a Woodruff key and secured by a pin which extends through the gear and shaft.

Repairing the Generator.

Indications of trouble in the generator are first noticed in the ammeter on the instrument board. At normal driving speed, twenty miles per hour, the instrument should register between 8 and 12 amperes charge. If there is less charge than this or no charge, the trouble lies in the generator, the cut-out or the wiring.

Trouble in the wiring is due to one of the following causes, which may be detected by a visual inspection.

Poor or loose connection in the wiring between the generator and the battery.

Dirt or fibre washer under the terminals of the wire.

Broken wire.

Wire grounded between the generator and the instrument board.

The troubles in the cut-out can be most quickly detected by trying on a new one, or one that is known to be in good working order, or by following out the instructions that were given for the repair of this part in previous article.

To determine whether or not the trouble lies in the generator, attach the positive wire (+) of a direct current volt meter, registering from 0 to 30 volts, to the terminal of the generator, and the negative (—) wire to the yoke (housing) of the generator. With the engine running at a normal driving speed, that is a speed sufficient to drive the car twenty miles per hour, the instrument should read 7 volts, or better.

If the generator tests less than 7 volts, disconnect the wire leading to the ammeter and run out the three cap screws which hold the bracket to the gear case. The generator is now free, and may be removed by prying it off with a screw driver, forcing the generator out and down until the gears disengage. The generator is then taken to the bench to be tested and inspected.

The trouble may be due to one of the following causes: Dirty commutator; brush springs weak or binding; brushes not seating properly; brushes not touching the commutator. The last condition may be caused through being held up by the spring; sticking in the holder or worn too short. Other causes are a short-circuit in the armature or field; ground in the brush; open circuit in the field, armature and brushes.

Besides the electrical trouble, the generator is subject to mechanical wear, as follows: Commutator rough or worn undersize, causing the brushes to rub on the mica; bearings broken or worn; brush ring shifting; third brush shifting.

Figure 3 shows a convenient arrangement for a generator repair bench. A six volt battery is connected, through an ammeter by means of a wire, to a bolt on the vise. Another wire is lead from the opposite terminal of the battery and is used as the movable wire in testing the generator. Immediately to the right of the vise, protruding through two holes in the bench are two terminal wires of a test lamp. The current in this circuit is 110 volts. The lamp is installed under the bench, and shows through the bullseye at the extreme right of the cut. At the rear of the bench, immediately behind the vise, is shown the nozzle of an air hose, which may be pulled up through the hole in the table when required. A weight on the hose pulls it back into position when not in use.

The generator to be tested should be set in the vise, as shown in figure 3, and clamped with a slight pressure to prevent it from falling out. The operator should acquire the habit of clamping the generator each time it is moved to prevent it from dropping to the floor, and causing possible damage. Do not clamp it too tight as the yoke may be sprung out of shape, causing the armature to ride on the pole pieces.

Remove the dust cover by running out the two screws which hold it to the brush bracket and then drive it off with a screw driver. This exposes the commutator and brushes.

Before applying the current to the generator try turning the armature shaft by hand to see that it turns free. If it does, touch the wire to the terminal to see if the generator will run as a motor. If it runs and draws less than 6 amperes, as indicated on the meter, the generator is probably in good condition, although the brushes may need resetting. If it draws a little higher than 6 amperes, take a piece of No. 00 sand paper and hold it against the surface of the commutator until it is bright. If this does not bring the amperage down, there is probably a short circuit or a ground. Never use emery paper as the emery is a conductor and is

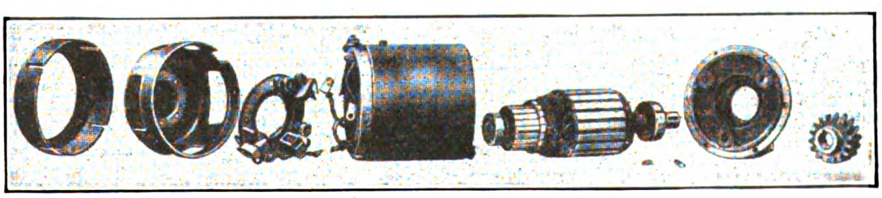


Fig. 2. THE PARTS OF THE GENERATOR IN THEIR RELATIVE ASSEMBLING POSITION

very apt to short circuit the commutator.

Usually, this treatment will be all that is necessary, unless the brush and bracket is dirty. However, while the generator is off, it is advisable to inspect the brushes to see that they are not sticking, and that they show a proper seat.

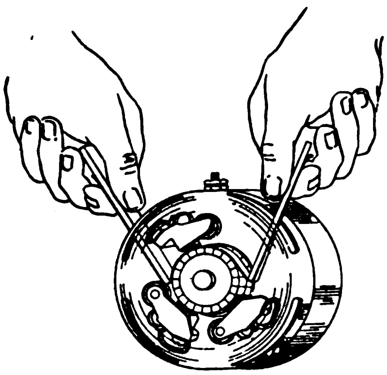


Fig. 5. ONE METHOD OF SANDING THE THIRD BRUSH

There are two essentials to the proper setting of a brush. The brush should show a 75%, or better, bearing, and the bearing should extend all the way across the brush in the line of rotation with the commutator. That part of the brush, showing a copper surface, is the bearing. See that the brushes are not too short, that is, the springs should still be bearing firmly on them and not catching on the side of the brush holder. Raise the brush by means of the pigtail. When released, it should snap back onto the commutator with a sharp click. See that the pigtails are in good condition and that the terminal connections are tight, by trying them with a screw driver. A loose connection is usually indicated by the heat that is generated at that point.

If it is necessary to install a new brush, or reseat an old one, proceed as follows: Cut a strip of No. 00 sand paper, so that it will fit onto the commutator, raise the brushes by pulling the spring back with a hook, and then pull the brush out by the pigtail, after which the spring is allowed to rest against the brush as shown in figure 4. Insert the sand paper under the brush with the sand side out; hold it so that it conforms to the shape of the commutator, and move it, together with the commutator, back and forth under the brush, the brush having been dropped onto the sand paper and the spring pressing against the brush. After the commutator is moved back and forth several times in this manner, the brush should be lifted and examined to see if it has been properly seated. If it has, remove the sand paper, and set the brush back into position.

Figures 5 and 6 show two methods of sanding the third brush, while figure 7 shows the method of sanding the two lower brushes. Figure 8 shows the incorrect method of sanding a brush. It will be noticed that the seat of the brush could not possibly conform to the radius of the commutator, after a treatment like this, and it is highly essential that the bearing be the full width of the brush. When the brushes have all been sanded, lower them onto the commutator, hold them in position with the springs and run them in by attaching the wires to their terminals. To assist in forming the bearing, a slight pressure may be applied to the brushes on the center with the fibre drift.

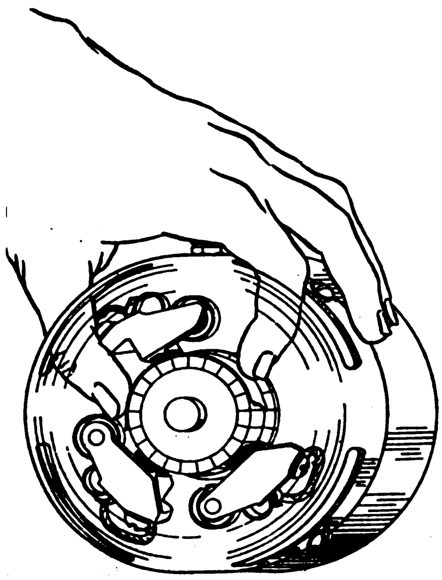


Fig. 6. ANOTHER GOOD WAY OF SANDING THE THIRD BRUSH

When the motor has been run for a minute or so, remove and examine the brushes. That part of the surface which is showing a copper color is bearing on the commutator. If a full bearing is not obtained, scrape off the copper colored part with a knife, or with a piece of sand paper rolled on a pencil, as shown in figure 9. The sand paper should be applied with a rolling motion. The repair-man, with a little practice, will become very skilled in the use of this improvised device in scraping the seat of a brush, but the amature will find the knife a much easier tool to use.

When the brushes seat properly, the lower brush should be set on the neutral point. Start the lower and loosen the three screws which hold the brush ring to the head. Raise the third brush, holding it in position as shown in figure 4, connect the wire to the terminal post. If the armature revolves, the brushes are not on the neutral point. Turn the ring against the direction of rotation until the armature ceases to turn, or until it revolves in the opposite direction. If it turns in the opposite direction, bring the ring back until the armature will not revolve in either direction even when started by turning by hand. The brushes are now set on the neutral point, which is their proper bearing. Tighten the crews which hold the ring to the head; lower the third brush and try it for running. If it turns over properly, drawing less than 6, and preferably 4 amperes, the generator should be assembled to the motor, and proper connections through the cut-out to the battery should be made.

The next operation is setting the third brush. The third brush may be moved back and forth on the brush ring. It is clamped to the ring by means of a bolt which is also used as a post for the brush spring. To move the third brush, together with its holder, loosen the nut on this post until the holder may be moved back and forth. The third brush should be set in such a position, as to give a charging rate of 10 to 12 amperes when the engine is running at a speed that would drive the car 20 miles per hour, which requires an engine speed of 800 revolutions per minute.

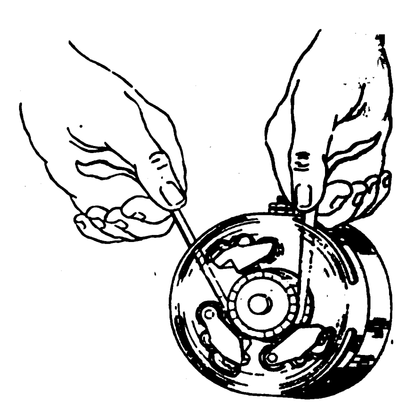


Fig. 7. THE PROPER WAY TO SAND THE TWO LOWER BRUSHES

OVERLOADING BIG FACTOR IN ROAD WEAR

WHAT is the real cause of excessive road wear? That is a question uppermost in the minds of highway engineers and public road officials at this time. Some contend it is the large capacity motor truck, but government tests and various investigations tend to disprove this theory in the light that to eliminate large trucks would greatly increase the number

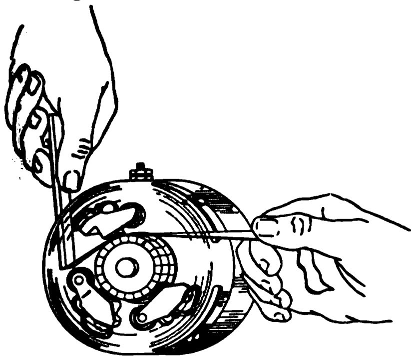


Fig. 8. A DECIDEDLY INCORRECT WAY OF SANDING THE BRUSHES

of small trucks on the road, thereby increasing road wear.

It is the practice of overloading, and, truck overloading is disastrous to both the vehicle and the highway. If its results were confined to the truck, it might be well to let each individual learn for himself that it does not pay. But unfortunately overloading is one of the principal causes of road wear.

A motor truck designed to carry a certain tonnage is constructed throughout, including width of tires and safety factors, to handle just its rated load. Any considerable overload gives more than the standard 800 pounds per inch of tire width and concentrates the load on this small point of contact. Furthermore, the overload is not distributed on all four wheels, but rests entirely on the rear axle, which further concentrates the load. Overloading does not materially cut down the speed and the result is that a higher rate of speed is maintained than should be given to the load even though properly tired.

It has been extremely noticeable in sections where the use of large capacity trucks is discouraged that there is a strong tendency to overload small trucks. This is only natural since the demand for motor hauling service remains the same and practically none can be diverted to other channels. When the smaller vehicle is overloaded, its effect on the road is tremendously magnified because its springs fail to function properely and the narrow bearing surfaces of its tires concentrate the impact forces so that they are greater than the road is capable of withstanding.

There is economy both as to road wear and as to truck operating costs in big unit loads, but not when they are carried on vehicles too small to handle them.

BIG DECREASE IN LIVE STOCK ON FARMS DURING LAST YEAR

Nearly 10,000,000 less head of live stock were on farms in the United States on January 1, 1921, than a year preceding, according to estimates based upon reports of agents and correspondents of the Bureau of Crop Estimates, United States Department of Agriculture. Horses decreased about 602,000 head, or 2.9 per cent; mules decreased slightly, 42,000, or 0.8 per cent; milk cows decreased 298,000, or 1.3 per cent; other cattle decreased 1,8880,000, or 4.2 per cent; swine decreased 5,078,000, or 7.1 per cent; and sheep decreased 2,047,000, or 4.3 per cent.

This Year's Totals

The total numbers on farms and ranges January 1, are estimated as follows: Horses, 20,183,000; mules, 4,999,000; milk cows, 23,321,000; other cattle, 42,870,000; swine, 66,-649,000; and sheep, 45,067.000.

The results of the 1920 Census of live stock have been issued for a few States only; the two sets of figures (Census and Crop Estimates) are not made from the same basis, and therefore are not comparable, in that the Bureau of Crop Estimates figures are the result of applying yearly estimated changes to the census figures of 1910, which were taken on April 15, instead of on January 1, as was done in 1920. No attempt has been made to readjust the bureau's 1920 figures to the new census basis in the few States for which census figures have been published. Readjustments will be deferred until the census will be complete for all States.

The total value of live stock has declined $2,271,576,000, or 26.7 per cent during the year, that is, from a total of $8,507,145,000 on January 1, 1920, to $6,235,569,000 on January 1, 1921. This decline is due partly to the reduction in numbers, but more to the lower value per head.

DON'T LENGTHEN YOUR WRENCHES

(*Copyright*, 1921, *by W. F. Schaphorst.*)

Several times I have seen the "kink" in print which shows how to make a wrench longer by "slipping a gas pipe over". It is a very simple procedure, and it may look and sound good to some, but I don't believe in making a wrench longer in order to put nuts on tighter.

As you doubtlessly have observed, wrenches for small nuts are invariably short; for medium nuts, medium in length; and for large nuts, they are long. The manufacturers therefore seem to have some "system" in making wrench lengths, and they have. The pitch of the thread is considered, the cross-sectional area of the bolt at the bottom of the threads is considered, and the strength of the man who does the tightening is also considered.

To make a wrench "twice as long" you therefore increase the tension on the bolt to twice the amount, the force of pull on the wrench being the same. By increasing wrench lengths I have frequently actually "stretched" bolts until

Fig. 9. SANDING THE BRUSH SO THAT THEY WILL HAVE A FULL BEARING ON THE COMMUTATOR

they broke in two, or I stopped turning as soon as I felt the bolt begin to stretch. This is poor practice and I do not do it any more. I do not increase the wrench's length any more because I realize that the elastic limit of a bolt should never be reached.

If you feel like making a wrench longer for "unscrewing" a nut—all right. But don't make it longer for tightening.

Red lead smeared on soft-steel arbors will help drive the arbors into the work without any difficulty.

Automobile Market Difficulties in England

JOHN Y. DUNLOP

THE year 1920 will long be remembered as a land mark in the history of the retail motor trade in England. The financial disasters so generally anticipated as the certainty of a long war dawned on the retailers, and to a certain extent, it has been avoided.

It was largely a young man's trade, and only a remanant of the older men and boys were left; but they managed to keep the selling organizations together. Early in 1919, they were ready for business, if they could only get the cars to sell.

Then 1920 was to make good for all the disappoints of the previous year, but here again the retail dealers were deluded by the promises of the makers, with the result that a great number of these orders are now nothing but waste paper.

In looking forward to 1921, the prospect of the selling side of the motor car trade is undoubtedly uncertain with the possibilities of either success or failure. The first and most vital factor that will have any bearing on the situation, is that of price reduction.

The price of cars have not been increased in proportion to the way other things have advanced. Things in general are costing 150 to 200 percent more in England today than they did in 1914, while many excellent cars on the market are only 50 percent above the pre-war prices. There are many more that have not advanced to the 100 percent mark; but that is a matter of little or no consequence, if the public will not or can not buy them. We must remember that the buyers of motor cars as a whole are decidedly poorer than they were in 1914. On paper they may appear to be in better circumstances, and perhaps some of them really imagine themselves rich; but the increase in their resources is not in proportion to the advanced cost of general commodities. With the exception, perhaps, of the farming communities, they are as a class poorer.

And what has the retail trade to offer those who wish to purchase as near the old price as possible?

It is not only the high price of motor engineering which will check the sales of next year. The still higher cost of body building will be an added difficulty, and the slow and restricted output of the body building factories, will be another contributing cause for buyers to cancel orders for high class cars with special bodies.

Another point which is causing much concern to motor and motor cycle retailers in England is the extent to which the German manufacturers are under selling us.

Six German shillings will buy today what one German shilling did before the war, and it also is well within the mark to say that three British shillings will buy on an average what one British shilling did before the war.

Thus when the Germans sell goods over here as he is doing, with that British shilling, he is able to buy German 12½ shillings, and if with that 12½ German shillings, he can buy twice as much, he is in a position to under sell English makers every time.

In the cycle trade in England, many of the best firms are working only a few hours a week, having little or nothing to do; not knowing how on earth to make ends meet. Even through the most prudent buying of material and keeping down the manufacturing cost as low as possible, the cheapest retail price of a bicycle is about 10 to 12 pounds.

A little syndicate went to Germany a month or two ago, and they bought one consignment of 14,000 German bicycles for 28,000 pounds, and they were an exact duplication of a well made British bicycle. minus tires and saddles the cost was only 2 pounds each.

In England today, the cost of building a bicycle for wages alone is over 2 pounds, to say nothing of overhead expense and material.

The same thing is going on in the motor car trade, only not perhaps in such a wholesale manner; but we are having German motor cars offered for sale every day. Only today, I heard of an instance in which a brand new Benz car, which is a very fine make of motor, being offered for 400 pounds. It was a beautiful limousine. The body alone could not be produced in this country, especially at the prices maintained by the coach builders trade union, for 600 pounds.

How is it that the Germans can sell at such figures. He does it this way, because he is really getting 5000 pounds in his own money for that car.

Underselling to such an extent is bound to bring the motor trade all over England into grave peril, and the terrific unemployment question will get worse. We are only on the edge of it, and unless some protection is offered there will be more of the pitiful procession of unemployed.

In the building of industrial cars, the high cost of bodies is adversely effecting the sales. In much of this business the bodies must be built or adapted to the trade, and even the small dealers and distributors require a body to meet their particular needs, before they are able to obtain the full advantage of motor equipment. To all of that class of buyers the purchase of a car is strictly a commercial proposition. It is worth so much to their business and no more, and the present prices of combined chassis and bodies is often far beyond the buyer's limit. Even the small man who buys a Ford would probably give 180 pounds; but he finds the standard van which he can get for an extra 45 pounds utterly unsuited to his business. To place an order for a special body would cost 150 pounds, which is a prohibitive price, so in many instance the business is lost.

The summing up of the matter both on the pleasure and industrial side of the question—the boom is past—money is scarce—and the future is very uncertain.

Through the experiment of distilling motor spirits from wheat straw, it is stated that a ton of straw will produce forty gallons of gasoline.

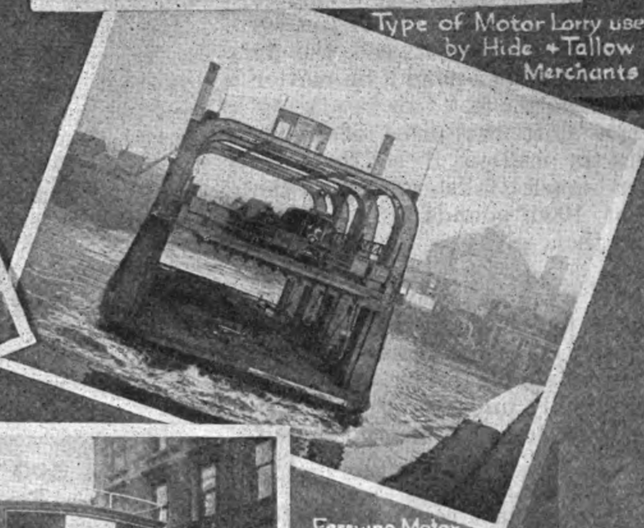
Thrift is an enjoyable habit—after you have acquired it.

Labor is a blessing—when you get the right price per hour for your perspiration.

Ford Motor Runabout are very popular with steam laundry Companies

Type of Motor Lorry used by Hide + Tallow Merchants

The type of Truck used largely by Furniture Makers.



Ferrying Motor Traffic across the River Clyde at Glasgow

Type of covered Truck used by the Department Stores in England

Type of Motor Lorry used by the Millers in the City of Glasgow

Typical example of steam motors used by Fruit Merchants

A HANDY CHART FOR BLACKSMITHS

This chart will be found useful by blacksmiths in making computations without doing any figuring at all. Just make a couple of marks on a piece of paper, shift the paper, and the problem's solved.

For example: How much will 1000 pounds of iron cost at 5c per pound?

Hold the piece of paper as shown in position A and make a mark opposite the 1c and 5c. Or, you could do it just as well by holding the edge of the paper opposite the 1c and make a mark opposite the 5c. Or, it could be done with a rule or a pair of dividers. The object is: Get the distance between the 1c and the price per pound, no matter what the latter is.

Then shift the piece of paper down to position B so that the upper mark falls opposite the weight 1000 pounds. The lower mark, then, gives us the answer—$50.00.

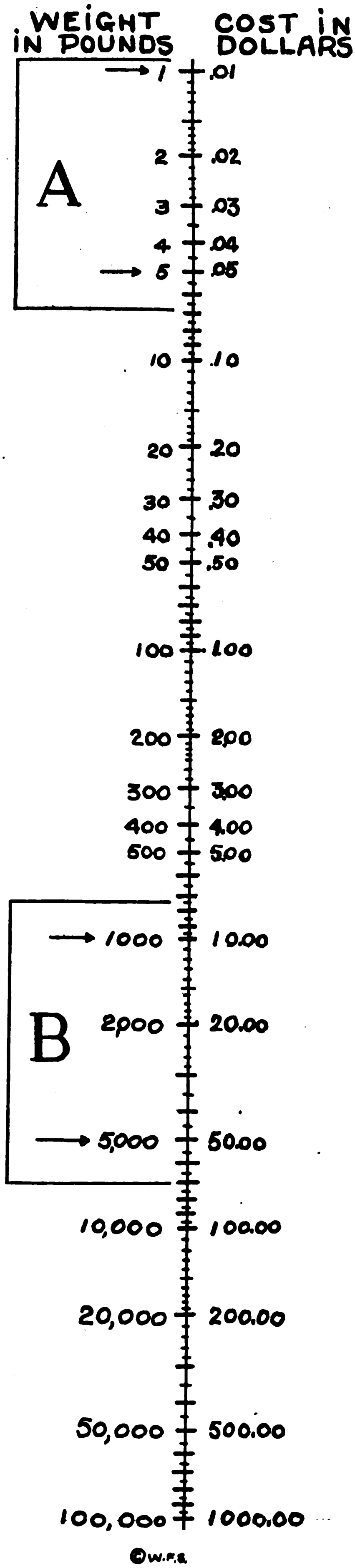
That was an easy one, true enough, but I chose an easy one purposely so as to make the explanation simple. The best way, now, to fully understand the chart is to work some problems yourself and it will "come to you". The chart is very simple.

Also, the chart can be used for dividing by just reversing the process. For example, position B shows that 5000 divided by 5=1000. No matter where the slip of paper is shifted, with marks the distance apart as shown, you can either multiply by five or divide by five.

The chart is not "absolutely accurate" but it is close enough for most practical purposes. It is based on the slide rule arranged in a single line.

A little experimenting on your part and you will doubtless find it interesting and valuable.

H. G. Near.



PLATFORM OF THE MOTOR PARTY

We point with pride to our record of never having exceeded the speed limit.

We point with glowing pride to our record of never having passed a street car on the left.

We point with effulgent and refulgent pride to our record of getting 22 miles to the gallon.

We view with alarm the way truck drivers issue from side streets.

AUTOMOBILES AND HOW THEY BEGAN

While it is given to few to possess and appreciate the joys of motoring, there can be no doubt that thousands of people are at present interested in the evolution of the automobile. Even old-fashioned ladies pass criticism on the movable palaces that glide through our city streets to-day, and history of the automobile makes pleasant reading.

We are told that the earliest type of automobile was probably used by a Jesuit missionary in China, and that it was merely an elaboration of the ancient Chinese wind-coach. This conveyance was driven by a jet of steam playing on a mill-wheel connected by gearing with one of its axles.

The first authentic page in the history of motoring, however, was not written until the time of James I. of England and Scotland, who issued to one Hugo Upton a patent "for the whole making of an instrument which shall be driven by the wind, for the transport or carriage of anything by land.

The year 1742 was a momentous one for motorists for in August it was announced that a certain Mr. Pinchbeck's curious machine that travels without horses ran from Hampstead to Tennenham Court in less than forty minutes in the sight of several hundred people.

In 1800, George Medhurst, a Londoner, was thought to have solved the problem of road transport but lack of capital foreordained his failure. Thirty-one years later, however, a Parliamentary Committee, after investigation, reported that three-ton steam-propelled carriages were capable of carrying fourteen passengers over good road at the rate of ten miles per hour. Every succeeding month saw new improvements, and in 1833 it was recorded that steam omnibuses accommodating 25 passengers, could travel 15 miles an hour.

Ancient literature has not forgotten this wonderful instrument of locomotion, and commencing with the "Opus Magnum" of Roger Bacon we find the words:—"One may also make carriages which, without the aid of any animal, will run with remarkable velocity.

The cost of Safety is only a thought.

BEST WAY TO REMOVE CARBON

IT sometimes happens that the best way to do a thing is also the cheapest and the quickest way. Seemingly this is the case with removing carbon from automobile cylinders. When one realizes the cheapness, the speed and the thoroughness of the oxygen process of removing carbon, it is surprising that purely mechanical means of various forms are still practiced to the extent that they are in some localities. Usually the mechanical process is slow and tedious and, in point of labor alone, far more expensive than the labor, oxygen and overhead for equipment where carbon is removed by the now generally approved oxygen process.

In view of the almost universal interest evinced in this subject, it may be timely to note again the fact that the oxygen process of removing carbon was long ago recognized as a standard of thoroughness and economy by automobile clubs and automotive manufacturers the world over. Previous to the discovery of this process ten years ago scraping was the only means known for removing carbon. The oxygen process was at first received with doubt and prejudice, a fear being felt that it might result in injury to the pistons, valves or cylinders. Such fears are now as amusing to the practical workman as would be apprehension in the use of the telephone.

Gasoline, like all liquid fuel products, contains a small percentage of carbon that remains as a deposit due to incomplete combustion. When the explosion occurs the carbon, which is chemically combined with hydrogen in all petroleum products, is released in the form of a fine oily sediment resembling lamp black that invades and adheres to the inner surfaces of the combustion chamber. The hard carbon generally found in motors is traceable to oil leaking into the cylinders past the piston rings, and it forms as a product of decomposition of the oil when the motor is hot.

All seasoned motorists easily recognize the symptoms of carbon. The warnings are poor gas mixture, a sluggish motor, dropping off of power in proportion to gasoline consumption, a knocking engine on grades, overheating of the motor on short runs, failure of motor to respond to carburetor adjustment, pre-ignition resulting in frequent backfires, etc. These evidences of carbon are more readily observed in high speed motors, because of the smaller combustion areas.

The oxygen process of removing carbon was a natural development of chemical research. It is well known that carbon has a high affinity for oxygen, and that bringing the two into contact in proper proportion and igniting them results in almost complete combustion of the carbon. This knowledge was simply applied to practical use in removing carbon from automobile cylinders. The product of the combustion of carbon with oxygen is carbon-dioxide gas and pulverized carbon, which pass out leaving the cylinder as free of the troublesome carbon deposit as when it was first assembled in the motor.

It may be noted that inferior grades of gasoline and oil are especially productive of carbon deposits in motor cylinders, and where the best grades are not used frequent removal of carbon is essential to motor economy and efficiency.

The equipment for carbon burning is compact, simple in construction and application and relatively inexpensive. Nearly every machine shop, garage and welding shop is now provided with an outfit for removing carbon, and is prepared to perform in minutes at small cost what was once an operation requiring hours or days More recently various mechanical contrivances have been devised to do the work semi-automatically, and some of them are very ingenious and fairly dependable; but none is so thorough, so rapid in accomplishing the work, or so generally satisfactory from all points of view as the oxygen process.

QUICK METHOD OF CASE-HARDENING SMALL MOTOR PARTS

GENERALLY speaking, case-hardening does not come within the scope of the car owner who does his own mechanical work, as it can only be done with special apparatus, including a muffle furnace and iron boxes within which the parts are packed along with a carbonizing compound. It may be explained that case-hardening is a process by which a comparatively thin coating of hard steel is formed on a part of mild steel or even of wrought iron. Thus the greater interior mass of the part remains tough without being actually hard and brittle, but the surface which has to resist wear is of a glass-hard nature. This combination of the two properties is of immense value in motor engineering. Before present-day methods of case-hardening became general, there was an old-time workshop method of treating a part requiring case-hardening giving excellent results, if a reasonable amount of care is taken. It is based simply on the principle of applying powdered yellow prussiate of potash to the red-hot part. This chemical contains a lot of carbon, some of which becomes absorbed by the heated iron surface and converts it into steel. Whilst still red hot the part is plunged into water and suddenly cooled.

The yellow prussiate method is very applicable to the case-hardening of the ordinary mild steel nut, which, thereby is able to resist rough usage with the spannger, but there is one important point in the process to be observed, namely, that the hole in the nut must be filled up temporarily with plastic clay, which is easily removed when the nut cools. This is to protect the thread from the action of the chemical. Small pinions and magneto sprockets can be similarly dealt with. The finely-powdered yellow prussiate must be copiously sprinkled on the part or the latter can be plunged into it and covered by it, and whilst still red hot transferred to clean water.

FLARING GASOLINE LINE TUBING

To flange the ends of small copper tubing for connections to carburetor, gas tank, etc., I use a pair of lineman's connectors and a center punch. I have used in my shop for some time a little block of steel with a ¼ in. hole drilled through and a hack saw slot at one end, to hold the pipe in a vise. Then the stub of a ⅛ in. drill is about the right diameter to insert in the end of the pipe to roll a flange on the end of it. By inclining the drill as it is revolved one can make any size or bevel of flange where the center punch is limited. Also the pipe will roll out more than it will stretch with a punch.—E. D. B., Athens, Pa.

Ball Bearing in Motor Cars

BALL bearings are an important factor in the operation and life of the motor-car, and yet they frequently receive little attention. They are subject to hard usage, and if they wear or work loose, other parts of the car may receive excessive strain and wear. While roller bearings are used in some cars, particularly in the hubs, ball bearings are more generally used. This is due to the fact that ball bearings have a lower co-efficient of friction, and consequently they absorb less power. Ball bearings, on account of their construction, have a longer life and are more compact. Four type are more generally used in motor-car construction; double row and single row, radials, radio-thrust bearings, and straight thrust bearings. One make of double row bearings which is self-aligning, is the best type where shaft deflection is present. Single row deep-groove bearings will accept a high percentage of thrust load in addition to the normal radial load, while the radio thrust bearing is resigned to take both radial and thrust loads. Thrust bearings will only take loads parallel to the axis of the shaft.

Ball bearings are used in many parts of some cars, while others only have them in a few parts. The tendency, however, is to their greater use, and on this account motor-car design has improved considerably in recent years. One of the most important and difficult sets of bearings is that of the crankshaft, especially in trucks where the heavy duty involves much wear which is difficult to take up. Plain bearings in this position are difficult to lubricate, because of the vibration, which tends to break down the oil film. These difficulties are overcome by the adoption of ball bearings. There is very little wear, and replacement involves no adjustment, but simply the substitution of a new unit.

On the fan shaft ball bearings have given very satisfactory service, because they have eliminated trouble often met with in plain bearings, which frequently gum up, run hot, seize. The fan will then stop and leave the engine without proper cooling, which will have serious results.

The clutch bearing is one in which a ball bearing is essential. While not subjected to heavy loads and operated only when the clutch is out, the difficulty of lubricating makes the duty heavy. The clutch throw-out bearing may be radial or preferably a thrust, since it carries the thrust load of the compression spring.

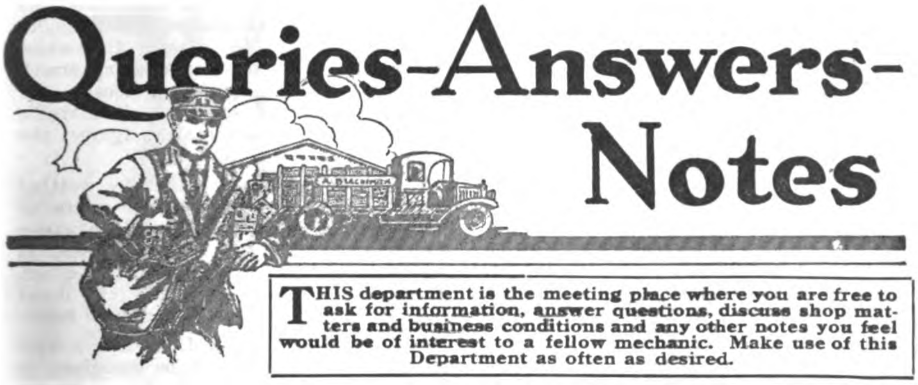
In the transmission, ball bearings increase the life of the gears and reduce frictional losses. They also provide the proper means for maintaining the gear centers since they will be subjected to practically no wear if they are properly mounted and lubricated. When assembled properly in the machine by the manufacturer they will not have to be adjusted by the user. Quiet operation, an essential feature of passenger car transmissions, demands accurate alignment and true meshing surfaces, both of which are aided by ball bearings. Another factor which has considerable influence on the life of transmission bearings is the influence of frame distortion upon the proper line-up of the shaft. Plain bearings being practically rigid throw excess strains of the bearings, which in turn will result in premature wear or destruction. Ball bearings of the self-aligning type will compensate to a certain extent for shaft distortions, and thus lengthen the life of the bearings.

For the jack shaft on chain-driven machines ball bearings are a necessity, on account of the distortion of the chassis, on which they are mounted. For the final bevel gear drive they are particularly desirable with helical gears to ensure accurate meshing. The thrust of helical gears should be taken by separate thrust bearings. The success of the worm drive depends to a large extent upon the satisfactory performance of the worn thrust bearings. This is particularly true for the operation of the worm gear in low gear, where heavy thrust loads have to be supported. Unless the worn thrust bearing is capable of sustaining heavy thrust with a minimum amount of frictional resistance, the performance of the truck will be greatly impaired. It will readily be seen that excessive power consumption in the worm thrust bearing will impose excessive strains on the engine, causing it to heat when climbing hills. When starting with heavy loads there will be excessive wear on the engine and clutch members, and the shocks will have a detrimental effect on the whole truck. Ball bearings on worm shafts have entirely eliminated these difficulties, since they will support heavy thrust with a minimum amount of friction. The absence of internal friction in the bearing will also eliminate all possible heating of the worm. In the latter, two radial and one double thrust bearings are usually employed.

In the differential, wherever heavy thrust loads are to be supported it is usual to provide separate thrust bearings, although radial bearings alone can be employed. Ball bearings are frequently used on the front and rear ends. Adjustable bearings are not necessary. The bearings should be of ample capacity and should include a thrust bearing in addition, for trucks. They will stand up as well as roller bearings and with higher efficiency.

The king bolt is generally supported on a heavy duty ball thrust bearing. Since it has to support the weight of the front end, and take heavy road shocks, a high grade bearing is necessary. The low starting friction of ball bearings makes them essential for the work. Ball thrust bearings with flat seats are used universally on steering gears. Magnetos, charging generators and starting motors employ ball bearings almost exclusively. The high reliability of this type of bearing makes it specially desirable for parts such as these, on which depend satisfactory operation of the whole car.

Take time semi-frequently to plan new and likely-to-succeed ideas for your business. If you don't plan some such things and work your plans enthusiastically, you will get into a rut before you know it.



Queries-Answers-Notes

THIS department is the meeting place where you are free to ask for information, answer questions, discuss shop matters and business conditions and any other notes you feel would be of interest to a fellow mechanic. Make use of this Department as often as desired.

Horseshoeing Price in New Jersey:—Am sending you price list we get for shoeing in Sussex County, N. J. I believe these prices prevail in most of northern New Jersey. There is very little objection raised to these prices. Some of these prices aro so low that no set of shoes should be put on for less than $3.00. No. 0 to 3, $2.50 per set; No. 4 to 5, $3.00 per set; No. 6 to 7, $3.50 per set; No. 8, $4.00 per set; resetting 0 to 4, $1.50; resetting No. 5 and larger $1.75; toe and heel calks, blunt or sharp, $.25 each; leather soles 1 to 4, $.75 pair; leather soles No. 5 and larger, $1.00 pair; rubber pads, 0 to 4, $2.50 pair; rubber pads No. 5 and larger $3.00 pair; resharpening No. 0 to 4, $1.75 per set; resharpening No. 5 and larger, $2.00 per set; Neverslip and Drive calk shoes No. 0 to 3, $4.00 per set No. 4 to 5, $4.50; No. 6 to 7, $5.00; No. 8, $5.50; Inserting calks, 5/16-3/8-7/16-½ in. each, .08c; 9/16-5/8 inch each, 10c.

Joseph Decker, New Jersey.

An Opinion From Kansas:—I see your request for opinions on prices. We are getting only a reasonable price for our work, and I can see no reason why we should lower our prices, and I for one shall keep my prices just the same no matter what others may cut. The Bible says, "He that wrongs his neighbor wrongs himself more so."

R. B., Kansas.

Horseshoeing Prices in Texas:—In regard to prices of work, we are not expecting to make any change in the present prices. We are getting for shoeing: Up to No. 3 shoes, $1.00 per pair; Up to No. 5 shoes, $1.25 per pair.

S. A. Cunningham, Texas.

Not Too Old to Learn:—I have been a subscriber of your journal for several years and every issue is taken care of. I have about 100 numbers bound up into 6 books, and I have a goodly number awaiting similar treatment; so you can see the respect I have for the AMERICAN BLACKSMITH. I have been a "banger of iron" for 42 years this month; but reckon myself still a young man at the anvil, and by no means too old to learn. Your journal has been and is still a great companion of mine. There is always some kink there worth knowing.

W. Perrow, Cape Town, South Africa.

Blacksmithing Process in Missouri:—We own and operate a garage and blacksmith shop at Archie, Mo., which is 58 miles south of Kansas City. Our garage is 44′ x 64′ while the blacksmith shop is 30′ x 50′. We have a Ford Service Station and handle gas, oil and grease.

Our charges for work is as follows: All auto work $1.00 per hour; Horseshoeing new, $6.00 per team, Resetting shoes, 75c a pair; Plow shaping, 40c per lay; shaping discs 25c per blade. Wagon Work: spokes in wheel 40c each; Setting wagon tires, $3.00 per set; Buggy tires, $4.00, per set; felloes, 75c each; Wagon tongue with old ironing, $6.00; Buggy poles, $9.50; Wagon reaches, $1.00 to $2.50 each. We try to base our charges so that we will get $1.00 an hour for our work. We have a well equipped shop using power and electric lights. We have a crew of three men and through the busy season we employ five men.

As to cutting prices, let me mention that our competitor in the garage business works for 75c an hour, nevertheless, we do most of the work. Lower prices is not what draws business, and it really doesn't make much of any difference, I believe, it is the service that the people get that counts, or at least, we find it that way. We have an acetylene welding and cutting apparatus, and we find that it is a good paying proposition.

C. W. Corland & Son, Archie, Mo.

Prices in Kansas:—My prices are the same as they were last fall and they shall stay the same all this year at least. I have had no complaints about my charges. Horseshoeing employs about half of my time and repairing the other half. The prices are as follows:

Horseshoeing with common light shoes: No. 1 to 4, $1.00 each; No. 5, $1.10 each; No. 7, $1.25 each; Old shoes recalked, 75c to $1.00 each; Vicious horses and stallions, $1.00 to $3.00 per shoe, any size; Plow shares sharpened, any size, 75c; Wagon spokes and felloes, 1⅓″, where only one or two are required, 75c each; where a whole wheel is filled, they can be set in for a little less; Setting 1½ inch tires, each $1.25; Tongue, when hounds are good, $9.00; Welding pump head rod, 50c; Express wagon axles up to 1½″, each weld $2.00; Removing brake rod from auto, replacing and welding, $1.00; Fender brace rods, $1.00; Welding 1″ shafts out of any machine, $1.00. We, who are located so far from the source of supplies, must consider freight. On horseshoes, per keg, I pay $1.45, and on wagon axles 90c.

Roy Butts, Kansas.

Making and Repairing Glass Blower's Irons:—Could any brother craftsman give me any information on the above subject? These irons are made of mild seamless tubing having ⅞ inch outside diameter and ⅜ inch inside diameter. The one end is tapered and rounded for the lips of the blower, while the other end starts to flare out at a point 6 inches from the end and tapers gradually until it has an outside diameter of 1¼ inches at the end. The inside diameter is also increased proportionally at this end, leaving a pear shaped hollow inside with a ⅜ inch opening at the extreme end. This end is known as the nose end. At a point approximately 14 inches back from the nose end, these irons burn off, when they have been in use for some time, and it is then necessary for the smith to repair them and restore them to their original length of 48 inches over all. I might add that the nose, which extends back for a distance of 6 inches has to be made of very soft iron, as steel seems to have an injurious effect on the glass that is being worked. There are many different sized diameter of these pipes; but I believe the principle in repairing them is all the same.

Arthur Johnson, Derbyshire, England.

Welding Spring Leaves:—In regard to spring leaf welding and setting, I will give you some of my ideas, which I have found to work out satisfactorily in my twenty-five years of experience. I find that to upset both ends of the broken leaf and scarf them off short, the same as you would iron, being sure not to get too long a lap, gives good results. When welding, if the lap is too long, it requires too much time to weld the parts. Wherever possible, I like to finish up in one heat. I dislike the second heat, although occasionaally it is necessary. When a second heat is taken, one is apt to over heat the part, with the result that the part is worked out light on both sides of the weld.

I find that Climax Welding Compound gives very good results, using it as follows: Place compound on both of the surfaces that will come together when the part is welded. The parts are then placed in the fire with the compound covered side up. They are allowed to remain in this position until the welding heat is nearly reached, then they are turned over in the fire and heated to the welding point. While there is danger of heating the parts too hot, one should not be afraid to use enough heat, because it is impossible to weld until the proper temperature has been reached. After the pieces have been turned over in the fire, apply a little more compound on top of the scarf. Watch the heat closely, and when the proper point has been reached, weld the pieces together with the least possible delay.

It is my opinion, that a great many of the spring leaves break either in the weld or next to it, break not so much as the result of a defective weld, as they do as the result of the leaves not fitting properly. It is important that the leaves be set properly, and that they fit reasonably accurate, otherwise another break is most apt to result.

When a spring is broken at the hole, it is sometimes advisable to change the position of the hole by changing the leaf end for end, thus allowing the hole to be drilled in another place; but be sure that the leaf fits properly. If a man hasn't a great deal of spring work to do, he is likely to neglect this important detail. A good way to avoid this difficulty is to take one of the good leaves that fits next to the broken one, and fit the repaired leaf to it. This can be done by pressing the repaired leaf over the good leaf. It should be heated and then clamped down on it with tongs, and allowed to cool in that position. Afterwards the leaf should be tempered if necessary, and then given the proper set by laying it on the anvil and striking the inside center with the peen end of the hammer. More springs are returned to the spring shop, I believe, as the result of improper fitting than those which come back as the result of poor welds.

I would like to say a few words for the benefit of the apprentice blacksmith. When you go to learn a trade, stick to your man until your time is up. There are so many that will work a year or eighteen months, and then go into business for themselves, confident in the belief that they have learned the whole trade thoroughly. I have worked some twenty-five years at the business, have run a custom shop, worked at car works, mill work, have handled steel of all kind, and I am sorry to say that every day something new crops up. So don't think after a few months that you know the whole business thoroughly, you really don't, and in all probability you never will. Another good point for the beginner to bear in mind is that this knowledge is not all acquired at the anvil, you must read and study, and above all apply yourself at your work, paying strict attention to the suggestions your boss has to offer. Remember that he hasn't been in business for years without learning something. He must have known something or he wouldn't have stayed in business. If I can be of assistance to anyone engaged in the craft, I will gladly do so.

H. M. Johnson, Pennsylvania.

Preventing Blow-Holes in Cast Iron Welds:—In nearly every issue of your magazine, you print an article on acetylene welding. I have found these both interesting and helpful. Can you tell me how I can keep blow holes out of cast iron welding? In many cases, such as water-jackets, I have had trouble with small holes that leak a little bit and make a bad looking job. If there is any way of overcoming this trouble, I would certainly like to know how.

E., P. Idaho.

Editor's Note: Generally speaking, there is no positive preventative for keeping blow holes out of cast iron at all times. There are so many things which cause this condition that it is difficult to have everything just right at the same time. However, the welder can, in the majority of cases, prevent their formation by giving special attention to conditions from which they result.

Most generally, blow holes are caused by impurities. Sometimes this is a condition which exists in the casting itself, and which the welder cannot correct. He can, however, improve matters greatly through the manipulation of the filler and flame. On the other hand, there may be impurities in the filler, even though it is of guaranteed quality. These impurities must be worked out as the filler is applied. This trouble can be lessened by buying filler rods of only the best quality.

Blow holes are also caused by dirt, which clings to the casting, getting into the weld. Dirt or grit which may have gotten onto the filler rod causes a similar effect. Much of the trouble experienced from this cause can be easily avoided by cleaning the casting adjacent to the weld thoroughly and also seeing that the filler rod is clean. The cleaning should always be done before the welding flame is applied.

When any foreign matter gets into the molten weld, it is burned up and attempts to escape in the form of gas. Sometimes this gas is trapped in the weld and forms blow holes that are not apparent on the surface. In other instances the gas succeeds in escaping but leaves tiny holes in the surface.

After we have done everything we can to prevent their formation by having all the parts clean, the next thing to do is get rid of those that do form. The simplest method, perhaps, is to melt the metal fluid enough so that the gas will escape. Sluggish, or poorly melted metal, will not flow together after the gas has passed through it; but will form a tiny crater or funnel-shaped pin hole. In other cases, the metal is actually so sluggish that the gas can not force itself through the metal. In these cases small pockets result below the surface of the weld. If the filler is applied in thick, poorly fused layers, blow holes are almost certain to result.

If everything regarding the torch, filler and flux is handled properly, the surest way to avoid, or minimize the presence of blow-holes is to melt the cast iron so that it is thoroughly fluid, being careful not to melt too much at one time. Allow the heat of the flame to penetrate into the weld; but do not force the welding.

Welding Compound for Steels.—I would like to take the liberty to ask through the Journal, a recipe for a flux to weld steel?

F. R., Ontario.

Editor's Note.—A welding compound for steel, which it is claimed gives very good results, is made as follows: Boracic acid, 41½ parts; common salt, 35 parts; ferro-cyanide of potassium, 20 parts; rosin, 7 parts; carbonate of sodium, 4 parts.

Heat the pieces to be welded to a light red heat and apply the compound; then heat to a strong yellow heat and the welding may be accomplished in the usual manner.

The precaution should be observed the same as with any of the cyanides, to avoid breathing the poisonous fumes.

It would be better and cheaper, perhaps, in the long run to state your needs to some reputable manufacturer, and buy a ready prepared compound.

Making a Pre-Heating Torch:—I would like to make a pre-heating torch to use in the welding trade, and would like some information on the subject.

G. W. B., Ohio.

Editor's Note:—An article on page 214, May, 1920 issue of the American Blacksmith gave complete instructions for making a pre-heating torch. It was also illustrated with a drawing. If you will refer to that issue, we believe that you will get the desired information. Advise us if you haven't a copy of that number, and we will send one to you.

Gluing Polishing Wheels:—Kindly let me know through the columns of your journal, the best way of gluing emery to polishing wheels. I use a common cloth wheel made of several thicknesses of muslin sewed together. The wheels are about 2 inches wide at the face. I use it for polishing plow lays mostly. Is there anything better to use than emery.

O. O., North Dakota.

Editor's Note:—To successfully glue polishing wheels, the first consideration is to prepare the wheel so that it will be in a receptive condition. After prolonged use and many glue and emery applications, the polishing surface becomes rough and uneven. The best remedy is to remove these coatings, entirely, then a new cutting surface may be applied. There is a special device made for this purpose; but in its absence good results may be obtained by placing the wheel either on a lathe or the polishing stand, and while it is revolving, loosen the emery by holding some rough metallic edge, such as a broken casting against the edge of the wheel.

It may be further smoothed by wetting with a piece of water soaked waste or cloth held with one hand while a stone manufactured or for such purposes, is held against the surface with the other. As soon as the surface is dry the usual glue and emery applications may be made.

Next the wheel is glued. It is a simple operation; but care must be exercised to see that the job is neatly done. If the wheel is new, several coats of glue and emery are required to build up a cutting surface. Place the wheel in a lathe and while it is turning, use sand paper to remove any uneven places. Apply a thin coat of hot glue, free from foreign matter. The wheel may be allowed to run for a time until the glue is nearly hard, when a wet cloth should be pressed against the revolving glued surface. This procedure will produce a smooth surface for the emery coating. A new wheel, since there is no emery body to build upon, should be given two coats of glue and emery. A drying period is allowed between the coatings.

Only a very high grade glue, that has been carefully prepared to eliminate all acids, alkalies and impurities should be used. A good emery glue possesses superior water absorbing qualities. To test glue for emery purposes, soak an ounce in about 5 times its weight in water for 48 hours at room temperature. If at the end of that time the water shows discoloration or if decomposition is evidenced by a disagreeable odor, the glue is not adapted to emery use; otherwise it may safely be used.

There is no simpler method of applying the emery to the wheel than through the use of a suitable trough. A glue application is made to the surface of the wheel and it is then rolled in the trough containing the emery of proper grade.

Experience has shown that No. 140 emery gives good results, however if not such a smooth surface is required, coarser emery may be used. Carborundum gives very good results in fact it is claimed that it cuts faster than emery.

Variations Allowance in Cylinder Bore:—Will you please inform me the maximum amount of variations allowable in boring or reboring a motor block or cylinder?

D. M. K., Oklahoma.

Editor's Note:—The maximum amount of variation allowed in reboring cylinders depends on the bore of cylinder and its length. We assume that you refer to the amount of variation in the taper of the cylinder, because a rebored job should be perfectly round in order that the rigs and pistons may conform properly to it.

In cylinders of four inch bore or less with a stroke of approximately five inches, a taper of from one to one and a half thousandths may be allowed, altho' it is advisable of course to have the cylinders as nearly straight as possible.

In measuring up old cylinders, it will be found that the bottom of the cylinder as a rule, is from one to two thousandths smaller due to the action of the rings, and if not excessive will cause no harm.

AMERICAN BLACKSMITH AUTO & TRACTOR SHOP

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William F. Wendt, President *L. J. Wischerath, Editor.*

SUBSCRIPTION PRICE

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BUSINESS IS ON THE UP-GRADE BUT NOT YET "RUNNING ON HIGH"

The great mass of the people are looking the facts squarely in the face." There are no delusions as to any sudden return to prosperity, nor of advancing prices, nor of scarcity in any lines. There is the realization that both time and patienec are required to work out the problems which confront us. Many have accepted the situation, and are adapting themselves to the inevitable, which is that much progress made in the way of adjustment.

In many of the large centers there is the curious paradox of much unemployment accompanied by growing savings accounts. The explanation seems to be that those who have jobs are none too certain of them, and are casting consequent anchors to windward in the shape of less spending.

The financial position of the farmer grows stronger as he is gradually liquidating his obligations, decreasing his cost of production, and finding more economical methods of distribution, largely through his co-operative associations.

It is one of the ironies of economics that the present business stagnation arises largely from an overabundance of wealth that cannot find a market. The copper industry illustrates this by having so large a surplus above ground, for which there is no prospective market, that all the mines are closed down.

Conditions are much spotted, both as to localities and lines of trade. In the retail trade, buying is better in the large cities than in the country towns. As is usually the case, surface indications in the great centers, such as crowded stores and places of amusement, with the vast number of automobiles on the streets, give scant indication of real underlying economic conditions.

There is much construction of hard surface roads under way as most communities seem perfectly willing to tax themselves for this purpose. These permanent highways open up far reaching future possibilities of cheap and efficient transportation to the motor truck but which for the nonce is content to bide its time.

In the field of transportation some enterprising cities are enlarging their trade territory by the extension of electric trolley lines into districts where before they had scant distribution. Paradoxically enough, so far from destroying the business of small towns in such districts, they have enabled dealers to carry smaller but better assorted stocks of merchandise and thus to increase their attractiveness and their profits.

The automobile and rubber industries have come back in a very definite fashion when some false prophets thought they had taken the full count for the time being. So far they have disappointed those who forecast a more spurt instead of a continuous performance. There are still few belated thinkers who have overstayed their time and who fail to realize that automobiles are neither a fad nor a mere luxury but an essential and inherent phase of modern life.

WE OFFER OUR APOLOGY

Publication of the May issue of the AMERICAN BLACKSMITH AUTO & TRACTOR SHOP is several weeks late this month on account of the printer's strike. A diligent effort has been made to get this number into your hands on time; but unfortunately this strike which is nation-wide, affecting all publishers alike, has made our attempt only moderately successful. Under these circumstances, we hope that our subscribers will be patient until these difficulties are adjusted.

Strikes, as we all know have the unfortunate faculty of upsetting schedules, and broken schedules are always a source of unpleasant criticisms—well meant, but often poorly directed. It is our hope, that before the next issue goes to press that these differences will be ironed out to the satisfaction of all concerned and that you will receive your next number, regularly, as in the past.

The Editor

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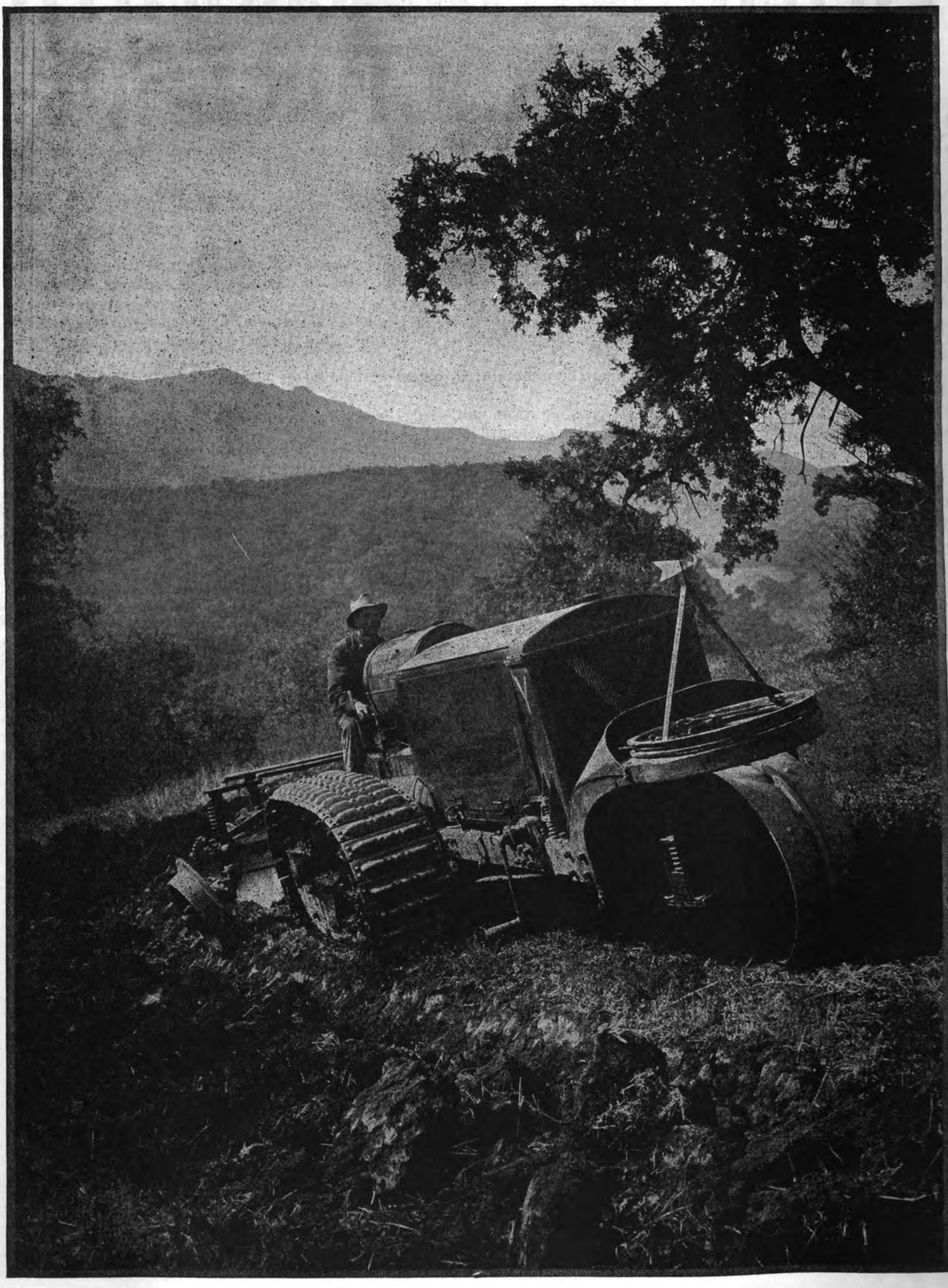

Welding Without Preheating

BY DAVID BAXTER

AS time passes methods change, and the oxy-acetylene welder is learning that there are a great many welding jobs which do not need heating previous to applying the welding flame; jobs that were formerly thought impossible to successfully weld without preheating. He is learning that much of the time and labor he used to spend on preheating arrangements were purely wasted, and that many jobs which he used to think required preheating to a dull red stage may be welded at a black heat. That many jobs which he used to preheat bright red may be welded at a dull red.

This does not mean, however, that preheating may be entirely eliminated from the gas welding process, or that it is an unim portant matter in all cases; to be handled in a slip shod manner. Quite the contrary; it means that the welder can save time and expense by paying more attention to the preheating; by studying each job and applying the heat in a more scientific manner. For, while there are numerous jobs where the preheating can be entirely omitted, there are still many jobs where it demands great care in the manner and extent of heating, previous to welding. There are still lots of jobs that seem impossible to weld without heating by some agency besides the welding flame; but on the whole, the welders have made rapid strides in the last year or so toward simplifying the preheating process.

The present discussion refers mainly to the art of preheating to control or eliminate expansion and contraction troubles, since there are lots of jobs that need preheating for other purposes. There are jobs that should be heated to facilitate the welding to insure better fusion and a more homogeneous bond, in which there is no danger of cracks or strains. So this paper must not be taken as an argument for the entire omission of heating by some agency besides the welding flame previous to, or during the welding. It means that much of the former preheating to avoid cracks, was unnecessary.

Of course, the welders ability must be considered. A naturally slow or poor torch operator may have to heat some jobs which the more proficient welder can handle without any preheating. Then, too, there are some jobs where the preheating may be only partially eliminated; that is, the heating is localized or closely confined to certain parts of the job. But in this, too, the factor of individual ability must be considered. However, lack of space prevents going into detail in many matters pertaining to preheating in all kinds of work. It is all based on the same theory, and each welder can follow it out by reasoning and good judgment.

This theory simmered down is that the weld and its adjoining heated metal must be able to shrink without resistance. The heated metal must occupy a smaller space when cold. It must be able to contract without something holding it back, or pulling against this contraction.

FIG. 1. THE LOCATION OF THE FRACTURE AND THE EXTENT OF THE GROOVING.

Since space does not permit the discussion of all the different reasons for preheating, let us take one specific example, and follow it through tht process. From this, the reader should be able to glean ideas for use on other jobs. Let us take a job which does not need preheating, nor heating by other agencies during the welding, because the weld is so situated that there is little or no danger of cracking.

This job is variously called a sheave wheel, groove pulley, rope pulley, or double flange pulley, and is illustrated in the accompanying photos. Let us see how the piece broken out of the flange was welded without heating, previous to applying the welding flame. A discussion of the little devices employed to facilitate the work should also prove interesting, as well as the manipulation of the flame in the making of the weld.

A part of the flange was broken out about six inches long, curving inward to near the center of the groove. This wheel was of cast iron, varying in thickness from a quarter of an inch at the edges to a half inch at the center. The main requirement in this section being strength. The weld would not require machining. The weld did not need to be absolutely free from pin holes and hard or porous spots, but these things cause weakness, so it was best to make a soft clean weld.

The first step in the process was beveling each side of the fracture to form a wide V-groove, when the broken section was fitted in place This brings up another thing, that many welders are trying to do do away with, viz: the elimination of grooving the fracture. But it stands to reason, that this is poor practice in almost every case, except where the nature of the casting prevents grooving. If the cast iron is over three-sixteenths of an inch thick, the crack should be grooved, if not all of it. This facilitates the welding and thus cuts down the welding time, which is probably the most important item, especially when preheating is omitted. It also permits the weld to be made from the bottom up, instead of from the top down. The torch operator can see what he is doing, through the entire weld; he need not guess at the fusion of any part. If no groove is made, the flame must be bored into the casting metal with its attendant risks of either oxidizing or carbonizing the metal.

This wheel was grooved with an emery grinder. The broken piece was ground back a distance equal to the thickness of the metal. The wheel edge of the fracture was also ground beveled. These two bevels formed the groove indicated in Fig. 1. A small portion of the crack

FIG. 2 THE FIRECLAY BACKING USED TO SUPPORT THE BROKEN FLANGE WHILE SPOT WELDING IT

along the lower edge of the groove was left intact to serve as a guide in fitting the broken part of the flange.

Next, some device was necessary to hold the broken part exactly in place, while the welding was started. This could have been done with clamps; or by having a helper hold the piece, until the welding was well under way. However, in this instance, the simple expedient of packing several handfuls of moist clay in the groove of the wheel, was employed. The broken piece was held firmly in place while the clay was pressed beneath it. The clay held the broken part securely in place while the groove was spot welded. The main advanage of this device was that the expansion and contraction of the weld metal was free to act, and still not cause any mis-alignment. The soft clay permitted the broken part to be pressed exactly to its original position. This step of the repair process is shown in Fig. 2. The clay is shown in the wheel groove, while the fractured groove is being spot welded, or tacked together with bits of filler metal.

Before fitting the broken part to the wheel, however, the metal immediately surrounding the fracture was cleaned, thoroughly, of all dirt and rust to prevent these substances from getting into the weld, as these impurities often cause trouble by being trapped in the weld, forming porous spots or pin holes. It is well, then, to clean the surface of the casting along the V-groove, until the bright bare metal is exposed.

After fitting the broken piece in place with the clay, the next step in the process was to spot weld it. This was accomplished by bringing a neutral flame in contact with the bottom of the groove near the center. Here the revolving flame soon melted a small portion of each side of the groove, to which was added a small bit of the filler rod. The rod having been brought in contact with the flame at about the time, it was introduced to the groove. Then the flame and rod were worked gradually along the groove bottom to melt enough of it and the filler rod together to hold the broken piece of the flange firmly in place. This spot welding, or tacking as it is frequently called, extended about an inch along the groove, approximately a quarter of an inch thick. It cooled almost immediately and held the piece of flange rigidly in place, so it could not shift or sag. The torch was laid aside and the clay removed from the groove.

The clay was removed on account of the moisture it contained before starting the main weld. When the metal became heated, this moisture would change to steam and cause trouble. Some clay might get mixed in the weld. At any rate, there was no advantage in leaving it in place after the groove was tacked.

After the clay was removed, the next step was the welding of the entire groove. The wheel was first shifted to bring the main or deepest part of the V-groove to a horizontal posiion. As iron tends to seek its own level , like water; the weld was more easily made in a horizontal position. The molten filler could be placed along the groove without danger of overflowing unfused portions. Fig. 3 indicates the welding position of the wheel, during the larger part of welding.

The neutral flame was brought in contact with one end of the tacked portion, where it was played back and forth along the groove to melt and flow together about an inch of the bottom. While this was being accomplished, the filler rod was brought close to the flame in order that the end of it might be heating in readiness to be melted when the groove bottom was ready to receive it. As the bottom edges of the groove flowed together the melting filler rod was placed in contact. Then the flame was manipulated to keep the melting filler flowing into it.

When the first inch of the groove was filled about half full the rod and flame were gradually moved to another section of the bottom where the process was repeated. And again slowly shifted as another inch of the groove was half filled. This finished about half of one end of the weld so the flame and filler were switched back to the tacked portion. This was re-melted and filled to the height of the the other portion. The flame was revolved over the spot weld until it melted. The the filler was applied with a turning movement.

The operation was repeated along the groove in the opposite direction to add a series of welds in the same way as the first welding. The welding was carried out about the same distance as the first operation, which then made about the half of the groove length filled;

FIG. 3. THE FIRST WELDING POSITION OF THE BROKEN WHEEL

half full of new metal. That is, a layer of metal stretched the length of the deepest part of the groove. This shifting back and forth was for the purpose of keeping the expansion balanced along the groove. This was the method employed to eliminate preheating. The broken part of the flange could be pushed outward by expansion without hinderance and could be drawn back again without resistance when the weld cooled and contracted.

The flame and rod were then worked back over the first layer to deposit another layer on top. This layer entirely filled the rest of the groove. Care was taken to see that the sloping sides of the groove were melted down before adding new metal. The first layer was also kept in a molen state when the filler was added. The flame was revolved in circles and played across the groove in short arcs, or was moved zig-zag, according to the needs of the melting weld. Filler metal was added to the best advantage, according to the receptive state of the groove metal. In slowly-mounting, converging, pools, the entire surface of the first layer was covered with filler metal. carefully soaked in with heat along the edges and rounded in a slight surplus along the top. The force of the flame in conjunction with puddling movements of the rod, served to lend a smooth, solid surface to the finished part of the weld.

This left about two inches at each end of the groove to be welded. And the theory of controlling the expansion and contration of the weld could still be followed. The expanded weld was still free to shrink without hinderance as there was nothing to hold the broken part back. It should now be readily seen why no heating, either previous to welding or during the process, was needed. The wheel remained stationary and the broken section moved in and out as effected by contraction and expansion.

The flame and rod were then applied to one of the unfinished ends of the groove. The flame was revolved over the rapidly cooling ends of the weld to re-melt and connect it to the new metal. The groove here was shallow, so it was necessary to add but one layer of filler. This was done by passing the flame back and forth across the groove and by twisting the melting rod into the molten groove. The flame and filler were kept in almost constant motion. Twisting and prodding, advancing and retarding, to meet the changing condition of the weld. The groove was filled to overflowing as the work proceeded and the surplus was thoroughly soaked in as the weld advanced. The flame was played along the edge of the surplus until the heat penetrates deep enough to melt below the edges of the groove; this is the soaking process that insures the two bodies of metal settling into one.

The process was thus executed from the unfinished end of the first weld to the outer end of the groove. Then the flame was quickly transferred to the other end of the groove to weld the last two inches of it. This process was much the same as the other two inches. The new metal was added a bit at a time thoroughly soaked into the metal below. The work was rapidly executed; but the first parts of the weld were cooling rapidly by this time, so the flame was played along the full length of the whole weld at intervals, to keep up the expansion and thus prevent cross-pulling of contraction.

When the last two inches of the weld were filled the next step was to "doctor" the lower or inner side of the whole weld, which is illustrated in Fig. 4. The wheel was quickly raised up on edge and blocked so that it could not roll. Then the flame and filler were applied to the rough and unconnected portions of the seam. Places where the weld had seeped through, or places where the melting had not been deep enough, were reopened and twisted full of new metal. Practically the whole line of the weld was re-opened and filled again. It is hard to weld exactly through without leaving rough portions on any weld. And if the weld is not made clear through it leaves a weakness. Therefore it is better to weld lightly along the entire under side of most welds.

When the under side of this groove was re-filled the side of a heavy filler rod was employed to give what is termed a "Hot-finishing" to the rough surface of the weld. This was done by melting the high spots and striking them smooth with the side of the filler rod.

The rod was given a sharp twisting swipe around the curve of the wheel groove. The surplus metal was wiped off. In doing this the movement of the rod had to be deft and rapid. The rod was pressed flat upon the casing beside the molten spot, then given a sidewise twist to flirt the top from the surplus metal. The welder was careful to not gouge the melted metal out below the surrounding surface.

This hot finishing process could be employed on the outside of the weld if desired. The "swiping" in this event would be done with a flat file by striking quickly across the surface of the higher parts of the weld after melting them. In fact this idea is good on many different jobs, and if properly executed will produce a weld surface resembling the original casting.

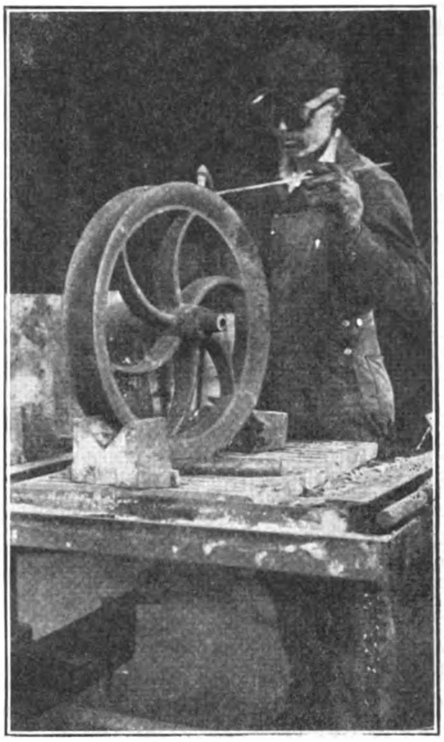

FIG. 4 REMELTING THE INNER SIDE OF THE FRACTURE.

After, "not finishing", the wheel groove, the casting was allowed to stand until the red heat died out. As soon as cool enough to handle, it was ready for the customer. No attempt was made to cause the weld to cool slowly by covering it with asbestos or other non-conductor, as is the case where there is danger of contraction cracks.

Now, the above description should furnish instructions that will permit the novice to weld many similar jobs. Almost any small part of an iron casting, which is not surrounded by metal, but is free to move with the expansion and contraction, may be welded without preheating. Unless it is so heavy that preheating will be an assistance in melting the metal, thus saving gas.

Hammering Circular Saws

IN the series of preceeding articles on circular saws, the discussion of their proper filing was concluded. In those articles frequent reference was paid to the

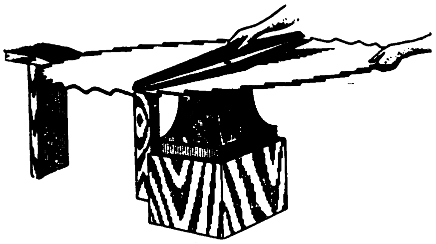

Figure 1.

necessity of proper tension, as well as having the saw filed properly, in order to obtain the best results. In this articles, the subject of hammering the saw in order to obtain tension, will be discussed.

All saws, if properly made, are what we call open towards the center, this amount being more or less in proportion to the number of revolutions the saw is to run.

The object is to keep the edge strained on a straight line, to prevent it from rattling in the guides, and cutting a zig-zag kerf through the timber. What applies to one saw in regard to hammering, applies to all. The circular saw is most difficult to treat, and even after the most careful instructions are given, it requires practicle ex-

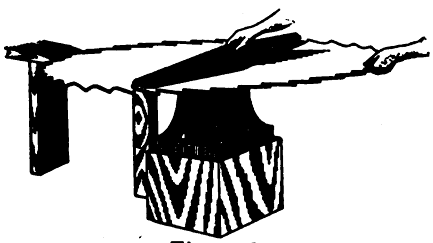

Figure 2.

perience and the most careful observation in order to hammer a circular saw successfully.

The strain on the rim, caused by the choking and wedging of sawdust, particularly where the teeth are close together, with narrow gullets, such as are used in large mills with fast speed, and the process of gumming, will in time stretch the rim, and it will begin to run snaky and make bad lumber.

However, before concluding that the saw needs hammering to adjust the tension, see if there is not some other cause for trouble, such as the saw being lined into the log too much, which would cause it to draw into the log and heat the rim, the guides not being properly adjusted, gullets being too narrow for the feed, or the teeth not being properly swaged and dressed.

What is required in the way of tools is an anvil, one straight edge 18 to 20 inches long, one about 36 inches, and if large saws are used, one 48 incles long will be required. A set of hammers, including one dog-head and one cross pein, weighing from 4 to 6 pound each.

In studing the art of hammering circular saws, it could be well for for those having charge of the saws to examine them careful when new, closely noting the amount that the

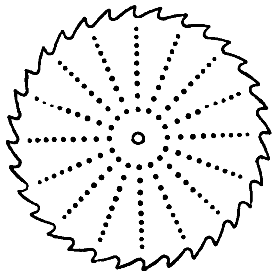

Figure 3.

saw drops away from the straight edge, as shown in Figure 5; also test in the same manner as shown in figure 6. It is a matter of much importance that these tests be made carefully, and we recommend that the measurements be taken therefrom.

There are tension gauges in use that may be adjusted to any amount that the saw may drop, but where nothing of the kind is available, a gauge may be made from a thin strip of steel. It should be of sufficient length to reach from the rim to the center of the saw, and made convex to fit the dish in the saw, when held, as shown in figure 5.

It is necessary to have one for the center, as well as from center to rim. It should be the same length as the one used from center to rim, and made to conform to the amount that the saw drops at the center, when held as shown in figure 6.

It is not recommended that these gauges be used as straight edges; that is for the purpose of finding lumps and leveling up the saw, but simply for the purpose of taking the measurement just mentioned.

A saw that has lost its tension will appear as shown in figure 2, and needs hammering, as shown in figure 3, but, before beginning to hammer it, examine the saw carefully all around, holding the saw and straight edge as shown in figure 5. If any part is found to drop away more than the rest of the saw, mark this part as shown in figure 4, and do not hammer as much, if any, at that place, until you have gone over the rest of the saw with the round-faced hammer, as shown in figure 4. Examine the saw carefully again as before, and, if any place is found that does not drop the required amount, mark around it or any other place that might be found lacking in the proper amount of tension. When all such places are located and marked, go over the saw, hammering lightly on each place. In each case hammering each side of the plate the same amount, to avoid dishing the saw.

If however, in the process of regulating the tension, the saw is found to be a trifle dishing, lay it on the anvil with the full side up, and hammer lightly over the body of the saw, as in figure 3, until it has been made perfectly flat on the log side. In testing for tension, be sure to have the straight edge at right angle with the part of the saw that rests on the board, and the opposite edge that is being raised with the left hand, while the straight edge should not be allowed to lean to one side or the other, but held in an upright position, or it will fail to show what is desired.

A straight edge reaching from center to rim of the saw is best used when hammering to regulate the tension. When this straight edge is applied as below, the saw should

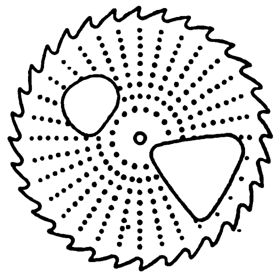

Figure 4.

fall away from the straight edge, as shown in figure 5. This will show the center of the saw to be stiff, as it should be to run properly and do good work. If a short straight edge of 6 inches is held over the center, and pressed down while the edge of the saw is being raised, it should show the saw to be nearly flat, or of equal tension at that part. It is very rarely necessary to hammer within the outer collar line.

Figure 5.

When beginning to hammer, as in figure 3, see that the face of the hammer is round so that the blow will be round, and do not srike too heavy, for it is better to go over the saw several times, than to hammer too much at one time, thus putting the saw in worse shape than when the hammering was begun.

After going over one side, mark off the other side, and repeat the operation with as near as possible the same number and weight of blows as struck on the first side, and as nearly directly over them as possible. Now stand the saw on the floor, holding it up straight, and test it wih the long straight edge, as shown in figure 12, and, if the hammering has been done equally on both sides, the saw should be very near true. If, however, it shows full on one side, and dishing on the other, mark these places that show full.

Place the saw on the anvil with the round or full side up, hammer lightly on the full places, test again with the long straight edge, and, if it appears true, put it on the anvil and test it for tension, which operation has already been explained. if it is found that the proper tension is lacking repeat the operation with the round-faced hammer, and when you have regulated it to the proper tension, you will have accomplished the most difficult part of saw hammering.

Again after testing with the long straight edge, put the saw on the try mandrel, if you have one; and every man that does any amount of this work should have one, and test with short straight edges to see that the saw runs true. Mark the places as they run off or on, as shown in figure 7, while turning the saw slowly around, and, where the saw runs off, lumps will be found most likely, as in 1, 1, 1, or what are termed "twist lumps" as in 2, 2, 2, in figure 8, or both may occur. These lumps must be taken out with a cross-face hammer, the blows being struck so that they will be in line with the lump; that is the mark or impression the hammer leaves, should run in the same direction that the lump runs as shown by the straight edge. A twist cannot be taken out with a round-faced hammer, neither is a round-faced hammer liable to twist a saw. On the other hand by using the cross-face hammer, twist lumps can be very easily removed, if the blows are struck in line with the lump, as above stated. The saw may also be thrown out of true by the lumps running towards the center, as indicated by number 3 in figure 8. In this case the saw will be on or off at points about opposite to one another. This class or lumps or twist is usuallly located and removed in the process of flattening the saw, and it is seldom necessary to run the saw on the try mandrel

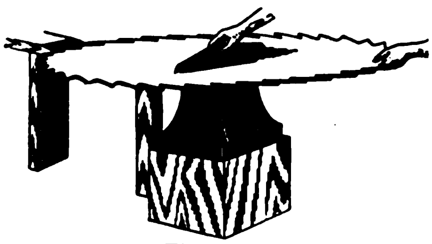

Figure 6.

to locate them. It is the small twists as at 1, 1, 1, that are hard to locate and sometimes cannot be located without running the saw on the try mandrel. Where a mandrel of this kind is not available, the saw may be tested on the mandrel of the mill.

In removing the twist lumps, the hammering must be done carefully. If the hammer is of proper weight, and the face properly ground, the saw can be made to run true without altering the tension to any great extent. The testing of the saw should be done with the full size of the saw towards the pointer, and knocking down the lumps from that side will make the saw flat.

Now, the saw should be placed on the arbor, and if for high speed it should sway gently from one side to the other in getting up to speed, and will then run steadily

Figure 7.

and do its work properly. But if it still rattles in the guides and acts snaky, it needs to be open more towards the center.

An experienced man will stand the saw on the floor, taking hold of the top edge, giving the saw a sudden shake, and if the center vibrates and the rim stand stiff, he knows it to be open towards the center. He will also test it by leaning the saw over, to see that it falls away from the straight edge sufficiently, as shown in figure 9.

If the saw is too open at the center, it will run from side to side, and will generally run off in taking off a light slab. After the first cut in a log, it will almost always run in. Great care should be taken not to run a saw when too open at the center, for if it should run out to any great extent, it is liable to become sprung at the collar line. In case the speed is fast, with good power the saw is liable to crack around the edge of the collar. Where a saw is too open at tht center as above stated, it should be hammered from the edge as shown in figure 10, and the distance to hammer in from the edge depends on where the loose parts are on the saw. If the center is loose to the

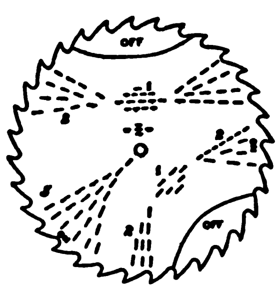

Figure 8.

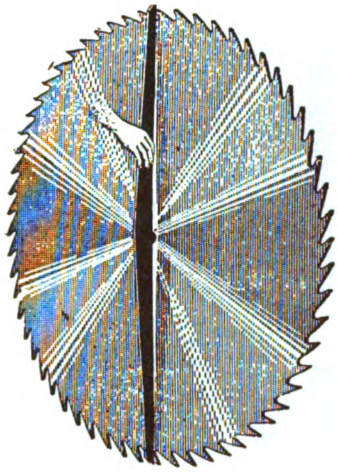

Figure 9.

first line, or the one nearest to the center, hammer from rim to that line; but, if the looseness runs out to the next line, hammer only to that line and so on. Or, the looseness may be irregular, as shown in figure 11, and need to be hammered as shown in the cut to regulate the tension, then proceed with the cross-faced hammer as explained by figures 6, 7, and 8, before regulating the tension and final truing. Do the same in the case of buckling or burned spots or sharp lumps over the collar line. These may be knocked down by placing two thicknesses of strong, heavy paper on the anvil, and by a few, well direct, light blows, you can knock down the lumps without expanding the metal, to the same extent as is straighten-

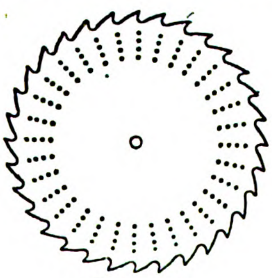

Figure 10.

ed on the bare face of the anvil.

In hammering with the round-faced hammer, it is very important to have the blows distributed evenly over the part to be hammered. It is better to begin at or near the collar line, and hammer on a straight line out to within 3½ to 4 inches of the rim; then move over as shown by lines in cut number 11, and hammer back to the center again. By hammering on uniform lines back and forth over the saw, you avoid putting lumps that would require much work with the cross-face hammer to true up the saw again. This matter of doing the hammering uniformly over the plate is one of the most important features in connection with the adjustment of saws, for hammering too much in one place would cause a lump or loose spot that would be hard to take out, which, if left there, would likely cause a blue spot to appear at that place, cause by the friction while in the cut.

If it is necessary to go over the saw more than once for tension, hammer between the lines already operated upon.

The dressing of the face of the hammers is an important matter. The round-face should be so dressed that if a blow is struck on the oiled surface of the saw, it should be about ½ inch in diameter, and the cross,face so that it should show about ¾ to 3/8 inch, for a sharp cutting blow is not effective

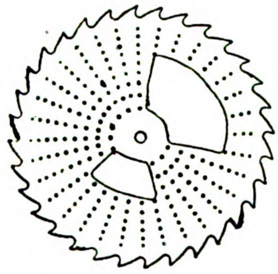

Figure 11.

in knocking down a lump or stretching out the metal.

In conclusion the following suggestions to beginners are timely: Do not be discouraged by the failure of the first attempt. Try to make yourself perfectly familiar with the instructions, and persevere in properly applying them. Carefully study the amount of opening the saw requires at the center of tension to suit the speed and feed, and to regulate this always use the round-face hammer.

Beginners in the art of saw hammering should begin with small circular cut-off saws—for this class of saws are, as a rule, given very attention in the mills. Go through the operations as instructed, and, after succeeding in putting one of the smaller ones in good shape by hammering, so that it will run true and steady in the cut without chattering, you will have advanced well in the art of hammering, and will be able to operate on larger saws without any greater risk of failure.

PLOW TROUBLES AND HOW TO CORRECT THEM.

Plows Pull Sideways

CAUSE

1. Not properly hitched to tractor.
2. Plow drawbar not adjusted properly.
3. Tractor running too far from furrow.
4. Drawbar too short.

REMEDY

1. Hitch drawbar to tractor so as to produce as little side draft on plows as possible.
2. Shorten adjustable straps on draw-bar.
3. Set draw-bar farther to right. Run tractor within 2-in. of furrow.
4. Lengthen with piece of chain, welding on 24 to 36 inches, same size as drawbar.

Tractor Pulls Over Into Furrow

CAUSE

5. Plows hitched too far to right hand side of tractor causing side draft on tractor.

REMEDY

5. Adjust drawbar of plows so as to equalize the side draft on tractor and plows. Hitch nearer the center of tractor.

Plows Will Not Go Into Ground

CAUSE

6. Drawbar hitched too low.
7. Plow has not enough suck.

REMEDY

6. Hitch drawbar higher.
7. Adjust depth levers, have point of share brought down, also drop share in throat. On some plows the bottom can be tilted on the standard so as to lower the point of the share. Have share sharpened.

One Furrow Higher Than the Rest

CAUSE

8. Beam sprung.

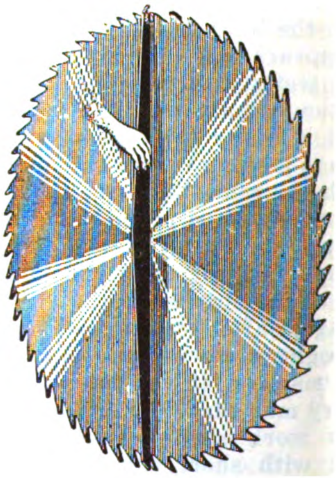

Figure 12.

9. Coulters not adjusted properly.

REMEDY

8. Have beams straightened so they are all exactly alike.

9. Set coulers on plow so that they will cut exactly the same width furrow. Adjust levers so plow is running level, each plow cutting the same depth.

Plow Will Not Lift

CAUSE

10. Clutch mechanism stuck.

REMEDY

10. If wheel slips, drawbar should be hitched higher. Oil lifting mechanism thoroughly.

Rear Plow Will Not Go In

CAUSE

11. Rear wheel set too low.

REMEDY

11. Adjust collar on rear wheel standard so that bottom of wheel is level with the bottom of plow when plow is dropped. See that reach rod from lifting mechanism is the proper length.

A HANDY CHART FOR FINDING THE AREA OF A RING

This chart will be found handy for determining the area of any ordinary ring, such as sketched on the chart. It is usually known as "the area of an annular ring." All you need to do is to lay a straightedge across the chart once and the area in square inches is immediately found in column B.

The old and common method is the complex one of squaring radii, multiplying, subtracting, and then wondering if your figures are correct, but this way is "positive." There's no guess work about it.

For example, What is the area of a ring whose distance D (see sketch) is 10 inches and whose width "w" is one inch?

Connect the 1 (column A) with the 10 (column C) and the intersection of the straight line with column B shows the area to be a trifle over 31 square inches. Isn't that simple enough?

It is a very easy matter to measuse the distance D and the width w with a rule, and the same rule can then be used as a straightedge in solving the problem on this chart.

W. E. SCHAPHORST

In order to obtain a firmer hold for machine screws when used in threaded holes in sheet metal, drill the hole with a drill somewhat smaller than the tap to be used. Then use a drift of the proper diameter to enlarge the hole. On using the tap, quite a number of extra threads can be cut, on account of the drift raising a bur on the metal.

THE BASEMENT FIRE HAZARD

Basement fires constitute a serious hazard which demands greater attention on the part of property owners. Most of them are due to waste paper, packing boxes, excelsior and rubbish which should not be allowed to accumulate. "Out of sight is out of mind," and many business men would be astounded if they realized the dangerous conditons they are permitting to exist in the portion of their premises usually most unguarded. Fires starting in basement frequently get such a start that they are a serious menace to the lives of those on the floors above. The remedy recommended by the fire prevention experts is better housekeeping in the basements, enforced by regular and frequent inspections by the owner or responsible employes.

The danger is greatest in the basements which are used only for storage. All sorts of rubbish accumulates, dries and becomes inflammable, and the hazard is increased by the frequent custom of keeping oils and other dangerous materials there. Many fires start from spontaneous combustion, from defective wiring or from the matches and stubs of careless smokers, and if excelsior, old boxes and waste paper are scattered about the blaze gets such a start that there is little chance of saving the property. The fire runs up elevator shafts and stairways, and in many cases serious loss of life has followed.

Owners of property should see that waste paper and packing material is taken care of and removed regularly, and that rubbish is not allowed to accumulate. They should

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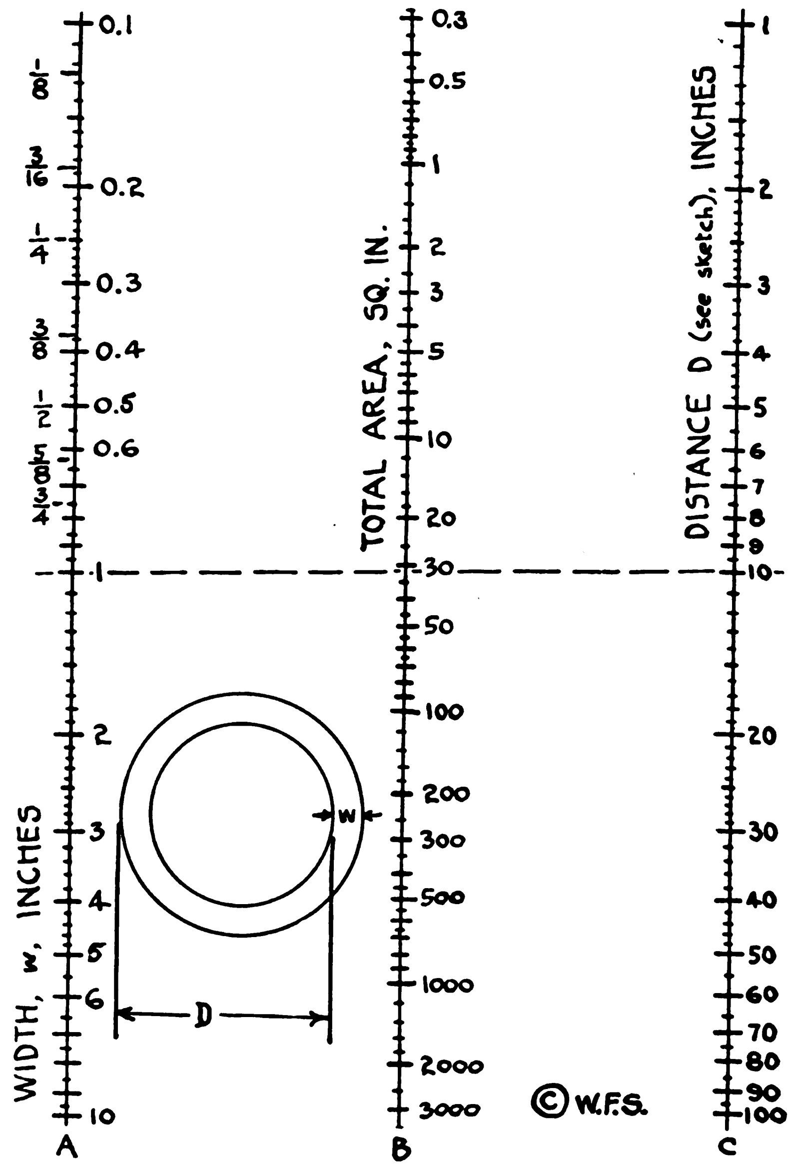


SHOP HINTS

LINING UP SHAFTING

In equipping a shop, the first work of the machinist is the erection of the shafting. The main line should be the first laid out, and the engine, together with the jack and countershafting, must be located from it after replacing the hangers as nearly as possible in a horizontal line. The shafting should be placed in the boxes and attached to the hangers. For lining the shaft, a level and a fine grass or silk line are indispensable.

The line is tightly drawn, horizontally, a short distance from the position it is desired the shaft shall occupy, and the distance from the surface of the shaft to the line is measured and made equal near each hanger by a stick such as is shown in the figure 1. The level is used to make the shaft horizontal, and, if the hangers are adjusable in two planes, the operation is quite rapid. When other shafting is to be erected parallel to the first, if the distance does not exceed twelve or fifteen feet, a long stick may be used by driving a nail into the end of the stick to allow some adjustment.

The level is used as before. When the distance is great, or obstacles prevent the use of the stick as suggested, a line may be drawn on the floor of the shop by dropping a plumb line from near the ends of the first shaft and connecting the points located. Another line, directly under the desired location may be drawn by direct measurement and the second shaft erected by dropping a plumb line to this second floor line near the ends of the second shaft. This method may be employed with such variations as the case may demand, even though a floor or wall is between the locations. In levelling up long lines, or around machines, or through walls, the hydzostatic level is the most convenient tool. It consists of two graduated glass tubes set in suitable bases and connected by a rubber tube. When the rubber tube is filled with water, and the glass tubes hung vertically from the shaft, the fluid should stand at the same graduation in each glass. These levels are made with self-acting valves to prevent the escape of the fluid. When pulleys or hangers make the direct application of a level to the shaft impracticable, leveling hooks, in connection with a wooden straight edge are very convenient.

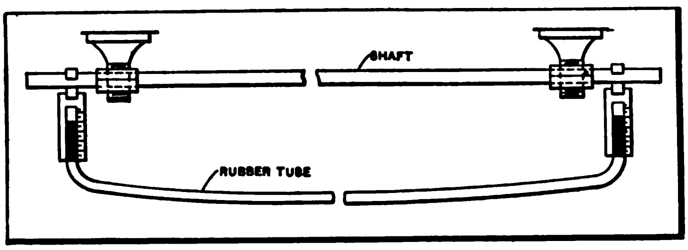


FIGURE 2. THIS TYPE OF A LEVEL MAKES IT AN EASY MATTER TO LINE-UP LONG LENGTHS OF SHAFTING

PULLING POSTS WITH A TRACTOR.

Here is a little job that the tractor will help out with, and one that is a big job when a spade is the tool used. Simply because a tractor is built for plowing and other field work is no reason that it cannot be used for the shorter hard jobs found everywhere. This job is accomplished by a power existing in a tractor which but few persons are aware of, not in particular the power as much as Any wheel rolling on a surface has a point on its rim that does not move forward as does the tractor. This point is where the rim is in contact with the surface on which it is rolling. And any given point marked on the rim at the ground surface moves forward only one third as fast as does the tractor until this point has reached a position as high as the axle of the wheel. This fact makes this post pulling job a practical operation, because a post must be lifted as near straight up as possible when pulling, otherwise it will be snapped off at the surface of the ground before it will be pulled. To perform the job the tractor is driven to the side of the post and a chain is used to snub the post to the rim of the tractor wheel as shown. As the tractor moves forward on low gear the powerful lifting force is given the post and it comes up without any exertion on the tractor more than in ordinary draw bar work.

CLEANING THE TRACTOR PUMP

The water circulating pump on many tractors is driven with a belt and on some it is driven from the fan and the fan driven with a belt from the flywheel or cam shaft. In such arrangements there is a simple method of cleaning the trash from the circulating pump when that part becomes clogged with pieces of material allowed to pass in with the water.

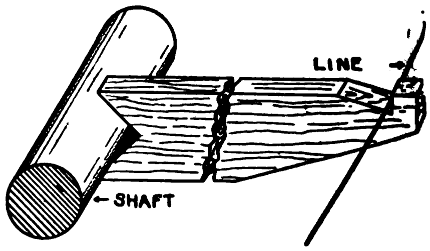


FIGURE 1. THIS SIMPLE TOOL FACILITATES MEASUREMENTS FROM THE SHAFT TO THE LINE.

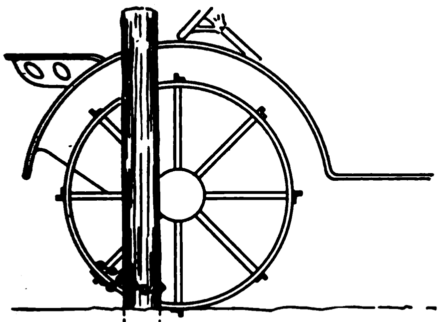
Simply cross the belt which drives the pump and the gears which force the water through will push back such accumulation as may have become lodged against it. As the water is also circulated in the opposite direction it helps to clear away the scales and loose trash.

TIMING THE MAGNETO FOR STARTING.

Magnetos with a snap starting arrangement on must be set so as when the snap turns the armature the points are separated otherwise no spark is made .By the notch and dog which cause the snap, becoming worn the time is changed and it is possible that the advancing lever may need to be placed different for starting than usual. To note this remove the breaker box cover and turn the motor over until the snap is made and at the same time note the points and see if the position is correct.

A sled to move stone on with tractor.

Loading and moving large stones from the field has always been a two or more men's job, but with the farm tractor the same work can be accomplished much easier and

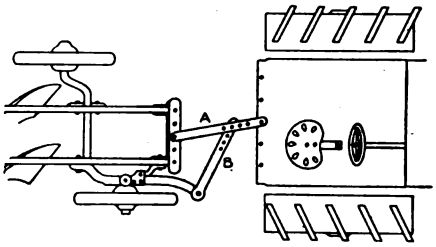


PULLING POSTS WITH A TRACTOR

quicker with one man than formerly with two or three men and a team. To perform this a special made sled is necessary. The sled itself need not be so different from the regular made stone sled, but the connections for the pulling are different. In the stone countries blacksmiths can add to their business by making and showing how this can be used with a tractor to an advantage. The method of operating the device is as follows. A hole is made under the stone with a rod or bar and a 3/8 steel cable or small link chain is doubled and the looped end placed underneath the stone and pulled over the top and attached to a hook on the tractor draw bar. The two ends of the cable are attached to the front end of the sled. Some soil is dug out in order to place the sled as far as possible under he stone. A snatch block pulley made as shown at (A) and attached as with irons (2) holds the front end of the sled straight in line as the stone is loaded. With the two cables within this pulley and the tractor moved forward the stone is rolled onto the sled and as the cable tightens when the stone can be rolled no further, and as the tractor continues forward the sled with its load follows. When the stone pile is reached the cables are taken out from the snatch block pulley and the tractor started again. This action rolls the stone off of the sled and pulls the sled on over the top of the stone as the tractor moves on back to the field for another load. If the holes are made under the larger rocks before the tractor is brought to work the job may continue without stopping the tractor or wasting fuel by its running idle while doing this work.

Attachments to make for using a horse gang plow with the tractor.

Where good gangs are at hand on the farm and a tractor is desired it is not good economy to sacrifice on the sale of the plow and have to purchase one designed for the tractor. And as many of the new tractors being sold are of the two plow capacity this fact is becoming more and more pronounced. Attachments may be constructed by the blacksmith that will make the horse operated gang nearly as serviceable as the tractor designed equipment by making but three parts as here shown. The bar (A) should be double, that is, one on each side of the plow clevis. The bar (C) is attached where the tongue of the plow is removed from and the connecting rod (B) completes the necessary parts. It



AN ATTACHMENT FOR USING THE HORSE GANG PLOW WITH A TRACTOR.

will be noted that as the tractor swings on a corner the bar (A) will swing with it and thus the plow be guided. Holes for different adjustments should be provided for and the device will fit separately.

On most plows the tilting lever may be reversed so as it may be reached from the tractor seat and a long lever attached in place of the foot lifting device and extending forward will make the plow as serviceable as a regular tractor designed plow.

G. G. Mc VICKER

(The Basement Fire Hazard)

Continued from Page 209

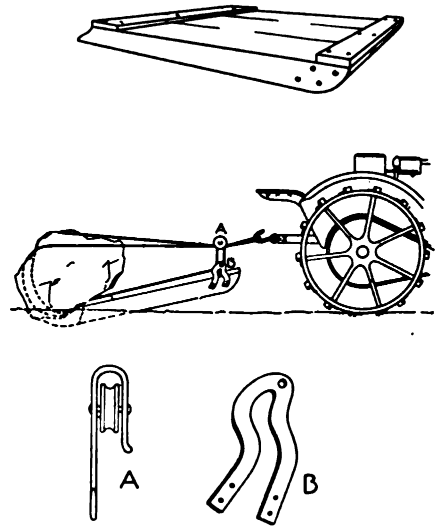
make it their duty to see that this is done, and should also make certain that flammables and explosives are properly safeguarded, that the wiring is standard, that smoking is not allowed, and that the general rules of good housekeeping are observed. By doing this they will protect life and property, keep insurance rates down safeguard their neighbors and the community, and do their share in reducing preventable fire wastes of the country.

HOW DOBBIN PULLS

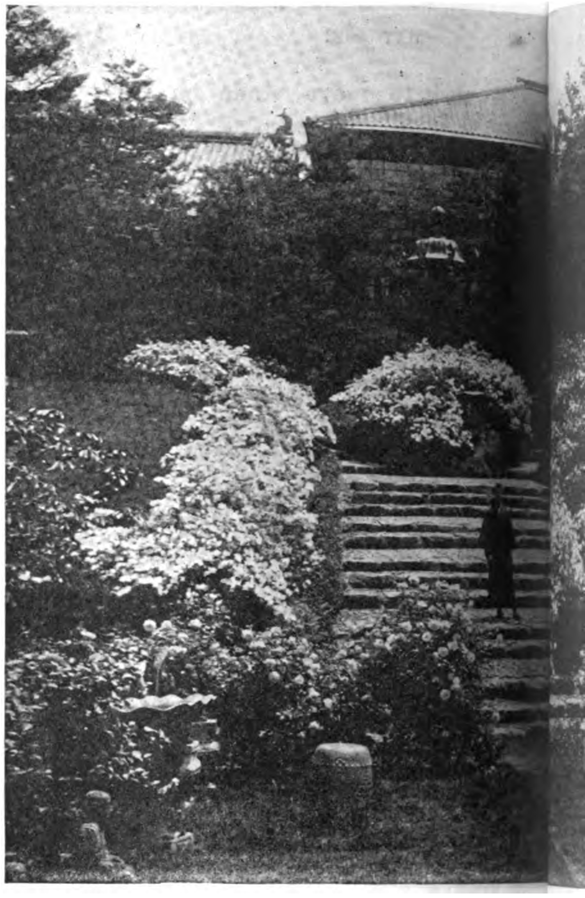
An interesting article regarding the pulling powers of the horse, and how it is effected by the position of the traces, appeared in a recent issue of the Scientific American. Without giving the matter some serious thought, one would not be inclined to believe that the horse's pulling powers were so vitally effected; however, the late Professor King of the University of Wisconsin has made a careful study of the matter, and has arrived at some interesting conclusions. Professor King has designed a special apparatus, which consists of a miniature horse, harnessed to several scales in order to study the effect of the angle of the trace, of the hock muscles and of the distribution of the horse's weight on draft.

To determine the effect of the angle of trace, Professor King attached a steelyard scale to the traces and, back of an arc, a screw with which he could increase the pull of the traces. Then setting the traces at a particular angle, the screw could be tightened until the forefeet of the horse were just raised from their base. In this position he would exert his maximum draft. It was found that when the traces were below the horizontal they exerted more draft than when they were on the horizontal, and

Continued from Page 218



THE HEAVIEST ONES ARE EASILY LOADED THIS WAY.



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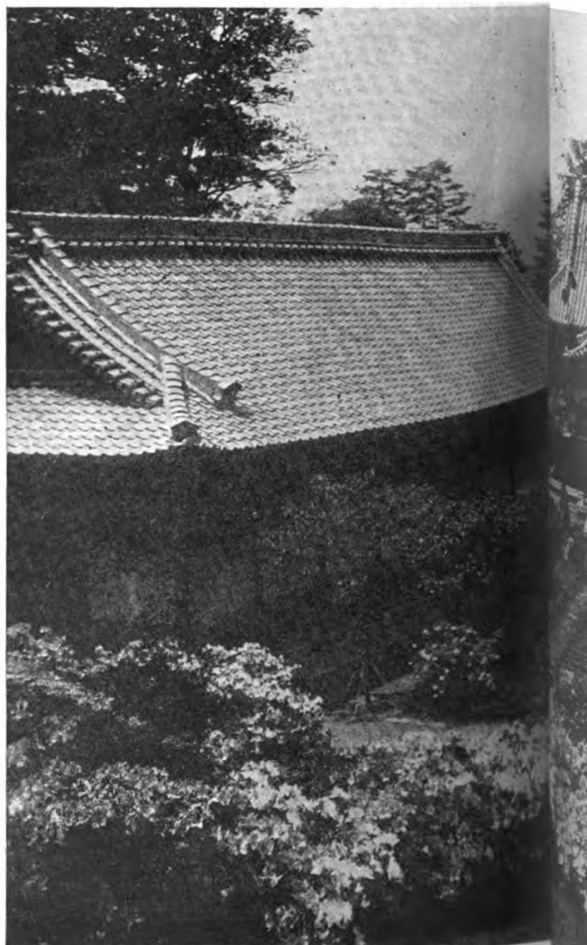
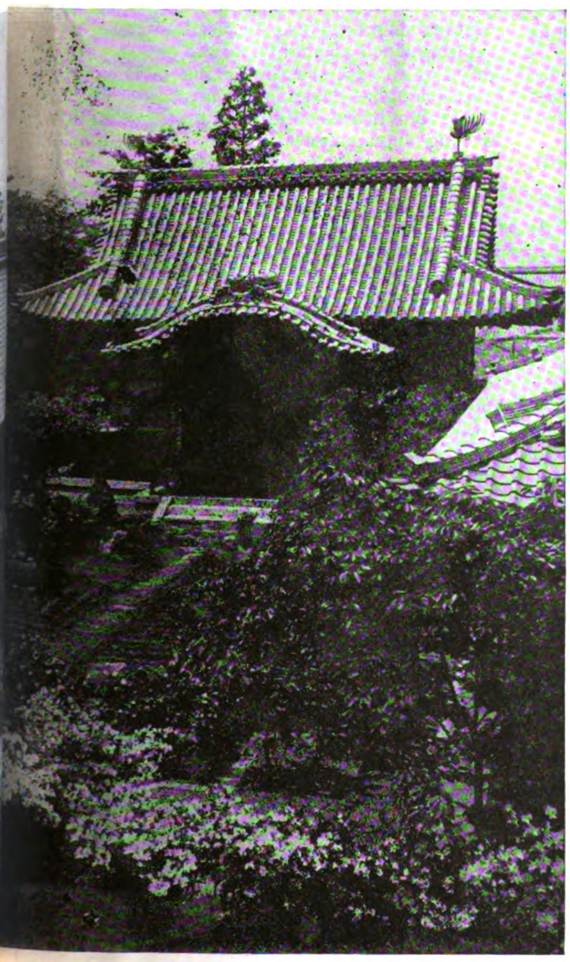
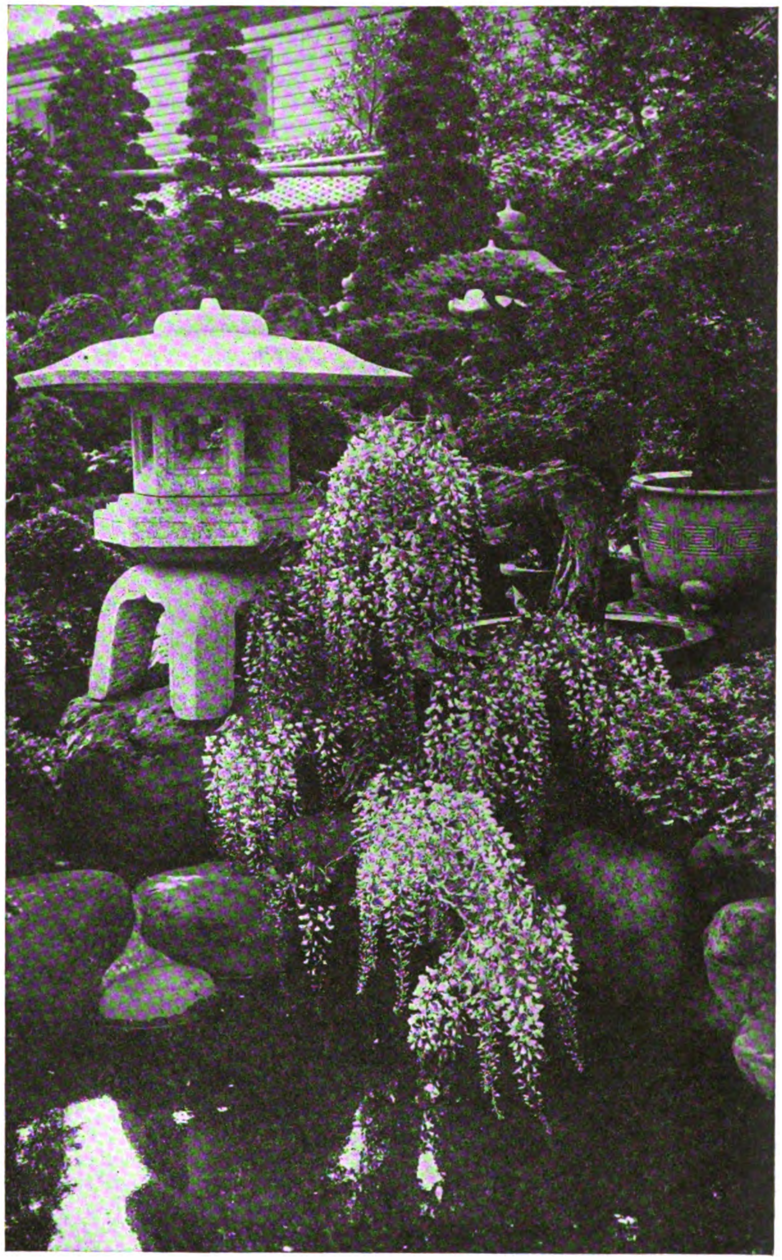
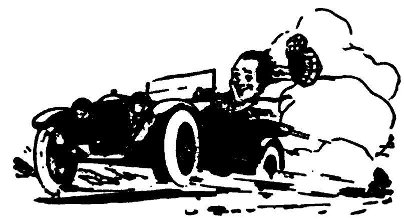


La.utiful Gardens





High Spots



Joseph and Isaac went to hear Billy Sunday preach, and after service, as they were going home Joseph said:

"Vell, Izaac, vat you t'ink of him?"

"I didn't like him," said Isaac. "Too much hell. It was hell, hell, hell all the time. And I don't believe there is any hell, Joseph."

"No hell?" asked Joseph, in amazement.

"No," answered his friend.

"Vell, then Izaac," said Joseph, "if there is no hell, where is bizness gone?"

"Tell me, what is the shape of a kiss?"

"I don't really know."

"Well, give me one, and I'll call it square."

In the Hospital.—An attendant entered carrying a thin red object.

"Did any patient order a postage stamp?"

"Maybee," said one feebly, "that's my mutton chop rare."—Kansas City Journal.

Satisfied.—"I'm sorry, young man," said the druggist as he eyed the small boy over the counter, "but I can only give you half as much castor oil for a dime as I used to."

The boy blithely handed him the coin. "I'm not kicking," he remarked. "The stuff's for me."

An Anxious Moment.—"All right back there?" bawled the conductor.

"Hol' no! hol' on," shrilled a feminine voice. "Jes' wait till I gets mah clothes on."

And then, as the entire carful craned their necks expectantly, she entered with a basket of laundry.—Boston Transcript.

Father's Advantage.—The children of a traveling salesman were having an altercation when their mother interfered.

"You children, of all others, should not be caught quarreling. Why, you never heard your father and me quarrel in your lives."

Little Ann, still sobbing from the hair-pulling her brother had given her, answered "He's—not—home—long—enough."
—Harper's Magazine.

ANOTHER FISH STORY

A very intoxicated man was wabbling along the street in a city one night when he came to a fish market with a large wooden fish hanging out. He immediately knocked on the door and shouted until the proprietor, who lived overhead, opened the window and angrily asked what was the trouble. "Shay mister, pull in; you got a bite," was the answer.

HIS DOUBT

"I am far from being an infidel," admitted the backyard farmer, gazing a trifle ruefully at where his garden had been. "Indeed, I believe the Scriptures, as old man Jucklin said, 'from kiver to kiver.' But in the light of my own agricultural experience this past season especially in planting and nurturing congressional garden seeds, I cannot help wondering a little about the text of Scripture which says that what a man sows that he shall reap."

Saying it Quickly.—A quiet way of "saying it with flowers" is to send "mums".—Vancouver Province.

Giving and Getting Back.—Christmas gifts fall naturally into two classes—presents and reprisals.—Montreal Star.

Many and Much.—Modern feminine attire displays many freaks of nature and much of them.—Peterboro Examiner.

Somebody Step on It.—Most of the snow shovels I saw yesterday morning were running on low gear.—Kitchener Record.

Fire Prevention.—In times like these fire prevention consists in working like fury when the boss is in sight.—Kingston British Whig.

Thirsty Sponges.—Between some men and sponges the only apparent difference is that sponges will take water.—Quebec Telegraph.

A Real Suggestion.—A merchant points out that there was no luxury tax on spats. Then why not an amusement tax.—Montreal Star.

One Short.—Caproni plans to build a giant aeroplane to carry 300 passengers. The day our turn comes only 299 will go up.—Ottawa Journal.

Heraldry for Every Day.—An appropriate coat of arms for many a family would be crossed yeastcakes surmounted by raisin.—Cobalt Nugget.

And With Reason.—"Teaching is a calling," declares the Alberta Teachers' magazine. Lately it has been a calling for more money.—Calgary Herald.

Where Sinners Stand.—Constantine will doubless keep in mind that his throne is a Greecy one. He has already slipped off twice.—Stratford Beacon.

Deadhead.—About the only person who doesn't seem to be paying for the war is ex-Kaiser Willhelm, Holland's prize refugee.—London Advertiser.

Getting it all at Once.—A Boston woman left half a million dollars to her hired girl, but the usual custom is to pay it to the lady in weekly or monthly installments.—Toronto Star.

A Hearty Appetite.—"How about a nice canary for Christmas?" asks an exchange. Speaking for ourselves, we prefer the usual turkey, even if the price is high.—Kingston British Whig.

That Changeable Complexion.—Right up to the minute was a Florida man who, in advertising for his lost daughter, included this in the inscription: "She was a blonde when last seen."—Cobalt Nugget.

Doesn't Work Both Ways.—The fellow who doesn't like to have to punch the clock at the office each morning usually is the guy who insists his wife ought to have dinner ready on the minute that evening. —Brampton Conservative.

Can't Blow Their Noses.—Crime is reported so rampant in some wicked cities in the "Wild East" that visitors arriving there take their lives in one hand and hang on to their valuables with the other.—Vancouver Province.

The Fly in his Ointment.—A Chicago poodle has fallen heir to $8,000, the dispatches tell us. The will of his late owner, a spinster, stipulates that poodle shall be given a daily bath, plenty of sauerkraut, and a Christmas tree each year. But why punish the poor animal with sauerkraut?—Border Cities Star.

Inside Stuff.—A heading in a recent issue of the Record announced "Artists See What Other Folks Miss." An old subscriber drops in to tell us if what he reads in Robert W. Chambers' novels is to be depended upon they sure do!—Sydney Record.

May Be Our Mistake.—Nobody ever thinks of looking in the mirror for the missing link.—Cobalt Nugget.

Where Consistency is Needed.—Variety is the spice of life and the downfall of liars.—Kingston British Whig.

The Small Town Habit.—Every little burg seems to have a burglary all its own these days.—London Advertiser.

Let's Settle This Thing.—Let D'Annunzio meet De Valera for the pest championship.—Toronto Mail and Empire.

Suspicious Sang Froid.—A regular guy is always a little suspicious of the man who feels at ease in the presence of ladies. —Fredericton Mail.

A Good Bringer.—"A leader must be able to bring the truth home to his people," declares an essayist. Also the bacon. —Kingston British Whig.

An Armful.—The fashion headliner who remarks that the "Blouse Occupies Important Place" said what we should call an armful.—Sydney Record.

Horrors!—Landlord in Hamilton, unsolicited, reduced his tenant's rent $5 a month. What if that sort of thing should spread!—Owen Sound Advertiser.

Never Monotonous.—One advantage of drinking wood alcohol is, as the thoughtful coroners all say, that one drink is usually quite enough.—Saskatoon Star.

The Novitiate.—Many a man believes in long engagements on the theory that the longer a man's engaged the less time he has to be married.—Regina Post.

Life's Little Paradox.—Time flies. The young lady who, as a child, went to bed with a warm flatiron at her feet now wears low shoes in the snow.—Fredericton, N. B., Mail.

Pickled Pork.—Two hundred cases of American whisky and gin have been found in a hog pen at Thorold. It is presumed the pen was occupied by a blind pig.—Quebec Telegraph.

Cheap Rent.—

He dropped his nickel in the plate,
And meekly raised his eyes,
Thankful his rent was duly paid
For his mansion in the skies.
—Canadian Opinion.

Hardly the Perfect Gentleman.—A woman sues her husband for divorce saying he rubbed butter in her face. A proper cause, considering the high price of butter.—Brockville Recorder and Times.

Where Overcoats are Unseasonable.—A man went to church in Montreal a day or so ago and his thousand-dollar fur coat disappeared. He says it was probably taken by someone who won't need it in the next world.—Toronto Star.

More Speed Potward.—Senator Capper of Kansas says the farm industry in the United States is "going to pot". The fact is that farm products are not going to pot quickly enough and in sufficient quantities.—Toronto Globe.

Benton's Recipes

To Protect Iron From Rust:—The following fluid is claimed to prevent the rusting of iron: 1¾ pints of each of linseed oil and brown varnish, 1 quart of turpentine, and 1½ ounces of camphor. Heat the mixture over the waterbath, stirring constantly, then immerse the articles for a few moments, rinse them off with warm water, and dry.

To Protect Lightning Rods, Metal Roofs, Etc., From Rust:—Convert 2 parts of graphite mixed with 8 parts of sulphide of lead and 2 of sulphide of zinc into an impalpable powder, and add gradually 30 parts of linseed-oil-varnish previously heated to the boiling point. This varnish dries very quickly and protects the metals coated with it from oxidation.

To Protect Wire from Rust:—Melt mineral pitch and add to it 1/15 part by weight of coal-tar and 1/20 part by weight of very fine quartz sand, and immerse the wire in the mixture. The coating becomes hard in 24 hours.

To Protect Iron and Steel From Rust:—The following method is but little known, although it deserves preference to all others: Add 1¾ pints of cold water to 7 ounces of quicklime. Let this mixture stand until the supernatant fluild is entirely clear. Then pour this off and mix it with enough olive oil to form a thick cream, or rather to the consistency of melted and recongealed butter. Grease the articles of iron or steel with this compound, and then wrap them up in paper, or if this cannot be done apply the mixture somewhat thicker.

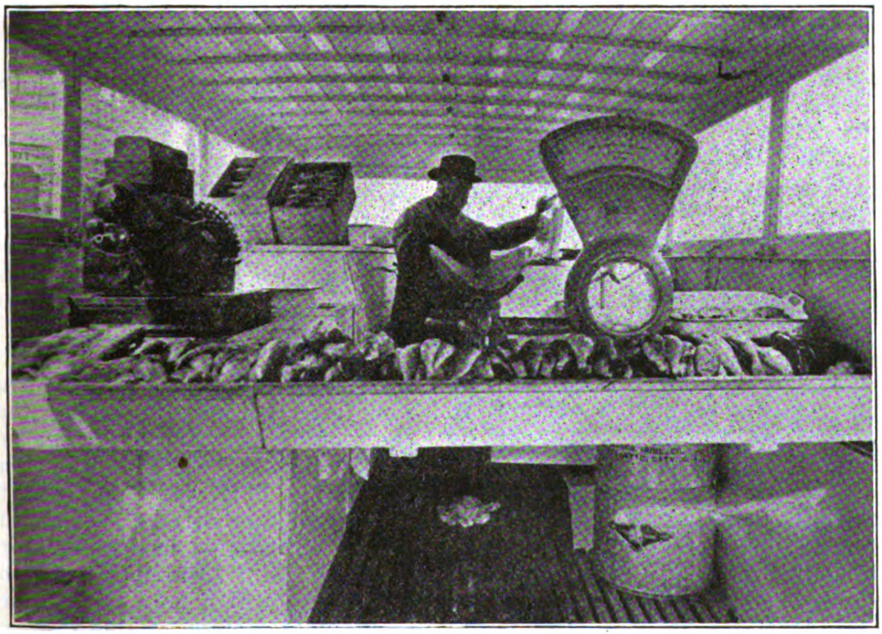
Cleaning Guns With Petroleum: — Cleansing a weapon with fats and oils does not entirely protect it from rust; the so-called drying oils get gummy and resinous, while the non-drying oils become rancid, and by exposure to the air acids are formed, and these attack the iron. For these reasons petroleum is to be preferred for this purpose. Petroleum is as great an enemy to water as are the fatty oils, and hence, when a gun-barrel is covered with a film of petroleum, it keeps the water away from the metal. The water resisting upon this film evaporates, but the oil does not, and hence no rust can be formed. It is very essential, however, that the petroleum employed be perfectly pure, for impure oil, such as is often met with in commerce, attacks the metal. Care must also be taken not to allow it to come in contact with the polished stock. When about to clean a gun some tow is wrapped around the ramrod and enough petroleum poured upon it to thoroughly moisten it; it is then pushed in a rotary manner through the barrel and back a dozen times, and the tow taken out and unrolled, and the upper and lower ends of the barrel rubbed with the clean part, after which it is thrown away. This removes the coarser portion of the dirt. A round brush of stiff bristles and fitting the barrel is now screwed to the ramrod, then moistened thoroughly with petroleum and twisted into the barrel, running it back and forth at least a dozen times, thus loosening the dirt that is more firmly attached to it. The first operation is now repeated, except that the tow on the ramroad is left dry, and the rubbing with this must be continued in all directions as long is it comes out soiled. The use of wire brushes is objectionable for cleaning guns, as the numerous steel points cut into the tube. Only soft tow, hemp, woolen rags, or the like should be used, as the petroleum dissolves the dirt sufficiently.

Lubricants for Redrawing Shells—Zinc shells just before reloading sometimes grit and should be immersed in boiling hot soap water. They must be redrawn while hot to get the best results. On some shells hot oil is sometimes used in preference to soap water.

For redrawing aluminum shells use a cheap grade of vaseline. It may not be amiss to add that the draw part of the redrawing die should not be made too long, so as to prevent "too much friction," which causes the shells to split and shrivel up.

For redrawing copper shells use good thick soap water as a lubricant. The soap used should be of a kind that will produce plenty of "slip"; if none such is to be had, mix a quantity of lard oil with the soap water on hand and boil the two together.

ROLLING FISH MARKET, LATEST NOVEL IDEA IN THE COMMERCIAL LINE.



AN AUTOMOBILE FISH MARKET WHICH IS TO SUPPLY INLAND TOWNS HAS JUST MADE ITS APPEARANCE IN ATLANTIC CITY. FROM DISPLAY WINDOWS TO A COMPLETE MARKET INSIDE, NO DETAIL HAS BEEN OMITTED. IT IS ELECTRICALLY LIGHTED AND EQUIPPED WITH MODERN SCALES AND CASH REGISTER. ROOM FOR A TON OF FISH IS PROVIDED, AS WELL AS SPACE TO ACCOMODATE SIX OR SEVEN CUSTOMERS.

Starting System Repairs and Adjustment

In the preceeding issue the article on this subject concluded with instructions for setting the third brush on the Ford generator so that the proper charging rate would be attained. In continuing the discussion, we will pick up the threads where we left off, and proceed with other repair suggestions regarding this unit.

When the proper charging rate is attained, the nut on the post should be drawn down. Since this nut draws down on the two fibre pieces, a little care is necessary to see that it is not tightened sufficiently, to cut through the fibre causing a ground.

Next, install the dust cover, making sure that the pigtails and all the other wires are in position so that they will not touch the dust cover, bracket or yoke, causing a ground. Also see that the field leads are not touching the armature, as the coils will soon wear through causing a short or ground. It is necessary to use only the top screw in securing the cover. The new styles are coming through with only one screw.

The new part that we will discuss in detail is the armature. There is small likelihood of trouble developing here unless the generator has been subject to abuse, such as running it without having the necessary ground connection or the complete connection to the storage battery. When the generator is run without the proper connection all the current is drawn off through the third brush passing through the field, thus the current and voltage becomes greater than the wiring is built to withstand, and in a very short time; in reality only a matter of a few minutes, the generator will be burned out.

If the leads from the field coils and the terminal post are allowed to rub on the armature, the insulation will be worn from the coil to commutator leads,thus causing a short or ground. If, by any accident water gets inside the housing, it will also cause a partial ground. If no testing apparatus is available, trouble in the armature may be detected by substituting a new armature. Unless one is thoroughly familiar with the work, it would be better not to attempt winding the damaged armature.

The armature may be removed by running out the screws which hold the front end bracket to the yoke. The bracket together with the armature, may then be withdrawn by tapping the edge of the bracket with a rawhide mallet, at the same time pulling on the end of the armature shaft with the other hand. To remove the armature from the bracket drop the assembly on a block as shown in B of figure 1. Striking the bracket as shown by A of the same figure is a poor practice as there is a possibility of springing the shaft, and a greater length of time is required for the operation when it is performed ths way.

The armature should be inspected to see that the mica is undercut.

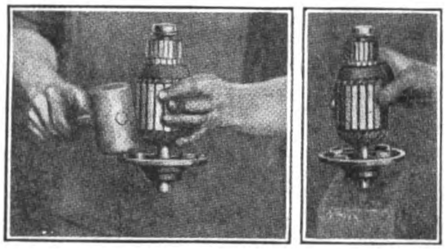


FIGURE 1. A. & B. REMOVING THE ARMATURE FROM THE BRACKET.

If the brushes ride on the mica, excessive heating will result. The mica should be undercut from 1-64 in. to 1-32 in. as shown in figure 2 B.

When this work is undertaken, care should be exercised to remove the mica clear to the edge of the copper. Do not leave it as shown in A of figure 2, as this is just as bad as leaving the mica all the way across.

If the generator has been water soaked, a leak of current will occur, causing a partial ground. In some cases this may be detected by the test lamp, placing one terminal on the commutator segment and the other on the shaft or lamination of the armature. This is clearly shown in figure 3. A ground will cause the lamp to burn brightly; a slight leak will allow the lamp to glow; if the lamp does not light at all there is probably no leakage between the coils and the shaft, indicating that any trouble in the armature is not caused by a ground. As there are two wires connected to each segment of the commutator it is impossible to test for an open circuit with a test lamp.

If the armature has become water soaked, it should be dried out in a warm oven, where the temperature will not exceed 250 degrees Fahrenheit. If the commutator has been worn rough, it is necessary to clean it up on a lathe.

Before replacing the armature, see that the ball bearings are tight on the shaft and that they turn freely. See that the felt washer is in good condition on the commutator end and that the steel washer is tight on the gear end. The first generators had a felt washer on the gear end. In case where armatures are repaired having this old style felt gasket, it is well to remove it and install the steel washer in its place. The bearings are removed on an arbor press. In replacing those bearings, they should be forced down to the shoulder of the shaft. The difference in the diameters of the two ends of the shaft should be noted, as the bearing for the shaft are not interchangeable.

Before replacing the armature, assemble it to the front end bracket, position the bracket on the bearing and drop the assembly on the block as shown in B of figure 1, only this time strike the other end of the shaft and drive the bracket on. Next see that the brushes are raised and held up by the spring. Wipe out the bearing seat in the brush end bearing and insert the armature through the yoke, tapping the bracket into position. Insert and tighten the two opposite screws, set the brushes on the armature and connect the wires to the terminal, running the generator as a motor. If it runs indicating that the trouble has been overcome, set the brushes and see that they bear properly. This was explained in the preceeding article. When the proper adjustment has been attained, insert and tighten the rest of the screws which hold the bracket to the yoke. Each of these screws are locked into position by means of a lock washer. When this is done assemble the generator to the engine, make all connections to the battery through the cut-out and then start the engine. Set the third brush and assemble the dust cover. This also was explained in the former article. If there is too much end play in the armature shaft, tighten the bearing in the brush end bracket. This may be done by setting a punch on the bearing housing and the bracket

A
Improper Method of Undercutting Mica.

B
Proper Method of Undercutting Mica.

FIGURE 2.

and striking it with a hammer. This operation is shown in figure 4. One tap usually suffiices.

It is impractical to detect short circuits in the armature without the use of a growler or complicated tests with a voltmeter. For that reason it is better to return that part of the generator to the factory if it is found defective, rather than to attempt the repair.

The next part that should occupy the repair-man's attention., is the brush holders. They should be inspected to see that they are not cracked and that they are securely riveted to the support. The brushes and that they are securely riveted to the support. The brushes should be free in the holder so that there is no danger of their being held off of the commutator. It sometimes happens that a deposit forms on the holder thus causing the brush to bind. If this occurs, withdraw the brushes and file the hole in the holder. Do not file away the brush, simply remove any high spots which may appear on it. At this time we might remark, that due to excessive heating caused by a dirty commutator, high mica or improperly seated brushes, the solder which holds the pigtails on the brush may flow, causing the brush to stick to the holder. The solder on such a brush should be filed off flush with the surface. A new brush should be inspected to see that the solder is flush with the surface at this place, before it is placed in the holder.

If the holder is loose on the support, it may be tightened by peening the rivets. When tightening the positive (insulated brush holder), take care not to crack the insulation. The third brush holder is not secured by means of rivets, but is held by a stud, nut and lock washer. Sometimes the nut may be drawn down too tightly, causing the head of the bolt to cut through the insulation; which causes a ground between the insulated holder and the support. Such a ground may be proved by holding the terminal of a test lamp, operating on a 110 volt circuit, on the holder and the other terminal on the support. If a light shows the holder is grounded.

Test the springs to see that they are not riding on the edge of the holders; but are exerting their full strength on the brushes. To do this raise the brush by means of the pigtail about 1-8 of an inch. It

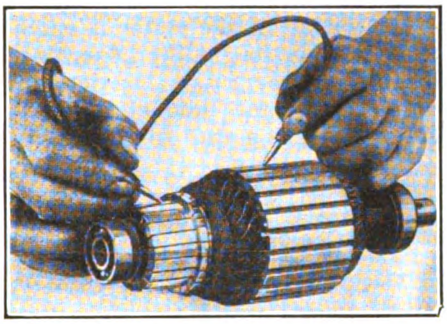


FIGURE 3. TESTING THE ARMATURE FOR A GROUND.

should, when released drop back onto the commutator with a sharp click. If the spring is riding against the side of the holder, it may be bent back to fit properly. If the spring has become weakened it should be replaced. This is done by removing the support and inserting a knife in the slot to spread the post, after which the spring may be withdrawn. The new spring is then in position and the slot in the post closed. The springs will be weakened by overheating, due to loose pigtail connections, which cause the current to be drawn off by the spring instead of the pigtail.

The brush holder support should also receive some attention. The earlier models of brusholder supports had short slots in the mortise, thus the movement for adjustment of the external current brushes was much smaller. If it is found that the proper neutral setting cannot be obtained where this style of holder is used, a new brush holder and support assembly should be installed. The position of the rivets which hold the insulating fibre to the support has also been changed since this equipment was first brought out. This new position prevents the fibre from rising between the two insulated brushes.

That little back mystery box, the cut-out, was treated pretty thoroughly in an article devoted entirely to that subject, however, there are a few suggestions that may be offered in passing that may be of value to the mechanic who wishes to familiarize himself with this part of the equipment. The cut-out is an electro-magnetic switch. It acts in the electric circuit the same way as a check valve acts in a pipe line. It allows the current to flow only in one direction—from the generator through the battery.

Figure 5 shows a wiring diagram of a cut-out. It consists of two coils and a pair of points. One of the points is set on a spring armature which holds the points apart until acted upon by the magnetism set up in the core. The wire leading from the generator is attached to the armature point. A wire attached to the stationary point makes a few turns around the core and is secured to the terminal, from which a wire leads to the ammeter, and thence to the battery. A fine wire leading from the generator wire is coiled about the core and is grounded to the yoke or frame of the car.

A knowledge of the following facts about electro-magnets is essential to the understanding of the operation of the cut-out:

First, when current is passed through a coil, the coil takes on the property of a magnet.

Second, the lines of magnetic force flow in one direction, according to the direction of the electric current in the coil.

When the engine is not turning over the cut-out points are open, as the engine picks up speed, the generator voltage builds up until sufficient current passes through the fine wire coil to draw the spring

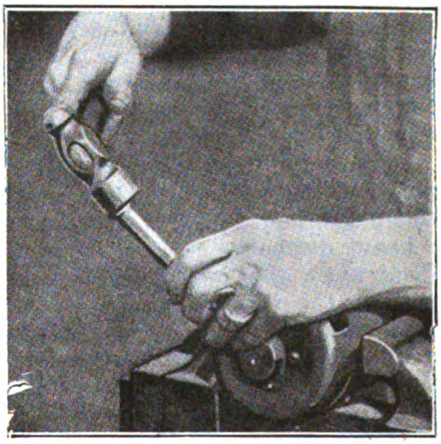


FIGURE 4. TAKING UP THE ARMATURE END PLAY.

armature down, closing the points. This closes the generator to the battery circuit, and, as the resistance through the coil is less than through the fine wire coil, practically all of the current flows through the battery. When the engine slows down and the generaor voltage drops to below the battery voltage, the current in the coil is reversed, the flow being now from the battery instead of to the battery. Thus, the magnetic lines of force become weaker and weaker until they pass the neutral point and start to act in the opposite direction. But when the neutral point is reached, the spring armature recoils, drawing the contact points apart, thus stopping the flow of current from the battery.

Once properly adjusted, the cutout should never need any care unless disarranged by some outside force or disarrangement of the system. If the base or cover is sprung by striking it, the instrument may be thrown out of adjustment.

The ammeter, or as one writer so aptly called it, "The watch dog of the battery," indicates the amount of current flowing through the battery when the generator is running at a charging speed, and the amount of current which the lamps and ignition are drawing from the battery when the generator is not cut in.

The automobile ammeters are only commercially correct, that is within 10 per cent., so that if it reads 13 amperes as the high charging rate, it is not necessary to change the third brush.

The hand on the dial should, however, register zero when the lights are off and the engine is not running. However, the hand may be off one point either way without danger to the system.

If it is on the discharge side disconnect the battery to the ammeter wire at the meter to make sure that the meter is not registering a leakage of battery current. If the hand returns to zero the wiring should be inspected for a ground.

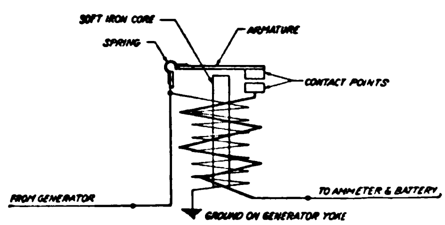
Care should be exercised that none of the wires are allowed to touch any metal part of the car, as a heavy discharge of current might disarrange the meter. When installing the wires it is advisable to wait until all the other connections are made before attaching the battery to ammeter wire to the ammeter terminal.

If any repairs or adjustments are found necessary to the ammeter, it should be returned to the factory as it is virtually impossible, without special equipment, to repair them.

A word in regard to the starting motor may not be altogether out of place. The starting motor is of the series wound type, that is, when the switch is in, the current passes from the battery through the field to the positive brushes into the commutator, then through the armature to the ground brushes.

To decrease the resistance there are two positive brushes and two ground brushes, half of the current passes through half of the field coils, and one of the positive brushes, the other half of the current flows in a similar path.

The wiring of the motor is much heavier than that of the generator, because it carries a heavier, or rather a greater flow of current. The motor has a stall torque of between 14 and 16 foot pounds and draws between 175 and 225 amperes when turning over an engine, depending on temperature and the amount the engine has been run in.



WIRING DIAGRAM OF GENERATOR CUTOUT
Figure 5.

There are no ball bearings in the starting motor. The brush end bearing is self-lubricating. The mounting bracket arm has a babbitt bearing for the bendix drive and a bronze bushing for the armature shaft. The last two bearings are lubricated by the oil in the transmission. The brush end bearing requires no lubrication as the motor is seldom run for more than a few seconds at a time.

Because of the short duration of its operation, the motor requires very little attention. However, it should be removed and overhauled one a year to ensure efficient operation. A back fire may spring the armature shaft or disarrange the bendix drive making repairs necessary.

If the motor fails to turn the engine over, test the battery, inspect the wiring and try turning the engine over by hand before removing the motor.

(Continued from page 211)

that the draft increased as the traces were raised; at an angle of twenty degrees the horse could exert twice as much draft as at the zero degree. The traces at an angle have two effects. One of making it more difficult to raise the horse off of his feet, and the other, tending to lift the wheel of the vehicle over obstacles rather than trying to drag it over them.

The hock muscle is probably of as much importance as the angle of trace. It is the straigtening of this muscle that pulls this load forward, so that the stronger the muscle the greater the load moved. In the model the tension of the hock was about twice that of the draft and, while the same may not be true of the living horse, it serves to show how strong the muscle must be to pull as it does.

Men may change the angle of the trace, but they cannot change the hock muscle nor can they change the distribution of weight. The horse must be selected with regard to the last two for the distribution of weight is also important. The horse is a lever with a fulcrum at the hind feet and, properly placed, weight will greatly influence his ability to pull. Using movable weights Professor King found that when weights were placed at the center of the animal and the traces at the horizontal, the horse could exert an additional draft equal to the weight added; but that if the traces were at an angle of twenty degrees, the increase was double the weight. Other things being equal then, the heavier the horse the greater the draft. When the weight was placed at the forequarters, the increase in draft was more apparent; but when the weight was at the hind quarters, the effect was less. This is what one would expect since the longer the lever arm the more effective the weight operating on it. Therefore, the desirable draft horse has heavy forequarters and not so much weight in the hind quarters, substituting there a strong hoek muscle for weight.

The model horse is still working, for it is now being used by the students to determine for themselves the truth of Professor King's findings.

The Necessity of Efficient Accounting

BY D. G. BAIRD

SOME time ago I found that a friend of mine had entered the garage and accessory business and was cutting prices to an alarming degree. Knowing that he had very little business experience, I questioned him at some length as to his system of accounting, margin of profits, and the like, but the only definite information I could get was that his daily business was totaling up to a handsome figure and that he was literally intoxicated by what he considered his remarkable success.

I reminded him of the necessity of careful accounting in such a business, mentioning several items which I felt sure he was overlooking, but he laughed awav my fears and continually returned to the subject of the volume of his business.

Less than two months later, this same young man was working for wages. He had done big business, but he had failed to properly reckon the costs.

This, of course,—failure in business—is the worst result of the well-known tendency on the part of retailers to neglect their account-systems, but it is by no means the only undesirable result of such practice.

A garage was recently destroyed by fire. The owner was a man who had "a good head for figures" and he knew almost exactly the extent of his loss, but the insurance adjuster doesn't settle on the basis of such estimates. In the absence of an accurate written account, he makes his own estimates—and the garage owner had to accept a sum considerably less than his actual loss, in spite of the fact that he had been fully insured before the fire.

Another very important reason for keeping an accurate account of one's business is the fact that banks are paying more and more attention to the accounting methods of the one who comes to them seeking credit. They are willing to grant larger loans, and often times on more liberal terms, to the one who keeps his books so that they can see at a glance how his business is prospering. Even though a man is successful, if he cannot show it by his books they will not consider him a desirable credit risk.

Many men keep an accurate account of income and disbursements, but fail to allow for depreciation on stock, buildings, fixtures, tools and other things subject to age or wear and tear. The shortsighted one thinks that because his truck is earning so much a day, while his gas, oil, and repair bills are only so much a day, he is making money; but the time is coming when his truck is going to be worn out and he is going to face an expenditure of several thousand dollars for another. If he were wise he would carefully estimate the life of his truck and would then figure so much for each day's deprecation on the machine. Then when the time came to buy another truck he would have the price of his old one to invest in the new.

Another common oversight is that of failure to charge interest on money invested in the business or rental on property owned and used by oneself. It may be that one who could earn only six dollars a day as a workman can earn eight dollars a day in business, but if he has to invest $10,000 in his business in order to do so he had better keep his job and lend his money on interest.

The man who is in business for himself is entitled to a higher wage than he would receive as an employe. As his own employer he has all the responsibility upon himself and will naturally work much harder than he would otherwise. Likewise, any member of his family who assists in the work is entitled to be credited with wages whether the wages are actually paid or not.

Incidentals are small bills that don't amount to much individually, but which amount to a great deal collectively. Postage, telephones, telegrams, stationery and office supplies, canvassing, and the like should be carefully charged to this account.

Taxes, insurance, water, lights, fuel, and other such items should be charged under fixed accounts.

We might continue such a discussion almost indefinitely, but possibly a summary of definite rules for efficient accounting will be more helpful. To sum up, then:

First—Charge interest on the net amount of your total investment at the beginning of your business year, exclusive of all real estate.

Second—Charge rental on all real estate or buildings owned by you and used in your business at a rate equal to that which you would receive if renting or leasing it to others.

Third—Charge, in addition to what you pay for hired help, an amount equal to what your services would be worth to others; also treat in like manner the services of any member of your family employed in the business, but not on your regular payroll.

Fourth—Charge depreciation on all goods carried over, on which you may have to reduce the price because of change in style, damage or other cause.

Fifth—Charge depreciation on buildings, tools, fixtures, or anything else that may suffer from age or wear and tear.

Sixth—Charge all fixed expenses such as taxes, water, lights, fuel, insurance, and the like.

Seventh—Charge all incidental expenses, such as postage, telephones, telegrams, canvassing, drayage, office supplies, etc.

Eighth—Charge losses of every character including goods stolen or sent out and not charged, allowances made to customers, bad debts, etc.

Ninth—Charge any expense not enumerated above.

Tenth—When you have ascertained what the sum of all sums of all the above items is, prove it by your books and you will have your total expense for the year; then divide this figure by the total of your sales and it will show the per cent which it has cost you to do business.

Eleventh—Take this per cent and deduct it from the price of any article you have sold, then substract from the remainder what it cost you (invoice price and freight), and the results will show your net profit or loss on the article.

Twelfth—Have your books audited from time to time and place the auditor's statement in a safe deposit box in the bank or some other safe place. Don't rely on your office safe. A monthly audit is usually most practical for a small business.

Overhaul Your Overhead

BY ROBERT FALCONER

YOU can't make an automobile run better by simply sitting down and philosophizing about it. No amount of thoughtful meditation will make a cracked spark plug work better, will adjust a worn bearing or clear the cylinders of a badly carbonized engine. There is only one way to put a poorly running car into condition and that way is to give it a thorough overhauling. To take it all apart, clean the parts, renew badly worn parts and carefully adjust each part when it is put together again.

Exactly the same holds true of business. Just thinking and talking about the business doesn't help unless that thinking and talking is followed by action. Most businesses do need action, do need a thorough overhauling. They have carbon in their cylinders, their parts are out of adjustment, there is poor ignition, some parts haven't seen oil for ages, but most disastrous of all, there are Packard parts in a Ford business. The parts are excellent in themselves but they don't fit the business and they most certainly do not improve the running condition.

There is one part of every business that has more than anything else to do with its running condition. It might be called the chassis of the business and it should be thoroughly overhauled at least once a year if the business is to run along smoothly and the profits earned are to prove satisfactory. This part is the overhead or the fixed expenses of the business. It includes all those expenses which would go on if the business was closed down for a week.

To the average business man the overhead seems something intangible, something light and airy that he can't get his hands onto, but which is gradually strangling the business. You know there are only five per cent. of the men who enter business who make a success. The remainder either fail outright or just merely exist. They do not make as much money as they would if they worked for some other concern and drew a regular salary. The cause of most of these failures can be traced directly to overhead. If the overhead was overhauled each year there would be far fewer failures and many, many more decided successes.

The overhead is not in reality as intangible as it seems. It can be taken apart and the parts examined as easily as is the case with an automobile or a lumber wagon. To show how simple the process is the following directions for overhauling the overhead are given:

The first thing to do is to divide the overhead up into these twenty parts:

1—Taxes paid on all property connected with the business.
2—Insurance premiums paid for fire, liability and other insurance on the business.
3—Cost of fuel used to heat the building or buildings occupied.
4—The rent paid or the rental value of the space used.
5—The salary the business pays you.
6—The salaries and wages you pay your employes.
7—The money paid out for advertising.
8—Telephone rental.
9—The interest on the money invested in shop machinery.
10—General shop expenses, such as cost of carrying material in stock, rental value of space occupied, etc.
11—General expenses of the office.
12—The money invested in office equipment.
13—The depreciation of buildings, machinery, equipment and property of the business.
14—The money invested in general equipment.
15—Repairs to equipment and buildings.
16—The value of material and parts lost through carelessness or theft.
17—Donations made to charitable and patriotic societies.
18—Bad debts.
19—Interest on the capital invested in the business.
20—The life insurance you carry made payable to the business as beneficiary.

Now that we have the overhead all pulled apart we can examine each part separately and discover if it really fits the business, or is too small or too large We can also learn if each part is doing all it should to speed up the prosperity of the business.

In looking over the tax bills for the property used in connection with the business it is well to consider if all this property is needed by the business. Could any of it be sold or rented without hampering the business? If it could the overhead expenses of the business can be cut down by just so much.

It is not good business to pay insurance premiums on policies having face values greater than could ever be collected. The only way to determine the amount of insurance to carry, that is insurance that is not fixed by law such as employer's liability insurance, is to take a careful inventory. Fire insurance that is not based upon inventories and fire insurance that is carried without taking frequent inventories, usually means money that is not well invested for the only way to collect the maximum amount of insurance is to have a copy of a recent accurate inventory in your safe deposit box. Take an inventory at once and find out if your insurance policies are for the right amounts.

Are you using more fuel than is necessary? Can you make any change in your heating system or in any of your operations that will cut down the cost of fuel without reducing the efficiency of the plant?

Are you using more space than is required for your business? Are you paying more rent than is necessary? Could you move to cheaper quarters without hurting the business or could you sub-let part of your space? Whether you own the property or not the rental value of the space occupied should be charged to the business. If the business cannot pay this rent less space should be used, cheaper quarters occupied or the revenue of the business increased to the point where it can pay the rent.

Do you pay yourself a regular salary? If not you are cheating yourself. If the business does not pay you as high a salary as you could draw from some other concern you are losing money by remaining in business. You would be better off working for some one else.

Are you paying the salaries and wages to your employes which result in the greatest return to the business? Sometimes salaries and wages too low are as bad for the business as salaries and wages too high. The object is to secure the greatest possible returns from your salaries and wages. Would higher priced or lower priced labor increase your profits? Is every man doing the work he can do best and is each job being done by men whose skill and wages are best adapted to that particular job?

Is the money paid for advertising resulting in the increased business that could be expected from the money invested? Can you use more effective copy in the space you pay for? Are you using the best mediums in which to advertise? Are you spending too much or too little for advertising and before spending any of this money do you carefully investigate the conditions to determine what returns you should expect? Money can be wasted or invested in advertising. The aim of every business man should be to invest it carefully.

Is your telephone service paying for itself? Could you secure a cheaper service or could you make a greater use of your present service to increase business? Do you use the telephone to save time and to increase business? Could you telephone to more prospective customers and thereby increase your business and make the telephone service more than pay for itself, make the telephone one of the most profitable conveniences or necessities in your business? Most business men can make their telephones earn a great deal more for them than they are earning at the present time.

Shop machinery often makes or breaks a repair man. If there is not enough, if too much of the work is done by hand in a slow and expensive manner, money is lost. If there is too much expensive machinery installed, machinery that is lying idle for the greater part of the time, the money invested in this machinery eats up the profits. Is your machinery equipment too expensive or is it inadequate? The greatest profits depend upon its exactly fitting the needs of the business. In some cases it is cheaper to have certain work done outside rather than to install machinery with which to do it or attempting to do it by hand.

Do you carry too much material and stock in your shop or do you have to order repair parts and stock while the job is being done with the result that your floor space is taken up by vehicles on which work is being held up while waiting for repair parts or material? Nearly every shop can adjust the stock more closely to the demands than is the case at present. It is also important to pay rental on no more space than is required for the business that is being done. Every additional square foot of space more than is essential reduces the annual profit by just so much.

Are you keeping adequate accurate records which you are using to increase the profits of your business, are you relying to a great extent upon guess work and intuition, or is there in your office a man who is a fanatic for records and is spending more time and money in keeping records than these records are worth? All records which will help you increase the profits of your business should be kept, and if you have not the time to keep them yourself you should hire someone to do so . If you can't afford to hire some one all the time you can secure the part time services during the evenings of some local man ambitious to earn a little extra money. Be sure to keep your office expenses and the records kept in the office in tune with the business.

Could you buy office equipment which would result in actually cutting down the office expenses or have you money invested in equipment that is too expensive for your business and is increasing the expense rather than reducing it? To-day there is on the market office machinery suited to offices of all sizes. The machinery to buy is that which will exactly meet the requirements of the business and at the same time require the smallest investment. Get the machinery that will do the work but pay as little as possible for thoroughly reliable machinery. For the small business, rebuilt machines often answer just as well as new ones and cost much less. Look into this office machinery question and be sure that your machinery equipment fits the requirements of your business.

Depreciation expense often depends to a considerable extent upon the care given the machinery, equipment and buildings. Sometimes a coat of paint will save hundreds of dollars. Sometimes cleaning and oiling machinery will add years to its life. Determine exactly what the depreciation is. Charge the business with the maximum depreciation but endeavor to cut down the actual depreciation.

Have you invested too much or too little money in general equipment? Are your service cars paying their way? Is there general equipment you could buy which would cut down expenses or increase business? It will pay to give this part of the overhead very careful attention.

Are repairs made to equipment and buildings made as soon as repairs are needed or are they delayed until greater damage is done and the cost of the repairs is greatly increased? It pays to make repairs promptly. The longer they are delayed the greater will be the cost.

Every shop loses more or less money through the spoiling of material and parts or having them stolen. Do you keep records of material and parts that tend to cut down this loss? Can you adopt methods which will lessen this drain on the business? Careful attention and intelligent thought and study given to this part of the overhead will usually result in materially cutting down its cost.

Are you an easy mark and over liberal in your donations, or are you so stingy that you hurt your business? There is a happy medium in the case of donations, a point beyond which it is an expense and a needless expense to go and below which will result in the loss of business to the concern . The best results require the careful weighing of each donation. Often the amount of donations can be cut down if care and thought is used. Sometimes it will pay to increase them. Much depends upon local conditions and the class of customers to which the business caters.

Bad debts are the stumbling block of many a business man. It is necessary to hold these down to the lowest possible point. If a customer never pays his bills it is better to let some competitor have this customer's business. Prompt and effective measures should be taken to keep uncollected bills down to the minimum. Nearly every business man has more of them on his books than is necessary or than the business can carry.

Always figure the interest on the total capital invested as part of the overhead and not part of the profits. Consider it as money loaned to the business just as you would if it was all borrowed from the bank. If you do not do so you are likely to pay more taxes on your business or your income than is due from you.

Business men to-day are protecting their dependents by ascertaining just how much money will be required to close out the business at a profit or running it till another guiding hand can take control in case their own is removed. They then carry insurance made payable to the business in an amount equal to the sum estimated. This protects the income of the dependents and often insures the continuation of the business in cases where it could not continue if such insurance was not carried. The premiums on such insurance are naturally part of the overhead expense.

Now that the overhead has been taken apart and each part examined make a few tabulations Draw up a list of all the items considered. Write down opposite each item the present cost. In another column write down what you believe the cost should be. Farther to the right opposite each item make notes of how the cost can be decreased or why it should be increased. Also write memorandums of how each item can be made to increase the business revenue or profit. For example opposite the telephone rental could be written something like this.

Keep a card record of all jobs with an estimate on each card of when further repairs will be needed and what these repairs will be. Place the customer's telephone number on the card and file it away under the date when new repairs will be needed. Each day call up these customers who should need more repair work done and try to secure the business.

Try to cut down each item of expense to the lowest point, make each item of expense increase business and profits to the greatest extent and overhaul you overhead at least once or twice a year. Compare each overhauling record with the previous ones and you will be surprised to learn how great a change has been made and how much harder your overhead is working to increase your profits.

USES FOR OLD RUBBER INNER TUBES

All motorists, and that term now includes many thousand farmers, accumulate damaged or unserviceable tire tubes. What to do with them is a question. But these old tubes can be used to give excellent and varied service.

If cut crosswise in widths from a quarter to a half inch, excellent rubber bands can be made. They may be used in numerous ways, as for holding the pages of note books, or for holding rubber tubes that have been repaired and are carried in the automobile. They may be used for holding the covers of tin boxes filled with small drills, cotter pins or nuts. They also serve for securing small bundles. Various other uses will suggest themselves to the owner. Being so much larger and heavier they are much more useful than the bands usually sold in stores.

Pieces of tubes may be cut with scissors and used for washers for various purposes. These washers will not last as long as washers made for general use, but considering what they are they give service for quite a while. Occasionally the nozzles on spraying outfits will not fit tight and a washer cut from an old tube will serve an emergency purpose and perhaps will save a special trip to town or to a store when work is pressing.

By starting at the end, cutting spirally round tube, one can get as long a strip of the rubber as one wants. These strips may be used to wind hammer and ax handles and iron lever handles on farm implements. Put on some rubber cement on the handles and then wind on the strips of rubber, being careful to keep them stretched fairly tight. There is a little trick to tucking the last end under the last "two time around" but after one handle has been wrapped the others are done easily. These wrapped handles do not blister the hands and the rubber wrapping will be found preferable to wrapping adresive tape.

Pieces of an old tube may be used for patching with a vulcanizer if the motorist does his own vulcanizing. The writer has used such patches for vulcanizing and found them very satisfactory. The purchased rubber is better, but in an emergency these pieces of tube may be used. Care should be taken, however, to trim the edges on a bevel, so that after the patch has been cured the edges will not chafe the casing.

Have the surface clean on both sides. Wash with a cloth dipped in gasoline and then sandpaper them thoroughly. If one does not have sandpaper a fairly good job may be done with an ordinary file or a whetstone. These have given as good results as sandpaper or emery cloth.

By all means save the valve stems. Some times a valve stem is damaged and must be discarded. The valve stem out of an old tube can be inserted, cemented, then fastened by the wing nut and lock nut, and the tube will be as good as it ever was.

BELT DRIVES

GETTING the most from a belt drive begins with the selection of a suitable belt for the job, and its necessary to determine exactly what will be required from that belt under service conditions. The factors are the horse-power to be transmitted from the shaft to the machine, the nature of the drive, the distance of the centers, and whether a cross or twist drive, is necessary. The conditons obtaining in the shop must next be investigated—that is to say, whether the belt will be likely to come into contact with oil, steam, or chemical fumes; and these factors will determine the material of the belt and the treatment to apply to it.

The pulleys for a belt drive should always be as large as possible, so as to reduce the strain on the belt fabric caused by bending over a small-diameter pulley. Again pulley faces should be wide, as it is far better to use a wide thin belt than a thick narrow one. The wide belt is more supple and will permit a larger area of contract, while the actual surface of contact of the belt with the pulley face will be increased, thereby transmitting more power. If it is not possible to use a wide belt it is advantageous to run two thin ones, one over the other.

When the belt is installed great care should be taken in joining two ends. Splicing and cementing is the best method, as the joint is thus made as strong as any other section of the belt, avoiding the too frequent error of weak joints, which give rise to irregular running with subsequent failure of the joint. Failing jointing by splicing and cementing some reliable type of fastener or riverter should be used, which does not injure the belt and which affords the maximum of elasticity. Butt-joint plate fasteners give good results and also lap-joint fasteners, and some types of belt lacing.

It is not good policy to run a belt to tight, as this greatly increases the friction on the shaft bearing and often is instrumental in causing partial distortion of the shaft itself. It is better a belt should run slack, with the tight or driving side downwards otherwise if the driving side is at the top of the belt the slack side will fall away altogether from the pulley face, and the position will be worse than in the case of a tight drive.

In order to promote "grip" between the belt and the pulley face and also to enable the belt to resist corrosive substances, the surface should be treated with some reliable preparation neither acid or alkaline. There are many excellent preparations on the market, and there should be no difficulty in selecting one which is the best suited to the purpose.

Belts should not be run at over their maximum speed. If the lineal speed of a belt is too high, centrifugal force comes in and tends to lift the belt from the pulley face, thus causing "slip and loss of power. If the pulley face is shown to be brightly polished it may be taken that "slip" is occuring either through running the belt at too high a speed or through not treating the belt surface properly.

The driving centres should not be too close, otherwise the natural stiffness of the belt will not permit it properly to bend round the pulleys. The most efficient distance for driving centres has been shown to lie somewhere in the neighborhood of twenty feet.

The alignment of the shafting and pulleys should be correctly tested before the belt is put into service otherwise one side of the belt will be put to a severe strain and the belt itself will work off the pulleys. The ideal drive for belt transmission is horizontal, about eighteen feet between pulley centres, and running at a lineal of about 3,000 feet per minute.

When a new belt is put on it should be tested for stretch about three hours after starting, and the necessary adjustments made. The second test should be twenty-four hours from the start, and another made in three days' time. After this the initial strength may be regarded as having been properly taken up, and the belt will have settled down. Regular inspection is, however, very necessary to determine the condition of the belt. All belt surfaces should be regularly scraped and washed with warm water to keep them clean and supple; this appreciable prolongs the life of the belt.

It is important in a machine or other shop to institute and maintain a regular system of belt inspection. This especially applies to belts from which the main drive is obtained, as the sudden failure of this or, for that matter, any other belt for that matter will probably lead to accidents, and is, as any rate bound to cause a cessation of work and the temporary holding up of what might be an urgent process.

How A Lubricant Lubricates

THE fundamental purpose of all systems is to reduce the fricton loss of the bearings to a minimum with lowest cost of lubrication and of operation. A bearing consists of two parts, the journal and the housing. For practical construction and renewal reasons the housing is divided into several parts. These differ with the design, but in all cases there are the bearing pieces or "brasses" which surround the journal and supply the bearing or sliding surace for the journal. The bearing pieces may either be of brass, or babitt metal. The larger units generally use babbitted bearings. Metallic friction between the journal and the bearing pieces is reduced or eliminated by providing a film of lubricant between these relatively moving parts, and the degree of perfection of lubrication attained will depend on how low a frictional resistance can be obtained. A perfect lubrication system will prevent all metallic friction and introduce only a minimum oil friction, as generally speaking metallic friction is greater than oil friction.

Metallic surfaces, no matter how well polished, are microscopically rough. When two such surfaces are rubbed together, the small projections and depressions tend to interlock. This can only be overcome by a tearing away of the projections, compressing or pushing them aside, or by the separation of the sliding surfaces sufficiently by a lubricant to allow the projections to pass each other. When the sliding surfaces are thus covered with a lubricant, in order that the projections may interlock, the lubricant must be pushed from the depressions and from around the projections. While liquids are mobile and will work out gradually from between two surfaces under pressure, yet the resistance to flow, or viscosity of the liquid, hinders the action and considerable time may elapse before the surfaces come into contact.

When oil is between two surfaces they will not, under ordinary conditions, be forced into as close contact as if the surfaces are dry; even if a long time is allowed for the action to take place. This is due to the property of most liquids to adhere to or to "wet" solids. This action is very strong indeed in the case of oils with metals, and is one of the governing factors which makes them such excellent lubricants. It is very difficult to rub all the oil from a metal surface unless heated, as the oil seems to get into the pores of the metal and refuses to be displaced.

This adhesive property of oil, however, although assisting in lubrication, is not sufficient in the case of turbines to maintain a film of oil between the rotating journal and the bearing, and prevent metallic contact. The maintenance of a film will depend primarily on the character of surface, load per square inch, rubbing speed, clearance, and viscosity of the oil at the temperature of the bearing. Smooth surfaces can operate with a less clearance than rough ones, and hence will require a less thickness of oil film to keep them out of contact. An increase in load on a bearing naturally tends to force the oil out and the parts nearer together, and, other things being equal, when a bearing is subjected to a heavy load, a higher viscosity oil is necessary to keep the parts out of contact than if the load is light.

The rubbing speed affects the amount of oil dragged into, or out, of a bearing. As previously stated, a film of oil adheres tenaciously to the revolving journal, and on account of the viscosity of the oil the adjacent layers to that adhering to the metal are dragged with it. These are resisted from entering the clearance space by the fact that the oil already there is being forced out by the weight of the bearing. This latter force is practically a constant, while the force dragging the oil with the journal is proportional both to rubbing speed and viscosity of the oil. It is thus seen that at high rubbing speeds an oil of less viscosity is required in order to maintain an oil film against the expulsion force than at low speeds.

The design of the bearing greatly influences the maintenance of an oil film. As mentioned above, a revolving journal drags the oil into the clearance space. This is assisted by having this clearance space somewhat larger at the point of entrance of the oil than at the other parts of the bearings. This forms a wedge of oil, the oil entering at the thick part of the wedge and going out the other thin edges. Analysis have shown that the pressure in the oil film varies in different parts, the least pressure existing at the top and sides of the bearing. It is therefore necessary that the oil be introduced at these points of low pressure. The clearance space allowed in most turbine bearings is 1/1000 inch for each one inch diameter of journal. In modern high speed bearings using light oils, it has been found that no oil grooves should be used as they may allow the loss of the built up oil pressure in the bearings space. In some bearings, however, oil grooves are still used.

—The Texas Co.

THE DIRTY SCALE

(*Copyright* 1921, *W. L. Schaphorst*)

I was trying to measure the diameter of a disc with a 4 inch steel scale. The diameter was several times the length of the scale so I decided, as we often do in such cases, to carefully make a scratch mark on the disc at the end of the rule and "step along" as often as was necessary.

A mechanic who happened to be nearby watched me as I worked and evidently decided that what I needed was a longer scale, so he handed me a folding wooden scale that he had apparently carried in his greasy trousers pocket since his early apprenticeship. I do not know the exact length of time, but it must have been of unusual duration, judging from the thickness of dirt on the scale.

That scale was a wonder. Its color was uniform all over—jet black. Not one line of figures was visible to an unpractised eye such as mine.

I carefully placed the scale on the disc and prayed that figures and lines would be visible at the desired point, but no such luck. I was "up a tree."

This time the mechanic was slower to appreciate my troubles. I I did not know the man well, and did not wish to irritate him, so with a grin that I use to indicate humor I casually remarked, "Have you a microscope?"

"What for?" he asked. He caught my grin and smiled.

"Well," I answered, "since I cannot read this scale with my naked eyes, I can think of no better way than to considerably enlarge it. A microscope might do the trick."

The mechanic did not answer directly. He looked at me in a queer sort of way, then he looked at the scale, studied it with about the same care that I use in reading a perfectly distinct scale, and muttered, "It's exactly 8¾ inches."

I could do no more than wonder how he did it. I was naturally dumfounded. So, I asked him to explain. "Come to think of it," he said, "perhaps it is harder for you to read than for me. See that scratch there? I know that scratch is right on the 8 inch mark because I put it there a long time ago to make the old mark more distinct. And the depressions that were made in the scale when it was first stamped are still there, although you may have difficulty in seeing them. I can't see the original black lines myself, but I can see the depressions." I re-examined the scale and sure enough the depressions, the 8 inch scratch, and many other scratches were there. I checked the disc with my 4 inch rule and found his measurement to be true.

However, after thinking it all over, and as we are taught to do now-a-days, after considering costs, possibilities of error, and general appearance, I am convinced that a clean, distinct scale is far preferable to a dirty one, even though long association with the dirty scale may have brought it so close to one's heart that it is believed to be indispensable.

MORAL: Carry a scale that any borrower can read.

USEFUL INFORMATION

To find the area of a square, the section of a flat bar, or of a rectangle, multiply the width by the thickness, which dimensions, in a square, are equal.

To find the area of an octagon, multiply the square of the diameter of the inscribed circle by .828.

To find the area of a regular hexagon, multiply the square of the diameter of the inscribed circle by .866.

To find the area of a trapezoid, multiply the sum of the parallel sides by the perpendicular distance between them, and divide the product by 2.

Diameter multiplied by 3.1416 = circumference.

Circumference multiplied by .3183 = diameter.

Square of the diameter multiplied by .7854 = area.

Doubling the diameter of a circle increases its area four times.

Abrasive paper and cloth should never be stored in a damp place, as the glue absorbs moisture very quickly. This loosens the grain and causes it to rub off before it is dull.

ANNEALING WITHOUT TARNISHING

A method of protecting polished metals which have to undergo annealing from the tarnishing which occurs under ordinary treatment has been patented by H. Schultz, Charlottenburg, Germany.

In this process a solution of boric oxide is used, completely excluding atmospheric oxygen, although it is applied only as a very thin film over the articles to be annealed. It melts at a temperature varying between 550° and 650° C. (1022° to 1202° F), according to is composition, and acts as a protection so long as it remains solid. Steel, for instance, remains bright when heated to the melting point of the composition, and no coloration takes place when it is tempered.

In the molten or semi-molten condition, it forms a perfectly gastight cover around the article, even when heated to the highest temperature used in pratice. The coating is perfectly fireproof, does not evaporate, and dissolves any oxidized matter on the surface of the heated metal. The coating can be applied either as a powder, sprinkled or dusted over the surface of the objects to be annealed, or as a liquid. It is soluble in water and methylated spirit, and the work to be annealed is simply dipped in the solution and allowed to dry. The coating peels off on cooling, or it may be dissolved in warm water.

Queries-Answers-Notes

THIS department is the meeting place where you are free to ask for information, answer questions, discuss shop matters and business conditions and any other notes you feel would be of interest to a fellow mechanic. Make use of this Department as often as desired.

On Workin Steel:—In looking through the American Blacksmith I notice some articles on tempering steel. Some are very good indeed and the instruction as far as it goes can not be criticized; but I would like to say that in many instances they have omitted an important detail, namely, the working of the steel. Tempering is but a small part of tool making, and I would like to say that it is my experience that if the steel is not properly worked, it is a very difficult task to temper the tool so that it will give satisfactory results. For 30 years I have been engaged in steel and iron working, and have run across some mightly difficult jobs which required considerable figuring.

It has been my experience that some steels will temper in water very nicely, while others require oil or some kind of grease such as tallow. With some few other ingredients, I find that tallow is the best for sharp edge tool, and will be pleased to give the reasons if requested. High speed steel can be tempered without any oil or grease at all, and will give good results if handled properly. It is also my experience that working is the most important part of handling steel. In this respect many blacksmiths are to be criticized for their carelessness. Steel can be worked in such a manner that it may be given afterwards to a very good man to temper it, and it will be impossible for him to harden it satisfactorily, so that it will stand up on the job.

Some men say that steel can be burned. I don't agree with them. It may be heated to the point where it is spoiled for the particular work for which they intended it; but steel can be melted and is just as good as it was before. I have melted self-hardening steel and molded it in bars and blocks for which purpose it was used, and it stood the test; so burning steel is a word in the past for me.

H. M. Johnson, Lewisburg, Pa.

Bell Metal:—Will you please tell me where I may buy small crucibles I have tried in a number of places but they don't seem to know anything about them.

I also want a small amount of bell metal in powdered form. Please tell me what the ingredients are, and also where I might be able to obtain a crucible.

I am having trouble welding ½" x 4" spring steel. Is there any good compound to make it stick? I take a bright yellow heat and am using a standard make of welding compound.

O. S., Alberta.

Editor's Note:—The small crucibles which will answer your purpose may be bought from the Jos. Dixon Crucible Co., Jersey City, N. J.

There are a number of formulas for bell metal. Some of the finest churches in the world have bells in which this composition is used: copper 3 parts, tin one part. Still another formula is to melt together under powdered charcoal one hundred parts of pure copper with 20 parts of tin, unite the two metals by frequently stirring the mass. Product—very fine. The first formula should be treated in the same manner. Another recipe is as follows: copper 71 parts, tin 26 parts, zinc 2 parts, iron 1 part. Bell metals for large bells consist of copper 100 lbs., tin from 20 to 25 lbs.

The trouble you are experiencing with welding steel may probably be traced to the quality of coal you are using. With good coal, a reliable flux and the heat of the proper temperature, you should experience but little difficulty.

Information Wanted:—Will someone give me an idea for making a saw frame with a sliding table? I want to make it of steel, or as near all steel as possible.

N. C. P., Nebraska.

Reducing the Amperage of a Generator:—How can the amperage of a generator be reduced?

A. L. W., Texas.

Editor's Note:—The amperage of a generator may be reduced by connecting resistance in series with the field coils.

A Partner for the Garage Business:—Sometime ago I wrote you for information about going into the garage business, and I received a very nice answer as well as some good information; but for some reason or another, I have not started in as yet. However, I expect to be ready for it as soon as the spring season opens up.

In taking in an associate you advised me to take him in on a strictly commission basis, rather than as a partner, and I would like to know what you would consider a fair offer.

My garage is to be 26' x 70', and I am postive that during the season there will be work enough for two men. I have two plans of my own. One was to build the garage and give my associate a guarantee of a $100.00 a month, and then we should go half and half on all the other profits.

The other plan, I have in mind is that I furnish the garage. and give the man 75% of what he makes and then go half and half about the investment in stock.

I do not feel sure that either of the plans will work out successfully, and I would appreciate very much if you would give me any additional information on the subject.

A. R., Wisconsin.

Editor's Note:—I'm afraid that we don't understand you quite clearly in regard to the percentage basis. In guaranteeing the man a certain amount every month, and then allowing him half of all the profits over and above that amount, do you propose that he furnish the tools and necessary equipment or are you going to attend to those details? If the latter is to be the arrangement, you should be careful to make ample deductions for wear and tear, depreciation and a liberal amount of the overhead expense of the business should be charged to that department. If you are furnishing all of the money with which to do business, and you are assuming the business risk, you should be compensated accordingly. In permitting your associate to own half of the stock or equipment, he becomes your partner within the meaning of the law, and as such he has the right to bind the firm to contracts which may be made in its name. He may do these things without your knowledge or consent. If necessary your personal resources could be used to satisfy claims that were contracted in this way. It is well to look into that detail and to be certain that you are not laying yourself liable for his actions.

Of the two arrangements you have in mind, it occurs to us that the first is the better of the two after some revisions are made. Making certain guarantees to your associate may be an excellent idea, if the party you have in mind is industrious; but is merely temporarily embarassed by a lack of working capital, and it is doubtful whether the business would pay well right from the start. On the other hand, if he is perhaps inclined to be a drone, this guarantee may be an inducement for him to lay back in the traces.

Perhaps the best arrangement after all would be a straight 50-50 proposition after the running expenses had been deducted and you had been compensated for carrying the business, because in reality every man works on a commission basis. If he doesn't produce the equivalent, or better, of his weekly salary, his services are not retained, whereas if he produces, more he does not participate in this additional earning; so that a straight commission always appeals to an energetic worker when a good proposition is presented.

Just a word of warning as to the selection of the man. Be sure and get one who is thoroughly competent. One job poorly done will scare away many other prospective jobs, even though the responsible party may have been let go. Get a good man, and then make charges that will permit good work to be done.

There is apparently two principal reasons why repair shops go wrong. One is trying to do cheap work and the other is credit. When a customer tells you that so and so will do the work for less than you have agreed to do, and when you know that the charge you have made is a fair one, you will be farther ahead to explain to your customer that your competitor is the best judge in the world of the value of his work, and then let him take the work there, rather than to attempt doing it at the other fellow's price. Such transactions would result in a slighted job in order to make it yield a profit, or else no profit at all, if it is properly done. Such actions mark a man for an early business suicide.

Another point to bear in mind is that a man is ever so much better satisfied with a job that he pays cash for, than one which he pays for long after the improvement which that repair afforded, is forgotten. When he pays for a thing it belongs to him and he will think of the better things regarding it, for it is only human nature to flatter one's self that he got the best of a bargain when there is no opportunity left of backing out, whereas, when the job hasn't been paid for, one is more or less inclined to find fault with the minor details in an effort to satisfy his conscience. A man always did, and always will object to paying for a dead horse.

Prices in Scotland:—National Master Farriers' and Blacksmiths' Association, Scotland Airdrie, Coatbridge and District Branch, Minimum Price List, Mary:

Cart and Lorry Horse, 22/ per set ($5.35); Farm Horse, 21/ per set, ($5.10); Heavy Van Horse, 21/ per set, ($5.10); Light Van Horse, 20/ per set, $4.87); Posting Horse, 19/ per set, ($4.62); Cobs, 18/ per set, ($4.38); Ponies, 15/ per set, ($3.65).

Removing shoes, half-price of new shoes. Heeling and toeing extra.

Bar and Strap Shoes, 2/ extra per shoe, (49c; Punching Cog Holes, 2d. each, (04c); Punching Toe Piece Holes, 2d. each, (04c); Stuffing Shoes, 1/6 per pair, (36c).

Leather soles and pads to be charged according to cost price. All shoes fastened to be charged.

Hooping Wheels (labour only), Broad Cart, £2 17s. 6d. per pair, ($14.00); Hooping Wheels (labour only), Narrow Cart, £2 10s. per pair, ($12.16); Hooping Lorry Wheels (labour only), £1 15s. per pair, ($8.54).

Boring holes, pins, and iron, extra. Cutting and refitting hoops half-price of new.

Supplying and Fitting Broad Straps to Naves, £1 15-15-0 per pair ($8.52); Supplying and Fitting Narrow Straps to Naves, 14s. per pair, ($3.41); Laying Plough Sock, 4/ ach, ($1.15); Pointing Plough Sock, 2s. each, ($49c); Laying Coulter, 2/6 each, (61c); Dressing Coulter, 1s. each, (24c); Laying Drill Sock, 3s. each, (73c); Laying Large Grubber Feet, per foot, 4s, (97c); Laying Small Grubber Feet, per foot, 3s. (73c); Laying Harrow Tines, 6d. each, (12c); Sharpening Harrow Tines, 3d. each, (06c); Supplying New Harrow Tines, 1s. each, (24c); Cart Mountings, 2/6 per lb., (61c).

The equivalents in American money was figured at the normal rate of $4.86 for one Pound Sterling. The present rate of exchange is approximately 25c lower, thus the actual equivalent in American money would be correspondingly higher.

A Five Horse Equalizer:—We note that in a recent issue of your publication, The American Blacksmith, that a Mr. M. B Hollingsworth of Washington, wants a sketch of a five horse equalizer that is so arranged that one horse walks in the furrow and the other four walk on the land. We are sending you herewith a rough sketch of one that will absolutely do just what he wants.

It is made of hickory 1 1-4 inch thick, 6 inches wide at the center and 5 foot 10 inches long. As will be seen on the drawing, the chain runs over two pulleys. These pulleys are 3 1-2 inches in diameter and 2 inches thick. A bushing is made so that they will not wear out from their contact with the bolt on which they turn. A piece of 1-2 inch gas pipe lends itself readily to this purpose. A strip of 2 1-4 inch band iron is cupped and then shrunk over the edge of the pulley, so as to make sort of a sheave of it. A 5-16 inch chain is used, and its arrangement is clearly shown in the drawing. 10 feet of this chain will be sufficient for this equalizer.

Aside from being general blacksmiths, we also do some manufacturing, as you will observe from our letter head. We make a woven wire stretcher, and we find a ready market for them wherever this style of fencing is used. We also make a garden hoe out of old buggy springs that is very popular, for we sell all that we can make. We also make a pancake-turner that is a big hit with the housewives of this locality.

Now, these with several other articles are made from what other blacksmiths ordinarily term scrap. We will gladly tell any smiths how any or all of these things are made through your paper, if they wish, thus helping anyone who wants to keep busy at a good profit. A man who is a mechanic and really wants to work doesn't have to worry, as there are a number of things such at these that he can fill in time at. Of course if he isn't mechanic enough to turn out something like that, he hadn't ought to be running a shop; but should really learn the trade.

We keep from two to five men at work all the time and could employ more if I only had the time to look after them, or could hire men worth the money that they demand, but that is hard to do nowadays. I might add, too, that we do a great deal of acetylene welding, and can weld anything from a suspender buckle to a drive wheel for a 40-horsepower tractor.

Marble Cutters' Tools:—I am very anxious to receive information about dressing and hardening marble cutters' tools and chisels.

I can get lots of chisels from our local works. The only thing I lack is a little information regarding foring and hardening them. Will you kindly, if possible, inform me how to forge and temper such chisels. I tried to temper some in the following solution: 2 ozs. Alum; 2 ozs. Saltpeter; ½ oz. Sal ammoniac; 1-½ lbs. common salt; but it does not give satisfactory results. Some are too hard, others too soft and none seem to tough enough. How is the best way to work the chisel with 4, 6 and 8 points? Can a swage be bought for that work, and if so where can it be obtained.

I have some of those in the shop now to be sharpened.

E. H. B., Illinois.

Editor's Note:—The first consideration is the steel from which the chisel is made. Low carbon steel can never be hardened properly so that it will do the work, while steel that is too high in carbon will be found brittle, and the results equally poor in the other direction. 75 point carbon steel seems to be the best suited for stone workers' tools.

Although the greatest obstacle to overcome in connection with stone-cutters' tools, after having a thorough knowledge regarding the steel that should be used, is to know the shape and the proper temper to give. Otherwise the steel is worked practically the same as in making a cold chisel, or any other flat tool that is to have a cutting edge.

In forging, one should be careful and apply the heat slowly so that there will be no danger of overheating any of the thin edges. It is also well to guard against too high a heat, for a tool that is once overheated can never be hardened properly afterwards.

Some toolsmiths cut off the old cutting edge, and then forge the stock down; it being claimed by those who advocate this manner of treatment, that beter results are obtained.

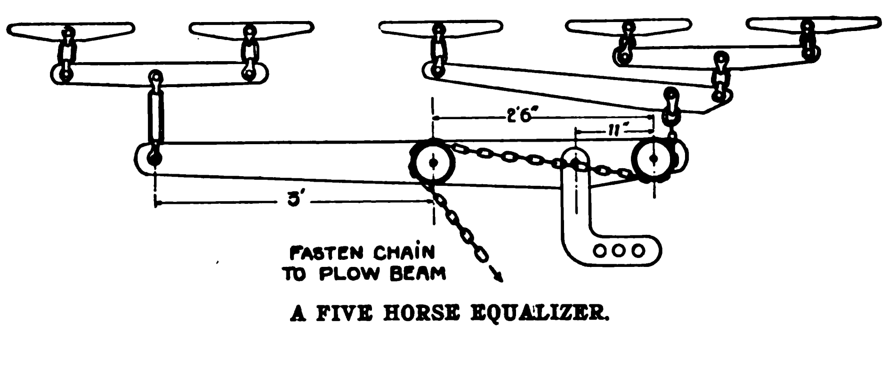
When hardening points and chisels, it is not necessary to heat them hot enough to harden any further back than ½ inch, but be careful when heating so as not to get the extreme thin cutting edge too hot. When quenching to harden dip deep into the hardening bath to at least one inch, so that the temper will draw very slowly to a dark straw, which is good for all ordinary tools, such as those particularly that are used on granite.

Tools for cutting marble are left with a little harder temper. The temper should be drawn to a very light straw.

The teeth are put in with a punch machine after the last hammering. In the small custom shops, this operation is performed with a sort of an improvised swage.

Water is as good a hardening medium, perhaps as anything else. The great difficulty lies in the fact that the tools are not forged properly. While one should be careful not to overheat the work on the otherhand the piece should be heated sufficiently so that it can be worked.

When the piece is forged at too low a temperature, and only light blows are used, what really happens is that the piece is skinned, so to speak. The outside is stretched and the center remains the same. Heat the work hot enough, work it thoroughly and rapidly, and we believe that you will experience but little trouble from this class of work.



A FIVE HORSE EQUALIZER.

AMERICAN BLACKSMITH AUTO & TRACTOR SHOP

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L. J. Wischerath, Editor

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TRANSPORTATION EQUALITY

MANY states are proposing legislation to limit the load that can be carried by a motor truck to such a degree that thousands of firms and men now owning heavy duty equipment will be forced out of business, and the capital invested in their trucks will be almost a total loss. Also, State and national taxation of motor trucks and passenger cars is being carried to an unreasonable point.

It seems that the old fable of killing the goose that laid the golden eggs has been forgotten, for motor trucks are one of the greatest aids to commerce that we have today. Motor trucks hauled 1,200,000,000 tons of freight in this country in 1920. This stupendous tonnage was almost one-half that carried by the railroads in the same twelve months, which amounted to 2,504,000,000 tons.

These figures do not represent a competitive tonnage, however, for most of the goods hauled by the trucks were also hauled by the railroads, and vice-versa. If the fast motor haulage had not fed the railroads, then the latter could not have transported this great volume. On the other hand, if the railroads had not borne the burden of the long haul, then the trucks could not have had the shipments to deliver at the other end.

But there are other ways in which the motor truck helps business and government besides quantity of goods hauled. The profits made in manufacturing them are taxed by the government. An additional excise tax is collected on the sale of each motor truck. The eventual owner also pays a state license tax usually based on horse power and weight. And in addition to all this, some states are now collecting a fixed sum for heavy duty trucks. In others, as before stated they are ruling heavy duty trucks off the road—or taxing them off—which amounts to the same thing in the end.

There are five main means of transportation today—steam, electric, inland waterways, motor vehicle, and horses. Each one is particularly suited to certain kinds of transportation, and should be allowed to do that haulage for which it is fitted with the least hindrance. They all serve the public, which, in the end, is the government. There should be no discrimination against any one of these as opposed to the other. Each should grow and develop in proportion to its usefulness to the country. Certainly, motor truck owners, because they are making a fair living, should not bear a disproportionate part of the expense of government, nor should trucks be legislated off the roads or taxed where other forms of highway transportation are not.

If someone answers, "The automobile and truck spoil our good roads," just ponder over this fact—it is the automotive vehicle that has brought us the better highways, and has contributed largely to their maintenance. Two-thirds of the 9,000,000 automobile and 1,000,000 trucks are owned by people whose incomes are $4000 or less per year. Ninety per cent of these car owners use their passenger cars more or less for business.

As far as traffic laws are concerned, motor truck manufacturers and motor truck operators are agreed that there should be laws governing the gross weight, width and length of vehicle and load, and that the first of these, the weight, should be on the tire-inch basis but they feel that all states should have a uniform law. Much motor trucking today is interstate, and as they are regulated today, operators never know whether they are breaking the laws until they are held for some infraction. Indeed, in many states the laws are so unreasonable that all truck owners are automatically infringing on the regulations.

The Federal Highway Council Uniform Road Law is eminently fair, we believe, to all roads and to all truck owners. This law limits gross weight to 28,000 pounds and 800 per tire-inch, and speeds on pneumatic tires up to this limit of weight to 25 miles per hour. Lesser speeds are provided for different weights on solid tires. Fifteen states have already adopted this law, which is endorsed by many highway officials and associations. Legislation that limits weight and speed of motor trucks should be the same the country over, the same as that governing rates on common carriers. These laws, properly enforced, would then govern truck operation properly, prevent undue injuries to the road, and be fair to all concerned.

That our present national government realizes these things, and will eventually bing about an equality of burden on the various forms of transportation is our firm belief, based somewhat on President Harding's own statement that "The motor vehicle has become an indispensable instrument in our political, social and industrial life, and that highways are not only feeders to the railroads and afford relief from their local burdens, but that they are actually lines of motor traffic in interstate commerce.

This view is shared by many men high in government and state offices, and will, no doubt, be an influence to discourage discriminatory legislation such as is being now proposed in many states, as well as to influence a sane and less discriminating taxation program.

It is certain that the automobile and truck are vehicles of usefulness. They are common conveyances, necessary to the business man, professional man and the farmer. Such an additional tax on them as was recently proposed by Secretary of the Treasury Mellon would be as senseless as one levied on the farmer's horse and wagon or upon every boat plying our rivers and lakes.

TO OUR SUBSCRIBERS

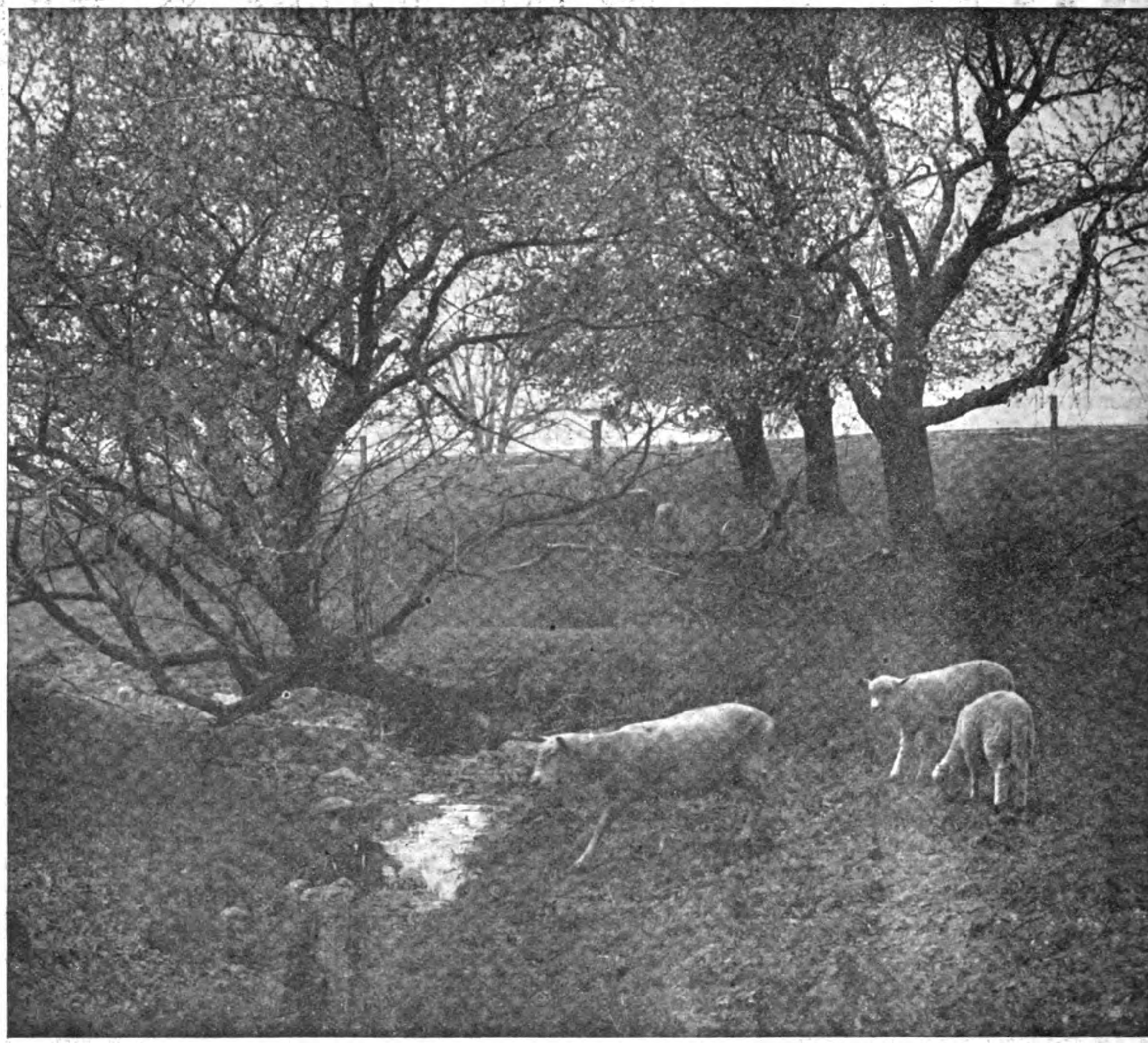
Since it would be virtually impossible to give individual attention to all of the letters that have virtually swamped our Subscription Department, requesting information regarding the delay in publication of the last two issues of the AMERICAN BLACKSMITH, we have taken this means of explaining matters.

In the last issue, we explained that the employees of our Mechanical Department all decided on a vacation at one time—because certain ideas regarding their employment did not agree exactly with ours.

Since then, however, all of these difference have been adjusted to the complete satisfaction of all concerned, and we are running along "on high"—just as though nothing had happened; except of course, that all the time lost during this "collective vacation" has not been completely caught up. While we are still considerably behind our regular publication date, nevertheless, things are adjusting themselves so favorably that we feel justified in promising delivery of your copy on time, or very nearly so, next month.

Under these circumstances, we are going to ask you to kindly overlook the delay this month.

—The Editor.



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Brazing With The Welding Torch

BY DAVID BAXTER

THE oxy-acetylene welding torch is probably the handiest brazing tool in use today. In fact, it might justly lay claim to being the best, on account of its adaptability to any size and shape of brazing job. Brazed joints may be made with the welding torch that can not be made with ordinary brazing torches. Then, too, the work of the welding torch is under better control and is more rapidly accomplished, due to its intense heat, combined with its small size; just enough heat may be applied to just the proper area of the brazed joint. This is an advantage particularly where the fracture occurs in an enameled part, since a comparatively small portion of the enamel is burned.

The blacksmith who operates an oxy-acetylene torch need not depend entirely upon the welding of broken castings and forgings to keep the equipment in use. There are several important uses for the torch besides welding, one of which is brazing. In fact as previously stated, the welding torch is very convenient brazing tool; one with which the blacksmith may tackle any sort of brazing job, and he will find there are some classes of repairing that can be made satisfactorily only by brazing. There are some that are more conveniently brazed which could be welded, but brazing is more economical.

The most important use for brazing is the mending of broken or cracked parts that cannot be successfully welded or soldered; either on account of their shape or situation, or because of the nature of the metal. Some metals can not be satisfactorily welded because the welding heat, the melting heat strictly speaking, changes their nature to such an extent as to render them brittle and weak; almost utterly worthless as far as strength is concerned.

On the other hand, it is advisable to braze some fractures on account of their location, or because it is cheaper and easier to do so. Fractures which are not accessible to welding, or fractures located in parts of machinery where welding can not be applied, on account of danger to other parts, are often brazed instead of welded, depending upon the metal to be joined and providing the bond does not require the greater strength of a fusion weld.

The commonest example of where

THE MALLEABLE PART OF A DRIVE SHAFT HOUSING BEING BRAZED IN PLACE.

brazing should be employed is in the mending of cracked or broken malleable castings. This peculiar metal is tough and ductile in its normal state. But when it is melted again its nature is entirely changed. From a tough, bendable metal, it is changed to a brittle, glassy material, which will break under a light blow, and will withstand but little strain. The melting of the weld does not change the entire casting; but enough of it is changed to render the bond of little value. That part of the casting which is melted to make the weld changes to the white, brittle iron, and, therefore, the casting will break in the weld. The wider the weld the easier it will break; that is the larger the area melted to make the weld the more malleable is changed to white iron, increasing the danger of breaking. It is no advantage to confine the weld to a narrow strip, since it will break in a narrow weld almost as rapidly as a wide one; the fracture will occur in the part that has been melted.

The temperature of the welding seems to make no difference in the melting of malleable. Nor does the condition of the flame, its size, or how it is manipulated. The melting results in brittleness in any event, and a true fusion weld can not be made without melting the casting metal no matter what kind of filler metal is used. A mild steel or Norway filler can be used and, while the filler may not change its properties, the melted malleable will still impart its brittle weakness to the weld. A malleable filler would only make the situation worse.

Malleability is given by a process of annealing, while they are made so it would seem that some sort of annealing process could be devised to be applied after welding, but so far as is known to the welder's trade nothing like this has been effected.

Malleable castings are used mainly where strength combined with lightness is essential. Therefore, it does not do much good to pile up filler metal along the fracture in an effort to reinforce it, if the malleable is melted; the brittleness is present.

Malleable castings can be mended quite satisfactorily, however, with a brass or bronze filler metal. But the process is not fusion welding. In fact, it is only an adhesion. The bronze is merely adhered to the surface of the malleable. If any of the casting metal is melted at all it is only a very thin skin of the surface. Most welders do not melt even the surface of malleable but pile the bronze on top, along the fracture. One of the peculiar characteristics being that bronze filler metal will adhere tenaciously if properly applied.

Thus, we see that in the repairing of a malleable casting is one instance where brazing is imperative, regardless of the nature of the fracture. Cnly by brazing can these castings be mended without melting the malleable. A variation of this is where malleable is brazed to steel, as in lots of automobile work. Another instance being where brass is to be brazed to steel. Both of these requires brazing for good results.

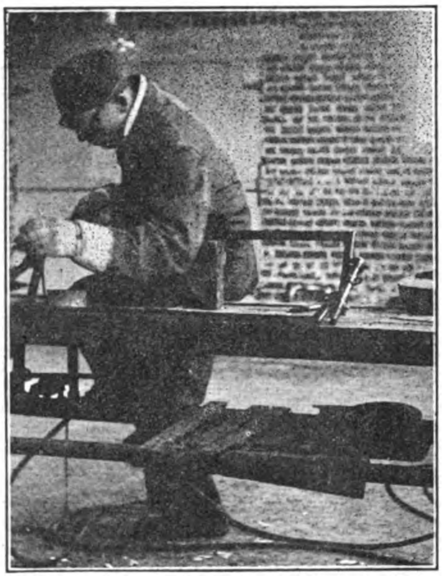
Now, in relation to brazing on account of its convenience, light steel or wrought iron jobs, such as bicycle frames, wind shield-frames, etc., are often brazed instead of welding because less heat is required to do the work and, therefore, less danger of damage to the surface of the surrounding metal. Such articles may be repaired without dismantleing the broken parts.

As stated above, brazing is merely adhesion. The filler metal is only "stuck" to the surface of the casting, or other thing, to be mended. It does not become a part of the whole as is the case with a fusion weld. The fracture is grooved about the same as for cast iron, or other metals, according to its thickness. It is, no doubt, better to groove or bevel both sides of all fractures in malleable, regardless of the thickness, but some welders merely pile up a reinforcing of bronze along the break, especially where the surplus filler does not interfere with the workings of the casting. If the fracture is grooved out, however, it stands to reason there will be more surface for the adhesion, and, therefore, greater strength to the repair, with less surplus reinforcing.

Most malleable jobs do not need preheating, which is so necessary on most welding jobs. In fact few of the other kinds of brazing jobs require preheating. This is, perhaps, the biggest advantage of the brazing process. There is no danger of distortion or overheating common to fusion welding; besides the saving of time and elimination of trouble.

Brazing is more particular in regards to working on top of the fracture. That is the brazing must be applied with the fracture in a horizontal position, or nearly so. The molten filler bronze has little or no surface tension; nor will it adhere perfectly in a slanting or verticle fracture. Vertical brazing can be done; but is not what it should be. It is similar to cast iron in this respect. And like cast iron or alluminum, the brazing filler should be well fluxed. A good brazing flux should be liberally applied to all fractures; at the start and during the entire process of applying the filler. The heated end of the filler rod is dipped in the flux powder at frequent intervals during the melting. This powder melts and spreads over the molten bronze to protect it from oxidization; both that due to the welding and to oxygen of the atmosphere. Brazing metal burns or oxidizes easily when in a melted state, if air or oxygen strikes it.

Therefore, when making a brazed joint, the torch operator should pay careful attention to his flame condition. He should adjust it accurately at the beginning and watch it closely during the melting of the filler. A strictly neutral flame is, no doubt, the safest, although some welders prefer a flame that carries a slight excess of acetylene, claiming there is less danger of oxidizing the metal; which probably is true as most of the oxidization, when melting brass, is caused by the flame. An excess acetylene flame is not so hot and, therefore, will not burn the brass or bronze so easily. At least the welder should not use a flame having an excess of oxygen, since this only increases the chance of oxidization.



BRAZING A BROKEN WINDSHIELD IS THE MOST PRACTICAL WAY OF MENDING IT.

Of course there is danger of burning the brazing metal with a neutral flame, too, if it is not manipulated correctly. Or, in other words, if it is held too close to the molten metal; particularly if it is held motionless. On the neutral flame may be too large for the job and consequently oxidize the metal. The angle at which the flame strikes the metal also has something to do with it; but a great deal is owing to the condition of the molten metal. The angle is shifted according to the action of the brazing.

We see, therefore, that it is advisable to employ a neutral flame for most brazing jobs, and, that it should be handled skillfully. The best rule to learn is this; watch the melting metal and handle the flame accordingly. Do not try to adopt any fixed style of torch manipulation.

Keeping these hints in mind, let us take some specific examples of brazing and endeavor to see how they work out. First, let us discuss the repair of a drive shaft housing, as that is more or less familiar to all. The one illustrated in the pictures must be brazed and not welded because the castings at the ends are malleable. Here is an example of compulsory brazing, if the job is to be mended with the welding flame; and this is the quickest and cheapest way to do it. If the casting works loose, or, if it is worn out and replaced with a new one, the procedure is practically the same. That is, the brazing process i semployed and is applied in the same way. Or if the housing breaks it usually does so at a point where the tube enters the casting. This repair should also be made by brazing; the fracture is joined by brazing a heavy filet of bronze around the casting connecting it to the tube.

In any event, after securing correct alignment of casting and tube, the first thing to do is to thoroughly clean the part to be covered with bronze. This is accomplished by burning all of the grease off with the welding flame. The grease and dirt is burned to a cinder and then brushed or scraped off. Both the casting and tube metal are cleaned bright and bare around the housing, an inch or so on each side of the joint.

This cleaning is to promote adhesion and to prevent any foreign substance from interfering with the placing of the molten filler metal. The brazing metal will lay to the clean metal well, whereas any dirt or moisture will cause weak unjoined spots in the adhesion.

In the instance illustrated in the picture, the malleable casting was not broken off so there was no grooving to be done. After cleaning, the housing was arranged on a pair of V-blocks, as indicated in the photos. This was for the purpose of preventing it from rolling and still permit it to be easily revolved. As the brazing proceeded the housing could be turned in the V-blocks to keep the bond horizontal.

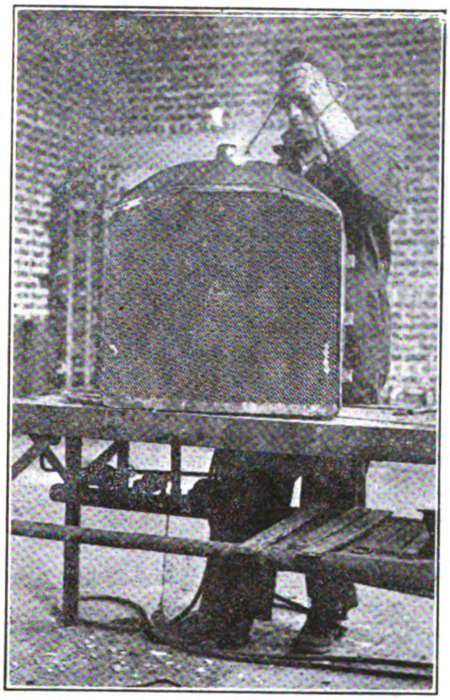
Next, the torch is fitted with a top a size or two larger than would be used on a weld, because it is essential to deposit more bronze than would be the case, if the filler was iron or steel, and also because a larger area of the casting and tube is to be heated. The torch is lighted and adjusted to the neutral position. Then a bronze filler rod a quarter of an inch in diameter is selected, and we are ready to do the brazing.

The flame is applied to that portion of the housing which is upward. It is swept back and forth over the tube and the end of the malleable casting, heating about an inch and a half of the curve, an inch wide. The top of the inner cone of flame is permitted to lick the housing, until it commences to turn red. Meanwhile the filler rod is brought close so it will be heating, too. To assist in this the flame is passed over the end of the rod as it sweeps the housing. This procedure is carried out until the heated surface becomes bright red in all parts. At which time the rod is just on the verge of melting. Then the flame is drawn back slightly and concentrated upon the filler rod to melt an inch or so of it over the bright red surface of the housing. The force of the flame and a twisting movement of the rod are employed to guide the molten metal. The melting rod is pushed along the corner of the casting to deposit a liberal fillet of bronze. The flame is advanced or retarded as needed.

When this first portion of the fillet is complete, the rod is placed aside, but the flame continues to be played upon the side of the housing as it is gently turned in the V-blocks to bring another portion of the joint upward. Then the rod is once more taken up and another section of fillet is applied in much the same manner as the first section. Thus the entire fillet is made in a series of adjoining sections; each of which is but a continuation of the previous ones.

The surface of the housing metal is always bright red, when the bronze is applied. And the bronze should be ready to be deposited the moment the housing is ready to receive it. This unity of motions is the secret of good brazing. It is easily acquired by practice if the torch operator pays attention to what he is doing, and he must time the movements so a liberal quantity of flux powder is applied at intervals during the brazing.

Another example of brazing is a wind shield frame, as shown in one of the accompanying photographs. This is an instance where brazing is optional; it is not absolutely necessary, because the frame is made of pressed steel, and may be welded with Norway iron or steel filler. However, it is more conveniently mended by brazing, as the steel is thin and is coated with enamel paint. To weld this job would require melting of the frame metal and a consequent burning of considerable paint on each side of the weld. Some of the paint is bound to be destroyed when the fracture is brazed; but not so much as when welding. First the broken or cracked frame is brought in proper alignment and placed flat along the edge of the welding table. Then the flame of the torch is lighted and adjusted the same as for the housing. It is applied to the fracture and followed by the bronze filler rod the same as was done on the housing. In fact the process is identical with the work on the housing. Neither article is melted



FILLING THE RADIATOR NEARLY FULL WITH WATER PREVENTS DAMAGE TO THE SOLDERED PARTS WHILE BRAZING THE FILLER NECK.

before the bronze is deposited, but merely heated bright red.

On neither job is any slow cooling process employed as is the case with the welding of many castings. The probable explanation of this is that both the bronze filler and the malleable and steel are ductil enough that contraction of the filling can not crack the joint. This brings out another advantage to brazing: it is not necessary to heat these jobs previous to applying the torch flame, because they do not need to be expanded. The torch flame will heat the metal sufficiently to cause the bronze to adhere without the aid of preheaters. After this job is finished, it is placed aside anywhere to finish cooling without a thought as to whether it will crack or not.

Let us take one more instance where brazing is essential. That is, one where welding would be out of place. In other words, welding is not entirely successful on radiator repairing.

Most automobile radiators are literally a mass of soldered joints so that to apply the welding process is to risk ruining the whole thing. This kind of work is nearly always all done by soldering, but there are a few instances where brazing is all right. One of such instances is shown in a picture illustrating this text. Here the brass nipple is being brazed to the upper radiator tank. A fillet of bronze is melted entirely around the old neck. The process is much the same as described above, in relation to flame, filler, flux and manipulation. The bronze is melted on top of the tank metal and around the neck without melting either. As the bronze adheres to the radiator, the torch operator walks slowly around the job so that it is not necessary to move it.

Before attempting such jobs as this radiator brazing, the operator should fill the radiator with water. This is done after plugging all outlets. The water will prevent the heat of the brazing from being conducted to other parts of the radiator, and thus insure against melting any of the soldered joints. In the honey comb type of radiator this is particularly essential.

The foregoing examples of brazing should enable the novice to pick up the art quite easily. It should give him some idea as to the general nature of the parts that should be brazed instead of welded.

The addition of chromium increases the elastic limit of steel, and the hardness, resistance to stock and alternate stresses are also increased.

The Starting Motor--Its Repair and Adjustment

THE conclusion of the preceding article deal with a brief description of the Ford starting motor and the work it is called upon to do in terms of electrical energy consumed. It showed that while the actual time the starting motor is in operation for the entire season is extremely short in comparison with the work done by the generator, nevertheless, the different nature of its work subjects it to strains and consequent depreciation which is entirely absent in the generator. For this reason it is important that it should receive periodical attention.

Few repairs, and only those of minor consequence can be made to this member of the electrical system without removing it from the car. To do this it is first necessary to remove the bendix drive. The opening in the transmission cover, through which the armature shaft and the bendix drive extends, is closed by a cap, which is attached to the cover by means of four cap screws. When these screws have been removed the cap may be withdrawn. It is necessary to manipulate the clutch lever in order to obtain clearance between the bendix drive and the low speed connection.

The bendix drive is now exposed and may be removed as follows: Bend down the ear of the lock washer, which is against the head of the set screw, using a pair of pliers for the purpose. Now, run out the set screw of the drive head. The drive head is keyed to the shaft with a Woodruff key; it is necessary, therefore, to draw it off with a straight pull. Not infrequently a burr is thrown up on the shaft by the set screw. Under these conditions it is best, from a view point of time saved and the possibility of damage to the part by using other methods, to withdraw the head with a special puller, which may be obtained from any of the branches for that purpose.

After the head has been removed, the key may be extracted by tapping a thin screw driver blade under one end of it, thus rolling it out, so to speak. When this key is removed, the remainder of the bendix drive may be readily withdrawn. If the burr thrown up by the set screw is very heavy, it may be necessary to dress it down with a fine file, before withdrawing the bendix.

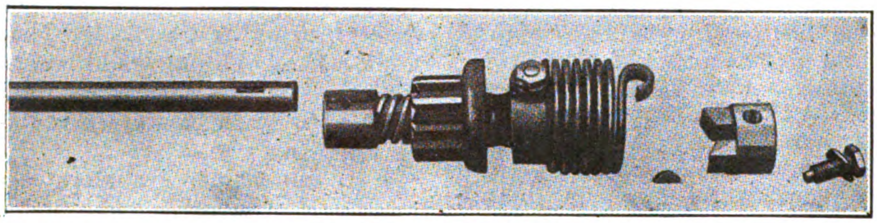


FIGURE 1. THE RELATIVE ASSEMBLY POSITION OF THE BENDIX AND STARTING MOTOR ARMATURE SHA

By referring to figure 1 of the accompanying illustrations, a clear, concise idea of the relative assembly position of the bendix and the starting motor armature shaft, may be had. This, no doubt, will be of assistance to the amateur, who is about to replace his first bendix. Figure 2 shows the shaft and gear after the spring has been removed. This is as far as the bendix may be taken down. It will be noted that both the shoulder to which the spring is attached, and the drive head are eccentric; this is to allow for the coil in the spring.

The sleeve indicated by A in figure 2, turns freely in the shaft, its function being simply to guide the spring as it coils. In assembling, it is necessary to see that the lugs of the drive head fit into the slots of this sleeve, in order to have the bendix function properly. It sometimes occurs under extraordinary circumstance that the bendix tooth will register with the edge of the tooth of the ring gear, thus preventing it from meshing. The sudden end thrust may shear the set screw, allowing the head to move back. This will cause the bendix to bind, so that it will be impossible to use the motor. It is then necessary to pull off the head, remove the broken set screw from the shaft, run the motor to see that the shaft is not sprung, and after a careful inspection of the other parts of the bendix, reassemble it to the shaft.

After the bendix has been removed, as explained above, the motor may be removed. Because of the steering column, it is necessary to remove the engine pan to obtain clearance. Run out the four screws which hold the mounting bracket to the transmission cover, disconnect the switch to motor wire from the terminal post, and remove the motor.

The starting motor may now be taken to the repair bench. This bench and its equipment is similar to the one used in repairing the generator, excepting the battery wiring which is much heavier, and the meter, which must read to 500 amperes.

The cables used on the starting motor circuit should be used to convey the current from the battery to the motor. All connections should be made with the lugs soldered to the ends of the wire.

Standard battery lugs should be used in making the battery connections. Before attaching the lugs to the battery terminal, it is advisable to clean the surfaces with a piece of sand paper, particularly the surface of the positive (+) ter-

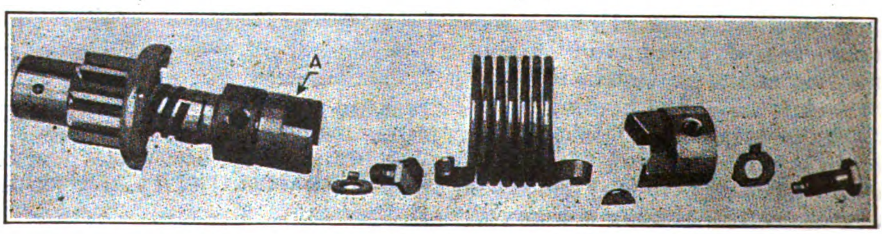


FIGURE 2. THE SHAFT AND GEAR O F THE BENDIX DRIVE AFTER THE SPRING HAS BEEN REMOVED.

minal, as a dark coating is usually present on this terminal.

When the motor has been secured in the vise, try turning it over by hand to see that the armature is

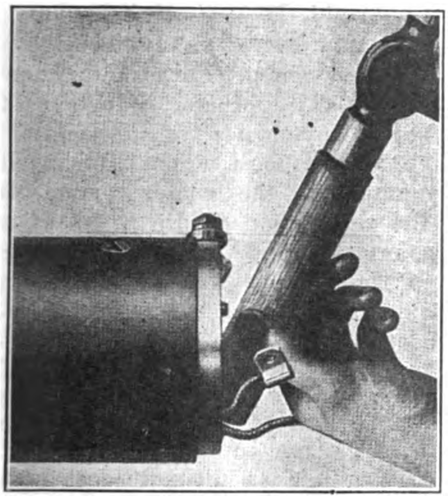


FIGURE 3. BENDING BACK THE COILS SO THAT THEY WILL NOT RUB ON THE ARMATURE.

free, a piece of sand paper wrapped on the shaft will aid in gripping it. If it turns freely, the dust cover should be removed and the commutator examined. If it is dirty, clean it with sandpaper, as previously explained in the articles dealing with the generator.

The repair-man will note that the mica between the segments of the commutator extend clear to the surface. While it is unnecessary to undercut the mica on the motor, as the brushes are sufficiently hard to cut it away, the repairman should make sure that the brushes are not being held away from the commutator by riding on the mica.

Try the brush connections to see that they are tight. If everything is in good condition, touch the wire to the terminal and the armature should turn at a rapid rate of speed with a slight hum, the meter registering between 50 and 100 amperes with little or no arcing at the brushes. If it draws approximately a 100 amperes or more and a decided hum is heard, it is possible that the armature is striking the yoke or the field leads. It will be necessary to remove the armature and find the high spots. The armature is removed by running out the mounting-bracket-to-yoke screws, after which the bracket, together with the armature may be removed. It may be necessary to tap the bracket with a rawhide hammer to start it. When they have been removed, the bracket may be slipped off of the armature shaft. Examine the armature to see where it is rubbing and examine the corresponding part of the yoke. If the armature is rubbing on the coils, they may be bent back closer to the yoke with a hammer and a block of soft wood as shown in figure 3.

If the field pieces are loose, the yoke should be returned to the Branch for repair, as a special fixture is required to hold them in place while tightening.

If a ground is indicated by the ammeter dial when the circuit is closed, trace it into the armature, yoke or brush end bracket as was previously explained in the article on generators. The following paragraphs treat the manner of testing the yoke.

The generator and starter yoke should be inspected to see that they are not grounded, and that none of the wires are broken. This is done with a test lamp. To see that the circuit is complete on the generator hold the test points on the field ter-

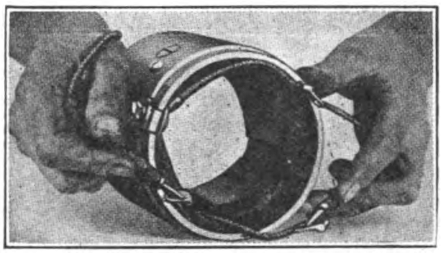


FIG. 4. TESTING THE FIELD COILS FOR AN OPEN CIRCUIT.

minals as shown in figure 4. If the circuit is complete, the lamp will light. It is hardly necessary to test the starter for a complete circuit in this way, because any break in the wire will be exposed to view. Simply inspect the connections carefully and see that they are properly soldered.

To inspect the yokes for a ground hold one test point on the lead terminal, and the other on the yoke, as shown in figure 5. In this case there should be no light, if the yoke is not grounded.

The coils should next be inspected to see if they have been damaged sufficiently to cause a short circuit. As tracing and repairing a short circuit involves disconnecting the coils, the repair-man should not attempt to perform this operation; but if he feels that the trouble is due to a shorted field coil, he should try a new yoke.

Care should be taken that the leads from the generator yoke are connected to the proper brush terminals. The earlier type of field coils were wound opposite to the later type, and it is necessary, therefore, to cross the leads on the latter. To determine how they should be connected, test the field with a battery and compass as follows:

Attach the leads to wires leading to the battery and try the field poles with a compass as shown in figure 6. The north pole, which is the blue point of the needle, will point to one pole, the south to the next, etc. If the poles do not indicate with reference to the terminals as shown in the diagram, reverse the leads on the battery wires and test with the compass again. If it indicates properly now, the lead attached to the positive (+) wire from the battery is the one to be attached to the third brush. It is impossible to mix the leads on the motor, as both are secured to the positive brush.

The brush end bracket of the starter motor differs from the generator bracket, in that there is no oil hole in the bearing end, the bearing being of the self-lubricating type, and a press fit in the bracket.

As there is little or no wear on the bearing, there is little likelihood of its needing replacing due to having worn over-size. If such a case arises, the bearing will have to be turned out on a lathe or with a square drift.

If the bearing should freeze onto the shaft, as would be indicated by

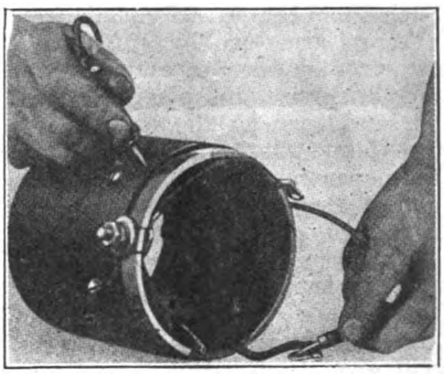


FIG. 5. INSPECTING THE YOKE FOR A GROUND.

the noise and uneven running of the motor, it will, of course, come out with the armature, in either case a new bearing is inserted, driving it in on an arbor press, or with a block of wood and a hammer.

As no adjustment of the brush setting is required, the brush holder support is riveted to the bracket directly in contact with the support, and the other two are insulated from it. The former are the negative or ground brush holders, to which the field leads are attached.

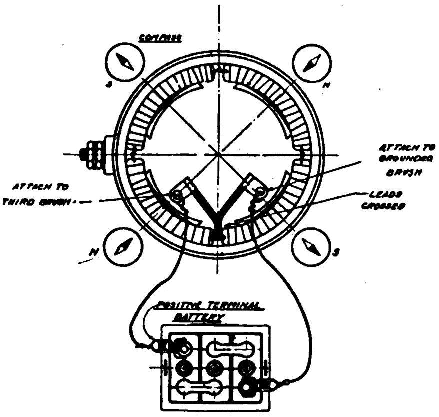


FIG. 6 THE MANNER OF CONNECTING THE FIELD LEADS MAY BE DETERMINED WITH A COMPASS AND BATTERY.

The brush holders should be inspected, and any necessary adjustment should be made as was explained in the previous article.

It is seldom necessary to install new brushes in the motor, as they are comparatively hard, and receive very little wear. When it is necessary they may be seated in the same manner as the generator brushes.

Where any amount of generator and motor work is done, it will be found most convenient to have a tool that will facilitate the work. Such a tool can be easily made from a scrap armature by cutting the commutator down so that it is 1-32 inch undersize, and placing a piece of sandpaper on the commutator. The joint where the two ends of the paper come together should be cut at about 10 degrees to insure a smooth surface on the brushes. To use the tool remove the armature, replacing it by the tool. Then the brushes are placed in position, and a few rotations of the tool will give the brushes a good seat.

The mounting bracket should be inspected to see that the armature shaft bushing and bendix bearing are in good condition. The bushing should be a slip fit on the armature shaft, while the bendix bearing should have as high as .008 inch to .010 inch play.

If the bendix bearing is worn oversize, it is necessary to have it rebabbitted. If the bushing is worn or if it has turned in the bracket, it should be driven out and replaced with a new one. After the new bushing is installed, an oil relief hole should be drilled into it through the hole in the bracket.

The old style motors were equipped with a felt washer to keep back the oil. This bushing may be driven out and replaced with the new type. The repairman should then drill both the bracket and the bearing. It is further necessary to drill a hole in the lowest part of the bracket to allow any oil which might accumulate to drain out.

In assembling the motor, the brush end bracket is first secured to the yoke by means of four screws and the brushes are held in the raised position by means of the springs.

Next oil the bushing and put the mounting bracket on the armature shaft and insert the armature into the yoke. Position the open side of the mounting to the right as you face the assembly, the terminal being up. Thus the opening will be towards the flywheel when assembled to the transmission cover.

After the bracket has been secured to the yoke with the screw and the lock washers, it should be check for fit with the bendix drive as shown in figure 7.

The bearing should be a free fit. If it is tight, loosen the bracket to yoke screws and tap the bracket over with a rawhide hammer. If there is only a slight bind, it is unnecessary to loosen the screws. If this does not overcome the difficulty the mounting bracket should be removed and examined, together with the yoke, for dirt or a burr, which would throw it out of line. If there is nothing to throw the bracket out of line, the bracket is probably out, and should be replaced with a new one.

When the motor has been assembled, excepting for the dust cap, it should be finally inspected to see that the brushes are down, the springs set properly, and that the leads are not rubbing on the armature, that the exposed ends of the wires and pigtails are in no danger of grounding, and that all connections are tight. Finally run it on the battery current for a short time, noting that it runs smoothly without arcing at the brushes, and draws between 50 and 100 amperes.

If this final test shows the motor to be operating properly, it is then ready to be installed in the car.

SELECTING THE RIGHT PULLEY

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Nearly every pulley has something to commend it, whether low first cost, lightness, reduction of slip, convenience of application, etc. The most important of all factors, in the writer's mind, is the elimination of slip which costs many thousands of dollars per year in the United States. It is safe to say that through the improper selection of pulleys our manufacturing plants are losing thousands of dollars daily. In many of these plants pulleys have been chosen with an eye on the low first cost rather than on ultimate cost with a resulting waste of power, fuel and time that is astounding.

During recent years the writer has been looking upon steel split pulleys more and more favorably. They have a number of advantages over other pulleys. When new, both cast iron and wood pulleys do very well, but after they are in use they do not work as satisfactory as steel pulleys or pulleys with steel faces.

A steel pulley does not swell upon getting wet and does not shrink upon getting dry. Atmospheric conditions have no influence whatever. Therefore due to the fact that there is no swelling or shrinkage when a steel pulley is once made tight on a shaft, it remains tight and does not slip, and therefore does not require re-bushing and refacing every little while. The steel pulley does not glaze the surface of the belt or become slippery due to liberated carbon as does

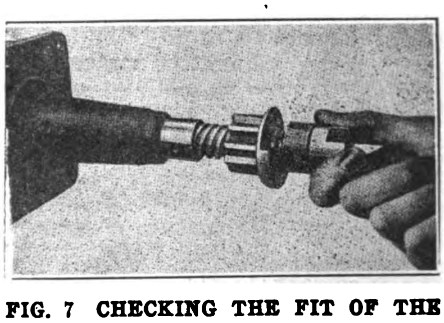


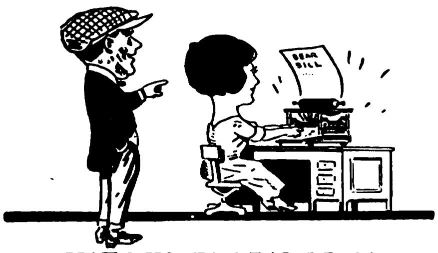
FIG. 7 CHECKING THE FIT OF THE BENDIX

a cast iron pulley. Steel pulleys also are immune to fire. They are not so liable to break as cast iron and of course they will not burn like wood or paper pulleys.

Steve Gets His Dander Down

BY D. G. BAIRD

NOPE, the Declaration of Independence and the Constitution of the United States wasn't wrote for the benefit 'uv them what chooses to earn their daily bread and a occasional slice 'uh butter by indulgin' in the popular pastime 'uv servin' the well-known breed 'uv plutocrats commonly called the down-trodden public.



"WE MAKE NOTES REAL PERSONAL"

It may be great sport for the missus to get her dander up because the missus of the castle next door decides it's a fine day to beat carpets the same day the first-mentioned missus puts on a loungin' robe and gets out her knittin' and takes a little recreation watchin' the electric machine wash the clothes and all; and she may cultivate her vocal talent all she pleases explainin' her opinion 'uv such conduct on the part of a neighbor or she may preserve a dignified silence and refuse to pass over a sample 'uv the next batch 'uv home brew and the like, but the gent what goes under the pseudonym 'uv the head 'uv the same family'll conduct hisself somewhat otherwise in his dealin's with them what condescends to bring him a little trade now and then.

That's what I 'uz tellin' Steve Bromley a spell back. Steve had a lot 'uh false notions about his rights and privileges as guaranteed by the above-mentioned historical documents, maintainin', among other things, that this is a free country and if a customer don't wanta trade with a certain shop he don't hafto and the said garage man and dealer shouldn't compromise his dignity by inquirin' into the wheres and the whyfores of the customer's peculiar habits as exemplified by his takin' his repairs and his trade somewhere else.

Steve 'ud spend a bunch 'uh coin in advertisin' in the papers and sendin' out circular letters and cuttin' prices and the like tryin' to get new customers, but when a old customer 'ud get his nose turned up about somethin' or other and begin' passin' up Steve's place just like a pay car 'ud pass a tramp Steve 'ud just get mad and say "let him go to h-Halifax! If he don't wanta give me his business he don't hafto," and wouldn't make no effort a-tall to find out what the trouble was and make things right with the offended customer.

That 'uz before I elucidated the problem and put him on probation, o' course. Since then he's reformed and's livin' the life 'uv a shopkeeper what's properly interested in substitutin' the city directory for his list 'uv customers and losin' one o' the same only by death or removal from the United States of America.

You see I'd known Steve's attitude on this subject quite a while and I'd gently remonstrated with him at sundry times, but without doin' any good. But when I learn that he's lost old man Joe Kane's trade—what 'uz the most valuable customer he had—I just naturally hafto come to the rescue and put his name in Bradstreet's instead 'uh lettin' him put it on the roster of the bankruptcy court.

"Steve," says I, broachin' the subject real innocent-like, "old man Kane's about the best customer you got, ain't he?"

But Steve ain't to be fooled by no such gentle diplomacy and he intimates rather plain that I know good and well that old man Kane's took his trade to another shop. He ain't got no idea why the old gent's took offense and his repair and accessory business to a competitor, and furthermore he's too independent to try to find out.

"Now, Stephen," says I when he's blowed off a lot o' steam about not havin' to run after folks to get 'em to bring him their trade, "there's just one criticism I got to offer 'uv your attitude towards your customers what get peeved and take their business to another shop, and that is that it's all wrong.

"Pride and independence may be all right for American citizens, but a gent what's engaged in the amusement uv' dependin' on the public to trade with him had better forget he's one of 'em when it comes to gettin' his dander up 'cause some gent acts ugly without apparent cause or provocation.

"Yep, when a business man gets his dander up over such a little thing as a customer steppin' on his pet corn without sayin' 'excuse me', he'd better forget all about it and coax his dander to go and lie down in a corner some place and behave itself while he goes and apologizes to the customer for havin' the said pet corn in the way and as a proof that he means what he says invite him to step on the other corn and then apologize again."

"Aw, you've always got a lot of fool notions about how to run a business, yu have," Steve complains. "I got a picture of you going out after a man and asking him why he quit you when he's acted the way old man Kane's acted. It's all mighty fine to stand around and talk about what the other fellow oughta do, but you don't have to practice what you preach. I do a good honest business and try to treat folks right, but if they don't wanta trade with me I ain't gonna run after 'em and beg 'em to—and you wouldn't neither."

"Well, you can't sometimes allus tell, Stephen. O' course your ouija board may be all right for prognosticatin'——"

"TOWIN' AN OLD GUY ASTERN."

"I guess I can tell by the way you act when I announce that Old Man Kane's trade's worth a cool hundred to me," Steve puts in real airy.

"And I presume you mean to insinuate that I ain't game to see your hand on that there little bluff, eh?" says I in some lofty tone. "I'll just give due notice to all concerned that money talks the only language what I can understand."

Steve puts up the collateral s'if he means business and I don't need no further inducements. Instead 'uh which I takes a little jaunt up the street and pays a social call on a gent name 'uh Kane and pretty soon we're talkin' 'bout garages and accessories and service and the like, and insida thirty minutes I'm back at Steve's towin' a old guy astern.

I elucidate for Steve's benefit how one 'uv his men put a old spring what had already been broke and welded in one 'uv Kane's buzz buggies and he got a notion Steve wasn't doin' his work on the level and his cart 'ud broke down and cost him a bunch 'uv coin and he'd lost a contract that 'uz worth about a millinium in pure coin 'uv the realm and all and Steve's gonna give him a bran new spring and put it in the vehicle and not in the ledger and's gonna show his good faith and workmanship by not lettin' it happen again and so forth and they shake hands and everybody's happy.

Steve's real joyful over gettin' his best customer back without havin' to compromise his dignity, and he even remembers to get out his check book, but I get somewhat absent minded and light my Havana with the century draft and when he calls my attention to the matter I tell him it ain't worth the trouble 'uv writin' it all out again and he can just put it on my account and listen to what I got to say and then I says it in the followin' manner and to this effect:

"Now you poor victim 'uv spurious selfsufficiency," says I "there's a gent what 'uz bringin' you a pile 'uv dough every week with his repairs and his supplies and all, and he got his probocis turned up and herded his business off to another tinkery and it uz worth a hundred plunks but you wouldn't sell half a hour 'uv your valuable time for such a paltry sum.

"Now," I goes on while Steve hangs his block in shame and terrible remorse, "just a little social chat and you've got a disgruntled customer back what'd gone sommers else with his business. But you can't go and have a interview with every bird what gets a notion your grease ain't greasy enough or your gas ain't gassy enough or you're too gassy yourself or the like. It'd take too much 'uv your two-hundred-a-hour time to pay 'em all a call.

"But you can drop 'em all a line and ask 'em if all's well. All you need is the cooperation of your blonde stenographer and your Uncle Samuel's mail service and the amputation 'uv a goodly portion of a certain fool notion what you've got about not wantin' to run after customers."

And with this oration as a introduction I make Steve put me on speakin' terms with the fair dame what presides in his office and we get busy and fix up a nice cheerful little note to Steve's old customers what he's suspicious have quit him cold. We tell 'em we ain't seen 'em 'round for quite a spell and we allus miss 'em when they don't show up ever so often and we want 'em to drop in next time instead 'uv kickin' the dust in our face and some more 'uv the same.

We make the notes real personal and friendly and all, callin' the folks by their nicknames or whatever Steve was addicted to callin' 'em when they usta saunter in towin' their rattle traps into dry dock in Steve's emporium. There ain't a stiff joint or spring in the whole letter.

Then we get up another communication to follow the trail 'uv the first one if it don't get results in some instances. In this epistle we tell 'em when a good customer like they've allus been stays away for many moons on a stretch we allus suspicions they must have a reason for their nonappearance and we can't help feelin' guilty in the first degree but we don't know what the charge is so we can't come out and own up to it and take the consequences. Then we tell 'em if there's anything wrong a-tall we just want 'em to slip in and whisper it in our ear and let us demonstrate our facility in playin' the new game 'uv "The Customer's Always and All Ways Right."

"INVITE HIM TO STEP ON THE OTHER CORN."

Well sir, when them there customers what had got huffy about one thing or another read them letters there just wasn't a thing they could do except come right in and shake Steve's mit like he was a long lost brother and tell him their grievances and let him make good or bust the bank roll in the attempt.

And Steve was on the job with his part 'uv the conspiracy. Yep, he'd kinda caught onto the peculiar notion that an American business is gotta be run on American principles and that a old customer what's tried and ain't found guilty's worth a half a dozen new customers what ain't never showed their willin'ness to abide by the rules 'uv the game.

THE REAL TEST

An athlete challenged a blacksmith to a trial of strength. The blacksmith reluctantly accepted, for he despised athletics. As for the athlete, he would have laughed up his sleeve at the blacksmith for being so foolish as to think that he could compete with a trained muscle builder, if his athletic suit had had any sleeves in which to laugh. As it was he lifted a 500 pound weight, chinned himself twenty-five times, and held out a ten-pound pair of dumbells at arms' length for "steen" minutes. And after the blacksmith had done all these things after him, but more awkwardly, it was the smithy's turn to set the pace.

"I have but one test," said the blacksmith.

And, giving his competitor a big sledge-hammer, he took one of the same weight himself, and each began to strike full-swung blows upon a piece of malleable iron. After three hours the athlete stopped, exhausted; but his competitor continued to rain blows upon the iron for a long time. The athlete complained that he had challenged his victor to a test of strength, but the the later had made it a test of endurance; to which the blacksmith replied, that not momentary strength, but strength spread out over an honest day's work, was the thing that counted, and especially in these times of readjustment.

It is easily seen who had the better of the argument and who was entitled to the decision for the fable illustrates, beautifully, the merits of that sterling quality, endurance. That is the thing that counts most in business or athletics. What any business needs to keep it built up and "going strong" is not "spurters" and "stuntist" for momentary work of spectacular attraction, but men who can endure week after week and month after month.

BLOWPIPE VS. AIR CHISEL FOR CHAMFERING CAST IRON

In preparing broken castings for repair by welding, the fracture surfaces are chamfered to permit thorough penetration of the flame, as it is necessary to provide a complete bonding of the molden metal in every portion of the joint if the welder is to produce a strength equal to that of the original metal.

For repairing breaks in cast iron the usual practice, and the only practicable way until recently, has been to chip out the chamfer or "V" with some form of mechanical cutting tool. In heavy work, where filing, grinding, or chipping with cold chisel and hand hammer, cannot be conveniently or economically done, the air chisel has been extensively employed, though at best its operation has always been both slow and laborious.

The job herewith illustrated and described would seem to point to an entirely new and much more effective and economical way of cutting the chamfer in cast iron.

The accompanying illustrations show a cast iron punch press frame, weighiinig 2800 pounds. One leg of this frame measuring 9 inches square in cross section was cracked entirely through. To weld this job it was, obviously, necessary to "V" out the metal, and as is the practice where it can be done, two "Vs" are made; that is, one on either side with the vertices meeting at the center. The chamfers were 3½ ins. in width at the top and each, of course, 4½ ins. deep.

To accomplish this preparation with an air chisel would require 12 hours' labor. As performed in this case, however, using an Oxweld Type C-6 cutting blowpipe, it is possible to complete the chamfers in approximately 40 minutes. It will be noted that the sides compare very favorably as to evennessness, with work done with the air chisel, and, as the chamfers can be cut in about 1-18 the time commonly required, the economy in time is a factor of considerable importance. On checking up the acetylene and oxygen consumption, while the cost of the gases tends to equalize the comparative money cost with that of chamfering with the air chisel, the saving in time alone is a consderation worth figuring whereever shop turnover is properly valued.

KEROSENE VERSUS GASOLINE

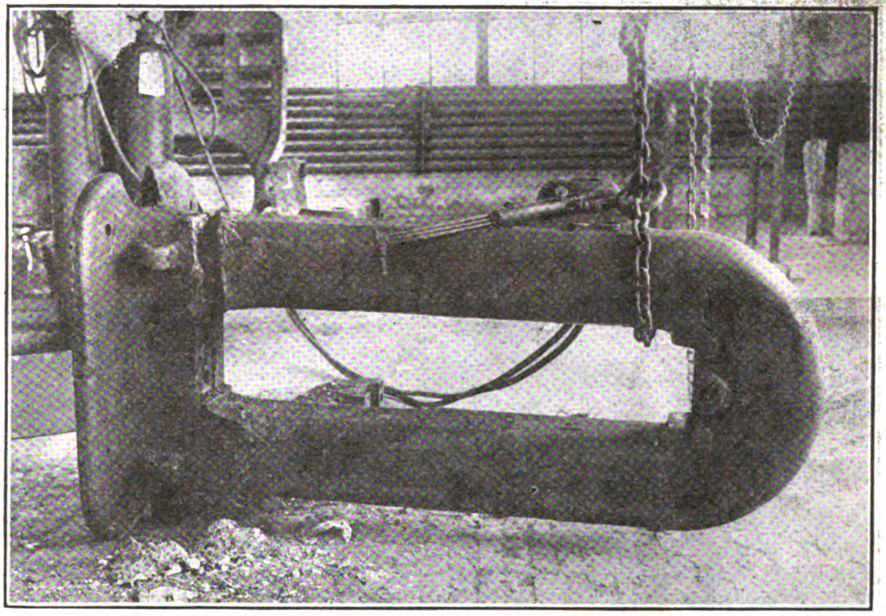
Although the cost of kerosene is considerably less than gasoline, it is not always the cheaper fuel of the two to use. This fact seems to have been established quite clearly at the recent extensive tractor tests held at Lincoln, Nebraska, and in which nearly all of the nationally known tractors competed. Despite its higher cost, gasoline seems to have the better of the argument.

It has long been the established rule in figuring the fuel consumption of stationary gasoline engines to allow one gallon per horsepower per 10-hour day operation, which brings us to the equivalent conclusion of 10 horsepower-hours per gallon of fuel. In actual test, this conclusion has been shown to be conservative, for under certain favorable working conditions even more efficient results have been obtained.

The average fuel consumption of the 65 tractors tested in the recent demonstration showed that they obtained only 4½ horsepower-hours per gallon of fuel consumed, or in other words, they were less than half as efficient as the stationary engine.

Quite naturally, this gives rise to the question, "Is kerosene as economical a fuel as gasoline?" From the tests it would seem not; but on the other hand the question may be raised, is it the nature of the fuel which results in the lowered efficiency, or is it due, perhaps, to the fact that present day designs do not permit utilizing all of the energy that is present in this lower cost fuel. Possibly some solution can be worked out along these lines for we have the peculiar paradox present, when drawing a comparison between gasoline and kerosene, that the latter has just as much energy in it per gallon as the best grade gasoline, in fact slightly more, and still in terms of actual work done, it is less than 50 per cent as efficient.

The lower efficiency of kerosene seems to be due chiefly to the fact that kerosene burning engines are designed with a lower working compression in order to avoid knocking. A goodly portion of the fuel either passes through the engine without being burned, either on account of this condition or else because it is difficult to properly vaporize this denser fuel with the present day carburetor, or else because of these conditions the fuel ignites so late in the power stroke that practically little of the explosive force is converted to useful work.

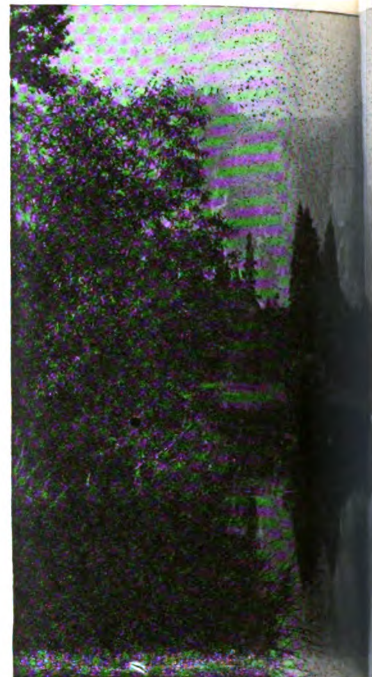


HEAVY CAST IRON CASTING CHAMFERRED WITH THE CUTTING BLOW PIPE.

There is no harm in making a mistake. Every man who amounts to anything at all makes them. But no man who is of much consequence makes the same mistake twice.

Speaking of short-time loans, that provision doesn't apply to the fellow who borrowed a dollar of you until to-morrow.

A VIEW OF THE GRANDE CANYON IN ARIZONA



CATHEDRAL ROCKS, YOSE

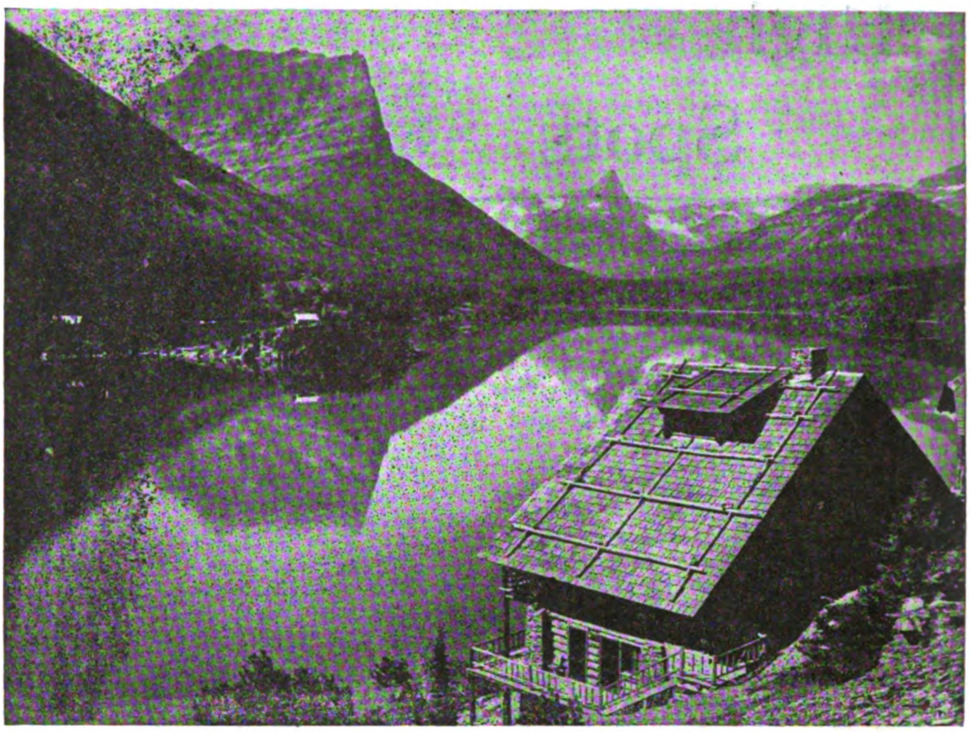
TAKING MOTION PICTURES
NATIONAL

ROCKY MOUNTAIN NATIONAL PARK, COLORADO.

DRAL NATIONAL PARK, CALIFORNIA.

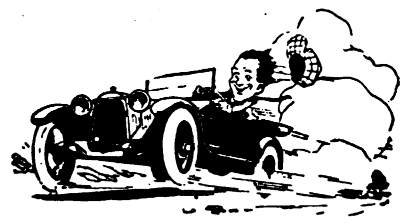
OTION VERHANGING ROCK, YOSEMITE
CALIFORNIA.

ST. MARY'S CHAPLET, GLACIER NATIONAL PARK.



VIEW OF MIRROR LAKE FROM PARADISE VALLEY, RANIER NATIONAL PARK,
WASHINGTON.

High Spots



Quite All Right.—A school-teacher in a small town in one of the Southern States was handed a note by one of her students. The note was from the pupil's mother, who explained why Sally had not been in school that morning.

The note read: "dere teacher, pleze exkuse sally for not being in skule this morning but her beau came saturday nite and they went out for a joy ride and didn't get back till this noon."

Impolite Pedestrian.—A taxi-driver who knocked a man down in Grace Church Street has summoned him for using abusive language. It seems a pity that pedestrians can not be knocked down without showing their temper like this—Punch, London.

Helen and—? "Mother's got such a surprise for you, Tommy!"

"Oh, I know all about that!"

"Not that you have two dear little sisters?"

"Yes, I do, and their names, too; 'cause when the Doctor told Daddy, he said 'Twins—oh! Hell and Blazes!"—London Weekly Telegraph.

Face Looked Familiar.—Dinah was a product of New Orleans, a big, plump "yaller gal," who could cook the finest dinners for miles around. One day a new butler appeared upon the scene, and Dinah's mistress noticed that she took a great interest in the man.

At last her mistress could stand her curiosity no longer and asked: "Dinah. do you know that new man?"

Dinah took another long and scrutinizing look and then slowly and reminiscently replied: "Well, I dunno, Miss Alice; but I think he was ma fust husband!"—Pittsburgh Chronicle-Telegraph.

In a Good Cause.—"Sir, would you give five dollars to bury a saxaphone player?"

"Here's thirty dollars; bury six of 'em."—Judge.

A Thought on Cellars.—A despatch from Chicago states that a girl, who has been confined in the cellar there for the past seventeen years, has lost the power of speech as a result: Some husbands may value their cellars more highly now.—Peterboro Examiner.

Where Angels Fear to Tread.—The Kentucky police have arrested that man who married his mother-in- law. Well, they also have to put wire screens around buzz saws, to keep folks from sticking their fool heads near them.—Ottawa Citizen.

Should be Satisfied.—The name of Patrick Henry, the famous Virginia orator of revolutionary days, has been enrolled in the hall of fame. He is the author of the famous phrase "Give me Liberty or give me death," and who got both.—Renfrew Mercury.

Excused.—Girl brides in New York under a certain age are required to attend school unless they present a reasonable excuse. One of them who had been reported for truancy sent a note to the teacher stating, "we have started a kindergarten of our own."—Vancouver Province.

"The Real Henry Clay."

One winter morning Henry Clay, finding himself in need of money went to the Riggs Bank and asked for the loan of $250 on his personal note. He was told that while his credit was perfectly good, it was the inflexible rule of the bank to inquire an indorser. The great statesman hunted up Daniel Webster and asked him to indorse the note.

"With pleasure," said Webster. "But I need some money myself. Why not make your note for five hundred, and you and I will split it?"

This they did. And today the note is said to be in the Riggs Bank—unpaid.

Her Topic

Uncle Jack, who was visiting them for the Christmas holidays from the West, wished to talk to Elizabeth's father at his office. He could not find the telephone directory and thus appealed to three-year-old Elizabeth for information regarding the phone number.

"Elizabeth, what does Mother ask for when she talks to daddy at his office?" he inquired.

Elizabeth was wise for her days.

"Money," she lisped.

His Worry

"Clearence," said the American heiress hesitatingly, "I think that you should be told at once how my father made his money. Our buisness men in this country have methods which to one of your pure soul, whose motto is 'Noblesse Oblige' can not but—"

"Cease Mamie, cease," said the young 'ord reassuringyl "tell me no more. However he made his millions I can forgive for your sake. But—er—has he still got them all right?"

Business

A train in Arizona was boarded by robbers, who went through the pockets of the luckless passengers. One of them happened to be a traveling salesman from New York, who when his turn came, fished out $200, but rapidly took $4 from the pile and placed it in his vest pocket.

"What do you mean by that?" asked the robber, as he toyed with his revolver. Hurriedly came the answer: "Mine frent, you surely vould not refuse me two per zent discount on a strictly cash transaction like dis?"

"I hear you had a puncture this morning?" Yes, I ran over a milk bottle." "Didn't you see it in time?" No, the kid had it under his coat" —Angwan (Nebraska Univ.)

Tube Bad.

"We had nothing but trouble all the way; four punctures and two blowouts."

"Quite, a tiresome journey." Cornell Widow.

At The Pump

"Had a puncture? No I'm just changing the air in the tires. The old air's worn out."—American Tribune (Dubuque, Ia.)

No Catchee

A starving tramp stopped at a kitchen door in California and asked for food. "You likee fish," asked the Chinese cook. "Yes," replied the tramp eagerly "All lite, come around Fliday."—Tennesee Mugwump.

Tramp—"Madam could you give me a dime for a bed "

Madam—"Why sure; bring the bed inside."—Southern Buck.

Out of Tune

Old lady to tramp—"But my good man, your story has such a hollow ring"

Weary Willie—"Yess missis, that's the natural result of speaking with an empty stomach."—London (Eng) Mail.

Mrs. Happyhome, "What can I do for you, my poor fellow?"

Tattered Tom—"Lady, the woman at th' next farm give me a piece of cheese. Would you be so kind as to surround it with bread."—Ayer (Mass) News.

Bite of Help

Tramp—"Can you assist me along the road mum?"

Lady—"Personally I cannot, but I can unchain my dog and I know he will be pleased to do so."—New Orleans Item.

"Madame," said Dusty Rhodes politely, "could you entertain a proposition?"

"I could," answered the firm lady pointing to the rug on the clothes line. "Either beat at it or beat it." —Topics of the Day Milms.

No Credit

"What does she say?"

"Says her face is her fortune."

"Now I understand what they mean by involuntary bankruptcy."—Louisville Courier Journal.

Times are Different

"Why is Wombat bustling so strenuous ly? I thought he retired with enough to live on"

"It looked like enough to live on—ten years ago"—Judge.

Topsyturvey Times

"A queer thing is on the cards in Europe."

"What is it?"

"The deuce is taking all the kings"—Baltimore American.

A Roundabout Method

"Pa, why do you always insist my singing when Mr. Bimley comes here?"

"Well, I don't lie to come right out and tell him to go."—Boston Transcript.

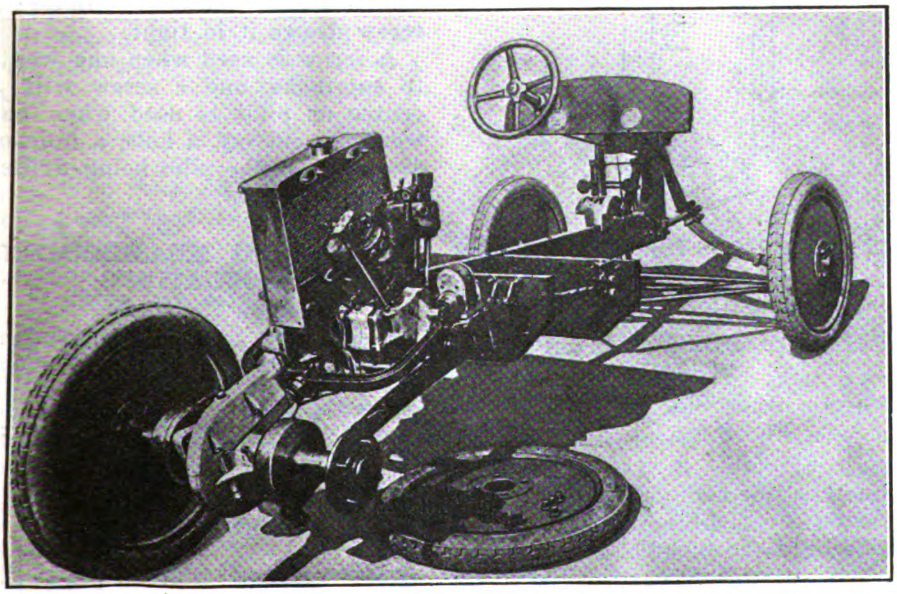
Not Any More

Now Wilhelm with a troubled brow
Counts up his various losses.
He cannot pay his board bill now
By giving iron crosses.
—Washington Star.

Benton's Recipes

HERE'S ONE THAT WASN'T SHOWN A T FARGO.

WE ARE WONDERING HOW THIS MACHINE WOULD HAVE BEEN RECEIVED AT THE RECENT TRACTOR DEMONSTRATION. SURELY IT WOULD HAVE BEEN A SOURCE OF COMFORT TO THE PROPONENTS OF THE THEORY THAT ALL TRACTORS ARE "SOIL PACKERS." THIS ONE MADE ITS APPEARANCE RECENTLY IN GERMANY. CONDITIONS THERE MAY BE IDEAL TO SUPPORT ITS TREMENDOUS WEIGHT. AT ANY RATE, WE'D ADVISE ITS OWNER TO KEEP IT THERE, AND NOT ATTEMPT ANY LOUISANA RICE FIELDS.



THE LATEST FRENCH INVENTION IS THAT OF AN AUTOMOBILE WITH OUT A CHASSIS, WHICH APPEARS TO BE PRACTICAL IN MANY RESPECTS. IN BUILDING THE MACHINE THIS WAY, IT IS CLAIMED THAT THE BODY CAN BE MADE NARROWER AND MUCH LIGHTER, THUS EFFECTING A SAVING IN FUEL AND TIRES. THE PHOTO IS A REAR VIEW SHOWING THE ENGINE AND RADIATOR.

Dressing the Grinding Wheel:—It may be of interest to some brother smith to know that the application of water to the grinding wheel before dressing them is of considerable assistance. I turn my grinding wheels over slowly by hand, pouring a stream of water on the edge of the wheel, and I find that the average wheel will absorb from a pint to a quart of water. If the water is applied in the form of a stream not larger than 1-4 inch in diameter, the wheel will absorb it as fast as it is applied. I then start the wheel, stepping aside to avoid getting wet fro mthe surface water that is thrown off. The wheel is now ready to be dressed in the usual manner.

To Protect Wrought-Iron Bridges From Rust:—The following process was observed painting the Britannia bridge across the Mania Strait in North Wales. All of the iron work was scraped and rubbed with wire and stiff bristle brushes until the surface acquired a metallic lustre. The holes, joints, and cracks were carefully cleaned and filled with red or white lead putty, and when dry the whole was brushed again and the bridge painted with 4 coats of the following paint at intervals of 8 to 14 days: white lead 560 parts, crude linseed oil 133 parts, boiled linseed oil (without an addition of litharge) 18 to 36 parts, and spirit of turpentine 18 parts.

After the fourth coat had been applied the whole was sanded with fine white sand. To the paint for the last coat enough Berlin blue had been added to give it a light grayish tint.

The parts of the bridge not exposed to view received, after thorough scraping and puttying up, 3 to 4 coats of a varnish obtained by mixing 8 parts of gas-tar, 1 of spirit of turpentine, and 2 of pulverized lime.

Blue Stain on Iron and Steel:—Polish and cleanse the steel thoroughly with lime, and then brush it over with the following mixture: Butter of antimony 8 parts, fuming nitric acid 8 parts, and muriatic acid 16 parts. Add the spirit of salt very slowly and drop by drop, to avoid too strong heating. Apply the mixture to the steel with a rag, and rub it with green, young oak wood until the desired blue color is produced.

A Nickel Buff—For buffing nickel work, work, there is nothing that will give a luster equal to Vienna lime composition. It can be made by the user, but it is more satisfactory to buy it of the manufacturer, as when homemade it air-slacks very rapidly; it is put up by the makers in air-tight cans of about one pound each, and this shape will keep until used up. It is also a good buffing composition on brass or other metals where there is not much cutting down to do, as it will cut down and color in one operation. If there is much cutting down, go over the work first with tripoli, then color with rouge or lime. All these compositions are put up in different grades for fast cutting, and also for dry or greasy work.

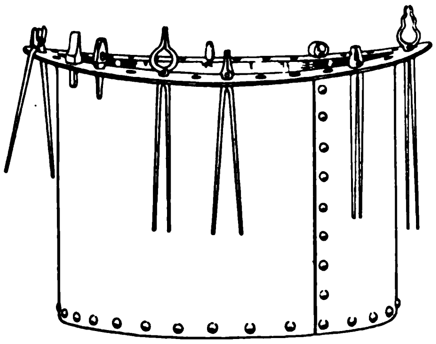
Abrasive paper and cloth should never be stored in a damp place, as the glue absorbs moisture very quickly. This loosens the grain and causes it to rub off before it is dull.

Do not dip high speed steel lathe and planer tools in water to cool them during grinding this causes cracks and checks. Grind tools of this kind with a liberal stream of water running on the wheel.

For lapping hardened steel, ordinary flour emery often leaves scratches caused by impurities. For the best results washed emery, such as opticians use should be employed. Keep in a covered receptacle to exclude all dust.

Shop Hints

"OLD BOILER CROWN MAKES BLACKSMITH'S COOLING TANK AND TOOL RACK"



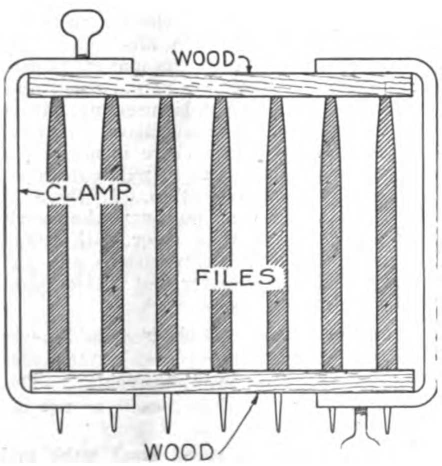
BLACKSMITH'S COOLING TANK MADE FROM OLD BOILER CROWN.

A blacksmith of Tanner, W. Va., located in an old oil field district, uses an old boiler crown for his cooling tank and rack for holding tools, such as tongs, punches, chisels, hammers, etc., as the drawing shows.

A valve is placed under the tank where the guage was removed, which makes it easy to change the water when fresh water is wanted.

A tank of this kind will last indefinitely and may be secured without much effort or cost, by just removing it from an old boiler.

Chester Cooper.



JIG FOR HOLDING SEVERAL FILES FOR SAW FILING

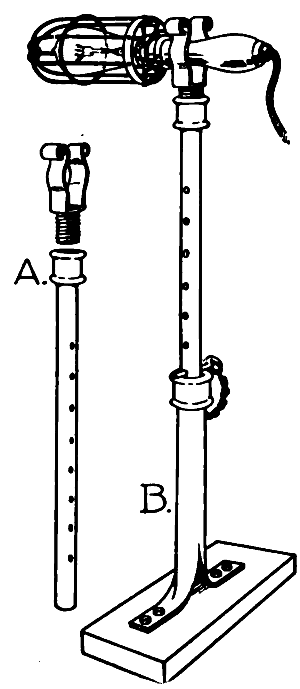
A SAW SHARPENING DEVICE

George H. Holden

A device for rapid saw sharpening is made with half-a-dozen saw files, two strips of wood, and a couple of clamps.

First arrange the files according to the saw teeth. In one wooden strip bore holes for file handle points; sufficient grip is maintained by file points at opposite end. This done, secure the files in position, and clamp as shown.

If the saw teeth are fine, it will mean you must miss every alternate one or two teeth. These are sharpened afterward, in like manner. Almost any number of files may be used, which both lightens the task and ensures perfectly even teeth.



UNIQUE HOLDER FOR THE PORTABLE LIGHT.

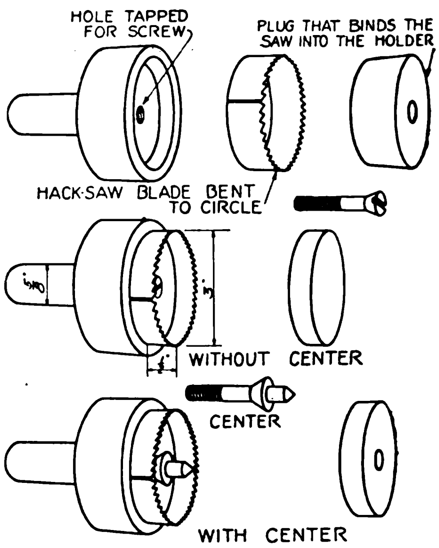
HANDY PORTABLE LIGHT STAND

From some odd pieces of large pipe, a bit of spring brass and a piece of plank, a very serviceable stand can be made, as shown in the sketch, for holding the shop portable lights at just the right height when working on car repairs. The member A is made of a size pipe that will fit into the lower part, as shown assembled in sketch B. A series of the holes provide for height adjustment.

Chas. H. Willey.

DISC OR CIRCLE CUTTER

If one has many dash board holes to cut for mounting instruments, clocks, etc., on the dash board of autos, it is worth while making up



CUTTING CIRCULAR HOLES IN INSTRUMENT BOARD IS QUICKLY DONE WITH THIS TOOL.

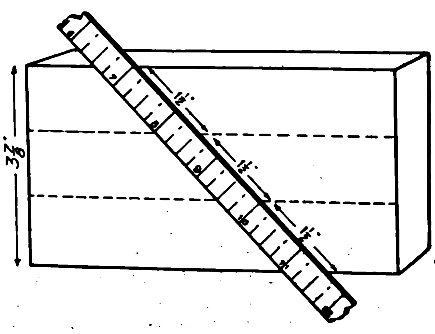
a tool for the work such as shown in the sketches. It can be made in a shop that has a lathe. The holder A is made of cold rolled steel and bored to the dimension of the circle to be cut. A hack saw blade is bent into a circle to fit in it. If necessary the temper should be drawn slightly. A plug with a slight taper as at B is made to wedge the saw into the holder; a screw draws it in tight.

A screw is used when one wants to cut disks, and a screw with a center or pilot is used when one wants to cut out a hole, a hole of same size as the pilot being drilled in the dash first.

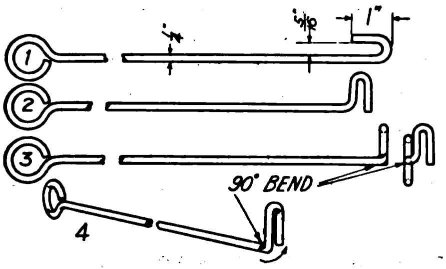
SIMPLIFYING MEASUREMENT CALCULATIONS

George H. Holden

I find the task of calculating measurements on metal and wood



DIFFICULT DIVISIONS ARE QUICKLY AND ACCURATELY MADE THIS WAY.



FORD OIL TESTER MADE FROM ¼ INCH BAR STOCK.

rendered much easier by placing my rule obliquely instead of crosswise.

For centering casting or marking divisions on the face, this simple method simplifies the task.

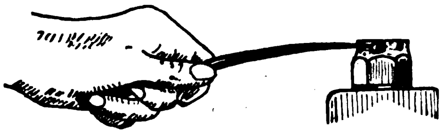
Sometimes I handle castings requiring to be grooved on the face. If two grooves are required on, say a 3⅞-in. face, the niches to be dead central, I slide my rule obliquely until it measures 4½ inches across. All I need to do then is mark off 1½ inches and 3 inches, and I have the exact divisions.

FORD OIL TESTER

A handy little tool that will find a ready market among the Ford drivers who don't like to "get out an' get under" to test how much oil is in the crank case, can be readily made by any blacksmith and sold at a profit for a dime.

The drawing explains clearly how the tool is made. 27 inches of quarter-inch round stock is sufficient.

Make up a couple, show them to the man that has just soiled his silk shirt trying to solve that oil mystery, and see if you don't make a sale. J. Baldwin.



COTTER PIN EXTRACTOR MADE FROM OLD FORK TINE.

A COTTER KEY PULLER

Cotter keys are often hard to get out especially if they are located in places which are hard to get at. The tool described below will serve efficiently in every farmer's tool kit and can be made at practically no cost.

A piece of a hay fork tine cut or broken off so it is about eight inches long does the trick. As the point is usually blunt from use, it probably will be necessary to sharpen it before it will work well on small keys. S. E. Gibbs.

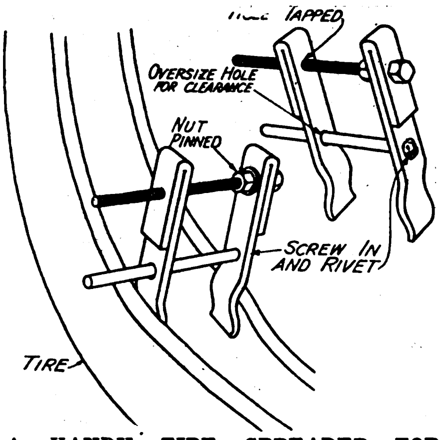
HOME-MADE TIRE SPREADER

For spreading the large size tires when working on the inside surface I have made a couple of spreading clamps from flat iron stock and some round rod. The illustrations show how the device was made and how it is used. Anyone having need for such a tool could understand how to make it from the sketches.

Chas. H. Willey.

HOT WATER HEATER FOR SHOP

Many shops are without hot water for washing, but have an engine which they run several hours a day. If a tank is used for cooling water there is plenty of hot



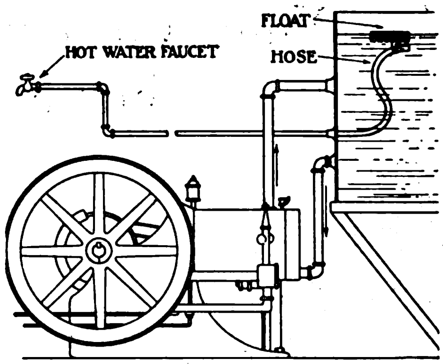
A HANDY TIRE SPREADER FOR HEAVY CASINGS.

water near the top of the tank; but it is rather difficult to drain the water easily.

If a hose is attached to the hot water faucet and the other end is attached to a float, it can be made to draw water from within an inch or so of the top. If the engine is not in use enough to heat enough in the water jackets the exhaust gases can be directed through a coil of pipe in the tank. If the latter is used a valve should be provided so the exhaust gases can be used only when needed, or the engine may over-heat during long runs. S. E. Gibbs.

PISTON RING COMPRESSOR

When placing the piston into the cylinder of a gas engine the rings are more or less hard to handle unless compressed by a suitable tool. Such a tool can be made from a pair of ordinary pliers and a piece of wire. A hole slightly larger than the wire should be drilled in each jaw as shown in the sketch. The



THIS ARRANGEMENT WILL FURNISH AMPLE HOT WATER

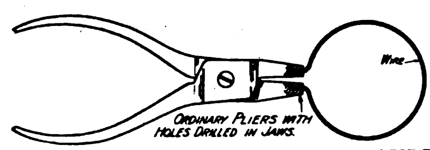
wire should be a little longer than the circumference of the piston upon which it is to be used. By having several loops of wire the compressor can be used on any number of sizes of pistons. When the pliers are usually held parallel to the piston.

S. E. Gibbs.

CLEANING ALUMINUM

The Metal Industry recommends this method of cleaning aluminum:

Remove the grease by washing in a very weak solution of lye to which sodium carbonate is added, as much as the solution will absorb. Wash in water; dip in a solution of caustic soda, two pounds to the gallon of water; wash; dip in concentrated nitric acid until all the caustic soda has been neutralized or remved; wash in water again and dry in hot, clean sawdust.



A PAIR OF PLIERS MAKE AN HANDY RING SQUEEZER.

(*Continued from Page* 234)

wood pulley has a disadvantage in that it is a poor conductor of heat, consequently if there is much slipping the pulley may heat up to the ignition point and start a fire. The steel pulley, on the other hand, is a good conductor of heat. The heat due to slip or creep simply passes through the rim and is then radiated out into the atmosphere. On an average the steel split pulley is 40 per cent lighter than the cast iron pulley and can be applied to the shaft without taking the shaft down. No set screws are required and only under exceptional circumstances is there any advantage in using a keyway.

Are Your Customer's Trucks Ready For Summer?

The sweltering days of summer will soon be with us and service stations will again be filled with heat-afflicted motor trucks and cars. Will your truck be in the steaming-radiator line? Or is it prepared to give uninterrupted service during the summer months?

Overheating and other common hot weather troubles are usually due to lack of forethough and to mistakes that can be easily avoided. The main points which require attention are briefly outlined below:

1. Do you understand the truck's cooling system thoroughly? If not, now is the time to go over it carefully and find out all there is to know about it. See that the flow of water is not impeded by any sort of obstruction and that the overflow pipe is not bent below the level of the base of the radiator filler. Be sure that the overflow pipe is not clogged or flattened.

2. Is the radiator clean? The front of the radiator should be free from dirt, license plates and signs. Also, the back of the radiator should be unobstructed so that nothing will impede the circulation of the air.

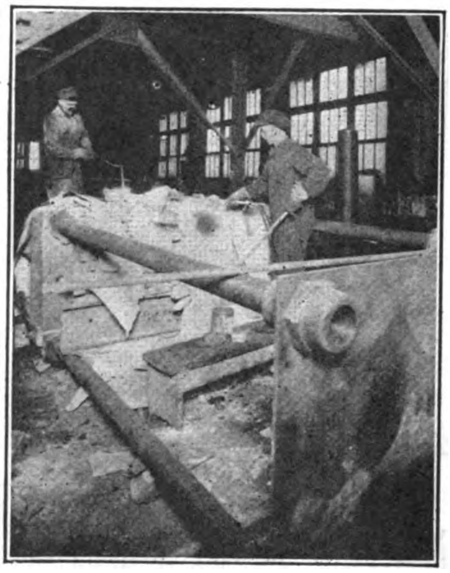
3. Are the hose connections water-tight and is the hose in good condition? Be sure that the rubber has not been affected during the winter by an anti-freezing solution. Only the best quality rubber hose should be used, as the inside tubing of cheap hose is easily worn away and the rubber particles carried along with the water clog up the radiator.

4. Does the fan turn freely and is the belt tension right? The fan should be clean and its bearings should be well greased. A good test is to turn the fan by hand with the engine shut off. If it is possible to slip the belt easily, but not possible to spin the fan, the tension is right.

5. Is the carburetor choke in proper repair so that it opens all the way? Better open the seasonal shutter on the hot-air tube. Is the float level correct? If too high, slight flooding will cause an over-rich mixture.

6. Does the ignition system furnish a spark of sufficient strength? A weak spark due to excessive lubrication of the magneto, dirty breaker or distributor, or weak magnets, will have an effect similar to late spark timing and overheating will result.

7. Are the valve tappets properly adjusted? They should have from .008 to .010 inch clearance, which may be gauged by about the thickness of an ordinary post-card, some motors require less. See the particular instructions for the car on which you are working.



THE BASE IN COURSE OF THE WELDING OPERATION.

8. Are the cylinders free from carbon? If not, remove it.

9. Is the oil in the crankcase clean? Gasoline, dirt, or other foreign substances will impair the quality of the oil in the crankcase resulting in overheated parts due to insufficient lubrication. The oil reservoir should be drained every 1,500 miles, the walls thoroughly cleaned, and a fresh supply of oil should then be put into the crankcase.

10. Are you using the right grade of oil? Because of the increased temperatures it is often advisable in summer to use a heavier grade of oil than in winter.

11. Are the exhaust pipe and muffler clean? Practically 40 per cent of the heat of combustion escapes through the exhaust. It follows, therefore, that if any part of the exhaust system is obstructed, a part of this heat must be carried off by the cooling water, which will naturally raise its temperature.

12. Are the brakes free? A dragging break will cause overheating in hot weather that might not occur in cool weather.

THE WELDING BASE OF 250-TON HYDRALIC PRESS

A typical instance of the practical application of oxy-acetylene welding in repair and maintenance of plant equipment is illustrated in the accompanying cut, which shows operators welding the base of a 250-ton hydraulic press that was badly broken in service.

The heavy base was broken entirely through, the fracture extending diagonally across the center. To properly bring the parts together for welding it was necessary to bind them with a chain and supplement this with a steel plate securely bolted to the uprights.

The necessary chamfering was done to secure penetration and proper bonding throughout the joint, and an improvised preheating furnace was then built up of "I" beams and loose brick. Approximately 126 pounds of charcoal and 200 pounds of asbestos paper for covering were used.

When the base was brought to proper heat, openings were made in the asbestos sheeting to afford access to the work in operating the torches and filling rods, and the actual welding was begun. After the work has progressed to a point where the girding interferred with the operators, the chain was removed, the steel plate being then sufficient to keep the parts properly aligned. There were 44 inches of linear welds (4½ inches deep) besides an area of 8 in. x 4½ in. that was missing and had to be built up. after welding the entire base was allowed to cool slowly in the furnace.

The job was handled by two operators, using No. 4 Oxweld blowpipes with No. 15 tips. Approximately 250 pounds of cast iron alloy rods were used in filling.

To have obtained a new casting would have cost the owner $800 and a delay of several months. The repair cost but a small fraction of this amount, was accomplished in a few days, and the machine was again in operation within a week from the time it was sent to the welding shop.

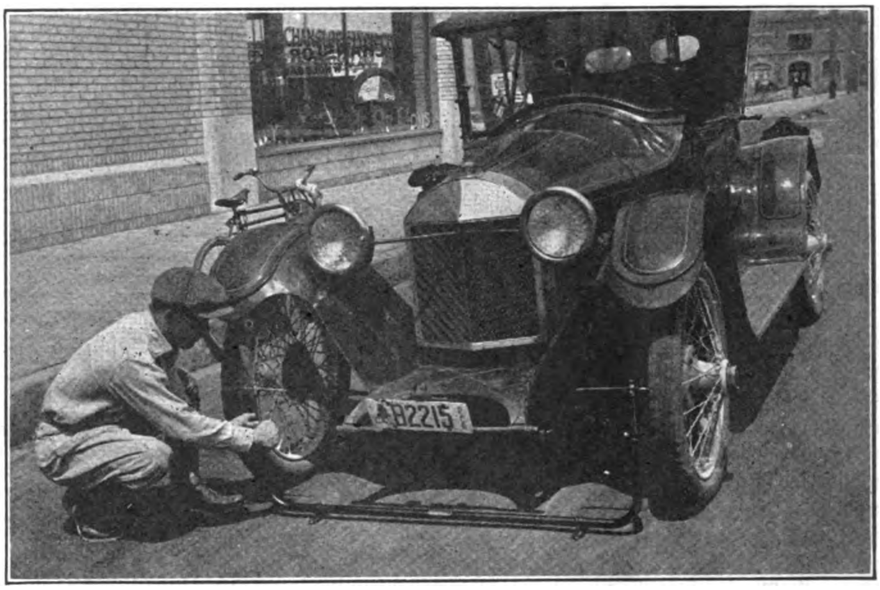
A Wheel Liner for the Mortorist

BY ALBERT MARPLE

Any motorist who has owned a machine for any great length of time knows that it is fatal to the automobile tire to have the wheels of the machine out of alignment. Especially is this realized by the fellow who is compelled, for financial reasons, to see that his tires give him the greatest possible mileage. When the wheels are out of alignment, this referring to both the front and the rear wheels, there is a constant grinding process going on all the while the car is moving between the part of the tire that is touching the roadway and the road itself. There is more or less of a skidding action, which results in the tread rubber of the tire being worn away long before the proper time. Generally speaking, every tire should leave the guaranteed-mileage point far in the rear before the tread rubber is worn away sufficiently far to expose even the breaker-strip—or the first layer of fabric. If it does not do this the motorist can take it for granted, providing the car is run over improved boulevards, that the wheel or wheels of the machine are out of alignment.

Every motorist should understand the fundamentals of keeping his wheels in alignment and of ascertaining whether or not they are lined up correctly. This cannot be done with the eye. It is not possible for a mechanic to look along the tires from the front to the rear of the machine or vice versa and tell accurately whether or not the wheels are lined-up properly. This work calls for an instrument that can adjust the wheels to the fraction of an inch, so as to eliminate practically all of the skidding motion, and thereby eliminate practically all of the unnecessary wear. Such an instrument has just made its appearance out in the western part of this country. This device is shown in the illustration accompanying this brief story. It consists of a metal frame, made of one-inch pipe or tubing, almost as long as the machine is wide, and at either end being curved or bent upward. Attached to the lower part of this tube is a pair of feet, which keep the device standing upright at all times. At the upper ends of the upturned portions of the tube are instruments which may be adjusted both for height and width, this enabling them to accommodate any size wheels.

The front wheels of an auto are both "cambered," closer together at the bottom than they are at the top, and "toes in," closer together at the front than they are at the rear. The wheels are arranged in this manner so as to provide for easy steering, minimum wear on tires, etc. The rear wheels are supposed to be perfectly straight or square with the machine. With this wheel tester that has just been invented it is possible to tell to the fraction of an inch whether or not the front wheels are "toed in" and "cambered" to the proper degree or whether the back wheels are true.



WHEEL ALIGNMENT MEASUREMENTS ARE QUICKLY AND ACCURATELY MADE WITH THIS DEVICE.

First the lining instrument is placed between the front sides of the two front wheels, as here shown and the adjustable parts of the instrument adjusted to the felloes of the wheels; then it is moved to the rear of the same wheels and the difference noted, etc. The rear wheels are tested in the same manner. After the relative alignment of the wheels has been ascertained, the wheels are trued up by the wheel-alignment mechanism, which differs on practically all makes of machines.

OBTAINING CREDIT ON FALSE FINANCIAL STATEMENT

Ralph H. Butz

Where a false financial statement is furnished to a mercantile agency with the intent that it be relied on for the purpose of obtaining goods on credit, the person rendering the statement and obtaining goods is guilty of larceny, according to a decision of the N. Y. Court of Appeals.

Woronoff & Edson gave a signed statement to the Dun & Bradstreet agencies, showing that they had a surplus of $22,827, and later on ordered from the Internation H. Company goods to the amount of $1,266. The seller requested a financial statement to which the buyer replied that they never gave any, but referred to the statement given the agencies.

In this statement it was stated that a cash book, ledger and sales book were kept. Before the time of credit expired the buyer filed a voluntary petition in bankruptcy. The seller served notice on them to produce their books for examination and their attorney replied that it could not be complied with as they were in the hands of a receiver. A warrant for their arrest was obtained under the provision of the penal law providing:

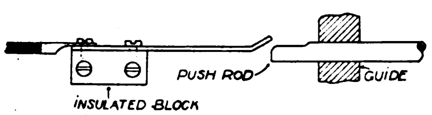
"A purchase of property by means of false pretense is not criminal where the pretense relates to the purchaser's means or ability to pay, unless the pretense is made in writing and signed by the person

(Continued on page 247)

Ignition System For Old Stationary Engines

S. E. GIBBS

Many of the old farm engines are equipped with make and break ignition systems, which are hard to get repair parts for when they fail to give satisfactory service. Builders of farm engines, who have gone out of business without providing



CONTACT MAKER USED IN CHANGING THE OLD STATIONARY ENGINE TO JUMP SPARK.

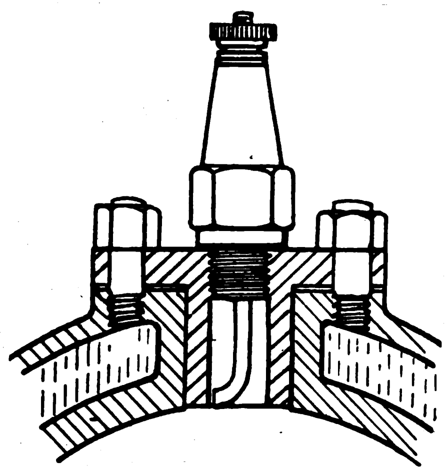
parts service for their customers, cause considerable loss in many instances. Many parts such as bearings, broken castings and carburetors are more or less easy for the average repairman to fix; but the ignition system is more delicate and is often the cause of an otherwise good engine being junked.

An old make and break system can be replaced with a standardized jump spark system that will give excellent service by any farmer at a small expense and with but a few hours' work. The material which consists of four dry batteries, several feet of insulated wire, a spark plug, a Ford or other vibrating coil, a small fiber block and some screws can be purchased at any garage or hardware store.

The old ignitor should be removed from the engine and all the parts discarded except the outer part or housing. Then the hole through the center of the shell should be drilled or reamed to the proper size to take a one-half-inch pipe tap. The outer end should be tapped deep enough so that a half-inch spark plug can be screwed in until only one or two threads can be seen. A seven-eighths-inch or metric plug would serve as well but the proper tap is not often to be had in the small shops so the one-half-inch plug will be found most convenient to the average user.

A plug with a heavy center electrode should be selected. It should be taken apart and a piece of steel wire welded to the center electrode as shown in the sketch. The electrode from an old plug is desirable for this piece as it is generally made of a special heat resisting material which gives exceptionally long service. The plug should be screwed into the shell and the point adjusted to the proper gap before the shell is placed into the cylinder. It is well to have two or more plugs prepared while at the job so that if one becomes damaged another will be handy and a delay can be avoided.

The old push rod which operated the make and break device should be cut off so it will not interfere with the spark plug and placed in a guide or slide and pointed so it will serve as a contact maker. A flat surface should be filed on the upper side of the end so a sharp edge will touch the contact spring as shown in the sketch. The contact spring should be mounted on a block of some insulating material which is fastened securely to the side of the engine.



SEMI-SECTIONAL VIEW SHOWING THE SPECIALLY MADE SPARK PLUG.

On some engines, the stroke of the push rod is adjustable, so that it can be changed after the engine is started, so the spark can be advanced. If this is not the case the contact spring must be made so it can be slid ahead when the spark is to be advanced. When timing the device the adjustable member must be put in retarded position and the piston placed on top dead center and the contact set to just touch.

Any vibrating coil will be satisfactory; but an old Ford coil is often handy and can be made to give good service if repointed. If a Ford coil is used the wires must be soldered to the contacts. The wiring diagram shows how to make the connections. A heavy high tension wire should be used on the spark plug lead.

The coil and batteries should be placed in a box and covered so that they cannot become damp or a short is likely, making starting difficult. The spark plug should never be turned, unless the shell is removed and the point adjustment is checked before the engine is to be started. The contact should be only for an instant or the batteries will be rapidly exhausted.

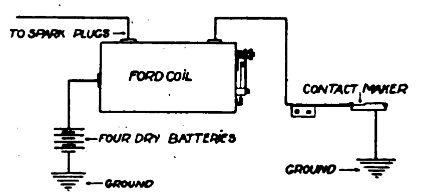
If such a system is carefully made it will give excellent service for years. One such outfit has been in service in a shop in southern Iowa, and has been in almost constant service for over five years.

A RADIATOR FOR THE SPEEDSTER

Here's a suggestion that will be welcomed by those who are engaged in that popular pastime of making the flivvers look like what they ain't. Often it is difficult to obtain a high, narrow radiator without going to considerable expense. One can be very easily made by cutting it from the central part of the core of a larger radiator which has been discarded. Frequently, it will be found that only the edges are worn out, and that the center is still quite serviceable. Such radiators can be bought at junk prices and the only additional expense is the time used in making the improvised article.

IRON PIPE AS GEAR PULLER

"One way to get a gear off a shaft," says Popular Mechanics, "is to find a piece of pipe a little longer than the shaft, file off the end to a very nearly true surface, and clamp it to the bench. Then slam in the shaft and let the gear



WIRING DIAGRAM USED IN CHANGING THE OLD ENGINE.

strike the end of the pipe. If the gear is hard, it will not be damaged by the blow, and if the pipe is faced off pretty acurately there is little, if any tendancy to damage the shaft."

AUTOS AND TRUCKS CAN NOW WORK IN ORCHARD

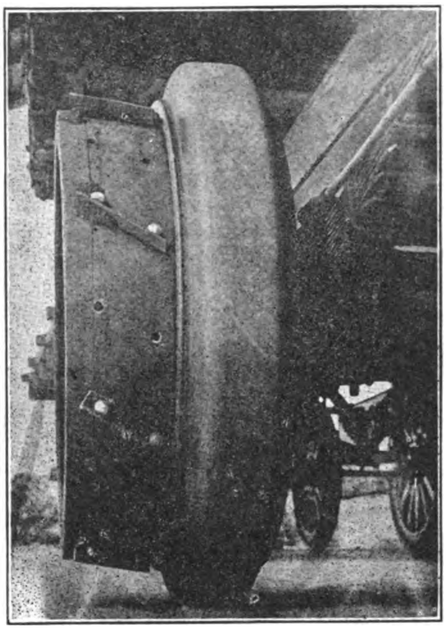
By Albert Marple

ONE of the most important of the latest inventions for the automobile and motor truck to make its appearance in the western part of this country, is the novel flange wheel. This new device makes the work of these gasoline-driven vehicles in the soft ground of the orchard or the grain field possible. It fastens to the outer side of the wheels of the machine. This flange enables the auto or truck to move over the soft ground just as rapidly and with as much ease, as it does on the boulevard, one feature of the contraption being that it does not interfere in the least with the operation of the vehicle on the hard-surfaced roads.

For quite a while, the tractor has been used in connection with various types of orchards and groves over all parts of this country. This vehicle has very successfully demonstrated its ability to take the place of the horse in the work of plowing, cultivating, etc., but when it comes to hauling the product to market, it is right there that the tractor falls down. This necessitates the keeping of a horse simply for the hauling of the product to market or the packing house. The use of the truck was given a thorough tryout recently in the western part of this country and the difficulty of the operating of the machine in the soft earth soon presented itself. It was just when the farmers have decided to give up trying to use the truck in the orchard that this new invention, used in connection with a two-ton Republic truck, made its appearance. It is needless to say that this flange wheel put an entirely different light upon the use of the truck in orchards, or, in fact, anywhere where the ground is soft.

This flange is made of very heavy steel, six inches in width, extending outward from the felloe of each wheel and held securely in place. This gives the machine the appearance of having been equipped for duty on the railroad rather than in the orchard. One of the points about this flange is that when used on hard-surfaced roads it clears the ground by several inches, the truck riding solely on the hard-rubber or inflated tires. When run from the hard street to the orchard the tires press into the soft earth until the flanges become engaged, when the machine runs along, on account of the greater bearing surface, just as does the wide-wheeled tractor. Provision has also been made for added traction, which the machine naturally needs when working in the soft ground. This is obtained by means of a series of cleats that have been fastened diagonally to the steel flanges fastened to the rear wheels.

A short time ago this new flange wheel was given a thorough tryout. With a trailer attached the truck plowed its way "over" the soft ground of the orchards to the loading point. When this was reached 145 boxes of oranges were piled upon the truck and the trailer, and at sixty pounds to the box it will be seen that the gross weight of the



THE FLANGE ATTACHMENT WHICH PERMITS TRUCKS TO BE OPERATED OVER SOFT GROUND

load was about 8,700 pounds, to which should be added the weight of three men, who rode on the truck The fruit was conveyed from the orchard, past the farm house and up the lane to the asphalt road, thence along this boulevard to the packing house, and all this without a stop.

But the benefits derived from the use of this new combination are not all told. The improved condition of the fruit is to be considered. Heretofore the wagons used in the hauling of this fruit to the packing houses have been ordinary steel-tired vehicles. The trucks invariably ride on rubber and it is claimed that the substituting of the rubber for the steel tire will do much toward maintaining the perfect condition of the fruit for packing and shipping, for it is known that any damaged fruit that happens to escape the trained eye of the packing house employee generally decays before it reaches its destination.

Many of the ranchers in the western part of this country are securing a great deal of assistance this year from this flange-wheel attachment in the handling of their crops, this including the owners of grain, fruit and produce ranches. It is probable that, everything considered, nothing has been invented during recent months for use in connection with the motor truck or automobile that will prove to be of such general service to mankind as will this flange-wheel attachment. This new device promises to inject genuine speed into the harvesting of all kinds of crops.

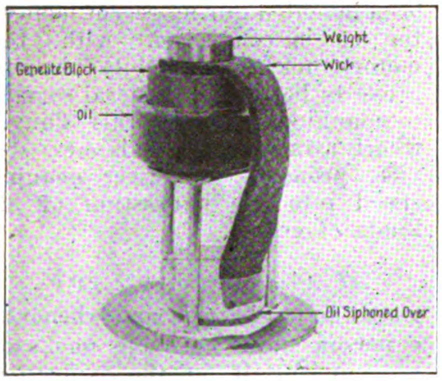
(*Continued from page* 245)

sought to be charged, and whenever a person states he keeps books of account and if, at the expiration of the term of credit, fails to pay, shall produce such books within ten days on notice for examination, and failure to do so is made presumptive evidence that every pretense relating to the purchaser's means or ability to pay in such statement were false at the time of making and known to be false." By an amendment the law also includes the giving of a statement to mercantile agencies with intent that it be relied upon as a basis of credit.

The court held: "Suppose the seller, with the statement in his possession, called upon the defendants and asked to see their books and they refused to permit any examination to be made, or suppose that upon a trial involving the truth of the financial statement given to the agency, these purchasers failed to produce or account for their books, would there not be a natural inference to be drawn from such refusal and failure that the books were not in accordance with the statement and that the latter was false? This provision of the penal law is but a statement of natural inference to be drawn from such facts. The presumption is not disconnected from the main facts; it is not arbitrary or unreasonable. It is the natural result to which the undisputed facts reasonably lead."

A New Wear-Proof Bearing Material

Most motorists are familiar with the annoyance of having the engine of their car overheat and stall at inconvenient times, owing to overheated bearings. Even if the crank case is full of oil, and the system working properly, the oil is liable to be so badly diluted by the products of partly consumed gasoline that it is inefficient.



SIPHONING OIL THROUGH METAL, SHOWING THE HIGH CAPILLARITY AND POROSITY OF GENELITE.

A new bearing material, known as Genelite, has recently been perfected, which, used in main bearings, crank pin bearings and similar places, will eliminate such troubles. Although it works better when lubricated, it can also be used without any lubrication at all. It is the result of years of research by the Research Laboratory of the General Electric Company to produce just such a material.

Genelite consists of a high grade synthetic bronze having about 40 per cent of its volume of powdered graphite evenly distributed throughout the mass. It is made by pressing the ingredients in a heavy metal mold, as near to final dimensions as possible, and then subjecting them to heat. The result is that the graphite is so firmly clamped into the mass that it will not wash out, even when the bearing is lubricated. It looks like bronze, but the characteristics are quite different. One of the most valuable of these, from an operating standpoint is its porosity. It is able to absorb as much as 2½ per cent by weight of oil; so, in some high speed applications, oil is applied to the outside of the bushing, and carried to the bearing surface by capillary attraction.

While any bearing works better when lubricated, there are places on an engine which are scarcely ever lubricated, owing to their inaccessibiliy. It is in such applications that the self-lubricating properties of Genelite are of great aid in saving wear and repair expense. A few of these applications are fan bushings, throttle control bushings, clutch centering bushings and pump shaft bushings.

The ability of bearings made from this material to withstand wear and rough usage is amazing. This was demonstrated in the case of a well-known make of automobile, the crank pins of which were equipped with Genelite, and the main bearings with babbitt bushings. Examination after the car had been driven 20,000 miles showed the main bearings and shaft to be very badly worn, while the crankpins were barely polished, and the Genelite in the large ends of the connecting rods had scarcely come to a full seat.

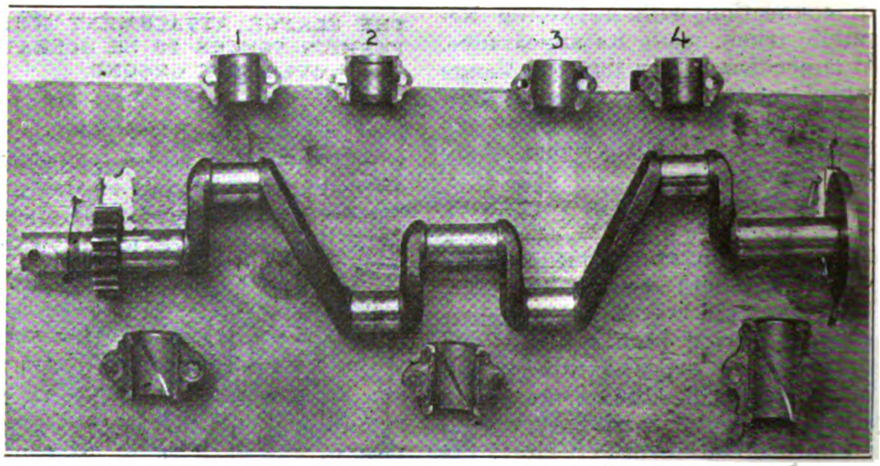
A FREE TEXT-BOOK ON STEEL THAT CUTS AT RED HEAT

The remarkable cutting qualities of Stellite, which contributed so largely to speeding up production during the war are pretty generally known. What Stellite is doing to aid peace-time production, however and the recent developments that have improved and extended its application are not so widely known. There are still some users of high-speed cutting tools who regard Stellite as an alloy of steel; unfortunately, they have tried to use it as they would high-speed steel, thus failing to obtain its full advantages. The new production records established with Stellite tools have created a demand for authentic information and specific facts concerning Stellite's advantages as a cutting metal.

Two new books, just issued by the Hayness Stellite Company will admirably satisfy this demand. They are text-books in convenient pocket size, containing valuable information never before published. They tell all about Stellite in an unusually interesting and instructive way. New method of obtaining increased speed—the latest advances in machine-tool practice—heat charts — tables — complete data and exceptionally fine illustrations are all graphically presented. There are many departures from the ordinary practice, which should make a careful study of the contents well worth while.

The completeness of the instruc-

(Continued on page 249)



THE CRANK PINS AND BEARINGS OF A WELL KNOWN MAKE OF AUTOMOBILE AFTER THE CAR HAD BEEN DRIVEN 20,000 MILES. THE CONNECTING ROD BEARINGS WERE EQUIPPED WITH GENELITE AND THE MAIN BEARINGS WITH BABBITT. AN EXAMINATION SHOWED THE MAIN BEARING AND SHAFT TO BE BADLY WORN, WHILE THE CRANK PINS WERE BARELY POLISHED, AND THE GENELITE IN THE LARGE END OF THE CONNECTING RODS HAD SCARCELY COME TO A FULL SEAT.

Delivering Three Cars At A Time

A VERY ingenious method of driving three automobiles at one time has been invented by W. M. Hinds of Los Angeles, California. This unique way of transporting machines from town to town was brought about by the delays caused by present delivery facilities. Mr. Hinds is the head of the service department of a large automobile concern. He saw that he had to devise some way of delivering cars to his customers—hence this novel train method.

The feature of this new invention is that the front car is not compelled to pull the two in the rear, but that the man seated in the front car operates, by a novel arrangement, the controls of the two rear cars, the same as he does the one in the car within which he is riding. In other words, the motors of all three cars are made to do their share of the work and the cars in the rear are not "dead weight."

In the first place an especially devised "trailer hitch" is used to link the three cars together. By means of this the two rear cars are made to "track" absolutely with the front machine, so that no difficulty is experienced in turning the sharpest corners. Another vital point is that the ignition systems of the two rear cars are connected up by means of insulated wires to a switch clamped to the steering column of the first car and easily in reach of the operator of the "train." The two rear cars are then put in high gear and the throttles set at a speed of about 20 miles an hour, or as fast as it is desired to run. The driver starts towing them with the first car, and when he has reached the proper speed he throws in the ignition that controls the two rear cars, whereupon their motors start, this being caused by them being in gear and the rear wheels turning over their motors.

It has been found that by having the motors of all three cars running it is possible for the train to "make a grade on high" that would be practically impossible for the train to make in "low" were the first car compelled to pull itself and the two cars in the rear. On the other hand, were the two rear cars left in neutral the problem of braking them would be much more difficult than it is when the three cars are connected in this manner. When the train starts a descent the brakes of the front car only are used, and as the ignition shut off the motors of all three cars turn over against compression and thereby furnish a very effective brake. In a case of this kind if the front car is put in "low" there is no need of applying the brake at all on the average highway grade.

This new device is being employed daily in the delivery of cars in southern California. It is also being used in the delivery of trucks which are taken in trains of two each. Deliveries are being made within 300 miles of the home office in this manner. After the delivery of a train the coupling and operating devices are sent back to the home office by express, ready for the next trip. A "train" of autos can be completely equipped for an outgoing journey in less than one hour.

THE IGNITION CONTROL USED IN OPERATING THE TRAIN OF SEVERAL CARS WITH BUT ONE DRIVER.

THE DEVICE FOR CONNECTING CARS SO THAT THEY WILL TRACK PROPERLY.

(Continued from page 248)

tions and illustrations covering this new and successful machine-tool practice, make these text books a valuable addition to the Working Library of every Shop Superintendent and Machinist.

The announcement of reliable text-books explaining the application of tools, whose speed is not limited by the heat from cutting, will be of unusual interest and value, coming at this time when it is so vitally necessary to get the utmost production at the lowest possible cost.

Copies of these new hand-books may be obtained without charge by writing to The Haynes Stellite Company, 30 East 42nd Street, New York City, for Volumes 9 and 10 of their Stellite Reference Library.

Submersion in a bath of cleaning solution instead of rattling drop forged parts in one plant added more than 100% to the useful life of cutting tools on each grinding and setting.

ONE REASON WHY TIRES WEAR OUT

Copyright, 1921, by W. F. Schaphorst

There would be absolutely no wear on an automobile tire if the tire ran on a perfectly smooth road. Fortunately, though, no such road exists. Unfortunately, as far as tire wear is concerned, rough roads DO exist.

Any road, to be of any value at all, must exert a frictional force on the tire. No automobile could run on a frictionless or "perfectly smooth" road. In order to have tractive force we must have friction, and with friction we always have wear.

These things being true we must, therefore, conclude that there will ALWAYS be wear on a tire no matter how smooth the roads may be made. The smoother, of course, the less the wear, but that is as much as we can say about it.

Again, no matter how much friction exists between the tire and the road there always is some slip. Properly, this kind of slip isn't slip at all but should be called "creep." It is unavoidable.

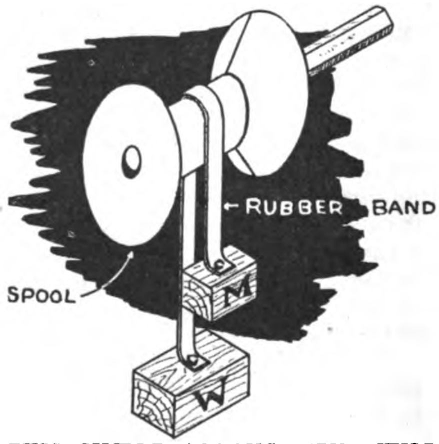
To illustrate, here is a simple way in which you can prove to your own satisfaction that creep exists and that it isn't slip: Hang a weight W at the end of a rubber band and another slightly lighter weight M at the other end. Support the two over an ordinary spool as shown in the sketch, running a lead pencil through the opening through the spool. You can now rotate the spool easily one way or the other and as the spool rotates the weights will move up or down, depending upon the direction of rotation of the spool. Keep up the rotation back and forth, however, and it will soon be noticed that a point on the rubber band doesn't always come back and coincide with the same point on the spool as would be the case if the weights W and M were equal. The weight W, being heavier, causes the rubber band to gradually move in its direction. This movement is called "creep."

The same is true in the case of an automobile tire. There is a gradual "creep" in the direction of motion of the tires. This holds true for the rear tires only. Front tires do not creep at all because they do not transmit power.

Creep has the same effect as slip in causing wear on the tires but it is so small that it is impossible to detect it with the naked eye, nevertheless it exists. In going a mile, for example, the rear tires may rotate 606 times whereas the front tires of the same diameter will rotate only 600 times. There are, therefore, six extra rotations of the rear tires due entirely to creep. These rotations are absolutely LOST as far as distance and power are concerned and besides they produce much of the excess wear suffered so much by rear tires.

Horse power loss is directly proportional to the creep. Thus if a rear wheel makes 100 revolutions, whereas it would make only 99 if "pushed" along as are the front tires the power loss due to creep is one per cent or 99 subtracted from 100 and divided by 100.

This will probably help toward explaining why the rear tires are the ones that suffer. It isn't due to slip alone nor so much to heavier loads. One of the BIG reasons is "creep."



THIS SIMPLE ARRANGEMENT WILL DEMONSTRATE THE TENDENCY OF TIRES TO CREEP

GARAGE SERVICE AND REPAIR STUNTS FROM IOWA

Every service station owner has seen many people stop a moment, as if almost in the notion of coming in and then turn and walk on before he could get to them to inquire as to their needs. In order to get more of such customers to come in one Iowa owner placed a sign on his door which read as follows:

"COME IN ANYHOW."

Many people were noticed who paused to look in and then read the sign and with a faint smile walked in and made some sort of an inquiry. Courtesy is often much needed in the average service station.

Many service stations are on a strictly cash basis and are using all sort of signs to make the fact known to their customers. However many of these signs are harsh and irritate the customer and show no willingness to serve. Mr. Guzzeman, of Iowa City, Iowa, has a sign which reads:

"Air Free."
"Water Free."
"Information Free."
"Everything Else Cash."

Another sign reads:

"Please Don't Ask for Credit"
"We Are Out."

Too many shops "Stay Out" signs offend good customers and are rather expensive from the standpoint of business lost. Mr. De Long of Colfax, Iowa, has a sign that does very well, and still is not offensive. It reads:

"We Like You, but Loafing Hurts Our Business."

The Iowa Vulcanizing Co., of Ames, Iowa, has a means of bringing the business in off the streets. They have a number of cards, similar to those used by the police. These cards inform the driver there is a tire on his car that needs expert attention. When these cards are tied to the radiator or steering wheel they always get attention and many drivers come direct to their place of business to talk the matter over with them.

"There is Business in the Mud Holes"

One Iowa dealer had several devices in stock which were of great assistance to a motorist when stuck in the mud. But no one would buy them when their car was sitting securely on the paving in front of his place of business. Finally he decided to take one of the devices along each time he got a call from a stuck motorist and by demonstrating it to sell while remembrance was still vivid. In many cases the motorist was apt to get stuck again on the trip so bought the device to avoid further pull out bills and delays.

A small nut, of other piece of metal, placed in a can of liquid metal polish, helps in breaking up the sediment.

Queries-Answers-Notes

THIS department is the meeting place where you are free to ask for information, answer questions, discuss shop matters and business conditions and any other notes you feel would be of interest to a fellow mechanic. Make use of this Department as often as desired.

Galvanizing by the Hot Method:—If you could give me some information on the hot method of galvanizing, I would be quite pleased. I would also like to know what kind of a tank to use.

EDITOR'S NOTE:—

To galvanize sheet iron work, and we assume that is what you are most interested in, the work should be dipped in a bath of muriatic acid 1 part, water 4 parts; leave the work in the bath long enough to break up the scale; clean with brushes or scraper so that the surface will be free from scale and dirt. Then dip in a fresh bath of muriatic acid and water, 1 to 4, with about 1 ounce of sal ammoniac to the gallon of solution. Then dry quickly and thoroughly in a hot oven or on hot plates of iron and dip in the zinc bath. Never dip if any moisture remains along the laps or rivets, because an explosion will result.

The zinc is melted in a large iron pan of sufficient size to accommodate the work to be done. Sprinkle a little powdered sal ammoniac on the surface of the molten zinc and then skim off the dross. The articles to be galvanized are then immersed in the molten zinc. Judgment is required as to the length of time for the immersion and temperature of the melted zinc. Very small work is immersed for only a few seconds.

Restoring Burned Steel:—In the April issue of your journal I see where S. A. H., of Indiana, inquires for a recipe for restoring burned steel. I have met a great many smiths who say it can not be done but I, for one, have accomplished it. A piece of steel can be restored by the following treatment:

1. Let it cool dead cold, but be sure to keep it out of a draft.
2. Heat again to the hardening point (about 1400 degrees, or dark red), then let cool.
3. Reheat and dress.
4. Heat again to the hardening point and let cool off perfectly cold in a preparation of the following: Ordinary machine slush such as is used to coat the polished parts of machinery for shipment, mixed thoroughly with one tablespoonful of potash lye to each quart of slush.
5. Heat again and harden and you have a tool ready for use.

To Temper Blades:—I also see comments on the method of tempering blades. The method I have used for a number of years is:

Before proceeding with the tempering I get a box about 2 inches longer than the blade and two or three inches deep; then I gather some very fine coal ashes (the finer the better, like sand if you can get them), dampen just wet enough to steam when the blade is put in. Heat the blade to the hardening point and then place in the ashes with the cutting edge down about half way. Leave until cold and you will have a well tempered blade without the drawing process.

W. J. K., Steelworker, Pennsylvania.

The Meaning of Phase:—Please answer through the columns of your journal the meaning of the word "Phase," as used in connection with electrical work. Philip Wand, New York.

Editor's Note:—"Phase" is an electrical term that is used in reference to alternating current. Briefly it may be described as follows: A single alternating current is termed a single phase current, whereas several currents differing in phase are termed "polyphase" or "multiphase" currents; thus, in a three phase system three currents flow, differing in phase from each other by 120 degrees.

Perhaps it would make it clearer if it were explained this way: A single phase, as was stated above, is a single alternating current. In the earlier days when electricity was used merely for lighting purposes, the single phase gave complete satisfaction; but since that time an ever increasing demand for current for power purposes has developed. Single phase motors are difficult to make self-starting under load; thus the great obstacle to the use of single phase alternating current became apparent, and of consequence multiphase motors and generator were developed.

The simplest form of the polyphase generator consists of two similar and independent single phase armatures mounted rigidly on the same shaft, one beside the other in such a manner, that the electromotive forces arrive at the terminals of the respective armatures when they are at their maximum values and are 90 degrees, or one-fourth of a period apart. The currents from such a machine are said to have two-phase relationship. The two separate armatures are supposed to revolve inside the same crown of field magnet poles.

The three-phase currents may be considered as those which are generated by a machine having three single phase armatures mounted side by side on the same shaft and revolved in the same field, each armature having as many slots as there are field poles. While a slot passes from the center of one north pole to the center of the next north pole, the electromotive force passes through one complete cycle. Hence the electromotive force given by three armatures, if properly arranged will be 120 degrees apart.

There are further adaptations of this principle; but the foregoing will suffice to illustrate the meaning of the phrase.

Installing Ford Connecting Rods:—On my car, I have a Bosch D. V. 4 magneto with an automatic spark, and I would like to know whether dry cells can be connected with it together with a coil.

I would also like to know which is the proper way to put a connecting rod in a Ford car. Some claim that it does not make any difference which way they are put in as long as they fit the crank shaft properly, and others claim that they should be installed so that the wrist pin set screw will face the cam shaft. Kindly let me have your advice on this. W. H. K., New York.

Editor's Note:—Dry cells and coils can not be used in connection with the above mentioned magneto, due to the fact that the contact breaker is unsuited to this adaptation.

The Ford connecting rod may be installed with the wrist pin set screw facing in either direction, however, it is usually customary to have this set screw facing the cam shaft, principally because on "L" head motors such as the Ford, it is a general practice to mark all parts with relation to the way that they face the cam shaft. This practice avoids confusion, permits parts to be returned to their relative working position, and especially where several mechanics happen to be working on the same job, it not only facilitates the assembly of the motor; but it avoids the possibility of mistakes.

It is not sufficient that the connecting rod should only fit the crank shaft properly. The rod should also be straight. Scraping the bearing more on one side than on the other often causes the rod to lean to one side, resulting in a piston slap or knock when the motor is placed in operation. Frequently it is possible to detect this condition by the fact that the upper part of the connecting rod bears against the wrist pin bushing after the piston is in place in the cylinder and the connecting rod fastened in running position to the crank shaft. An equal amount, or nearly so, of the wrist pin should show on each side of the connecting rod between it and the two wrist pin bushings.

Not infrequently connecting rods are twisted in disassembling them from the pistons, because the rod is held in a vise while the wrist pin set screw is removed. A much safer way is to hold the piston by means of a rod placed through the hollow wrist pin. Very often rod sprung in this manner cause a knock that is extremely difficult to locate and often the rod that is causing the trouble can only be detected by placing it in a straightening jig.

Rebabbitting the Crankshaft Bearings of a Steam Tractor:—I would like the advice of some other smith on rebabbitting the crankshaft bearings of a steam tractor, the method of aligning the crankshaft, and also what kind of babbitt to use. Harry Austin, Montana.

Editor's Note:—First, all of the old babbitt should be melted out of the bearings and caps. The journals on the shaft should be cleaned thoroughly. Then the shaft is laid on the bearing which are to be poured. Now the shaft should be lined up properly, that is, that axis of the shaft should be square with the cylinder. This may be accomplished in any manner that suggests itself to the man doing the work. It is difficult to lay down any specific instruction because we are not familiar with the design of the machine. Besides being square to the cylinder the shaft should also be centrally located in the bearings and should be held in that position while the babbitt is being poured. Small machinist's jacks are very handy for this purpose, as the shaft can be readily raised or lowered whichever is necessary.

The cap is now applied to the bearing after a sufficient amount of shim stock has been placed between the bearing and the cap. This is to allow surplus stock, so that the cap and bearing may be scraped and fitted after they are poured.

This done, wet fire clay is applied around the edges of the bearing so that the molten babbit will not flow out. Space is also provided at one end of the bearing so that the molten babbitt may be poured in. This can be most easily done by working the clay up in a small funnel shaped opening.

This serves a two-fold purpose. It allows the babbitt to be easily introduced and it also provides as space where a sprue may be formed, so that if there is any impurities in the metal it will rise and stay in this part of surplus metal instead of remaining in the bearing itself where it is apt to cause damage.

The fire clay should be dried out thoroughly so that there will be no danger of an explosion when the molten metal is introduced. This can be done with a gasoline torch. It is well to preheat the bearings slightly, as the babbitt runs in much more evenly; but care should be taken that the flame is not directed into the bearing itself, otherwise a carbon deposit is likely to form which will prevent the babbitt from adhering properly.

Heat the babbitt so that it will char a pine stick and then pour it into the bearing, Any babbitt bought from a reliable supply house will answer the purpose if the use has been explained to them.

When the babbitt cools remove the cap. We should have mentioned that at least one of the shims should have extended clear across the face of the cap and touched the shaft so that the babbitt would be divided. This will facilitate the removal of the cap.

When the cap is removed the shaft is also taken out and the line bearings scraped smooth, after which the caps are treated similarly. It is essential that all oil ducts or grooves be cut in the new bearings and that the corners of the bearings be relieved so that they will not bind on the shaft.

This method of pouring the bearing around the shaft itself gives dependable results if done carefully, and saves the time and expense of having a mandrel made to use in its place.

"Cut-Out" Fallacy:—Would you kindly explain the action of the cut-out in the electrical system of an automobile? Does the cut-out prevent the battery from being over-charged?

J. L. D., Missouri.

Editor's Note:—The cut-out might be described as a check valve in the electrical system. It keeps the current flowing only in one direction, namely, from the generator to the battery. When the car is not in operation, the points of the cut-out, through which the electrical energy passes to the battery are held open by means of a spring so that there is no connection between the battery and the generator. As soon as the car is started, the generator begins to produce current, which gradually increases with the speed of the car until sufficient current is produced to close the automatic switch or cut-out. This is done by running the current through a fine wire coil to produce a magnetic force great enough to draw the switch points together. The closing of this switch connects the generator to the battery through a second or series coil of a few turns of heavy wire. So long as sufficient current is being supplied to the battery the magnetic force of the coils is great enough to overcome the tension of the spring which is constantly trying to pull the points apart. As the engine is slowed down and the charging rate becomes lower, the magnetic force also becomes weaker, until finally the magnetic forces is less than the tension of the spring, and consequently the spring pulls the two points apart, thus disconnecting the battery from the generator. This is highly important for the reason that electricity always flows from the higher potential or voltage to the lower just the same as water. Now if it was not for the cut-out, the battery would discharge itself into the generator, either when the voltage of the generator was less than that of the battery or when the car was stopped.

Many people cherish the delusion that the automatic switch or cut-out protects the battery against overcharging—that it automatically opens the charging circuit when sufficient energy has been put into the battery. It would be fine if the cut-out would do this; but unfortunately it cannot. This fact accounts for batteries being overcharged when the car is run for long periods at a high rate of speed if the charging rate from the generator is too high.

THIS ISN'T SO HARD ON THE EDITOR:—Enclosed please find check for $2.00 for your most interesting and valuable magazine, **THE AMERICAN BLACKSMITH.**

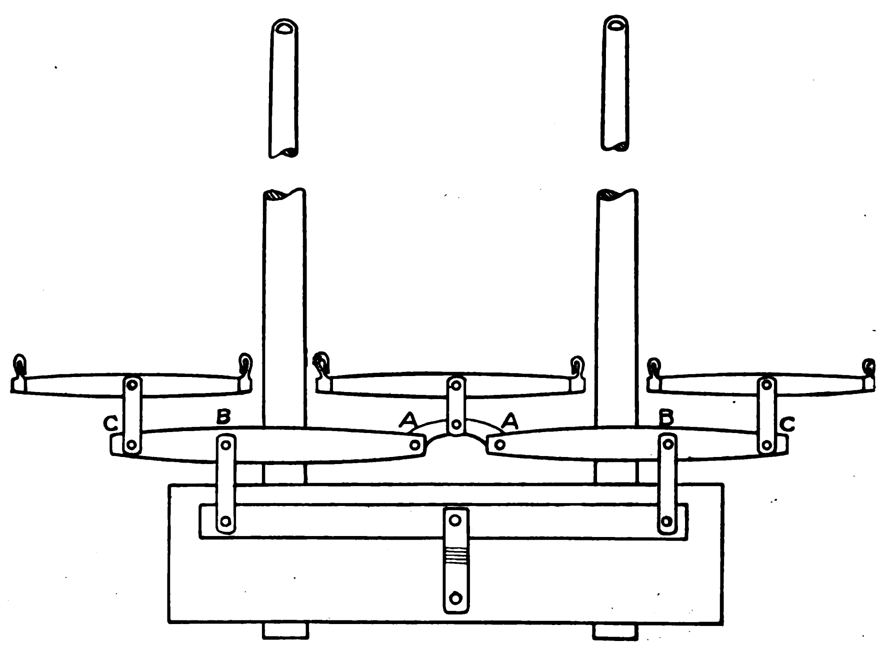
I was born and brought up on a farm. About five years ago I subscribed to your journal, and started reading the different articles on general blacksmithing. Shortly after, I bought a forge, anvil and some tools, and started working out what I had learned by reading your paper.

At the end of one year, with the American Blacksmith coming to my assistance every month, I felt confident that I could run a blacksmith shop of my own. I bought the only shop in my home-town, and I am still here, having all the work I can do; and have never been stuck on a job yet. Of course I have kept my eyes open, and whenever I have stepped into another brother's shop, and saw some good idea worked out, I didn't forget it, but came back to my shop and profited by what I had seen. I would think, well they probably got that from some number of the American Blacksmith before I subscribed.

Once in a while, I see some things in the Queries, Answers and Notes column with which I do not always agree. One that amused me was contributed to a recent issue by J. R. D., of Pennsylvania. It explained his attempt at a three horse hitch. I would like to ask Mr. D., how the draft would be distributed among the three horses, if the middle horse should lag only slightly behind the outside ones, or if the middle horse should be fast dispositioned and get way ahead. It looks to me if the middle horse gets ahead, he is drawing against the outside two, or more than his third or vice-versa If he gets behind, he doesn't draw any.

Here is a three horse hitch that I have always made, and it works perfectly. By referring to the drawing which I am enclosing herewith all the necessary details may be had, except perhaps to explain that the distance from A to B should be just double the distance from B to C.

John Gibbon, New York



MR. GIBBON'S DESIGN OF A THREE H ORSE EQUALIZER.

AMERICAN BLACKSMITH AUTO & TRACTOR SHOP

VOLUME 20 JULY, 1921 NUMBER 10

E. D. Corson, President
G. A. Castle, Vice-Pres.

BUFFALO, N. Y., U. S. A.

A. W. Bayard, Secretary.
W. O. Bernhardt, Treas.

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For $1.00 per year, payable in advance, The American Blacksmith, Auto & Tractor Shop will be sent, postage prepaid to any postoffice in the United States. To Canada, $1.25; to other countries, 6 shillings. Reduced rates to clubs of five or more on application.

Remittances may be made by money order, express order or checks payable to The American Blacksmith Company. We will also accept uncancelled postage stamps or currency, but for safety these should be sent by registered mail.

Subscribers should notify us at once of non-receipt of paper or change of address. In latter case, give both old and new address.

Correspondence on all smithing and auto subjects solicited. Always give name and address, which will be omitted in publishing, if desired. Address all communications to the

"AMERICAN BLACKSMITH COMPANY"
BUFFALO, N. Y.

Cable Address: "Blacksmith, Buffalo"

A CHANGE OF OWNERSHIP

Friends of American Blacksmith, Auto and Tractor Shop will be interested to learn that there has been a change in the ownership and management of this publication.

All of the present owners have been connected with the publication in years past, so that there will be no radical departure from the wellfounded policies, except to still further improve, and increase its interest and practical character.

The new owners and managers of American Blacksmith, Auto & Tractor Shop are Mr. Egbert D. Corson, President and Mr. George A. Castle, Vice-President. Mr. Corson and Mr. Castle are prominent printers and publishers and have been connected with actual printing and publishing of the journal for eight years. Mr. Walter O. Bernhardt the new Treasurer was Editor of the publication for fifteen years. He returns to the Editorial and Circulation direction of the paper. Mr. Albert W. Bayard, Secretary, was associated with the publication from its beginning, and will have charge of the general management of the journal.

It is needless to say that the new owners are planning on the still further improvement of American Blacksmith, Auto & Tractor Shop, and every reader may be certain that advancement and progress will be the watch word of the new owners.

HAVE FAITH

We have had a period of shrinking values. The fat profits of the year just past are disolving into depreciated inventories and accumulated overhead.

New values are rapidly becoming established. Rather, we should say, the old and tried values are being re-established. Hard work, thrift and husbanding of resources are supplanting the waste and extravagance, the lost motion, over-consumption and the inefficiency of constructive work that crept in during the last period of intensive prosperity.

Absorbed as most business men are in scrutiny of falling prices and vanishing profits, it is not the easiest thing to lift one's gaze from this spectacle and view the situation as a whole.

But, we should not allow ourselves to lose sight of the great fundamental fact on which hinges the welfare and prosperity of every individual and business concern of this country today.

America is today the creditor nation of the world with all of its vast resources unimpaired. It has no devastated areas. Its soil is still pregnant with life, requiring little more than the regular passing of regular seasons to pour new wealth into our laps and new health into the business of the country at large.

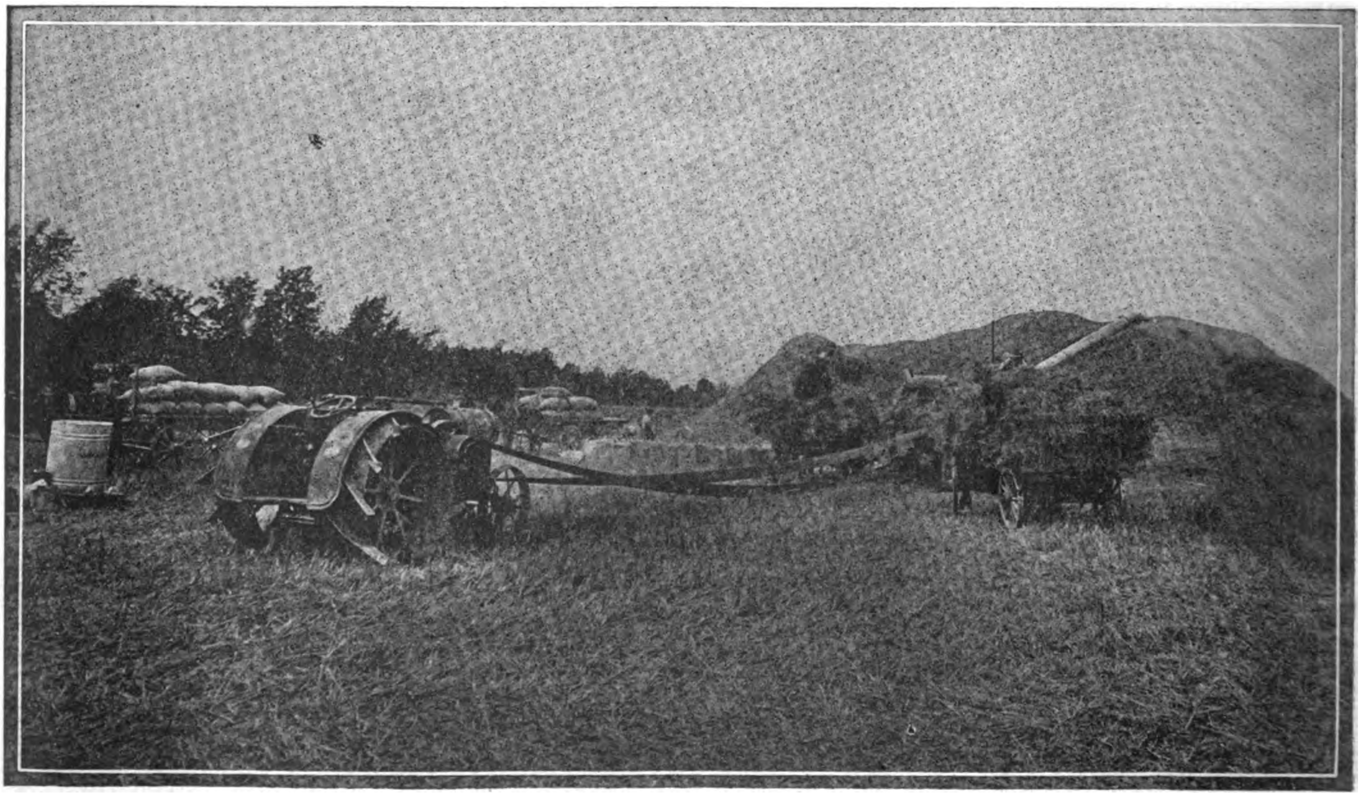
This immense national asset coupled with a determination to work and save, to work efficiently and to avoid waste, can have but one result, i. e., renewed prosperity and a return to a freer exchange of commodities between the different groups of producers.

We do not anticipate a return to that intensive and heretofore unparalled degree of prosperity that came to America during 1918-1919-1920 and we do not want that as it brought extravagances and wastes from which we are now suffering. But we do look forward to sane substantial prosperity where values will be recognized, service will be scrutinized. A period during which substantial gains will accrue to all who are worthy.

CONTENTS JULY 1921

The National Food Supply and the Repair man

Scenes such as these are impossible without the aid of the smith-craftsman and repairman. Here is shown an actual demonstration of the worth and importance of the smith and repairman for without him the machines so necessary to the constant sawing, growing and harvesting of the world's great food crops, could not be kept in the service of feeding humanity. All power to the Smith and Repairman.



The Lubrication of Motor Vehicles

How Neglect of Lubrication Effects Mechanism

THE technical importance of automobile racing to engineers lies in the fact that the vital weakness of any mechanical device can be picked out only by pushing it to its utmost limit. There are many machines which will stand up in ordinary service but fall down when subjected to an emergency overload, which will always come sooner or later. This is one of the reasons for the difficulty experienced in developing reliable airplane engines, the service required of them continuously being more severe than that of racing automobile engines during their fastest spurts. One of the principal lessons learned from all racing and airplane developments has been the fundamental importance of lubrication. Its neglect is certain to result in rapid wear and eventual failure. The life of any mechanism is limited by "old age" just as surely as is human life, the length of service rendered before "old age" develops being a question of wear, and wear is a question of lubrication. It is only by systematic inspection during the service of even the most perfectly constructed machine, that one can be sure that something may not have interfered with the proper lubrication, which will reveal itself only after the wear has already occurred.

Periodic Inspection as a Preventative of Trouble

For this reason, in service where maximum reliability is essential, such as that of railroads and airplanes, the mechanical equipment is given a careful inspection at definite periods before trouble is expected to develop. These periods are determined by long experience as the shortest time the mechanism may be depended upon to operate without danger to service. Inspection is then made without waiting for trouble to develop. It is a common sense application of the principle of prevention. A good example of this type of inspection is presented by the routine of a certain well-organized motor-bus transportation company, where every vehicle is given an inspection covering fuel, oil, water, etc., each morning; a general overhaul covering lubrication in detail, carbon removal, spark plugs, bearings, valves, etc., after each 2,000 miles; and a complete dis-assembly and rebuilding each year, which represents approximately 30,000 miles. Those familiar with airplane engine maintenance during the war will recognize the similarity of the above to the daily preliminary inspection, the more thorough inspection after 10 hours or so, the "top overhaul" and finally the complete overhaul after 50 to100 hours, depending on the type of engine. It is only by means of such precautions that failure can be minimized in service, and the effectiveness of such measures is very apparent to anyone who knows how rarely the equipment of the bus company just mentioned ever breaks down on the streets.

Operators of commercial vehicles, and pleasure car owners, are only beginning to realize the saving of expense and avoidance of annoying delays which result from a similar application of the principle of inspection for trouble before trouble occurs. This beginning is represented by the annual overhaul of automobiles and trucks which has now become quite common in the spring of each year. Since so many users of automobile equipment are now getting their vehicles into condition for the summer and are making the necessary repairs and replacements of worn parts, it will probably be of particular interest at this time to call attention to some typical examples of the conditions which may be found during this inspection, and show the reasons for them, as well as suggest ways by which they could have been prevented. It is such common knowledge that machinery must always be lubricated and many operators are so sure they know the whole story that it is difficult to impress upon them how very far-reaching may be the results of giving the attention to this important subject that it deserves. Probably over three-quarters of all the parts replacements made on motor vehicles are of the nature of those described in this article, and are the results of improper lubrication. They are not necessarily the result of imperfect design nor of the use of the wrong lubricant to start with.

How Fuel Gets Into Oil

To begin with the engine: a new factor in its maintenance has devoloped during the last few years because the very volatile fuel used prior to that time is no longer available in sufficient quantities to supply the tremendous demands of the present day motoring public, who consumed 4,178,000,000 gallons last year in the United States alone. The fuel now available is not as volatile, though it is superior with respect to the power obtainable per gallon. If this fuel is to be burned properly in modern engines, it must be vaporized to an extent which demands heating the mixture of fuel and air to well over 100° F. During cold weather, starting with this fuel is often almost impossible unless "priming" is resorted to, by which is meant the addition of an excessive amount of liquid fuel to the cylinder, either by pouring it in through pet cocks or by "choking" the carburetor. A little of the fuel vaporizes at the temperature of the cold engine, and if enough is vaporized, starting is possible, but most of the fuel remains unvaporized and has a tendency to wash the lubricating oil from the cylinder walls. Priming and driving with a choked carburetor should be resorted to as little as possible, and when it is

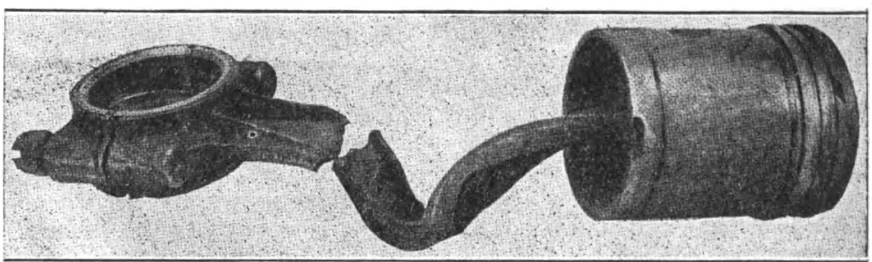


FIG. 1.—THIS BROKEN CONNECTING ROD RESULTED WHEN THE PISTON SEIZED AT HIGH SPEED, BECAUSE THE LUBRICATING OIL HAD BEEN TOO GREATLY DILUTED WITH FUEL. NOTICE THE LOWER BEARING IS STILL IN PERFECT CONDITION.

done the engine should never be run at more than moderate speed until fresh lubricating oil has had time to work up on the cylinder walls to replace that which has been washed off by the liquid fuel. Figure 2 shows a piston from a motor truck, which seized and scored the cylinder as well as itself, simply because of excessive priming.

During the time a cold engine is running while it is warming up, the temperature of the fuel mixture is not high enough to vaporize completely the fuel from the carburetor, with the result that some of it enters the cylinders as drops of liquid fuel, which are thrown out toward the cylinder walls by the swirling, turbulent motion of the mixture as it rushes into the cylinders. Those drops of fuel which touch the cylinder walls mix readily with the film of lubricating oil there, making it so fluid that it works down past the piston rings and into the crank case. In this way fuel accumulates in the oil in the crank case from every start when cold, and as some cars are driven during the winter without any attempt to prevent the radiator from keeping the engine too cool, the mixture for months at a time is too cold to vaporize completly and liquid fuel continues to get into the crank-case oil as long as the engine runs.

Another cause of rapid dilution is the operation of an engine with one or more cylinders "missing." As none of the fuel is burned in the "missing" cylinders, the effects of wet fuel just referred to are much aggravated.

Effect of Fuel in the Lubricating Oil

It does not require much fuel mixed with oil to make it so thin that it has almost no value as a lubricant. A sample of oil used for barely a month in a well-known eight-cylinder car, during very cold weather, was examined recently and found to contain so much fuel that it was over twenty times as fluid as the original oil. The reason for this excessive dilution was that the thermostat in the cooling system was not operating properly and the water jacket after an hour's run was barely warm enough to feel comfortable to one's hand. The particular class of lubricating oil originally used does not start to distill at temperatures below about 600° F., and since 50% of the used oil distilled below this temperature, it is assumed that no more than the remaining 50% was lubracting oil. In order to show that the oil remaining after 600° F., was practically identical with the original oil, data for the latter is shown by crosses, to such a scale of percentage that the starting point, or 0%, will begin where the temperature of the used oil reached 600° F. In the same

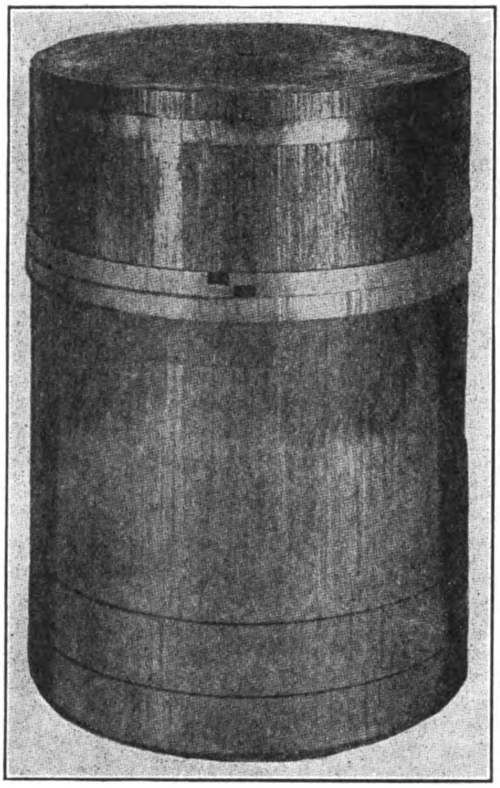


FIG. 2.—A SCORED PISTON FROM A MOTOR TRUCK, DUE TO EXCESSIVE PRIMING. THE SPOTS AROUND THE TWO SMALL OIL DRAINAGE HOLES HAVE BECOME BLUE WITH HEAT, SHOWING THAT THE DRAINAGE OF THE OIL WAS FAR TOO THOROUGH.

way complete distillation curves for gasoline and kerosene are compared with that part of the used oil which distilled below 600° F. Notice that the latter lies midway between the curves for pure gasoline and kerosene, and shows that the fuel in the oil was similar to gasoline deprived of three-quarters of its most volatile part. If the distillation had been discontinued at about 600° F., all the fuel would have been driven off, leaving good lubricating oil of as great a viscosity as when new. This is essentially the process now successfully used for "reclaiming" oils, except that steam is used because the same results are secured with lower temperatures. Thus it is seen that this dilution with fuel is not in any sense of the word a "breaking down" of the lubricating oil.

In order to determine the ill effect of running an engine with very dilute oil, a laboratory test was was made, in which raw kerosene was deliberately added to the oil. The result is shown in the illustration on page 1. A piston seized while running at good speed and the power of the other five cylinders buckled up the connecting rod, broke it and forced the lower end through the crank case several times before the engine could be stopped. The bearings, however, as can be seen, were not injured in the least.

Burned Out Bearings

When a bearing, which is shown to be correctly designed like the specimen shown in Fig. 3, is "burned out," there is but small chance that it was due to diluted oil. It will have been caused almost always by the fact that it got no oil at all, diluted or otherwise, and in addition to the resulting excessive heat of friction, the means of carrying off heat was interrupted. It must be remembered that oil in a high-speed engine serves a dual purpose of cooling the bearings as well as reducing their friction. When a bearing fails to get oil its temperature rises until it may actually melt, as did the one of Fig. 3.

Four Causes for Bearing Failures

Bearing trouble in service is usually caused by allowing the oil level to get too low through inexcusable carelessness. In cold weather a similar effect may result if the oil is too cold to flow when the engine is started. This is another reason for warming a cold engine up slowly beforefore using, for there are many oils on the market which thicken up like vaseline and will not flow at temperatures below the freezing point of water. In order to counteract the effects of sluggish or even congealed oil when starting a cold engine, engineers frequently recommend the use of a different oil in cold weather from that which is best for usual warm weather conditions.

A third cause for burned-out bearings results when water gets into the crank case and freezes around the oil pump. Water vapor is one of the products of combustion of gasoline, and if the pistons leak badly it will condense in the crank case during cold weather. After standing some time the water separates to the lowest part of the oil sump, which is usually near the oil pump, and if it is cold enough to freeze, a broken oil pump may result when the engine is started, and, of course, no oil can be pumped to the bearings.

There is still another possible cause for failure of oil to get to bearings. Solid matter such as large chunks of carbon, but principally lint from cotton waste or rags used carelessly before re-assembling an engine, may easily clog the oil passages entirely, or at least stop up the inlet to the pump. Those engines which are lubricated by plunger pumps with ball or other automatic valves, are particularly liable to trouble because even fine sediment, if it lodges around the intake valve, will prevent delivery of oil.

Sediment and Wear

So far nothing else has been said about sediment. The mere fact that heat discolors any oil by precipitating fine carbon particles, has led many to believe that all sediment is some form of soft carbon which, of course, could do no harm as an abrasive. The fact that sediment may consist of good abrasive material was well illustrated by a test recently made at McCook Field, on a Liberty airplane engine. Oil that had been used only ten hours was "centrifuged" to separate out all all solid matter heavier than the oil. An examination of the sediment reveals a large amount of iron and steel which must have come from the piston rings and cylinders. A large percentage consisted of a very fine aluminum powder which must have come from the pistons. A small quantity of bronze powder was observed, also babbitt bearing metal. All of the above undoubtedly came from the working parts of the engine. Small chips, which resembled chips from machinery processes were present; sand varying from very fine powder to small pebbles and carbon in various forms and sizes were also found. The sand was probably from the core and that could not be cleaned out of the castings, and the carbon particles may have baked on the under side of the piston head and fallen off. There were also found small brown particles that looked like sand but

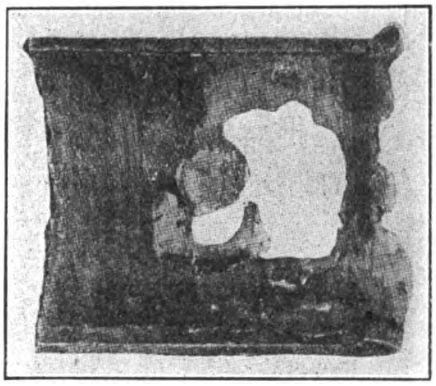


FIG. 3.—A "BURNED-OUT" DIE-CAST CRANK-SHAFT BEARING; THE RESULT OF RUNNING THE ENGINE WITH NO OIL AT ALL ON THIS BEARING.

would crush easily, and the conclusion was reached that these were made up of dust taken in through the breather. A motor vehicle, particularly a tractor, operating in air laden with dust, would show a much greater proportion of sandy grit than this. Quite a little would enter the engine with the air to the carburetor, and wear its way past the pistons, though of course this is almost unknown with airplane engines, or tests made indoors .Analysis of "carbon" removed from the combustion chambers of motor vehicles, shows the presence of silicon from fine sand.

Bearing Wear

Now all this solid matter is car-

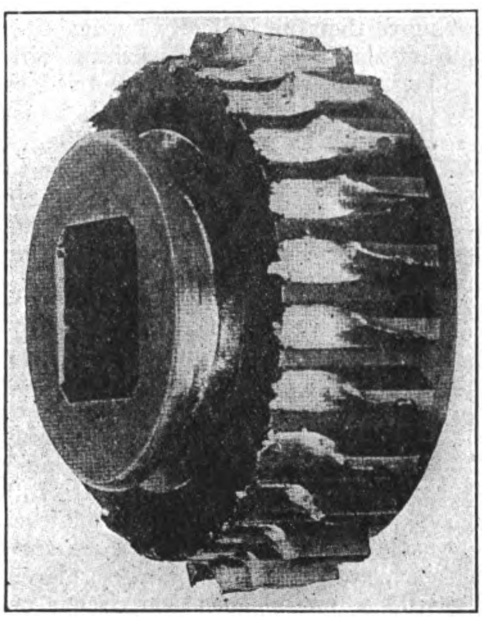


FIG. 1.—A BADLY WORN GEAR FROM THE GEAR BOX WHICH HAS SEEN HEAVY SERVICE. THE METAL WHICH WAS WORN AWAY HAS GOTTEN INTO THE LUBRICATING OIL IN THE FORM OF FINE CHIPS, WHICH MAKES A GOOD ABRASIVE.

ried into the working parts of an An experiment made by a large au- engine by the circulation of the lubricating oil, and acts like an abrasive which is as sure in its action as emery, even if not as rapid. It is probable that it is almost the sole cause for bearing wear and a large factor in piston and cylinder wear. tomobile engine manufacturer gives good evidence of this. An engine in good condition was run under load for sixty hours, the oil being drained frequently and replaced with new oil. When overhauled, the bearings showed no noticeable wear, and the piston wear was not enough to measure. It was run again under the same conditions, but with dirty oil which had been drained from other engines after long use on the road. After only a few hours, wear had proceeded to such an extent that the engine became noisy in operation, and when again overhauled after sixty hours running there was enough wear to measure easily.

Removal of Diluted Oil and Sediment

How can the user of motor vehicles protect himself against these ill effects of fuel and grit in his oil? Simply by draining it all out at frequent intervals and replacing by fresh oil. Means have already been suggested for reducing the rate of dilution by fuel to a minimum, but it cannot be prevented entirely during the cold weather, and the slow wear of pistons and rings which mix metal dust with the oil, and the fine sandy dust which gets in from the air, can hardly be prevented. It is impossible, unfortunately, to give any definite rule as to how often the oil should be drained from the crank case and replaced with new. The more often it is done the better, but while the cost of the oil is small when balanced against the cost of repairs and replacements of worn parts, there is a limit beyond which but little will be gained. As a general rule the change for an automobile or truck should be after about one thousand miles of ordinary driving, but if over very dusty roads, or during cold weather, particularly when short trips are made, this distance should be reduced to 400 or 500 miles, or once a week. A new engine, or one with newly re-bored cylinders, should be drained after the first 300 miles to remove the metal dust resulting from the first polishing of the new surface. It is usually considered good practice to wash the crank case with kerosene after the old oil has been drained, since the sediment which remains behind is difficult to dislodge in any other way. A quart or two of kerosene agitated by spinning the engine for a few minutes is a very effective way of washing the crank case thoroughly. The spinning should be done by hand if the engine is not provided with an electric starter to do this, but under no circumstances should the engine be run under its own power for this purpose. Sometimes the drain cocks are not placed so that all the kerosene can be drained from the crank case, and it is very desirable to repeat the spinning with a little light motor oil which should be drained before adding the new oil.

Gear Boxes

The gear box and rear axle are parts which give so little trouble that usually they are almost forgotten by car users. Forgetfulness, however, has its price even with these reliable parts, as the accompanying illustration show. Fig. 4 shows a clash gear taken from the gear box of a motor vehicle used in heavy city traffic where over 600 accelerations are made each day. No lubricant can prevent teeth from chipping when they strike during gear changes, but the metal which is gone from the teeth got into the oil in the form of very fine chips or hard metal, which make a good abrasive. As gear oils and greases are very viscous they carry even fairly large chips with ease, and whenever the gears are in motion these chips will be repeatedly brought into the ball bearings and between the gear teeth. The ball-bearing of a 7-ton truck shown in Fig. 5 is an example of what can happen when chips get into it. The steel became so heated that some of the balls became welded to broken chips, and further destruction was avoided only when the inner race broke and by slipping on its shaft, acted like a plain bearing.

In the early days of automobile history gear boxes and axle housings were so poorly constructed in most instances that no lubricant could be prevented from leaking out except a stiff grease. Thus grease came into use for these parts not because it was the best lubricant for them but because it was the only lubricant that would stay. As time passed, details of motor vehicle construction improved, and since few gear boxes or housings will now allow a medium-bodied gear oil to leak out, the use of stiff grease is inexcusable and only due to mental inertia resulting from experience in the past. Such a grease is the best material in the world for suspending metal chips and holding them in dangerous proximity to the moving preventing damage from them is first of all to use a lubricant fluid enough to allow the chips to settle to the bottom, and then make sure to remove them periodically by draining out the dirty oil and washing with kerosene. Those who have tried to clean out all the grease from a housing, will comprehend the difficulty of doing it thoroughly enough to remove all chips. In general, a gear box should be washed every 5,000 miles at least, and inspected for possible leakage more often.

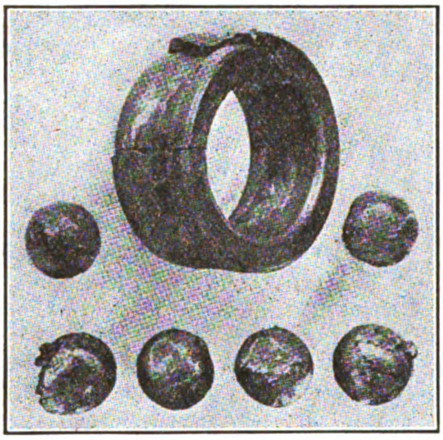


FIG. 5.—THIS INNER RACE AND BALLS WERE TAKEN FROM A BALL BEARING DESTROYED IN SERVICE BECAUSE OF CHIPS OR OTHER MATERIAL GETTING INTO THE BALL RACES. THE BALLS WERE BLUED BY THE RESULTING HEAT AND WELDED TO BROKEN PARTICLES, AS CAN BE SEEN.

Under certain conditions an unsuspectedly large amount of power is absorbed in the transmission merely by dragging the gears through a very viscous lubricant. To reduce this loss it is accepted practice not to fill the casing full of oil, but to maintain an oil level as low as possible and yet be sure each gear will be lubricated. Even with a low oil level, too viscous an oil should be avoided, because there are bearings which are lubricated only by the oil splashed up to them. Generally speaking, ball bearings do not need much lubricant, but gear boxes and rear axles are often provided with roller bearings, which must be lubricated, as well as the plain bronze bearings frequently used in gear boxes and usually found in differentials.

Rear Axles

There are, unfortunately, a few rear axles now in use which are not tight enough to prevent a gear oil from leaking out at the wheel hubs, if it is as fluid as is desirable from the viewpoints just mentioned. There are several axles which will leak at the hubs if the oil level is too high, and aside from making the wheel unsightly the oil may get on the brakes and impair their holding power. But some axles will not hold oil even when the level is low enough and in such instances there is danger of losing all the oil without knowing it, and running with unlubricated gears. This is bad in any case, but is disastrous with worm gears, and bronze worm wheels cost money. Bronze worm wheels, run dry for only a few hours, have been cut to such an extent that the teeth were actually stripped off. Even in ordinary service a worm wheel frequently wears considerably, and as soon as the wear starts the metal particles worn off when carried with the lubricant make a good abrasive and will accelerate the wear which supplies still more metal particles. Such unpleasant experiences as worm wheels ruined because of running dry can be avoided usually if the oil level is inspected at frequent intervals, and if the oil is low the leak may be caught in time and corrected by renewing the felt rings or other devices designed to prevent leakage.

Caution would direct the use in axles which are known to leak, either regularly or occasionally, of gear oils thick enough to leak slowly if at all. In rear axles the use of a heavier oil than is desirable in gear boxes, even a "fluid grease," is not as serious because there are no clash gears to deposit chips in it, and the loss of power from churning the oils is not as great. Yet it must not be forgotten that there are plain bronze bearings in almost all differentials, and oil must be fluid enough to get to them occasionally at least. The careful operator will inspect the oil level every thousand miles or so, particularly if the final drive is by worm.

Chassis Parts

Of all the moving parts of motor vehicles the engine and transmission system receive the most attention to lubrication, because it is known that they cannot run long without some kind of lubricant. Since even these parts are often sadly neglected it is not surprising that universal joints, steering gears, drag links, spring shackles, brake rod clevises, starting motors, driving chains, and the like, are often almost forgotten. The large number of such parts requiring lubrication is evident. The chart supplied by one manufacturer shows fifty-nine 59 places requiring lubrication, though over a dozen brake clevises and joints are not included. This number sounds large to the uninitiated, but is not unusual, and if it is a surprise to the reader he can be reasonably sure that he has overlooked many such parts on his own car. Of course, it is a nuisance to care for all these parts regularly and attention to them is often postponed almost indefinitely until it reaches the point of neglect, simply because the vehicle will run even when they are not lubricated. Yet is there anything that makes a good vehicle seem cheaper than that irritating squeaking which results? Whenever a squeaking vehicle passes on the street you can be safe in making a mental note that the driver is neglecting it and its second-hand value is falling needlessly. Squeaking is nothing less than a loud protest of neglected parts, as they are wearing out. Fig. 6 shows typical unlubricated spring shackle bushings such as may be found in the junk boxes of any service station. It is similar to bushings all over a chassis the conditions of which a vehicle in good condition and one that is "worn out." Bushings are not expensive, but the labor of replacing all the bushings and clevises in a car—rebuilding it—is expensive. Such parts are frequently lubricated by grease because of the high pressures and low rubbing velocities existing, and because it remains where it is wanted. The grease cups are often inaccessibly placed, and are a nuisance to fill, but patented types of grease guns and oil lubricators are now coming on the market, which make greasing a much simpler operation, and one that should not be too much to expect of a driver every week. Engineers are giving much attention to simplifying chassis lubrication to such a point that the average vehicle operator cannot object to the time necessary for this important matter.

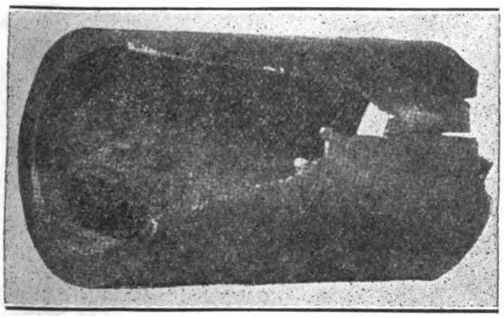


FIG. 6.—THIS WORN-OUT SPRING SHACKLE BUSHING IS CHARACTERISTIC OF A LARGE NUMBER OF BUSHINGS THROUGHOUT THE CHASSIS OF ANY NEGLECTED CAR. THIS WEAR WAS PROBABLY ACCOMPANIED IN SERVICE BY CONTINUAL SQUEAKING.

The examples of failures which have been described, and the evident resulting expense as well as idle time required for replacements, should drive home vividly the folly of neglecting the lubrication of even a good motor vehicle in spite of having used good lubricants. The serious damage caused by loss of lubricant through leakage, the increased wear resulting from abrasive particles which inevitably get into lubricating oil, as well as the loss of lubricating properties due to dilution from fuel, have been emphasized in detail, and remedies suggested, particularly that of changing the lubricant at suitable intervals. The whole question of precaution for the prevention of premature wear and depreciation is well summarized in the familiar adage, "An ounce of prevention is worth more than a pound of cure."

Welding A Transmission Case

By David Baxter

In discussing the repair of a transmission housing, such as shown in the photos which accompany this article, it is no doubt better to tell how the work was done, rather than to attempt to lay down any rules for doing of such work. Principally because there are always several ways of doing a thing. On nearly every job there are minor details that may be changed to suit individual judgment of the different welders, or shop conditions and equipment. The condition of a certain repair job may be the same; but the manner and means of treating it may vary considerably in different shops. So by telling how a thing was done does not imply that it is the only way it could be done successfully.

The transmission case illustrated here is only another glaring example of the tremendous waste that was going on before the advent of the oxy-acetylene torch. Such jobs as this were impossible to mend before the torch welding process was discovered, and later applied to practical work. Such jobs as this would be consigned immediately to the junk pile, if it were not for modern welding methods. Not merely because the case was a casting of complex design, but because it was of aluminum. This peculiar metal is very difficult to handle even by an expert welder. However, aluminum castings like this are being repaired every day by oxy-acetylene torch welders all over the country, and, where the torch operator is careful as to the smaller details, satisfactory results are obtained. The purpose of this article is to discuss many of the little details and devices employed in making this difficult repair.

In Fig. 1 is shown the first step in the process. This picture also shows the extent and nature of the damage, together with the varying thickness of the metal through which the fracture ran. All of these conditions have a great deal to do with the success or failure of the welding, and all of which have an influence on the manner of doing the work.

For instance, the thick heavy portions of the weld required greater patience, as well as greater care in applying the flame and filler metal, because of the depth, it was necessary to melt the metal so that the bottom of the weld would be reached. This was lessened to some extent by the method employed by many welders of grooving out the thick parts about the same as for cast iron or steel welds. A debatable point, however, since it is just as well to melt and puddle out the crack as it is to groove it. This might be left to the individual who knows his ability and has a personal preference.

At any rate, in this particular instance, none of the crack was grooved previous to welding, except the thick corner. The first step in the process was to weld the broken part of the flange in place in the neck part of the casting, in the position indicated in Fig 1. This position was taken to keep the weld as near level or horizontal as possible on account of the tendency of molten metal to overflow the unwelded portions of the crack. The weld could be puddled so that it would settle more homogeneously where it was level. This horizontal position was maintained throughout the flange welding by rolling or tilting the piece of casting to that end.

This part of the housing was welded without heating previous to applying the flame, or preheated, as it is called, because the nature of the break in the flange permitted the broken part to move with the actions of expansion and contraction. That is, the small broken piece could move outward when the metal in the weld was expanding and then when it cooled and contracted, the broken piece could be easily drawn back by the pull of the shrinkng weld. Ordinarily, it is better to preheat an aluminum job; in fact, it was necessary on the balance of this job. But this first weld was made with the part cold at the start.

In detail, the application of the flame and filler metal was as follows: A strictly neutral flame issuing from a welding tip a very little smaller than for the same job in cast iron, was applied to the fracture by playing it back and forth along one of the cracks in the neck portion. At the same time the filler rod was brought fairly close to the flame, so it could be heating in readiness to melt when needed. The flame was played back and forth along this crack until about an inch and a half of it became fluid or nearly so. This condition must be watched for closely, as as aluminum does not get red before melting. It merely flattens or becomes wavy under the flame pressure. By advancing and retarding the flame quickly the welder could estimate the depth of the melting. When it was apparent that the metal was melted almost the full depth of this section the filler rod was introduced. The welder being careful, however, to keep the fluid portion confined to a narrow strip. Not much over a half inch wide.) This was essential to prevent the aluminum from collapsing, which is a mean trick of this

FIG. 1.—THE BROKEN FLANGE WAS WELDED FIRST AND WITHOUT PREHEATING.

metal. The whole weld will suddenly fall inward without warning if an area too wide is melted, because aluminum has but little strength or tenacity when heated above a certain point. And this point is not the fluid state either, but considerably below that. Therefore, this welder confined the weld to a narrow strip along the crack.

When the filler was introduced the melting end of it was dipped or pushed into the molten crack. At the same time it was given a twisting movement combined with a sort of sawing motion. The rod was moved back and forth in the molten bath to break up the oxide and permit the broken edges to flow together.

This movement of the filler rod is often termed puddling; but in reality consists of a combined triple motion, so to speak. The rod twists, saws and pats or puddles. This is for the purpose of bringing the oxide to the surface, in order that the two sides of the crack may join into one mass. Oxide is the aluminum welders worst enemy. It prevents the metals from flowing together; in fact, it seems to cause the sides of a crack to repel each other. A thin skin of oxide forms over the surface of the aluminum. This skin will not allow the metal it encloses to join another body of metal; which also has an envelope at the same time. These two skins of oxide will not permit the two bodies to join perfectly, or to become one, unless the oxide is broken up and floated to the upper surface of the weld, or else scattered throughout the weld. The latter is not good practice, because it leaves the weld porous or full of pin holes. The application of the welding flame tends to aggravate the oxidizing, therefore, it should be handled carefully, quickly and deftly, and should never carry an excess of oxygen, for it is oxygen that turns the metal to oxide; hence the name, oxide.

After the first inch or so of the crack was puddled together, the flame was moved to an adjoining portion where the process was repeated. Then to another portion and so on until the entire crack was welded. When this was complete the flame and filler were transferred to the other crack to repeat the process. The melting and puddling was continually advancing without pausing over any small spots that did not react exactly right. It was better to go back and "doctor" these spots after the weld was finished, than to pause long in one place. Pausing only tended to increase the width of the weld and cause danger of collapse or at least a sunken spot in the weld. During the welding of both cracks the operator endeavored to melt the full depth of the crack and no more. He also was careful about prodding, in order to keep from pushing the rod through the casting.

When the side cracks were welded the neck position was changed to weld the flange cracks in much the same manner. Care should be taken at the corners to join these welds with the crack welds. Then the position was again changed to "doctor" the inside of the neck wherever the weld was found imperfect. When this was completed the neck was ready to attach to the main body of the housing.

Fig. 2 indicates the first step in the welding of the neck to the body. The casting was arranged on the combined welding and preheating table so the flames of one gas burner would enter the inside of the case, heating the broken end. To accomplish this effect the case was tilted and propped with a couple of V blocks as shown in the picture. This arrangement permitted the direct heating of about one-half of the transmission case, the heat being conducted to the balance of it, gradually diminishing in intensity to other parts of the casting, thus equalizing and shading off the expansion.

Preheating in this event was to expand the casting in order that there would be no strain when the fully expanded weld metal cooled and contracted. That is, the surrounding metal or that part of the casting on each side of the fracture would offer stubborn resistance to the pull of contraction when the weld cooled, if the job were welded without preheating. This stress, or pull, would be the greatest near the weld, gradually less farther from it. Therefore, the direct heating of only part of the job.

After arranging as stated, the gas was lighted and allowed to burn until the casting was hot in the upper part. This heat was not carried to anywhere near the melting point, both because it was unnecessary, and because there was danger of the casting collapsing or causing it to warp out of alignment. The weight of the job might cause it to sag. However, the case was heated until it lost much of its metallic sound when tapped with a file. The heat condition is difficult to describe, but it could be said that the temperature was not as high as used to be thought necessary or even imperative.

FIG. 2.—THE NECK WAS WELDED WITH THE PREHEATING FLAME INSIDE THE CASE.

It will be noticed in Fig. 2 that no asbestos covering or other enclosure was used while this job was preheating, such as used to be the custom in earlier days of the welding profession. The welders are learning that many jobs are good, if not better where, where they are heated in the open. It is in cooling that the covering is essential. The majority of castings may be heated and welded without covering, but should be well covered when cooling.

The arc of the neck weld was accomplished in the same combined puddling and fluxing method that was employed on the flange welds. With the same watchful care about preventing the flame from blowing through the metal; or the rod from pushing through, the weld was confined to a narrow strip and accomplished as rapidly as possible to prevent the heat from spreading. The preheater was allowed to burn during the welding procedure the same as at the beginning, thus keeping up the expansion.

When the first curve of the neck weld was completed the casting was quickly shifted to another position. This is shown in Fig. 3. The other two of the battery of gas burners were lighted and allowed to burn slowly beneath the housing, while the operator welded the crack along the side. It is needless to describe this welding process as it was practically the same as the others, except that the weld was started where the neck weld stopped, and worked to the open end of the crack.

Then the case was immediately inverted, the last weld being thoroughly congealed before moving. This brought the opposite side, or the last section of the weld upward. This was welded in the same manner as the other portions of the fracture. There was no pausing after turning the job, as it was desired to weld the whole crack while

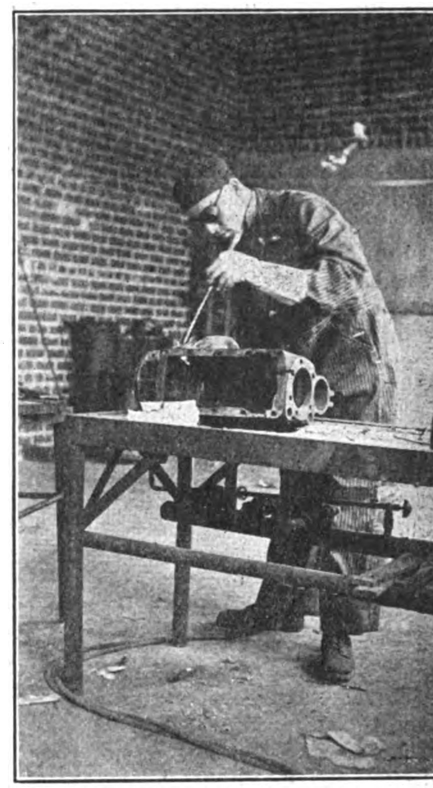


FIG. 3.—THE CASE PLACED ON ITS SIDE TO KEEP WELD HORIZONTAL.

the casting was expanded. After this it was necessary to weld the crack at the other end of the case. This was easily accomplished, as the casting was fairly hot all over by this time.

A piece of carbon was filed to fit the hole through which this crack extended, for the purpose of saving the hole. The metal was welded close around the carbon on both sides and thoroughly puddled together. In order to accomplish this the casting was turned and tilted several times at different angles, at all times keeping it over the gas flames to maintain the heat and consequent expansion.

When this last weld was finished, the whole job was ready for cooling. In order to make the cooling occur slowly, the whole casting was wrapped in asbestos paper as shown in Fig. 4 of the illustrations. The housing was placed on end over one gas burner and wrapped with the asbestos paper in such a way that no part of it was exposed. Thus the heat of the casting was confined to the absestos enclosure and prevented from radiating rapidly.

The slow cooling process is explained in the theory that follows: The heat of the weld and the hotter portions of the casting was gradually conducted to the cooler parts, equalizing it. The heat of the heavier parts was conducted to the lighter parts, tending to keep it equalized. These actions resulted in equalizing the expansion throughout the whole case.

Then the heat of the case passed or radiated to the space between the casting and the asbestos paper. This tended to further equalize the expansion by surrounding the case with hot air. Then this heated space gradually lost its temperature, as the heat escaped to the outer air.

On the other hand, this means that the contraction diminished gradually and evenly throughout the whole case. In other words, it was equalized to the very last. This gradual decrease in temperature allowed or caused the whole casting to shrink in unison, so there would be no stress set up by the contracting weld metal.

After the case was wrapped the gas jet was turned off and the job allowed to remain under cover until cold enough so that it could be handled bare-handed. Then the rough parts of the weld metal were trimmed off with a sharp rasp. It is much better to give this kind of work a pleasing appearance than to turn it over to the customer as it comes from the torch, because an

FIG. 4.—WRAPPED IN A SHEET OF ASBESTOS FOR SLOW COOLING.

aluminum weld is a somewhat ragged affair at best. It may have strength, but it certainly does not look it.

The flux used on this job was especially prepared for aluminum and was applied in connection with the puddling by dipping the heated end of the filler rod in the flux powder and depositing a quantity of it upon the melting weld at frequent intervals during the operation.

MAKING OLD WAGON TIRES DO COMMUNITY SERVICE

H. N. Albeck, blacksmith at McGregor, Iowa, has found a way to make old wagon tires give community service. They were conducting a clean-up campaign in his town recently. One of the storekeepers came to him and said, "We have so much trash, papers, boxes, etc., to get rid of all the time. The back of our place is always littered with them. If we could get some sort of a thing in which to put them and burn them we could clean up and stay cleaned up. Can't you fix something for us?"

Now, it happens that Mr. Albeck is one of the Councilmen of his town and had a particular interest in the "clean up campaign." He gave a little thought to the man's request. His eye at the moment happened to rest on a scrap pile of old wagon tires, that he wanted to get rid of as part of his clean-up duty. An idea came and he answered, "Sure I can fix something for you."

The photograph shows what he made. A rubbish burner made from old tires and some cast off woven fence wire. There are rubbish burners on the market, but they are small for household use. The wagon tire makes a large burner, suitable for business places. Two tires were used at top and bottom and four upright pieces. The wire was put about this frame after the iron pieces had been bolted together.

The burner has attracted the attention of other business men and it appears now as though rubbish burners are going to be quite a side line with Mr. Albeck.

F. L. Clark.

A RUBBISH BURNER MADE OF OLD WAGON TIRES AND FENCE WIRING.

CUTTING OIL GROOVES IN BEARINGS

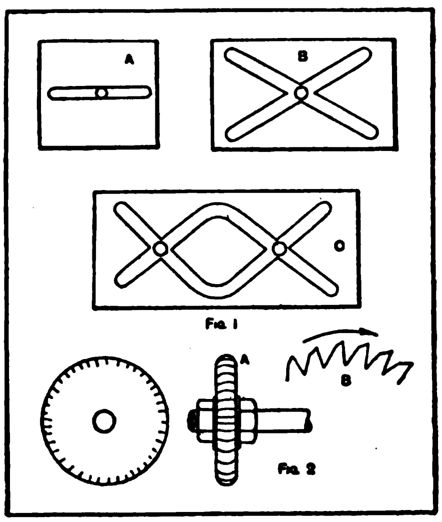
Cutting oil grooves in metal bearings that have been renewed often presents difficulty if one has not the necessary equipment at hand. Especially is this the case where the oil-grooves are running in a diagonal direction across the bearing. The bearings shown in Fig. 1, for example, show quite common methods of grooving. That shown at A is, however quite a simple groove and can be simply cut by means of a small round-nosed chisel. The others, namely B and C, cannot be so easily made as when cutting crosswise, for owing to the curvature of the bearing itself the chisel cannot be held at the correct angle, and in consequence will tend to dig in.

Fig. 2 shows a tool simple to make and to adapt for running and be easy done, no matter how complicated the grooving might be. It consiss of a small wheel somewhat resembling a milling cutter, which can be mounted on the spindle of a small electric motor a mandrel in the lathe, drilling machine, or failing this, it may even be operated in a strong wheel-brace held in the vice while the handle is turned.

This small cutter wheel should be about 1½ in. to 2 in. in diameter , about ¼ in. thick, and the shape should be as shown at A (Fig. 2), that is, with a semi-circular edge all round. Teeth should be filed into the edge of this wheel taken to see that the direction of the teeth is correct for the direction of rotation of the particular machine in which the cutter is to be used. These teeth should be filed in to the shape shown at B (Fig. 2), where the direction of rotation is shown by the arrow. It should be noticed that a hole is required in the center of the wheel to admit the spindle upon which it is to be run. This spindle also should be screwed sufficiently to permit of the cutter being tightened up with a nut and washer each side. The cutter should now be hardened and tempered to a dark straw color, and it is then ready for use.

The mode of working is simple. Run the cutter, when mounted in the lathe or whatever machine is to be used, and press the bearing lightly against it, guiding the bearing in the direction the oil-grooves have to take. Some care may be necessary at first to get bearing, for without a firm and even pressure, both against the wheel and in the direction of the oil-groove, the bearing will wander and make wider grooves than is required. It would, perhaps, be advisible to practice a little with some old metal before trying a bearing that has taken half a day to fit.

If one cannot operate the grooving as carefully and evenly as one would wish the difficulty is easily overcome by making a template of thin sheet iron, which will exactly fit into the bearing in which the grooves are to be cut to the width, length and shape desired in the finished work. It will then be much easier to cut the grooves, as the template will prevent the cutter wandering over the face of the bearing and it will also give the worker greater confidence in operating. Of course, the template is only necessary in starting the grooving, for after this the cutter will keep in the groove already formed and the bearing can be run backwards and forwards until the required depth of groove is obtained.



CUTTING OIL GROOVES IN BEARINGS. FIG. 1 SHOWS SHAPES OF OIL GROOVES. FIG. 2 SHOWS A SIMPLE OIL-GROOVE CUTTER.

HAME-MADE CYLINDER LAP

James F. Hobart

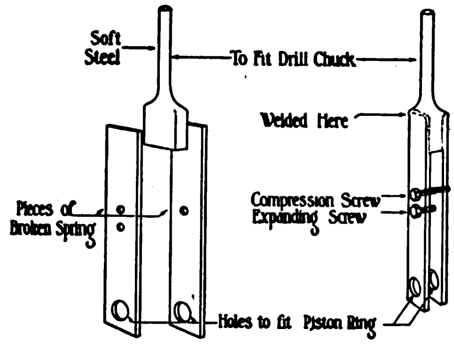
We had to take some cylinders to a machine shop to be lapped, and found it would be several days before we could get the work done. We couldn't stand the tractor delay and determined to do the lapping at home in our own shop where we had no lathe but did possess a pretty good hand and power drilling machine.

A discarded piston was found which would barely slide into the cylinders. This piston was hacksawed in half lengthwise to be used as an expanding lap, with emery and oil to do the cutting inside the cylinder. To drive the piston-lap, we rigged an attachment which was screwed into the drill chuck same as an ordinary drill of as large diameter as would enter the chuck.

To make the driver, a piece of steel was forged to fit the drill chuck as shown, one end being left rectangular to fit between two pieces of broken vehicle spring as shown by the illustration. Later, holes were made in the bits of spring as shown by the sketch and as will later be described. Then the two pieces of spring were welded to the rectangular end of the chuck-piece as shown by the righ-hand sketch.

The holes in the lower end of each spring were made the same size as the wrist pin holes in piston. The pins fastened each spring loosely to one of the piston halves —fastened loosely so the piston could adjust itself to a fair bearing inside of the cylinder. The spring was so fastened to the pins that the piston halves were forced to turn with the springs and to move into and out of the cylinder with the springs accordingly as the drill spindle was moved up or down; the cylinder being fastened accurately to the drilling machine table.

When first made, the two piston pin-holes were the only ones in the pieces of spring, the stiffness thereof being depended upon to hold the half pistons outward to do their work. But it was found a very troublesome job to so compress the springs that the split piston could be made to enter the cylinder, and



Lap Driver

LAPPING TOOL MADE FROM SCRAP METAL

many a minute has been spent trying to hold both halves fair with the cylinder with one hand while the other hand screwed down on the drill spindle until the split piston could be coaxed to enter the cylinder.

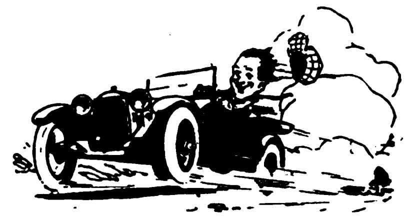
Later, the two upper holes were drilled and through one spring the hole was made large enough to receive the body of a long cap screw. The hole through the opposite spring was tapped for the cap screw so that when the head of the screw was screwed down against one of the springs, the ends thereof would be drawn together and the piston halves brought close together so as to enter the cylinder readily.

Still the cutting action of the lap depended upon the stiffness of the two springs and later another hole was drilled and tapped through one of the springs as shown and a set screw inserted therein by means of which the two springs—and likewise the two piston halves—could be forced outward as required to make the emery on the piston halves cut the cylinder properly.

The springs could be thus forced apart or drawn together and by loosening one screw and tightening the other, a very nice adjustment of the piston halves could be made. The resiliency of the springs still held the emery-covered piston halves out to their work and enabled them to yield while passing through the smaller parts of the cylinder. We made the above described apparatus and successfully lapped out the engine cylinders some time before the machinist was ready for our work.

This saved us considerable time in awaiting the time of the machinist and idle machines mean real money these days.

High Spots



Good and Sufficient

"She's giving a very elaborate party."

"Gotten up solely on my account."

"I thought you two were on the outs."

"We are. And that's the reason she got up the party."—Kansas City Journal.

Wasn't He Cute?

Wifey—"You must not expect me to give up my girlhood ways all at once."

Hubby—"That's all right. Go on taking an allowance from your father as if nothing had happened."—Brooklyn Citizen.

Clumsy Cheating

The Kaiser said, "What shameful fears
I'm now compelled to feel;
I stacked the cards for thirty years
And then mussed up the deal!"
—Washington Star

Squeezed Dry

"Si hubbard told me he got a heap of work out of you when you was workin' fer him," said the farmer.

"Wal , Iallow he did," said the hired man. "Fact is, I guess he just about got it all."—Boston Transcript.

Merrily We Roll Along

A man entered a drug store very hurriedly and asked for a dozen two-grain quinin pills.

"Do you want them put in a box sir?" asked the chemist, as he was counting them out.

"Oh no, certainly not," replied the customer. "I was thinking of rolling them home!"—Tit-Bits.

Sure To Come

"Oh mama, I'm frightened!" came from little Tommie in bed.

"What are you frightened about my son?"

"I hear somebody on the roof."

"Oh, well go to sleep, my boy, it's only your father taking off his shoes before he sneaks through the scuttle. He's just got home from the club in his airship."—Yonkers Statesman.

For Better or for Worse

At the end of six weeks of married life a Southern darky returned to the minister who had performed the ceremony and asked for a divorce. After explaining that he could not give divorces, the minister tried to dissuade his visitor from carrying out his intention.

"You must remember Sam, that you took Lize for better or for worse."

"I knows dat, parson," rejoined the darkey, "but she's wuss than I took her for."

Why He Came Late

Young John was late in attending Sunday school that particular Sunday and the minister inquired the cause.

"I was going fishing, but my father wouldn't let me," announced the lad.

"That's the right kind of a father to have. Did he tell you the reason why you should not go fishing on the Sabbath?"

"Yes, sir," replied John; "there wasn't bait enough for two."

A Willing Patient

"There's no excuse for your being afflicted," said a friend. "I used to have rheumatism. When it would strike me I would go home and have my wife throw her arms around my neck and give me a massage treatment. It helped me every time. You ought to try it."

"I will," replied the man. "When will I find your wife at home?"

A MATTER OF DIET

A negro employed at one of the movie studios in Los Angeles was drafted by a director to do a novel comedy scene with a lion.

"You get into this bed," ordered the director, "and we'll bring the lion in and put him in bed with you. It will be a scream."

"Put a lion in bed with me!" yelled the negro. "No, sah! Not a-tall! I quits right here and now."

"But," protested the director, "this lion won't hurt you. This lion was brought up on milk."

"So was I brung up on milk," wailed the negro, "but I eats meat now."

BRACING ATMOSPHERE

The American tourist in Scotland was being shown around by a guide and was affecting supreme indifference to everything.

"Loch Lomond? That puddle?" he exclaimed with scorn. "Why, we have lots better ponds than that in the United States, and those mountains are only called hills back home. Scenery Poof!"

"Ah, but mon," retorted Sandy undisturbed. "D'ye see those three fine big buildings yon? There're distilleries, an' they're all working."

HOW COME, SAINT?

St. Joseph, Missouri, must be in a class with fabled Sodom and Gomorrah when it comes to general wickedness. At a recent Sunday evening service this sign adorned a church.

"Evening service, 7:30. Subject of sermon: 'Where Millions Sin.' Get the habit. All are welcome."

SHE HAD A "COME BACK"

The extremely thin woman in the street car recented the stout woman's crowding her and turning to her remarked: "They ought to charge by weight in this car." The stout woman looked at her contemptuously and remarked quickly: "Well, if they did, they wouldn't stop for you at all."

THE ONE BEST BET

First Citizen—"See in the paper that Congress will use the pruning knife."

Second Citizen—"Well, I'll bet it won't itself."

Misunderstood Distressed Damsel—"Oh, sir, catch that man. He wanted to kiss me."

Pensive Pedestrian—"That's all right. There'll be another one along in a minute."

They are now calling the Canadian border the "far-flung bottle-line."—New York World.

Silent contempt is the noblest way a man can express himself—when the other fellow is bigger."—Life.

A thirsty individual called at a hotel in North Wales and asked for a glass of beer. When he tasted it, he asked?

"What do you call this?"

"Victory ale," was the reply.

"My goodness!" he exclaimed. "Then we lost the war after all!"—Ideas.

A reporter was misinformed, and the obituary of a live man appeared in the Daily Tribune. Of course, the man was more or less indignant about the error, and rushing to the phone called the editor. "I see in your dirty old sheet that I am dead," he snorted.

"Yes,'" replied the editor. "Where are you speaking from?"—Candy News.

SUGGESTIONS FOR MR. EDISON

Since Mr. Edison's famous list of questions became known to the public, the number of people, humorous and otherwise, who have come forward with suggestions for a new list is simply astonishing.

We offer below a few of the questions which some people think every educated person should be able to answer:

Is Fahrenheit the name of a German river or a tire fabric? To what extent if any?

Can oysters see and would it do them any good if they could?

What kind of leather is used in making Filet of Sole? Bound Galli-Curci.

Who wrote "The Face on the Barroom Floor?" Was anything ever done about him?

Why was Shakespeare born in Stratford?

What American playwrights write in English?

Describe the methods employed by an actor in getting a salary of $1,000 a week?

Whom was the Prince of Wales Theatre named after?

How many strikes is TUH?

Where is the Ulna bone located?

Which has been done oftener, Harlem Eddie Kelly or the Old Oaken Bucket?

What is Zbyszko? It is used internally or externally?

Explain the Einstein theory in words of one syllable

Where is Charles Ross?

Where are the Monadhliath Mountains?

Where was the Serbonian bog and what entire armies were sunk therein?

Who wrote "Mary Had a Little Lamb?"

What is a bannalanna?

How many white beans, on the average, to the bushel?

Where was Maxfield Parrish's famous mural painting in regard to King Cole installed? And where is it now?

Building Good Will With Tires

Robert Falconer

In this article Mr. Falconer tells how a tire department operated on the right basis will build up trade, because of the very factors that seem to argue against the possibilities in the tire field.

THERE is probably no part of the automobile business in which the dealer has experienced more troubles than that of handling tires. The manufacturers have from time to time increased their tire mileages and so much stress has been placed upon these mileage guarantees by a certain class of dealer that people have come to put less faith in such guarantees.

So many things can happen to a tire in the course of its useful life to shorten its mileage, in spite of the quality, the average car owner knows so little about tires, and there is such carelessness on the part of most of these owners in keeping tire mileages that adjustments that are fair are difficult to make. This has given an opportunity to "gyp" dealers. These dealers handle seconds, or tires of inferior manufacture, make great claims, sell tires for a season and, unless the city is large enough to provide a goodly supply of "suckers", move on to some other community the next season.

It is this class of men who have given the tire business any soiled reputation that it may have. It is also this class of men operating in the used car field that has given rise to many of the used car problems. It is because of this class of men that some accessory dealers and automobile dealers have carried tires as an accommodation to their customers rather than something to push for profit. They have feared that pushing the sale of tires will place them in the same class with these tire dealers of unsavory character.

The fact that there are dishonest men in the retail tire business is all the more reason why every honest dealer should push the sale of tires. The more honest dealers there are in a community who are doing so, the less the opportunity for dishonest dealers to flourish. The fewer the honest dealers in town who are ushing tires, the greater the opportunity of the dishonest dealer.

It is such conditions as these that make it possible to build good will through service. It is such conditions as these that make it possible for dealers to grow so rapidly and prosper so largely. When the public learns that any dealer gives a square deal and good service, the car owners just simply flock to that dealer.

A year ago a man just discharged from the army opened a tire store. He gave each and every customer a square deal and before the year ended found it necessary to move into larger quarters. A concern with a good reputation for honest dealing recently added a line of automobile tires. This reputation of the firm alone is bringing in a very satisfactory volume of business.

To build good will through the handling of tires, two things are important. First the tires to sell should be selected with care. It does not make so much difference what bright promises are made in regard to the mileage, as it does that the tire will give satisfactory service. It is well to give all tires received careful inspection as soon as they are received. If they are not in first class condition adjustments should be made with the manufacturer before a tire is placed on sale. Mistakes will sometimes happen in spite of everything and the dealer in tires will do well to see to it that these mistakes are not passed on to the car owner.

When the tire is sold it will be well to give the buyer some instructions in regard to the proper use of tires. Most tire trouble, most of the dissatisfaction in the service that tires give is due to the ignorant way in which tires are used. Fast driving around corners, driving with tires that are nearly flat, scraping the tire up against curbs, driving directly up against the curb, and many other practices of a goodly number of automobile drivers serve to decrease the life of tires. The people who do these things are also often those who make the greatest fuss about adjustments. Some people will never be careful, but most people, if they are cautioned a sufficient number of times, will either mend their ways or make allowance for these ways in the wear of their tires.

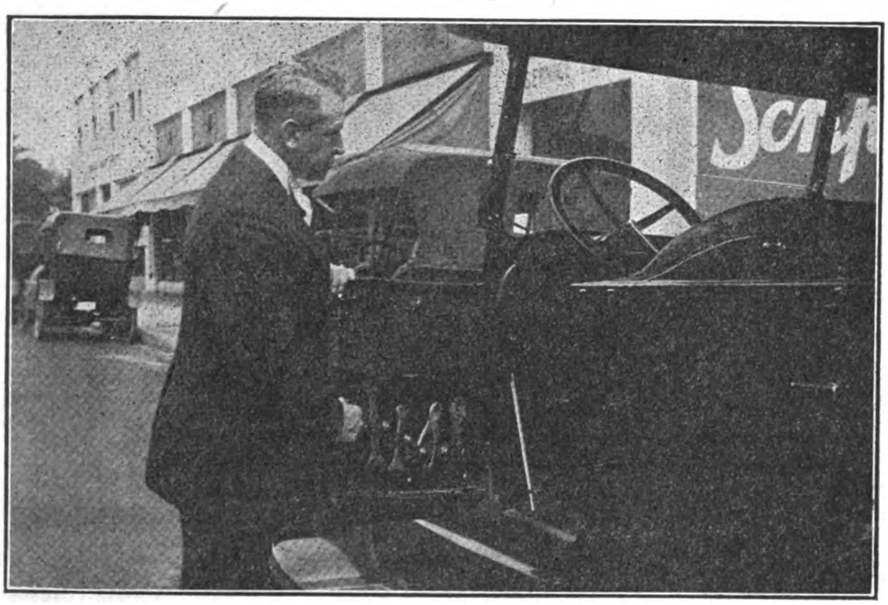
There is another class of people who are very careful about their driving but who work a great deal on their cars and not being first class mechanics do not have all parts in perfect adjustment at all times. People in this class may get their wheels out of alignment and wear out tires in this way. If they have done their own car repairing and adjusting, they resent being told that their wheels are not in alignment. In such cases, it is better to merely show them how you find out whether or not the wheels are in perfect alignment Once having been shown how to test for alignment they may take the hint and make certain that their wheels are really in alignment. If a man does not make his own repairs he is more likely to welcome information in regard to the alignment of his wheels. He can blame the whole thing on the garage or the repair man. If the man who sells him the tires also runs a repair shop, it is more than likely that business will result when new tires are put on. The wheels are placed in perfect alignment and the owner is shown what effect this has upon the wear of the tires.

Just merely delivering the tires over the counter to the car owner is not likely to result in the very best results from a good will point of view. Doing all that is possible to show the owner how to increase the length of life of his tires will help a great deal along the line of inspiring confidence on the part of the car owner in the dealer.

When it comes to adjustments, many dealers who are making real successes of their business say that a liberal policy pays better than one that is not so liberal. These dealers put it this way.

If a car owner comes in to get an adjustment and the dealer takes a lot of time to examine the tire, possibly sending it back to the factory and keeps the adjustment down to the very lowest point, there is a tendency on the part of the car owner to feel that it is all a trade and that it is perfectly fair to use any method to beat this dealer. It becomes a case of trading and the best trader comes out at the big end.

On the other hand, if, when the car owner comes in for an adjustment and the adjustment is made promptly, the buyer being given the benefit of the doubt, he feels that he is being treated honestly and that it will be dishonest to try to get the better of the dealer. The whole thing is placed upon a different basis than it was when the buyer felt that the dealer was trying to give as little as possible in



A VERY HANDY AND CONVENIENT TOOL CASE FOR THE MOTORIST.

the way of an adjustment. It makes a difference to him whether he feels that he will have to fight for his rights in order to get them, or that the dealer will give them to him without a fight.

One dealer says it is his experience that every tire adjustment made is the best advertising that he can do. He says that when a man comes in and buys a tire for $30 and that tires does not run more than half of the mileage guarantee, that when he sells the owner a new tire for $15 he has spent $15 for the kind of advertising that will bring him the maximum amount of business. For this reason he always gives the customer the benefit of the doubt in making adjustments and has found that this policy has resulted in good will that has been of immense value to his business.

The sort of service that will make the tire department the most profitable from a good will building point of view, is doing everything that can be done to help the car owner secure the greatest possible mileage from his tires. The average car owner comes sooner or later to learn, that it is not in buying tires where they can be purchased at the lowest possible price that results in the minimum tire cost, but that it is in buying tires from the man who stands back of all his guarantees, and who keeps all of his promises, the man who really takes an interest in helping the car owner get the maximum mileage from his car.

stores, accessory stores, as well as

Blacksmiths, garages, hardware regular tire dealers have created a considerable amount of good will for their businesses by giving real tire service. Where the tires are carried as a side line instead of the main line, this good will is valuable in two ways. It increases the sales and the profits in the tire department and the good will created for tires attracts customers to the other departments of the business. If a man's main business is so far removed from the automobile business, as that of shoeing horses he can make a real tire service an asset. If he is able to keep the automobiles of his customers well shod he is not going to lose any customers for horse shoeing provided his horse shoeing service is satisfactory. If, however, some competing horse shoer starts as a side line a really good tire service, customers are likely to leave and go to the horse shoer who has added this new feature to his business.

Because so many people have had unsatisfactory experiences in regard to automobile tires the opportunities of making friends through the selling of them are greater than they are in the handling of most any other kind of merchandising. If from the first every effort is made to use them to create good will, placing the matter of profits second, the chances are the profits on the tires will soon grow to goodly proportions.

A NEW TOOL CASE FOR THE MOTORIST

From time to time different features are being presented for use by the motorists of this country, but it is a long time since a more desirable tool holder than the one shown in the accompanying illustration has been presented. Nearly every motorist is on the lookout for devices and ideas that will result in a saving in time and expense in the care and repair of his car. This being true, it is probable that nearly every motorist will be interested in the unusual yet practical tool carrier here shown.

The lower about two-thirds of this door has been cut away. Several short lengths of strap, permanently fastened at one end and snaps at the other, are arranged in a row across the space caused by the cutting away of the door. In these the tools, most frequently used by the motorist in the care of his machine, may be hung. The piece of door covering originally occupying this space is hinged in its former position at the bottom, so that when it is closed the container-door can hardly be distinguished from the ordinary car door.

The convenient location of this container is its most attractive feature. When some trouble develops with the car it takes but a moment for the motorist to open this compartment and remove the particular tool that is required.

Albert Marple.

Stanley Sets Up A New Stand

By D. G. Baird

I'M a modest and unassumin' citizen 'uv this here land 'uv free tax, free graft, and forbidden hootch, and I don't like to toot my own horn atall—not even when a haughty fat dame places her anatomy in the very spot where my bumper's due to arrive about three-quarters 'uv a second later—but when it's a matter 'uv savin' the lives and the gas tanks 'uv the darin' motorists 'uv the country and the pocket books 'uv the illustrious practitioners what makes it possible for the said motorists to motor, to say nothin' uv the matter 'uv the remuneration what's to be had by all concerned — w'y, that's what might be called extenuatin' circumstances, so we'll proceed forthwith immediately to extenuate the extenuation.

Wherefore, be it known to all men and to them as derives their bread an a occasional hunk 'uv butter from the the patriotic labor 'uv supplyin' and ministerin' to the needs 'uv the aforementioned motorists, that these said addicts 'uv the highway habit have other needs that may well be supplied by the noble keeper 'uv the garage, and that one frater 'uv the fraternity has been prevailed upon by yours truly to install a machine what makes music that's much pleasanter to the ear 'uv the owner than that 'uv the usual canned variety—namely, and to wit, a cash register.

(The editor will leave twelve dollars worth 'uv white space just here to suitably emphasize the importance 'uv this announcement and to save us the trouble 'uv thinkin' up words to fill the said space).

If the reader is ready, havin' recovered his composure after the above thrillin' announcement, we will proceed with the proceedin's.

Stanley X. Higginbotham is the cognomen 'uv the pioneer in the new line above referred to and Stan's as fine a tinsmith as ever tinned a tin lizzie. Yep, Stan's some practioner when it comes to ministerin' to the ailments and appetites 'uv the Ingersolls 'uv the byways.

But Stan's woefully deficient in that remarkable faculty what's so highly developed in members 'uv the law-makin' bodies 'uv these here United States. He just ain't got no imagination worth mentionin' atall. That's why he's got a bad case 'uv the pessimistic blues when I drop in to pay him a social call a spell back. He just don't seem to be able to undersand that the things what a lot 'uv times seems like the worst kinda misfortunes is blessin's with false faces on.

F'rinstance, he's some worried over the growin' habit 'uv a lot 'uv his customers 'uv fillin' their gas tanks with anti-Volstead propaganda instead gas, thereby de privin' him'uv a honest trade in flivver fuel 'uv standard brand. Then to the drug stores and hardware stores and department stores 're all gone into the cut-rate accessory game and there ain't no chance to compete with them in that line, so his business is dwindled down to nothin' but storage and repairs and the like. He ain't got a thing to sell but space and labor and he ain't sellin' none too much 'uv that.

"Well, Stan." says I real optimistic, "a wise man once said there ain't no use to weep over spilt hootch." And—would yuh believe it?—that there one magic word—"hootch"—suggests the solution 'uv the bafflin' problem right off. Some powerful brew, eh?

Anyhow I see through the situation clear as day and I set right in to educate Stan in the rudiments 'uv a new line.

"Stan," says I in a judicious tone, "it is a fairly well known fact that wood alcohol is hard on the stomach." He admits the truth 'uv my assertion and I go on with my remarkable logic: "You'll no doubt admit further that it 'ud be to your material advantage if all them there cars that're sailin' by out there all day long and a big part 'uv the night 'ud stop at your establishment? Yes? And you've already informed me that the druggists 're gettin' your accessory trade.

"Now, why not kill a whole flock 'uv birds with one brick? My suggestion is that yuh improve the health 'uv the passin' pleasure seekers what're accusomed to kick dust into your nice establishment by breakin' them 'uv the wood alcohol habit, bring them into your place 'uv business for the purpose 'uv turnin' over to yuh sundry coin 'uv the realm, and get even with friend druggist by takin' some 'uv his trade away from him."

"Sure!" says Stan. lookin' at me some peculiar like. "That'll be fine. It's a mighty warm day, don't you think so? I'll call the missus and ask her to bring us a little lemonade." And he starts edgin' off toward the door,keepin' a suspicious eye on me 'sif he thinks I'm gonna hit him in the back when he faces away from me.

But there's all kinds 'uv method in my madness and I go right on with my plans and purposes: "Never mind the refreshments for me; save them for the folks what's passin' yuh up all the time just like a pay car passin' a bum."

Stan kinda hesitates between callin' the ambulance and hustlin' me off to the padded cell and stayin' a while to satisfy his curiosity, but his bump 'uv inquiry gets the best 'uv him. He hesitates and he wantsta know what I'm drivin' at.

"Just what I announced," I assures him. "Save the refreshments for the traveling public 'cause they're gonna come in and buy all yuh got on hand."

"Say!" Stan breaks loose then, "what in samhill 're you driving at any way. What am I gonna do with refreshments for the traveling public of his here highway?

THE DRUGGIST GOT THE ACCESSORY TRADE

You think I'm gonna turn philanthropist and set up a Red Cross station here for the relief of victims of the heat or something?"

"Well, yuh might call it that if yuh so desire," I elucidate airily. "You're gonna furnish the thirsty victims 'uv the Volstead misunderstandin' with wholesome relief from their sufferin' and you're gonna collect suitable reward therefor.

"You're gonna plant a nice flower bed out in front 'uv this here eye-sore buildin' and you're gonna fill the motorists tanks with gas, their vacuum bottles with substitutes for hootch, their lunch baskets with ham sandwiches, and their cigar cases with fine Havanas. You're gonna—"

But Stan's heard enough to convince him he'd better hurry his call for the ambulance, so he makes a quick dive for the door. I'm no wise discouraged, 'cause I'm lookin' for just such a reception 'uv

A FILLING STATION THAT MEANS A FULL TILL

my excellent suggestion. That's always the way. Yuh know they wouldn't believe Columbus when he told 'em he'd discovered that West is east.

Well, I stroll along after Stan and begin to point out some of the improvements what I've got mapped out already. He's got more room in his buildin' than he's usin' and I see at a glance just how everyhing can be rigged up ship shape. Then I proceed with my explainin'.

"Stan," I says, says I, "a lot of folks pass here what're takin' considerable trips, don't they?" He admits the allegation and I hurry right on pressin' my advantage: "And a lot'uv 'em stop at the drug store down the street?" Again he's got to admit I'm in the right. "Then tell me why they stop at a drug sore and don't stop at your garage like a motorist oughta do."

"Well," Stan tries to explain, "they stop at the drug store for different things. Maybe it's for something cold, or for cigars, or eyebrow pencils for the ladies, or a sandwich, or something. As for stoppin' at my place, there's another fillin' station down the street there and it seems to get all the business of gas and oil and spare tires and the like."

"Exactly!" I exclaim in triumph. "And that other fillin' station is right close to the drug store, ain't it? " Again Stan owns up that my deductions is marvelous correct and I come to the climax 'uv my wonderful chain 'uv thought.

"Now yuh've just said that a lot'uv folks stop at the drug joint for refreshments and cigars and toilet goods and the like and that the garage right close to the dope shop gets all the regular gas and accessory trade. Why don't yuh put in all them there things what motorists stop at a drug store for? And a rest room for the ladies? And a nice sign announcin' to the travel-weary folks that you've got all these here conveniences and necessities? And a handsome—"

"Looka here!" Stan butts in afore I'm well sarted, "what yuh think this is anyhow, a pink tea garden? I'll have you understand this here's a regular garage and—"

"That's all right, too. But puttin' in these here side lines is not only gonna double your profits, but it's gonna build up your trade in the regular line, see?

"There's a lot'uv folks what're takin' long hikes in their machines in the spring and summer and the rest 'uv the year too, and they're tired and hot in the summer and tired and cold in the winter. They'd be glad to drop into a nice place where the women folks could clean up and rest up and shine their noses in front'uv a nice mirror and look at some nice flowers out in front and all, and the men folks could get a good smoke and fill their cigar cases, and they'd like to get somethin' cold in the hot weather and somethin' hot in the cold weather and fill their vacuum bottles with an abundance 'uv the same, see?

"Yuh won't be out hardly nothin' to speak of a-tall. All yuh gotta do is rig up a petition on the north side 'uv the shop here that you ain't usin' nohow and put in a soda fountain and a loungin' room for the ladies and a ladies' and a gent's lavatory, and make some nice little flower beds out in front. Then when—"

"Say, you go tell that to Sweeney, will you!" Stan breaks in somewhat unappreciative. But he's got another interruption comin'. Just abou the time he's beginnin' to tell me how many different kinds 'uv a lunatic I am there's a nice little lady steps out and has a say, she has.

It's Mrs. Stan and she's been listening' to our line 'uv chatter and she's all enthusiastic about it. Sure, she tells Stan jus what's what and he begins to see the error'uv his way right off when that there little lady'uv his takes a hand in the game.

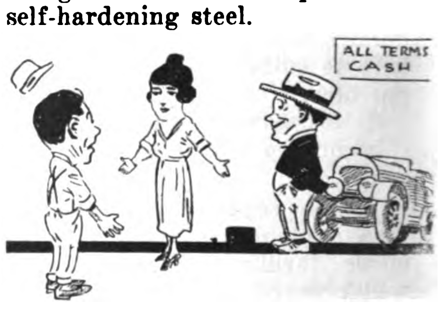
She's all enthusiastic about the whole idea and she tells Stan she'll boss the new stand and tend to the flowers and make the women motorists what come in feel right to home and all and everything'll be lovely.

And it was and is and shall be lovely. Sure! W'y Stan's makin' more off'n his new stand than he usta make off'n his garage and accessory business and he's makin' more off'n that in a day than he usta make in a week. Folks all along the line hear about his place—all nice and attractive with flowers and loungin' room and lavatories and somethin' cold or hot and good smokes and gas and accessories—and they make their plans to stop for fifteen minits or ha'f a hour and stretch their legs and get somethin' to eat or drink or smoke or—Oh, it's fine business!

A SHOP TALK ON HIGH SPEED STEEL

To enter any shop today where machine work is being done and not hear high speed steel mentioned would be rather unusual, and indicates that the average foreman and workman are out to get all they can from tools they are using. Naturally, they turn to high speed tools to accomplish the work, discussing some and "cussing" others.

"High Speed Steel"—a much used and abused term—had its beginning with Taylor and White of the Bethlehem Steel Company, who followed up the discovery of Rob't Mushet, of England, that the simultaneous presence of tungsten and manganese in a steel produces a self-hardening steel.



SHE TELLS STAN JUST WHAT'S WHAT

After long series of experiments in 1900, they introduced an alloy steel which was much superior to Mushet's and possessed red hardness—that is, the cutting edge of the tool could become red hot without having its cutting power impaired.

Following the introduction of high speed steel all machines then in use were gradually redesigned and made stronger to utilize the full power of the new steel. At the same time a multitude of new "high speed steel" alloys flooded the market, many of which were very short lived, being "high speed" only in their method of production. Out of these, however, there has been developed a line of high speed steels which are almost as essential in our shops today as the power to turn the lathe.

Some idea of the benefits gained by the introduction of high speed steel is readily apparent, when we come to learn that the cutting speed has been increased from 16 feet per minute to 99 feet per minute in 1906, and even greater in 1920. This is what has been done by high speed steel in revolutionizing production and putting it on the plane that it occupies today. High speed steel has been the main factor in the production of the modern automobile and tractor, and has made possible the medium priced machines.

The exact chemical analysis of high speed steel is of secondary importance, as there are many reliable manufacturers putting out their own brand of high speed steel, which they back with their reputation. In other words, select your steel by trial, then trust the steel maker to supply you with that un-
forward to discover the secret.
changing quality, a trust that most of them will readily fulfill, as the manufacture of high speed steel is strictly a quality proposition.

Whether the alloy be straight tungsten, or tungsten alloyed with other elements, is of minor importance; select your steel by trial, remember to play the game square, and give each steel the heat treatment recommended by the maker.

In cutting off a piece of high speed steel from bar stock, do not nick and break. If the bar from which the piece is to be cut is unannealed the use of an emery wheel is imperative, as nicking or breaking by a sudden blow causes fractures in the bar which will not show up until the tool is placed in operation, thus resulting in a direct loss of time and material.

If the bar stock is annealed, a hacksaw or milling cutter may be used to cut it off. Cut clear through the bar. Do not nick or break. If the bar is of large cross section, cut off while red hot, using a chisel after the piece has been uniformly heated to 1800° F. Cut clear through; do not nick or break, and allow the piece cut off to cool before reheating for forging.

Most of the high speed steel on the market today is supplied in the annealed condition, a commendable feature, as proper annealing is essential to the success of hardening operations to follow. If annealing is required, however, the following operations are recommended:

Place the steel to be annealed in a pipe, box or muffle. In packing, arrange the steel so that at least one inch of packing, consisting of dry powdered ashes, charcoal or asbestos, is between the piece and the box or pipe, either of which should be sealed. Place the receptacle with the steel in the furnace and heat slowly and uniformly to a temperature of 1800° F., holding it at that temperature until the piece is uniformly heated, allowing one hour for each one inch of packing and steel. Then shut off the furnace and allow the entire furnace, box tools, etc., to cool off very slowly. The slower the cooling the softer the steel. If a muffle is used, remove the steel after it has been heated to the proper temperature and 'soak'' and bury it in dry ashes, asbestos or some similar poor conductor of heat.

The methods used in ordinary drop forging and low carbon steel forging are not applicable to the forging of high speed steel. Carbon steel can be forged at a dull red heat without detrimental effects, but high speed steel would be rendered useless by this sort of treatment.

The forging of high speed steel is a very particular operation and great care should be observed in the proper heating and working of the metal. Overheating the steel must be avoided, as well as working too cold. Cold working will produce fractures that will not weld, and thus ruin the tool.

In forging a tool, gently warm the stock and heat slowly up to 1800° F., and forge with quick blows from a hammer sufficiently heavy to work the metal to the center. Reheat as many times as necessary as soon as the metal begins to stiffen up under the hammer, and under no circumstance forge the steel under a dark lemon to orange color, or 1700° F. This short range of temperatures must be observed if successful work is to be done. Never allow the tool to soak after the desired forging temperature is reached, and do not heat the tool farther back than is necessary to form the shape required.

After forging allow the tool to cool in dry ashes, lime or asbestos. Do not place on the damp ground or in a draught of air, as cracking will result.

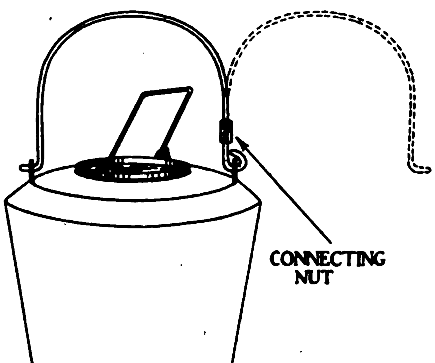
When carbon steels are heated above their critical temperatures the cementite or carbides go into solution, but in tungsten steel the carbides are extremely refractory and do not disolve completely at 2300° F.; but in the forging operation their breaking up is accomplished, thus giving a forging the ideal structure with its attendant strength. The forging of high speed steel is to be highly recommended but all who do such work should obey the rigid rules laid down if they wish to succeed.

Prior to the hardening operation all tools should be machined or forged as closely to the finished

KEEPS GLUE-KETTLE HANDLE COOL

The following method of keeping my glue-kettle handle cool during heating, has been found effective.

First, the handle is cut on one side, as shown, and each end then threaded to fit a connecting nut.



The extreme end on opposite side of handle is then bent at right-angles instead of being curved. By this means, the handle may be swung out of position while the kettle is on the fire; then swung inward and the end sprung into position.

When not in use the handle falls into ordinary position, of course.

George H. Holden.

size as possible, leaving only a minimum of metal to be ground off after hardening to give the proper size, thus eliminating as much as possible any chance of burning the steel during this operation.

The theory covering the hardening of high speed steel and the reason that steels of this type hold their red hardness has not yet been determined, in spite of the fact that considerable effort has been put

Taylor and White's own methods developed in 1900 at the time of their experiments are applicable today on practically all brands of high speed steels. They treated the tool at 2300° F. and quenched it in molten lead at 1150° F., for about five minutes, following by cooling to normal temperature by any method such as air blast, oil or in air.

Stating Taylor and White's methods in present-day practice, we find that for best results three different furnaces are used, although two are sufficient. Furnace No. 1 preheats the tool to 1000° XXX—1200° F., while furnace No. 2 operates at 1500°—1650° F., and should contain only a couple of tools at a time. The third furnace operates at 2300° F., and is used for the final heating of the tools preparatory to quenching. The tools are transferred from Furnace No. 2 to No. 3 one at a time, brought up to temperature and cooled in lead, oil or air blast.

To quench in water will almost invariably result in cracks in the tools, cracks which may not be in evidence at once, but which will eventually cause the failure of these tools. The best practice is to quench the tool in molten lead at 1050° F., for five minutes, and then allow it to cool to the normal temperature in the air. Tools produced by this latter method generally prove to be superior tools produced by any other method.

For hardening reamers, drills and tools which bend easily during the hardening process, there is coming into general use the vertical type muffle furnace. This furnace is circular, gas or oil fired, down the center of which a tube is inserted with small openings around the bottom, through which reducing gases are allowed to enter. This tube acts as a muffle to protect the tools suspended through the holes in the cover from direct contact with the flames. Temperature up to 2400° F. are readily maintained with such furnaces and straight unscaled tools are produced.

The general rules covering the hardening of high speed steel are as follows: Preheat slowly to 1200° F.; heat slowly up to 1500°—1650° F.; heat rapidly from 1600° F. to 2300° F.; quench in oil or molten lead at 1050° F.; do not quench in water; temper or draw to required temperature.

In normal work using high speed steel, small furnaces are used, either oil or gas fired. Gas is much to be preferred, as it not only gives a cleaner heat, but is more easily regulated. The one precaution which must be observed in either type of furnace is that a reducing atmosphere, or non-oxidizing, non-scaling atmosphere, is maintained in the furnace at the time that the tool is inserted, in order that a bright unpitted tool may be produced. In a gas furnace this is attained by turning the gas on until a small tip of flame is coming out of the top of the vents on the furnace; with oil burners give the oil valve a turn until a slight smoke is produced. Muffle furnaces are coming into use for this work and more. Especially is this true of the vertical muffle suspended tool type for drills and reamers.

In past years most attention was given to the methods and temperatures for the hardening of high speed steels; but in the light of later developments the drawing or tempering is of equal importances.

It is now known that high speed tools quenched in oil from 2300° F. are softer than the same tools after drawn or tempered in lead at 1050° F. than when quenched in oil and drawn to 1050° F.

All lathe tools or tools which are used under severe conditions must be drawn to 1050° F., if they are to give any degree of service. If such tools are put into service untempered, and they get red hot on the tip, planes of strains are set up in between the hot tip of the tool and the cooler shank, which may cause it to fail by breaking off at the tip.

The tempering process to be recommended is as follows: Either a lead pot or salt bath is required for drawing or tempering high speed steels at 1050° F. The tools to be tempered, if they have been quenched in oil and not in molten lead at 1050° F., are warmed up and placed in the lead or salt bath heated to about 600° F., and then heated up slowly to 1050° F., and held at that temperature from 15 to 20 minutes before being removed. Tools tempered in this manner not only possess the maximum hardness, but maximum toughness, and are in every way much more reliable tools to work with.

In order that the hardening effect of drawing at temperatures up to 1150° F. may be more in evidence, the following table of Carl H. Hewitt is given:

18% tungsten steel quenched in oil from 2300° F.

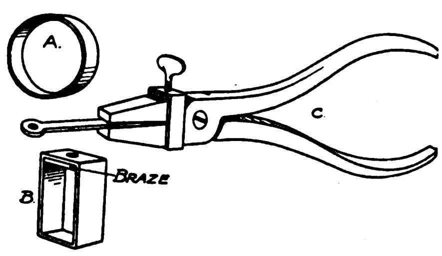
Sleroscope Hardness.	Drawing Temperatures ° F.
97	700°
98	800°
98.5	850°
99	900°
100	950°
101	1000°
102	1050°
103	1100°
105	1150°
65	1500°

The increased hardness from 95 to 105 by drawing is very marked. Heating beyond 1150° F. causes the steel to again soften, so much so that at 1500° F. shows only about 65 on the sleroscope.

A tool which has been annealed, forged, hardened and tempered properly can be very readily spoiled by poor grinding and improper clearness. It is generally conceded that more tools are

HANDY PLIER VISE

By the simple scheme of sawing off a piece of heavy steel tubing, as shown in A, and forming it into



a rectangle shape as at B, then drilling and tapping it for a small thumb screw, it will convert a pair of pliers into a simple hand vise as indicated in the larger sketch C.

If the rectangular piece is made from very light stock, it should be reinforced as shown in the drawing so that the threads will not strip.

Chas. H. Willey.

spoiled through overheating in grinding than in any other way.

All tools should, therefore, be rough ground as near the required measurement as possible, before the final hardening operation; so that when the finish grinding is done the amount of metal to be removed will be small. A copious steam of cooling water or solution should be kept flowing over the tool at all times, especially at the point in contact with the grinding wheel. Upon completion of the grinding operation, as angles of clearance should be checked and the seat of the tool inspected for exactness, as much depends on this one feature.

WHAT MAY HAPPEN TO A SECRET PARTNER

The point of partnership law which is brought out by the following letter, I do not remember writing anything about for a long time:

"I will thank you for some views upon the following problem, omitting all names if you are pleased to publish the letter. About a year ago a young cousin desired to engage in the retail —— business in this city and not have sufficient capital I agreed to stand back of him to a certain point. There were reasons why I could not be known in connection with the business so the agreement, which we made in writing between us was that I should contribute a certain sum of money, and should not be responsible for any of the firm debts. The business was to be run in his name and he was to be considered the sole owner. My connection with it was to be a secret between us, so as to safeguard me from being responsible for the firm debts, which we were advised, would be the case if my name was not used. The agreement, however, was that I was to be a regular partner and receive half the profits. I also had a verbal agreement with him that if the business did not succeed in itself the first year, I would be willing to give up a little more money.

"My cousin managed the business and managed it very poorly. The consequence is that we find ourselves about $5,000 in debt and with nothing ahead. It appears that somebody must either put up more money, or it will fail. I am not willing to put up any more money, and what I wish to know is. if the worst comes to the worst, can they hold me responsible for any of the $5,000 worth of debts, since I was not to be known as a partner, and nobody relied upon me in dealing with the business. I am informed now that if the creditors get after the business they can put my cousin on the stand and make him tell whether anybody but himself has any interest in the business.'"

The question therefore is, to what extent is a secret partner, who has not been held out as a partner and whom no one outside knew as one, responsible for the debts of the partnership? Is he responsible merely up to the extent of what he has put in, or to the full extent of his personal holdings, as a regular partner would be?

The answer is that he is responsible for everything to the full extent of his personal holdings, precisely as a general partner, for that in what the law considers him. The laws of all states provides a way in which a man who wishes to make a limited investment in a partnership, so that he will not be liable for the firm debts—the very thing that this correspondent wished to do—can accomplish the desired result. If he doesn't use that way, he is gone, provided he is smoked out. And he always can be smoked out, for all that is necessary is to put the ostensible partner on the witness stand in whatever proceedings have been undertaken, and ask him whether anybody has any interest but himself. I have done this repeatedly with perfect success where the witness did not wish to perjure himself.

The law as to dormant or secret partners is tersely stated from a leading case, thus:

> One partner has an implied authority to bind the firm by contracts relating to the partnership business, whether such contracts be evidenced by bare agreements, oral or written, or by negotiable instruments and this rule is applicable to dormant as well as known partner. A dormant partner is liable for contracts of teh firm during the contracts of the firm during partner.
>
> The acceptance of a promissory note from the ostensible partners by one unacquainted with the existence of a dormant partner will not preclude the creditor from bringing an action against all who participated in the profits of the partnership.

In other words, even if you have dealt with Henry Jones and been glad to deal with him, under the impression that he was the sole owner of a business, even if you have taken his personal note for some transaction in connection with the business, you can still go after William Brown, if you find out afterwards that he was a secret partner with Jones.

It is a good thing to remember when you are tempted to go into deals in which you are not to be known.

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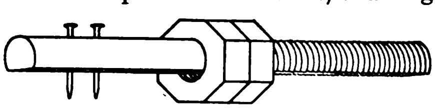
A QUICKLY MADE GAUGE

A handy marking or mortise gauge in case of emergency is made in a few minutes, as follows: First take two ½" nuts. Now cut a strip of wood to fit, making



one flat edge, as shown. This done, force on one of the nuts with a spanner. As the nut travels along, a suitable thread is made in the wood. Next put on the other nut, bringing up the two flush so that they lock.

A couple of nails can then be driven in at either end at required distances, and the nuts moved accordingly.

George H. Holden.

IS CASTOR OIL GOOD FOR BELTS?

A prominent writer recently wrote this in a well-known trade paper:

"The belt should be run about half speed and an occasional application of castor oil should be made to its face to limber it up."

While it is true that castor oil is better than nothing at all, the writer is unable to understand why castor oil is so frequently recommended for application to belts when it has been proven time and again to be harmful to the belt's fibers. What is more, it does not prevent slip as well as a treatment made especially for belts.

The writer has in mind a 12-inch belt which connected a 4-foot driving pulley running at 213 revolutions per minute to a 14-inch driven pulley. This belt drove a 682 light dynamo and even when treated castor oil, had to be run very tight with a man constantly at hand to prevent slipping off the pulleys. When a belt slips, the lights of course are bound to flicker. Later on a belt treatment made especially for belts was applied, and the drive was so improved that an 850 light dynamo was substituted for the 682 light dynamo. In spite of the 25 per cent. increase, the same belt now runs quite slack, does not slip, and requires no attention.

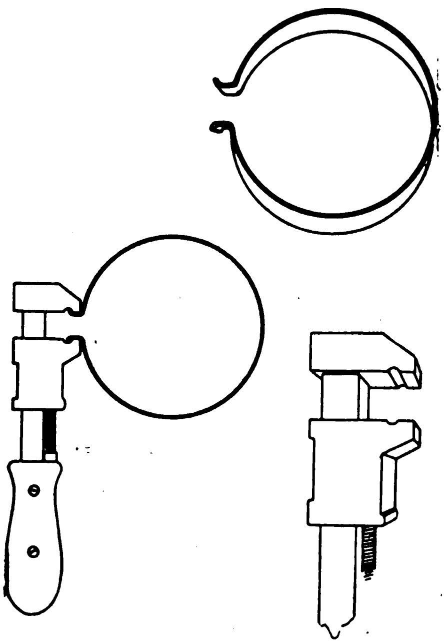
Castor oil is gummy. The gum in solution is carried in and among the belt fibers as far as the oil penetrates. The liquid parts of these oils slowly dry out and leave the gummy element, which continues to stiffen and sooner or later becomes hard enough to crack. When these elements do crack the belt fibers crack with them. This explains the fine transverse cracks, particularly across the back of belts which have had initial or subsequent treatment with castor or linseed oil. It is these same gummy elements that make a belt so treated look slick and smooth, and, in a measure, lessen its tendency to slip. Both of these oils also decompose into harmful fatty acids. Proof of the decomposition of castor oil is obtainable by placing some in an uncorked bottle, setting this in strong sunlight or in a warm place and in time observing the changed appearance.

Cases are on record also where castor oil has caused leather belts to rot. By saturating a piece of leather belt with castor oil and placing near a radiator or other warm place, it will be found that the castor oil will decompose and will then attack the leather, causing it to become so weak that it can be easily torn with the hand.

It is, therefore, evident that in the end, treatment of belting with castor oil is uneconomical. It may not cost as much per pound as a treatment made especially for belts, but the writer certainly does not recommend castor oil.

TO COMPRESS PISTON RINGS

Wnen replacing a piston in the cylinder of the motor one never seems to have fingers enough to hold the rings compressed so as they will go in and push the piston at the same time. A very serviceable device may be made of a thin strip of steel for this purpose and when used with a



AN EASILY MADE PISTON RING COMPRESSOR

monkey wrench makes a cheap acquired tool.

The strip may be an inch wide and each end must have a hook bent on it to hook in notches cut in the jaws of the monkey wrench.

These notches may be cut by a hack saw or the jaws may be closed tight together and a drill run thru, cutting half into each jaw, if they are not hard otherwise they should be annealed.

When the strip is placed over the ring and the wrench screwed closer with the ends of the strip between, the ring is compressed to the groove so as it will pass the edge of the cylinder wall.

GAS ENGINE VALVE REPAIR

REPAIR work is so varied in character and the appliances for undertaking repairs so numerous that it is impossible during a life time for one individual to become possessed of a knowledge sufficient to undertake any class of repair at any given moment. True, repair work calls forth ingenuity and resource, and the adoption of some means to attain the end; but the means used is often an inefficient and expensive one, and had the user had access to other sources of information he would have been saved much worry and expense. Thence the value of interchange of ideas; of pooling of experience. It gives those participating the benefit of each other's experiences, enlarges their vision, and makes them more proficient in their calling.

One morning it was found that a large left hand cylinder of 250-h.p. gas driven set had ceased firing. An examination of the magneto, plug and valves failed to show any reason for the occurrence. The set was shut down and when the inlet valve cover was removed it was found that the head had broken off the exhaust valve. A spare valve had been ordered some time previously, but had not yet arrived, and as it was essential that the set should be put into commission at once it was necessary that the valve should be repaired. The valve was of cast-iron; head and stem being cast into one piece. As the valve was water-cooled it was hollow throughout the stem. The bottom of the stem being closed by a screwed plug. This plug also serves to carry the spring shackles. The valve was withdrawn, a seven-eigth-in. diam. hole drilled in the center of the head and a long ¾-in. bolt passed through it to bind the head and stem together. The screw plug on the bottom of the stem was discarded and a large cast-iron washer put into its place, the whole being firmly tightened up in position.

As the engine was urgently required, no attempt was made to grind in the valve, and although it was noticed that the face of the valve seat seemed a little rough, in the hurry scant attention was paid to it. When the set warmed up, however, the real condition of the seat was found; the engine passing part of the charge into the exhaust silencer and refusing to carry more than a three-quarter load.

At the end of the fourth day the new valve arrived and preparation was made for getting it into its place. Imagine the consternation on lifting the old valve from the valve seat to find that there were three large dents on the face extending for about 1-in, and about ¼-in.

deep. Having no such tools and no appliances for reseating valves, all such work being done by outside firm of engineers. It is best to continue the relation of what was done in the works engineer's own words "We debated whether we should draw the seat and file out the marks or whether we should wait until morning and have tools sent up to do the job. I was anxious, however that the engine should be ready for the morning as the load was too much for the smaller sets. I decided to make a cutting bar, and on casting about for likely material my eye fell on the fractured valve. Two three-eigth-in. holes were drilled in the face, and two three-eigth-in. round steel tools were made, and driven into the valve head, leaving their cutting edges projecting about one-eight beyond the face. The bolt head was bored and tapped ¾ in. and a long ¾-in. rod with squared end to take tap wrench was screwed into it. With this primitive device we cut down the valve seat until the marks disappeared. The valve was ground into its seat and has been running splendidly since.

MAKING THE SPEEDSTER WATERPROOF

The accompanying illustration shows a feature for which the owner of the speedster type of automobile has long been looking—something that will protect the driver in the event of a sudden wind or rain storm. This may be termed the "emergency" cape, for that is just what it is. When not in use it may be folded and placed in the tool box or beneath the seat of the machine.

This novel arrangement is so shaped that when in use it covers the "cockpit" of the machine entirely, excluding all wind and rain. It is held in place by a series of buttons, arranged at convenient points around the edge of the seating space. The cape fits snugly about the throat of the wearer, so that only the head of the operator is visible. This cape is light in weight, quickly applied and serves the purpose for which it is intended in a very satisfactory manner. It may be made at a trifling expense by the owner of the speedster. When not in use it folds compactly and takes up little space in the tool box. This photo shows Miss Dorothy Dalton, the movie star, wearing the cape.

Albert Marple.

Piston Rings Improperly Installed Cause Trouble

By N. Ward Guthrie

A recent occurence in a local shop again laid emphasis on the fact that considerable trouble may arise from that apparently insignificant and simple job of installing a new set of piston rings to over come the annoyance a motorist was experiencing from his motor pumping oil.

A thorough analysis of the whole proposition has lead to the sad but unalterable decision that many of the mechanics doing this class of work are still slightly in ignorance on some points, and that the natural consequence of their short-coming result not only in the lowered working efficiency of the motor; but they often lead to serious consequence that can be corrected only through expensive repairs. Such a case is brought to light by the repair job which I propose to discuss.

It occured to me, that the troubles experienced by this repair man are noteworthy of mention and if they could be called to the attention of those doing similar kinds of work that an occurence of this kind might be avoided in their shop.

Briefly, the whole case may be summarized as follows, and I believe that it is important to delve slightly into the whole case in order that we may see the symptoms which suggested this repair; just what was done and what the ultimate result was:

A motor of one of the popular makes of cars was overhauled. An examination of the cylinders showed them to be free from scores and to be round within approximately one half thousandth of an inch. They were tapered slightly, being slightly more than one half thousandth of an inch smaller at the bottom than at the top. The pistons were fairly round and fitted the cylinders with an average clearance of slightly less than 6-1000 of an inch. No trouble whatsoever had been experienced with the motor pumping oil or with the pistons showing any indication of slapping; but since the motor had been pulled down it was deemed advisable to at least install a new set of rings on the old piston.

Since the old pistons fitted the cylinders with nearly the maximum amount of clearance allowable, it was decided that perhaps the rings alone could not be depended upon to prevent excess oil from working up, so as an added precaution the pistons were chamfered and drilled. This was done by chamfering the lower ring groove along the bottom edge, cutting the chamfer at an approximate angle of 45 degrees and to a width of about 3-16 of an inch.

drainage of oil be too complete.

Equidistant around this surface 8 No. 28 drill holes were drilled at an angle of 45 degrees to the side

DOROTHY DALTON, THE MOVIE STAR, MAKES THIS WATERPROOF COVERING FOR THE SPEEDSTER DOUBLY INTERESTING.

of the piston. This brought the holes perpendicular to the face of the chamfered surface.

New rings of the highly advertised patent type were installed, and good results were obtained; but only for a short time. After the motor had been run for about one thousand miles, a decided piston slap developed in number four cylinder.

The offending piston was removed, and lest a simular experience would be encountered with the other cylinders, the remaining pistons were also removed and replaced with pistons .002 in. oversize. They were carefully lapped in to give a clearance of between .003 in. and .004 in. at the top of the cylinder.

The same rings were replaced, and because the new pistons fitted with a smaller clearance, it was decided not to drill the pistons lest the drainage of oil be too complete. Trouble was experienced right from the start. Oil worked past the pistons so freely that the motor smoked badly, plugs frequently became short, and it was necessary to remove the head several times to regrind exhaust valves that were being held open from carbon deposits that had formed under them.

It was hoped that conditions would improve after the motor had been run long enough to give the rings an opportunity of setting themselves. However, hopes proved to be in vain, for while the piston slap had been corrected, the other conditions failed to improve in the slightest.

Again the pistons were removed. This time another set of patent rings with a turned outer surface, which is supposed to furnish quicker seating qualities were installed on the same pistons after they had been drilled and chamfered like the first set of pistons.

The motor was placed in operation and a decided improvement noticed. It was run just one week, and to all indications had limbered up nicely, when on a long run with a slight up grade, the motor seized so tightly that it was impossible to turn it over.

The car was pulled back to the shop, the motor torn down and examined thoroughly. The cylinders were badly cut in places as were the pistons and rings, while in other places, metal from the pistons and rings had been actually fused to cylinder walls from the friction and heat.

Now for the coroner's verdict—what caused it. The motor had ample oil—a surplus in fact, and it was new oil too, not oil that had lost all of its lubrication qualities. In this case the drainage of oil had been too complete, which condition was further aggravated by the rings having rapidly worn so as to conform closely to the cylinder walls. This condition was made possible through the fact that the outer surface of the rings had been turned so as to afford quick setting qualities. This must not be taken as proving that this particular style of ring possesses no merits and is a type to be avoided, quite to the contrary, it was a better ring than was installed in the first instance and would have worked out very satisfactorily had not the pistons been drilled.

Let us go back a step, and find out what was wrong right from the start and what should have been done to nip the trouble right in the bud. In the first place, an overhaul job should not have been built up with pistons giving a clearance of .006 in. on a motor with a bore less than 4 inches. The proper allowable clearance for cast iron pistons is not in excess of .001 in. for each inch diameter of the cylinder. New pistons and rings should have been installed in the first place, and these pistons should not have been drilled and chamfered until it was found that they really pumped oil in actual service and then this operation should have been resorted to only after other corrective measures had failed.

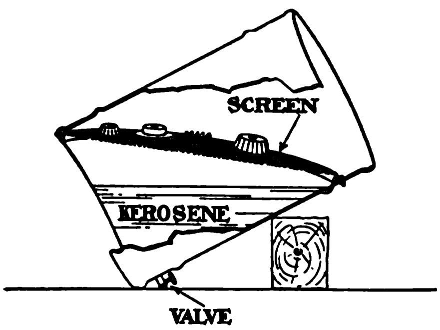
In the second place where trouble was experienced due to the pistons pumping oil, it was due to the rings and not the piston. The rings that were used with the original pistons and which were later installed on the oversized pistons which seemed to cause all the trouble from excess oil, would have pumped oil in the first instance had it not been for the fact that the pistons were drilled and thus allowed the surplus oil to work through the piston and back to the crank case.

An examination of these rings showed that they fitted the piston groove perfectly, that they had the proper gap at the ring joint; but they lacked one mighty important quality—Wall tension is the inherent spring in the ring itself and the means by which the ring conforms to the cylinder wall under the pressure of the explosion. If the ring is weak, has not the proper tention, it is a foregone conclusion that the ring will collapse under the pressure of the explosion. Secondly this first style of ring was of the concentric type, that is it was the same thickness through out its entire diameter. Its outer surface was ground; that is the part of the ring that comes in contact with the cylinder wall.

Now the faults of this ring were, first, that its wall tension was only 4 pounds, whereas a ring with a wall tension of around eight pounds would have given much better results. The wall tension of which we are speaking may be roughly estimated, as the force necessary to close the gap in the ring. Secondly, in many styles of concentric rings the wall tension is unequally distributed. That is the ring presses harder on one part of the cylinder than on the other, which was particularly true in this case, and the third contributing cause was that the ground surface of the ring permitted it to wear to a good fit in the cylinder only very slowly.

In discussing the turned ring versus the ground ring, we are speaking now only of the outer surface of the ring—the part that comes in contact with the cylinder wall, there are some advantages to be claimed for both; but it would seem that the turned ring has the better of the argument. This is primarily true because the first requirement of ring is to fit the cylinder as near perfectly as possible. The arc of the ring should conform conform to the arc of the cylinder bore. Now, then since it is nearly impossible to make either part so that they will fit perfectly, the fit is always improved through wear. The high spots on the cylinder and the rings and piston are gradually worn down and we have a better fit than when new. This condition becomes even more imperative where new rings are installed on old pistons, since the old cylinders are very often worn slightly out of round; but not enough to require regrinding. Here is were the turned ring has a decided advantage over the ground ring. It wears down to a fit much more quickly, because its outer surface is more or less inclined to be rough from the turing tool, and it is only necessary to wear away these high spots, as compared to wearing away the entire smooth surface of a portion of the ground ring.

So that it would seem that the ground ring is going to come to a seat or "wear in" not only quicker but more closely. This advantage must be treated with discretion, as is shown by the job that we were discussing. Since it is going to come to seat more quickly, and pos-



TO EASILY CLEAN GREASY AUTO PARTS

sibly more accurately, it will permit the motor to be operated with even a greater quantity of oil, and any attempt to provide means of draining the oil as was done in this case will certainly result disastrously.

In conclusion, bear in mind that drilling pistons should only be attempted as a final resort, and when it is done it is well to use the old rings. Secondly, pistons that have already been drilled and chamfered can be supplied with new rings only with the attendant risk of having the cylinder run dry, and seizing which often requires regrinding of all cylinders, as was the experience of the man whose case we just discussed.

TO CLEAN GREASY AUTO PARTS.

More care would possibly be given the auto if the dread of cleaning the greasy parts when removed The accompanying sketch and the following explanation for its use will show that this necessary work can be done without having to swab the parts in a kerosene bath by hand and fish them out of the bottom when cleaned.

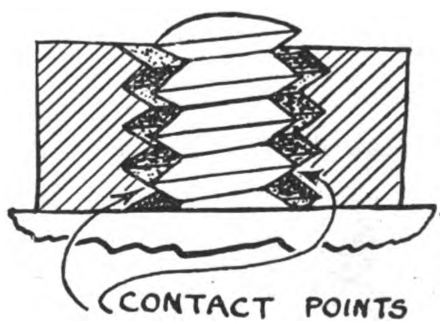
The container for the device is a fifteen gallon size steel oil drum with the head removed. On the inside of the drum reaching from one bottom side to the oppoosite top side a three eights inch steel hoop is fitted so as to fit close around the inner side of the drum This hoop is removed and brass window screen fitted over it.

A hole is punched thru the side of the drum at a point where the hoop reaches to and a bolt with a projecting head inserted so as the hoop may be snapped over it to hold to place. To use the device the drum is turned over in just the opposite position as here shown and the parts to be cleaned are placed in it. Kerosene is then poured on them and a broom or brush with a long handle is used to loosen the grease. After sufficiently cleaned the drum is rolled half over allowing the kerosene and grease to flow to the bottom while the parts cleaned will rest on the screen from where they may be easily removed. After the dirt and grease has settled to the bottom of the drum the valve which should be attached on this side is opened to allow this accumulation to run out but closed in time to cleaning job.

NUTS SHOULD ALWAYS FIT

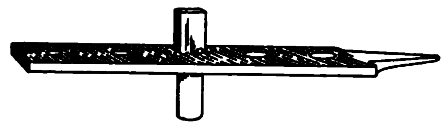
Many amateur machinists never think of the fact that a poorly fitting nut should not be used on a bolt, especially if the function of the bolt is important, and if it must resist much of a pull. In fact, poor-fitting nuts should "never" be used.

My sketch shows that a nut of one thread, say 12 threads per inch, can be placed upon a bolt of ten threads per inch. It depends upon the thickness of the nut. If too thick you can get it on only part of the way. However, too many amateurs think, "Well, if it will go on part way, why doesn't it go on all of the way?" and then it is forced on with a wrench. In forcing it on the threads on both the nut and bolt are ruined.



POORLY FITTING NUTS SHOULD NEVER BE USED

In cases of this kind it is evident from the sketch that only one thread can be in contact, and that isn't in contact all the way around because of the varying pitches. And if the nut is so long that another thread comes in contact the second contact will be on the "other" side of the thread so that when the nut is forced on it does nothing more than "oppose its own self" and ruins both nut and bolt.



Nor should nuts be used that are "too big," even though they have the same thread and "seem" to fit except that they are very loose. Where nuts fit in that way they are held by the "tips" of the threads only and it doesn't take much of a blow to shear those tips off as you have perhaps learned through experience.

In a nutshell—use only nuts that fit.

CUTS DOWELS IN RECORD TIME

Having occasion to make a number of dowels of different sizes, at short notice, I delivered the goods on time by forcing the pins through different 'sized holes, drilled in an old rasp, of oblong section.

The rasp was drilled with a ¼", ⅜", ½", ⅝" and ¾" hole, and each hole was left sharp on the underside, as the drill passed through, thus acting as a cutter.

Turning the rasp over, I then forced the wooden blocks through the holes, by hammering.

During the operation, I rest the rasp on a wooden block with a hole in it, and, as the pins pass through the holes they are shaped, in every way, as good as if actually turned in a lathe.

Of course, a piece of steel makes a better cutter, if you have a suitable piece handy, but in my case, time was of primary importance.

George H. Holden.

Queries-Answers-Notes

THIS department is the meeting place where you are free to ask for information, answer questions, discuss shop matters and business conditions and any other notes you feel would be of interest to a fellow mechanic. Make use of this Department as often as desired.

Restoring Burnt Steel:—I was looking over a March number of your publication yesterday and noticed where a Mr. S. D. H., of Indiana, asked for a formula for taking the burn out of steel. Your reply was also noted.

Enclosed herewith, I am sending you a formula that we bought about 35 years ago. While it is our experience that burning steel is extremely bad practice, nevertheless, this formula can be relied on to make good burnt steel.

Mix together the following ingredients in the order named: One pound of borax; 2½ ounces yellow prusiate of potash; ¼ pound of muriate of ammonia. Mix thoroughly in one-third of a pint of rain water, after which boil over a slow fire until dry.

Pulverize, and after heating the steel to a good red heat apply and use the same as common borax.

M. N. Storey, Mississippi.

Regarding Thermit Welding:—I was very much interested in an article which appeared recently in the American Blacksmith entitled, "Repairing the Frame of a Large Power Press by the Thermit Process." I would like to ask a few questions concerning same.

What is the difference between the molding sand used in the foundries and the "backing material" referred to in connection with the thermit welds?

Of what ingredients is the yellow wax pattern composed?

By what definite process is the thermit ignited, or which is the best way of igniting same?

A. C. G., Missouri.

Editor's Note:—It is practically impossible to lay down any fixed rules for the mixing of molding sands, as requirements for different classes of work vary greatly, as do the quality of material obtainable in different parts of the country. The material used in "backing" the thermit mold is prepared in the same manner for each weld, so that it is readily apparent that a comparison is difficult to attempt.

A formula for molding loam which is reputed to give good results is made from one part of coarse Jersey moulding sand; two parts of coarse Jersey fire sand; one part of white pine saw dust, mixed with seven parts of the above mixture. Mix with a thick clay wash formed of clay of high plasticity.

The loam or backing material used in Thermit welding is a mixture of two-thirds sharp sand and one-third fire clay. The facing material is made from one-third fire sand; one-third fire clay and one-third ground fire brick.

Crushed sandstone is not suitable for use in connection with thermit welding, and while ordinary sand might be used in the backing material in an emergency, its use is not recommended.

The yellow wax is commercial wax with a parafine base.

Pin grease or wood should not be substituted for wax, for while they will burn out during the process of preheating, they will leave a carbon deposit in the cases of the latter, and sulphur in the case of the former. Either of these elements have a decidedly bad effect on the weld.

There is absolutely nothing explosive about the present thermit reaction, and there is no danger in storing or handling it, owing to the fact that it requires nearly 2500 degrees of heat Fahrenheit to ignite it. It is for this reason that a special ignition powder (Barium Piroxide) is required to start the reaction. A half of a teaspoonful of the ignition powder is placed on top of the thermit in the crucible. This may be ignited with a parlor match, but a safer way is to ignite it with a red-hot iron, as in this way one can stand some distance away from the crucible when the reaction occurs.

It is said that the engravers and watch makers of Germany harden their tools in sealing wax. The tool is heated to whiteness and plunged into the wax, withdrawn after an instant and plunged in again, the process being repeated until the steel is too cold to enter the wax. The steel is said to become, after this process, almost as hard as the diamond, and when touched with a little oil of turpentine the tools are suitable for piercing the hardest metals.

Blue Bronze. Following is a well known process for coating metal a beautiful blue bronze:

Prepare a sand bath as large as the article to be bronzed. Cleanse the metal from all grease by dipping in boiling potash lye, and treat it with white wine vinegar. Wipe and dry the surface thoroughly and rub it with a linen rag moistened with hydrochloric acid. Allow the coating to ry for a quarter of an hour and then heat the article on the sand bath until it has assumed the desired color, when it should be removed.

MAKING THE TRUCK PAY

It will surprise many truck owners to know that there are many agecnies where co-operation, record of previous enterprises and statistics on motor truck operation may be obtained to assist them in making more money with their motor trucks.

The Department of Agriculture at Washington, the National Automobile of Commerce, 366 Mados n Avenue, New York City, the research department of the big tire companies, and the traffic engineers of most of the larger truck concerns, all have information and data wihch wlil be of benefit to those motor truck owners who are interested in farming inter-city lines for the haulage of more goods, both freight and express, and any rural motor express work.

In addition to the above available sources of information for the truck owner, there are the local chambers of commerce in almost every city of 25,000 or more in the United States, as well as the more recently formed local transportation associations in many of the larger cities. Bulletins of various kinds, booklets unnumbered, and cost figures without end, may be obtained from these sources, which will enable a man or a firm to form motor truck lines which will be profitable and a source of great convenience to the shippers.

A recent bulletin by the Firestone Tire Company says "A healthful state of inter-city haulage will be brought about when the truck manufacturer, truck dealer and truck owner, function as one." They also say that one great source of satisfaction to the truck owner is co-operation among themselves.

While the above is surely true, yet we can truthfully say that the manuacfturer has co-operated to no small extent in the past to help the truck owner so arrange his business that the small items are kept track of, to the end that the operator can make money. Many dealers throughout the United States, at least our own, have spent a great deal of time and thought on the development of these motor truck routes, and so we believe that the prospective truck owner, or those who already own trucks, can immediately find a source of information without looking very far, which will help him in the present plans for securing more haulage for his trucks.

A recent bulletin issued by the National Autmoobile Chamber of Commerce is entitled "Motor Transport Cuts Time and Cost of Shipping in New England"—another, "Good Roads and Motor Transportation"—still another, "Motor Trucks Save 45 Hours per Shipment for Bay State Manufacturers." Bulletin No. 931 of the United tSates Department of Agriculture is entitled "Corn Belt Farmers' Experience With Motor Trucks." Ontario Department of Agriculture, Canada, has issued Bulletin No. 277, entitled "Motor Transportation in Rural Ontario." All of these booklets and many others may be obtained from the above sources, and will be most profitable to those who are interested in motor trucking.

Certainly one of the greatest jobs in food and factory production is transportation, and the world needs just as much food as it ever did, and much of that food to be marketed properly must be transported quickly.

Motor trucks can do this job better than any other form of transportation.

Business is coming back slowly but surely, and an increasing number of motor truck routes are a necessity if we are to continue economy in haulage.

AMERICAN BLACKSMITH AUTO & TRACTOR SHOP

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The Horse and Mule and The 1920 Census

Were one to ask the "man on the street," (as the saying goes) as to the number of horses and mules of today as compared with the number say of ten years ago, his answer would without doubt be that there were far fewer of these animals today. The census figures however disclose the fact that there are over a million and a half more horses and mules reported in the census of 1920 than there were reported in the figures of 1910.

The actual figures for 1910 were 19,833,113 horses and 4,209,769 mules. The 1920 figures are 20,142,455 horses and 5,450,623 mules. Thus it will be noted there was an increase of 309,342 horses and 1,240,854 mules. In this connection it must be pointed out that the actual increase is even greater than the figures given because of the fact that the 1910 enumeration was of April 15th while the 1920 figures are of January 1st.

It has been popularly supposed that the number of both horses and mules had decreased in the past ten years but the figures just released by the census bureau show that this impression has no foundation in fact. Naturally, one is prone to base their opinion upon the number of horses one observes and with the great number of motor vehicles seen upon the streets and roads it would seem as though the horse had become almost extinct.

According to the figures compiled by the Automobile Chamber of Commerce the horse is still by far in the majority there being 9,211,295 motor vehicles of all kinds registered in the United States as against over twenty million horses as given above.

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The Farmer and The Automobile

Elsewhere we give the number of horses and mules in the United States as shown by the 1920 census. In connection with the figures it will be very gratifying to the great majority of "Our Folks" to know that there are 3,080,810 passenger automobiles owned by farmers in the United States to every two farms. In some states this figure is far exceeded as for example in New Jersey where the figures show 116 farm-owned automobiles for every 100 farms.

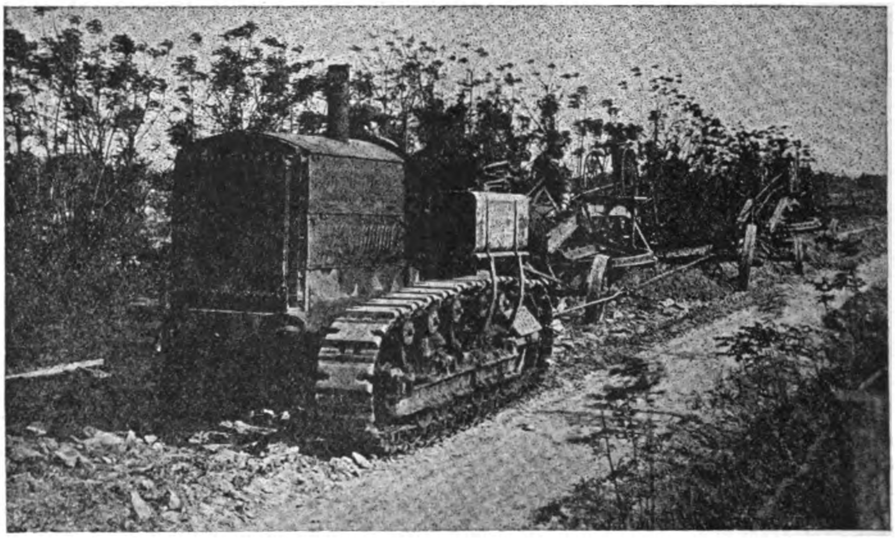
This proposition of passenger automobile in the farming communities taken in connection with the number of trucks and tractors used on the farms of today must make very evident to the smith and repair men, the need and necessity of real practical knowledge on auto, truck and tractor repair work. These machines must be kept going and the smith and general repair man are the logical men for the task. The introduction of the oxy-acetylene torch into the modern smith and repair shop has gone a long way toward enabling the modern repair craft to not only keep these machines in service but has enabled them to actual salvage a great quantity of machinery that would otherwise have found only the scrap heap.

And the practical training of the smith and general repair man, has knowledge of practical mechanics, his thorough familiarity with vehicles and machinery of all kinds, enables him to successfully solve the mechanical troubles of the auto, truck and tractor owning farmer.

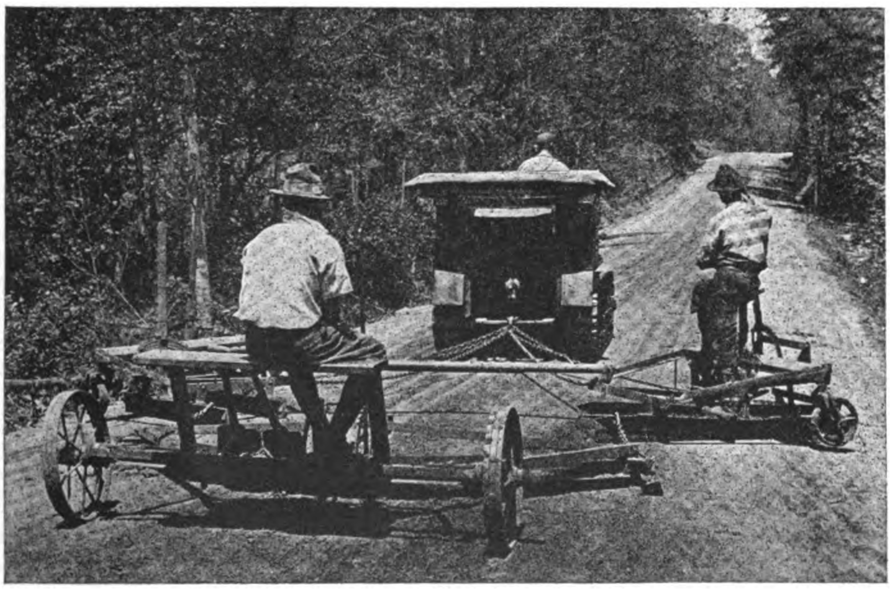
There is still need for horse shoeing knowledge as shown by the horse census, but the importance of machine and motor knowledge should not be overlooked.

Good Roads and The Smith-Craftsman and Repairman

GOOD ROADS MEAN MORE BUSINESS FOR THE SMITHING CRAFT AND REPAIR SHOP



GOOD ROADS ENLARGE THE TRADE OF THE SHOP INCREASING THE RADIUS FROM WHICH IT DRAWS BUSINESS



ROADS SUCH AS THIS ARE BUSINESS BUILDERS IN THE COMMUNITY. THE SMITH AND REPAIRMAN ARE GOOD ROADS ADVOCATES

Welding A Motor Cycle Crank Case

BY DAVID BAXTER

In this very instructive article Mr. Baxter goes very thoroughly into the details of the very difficult and exacting operation of the welding torch on motor cycle work.

The blacksmith who engages in automobile and truck repairing will undoubtedly be required to give some attention to motor cycle work, since this is one line of business which is rapidly increasing due to the adoption of this mode of travel to special purposes, aside from its general use by the pleasure seeking public.

And as a general rule a motor cycle needs more repairing than an auto because of the rough treatment to which it is subjected, and to the rate of speed at which it usually travels. A machine that travels fast is bound to wear out sooner and break oftener than a slower moving vehicle. Besides, the parts are comparatively smaller and lighter and therefore more liable to break. All of which tends to make more work for the repair man, so that the smith will find it at least a lucrative side line if he prepares to mend motor cycles as well as other automotive vehicles.

But to handle this class of work successfully in all departments the blacksmith should be equipped with a gas welding plant. For there are many motor cycle parts that can be successfully repaired only by welding. Then there are many other parts that are more conveniently repaired by welding than by any other process. There are many castings and special steel forgings which the smithy cannot mend in the ordinary forge way. He must either have a welding plant or pass up a lot of work.

An oxy-acetylene welding plant is no doubt the best all-around outfit, because it is simple and easily adaptable to any kind of welding. The average mechanic can readily learn to operate it and if, like the blacksmith, he has had experience in heating metals and knows their characteristics, he should have no trouble at all in mastering motor cycle work; as well as all kinds of heavier welding.

Motor cycle welding is all light work compared with auto or truck parts. Which is in favor of the welder except that it probably requires a greater degree of skill in touch manipulation. That is, it requires a quicker or defter touch; a lighter grip on the welding torch so to speak. But of course while the welding is less, there is also an unfavorable side to the welding of motor cycle parts. This is the danger of overheating or burning the thin metal sections. If the welder tries to force this class of work he will soon burn the life out of the metal. Even a smaller flame applied too fiercely soon reduces the metal to worthlessness.

In the modern motor cycle there are usually to be found nearly all kinds of metal used in cars or trucks, so that the welder accustomed to automobile work will find no difference on that score. Each of the various metals requiring a slightly different application of the welding process. Some requiring more care than others in preheating previous to applying the welding flame. Some requiring more care than others in regards to the fusing of the metal. Others that do not need to be heated at all.

Take as an example, cast aluminum: Here is a metal that is very difficult to weld for some torch operators, especially the beginners. Even the experienced man will sometimes strike an aluminum job that is extremely hard to handle, not because it is large or complicated, but because of the actions of the melting metal. It apparently will not flow and mix with the filler metal. If the operator is a novice he will probably give up in disgust. But the most trouble is no doubt due to a difference in the quality of the aluminum, presupposing of course that the welding flame is correct and is well handled. Some aluminum casting alloys contain a higher per cent of zinc or other components. The higher the zinc content the cheaper the alloy and the harder it is to melt and flow properly. The zinc has such a low melting point that it burns out while the aluminum is melting. Or in more scientific terms the cinc changes to oxide upon the slightest provocation. This makes the weld more difficult to fuse, as oxidized aluminum will not mix readily. In fact two parts of molten aluminum tend to repel each other until the coating of oxide is broken up and removed.

Now in the foundry where the aluminum castings are made it is but human to make mistakes and run out a batch having a higher per cent of zinc than the rest. It is also human to overmelt the metal and pour it in the castings in poor shape; sometimes badly burned or oxidized. The castings may look all right but the metal is wrong even though it passes inspection. Such things react worse upon the welder because he doesn't know the metal is bad. He melts into the casting expecting it to be like the average aluminum job, only to find it refuses to fuse and mix properly. He blames the flame, the flux, filler, and even himself. And finally resorts to a slow puddling, fluxing process to get the weld to hold at all. The excess of oxide must be broken up and worked out of the weld. To merely scatter it is not always satisfactory.

In any aluminum job the flame must be just about right and it must be manipulated skillfully, but in a job where the metal is poor the welder must use extra care if possible. The flame should be manipulated and maintained neutral throughout the entire job after being certain it is strictly neutral at the start. When in doubt the gases should be increased and then cut back to neutral again. This test should be made at frequent intervals if the torch is not working properly. The neutral flame is probably the greatest factor in aluminum welding. Although some welders claim that a flame carrying a very slight excess of acetylene is just as good if not better, basing their claims on the fact that there is then sure to be no oxygen left to oxidize the metal after the flame combustion.

The manipulation of the torch plays an important part in the welding of aluminum. The welder is cautioned to keep it in motion. But this does not mean to keep it continually swinging revolving, and jerking. Instead it means to watch the melting metal and move the flame accordingly. Confine its effects to as narrow a strip along the fracture as possible. If too large area is melted the metal is liable to collapse. When the metal reaches a clean fluid state swing the flame away or draw it back a trifle. Advance it a little to melt faster. Be ever ready to shift the flame the moment the metal is right.

In manipulating the flame it is often well to have it strike the metal at an angle instead of boring straight into it. Seldom bore the flame directly into the molten bath. Striking the weld at an angle the flame spreads out and tends to ward off the oxygen of the atmosphere as well as preventing the torch oxygen from being injected into the melting aluminum. It also tends to apply a soaking heat which is better than to force the melting with too much pressure.

Where the original casting metal is poor a milder flame is often effective. That is, the pressure is cut down a little and a smaller tip is used on the torch. But the operator should remember to weld rapidly and keep the fused portion narrow. The flame works in unison with the filler rod or with the puddler. First the flame advances to get the casting metal fluid an fluttery. Then the flame is drawn back to permit the puddler to be sawed back and forth, with a light touch, to break the crust of oxide between the two edges of the fracture and allow the metals to mix. Or, more strictly speaking to force the two edges to mix together.

Another thing which the welder must watch in welding aluminum is the tendency to sag or collapse. There is danger of this in all aluminum castings since this metal has practically no strength when heated very hot. Particularly is this true of a poor grade. The whole casting is liable to fall in if overheated when preheating; at least it is liable to sag and then cool crooked. Even when heated correctly the casting must be handled with care. The weld especially should be carefully made because it is easy to push a large hole through the weld with the puddler or filler rod; especially if a large area is heated by the welding flame.

Several devices are used, such as that shown in the picture to keep the casting in alignment; to prevent it from warping out of shape. However, we will take that up later. Let us now say something about flux filler metal as it applies to a poor grade of aluminum motor cycle casting.

The flux should be in powder form and applied to the weld with the puddling tool or by dipping the heated end of the filler rod in it to carry a quantity quickly to the weld. Enough of the powder will adhere to the hot rod to flux about an inch of the crack. Some welders sprinkle the powder over the melting metal at frequent intervals during the melting. This is liable to be wasteful, however.

The novice should not depend upon flux alone to make a good weld. But should use it in connection with puddling. The flux usually does more to protect the weld from oxidization than to cause it to flow together. It might be said that flux does not eat up the oxide but prevents more from forming.

In regards to filler metal: this also should be purchased from a responsible manufacturer unless the welder is qualified to cast the aluminum rods himself. Like other kinds of filler

FIG. 1.—THE WELD WAS STARTED WITH THE CASE IN THIS POSITION

the aluminum rods should be selected according to the metal thickness in the fracture. There is more latitude in this, however, than in cast iron rods. That is, each diameter size rod has a wider range of metal thickness; one size rod may be used for several thicknesses of metal if it is manipulated accordingly. For instance many welders use a three-sixteenths rod for all welds from one-eighth to three-eighths inches thick. They feed it in faster or slower according to the receptivity of the weld. And the rod is often used for a puddler at the same time in feeding in the new metal. But this is probably not so effective on poor aluminum as is the puddler made of iron or steel. The fracture is puddled first for an inch or so, then the filler is taken up and twisted and sawed into the weld.

A puddler is handily made by flattening an inch of a quarter inch round iron rod. The flat part is trimmed like a tiny flat spoon. The spoon portion may be bent up a little or left straight to suit the ideas of the individual.

We have now covered most of the generalities of welding poor aluminum, let us take a specific example and see how the mechanical details work out.

The casting which is clearly shown in the accompanying engravings was cracked about half way round in the part indicated by the welding. The metal through which the crack ran was approximately a quarter of an inch thick. The operator did not know, of course, that the aluminum was a poor grade until the torch flame was applied. The job was therefore, prepared for welding and preheated the same as the average work. The first thing was to wash off all grease and other substance along the crack. The adjoining metal for a space of two inches on each side of the fracture was thoroughly cleansed. This was essential to prevent any foreign substance from interfering with the fusion. Both the inside and the outside of the case were cleaned.

Next the casting was arranged to insure against sagging. For in order to make the job entirely satisfactory it was necessary to preserve its alignment. This was taken care of by clamping two flat bars of iron to the flanged side of the case as is shown in the photographs. These pieces of iron were half an inch thick and therefore rigid. They were screwed firmly in place along the edge of the flange.

This arrangement prevented the job from sagging in event it heated too much. In fact it was liable to collapse of its own weight if overheated. By clamping the bars against it the casting was made rigid enough that there was little danger of warping either. Which sometimes happens from unequal contraction. Both of these dangers were augmented by having to turn the job several times while very hot. To obtain the best results the casting had to be turned several times to keep the portion being welded in a horizontal position. Aluminum welds best where the weld is level because it has little surface tenacity when in a molten state.

After cleaning and clamping the next step was to arrange for preheating. This was done by tilting the case so the cracked end would be directly above one of the natural gas burners of the welding table. This position is indicated in Fig. 1. It was essential to heat this job before applying the welding flame because of the nature of the crack and the shape of the casting. The shape of the job would cause it to offer stubborn resistance to the pull of the contracting weld when it cooled. No precautions were taken to confine the preheating by covering the job as is the custom on many jobs. In fact the casting was preheated and welded in the open, or without covering. But it was kept evenly heated by the gas flames during the entire welding process. The tilting position shown in the picture brought the first portion of the crack upward.

One of the three burners which may be seen beneath the table was turned on until the flames enveloped the under side of about half of the casting. With a job of this sort it is not always necessary to heat all of the casting unless the welder is a raw beginner. The heat passes by conduction to the balance of the casting with decreasing intensity in the part farthest from the source of heat. Thus the expansion decreases gradually to the cooler parts and eliminates abrupt changes. That is, a cold portion does not join a hot part.

After lighting the gas burner it was allowed to burn for probably fifteen minutes. It is difficult to describe the temperature to which the heat was raised before starting to weld. To say it was heated until the greasy casting stopped smoking might fit the situation.

When the casting was heated, the welding flame and filler rod were applied to the end of the crack as indicated in Fig. 1. The flame was passed back and forth along approximately an inch of the crack. Meanwhile the rod was held close and ready for use. But the aluminum did not react properly. It turned a gray hue and would not flow right. Nor would the melting filler settle and mix with the casting metal; then the welder saw that this was a time for intensive puddling.

The filler rod was placed conveniently near and the puddler taken up. Again the flame was applied to the first inch of the crack; the puddler being held down close to the casting. As soon as the metal at the crack showed indications of becoming fluid the puddler spoon was dipped into the flux and placed in contact with the weld. Then the puddler was sawed gently back and forth in the weld, knitting the sides of the fracture together. Then the process was gradually moved to another inch of the crack where the puddling and fluxing was repeated. This achieved, the operator laid aside the puddler and took up the filler. The first inch of the weld was re-melted and filled with the rod metal. Then the second inch was filled. By this time it was necessary to turn the casting over a trifle to bring another portion of the crack upward. When certain the casting could not fall, the puddling was again repeated to a couple of inches of the crack. Which was in turn filled with the rod metal.

Thus the entire curved part of the fracture was welded in a series of puddling and fillings. At times the

FIG. 2.—CLAMPS ASSIST IN HOLDING THE CASE WHILE WELDING

welding flame was directed squarely down upon the weld and at other times it struck the weld at an angle first one way, then another. But the flame was in reality in motion all the time as was the filled or puddler. The filler was not permitted to drip into the weld but was fed into it by direct contact.

The preheater gas was kept burning all the time, enveloping half of the casting. Even when the last flange part of the case was being welded, the first operation of which is shown in Fig. 2. It will be noted that the clamping arrangement is still in place. The clamps and flat bars of iron were allowed to remain until the casting was almost cold.

After finishing the outside of the last flange weld, the case was laid upon its back while the operator retouched the inner side of the weld. The same alternate puddling and filling process was used in this. Flux was also employed and the casting was kept in the same position relative to the preheater flames. This as well as the outside seam was executed as rapidly as possible without pausing to go back over any parts that seemed poor. Little defective spots were remedied after the main weld was finished.

When the last inch of the inner seam was finished the next step was to cool the job. That is it was arranged to cool slowly and evenly. Which was achieved by spreading a sheet of asbestos paper over the whole job and tucking it in around the edges.

Then the gas was extinguished and the job allowed to stand until practically the same temperature in all parts. Or until the weld had transmitted its heat to the air and to other parts of the case.

The job was then almost cold enough to handle. After which it was ready for filing and machining the rough appearing weld.

Some Practical Hints on Maintenance and Repairing

J. K. RODGERS

SMALL, stationary gas engines occasionally need repairing and overhauling. A service man stated recently that there had been an epidemic of small-engine troubles in his territory. "Improper cooling and lubrication occasionally put the gas engine out of commission," he explained. "Some makes of gas engines are screen cooled, others are hopper cooled, while some types are cooled by the continuous circulation system. If the cooling system fails to keep the valves and pistons from becoming too hot, trouble will follow. When an engine fails to cool properly, the first essential is to remove dirt or other foreign material from the cooling system.

"Various troubles result from improper lubrication. When an engine seems to work too hard, suspicion should be directed to the lubrication system. I recommend a heavy oil for gas engine lubrication. When the lubricator is adjusted to deliver eight drops of oil per minute, and a good grade of oil is used, proper lubrication should result."

After a service man has cared for a number of auto and tractor engines, he decides that while all engines are more or less greasy, some become entirely too greasy and dirty. When such an engine is brought to the shop, a careful inspecion should be made to see that the oil lines are tight. When they are found to be in good condition, see whether the operator has used ordinary care in filling. If the engin's greasy condition cannot be traced to the above causes, it is advisable to examine the breather tube carefully. The oil is occasionally churned into a fine, misty spray which blows from the breather tube and adheres to the outside of the motor. The quickest way to eliminate the trouble is to cut a piece of small-mesh screening into three pieces of equal size, lay them together, and fasten securely in the breather passage. It is best to fasten the screen at an angle, so the oil which is caught will drain back into the crankcase.

The other day a service man was asked whether he found considerable use for tape. "I find plenty of use for it," he replied. "It is particularly handy for taking up lost motion caused by damaged or worn threads in small connections and turnbuckles, such as the ones used to operate circuit breaker and throttle on automobile motors and gas engines. My plan is to wrap the part tightly with fresh adhesive, tape, then apply a coating of shellac to stiffen the material."

Tuning up new cars is part of the service man's regular routine. This job, by the way, is not so simple as some car owners suppose; for if the new car gets out of adjustment, and the trouble is not corrected promptly, expensive repairs may result. The rear wheels, in particular, merit attention. It is imporant to see that wheels which are held rigid by a nut and key are tight on the axle shafts. When the wheels loosen, and the car is run any distance in this condition, injury may result. After inspecting the rear wheels, give attention to the front ones. If they show much lost motion or "shake," adjust without delay. Always cotter-pin the nuts securely, as a moderate loosening on the threads will prove a source of trouble.

Occasionally we find bolts which insist on working loose in spite of repeated tightenings. When such bolts are in important places, and replacing with new bols doesn't end the trouble, it is advisable to take a thin iron washer, place it betwen lock nut and nut, then bend one portion over the sides of the lock nut, and turn the remaining portion of the washer over the other nut. "I have tried this plan repeatedly with good results," explained a service man." I use washers which are considerably larger than the nuts. I split each washer from the edge inward with a cold chisel, so they will bend easily and fit closely."

"Owing to the vagaries of presen-day gasoline, it is essential to change the oil in a crankcase at regular intervals," remarked a service man. "When I tackle a car which has ben driven in the shop for overhauling, the first thing I do is to drain all the oil from the crank case. After cleaning out the crankcase with kerosene, I prepare for the other work. After I am through repairing the car, I always put in new oil."

When new piston rings are put in a motor, make certain that the work is done properly. When repairing a two-cycle motor, and putting in new rings, make certain that the rings openings do not come in line with the exhaust or intake ports. If this should happen, the ends of the rings may open into the ports, resulting in broken rings and scored cylinders. If you are putting in rings which are provided with more than one opening, you may find it necessary to change the position of the pins which hold the rings in place. When putting in oversize rings or pistons, and same are being lapped in or ground to a fit with grinding compound, better slip a block of wood in cylinder head which will prevent piston from going in too far, and allowing top ring to spread and hang in combustion chamber.

Mechanics who expect to work with tractors, autos or stationary engines will find a thorough knowledge of magnetos beneficial. High tension magnetos are the most popular, and are in general use. In the rotary aramature type of machine (which is in the high tension class) both the primary and secondary windings are on the rotating armature, and the high tension current is taken from the rotating member by means of a heavily insulated slip ring.

Another class of pure high tension magneto, is provided with stationary coils, and the rotating member consists of two pieces of magnetic material separated by a nonmagnetic center piece. The magnetic flux is lead through the laminated core of the primary and secondary windings, always in the same direction.

A good magneto is astonishingly trouble-proof. However, when something does happen to go wrong with the magneto, the service man will be called on to display his knowledge of magneto construction:

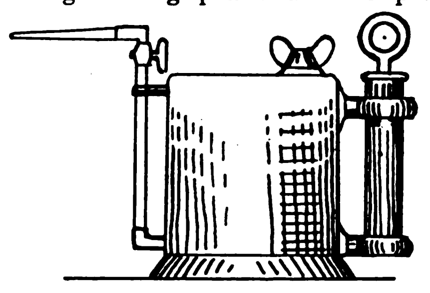
When a mechanic is asked to state why an engine vibrates, he should remember that carbon may cause the trouble. The bearings may be properly fitted, and other adjustments in order, but carbon deposits on piston heads cause uneven running. If the end pistons are burdened with heavy carbon deposits, they will not balance with the middle ones, which will cause the whole engine to vibrate, especially when running at high speed. A considerable amount of carbon on any one (or two) pistons will cause vibration. Removal of carbon will frequently remedy the trouble.

"I inspect many Ford cars in the course of a year, and find that numbers of the motors do not give as efficient service as the owners require, because the front cylinders get too much oil. A sheet-steel plate, about one-eighth of an inch thick, and properly shaped, placed under the front support of the motor will assist in correcting the difficulty. Another way to remedy the trouble is to remove the front piston and bore four slanting holes through it about an inch from the

Discarded Blow Torch as a Pressure Oiler

George W. Wilson

Having a gasoline blow torch, such as used for soldering, that was no longer safe to use, a young man made a handy and efficient pressure oiler. The generating pan and flame pot



were removed from the tank and in the place of these part of a small gas fixture was securely fastened. This fixture included a shut off valve. In the end of this pipe a long spout from an old oil can was then soldered. All that is necessary to oil a difficult place or fill an oil cup, is to pump up a head of air and turn the oil on.

bottom. I prefer the former method.

The clutch on my tractor is done for; you'll have to come out and see what's the matter," complained a farmer early last autumn. The patient service man wiped the thickest of the grease from his hands, and accompanied the farmer. He even found the cause of the trouble. The farmer had neglected to engage the clutch, which operates belt pulley, while he accomplished a four weeks' job of plowing. The cluch being disengaged, wore gradually, and when the farmer was ready to do some belt work, was out of commission.

Regular lubrication is about the only attention a staring motor in a two unit system requires. The connections should be kept bright and clean, while dirt, grease, etc., should be kept out of the commutator housing. When the starter refuses to work, see whether a loose connection, a grounded (or broken) wire or a brush sticking in its holder isn't causing the trouble.

Troublesome misfiring may result from a loose breaker box or weak magneto magnets; while these conditions are rather rare, they are worth keeping in mind. When the magnets are weak, a motor will not run smoothly at slow speed "on high," and the en-

Before-The-War Blacksmith Becomes An After-The-War Jeweler

To make an expert jeweler out of a blacksmith is an accomplishment for any school. To take a shell-torn, nerve-racked ex-soldier blacksmith and transform him into a capable jeweler is a superaccomplishment, and the school effelting this transformation may well be proud of its work.

It may perhaps be of surprising interest to the citizens of Baltimore not familiar with the big things being done for disabled soldiers that such transformations are actually being made at "The Buddies' Jewelry Shop" in Baltimore, under the guidance of Miss Alice Wilson, an expert instructor in jewelry making and designing.

Rings, bracelets, pendants, and other fine pieces of jewelry are being turned out daily by the students that would do credit to any noted jewelry manufacturer. And the astonishing fact is that not one of the students had any previous experience in work of this or a like nature.

Even Geometry Taught

In addition to designing and making jewelry, the students are taught every process in the manufacture and fabrication of precious metals, how and where the various stones used in jewelry are procured, and a general knowledge of higher mathematics, including geometry, which is used in designing various articles.

Some of the students are permanently crippled, some are suffering from the after-effects of gas; in fact, every student passing through the school was assigned to the course by the Federal Board because he was unable to follow his former vocation.

Horseshoe on Escutcheon

Gaetano Teramini was a blacksmith in his native village in sunny Italy. His father and his father's father also practiced the art of making horseshoes, metal wagon parts, and all the things that go with the trade. In the long distant past his ancestors also followed the peaceful smithy's art; but in those days instead of being called blacksmiths they were known as armorers.

Came the day when the urge of New World attraction caused him to emigrate to the land of promise, America. Had he not been told innumerable times that he could make as much money in one day in golden America as he could make in several months in Italy? His arms were strong, his heart was stout, and without any fear for the future he sailed for America, landing in New York in May, 1912.

Helped To Make "Steel Horses"

After a lengthy search for work he secured a position, not at his old work of shoeing horses and mules but at the more or less prosaic work of making hand-forged parts for metal steeds—automobiles. Came the time when a world-wide conflagration plunged the countries of Europe into war. Teramini felt far removed from the struggle and went on his peaceful way, accumulating the American dollars that would enable him to "bring over" a certain rosy-cheeked lass that was patiently waiting.

Having taken out his papers, he felt that he was a full-fledged American, and took pride in designating himself as such. Then came the day when America plunged into the struggle. The same day that this country took its stand by its Allies found Teramini at a recruiting office explaining in broken English that he was an American and wanted to fight for "disa countree."

Wanted a Gun

He was accepted, and on account of his knowledge of blacksmithing was informed that he would be assigned to that duty. But this was not what Teramini enlisted for, and he stated his position in no uncertain tones. He wanted a gun and wanted to fight, and he was so insistent that he was placed in a combat regiment and soon found himself overseas and in the thick of the fighting.

His knowledge of English was limited, but he could fight, and such was his courage that he was made supremely happy by being made a corporal. What if he did have difficulty in making known his commands to

A Magnetic Chain-Wheel Puller

The chain wheel of a magneto fitting on a coned spindle holds with surprising tenacity when it is desired to withdraw it, and it is most unwise

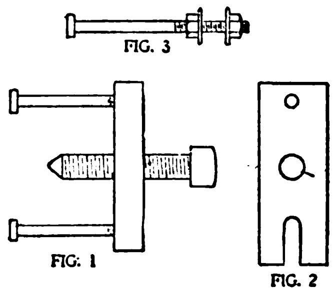


FIG. 1.—WHEEL PULLER COMPLETE. FIG. 2.—VIEW OF PLATE. FIG. 3—LEG WITH NUTS AND WASHER.

to attempt its removal by any other means than a wheel puller.

A simple and useful little tool can be made as shown in the accompanying illustrations, where Fig 1 shows it complete and ready for use. It consists of a short piece of iron about 3/4" wide by 3/8" thick and 2" long, drilled and tapped to receive a 5/16" or a 3/8" starting-screw and two legs which engage in the pear-shaped slots of the chain wheel. These legs can be made from two large-size wire nails. The countersunk head should be filed back and a little taken off the circumference of the head (just sufficient to enter the apertures in the chain wheel), when the heads will become the shape as illustrated. Fig. 2 indicates the plate, showing the hole for central screw and 3/16" tapped holes as fitted for only one size of wheel. Should it be required to use the tool on various types of magnetos, it will be advisable to drill out and slot both ends of this plate and fit the legs with nuts and washers (Fig. 3). This method will render the legs adjustable to various makes of magnetos.

the small squad under him? He felt that the only command they needed to know was "Let's go!" and he used that one command often. Then one day the Germans in one of their periodical moments of "strafing" sent over a perfect hell of shells and gas.

Shell "Marked With His Name"

Corpl. Teramini and his little squad lay still in the trench, waiting for the outburst to subside. But a large German high-explosive shell had other ideas for the little group, and after it landed—and the squad landed with the pieces—the squad was no more. At least, that was the first impression of the first-aid men. But Teramini did not let go so easily, and in due time found himself viewing life from a hospital bed, permanently crippled.

His first thought was of Rosie, the girl who was waiting for him to send for her. How could he send for her, now that his leg was gone and he would be unable to "maka da horseshoe" any more?

Doing Finely Now

After a period of rest and medical attention he was sent back to America and in due time fitted with a cork leg, and managed to hobble around on it. But his heart was heavy because he could not work.

Being entitled to reeducation on account of his physical handicap, he chose jewelry making, and was duly installed in the Federal Board jewelry school in Baltimore. His progress was rapid, and he displayed positive genius in designing and making rings, brooches, and other gewgaws dear to the heart of femininity. Now he has about completed the course of study prescribed for students of the school and is assured of a good position.

IN CASE OF SEVERE INJURY

F. H. Sweet

While automobile repairing is not classed as a dangerous occupation, yet accidents are more or less frequent in the shop or on the road, and a knowledge of first aid principles may often avert more serious consequences and do much to alleviate the pain of the injured person pending the arrival of a competent physician. The following information may be studied to advantage by all interested in mechanical work and by automobile operators as well:

Shock is a sudden depression of the vital powers arising from an injury or a profound emotion acting on the nerve centers and inducing exhaustion. The symptoms are subnormal temperature and irregular, weak and rapid pulse; a cold, clammy, pale and profusely perspiring skin; irregular breathing; the person affected usually remains conscious and will answer when spoken to, but is stupid and indifferent and lies with partly closed lips. Always be sure that there is no concealed hemorrhage. In treating it, lower the head, wrap the patient in hot blankets and surround him with lamps or other heat-giving objects Give an ordinary stimulant, as black coffee, to be sipped as hot as can be borne; half teaspoonful doses of aromatic spirts of ammonia in a glass of water may be given every 20 or 30 minutes, or other simple stimulant, provided there is no hemorrhage. One or two teaspoonfuls every 15 or 20 minutes will help to tide over until the doctor comes. Inhalation of oxygen is often of much service; artificial respiration may be necessary in some cases. Hot applications over the heart and spine should be used if practical. **Always hurry up the doctor.**

A fracture is a break in a bone caused by direct or indirect violence. Fractures are the most important class of injuries with which we have to deal, not only because they render the victim a cripple for the time being, but because the further usefulness of the limb depends upon the recognition of the trouble and its immediate and proper treatment. Frequently ignorance or carelessness in handling a fracture in the beginning renders the sufferer an invalid or cripple throughout his life. In examining the fracture, great gentleness in handling the part should be exercised. The limb should be handled as little as possible. If the nature of the injury is in doubt, it should be treated as a fracture until the doctor arrives. Never allow a person suffering from a broken limb to be moved until the part is properly supported by splints. To treat a fracture, draw the fractured limb into a natural position and hold it there by the application of splints.

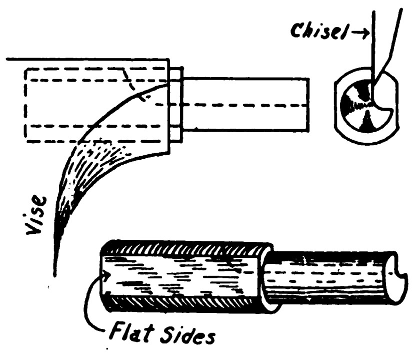
A dislocation is a complete separation or displacement of the surface of a joint, caused usually by direct violence, but may sometimes be produced by indirect violence or sudden muscular contraction. The symptoms are: Pain, swelling, discoloration, rigidity; the natural position of the limb is changed; the length is altered. In treating, restore the bone to normal position and hold it in place. To properly reduce the dislocation, some surgical skill and knowledge of the anatomy of joints are required. First-aid men should never try to reduce any dislocation except those of the jaw and fingers.

A sprain is a twisting or wrenching of a joint, producing a tearing of the ligaments and sometimes of the surrounding soft parts. It is followed by severe pain and marked swelling and discoloration. Sprains are important injuries and should be properly treated immediately, as sometimes permanent disability may follow failure to give them proper care. They are very often more serious than a fracture. To treat them, let the injured person rest; elevate the injured part and fix it in place either

Cutting Rings in Quantity

G. A. Luebs

In making up large quantities of steel or brass, an arbor made with a shearing edge as is shown in the illustration will cut or assist in cutting the wound wire into the required rings much faster and with greater



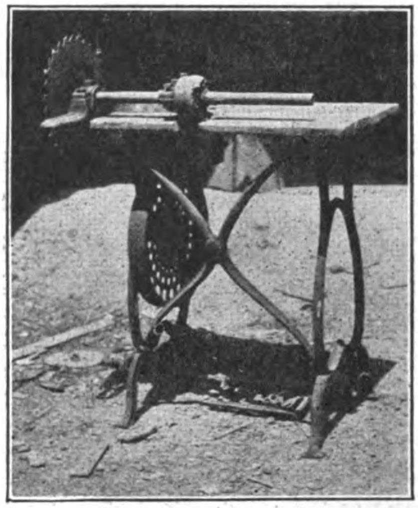
ease than the usual method of placing the spring on a flat block and cutting from the inside with a chisel. The mandrel is made from drill rod, the flute is cut in on the grinder or shaper, and then the mandrel is tempered. The extension should only be an inch or an inch and a half in length and the body is caught in the jaws of a vise. The chisel used with this tool is ground with a bevel on one face only. The wound wire is set over the mandred and the chisel used to cut along the shearing edge. Several rings are cut off at one time and these are removed from the mandrel. The cutting of any quantity of steel or brass rings, makes the use of this tool desirable. In making very large quantities the cutting edge may dull, in which case it is readily ground.

with splints or by wrapping the joint tightly with a roller bandage or with adhesive plaster. Give hot or cold applications by placing the injured part in hot or cold water or by the application of towels wrung out of ice water or ho water.

Strains are the wrenching of a muscle or tendon exertion and is usually caused by violent or sudden unexpected movements. A strain generally occurs in the muscles or tendons of the arms or legs. The sympton is sudden, sharp excruiating pain. In treating, have the injured party rest; bandage the injured part tightly or apply adhesive plaster. It is sometimes necessary to prevent movement of the part by splinting.

Burns are caused by exposure of the body to dry heat, such as the heat of fire or explosions of gas, whereas scalds are produced by moist heat, as the heat of boiling water or steam. The danger from a burn depends upon its depth and extent, and also on the age and general condition of the person injured. The symptoms in a first-degree burn are: Severe, burning pain, reddening of the skin, formation of blisters; in a second-degree burn, destruction of the skin; in a third-degree burn, destruction of the skin and some of the tissue beneath. In severe burns shock is present. The treatment is to carefully remove the clothing from the burned part, exclude the air as quickly as possible from the burned surface with some clean covering and treat for shock. The most generally used covering for burns is picric-acid gauze. This is ordinary sterile gauze which has been saturatd with one-half to one per cent. solution of picric acid. It has this advantage—it is clean and ready for use. Moisten the picric-acid gauze with clean water and put it over the burned surface. Over the gauze place a layer of absorbent cotton, then apply a bandage to hold in place.

Carron oil, which is a mixture of equal parts of limewater and linsed oil, is often used, and is very good. It is applied as follows: Take a piece of sterilized gauze large enough to cover the burned surface; saturate the gauze with carron oil and cover the burned Surface. Dress with absorbent cotton and cover with a bandage. Vaseline, sweet oil, olive oil and balsam oil are all good dressings. If nothing better is at hand dissolve some bicarbonate of soda in sterilized water. Gauze wrung out of this and spread over the burn will give relief. Remember that severe burns are accompanied by shock, and always treat a burned patient for shock as well as for burns.



THE DISCARDED SEWING MACHINE MAKES AN EXCELLENT SAW STAND

Schaefer's method of artificial respiration is not as generally understood as it should be. It is: Free the victim from electrical current conductors, or in case of drowning, roll on a barrel or substitute to expel water and instantly remove him to fresh air. Rapidly feel with the finger in his mouth and throat, and remove any foreign body (tobacco, false teeth), then begin artificial respiration at once. Lay the subject on his stomach with arms extended as straight forward as possible and with face to one side so that the nose and mouth are free for breathing. Let an assistant draw forward the patient's tongue. Kneel straddling the person's thighs and facing his head; rest the palms of your hands on the loins (on the muscles of the small of the back) with fingers spread over the lowest ribs. With arms held straight, fingers forward, slowly swing forward so that the weight of your body is gradually and without violence brought to bear upon the subject. This act should take two or thre seconds. Then immediately swing backwards so as to remove the pressure, returning to the position first mentioned. Repeat regularly 12 to 15 times per minute the swinging forward and backward, completing a respiration in four or five seconds.

As soon as this artificial respiration has been started and while it is being conducted, an assistant should loosen any tight clothing about the subject's chest or waist. Continue the artificial respiration without interruption until natural breathing is restored (if necessary two hours or longer) or until a physician arrives. If natural breathing stops after having been restored, use artificial respiration again. Some patients have been revived after several hours of hard work.

As soon as signs of life appear the lower limbs should be elevated and rubbed vigorously toward the heart. Hot applications should be used over the heart if practicable. If the patient gains consciousness and is able to swallow give hot coffee or half-teaspoonful doses of aromatic spirits of ammonia in water and treat as in shock. Do not put any liquid in the patient's mouth until he is fully conscious. Give the patient fresh air, but keep him warm.

Send for the nearest doctor and pulmotor as soon as the accident is discovered.

A Shop-Made Circular Saw Bench

GEORGE W. WILSON

Here is shown a simple circular saw bench supported by an old sewing machine frame. This is not arranged for fine and very accurate sawing or ripping but it saves a great deal hand labor on the odd sawing jobs around the shop and it is just the thing for cutting up fire wood.

A description of how the sewing machine frame was utilized is not necessary as the photograph shows clearly just how this very practical machine is put together and how it is used.

New Rules From Old Squares

LOUIS SCHNEIDER

An ordinary wooden measuring stick will not do for a blacksmith's use, for it would be soiled beyond reading, burnt on hot iron or broken in short order. A flexible steel rule is the best, of course, but lacking this an excellent tool for measuring in the shop may be made from an old steel square. The tongue is cut off the body close up—a hacksaw doing good work here—and the severed parts kept about the forge. Unless due allowance is made, the outside edge must of course be read when the body portion is used, and the inside edge for the tongue. These pieces are far handier than a complete square for most work, for, being straight pieces, they cannot become tangled up with tongs, rods, or other tools or material among which they may be thrown.

Access to a cold saw will allow of ripping both the body and tongue lengthwise. The heavy end of the inner side of the body may then be cut off, so that the reading will begin at zero. The outer edge of the tongue cannot be made to read so unless the square is in the first place cut so that the line of severance runs from the corner of the outer angle of the square to the corner at the inner angle. The drawback to cutting the square at this angle lies in the fact that the outer cut ends will be sharp points, easily battered, and so soon rendered incorrect as far as close measuring is concerned.

Holes may be bored in the ends of the various sections if it is desired to hang them.

How to Put a Handle in a Rubber Mallet

Rubber mallets or hammers are very useful for hammering delicate metal parts that must not be scratched or battered. Every mechanic should have a rubber hammer handy.

One of the objections to the ordinary rubber hammer, however, is that it easily "flies off the handle," as it cannot be wedged like a metal hammer, the wedges simply stretching the hammer-head which is liable to fly off through the window at any time.

To overcome this objection a friend of mine has hit upon the method of using a handle similar to those used in earth picks—sometimes called a "pick-axe". These handles are large at the head end and are inserted into the head by slipping the grip end into the steel first. In this way the danger of flying off is overcome.

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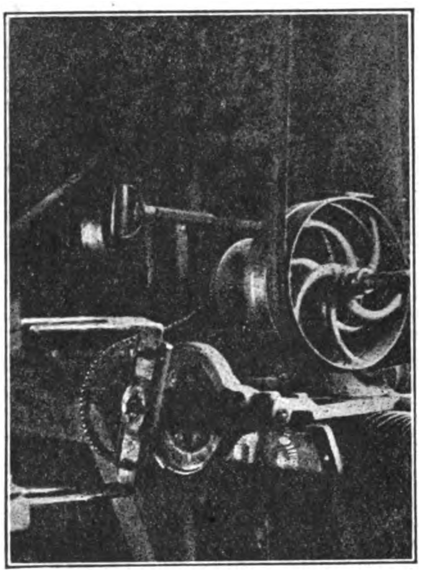
Practical Power Threading Machine From Discarded Machinery

GEORGE W. WILSON

A most useful and interesting shop machine was made from junk found around a village blacksmith shop. It is a power threading machine. The pulleys are from a discarded pump jack using the original shaft and base. The belt shifter is a broken spade handle. On the end of the pulley shaft the sprocket from a bicycle was used to drive the second unit. This is driven by a bicycle chain running over a sprocket from a cream separator. This sprocket is on the end of a shaft which with its gearing was taken from an old Plano farm mower. The original gears are used without change. To the end of the third shaft, which is at right angles to the second, a piece of heavy wagon tire was bolted. The ends of this were bent at right angles to the center and slots about fifteen inches deep were cut in the ends of the arms thus formed.



A POWER PIPE THREADER MADE FROM CAST OFF MACHINE PARTS

After the first round of threads are started by hand on a pipe or bolt, the arms of the threading tool are slipped in the slots in the wagon tire, and as the threads are cut the tool advances onto the work, sliding freely in the slots.

The length of threads may be regulated by the position of the work in the pipe vise as the threading tool stops when it gets beyond the turning arms.

The ratio of the gearing of this device is such that threads may be cut on a three-inch pipe merely by turning the drive pulley with one finger. This machine is used every day for all threading jobs of any size and is the envy of other smiths hereabouts.

Watch The Valves

The power of a tractor, automobile or other internal combustion engine is largely dependent upon the good fit and accurate timing of its valves. The valves are put on an internal combustion engine to permit the fuel and air mixture to enter the combustion space in the cylinder, to inclose tightly the burning gases during the power stroke, and to give the burned gases an opportunity to escape on the next stroke. A good fit is essential because the valves must hold the gases within the cylinder under pressure at times, and even a slight leakage may mean a big loss of power. If the valves are not properly timed, it is equivalent to permitting a deliberate leak of the gases from the cylinder, which again means loss of power.

Valves should be examined at regular periods and if they are pitted or if they show any indication of leakage, if the seat of the valve is not perfectly bright all the way around, then grinding must be done. On most engines it is difficult to get valve timing out of adjustment so long as the cam shaft retains its relative position, or the cam shaft gears are not changed. If by any chance they do become misadjusted, adjust them with the aid of explicit directions on that particular make of car, tractor or truck. Extreme care is necessary in this readjusting so as to have the timing perfect—and nothing short of perfection in this readjustment will suffice.

Sentiment and Farming

THE COURIER-NEWS, FARGO, N. D.

Under the blaze of a terrific sun here in Fargo these last three days of the Farming Demonstration, tractors and horses labored in the plowing and preparing of the seed bed of ten acre plots.

Twelve beautiful teams of from five to eight horses each competed against each other for cash prizes but only five teams were able to complete the alloted task, on account of the heat. Five horses succumbed and died.

Forty tractors were entered for test records and all except one qualified and completed the work.

Thousands of farmers who witnessed this work of the tractors and the horses sympathized with the horses working in the terrific heat but the hard-headed business farmers present realized that the summer following must be plowed the latter part of June under the actual conditions which prevail and they saw plainly that the horses were not equal to the job.

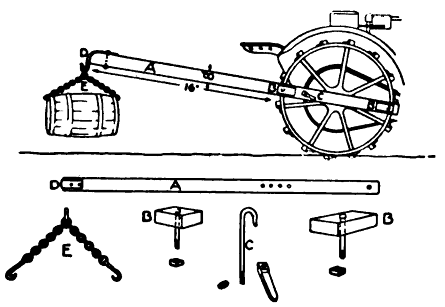
On the other hand the tractor motors which got unusually hot worked at the highest efficiency and completed their alloted 10 acres in about one-fourth of the time of the horse drawn outfits.

This difference in time of operation is important in every farm community in the country. Especially in North Dakota where the season is short, is this comparative test between horse farming and power farming of great value.

The business farmer should realize that mechanical power is the time saver which enables the power farmer to take care of his crops in the right way and at the right time. His sympathies may be touched by horses forced to work under pressure, but nevertheless he should not allow his sentiment to bias his business judgment in farming with mechanical power where results are all that count.

A Lifting Arm for the Tractor

There are many jobs about the farm that are not easily accomplished with one man that may be made easy with the help of this lifting arm attached to the tractor and as the tractor is not made with a view of its doing this kind of work it is the user, the salesman or other person with ingenuity and enterprise to suggest it. The blacksmith can make one and after one demonstration the demand for the attachments will soon repay him for the time spent in showing the stunt. The arm made of a 3"x8" oak 16ft.



USING THE TRACTOR FOR LIFTING

long, as shown at A. On one end of this is bolted a hook to which a chain or rope may be attached. Now bore holes as shown in the arm in position so as to fit inside when the arm is attached to the wheel. The hook shown at C with threaded end and hand nut is to hook over a spoke and clamp the arm to the wheel with. The arm is placed on the wheel so as the front end lies against the under side of one of the extension lugs and the back side so as it rests on top of one of them. With the load, that is to be lifted, attached the tractor is started forward on low gear and perhaps by slipping the clutch for a more easy movement, if the load such as a barrel of fuel or lubricating oil, is to be loaded in a wagon the front guide wheels of the tractor should be cramped short to one side so as to keep it from moving forward, the arm and its load will be swung over the wagon which has been placed at the side. Wagon boxes may be lifted on and off, harrows and plows may be loaded, telephone posts may be raised and set in the prepared holes and various other like jobs accomplished.

A Blacksmith Who Pulls Teeth and Repairs Watches

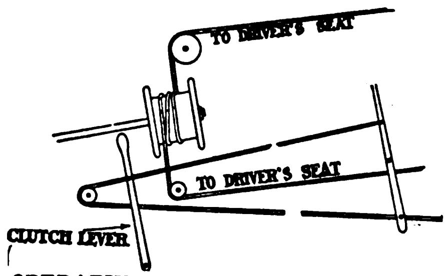
The village blacksmith in a Montenegrin town is a most accommodating person. He will pull your teeth as readily as he will shoe your horse, and whether it is your watch or your phowshare that needs repairing, he will set to work with his sledge and his tongs as readily on the one as on the other. There are few things he can't do, and there is nothing that he won't attempt. Shoeing horses is only one of his trades.

There are few tools to work with in Montenegro, and usually a peasant will have but one ploughshare or hoe. When this breaks they must take it to the blacksmith and hold up work until it is repaired. This explains why Balkan war reconstruction is so slow. The only aid received so far has been from America, the Red Cross bringing in a million dollars' worth of modern farm machinery to sow and harvest the crops, meanwhile giving out clothing, food and medicine in order that the people might live.

Unfortunately, the crops last autumn, which were to have supported the people through the year, were a complete failure, owing to the enormous numbers of grasshoppers and locusts, and the Red Cross has therefore not yet been able to withdraw from Montenegro as it had intended. Its aid will be sorely needed for another year at least.

Operating The Tractor From The Grain Binder Seat

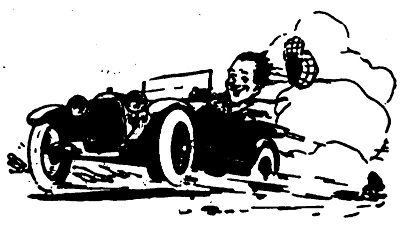
When but one man is on hand to operate the tractor and the grain binder, which it is pulling there must necessary be some arrangement for him to guide both the tractor and manipulate the binder levers. To make this possible a simple method is here shown and one that may be constructed without and special parts. It is so as the tractor may be driven from the seat of the grain binder.



OPERATING THE TRACTOR FROM THE BINDER SEAT

Make a drum of a piece of a log or one built up of slats nailed on a couple of center wood wheels, and attach it to the shaft supporting the guiding wheel. Secure it to the hand wheel with a couple of U bolts around the spokes and make a flange of sheet metal for the other end. Wrap on the drum several turns of a half inch rope and pass the ends thru pulleys one on each side of the supplied drum. These pulleys may be attached to some part of the frame or braces on the tractor. The ends of the ropes pass back to the binder seat and by pulling on either one of them the drum is turned and thus the tractor guided as tho the person was driving horses. To operate the clutch and auxiliary lever is attached to the binder where it may be handily reached from the seat. A rope is attached above the fulcrum of this lever about 12 inches and passes to the clutch lever on the tractor. The same rope continues on forward around a pulley attached to the tractor frame and then back to the bottom of the lever on the binder. It may thus be seen that when the one lever is operated that the other must be likewise moved. These two ropes to operate the clutch must pass through pulleys mounted directly over the point where the tractor is connected to the binder in order to make them keep.

High Spots



Spoon Flivver Anthology

Here lies the remains
Of Chester Sapp;
He drove his car
With a girl on his lap.
—Washington, (Pa.) Observer
Poor Chester might still
Have been alive
Had he only taught
The girl to drive.
—LaMonte (Mo.) Record
The moral learned
From this sad loss
Is—Drive a buggy
And a gentle hoss.

Cheap Enough

..Magistrate—"How did you manage to extract the man's watch from his pocket when it was provided with a safety-catch,

..Prisoner—"Excuse me sir, that is a professional secret. I am willing to teach you, however, for two guineas."—Tit Bits

Thousands to the Good

"Had my fortune told today, dear."

"What a waste of money," said her husband.

"Not at all. I gave the woman fifty cents and she told me I would enherit $50,000. Wasn't that a bargain?"—Boston Transcript.

Made Greater Speed.

"In some respects you are greater than Napoleon," remarked the faithful attendant.

"But," protested the deposed ruler, "I'm down and out."

"Yes. Your finish is very much like Napoleon's, and it took you a very much shorter time to reach it."—Washington Star.

Preparing for Jack

Mr. Simpson's voice rumbled through the house. "Mary, here's the baker. How many loaves? Two, as usual?"

"Two loaves indeed," replied Mrs. Simpson, "Have you forgotten that Jack is coming home on leave today?"

"Of course!" said Mr. Simpson as he suddenly remembered his sailor son was coming home. "Here, Mr. Baker, back your cart up against this door, and tip her up."—Tit-Bits.

Drought Broken

Two Jews were on a journey on a hot summer day. "Have you anything with you, Matthias?" asked one.

"Yes, a bottle of wine. What have you, Moses?"

"Dried tongue."

"Good! We'll divide our provisions."

Matthias produced the wine and it was divided. Then he asked his fellow traveler to bring out his provisions.

"I?" said Moses.

"Why yes, the dry tongue you said you had."

"I haven't got one now," was the cool reply.—Boston Transcripe.

Accounts for Their Pallor

"Why did you use the expression 'as pale as a doorknob?'"

"Doorknobs are in doors so much, you know."—Boston Transcript.

A Mean Remark

"Dead men tell no tales," observed the sage.

"Maybe that is the reason why so many widows get to marry again," commented the Fool.—Nashville Tennessean.

What's The Use.

Judge—"The police say that you and your wife had some words."

Prisoner—"I had some, but didn't get a chance to use them"—Puck.

May Start Revolution

"Why do they say, 'Nobody loves a fat man'?"

"There's bound to be a suspicion that anybody overweight just now is getting more th-- his share of the food"—Washington

Beats the Band

Blobbs—"If you are going in for music which instrument would you choose?"

Slobbs—"Well, I've always thought I would like to be a soloist on a cash register"—Philadelphia Record.

Honesty Itself

Application for employment was made to a Louisville business man by a young chap from the mountain region of the State. The Louisville man was favorably impressed by the stranger, but as no references were offered he sought out the sheriff of the young man's home county and asked:

"Do you know Bill Sarks?"

"Shore, I know him."

"What kind of a young man is he?"

"Pretty fair."

"Is he honest?"

"Honest? Shore. Why he's been arrested three times for stealin', and acquitted each time."

Overlooked Him

Two lawyers before a probate-judge recently got into a wrangle. At last one of the disputants, losing control over his emotions, exclaimed to his opponent:

"Sir. you are, I think, the biggest ass that I ever had the misfortune to set eyes upon."

"Order! Order!" said the judge gravely. "You seem to forget that I am in the room."

Accurate

A Brooklyn Sunday-school teacher once had occasion to catechize a new pupil whose ignorance of his Testament would have been amusing had it not been so appalling. One Sunday she asked the little fellow how many commandments there were. To her surprise the lad answered glibly enough, "Ten, ma'am." "And now, Sammy," asked the teacher, "what would be the result if you should break one of them?" "Then there'd be nine," triumphantly answered the youngster.

A Blunderer

"What you need, madam, is oxygen. Come every afternoon for your inhalations. They will cost you $4.00 each."

"I knew that other doctor didn't understand my case," declared the fashionable patient. "He told me all I needed was plain fresh air."

Costly Indigestion

Anybody who has traveled recently across country will appreciate the remark of the man who was asked, "How's the railroad situation?", and answered, "About the same. Congestion in the freight cars and indigestion in the dining cars. And what is worse, the price of the indigestion is piratically excessive.

And a Few Years More?

"Why, it seems only yesterday," said the venerable friend of the family, "that your daughter was a little girl in short skirts, and now—"

Here the friend of the family smiled to hide his embarrassment.

"—Now she is a full grown young lady in shorter ones."

No Re-Peter

Judge—"What is the charge?"

Police — "Intoxicated, your honor."

Judge (to prisoner)—"What's your name?"

Prisoner—"Peter Gunn, sir."

Judge—"Well, Gunn, I'll discharge you this time, but you mustn't get loaded again."

H—

"And now, Johnny," said the teacher, "can you tell me what is raised in Mexico?"

"Aw, go on," replied the bright boy, "I know what you want me to say, but ma told me I shouldn't use bad words."

No Wonder

"I like to talk to Jenkins; he's such a good listener."

"Yes; he's been married ten years."

We'll Say So

"It says here that the railroads killed very few people last year," said the Old Fogy, as he looked up from the newspaper he was reading.

"No wonder!" commented the Grouch. "The automobiles got first crack at them."

This Wasn't a Hardware Store

Moses—Have you heard about the fire at Jacob's place?

Isaac—Yes, the police seem to think it vos an electric light on the first floor and the insurance company think it vos an incandescent light on the ground floor.

Moses—Vell, my opinion is that it vos an Israelite in the basement.

Bushing A Timkin Bearing

JAMES F. HOBART

This job of bushing a bearing was accomplished without the usual tools—a hammer, a cold chisel, a file and an iron wedge were the only tools available. The story of how the job was satisfactorialy done and how the "calipering" was done without calipers will interest every reader of "Our Journal."

"There are tricks in all trades but mine," said the colored wood sawyer as he worked away. "But dere am no trick here. Dat stick *must come off!*"

The writer thought of the old darky when he was trying to "tune up" a recently purchased used car and found too much looseness in one of the forward wheels. Upon removing the wheel it was found that some enterprising repair man had placed a Timkin bearing with a 1 5/8" bore upon a 1 1/2" axle!

That bearing had to be bushed and there was not even a pair of callipers at hand with which to determine the diameters of shaft and bore of bearing so as to select bushing material. All the tools available were hammer, cold-chisel, a file and a four-pound wedge used for splitting firewood. The latter did duty as an anvil in the bushing operations.

The first thing was to determine the required thickness of a bushing, and then to find material therefor. No callipers were to be had, so the bearing and axle were cleaned thoroughly, all grease and dirt being scraped and washed out and the parts wiped clean. Then the bearing was placed squarely upon the axle as shown by the engraving—Calipering With a Wedge—and a bit of shingle was planed smooth about a quarter of an inch wide and slipped between axle and bearing as shown.

A pencil mark was then made across the wedge close to the Timkin bearing and when the wedge was removed and measured with a rule, it was found that the thickness at the pencil mark was one-eighth inch as closely as could be determined. One-half that thickness, or one-sixteenth inch was the thickness of bushing metal required. But where to find a strip of metal one-sixteenth inch thick—that was a question which looked like a "corker"!

All the old junk around the place was overhauled. Steel barrel hoops were hunted out and found either too thick or too thin and the prospect of finding proper material looked dubious. Just then, a strip of galvanized steel standing in a corner of the garage shed caught my eye and I got hold of that material in a hurry. It proved to be 1 1/32" wide and 1/16" thick as nearly as possible to measure with the rule. Several months ago, two bits of steel were picked up near a freight car where some galvanized sheet steel plates had been unloaded, the steel strips serving to fasten a bunch of the sheets together. I chanced to save the strips of steel and it pays to gather and put away such things. One is sure to need them sometimes.

The length of steel required for the bushing was found with a strip of paper as shown by the engraving—Length of Bushing—the narrow strip of paper being wrapped closely around the axle where the bushing was to lie. A mark was made fair with the inner end of the paper—First Pencil Mark—as shown in the picture, then the paper was carefully placed inside the bearing and another pencil mark made fair with the end of the strip. This is the Second Pencil Mark.

Next, another mark was made midway between the two marks above mentioned and the strip of paper up to the middle mark gave exactly the length required for the steel bushing which was cut to the length indicated by the middle mark. It was found that the axle measured 4 45/64" in circumference, the Timkin bearing measured 5 7/64", which the bushing was cut to a length of 4 29/32" and was found, upon bending, to be of the right length.

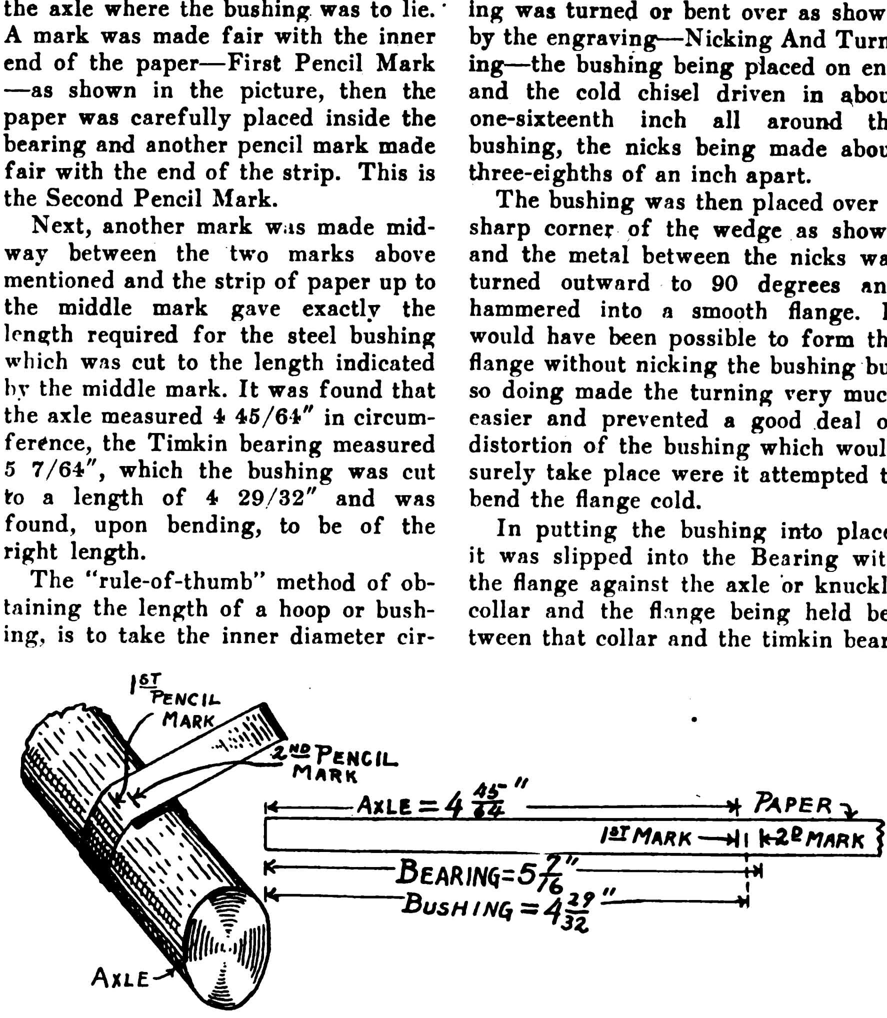
The "rule-of-thumb" method of obtaining the length of a hoop or bushing, is to take the inner diameter circumference and add thereto three times the thickness of the strip to be used. This would make the bushing strip a very little too short. If 3.1416 times stock thickness be added, the length will be pretty near right and as found by the strip of paper method.

The piece of steel was then bent around the axle, using a hammer for that purpose and starting the bend in the angle made by a bilt of board laid on a block of wood. The short bends sometimes made in that manner were removed by hammering the bushing upon the axle. This would open the bushing too much and it was alternately closed with the hammer and opened upon the axle until it had been made a perfect fit upon the axle and would almost but not quite slide inside the timkin bearing.

To prevent the bushing from working past the timkin bearing and down into the space between the two bearings, one edge, or end of the bushing was turned or bent over as shown by the engraving—Nicking And Turning—the bushing being placed on end and the cold chisel driven in about one-sixteenth inch all around the bushing, the nicks being made about three-eighths of an inch apart.

The bushing was then placed over a sharp corner of the wedge as shown and the metal between the nicks was turned outward to 90 degrees and hammered into a smooth flange. It would have been possible to form the flange without nicking the bushing but so doing made the turning very much easier and prevented a good deal of distortion of the bushing which would surely take place were it attempted to bend the flange cold.

In putting the bushing into place, it was slipped into the Bearing with the flange against the axle or knuckle collar and the flange being held between that collar and the timkin bear-



HOW THE MEASUREMENTS WERE MADE FOR THE BUSHING

ing, it was impossible for the bushing to fall out or work loose, and there the bushing has staid and done its work for more than seven months with no signs of giving out, a bushing perfect in fit and in action and made almost without tools.

A Time-Saving Belt-Chart

W. F. Schaphorst

Here is a chart that will be found handy by belt men, or by purchasers of belts, for figuring the belt width necessary to transmit any given power knowing the horsepower that is to be transmitted and knowing the speed of the belt.

Or, if the belt width is known and if the speed is known the horsepower can be determined. Or, if the belt width is known and the horsepower is known the speed at which the belt should be run is easily determined.

For example: It is desired to transmit 10 horsepower through a single leather belt, the belt speed to be 3000 feet per minute.

With a sheet of paper find the distance from the 10 in Column A to the 3000 in Column B. Then step off the same distance upward from the 10 in Column A to a point in Column B and there's the answer—3 inches wide.

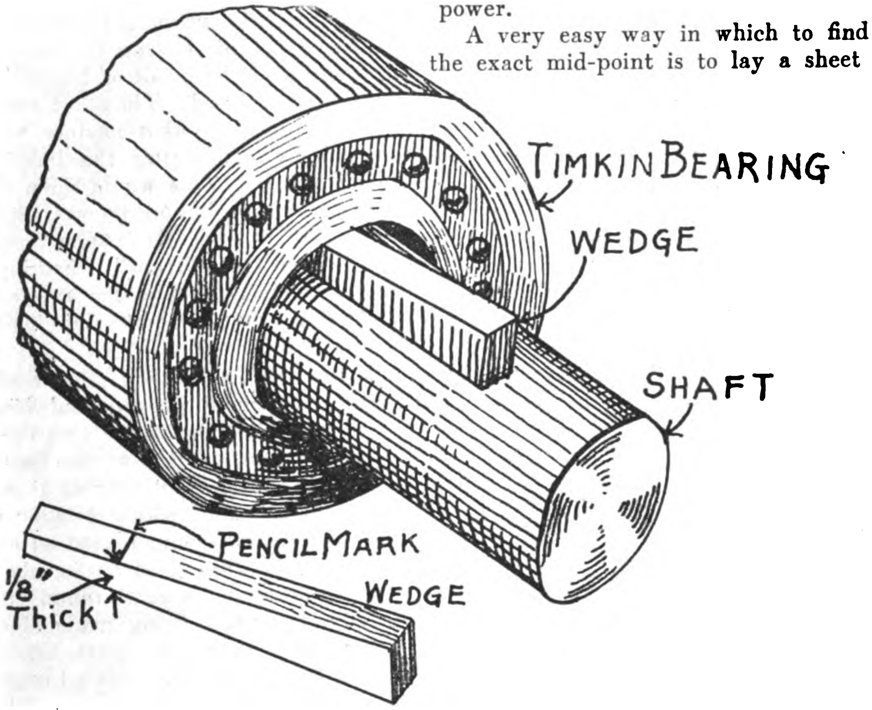
Again, for example, if we have a belt 4 inches wide and wish to transmit 20 horsepower with it, what must be the speed of the belt?

With the sheet of paper measure the distance from the 4, Column B, to the 20, Column "A". Then from the 20 Column A, measure downward the same distance to a point in Column B and there is the answer—4000 feet per minute.

Again, let us suppose that you have a 9 inch single belt running at 2000 feet per minute. What horsepower will it transmit?

Find the mid-point between the 9 Column B and the 2000 Column B. Directly opposite the mid-point in Column A is the answer—22.5 horsepower.

A very easy way in which to find the exact mid-point is to lay a sheet of paper along Column B, the upper corner being exactly opposite the 9 Column B. Make a mark on the sheet of paper opposite the 2000, Column B. Then fold the paper bringing the upper edge down to the mark and make a crease in the paper. The crease will fall exactly at the mid-point. This is an accurate and very quick way in which to bisect any line.—*Copyright 1921.*



HOW THE BEARING WAS CALIPERED WITH A WEDGE

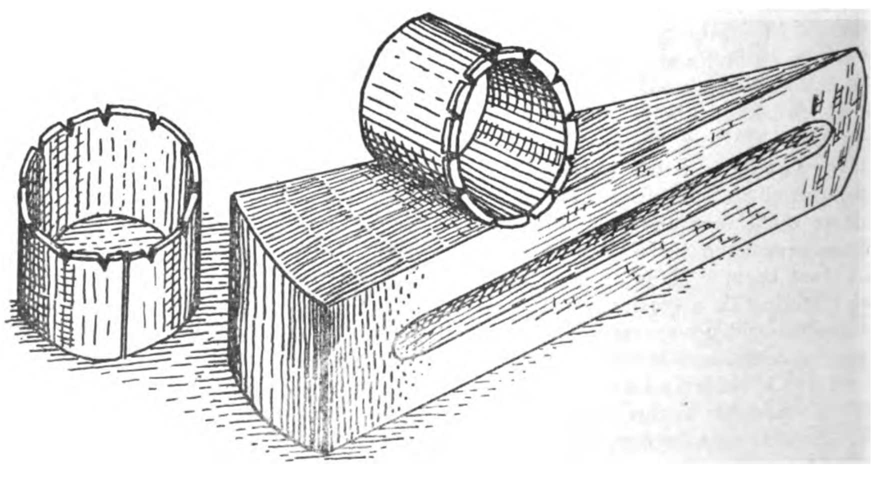
The Evolution of The Modern Vehicle Spring

N. Ward Guthrie

HAVE you ever watched one of our modern autombiles glide over a rough country road—one of those back roads that are patiently awaiting the attention of the State or Federal Highway Commission? As it swept past, have you not marveled at the comfort of the passengers in spite of road conditions that violently shook the whole running gear and kept the wheel bouncing and jumping up and down as they vainly tried to follow the road's irregularities; while the body of the car seemed literally to float on with a gentle swaying motion? Secretly, you may have made the admission, "It's a nice riding car," or "What wonderful springs;" but aside from that have you ever given a serious thought to the springs origin, or the problems and difficulties that have been encountered in bringing out those wonderful riding qualities? Many of us are prone to look on the vehicle springs as quite a simple mechanical device that came about quite naturally—like Columbus discovering America—we don't see how he could have missed it.

The modern vehicle spring is something more than a simple makeshift mechanical device. It is the evolved result of years of study research and exhaustive experiments—not the result of a labratory experiment—not by a long shot.

For nearly two hundred years springs have been used to improve the riding qualities of the different



HOW THE BUSHING WAS NICKED AND THE EDGE TURNED kinds of vehicles since in use. They served their purpose admirably; but with the advent of the automobile, a new set of conditions were brought about. The old fashioned springs were applied to the new task, and they were found wanting in many respects. Many failed to survive the terrific pounding, vibration, twisting and violent shocks to which they were subjected. So we found, that although springs had been used for over a hundred years, we were still relatively ignorant of some of the inherent weakness brought to light through this latest application.

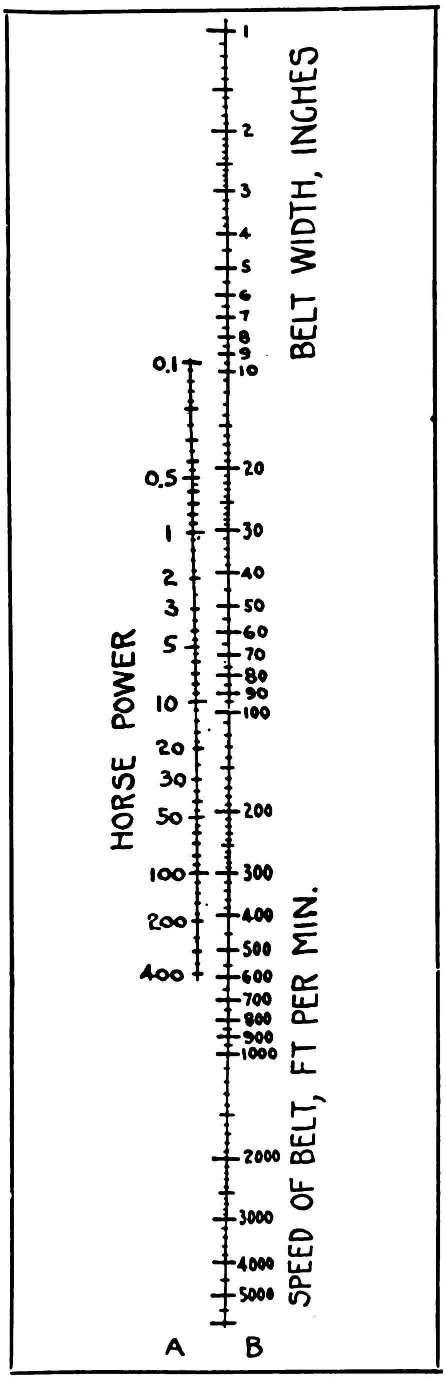
The circumstances surrounding the discovery of the predecessor of the modern vehicle spring is, indeed, hazy. Little is known of their origin, except that history seems to show that about the year 1750 these devices made their appearance in England among the vehicale makers there, and that shortly after, they were popularized in both France and Germany.

Little progress was made for a number of years. The methods of manufacture in vogue those days was so slow and tedious that in spite of the existing wages being nil, so to speak, so much time was consumed in making a spring that the finished product was prohibitively expensive. They were a luxury in fact, and like all other inventions, little progress is made until public approval is attained, and there is a sufficient demand to enable manufacturing to proceed on a large scale with the attendant improvements in both processes and product.

The prohibitive cost of springs in those days permitted only limited use, and one wouldn't go far amiss in assuming with Mr. William Bridges Adams, "That wealthy gentlemen lead the way by having coaches built on springs or altering their vehicles."

Progress in inducing the more general adoption of vehicle springs laid dormant for nearly eighteen years, then in 1768, Dr. R. Lovell Edgworth demonstrated publicly the advantages of vehicle equipped with springs, and for his efforts, he was awarded three gold medals by the Society of English Arts and Manufacturers.

Conclusive evidence that this official recognition of merit must have given the vehicle spring the necessary impetus to bring it into more general use and approval is shown by the familiar work of William Felton entitled, "A Treatise on Carriage and Harness," published in London in 1790, for he tells us that springs had been placed on the market at that time, showing that the industry was at last under way.



A TIME-SAVING BELT-CHART

Just what pattern springs were used, how they were arranged or how the vehicles were suspended in those days has been left almost entirely to our imagination, until some fourteen years later, when Obadiah Elliott in 1804 obtained a patent for suspending vehicles on elliptic springs. The success of his effort was promptly recognized by the Society of Arts, who awarded him their gold medal. This official recognition of merit contributed largely to the popularity which his product was later destined to enjoy.

Little more is heard of any drastic changes in spring design or their application to vehicles, during the ensuing fifty years. Various designs were brought out; but their style and application were merely refinements of what were already in use.

In 1855 is the first intimation we have that springs received any particular scientific investigation. It was then that Clark expounded the laws governing spring deflection. Like many of the early investigators in their respective fields, his theories in many instances failed to have been properly stated, and in the light of more recent and accurate investigatons, we find that many of his conclusions were incorrect.

Within the last decade, springs have been subject to more extensive and exacting investigations, and many of the old pet theories regarding them, which have been harbored for years, were given a well needed and decent burial.

Along with the advent of the automobile, Reuleaux studied the action of spring deflection and the stress of these members. These theories, too, were destined to be short lived, for in 1894 G. R. Henderson corrected the Reuleaux formula for deflection, while at the same time we are indebted to Prof. John Perry for calling attention to the internal stress produced by "nipping."

The discoveries that were made by the scientific investigators were readily applied by those devoted to the mechanical side, and credit must not only be given to them, but to those who produced the raw material which made these accomplishments possible.

In making the early type of spring, one of the greatest mechanical difficulties was to produce a spring leaf of reasonably uniform thickness. This is a requirement of most vital importance. Close limits were not to be had when the product was hand-made, except perhaps only through the most painstaking efforts, and this of course involved an expense that made the operation prohibitive. The process of rolling steel offered the first logical solution in this connection. It was introduced by Cort, and through it has passed through many refinements and improvements to meet the constantly growing and more exacting demands, it served its purpose as one of the greatest steps in the mechanical improvement which lead to the present day spring.

Here we branch off, and in fairness to all concerned it is difficult to say to whom the greatest credit should be given. We have the metallurgist, the heat treatment expert, the manufacturer and the hundred and one others contributors through whose combined efforts danger of spring breakage is rarely known along our rough roads, and "thank you mams" no longer strike terror in the heart of the motorist.

The heat treatment that imparts that marvelous flexibility and strength to the present day spring steel would be a matter of guess work and uncertainty were it not for the pyrometer, and for this instrument, which records the steel's temperature accurately, during its heat treatment, we are indebted to the English potter, Wedgewood. True, the original instrument has passed through many changes, and it has superseded by different styles of apparatus, such as those introduced by LeChâtelier, Sir William Siemens and many others. The increased sensitiveness of the later style instruments have made possible the increased production and a more uniform product.

Great strides have been made in the selection of the proper heat treatment of the various steels. This is a mighty essential feature that might easily be overlooked. We might have a steel of the finest quality obtainable and well suited to this class of work, still if it is not treated properly, we have a spring doomed to let us down, perhaps at the first bump.

The late Chas. P. Dudley of the Pennsylvania Railroad was perhaps the first to begin an extensive investigation into spring steel alloys, and his metallurgical investigations have given the world most valuable information that has been incorporated along with that which has done by other investigators along different lines.

It is needless to recount all of the wonderful strides that have been made in the production of the steel itself, and the work of Dr. Sorby, of Sheffield, regarding the micro-structure of steel, and the later and improved thoughts that have been added by Sauveur and others, who brought us into a field of improvement, the ultimate possibilities of which can not even be predicted.

Then, too, we must not slight or overlook the spring manufacturers. Through their untiring efforts in constantly endeavoring to bring out a more mechanically perfect product. To accomplish this end, numerous varieties of special machines, not only for production purposes, but for the testing of the finished product as well, have been developed.

It is highly essential to know how the pring is going to behave in actual service, yet the lapse of time if observed under this condition would permit thousands of springs to get onto the market before some inherent defect became apparent, for springs have the faculty of sometimes hidding their weakness for a long time. To overcome this delay in determining definitely just what the endurance of the spring actually is, we have the Spring Endurance Testing Machine which was brought out about 1909. This machine furnishes in the course of a few hours information regarding the ultimate durability of the spring that otherwise would not be obtained from observation under actual service for months or even years.

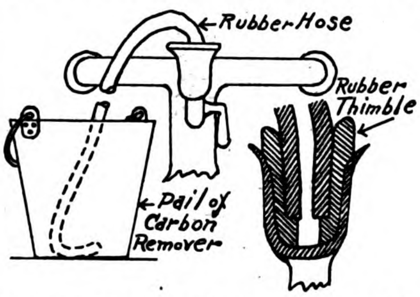
These are some of the more salient points regarding the evolution of the modern spring, which irons out the bumpy roads, and which are so frequently looked upon as merely a few layers of steel one upon the other.

Simple Method of Decarbonizing Gas Engine

N. Ward Guthrie

Water is of benefit in the removal of carbon where the deposits are not too heavy, however some of the liquid carbon removes mix with water and in consequence the method shown in the attached engraving is of special advantage to apply the cleanser to the engine when the intake manifold of the engine is fitted with the usual priming petcock.

To use this method simply fill any large pail of water from the hydrant, put in the required quantity of car-



bon remover and mix them thoroughly. Attach a piece of rubber tubing to the petcock on the manifold and drop the opposite end of the hose in the pail. Start the engine and after it warms up open the priming cup slightly. It will take about half an hour for the engine to clear the bucket of the cleaning preparation during which time the owner can attend to other matters of upkeep. Weekly cleansing of the engine with this method involves practically no work and is assurance of a quiet and smooth running engine.

Taking Care of Belts

W. F. Schaphorst

I have had more than average experience with belting and power transmission problems during the past 15 years and have written a number of articles for the technical press on power transmission through belting.

Recently an editor of one of the foremost trade publications in a field where much belting is used asked me to explain why I was continually telling the user of belts that belts should be properly cared for. I was told that many of the readers of that publication do not care for articles of that kind. The editor wrote:

"Can't you give us some items on belts or transmission without so much reference to belt dressing?"

There is no question but that I am enthusiastic about taking proper care of belts to get best results. I admit it. I have had enough to do with belting to be convinced that taking care of a belt is the principal point of importance after its selection. I believe care is of as much or more importance than the kind of belt in use.

A number of years ago a well known mechanical engineer assisted by the writer made a series of tests on carefully treated belts, and in these tests it was demonstrated conclusively that good care is of vital importance.

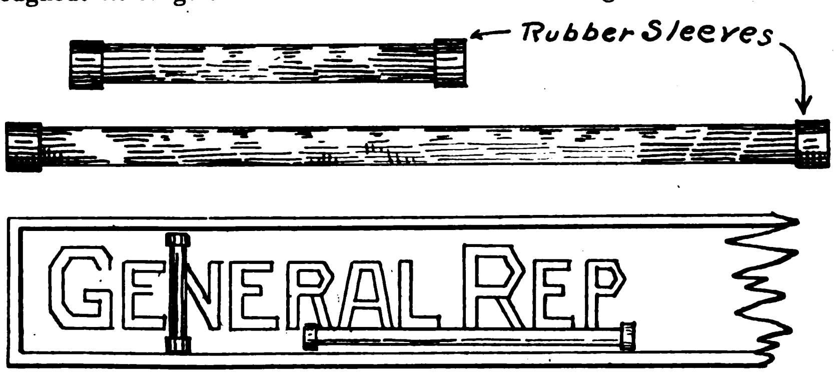
I do not doubt but that many users of belts are opposed to treating them, and they have a right to be if they wish to, but I have yet to read a single good argument in favor of the undressed or un treated belt. The only argumen I know, which is only an excuse, is that it takes a little time to treat and care for a belt and of course that is only a lazy man's argument. It would be very difficult for me to conscientiously write anything about power transmission through belts without mentioning the care that should be given to the belt. Belt treatment stops slip and slip is the belts greatest enemy. Slip is undesirable in efficient belt transmission.

(*Copyright*, 1921)

Simple Aids For The Sign Painter

G. A. LUEBS

The two roller rulers shown in the accompanying engraving are of service to the sign painter. These rules consist of two circular rollers made on a wood turning lathe or if obtainable use sections of curtain or portiere poles. These should be an inch or an inch and a half in diameter and the short one about fifteen inches long and the long one about three feet. A thimble of rubber on each end provides sufficient friction to hold them on place while the letter is being chalked on. Where the rubber tips are of equal size, lines will be reasonably parallel when the ruler is rolled across the face of the sign. The short roller is used for the verticle lines of the letters. The next job of lettering which you have to make, try out a broom handle in the event you wish to try the advantages of there rulers. This makes a simple tool which is procurable without any preliminary work, although a brown handle is not of uniform diameter throughout its length.



TWO SIMPLE AIDS FOR THE AMATEUR SIGN PAINTER

Fitting Eccentric Bushing to Pinion

Fig. 1 represents a train of gear-wheels, the lower wheel in the diagram being the driver. The smaller and intermediate pinion, revolving on a fixed stud, transmits the motion to the top gear-wheel. It was discovered that the action of the driving wheel on the pinion caused excessive wear to take place in its bore, with the result that the pinion ran too much out of gear or mesh with the driving wheel, as indicated by the arrow.

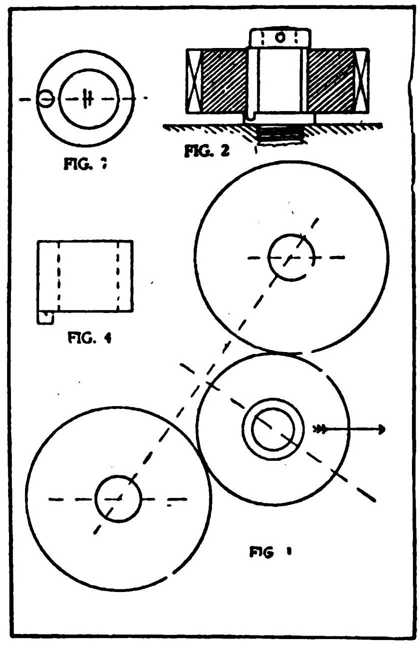
A temporary repair was effected by fitting an eccentric bushing, thus bringing the pinion into correct mesh with the teeth of the driving wheel until it was convenient to make a new pinion. Fig. 2 gives a section of the pinion with the eccentric bushing in position over the stud; the bushing is kept in a stationary position by the small dowel engaging in a drilled hole in the collar of the stud. Fig. 3 shows the eccentric bushing in plan, and Fig. 4 the bushing in side view; the dowel is formed out of the solid metal by cutting off a portion of the bushing with the hacksaw and finishing off by filing.

In making the bushing it is more satisfactory to drill the material first, and then to mount it on a stub mandrel held eccentrically in the chuck jaws of a lathe, finishing off to correct outer diameter.

Making The Ford Coil Waterproof

It isn't always convenient to cover a certain popular type of car with a tarpaulin, or to hold an umbrella over the hood when driving through the rain so that the coil will not be short circuited by the water. Here is a suggestion that will obviate that trouble at least.

Remove the coil from the dash. Heat a piece of half-inch round stock to a bright red and burn the



FITTING ECCENTRIC BUSH TO PINION
FIG. 1.—DIAGRAM OF WHEEL TRAIN.
FIG. 2.—PINION FITTED WITH BUSH.
FIG 3.—PLAN OF ECCENTRIC BUSH.
FIG 4.—SIDE VIEW SHOWING DOWEL SOLID WITH BUSH

hole in the dash through which the terminals pass, so that they will have 3-16-inch clearance. Scrape the charred edges with a knife. Replace the coil. Then you can drive through the next rain storm with impunity. James Baldwin.

Combined Pinch Bar And Nail Puller

The combined pinch and nail puller shown by Fig. 1 is made from a suitable section of tool steel, the size of section depending entirely on the size of tool required. The dimensions given herewith will be found suitable for any nail from 1" up to 6" in length, providing that the jaw A (Fig. 1) and shackle (Fig. 2. have been made to size. In fact the working of the whole tool depends upon how the jaw A (Fig. 1) and the shackle jaw B (Fig. 2) fit. To shape the member shown by Fig. 1 a piece of tool steel 1' long and 3/4" square is required. Forge it to the dimensions given in Figs. 1 and 3, the handle to be drawn away to whatever thickness the maker or user thinks suitable. A 5/16" hole is drilled to take the rivet (Fig. 4); for the position of hole, see Fig. 3. For the member shown by Fig. 2 use 3/8" by 1/4" steel 5 1/2" long. Jump the ends so as to give enough material for the holes to be punched therein. Now bend to shape and draw away the bottom edge of shackle jaw to dimensions as at c (Fig. 5). The whole is now ready for riveting together.

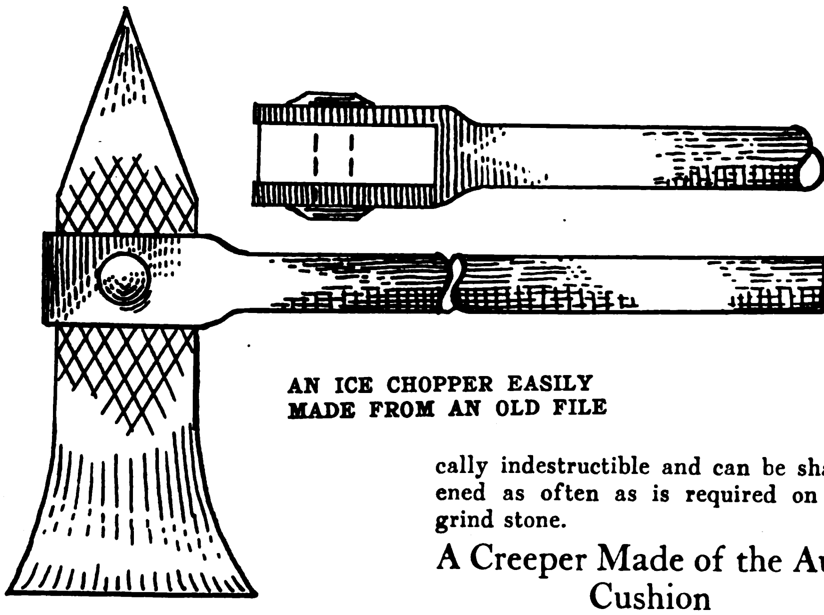
To pull a nail with this tool, lift the shackle with the left hand, push the jaw of the pinch against the nail to be drawn, drop the shackle, and press against the opposite side of nail head. Put pressure to the lever and the nail will be withdrawn.

When the tool is required to act as a pinch bar pull the shackle back against the handle or lever and use in the ordinary way.

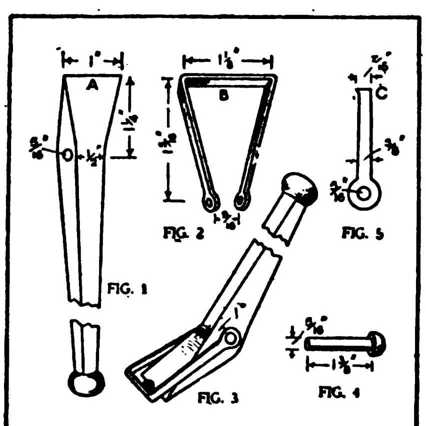
An Ice Chopper From a File

G. A. Luebs

An ice chopper or pick is not necessarily expensive, however it is one of those tools constantly needed but seldom purchased. A few minutes of spare time and a section of an old file will enable you to make a chopper which is more rugged than the usual ready-made type. Take an eight-inch length of flat file and place this in the fire to anneal. While hot flatten out one end and bring the other end to a point. Drill a hole through the center and rivet on afifteen-inch length of pipe split at one end to form a handle. This tool is practically indestructible and can be sharpened as often as is required on the grind stone.



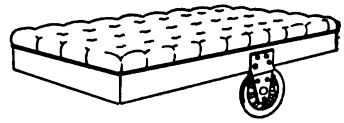
AN ICE CHOPPER EASILY MADE FROM AN OLD FILE

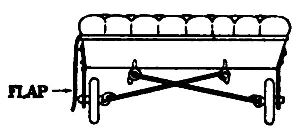


A COMBINED PINCH BAR AND NAIL PULLER

A Creeper Made of the Auto Cushion

It is of enough inconvenience to have to get down under the auto to adjust or repair some part when it is on a floor in the garage, but when such a call necessitates itself out on the road some sort of a so called creeper is much wished for. And here it is and always has been as long as the auto has been known but just how to fix it so as to be handy perhaps never entered your head.





A CREEPER MADE OF AUTOMOBILE CUSHIONS

Procure two heavy barn door hinges of the (T) type and of the 8 inch size. Cut off the end two inches and drill a ⅜ inch hole near the end. Procure two wheels about 4 inches in diam. and with bushings and eye bolts attach them to the inside of the hinges.

The other end of the hinge is then attached with stove bolts to the sides of the auto cushing about 1-3 the distance from one end.

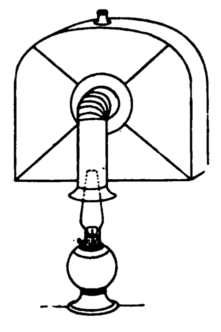
Rods with eyes in one end and a hook in the other are attached to support the wheels under the cushion when used as a creeper.

Screw eyes are attached at proper placesfor the ends of the seat as a cushion the wheels and rods to hook into. When on the rods fold up under and next to the springs as they do not interfere.

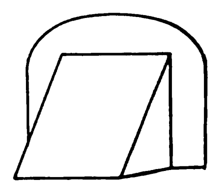
Radiator Heater

John Denbo

The season of freezing radiators and cold motors will soon be with us again.



The illustration shows two forms of radiator heaters that can be easily made by any mechanic or tinsmith from tin or sheet iron. These hoods are made to fit the front of the radiator and are held in place by providing a hole to fit over the filler cap as shown.

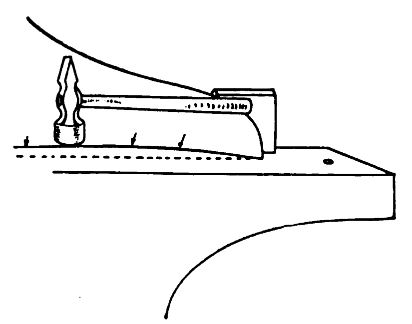


A lamp or oil stove will furnish sufficient heat to prevent freezing, even in very cold weather. A draft shield should be provided if there is danger of the lamp being blown out.

When Sharpening a Plow Share

John Denbo

If the point of a plow gets too much over toward the land side of



the share in sharpening or pointing heat the share well up and strike in the direction indicated by the arrows in the illustration, until the edge assumes the shape as shown by the dotted lines.

Leveling A Horse's Foot

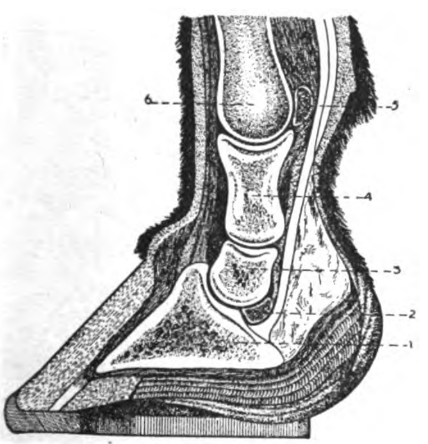
E. H. MALOON

In this article Mr. Maloon, who has shod horses for fifty-four years, presents an idea that will prove most revolutionary to a great many of our readers. Mr. Maloon says: "A colt should be made to keep his feet under him right and this too from the beginning of his life. I know I can make a colt's foot-bones grow and harden up so he will walk as he should when his bones are set as they will be when he is about five years old." Read this article by Mr. Maloon carefully and then let us have your side and opinion. We are ready to open our columns to a full discussion of the matters suggested in Mr. Maloon's excellent article.

The very picture of a horse's foreleg from the ankle down together with description of bones and joints, that I have ever seen, was in "Our Journal" of May, 1917. The poise I do not like as it is a little too upright, but aside from this it is perfect to my mind.

The description is very lucid and plain, and as I look at it and absolutely correct. In the article accompanying the cut, Mr. Camp says something on the leveling of the foot that I do not agree with. For instance we will take the colt that has never been shod. His front foot has worn away where the most strain has been and he is walking in the way of the least resistance. Nine times out of ten you will find this foot inclined to toe in. The outer half of the toe is worn away and there is more hoof on the inside than on the outside of the foot.

Now how to shoe this foot has for thirty years been a hobby and a talking point of mine. I have had a hoof leveler and have read everything that ever came my way on this particular subject and most every writer is against me in telling how to shoe this colt. Now suppose we use a leveler or our eyes and cut that hoof so it will rest as near perfect under the leg as we can see; and this is just what the book says we must do. Now what have we done? We have taken a foot that nature put on a colt (whether it is right or wrong does not enter into this article) and the colt has used it and worn his foot just as the joints and ligaments have caused him to step in a natural way and with the least muscular effort. And in return we have given the colt a foot with which he cannot take one step without putting forth much extra strength in order to make the foot do its work and causing the muscles and ligaments to do unnatural work. This kind of shoeing may go on for years and when we take the shoes off and turn the colt out to pasture, what is the result? The hoof returns to the shape it was in when it was first shod. Now what have we gained in keeping that foot and leg in misery to the colt for years? Simply nothing.



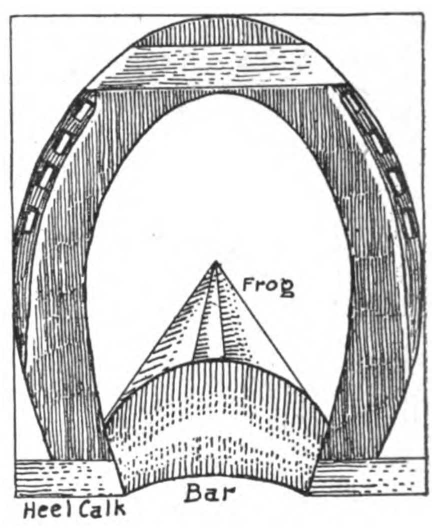
HERE ARE SHOWN THE CORRECT POSITIONS OF THE FOOT BONES EXCEPT AS MR. MALOON INDICATES IN HIS ARTICLE

In all of my handling of horses I never got very far away from nature. Take a horse that interferes and remove his shoes and as soon as he can wear his foot into the shape that nature says is right, the horse will stop hitting himself. You can then put on a light flat shoe to keep his foot from undue wear and he will not hit himself.

I say it is rank cruelty to animals to twist their feet into shapes that nature says is wrong for that particular animal. My way is this: In mild cases I let the foot go as nature says in right and in bad cases I meet nature part way. No common, everyday man ever had better luck in making deformed horses go than I have had. We read of leveling a horse's foot. Is a foot level when both sides are doing an equal amount of work, or is it level when one side of the foot is doing it all? My way of leveling a foot is to place both sides of the foot onto the floor full and equal; that is, one side shall carry as much weight as the other, and I put my calks where the most wear comes. That is, I put my toe calk where he will wear it down evenly. The heels I turn out at right angles and cut them off so that a rule on the heels will show the same width that the foot has at its widest part. This applies to calked shoes only. A man has no right to fit his shoe close in at the heels and thus take from the horse two inches or more of his balancing power.

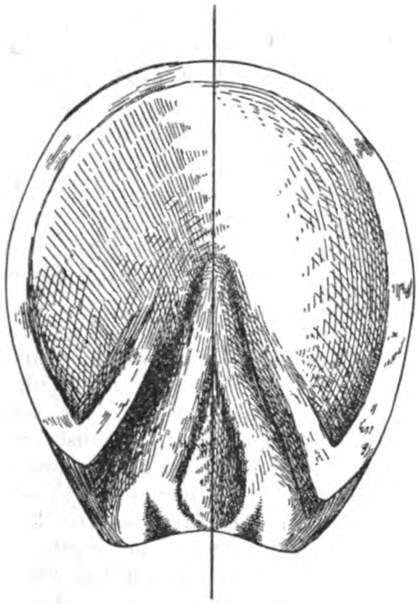
I do not know of any hard and fast rules that a man can follow in shoeing a horse. To be successful, a horse shoer must have common sense in good big quantities, he must know the horse from top to bottom and he must apply his common sense to what he does for the horse as the horse cannot tell him what he wants. If the horse could he might tell you to take care of his front feet carefully after he is one year old, and until he is five, keeping them under his leg and not to let the bones and muscles grow and harden up crooked.

A few years ago I was asked to examine a year old cold that was walking on his angle joints and toe and had done so since he was foaled. I was asked to decide whether I could help him or whether the colt should be killed. On examination I found his joints all limber and that the foot could be put into place by hand. I told the man that I could keep his foot in shape with a shoe. This I did,



THIS BAR SHOE ENCLOSED IN A SQUARE ILLUSTRATES MR. MALOON'S PRINCIPLE. THE HEELS SHOULD BE TURNED AT RIGHT ANGLES SO THEIR ENDS WILL MEASURE FROM END TO END THE SAME WIDTH AS THE FOOT

lowering his heels by degrees, and at three years old he and his mate were sent to Pinehurst, N. C., and put to work. His owner told me this summer that the animal was still working and



THE TWO SIDES OF THE NATURAL UNSHOD FOOT ARE ALIKE IN CONTOUR

that his ankles had never troubled him. This shows what knowledge, common sense and a little care can do for a colt that was worthless, as he was when I first saw him.

Calks on a horse shoe are bad business from any point of view, and I wonder that a horse goes sound as long as he does. If the shoer would use bar shoes for calked shoes and rubber pads for flat shoes foot troubles would be very much less.

Life Insurance For Fan Belts

Louis Schneider

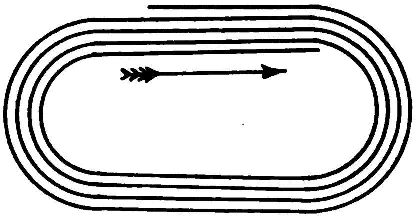
There is a type of motor fan belt that is built up of spirally wound layers of fabric buried in vulcanized rubber. The life of such a belt may be prolonged if it is properly placed on the pulleys. The arrow in the diagram indicates the proper direction for the pull in such a belt. The engine pulley of course exerts a great pull on the fiber of the belt, and if the pull is the reverse of that shown the pulley will have a tendency to tear loose the inner end of the spiral layer of fabric, and so soon ruin the belt.

If the fabric of a belt of this type begins to tear apart, take the belt off and set short tubular rivets through it at intervals, with the heads on the inner side. Much added service can be had out of a belt if it is treated in this manner in good time.

Simple Car Handling Truck For Shop Use

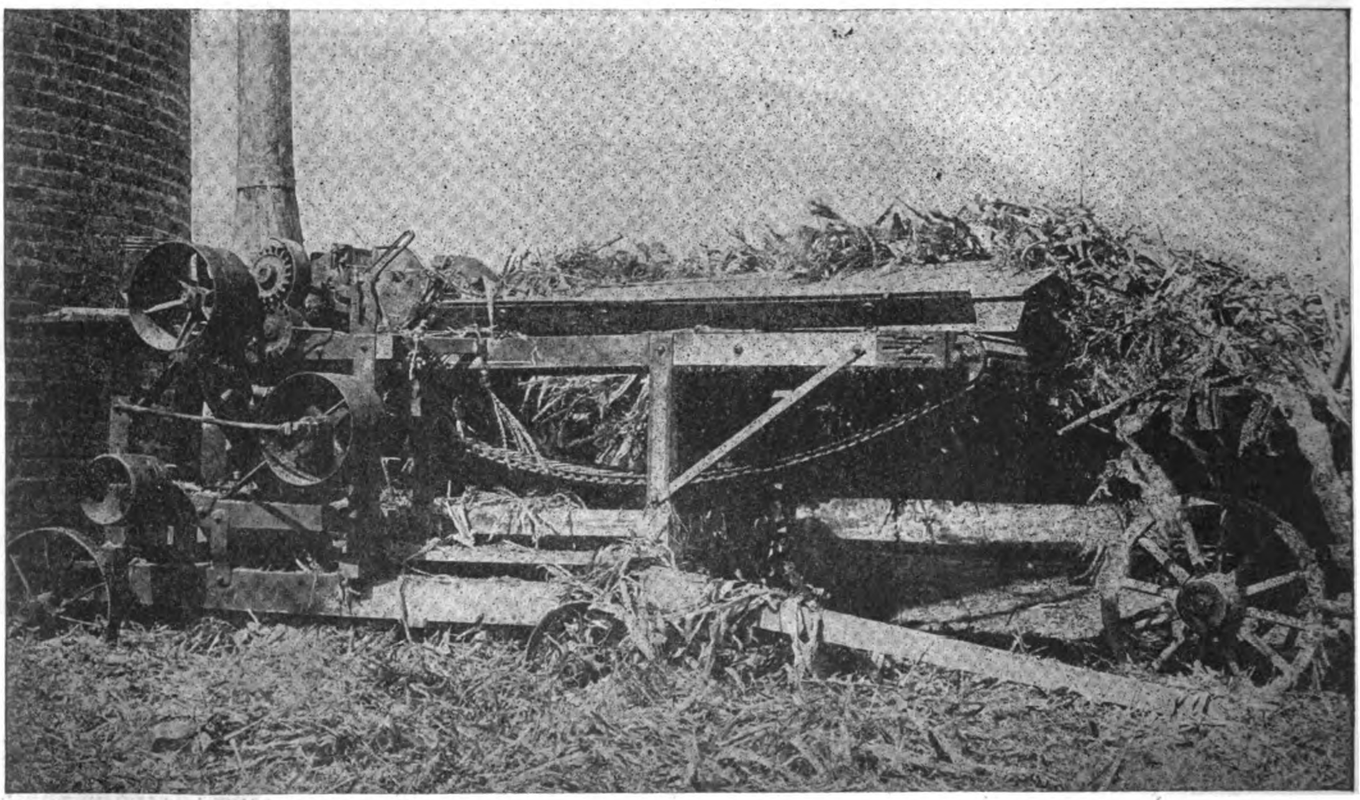
G. A. Luers

To move cars sidewise in the crowded shop when repair work is to be done and the car is to be moved out

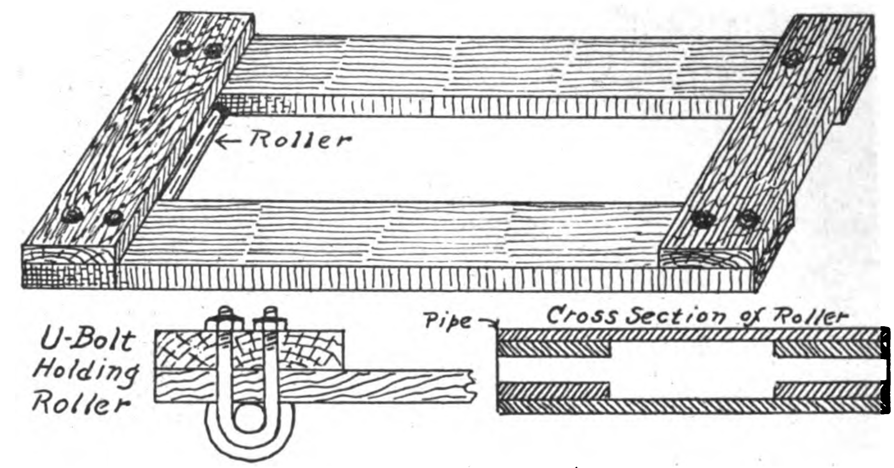


LIFE INSURANCE FOR FAN BELTS

of the path of incoming or outgoing cars necessitates the use of a wheeled jack or other slewing device. The simplest form of a slewing truck for this work is depicted in the illustration. Several of these ready made fixtures may be used advantageously. They consist of two long planks with two short planks nailed securely across the ends. Rollers are made of eight-inch lengths of pipe, the ends of which are plugged with old wrist pins from pistons and these roll on five-eight inch bar stock, secured to the lengthwise planks by "U" bolts. The front and rear wheels are simply lifted or jacked up and one



THE HUM OF THE ENSILAGE CUTTER AND THE BLAST OF THE SILO FILLER WILL SOON BE HEARD IN THE LAND. ARE THESE MACHINES READY FOR THEIR TASKS? HAVE YOUR CUSTOMERS BRING IN THE BROKEN ONES NOW of these trucks placed under them. The car is then readily rolled as far sidewise as may be required.

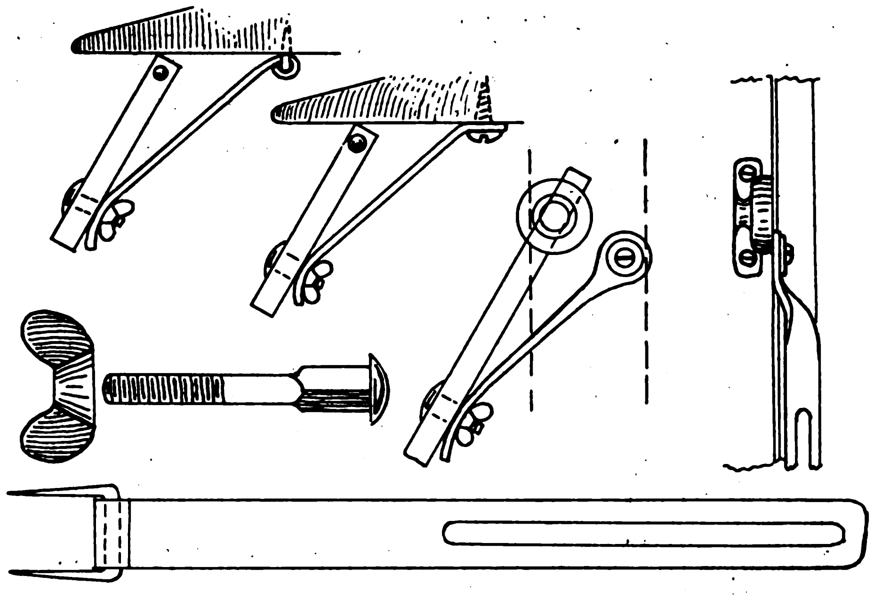


A VERY EASILY MADE DEVICE FOR HANDLING CARS IN A CROWDED SHOP

A Simple Adjuster for Windshields

G. A. Luers

Automobile windshields particularly on speedsters require a rigid support to hold them in any desired position. A circular or arc-like support involves considerable work. The support shown in the accompanying illustration is simple and easily attached to either a new shield or as supplemental to a shield where the friction hinge is not capable of holding the shield rigidly in the position desired. The adjuster consists of a slotted strap, either flexible enough to be screwed down at one end or fitted with a hanging support. This support is attached at some point behind the shield hinge. An ordinary stove bolt, with the square shoulder under the head and a wing thumb nut is the means of clamping. This same device is also applicable to doors or transoms which it is desired to hold open for purposes of ventilation.

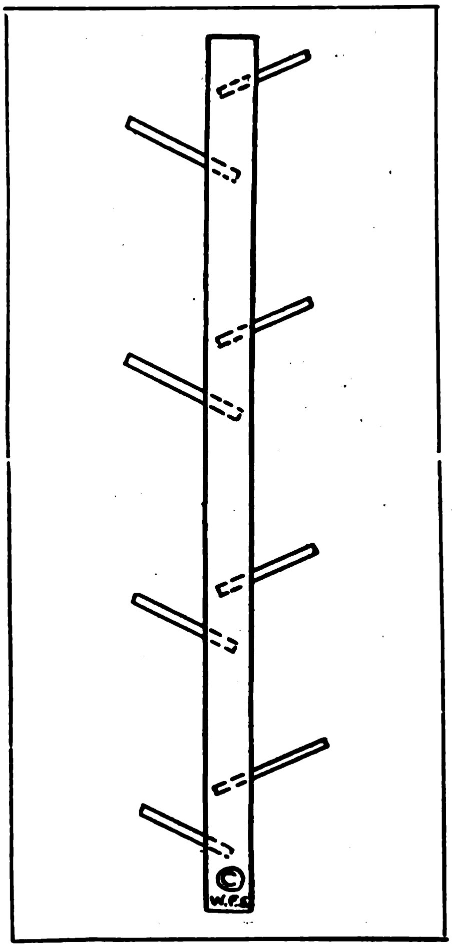

AN EFFECTIVE HOLDING DEVICE FOR THE WIND SHIELD

An Excellent Rack For Heavy Materials

Here is an excellent and very simple rack for pipe, strap iron, bar iron, wood or other heavy materials. No nails or screws are required whatever, and it is very strong. Those who have ever tried to make pipe racks for heavy materials out of nailed or screwed cleats, brackets, wooden bars, etc., will appreciate this very simple design.

To make this rack, simply bore holes into 4 inch by 4 inch timbers, or timbers of other suitable size, two or more, at a slight angle, as indicated in the drawing. Make the holes "just large enough" so that short pipe lengths can be driven in easily.

By inserting pipes on both sides of the posts the entire stand can be perfectly balanced, eliminating the danger of pulling walls over, as has frequently occurred due to eccentric loading. But with this rack, even if unbalanced, the top of the beam can be fastened in such a way that there will be absolutely no danger of its falling over.


A STURDY RACK FOR STORING HEAVY BAR STOCK

Looking Forward

They had just become engaged.

"I shall love," she cooed "to share all your griefs and troubles."

"But my darling," he purred, "I have none."

"No," she agreed, "but I mean when we are married."

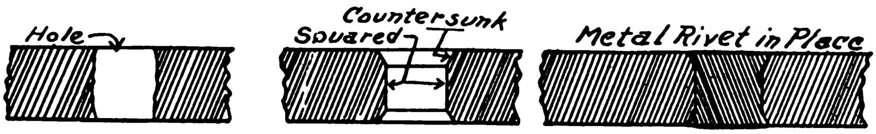
A Deep One

"Gosh all hemlock!" exclaimed the first farmer; "ain't yer struck water yet: How deep hev ye gone?"

"'Bout a hundred feet," replied the other placidly.

"Ain't ye discouraged?"

"O! I dunno, I can't say I ain't getting a long well."



HOW THE HOLES IN METAL TRAYS MAY BE PLUGGED EFFECTIVELY

Annealing Steel

The following is a formula for annealing stel. For small pieces of steel, take a piece of gas pipe two or three inches in diameter and put the pieces in it, first heating one end of the pipe and drawing it together, leaving the other end open to look into. When the pieces are a cherry red, cover the fire with sawdust, and leave the steel over night A charcoal fire should be employed.

Mending a Hole-Shot Metal Tray

LOUIS SCHNEIDER

A pair of heavy metal trays, that had originally seen service on an agricultural machine, being full of badly worn holes of various sizes where bolts had attached it to the frame, were mended by truing up the holes with reamers of proper sizes, countersinking the holes on both sides, sawing short ends of rod iron to fit the holes, and riveting these ends in while they were hot.

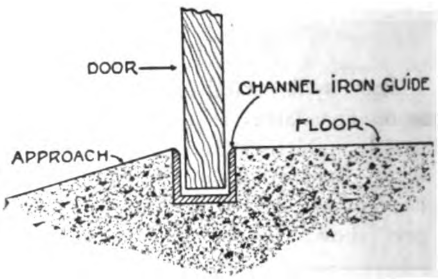
The process from the rough hole to finished repair is suggested by the sketches, and may be used in many other instances where the body of the perforated metal is not too thin.

The trays were used for many varied purposes, from containing bolts to watering poultry, the tight hot riveting making them water tight.

Machine Shed Door Guide

Sliding doors are often run in a guide to prevent them blowing away from the building and to prevent the wind from blowing snow under it. However, when such construction is used on machine sheds or barn drives the edges of a concrete floor are broken off and the chips fall into the guide to bind the door.

If a channel iron is imbedded in the concrete, and used as a guide the trouble is eliminated. The steel tires of wagons or machinery strikes the edge of the iron and no



SECTIONAL VIEW SHOWING HOW THE CHANNEL IRON IS EMBEDDED IN THE CONCRETE.

damage is done. This type guide is smooth and makes possible easy sliding of the door, even when it is held against the guide by the wind. Ice is also easily chopped from an iron guide without damaging it.

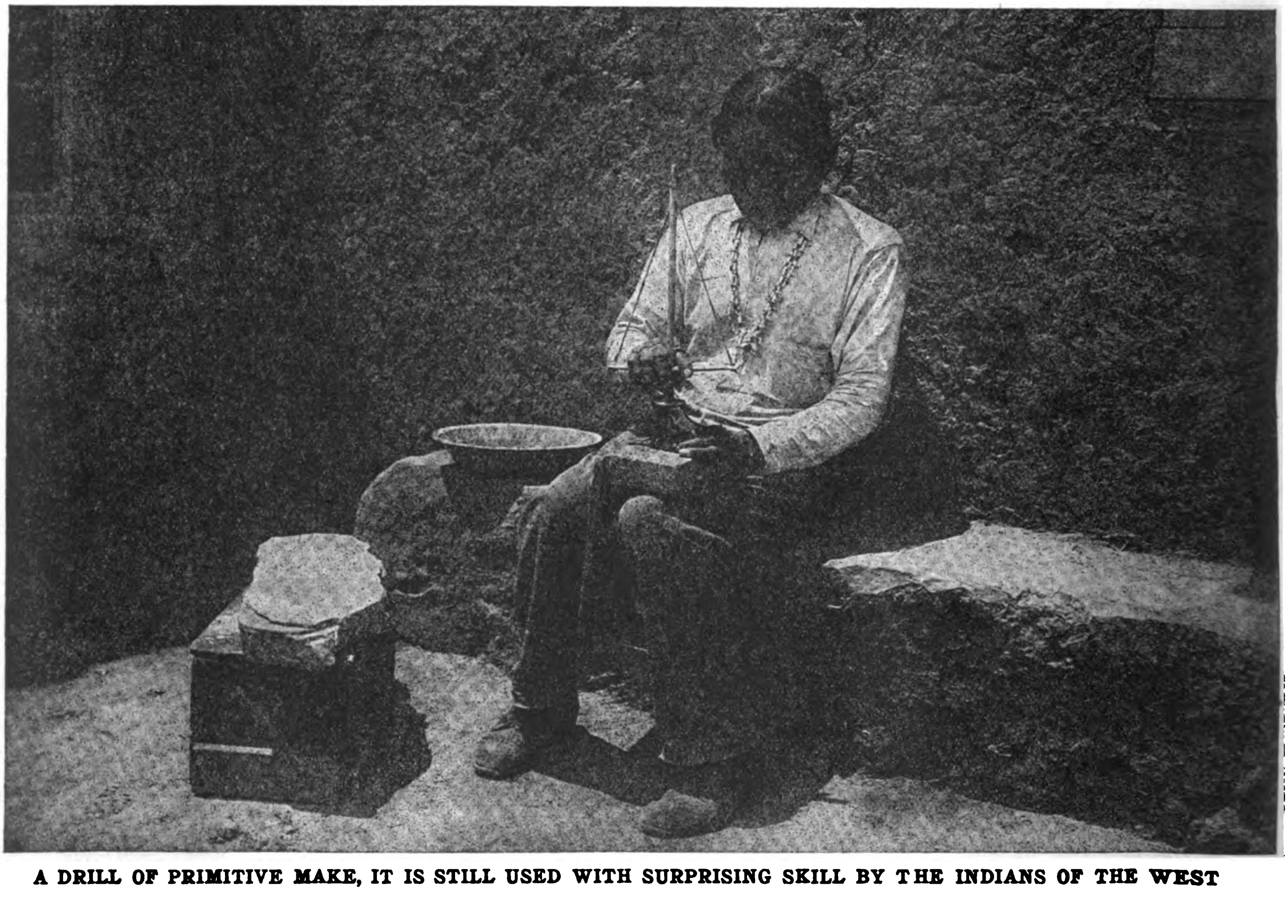
S. E. Gibbs.

Didn't Tell the Truth

Jones—I know now that my wife lied to me before we were engaged.

Brown—What do you mean.

Jones—When I asked her to marry me she said she was agreeable.



A DRILL OF PRIMITIVE MAKE, IT IS STILL USED WITH SURPRISING SKILL BY THE INDIANS OF THE WEST

Queries-Answers-Notes

THIS department is the meeting place where you are free to ask for information, answer questions, discuss shop matters and business conditions and any other notes you feel would be of interest to a fellow mechanic. Make use of this Department as often as desired.

Cheer up!. The Anti-Tobacco League may go up in smoke.

It's a mistake to suppose that a woman wants the last word. Some women won't even admit there is such a thing.

All things are possible. Instances have been known where men have been on the level and have still risen in the world.

BUILD A FORD FOR YOURSELF, or let us build one for you. Every Ford part in stock by piece or bushel; less than half price. Open Evenings and Sundays.—Ad. in Chicago Tribune.

When Wood Screws Pointed:—Can you kindly send me the date that points were put on wood screws? I have been taking some old furniture apart and found some of the early make. Would like to know when the change took place. H. N. Pope, Connecticut.

Advertising In Verse: In a recent issue, I saw an article entitled, "Advertising in Verse" by Ernest A. Phillips, and thought I would send the ad, we run in our local paper. Business in our locality is very good. We are on the jump every minute.
Adam T. Wible, Maryland.

Non-Rusting Soldering Fluid—To prepare a soldering acid that will not rust iron, add to a saturated solution of zinc and hydrochloric acid ¼ art ammonia, and dilute the whole with an equal quantity of water. This has been very successfully used on knitting machines in soldering kneedles to their holders where an acid with the above characteristics is essential.

Central Iowa Prices

Mower Repairs—Welding sickle for mover, $1.00; Welding sickle for binder, $1.25; Welding sickle pitman, 75c; Welding new hook on pitman, $1.00; Putting straps on wooden pitman, 25c; Mower sections put on, each 10c; Guard plates put on, each 15c; Sharpening sickle, 5 foot, 75c; Sharpening sickle, 6 foot, $1.00; New mower tongue, oak, $7.00; New mower tongue, pine, $5.00; Putting in, extra, $1.00; Cutting mower bar off, $2.00.

Setting Wagon Boxes:—Replying to H. P. J's. inquiry, regarding the manner of setting wagon boxes, this is my method: If the boxings are to be set in iron wheels, and the opening around them is large enough to allow the solution to run in, set the box in place, and then true it to the wheel. Then put mud or some other material in the small end to prevent the solution from running through. Melt sulphur and pour it in until the hole is filled, after which pour water over it. If the opening is not large enough for this, Benton's Recipes in the September issue gives the recipe of an alloy for filling holes in castings, that works very nicely.
E. B. Drury, Trickman, Texas.

Novel Tonneau Wind Reflector—Various type of windshields for the tonneau of the automobile have made their appearance in recent months. The ordinary tonneau windshield has a solid piece of glass extending all the way across the back of the front seat, with a wing extending outward at either side. This type is very satisfactory with the exception that it interfers with the conversation of those sitting within the car.

This new wind deflector is unique and different in that it does away entirely with the piece of glass across the back of the front seat. This deflector consists simply of two glass wings, attached to the back of the front seat near the side of the machine. When the shields are not in use they are folded inward and fit above the back of the front seat, but when the car is running they may easily be swung around to the desired point.—Albert Marple.

A Letter From Manitoba:—I have been reading your valuable paper year after year and it has been a great help to me. I have a general blacksmith shop in a good place for business I have a 3½ HP engine, emery stand, drill, disk sharpener, 25lb. trip hammer, "Just Right" plow share roller run by the engine which saves me a lot of hand work. I have an oxy-acetylene plant and have had it for the past eight years. I do a lot of welding with good success. I have studied it all I could in that time by reading and while I was working. A man may get good at it, but there is always something for him to learn.

I have some experience in welding crank shafts which may be of some help to some brother welder: I splice the ends down 1 inch on each end and put in a piece of steel, say a piece of sleigh shoe cut the right size. Then I bevel the outer edges good so as to give lots of room to weld the steel across the break. This helps to take the strain off the weld. I have fixed several that way and not one has broken. Just have a big enough tip to weld nicely: then thin out because of the danger of burning it. Don't try and do it too fast and your job will stand.
W. N. Parker, Manitoba.

Ford Clutch Drags—Car Pointing—Mechanical Starters—I am writing to you for information and trust that you will be able to tell me what to do. I have a Ford car. It was an old car when I bought it—a 1914 model. This car is hard to crank. The clutch drags so hard that when I put it in neutral and push it, it will turn the engine over. Last year I overhauled it and put in a new transmission and brake drum; also took out five of the transmission thrust plates. I can't see that any of the thrust plates are warped. When I put the lever in neutral the clutch fingers are lose; none of the transmission bands are tight. I use Mobile "E" oil. I have done everything to this car that I could think of, but I cannot keep it from dragging. I have spoken to several garage men but they didn't seem to know any more than I did. I also wrote to the Ford Motor Company, but received no answer.

Please tell me how to go about painting an old car. What kind of paint should be used. Should I rub down the last coat before applying the varnish? Should I thin the paint to avoid brush marks?

Also tell me which is the best mechanical starter for a Ford, or are none of them a success?
Olmer Olson, North Dakota.

In Reply:—Mr. Olson, has, no doubt, done all of the logical things in an attempt to adjust his clutch. I cannot suggest anything from my experience. Perhaps some reader who has had similar experience can give him some information that will help.

On the painting question—there are a number of car painting systems now on the market and made by reliable manufacturers and which produce very good resolute. One of these systems if used by Mr. Olson will produce a very satisfactory job and at a minimum expenditure of time and labor. Full directions accompany these plans or systems.

On the subject of rubbing last coat before applying the varnish. The finish of a car is dependent upon the building up of a proper body. Rubbing down the last coat will improve the final result as varnish has a tendency to intensify or magnify defects. Also, a perfect surface before the varnish is applied will be just that much better after the application of varnish.

Thinning paint to avoid brush marks depends upon the ability of the brush operator. Paint should be of just the correct consistency to flow properly. It should flow out with no trace of brush marks and yet not be so thin as to flow beyond control when applied to vertical surfaces.

There are a number of mechanical starters for Fords on the market, but the writer cannot voice an opinion on any of them because of lack of experience with them.
A. J. M., New York.

On Hardening and Tempering:—In reply to E. H. B. of Illinois, would say leave the patent baths out. Use just plain water or perhaps a little salt in it. Get a good grade of steel and stick to it. Never mind what some glib-tongued agent may say of his goods. Next, use care in heating and also working. I have seen many a tool spoiled by hammering too cold; the workman thinking he was doing fine work. I think it is a good plan, after the tool is made, to heat it a little and anneal and harden all at a time, as a forging fire is not a hardening fire. Be sure to coke up coal enough to do the job so you will not have to use green coal, but charcoal which gives the best results. Another point is that care must be used in heating. For the hardening, heat just hot enough to harden. It stands to reason if the tool is over-hot when put in bath, it will be much harder than if it was just the right heat. If both are drawn to the same color, the one that was the highest heat will still be harder than the one of lower heat, though they are both drawn to the same color. Would advise him to get a block of the goods he expects his tools to be worked on and make a tool, use it himself, and note the result. He then can see where he is at fault and make his changes.

H. N. Pope, Connecticut.

A Giant Brush Mower

A very interesting machine which recently has been developed is a mower which can be used in the clearing of brush land. It has a sickle 16 feet long, the sections being 12 inches wide at the base, and it is built for use in a three-plow tractor As the machine is drawn along, the sickle is brought up against the brush with a sawing action and it is claimed that soft wood trees up to six inches in diameter can be cut off close to the ground.

Don't Run Belts Too Tight

Belts should not be run too tight because undue tension puts a strain on the bearings, pressing the oil out from between the shaft and the bearing, thus causing it to run hot or maybe causing it to be ruined. Just enough tension should be put on the belt to make it cling well to the pulleys; any slack should be on the upper half as this will tend to increase the arc of contact. Good practice indicates that no pulley should be smaller than two inches in diameter and it is well to have at least two inches of diameter in pulley for each ply in the belt. Pulleys also should be made a little bit wider than the belts.

Big Power Farming Outfit For South

Complete power farming outfits are to be found all over the country, but Ernest Moore, of Sharon, N. C., recently purchased what was declared to be one of the most complete power farming outfits in that section of the country. It consisted of a tractor, a disc gang plow, a mould board, a double disc harrow, pulverizers and plow drill.

The farm which Mr. Moore owns and on which he is going to use this outfit is one of the most valuable farms in the famous Mecklenburg County, and is ideally situated for power farming. The equipment is especially designed for grain and grass farming, which has long been urged by experts, as the only solution to the cotton raising problem as it affects this country and in a large part the entire South.

Saving Crank-Case Oil

Thousands of gallons of diluted crank-case oil have been wasted in the past simply because satisfactory methods of reclaiming it have not been available. The deterioration of such oil results mainly from dilution and from the presence of dirt, dust and other injurious things

A method of salvaging this diluted oil has recetnly been developed and the equipment for the process is being manufactured in sizes suitable for the use of public garages and other agencies that have a considerable quantity of crank-case oil to dispose of.

Two separate operations are necessary in order to renew the original viscosity and fire and flash-points; first it is necessary to eliminate the dilution and second, all harmful solid matter in the oil must be removed. The gasoline is driven out by distillation, while the solid matter is removed by precipitation The total cost of operating the reclaimer approximates 5c per gallon.

The local garage will probably find custom work in reclaiming oil very profitable.

"Poorest" Land To Be Redeemed

A movement is on foot for the establishment of an experimental farm on the poorest 40 acres to be found in northern Indiana. It is expected that some county in this district will donate the land and that the Purdue Experiment Station will provide the labor and will co-operate with the County agents of the district in mapping out a three, four or five year plan for its modern principles will of course be practiced, not only in the crop rotations and in renewing the fertility of the land, but also in conducting operations economically. It is expected that equipment for operating this experimental farm will include a power farming outfit, since tractors and other power farming machinery have already definitely established themselves as economical operating units in this section of the country.

In this connection the success of such an experiment by Dr. C. G. Hopkins, of the Illinois station, is recalled. Dr. Hopkins on his own personal initiative purchased the poorest farm he could find in Southern Illinois and demonstrated its return to a high state of culture through the use of scientific principles and methods.

First Aid For Magnetos

Usually it is well when any trouble includes the magneto, to let the "mag." absolutely alone and for attention by an expert. However, there are some things about the magneto that any practical man can fix and these common troubles and their remedies are given below:

1. Dirty interrupter points. These are especially noticeable by the way they are when the magneto is running. Usually all that is necessary is to wipe them off and file them down true with a fine file. The contact surfaces should meet squarely.

2. Failure of contact points to separate. In most magnetos the interrupter mechanism consists of a steel cam against which a fiber block strikes. The fiber block may wear away, thus leaving the breaker points in contact. Usually and adjustment of the contact screws will fix this, or it may be necessary to put in a new part. Look also to the spring to see that it has not lost its elasticity.

3. Loss of magnetism in the magnets. This can generally be detected easily by the lack of resistance when the armature is turned by hand. The remagnetizing is a job for the service station or shop especially equipped for this purpose.

4. Short circuited windings. Sometimes due to the clogging of the safety spark gap. The current may jump from one winding to another, puncturing the insulation in between. The magneto may still spark with a short, weak spark. Here the only remedy is rewinding.

5. Short circuited condenser. The purpose of the condenser is to intensify the spark. When the insulation of the condenser has been punctured so that a short circuit is formed, the condenser no longer functions. The only remedy is a new condenser.

Horse Sense on Belts, Power and Pulleys

The belts which are ordinarily used on the farm machines are usually either of stitched canvas, rubber or leather.

In the stitched canvas belt, cotton is the material which is generally used in the making. Several layers or plies of cotton duck are overlaid upon each other and sewed or stitched together so as to increase the strength and prevent excessive stretching. They are sometimes impregnated with oils or greases and are painted with an elastic paint so as to further increase their durability.

Rubber belts usually have cotton duck as a back bone, the duck being laid up in several layers and thoroughly impregnated with a rubber compound forced into the plies and vulcanized under terrific pressure, which unites the rubber and the duck into one practically inseparable body. Rubber belts are not affected materially by atmospheric conditions though they are likely to be injured by oils or greases.

Leather belts are perhaps the most durable but are also likely to be the most expensive. The best leather belts are made of the hides of four-year-old steers killed in the fall, and only the center back strip from the hide is used. Leather belting can be made as heavy and as wide as desired, and can be kept in good condition by being dressed with a mixture of two parts of tallow and one of codliver oil. Neatsfoot oil can also be used on leather belts, but it will injure rubber belting

The amount of power transmitted depends to a large extent upon the area of the belt which comes in contact with the pulley. For this reason as wide a belt as possible should be used and the arc of contact or "lap" should be as great as possible The pulley should always be a little wider than the belt and to prevent the belt from running over the edges of the pulley and tearing it, the pulley should be given a slight crown at the center Very small pulleys are injurious to belts, since the sharp bending is likely to break the fabric Belts should not be stretched too tight, for such treatment not only injures the belt but increases friction due to tight bearings. Belts can be operated at speeds up to a mile per minute wtihout serious danger.

If the slippage of a belt is disregarded, the speeds of two pulleys connected by a belt will vary inversely as the diameter of the pulleys. If we designate capital D the diameter of the driver; small d the diameter of the driven; capital N the revolution of the driver and small n the revolution of the driven, the following equation is true: $DN=dn$.

Stating this as a rule, the product of the diameter of the driver and its revolutions per minute is equal to the product of the diameter of the driven and its revolutions per minute.

If any three factors are given, the fourth one can be easily found by substituting the values in the equation given above.

AMERICAN BLACKSMITH AUTO & TRACTOR SHOP

VOLUME 20 SEPTEMBER, 1921 NUMBER 12

E. D. Corson, President
G. A. Castle, Vice-Pres.

BUFFALO, N. Y., U. S. A.

A. W. Bayard, Secretary.
W. O. Bernhardt, Treas.

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CONTENTS SEPTEMBER 1921

THIS IS YOUR PAPER

We want every reader of "Our Journal" to feel that this is his paper; for such it is in fact. We want you to write us on your problems and puzzles. We want you to use these columns for your discussions on trade and shop matters. We want every reader to feel it his duty to write occasionally to the Editor. Tell him about your work, your shop, your trade. Tell him what you are doing. tell him about your equipment, what you are doing to enlarge your business and how business is going with you. But what ever you write remember this is your paper, and we would rather have a good practical hint or a soundly interesting letter from one of "Our Folks" than a whole truck load of stuff from some professional writer who has the literary training but not the practical ideas.

OUR TWENTIETH ANNIVERSARY

Twenty years ago—September, 1901—the first number of The American Blacksmith made its appearance. Twenty years have passed since "Our Journal" started its monthly visits to the members of the great smithing craft.

For twenty years "Our Journal" has taught and preached—spoken and cautioned—advised and counseled—and represented the smithing craft, the general repair field and the allied interests.

Great changes have taken place in the craft and trade during these twenty years. Changes that have put modern methods into the shop.—modern machines on the shop floor—an enlarged field at the shopman's command and a large opportunity for profit and money.

And on this, the eve of "Our Journal's" twenty-first year we are pledging our continued support of the craft and trade and those things which are best and good, "Our Journal" will continue to support and to encourage better shops, better men, better methods, and all matters which have for their object the best interests of the craft.

WE STILL ASK YOUR PATIENCE

For several months past it has been very apparent to our readers that delays beyond our control were interfering with the prompt delivery of "OUR JOURNAL." We are glad to say, however, that we are gradually getting back to our regular date of issue and at the present rate we will be getting your paper into the mail promptly and upon the proper date within another month.

We regret more than any of our good readers the unavoidable delay which has been so apparent the past few months. We greatly appreciate the extreme good patience of all of "OUR FOLKS" and we want to take this opportunity to sincerely thank each and every one of you for your co-operation.

A NOTABLE SERIES OF PRACTICAL ARTICLES

Next month will see the starting of a most notable series of articles on the subject of repair methods and practices. These articles are by Gustav H. Radebaugh and are entitled "Standard Mechanical Practices In Repair Work." They will relate directly to repair operations on automobiles, tractors, trucks, and agricultural implements and farming machinery. Practically every line of work done in the general repair shop and by the general smith will be detailed, explained and pictured. Each step in each operation will be shown by carefully posed photographs which are then carefully and fully explained in detail.

Thus through a series of twelve articles will be shown the standard methods followed in repair work of all kinds. You will want to secure the full and complete series, for which each article is complete in itself. the full series makes a text book on repair work that will prove the most practical and valuable collection of information of its kind.

Mr. Radebaugh, the author of these articles is Superintendent of Machine Laboratory and Instructor in Machine Shop Management and Practice in the Mechanical Enginering Department of the College of Engineering at the University of Illinois. He is a member of the American Society of Agri. Engineers and also the Society for the Promotion of Engineering Education. He has made special investigations in several large industrial plants in Time Studies and in Standard Mechanical Practices. He is an extensive contributor to the trade and technical papers and magazines and his expertness in the application of photography is well demonstrated in the engravings and illustrations which accompany his articles.

It is with a great deal of pleasure that we present these excellent articles by Mr. Radebaugh to our readers. And in the reading of them we know that "Our Folks" will share our pleasure and satisfaction.

The Worth of A Smile

Little Jimmy Godfrey, aged thirteen, climbed a tree—out in Kansas City—to gather walnuts. He came in contact with an electric wire. One side of his face was burned, leaving an ugly scar. A damage suit against the power and light company was instituted on Jimmy's behalf. The chief element of damage about which the claim centered was that Jimmy had lost his youthful smile. On the witness stand, Jimmy was asked to try to smile. The only result was a puckering of the lips and a melancholy drawing of the face. A physician testified that the smile muscle in his check had been bound by the scarred tissue above. The jury promptly returned a verdict giving Jimmy $20,000. That becomes the officially fixed value of a smile.

Moral: If a smile is worth $20.000 when you lose it, it is worth $20,000 when you use it. The world is full of Jimmy Godfreys—some of 'em little chaps like him, some of 'em big, grown-up folks. Some of 'em are like Jimmy used to be—with a warm, cheering, helpful smile that makes life happier for everybody in it. Some of 'em are like Jimmy is now — "smile muscle" always gone—instead, a deep, dark, forboding frown that makes the world a little darker and a little gloomier for all who come in contact with them.

They paid Jimmy $20,000 to compensate him for his loss. His loss! Do you get that! In other words, important as Jimmy's smile was to others, it was most important of all to him.

If all the "smile muscles" in the land were electrocuted, and all the radiance went out of the faces of those—you know them—who help us turn the dark clouds inside out, all the gold in the world couldn't shine bright enough to make a compensating light.

(An Editorial in the Grand Rapids Herald)

Welding A Tractor Cylinder Casting

BY DAVID BAXTER

In this article Mr. Baxter tells how a crack in a rather inaccesible part of a cylinder casting was welded. As he says. "It may have been done some other way, but this is how the job WAS done." Even if you never have a job of this kind to do it will set you thinking and help you with all of your welding work.

WETHER or not some of the methods employed on this job and described herein are the best is probably open to discussion at least. Because what one welder can do with perfect safety and satisfaction, another may not be able to handle. A lot depends on the ability of the welder and to his understanding of his welding apparatus; and to his understanding of the fundamentals of the process.

However, this article is not intended to be a discussion of ways and means in relation to their comparative merits. But is intended to help welders in general and the novice in particular.

There are no doubt several ways of handling this job, either in point of economy or facility. But that is not the point. The idea is that this job was handled as will be described below and that the welding was successful.

This casting was the cylinder block of a well known tractor engine weighing approximately three hundred pounds and having an average metal thickness of three-eights of an inch of cast iron. The crack to be welded was located in an interior wall of the water jacket; accessable only through one of the cylinder openings, and had not the block been one of the removable bore or sleeve bore type, the welding would have been almost impossible. Another minor crack was located in the narrow stripe of metal between two of the cylinders at the bottom, but this was readily accessable from the outside.

It was the interior weld that caused the trouble in this job, but as stated the engine was one of the sleeve type so the matter was simplified considerably, and therefore the removal of the sleeves was the first step in the repairing. This was accomplished as indicated in Fig. 1, with a crude arrangement consisting of a long bolt with a cross piece of flat bar iron that just caught the lower end of the sleeve, and a slab of iron, with a hole through the center, to engage the cylinder head studs at the other. On top of this slab was placed a sufficient number of washers to give the desired purchase to the large wrench. By turning this wrench the bolt was tightened enough to back the sleeve out.

When the sleeves had been removed the next step was to prepare the interior crack for welding. It was manifestly out of the question to do a good job of grooving this crack, a proceeding which helps so much in most cast iron welding jobs. But the welder succeeded in cleaning the rust and corrosion from a strip of the metal along both sides of the crack by scraping with a file and wire brush. This greatly improved the chance of obtaining a good weld by removing the danger of foreign substance getting trapped in the weld. Rust and other matter often gets into a weld to cause pin holes or porous spots in the finished weld, so it is always safer to thoroughly clean the vicinity of all welds. Sometimes this dirt will not harm the weld, but will cause trouble with the welding flame.

After removing the sleeves and cleaning the line of welding the next problem was to out wit contraction; in other words, to insure a weld that will not check or crack back. The only thing to do in this case was to preheat. In some jobs the danger of contraction cracks may be eliminated by wedges, jack screws, clamps, etc. But in this case none of them were applicable on account of the interior location of the fracture. In the first place the crack surrounded as it was by metal walls of differing thickness and varying complexities of design, was almost certain to re-crack if the job was not properly expanded. The complex design would offer stubborn resistance to the pull of weld contraction when the fully expanded weld metal cooled. If the block were welded cold, or was improperly or insuffciently heated, previous to and during the welding, the contracting weld metal would pull apart, either directly in the weld or in some weak portion near it, and then probably several cracks would develope, running transversely to the weld.

FIG. 1—THIS IS HOW THE SLEEVES WERE PULLED OUT OF THE BLOCK

To get away from these conditions, the welder was forced to preheat the job. The desired effect was to heat the casting enough that it would be expanded, enlarged so to speak, when the expanded filler metal was applied to the crack; in other words, when the weld was expanded. This being achieved and the job was permitted to cool, the weld and the balance of the casting would shrink in unison. The surrounding metal would follow the shrinking weld metal inward if the whole thing cooled uniformly. To insure this effect, practically the whole casting had to be preheated. Not only that, but the heat had to be maintained during the application of the welding metal.

The heating was accomplished upon a preheating table over a battery of three natural gas burners. The block was placed flat upon one side with the cracked wall downward and the crank case portion hanging over one edge of the table. This device provided for the heating of only the cylinder part of the casting; principally the lower half of this. The half which contained the crack was therefore heated the most. Enough of the block was heated to provide expansion in the region of the weld.

The gas burners were allowed to burn with gradually increasing force. Several sheets of asbestos paper were spread over the casting to confine the heat and thus hasten the preheating process. The job was allowed to heat thus under cover until the lower half was red hot, when seen through the bore openings directly over the crack.

Some welders raise the heat to a bright red stage but this seems unnecessary as the weld cools to the temperature of the surrounding metal almost as fast as the filler is placed. Therefore if the weld is the same color as the adjoining metal when the weld is finished they will be equal in expansion and should contract in unison; providing of course that the cooling is uniform.

When this block reached the red stage the welder started operations. He used a long torch with a short medium size tip, adjusted to give a strictly neutral flame. A large torch would not be manipulated properly in the interior of the casting; and a small one would not furnish enough heat to fuse properly.

The flame must be handled in harmony with the melting condition of the weld and the manipulation of the filler rod. It must always be ready to advance when needed and to retard when too ardent. It should be concentrated upon the end of the rod when a quantity of the filler is needed. And ready to receive the filler when it is ready to be deposited.

The filler metal used on this job was a quarter inch rod of high silicon gray cast iron, necessary to produce a soft tough weld. For this thickness of metal a smaller rod is more liable to burn and cause a poor bond. Or if it doesnt, it slows down the welding operation needlessly because the operator must gauge his melting to suit the metals. A large rod supplies too much filler or endangers over-melting in the casting metal, in an effort to keep a large area ready to receive the filler.

The manipulation of the rod is almost as important as that of the flame. It should be kept in motion; twisting and sawing to mix with the casting and to keep the slag floating: or prodding and flirting to remove bits of dross from the bath; applying the flux powder at correct intervals; pushing new metal into the weld but never allowing it to drip therein. But this does not mean that the filler rod should be aimlessly prodded in the weld all the time. It means that the operator should watch the condition of the weld and melting filler and handle them accordingly.

When this casting was hot enough the flame and filler were inserted through the bore opening. The flame was applied to the far end of the crack, where it revolved over about an inch of the surface along the crack. As this crack was not grooved the operator had to let the heat soak in deeper to melt the full depth of the metal. He measured the depth of melting by the fluidity of the metal under the flame. Then the rod was brought in contact to twist a quantity of it into the molten crack and knit the sides together. As this was achieved the flame was gradually moved along the crack to melt another section of it. The filler rod was withdrawn only to dip in the flux pot and carry a bit of the powder back to the weld; where it was deposited while the filler remained in contact with the molten bath, to twist off another portion.

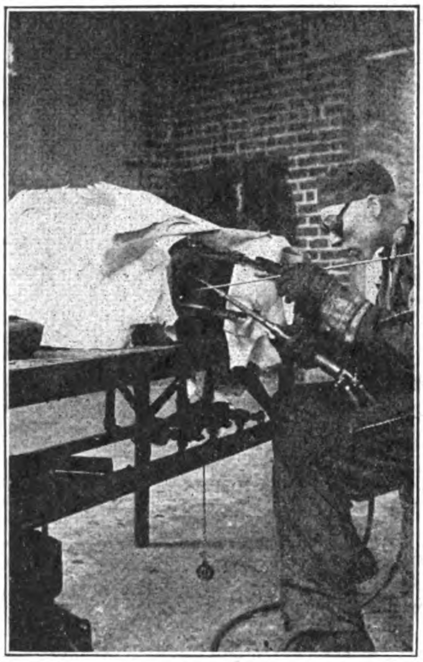


FIG. 2—THE CASTING WAS COVERED WITH SHEET ASBESTOS TO CONFINE THE HEAT

Thus the entire length of the crack was melted deep and stirred together with new metal from the rod. With liberal quantities of flux applied to each section of the melting. As the outer end of the crack was neared the process became easier because the rod could then be held in a more nearly perpendicular position more favorable to the knitting process.

By the time the second inch of the weld was filled the first had congealed and subsided to the same stage of heat as the surrounding casting. By the time the third inch of the crack was welded the second section had cooled to the same stage as the first. Thus, at the end of the crack the whole length of the weld was practically the same stage of heat. And therefore it would cool and contract in harmony with the rest of the casting.

Before allowing the job to cool, however, the block was lifted up and arranged as shown in Fig. 3. This in order to place the short crack between cylinders in a horizontal position. It is difficult to make a perpendicular weld in cast iron so the position of the casting was changed to bring the last crack level. This was accomplished as quickly as possible to prevent loss of heat a thing which would increase the contraction to the danger point.

The operator attached the last weld without losing any time and "sewed up" this crack in much the same manner as he made the interior weld. This crack was not grooved either, so it was necessary to melt the full thickness of the metal when adding the filler. A slower soaking heat was used in this as the metal between the cylinders was thinner. there was more danger of blowing or prodding a hole through in an effort to force the welding.

While this last weld was being made the block was cooling, and therefore contracting rapidly, although evenly and regularly as the air had free access to all parts alike; passing through the cylinder bores to cool the interior about as fast as the outside. But, while this was particularly risky, it was not absolutely safe. In fact it might have been very unsafe had the operator been a rank beginner. As it was, not a moment was wasted so the job was ready to finish cooling by what is called the slow process.

This consisted of wrapping the casting in asbestos paper to retard the radiation and thus force a slower passage of the heat to the open air.

As suggested in the start this job could have been done in other ways; probably equally as well. It could have been heated with oil burners or with charcoal fire. Or it might have been done without covering providing plenty of heat arose on three sides of the block; the covering in this particular event was to hasten the process.

The weld could have been started at the outer end and worked inward, but then the operator would have had to weld with the extra heat beneath the torch all the time. Which might have caused backfiring trouble, trouble in keeping the flame adjusted.

The casting might have been cooled without covering; some such jobs often are. The shape of the weld influences this. If the operator is expert and lays a weld the same thickness and width its entire length he knows the shrinkage will be uniform. But if the weld has thick "lumps" in it this extra metal will have more contraction.

However, each welder knows his own ability and should suit his methods to it in the welding of different jobs.

Practical Hints on Solders and Soldering

THOS. NEWTON

IN WORK

A solder is really an alloy of two or more metals, and the peculiar characteristics of a given solder depend on the percentage combination of its constituents. The melting point of the solder, of course, must be below that of the article to be soldered, and its hardness and tenacity must be as great as is compatible with its ready application to the purpose for which it is intended. The solder must flow readily with the aid of a suitable flux, and it must be capable of easy manufacture as a commercial proposition.

Soft solders are composed of tin and lead in varying proportions, and bismuth and antimony are added in small quantities when it is desired to make the solder softer or harder. Before dealing with the composition of different solders, a little information concerning their constituent elements will perhaps be acceptable. Tin is harder, more malleable, more ductile, and is a better conductor of heat than lead. A cubic foot of tin weighs 455 lb., but a cubic foot of lead weighs 710 lb. It is interesting to note here that an increase in the percentage of tin in solder produces more bulk than would otherwise be the case. Conversely, any increase in the percentage of lead in solder results in a decreased bulk. An undue proportion of lead in a given solder cheapens the solder as regards price per lb., but it should not be forgotten that a coarse solder does not flow readily, nor is it so economical as a finer

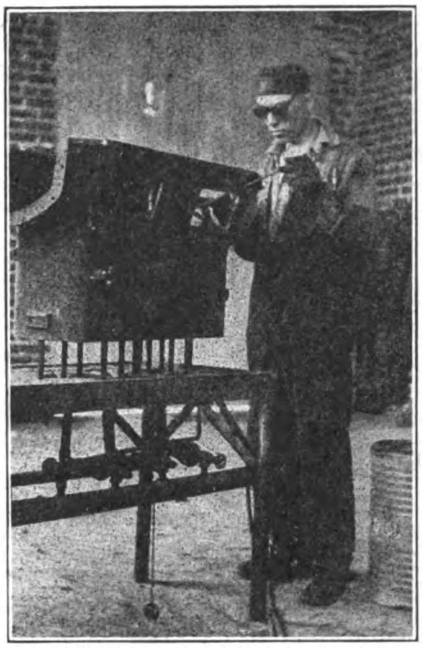


FIG. 3—THE BLOCK WAS TURNED UP SIDE DOWN TO MAKE THE LAST WELD

solder for the ordinary purposes of a tinsmith. Moreover, the bulk in relation to weight is less.

Some Metals and Their Properties

Metal.	Sp. Gr. (Water=1)	Tenacity (Tons per	Conductivity (Silver=100).	Melting Points Deg. Fah.
Tin	7.8	2	15.2	450
Lead	11.3	1.6	1.8	620
Bismuth .	9.8	1.6	1.8	507
Antimony	6.7	0.5	8.5	620

Although the melting point of tin is 450° F., and that of lead 620° F., a solder consisting of equal parts by weight of lead and tin has a melting point of 370° F. This is the ordinary solder of commerce used by tinsmiths generally. Among its many advantages are the following: It flows readily and cleanly; its tenacity is more than the combined tenacity of its constituents (lead and tin); there is no possibility of poisoning when it comes in contact with food; it is readily made and is easily manipulated; it possesses a low melting point. Bearing in mind the respective melting points of tin and lead, it is curious to note that a solder consisting of 2 parts of tin to 1 part of lead melts at 350° F., and yet it is the hardest among the tin-lead alloys. Another curious fact is that a solder consisting of 40 parts of tin to 60 parts of lead is equally as hard as one consisting of 70 parts of tin to 30 parts of lead.

The melting point of a solder can be lowered by increasing the percentage of tin in its composition. Plumber's solder, consisting of 2 parts of lead to 1 part of tin, for example, melts at 440° F. By increasing the amount of tin until the lead and tin are present in equal quantities by weight, the melting point is lowered to 370° F. A still further increase in the amount of tin until the solder consists of 2 parts of tin to 1 part of lead results in the melting point being reduced to 350° F. This latter alloy is usually considered to be the best fine blowpipe solder.

The highest quality tinsmith's solder made fuses at 334° F., and consists of 1½ parts of tin to 1 part of lead.

A foreign substance like zinc should be rigorously excluded from solder, since even a minute quantity of this metal would spoil a pot of solder.

It has already been shown how a combination of tin and lead yields a solder which is more tenacious than the combined tenacity of both. This tenacity, or cell cohesion, can be further increased by the addition of antimony to the solder. A good workable proportion is about ¼ per cent.

Bismuth is a constituent of solder when a low fusing point is required, but it is rather an expensive metal to use in this connection. A solder consisting of 3 parts of tin, 2 parts of lead and 5 parts of bismuth will melt at 212° F., which is the temperature of boiling water. Even a lower melting point than this can be obtained by altering the proportions of these constituents. Cadmium is also another constituent employed for obtaining a readily fusible solder. For example, a solder consisting of 8 parts of lead, 4 parts of tin, 15 parts of bismuth, and 3 parts of cadmium will melt at 150° F.

The composition of some soft-solders, together with their melting points are given in the table on page 306.

Unless the percentage composition of a given solder can be guaranteed by the makers, it is better to make one's own. First melt the lead, scatter sufficient resin in the metal-pot to form a film to prevent oxidation, then add the tin, stir thoroughly with ladle, occasionally taking up a ladleful and pouring it back again, then pour it into a corrugated iron solder-mould to form strips. Under no conditions should the metal in the pot be allowed to red hot, otherwise oxidation will occur, and this will result in the formation of much dress and scum.

The disintegration of a given solder through electrolysis is probably more dependent on the flux used in connection with the solder than on the composition of the solder. An acid flux might very well produce a set of conditions which would favour the electrolytic. It is therefore important, from more than one point of view, that the action of any such acid should be neutralised after the soldering process. This can best be done by washing off the remains of the flux with an alkali, such as a solution of common washing soda and water.

There are many fluxes in general use, and each has its peculiar advantages and disadvantages. A good flux should facilitate the flow of the solder; it should prevent oxidation of the metal; it should be capable of easy application; and, after the soldering process, the remains of the flux should be capable of quick removal. Tallow, resin, resin and oil, hydrochloric acid, and chloride of zinc, or "killed spirts," are all suitable and useful fluxes for soft-soldering. Each has its own distinct sphere of usefulness in sheet-metal work. Any of the first three can be used when soldering lead or pewter, but they would be quite unsuitable, say, for galvanised-iron. Hydrochloric acid is the recognised flux for galvanised-iron. Resin can be used for soldering tinplate; but after the soldering process the resin sets hard and has to be chipped or scratched off. This is detrimental to the tinplate, inasmuch as the thin coating of tin on the tinplate is liable to be scratched off here and there; the metal (which is really iron) is thus exposed, and rusting ensues. In order to avoid this detriment a mixture of resin and oil is used instead of the resin alone. After the soldering process the remains of the resin and oil flux can be easily removed with a piece of rag or a pad of waste. Chloride of zinc, or "killed spirits" (which is made by dropping scraps of zinc into hydrochloric acid until effervescence ceases), is the standard flux for tinplate, copper and brass. For new tinplate work the addition of a small quantity of water improves the flux. Hyrochloric acid is used as a flux for zinc, as well as for galvanised-iron. When this flux is used for soldering new zinc, it effervesces more or less violently. This can be avoided to some extent by adding to it an equal amount of "killed spirit," and, incidentally, this improves the flux. Many proprietary fluxes have from time to time been marketed.

Table of Soft-Solders and Their Melting Points.

Tin (Parts by Weight).	Lead (Parts by Weight).	Bismuth (Parts by Weight).	Melting Point Deg. Fah.	Description of Solder.
8	2	5	212	Fuses in boiling water.
1	1	2	203	Pewterer's solder.
1⅓	1	—	334	Finest quality tinsmith's solder
2	1	—	350	Finest quality blowpipe solder.
1	1	—	370	Ordinary quality tinsmith's solder.
1	2	—	440	Ordinary quality plumber's solder.
1	3	—	452	Coarse quality plumber's solder.

Table of Hard Solders or Brazing Spelters and Their Uses.

Copper	Zinc	Silver	Description and Use.
2	1	—	Very hard. for iron, steel and bronze.
3	2	—	Hard. For light iron and copper.
1	1	—	Soft. For brass work
8	8	1	Softer. For light brass.
1	0	4	Hard silver solder.
1	0	2	Soft silver solder.

THE COMPOSITION OF HARD AND SOFT SOLDERS IS GIVEN IN THESE TABLES

The adhesive power of solder is largely dependent on the use of a suitable flux in conjunction with the solder. Recent experiments have demonstrated that, by substituting a more suitable flux for one not quite as suitable, the tensile strength of a given joint could be increased from 6,000 lbs. per sq. in. to over 17,000 lb. sq. in. This fact emphasizes the importance attached to the use of a flux specialy suitable for the work in hand.

The hard solders are in another category altogether, and they are all generally refered to as "brazing spelter." Since, however, hard solders are used for widely different purposes, and considering that their fusing purposes, and considering that their fusing points vary greatly, according to the percentage combination of their constituent elements, it is always advisable to ascertain if a particular solder will best meet the requirements of a particular job. A hard solder may be bought as "brazing spelter"; it may fuse readily and appear to be all that is required; yet its very property of quick fusion, while being eminently desirable for some classes of work, may stamp it as being equally undesirable for other work.

In order fully to appreciate what is actually required of a hard solder, it should be understood that a "spelter" or solder which fuses too readily may be but little better than one which has a too-high melting point. The nature of the work in hand should always determine the approximate fusion point of the brazing spelter to be used. The fusing point of the brazing spelter should, of course, be below that of the article to be brazed; but not too much below it, if the strength of the joint is an important consideration. A hard solder which would be quite suitable for a delicate soft-brass job, would be quite unsuitable for a heavy iron job where a strong brazed joint is most essential. Conversely, it might prove disastrous to attempt to use on a delicate soft-brass job a hard solder which would be ideal for use in connection with a heavy job in iron.

Hard solders are composed of copper, zinc, and sometimes silver, in varying proportions. The fusing point of a hard solder is raised by increasing the percentage of copper in its composition. By increasing the percentage of zinc in its composition the fusion point is lowered. Still lower fusing points may be obtained by adding a percentage of silver.

It is much more satisfactory to buy hard solder than to make it; but when buying it the use for which it is intended should be specified, so that of course, hard solders having other percentage compositions than those in the foregoing table, but those tabulated are quite sufficient for all ordinary purposes.

The best and most reliable flux for brazing is borax. Some workers simply crush the lump borax into a fine powder, and apply it in powdered form to the article to be brazed. Others mix equal quantities of powdered borax and brazing spelter together in a little clean water, and apply the mixture. In the latter case a little powdered borax is also held in reserve, to be thrown on the job, if needs be, in order to facilitate the fusing of the brazing spelter.

Borax is a compound which contains water held in chemical combination. When heat is applied to the borax, as in brazing operations, the water is driven off in the form of steam, and this causes the borax to swell. Sometimes the swelling of the borax causes it to fall off the job together with the brazing spelter. It is always better, therefore, to roast the borax in order first to drive off the water (known as the water of crystallisation) before using it as a flux. This prevents subsequent swelling of the borax and the inconveniences which would result.

Fitting Demountable Rims

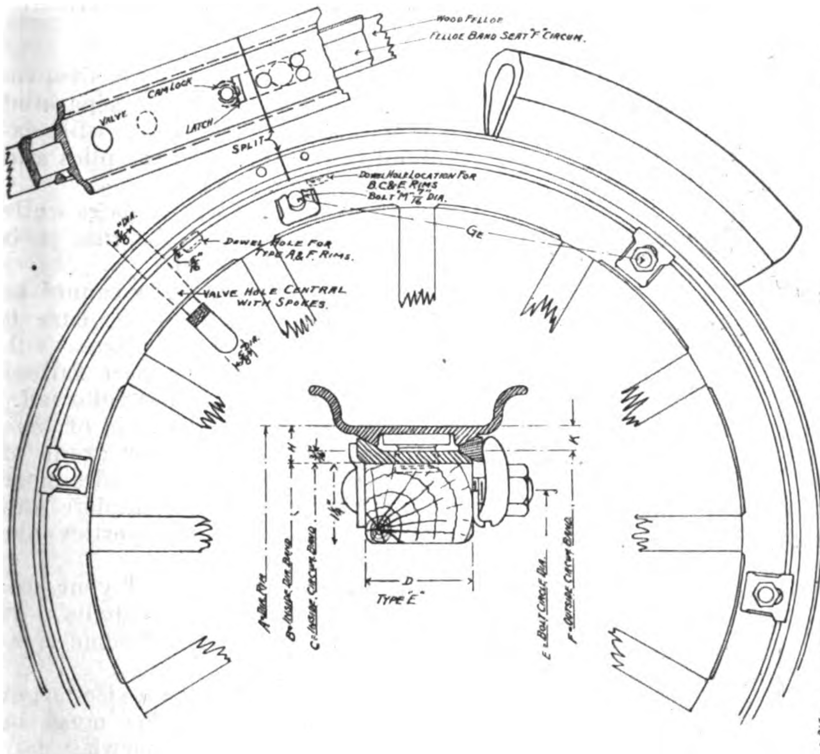
C. MORR
FIRESTONE STEEL PRODUCTS CO.

From the question asked your correspondent, is very evidently interested in fitting demountable rims to a Franklin Car. Just why he has in mind the type used on a Dodge he does not explain. Nor does the writer understand his idea on this, because the sizes are not at all adaptable. Further and in addition to this draw back, the Dodge wheels have steel felloes instead of wood. These steel felloes can not be applied except by a manufacturer of wheels.

It is entirely reasonable and very practical however to apply Firestone Rims to Franklin wheels and a great deal of work of this kind is done. Of course it is necessary to remove both the wood felloe on the Franklin wheel as well as the rim. The spokes are then cut down and a new rim applied and then the Firestone felloe band is applied.

This work is right along the line of the thoroughly experienced wheelwrights' work so that with the dimentions given, he should have no great difficulty in making the change.

In applying the felloe band it must be so located that the valve hole is central with the spokes and naturally, of course, midway between two spokes. To locate bolt measure with tape 5¼ inches on the felloe band seat from the center of the valve hole to a point on the band over the point where bolt M is to be located. This dimension is the same for all size rims. After locating bolt M space equally for the number of bolts on given bolt circle using dividers set for dimension under column GE in the table. The dimentions given are for the application of the three different types of rims illustrated respectively at diagrams marked "type E"—"C"—and "F."



DIMENSIONS TYPE "E"

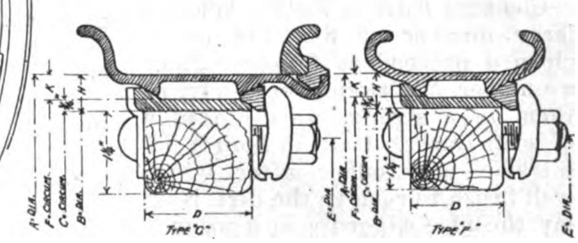
SIZE	A	B	C	D	E	F	GE	H	K		NUMBER OF BOLTS
32x3½	25"	23 13/16"	6'-2 13/16"	1½"	22 15/16"	6'-3 63/64"	11 15/32"	19/32"	13/32"		6
32x4	24"	22 13/16"	5'-11 31/32"	1¾"	21 15/16	6'-0 27/32	10 31/32	"	"		"
33x4	25"	23 13/16"	6'-2 13/16"	1¾"	22 15/16	6'-3 63/64	11 15/32	"	"		"
34x4	26	24 13/16	6'-5 61/64	1¾	23 15/16	6'-7 5/8	11 31/32	"	"		"
32x4½	23	21 31/32	5'-8 5/32	2	20 23/32	5'-9 7/32	10 23/64	43/64	31/64		"
34x4½	25	23 31/32	6'-2 5/16	2	22 23/32	6'-3½	11 23/64	"	"		"

DIMENSIONS-TYPE "C"

32x4	24	22 13/16	5'-11 31/32	1¾	21 15/16	6'-0 27/32	10 31/32	19/32	13/32		6
33x4	25	23 13/16	6'-2 13/16	1¾	22 15/16	6'-3 63/64	11 15/32	"	"		"
34x4	26	24 13/16	6'-5 61/64	1¾	23 15/16	6'-7 5/8	11 31/32	"	"		"
32x4½	23	21 31/32	5'-8 5/32	2	20 23/32	5'-9 7/32	10 23/64	43/64	31/64		"
34x4½	25	23 31/32	6'-2 5/16	2	22 23/32	6'-3½	11 23/64	"	"		"

DIMENSIONS TYPE "F"

30x3½	23	21 25/32	5'-8 37/64	1½	20 25/32	5'-9 39/64	12 17/64	39/64	27/64		5



WITH THE DIMENSIONS AND INSTRUCTIONS GIVEN IN IN THIS CHART DEMOUNTABLE RIMS ARE EASILY FITTED

How To Clean Clogged Files

W. J. HARLEY

FREQUENTLY one sees in the shop a number of old files lying about useless because they have become clogged with dirt, grease, paint or metal. These files have been found to either glide over the work or scratch it, and have consequently been placed on one side and a new one brought into use. It is obvious, therefore, that if some simple method can be employed to clean the files and to render them useful, a great saving will be obtained. The following simple but well tried and effective remedies will help considerably in this direction and will ultimately eliminate much of the waste which occurs in this direction.

Files Clogged with Oil or Grease—Boil the files for a few minutes in very strong soda water to dissolve the grease. This will also loosen any dirt that may be embedded with the grease, and this can be removed by rubbing with wire brush. When this has been done rinse the files in clean boiling water and dry them before a fire. Any small lumps of metal left embedded may be picked out by a scriber point before washing and drying.

Files Clogged with Paint.—Paint and substances of a like nature can be removed by giving the files a good coating of paraffin oil, and then washing in strong soda water, using soap and a stiff brush. Solid lumps must be picked out, more paraffin oil applied, and finally another wash and a good brushing.

Afterwards, the files may be sprinkled with fine emery or ground cinders, and then a vigorous brushing will effectively remove all foreign matter left over from the previous operations.

Files Clogged with Metal.—(1) First wash in a strong caustic-soda solution, rinse in water, scrub, wash and dry quickly to remove grease, dirt, etc. (2) Immerse in a solution of 1 pt. of nitric acid, 1 gill of muriatic acid, and 1 gal. of water. This will not only dissolve soft metals, but will sharpen up the teeth on the file. Lastly, to prevent rusting through the acid treatment, transfer to a caustic-soda bath, after which well rinse and dry in the usual way.

An Electrical Method of Cleaning.—Make up the following acid bath; 2 parts of nitric acid, 1 part of sulphuric acid, and 25 parts of water. Immerse the file in the acid, leaving the fang end protruding, and connect this end to the positive pole of a Daniell cell. Now make a wire coil which will go over the file without touching it. Immerse this coil in the solution round the file, bend one end of the coil to point towards the file, and connect the other end to the negative terminal of the battery. Let current pass for ten to fifteen minutes, afterwards rinse and dry quickly. The cleansing is hastened by the current and much better results are obtained.

Cleaning Files in Bulk.—When a large number of files are to be cleaned proceed as follows: Place a number, say twenty or thirty, of them in a strong, warm solution of soda water. Half an hour's immersion will suffice after which well brush to remove the dirt. Next lay the files edgewise in a wooden bath, leaving a slight space all round them. Cover them with water and add a quarter of its bulk of nitric acid, after which rock the tray regularly to enable the acid to well soak into and scour the files.

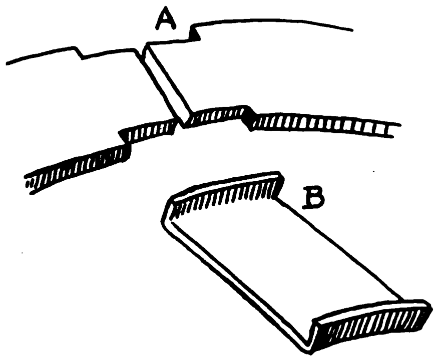
Fine files may be treated thus for a quarter of an hour, and rough ones about twice as long. Transfer to a pail of water and scrub with a stiff brush. Again place them in the acid bath, adding half as much more nitric acid as was added before, and wash in cold water. Add to the acid solution about one-eighth of its bulk of sulphuric acid. After the fumes have disappeared replace the files and continue the rocking motion for about one minute for fine files and three minutes for rough. Well rinse out all acid with water, and dry in front of the fire. When warm smear with oil, after which it will be seen that the files are rendered as clean as new. Files may undergo this process about twice, after which re-cutting is probably necessary.—(From Work)

Helping An Old Piston Ring

G. G. M.

When repairs are being made on the gas motor and new rings are needed but not at hand, a temporary repair may be made that will greatly help the power and will neither do harm to the motor nor prevent future repair parts from fitting.

Secure a piece of brass about 1/16 inch thick and form it as



shown at (B). This view of the piece shows with the bottom, from outside to outside. The piece should be the exact width of the piston ring. The sides are bent up and curved on their top edges to fit the curvature of the cylinder wall. The ends of the ring as at (A) are then notched with a file so that when placed on the piston the newly made brass plate will just fit under the ring. The bent up projections close the gap due to the wear of the ring and makes a good substitute for a new ring.

Straining Gasoline

JAMES F. HOBART

Strain gasoline by all means but don't use doubtful or greasy rags therefor and don't use a bunch of cotton waste thrust into a funnel for a strainer. I have seen gasoline strainers made with cotton waste and a funnel and twice have had the pleasure (?) of going all through the gasoline system, from tank to carburetor and removing therefrom a collection of lint which was torn from the waste and carried by the gasoline a bit at a time to be deposited all through the system.

Right in the carburetor, underneath the float valve was found a little ball or fine lint which actually prevented the float from falling properly when it should do so. If you may have been using a cotton-waste strainer, look into the carburetor immediately and see what evidence you will find there against the use of any cotton material whatever for gasoline straining purposes — Use chamoise skin and nothing else for straining gasoline.

Some Facts and Pointers For The Tire Repairman

BY GOOD RICH

Do not attempt extensive repairs on cases with separated fabric. The heat will expand the air between the plies and increase the damage.

Never proceed with repairs while the fabric is wet. See that it is thoroughly dried out.

Repairs on large cases cannot be cured through, unless the cure is finished on an inside steam vulcanizer. You can expect failure where this course is not followed.

Use only the best grade of benzine or gasoline. A low grade of these will affect your repairs more than you imagine. Complete and rapid evaporative properties are absolutely essential.

Blow the water out of your sectional vulcanizer occasionally. If you do not you will get some erratic cures.

Any air bag used in a size larger case than intended for must be properly padded, otherwise you will soon ruin it. Always use the proper size for each case.

The life of an air bag can be greatly prolonged if handled properly.

An air bag should never be removed from the case by grabbing hold of the tube. You will tear the tube sooner or later. Take the air bag by its lower end and force it out by putting the hand underneath it.

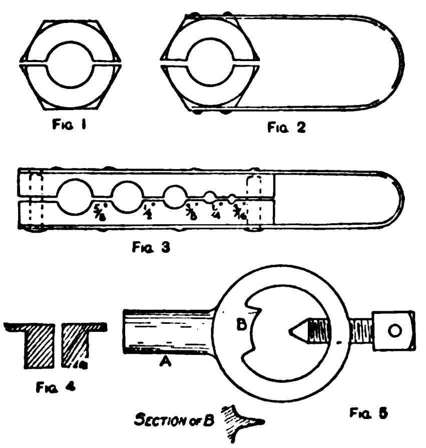
Round out your air bags with a little air when not in use. This helps preserve them.

Retreaded or repaired cases should be put in service immediately to obtain maximum service. They deteriorate faster than new cases and if held until the emergency arises for their use, they may prove unsatisfactory.

When removing a case from the vulcanizer, if it shows a tendency to blister, immerse in water. This will generally overcome the difficulty.

Extensive blistering of a repair usually comes from either improperly cleaning the carcass, moisture in the fabric or not allowing the cement to dry. Porous spots indicate insufficient pressure, unevaporated benzine or moisture in the cement.

Blowout repairs which go bad are due either to not stepping the



A NUMBER OF DIFFERENT WAYS FOR HOLDING THREADED WORK

fabric back far enough, failure to protect the edges of the new fabric with thin strips high grade gum, or lack of a thorough cure. Any unevenness in the repair will prevent an equal distribution of the strain and result in a hinge, which will soon break through.

Repairs will present a much neater appearance if the ragged edges are smoothed off with a file before the case goes out of your hands.

If only one or two plies of fabric on the inside of a case are broken, but these breaks appear at several places, it may be made to give its mileage by relining it with one or two plies of tire body fabric, the outside ply to be frictioned one side only. After thoroughly cleaning use a good quality vulcanizing cement.

After cementing a case for repair, do not place in a draft to dry. This allows a hard film or crust to form on the surface of the cement, while it remains soft underneath. Blistering will result.

There is such a thing as allowing cement to dry too long. Its adhesive qualities are thereby lost and the purpose of its use defeated.

Keep your gum stock clean and covered up from light and air. If dry, freshen up by wiping well with benzine. Do the same if soiled or dirty. Let benzine thoroughly evaporate before using stock.

If gum stock sticks to liner, wet opposite side of liner with benzine. This will remedy the trouble.

Dust cases and vulcanizer with soapstone before applying cure. For this purpose put two pounds of soapstone in a cheese cloth bag. It will sift through handily as you need it.

To overcome sticking of an old case to vulcanizer, apply a thin coat of rubber cement to case and dust with soapstone.

Clean out cavities of your vulcanizer with emery paper occasionally. This will remove all particles of dirt or old gum which otherwise will mar the appearance of your repair.

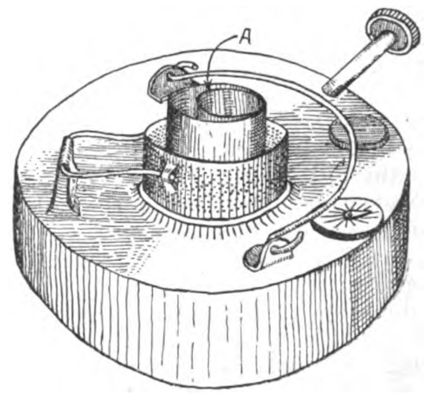
Holding Threaded Work In The Vise and Lathe

W. J. Harley

It is often necessary to hold work that has been threaded in a vise for some operation to be performed on it, but at the same time it is difficult to hold such work securely without risk of damage to the screw unless some device is used.

In the first method to be shown nothing more elaborate is required than a few various-size nuts, the sizes depending on the screws in use and which have to be held. Now if these nuts are cut in half as shown in Fig. 1 a ready holder is obtained by placing a half nut on each side of the screw and tightening up in the vise or other holder, as the case may be. Of course it will be obvious that each set of split-nuts must have exactly the same pitch of screw as the work to be held, otherwise the remedy will be worse than the disease. To avoid the necessity of holding the half-nuts as shown in Fig. 2. This will grip the nuts to the work while cramping it, and will also prevent the two halves becoming lost.

A rather more elaborate but at the same time a more useful device is the cramp shown in Fig. 3. It is made up from two pieces of square steel of size depending on the range of screws in use. Two pegs or bolts are placed through holes drilled at each end of these square blocks to act as a guide to keep these square blocks to act as a guide to keep them level. A spring can be riveted on as shown. With a thin piece of metal clamped between the two blocks holes can be drilled and tapped to take the various screws in use. It will readily be seen that to hold screwed work in a vice it is only necessary to place it in the correct position in the clamp and tighten up as desired. For lathe work it will be better to leave off the spring and tighten up the clamp with bolts through the ends, and using the whole thing as the carrier.



THE OIL HEATER LAMP BEFORE FIXING

Fig. 4 shows material of improved section which can be used instead of the ordinary square blocks. The lips of this section rest on the jaws of the vice, and for heavy work is a convenience.

A very useful carrier for a wide range of screwed work is shown by Fig. 5. It is made up in the form of a round ring with a projection A for driving purposes. A projection is also left standing within the ring, the section of which is shown at B. On the opposite side of the ring a hole is drilled and tapped to take a square-headed screw. This screw has a point, hardened and tempered, and has an angle of about 40°. This screw will tighten up work, allowing the projection B and the point of the screw to hold any threaded work between any two threads without damage.

These devices may be altered or modified to suit particular cases, but sufficient has been given to enable anyone to overcome the difficulty of holding any work of this nature safely and securely without any fear of the screw threads being damaged in any way. (English Work)

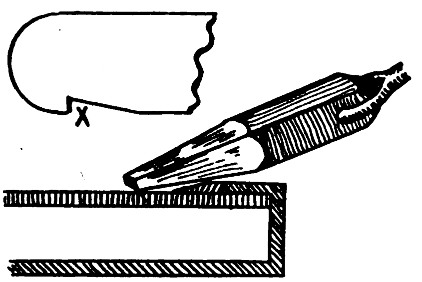
Repairing A Burned Oil-Heater

JAMES F. HOBART

Kerosene heating stoves occasionally go bad, smell badly, smoke horribly and even take fire and burn out, but I never yet knew of a case but where the trouble was with the user and not with the stove. Recently a stove used for heating a smithy office and which smoked badly, caught fire and was thrown out badly blazing.

It was a modern stove with flat lamp and improved stop to prevent the wick from being turned too high. Not a thing was broken or out of place with the lamp, save as shown in that engraving at A—the wick-tube had been bent to one side so that the wick could not be turned up or down. The hinged ring was also bottom side up and this position of the piece had caused the lamp to smoke badly because of a wrong admission of air around the wick. Somebody had ignorantly turned the ring bottom side up and in persistency in the use of the stove in spite of its smoke protest had resulted in its catching fire and being thrown out of the window.

Many stoves are found with a bent wick ring and the following proceedings may enable such stove lamps to be made as good as new as this one was. To straighten the tube it was necessary to melt the soldered joint at the lower end of the tube, pull the inner tube central and solder it in that position. To pull the tube into



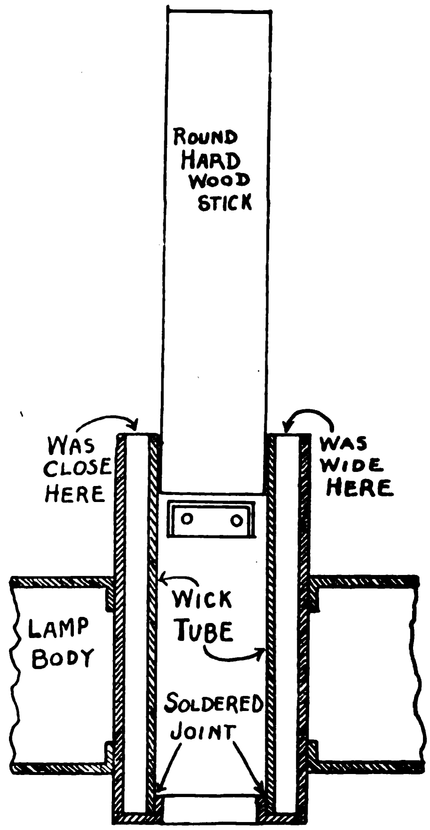
THE SOLDERING OF THE WICK TUBE GAVE A BIT OF TROUBLE

place, a round stick of wood was found which fitted tightly into the upper end of the tube and which was forced down to the clip which supported the flame baffle-plate—that piece which prevents the wick from being turned too high. Four little wooden wedges were then whittled out, each about a quarter-inch square and three inches long. These wedges were for holding the tube in place after it had been unsoldered and pulled into a central position in the inner tube. Placed at four points equal-distant they held the tubes firmly in place until they were soldered fast.

To unsolder the tube, the stove was placed over the fire. Only a couple of minute's heating was required to melt the solder, and the long stick served admirably as a lever for pulling the tube into place where it was quickly centered by the four wedges which held the tube securely until it was soldered again.

The soldering of the wick tube gave a bit of trouble for, as shown in the engraving the outer tube had been bent inwardly and brought up over the inner tube so that a soldering copper could not be put into the corner between the two pieces. The spreader clip prevented the copper being thrust through from the top end of the tube.

The joint was finally successfully soldered by scraping bright and clean the end of the turned-in tube and the adjacent side of the inner tube. The scraping was done with an old table knife, a scraper notch being filed therein as shown at x. After the adjacent surfaces had been carefully scraped bright, solder was bridged across them by holding the soldering copper as shown. After soldering, the lamp was filled with water and found tight. The stove when put together, filled and lighted, proved as good as a new one and is in constant daily use as required.



THE WICK TUBE HAD TO BE CORRECTLY CENTERED

The Cheap Job Of Repainting

W. A. R.

The best way to get at a cheap job of repainting, is to unhang it so that you can get at it conveniently. Some painters on a cheap job of repainting do not unhang the vehicle and this is where they lose time. Just count the time you are lying on your back trying to paint behind the springs and standing on a box to paint the top and the dirt you have to contend with. After all it will be an inferior job of painting, if done this way. A good painter would take it apart by all means. You can do better work, more pleasant work, and time will be saved, and saving time and stock is a big item nowadays, considering the prices for repainting. I have seen a few painters working with the top on and will say that I have never yet seen a clean job when finished. The vehicle with the top on takes up more room (which is an important consideration in the small shop), is harder to handle, and in the end nothing is gained but hard work to get a good clean job.

After unhanging your cheap job of repainting, number everything that is with the job, wash good and clean the grease off the gear, etc. While you are cleaning up, and when the body is dry, sandpaper the body and give the same a coat of rough stuff and white keg lead, not mixed with oil or japan. There is enough oil in the rough stuff to answer all purposes if ready mixed. Never use oil in a cheap job of painting, as you have not the time. and then this roughstuff with turpentine is ready for use. After this coat is dry, glaze or putty all over if needed. If you can get your putty on smooth, do not sandpaper as some do. Save time by just putting one or two more coats of rough stuff. Now rub down all together. You save time and that hard sanding, and you secure as good a job. Do not attempt to secure a good job by just coloring over the old paint, and varnishing. Always roughstuff your body as I have before stated. After you rub your body out of the roughstuff, sandpaper lightly. Next give the body a coat of solid covering color varnish; rub and finish.

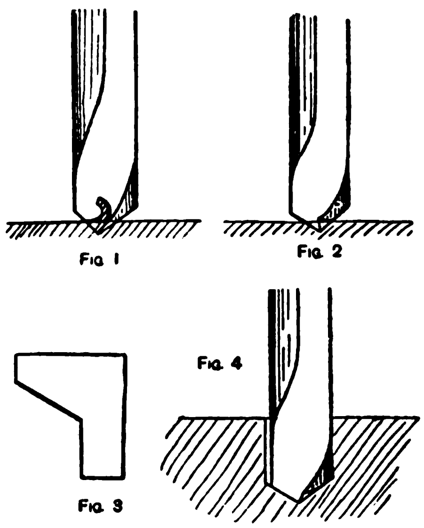
Now use a good body varnish for the gear, if it is in fair shape, sandpaper and then give it a coat of varnish. You can get any shade or color of varnish that you wish. After the color varnish is dry on the gear, moss and stripe. Then have a good gear varnish to finish, and for this purpose there is nothing better than Valentine's one-coat coach varnish for body or gear. I notice that the Valentines are making a four-day system and, although I have never used the same, I am quite sure it is O. K., if it is half as good as their varnishes which I consider the best made, even if a little higher in price than some. Valentine solid covering color varnishes can be purchased in quart or any size cans for repair work. For new spokes, runs, shafts or anything you repair that needs a coat of paint that will cover well and dry quickly, they have just the thing in small cans preventing waste. Try it. And while speaking of varnish, let me emphasize the fact that of all liquid coatings varnish demands extreme care. In fact, the painter cannot use too much care in producing a perfect surface. You may use the best varnish made, but if you do not use care in selection of your working utensils, you may just as well use the cheapest grade of liquid obtainable. Look carefully to brushes—see that they are clean. A dirty, dusty brush cannot produce a clean varnished surface; and the same applies to the containers for your varnish. Then the surface to be covered is also of great importance—its condition has a direct bearing on the result obtained. It must be clean, smooth and perfect if you desire the varnished surface to be clean, smooth and perfect. If the unvarnished surface is not exactly right, don't rely upon the varnish to cover the defect. That isn't what varnish is for.

A Talk On The Grinding Of Twist Drill

W. J. HARLEY

IN WORK

TO grind correctly a twist-drill is not so simple a matter as would at first appear. One only needs to examine a number of drills ground by hand to find faults, the presence of which makes the production of an accurate hole impossible. There are so many errors in human judgment, and so many



GRINDING TWIST-DRILLS. FIG. 1—SHOWING TOO MUCH CLEARANCE. FIG. 2.—SHOWING NO CLEARANCE. FIG. 3.—USEFUL GRINDING GAUGE. FIG. 4.—EFFECT OF UNEQUAL LIPS

possible variations from the correct shape, that entirely to eliminate every source of inaccuracy would need machine grinding. It is, however, possible to grind reasonably accurately by hand, and if the most glaring sources of error are pointed out it will at least give the worker some idea as to what to guard against.

In the first place it must be noticed that a twist-drill is manufactured to a standard shape, having a definite angle of clearance for both its lips. This angle is easily altered by grinding, and too much or too little clearance may easily be imparted. The effect produced in each case is harmful. In Fig. 1 is shown the effect of too much clearance. The keen edges of the drill in this case bed themselves too far into the metal (especially if soft material is being worked), and tend to tear it out in lumps far beyond the capacity of the drill. In consequence one obtains either a rough, torn-out hole, a broken drill, or perhaps both.

In the case of too small or no clearance, as shown in Fig. 2, the cutting edges of the drill fail to bite into or enter the metal, and therefore the drill fails to cut. The result is that the worker tends to crowd on more force to get the drill to start cutting, with the results that the drill grinds itself upon the work, gains heat which probably draws the temper of the drill, and ultimately fails altogether, becoming too soft for further use until it is re-hardened, tempered and ground in the right way. At the same time, it is quite possible that the work itself may be spoilt altogether.

In grinding, therefore, be especially careful to give the lips of the drill the same angle relative to the axis of the drill, and see that both have the same clearance angles. A gauge made, as shown in Fig. 3, to the correct angle of the drill before grinding will help a little to keep within working limits.

Another common fault is unequal lengths of the cutting edges of the drill, which means that the actual point of the drill is not in the center. Whilst grinding, these lengths should be checked by careful measurement. The result obtained by unequal grinding is that the hole after drilling is somewhat larger than the actual size of the drill, a method often resorted to in drilling a hole larger than the size of the drill, when no other drill is obtainable. The drill with unequal lips, instead of cutting a concentric hole, cuts an eccentric one, as shown in Fig. 4. A good test for this fault is to push the drill through the hole after drilling. If everything is correct it will be an exact fit in the hole, but if the lips are unequal the drill will drop through quite easily. A similar result, it must be borne in mind, is produced by a drill with a bent shank.

The unequal grinding of the lips produces another fault, namely, one lip is more prominent than the other, and therefore does the whole of the work. It must be remembered that in the case of a feed of one hundreth of an inch per revolution of the drill, each lips cuts one two-hundredth part of an inch per revolution. If, therefore, one edge is too prominent it must cut more than its allotted portion.

When The Frost Is On The Pumpkin

JAMES WHITCOMB RILEY

Editor's Note:—There is probably not a single reader of "Our Journal" who has not read this famous poem. Ye Editor has read it periodically for lo, these many years and his only excuse for putting it on this page this month is because it is most appropriate this month. Read it now giving a thought to the season and to this most glorious time of year.

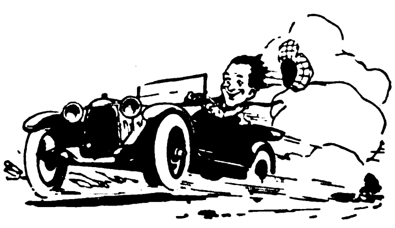
When the frost is on the punkin and the fodder's in the shock,
And you hear the kyouck and gobble of the struttin' turkey-cock.
And the clakin' of the guineys, and the cluckin' of the hens,
And the rooster's hallylooyer as he tiptoes on the fence;
O, it's then's the times a feller is a-felin' at his best,
With the risin' sun to greet him from a night of peaceful rest,
As he leaves the house, bare-headed, and goes out to feed the stock,
When the frost is on the punkin and the fodder's in the shock.

They's something kindo' harty-like about the atmusfere
When the heat of summer's over and the coolin' fal is here—
Of course we miss the flowers. and the blossums on the trees,
And the mumble of the hummin'-birds and buzzin' of the bees;
But the air's so appetizin'; and the lanscape through the haze,
Of a crisp and sunny morning of the airly autumn days
Is a pictur' that no painter has the colorin' to mock—
When the frost is on the punkin and the fodder's in the shock.

The husky, rusty russel of the tossels of the corn,
And the raspin' of the tangled leaves, as golden as the morn;
The stubble in the furries—kindo' lonesome-like, but still
A-preachin' sermuns to us of the barns they growed to fill;
The strawstack in the medder, and the reaper in the shed;
The hosses in theyr stalls below—the colver overhead!—
O, it sets my hart a-clinckin' like the tickin' of a clock,
When the frost is on the punkin and the fodder's in the shock.

Then your apples al is gethered. and the ones a feller keeps
Is poured around the celler-floor in red and yeller heaps;
And your cider-makin's over, and your wimmern-folks is through
With their mince and apple-butter, and theyr sauce and saussage, too;
I don't know how to tell it—but ef sich a thing could be
As the Angels wantin' boardin' and they'd call around on me—
I'd want to 'commodate 'em-all the whole-endurin' flock—
When the frost is on the punkin and the fodder's in the shock.

High Spots



Watch your collections and then your creditors won't need to watch you.

Paint and Labor both cost money but decay costs more than both

Exercise of brain is as necessary to health as exercise of body. Does "Our Journal" make you think?

To make a change is not always best but it shows that you are alive—and sometimes that is necessary.

Before they will balk most businesses will stand a heap of prodding. Now is a good time to prod.

Exceeding the speed limit is usually disastrous, whether on the road to success or the road to ruin.

"Ever notis thet the cheery cuss who helps others helps himself more while the grouch loses more than anyone." Says Uncle Ezra.

To keep expenses down is commendable of course, but don't let the vehicle of business go to ruin for want of a litle oil or grease.

You Excel your competitors in some way. Find out what that "some way" is and then shout it from the shop front by means of a sign. Make a big noise about it. It will bring trade your way.

The motto Card over a Sales manager's desk reads: "The bee that gets the honey, doesn't hang around the hive." The motto card in a smith shop reads: The ant that digs in one spot soon has a home."

Watch out for that series of articles on "Standard Mechanical Practices." They start soon and will prove a feature of the mechanical literature of the present age. You'll want to get the full series, too, so renew promptly.

What are you doing to broaden your field of business? One general smith we know has just erected a new sign which reads. "Bring Your Hay and Gas Motors Here for Fixing." Another one reads.—Horse and Motor Vehicle Work of all Kinds Done Properly and Promptly."

The best smithy and repairman in the county you may be, but who will know if you do not tell of it? Let the country round about know what you can do and how well. Persistency in keeping your name and business before the people will win every time.

Single cylinder methods won't do for these six and eight cylinder days. Keep abrest of the times. The Modern year demands modern methods. Because your grandfather did it that way is no reason why you should do it that way. It is a case of keeping up with the leaders or dropping out of the race.

To hear from every reader would please us—we want to know how "Our Journal" is fitting in. If it is giving you the information you want tell us if you want information on subjects not covered we will get the information for you. This is your paper.—We want you to use it. We want you to get the full value out of every issue. Write; right now. The Editor will be glad to hear from you.

Better than one by far are two heads. The mutual consideration of methods and ways of doing work. the exchange of ideas and the voicing of suggestions and opinions— these things all bring out the best that is in us as members of the good old craft. Let us one and all resolve to make more use of "Our Journal" as a medium for the exchange of ideas and opinions

Tom Tardy will be remembered by many of you older readers as a more or less famous smith of the old type who, though claiming an experience of some twenty-five or thirty years at the trade, is still lacking in real knowledge of the good craft. Tom, to describe him briefly, is one of the individuals usuallly associated with the chronic easy chair habit in fact many of you will recall his troubles in attempting to keep his old arm chair in the shop in usable repair. We have located Tom again and will endeavor to chronicle his activities, (if his doings may be so dignified) from month to month. We feel certain that "Our Folks" will be glad to know of our old friend again.

THE RICH CONTRACTOR

"It is said that a certain contractor well known throughout Ohio, started out poor twenty years ago, has retired with a comfortable fortune of $50,000. This money was acquired through industry, economy, conscientious effort to give full value, indomitable perseverance, and the death of an uncle who left him $49,-999.50."

HORSE FACTORY

"Mamma," said a little boy after coming in from a walk, "I've seen a man who makes horses."

"Are you sure?" asked his mother.

"Yes." he added; "he had one nearly finished when I saw him; he was just nailing on its back feet."

The husband, who had a great habit of teasing his wife, was out driving in the country with her, when they met a farmer driving a span of mules. Just as they were about to pass the farmer's rig the mules turned their heads toward the auto and brayed vociferously.

Turning to his wife, the husband cuttingly remarked, "Relatives of your, I suppose?"

"Yes," said his wife sweetly, "by marriage."

Cashing In On Accidents

Detroit Shop Specializes In Wrecked Auto Service

D. G. BAIRD

THE city of Detroit goes to great pains and expense to prevent traffic accidents. In addition to maintaining a large and efficient traffic force, the city enforces drastic traffic rules, carries on educational campaigns for the purpose of warning the public of the danger of accidents, and once each year stages a safety campaign in which parades of wrecked automobiles and trucks are featured.

> This interesting story of a Detroit wrecked auto service contains a number of suggestions for readers of "Our Journal." Not many readers are located so they can go so elaborately into auto repair service as the Detroit company, but there is profit to be made in real service of this kind and it can be planned according to locality and need.

Notwithstanding these precautions, however, Detroit motorists continue to make junk of their vehicles at such at rate as to furnish ample excuse for the existence of a shop that fattens on the accidents of others. The Olympic Wrecked Auto Service specializes in picking up wrecks that are beyond the ability of the usual service station to handle and picks up something like 250 wrecks a month, the year around.

Unusual Equipment

This shop operates five complete Nash Quad wreckers and is prepared to pick up any kind of wreck in any location in the state. If the car to be handled happens to be in a ditch twenty or thirty feet deep, so much the better for the wrecking crew. Their cables will hoist any car or truck out of a ditch fifty feet deep with ease.

The wreckers have a four-wheel, direct drive with a power take off that operates a wrench capable of lifting 35,000 pounds on a direct lift. Each truck is equipped with two pairs of extra wheels and axles, so that in picking up a wrecked car they can, if necesary, mount the wreck on their own wheels and haul it anywhere. The slogan of the shop is: "We Pick Up Cars—We Do not Drag Them."

These wreckers are operated on a twenty-four hour schedule every day in the year. As the Olympic Wrecked Auto Service has exclusive rights to the use of the Nash Quad in the state of Michigan, they are frequently called upon to go far out into the state and pick up wrecks. Some of these are shown in the accompanying illustrations.

One is that of a five-ton truck that has fallen through a wooden bridge on a country road, several miles from Detroit. The rear end of the truck is down in the ditch, while the entire machine is turned over on its left. This was a very easy job for the wrecker, however, as all that it had to do was to pick up the rear end of the truck, swing it upright, and let it drive off on its own power.

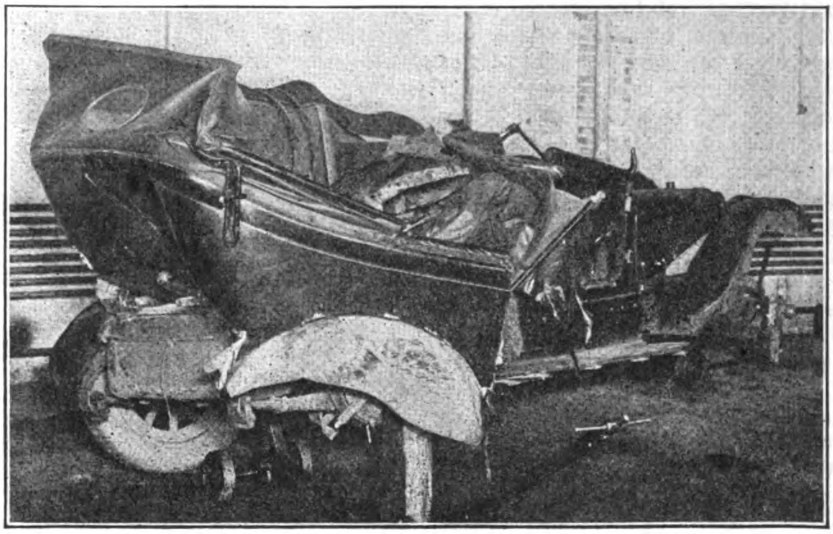
The completely wrecked passenger car shown in the other ilustration is a Winton after it was struck by a Grand Trunk railway train and hauled into the Olympic shop. This car was hit by a passenger train and its two occupants were killed in the wreck. The remains of the car were picked up by the Olympic Service, hauled several miles to their station, and there held as evidence for the coroner's investigation.

Fishing Automobiles Out of a River

Detroit has a river front of some nine miles on the Detroit River and a favorite sport of observers of the eighteenth amendment is that of giving their vehicles an early morning bath in the cool waters of this stream. So popular is this pastime, in fact, that the Olympic people find it necessary to have a deep-water diver at their service at all times. This diver does not, of course, devote all his time to going down after automobiles, but the wrecking company has an agreement with him that he is to dive for them at a moment's notice, no matter what other work he may have on hand at the time.

When J. W. Winthrop was deceived by the light on the water and mistook the Detroit River for a stretch of wet pavement, driving his Ford sedan into thirty feet of water, for example, he thought his car was irretrievably lost and that he himself was very fortunate to be alive after going down with it. But the Olympic Service found little difficulty in getting a hook onto the rear axle of the machine and in hoisting it onto the dock. A few minor repairs made it as good as new and Mr. Winthrop vowed never again to get within a city block of the Detroit River at night.

SOMETIMES A CAR IS QUITE BADLY SHAKEN WHEN HIT BY A TRAIN



Night Is Busiest Time

One would naturally surmise that the majority of accidents would occur during the day because of the fact that there is far more traffic during that period than at night, but such is not the case.

"Our busy period is from midnight to three in the morning," declares E. W. Cole, service manager. "During the day we have comparatively little to do, as a rule, but about midnight business picks up. Home-brew enthusiasts who have been having a little party at the home of friends, boot-leggers who ply their trade in the night time, and those who patronize them

THIS FIVE-TON TRUCK DID MORE DAMAGE TO THE BRIDGE THAN TO ITSELF

start out in their cars and meet with all kinds of mishaps."

"Nearly all accidents are caused by drunkenness, carelessness, or bull-headness," says Mr. Cole. "The first-named being the most common source ofb usiness for the wreckers. When one has imbibed a few drinks of the kind of whiskey to be had these days one is likely to do almost anything. Men have been known to try to make their cars climb telephone poles, while others have driven at high speed straight into the river, apparently on purpose."

In addition to the serious smash-ups, the Olympic also gets a great deal of night work that would be handled by the service stations if the accidents occurred during the day. Many service stations do not operate at night, so when a call comes for a tow for one of their customers it is turned over to the Olympic and they haul him to his service station and collect from the latter.

In such cases the service station which turns over the business is given a discount of twenty per cent. The Olympic station takes care to see that the owner is not overcharged for the service, however, by mailing him a post card (shown in the engraving) on which he is informed that on a certain date they hauled his car from a certain place to a certain service station and it states their charge. The owner is asked to notify them of any overcharge or discourtesy. At the bottom of this card the rates of the Olympic wrecking service are given and the recipient is asked to preserve these.

These rates, acording to the card, are $4 for straight tows inside the Boulevard circle (about four miles from the center of the city) where owner steers car; $6 an hour where one or both ends of car have to be loaded, and $10 an hour for wrecking service with trucks. Mud pulls, ditch work, acording to job. In making runs into the country, the company charge either an hourly rate, a mileage rate, or a contract price for the job.

When a call for the wrecker comes in, a blank is immediately made out in triplicate, showing the date, run number, name of owner address, license number, make of car wreck location, where the car is to be taken who called, remarks, received by time out, time in driver, and amount of charge. This order is stamped in an electric clock showing the exact time the wrecker left and returned. One copy of the order is then filed under the heading of make of car, another according to the number of the job, and the third is held until the bill is paid.

This firm is custodian for the sheriff of the county and gets a great deal of business from him and from the police. Cars to be held on writs of replevin, for coroner's investigations, and for identification are towed in and held at the service station.

Rebuilding Wrecked Cars

The Olympic Company also rebuilds wrecked autos, about seventy per cent of the wrecks that they pick up being left with them for rebuilding. They will, however, haul a wreck to any garage or service station, the owner being under no obligation whatever to have his work done in their shop.

All rebuilding is done on a straight contract basis. The car is carefully inspected and a list of repairs and parts needed is made, then the owner is told just exactly what is will cost him to have the job done, and it costs just that. As the majority of their jobs are the complete rebuilding of cars, these costs usually mount up into hundreds of dollars each. In case the owner thinks the price asked is excesive, he may bring in the other garage or service men and have them bid on the job right there in the shop. The Olympic invariably gets the work under such circumstances, because they are specialists in that line and know the costs of such work better than others.

The company retains all salvage and that which is worth anything is sold as used parts.

Getting The Business

As no other service station in the city is prepared to handle all kinds of wrecks and smash-ups, the Olympic people have little competition in their special field. They do, however, go to considerable expense in advertising to let the car owners know where to find a wrecker in case they need one.

Two half-pages and one full page of advertising matter are run in the city telephone directory, and mile-board signs are posted on all the principal roads within a radius of forty miles from the city. Employees wear uniform overalls, on the backs of which appears the name of the company, and the wrecking machines themselves are conspicuously decorated with advertising matter.

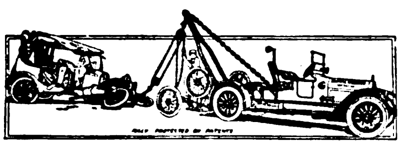
During the safety-week campaigns promoted by the city, the Olympic people always take part in all the daily parades, hauling actual wrecked cars through the streets of the city and bearing signs telling something of the circumstances of the accidents which resulted in the smash-ups.

More accidents occur during the winter than during the summer, but the Olympic Service keep their five wreckers fairly busy hauling in junk that once was automobiles all the year around.

Watch The Push-Rods

JAMES F. HOBART

When you are grinding in an engine valve without removing the push-rod, watch out that the valve is not resting harder against the rod than it does against its seat. A young mechanic worked hard grinding a valve under similar circumstances and could not make the valve come "down" to a fair bearing and he was very "weary" when an experienced friend showed him how the valve stem was bearing "hard" on the push rod as well as "almost" against the valve seat.



Dear Sir:
We hauled your car as follows:

Make of Car ....

Date ....

From ....

To ....

Our Charge is $.................... PAID / CHARGED

Kindly advise this office of any overcharge, or any uncourteousness on the part of the drivers.

CUT CARD HERE AND KEEP STUB

OUR RATES ON WRECKING SERVICE

Straight Tows inside Boulevard circle, where owner steers car $4.00
Wrecking Service, where one or both ends of car must be loaded, per hour $6.00
Wrecking Service on Trucks, per hour $10.00
Mud Pulls, Ditch Work, according to the job

OLYMPIC WRECKED AUTO SERVICE
124-128 SPROAT ST. :: PHONE CADILLAC 1191
WE RE-BUILD WRECKED CARS
Estimates Cheerfully Given

A CARD IS SENT TO CAR OWNER TELLING HIM CHARGE FOR HAULING

Always make doubly sure that a valve is free to rest upon its seat before you begin grinding. Place a thin steel "feeler" or a sheet of thick paper—the steel is by far the best—between valve stem and push-rod and in that manner make sure that not only is there space between valve and rod, but that there is space enough to take care of lowering the valve during the grinding-in process.

Stellite—The Wonder Metal

R. C. ROHRBACKER

> Here is a story that reads almost like a fairy tale. Even in these days of continual surprise in industrial and mechanical development, a metal so hard, stainless and proof against rust would be a marvel. Yet here is such a metal, and in addition to these advantages to a luster rivalling silver and it never tarnishes. But then, this is a wonderful age despite the howls of some folks for the "Good Days of Old." Read the story of stellite and its wonderful qualities.

HARDER than steel; having naturally a temper that heat treatment cannot alter; susceptible of being given the keenest and most enduring cutting edge ever known; unaffected by heat up to 1500° F., excepting that it is tougher at red heat than when cold; impervious to rust; immune to the attacks of ordinary corrosives and acids: of luster outrivalling burnished silver and that never tarnishes; having as well many other properties and qualities not found in any other metal either element or alloy—that, in brief, is Stellite, the metal that has revolutionized industrial practices, established new operative standards in surgery, served even the arts, and that has given to science one of the most useful and most extraordinary discoveries of modern times.

These seemingly extravagant claims for Stellite are really not immodest, but are carefully conservative and are measured only by what is definitely known of this wonderful alloy.

A dozen years ago Stellite existed only in the imagination of its creator, but he did not then fairly vision the broad field of usefulness it was destined to occupy. Even now, when its composition, general properties and present applications are known, may not be said with certainty what will be its scope of utility some years hence.

Before going more fully into the properties and uses of Stellite let us touch briefly upon the origin of the alloy. Very few worth-while scientific achievements leap heaven-born from the brain of man. Most of them are the fruit of years of questing into the mysteries of natural phenomena, years of alternating discouragement and hope, of almost grasping elusive ultimates, of repeated failures that are really stepping-stones of progress, because experience gained through errors suggests their avoidance in the future, thus pointing the true way and rewarding at last the scientist who perseveres with fidelity and patience.

REPAIR ORDER

Name W. J. Brown

Address 1021 Cherry Street Phone Mn.1926

Car Jordan License 23497

Date June 30, 1921 Job No. 1197

WORK TO BE DONE

Straighten frame--front and rear
Straighten horns
Straighten front axle
Repair front springs
Straighten tierod
Straighten steering rods
Straighten right running board bracket
New right running board
New right front fender
New right dust shield
New right rear fender
Repair body and doors
Repair rear end
New right rear wheel
Straighten brake rods
New brake arm
New left rear fender
New tail light
New wind shield glass
New motometer and cap
New right door glass
Repair bumpers

We Retain all Salvage

Contract Price on Above Repairs $ 463.75

Work not listed in Contract will be charged additional. Agreed and

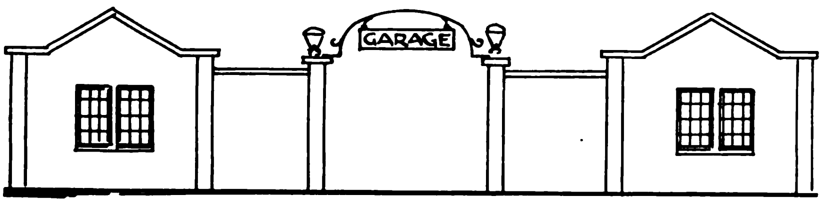
Signed by W. J. Brown

THIS LEAVES NO QUESTION ON CHARGES FOR WORK TO BE DONE

The story of Stellite began thirty years ago when the eminent physicist, Elwood Haynes, builder of America's first automobile and discoverer and patentee of stainless steel, a student at Worcester Polytechnic Institute, began a study of the effect of tungsten on iron and steel. It was a subject of which little was then known, but with the development of the automobile, dating from the early nineties, came practical application of tungsten as a metal alloy. The formulae worked out by Haynes in the eighties, were carefully recorded and preserved, and they are recognized today as fundamentally the basis of all alloy steels.

One might suppose that, with the

automobile, alloy and stainless steels to his credit, the researches of the scientist would relax. But his was an inquiring mind that would not rest. Success only whetted to greater eagerness of effort a nature that could never be reconciled to retire on laurels won.



FRONT ELEVATION OF THE GARAGE SHOWING ENTRANCE

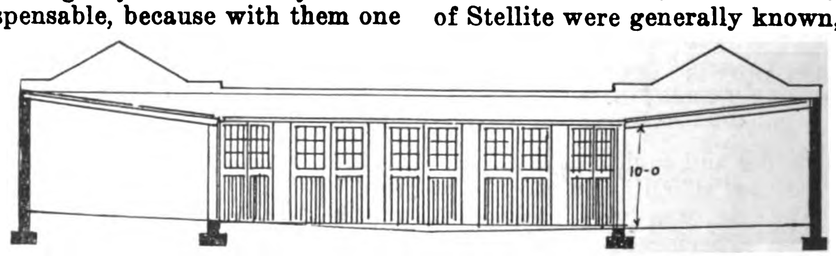
From the first, in the back of his brain had glowed an unsatisfied idea, viz: the discovery or production of a metal combining the cutting qualities of steel with the imperishable luster of gold and platinum; in fact to unite in one master metal the best features, qualities and properties of all metals. Stellite was the reward of his perseverance.

Stellite Products

Among the products that are now being manufactured from Stellite are: high-speed cutting tools of every description, surgical and dental instruments, pocket-knives, table cutlery, chemical apparatus bearings bushings cloth and fabric-cutting knives, fruit slicing and skining knives, heat-resisting scrapers, forming tools, rollers gauges, parallels "V" blocks punches, bending dies, forming dies drawing dies thrust washers discs, valves valve seats, glass moulds, plungers for pressing hot glass bottom plates, ladles crucibles and surface plates resiting acids or heat up to 1500° F.

In reviewing the extended list of present uses of Stellite one may well imagine that Mr. Haynes must occasionally indulge a deflective smile when he recalls the lonely little inspiration that set his mind working on the problem of winning a master metal for the world. His one idea, and one that persisted throughout, even when Stellite's greater uses unfolded before him, was to manufacture table-knives. Just as he was preparing to carry out his original plan the war stepped in with its demand for war materials of every kind, calling for enormous production and drafting every available energy and resource to speed up factory out turn. The output of most plants was limited to the speed with which lathes and other machine tools could be operated, and their speed in turn depended upon the limitations of the efficiency of the cutting tools in use. It is well known that steel tools cannot be operated above certain definite speeds, because above those speeds the tools heat so rapidly that their temper is ruined. By using Stellite, which cuts better at red heat than when cold, cutting speeds could be safely increased. In many instances speeds were doubled or trebled, and in some cases multiplied many fold. Because of its hardness, Stellite did not have to be ground so frequently, which resulted in additional saving of time. Also, by its use, specially heat-treated castings and forgings that could not be handled at all by ordinary tools were easily and speedily machined. Stellite, indeed, was the only means by which many plants were enabled to materially increase their output during the war, because in so many instances additional men, machinery and factory space were not obtainable.

Out of the experience of the war the world gained many valuable lessons. Not the least valuable, certainly, was that Stellite cutting tools are supreme wherever speed production is necessary. In periods of emergency and rush they are indispensable, because with them one



SECTION THROUGH BUILDING FROM A TO B OF PLAN VIEW

machine and its operator or crew will do the work of two or three machines and crews using any other high-sped cutting tools. Very naturally, Stellite has been retained in plants where operating efficiency and economy are closely observed; and naturally, also, its uses, originally confined to lathe tools because it was at first supplied only in the form of bar stock have been greatly extended to embrace drills milling cutters and every other form of high-speed cutting tool that is used. Moreover, the properties it exhibited in the large machine shops of the country readily suggested other uses, some of which may be said to have "arrived", while some others are still under investigation. The adaptability of Stellite for ball bearings is now in process of determination. The problem in this case is not one of suitability, but rather a problem of casting. There can be no doubt that Stellite ball bearings would be superior to any other, especially in any mechanism where the bearing is submerged in water or exposed to either moisture or grit, as in the case of certain drilling and pumping machinery. Experiments are also being made to determine the adaptability of Stellite for bearings that are exposed to salt water and that cannot be lubricated, as in certain instances that occur in marine construction. Here again the problem is mechanical, and apparently it is one that will be satisfactorily solved. One very interesting use of Stellite that has developed recently is in rolling mill work. One of the Pennsylvania mills is using a large Stellite scraper to clean the scales from billets and plates as they issue from the rolls. This use was thought of and definitely solved by the steel people themselves. The development is so recent that is has received no publicity and only the barest statement concerning it is authorized at this time.

Other Uses

Even before the industrial uses of Stellite were generally known, it was quite extensively used for the surgical profession. Government records show that the Stellite factory turned out 30,000 scalpels for the War Department during the war. It was the returning army surgeons, familiar with the use of these instruments in overseas service, who determined the future of Stellite in this field. They brought back such glowing accounts of the new instruments, instruments that were stainless, that were susceptible of a keener cutting edge than it was possible to give to steel, instruments that were not affected by acids or other means employed in sterilizing, that could be held over the Bunsen flame until red hot without impairing their temper, instruments of exceptional and enduring duty —such reports, in fact, that a demand for Stellite became immediate in not only the surgical but the dental profession.

From scalpels to pocket-knives is a short step mechanically. Stellite pen-knives were designed and manufactured. They are real gems little masterpieces of beauty and excelence, quite unlike anything else in the line of pocket cutlery. Stellite table-knives are also manufactured now. Like all other Stellite products, the blades have inherent and enduring temper, are stainless and rust-proof, resist all fruit acids, and take and retain permanently a brilliant polish.

Doubtless there will be many other uses discovered or developed for Stelite, but it seems at the present time that its great field lies in the speeding up of production in those processes that depend upon high-speed cutting tools.

A Practically Arranged Garage and Repair Shop

JOHN Y. DUNLOP

THE average public garage as generally arranged is a large single room where cars may be parked along the walls and where each car owner has access to the entire room. This type of car shelter has the very serious objection however of affording no protection for the contents of the individual cars nor for the accessories which may be carried. In fact some garage proprietors go so far as to state plainly that no responsibility accepted for rugs, clothing or other articles left in cars.

This has given added popularity to the individual garage or "stall" where the car owner can store his car and have it under lock and key. Each car stall or shed in such a garage is let very much as a house is let. Each car owner leases his individual car apartment for a definite length of time and can come and go as may please his fancy. The same advantages are to be had in the large public garage with respect to washing service, repair service, and there is of course filling station in connection.

In the engraving showing the plan of the car stalls it will be readily observed that each stall or shed is inaccessible to anyone except the car owner who has the key. For the purpose of repairs and washing service on the absence of the owner it would be an excellent idea to have all of the locks operate on the master key principle. On this plan, each owner could unlock none other than his own individual stall. The garage attendant however could with his master key open any compartment, this as stated, for the purpose of working upon the car while not in use.

The building for this stall arrangement is best made of brick, the outer wall being 14 inches in thickness while the partitions are 4 inches and of cement slabs. Local conditions may however make a brick wall prohibitive in cost and possibly other fire proof construction will be necessary.

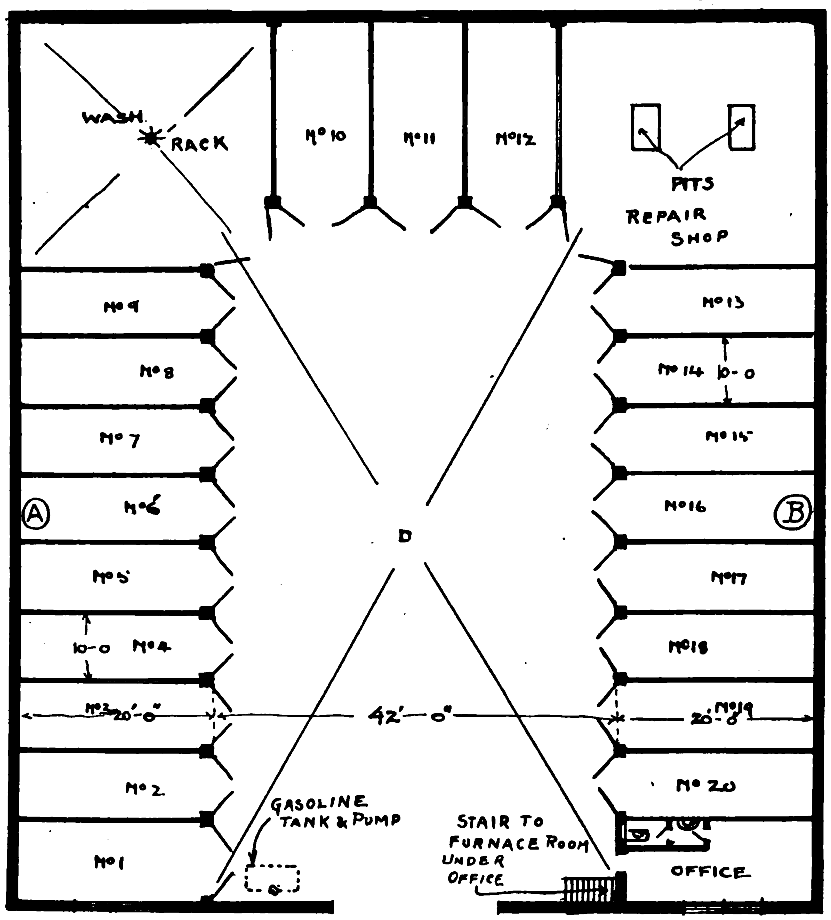
The roof of each compartment is of 9 by 3 inch rafters laid on 18 inch centers and covered with patent roofing. The roof has a slope of two feet.

It is almost unnecessary to say that each compartment is as nearly fireproof as possible. To reduce the fire risk the ceiling of each compartment should be covered with one of the asbestos plaster sheetings now to be found on the market.

The flooring of both the yard and also the compartment spaces is best if of cement, but this in some localities may involve a larger expenditure than seems expedient and a good bed of deeply laid cinders if well rolled and heavily packed will suffice.

It will of course need to have some arrangement for heating the compartments in the winter and a furnice room is arranged for in the space beneath the office. This may be reached by means of a stair leading down from the office room or may have a stair located just outside the office door.

The plan as drawn shows the gasoline service pump just inside the yard entrance. A better loca-



PLAN OF GARAGE SHOWING CAR STALLS AROUND DRIVE YARD WITH WASH RACK AND REPAIR SHOP IN REAR CORNERS AND OFFICE AND FILLING STATION IN FRONT tion however would be at the curb just to one side of the entrance incline. This will be much more convenient for the trancient motorist and yet be just as convenient for the tenent car owner.

The washing rack and repair shop are located in the corners and are lighted from the roof. The car compartments are of course fitted for electric lighting. The reader will of course understand that there is no covering over the middle section between the two lines of sheds. This part is open for the movement of cars from and to their stalls.

An excellent and very practical idea in connection with the building and starting of a string of stalls built on this plan would be to lay out the entire plan as here described and then to build only as many sheds as could be readily rented. The compartments could then be added to from time to time as additional tenants were secured.

Building a Two-Room Camping Van

R. H. LOMAS

THIS van, a side elevation of which is shown in the engraving at Fig. 1 is designed for use either as a trailer behind an automobile or to be drawn by a team if desired. Light weight combined with strength has been the guiding principle in its design and construction—says Work.

The body is 15 ft. 6 in. long over the lower end of the corner pillars, the veranda or platform at the front projecting 2 ft. 2 in., the width at the bottom of the pillars being 6 ft. 9 in., and the height at the sides measured over the frame 6 ft. 5½ in. The sides and ends are splayed 1½ in., making the length and width 3 in. larger at the top to take off the box-like appearance.

The van is divided into two compartments, fore and aft, by a partition with two sliding doors. Access is also gained to each compartment by a separate door to each, one at the front and the other on the near side, so that there is no need to go through one room to enter the other.

The interior dimensions are: Front compartment containing the cooking stove, 6 ft. 2 in. long; back compartment or saloon, 8 ft. 10 in. long by 6 ft. 5½ in. wide at the floor; height at sides, 6 ft. 2¼ in., and height at centre to underneath clerestory roof, 7 ft. 6¼ in. Height of body from the ground, 3 ft. 6 in.

The seat in front on the right hand side has a storage box beneath it. This seat is of course optional and will probably not be necessary if the van is used as an automobile trailer.

Two windows on the near side of the body, and one in the upper half of each door, together with the roof lights, will admit sufficient light without having windows on the off-side, which would interfere somewhat with the furnishing of the interior, the blank side, moreover being an advantage should the necessity arise of placing the van against a wall. There is also a small window placed in the back of the van.

Fig. 2 is a front view of the van showing the shaft A that carries the brake hand-wheel fixed at an angle to enable the screw and stay to be situated as near the centre of the body as possible and so equalize the stress on the roller or spindle carrying the lever and flaps to which bloks c (Fig. 1) are fixed.

It will be seen that the front door is in three parts, the lower one being hung to the off-side pillar, and the upper halves made to fold back on both sides, all three sections opening inwards.

Fig. 3 is a back view showing the back window, the cupboard with double doors between the wheels,

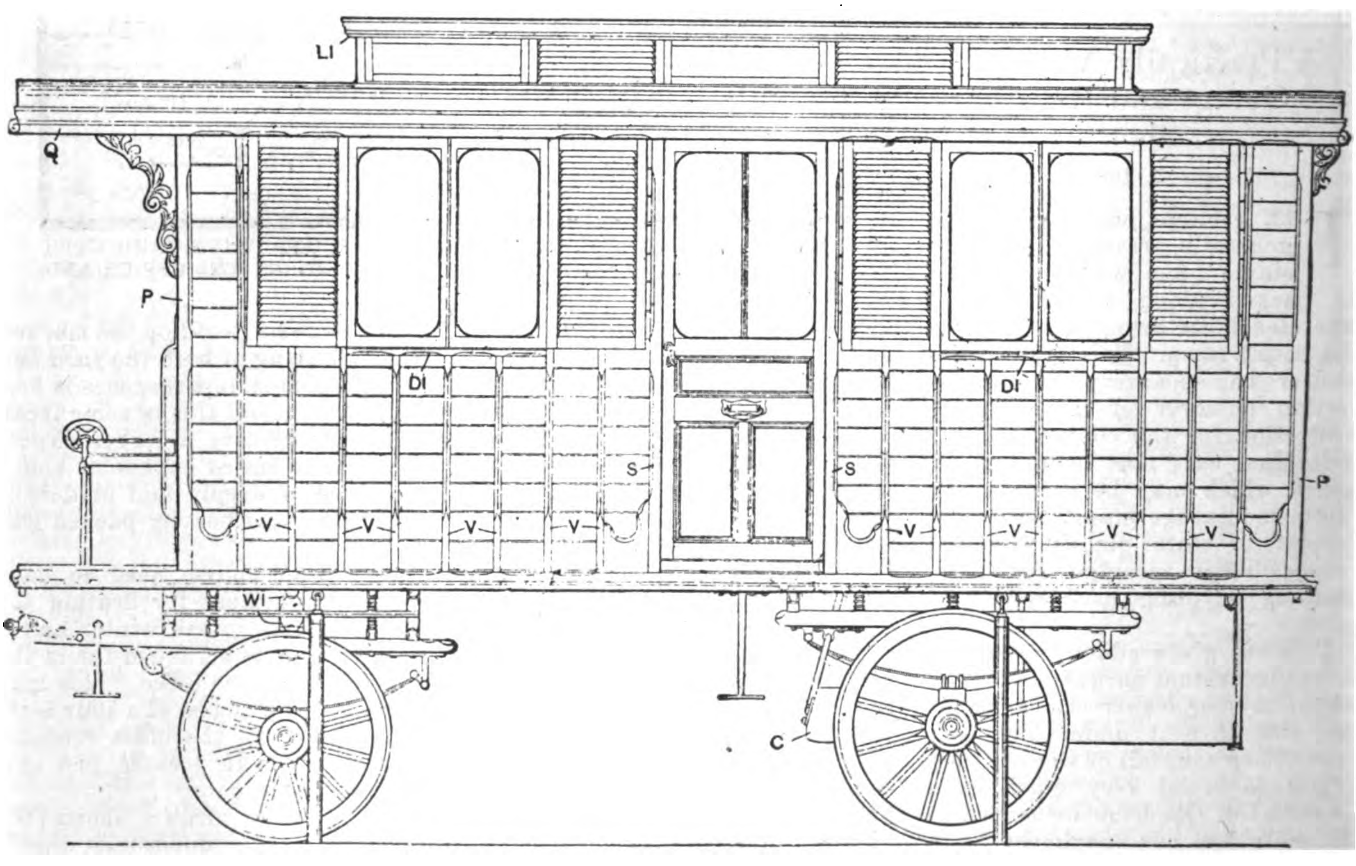


FIG. 1 SIDE ELEVATION OF THE CAMP TRAILER SHOWING GENERAL APPEARANCE

and the hinged flap D which lifts up so that tent poles, etc., can be placed underneath the floor between the frame.

When getting out the timber, which should be well seasoned and free from knots and shakes, allowance must be made for waste in planing and dressing to bevels, as the finished sizes will be given unless otherwise stated. The bottom frame should be of oak, and the upper frame should be of ash with elm corner blocks and brackets, unless the van is intended for use in tropical climates, in which the whole of the framework is the better of teak as it resists the attacks of insect pests. Red deal is sometimes used for the upper framework, but requires being a little larger in cross section than ash and teak. Various kinds of maple, sequoia, and red deal, the latter being the most durable and is extensively used for this class of work although it is not so pleasing in appearance when stained and varnished. The boards are from 3 in. wide to 5½ in. wide by 3/8 in. to ½ in. thick, and either tongued, grooved and beaded, or rebated and beaded the latter being the stronger method, especially for the thinner pieces. These are the actual sizes, and when ordering the matching, the larger size mentioned would be written 6 in. by 5/8 in. matching is suitable. The narrower the boards the les shrinkage there will be.

A plan of the bottom frame with the wheels and fore-cariage removed is given by Fig. 4, and for which will be required two bottom-sides (E) 17 ft. 10½ in. long by 3 in. deep by 2-3/8 in. wide; two mid-pieces next (F) 17 ft. 1¼ in. long by 3 in. deep by 2½ in. wide; two mid-pieces (G) 17 ft. 1¼ in. long by 3 in. deep by 1-3/8 in. wide; front cross rail (H) 6 ft. 7¼ in. long by 3 in. deep by 1½ in. wide; front ear-bed (J) 6 ft. 5½ in. long by 2½ in. deep by 2¾ in. wide; hind ear-bed (K) 6 ft. 1½ in. long by 3 in. deep by 2-3/8 in wide, both when bevelled; cross rails of cradle-carriage (L) 6 ft. 9 in. long by 3-3/8 in. deep by 2 in. thick, lightened out underneath on each side of the guides to 3 in. deep.

The bottom-sides are bevelled on the face side, and the front and hind ear-beds on both sides, to the splay of the body, namely, 1 in 52, while the mid-tembers and cross rails of the under-carriage are square both ways. The mid-pieces are framed into the front cross rail with haunched tenons the ends of the rail being stump-tenoned into the bottom-sides 2¼ in. from the end. The front and hind ear-beds are fixed across the top of the mid-pieces with 3/8-in. bolts, the ends of the beds terminating 1¾ in. from the face of the bottom-sides, to which they are secured with wrought-iron knees M, also shown by the enlarged view of the lower corner joint (Fig. 5) where E is the bottom-side, K the ear-bed, M the knee-plate, and N the corner pillar. Fig 6 is a cross-section of the hind ear-bed showing how it is fixed to the mid-pieces, which are sawn off ¾ in. from the face or back of the ear-bed to make room for the hinged flap D. The width over the cross rails of the cradle-carriage is 4 ft. 9 in., and from the hind rail to the face of the hind ear-bed is 2 ft. 4½ in., these rails being fixed underneath the bottom-sides and mid-pieces.

The four corner pillars P (Fig. 1, 2 and 3), 2-3/8 in. by 2-3/8 in., are boxed out 1-1/8 in. by 1-1/8 in. as shown by the cross section (Fig. 7), and tenoned into the bottom-side and the cant rail Q, being fixed at the bottom end with a strap-bolt (Fig. 8) let into the

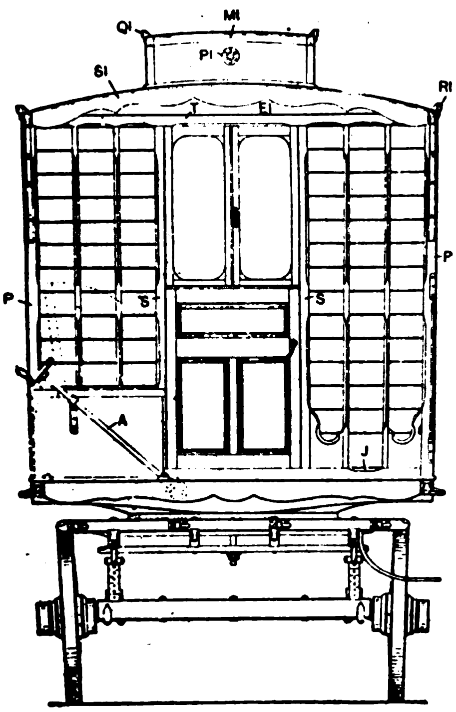


Fig. 2

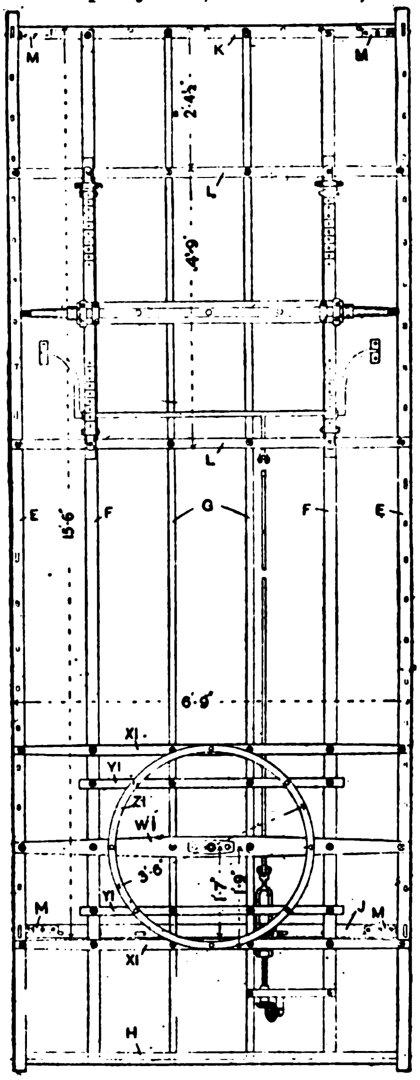


Fig. 4

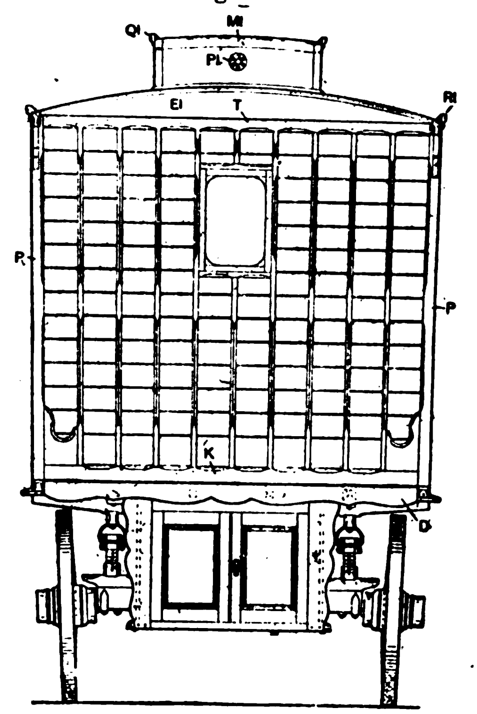


Fig. 3

THREE VIEWS OF THE CAMP TRAILER—FIG. 2 SHOWING THE FRONT ELEVATION, FIG. 3 THE REAR ELEVATION AND FIG. 4 A PLAN OF THE BOTTOM FRAMING inner side and fixed with screws, the dotted lines R (Fig. 5) indicating the position. A large washer or a plate is placed under the nut at the bottom to span the mortise. The cant rails Q are 18 ft. 6½ in. long by 2¾ in. deep on the inner side by 1¾ in. wide. The door pillars (S), 2 in. by 2 in. are boxed out ¾ in. deep from the back by 5/8 in. on from the edge for the panel boards, and 7/8 in. from the back by 5/16 in. on between the pillars for the front door checks, the side door checks being boxed out 1-1/8 in. from the back by 5/16 in. on.

The wheel fittings for this van if used as a trailer had best be of the regulation automobile phneumatic type, although the ample spring arrangement will protect the van body and its contents against road inequalities and riding jars.

The finer fitting and furnishing of the van had best be left to the personal preference of the owner. There is practically no limit to the manner in which these traveling camps or bungalows are now outfitted. From the barest of necessities which characterize the trailer of the tourist who enjoys "roughing it" there are all stages of refinement up to the "traveling palace" of the millionaire who insists upon luxurious comfort and ease. Usually the person planning the use of such a trailer as described has his own ideas as to what is necessary in interior fitting.

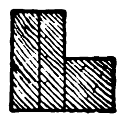


Fig. 7.—Cross Section of Corner Pillar.

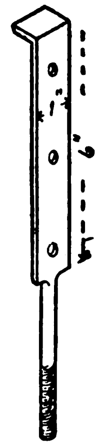


Fig. 8.—Strap-bolt.

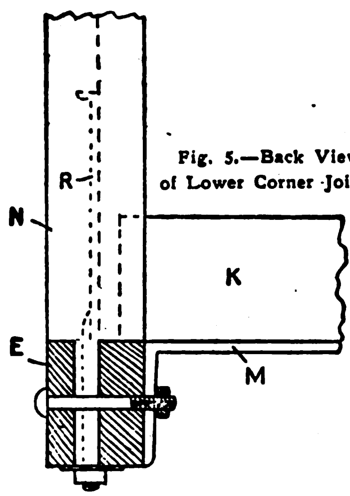


Fig. 5.—Back View of Lower Corner Joint.

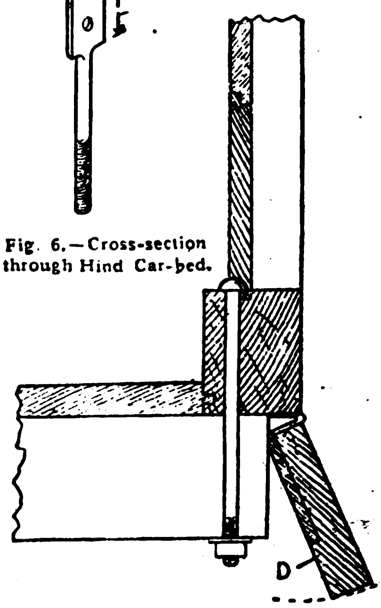


Fig. 6.—Cross-section through Hind Car-bed.

DETAILS OF CONSTRUCTION IN THE BUILDING OF THE CAMP TRAILER

An Easily Made Shear And a Handy Punch for the Repair Shop

> Editor's Note: — An Illinois Reader has asked how to make a simple punch and shear for use in the shop on general light work. He was referred to a previous issue of "Our Journal" and in so doing it occurred to us that other readers may be interested in these handy shop-made tools which were built by Mark C. Harned and described in one of our earlier issues.

The engravings on page 321 show a shear and also a punch which I designed and made myself. The frame of the shear is made in two parts, each being a duplicate of the other, the parts being bolted together with the lever and shearing knife hung or hinged between them. The cutting shear works tightly between the two frames and close up to the steel plate which is inserted and bolted to one of the frames. This method of fitting the cutting shear eliminates all side spring and prevents the cutting edges from giving way. The half frame opposite the one in which the cutter is fastened should either drop below the other or have a niche cut out of it so as to allow for the clearing of the iron which is being cut. In my shear I am able to cut ¼ by 4-inch flat iron and up to ¾-inch round stock.

The frames are made of 5/8 by 3-inch stock, and the corners welded by means of inserting a piece of square stock. No doubt you will find it a difficult job to weld this frame up in nice shape, but by cutting a V out of the iron at the corners before welding you can do it very easily and nicely. The method of hanging the lever and the connecting toggle is very clearly shown in the engraving.

It will be noted that the power in the punch is exerted by means of an eccentric on the end of the lever shaft. This operates on the end of a steel shaft, the bottom of which is provided with a shuck to hold ½-inch round shank punches. The shaft is turned and works in two close fitting eyes (E, E) made from flat stock and riveted into the frame with two rivets to keep them rigged so that they never bind the shaft and hinder the operation of the spring which serves to lift the punch. The frame of the punch is also made in duplicate.

The anvil is of steel and dovetailed into the frame. It is provided with two holes 3/16 inch and ¼ inch in size, which are the only sizes I have tried so far with this punch. This is a very handy tool for punching all thin band iron and especially plates which are to be nailed into place. I cut plates of this kind, shape on the shear and punch them in this little tool and I find I am able to do work very quickly in this manner..

BUSINESS

A train in Arizona was boarded by robbers, who went through the pockets of the luckless passengers. One of them happened to be a traveling salesman from New York, who, when his turn came, fished out $200, but rapidly took $4 from the pile and placed it in his vest pocket.

"What do you mean by that?" asked the robber, as he toyed with his revolver. Hurriedly came the answer: Mine frent, you surely vould not refuse me two per zent. discount on a strictly cash transaction like dis?"

Nothing On Him

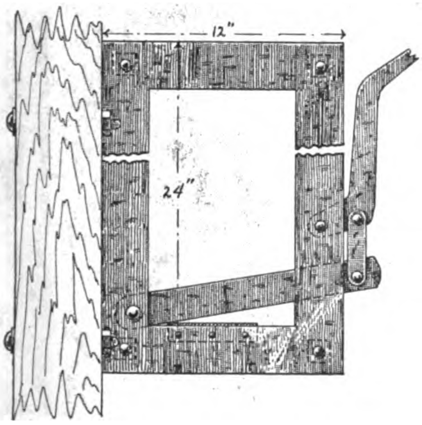
"Do you know that I started life as a barefoot boy?" said a merchant who had been rather successful.

"Well, I wasn't born with shoes on myself," answered the clerk.

Anatomy Of The Horses' Foot And Leg

Editor's Note:—Since the appearance of Mr. Maloon's excellent article entitled "Leveling a Horses' Foot" which appeared in last month's journal, several of our readers have inquired on matters relating to horse anatomy. We are accordingly republishing here a very excellent article written by Mr. E. W. Perrin which will no doubt interest many of "Our Folks and no doubt throw some light upon what is to some a rather mysterious subject.

THE great need of intimate knowledge of this important branch of the art of horseshoeing is emphasized in the large number of horses you may see today with the hoofs fitted to the shoes instead of the shoes being fitted to the hoof. After all that has been written upon the subject



A HANDY SHEAR EASILY MADE IN THE SHOP

there are thousands of smiths shoeing horses today who have no knowledge by the hoof on which they work every day.

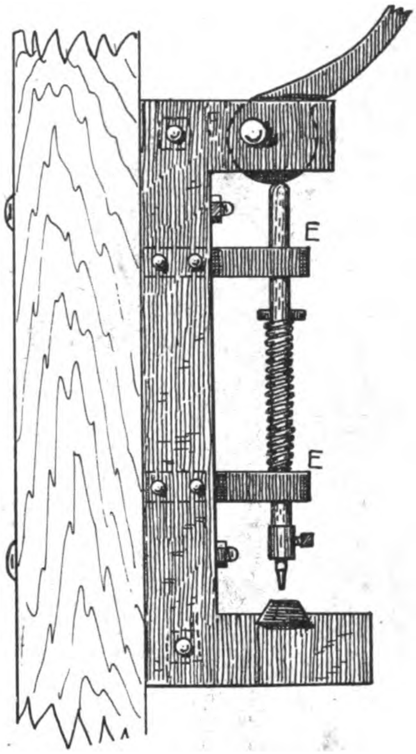
The preparation of the horse's hoof for the shoe is an operation which requires an intimate knowledge of the foot and its relation to the limb of which it is the base. Where to cut and where not to cut; why the hoof of this horse should be high at the heels, while another should be low; how to level a hoof, etc., are problems which cannot be understood without a study of anatomy.

A dissection of a right fore-leg from the elbow to the foot is shown at Fig. 1. In this specimen the skin, connective tissue and hoof have removed so as to show the muscles of the arm and the tendons and ligaments of the foot. In describing this specimen I want to call your attention to the foot in particular. You will observe that it is the exact counterpart in shape of the hoof into which it accurately fits. Seeing that this horny box —the hoof—envelopes one of the most complicated organs of the whole body, the intimate relation of hoof and feet become more apparent, and the knowledge of anatomy and physiology is appreciated as indispensable to scientific shoeing.

The sensitive laminae is shown at A, while B is the coronary cushion and really a continuation of the true skin of the leg. The coronary cushions run around the foot at the coronet, lying in the depression at the top of the wall of the hoof. Its surface is covered with hair-like projections which fit into minute tubes in the wall of the hoof. At the heels the coronary cushion turns in and forward to form the bulbs of the sensitive frog. The function of the coronary cushion turns in and forward of the hoof, hence, whenever there is an injury to the coronary cushion there is a corresponding flaw in the wall of the hoof. Occasionally, owing to a severe injury, a portion of this cushion is lost, in which case the wall grown by it will be absent and only the inner layer of soft horn will cover the sensitive laminae. Since the advent of barbwire as a field fence, the number of defective hoofs resulting from wire cuts on the coronet has been very large.

The sensitive laminae is a membrane highly charged with blood-vessels which extends from the coronet to the plantar surface in a large number—500 to 600—folds or leaves. Each leaf dove-tails into corresponding horny leaves of the insensitive laminae within the wall of the hoof. The sensitive laminae covers the entire os-pedis or coffin bone, and is the only membrane between it and the hoof. At the heels it turns under the plantar surface, following the course of the bars. It is plentifully supplied nerves and blood vessels, and its function is to secrete the inner layer of soft horn and share in sustaining the weight of the animal.

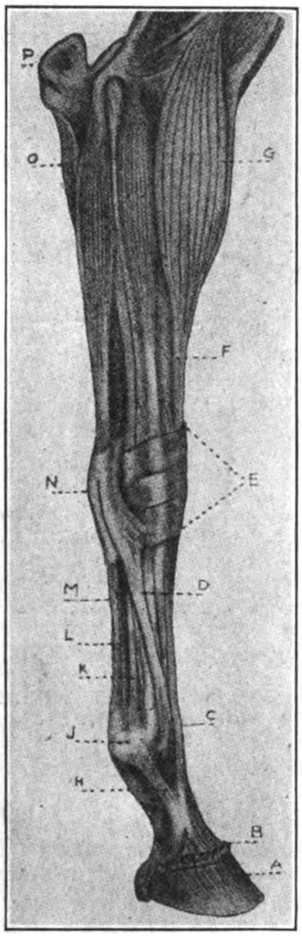
Muscles are composed of red colored material, which under a magnifyng glass is seen as innumerable threads or fibres, bound up into bundles of every conceivable shape, according to the particular work they perform. By contraction of this muscular fibre the various parts of the body are moved. A muscle is attached to a bone at one end in a fixed position called its "origin." It is usually attached at its other end to a tendon or ligament which is called its "insertion." In Figs. 1 and 2,



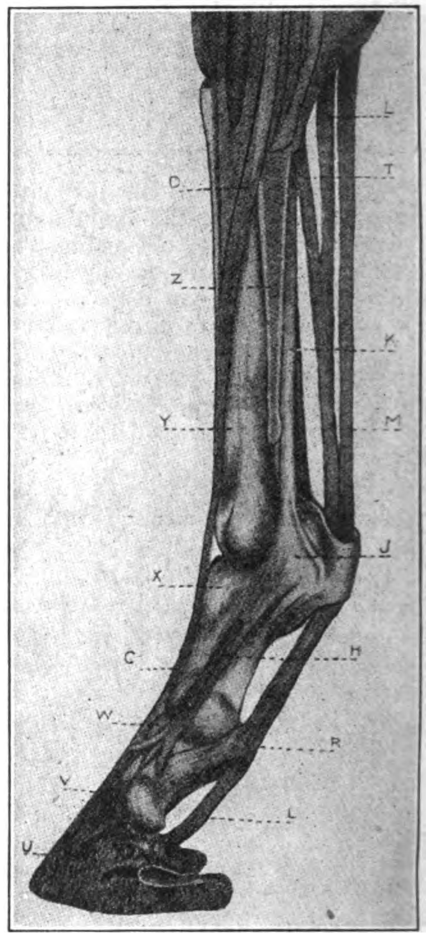
A SHOP-MADE PUNCH FOR THE REPAIR MAN

C is the extensor pedis which takes its origin at the elbow. Just above the knee the muscle joins the tendon, descending the outside front of the knee, following the course of the cannon bone Y and over the front of the phalanges, joining with the branches of the tendon superior sesamoidal at the os coronae W and is finally inserted in the highest point of the coffin bone at V, Fig. 2. Its function is to extend the foot. D is the lateral extensor tendon of the foot, and is joined to its muscle above the knee and is inserted into the phalanges of the foot. Its function is to give lateral movement to the foot. The tendon superior sesamoidal at K is commonly called the suspensory ligament. It is a powerful brace, takes its origin in the back of the knee and descends about two thirds the length of the cannon bone. At this point it divides, one branch being inserted into each sesamoid bone at the fetlock J. from where the branches H extend downward and forward, joining with the extensor| pedis and are finally inserted in the sides of the short pastern. In Fig. 1 G, corresponding to the large muscle of the arm, it is the great extensor of the knee. F in the same figure is the lateral extensor of the knee. E is the wide, flat band which encircles the knee—it is called the annular ligament. P is the ulna or point of the elbow, the peculiar construction of which forms a fulcrum for the action of the muscles attached to it. M in both Figs. 1 and 2 is the tendon flexor perforatus, which has its origin in its muscle above the knee. It descends the back of the leg just beneath the skin to the fetlock, to which its borders are attached at the sesamoid bones. Here it forms an oval shaped tube through which the tendon flexor perforans passes on its way down to the foot. From the fetlock the perforatus descends the back of the pastern for about four inches, at which point it divides into two branches which extend downward and forward and are inserted sidewise on the lower border of the long pastern and the upper end of the short pastern, on which bones they act simultaneously, inflexing the pastern. L, Figs. 1 and 2, is the tendon flexor perforans which is joined to its muscle just above the knee and from whence it descends the back of the leg, lying close to the perforatus. About midway between the knee and the fetlock it is joined by the metacarpal or check ligament, T in Fig. 2. The upper end of this is inserted in the head of the cannon bone. The perforans passes down at the back of the fetlock through the tube formed by the connecting cartilage of the sesamoid bones and the perforatus tendon. From this point the perforatus forms a sheath for the passage of the perforans to the point of its (perforatus) division, R, Fig. 2. Here the perforans drops through and descends to the foot, passing over the navicular bone (not seen in these engravings) and is finally inserted in the crescent of the coffin bone. The function of this tendon, as its name implies, is to flex the foot.

It will be seen from a mechanical standpoint that when these flexor tendons (those at the back of the leg) are acted upon by their contracting muscles they act like ropes upon pulleys by lifting the limb. When the extensor tendons (those on the front of the leg) are acted upon by the contraction of their muscles they extend the limb. Each joint works upon a well lubricated surface in obedience to the action of its tendons and ligaments. The brain conveys it well through the motor nerves to the voluntary muscles, which contract and relax in obedience. Thus a marvelous animal economy performs the movements of the body. What a wonder that so complicated a structure keeps in repair so long, even under the disadvantages of improper shoeing. The foot being the base and foundation of the limb above it, imperfect shoeing may and does affect not only the foot but the whole limb. Hence the importance of this subject can scarcely be overestimated.



A—Sensitive laminae.
B—Coronary cushion.
C—Extensor pedis.
D—Lateral extensor of foot.
E—The annular ligament.
F—Lateral extensor of knee.
G—Great extensor of Knee.
H—Branches of tendon K.
J—Attachment of tendon K.
K—Superior seamoidal.
L—Flexor perforans.
M—Flexor perforatus.
N—Traprezium.
O—Extensor of phalanges.
P—Ulna or elbow.
R—Bifurcation of perforatus.
T—Metacarpal ligament.
U—Coffin bone.
V—Insertion of C.
W—Short pastern.
X—Long Pastern.
Y—Large cannon bone.
Z—Splint bone.



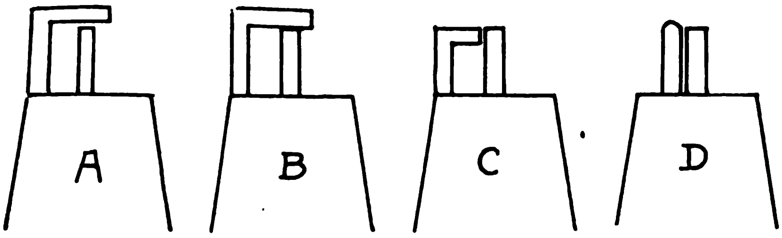
THE INTERIOR STRUCTURE OF THE FRONT AND HIND LIMBS MADE PLAIN

Change Over The Spark Plugs

James F. Hobart

Wouldn't it be a good idea to change or make over the spark plugs to types which will not have the spark gap changed by expansion or contraction of the central point or electrode? In nearly every spark plug in use at the present time, there is a central metal post which extends through the whole length of the porcelain, mica, or other insulating material used in the spark plug. The other spark point being a wire attached to the cylindrical case of the spark plug.

The types in the engraving at A and B are not at all desirable from the writer's point of view and should this kind be in use in your car, then wouldn't it be a good idea to change to one of the types shown at C and D? The point is just this—when a plug is used as shown at A, the central post or contact is a straight piece of metal, protected by the plug insulation from quick heat expansion or contraction. When the engine is started, the plug of course expands according to the heat of the engine, but the central post is slow to respond to the heat because of the porcelain insulation being a rather bad heat conductor.



VARIOUS TYPES OF SPARK PLUGS WITH VARYING DEGREES OF SPARKING EFFICIENCY

In this type of plug, the spark is formed off the end of the central post and the result of the slowness of expansion of that post when the engine is started, is first to widen the spark gap because the bent over point and its support is first affected by the heat of the explosions. As the engine becomes heated, the spark gap resumes its normal width again, but in case the shell of the spark plug be made of iron or steel, the ratio of expansion between the shell with the bent point and the central brass post is such that after the engine became fully heated, the spark gap would be narrowed as is shown at B. The brass expands more than the steel.

Use the type of spark plug shown at C. and D. with the plug at C. the spark is formed off the end of the bent point and against a side of the central post so that no matter how much that post may lengthen or shorten, the spark gap will remain always of the same width. Another type of plug wherein the spark is formed between the sides of both members of the plug is shown at D. Expansion has no effect upon this plug, and there is the added value —seemingly—of having the spark formed between two rounded members instead of between one side and one end. Try a spark plug of the type at D. when you have ignition trouble that seems very mysterious and impossible of solution.

TRACTORS IN CONNECTICUT

It has been generally supposed by the average individual that the tractor was applicable for successful use only on the large tracts of the west, but a recent bulletin published by the Connecticut Agricultural Experiment Station shows that the tractor is being operated profitably and successfully on the so-called small farm.

A survey was conducted on 45 Connecticut farms using a total of 59 tractors, and it was found that the most satisfactory results were obtained on farms where each tractor operated an average of 76.5 acres. The most popular and satisfactory horse power rating varies form 8-16 to 12-22. The three plow tractor seems to be the most popular, but it must be remembered that in Connecticut 10 and 12-inch bottoms are customary.

More than 82% of the farms reporting used the tractor for belt work to good advantage. It was found that the most successful tractors were used from 90 to 100 days per year. A total of 101 horses on 32 farms were displaced by tractors.

Queries, Answers, Notes

This department is the place for discussing shop and business matters. Here you may ask for information on any topics or matters that interest you; bring to the attention of the progressive craftsmen of the day the subjects that should have their attention. You are requested to make use of this department as often as desired.

On Using Old Rubber Tires:—Can any brother reader tell me how the rubber tire repair men treat old rubber in order to make it useable in the repairing of tires? I know that some tire repair shops grind up old rubber and treat it in some way for use either as a cement or as a filler material in the repair of worn tire shoes. This information would be of considerable help to me in the working up of old and otherwise useless stock. I am sure that other readers would also appreciate this information. J. C. L., Illinois

Planer Bits for Matched Flooring:—Could you tell me where I could get some steel for making bits for matching-heads on a planer for matching flooring, etc. The bits are 5/16 x 2 in. wide? Can you tell me what kind of steel is used and how it is tempered and what kind of a bath is used to temper it in?

W. C. PRICHETT, Minnesota.

In Reply:—We note your question regarding bits for planer heads and suggest that you get in touch with the Crescent Machine Company, of Leetonia, Ohio. They can furnish you with practically any kind or style of bit that you may require. Of coure, you understand that these will be the finished bits, ready for use in the machine. Should you, however, require steel for the making of these bits yourself, we would suggest that you get in touch with any of the blacksmith supply houses. There are a number of these advertised in "Our Journal" such as the Campbell Iron Co., of St. Louis, Mo.; also Cummings-Emerson, Peoria Ill. You are probably, at the present time, doing business with a reliable jobber and he can, undoutedly, supply you with the steel suitable for this purpose.

A. B. A., New York.

His Service Car—Bending Spring Eyes.—I am thinking some of overhauling my service car; it is a Buick Model 31. The two end bearings are made so they can't be taken up. They are solid bearings and the crankshaft slips through them. I think they are a little loose. How do you think I can tighten them? And do you know where I can get a manifold made to raise my carburetor about eight inches? Then I can put a vacuum system on and get better vaporizing results.

I also am making a great many main leaves for springs and would like to know of some device for turning the eyes. Maybe, you know of something a man can make at home.

F. W. KITTO, Illionois.

Forging and Tempering Cold Chisels:—There is one request I would like to ask the Editor as well as the brother smiths. What is the correct way to make a cold chisel and temper it. Where I work they use quite a few of them and, coming in contact with all kinds of steel, I have quite a chore to keep them in condition. I have used all kinds of methods and find that I have not struck the right method yet. F. R. P., Wisconsin.

In Reply:—In all shops, large and small, the cold chisel plays an important part. Some smiths are skilled in making this little tool and turn out a nicely tapered, thin, keen-cutting chisel that will do a large amount of work with little labor. Others turn out a stubby tool, left that way to make it stand, and it necessitates an expenditure of an extra amount of muscle to do the work. For the benefit of the unexperienced ones the writer will explain what he has found to be the best way. There is no use of my saying "take a piece of good steel," as I am well aware that most smiths have to take what they have and make the best they can of it. But I do say that a poor piece of steel properly forged and tempered will be better than a good piece improperly forged and tempered. The forging heat differs according to the carbon in the steel, the same as in hardening. The higher the carbon the lower the heat, but the first heat should be high enough to work freely. If a power hammer is used, the heat can be lower than when drawn out with seldge, as the force of the blow of a power hammer is harder and it draws the steel evenly through the center, which is important. With sledges it has to be heated to a higher temperature to do this same thing. The first drawing should be done square, tapering all the way to the point. Then pound on the top and bottom sides evenly, as much on one as on the other, turning the chisel with every blow. If the chisel gets crooked do not turn it on its edge to hammer it straight, but keep it flat and hammer on the inside of the curve. This will make it straight again. The next heat should be lower, closing the grain in with lighter, even blows, stopping when the stock gets dull red. Do not wait until it is black. Some smiths claim it should be packed at a real low red just before it gets black. I think it safer to pack it just below the refining heat, as it surely has to be raised to that heat to be hardened and there is less risk, of breaking the molecules apart than there is if hammered a little too cold. The chisel is then heated to a low red and allowed to cool off and then ground. The bevel of the cutting edge should be ground even and the end slightly rounded. The chisel is then hardened at the lowest heat at which it will harden. This is best found out by taking a small piece from the bar, drawing it down thin and hardening at different times from a low red to a full red, breaking off the end each time and examining the grain. The heat that leaves the grain finest and closest is the desired heat. B. H., New Jersey.

An Interesting Letter From Missouri:—I have been reading The American Blacksmith for more years then I can remember. I am still a comparitively young smith and can recall my first introduction to what I have come to know as "Our Journal." I was working for an old smith whom I really believe was the best mechanic in the county. He was a fine old gentleman and not only taught me what he knew of the trade but he also gave me some lessons on life and character that I hope I will never forget. This man was of the old school, knew his trade very thoroughly but could not seem to see the automobile and its meaning to the smithing craft. He consequently was overwhelmed in the march of progress, not perhaps because of his disbelief in the future of the motor vehicle as because of his great love of the good old smithing craft.

This fine old gentleman was a reader of The American Blacksmith when I came to work for him. On my second day with him he handed me a copy of the paper and said:—"Boy if you want to get anywhere in this business don't depend upon yourself alone for getting practical information on the trade. You cán get a certain amount of information by gathering it at first hand but that will limit your knowledge to what you can see and hear. You will need to do more then simply observe and listen and that means that you will have to read—that book that you have in your hand is the book to read. I have read it for all of the time since it has been published and there is not a single copy of it that does not tell me something I never knew before."

That little talk settled things for me, for I figured at the time that if that was the case with this man and that he could get something of value out of the paper with all of his experience in the trade, how much more valuable would such a paper be to me who had not yet cut his eye teeth at the trade.

It is needless for me to tell you that I have enjoyed "Our Journal" all of these years and that I am more interested in the paper every day. I have endeavored to keep up with the times as I have come in contact with them and have not only taken on the motor vehicle work but have put in the modern tools such as the oxy-acetylene welder and cutter and such other tools of modern design as I have found need for them and ability to finance their purchase.

And that reminds me of a matter that I do not think the average shop man ever considers:—I mean the financing of his business. The small shop requires financing just as the large one does if the owner is going to make any progress. He cannot hope to have a sufficient amount of cash on hand at all times to take advantage of money-saving purchases every time an opportunity is offered That is where the Bank comes in. And if the smith has taken proper care of his business he will have little or no trouble convincing his banker of his right to a loan to finance his purchase. This of course means accounts correctly kept and records that are out of the scrap-paper-and-slate-class.

Another matter to which I think the repair shopman and general smith should give more attention is the appearance of his place of business both inside and out. Some shops look like junk heaps with a roof on. There is no excuse for it for the average smith is skilled in the use of wood working tools as well as iron and he can keep his shop in perfect repair on the days when he is not overly busy. If he will take care of the little holes and jobs of repairing when they are small they won't take long to fix and there never will be any big ones to care for

Still another matter that I am rather a crank on is keeping up with the times. I have endeavored to broaden out at all times. When I see an opportunity to add another line of work to my already long list I go at it just as quickly as I can. If I haven't the tools or equipment necessary to do the work I soon arrange to get them. Of course, you understand I mean work that will come in profitable volume to make the investment profitable. Too many shop owners are letting good opportunities get away from them all the time simply because of some prejudice against it, like the dyed-in-the-wool horse shoer who refuses to ride in a modern automobile. I was taught by the smith mentioned in the first part of my letter, to consider shoeing the finest trade and profession on earth. I still think that the proper shoeing of God's most noble animal, the horse, an accomplishment far above the fixing of the finest motor or car ever built. But that belief doesn't keep me from repairing all the motor cars that come my way. Nor does it make any difference in the way I treat any jobs that are brought to the shop

We still do quite a bit of shoeing and also repair autos, trucks and tractors. Wagons are still brought in for repair as well as an occasional buggy, but by far the most profitable work is the motor car work. This comes in on short notice as a rule and must be gotten out in a hurry, but it is generally good pay and good profit

Well I have chattered enough for one time so will close. I would like to hear from some of the other 'Boys" on the topics mentioned and to have the ideas of other readers of "Our Journal".

C. J. STEVENS, Missouri.

That's Different

After a salesman had sold a big order of goods to the Scotch buyer for a Chicago store he sought to make the Scot a present of a box of cigars.

"I'm sorry I canna accept," the Scot said, "but there's a rule of the hoose that ye canna accept presents from salesmen."

"Well," laughed the salesman, "I'll sell them to you for five cents, then."

"That's different now," the canny buyer replied. "I can buy my smokes anywhere I please. I'll take four boxes."

Off to Poor Start

Rastus had indulged in a dice game that had ended in a free-for-all cutting scrape. "Why didn't you run away when you saw trouble coming?" one of Rastus' white acquaintances inquired.

"Boss, Ah did run away," asserted Rastus.

"Then you didn't run fast enough, I take it," said the acquaintance.

"Yes, sah, I done run fast enough too," insisted Rastus. "De trouble was Ah didn't sta't soon enough."

Yes, Indeed

"The more a man has the more he wants," said the fat man.

"You wait until you have triplets in the house and you'll change your mind," replied the thin man.

AMERICAN BLACKSMITH AUTO & TRACTOR SHOP

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E. D. Corson, President
G. A. Castle, Vice-Pres.

BUFFALO, N. Y., U. S. A.

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GETTING YOUR MONEY'S WORTH

In our recollection; and our memory concerning "Our Journal" goes back these many years; we cannot recall one single instance when a regular reader has accused us of not giving him his money's worth in the pages of this publication. However, a recent letter received from a Missouri smith (and all of you know how necessary it is to show the Missourian) brings up a matter that will bear emphasis at this particular time and here.

This reader writes as follows:—

"I have been reading the paper for a good many years and have accumulated quite a collection of 'Our Journals'. So now when I am puzzled by any job that comes into the shop the first thing I do is to go through the back numbers and I usually find just what I am needing."

Here is a reader who is getting the full benefit from his reading of this publication. Not only does he keep in touch with the monthly doings and advances in the repair trade but he turns his collection of journals into a reference library of the most valuable kind for his business.

Keep your back numbers and get the full benefit of the sound, practical information that has been published before. One practical shop man we know keeps a reference file of all of the articles that appear on his particular kind of work and when he is up against a particularly difficult job he consults his reference file to see if some one hasn't had the same kind of a job before.

No man can hope to carry in his mind information on every job that is brought to him. Experience is a great teacher but if a man is to depend upon experience alone his practical knowledge will indeed be limited—limited to his own narrow sphere of activities. On the other hand the man who will read and learn from the experiences of others is simply multiplying his own experience by the amount of reading he does and by the practical information he absorbes.

CONTENTS

OCTOBER 1921

THE REPAIR MAN OF TODAY AND YESTERDAY

Have you paused recently, Mr. Reader, and looked back along the years to the craft and worker of twenty, thirty years ago? Have you paused in the manipulation of your modern gas torch to look across the years to your brother craftsman with his weasing bellows and his resounding anvil? Have you thought of the grand old craftsmen of those days when the horse, buggy and wagon were the "patients" upon which the smith operated?

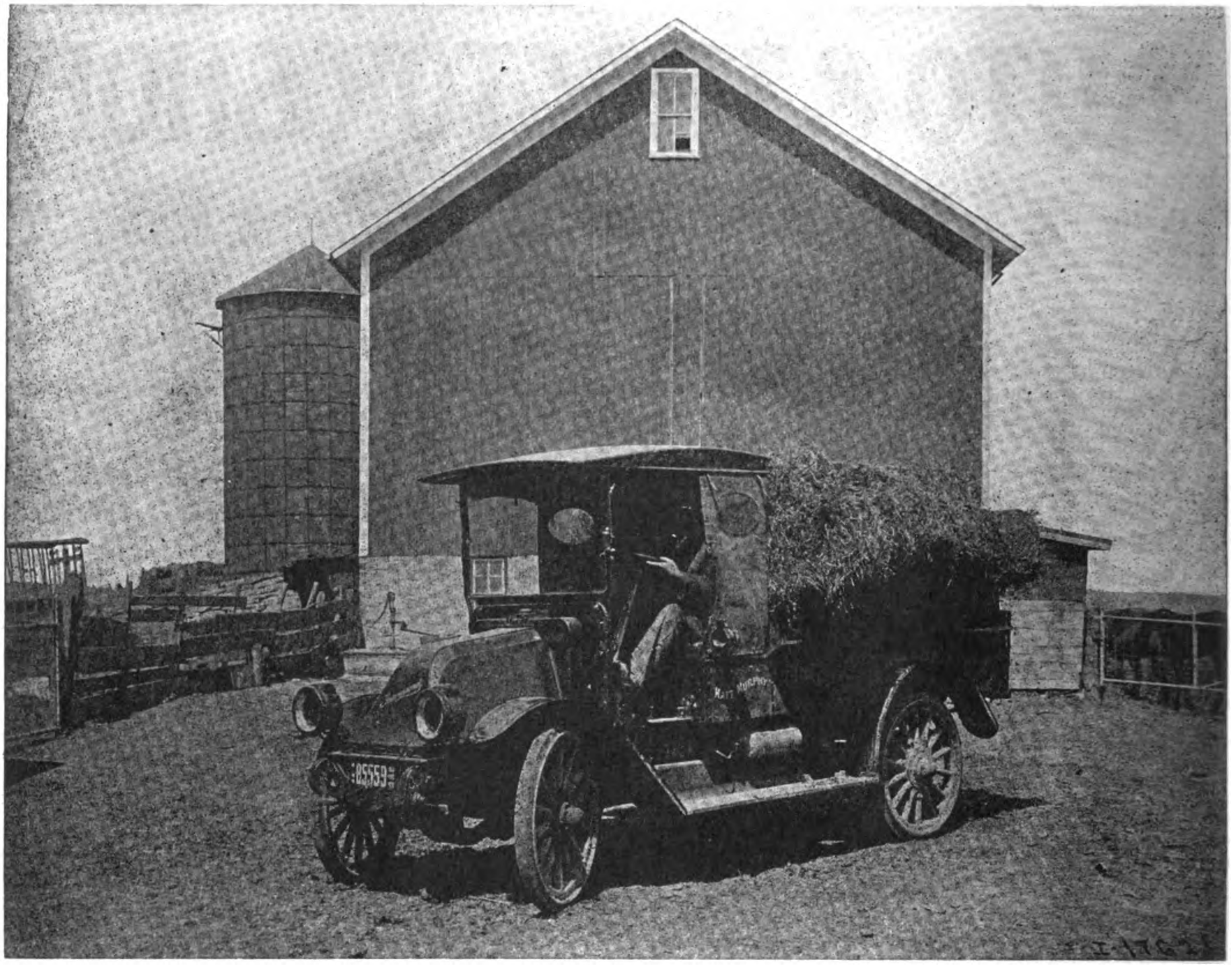
Consider in this glance backward across the years how the trade of smithing and general repairing has advanced. Think of the larger sphere of activity occupied by the general repairman of today. Think of the opportunities he has for the enlargement of his business, his trade and his activities. Consider how much more he must know today in order to care properly for the line of customers coming to his shop.

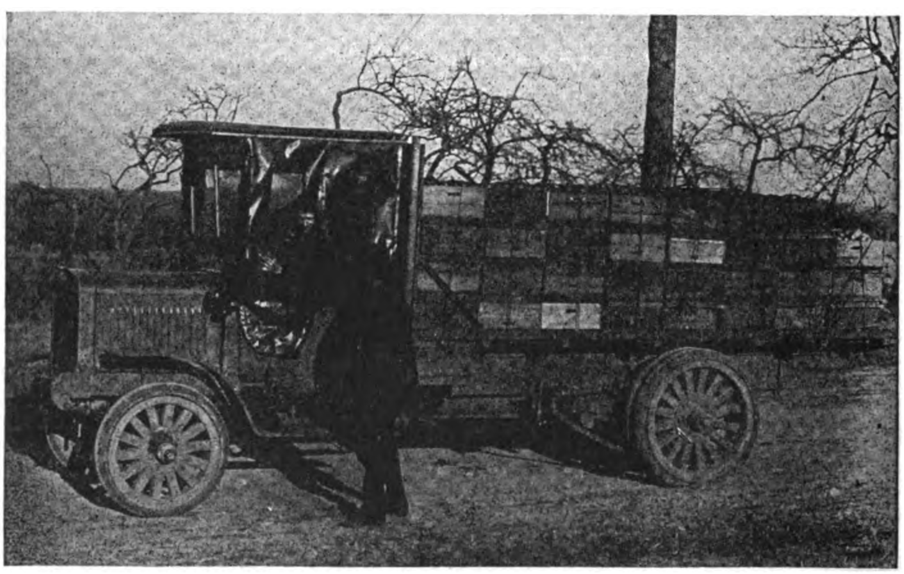
Have you taken full advantage of these opportunities? Have you kept pace with the advances made in the craft? Have you taken advantage in full of the opportunity presented in the automobile business?

In any event let us know what you have done. Tell us your own craft story. We want others to be guided to a larger and bigger success. Write your story now.

SUBSCRIPTION AGENTS

DO NOT give money to any agent or representative unless you know who he is. There are many unauthorized agents and unscrupulous collectors representing themselves as agents and collectors for "Our Journal" and we wish to warn every one of "Our Folks" against them. Do not under any circumstances give them any money unless you know them. If there is any doubt send your money and orders direct to Buffalo, N. Y.





THE TRUCK ON THE FARM

The great increase in the number of trucks on farms, as shown by the recent census, emphasizes the increasing opportunities for the smith and repairman.. For not only does this mean more work in repairs and repair service but the increased importance of the truck sales agency in the small town and rural districts. Many of our readers have already secured the agency for good trucks—more could do so with real profit.

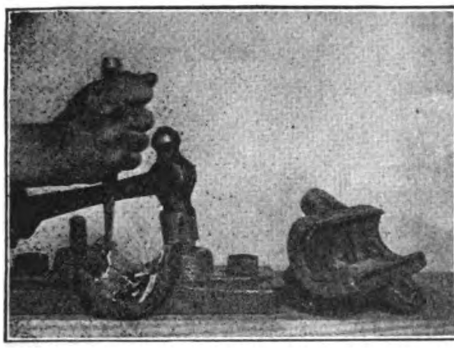


FIG. 1—OLD BABBITT METAL IS REMOVED WITH A COLD CHISEL

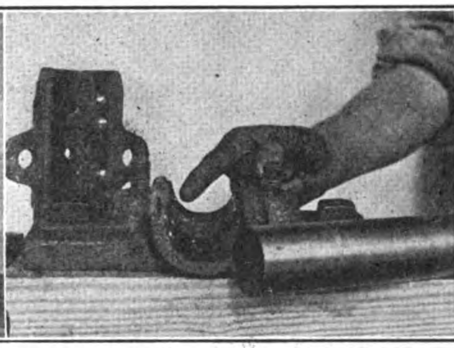


FIG. 2—THE ANCHOR HOLES KEEP THE BABBITT IN PLACE

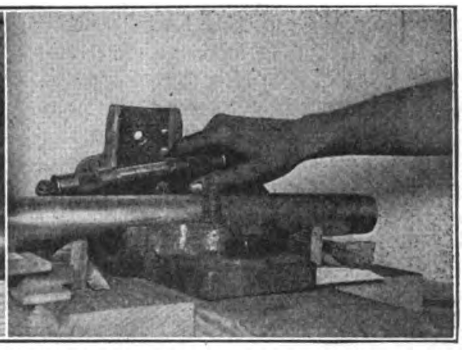


FIG. 3—THE SHAFT IS CAREFULLY LOCATED AND LEVELED

How to Rebabbitt a Shaft Bearing

GUSTAVE H. RADEBAUGH

THIS is a job often required of the repair man. When truck, tractor, or machinery are out of order on account of worn out bearings, it is important that the repairs be made as quickly as possible. The rebabbitting of a bearing can be done successfully, with little experience of this kind of a repair by simply following the operations as given in this article.

Babbitt metals are divided into three classes; 1, tin, antimony and copper alloys; 2, tin antimony, copper and lead alloys; and 3 tin, copper and zinc alloys. The name babbitt is derived from that of the inventor Isaac Babbitt of soft metal lined bearings. The term babbitting has been applied to the process of applying soft anti-friction metals inside a hardened shell for the purpose of producing bearings.

Babbitt metal is extensively used. It can be purchased from most dealers in machinery and from repair or jobbing shops. It is marketed in the form of small blocks or pigs. To avoid blow holes in the babbitt lining of a bearing it has been found that by covering the mandrel or shaft while heated with a thin coating of a solution composed of one or two pounds of Jersey red clay to three gallons of water. The formation of bubbles will be prevented and the lining will have a smooth surface. Oil causes the babbitt to blister.

Editor's Note:—This is the first of Mr. Radebaugh's articles on Standard Mechanical Practices. Each of these articles will be complete in itself, but all will have an intimate bearing on work performed by the modern practical repair man These articles will deal with mechanical operations of intest to the experienced mechanic as well as to the beginner. In the article the figures preceeding the naming of each operative refer to the engravings numbered in like manner.

It is important when pouring that the metal is poured from a ladle that has a rounded spout rather than one with a flat sharp spout which tends to produce a porous area or blow holes. Putty is preferable to clay for luting or sealing the ends and sides of the bearings as the moisture in the clay tends to cause sputtering. Exercise caution when pouring babbitt into a box; be absolutely certain that the inside of the box is dry. If damp it causes the heated metal to sputter and sometimes it explodes with force enough to scatter the heated metal.

Prior to pouring the babbitt, the bearing should be heated to prevent the molten metal from becoming chilled and sluggish. The common method of determining the pouring temperature of babbitt metal is by testing with a dry pine stick. If it chars the metal is of the correct pouring temperature. Never beat the babbitt to a red heat. This destroys the usefulness of one of the most important alloys in the metal. When heating the babbitt in a forge fire be very careful that none of the metal is scattered in the fire. It will find its way to the tyere iron and close up the blast openings.

1—Removing the old babbitt.—The old babbitt is removed by taking a flat cold chisel and driving it

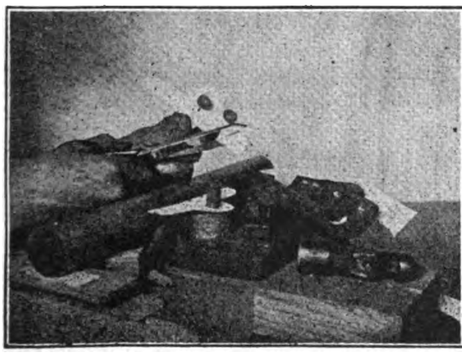


FIG. 4—PAPER LINERS BETWEEN BASE AND CAP

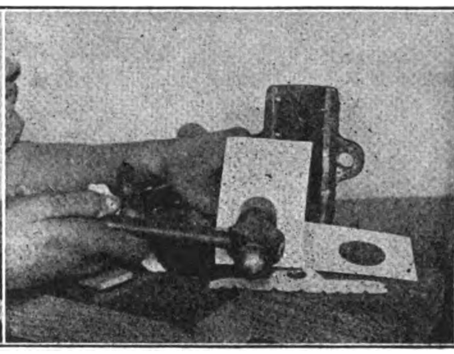


FIG. 5—PAPER ENDS KEEP THE HOT METAL FROM THE WET CLAY

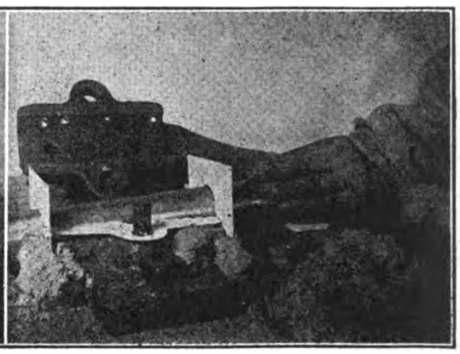


FIG. 6—THE CAP IS NOW READY TO BE PUT INTO PLACE

into each side of the box between the babbitt lining and the cast iron shell. The old babbitt will break off in the manner shown. This is not a difficult operation as many times the entire piece of babbitt is removed intact. The old metal can be remelted and used again. If the box is covered with oil and muck, place the base and cap in the forge fire and heat until the oil burns off.

2—Holding the babbitt lining in place. In this view the anchor holes are shown in the base and cap of the box. These anchor holes are used to hold the babbitt lining in place. Cast iron shells are rarely ever tinned which is very common practice for the bronze shells such as is used on automobile engine bearings. If these anchor holes are not in the box and no other method provided they should be drilled as it is important that the babbitt lining is held by some method. When removing the babbitt sometimes the anchor holes do not clean. One of the best ways to remove the

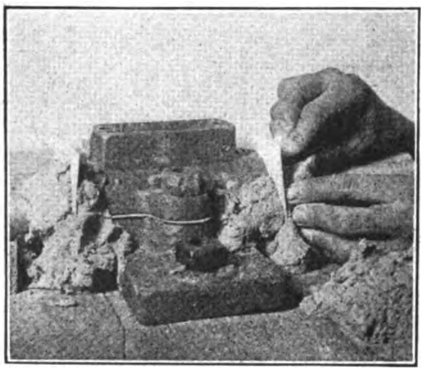


FIG. 7—IT IS GOOD PRACTICE TO CLAMP THE TOP CAP INTO PLACE

cutting the small notches along the inside edge of the cardboard liners both the top and the bottom can be poured at the same time. These notches are cut in the manner shown to permit the breaking apart of the cap and base after the babbitt has been poured.

5—Cutting the paper ends. — These are used to keep the hot babbitt from coming in contact with the damp clay which is used for

It is good practice to clamp the cap in place with the two clamp bolts as it insures the proper location of the cap. With the putty or clay the open edges are sealed. Good luting materials are putty, fire clay or ordinary clay. The bearing cap should be provided with a hole for pouring the metal through and one or two holes to permit the escape of gases. These holes or a bearing as shown should be about three-eights of an inch in diameter.

8—Heating the babbitt.— The babbitt scrap that has been removed from the box with the necessary amount of new metal is placed in the ladle and heated very slowly until a dry pine stick will char when placed in the molten metal. This test is the one commonly used by trained mechanics when heating babbitt metal. Do not heat the metal to a high temperature. This can be noted if the pine stick fires. It is not good practice to leave babbitt on the fire longer than neces-

FIG. 8—THE BABBITT SCRAP IS REMELTED WITH SUFFICIENT NEW METAL

FIG. 9—THE HEATED METAL IS STIRRED TO INSURE A UNIFORM COMPOSITION

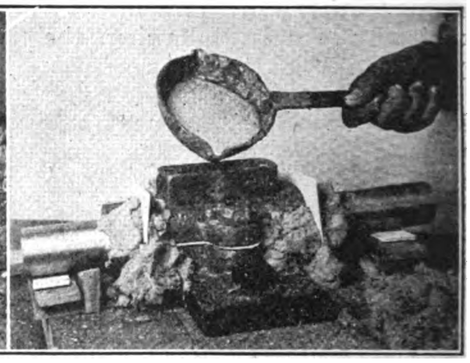


FIG. 10—ONE OF THE SECRETS OF GOOD BEARINGS IS THE MANNER OF POURING

metal left in the holes is by heating the box in the forge fire. These holes must be clean when rebabbitting.

3—Leveling the shaft or mandrel. After the box has been thoroughly cleaned from all loose babbitt metal and oil the shaft or mandrel is then located and properly lined and levelled. A very useful blacking scheme is to use small wedge blocks as shown in this view. After the shaft is brought to the proper position by adjusting the wedge blocks, it must be more securely held by placing flat blocks under each end. It may be necessary to use paper shims in this blocking operation.

4—Cutting paper liners.—The liners are used to go between the base and the cap of the box. In

sealing the ends and sides. This is done to prevent the hot metal from running out. If the hot babbitt comes in contact with the moisture it tends to cause sputtering. Before placing the liners, as shown in the next operation, the cast iron box should be heated. This will insure a more even flow of the metal.

6—Inspecting the location of the liners.—The liners are now all in place and the lower half of the box is ready to receive the cap. A mixture of fire clay and water making a paste the consistency of putty is used for luting and sealing around the box to prevent leakage.

7—Closing the box.—After the liners have been put in place and the shaft properly lined up the cap is ready to be placed on the base.

sary. It should be poured as quickly as it comes to the proper heat. To secure a good serviceable bearing these principles must be closely observed.

9—Bearing of uniform composition.—Before pouring, the babbitt should be stirred thoroughly to insure a lining of uniform composition. The reason for this is that the alloys in the metal have a tendency to separate and seek different levels in the laddle. Previous to pouring, the top of the molten babbitt should be cleaned off as illustrated in the operation and the refuse should not be permitted to fall into the forge fire.

10—Pouring the babbitt.—In this operation care must be exercised in pouring the metal quickly. One of the secrets of good bearings is the

FIG. 11—THE CAP IS REMOVED AFTER BEARING IS COOL

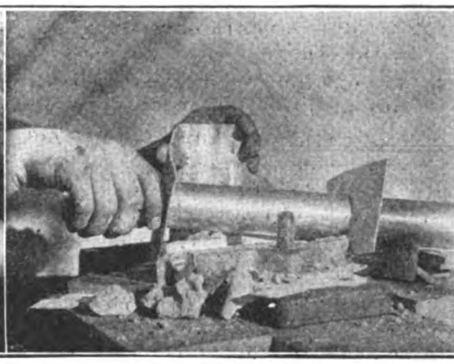


FIG. 12—THE NEW LINING IS INSPECTED FOR SMOOTHNESS

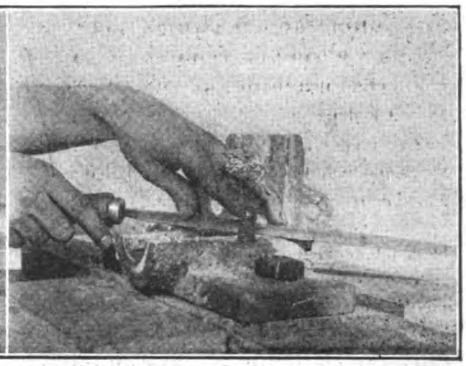


FIG. 13—EDGES OF BEARINGS ARE FILED AND TRIMMED

manner in which the metal is poured into the box. Failures are caused by having the box damp instead of warm as suggested in one of the other operations, by using a ladle with a sharp or flat pouring spout instead of a round spout; by not having the box ends and sides properly sealed, and by not having enough material in the ladle to fire the bearing.

11—Removing the cap from the base.—After the bearing has been poured it should be permitted to cool before trying to separate the cap from the base. This operation is performed according to the manner shown in the view. The clamp bolts are removed and a flat cold chisel is driven between the bearing cap and the base. This causes the metal to separate which ran through the small notches in the liners. This operation should be performed on each side of the box so that there will be no tendency to loosen up the bearing metal from the cast iron.

12—Inspection of bearing.—In this view the bearing cap has been removed which permits the removal of the shaft or mandrel. A close inspection can be made of the babbit lining to determine if it will make a good bearing. If defective, the babbitt lining is removed and the pouring operation is repeated. A lining to make a good bearing must be smooth and free from cold shorts.

13—Cleaning the babbitt lining. —When pouring a bearing the hot metal runs into the small crevice between the cap and base. This causes the babbitt lining to have fins and uneven edges. These should be removed by using the bastard or coarse file as shown. The edges of the babbitt lining should be filed to about a three-quarter inch radius. The bearing surface of the babbitt lining should be filed and scraped to a smooth even finish. The cap and base are fitted together testing the fit of the bearing on a mandrel or shaft. New liners are cut and fitted. They should be thick enough to permit the clamping of the cap and base together with the clamp bolts without binding the shaft.

14—Drilling the oil hole.—In the cap of the box oil holes should be provided. Holes used for gas escapes are filled with babbitt during the pouring operation and it becomes necessary to remove this metal. One method is drilling with he breast drill as indicated in this view. Another very effective method is to core out these holes with wooden plugs, care being exercised that a free passage for air exists between the plug and the sides of the hole. After the metal cools these plugs are driven out and a clean hole is obtained thus eliminating the use of the breast drill as shown in Fig. 14.

15—Cutting the oil grooves.—In this operation the oil grooves are cut by using a round nose gooseneck chisel. After the grooves have been cut, smooth the bearing down with a half-round file and by scrapping. Grooves are cut in the surface of the bearing so as to distribute the lubricant evenly over the entire length of the journal. They are also cut so that they will collect the oil which would otherwise run out at the ends of the bearing and return it to some point where it may again be used. The common dimension for oil grooves is 3/32 inches to ¼ inches in width and 3/32 inches to 1/8 inches in depth.

Bringing the Welder to the Job

DAVID BAXTER

A new field of endeavor is rapidly opening for the blacksmith who is equipped with an oxy-actelylene welding plant. No longer is he compelled to take a machine down in order to repair the break. The gas welding process has been developed to such an extent that now-

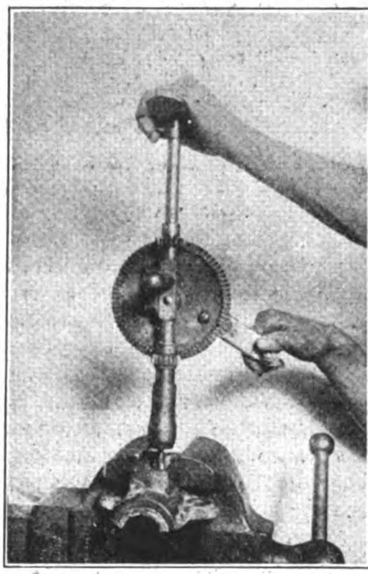


FIG. 14—IF NOT CORED HOLES ARE DRILLED FOR OILING

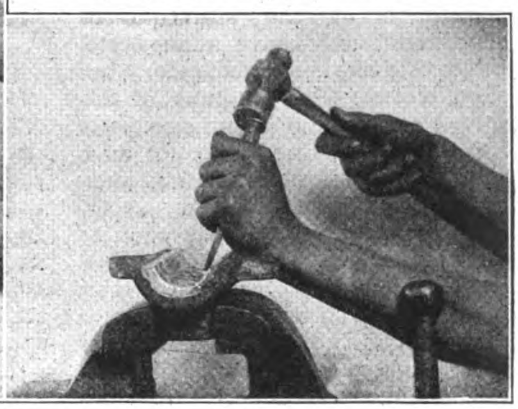


FIG. 15—LAST OPERATION IS THE CUTTING OF OIL GROOVES

days inumerable castings may be welded without removing them from the machine on which they were broken.

He can now repair malleable castings while they are in place on the farmer's machinery, making them stronger if anything than they were before breaking. A few years back he would have been considered a trifle insane if he had said he could weld malleable casting in the shop not to mention doing the work without taking the part from the machine. But this is just what the blacksmith can do today if he operates a welding torch.

It also means that the smithy also can go anywhere to do the work; that the farm or other customer need not drag a crippled machine to the blacksmith shop to have it fixed.

All the blacksmith has to do is to load his outfit into a car and go out to the farm or place in town. The farmer of course the chief patron of the blacksmith and usually needs the repair in a greater hurry. The tractor and combined harvester thresher has been adopted so rapidly in the last few years that this new field of work for the smithy torch welder seems to have been created all at once so to speak.

Usually, when the tractor needs repairing it needs the work quickly. Which is all the more reason why the portable feature of an oxy-acetylene welding plant is such a blessing. The tractor breaks down; the farmer phones to town; the torch welder loads his outfit into a flivver and in half an hour is working on the repair. And this may happen in the middle of the threshing season when every hour counts so much.

For the blacksmith to take full advantage of the situation he should not only have a good stationary acetylene generator but should always have a tank of dissolved acetylene on hand especially for the purpose of going out on a job. It is risky and actually dangerous, to take a stationary acetylene generator out of the shop to do welding jobs, even though it is light enough to move. If this plant is moved while loaded with carbide and water, the jolting of the car or wagon is liable to cause too much gas to generate through the constant dropping of carbide. Even where the utmost care is employed it is a dangerous proceeding to move a stationary outfit.

If the smithy does not have a drum of dissolved acetylene he should at least have a really portable generator, which is constructed for the purpose of moving around under all conditions. And there are few kinds of them on the market at present. But the tanked gas is perfectly safe to move and is not too heavy for one man to handle. It is much to be preferred. In relation to the kinds of work the smithy may do outside of his shop, let us take for example the farm tractor. As previously suggested this class of welding may be divided into two general groups. First, the kinds where it is necessary to remove the broken part from the tractor. Second, where the welding may be done without dismantling the machine.

A PORTABLE WELDING OUTFIT EASILY BUILT BY THE PRACTICAL SHOP MAN

In the first event the blacksmith will find that this class is itself divided. Work where it is necessary to remove the casting on account of having to heat it previous to applying the welding flame. And the kind where the position or location of the broken part makes it impossible to reach it with the flame.

Even then these classes are modified, because it sometimes happens that the part may be preheated without removing it from the machine. A great deal depends upon the skill and good judgment of the torch operator. And some broken castings may be welded by removing some other part of the machine.

In consideration of castings that must be removed to preheat: this class is such as would crack when the weld cooled because the shrinking weld metal would pull away from the surrounding casting. That is, if the broken casting was of such shape that it would rigidly resist the pull of the contracting weld, then it must either crack in the weld or some weaker portion of the job. The rigidity may be caused by the shape and size of the casting or by the way it is fastened to the other parts of the machine.

On the other hand, the parts that do not need to be removed to weld on account of liability to contraction cracking but on account of the weld location or the inaccesibility to them will be found to group in one general class. Which is, in few words, the class where the parts on either sides of the weld are free to be drawn inward by the contracting weld or pushed outward by the expanding metal. Such as lugs, bosses, flanges, handles, etc. For instance a lug is broken off, the fully expanded weld metal is added and the job cools. The cooling weld shrinks and as it does so it pulls upon the broken lug. But this lug is free to be pulled inward so there is no danger of cracking. However, if this lug was merely a connecting brace between two solid sections casting, then these solid sections would resist the pull of the contracting weld and a crack would be the result.

Under this theory two quite heavy parts may be welded together without cracking. Wheels with broken teeth come under this heading but where a spoke is broken the wheel comes in the preheating class. Sometimes it is necessary to remove the wheel from the tractor and sometimes it can be preheated in place. In the latter event the preheating is usually done with the welding flame. A section of the rim at the outer end of the broken spoke is heated with the welding flame until it expands and spreads the crack enough to take care of the contraction when the weld cools.

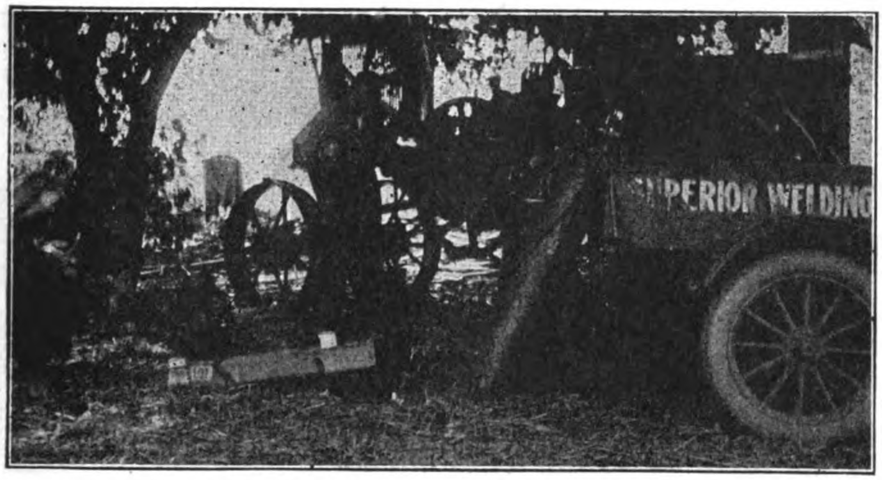
After some experience in welding the blacksmith can soon learn to judge when the job needs preheating; also whether or not he will have to remove the job from the tractor.

When called to weld a tractor job on the farm the smithy should make it plain that certain precautions are necessary in case of fire risk. It is preferable to have the farmer haul the tractor to some sheltered spot, also a shady one. If this is impossible then some one should be near when the welding is done to prevent chance of fire spreading. Particularly if the welding is to be done in a wheat field. Several buckets of water and a number of wet sacks are not a useless precaution. Sometimes an exploding bit of grease or metal exide will start quite a fire if not immediately quenched.

Then there is another danger in welding tractors with the broken part in place. This is the danger of the oiling system or gasoline tank catching fire. The smithy should always take cognizance of these things before he starts to weld. The tractor gears are often covered with grease; these should be guarded. A liberal supply of sheet asbestos should always be taken along for this purpose.

And when going out on a job the welder should take several extra torch tips as he can not tell the exact nature of the job without seeing it . Besides a single tip may be put out of commission before the weld is completed. And what is true of the tips is also true of the filler material. Several different sizes of filler rods should be in the portable outfit. Accurate welding requires correct size in rods for the thickness of metal to be welded. Also it may not be iron or steel that is to be welded so the operator should take along several bronze and aluminun rods when going to the farm to weld.

But let us take the instances illustrated in the photographs which accompany this discussion. By going somewhat into detail in this job the smithy welder may be able to get a clearer impression of what is essential on an outside tractor job. This particular job was two fold in that it required the brazing of a clutch shoe hanger and the welding of a cast iron lug in another part of the clutch gear. Neither job needed preheating as in the latter the lug was free to move with the weld contraction. While in the brazing job it was not necessary to melt the hanger metal and for that reason not necessary to preheat; which did not furnish much heat to be conducted to other parts of the casting.



BRINGING THE WELDING PLANT TO THE JOB WHEN THE JOB IS ON THE FARM

It is useless to weld a malleable casting because the melted malleable turns to a white brittle iron when melted, devoid of strength and not machineable. In a true fusion weld both the casting and the filler metal are melted. It is this melted part that turns to white iron so that while the balance of the job is as strong as ever the weld is very weak. But in brazing only the filler metal is melted so there is no brittle portion in the bond. The filler bronze is merely adhered along the top of the fracture. Even the surface of the malleable is not melted.

However, let us see how the broken clutch lug was mended for this is a good example of brazing malleable cast iron. First the broken piece was thoroughly cleaned of all rust and grease. Then the edge of the fracture was filed slanting on one side. The part from which this piece was broken was also cleaned and filed slanting on the same side. Then a portable vise was arranged as shown in one of the pictures, to hold the broken piece in place. Some care was essential to see that this broken part fitted exactly since it was necessary to keep it aligned on account of the hole in which the shoe was bolted.

The vise held the broken part in place until the brazing was finished. A neutral welding flame was passed back and forth along the groove formed by the filing of both parts. This groove was heated bright red but not melted. Meanwhile a bronze filler rod was brought close to the flame so it would be ready to melt the moment the groove was correctly heated. When this was done the flame was concentrated over one end of the groove and the filler rod placed in contact. As the filler melted it was flattened out in the groove and the flame quickly drawn back. Then the flame was advanced and the rod pulled along the groove to deposit another drop. Thus the entire length of the groove was filed a drop at a time.

This first layer of bronze was allowed to cool; after which another layer was added. Some skill was required as there was danger of the molten filler dropping out of the groove due to the location and position of the melting. It was necessary to watch closely and draw the flame back the moment the metal was deposited. To hold the flame too long was to get it too fluid and therefore increase the liability to run out of the weld. When very fluid, bronze filler has but little surface tension and will quickly run out of the groove if it is not in a horizontal position.

A thick surplus of bronze was piled up along the filling strengthen the repair. Then the opposite side of the fracture was reinforced with the bronze filler. To do this it was necessary to remove the vise but the first filling was by now strong enough to hold the broken piece in place.

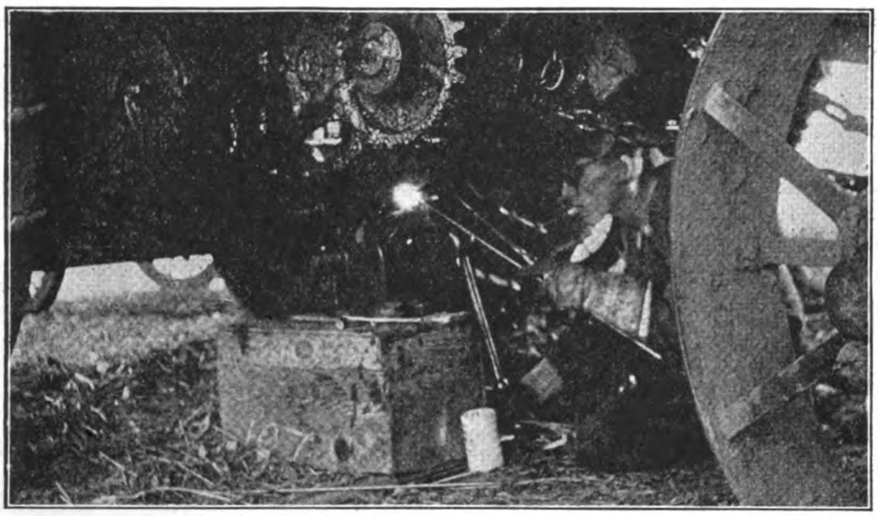
Being located underneath the tractor the whole brazing process was somewhat awkward. But as it was unnecessary to melt the casting metal the welder found it a comparitively easy matter to deposit the bronze filler. A liberal supply of flux was supplied by dipping the heated end of the filler rod in a can of the flux powder everytime a drop of the molten bronze was being allowed to congeal in the groove.

This job was not preheated nor was it slow-cooled or annealed. After the last filet of bronze had been applied the job was ready for service except for a little filing at each end of the shoe bolt hole.

The other job illustrated herein consisted of welding on a small broken lug made of cast iron. This weld, however, was in a horizontal position so that the fact that the casting metal had to be melted made little differnce. And the lug being free to move in and out with expansion and contraction made the welding a simple job. Because the casting had neither to be removed from the tractor nor preheated; it was welded in place without disturbing any of the tractor machinery except to remove a bolt and pull back the bar an inch or two.

This crack was not grooved out but was melted the full depth with the welding flame. The flame was played in small circles over one end of the crack until it melted deep and fluid. Then the heating filler rod was twisted and melted into the molten crack to knit the sides into one mass. Where the casting was thickest, part was melted and scraped out with the filler rod to enable the welder to reach the bottom of the crack. The full length of the crack was fused as rapidly as possible without forcing the flame too often in the molten mass.

These two jobs are but a few of the infinite number of welding jobs the blacksmith may do on the farm if he is equipped with a portable oxy-acetylene torch outfit. He need not stop at tractor work but may include any and all kinds of farm machinery.



UTILIZING A PORTABLE VISE WHILE WELDING A BROKEN PART ON THE TRACTOR

Automobile Brakes and Braking

Here are some hints on automobile brakes and braking that will be of interest and value to the repairman as well as the driver. These hints are taken from one of the bulletins issued by the National Safety Council in their safety lessons for automobile drivers. A reading of these suggestions will give the repairman and the auto driver a proper appreciation of the importance of brakes in the car.

1. The brakes should be tested each day. Before going half a block from the garage make a service test by throwing out the clutch and applying the brakes. If possible, select a dry spot for making this service test. Under no circumstances should the car be taken farther if the brakes are not operating properly. Drive back to the garage and see that the faults are corrected before driving out again.

2. Automobile brakes have a definite relation to safety. Important points are:

a. See that a good type of brake lining is selected.

b. Make sure that brake lining is properly installed.

c. Keep the brakes in good operating condition.

d. Make frequent tests for proper brake adjustment.

e. Apply brakes properly when "on the road."

3. There are many types of brake lining on the market. Do not use linings that are too soft or too thick; such linings easily become matted and necessitate almost constant adjustment. Good linings are woven with plenty of asbestos, some also have fine copper wire woven in.

4. Only an experienced mechanic should install brake linings. He should be sure the lining is properly stretched to avoid wrinkling. The rivets should be properly countersunk; otherwise the metal of the rivets will score the brake drum and the brakes may not hold properly.

5. To keep the brakes in good condition:

a. Once in two months remove the rear wheels and wash the brake lining in kerosene. This removes all oil and grease which if present take the "bite" out of the brakes. Never oil brake lining.

b. Brakes squeal when they are glazed or when improperly adjusted. Squealing can often be stopped by removing wheels and roughening the brake lining with a file.

c. If the brake lining is worn down to the rivets, sink the rivets still farther or have the brakes relined.

d. Wipe off and oil the brake mechanism every 500 miles, or at least once a month.

e. Make regular systematic brake inspection a habit. The loss of a cotter pin might lead to a serious accident. When a lock washer is removed, don't put it back; use a new one.

6. More accidents result from faulty adjustment or application of brakes than from any other cause.

7. All drivers should keep the brakes adjusted properly. Brakes should not drag: if they do they will heat up and be worn down unnecessarily. Brakes should not be too loose; loose brakes do not act quickly enough. Different adjustments are made for different types of brakes:

a. On the shaft brake there is a nut on the brake band which can be adjusted to make the brake band neither too tight nor too loose. Brake rod can be turned either to right or left to make it proper length for efficient use of brake.

b. On axle or wheel drum brake where equalizer is used apply brake when engine is still. Adjust equalizer until it is parallel with axle.

c. On external type of wheel drum brake tighten or loosen adjusting nut on brake band, and equalize length of brake rods.

d. On internal type of wheel drum brake it is necessary to remove rear wheels. Adjust cam plates and adjusting nuts, also equalize length of brake rods.

8. After the brakes are adjusted so they are neither too tight nor too loose, they should be tested every 1,000 miles, or at least once a month, to make sure that the braking power is equally divided between the two rear wheels. Many cars skid, not only because of slippery streets, but also because of unequal division of braking power. Jack up rear wheels and apply brake far enough so that it is just possible to turn one wheel by hand. Adjust brake on other wheel so the same amount of energy is required to turn that wheel by hand.

9. Do you apply your brakes properly when "on the road"?

a. When coming to a stop on a straight-away, shut off the gasoline throttle and leave the clutch engaged until just before you come to a stop; this method of stopping is especially advisable in wet weather because it lessens the tendency of the car to skid. It also helps to distribute the braking power equally, and assists the action of the brakes. Do not shut off the ignition until after you have stopped; it may be necessary to make a quick start. Find out the idling speed maintained by your car when the gasoline throttle is closed, then never (except in emergency cases) try to use your brakes when the clutch is engaged and the car is traveling slower than the idling speed.

b. In going down an ordinary hill, leave the clutch engaged and close the gasoline throttle. This helps cool the engine and also makes it unnecessary to use the brakes. It is sometimes desirable to turn off the ignition switch; this further cools the engine and adds to the braking power.

c. In going down steep hills or when descending ordinary hills with a heavy load, put the gears in intermediate or low speed at the top of the hill and leave the clutch engaged. Shut off the gasoline throttle and, if desirable, turn off the ignition switch.

d. In ordinary driving, do not use the brakes oftener than necessary; regulate the speed of the car as much as possible by use of the throttle. If the car is equipped with a foot throttle use it in preference to the hand throttle. This leaves the hands freer to operate the gears and the steering wheel.

e. In making an emergency stop, leave the clutch engaged, apply the foot brake, and pull the hand brake; but do not "lock the wheels." Keep the wheels rolling; otherwise there is danger that the car might slide or skid.

Something About Automobile Clutches

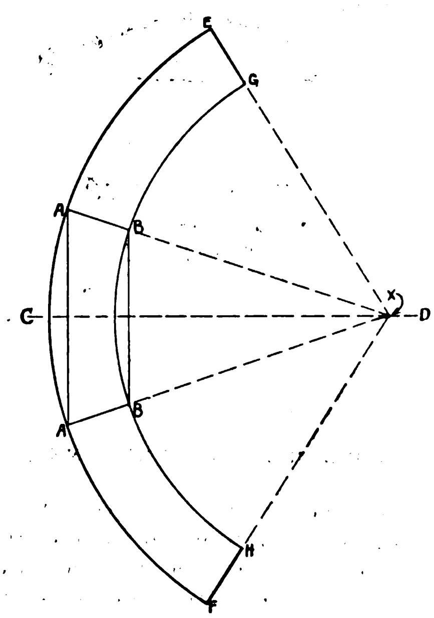
C. J. WANDER

There are in all about six or seven distinct types of clutches used on the cars of today. However there are but three or four of these that the average repair man need concern himself with. The others are used to a lesser extent and will seldom be found in the average job for repair.

In the group of clutches which the repair man must know if he is to take of the average run of cars that go past his shop, there is first the cone clutch, which is no doubt still the most frequently found on the average car. Then comes the disc or plate clutch. The other types then follow in a greater or lesser extent i. e. the contracting clutch, the one operated by an expanding band, and then come the magnetic or electric clutches and then those known as hydraulic or fluid clutches.

Clutches really offer many chances for trouble in the perfect operation of the average car. There is considerable loss of power in the car with a clutch that is not operating as it should. For example with a clutch that is slipping to any extent there is a considerable loss of power because all of the power generated by the motor and delivered to the fly wheel is not transmitted to the driving of the wheels for it is lost in the clutch mechanism. On the other hand if the clutch is dragging there is loss of power because of its absorption of the clutch mechanism. It is therefore an important part of the car to which attention is demanded by the repair man. Clutch trouble is usually trouble that the average car owner cannot take care of himself.

Now let us take up the troubles that are most frequent in the more common types of clutches. In the first place the type known as the cone clutch takes its name from the fact that it consists of a cone shaped meta. part, sometimes of aluminum, which is faced with leather. With a clutch of this type



IF THE OLD CLUTCH LEATHER CANNOT BE USED AS A PATTERN MAKE A NEW PATTERN

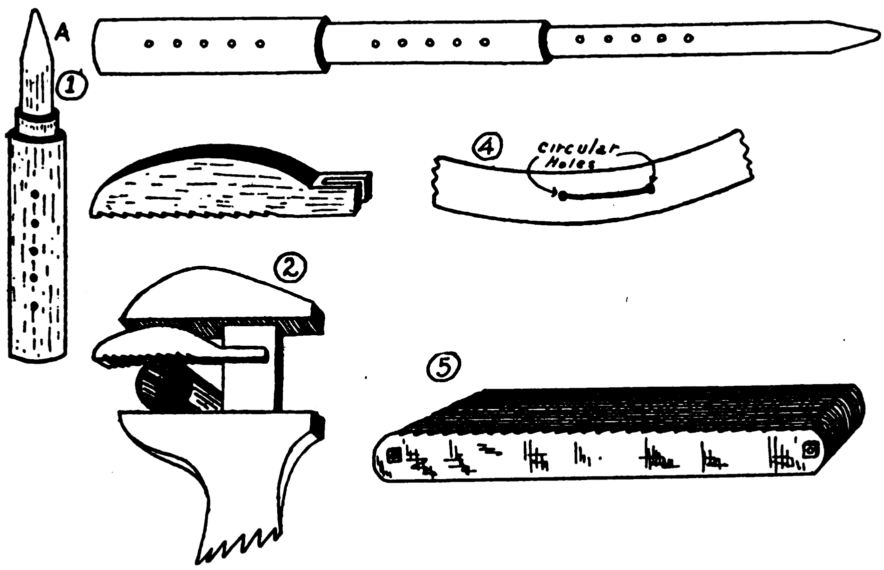
the leather should be occasionally dressed with a little neatsfoot oil. This will usually keep it in good working condition. It is necessary however, due to the neglect usually handed to the average clutch, to occasionally clean off the clutch leather and for this purpose gasoline should be used. After thoroughly cleaning the grease and dirt from the leather apply a little neatsfoot oil when the clutch will again operate properly.

In order to do this it will be necessary to have some one hold the clutch out so you can get at it. If you are compelled to work alone cut a stout stick the correct length to hold the clutch pedal out by bracing the pedal forward from the front of the driving seat. The oil can then be applied very easily and handily with an oil can. Be sure to get at all parts of the leather both in cleaning it and when applying the neatsfoot oil. If the clutch has gone for any considerable period, and most generally it has gone for a very long time without any attention whatever, it will need a considerable quantity of neatsfoot oil to make it soft and pliable again.

There replacing of a worm or burned leather in the cone clutch is not as difficult a job as the average repair man would have you think. The worst part of the job is the removal of the clutch parts preparatory to the fitting of the leather. This procedure differs of course in the various makes of cars, but will except in very few instances, be a comparatively easy job for the repair man who uses his head. Perhaps one matter that had best be mentioned right here is the strength of the clutch spring. Do not attempt to hold this spring without mechanical aid of some kind. On most cars some provision is made for this by means of a plug hole wherein a pin or punch may be inserted after the clutch spring has been properly depressed. Thus the spring is held out of the way while the clutch is removed for replacing the leather.

In the event of having a ready fitted leather of the proper make and type the fitting of the leather becomes a comparatively easy task. However this is not always the case and a leather usually has to be cut. This like any other job is very easy when you know how to go about it, but it is almost impossible to fit a clutch leather properly unless one knows just how to proceed with the job.

If the old leather can be removed in its entirety the cutting of the new leather will be a comparitively easy matter by using the old leather as a pattern. However if the old leather is badly worn or if it cannot be removed in one piece it will be best to make a layout of the clutch pattern as shown in the engraving, on page 333.



FOUR PRACTICAL HINTS WHICH THE REPAIR MAN WILL APPRECIATE

In the first place it must be remembered that the surface of the clutch to which the leather is fastened is a portion of a cone and it is therefore necessary to use extreme care in marking out the pattern from which the leather is to to be cut.

To go about the job it is of first importance that all of the old leather be removed from the surface of the cone. The rivets which held the old leather are all carefully removeu and all dirt and grease removed from the metal. Now secure enough rivets of the proper size for the new leather. The reason the new rivets should be provided before the new leather is cut is because it is much easier to fit the rivets when the rivet holes are clean and unobstructed.

Now measure the cone very carefully taking the diameters at both the large and also the small ends and also the width. Then take a large sheet of paper and lay the cone out on this as shown in the engraving at A, A and B,B, drawing the cone to exactly the size of the actual dimensions. In other words the larger diameter of the actual cone on the machine should be the measurement from A to A. The measurement from B to B should be the actual dimension of the cone at its small end. The dimension from A to B should be the actual width of the cone.

Now bisect the line AA and draw the line C to D which is of course at right angles to the line AA. Now extend the lines A B until they meet the center line C D at the point X which represents the apex of the cone. With the point X as a center the arcs represented by the lines E to F and G to H are then drawn. The distance for these arcs they may be easily measured by marking the lines E G and F H at points slightly greater then the measurement of the lines A A and B B. In other words the distance in a straight line from A to F should be slightly more then the distance from A to A. The figure enclosed by the lines E F H G is the pattern for the cone leather. This may now be cut out and the leather cut accordingly.

In preparing the leather for the cone soak it thoroughly in water or neatsfoot oil until it is soft and pliable. Bear in mind that the leather must stretch easily and that its softness has much to do with its easy and proper operation on the car. Having gotten the leather soft and pliable lay one end of it on the cone and rivet it into place. The leather is then drawn down tightly past the next line of rivet holes and again riveted into place. Proceed in this manner until the entire leather is securely fastened and firmly secured. After all of the rivets have been secured trim off the end of the leather and then go carefully over the rivets and see that all of them are well clinched and that the heads are well below the surface of the leather so as not to hit the inside of the other part of the clutch mechanism.

In some types of clutches there are springs under the clutch leather. These are for the purpose of having the clutch take hold easier and with less jerk. Sometimes if the clutch of this type is not operating properly these springs may need adjusting, which adjustment can be very easily made by turning the nut or bolt which holds each spring. If the clutch of this type is slipping the springs should be adjusted and if the slipping persists it will then be necessary perhaps to fit a new clutch leather.

With reference to the disc or plate clutches: these require little attention except an occasional adjustment which can be made by any practical man with an understanding of automobile mechanics.

A Half Dozen Practical Hints for the Repair Man

GEORGE H. HOLDEN

A Telescopic Crowbar

For upwards of twelve months I have made use of a telescopic crowbar, as shown in Fig. 1. Section one is an ordinary short length of solid steel, pointed at one end, and drilled with five holes. The remaining two sections are built up of 18 inch lengths of steel tubing, similarly drilled.

The advantage of this tool is that it is compact for carrying; the weight being also less than a solid bar of similar length. The leverage is adjustable to suit almost every need; being held rigid by cotter pins run through the tubular sections, according to requirement. When out of use, the tubes slide over the bar, as shown at A. The extensions may be caried out even further, of course. But for all ordinary purposes, I find two tubular extensions fill the bill quite well.

Utilising Spanner As Pipe Vise

Having a use for a pipe vise suitable for small bore gas tubing, I utilized a small wrench for the purpose, with gratifying results. I first made a toothed-lip piece, as shown; cutting the square section end to form a groove. This I inserted between the jaws of the wrench so that the lip was held rigid during use. The "lip" only takes a few minutes to make, and almost any moveable wrench is convertible into a pipe vise at will. The accessory is attached or detached in a second, and occupies no room worth mention.

Nail-Straightening Tool From Old File

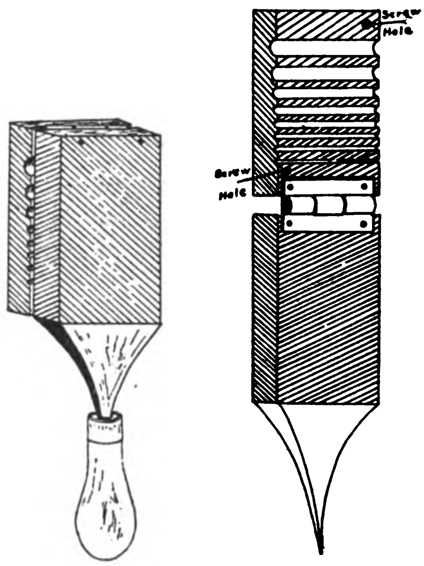
Having a quantity of bent used nails. I made a useful nail-straightener from an odd file length, as shown in Fig. 3. Selecting an oblong section file, I cut off 6 inch lengths, exclusive of the handle end.

I then affixed an old hinge by drilling suitable holes in file ends, securing same by means of set screws. The two halves then folded over forming a vise.

This done, I made a few cuts with hacksaw across the bottom section, finishing off with a round section file. The grooves were easily made after temperature of the file was lowered. Two screws through grooved half secured the tool to a piece of strong board. On inserting nails in the grooves and bringing down the handle with force, the bent nails are straightened as fast as the lever can be operated.

Checking Rips In Auto Tires

When I have a cut or ripped inner tube to repair, I find that making a small hole either end (as shown in Fig 4) prevents the gap lengthening, no matter how much the tire is used afterward.



A USEFUL NAIL STRAIGHTENER FROM AN OLD FILE

The holes are made by heating a blunt end 1/16 inch wire nail. Holding the affected part between thumb and forefinger, I then pierce the nail gently at either end of the cut. In this way, the ends cannot spread, causing further havoc.

Old Hacksaw-Blades As Files

I find my old hacksaw-blades save me eight to ten dollars on my file and rasp bills every year.

As soon as the old blades are useless for cutting, I store them until a sufficient number are collected. A dozen or so are then placed side by side, and bolted either end. In this way a cheap and efficient tool for such odd jobs as reducing metal, etc. is made.

Almost any width of file may be built up in this way. When they are useless for metal working, they may be utilized further as rasps for wood and leather.

Any section becoming unduly worn may be replaced by fresh blades, of course.

Making Iron-Work Rust-Proof

One of the most efficient methods of rendering ironwork rust-proof is to heat the metal until hot, and then apply a thin coating of linseed oil.

On the metal being heated, apply the oil with a brush to the parts and allow to cool, when the film of oil acts as a varnish, and, unlike ordinary paint and enamel, it does not easily "chip."

Bright steelware, such as table-knives and fine tools, may be kept free from rust by dipping in a solution of soda) four parts of soda to one of water), then dry, wrap in flannel, and keep free from damp.

Good Fuel Economy Easily Obtainable

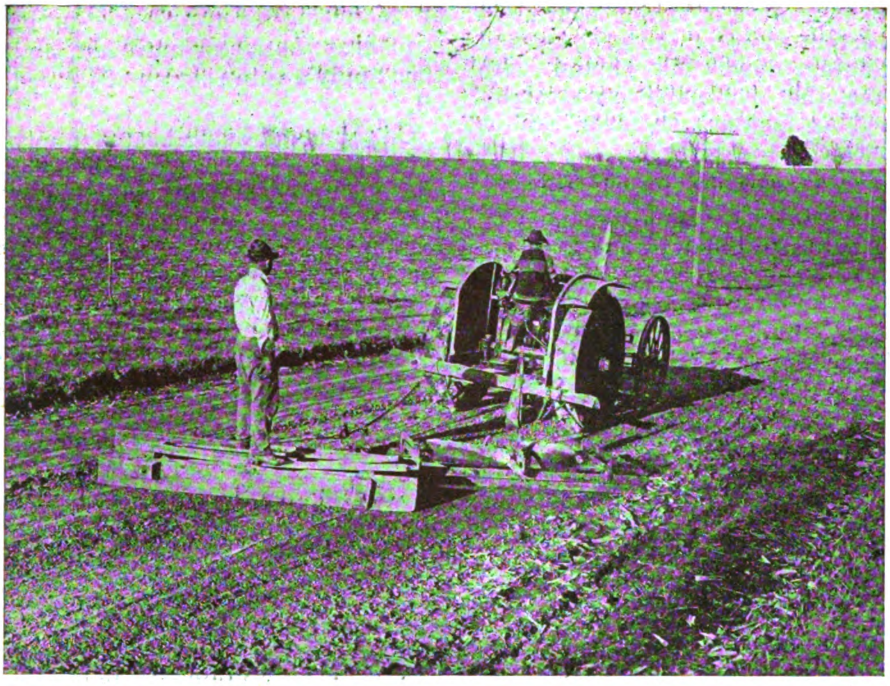
Recent reductions in the price of motor fuels are no excuse for carelessness in the utilization of such files. The desirability and necessity of maintaining good fuel economy is just as great as ever.

Among the important things affecting fuel economy may be mentioned proper adjustment of the carburetor. All the carbureting accessories such as air meters, fuel vaporizors, etc., should be in first-class working order. The carburetor jets should be clean and all fuel passages must be clear and free of leaks. Leakage of air through faulty gaskets, badly fitted valves or other places, sometimes causes faults in operation which are improperly ascribed to the carburetor.

Using the choke excessively is also productive of much trouble in causing carbon deposits and in clogging mufflers. This results in a sluggish engine, reduction of power, and, consequently, more fuel. A vicious cycle is thus established.

Valves should be carefully fitted and properly timed. Factory timing is rarely incorrect and when any repairs are made, or any overhauling of the motor is done, care should be taken to check the time accurately. The cooling system has some effect on fuel consumption. Generally speaking, the hotter an engine runs the less fuel will be used, but this has some exceptions. Cool operation results in fuel condensation in the combustion chamber and consequently carbon formation.

Adequate lubrication is also essential. Bearings that are too tight absorb power and it takes fuel to produce power.



A MULE SKINNER'S TRACTOR PHILOSOPHY

W. H. Gardner in Orchard and Home

Nor whip, nor goad, nor ridicule
Will raise a hair on stubborn mule;
Yet—scorch him with a vicious oath
The beast will lose a season's growth!

But tractors are of tempered steel,
And neither listen, sweat nor feel.
To lash them with profanity,
I hold is an inanity!

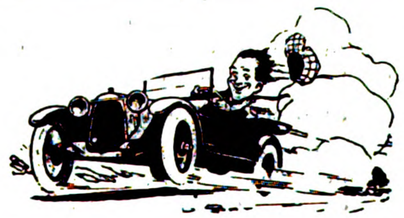
An empty radiator's fizz
Provokes, perhaps, a mild "Gee whiz!"
For "some one" let the thing go dry.
(That one, I know too well, was I!)

And when the tortured pistons wheeze,
I should be called a hunk o' cheese!
For tractors, oil-less, always halt—
The motor should not bear the fault!

The mule, it always seemed to me,
Appreciates profanity;
But when the tractor's halt and lame,
The driver usually is to blame.

And if a mule decides to balk,
He quite deserves expressive talk;
But when the ungreased pinions burst,
'Tis I who should be roundly cursed!

High Spots



Try the phone the next time you have a slow pay customer to deal with. After you've sent him a bill two or three times just ring him up on the phone.

And its a good thought—Some one has said that a person's real happiness begins just as soon as they discover that work is not curse but a blessing.

Are you selling supplies and accessories to the owner of auto, trucks and tractor or are you letting this profitable business go to ome inexperienced upstart who has no practical knowledge of mechanics.

Did you read "The Worth of a Smile" which appeared on page 30 of the September number. If not it will pay you to turn to it right now and to heed the advise suggested. When a jury considers a smile worth twenty thousand dollars to a child of thirteen how much do you suppose a smile is worth in business?

When you hear of one of your customers selling a good lot of produce—get busy quick and hand 'em your bill. The time to collect money is when you know there is money where the collecting is to be done. Strike while the iron is hot is a pretty good motto to follow in lines other than forging.

Have you sent in that letter for the Editor? Better get busy now and tell him about things in your section. You like to read the letters from other readers—the others will enjoy your letter business go to some ineperienced upstart picture taken send it in for our pages. This is "Our Journal" remember.

Do you realize that the modern shop man needs to know more and more each day to keep up with the procession of progress? Look back twenty years and see what the shop man and smithing craftsman of that time were required to know. And yet those days were the days of good old crafters who knew thoroughly all about their work and they took great pride in doing superior work.

You can't build a house on the foundation under your neighbor's residence. Neither can you run a business on the money in your debtor's pockets. And the money that he owes is just as much yours as tho' you had it in your own cash drawer—it is simply a matter of collecting it. Clean up the old accounts NOW. Go after them tactfully, persistently and thoroughly. If necessary sue for your money. But get what belongs to you.

You can chatter, prattle and preach on one subect for an entire life time but if your hearers will not think about what you are saying you might better save your breath. To get lasting value out of the items and articles published in these pages you must think and think hard. Apply the ideas proposed by the writers—use the hints, kinks and suggestions set forth. Get all you can out of these pages —then you will get full value and more for your time.

Of course it isn't well to suspect everyone, but do be careful about handing your good hard earned money to strangers. A man may wear fine clothes, talk well and yet be a faker or sharper. And remember not all sharpers are attempting to sell gold bricks—some are suscription agents.
just as much. And if you've had a shop white wash improve the interior appearance of the shop these days. Apply it now before the closed-shop-days come with a bite of frost and a swirl of snow.

Perhaps you've noticed—Perhaps you haven't but we will have fifteen numbers to the present volume of "Our Journal." In other words instead of starting the new volume with the October number as we have always done in the past we are putting the October, November and December issues in volume 20 and will start Volume 21 with the January number of 1922. This will make the volumes of "Our Journal" begin and end with the calendar year and relieve much confusion for our readers, advertisers and simplify many matters for ourselves.

The long evenings of the coming winter is not a curse but a blessing for the progressive and ambitious shop man to sprig up on one or two lines of work upon which he is not fully informed. Our Book Department is ready and willing to give any and every reader any and every help in the choosing of proper books and in securing them at the best possible prices.

LINCOLN SAID:—

"Let us have faith that right makes might and in that faith let us dare to do our duty as we understand it. I do the best I know how—the very best I can—and I mean to help doing so until the end. If the end brings me out all right what is said against me won't amount to anything. If the end brings me out wrong, ten angles swearing I was right would make no difference."

Bending Tubes and Rods

The Tools and Devices are How to do the Work

A. J. RAND

Tubes and rods are used in so many ways in these days that it is necessary for the practical repairman to know something of the tools and devices necessary for work of this character and then to know the principles which apply to the actual work.

The automobile, truck and tractor and in fact all machinery, are well supplied with tubular and solid parts that are bent into various shapes for proper application and while tubing and hollow sectional parts require considerably different treatment than solid rods, what is said of tubes will generally apply to rod bending.

Some tubes are made of such excellent material that cold bending may frequently be used. This is particularly the case with cold drawn weldless steel tubes. The process of manufacture through which the tubes pass originally demands a high class of materials. If the repairman is in doubt as to the quality of the steel tubing, they will do well to take no chance and heat the work instead. Even where the quality is right, a considerable hardness of the metal may make cold bending a somewhat risky proposition.

Steel tubes are manufactured with various degrees of hardness depending on the character of service the tube is designed to perform. Sometimes, it is quite essential that the tube be rigid and strong. And as carbon givs these qualities, such steel will contain more carbon than where a soft pliable material is wanted possessing moderate strength. The repairman can get a line on the tubing he had in hand by using a file on it. If he is satisfied that the tube is weldless and has been made by cold drawing, he may be pretty confident of the quality.

Some tubing may be bent just as it is; it is safer, however, to **fill** all work before attempting to bend it. For cold bending a very useful material though not the only one—is **lead.** This metal melts at about 619 degrees Fahrenheit, and this low melting point makes it especially desirable to use, as we shall see. We heat the lead in some suitable vessel, put a funnel in one end of the tube, after plugging the other end or standing it on the ground, and then pour the lead in to fill up the interior space. Its low melting point make the re-melting an easy matter and greatly facilitates the removal of the metal from the tube after the bending is completed. The whole is simply heated and the lead permitted to run out into some vessel. When we note that 619 degrees is 250 degrees lower than the lowest red that is visable in the dark when steel is heated, we will perhaps understand that the necessary heating of the work to get rid of the lead will not injure the steel or even enlarge its grains. Of course, one may go at the heating so carelessly as to heat a part of the tubing much beyond what is needful. Instead of simple lead, one may use some of the alloys of the metal. The object in view in using a filling is to keep the tube distended everywhere while bending is going one. The thinner the tubing, other things being equal, the more necessary it is to use a proper filling. Furthermore, with thin tubing, heavy material for filling seems to be especially desirable. Lead, it will be seen, is just about the thing.

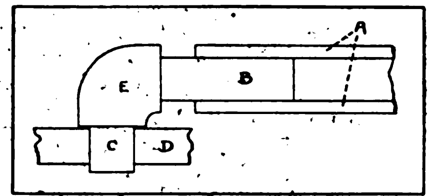


FIG. 2.—SECTIONAL VIEW OF STUD IN ONE PIECE. A—TUBE END.—B. HORIZONTAL END OF STUD.—C.—VERTICAL END OF STUD. D.—TABLE. E.—ELBOW.

For **hot bending,** we may substitute **sand** for lead. We plug the ends of the tube, completely filling the intervening space. Instead of sand, we may sometimes use a soft iron rod. However, in this case, we should look ahead and consider how we are going to get the rod out after the bending. If none of the tube is to be left straight and the whole length is to be bent to the same degree of curvature, we need ordinarly expect but little trouble in removing the rod, provided our means for bending are right. But if one part of the tube is to be left straight, or even if one part is curved, differently from another part, the rod will stick, On the other hand, the rod is permissible where the tube is to be regularly coiled with all coils the same size. The rod may be "unscrewed" out of the finished coil. The fit of the rod should not be too tight to permit withdrawal nor too loose to provide suitable support. We must not overlook the fact that, when bending is going on, we have two pieces of metal to bend. If the rod is not especially soft, naturally the heat may be needed to penetrate

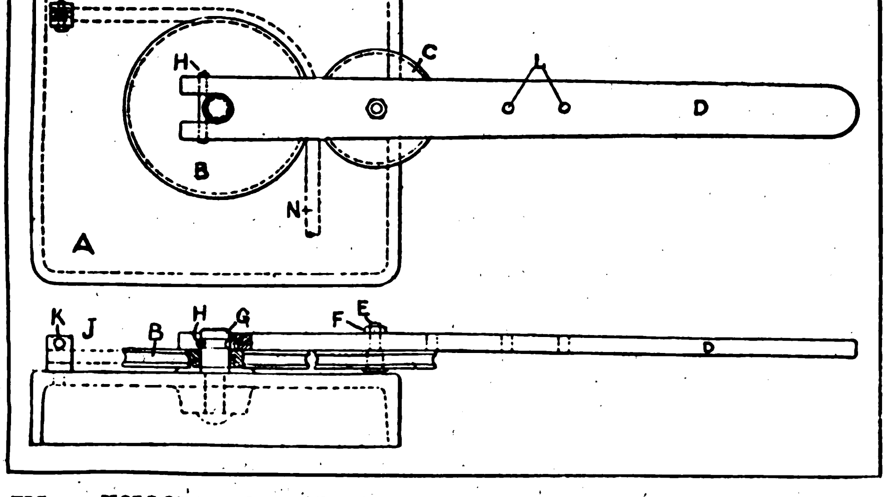


FIG. 1—HOLLOW TUBES OR SOLID RODS MAY BE BENT ON THIS EASILY MADE BENDING MACHINE

into it to make the work go along easily.

In doing the actual bending of tubing, we should forget all about hammers and anvils and vises and wrenches. The work is not to be struck. A special bending device is, in general, absolutely essential. It need not be an elaborate affair, and may be properly made for the most part by the repairman himself in his own shop. There are several varieties. A representative appratus will have a suitable form or mandrel on which the tubing is to be bent. This may or may not be a full circle. Even when we wish to make a bend of a complete circle, it will usually be unnecessary to to have a form of more than a fraction of the full circuit. In addition to the mandrel or form, we need a stop for holding tha work against the form. A lever is to be provided, by means of which the tube is forced up against the form and the bend produced. All this, so far as I have described is pretty much the same as for some of the devices used for bending solid bars. There are certain differences, however. The edge of the form should be provided with a groove to suppor the tubing better than is possible with a plain surface. Naturally, the groove is round in section. But the radius of curvature of the groove section is a trifle larger than the radius of a section of the tubing. It is not necessary to make it very deep—something distinctly less than a semi-circle is all that is necessary for groove section. The surface of the stop against which the end of the tube presses should also be grooved. The fulcrum, or point of support, around which the lever turns is not left to be simply where one can get support but is fixed at the center of the circle of the bend that is to be made. Then, instead of using a simple projection on the lever as the thing to come against the tube and force it up against the form, a grooved wheel is employed. There is no dragging action at all when this wheel operates against the tube, but a simpl rolling action. The groove in this wheel is made similar to that in the form. It may be wise to give this groove a good depth, so as to provide for good control of the tubing. The diameter of this wheel may, within reasonable limits, be anything you like. It does not have to agree with the diameter of the circle of the form.

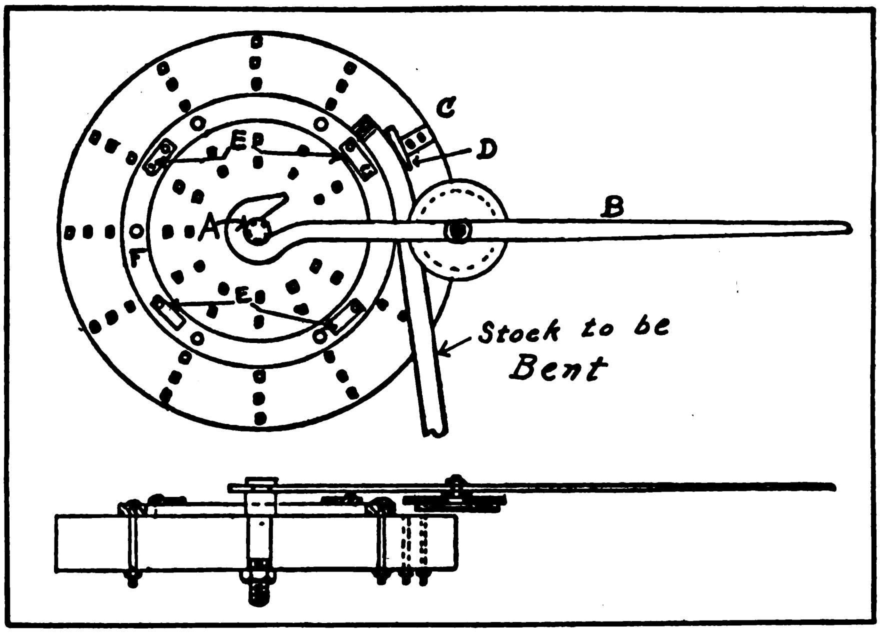


FIG. 3.—AN EASILY MADE BENDING DEVICE FOR TUBING OR RODS

The engravings show two varieties of machines usable for tube bending. With respect to the use of the device shown in Fig. 1 the tubing need not necessarily be filled with sand or other material. There is a cast-iron base A which is cored out underneath, thus giving comparative lightness and saving iron. It may be 2 feet on a side. A boss is arranged underneath at the center to add to the thickness and thus give good support to the stud pin G. There is also a slight boss on top in the same region. This enables the wheel which is to be mounted on the stud to clear the top of the table. The stud pin may be made in two parts. One will be the equivalent of a bolt with its head underneath. The second part will thread on the upper end of the bolt and form a kind of a nut. The lower part of this nut provides a bearing surface upon which the grooved wheel B may be mounted. The upper part is provided with a groove. The lever D is slotted at one end to permit it to get a bearing against the top of the stud. A tapered pin holds the lever in place, this pin lying in the groove in the top of the stud and permitting the lever to be turned in a horizontal plane. The lever may be made of hard wood, in which case we use a bushing between the wood and the top of the stud. This bushing may be cut away at one spot so as not to interfere with the tapered pin H. Underneath the lever is mounted a second grooved wheel C. A suitable pin and nut provide a bearing. Note that the head of this pin at the bottom is made quite flat to permit it to move back and forth over the table. It should be observed that this second wheel C may be set at various points along the lever, thus providing for the use of various sizes of the wheel B. The changes in B correspond to changes in curvature that may be desired. It is not necessary to have more than the one size of C, although it may be serviceable to have various wheels to provide changes in groove for different diameters of tubing. The provision with this machine for holding the tube is rather an elaborate one. A short piece of square bar is turned round for, say 1 inch at one end. A suitable hole of the same size in the table permits the insertion of this rounded end. This place is to provide for a clamp through which the end of the tube is to extend. Consequently, we bore a hole through the other end of the piece, the hole running clear opposite. This hole is made a trifle larger than the pipe which is to be held. To produce the grip on the pipe, the hole will have to be contracted. Accordingly, we saw through the material above the hole haking a slot running parallel with the axis of the tube when in position. By drawing together the metal to each side of the slot, we will narrow the hole and grip the tube. We may provide for this clamping action in one or two simple ways. We may bore a smooth hole through the metal on both sides of the slot, this hole being perpendicular to the plane of the slot, and use a bolt and nut. Or, we may leave the hole smooth to one side of the slot and thread the other part. A

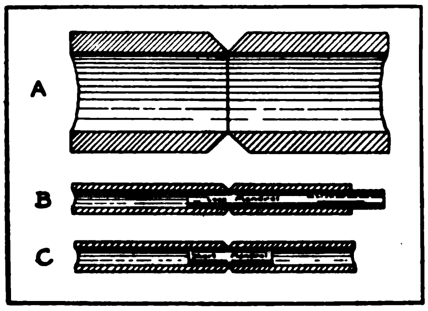


FIG. 4.—AT A, ENLARGED VIEW OF TUBING IN SECTION READY TO BE WELDED. B.—WITH LONG MANDREL IN PLACE. C.—USING SHORT BAR OR MANDREL

square-headed bolt, threaded to match this thread and made of the proper length will give us the means of clamping. However, it seems simpler to the writer to use a different form of stud (See Fig. 2). Instead of clamping the tube from the outside, we may use a kind of plug inserted in the tube. We take a piece of round stock of suitable size and length, and prepare the one end for insertion into the table top. That is, we use stock larger than the hole in the table, turning the end of the piece down to the proper size. In this way, we provide a suitable shoulder. We bend the other end at right angles and this provides for the piece to enter the tube. If necessary to reduce the size, we turn this end to the interior diameter of the tube before putting in the right angle bend. Such a stud is easy to make and will support the walls of the tube during the operation of the machine. The fit with the tube should be moderately tight, and this part of the stud should not be too short. By using this form of stud, we get rid of the boring of holes in the stud. We need have but one operation on the lathe, if we select stock of just the right size for entrance into the tubing. It is not necessary to confine ourselves to a single hole in the table top. There is an advantage to be gained by the use of the more elaborate stud that one should consider before making a final decision. In using the machine with the clamp arrangement, we may run the pipe in towards the forming wheel. Here it may be bent, little by little, the feeding in of more and more pipe being accomplished by continuing to shove the pipe through the clamp in the same direction used when starting. Of course, we loosen and tighten the clamp for every advance. Besides, the simpler stud does not provide against the tube pulling off; so that at the beginning of an operation, we might have to hold the tube on to keep it from slipping.

The machine seems to leave a short piece of tubing un-bent. In order to complete the bending, whether we use one style of stud or another, we may proceed as follows: A little before the machine has approached its limit, we insert in the tube a snug-fitting rod as far as it will go and do the final bending that we would ordinarily do with the machine with the rod thus in place. We now go to a finish by simply advancing the rod in the clamp and using the latter to hold it. Of course, we may need to pack the rod in the clamp in order to make it grip.

This machine and also the one yet to be described may be used to bend flat bars on the edge and the standard forms of angle bar. I will now give an account of the second machine.

The apparatus consists in part of a circular table pierced with numerous holes. (See Fig. 3). These holes are arranged along radius and correspond to various circumferences. They provide a means of securing a ring of metal to the table with ordinary bolts. We may take off one ring and put one on another group of bolt holes. These rings correspond to the forming wheel of the other machine. The tube or bar that is to be bent is

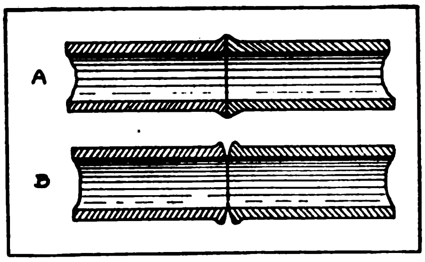


FIG. 5.—TWO WAYS OF PREPARING TUBING FOR WELDING

forced against the edge of the ring. Naturally, the precise shape of this edge will vary in accordance with the nature of the work. For tubing, it will be best to provide the forming edge of the ring with a curved groove. It will often be unnecessary to provide more than a moderate sized arc—say 60 degrees in length. The bolt holes also provide a means of securing a suitable stop to hold the work up to the forming ring. Naturally, the shape of this stop will vary with the work. A large hole is provided at the exact center of the table. We thus provide for a stud pin projecting up from the table at its center. This gives us a suitable support against which to press in turning a lever. The lever, just as in the other machine, is fitted with a wheel on a removable stud. This wheel, as before, is the element which presses up against the work and curves it round the form. Its edge will naturally be shaped to suit the work. The inner end of the lever is made in hook form, permitting it to be readily put in place over the central stud. Now we may perhaps make one or two changes in this apparatus which will probably make it easier to con-

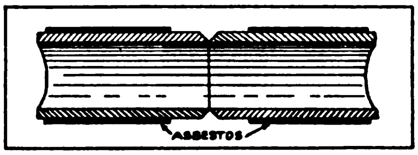


FIG. 6.—SECTIONAL VIEW OF ENDS READY TO WELD TOGETHER WITH ASBESTOS STRIPS IN PLACE

struct. If it seems easier to use a wheel for the curved form instead of a ring, then we may dispense with a good many bolt holes. If we use a sector of a circle instead of a complete wheel, we may need a hole of some kind in order to provide for keeping the sector in place. As to the material to use for the table — wood or cast-iron — the smith may judge for himself, taking into account the work he proposes to do.

Joining Sections

The repairman working with tubes, will, at times, have to solve the problem of uniting sections either before or after bending. Perhaps the most convenient method of doing this is that which makes use of the oxy-acetylene welding process.

Let us consider first the case where tubes are to be welded **previous to bending**. We will assume, by way of illustration, that we are uniting straight pieces. First we bevel off the edges of the two ends to a bevel of 45 degrees (Fig. 4-A). The ends should fit exactly and their edges jammed sufficiently together to prevent the entrance of molten metal into the tube while welding. After jamming the ends together there will likely be more or less roughness on the inside of the tube which should be carefully cleaned off with a hand reamer.

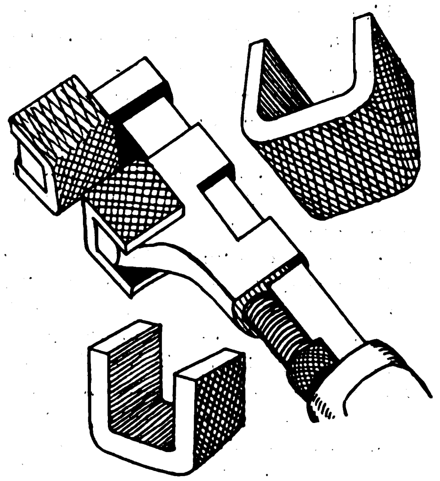
The two pieces of work should be secured in a vise or between clamps before beginning operations with the welding torch and measures should be taken to provide for turning the tube and holding the ends in place while welding. An easy way to do this is to mount the two ends on a sort of mandrel which may be either a trifle longer than one piece, so one end of this mandrel will serve as a seat for the other piece while its opposite end serves as an aid to withdrawing the bar after welding (Fig. 4-B); or, instead, we may use a short piece of bar just long enough to provide a seat for both ends where they are to be joined and which may be knocked out afterward (Fig. 4-C). We then begin work by uniting the ends roughly at three points equidistant from one another, knocking out the mandrel and then proceeding to weld the tube all round.

If the tube walls are not thicker than 3/16 of an inch, the welding may be done without beveling the ends at all and without the use of a welding rod. The ends should, in this case, be upset and then cleaned out in the bore; the object being to provide exterior ridges without, however, leaving any roughness on the inside. The two pieces of work are now jammed together, butt to butt (Fig. 5-A) and the welding carried on by heating the metal of the walls **clear through.** The heat must be just sufficient to bring the inside edges of the joint to the melting point.

We may bring still heavier tube walls within the scope of this method by the double operation of upsetting and beveling. The beveling need not be much of a departure from the ordinary plain edge. The object is to provide a sufficiently open groove when the two ends are together to enable the operator to get a melting heat clear to the bottom. The amount of upsetting will naturally vary with the amount of beveling. The two ridges are to supply material to fill up the groove and finish off the weld. That is all. So we bevel and upset just enough to accomplish the heating and the filling (and finishing) (Fig. 5-B).

The work of welding tube ends together may be aided by the use of asbestos strips wound round the ends, one strip to one side of the weld and the other strip to the other side (Fig. 6). The object of using such strips is to prevent the radiation of heat from the work to either side of the joint. The loss of heat by such radiation will then be made up by heat from the joint and this last loss by heat from the welding flame. However, if there is no trouble in driving sufficient heat clear through the tube walls without the use of the asbestos, then naturally it may be omitted.

Whatever mode of procedure be employed, if the work is done right, then we will get a fine joint. If full strength is important and it is not desired to have a rounded ridge all round the finished work, then we must anneal. This should be done with great care and in accordance with modern methods of annealing.



AN EMERGENCY PIPE WRENCH

Where the welding is done **subsequent to bending,** it may be impossible to use a steel mandrel, short or long. In such a case, we may use a plug of wood. If the wood is fairly hard—maple, for example—it may resist the heat of the welding operation long enough to cover the case. However, we may if we choose wrap the plug with asbestos cloth. The plug may be removed by heating the work in the region of the weld, and then knocking out the charred material.

If the shop is not equipped with a suitable gas-welding outfit, the repairman may weld tube ends by the more usual means of the ordinary blacksmith's welding.

But in case he uses the oxy-acetylene torch, he should bear in mind that he may save money by handling the work just right. Oxygen and acetylene are expensive gases. It is often the case that the torch need not be used on the work at all for the early part of the heating. The two ends of the tubing may be preheated in the forge or by the use of a cheap gas flame.

Kinds of Gasoline

Modern refining methods have developed three types of gasoline.

The first is the "straight" refinery gasoline, made by distilling crude oil.

The second, or "casing head" gasoline is produced from natural gas by process of compression or absorption. It is so volatile that it is usually blended with a small proportion of heavy naphtha to produce a mixture which is both safe for use and moderately cheap.

The third type is the "cracked" or synthetic gasoline which is made by further reduction of heavy residual oils through special heating processes. Cracked gasolines are usually marketed in the form of blends with the other two types.

Benzol, another internal combustion fuel is a by-product incidental to the manufacture of illuminating gas and coke, sometimes distilled from coal tar. It gives results comparable with gasoline but has a very foul odor when burned.

A Trio of Handy Repair Shop Helps

C. H. WILLEY

Here are three handy repair shop helps that will appeal to almost every repair shop man. The first of these is a simple scheme to transform any monkey wrench into a serviceable pipe wrench.

First take two short lengths of old file and after heating them properly bend in the U-shape as shown in the engraving. These when placed on the jaws of the wrench will enable you to handle most any pipe within the size limits of the wrench. In heating and bending care must be exercised so as not to flatten the teeth of that part of the file which will bear on the pipe.

The second stunt is the handy small parts tray shown in the engraving and made from a few old tin cans. The tin cans are cut through from one side only leaving one side uncut as shown. They are then properly bent and placed in a shallow wooden box. After fastening them securely into place they make a very handy tray for the holding of the many small parts such as washers, nuts, bolts, cotter pins, and the innumerable other small parts that are in danger of getting scattered about. The number of compartments possible in such a tray as this makes it easily possible to keep the various small parts separated as to size.

Here is a little improvement on the usual socket wrench that will make for speed and ease in handling. It is simply the matter of bending the ends of the handles, one of them being bent up while the other is bent down. This simple change will enable you to use the wrench with more speed.

A Plea for Natural Methods in Shoeing

H. L. BENHAM

Mr. Maloon's excellent article in the August number interested me very much and I am glad to say that I too am a firm advocate of nature's principles. Certainly the shoer who gets very far away from nature and natural methods cannot do any horse very much good, whether that animal is being shod for normal or abnormal conditions in the feet.

I hardly think there are many real shoers who are worthy of the name who can argue against the natural method and natures principles. The main point is the individual shoer's ideas of natural methods and his interpretation of nature's principles.

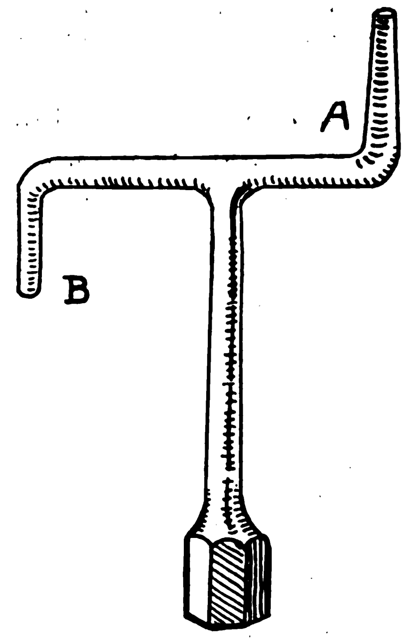
It's like the old story of the doughnut—the optimist sees the cake in the doughnut while the pessimist sees only the hole. And so in shoeing, one shoer may see the problem of shoeing a given horse in an entirely different manner and base his arguments on an entirely different interpretation of the priciples that govern foot action and foot and limb structure.

Unquestionably, a correct understanding of foot and leg anatomy are necessary to a correct understanding of shoeing principles. It is just as necessary for the dentist to know something of the human body as it is for the lawyer to know the fundamentals upon which law interpretations are based. The shoer who attempts to shoe horses with nothing but a surface knowledge of the horse's foot and limb structure will not get very far in the shoeing profession.

In my estimation, the closer one can come to a natural fitting of the shoe and the closer you thus come to a natural tread for the animal, the better will be the foot health and the general condition of the animal.

I am reminded often of the saying of an old shoer under whom I learned some of the trade. This man always said that, a horse was as old as his feet. Meaning, of course, that the condition of a horse's feet indicates the animal's health and degree of usefulness. This is, of course, some what exagerated but it indicates the importance of foot health for this most important of man's animal friends.

Now, to get a natural foot is a simple matter in the colt and in the horse that has not been forced to wear shoes that are not based upon nature's principles; but for the animal that has been compelled to wear any and all kinds of shoes made and fitted by as many different kinds and types of shoers, the shoer is going to have more of a problem.



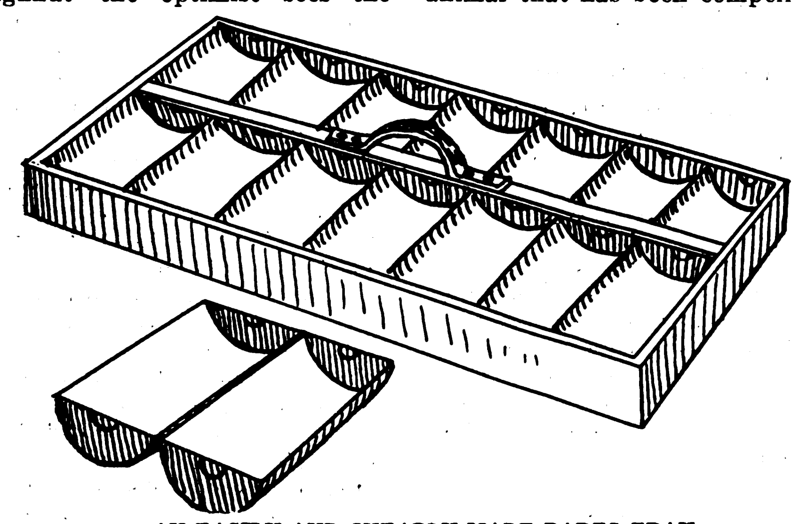
AN IMPROVED SOCKET WRENCH

For the colt or horse that has gone naturally a study of the hoof and foot as worn will give the practical shoer all the information he needs for the proper fitting of his shoes. Here I quite agree with Mr. Maloon's method of leveling and fitting.

For the horse that does not go right, however, nature's way is going to be somewhat more difficult. The wear of the shoe must be taken into consideration. Nature must be helped and aided. And there are no cast-iron rules that the shoer can follow.

If I were asked to tell what in my estimation is the most important qualification for the practical shoer I would say—"Common-Sense." That one qualification will carry a shoer farther along the road to success in shoeing than any other one thing.

In closing this rather rambling talk on natural shoeing I want to express a thought that I think will bear the serious thought of each reader of "Our Journal." I would like to see a free and thorough discussion of this subject at this time. Why not write in to the Editor and tell him your ideas on this subject. I've expressed my ideas. You are free, Mr. Reader, to take exception to them, but in doing so I would like to know why you object and your objection to my argu-


AN EASILY AND CHEAPLY MADE PARTS TRAY

ments. In that way we can both learn. And while I am old enough to be the grandfather of the majority of the younger craftsmen of today, I am not too old to learn new tricks, contrary to the popular saying regarding old dogs and new tricks.

The Sale Of Automobile Supplies and Accessories By the Repair Shop

J. N. Albert

The matter of selling automobile parts, supplies and accessories by the repair shop is a subject of most timely importance and a subject that will repay the repair shop proprietor for all the time he spends in studying the subject. The sale of supplies and accessories is one of the most profitable departments of the entire automobile industry. For the small dealer it presents opportunities for profit that are greater then almost any other line he can handle. And in the handling of auto parts the dealer more properly speaking, the repair man will never be accused of devoting his time to something that is not his business.

The subject of selling auto parts is worthy the consideration of any repair shop proprietor no matter where he may be located. Of course for the repair man whose shop is located on a main highway the chances for the sales of parts are greater then for the man whose shop is located on some side road. However, business can be secured from car owners in the neighborhood of the shop as well as from the tourists who pass on the busy highway, so that while the shop on the main highway has the better chance for sales, the shopman whose establishment is located on a side road should not hesitate to put in a small stock of parts and supplies such as he knows he can sell.

Of course this is not a matter into which the shop owner should rush blindly. Make a canvass of the possibilities for the sale of supplies. Count the number of car owners in your vicinity, the number of trucks, tractors and passenger cars owned by them. Then consider where they are in the habit of buying their supplies, parts and accessories.

In connection with your consideration of the matter along these lines, consider also the number of automobiles that pass your shop. These will naturally bring a certain amount of business and while it is trade of a transcient character it never-the-less brings profit and cash to the shop.

One of the most essential and most important features of the automobile supply business is the installation of the gasoline service tank and pump. This will bring more supply trade and be the means of prompting more sales for supplies, parts and accessories then any one factor that could be installed. Any reader considering the installation of the necessary gasoline service station tanks and pumps will be supplied with definite information on how to secure the necessary equipment by writing the Subscribers Service Department for information.

Standard Specifications for Chains and Hooks

An Australian reader has asked concerning a table or chart which would give him the proper dimentions and proportions for the making of chain links, rings and hooks. This reader is engaged as smithing foreman on a large construction job where a considerable number of hoisting chains are used. These are requiring constant repair and replacement and the need of a table of standard specifications is badly felt.

Our Australian friend was supplied with the table and chart which was published in an old number of "Our Journal" and we are publishing it again at this time for the information of other readers who may be interested in work of this kind. We are indebted to our friend Mr. J. C. Lamon of Tennessee for this chart and are publishing his remarks concerning its use just as they appeared originally. Every reader will recognize this table as one of extreme value and importance for the smith having any quantity of chain links and hoisting hooks to make or repair.

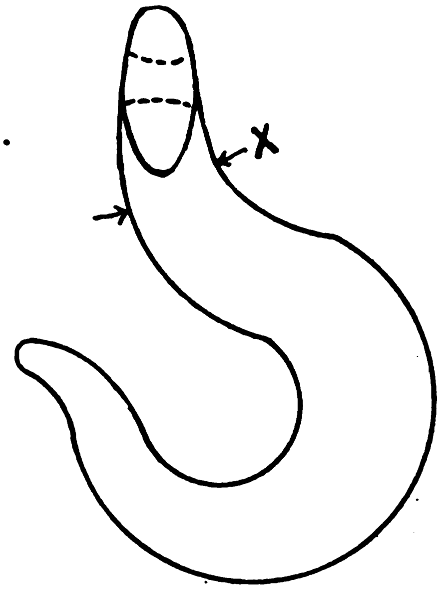


TABLE OF SIZES OF STOCK FOR MAKING HOOKS

Capacity of hooks in tons	Diameter of stock in inches
¼	11/16
½	3/4
1	1 1/16
1½	1 1/4
2	1 3/8
3	1 3/4
4	2
8	2 7/8
10	3 1/4

MR. LAMON GIVES HERE THE DIMENTION OF STOCK FOR HOOKS OF GIVEN CAPACITY

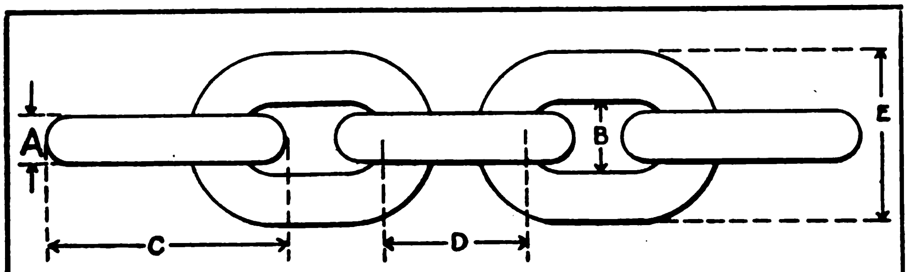
Mr. Lamon in his original article says:

Having a large number of hoisting chains for handling stone and skips of various sizes to make and repair, I found it a great convenience to have a table of standard specifications to refer to. Any one having work of this nature could post a copy of these specifications in the forge shop and refer to them as the occasion demands. It will save much time and worry. The table of sizes given have proven satisfactory here where the work is of the hardest kind.

Where the hooks are subjected to unusual shocks or strains it might be advisable to make hooks of larger stock. Where the approximate load to be handled is known by referring to table the size of chain can be selected.

Dimensions of hooks are given.

Diameter of stock for hooks are given.



A—WIDTH OF STOCK. B—INSIDE WIDDTH OF LINK. C—OUTSIDE LENGTH OF LINK. D—OUTSIDE LENGTH OF LINK. E—OUTSIDE WIDTH OF LINK.

STANDARD SPECIFICATIONS.

B—1½xA. D—3xA. C—5xA. E. 3¼xA.

RINGS SHOULD BE 1½ TIMES THE DIAMETER OF CHAIN.

THE STANDARD SPECIFICATIONS FOR CHAIN LINKS ACCORDING TO MR. LAMON

For instance, a hook of four-ton capacity would require stock 2 inches in diameter and sixteen inches long. For one-eighth of an inch diameter of stock, it requires one inch in length of stock. The dimensions for hooks is taken at X.

Jernberg in his "Hoisting Hooks, Their Correct Design and Proper Treatment" which appeared in these columns in 1913 gives the formula or specifications as shown in the diagram in Fig. 2. These dimensions by Jernberg were worked out after a very elaborate and very thorough series of tests and experiments in the testing laboratory. Lamon on the other hand has worked out his formula from actual working conditions, as found in the large construction work and development project with which he was connected.

In Jernberg's article one fact mentioned in connection with the making of hooks is the statement that low carbon stock is best for this purpose. Properly forged and worked this metal will bend and the hook will open before it will break.

Good Tools Are Profitable

It may be desirable to keep the old tool working just as long as possible, but it is not necessarily always the most profitable thing to do. It must be remembered that machines are continually being improved and the time may come before the machine is worn out when it should be discarded because of obsolescence.

Obsolescence is a big word, but it means a lot. A machine is obsolete when the money one loses through its use would pay for a new machine of improved type, which would do the work faster, better, more economically.

There is certainly such a thing as keeping a machine too long. The selfrake reaper had to give way to the modern binder. The modern corn planter displaced the old hand operated type. The process of displacement is continually going on.

The modern repairman requires the best and most up-to-date tools and equipment. He must of necessity know the cost of production in order to know whether his business is profitable or not. The use of labor-saving equipment is the best insurance of profits. The man with the hoe, the scythe, and the flail has passed, and the wheels of progress carry the craftsman of today on a good road to sure profit and pleasure in his business.

The Porter's Guarantee

Passenger, to porter on midnight sleeper, "Porter, what time does this train arrive at Pittsburgh?"

"Eight o'clock a. m. Eastern Standard Time, Sah."

"Will the train arrive on time?"

"Yes, sah. Yes, sah! it will arrive on time."

"Is the train always on time?"

Yes, sah! Why boss, through all the great blizzards we is the only train that arrived at Pittsburgh on time."

"Well porter, do you guarantee that this train will arrive at Pittsburgh at 8 o'clock tomorrow morning?"

"Yes, sah! Yes, sah! I dun guarantee that dis ere train will arrive at Pittsburgh at 8 o'clock tomorrow morning."

"But porter, suppose the train does not arrive at 8 o'clock?"

(After some cogitation) "Well boss, you see it am dis-a-way, the guarantee dun run out at 8 o'clock."

Standards for Testing Welds*

Note: These specifications are intended primarily to serve as a standard, uniform basis for testing and comparing sample welds as distinguished from welds in structures. The testing of the latter must necessarily be by non-destructive methods which would therefore be, in general, quite different from those employed in examining sample welds(test welds)made(for example, for the purpose of testing a welder's proficiency, comparing welding wires or comparing welding methods.

1.—Definitions

The following are definitions of terms employed in this specification.

(a) A Weld is a solid union of metallic pieces formed by uniting or consolidating by hammering or compressing with or without previous softening by heat.

Note: This definition is quoted from the Century dictionary. It is the broad definition of a weld and therefore includes forge welding and resistance welding by either the butt or spot process. While these specifications are prepared specifically for fusion welds, it is obvious that some of the tests can be applied to other types of welds.

(b) A fusion is a weld formed by heating to a fluid state the

*Report of Committee on standard tests for welds of the American Bureau of Welding.

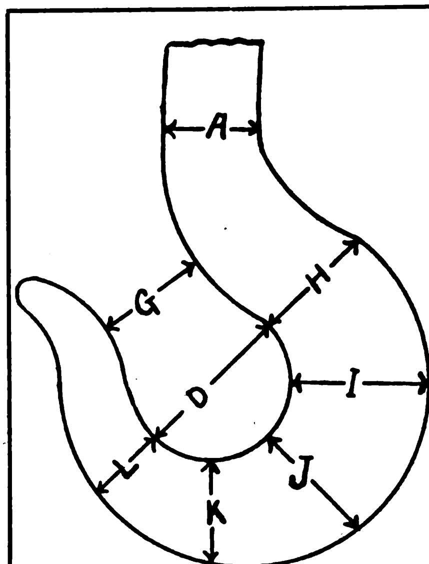


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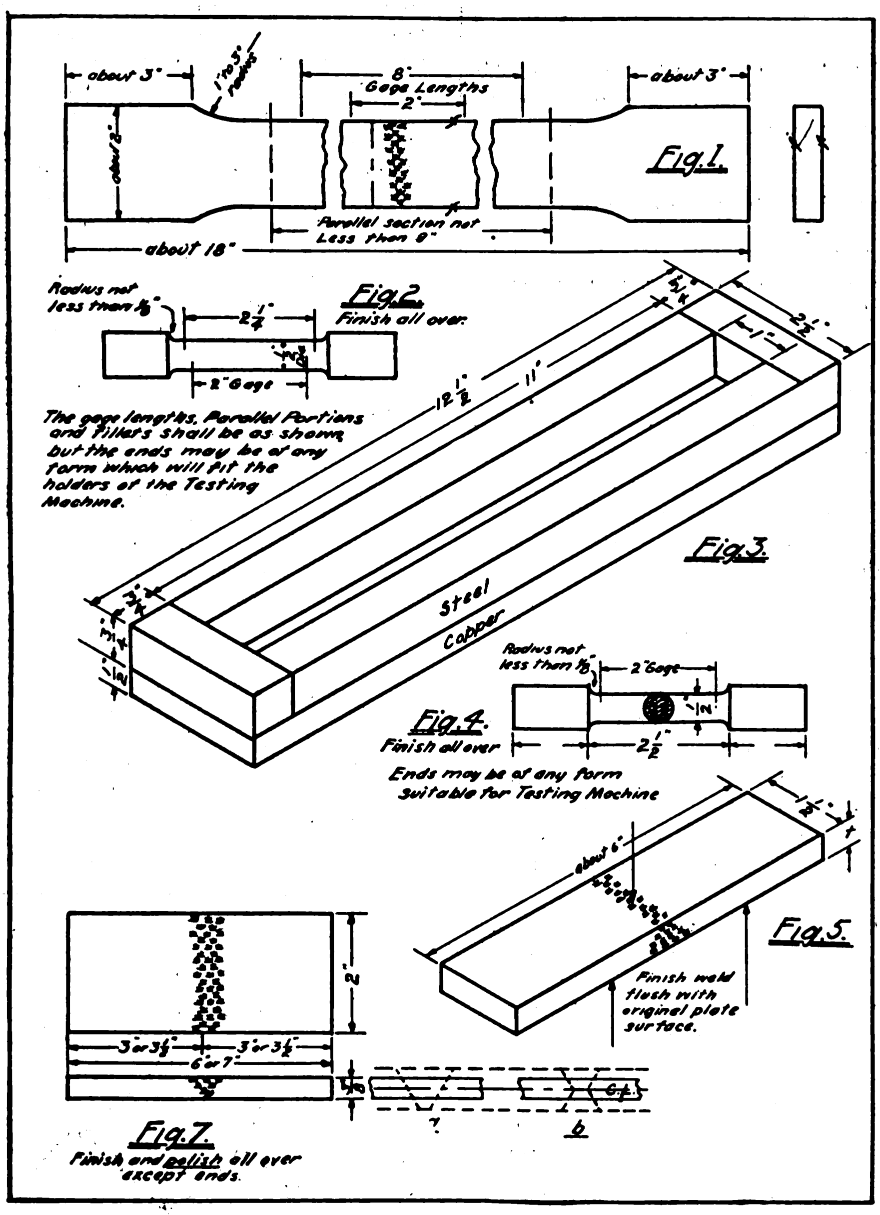
FIG. 2.—THE PROPERLY PROPORTIONED HOOK ACCORDING TO MR. JERNBERG.

edges of the pieces to be joined and allowing the metals to flow together (with or without additional molten metal being supplied) without any pressure being applied. The heat may be supplied by a gas flame, an electric arc, thermit or otherwise.

(c) In a fusion weld, the base metal is the material composing the pieces to be united by the weld. Unless otherwise expressly stated, it will be understood that a weld joins two pieces of identical material.

(d) In a fusion weld, the weld metal is the material which has been used in forming the weld. It may consist entirely of the base metal adjacent to the weld or of the material added to the fused base metal from a welding rod or electrode, or other material.

(e) Filling metal is the metal added during the welding process to form part of the weld. In gas welding it is supplied by means of a welding rod, in carbon arc by a filling rod and in metal arc welding by the electrode.



VARIOUS BARS AND THEIR DIMENSIONS FOR TESTING THE WELDED PORTION

(f) A test weld refers to a sample of welding which has been performed under known conditions and upon which mechanical tests are to be made.

(g) A test specimen is a prepared piece on which a mechanical test is to be made.

2.—Shop Standard

Bending test only.

3.—Commercial Standard

(a) Bending test.

(b) Tensile test.

Note: It is probable that eventually it will be desirable to include a fatigue test when a method is standardized which will be suitable for commercial application.

4.—Research Standard

A. Tests of Base or Parent Metal

1. Chemical analysis. To include carbon, manganese, silicon, phosphorus and sulphur.

2. Mechanical tests.

(a) Tensile. To include yield point, ultimate strength, total elongation and reduction of area.

(b) Bending. (c) Fatigue.

3. Metallographic. Photomicrographs at 100 diameters.

B. Test of Weld

1. Mechanical tests

(a) Tensile. To include yield point, ultimate strength, total elongation and reduction of area.

(b) Bending. (c) Fatigue. (d) Impact.

2. Metallographic. Photomicrographs at 100 and 500 diameters respectively at (a) the junction between the base metal and the filled-in metal, (b) the base metal adjacent to the junction, (c) the center of the filled-in metal.

C. Tests of Filled-in Metal

1. Chemical analysis. To include carbon, manganese, silicon, phosphorus and sulphur.

2. Mechanical tests. Standard round specimens to be prepared from ingots deposited in a base-metal mold of such dimensions that normal cooling conditions will be approximated.

(a) Tensile. To include yield point, ultimate strength, total elongation and reduction of area.

(b) Bending. (c) Fatigue.

3. Metallographic. Photomicrographs at 100 and 500 diameters respectively.

5. Standard procedures for mechanical tests.

1. Preparation of test welds.

No detailed instructions for the preparation of test welds can be given as the dimensions, materials, etc. will depend upon the purpose for which the weld is being made. The test weld should, however, duplicate as nearly as practicable. the commercial welds which it represents and should preferably be of such a size as to permit preparation of enough specimens from the one test weld to make all of the mechanical tests which are to be made.

When the test weld is made with material in sheet or plate form, the longest axis of the test specimen should in general, be parallel to the direction of rolling.

2.—General Procedure

(a) Wherever applicable, the standard procedure of the American Society for Testing Materials as given in the A. S. T. M. Standards for 1918 (serial designation E-1-18) shall be followed.

(b) Three duplicate specimens shall be tested in any one test and the average taken as the value of the property determined by this test.

3.—Tensile Tests,—Base Metal

(A) Test Specimens

(a) Sheet or Plate Material. The test specimen for sheet materials is shown in Fig. 1. The thickness of the specimen may be any that is desired, but a thickness exceeding ¼ inch would require a testing machine in excess of 100,000 lb. capacity. If the specimen is cut from standard sheet material, it is usually not necessary to machine the 1.5 inch faces of the specimen.

(b) Cast Material. The test specimen for cast or brittle materials is indicated in Fig. 2. It is particularly important to use swivel specimen holders when testing such specimens in order to eliminate entirely undesirable stresses.

(B) Test Results to be Recorded

(a) Ultimate Strength. Unit stress (lb. per sq. in.) computed from the area of the original section.

(b) Yield Point. Unit stress (lb. per sq. in.) at which marked increase in deformation of the specimen occurs without increase of load as indicated by a sudden increase of the rate of elongation as shown by dividers.

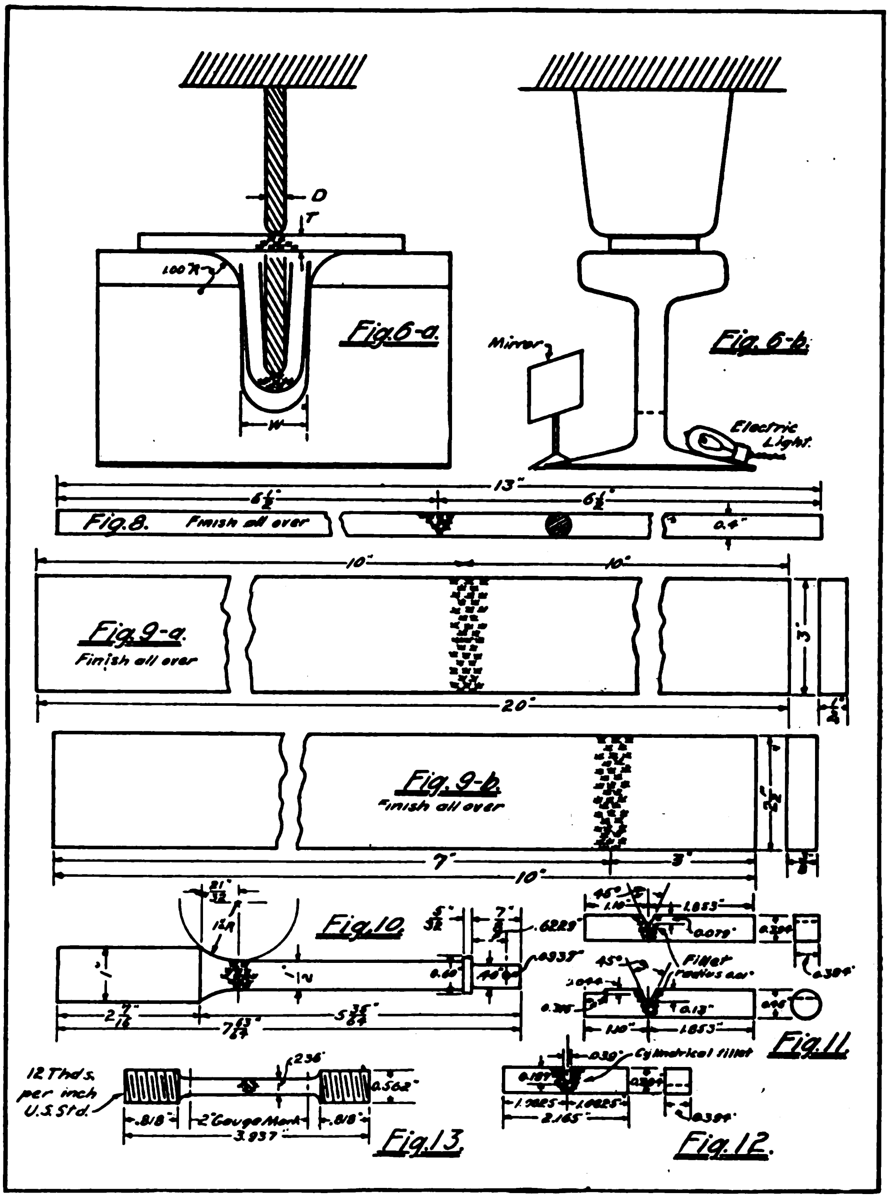
(c) Contraction of Area. Expressed in per cent of the original area.

(d) Appearance of Fracture. The appearance of the fracture as determined with the aid of a low power magnifying glass (such as jewellers use) should be recorded. The characteristics described by the following nomenclature should be covered indicating as far as possible the per cent of the total area which is involved. For example, "10 per cent not welded" would signify that approximately 10 per cent of the total area of cross section at the fracture is exposed base metal—that is, not welded.

Spongy: Full of small cavities; the structure resembles that of a sponge; porous.

Slag inclusions: Foreign matter entrapped in the weld.

Gas pockets: Small or large cavities more or less isolated (i. e., not of a regular spongy structure.)



THE APPARATUS USED IN TESTING WELDED BARS AND ADDITIONAL BAR SPECIFICATIONS

Not welded: Exposure of any portion of the surface of the base metal indicating imperfect fusion between the base metal and the filling metal.

Laps: Imperfect fusion between adjacent portions or between successive layers of filling metal.

(The recording of the following data is optional.)

(e) Proportionality Limit. Unit stress (lb. per sq. in.) at which the deformation ceases to be directly proportional to the load.

Any type of extensometer may be used but in precise work the deformations of two opposite elements of the specimen, preferably on the edges, should be obtained. For ordinary purposes deformations in only one element of the specimen need be measured, but in that case the gauge marks should be on the center of the line of the 1.5-inch side.

The gauge length may be either 2 or 8 inches.

(f) Modulus of Elasticity. Unit stress (lb. per sq. in.) computed from data obtained from a specimen having an 8-inch gauge length; measurements to be taken on two opposite elements, one on each edge of the specimen.

(g) Total Elongation. Gauge marks shall be laid off every inch along a line at the center of one of the 1.5-inch faces of the specimen before placing in the testing machine and the total elongation in every inch after rupture recorded. The total elongation in the 1-inch, 2-inch and 8-inch (if any) length which included the break shall be reported.

*.—Tensile Tests, Weld Metal

a. Test Specimens

The shape and dimensions of the test specimen are shown in Fig. 3. It shall be prepared from a bar of weld metal, ¾ by 1 by 11 inches. This bar shall be formed entirely by depositing filling metal in an open box of the shape shown in Fig. 3, employing exactly the same method used in making the corresponding test weld. For metal electrodes this box shall consist of a copper plate ½ inch thick, upon which is secured a frame of steel bars, ¾ inch square. The parts of the box are secured in any convenient manner. The copper plate, during this operation shall rest upon a steel plate. After the bar is formed, the copper plate and the frame may be removed by any suitable machining operation.

For gas welding, the copper plate should be replaced by a steel plate. For thermit, a box of suitable refractory material should be used.

(B) Test Results to be Recorded

These shall be the same as those prescribed in Section 5, 3-B (base metal) except those involving an 8-inch gauge length. If, however, the modulus of elasticity is desired, a specimen similar to that shown in Fig. 2, with a gauge of 8 in. shall be employed.

5.—Tensile Tests, Weld

(A) Test Specimens

The shape and dimensions of the test specimen are shown in Fig. 1 with the weld at the center. If the material is cast or brittle, the specimen shown in Fig. 2 shall be used with the weld located at the center.

It is especially necessary that the 1.5 inch sides of the specimens be machined, particularly if the two pieces of base metal are offset or if they form an angle at the weld. Tests made in the latter case, where the specimens are not machined, are not reliable. Furthermore, care must be taken that specimens having the latter defects are not "straightened" before being machined because such treatment is likely to materially decrease the strength of the weld. A roughing cut in a planer or shaper which will just "clean up" the surfaces of the specimen is sufficient.

(B) Test Results to be Recorded

The requirements for test results given in Section 5, 3-B (base metal) shall be followed.

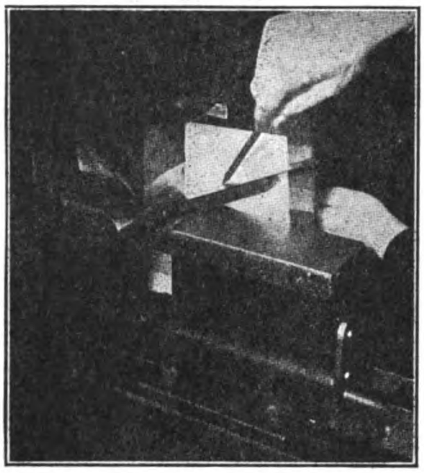


FIG. 14—MEASURING THE ANGLE IN BENDING TEST

6.—Bending Tests,—Base Metal, Metal and Weld

(A) Test Specimens

(a) Base Metal and Weld. The shape and dimensions of the specimen are shown in Fig. 5.

In the case of welds in flat rolled material, the surface of the weld shall be machined substantially flush with the surface of the specimen unless the specimen is bent or offset, in which case it shall be machined all over. Cast and other irregular specimens shall be machined all over. It is essential that the edges of all specimens be machined to remove material in a condition likely to cause premature failure.

The thickness, t, of a weld specimen shall be as nearly that of the base metal as possible.

(b) Weld Metal. A specimen may be prepared from a bar of weld metal prepared as prescribed for tensile tests (Section 5, 4-A). The box, Fig. 3, shall however have a width of 1.75 inches and the thickness, t, of the specimen shall be that of the test weld. These specimens shall be machined all over.

(B) Apparatus

In order to load the specimens so that as large a part of the bend as possible shall occur in the weld metal, the special fixture outlined in Fig. 6a and 6b shall be used. It is most conveniently used with any standard universal testing machine but may be operated by any other convenient mechanical means.

The cylindrical surface, D, (Fig. 6a) about which the specimen is bent shall conform to the requirements of the American Society for Testing Materials for bending tests of the base metal.* This piece is attached to the under side of the moving head of the testing machine. Upon the platform shall be fastened two blocks having machined top surfaces and polished corners of radius, R, of 1 inch. These blocks shall be separated by a distance, W, equal to D plus 2T plus 1/8 inch. A lubricant of lard oil and graphite or similar compound shall be used on these surfaces.

Two specimens shall be tested. The load shall be applied at the center of the weld,—in one specimen to the open side of the "V" and in the other specimen to the closed side.

The rate of application of the load shall not exceed that at which the beam can be kept balanced at all times or a maximum of 2 inches per minute.

The angle through which the specimen is bent may be measured by any convenient method. The following method is described as a matter of information.

A piece of paper is held firmly against the edge of the specimen when it is in place on the testing fixture and a line drawn on the paper along a corner of the specimen, thus outlining the shape of the specimen so far as bending is concerned. A line is drawn before loading and after failure occurs. The change in the angle in the two lines as determined with a draftsman's protractor is the angle through which the specimen had been bent a failure. See Fig. 14.

(C) Tests Results to be Recorded

(a) The total angle through which the specimen has been bent when the first crack appears upon the convex surface (that is, the

Weld Metal and Weld.

*For ship-plate steel (58000-68000 lb. er sq. in. tensile strength), it is "The test specimen shall bend cold through 180 degrees without cracking on the outside of the bent portion, as follows: For material ¾ in. or under in thickness, around a pin the diameter of which is equal to the thickness of the specimen; for material over ¾ in. to and including 1-¼ in. in thickness, around a pin the diameter of which is equal to 1-½ times the thickness of the specimen; and for material over 1-¼ in. in thickness, around a pin the diameter of which is equal to twice the thickness of the specimen."

sum of the angles through which the two halves were bent). To be measured without removing the load.

Note: An electric light and mirror will assist in observing this surface as indicated in Fig. 6b.

(b) The load on the specimen at which the first crack occurs.

7.—Fatigue Tests,—Base Metal.

There is no generally accepted unit or standard of comparison for fatigue tests so that the results given by the several machines which have been developd for such tests are not directly comparable. It is not practicable at the present time to recommend the use of any particular type of machine and consequently test specimens are shown for all of the more common types.

Although in general the results of fatigue tests are of maximum value only when compared with similar results obtained on the machine, it is assumed that reference tests will be made on the base metal so that the results of tests on welds and weld metal can also be stated in terms of the results of tests of base metal. It is hoped that this will permit direct comparisons between tests made with different types of machines.

(A) Machines and Test Specimens

(a) General. For tests of weld metal it will be necessary to form a suitable bar in a box similar to Fig. 3 and having the proper dimensions.

Fatigue tests specimens should in general be machined all over (except the ends) and the surface carefully polished (preferably with the polishing marks parallel to the longest axis of the specimen). No. 1 Manning emery cloth or paper or its equivalent will produce a satisfactory surface.

Provided the specimens are prepared from a test weld or other material of greater thickness than the specimen, an equal amount shall be removed from both sides so that the specimen shall represent the material at the middle as indicated at a and b, Fig. 7.

(b) Upton-Lewis Improved Machine. This machine puts a bending load on the specimen which is reversed during each revolution of the machine.

Specimen shown in Fig. 7. The distance between the jaws of the machine shall be ½ inch. If the specimen is a weld specimen, the jaws shall be equidistant from the center of the weld metal.

(c) Farmer Machine. This machine was designed specially for testing weld specimens. It tests the specimen as a simple rotating beam with free supports at the ends and two equal loads on a section at the middle. Specimen shown in Fig. 8. If the specimen is a weld specimen, the meld metal shall be at the center.

(d) Strohmenger Reverse Torsional Machine. Comparative results only can be obtained as there is no means of determining the stress. This machine loads the specimen in torsion which is reversed for each revolution of the machine.

Speciman shown in Fig. 9a.

(e) Strohmenger Bending and Impact Machine. Comparative results only. The machine strikes the specimen which is held as a cantilever beam, bends it and releases it. This operation is repeated upon the other side of the specimen. The weld, if any, is placed just outside the clamp in such a position as to develop the maximum stress in the specimen. The specimen is shown in Fig. 9b.

(f) Moore Machine. This machine was designed for the Bureau of Standards for testing large size specimens of joints, both welded and riveted. It loads the specimen as a simple beam at the third point and the direction of loading is reversed for each revolution of the machine.

Specimens. Any thickness not exceeding about 1 inch, width 8 inches, length 32 inches. If the specimen is a weld specimen, the weld metal shall be at the middle of the length of the specimen.

(g) White-Souther Machine. This machine loads each end of a rotating specimen as a cantilever beam. It is then rotated. The specimen is shown in Fig. 10.

(B) Test Results to be Recorded

(a) Number of cycles of the stress required to cause failure. A cycle is the period of time at the end of which the repetition of the variations of stress is begun.

(b) The stress developed in the specimen (if possible).

THIS department is the place for discussing shop and business matters. Here you may ask for information on any topics or matters that interest you; bring to the attention of the progressive craftsmen of the day the subjects that should have their attention. You are requested to make use of this department as often as desired.

Wants to Make Knife Blades—I wonder if some brother smith could tell me how to temper jack knife blades and butcher knife blades and what kind of steel will do for them. R. H. Morriss, Nebraska.

Australian Appreciation:—As Shelly said to the skylark: "Hail to thee blythe spirit", salutations to you, also congratulations. I would not do without "Our Journal" for a great deal. However, I feel better now that I am enclosing the amount owing to you. Trusting this reaches you safely and thanking you for continuing my subscription. I remain.

Adam Clark, Jr., Australia.

Wants to Use Charcoal for Preheating:—I am interested in acetylene welding and would like to hear more about preheating cylinders and motor blocks with charcoal as I think that is the best way to heat cylinders. If there is anything better than charcoal let me know. I have a large oil heater also but do not like it so well on account of the blaze which it throws and makes it disagreeably hot to work over. Anything you have on the welding game let me have it. I have fair business at this time. I do auto and tractor work also. Arch Wood, Indiana.

A Reader for Sixteen Years:—I have been receivng The American Blacksmith now for about 16 years and have enjoyed and profited by every copy, also I don't think I have missed a single copy being delivered during that time. And I must say you have kept the paper up to date in every way. I have been located here for about 12 years, handling jobs of every description from the making of a split link to overhauling a "Henry", so you can guess the paper is mighty handy to me. Wishing you every success and may Old Benton never run out of recipes.

J. B. Luxton, Australia.

Franklin and Dodge Clutch Adjustment:—Will someone tell me something about the following clutches: The first one is on a Franklin car and runs in oil. It slips badly and I cannot see that there is any adjustment for this clutch. This as you no doubt know is a disc plate clutch some of the discs being of steel and some of them of bronze. Can you tell me what to do with this clutch to get it to work properly? The other is a clutch on a

Dodge which the owner tells me has an adjustment. I wonder if some reader can give me this information?

C. H. Brander, Illinois.

In Reply:—The Franklin Car referred to has a clutch made up of twelve discs of bronze and eleven of steel. These discs run in oil and are unlined. This oil should of course be drained occasionally and new clean oil supplied. The proper way to do this is to run the old oil out and then to run in some clean kerosene oil and to allow the engine to run for a short time with this in the case. While the engine is running push the clutch pedal in and out occasionally so as to clean all the discs thoroughly. When certain that the discs are well cleaned drain the kerosene out and put the proper quantity of oil in, which is about a gun and a half if you use the gun that comes with the car. There is no adustment for this clutch. If a stronger spring adjustment is necessary for this clutch you will need to secure a new spring from the factory.

On the Dodge car you will find a dry plate clutch. This consists of four driving discs which are supported on six pins held in the fly wheel and three driven discs which are held in the clutch spider. The driving discs are covered with woven wire and asbestos fabric which is riveted to the discs on both sides. The driven discs are of plain steel. To adjust the clutch spring compress it until the split washer which is on the clutch shaft, can be moved forward into the next groove. In making this adjustment care must be exercised to see that both halves of the split washer fit snugly into the groove and that the clutch spring retainer fits around the washer.

A. H. M., New York.

An Appreciative Letter from Queensland.—I am writing to you about your valuable book—"Our Journal." For years my father has gotten the Journal, and the other night I was looking through some of them and I saw a great deal about motor repairs in them. I am learning motor repairing so they would be very useful to me. I am in the blacksmith trade, and we want to start motor repairing in with the blacksmith trade. My father has a blacksmith and coach builder shop, and two brothers and myself help him. He has a good business, has been established since 1878 and for over 40 years the business has had the name of Buck. Edwin Buck, Australia.

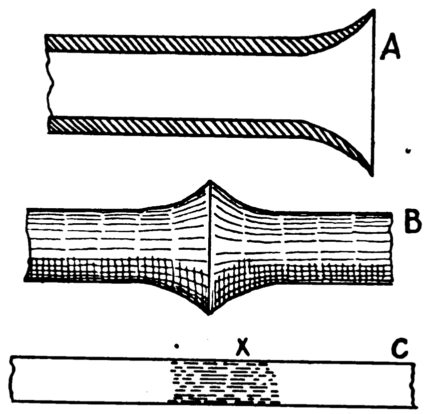
Welding a Tubular Axle:—Will some one kindly tell me how to weld a hollow axle. I am a youngster at the smithing game and haven't had as much experience as I hope to have before I pass over the river,—so would like to have one of the older "boys" tell me how to go about this job. The axle is on a wagon that needs quit a little work. I know how to go about everything except the hollow axle. I like the paper and get a lot of good practical information out of it.

L. J. T.—Oklahoma.

In Reply:—There are no doubt other ways to repair a tubular axle but I would suggest our young smithing friend to adopt the following method. First heat the ends of the broken axle and scarf and shape both broken ends as shown at A in the engraving. Shape them both up as uniformly as possible. Then forge a piece shaped like the piece at B to fit inside the two ends. Have your fit come as close as you can and shape your solid piece B as well as you can.

Right here I might mention to our young friend that the proper way to make piece B is to take a piece of round stock as shown at C and heat it as per the dash lines at X. Then pound it on end on the anvil until it is upset in the center or heated part. After getting an upset of sufficient size at X forge the bulge or upset to proper shape.

Now heat the forged piece thoroughly all over and drive the broken ends on it



WELDING A TUBULAR AXLE IS EASY WHEN YOU KNOW HOW

firmly. Then take a good heat on the entire piece and drive all together welding the ends and solid center together. This will make the axle solid at the weld and it will outlast any part of the wagon.

W. C. Frank, Pennsylvania.

To Tighten Loose Auto Rims:—I wonder if anything can be done to loose rims on automobile wheels to tighten them when they have become very loose. Will some reader of the paper tell how this job may be accomplished? Possibly some reader has had work of this kind to do.

P. E. Hand, New York.

In Reply:—Mr. Hand does not tell the kind of rim to which he has reference but perhaps we can give him the information he wants by telling him how the various kinds of types may be tightened. If the loose rim is on the common type of wood wheel and the felloe comes just inside the rim then the entire rim should be removed from the wheel and a band of thin sheet iron attached to the outside of the felloe. The thickness of the sheeting will of course depend upon the amount of looseness or play in the rim. When the band of thin sheet iron has been applied the regular rim that holds the tire is then shrunk on in the usual manner.

If the rim is of the type that is secured to the wheel by means of lugs and known as the demountable type, it will be necessary to increase the wedging effect of the lugs in some way. This may be accomplished by the use of larger lugs, or by building up the lugs with the addition of metal by means of the gas welding torch, or by the use of shims applied at the points where the lugs wedge under the rim.

In the event of the rim being damaged to any extent it will be necessary to replace it with a new one as it would be time wasted to attempt to repair a rim that has been hammered out of shape.

C. R. Coplon, Ohio.

An Interesting Letter from Ohio:—It seems it is but one year that I have been reading "Our Journal." I am busy with a large family and one thing or another has kept me busy. I am not now following any branch of blacksmithing or horseshoeing and while I am busy otherwise, I am not too busy to read good mechanical articles anytime. I often wish I could have had your paper 40 years ago when I first started at the trade in 1880. After I served my time I used to size up different smith jobs to see how they were lapped or which way scarfed or put together. Your paper certainly has been good for lots of fellows. I never saw anything made of iron or steel that I could not make and forge it right. But the other fellow might do it different and easier, and that's the point you should or can make clear to the mechanics. Of course your magazine has done a lot of it.

Isn't it a shame that so many mechanics and smart men don't share their knowledge with those who have not benefited. I have often wanted to write articles for your paper but too much hard work, buying property, building, and raising a family and educating them is plenty to do as I never had much help.

John A. Enright, Ohio.

American Motor Cycles in Australia—Things have been pretty adverse here since the war until now, high prices, wages, scarcity of materials, etc. Petrol is at present here 4/6 ($.84) per gallon. motor oil 10/6 ($1.92) per gallon, yet motoring has gone ahead stronger than ever.

As you know from former letters, I am running a small motor garage and a repair shop for almost everything. I now also am running an agency for Indian Motor Cycles, which will surely be well known to you as it is one of the formost American machines and is also the formost here. I myself use one of them and a spring frame too. We have few motor cars here but when they will come down in price there will be dozens of them as people are finding out fast that the motor provides the cheapest means of travel, at the price of petrol as it is now. One farmer here who owns a Dodge said only the other day to me that even with Petrol at 10/ ($1.80) a gallon it would pay him well to run his car as he has several places and these are far apart. He said with horses it took him a long day to reach one of them and another day to come back, but with the car he does it all in one day.

Here is a little happening that is interesting as showing how a motor saved a life. Summer before last, a farmer's wife was bitten by a snake and no one was at home but her children, and the nearest doctor lived 10 miles away. She sent one of the children to call a neighbor who owned a motor cycle. He had no side car but he put the woman on the parcel carrier and thus took her to Swan Reach the nearest doctor ten miles away in but ten minutes, and thus her life was saved. Otherwise there would have been little chance to save her as the snakes here are very poisonous and delay is usually fatal. I am by this only saying what a boon it is to have a motor vehicle handy for such emergencies. F. H. Gierke, Australia.

AMERICAN BLACKSMITH AUTO & TRACTOR SHOP

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WINTER'S AHEAD

Before this sharper days have already warned us that Old King Winter is about to pay us his annual visit. Are we all of us prepared to receive him and to turn his stay with us to the best advantage? With some it means a brisker working season, and all the necessary preparations should be made in advance to make the most of it. How about the supplies? Is the shop equipment in order, or is anything needed? These questions must be asked and answered.

In other lines, Winter brings a time of slacker work. The proprietors of such shops do well to check up the lessons of the preceding season, and to make their plans for the future accordingly. It quite often happens that when a shop-owner comes to figure up his business for the preceding season or twelve-month (and no good craftsman in these progressive days fails to keep a proper set of books) he finds himself faced with a continued decrease of business and profits. In such cases there are usually several remedies which can be considered. He can plan to cut expenses, and it is really surprising what a little study and ingenuity often can accomplish in this direction. He can advertise to increase his business. If local conditions are poor in his line and offer no prospect of getting and better, he can consider changing his stand. The trouble with this is that when he moves he sacrifices the acquaintanceship and good-will that he has secured at the old stand and on top of that may find conditions at the place no better than at the old. Instead of moving, therefore, a more satisfactory solution of the problem often lies in taking up new lines of work in addition to or in place of the old. Plans for such changes are best made during the slack season.

Contents November 1921

THE EDITOR IS A HUMAN BEING

The Editor, your Editor, is not a cold, calculating high-brow, hidden in an inner chamber of mahogany, brass and thick, plush carpet, but is just a real, honest-to-goodness human being, sitting at his old desk in his little six by ten office, sleeves rolled up, hard at work every day of the week, trying to serve as best he can his army of readers. Being a human, he has his pleasures and his disappointments, just like all the rest of us. Now if any of you have ever wondered just what your Editor is like, we are going to let you in on a little secret. There are two things that happen quite frequently in the course of his daily grind that please the Editor tremendously, in fact, they just naturally almost tickle him to death, which you see proves that he is very much a human being. One thing is to have drop out of the morning's mail a nice, long, newsy letter from some subscriber, with a photograph and description of his shop, or perhaps a little story of some interesting job that the reader has done and feels proud enough about about it to tell it to other boys who read the paper. The other thing is to have the head subscription man bring him over a letter from some reader who has written to say that he finds the paper a real help to him in his everyday work.

SUBSCIRPTION AGENTS

DO NOT give money to any agent or representative unless you know who he is. There are many unauthorized agents and unscrupulous collectors representing themselves as agents and collectors for "Our Journal" and we wish to warn every one of "Our Folks" against them. Do not under any circumstance give them any money unless you know them. If there is any doubt send your money and orders direct to Buffalo, N. Y.

"KEEP 'EM GOING."

Slogans and mottoes of one kind and another have been used in connection with the activities of the good old smithing craft since before the building of Solomon's Temple when the smith received his first due recognition. Many and wonderful have been the changes in the craft since those days and the smith is still entitled to the place of honor among the artisans.

And it seems to us no phrase or slogan is more appropriate or more in keeping with the important place filled by the smithing craft today, than the three word slogan which titles this editorial. No single phrase or sentence so aptly expresses the spirit of the smith and repair craft of today.

Let us consider for a moment — in order to make our thought clear—the millions of vehicles of all kinds, whether propelled by hay, steam or gas motor; and when they are ill or out of sorts who is the logical man to "Keep' Em Going"?

If it is the gas motor itself which has broken down—if the "hay motor" needs new shoes—if the steam motor has developed a cracked cylinder—who is the chap to "Keep 'Em Going"?

And so we might cite instance after instance to prove the right of the craft to the slogan "KEEP 'EM GOING". But our main thought in connection with this slogan is that the use of it will bring to the general public a quicker realization of the importance of the part played by the up-to-date and progressive craftsman.

It is our suggestion that "Our Folks" make liberal use of this slogan, on their letter heads, envelopes, shop signs, advertising matter and wherever it is suited to bring home the idea set forth here.

We would like to hear from everyone of Our Folks on the subject with their recommendations for or against the liberal use and wide distribution of the thought behind this slogan.

Let us have your ideas on the matter right now Mr. Reader. We want your help and suggestions and thoughts on the matter—NOW. —

Getting Better Results From Grinding Wheels

GUSTAVE H. RADEBAUGH

The auto and tractor blacksmith shop is not complete without a good grinding stand and the necessary grinding equipment to do all the grinding and polishing of soft and tempered steel tools used in general repair work. Too many times a good serviceable grinding stand is purchased for the farm shop and properly installed but the purchaser is disappointed in the work obtained from the machine. The reason for the workman's inability to obtain good work traces directly to the grinding wheels and supplies. To get the best results from this machine the types and grades of wheels should be known. It must be appreciated that the grinding wheel is the business end of this machine. Oftentimes cheap wheels are supplied with the stand and the operator meets difficulties which are very discouraging. The same supplies should be used in the auto and tractor blacksmith shop as are found in the best commercial shop.

To fortify against grinding demands, two types of grinding wheels should be supplied—one for tempered steel and the other for sofe metals. The emery wheel used for so long a time for grinding work has been substituted with commercial abrasives known to the trade as carborundum, aloxite, alunden, and corundum, and manufacturers have given out extremely useful information about these abrasives. Knowing what these abrasives are and what type of grinding they are used for will be helpful when making a selection of wheels for the grinding stand.

In Plate I is shown the type of supplies that will give real service on the grinding stand and on the bench. The grinding wheels shown here are made from carborundum and aloxite.

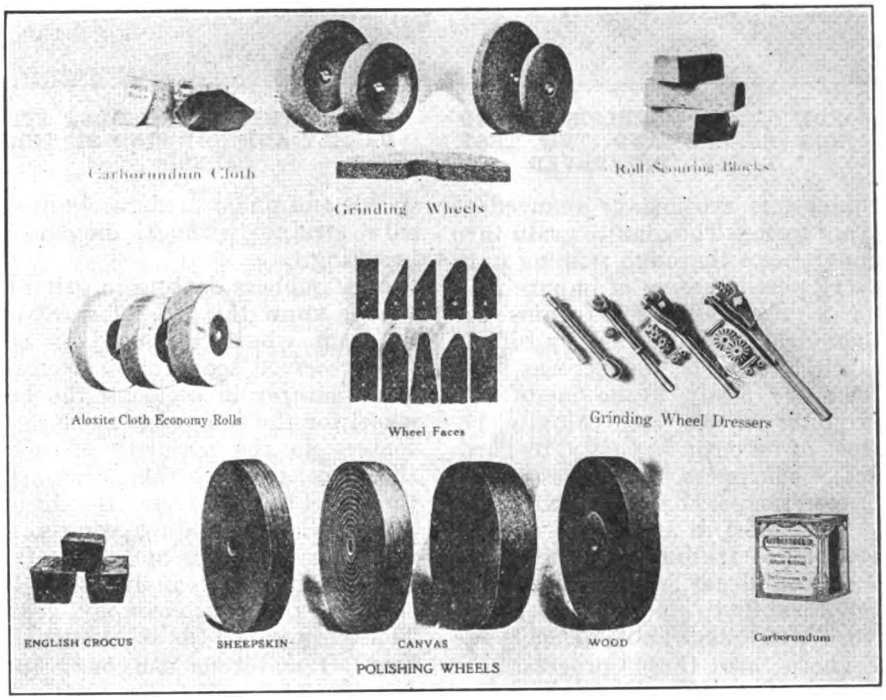


PLATE I — SHOWING SEVERAL DETAILS OF GRINDING AND POLISHING WHEELS AND SUPPLIES

Carborundum is a manufactured abrasive. It is not found in nature. It is a chemical combination of carbon and silicon. It is the trade name given to carbide of silicon, a substance discovered by Edward G. Acheson in 1891. It is very much harder than any other known abrasive, which gives it great durability. It is made up of small, sharp crystals just brittle enough to break slightly in use. The sharp edges of the crystals cut clean and fast, while the brittleness, by presenting fresh cutting edges constantly, prevents glazing. The characteristic property of brittleness makes it highly efficient for grinding and polishing on such metals as cast iron, chilled iron, brass, and bronze, also marble, granite, and pearl—in general, materials of low tensile strength.

The abrasive material for grinding steel successfully must be not only hard and sharp but tough. These characteristics are found in aloxite, a new aluminous abrasive. Aloxite is the purest form of aluminum oxide. It is the product of the electric furnace, differing materially from other aluminous abrasives in several of its characteristics, the principal one of which is its temper, which gives it the ideal steel-cutting material.

Process Used in Making Aloxite

In its crude form aloyite is taken from the electric furnace in the form of an immense compact pig weighing several tons. This pig, by means of special, powerful ma-

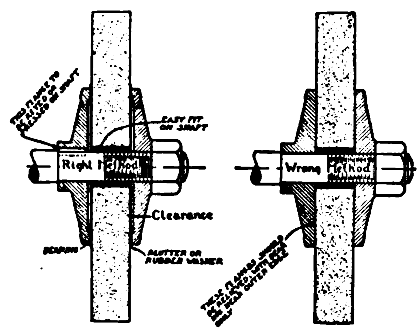


PLATE 2—THERE IS A CORRECT METHOD OF APPLYING A GRINDING WHEEL TO A SPINDLE. IT IS SHOWN AT THE LEFT

*This is number two of Mr. Radebaugh's series of articles on "Standard Mechanical Practices in Repair Work." Each article is complete in itself. The first one appeared in the October issue—the third will appear in a succeeding issue.

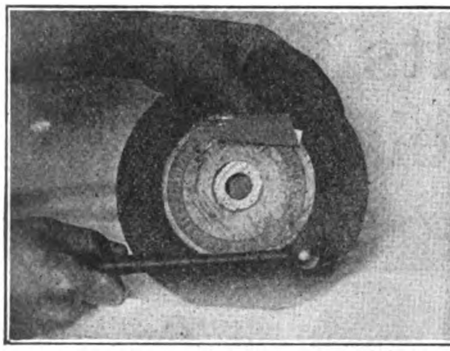


FIG. 1—THE WHEEL IS TESTED FOR CRACKS AND THE TEST RECORD PRESERVED

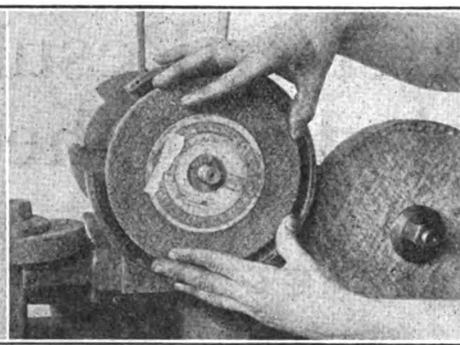


FIG. 2.—THE WHEEL MUST FIT FREELY AND NOT BIND ON THE ARBOR

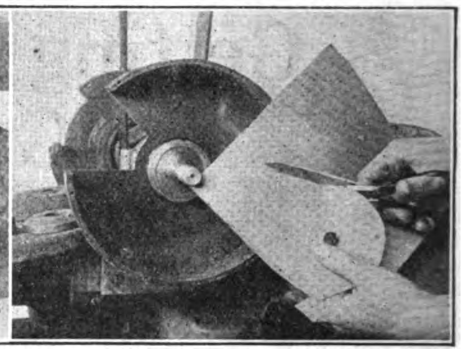


FIG. 3.—BLOTTING PAPER OR RUBBER IS APPLIED BETWEEN FLANGE AND WHEEL

chinery, is crushed or reduced to grain form. The aloxite grain then undergoes a thorough refining until every possible atom of impure matter is removed. The grains are then dried out, graded by sifting through a series of screens, and then are ready to be made into grinding wheels, etc. Aloxite, because of its positive purity, its hardness, sharpness, toughness, and proper temper, has been extensively successful in all classes of steel grinding. It not only cuts fast, cool, and clean, but shows wonderful durability, standing up to the work with remarkable tenacity.

There are three processes of manufacture. The vitrified process consists of bonding the grain with certain clays, and vitrifying or baking at high temperature, thus changing the clays to a substance similar to porcelain. The vitrified wheels are most generally used owing to the possibility of securing by this process a wider range of grades and because they can be made more open and porous, thereby assuring a cool cutting wheel and because they stand up to the work with decided durability. However, owing to their rigidity, vitrified wheels are not used on work where a very thin wheel subject to side strains is required.

In the silicate process silicate of soda is employed as the bonding agent. They cut less harshly than the vitrified and are used extensively for knife grinding and for sharpening saws and woodworking tools in furniture, sash, door and blind factories and planing mills. Silicate wheels can be supplied with a wire web if desired.

The thin wheels are generally made by the elastic process, which consists of bonding the grain with a more or less elastic material, such as shellac or rubber. These wheels are extremely tough, fast cutting, and can be run at decidedly high speeds and under moderately heavy side strains without danger of breaking.

Most jobbers dealing in grinding wheels know the type of work the different wheels are used on and have received cooperation from the manufacturer in securing the best wheel for the job. It is more satisfactory in the majority of cases, therefore, to leave the selection of the wheel to the dealer. Conditions under which grinding wheels are used vary to such an extent that no absolute rule can be given for selecting the right grain and grade. There are no wheels so constructed that all materials can be ground equally well with one wheel. In auto and tractor blacksmith shop practice it is not necessary to have more than two styles of wheels.

One of the large manufacturers of wheels recommends a wheel 14 inches in diameter, 2 inches thick, 1¼-inch arbor, grit 24, grade H vitrified bond, of carborundum material, and an aloxite wheel of the same dimension, grit 24, grade H vitrified bond for all the types of grinding jobs that will be done in the repair shop. The aloxite wheel is used for all steel grinding; the carborundum for castings, etc.

When a new wheel is received it is good practice to test it. (See Fig. 1.) Wheels in transit sometimes are broken or cracked so slightly as not to be noticeable. A simple test is made by a few light taps with a hammer. If the stone rings it is safe for operation. Before shipment all makers of good wheels test the wheel at approximately 50 per cent in excess of the speed at which the wheel will be operated. On each wheel a tag will be found glued to the center of the wheel. The kind of wheel (carborundum, aloxite, alunden, corundum) the grain and grade, size, number, outside diameter, and size of hole, surface, speed the wheel should run, and the speed at which the wheel was tested is some of the information found on this tag. This tag should be filed away for reference; if a wheel is not satisfactory, information about it can be secured from this record. This tag is equally valuable as a reference when ordering duplicate wheels.

In placing the wheel on the spindle of the machine do not force it—the hole in the wheel should be at least .005 inch larger than the spindle diameter. It is very essential that the wheel does not cramp. If it goes on the spindle free (Fig. 2) that insures proper fitting of the wheel against the inside flange. Too much cannot be said about the importance of the proper mounting of the wheels. To make it possible to get a clearer idea of

FIG. 4—THE NUT ON THE ARBOR IS CAREFULLY TIGHTENED

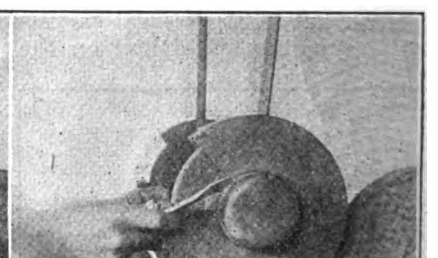


FIG. 5—ADJUST THE REST CAREFULLY TO INSURE SAFETY

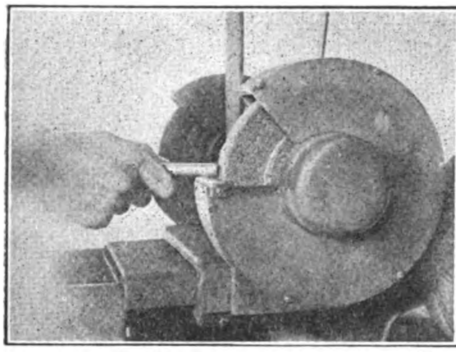


FIG. 6—IMPROPER METHOD OF GRINDING ROUND STOCK WILL INJURE WHEEL

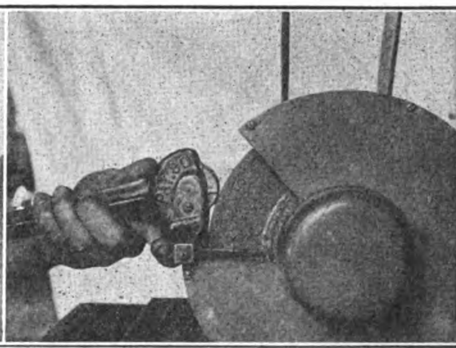


FIG. 7.—THE WHEEL SHOULD BE FREQUENTLY TRUED SO AS TO CUT PROPERLY

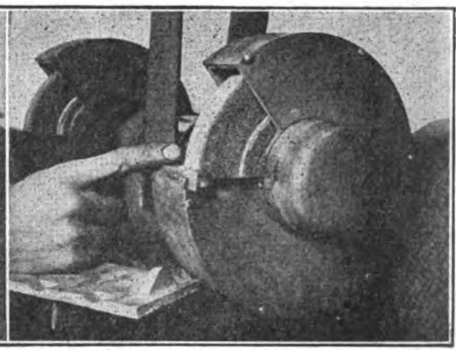


FIG. 8.—THE FACE OF A WHEEL SOMETIMES BECOMES GLAZED AND LOADED

the correct practice, the right and wrong methods are shown in the engraving marked Plate 2.

Flanges at least one-half the diameter of the wheel should be used. Compressible washers of old leather, rubber packing, or blotting paper, slightly larger than the flanges should be placed between the wheels and flange (Fig. 3). If none of these come with the wheel it is an easy matter to make up several from heavy paper taken from packing boxes. This practice protects the wheels. The pressure on the wheel is distributed evenly when the flange are tightened by taking up any imperfection in the wheel or flange.

It is too often the practice when placing the wheel to turn the nut on the spindle too tight. The flanges should be tightened only enough to hold the wheel firmly, avoiding any unnecessary strain. (Fig. 4) With the left hand the operator holds the belt securely and, with the wrench, the nut is brought up snugly against the washer. One jobber, to emphasize the importance of unnecessary tightening of the spindle nuts, makes the following statement: "On a 1½-inch floor grinding machine equipped with 8-inch standard relieved flanges a man with a 2-foot wrench can easily exert a crushing pressure between the wheel and flanges of 3,600 pounds. It is obvious if this pressure is placed on a wheel that damages to the wheel will result." The spindle of the grinding stand regulates the size range of wheels that can be used safely. Table I gives the diameter and face width of wheels that can be used on certain size spindles. When ordering wheels this table gives useful information for deciding on sizes of wheels.

Secure Parts Which Are Easily Adjustable

Every grinding stand should be provided with a safety hood and a grinding rest that may be adjusted easily. It is very important that the rest be adjusted close to the wheel at all times. In many grinding operations the job is of such size that it can easily be caught between the rest and the wheel and causing injury to the operator. The grinding rest and hood shown (Fig. 5) gives a good example of a well-protected wheel. When grinding the wheel should always turn towards the operator; always move the work over its entire face. Many times upon the inspection of a grinding wheel it may be found that the face is uneven, which makes it very difficult to do good work. This is caused by holding the work being ground in one position. One of the most common of these improper practices is in grinding a rod, as shown in Fig. 6.

In cutting threads on rods the die will start more easily if the end of the stock is pointed to receive the die. The easiest way to do this is on the grinding wheel. There is no need, however, for wearing the wheel uneven if the rod is moved across the face as previously explained. Never hack or gouge a wheel as there is danger of cracking the wheel to the extent that it may break when in use.

When the wheel does not cut as freely as it should and the work heats quickly, the wheel probably needs dressing. This can be done with the grinding wheel dresser. Four styles of these tools are shown in Plate 1. It is always a good plan to have a dresser constantly at hand and ready for use because it is of utmost importance to keep the wheel sharp and perfectly true. One style of these dressers is shown in use, (No. 7). I have found that a much truer job can be secured if the dresser is held in a positive position by bringing the lugs on the bottom of the dresser against the grinding rest. If the wheel is running out of true, the dresser

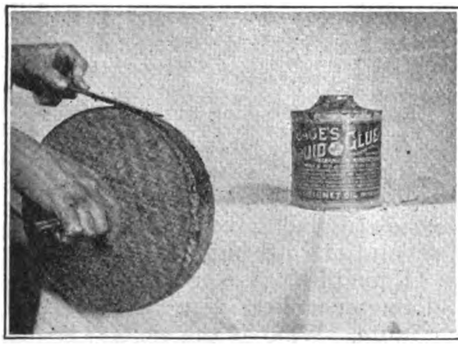


FIG. 9.—FOR THE POLISHING WHEEL. GLUE IS FIRST APPLIED TO THE WHEEL FACE

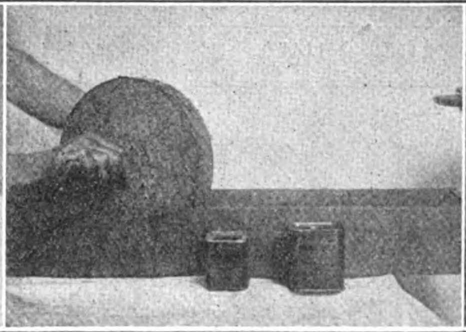


FIG. 10.—WHILE THE GLUE IS WET RUN THE WHEEL THROUGH EMERY POWDER

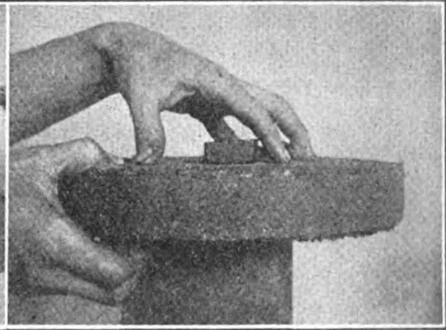


FIG. 11.—THE WHEEL IS THEN ALLOWED TO DRY THOROUGHLY WITH ITS FACE UNTOUCHED

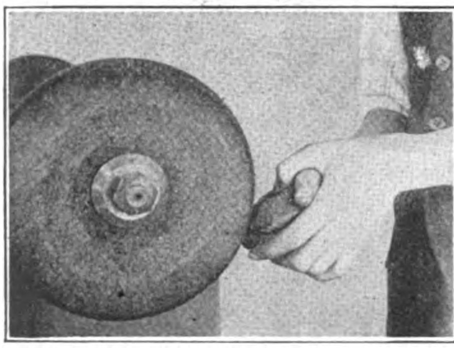


FIG. 12.—CROCUS POLISHING CAKE IS USED ON THE FELT BURNISHING WHEEL

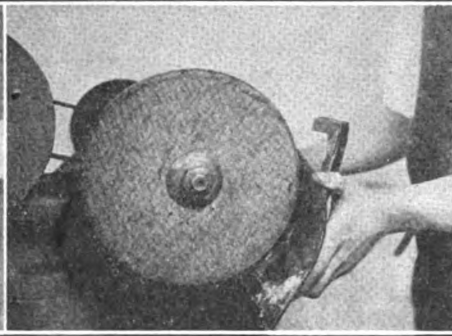


FIG. 13.—THE WORK CAN BE POLISHED TO ANY DEGREE BY SUITABLE WHEELS

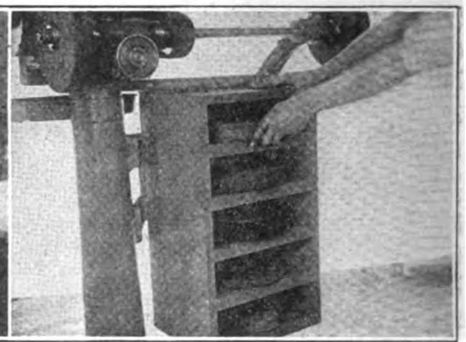


FIG. 14.—A SIMPLE SHELF ARRANGEMENT PERMITS OF EASY AND HANDY STORING

being held in this manner will remove the high spots, as two different centers have been established. It is evident if the dresser is held free the wheel will not be dressed true. It will follow the peripheral shape of the wheel. However, the wheel can be sharpened without the use of the bottom lugs by holding the dresser against it.

If a commercial dresser is not in the shop a very good grinding wheel dresser can be made from scrape steel for the handle, supporting five or six 5/16-inch washers on a bolt. This homemade dresser is not the best for trueing a wheel but it will sharpen a wheel satisfactorily. One old shop kink that will help judge the usefulness of a wheel is that if too much dressing is necessary it is an indication that the wheel is too hard for the work or that it is speeded too high. If the proper grade of wheel is used it should run at a surface speed of 4,000 to 6,000 feet per minute. Referring to Table 2, the diameter of the wheels and the revolutions per minute of the spindle is listed which will give a surface speed of 4,000, 5,000, and 6,000 feet.

To make it possible to install a grinding stand properly or to check the surface speeds of wheels in the shop, it is practical to use a few simple rules to determine the size of pulleys. Some of these rules can be applied to other speed-regulation problems to good advantage. The following are rules for calculating speeds and diameters of pulleys: 1. Proposed speed of grinding spindle being given, to find proper speed of countershaft.

Rule: Multiply the number of revolutions per minute of the grinding spindle by the diameter of its pulley, and divide the product by the diameter of the driving pulley on the countershaft.

Example: The driving pulley on the countershaft is 16 inches in diameter, the pulley on the grinding spindle is 8½ inches in diameter and makes 1,000 revolutions per minute. How many revolutions per minute does the countershaft make?

$\frac{1000 \times 8\frac{1}{2}}{16} = 530$ revolutions per minute, speed of countershaft

2. Speed of countershaft given, to find diameter of pulley to drive grinding spindle.

Rule: Multiply the number of revolutions per minute of the grinding spindle by the diameter of its pulley, and divide the product by the number of revolutions per minute of the countershaft.

Example: The pulley on the wheel spindle is 7½ inches in diameter and should make, 1,200 revolutions per minutes. The countershaft runs at a speed of 530 revolutions per minutes. How large should the driving pulley on the countershaft be?

$\frac{1200 \times 7\frac{1}{2}}{530} = 17$ inches, diameter of driving pulley on countershaft

3. Proposed speed of countershaft given, to find the diameter of pulley for the lineshaft.

Rule: Multiply the number of revolutions per minute of the countershaft by the diameter of the tight and loose pulleys, and divide the product by the number of revolutions per minute of the lineshaft.

Example: A lineshaft running 150 revolutions per minute is to drive a countershaft 530 revolutions per minute. The driven pulley on the countershaft is 8 inches in diameter. What diameter should the driving pulley on the lineshaft be?

$\frac{8 \times 530}{150} = 28$ inches, diameter of pulley on line shaft.

Rules for Obtaining Surface Speeds

4. To find surface speed in feet per minute of a wheel.

Rule: Multiply the circumference (diameter x 3.1416) by its revolutions per minute.

Example: A wheel 24 inches in diameter makes 79 revolutions per minute. What is the surface speed in feet per minute?

6.283 x 796=5,000 feet, surface speed.

Minimum size of machine spindles in inches for various diameters and thickness of grinding wheels.

Diam. in Inches	Thickness of Wheel in Inches ½"	¾"	1"	1¼"	1½"	2"	2½"
4	½	½	....	....	....	....	....
6	....	½	⅝	....	....	....	....
8	....	....	¾	¾	....	....	....
10	....	....	¾	¾	¾	1	....
12	....	....	....	1	1	1	1
14	....	....	1	1¼	1¼	1¼	1¼
16	....	....	1¼	1¼	1¼	1¼	1½

TABLE NO. 1.—GIVING SIZES OF MACHINE SPINDLES FOR VARIOUS SIZED WHEELS

5. Surface speed and diameter of wheel being given to find number of revolutions of wheel spindle.

Rule: Divide surface speed in feet per minute by the circumference. (See table).

Example: A wheel 20 inches in diameter is to be run 6,000 feet surface speed, per minute. How many revolutions should the wheel make?

6,000 ÷ 5,236=1146, number of revolutions per minute wheel should make.

When grinding very soft metals, such as lead, aluminum, or brass, the wheel, if not specially made to cut these soft metals, will become "loaded" and will not cut. A wheel is "loaded" when the pores of the wheel are partly or entirely clogged with the material being ground, which prevents the wheel from cutting, and causes excessive heating of the job. If a wheel does not cut, inspect as shown in Fig. 8. If the wheel is loaded the surface will show it very plainly. This is caused by the wheel being too hard or the speed too slow or of improper grain and bond. To overcome this increase the speed or use a softer wheel.

Four types of polishing and buffing wheels are shown in Plate I, those made from sheepskin, canvas, stitched and plain, and wood are only a few of the soft wheels used for polishing and buffing. These wheels are used on the grinding stand at a little greater surface speed than the grinding wheel. It is recommended by the manufacturer of these soft wheels that to get the best results they should be used when running at a surface speed of 7,500 feet per minute. Every auto and tractor blacksmith should be supplied with one or more soft wheels. Such wheels can be resharpened by applying new abrasive material. This is done by applying glue as shown in Fig. 9. After a good heavy coat of glue is placed on the wheel it is rolled in a box, as shown in Fig. 10, which contains abrasive material. It will pay to make up a neat, substantial box for this purpose as it is essential that the surface on which the abrasive material is placed be true and close grained. It is always well when rolling the wheel to apply considerable pressure because this has a tendency to force the grinding crystals well into the glue. After the wheel has been well rolled and the abrasive crystals cover the entire face of the wheel,

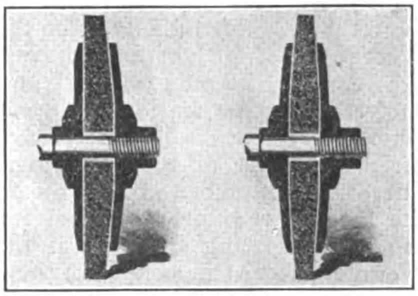


FIG. 15.—FLANGES OF WIDE DIAMETER WILL ALSO SAFEGUARD THE GRINDING WHEEL

it is good practice, to guarantee a good job, to roll the wheel over a smooth board executing considerable pressure on the wheel. This will even up the face and cause the crystals to hold more firmly on the wheel when in use. The abrasive crystals for soft wheels can be purchased in cans in sizes from ½ pound up to 10 and 20-pound kegs. The most common sizes for polishing range from 20 to 80 grain. There are very few jobs in general repair work requiring any finer grade than No. 80. Grain sizes of abrasives between 20 and 80 are 20, 24, 30, 36, 40, 46, 54, 60, 70, 80, the 20 grade is the coarse, the 80 the fine. Finer grades run 90, 100, 120, 150, 180, and 200, and are used to prepare work for very high polish.

Once rolled thoroughly the wheel is then laid away to dry out thoroughly before using. It should be permitted to season in a warm, dry room for several hours. It is very important that the face of the wheel does not come in contact with any object as there is danger of injury to the grinder face. One method of placing the wheel for drying is shown in Fig. 11.

If a very high polish is required on a job it can be obtained by buffing. Wheels used for this type of work are usually made from felt, and there are many kinds of felt wheels on the market. Mexican gray felt is the cheapest and will render good service. A buffing composition is used, and in Fig. 12 the operator is applying some of this composition to the wheel preparatory to buffiing a small garden plowshare which in Fig. 13 is being polished on a soft wheel in preparation for the buffing operation. The composition used on these buffiing wheels for general work is usually in the form of sticks or cakes. In Plate I are shown cakes of English crocus. As a rule these cakes are compressed tallow or some other heavy grease, containing a polishing material such as tripoli, crocus, rouge, flour emery, etc. Polishing and buffing wheels are made in sizes ranging from 6 to 18 inches in diameter and ½ to 2½ inches in thickness. A very good, yet cheap, cement used in cementing emery cloth to wooden wheels is made with four and one-half pounds of rosin, three pounds of paraffin, and nine ounces of vaseline. Melt the ingredients and mix them thoroughly. Heat the surface of the lapping wheel and spread on the mixture; then rub the emery cloth down to exclude all air sacks. Allow the wheel an hour or two to set and it is ready for use.

To protect wheels from severe misusage they should be stored properly when not in use. In Fig. 14 is shown an inexpensive means of storing grinding-stand supplies in a convenient but substantial storage. It is much better to arrange

Table of Grinding Wheel Speeds

Diam. in Inches	Rev. Per. Min. for Surface Speed 4,000 Ft.	5,000 Ft.	6,000 Ft.
4	3,820	4,775	5,730
6	2,546	3,183	3,820
8	1,910	2,387	2,865
10	1,528	1,910	2,292
12	1,273	1,592	1,910
14	1,091	1,364	1,637
16	955	1,194	1,432

TABLE NO. 2.—SHOWING SPEEDS AT WHICH VARIOUS SIZED WHEELS MUST REVOLVE some kind of protection for these supplies than to permit them to be abused by allowing them to lie on the floor. With the storage case near the machine there is always a better chance to have the wheels put away properly.

Much has been written about the causes of grind-wheel accidents. Accidents do happen occasionally and it is, therefore, the best practice never to operate grinding wheels without the wheel being properly enclosed in a hood. Protection flanges for safeguarding grinding wheels are shown in Fig. 16. Another very ordinary shop safety protection is always to wear goggles to protect the eyes. The blacksmith operator should take advantage of the safety regulations following in commercial machine shops. To use the right wheel at the right speed, properly protected, will make it possible to do more and better work.

Treating Automobile Springs to Improve Their Riding Qualities

R. J. Adams

There is probably no part of the motor car that receives less care than the springs and there is certainly no part of the car that has more to do with the easy riding qualities and comfort of riding then these same important members of the under part.

I have made springs some what of a hobby and specialty in my automobile work and have developed a spring treatment that my customers are glad to pay a good price for. As most every one knows it does not take long for the average set of springs on the average car to become rusted and noisy. In my estimation the great majority of squeaks in the average car are because of rusted springs. There are a number of devices on the market that are intended for use in lubricating springs but the average motorist does not use them to any extent and that gives me a fine opportunity to offer a service on springs that is rather exceptional. And as this treatment improves the riding qualities of the springs on any car whether it is a "Flivver" or a real deluxe limousine. I am able to get repeat jobs and make a good profit on every job I do.

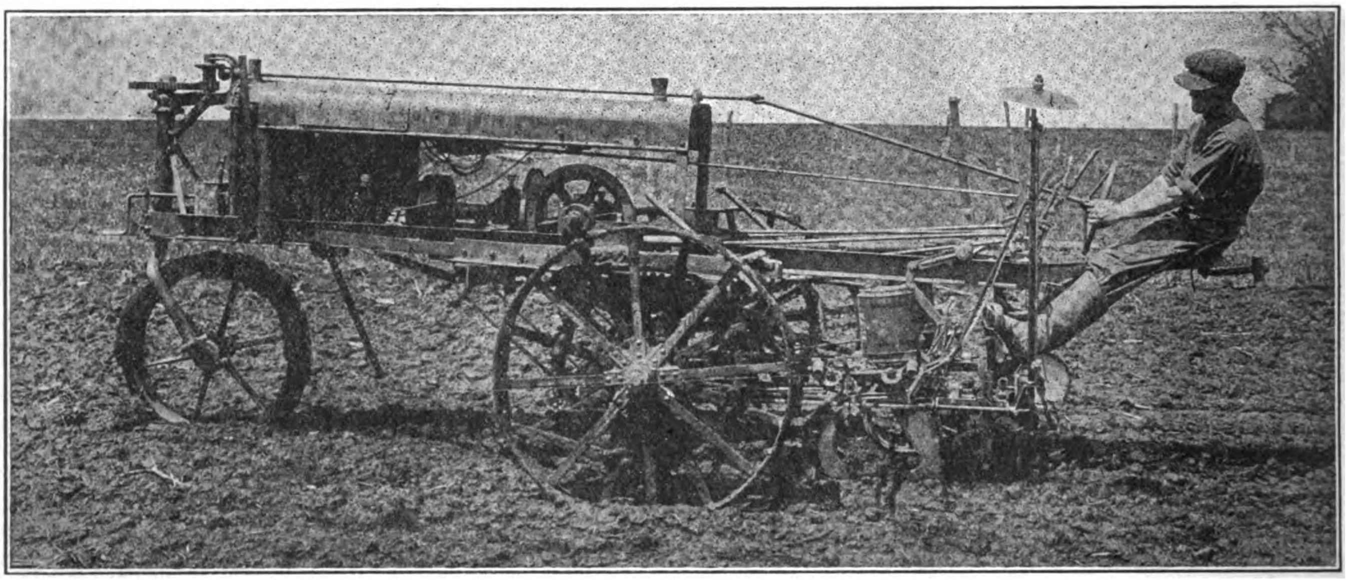
Of course there is but one way of lubricating a spring properly, and that is by removing the spring from the car. The short methods of jacking up the body of a car and thus separating the leaves is at best a make shift and if not done properly may even result in injury to the spring leaves and even possible breakage. Another matter in connection with the spring service that I am speaking of is the fact that you are giving a real service and not make-shift and you are of course charging accordingly.

To treat the springs properly the first thing to do is to remove the entire set from the car. After taking them down, that is, entirely separating the leaves, wipe all of the free rust from the surface of the leaves and then let them soak in a tub or vat of kerosene. After letting them remain in this for a while wash them thoroughly using a stiff brush to remove all of the rust, dirt and other foreign matter.

Now remove the leaves from the kerosene, wipe to remove the surplus oil and then immerse them in a bath of boiling hot "spring dope". This is simply a mixture of graphite and tallow which you can mix up for yourself. There are several mixtures on the market for the same purpose but this will answer just as well as any that I know and the ones you buy will certainly cost you more then this simple and easily secured combination. The leaves should be boiled in this mixture for several minutes but not long enough to heat the springs to any considerable temperature.

After this treatment the leaves are assembled and as they are thus put together flake graphite is put between the leaves. Do not wipe the spring leaves after removal from the hot dope but allow them to dry naturally with as much of the dope adhering to them as possible. After assembling the leaves properly in their respective springs they may be replaced on the car. And any auto owner who has had his car treated in this manner will be very glad to recommend your spring service to everyone he comes in contact with.

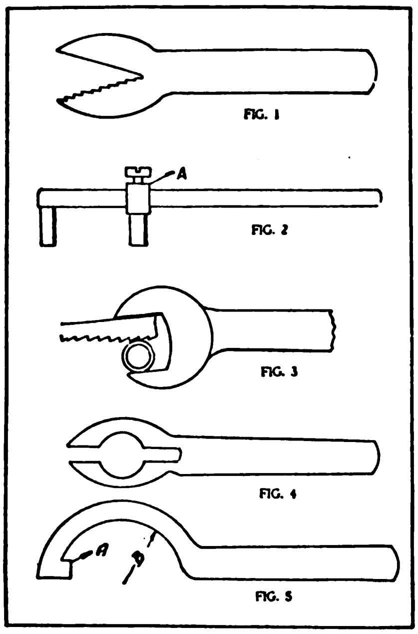
A little point in connection with the promotion of the spring service as mentioned is the fact that you get a first chance at any springs that may be cracked. These cracks will of course show up in the cleaning operations and they present an excellent opportunity for you to install a set or two of new springs.



THE TRACTOR OWNER MUST DEPEND UPON THE PRACTICAL REPAIR MAN TO KEEP HIS MACHINE IN SERVICE.

Several Special Wrenches

Special wrenches shown in the accompanying engraving are extremely useful for purposes for which the ordinary spanner wrench will not do says W. J. Harley in Work. They are all easily made and would certainly be an adjunct to anyone's tool kit. Fig. 1 shows the crocodile spanner. One side of the spanner is toothed to permit of a grip upon any work. This type of spanner is useful for turning screws, studs, small nuts or pipes, and being thin compared with the ordinery type of spanner, it can be used in places where the latter will not go.



SPECIAL SPANNER WRENCHES FOR SPECIAL USES

Fig. 2 shows a type useful for turning fluted or castle nuts, wheels, gears, etc. It is made adjustable so that any size may be taken. It is made up from 3/8-in. square steel with a sliding piece A forged from 5/8-in. square steel. The pegs protruding should be finished about 1/4 in. diameter and about 1 in. long. The slide piece must be drilled and tapped for a locking screw. It can at once be seen that it is only necessary to set the pegs to the distance demanded by the flutes in the nut or wheel when a good turning force can then be obtained.

Fig. 3 shows a useful addition to the ordinary spanner which will make it suitable as a pipe wrench as well. It consists of a small steel block about ½ in. wide and ½ in. thick at one end and about 1/4 in. thick at the other. Teeth are filed into its sloping face as shown, and its use may be clearly observed from Fig. 3.

Fig. 4 shows a useful spanner for winged nuts, and Fig. 5 another form also useful for fluted nuts. In this latter type the portion marked A fits into the flute, and the radius B is equal to the radius of the fluted nuts for which the spanner is to be made.

Air Strainers on Tractors

Some tractor owners do not seem to realize that every attachment on a standard machine is put there for some purpose. No manufacturer would spend money for an air strainer, for instance, if without it the tractor could live out its full expected life and at the same time give satisfactory service.

Observations made during the past year show that on many a tractor the air strainer or cleaner was not in working order. No tractor engineer that we know of has been able to design an engine that will successfully resist the scoring and excessive wearing action of dust on the walls, piston rings, valves, bearings and in fact all the inner working parts of the engine, and probably never will be able to do so.

The tractor owner should thoroughly understand that better operation and increased life will result from keeping the air cleaner working. It is not at all an unusual thing for a tractor to suck in several pounds of dust, per day, through the intake if it be not equipped with an air strainer.

How I Got Started in Automobile Work

H. K. JOHNS

The editor has asked me to tell how I got started in automobile work and although I am not a writer I will attempt to tell you how it came about.

I have been doing more or less automobile repair work and overhauling of machines for the past six or seven years and let me tell you boys, I have never regretted the day I got started in this work. But then all of you must know by this time that fixing up a motor is far preferable to the shoeing of a horse, not to speak of the greater profit one makes in the motor and auto work.

But let me get back to the beginning. Before taking up auto work I operated a general smith shop doing all kinds of horse, vehicle and general smith work. Being located in a busy little town in the middle west I had about all that I and two helpers could do. Of course there were slack times as there are in the best of shops even today, but generally speaking we were kept pretty well on the jump to get our work out on time. Of course I need hardly mention how from this state of affairs trade gradually took a slump until first one helper and then the other was let out.

I worked alone for a time carefully watching business in practically every line and noting how my trade gradually dwindled until I found it difficult to keep busy all of the time.

During this change in my business two garages started up in my town. The owners were men from other towns where they had been employed in similar work as assistants. They were supposed to be mechanics but it did not take me long to find out that they knew about as much of real mechanics as I did of astronomy. They never turned a job down, but there were very few that they did correctly. At the same time they put up a fine bluff and got away with it in fine style—at least until the folks of the town got onto the bluff.

Well all of this with the fact that my smithing business was getting less every month started me to worrying and brooding and to a fault finding with fate. It seems queer that when a man finds things going badly how he will generally blame most everything except the real cause of the condition—himself.

Of course I blamed the automobile for taking my business away from me and one night after a particularly poor day with a bunch of bills coming due and little or no money to meet them. I was particularly bitter in my railing at fate and over the condition of affairs that permitted two unknown and know-nothing mechanics to come into my home town and to make good money that should really come to me.

My wife listened to my heated talk for quite a while in silence and then she calmly asked me what kind of a mechanic I was that I would allow any man and epecially men from out of town to come in and put me out of business. This naturally lead to a very heated discussion which finally got down to some real constructive suggestions—from the wife.

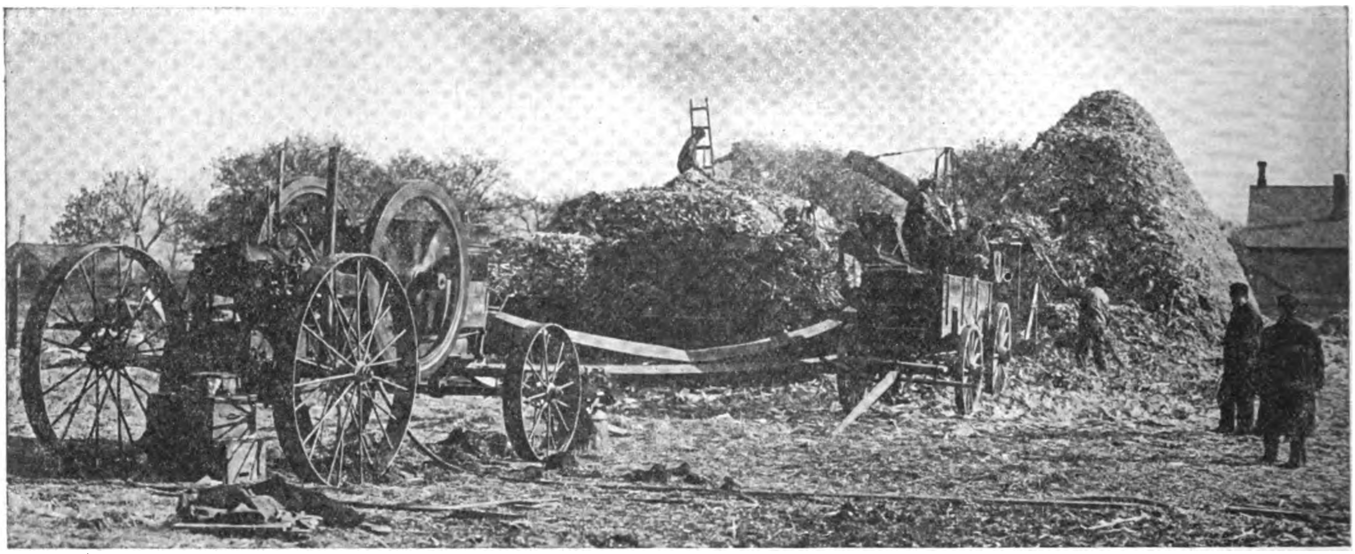
And let me put in right here something about the right kind of wife. I know this is not an editorial on family relationship nor an article for the Ladies Home Journal, but it is a fact never-the-less that the right kind of a wife can give a man more real straight-from-the-shoulder information on his short-comings and what he should do, then all the male friends he ever had or will have.

experimental purposes and experiment and tinker I did with a will. I took that car apart and rebuilt it until I knew every nut, bolt and cotter from radiator cap to tail light.

To help me along the right road I got several books on automobile mechanics and repair. I asked friends who had cars to let me help them overhaul their machines and in this way I got an excellent foundation for my future work. Of course all this time I was also attempting to run the shop and to do the work that came in.

lines I had a chance to buy out one of the very men who came close to putting me off the business map. This shop has been enlarged once since I bought it and is now beginning to be rather cramped. I employ a force of from five to nine men regularly and have at my call several men who come in on special work when I need them.

We are beginning to care for an increasingly larger number of tractors every season and this past season we enabled many a farmer to keep his machine going because of our promptness in getting to



SCENES SUCH AS THIS ARE ANOTHER PROOF THAT THE SMITH IS THE MAN BEHIND THE KEEP 'EM GOING SLOGAN

The final verdict and decision of that evening's talk was that I would have to go into the automobile lines if I was to continue as the main support of my family. It seems hardly necessary for me to go into details of the arguments that were put forth by my "better half" on why I was in better position, better equipped, and why I had every advantage over the two garage men. But the fact remains, I went into the automobile lines.

Understand, I knew nothing about automobiles. I didn't even know how to run one. I did know something about a gas engine because I had one in the shop, but as for the mechanics of the auto I was about as green as parsley.

So the first thing I had to do was to learn something about the automobile. And the first thing I did in that line was to buy a used car. It was one that had been most thoroughly used. I didn't buy it with the idea of running it. No one could have purchased it with that idea in mind. But I got it for

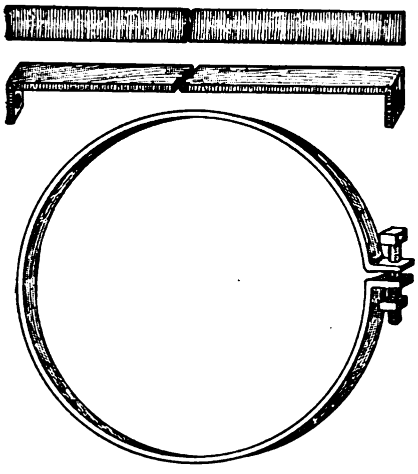
I finally passed the word along to my customers that I could take care of their auto work. I changed my shop sign to include auto and truck work and, while it was slow in coming my way I now have the satisfaction of doing all of the auto work of all of my old customers and have gained a big list of new customers, besides.

My next step was to stock parts and accessories. Of course I began with parts for Fords and then I went into things for other cars. I now handle about anything that the average motorist can call for from tires and tubes, oils and grease, gas and air, to lens and spark plugs, wheels and rims, radiators, tops and bodies. In the line of repair work we can do most anything in my present shop, that the motorist, truck owner or tractor owner calls for.

Of course I am not in the same shop that I was in when I began with the automobile work. Several years after starting in the auto

him with our portable welding outfit. And this by the way has been a very important factor in getting and holding new trade. I did not realize what a big profit maker this outfit would be until we had been running it for several weeks and the farmers learned about this service. Of course we never lost a single opportunity to advertise the portable welding service and of no little importance in the building up of our business is the placing of signs at points on all roads within a goodly radius of the shop. We used signs on the roads long before we had the portable outfit, but when we installed this we lost no time in making the fact known by means of the signs.

Very naturally of course this has all meant a great deal of hard work and it has also meant working long before and long after the regular hours, but it has paid and paid well. I have now reached the stage where I can take things a little bit easier then formerly although I still open the shop and



AN EASILY MADE PISTON RING COMPRESSOR

pay very strict attention to the business.

And now just one more word before closing this little story—through all this building up of what has practically meant a new business I still continue the shoeing of an occasional horse and the repairing of an occasional buggy and wagon. And I have also taken a partner into the business—the "& CO." represents the person who really started me in the automobile line—my wife.

A Simple Piston-Ring Compressor

Oscar E. Malech

Pick up from the scrap pile a piece of light weight galvanized iron about 1/32 inch in thickness. From this cut a strip 3/8 inch wide by 13 inches long. Next take a 6/32 screw about 1½ inches long, threaded the entire length, with a nut on it. Drill a hole in each end large enough for the screw to slip through freely 5/16 inches from each end. Next bend strip ½ inch back from each end to a quarter bend. Then shape it round and slip screw through holes and put on nut.

To use it, slip this round band over piston ring allowing the lower half of ring free to enter cylinder. Then turn up screw with driver until piston ring is compressed and piston will drop down to the band. Then turn back screw and repeat for the other rings. This size band was used for piston rings 3/16 by 3-11/16 inches. The same size band can be used for rings 1/8 inch smaller or 1/4 inch larger. If rings are larger or smaller cut band accordingly.

A Foot Power Hammer Easily Built in the Shop

"Work"

A treadle hammer of the Oliver type, an adaptation or even copy of which may easily be made, is shown in the engraving.

Two wooden posts are driven firmly into the ground, and should preferably be bedded with cement or concrete. Two screwed centres are screwed into these posts(one into each) to carry a wooden mandrel of tapered form, which supplies the intermittent motion for the hammer blows. The mandrel is provided with iron cone-cups, driven into each end of the mandrel, in which the wall centres run. Iron bands should be shrunk on to the mandrel at each end, and also on its parallel portion to obviate its tendency to split under the hammer blows.

The hammer shaft, of ash or beech, is mortised into the mandrel. The hammer head is recessed to receive top swages, and corresponding bottom swages are let into the anvil, which rests on a massive cast-iron block. The anvil for this hammer had best be one other than the anvil regularly used for hand forging. Perhaps the best arrangement would be to have this power-hammer anvil adjoining the regular anvil. Thus the hammer will not be in the way when hand forging and yet will be convenient for use when this mechanical helper is needed.

The hammer is operated by means of a treadle board, to which one end of a chain is attached, its other end being secured to a flexible wooden bar fixed to a beam or rafter. A short lever interposes between the flexible bar and the treadle board, being attached to the chain and is also driven into the mandrel. Upon motion being imparted to the treadle, the chain causes the mandrel to oscillate and so transmit motion to the hammer. The flexible bar gives the return motion.

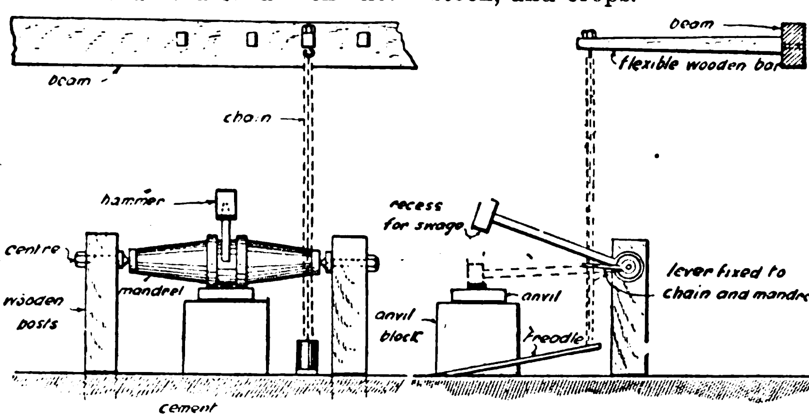
Horseless Farming Coming

When one sees what a farmer like E. C. Ketcham of Iowa can do with modern farm power, the horseless farm does not seem to be so far distant in the future.

Mr. Ketcham himself is a graduate of the Iowa State College and has very up-to-date ideas about farming. He makes his living from his farm and is therefore not a tractor farmer because of a hobby.

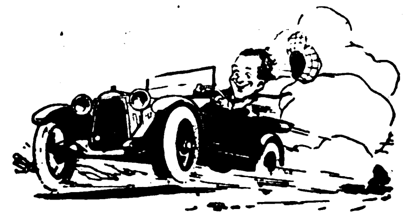
"If I can read boys aright", he says, telling his story, "the coming generation will see a great number of motor power farmers. I use tractors because I can get more work out of them than horses give me. I work long hours during the growing season—often am in the field an hour before my neighbors, and stay there till dusk. Horses could not stand that pace. With motor cultivartors I can cultivate 25 acres of corn in a day. Alone I have cut 40 acres of grain in a day and a half, pulling an 8 foot binder behind the tractor. I do all of my own repair work on my machines, but do not wait until the break down before attending to them. The greatest cause of trouble in motor machines is that many operators do not understand and use the different grades of oil properly.

"My ideal," he said, "is to farm without horses, farm more intensively than the average farmer does, have a patch of alfalfa or sweet clover, use some lime and fertilizers, and raise better live stock, and crops."



A FOOT POWER HAMMER SHOWING FRONT ELEVATION AND ALSO SIDE ELEVATION OF THE COMPLETE MECHANISM

High Spots



THE TRACTOR

The Tractor on the farm arose
Before the dawn at four;
It drove up cows and washed the clothes,
And finished every chore.
Then forth it went, into the field,
Just at the break of day;
It reaped and threshed the golden yield,
And hauled it all away.

It plowed the field that afternoon,
And when the job was through,
It hummed a pleasant little tune,
And churned the butter, too.
And pumped the water for the stock,
And ground a crib of corn,
And hauled the baby round the block,
To still its cries forlorn.

Thus ran the busy hours away,
By many a labor blest;
And, yet, when fell the twilight gray
The Tractor had no rest.
For, while the farmer, peaceful-eyed,
Read by the Tungsten's glow,
The patient Tractor stood outside,
And ran the dynamo.

—George Fitch.

Put it down in black and white. Keep a record, and it will help keep you.

Make hay while the sun shines and strike while the iron is hot, but don't lay off on the rainy days waiting for the sun.

There is as much in knowing when to keep still as in when and what to say in order to become a good conversationalist.

It's bad business to knock your competitor, because you are advertising him when you do. Let him do all the knocking, and confine your effort along that line to your anvil.

Keep you ears open and you can often pick up scraps of news that will help the collection department of your business. When you hear of a customer being flush, then is the time to strike for your money.

Be a grouch. That is, if you have more more business than you want. A surly nature driveth away much custom, yea, as a busines killer it runneth a close second to botch workmanship.

If a smith is seeking exercise then there is an excuse for a poorly arranged shop. But if he is seeking efficiency and best service to customers he will have his shop arranged so that a minimum of time will result in a maximum of work.

Step right up to your desk and tell your Editor all about that handy kink you discovered, or that last special job that you did so successfully. That's one way to help raise craft standards, and higher craft standards mean more profits all along the line. Your next move.

Clinch 'em We're speaking of profits, now, not nails. Every job should show some profit, even if only a small one. And the first step in making a profit is to find out just what your costs are. The last step in the clinching process, of course, is to get the money in the till, because profits on paper don't help pay your supply bills.

There's such a thing as being too economical. A dollar saved is a dollar earned, it is true, but if it means going without a needed tool, then you may lose two dollars while you are saving the one. So it is also well to remember that other sound business saying, that you can't make money without spending money. Strike a wise balance between the two.

When you are tempted to change your location, think about what happened to the rolling stone. The pasture always looks greener on the other side of the fence, no matter which side you happen to be on. Before you actually pull stakes, better see if there isn't some way of speeding up business at the same old stand.

Don't be afraid to tell the Editor—your Editor—what kind of reading matter you would like to see in your Journal. Far from disliking such suggestions, he is always glad to have readers show their interest by telling him what they want in these columns. So don't let Nineteen Twenty-one pass into history without sending along that nice, chatty letter you have been intending to write him.

Treat 'em rough! If a man owes you an honest debt, if he has the money to pay, if he stands you off for months without good reason, he forfeits all right to courteous treatment, and he should be handled without gloves. Go after him hammer and tongs, and if he fails then to come to time, hand your claim to a lawyer and instruct him to go right after the cash.

There's only one way to build a business, and that is on the basis of the right service at the right price. A man can get away with poor workmanship, low-grade material or sharp practice for a time, perhaps, but his deeds will find him out. The man who prospers and builds a successful business is the man who gives a square deal to all men at all times. There is no getting away from it.

When they talk good roads, anywhere, anytime, never fail to put in your best word in favor of them. They are the best investment any community can make. Good roads promote prosperity. They help farmers haul their stuff. They encourage the use of trucks and automobiles. They make it possible for you to draw trade from greater distances. Boost for better roads, in season and out.

Military service is fine when the need arises but how much finer it is to be in a creative service than in a destructive service. Smithing and repair shop work are truly creative for they conserve rather than destroy this world's goods. It will take the world generations to overcome the effects of the destruction wrought during the world war.

A Boy To Learn Smithing is wanted by an Iowa craftsman. This is an opportunity for some young chap to learn general smithing including wood working, smithing and shoeing. This smith prefers a Frenchman, Englishman or Swede. "No German need apply" he says. Any young man desiring to investigate this opening and who wants to go to Iowa will be put into touch with the opportunity by writing to the Editor.

What's a smile worth in cash? The ability to make friends is a big thing. Ever stop to think what it is worth to you in a business way? Truly, it pays to be popular. Other things being more or less equal, where is a customer more apt to go for a job, to the shop of a grouch, or to a place where he can be sure of a smile and a cheery greeting? You know the answer. So try to be popular. One way is to show an interest in what interests the other fellow.

Look to your light. As the short, dark days approach, the careful shop owner looks to see if he can improve the lighting conditions in his place. He knows that plenty of good light pays big dividends on the investment. He knows that it means better, quicker work ,and that it lessens the chance of accident. And if he has electricity, he also knows that any live electrical contractor or supply house can give him a pile of good suggestions for getting the best lighting effects at the least cost. Although this is a light matter, it should not be treated lightly.

THE SEVEN WONDERS
Of the Auto, Truck and Tractor World

1—The A. T. or T. that will run without oil.
2—The A. T. or T. that will run without a spark.
3—The A. T. or T. that will run without fuel.
4—The A. T. or T. that will run without water in the radiator.
5—The A. T. or T. that will run with dirty or cracked spark plugs.
6—The A. T. or T. that will run with a clutch out of adjustment.
7—The A. T. or T. owner who expects his machine to run under any of the above conditions.

Airplane Smithy: "All Kinds of Aircraft Repaired and Satisfaction Guaranteed. What are you laughing at? Never heard of a blacksmith tinkering air wagons. Well, young fellow, less than twenty years ago I gave it out as my expert and unadulterated opinion that we roadside knights of the anvil would be doctoring up those new fangled gas buggies before so very long, and they nearly split their sides a'laughing at me. Was I right, Now I see that they are building these sky sleds all out of metal, so I'll proceed to make another prediction. Listen.—More than one of the boys now in the business will live to see the day when a two-legged bird will drop down beside his shop out of the blue and ask to have his tail straightened in a hurry because he has to meet another bird in Havana that evening. This old world sure does move mighty swift these days, so I think I'll just run over to town and see if I can find a book to study up on these here ailerons, and struts, and other aircraft fittin's. Nothing like being ready for trade when it comes. So long."

Welding a Tractor Cylinder Block in the Open Air

DAVID BAXTER

With winter coming on apace the American blacksmith should now prepare for the usual amount of cracked cylinder repairing, particularly the cylinders of tractor engines, because of the great increase in the use of these machines in the season just past although the farmers are as a general rule tending toward better housing conditions for their machinery, and especially the tractor, there is no doubt but that many of them will forget to drain the water jackets and will thereby furnish a deal of work for the blacksmith who is equipped to do this class of repairing.

All of which means that the smithy who operates a welding torch in connection with his forge business, will get the bulk of the tractor repairing in his district. In fact, he will get all of it, in so far as the mending of cracked water jackets is concerned. For it is only by torch welding that cracked tractor cylinders can be satisfactorily repaired. And further, it can be truly said that the oxy-acetylene torch process is the best of all methods of welding for this class of work.

However, this is to be an exposition of the art of welding one particular tractor block as indicated by the accompanying photos. Lack of space bids us refrain from going deeply into the details of oxy-acetylene welding, so it must be taken for granted the reader is fairly experienced in the handling of welding apparatus. However, we will go considerably into details in regard to the mechanical devices employed in this particular job.

First, the job as a whole was to weld three cracks in the side of the cylinder block; which are indicated in Fig. 1. This picture also symbolizes the first step in the repairing: the grooving of the cracks. The block weighed over two hundred pounds, so it was deemed cheaper and simpler to weld it right where it was dropped from the farmers wagon. The welding torch could be brought to the job a great deal easier and quicker than the heavy casting could be taken inside the shop and lifted up on the preheater table. Not to mention lifting it down and moving it out of doors after. Such little details are not usually considered but they are a part of the fine art of cutting costs in welding jobs. Every blacksmith will do well to give the matter some thought.

The metal through which the fractures extended was approximately half an inch thick, making it very essential to groove out the cracks, both for the purpose of enabling the welder to fuse the full depth of the metal, and to permit him to be certain he was doing so. To weld metal no lighter than this without cutting a groove along the crack is to have some poorly connected spots in the finished weld; then there are many chances of pourous portions in some parts of the weld, too; it takes longer to make the weld and thereby increases the danger of oxidizing it. Several other things could be mentioned but these should suffice to convince the welder it is better to groove a crack of this nature.

There are several ways of removing the groove metal but in this instance it was cut out with a diamond point chisel. Care being taken to prevent lengthening the cracks or creating others by heavy hammering.

FIG. 1—THE METAL WAS CUT AWAY FROM BOTH SIDES OF THE CRACKS IN A V-SHAPED GROVE.

The cast iron of which the block was made was cut away from both sides of each crack until the V-shaped groove thus formed was approximately twice as wide at the top as the thickness of the metal through which it ran. The sloping sides extended to the full depth of the metal thickness. Each groove was cut a half inch past the visible end of each crack. This was to make sure the entire crack was included in the groove. At the extreme end, each groove was brought to the surface in a gradual slope. Where the cracks extended into the large hole in the side of the block the groove was chiseled the full depth straight through. It was at this part of each weld that the fusing was the most particular on account of the necessity of filing the finished weld level with the surrounding metal; the metal must not be too hard to file.

The next step consisted of cleaning the metal along each side of each crack to prevent chance of foreign substance from entering the melting weld which might have an adverse effect upon it. The adjoining surface of the block along both sides of each groove was thoroughly cleaned of all paint and grease. The bare iron was exposed by chipping lightly with a flat chisel. About an inch on each side of the cracks was cleaned in this way. Then to be sure there was no corrosion scale adhereing to the inner side of the jacket wall, the welder tapped smartly along each crack with the pein of the hammer, tending to jar the scale loose so it would drop away from the under side of the weld. This is one detail that few welders pay any attention to, but is really important since the adhering scale may become entangled in the melting weld to cause trouble in the fusion.

When satisfied that all of the scale was jarred loose the welder then arranged the job for preheating, which was the next detail in the welding process.

In arranging for the preheating, the cylinder block was raised and blocked above the ground about six inches, to afford a clear passage for the flames of two air-pressure oil burners to be used in heating the job. The cracked side of the cylinder was placed upward in a level horizontal position, which is so essential on cast iron work, due to the tendency of molten cast iron to overflow or to run out of the weld if it is not nearly level.

One oil burner was situated at each end of the cylinder and arranged so the flames would pass beneath and rise up on both sides of the casting. In this way the whole job could be heated to almost any desired degree. It was particularly to heat the jacketed portion of the block.

The main reason for heating the casting previous to applying the welding flame is to expand the metal, so there will be no great difference between the contraction of the weld metal and that of the surrounding casting when the job cools. Had the job been welded cold, the weld metal, which was fully expanded when applied, would have contracted when it cooled, and pulled away from the balance of the casting which was not expanded or would have cracked the casting in some weaker part.

By heating the job previous to applying the weld the whole casting was expanded so it could shrink in unison with the weld when the job cooled.

A minor reason for the preheating was to facilitate the welding. It is easier to weld hot, even though not red hot, metal than it is cold metal, especially of the thickness of this casting. A cold casting sucks considerable of the heat from the torch and thereby decreases its melting power. The heat of the flame is carried away by conduction so rapidly that until a comparatively large area is heated, it is difficult to obtain proper fusion of the metals. Therefore this job was heated to make the welding easier as well as to prevent contraction cracks.

After the oil preheaters had been located, lighted and generated, and placed as shown in Fig. 2, the whole job was draped with sheets of asbestos paper. This was for the purpose of confining the heat to raise the temperature quicker and more evenly. Also to protect the torch operator from the heat of the block while welding. Then, too, the asbestos tended to cause the whole casting to heat alike and thereby keep the expansion equalized. By shutting out the outside drafts the paper also served to protect the casting from strains that might be the results of welding the job out in the wind.

When the asbestos was in place the oil burners were turned on full blast until the flames filled the interior of the space beneath the asbestos paper. The job was then allowed to heat for about an hour or until it became dull red in the part containing the water jacket. This condition being ascertained by peeping beneath the asbestos from time to time as the heating progressed. The oil burner flames were re-directed a time or two before the best adjustment of the flame envelope was attained.

FIG. 2—THE NEXT DETAIL WAS THE PREHEATING OF THE JOB

Meanwhile the long torch with over medium size welding tip was fitted to do the work. Quarter inch gray cast iron filler rods were selected and placed near the casting. The regulators were set according to the tip size given in the tables furnished by the torch manufacturer. A patent flux powder was handily placed near the job. But no arrangements were made for turning the hot casting as it was to be welded completely in the position which it was preheated. Many heavy jobs must be moved several times during the welding process and a wise welder will have hooks and tongs ready so that no time will be lost when ready to turn the job. All little details, such as mentioned above, are better arranged in advance. In fact some welds are lost by not being ready.

A neutral flame was utilized throughout this entire job. Not only was the flame adjusted at the start, but was readjusted as the heat of the job affected it. As the torch heated it was necessary to make a slight adjustment to keep equal proportions of the gases supplied to the flame. Both acetylene and oxygen expand when heated so they naturally change in passing through the torch after it gets hot. Not much, however, yet enough to require a slight adjustment of the flame to keep it neutral.

A neutral flame is essential for good welds on castiron since a flame carrying excess of oxygen is liable to burn or oxidize the metal to make it brittle and porous. While a flame carrying an excess of acetylene tends to carbonize the weld and make it hard. This condition makes it easier to crack, due to its excessive shrinkage. Hard welds sometimes crack in spite of ordinary percautions in preheating and slow cooling.

When all was in readiness, the asbestos paper was torn back in a narrow slit directly over one of the cracks, exposing the red hot groove. Then the neutral flame was brought close to the outer end of this crack, where it played back and forth along perhaps an inch of the groove. In the meantime the filler rod was brought close to the flame to be heated. As soon as the groove started to melt the flame was concentrated in tiny circles over the end of it and the red hot rod was placed in contact. Then the flame was passed over the rod and groove as they melted and settled into one mass. At the same time the rod was twisted into the melting groove. When this portion of the groove was melted full the welding flame was gradually moved to the next portion while the rod was dipped in the flux pot to carry a pinch of the powder to the melting groove. When the flux was deposited the rod remained in contact to twist and prod another deposit of the filler in the newly melted section of the weld.

Then this procedure was repeated in another section of the groove. And again in another, until the entire length of the grooved crack was completely filled and leveled down. The latter being accomplished by passing the flame slowly along the edge of the surplus filler until it became fluid enough to settle into one mass. The rod was used to smooth the rough spots and help remove bits of slag or oxide.

When the last half inch of the groove was filled, with a trifle more surplus filler to provide machining stock around the hole, the welded crack was carefully re-covered with the asbestos paper.

Then another opening was made in the paper directly above another crack. Here again the flame was quickly brought in contact with the outer end of the red hot groove. Where the same treatment was accorded as was given the first crack. Both welds were made from the outer to the inner ends, for no particular reason except handiness. The second crack was welded complete like the first in a continuation of short sections blended into one. Each section was thoroughly fluxed with the powder by dipping the heated end of the filler rod in the powder.

Then the second crack was quickly covered and an opening made in the asbestos directly over the last crack. This crack was immediately and quickly dispatched in the same manner as the first two. In all three the welder was careful to melt the sloping sides as as well as the bottom of the groove before adding new metal. A portion of the sides were melted down with the bottom before adding the filler. Then as the grooves were filled higher up, the sides were again molten when the filler metal was applied.

The flame and filler were in almost constant motion throughout the welding. Which does not mean, however, that they were continually swinging and jerking about, but that they moved according to the melting condition of the weld. When the melting and mixing were slow the flame was advanced. And the opposite when the melting was too rapid. Thus the flame was moved as the needs of the melting required.

When the last crack was filled a sheet of new asbestos paper was spread over the top of the casting to shut out all draft. After this the oil burners were allowed to operate five minutes before shutting them off. Then both burners were removed and the heat of the casting further confined by strips of the asbestos. Thus the cylinder block was forced to cool slowly by a process of slow radiation. The job cooled only as fast as the heat beneath the paper could escape to the outer air. Which insured a very even contraction with but little chance of cracking. In a word the heat of the weld was held back with the heat of the whole casting. Or, the pull of the weld contraction was so closely followed by the shrinkage of the entire casting that there was little danger of cracking due to the weld pulling away from the surrounding metal.

The cylinder block was permitted to remain under the asbestos covering until cold enough to be handled with bare hands. After which it was filed and otherwise made ready for service on the tractor again.

FIG. 3—THE ASBESTOS SHEETS HELD THE HEAT IN WHILE APPLYING THE TORCH.

Now the main thing on these water jacket jobs is to have the casting heated evenly throughout and weld as rapidly as possible. After which the job is forced to cool slowly.

Smaller or larger cylinders are handled in the same manner with due regard for their size in relation to the heating and cooling arrangements.

How to Braze Band Saws

A braze properly made should give no evidence of itself in the work or running of the saw says a writer in Work. A good braze is not difficult to make providing proper care is given to every part of the operation.

First square off the ends of the saw, and be sure that, after allowance has been made for the lap, the set on one end of the saw corresponds with the set on the other end. Failure to observe this will make necessary what is known as a raker tooth, which will be very troublesome if the saw is machine set.

The length of lap is usually determined by the space of the teeth. The space between two teeth from each end of the saw will be sufficient. These are then filed off to form the joint, as in the accompanying illustration. See that they are filed perfectly true, and flat, taking care the ends are not filed down to a knife-edge. Also see that one edge of the lap is not filed thinner than the other, or a twist in the saw will result. This is rather a difficult thing to correct.

Next place the saw in the brazing clamp, and see that the back is perfectly straight, and that the ends of the saw come exactly in the centre of the opening in the middle of the clamp. Set the laps so that the point of one lap lacks 1/32 in. of reaching the heel of the other. This is to allow for expansion when the heat is applied. During the process of placing the saw in the clamp care must be taken not to touch the joint with the hands, as the least particle of dirt or grease on the laps will spell failure, and as a precautionary measure it is as well to wipe the laps with a piece of rag dipped in muriatic acid after they have been placed in the clamp.

Now cut a piece of thin brass, or better still silver solder, about the size of the lap (silver solder is sold by almost all saw makers specially for this purpose in rolls of various width), and clean it thoroughly by rubbing both sides with a piece of old emery-loth. Next is the flux; for this there is nothing better than borax. It should be finely powdered, and a very little placed between the laps. Then put a little on the solder, and, opening the laps slightly, slip the solder between them. As an alternative to silver solder, brass wire may be used. It should be soft and no thicker than No. 18 or 19 gauge, but instead of being placed between the joint it should be wrapped round the ends, crossed in the middle and the ends of the wire twisted together. In this case it is as well slightly to damp the borax as the wire on the underneath side of the saw will help it to stick.

After making sure that the saw has not lost its alignment in the clamp, the heat may be applied. This may be done either with a blowlamp or a pair of tongs. If the former a pair of pliers will be needed to nip the joint together just as soon as the brass runs. If tongs are used they should be heated to a good bright red. No hard and fast rules can be made as to how hot they should be; the hotter the better so long as they are not burnt. When they are hot enough, clean the insides of the tongs quickly and apply to joint. Nip tightly and keep on until they turn black, remove, and fan the joint with old newspaper or anything that will cause a draught for a minute or so. This will cause the metal to cool more rapidly and take on something of the same temper as the remainder of the blade.

When cold, remove the saw and clean up the braze. The most convenient way of doing this is to use a piece of wood of sufficient thickness cut to the segment of a circle and fixed in a bench vice. Lay the saw over the segment and file lengthwise. If the proper allowance was made for expansion when the saw was placed in the brazing clamp, very little filing will be necessary. In any case the braze should not be filed any thinner than the rest of the saw. If the necessary care has been taken up to this stage, practically all that is needed is to remove the surplus solder, file and set the teeth at the braze, and the saw is ready for use.

Cleaning Modern Firearms

It would seem almost unnecessary to publish anything on this subject when one considers the great amount of firearms cleaning that has taken place during the last several years, yet so many of our readers have asked for information on some phase of this subject, that we are glad to publish this article which originates with no less an authority than the well known Remington Company.

Any piece of machinery will give good results only so long as it is in good mechanical working order. The barrel of a shotgun, rifle or pistol performs a vital function, and a firearm may be said to be in good mechanical order only if the barrel is in such condition that it can properly perform its functions. The mere fact that the barrel is in such condition that the bullet or shot charge can go through it, does not mean that it is functioning properly, for a rusted rifle or pistol barrel may discharge its bullet at the muzzle or the shotgun barrel may throw its shot charge, but if the bullet does not fly true the shooter will not get the game and in the case of a shotgun a rough

TYPE OF JOINT USED WHEN FITTING ENDS OF BAND SAW

barrel may so completely spoil the pattern that the shooter does not get satisfactory results.

In caring for any firearms it is well to remember that a few minutes work devoted to cleaning by the proper methods within an hour or two after the firearm is fired is worth more in results than an hour's labor two or three days later.

Research has shown that the principal trouble in the way of rust and pitting is caused by one of the components of the primer. This substance, known as potassium chlorate, is present in all modern primers and unfortunately is practically insoluble in oil. It is, however, soluble in water and that is why ordinary ammonia is so effective in cleaning the inside of a barrel. To simplify matters, we

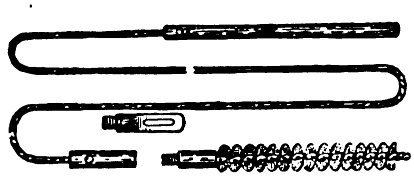


Fig. 1

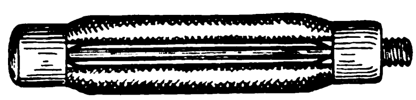


Fig. 2

A FEW MINUTES AT CLEANING MAY MEAN GOOD OR POOR MARKSMANSHIP

give the following rules for cleaning firearms which if followed intelligently will always keep the barrel in good shape.

High Power Rifles

Pass through the barrel two patches well saturated with strong ammonia. Follow with four or five dry patches and then with one patch soaked with some high grade neutral oil. If the ammonia patches come out a very deep blue color, metal fouling is present in the barrel and the ammonia treatment should be continued beyond the limit above mentioned until the patches come out nearly colorless. Use only steel or wooden rods as ammonia attacks brass.

Low Power Rifles

Scrub the barrel with a brass bristle brush. Pass two ammonia soaked patches through, followed by four or five dry patches and then an oily one.

Revolvers and Automatic Pistols

The methods used for .22 caliber rifles are correct for revolvers and pistols. Be sure in the case of revolvers to clean each chamber of the cylinder in the same way as the barrel.

Shotguns

Scrub the barrel with a brass brush, especially near the choke, as leading usually takes place in a shotgun barrel at the choke and just in front of the chamber. The rest of the procedure is the same as for low powered rifles.

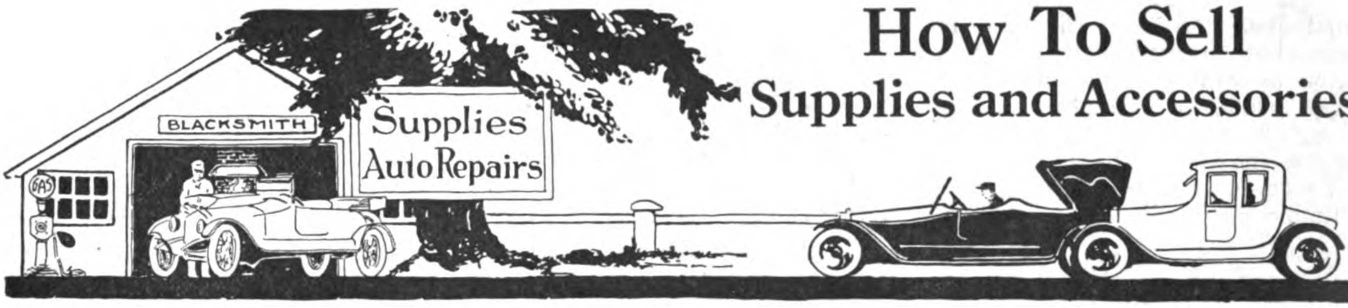
For cleaning rifles and pistols a steel rod is best. Figure 1 illustrates a field cleaner with brush or slotted piece for cloth patches. For cleaning large calibre pistols and shotguns a wooden rod is very satisfactory. For pistols, the rod is of course made in one piece, but for shot guns there are a number of good jointed wooden rods made, with a threaded end which will take a wool swab or the Tomlinson Cleaner shown in Fig. 2. The brass wire cloth side pieces remove leading and surface rust.

The advertising opportunities that are presented to the smith at every turn of the road limited only by the turns of the road at which he places his signs. Lots and lots of smiths have put up signs along the roads leading to their shops and for a radius of from three to five and six miles depending upon their locations. Signs of this kind permit of broad latitude in their wording and the more originality that the smith can get into them the better their advertising value. If you haven't tried this kind of advertising write up a few cleverly worded signs, making the text matter just as short as possible to tell your story and then put up a few at the most largely travelled points. A very small expenditure will enable you to test out this idea and then you can increase the number of signs each season until you have the country side well posted on where folks should go to have work done properly and promptly.

Constant Reminder

He (to wife who is off for the beach)—Now, don't forget me dear.

She—As if I could Jack. The surf at night sounds just like you snoring.



How To Sell
Supplies and Accessories

This department tells you how to sell supplies and accessories. The selling points on actual items of equipment are here presented in actual sales talks. Here you will find selling arguments which will help toward sales and profits.

Jim Reid, Jaffe Specialist, Hands Out Some Radiator Wisdom

Joe Harder was rolling along the Lake Ridge Road in his "Henry", when he espied a new sign on Jim Reid's shop. Joe usually knows about everything going on in the county, but this was a new sign even to him. In his surprise, he applied the brakes so quickly that the rear wheels of his touring model slewed around until the entire machine drew up, tail light first, to the very threshold of Jim Reid's shop.

Jim had evidently seen the rather undignified approach of Joe's Ford, for even before Joe and his machine had come to a stop, Jim was at the door of the shop.

"What's the matter, Joe, has she taken the bit in her teeth?" and Jim smiled broadly as he greeted his visitor.

"Naw, she shied at that new sign o' yours up there". And Joe pointed to a gigantic red radiator over the entrance to the shop.

"What's thet the sign of"? questioned Joe. "Looks to me as though there had been a fire sale of red paint. And where in the world is the car thet thet there radiator came off of?"

"Well, in the first place," began Jim, "That is a sign that I can now take care of your radiator troubles as well as the few other troubles that you have been coming to me for. And in the second place—"

But before Jim could finish, Joe exclaimed:

"What's that? Do y' mean to tell me that you can fix thet there radiator o' mine. No wonder the old bus' shied when we came along by here."

"Yes, I can put an end to every Ford driver's radiator troubles, and your radiator troubles will be over, too, if you will listen to me and take my advice."

"That sounds, good, Jim," returned Joe, dubiously, "but I'm from Mazoo-ri, y' know, an' y' gotta show me."

"All right, I'll show you," was Jim's prompt response. "How many times have you watered that car of yours today?"

"Why, good gosh, I've toted water three times since I left home, an' I've only been over to the Holland Mill and back as far as here. That tank is gettin' thirstier than a Sahara Desert." And Joe reached for his pipe and tobacco.

"WHEN I SAY THE JAFFE IS GUARANTEED NOT TO FREEZE I MEAN IT" said Jim.

"Well, let me tell you something: you won't be rid of your job as water-boy until you let me put a Jaffe Radiator on that car of yours. You've had the tinsmiths tinkering with that old radiator so much, since she froze up on you last winter, that there is hardly any of the original metal or solder left on the poor old thing. And the efficiency of the radiator is nowhere what it should be, to say nothing of the continual leaking."

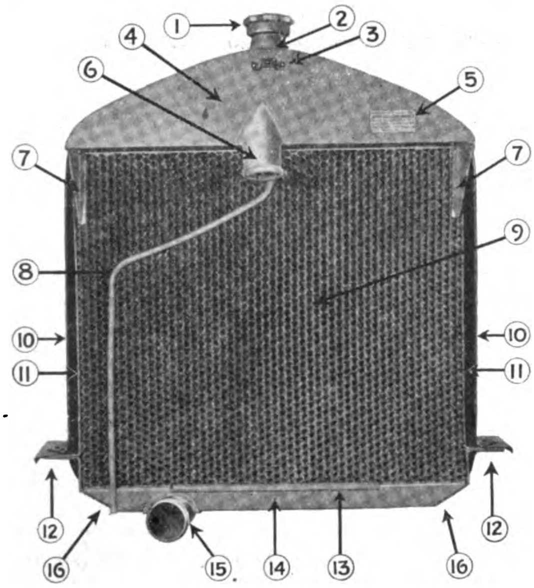
"Well," began Joe, as he filled his pipe, "I'll tell you, Jim, just about the time I get to thinking of gettin' a new radiator, some guy comes 'long and tells me what a fool I am to buy a new one when all I need do is to put a couple o' quarts of his Hokus-Pokus into the tank, and my radiator troubles will be over. And now you come along with a new gag trying to tell me how to overcome radiator troubles and make riding a pleasure, even in a Ford. Well, go to it, is all I gotta say." And with that, Joe lighted his well-filled pipe and waited for Jim to tell of his new radiator service.

"In the first place," began Jim, "I can put a new Jaffe Radiator on that car of your's and it won't cost you any more than any other Ford radiator. In addition to that, you will get a radiator that is absolutely guaranteed not to be damaged by freezing, no matter how often or how tight she freezes."

"What are y' givin' me now, man?" cut in Joe. "Don't tell me that a radiator can be frozen and not damaged. I wasn't born yesterday. I cut my eye teeth on a Ford radiator. Better tell that to somebody without automobile brains."

"I don't blame you for doubting me," came back Jim. "But you know I'm not in the habit of saying a lot of things that are not absolutely true. And when I say that the Jaffe radiator is guaranteed not to freeze, I mean just that. It's been tested and proven, and that guarantee is backed with real money."

"Money certainly talks," replied Joe. "But I'll be glad to know how it can be done. You know as well as I do that they can't made a radiator strong enough to stand freezing. Water jackets freeze and crack, and a radiator is not as strong as a cylinder casting."



"FROM THE FILLER CAP TO THE DRAIN TUBE, WE'LL TAKE EACH PART OF THE RADIATOR" Continued Jim.

"Well, here is a radiator that will stand it," said Jim, as he placed a Jaffe radiator on the bench. "You know water won't run up hill, but a pump will force it up. The Jaffe radiator is designed so it will stand repeated hard freezings. It is built and assembled of the best materials for radiator construction, and is backed by a money guarantee. From the filler cap to the drain tube you will find every part of this radiator honestly built of honest materials.

"Take each part of the radiator, for example", continued Jim. "Here you've got a heavy polished filler cap. The neck here at the filler hole is of heavy gauge brass. The tank is of one-piece drawn brass. There are no soldered joints or angles about it. The shell is cold rolled steel, and that black enamel is baked on. Or if you want it, you can have it in a nickel-plated finish. These side brackets are of strip steel, and are not soldered to the core."

"That don't look good to me" interrupted Joe, pointing to the side strips. "Seems t' me it would be better if them side strips was fastened to the core. Looks kinda loose to me."

"If the brackets were soldered to the core, it would prevent expansion and contraction of the core", Jim responded promptly. "You see, if this core was fastened rigidly along the side here, the constant vibration and play would have a tendency to weaken the core. But in this construction the core has a chance to expand, and is practically free from hard road shocks.

"But how can the bracket hold the core if it isn't fastened to it?" again objected Joe, rather heatedly.

"The side bracket extends from the top tank to and around the bottom tank,' replied Jim. "That gives you great strength with flexibility, which you want for the core. And here is a little thing that will show you the attention paid to little details by the Jaffe people. Instead of making this hole in the side bracket round, they make it oval, so as to make fitting easy. Both the inlet and outlet connections are stamped from heavy plate, and are lead coated."

"What's the idea of the lead-coating?" asked Joe.

"To protect the inlet and outlet tubes against corrosion," returned Jim. And then continuing, he said: "And last but not least is the core of the Jaffe. This is really the real feature of this superior cooling device. In the first place, it is of true cellular, honeycomb design, combining greatest possible cooling efficiency with large capacity and neat appearance. The honeycomb design hasn't a "cheap" look. And the very construction and design prevents the core from being damaged by freezing. And another big advantage in this special design in the Jaffe is the ease with which it can be repaired. If your Jaffe radiator is jammed in a collision or in any other way, I can cut out the damaged section and insert a new part, and the whole radiator will be just as good as new. The repair of a Jaffe is one of its great features, although the very fact that it is not damaged by freezing makes repairing unnecessary, except from serious accident in collission.

"And finally, Joe, that radiator", and Jim patted the glistening top of the Jaffe that stood on the bench, "won't cost you any more than any other radiator that you buy for your Ford. Now the decision is up to you."

"Well, Jim, I guess you've got the goods all right. If that radiator is half as good as all you say about it, I want it on my 'bus. Better get busy and put that one on just as soon as you can. I'll call in tomorrow and get the car."

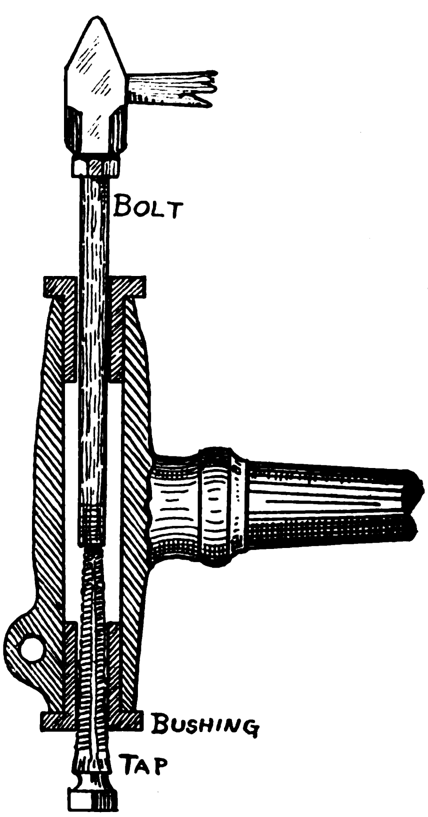
And with that, Joe knocked the ashes from his pipe, put it in his pocket, and departed.

Jim smiled as he thought of the profit of his few minutes' talk, and of the satisfaction in handling a line that he believes in.

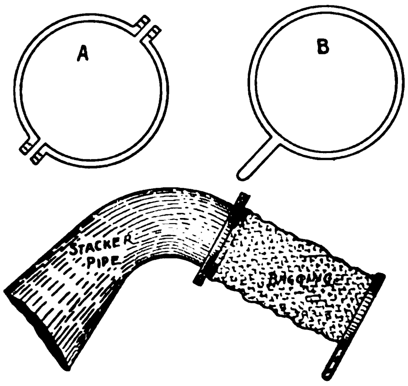
How to Remove Old Bushings From Ford Spindle Bodies

S. L. Hirschman

Removing the old bushings from the Ford spindle body is usually a job that is attended with considerable fussing, fuming and general cussing. Anyone who has attempted the job as it is usually attempted by the average repairman, will quite agree with me in what I say



HOW A RATHER TROUBLESOME BUSHING IS EASILY REMOVED of the operation. Howover there is no reason for the fussing and cussing if one will go about the job in the right way.



AN EASILY MADE HANDLE FOR THE STRAW STACKER

Almost every shop worthy of the name has a number of discarded taps lying about. Take one of these discarded taps—a half inch one will do nicely—and screw it into the bushing as shown in the accompaning engraving. If you turn it in about three turns it will be sufficient. Now insert the old spindle bolt in the other end and a few good sharp blows on the end of the bolt will bring out the bushing with little difficulty. To remove the tap from the bushing use a pipe wrench. A half turn or so will do the trick.

This same idea is also applicable to the removal of bushings from other machines as well, saving the mechanic a great deal of troublesome tugging and pulling at parts that seem very persistent in sticking on the job after their usefulness has ended.

A Cylinder Lapping Tool

S. E. GIBBS

A very satisfactory tool for lapping cylinders can be made in a few minutes from an old piston, a half-inch rod, and a nut. First drill a hole in the head of the piston and thread it to take the half-inch threaded rod. Then take a hack saw and slit the piston from the outside edge through to the center hole as shown in the engraving at A. Now put the nut in place on the rod and screw the rod into place in the cylinder as shown in the engraving at B.

The operation of this device is simplicity itself as may be observed in the diagram or sectional view at C. It will be observed that tightening up on the nut will tend to cause the threads on the rod to ride up on the threads of the piston and thus the piston is spread and made suitable for a considerable range of cylinder diameters.

A Handy Attachment for the Straw Stacker

A. H. L.

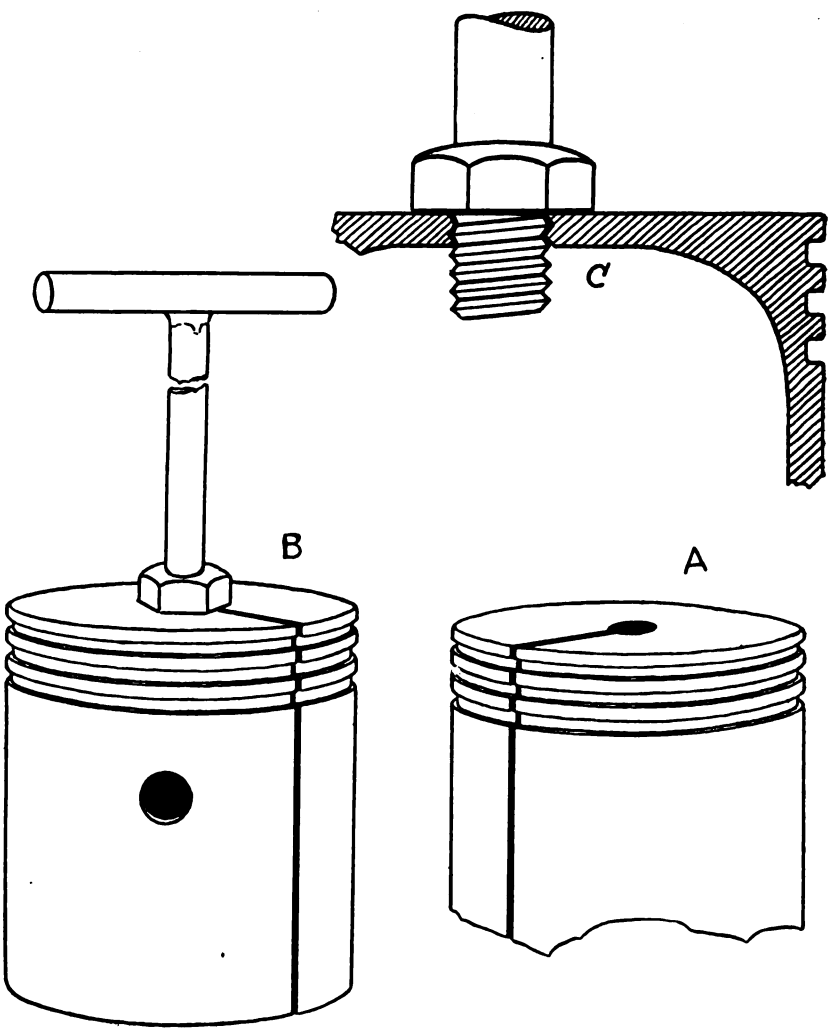
The accompanying illustration shows a handy device for use on the straw stacker when the straw is to be placed in the barn. As a usual thing the stacker pipe is too short to carry the straw to the far end of the barn and the easily attached extension will make the matter of distributing the straw a very simple matter.

The extension consists of two iron rings of a size about the same as the end of the stacker pipe. One of these rings (A in the engraving) should be so constructed as to allow for placing over the end of the stacker pipe and securely clamped around it. The other (B) is a solid ring with a handle if thought necessary.

In applying the device to the stacker pipe baging or canvas tubing is used of any reasonable length. The clamping ring is stitched into one end of the tube while the solid ring is fastened into the other end. The handle on the solid hoop enables one man at the discharge end of the stacker to distribute the straw anywhere in the barn.

The clamping ring may be made of old tine iron or any scrap band stock. The solid hoop should be made as light as possible so as to be easily handled.

Are you the man that has been putting off writing to the Editor? Just jot down some interesting craft experience, tell about some job you have done, or describe your shop, quipment and line of work—it will be pretty sure to make good reading for the boys whose letters you have been enjoying.



A VERY SATISFACTORY TOOL FOR LAPPING CYLINDERS CAN BE MADE FROM AN OLD PISTON, A ROD AND A NUT

A Word to the Young Horseshoer

E. H. Haloon

Today there are many men working at blacksmith and horseshoeing who never learned any trade. Being of an ingenious turn of mind they can do fairly well in repair work, but when it comes to shoeing horses it is another question, and I say in fair dealing to the horse no man should be allowed to manipulate a horse's foot without a license showing that he does know something about a horse's foot and how to shoe it. Instead of this anyone can maltreat a horse's foot in anyway he sees fit, causing the horse untold misery and permanent lameness and nothing is ever said about it. This is all wrong to my mind and influential men should talk and write against it.

Years ago I learned my trade from my father, who was called a good shoer, but his knowledge was of the outside of the foot and so he could only teach me as far as he knew. I was satisfied and my customers came from as many as fifteen miles away to have me shoe their horses. And they gave me more money than the regular price. Of course I just naturally got a swelled head. This lasted until I had a competitor in the form of a young man, who, beside having a swelled head actually knew more about a horse than I did. It took me some time to make up my mind that this was a fact.

I never was good at playing second fiddle so made up my mind to know all there was to know about a horse's foot and leg as high up as the knee. I got endless specimens and several books and as I read I cut the specimens up. I got plates and charts and found in the specimens what the books told me was there. All this covered nearly two years before I decided to gun for the new man

I began to follow him closely as he was right next door and luck favored me. There was a horseman in town who had probably 100 horses and colts. He raised horses on a large scale. When this man came to town I expected his work, but the new man got it and it hurt my feelings and as I was then surely the best man. Luck however favored me in one of the new horses becoming lame under the other fellows care. I left no stone unturned to get in with the man who had charge of the horses and the result was that I soon had charge of the shoeing of the colts, drivers and trotting horses, as I demonstrated that I knew what I talked about. This horseman would often have me at his house half the night in consultation as to what could be done to some of the fast ones to get just a little more speed.

Since then I have taken advantage of everything that came my way and am now considered good authority on horseshoeing in a small way. What I write seems to be well taken.

Now young men, I have told you this story to show you what you can do if you want to try. I say don't sail under false colors or play second fiddle to anyone in your class. Get a good work on the anatomy of a horse's foot and leg; get specimens and cut them up until the whole matter is in your head, then talk it to your customers and practise it. When you get a chance go just as far as you know and no farther and you will soon find shoeing horses is a real science instead of a drudgery, to get a living.

I have been at it more than 50 years and there is hardly a day goes over my head, but what I can say at night that I know more about horseshoeing than I did yesterday. A man was in my shop this morning who came twelve miles to have his horse shod behind. He said to me, "You cannot think how much you helped my horse forward. He is not the same horse and I drove him over here and he did not sweat, thus showing me that he is going easy." And this is a new horse to me and came from a crack shoer in a nearby city.

THE HORSES FOOT MUST BE PROTECTED WHEN HE IS TAKEN FROM THE RANCH TO THE MODERN ROAD

Some Common Horse Sense On Horseshoeing

A. C. Hall

Years ago there was much discussion in these columns on the subject of the application of the shoe to the horse's foot and the calling of the operation as a necessary evil. Now, happily, there seems to be no more discussion of the subject from that angle and every one seems to agree on the subject in that the application of iron and steel to the horses feet in absolutely necessary to the usefulnes of the animal.

One may look upon the matter as conclusively solved by the fact that in all the years since the horse was first used as a draft animal there has never been a better, more simple, or more inexpensive device discovered than the well-shaped, properly formed shoe of iron or steel. It is most thoroughly efficient in its work of protecting the animal's feet and it has made of the horse the most useful of man's animal friends.

It is therefore agreed that the matter of attaching irons to the foot of the horse is correct, but on the subject of the manner of the attachment much can be said. I think it is fully agreed by every farrier worthy of the name that the manner of attaching the shoe by means of nails is the best yet devised. There have been various devices and methods of holding the shoe to the foot, but all such that have been offered have been found lacking in some particular. It is of course well known that the incorrect application of nails causes serious foot troubles but nothing so far offered by several generations of inventors has been found as satisfactory nor as efficient.

We must therefore conclude that it is the skill and knowledge with which the shoe is applied that has most to do with the foot health of the animal,—it is surely not the very manner and means of protecting the animal's feet that have been found best in all of the years since the first horse assisted man with his burdens.

When one considers the great lack of fundamental knowledge in the average run of farriers, it is indeed surprising that no greater number of animals are encountered with feet that are improperly shod. There are indeed surprisingly large numbers of horses whose feet are in anything but healthy shape, and this may be readily determined by any careful observer who will simply note the gaits, the foot action, and the standing and walking positions of the animals that come under his observation. Yet not-with-standing this fact, it is a wonder to me that there are not greater numbers of horses that are lame, maimed, diseased or disabled.

Higher knowledge of those matters and subjects that have to do with shoeing, or rather with proper shoeing, never had the attention of the majority of smiths and farriers and some have even scoffed at the reforms and suggestions of the well meaning members of the craft who have given of their time and knowledge and even money toward the proper education of the members most in need of proper guidance.

Until time itself ends there will always be differences of opinion on all matters of human endeavor, and not the least of these is the subject of the proper manner of shoeing man's best animal friend. Yet, in the opinion of the right thinking, keenly observing, and properly experienced farrier, there can be no question regarding the need of protection for the horse's foot and the conclusion that nothing so far offered is better than the proper and intelligent application of the metal shoe.

NOTHING HAS BEEN FOUND SUPERIOR TO THE MODERN SHOE WHEN PROPERLY AND INTELLIGENTLY APPLIED.

Some of the Things a Horseshoer Should Know

ALLAN B. SMITH

After an experience of more than forty years, I am going to put in writing my ideas as to what a horseshoer should know before he should be allowed to practice the craft.

In the first place, he must have a thorough knowledge of the anatomy of the horse's foot, because no man can do an intelligent job unless he has a fair understanding of every portion of the foot and hoof and their relations one to another. He should take a hint from the case of a surgeon, and painstakingly disect for himself a number of horse's feet, so that he will know the location and size of all of the different parts.

A horseshoer with a good knowledge of the structure of the foot will know how to avoid injuring it by injudicious rasping or paring, and will be able to avoid much needless suffering on the part of the horse. It will be a big help to him also in correcting most of the common troubles to which the foot is subject.

When it comes to handling the hoof itself, he is extremely careful in cutting off the clinches of the nails so that the horn of the hoof is not damaged in any way. He is careful also when loosening the shoe, because the proper way to remove a shoe is an important thing which some smiths overlook. In placing the pinchers to loosen the shoe, he takes care to avoid the seat of corn, and grips the shoe above the part of the sole at the quarter of the foot.

Another important thing for the good smith to know is, that the less iron used the better; so he makes a shoe that is light for the horse to carry but hard for him to wear out, because he places the iron at the proper point.

The competent smith is equally careful that the horse receives no injury whatever in putting on the shoe.

Finally, I would say "be a student always." Try to learn the reasons back of things and to improve, because intelligence, square dealing and industry will bring success to a man in almost any undertaking of life.

More On Leveling the Horse's Foot

C. D. SIDDERS

In regard to Mr. Maloon's article on leveling a horse's foot I want to say that I do not quite agree with him. Just because a horse's foot is run over I do not think it best to level it the same as it is worn. I try to level most of the feet that I shoe and I do not think that I torture the horse either, although I do not think it practical to try to level all of them, especially those with a stiff pastern joint.

The majority of people wear their shoes faster on the outside than on the inside edge. But if you ask them if it is necessary to run them over for comfort, they will tell you, no that they feel more comfortable when not run over so badly. You might ask them if a new pair of shoes gives as much comfort as an old pair and you will find that for the first day or two they probably will not especially if they are about a half size too small. But if in doubt as to my statements ask your neighbor who has a run-over shoe.

And, by the way, what has become of the man who used to successfully set tires cold? I have not heard from him for quite a while.

Queries-Answers-Notes

THIS department is the place for discussing shop and business matters. Here you may ask for information on any topics or matters that interest you; bring to the attention of the progressive craftsmen of the day the subjects that should have their attention. You are requested to make use of this department as often as desired.

Hardening plowshares—As I don't think it is quite fair for me to read all the brothers write in Our Journal without giving something in return, I will tell about a compound that has given me very good success. I take four ounces of cyanide of potassium (a deadly poison) and four ounces of sal ammoniac. After pulverizing these, I mix in very thoroughly two ounces of bicarbonate of soda. To use, heat the share to a dark red and sprinkle the mixture on the face I have found this a great improvement over water for hardening shovels and plowshares.

B. A., North Dakota.

A Lawn Mower Kink:—In my estimation, if there is much lawn mower sharpening business in the locality, it will pay a man to make a special drive for these profits, and for the other kinds of work that it brings in. I also believe it pays to put in a special machine, for I am a great believer in improved, labor-saving tools of all kinds.

But if a man only has a little lawn mower sharpening, the following suggestion may be of some help. First, I reverse the dogs so that the machine will run backwards. Then I make a crank and fasten it to the wheel, so that I can turn the cutter bar. As a grinding compound, you can get good results by mixing No. 80 grain emery with ordinary machine oil, and a little use will soon tell you just how thin the mixture should be for best results. W. B. A., New York.

Cash or Credit?—I am a young smith who would appreciate some advice from some of the old hands on a matter that troubles me a lot. I started in business for myself about a year ago, and have worked hard to give satisfaction and build up a good trade. But I find that a number of my customers seem to think they can take advantage of me because I am young and a beginner trying to get a start. They are very particular about having me do a good job and get it out quickly, but when I go after them for my money, they put me off with some flimsy excuse or other, or pay me a little on account to keep me quiet, and all the time their bill keeps on growing till now I am worrying most of the time. I want to get and keep all the customers that I can, but I can't run my business if I don't get my money in a reasonable time. Will some of the old timers tell from their experience what is the best way to handle this situation? Should I put my whole business on a strictly cash basis, as I feel strongly tempted to do at times, or shall I use strong methods with those slow pay customers, and tell them plainly that if they want my service they have got to pay, and pay promptly, like any other good business man. W. A. B., New Jersey.

On Setting Buggy Axles:—Can you give me some information on setting buggy axles? J. E. Lyons, New York.

In Reply:—The rules as observed by us for years, in the setting of buggy axles may be briefly stated as follows: When wheels are nearly of the same height make the front axle 3/16 of an inch longer than the rear axle. If there is a difference of any considerable amount, say six or eight inches, we make the front axle ¼ of an inch longer than the rear one.

Now in the actual set of the axles for buggies—wet set so that the wheels will bear evenly at the bottom. In other words we use the plumb spoke method. With a one inch tire and wheels that have a 3/8 dish the two wheels will set 2-3/8 inches wider at the top than at the road bearing surface. The wheels should set at right angles at the bottom.

H. J. G., New York.

Trouble with Rifle:—I wonder if the Editor or some reader can help me out in solving a very perplexing problem (to me at least) in the action of a small calibre rifle. I have had an unreasonable number of misfires this past season and in attempting to remedy the trouble have tried various makes of cartridges. Still the difficulty persists so that I am wondering if the failures are not the result of rifle trouble.

L. G. Wallace, New York.

In Reply:—The difficulty is no doubt with the rifle. If your ammunition is good and not damaged or affected in any way the trouble experienced indicates that your gun is not working properly. The cartridge is not being struck a good sharp blow. This may be because of a weakened spring or gummed oil. Try cleaning the action thoroughly and then apply a good gun oil or three in one is very good. If this treatment does not make for perfect firing put in a new spring. S. S. B., New York.

How to Melt Brass:—I would like to know if it is practicable to melt brass on a small scale in a crucible in the forge. Also bronze. I have in mind the casting of brass and bronze bearings of small size. Can you advise me along this line.

F. C. Z., Ohio.

In Reply:—When melted in an open crucibles brass oxidizes rapidly on the surface. It is therefore necessary to carefully strain the surface of the melted metal before pouring. If the metal is sprinkled with finely powedered charcoal this oxidazation will be greatly lessened.

In melting in a crucible in the forge have your fire good and deep and the blast should be moderate and even. In building the fire around the crucible use fire brick, coal and clay if necessary to confine the heat, and keep your blast as uniform as possible.

For any considerable amount of melting of this kind a simple furnace should be built. Plans for one appeared in old issues of "Our Journal."

L. J. Jones, New York.

The December issue of 1916, page 71 contains an article on "Melting Furnaces for the Amateur Founder" which will no doubt interest our Ohio Reader.

The Editors.

From an Outsider—I am not a smith, any more, in fact, haven't taken a heat these twenty-five years, but I like to read The American Blacksmith just to see what the boys are thinking about and to see how the good, old trade is gradually developing to better standards. I want to state my opinion right here that one of the things that held the craft back for many a year is that they did not appreciate the value of the services that they were giving. I don't think as a general thing that blacksmiths ever charged enough for their time, I am not recommending that you ought to over-charge, for that is almost as bad in its way as under-charging. I never will forget a little case that came under my eyes only a few years ago, which shows one of the things that have been ailing the profession. It was this:

An automobile owner brought a little job to this smith's shop. He wanted a broken bolt on his top replaced, but the old bolt was rusted in tight, and to do a good job, the smith had to call his helper, and together they made the little repair in fine, workmanlike manner and to the complete satisfaction of the owner, who, by the way, was not a regular customer, and therefore not entitled to any such little accommodations. The two mechanics had spent about ten minutes time, getting the bolt out, finding a new one of just the right size, fitting it, and touching it up with a little paint. The amount charged for this service was—15 cents. Why, most car owners would gladly pay 40 or 50 cents, and then tip the helper from 10 to 25 cents in addition. And so I say, find out what your time is worth per hour, do good work, and charge accordingly.

W. A. Brown, New York.

Testing Locomotive Parts:—Here is a good suggestion for testing various locomotive parts for cracks or defects during overhauling, such as valve stems, crank pins, axles, piston rods, motion work or other vital parts in fractures may have developed during use. After the parts have been cleaned and examined, a thin, even coat of a good white-wash should be applied. After this has thoroughly dried, if there are any flaws or cracks the oil will work out and show up very plainly on the white-washed surface? This same method can also be used to advantage in detecting cracks in frames or in fact many other parts. It is also recommended that such parts be annealed if possible, because flaws will show up while the pieces are hot.

Hacksaw Suggestions:—An exchange gives the following good pointers when using hacksaws. Under no consideration should a hacksaw blade be used dry, as any slight increase in speed will draw the temper in the blade. The proper lubricant will permit an increase in the number of srokes. Oil should never be used in its pure state, as it is not adapted for this class of work. Experiments convince us that the best medium for cooling the blades is a water mixture of high grade soluble cutting oil. The work should be kept flooded.

Exhaust From Gas Engines:—Every year a certain number of deaths occur due to the exhaust from gas engines in confined places, and as many such accidents take place in garages with insufficient ventilation on account of cold weather, a word of warning at this time is in order. The exhaust gases from motors contain a greater or lesser amount of carbon monoxide, which is a deadly gas. When the combustion is complete, that is, when just exactly the right proportion of air is mixed with the gasoline vapor to burn it all, the product is mostly carbon dioxide, or CO^2 as the chemist writes it, and this is an inert but harmless gas. If the mixture is not exactly right, and this is usually the case, then some of the carbon in the fuel is incompletely burned and produces the deadly carbon monoxide, CO. For this reason, the safety first rule demands that a person should not work in a closed room or unventilated space where the exhaust of a gas or gasoline or kerosene engine is permitted to escape. A small amount of this gas may not be especially injurious, but one takes the chance of being overcome by remaining in such an amosphere.

How to Weld Monel Metal:—Here is a tip for handling this kind of a job that I got hold of recently that seems to work out very well. The temperature is brought up to somewhere around 1500 F. before the weld is started. After the weld is completed, it is raised to the same temperature and then immediately placed in hydrated lime so, as to completely cover the weld. The action of this is to exclude the air, this and the slow cooling preventing cracking.

B. W. A., New Jersey.

This Manitoba Smith Believes in Advertising:—The new year is near at hand, and as many business men and artisans make it a practice to address letters or greetings to their customers at that time, we are glad to print below a copy of what one of our good Canadian friends sent out last year. In sending this letter to us, Mr. Hathaway tells us that he is a firm believer in the Magic of printers ink. At the top of his letter-head, he has: "Ours is a black business run white", and "Our Motto: It can be done". Mr. Hathaway's New Year's letter reads thus: "The object of this circular is to thank you for your patronage for the past year and solicit the same for 1921; also to tell you of some of the things I hope to do for my patrons this year. It is something to say that I did not have a customer to make a second call for his work last year. This fact should be worth something to busy men. Now sir, I have had the winter to improve my equipment. I am ready to do speedy and efficient work. The high class of steel put into farm implements today requires scientific manipulation. I read the best literature on the subject procurable in America, and I practice it.

"Some of the things I want you to expect and demand from my shop are: Work promptly and satisfactorily done; courtesy to you, your wife, children or servant. You may have the use of our tools at any time. I will be ready to help you, morning, noon or night, and if you are not satisfied, your money back. You can help to avoid disappointments by bringing and having your repairing for the spring done early."

Here is an example that may be followed with profit by other readers.

Treating Warped Plow Shares—If you can find space in your valuable paper, I would like to give my idea about warped plow shares. I have read in your paper how to sharpen them and paint them and how to provent them from warping, but I have never read how to take the warp out of them. I would like to tell the brother smiths how I do it.

In a great many cases new shares will warp more easily than shares that have ben sharpened a few time. In sharpening plow shares, I use a pair of tongs that grip over the landside—a share isn't so liable to warp that way. If the share warps, keep on sharpening till you have finished it, then heat the share in the fire, top side down; heat all over and heat evenly. Then put it on the anvil in the same position as you had it in the fire; with the tongs in the throat of the share, hit it on the outer corner, one or two light taps and the warp will be all out. When a share warps it doesn't warp at every point, so it is necessary to take out the warp the same as it went in. Just try this once or twice, then you will see that it is the right way. Allow it to cool and then temper. W. W. Parker, Manitoba.

Marking Steel Tools:—Please give me name or names of an acid or mixture of acids that I can use for marking tools such as steel squares, calipers, etc.

J. C. Lamon, Kentucky.

In Reply:—Heat an iron or an old pillar-file with a smooth side, and with it spread a thin, even coat of beeswax over the brightened surface to be etched. With a sharp lead pencil (which is preferable to a scriber) write or mark as wanted through the wax so as to be sure to strike the steel surface. Then daub on with a stick etching acid made as follows: Nitric acid, 3 parts; muriatic acid, 1 part. If a lead pencil has been used the acid will begin to bubble immediately. Two or three minutes of the bubbling or foaming will be sufficient for making; then soak up the acid with a small piece of blotting paper and remove the beeswax with a piece of cotton waste wet with benzine, and if the piece be small enough dip it into a saturated solution of sal soda, or if the piece be large swab over it with a piece of waste. This neutralizes the remaining acid and prevents rusting, which oil will not do. S. I. D., New York.

On Well Drills:—Would you kindly give me information concerning well drills? I would like to know how to sharpen and temper them. I have never had anything to do with them and as I intend to go into the oil fields pretty soon, would like to have a sketch of one; also the way to sharpen and temper the same.—

W. B. Arizona.

In Reply:—A great number of articles on this very subject have appeared in earlier issues of "Our Journal" and it would of course be impossible to print in one article all the information this Arizona reader will need and want. We are however reprinting an excellent article on the subject of "Tempering Well Drills" which was written by our well-known contributor Mr. L. R. Swartz. This article appeared in our columns quite a number of years ago but W. B. will find lots of good sound practical advice in it today. The Editors.

TEMPERING WELL DRILLING TOOLS

By L. R. Swartz

Since the process of heating and forging in dressing bits is of such vital importance in producing a proper temper, we will (for the sake of convenience) assume that they are but a part of the process of tempering and treat them under the same head.

With good, clean coal, make a deep fire and when it is well started put the bit well into it so as to get four or five inches of the end hot—as bakers say, "use a moderate oven." Do not hurry the heat but give it a chance to work through the steel evenly and, in order to lo this, turn the steel over in the fire so as to get a uniform heat from both sides. Avoid a sharp cutting blast, but work with a steady, even blow to your fire. Do not burn the corners of the bit—a small, shallow fire with sharp blast is certain to burn the corners, and burnt steel will not cut hard rock. The corners do about two-thirds the cutting. A 14-inch fan for tool dressing is recommended. The 6-inch and 8-inch fans put on some machines are too small.

After the bit is hot, give it a good strong hammering in the center with a 10-pound sledge, and work out to each corner from the center. Keep turning the bit over so as to forge both sides alike. Have the edge straight across and not rouning and the corners ¼ to 3/8 inch larger than the gauge. Reheat the bit to bring in the corners. In bringing in the corners, being where the flare starts to swell from the shank, and work down to the corners. If the forging does not begin near the shank, the steel will push up and form a sheet after a few dressings, and it is then only a question of time and cold water as to how soon the corner will crack and fly off. Strike hardest when the bit is hot, and lighter as it cools. See that your fire is clean and raise your hardening heat.

Use a tub 6 or 7 inches deep, and have in it a rack of worn-out tire iron, so that you can stand the bit on its sharp edges to allow the water to reach the cutting edge from below. The water should only reach up 1¼ inches on the steel and be agitated until the bit is hardened. Then lay the bit down and rub the bevel bright with brick or sandstone, and a sthe color runs down to a coppery straw color quench, and the color will be about what you want.

Unless you have poor steel to begin with, you will have a good job. If your steel has lost carbon on account of poor coal or overheating and refuses to harden properly, make a paste of rye chop, resin, salt and water in the following proportions: two parts chop, one part resin, one part salt and enough water to form a stiff paste.

Allow the bit to cool until it is black. When you have finished forging, paint the bevels and corners with the paste before raising to the hardening heat. This forms a crust. Now put into the fire and heat and harden as above described.

In the bath, dissolve about a pint of salt and a lump of alum and bluestone about the size of an egg.

This treatment has given good results even with poor steel and will not harm the best steel. A bit cannot be properly dressed for hard rock in a hurry. About forty-five minutes is the time required to dress and temper 5-5/8 to 6-inch bits.

On Case hardening:—Is there any way to case harden without using poisonous chemicals? I wish you would tell me how. I have heard that there is such a way, but the man who told me would not disclose the "secret' as he called it.

A. S. Anderson, North Dakota.

In Reply:—With reference to case-hardening without using poisonous chemicals; here are several formulas, one of which is, no doubt, the one used by the man with whom you had the discussion. Of course, the poisonous chemical to which you refer for the purpose of case-hardening is cyanide, which is a deadly poison. However, prussiate of potash will also give you excellent results, and it may be used practically the same as cyanide—simply heat your metal to a good red heat and then sprinkle with the prussiate of potash. The potash should be very carefully and thoroughly crushed so that there are no lumps in it. After sprinkling it on the hot metal, rub it with the end of a rod until it fuses and runs all over the article you are attempting to caseharden. Several applications of the prussiate of potash may be made if you want a deep case, reheating the metal as may be necessary. After the potash has fused well and had an oppotrunity to penetrate plunge the metal into clean cool water.

Another mixture used in the same manner is made of three parts of prussiate of potash and one part sal ammoniac; or another mixture may be made of prussiate of potash 20 parts, saltpeter 20 parts and sal ammoniac 20 parts. These substances are finely pulverized and then thoroughly mixed. S. S. D., New York.

Treatment of Battery in Winter:—Will you or some reader tell me what is done with the storage battery on an automobile in winter. I see that some of the battery service stations offer to take care of car batteries during the winter. I would like to know the reason for this.

John H. Dolson, Ohio.

In Reply:—If a battery is subjected to temperatures below zero there is danger of the battery solution freezing and thus breaking the jars. Any battery that is left in a cold place should be kept up to a full charge. If this is not done the solution being of a low density might freeze. The proper treatment for a battery that is likely to be subjected to extremely low temperatures is to remove the battery from the car and to store it in a dry, warm place and then to give it a recharge once a month. This will keep the battery in good condition and as many car owners haven't the facilities for caring for a battery in the winter months this is a service that is very necessary.

S. S. D., New York.

Correcting Excess Oil in Cylinder:—In old cars, considerable trouble is often experienced by too much oil getting up into the cylinders past the pistons, causing carbon and all the ills that come from it. The oil enters during the intake or suction stroke, when it is sucked past worn rings in the same way that the fresh charge is sucked in through the intake valve. The following plan to help this state of affairs is recommended, and I have found that it helps a whole lot.

A small groove is turned in the lower face of the piston, something like the slots for the piston rings. Next two or more small holes on opposite sides, are drilled clear through the piston wall, from the bottom of the groove to the inside. The action of the groove is to wipe off the excess oil from the cylinder wall, and let it flow back into the crank case through the holes. Care should be taken not to remove a great deal of metal, or otherwise you are apt to disturb the balance of the moving parts and set up engine vibration. Bevel the lower edge of the groove.

B. A. B., New York.

Burning out carbon; a warning:—Last summer I had an experience that has something in it for the other boys, so I am going to pass it along. Inside of three weeks, four cars came into the shop with broken pistons so when the last one arrived, I concluded it was about time to do some investigating. The first thing that struck me in looking into the matter was that each one of the motors had overhead valves and removable heads. This gave me a hint, so I had one of the boys call up each of the owners, and I found out that in each case the carbon had been burned out just a short time before the piston smash. What had happened was this: The heat produced in the oxygen burning-out process had attacked and burned the copper gasket sufficiently to allow water from the jacket to leak into the cylinder. Probably the car stood long enough without using to fill or partly fill the cylinder, so that when it came to be started, something had to break. Copper is a metal that will melt at a comparatively low temperature, and it should not be exposed to any such treatment. Removable head motors with copper gaskets can be burned out without damage, but the work should only be done by very experienced workmen, and my recommendation in such cases that the carbon should be removed by scraping, and to do a good job requires that the head be taken off. In fact, in our shop we never burn carbon out of any kind of a motor, for we don't believe in it. It is the easiest thing in the world to warp and injure a valve by the burning process if the valve isn't completely seated. The moral of this story, of course, is that car owners do not always save money when they patronize cheap processes or inexperienced workmen. W. Q. B., New Jersey.

Oxy-acetylene profits:—I was one of the first shops anywhere around me to put in an oxy-acetylene welding outfit, and it has been the best piece of equipment that I have ever bought. I found it helped me in more ways than one, because it not only enabled me to do a much wider variety of work than I was doing before, and that is a good thing for any business, but it brought in more custom on my regular lines, too. When a man had a welding job to be done, he quite often brought in another piece of work at the same time.

Then, too, it gave me a name for being up-to-date, and you can't have too much of that in any line of work. I also find its a mighty good advertisement to put on your letter-head. My books show that I started to pull out of debt right after I put in the welding equipment. Now I have a nice, modern shop, and a snug little home, all paid for and clear, and am looking forward to keep my business growing all the time. Elmer S., Ohio.

Look to the brushes:—I am a great believer in service, and in my case it had paid me well to always be on the lookout to give good measure to my customers. There are many little things about a car which if neglected are apt to lead to trouble, and I firmly believe it pays to help the car owner get the best service from his automible. The generator brushes I find are usually overlooked, so that when a car passes through my hands, I usually open them up to see if they need attention. In this way I have saved many a customer the expense of commutator repairs, or even a new armature if the brush wears down so that it lets the brush holder cut the commutator very badly. A. B., New Jersey.

What is your experience?—Not long ago we received a letter from one of the brothers who said that he had taken up automobile work,. put in the necessary tools, and tried it out for two years, after which time he gave it up entirely and went back to his blacksmith work, pure and simple. What do others have to say?

The object in taking on any new line is to secure increased profits, and we can easily understand that what may be a good move for one shop may be a poor move for another. As a general rule, the more different lines a shop can handle well, the better is its business, largely because it is less apt to feel a slump when it draws trade from a lot of different fields. In our estimation, automobile, truck and tractor work is a logical and legitimate line for the smith and repairman to get into. In order to make a success at it, however, the shop must be able to handle such work properly, which means that it must have the necessary knowledge, experience, and equipment. And every one of these three essentials may be acquired by the craftsman with ambition and industry.

We invite letters from other smiths who have branched out into motor repair and similar lines of work. Such letters would be of more than usual interest and value to brother mechanics if they told three things. First, how they secured the necessary experience; second, what new tools or equipment they put in for the work; and third, what their success has been in the new work. The Editor.

How are your machines?—All in good working order? The time to overhaul and fit them up for use is when things are a bit slack. Be glad of the occasional slump in business—that is your opportunity to fix up things for the rush periods.

Power from Stream:—Will you kindly inform me through Queries & Answers Notes how much power I can get from a 4-inch stream of water falling 40 feet, and what would be the best size diameter Pelton Wheel to use? I intend to use a nozzle and reduce the stream to about 5/8 inch where it strikes the wheel and run a generator for light and power. I thank you for the information and our fine paper. H. J. Wyatt, Washington.

AMERICAN BLACKSMITH AUTO & TRACTOR SHOP

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E. D. Corson, President
G. A. Castle, Vice-Pres.

BUFFALO, N. Y., U. S. A.

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W. O. Bernhardt, Treas.

SUBSCRIPTION PRICE

For $1.00 per year, payable in advance, The American Blacksmith, Auto & Tractor Shop will be sent, postage prepaid to any postoffice in the United States. To Canada, $1.25; to other countries, 6 shillings. Reduced rates to clubs of five or more on application.

Remittances may be made by money order, express order or checks payable to The American Blacksmith Company. We will also accept uncancelled postage stamps or currency, but for safety these should be sent by registered mail.

Subscribers should notify us at once of non-receipt of paper or change of address. In latter case, give both old and new address.

Correspondence on all smithing and auto subjects solicited. Always give name and address, which will be omitted in publishing, if desired. Address all communications to the

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INDEX TO VOLUME TWENTY

On pages 395 and 396 of this issue you will find the index to volume 20 which ends with this number. With the closing of the volume in December instead of September, we are changing our volumes to correspond to the calendar year. Consequently, in this volume now closing there are fifteen numbers—a fact that our many readers who bind their copies will want to remember.

WATCH YOUR STEP

All the world is crying for lower prices, so that this is a time when everyone who has anything to sell, services as well as goods, must use care and good judgment, in fixing his prices. No fair-minded man will dispute the statement that before the war the average blacksmith and repair shop did not charge enough for the services which they rendered. There were a number of reasons for this state of affairs, which it is not necesary to mention here.

Every reader of The American Blacksmith should remember one thing when the demands are made upon him from time to time for reductions in prices, and that is this: the old pre-war charges were too low, so that he should strongly resist any effort to bring present rates down to those old levels. Most customers are quite reasonable, and it often takes a very good agent to explain to them about the cost of materials and other items entering into the make-up of one's prices. Of course, a great deal depends upon the competition in the neighborhood, and here is where good judgment is called for. To meet cuts in prices below the fair profit level many shops have found it a good plan to render a higher quality of service. for the most desirable class of customers can usually be attracted and held, at higher prices, by a superior kind of workmanship, materials, and attention to details.

Contents December 1921

WHAT HAVE YOU PURCHASED FROM ADVERTISERS?

The advertisements in every issue of "Our Journal" are for your use. You cannot get the full value of this publication unless you read the advertising. Note the new machines the new lines, and the labor and time saving methods, suggested by manufacturers. Note the opportunities for increased profits that are presented. Now in order to enable us to serve "Our Folks," to the greatest possible advantage, we want to know how some of you are using the advertising section. We want your story of what you have recently purchased from advertisers. We want to know how these purchases have enabled you to make more money, to save time or to save labor, in your shop.

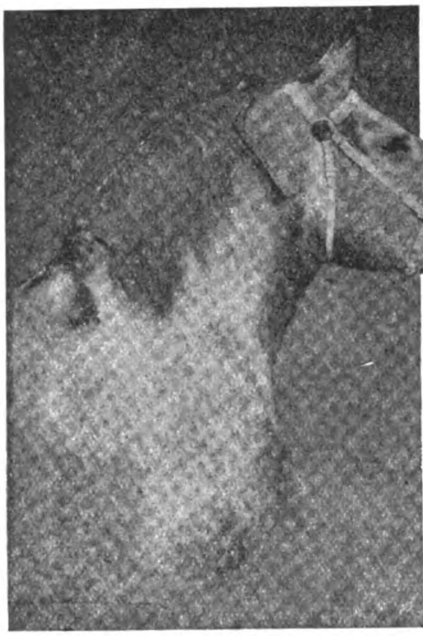
And just to stimulate the writing of letters and stories of this kind, we will present a five years' subscription to the reader who writes the best story, and to each reader who sends in a story for publication, we will present one of our blacksmith pictures. These are a reproduction in full color of the well known painting "The Blacksmith" which hangs in our offices.

Let us have your story on how you are making use of our advertising columns. Tell us what you are buying from advertisers. Tell us how the machines and equipment are saving you time, money, and labor.

SUBSCIRPTION AGENTS

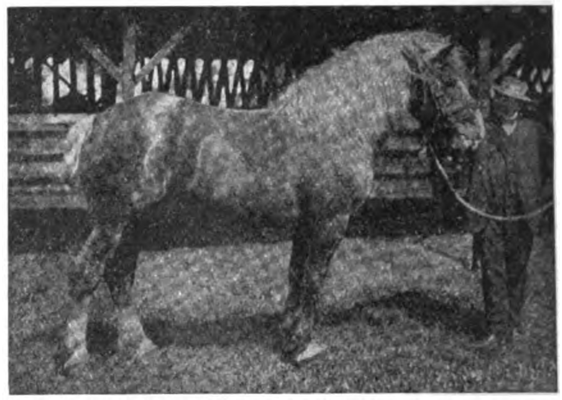
DO NOT give money to any agent or representative unless you know who he is. There are many unauthorized agents and unscrupulous collectors representing themselves as agents and collectors for "Our Journal" and we wish to warn every one of "Our Folks" against them. Do not under any circumstance give them any money unless you know them. If there is any doubt send your money and orders direct to Buffalo, N. Y.

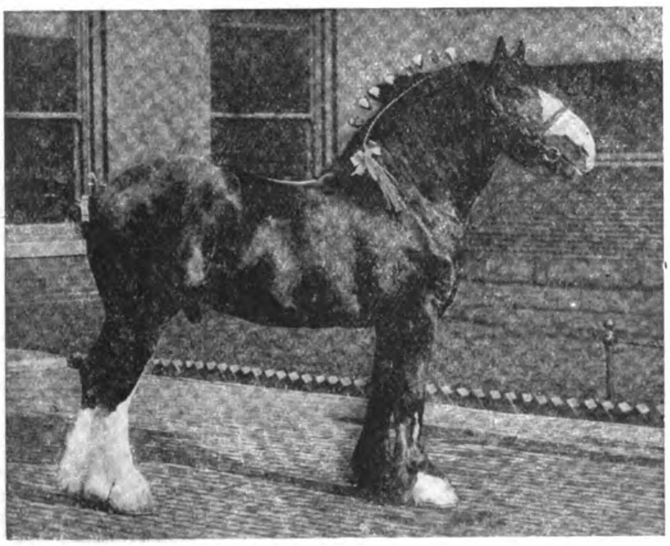
A Page of Prize Winners

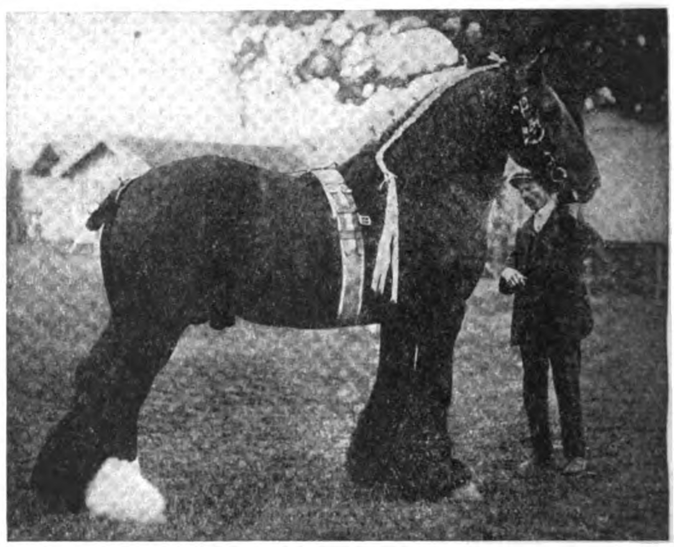


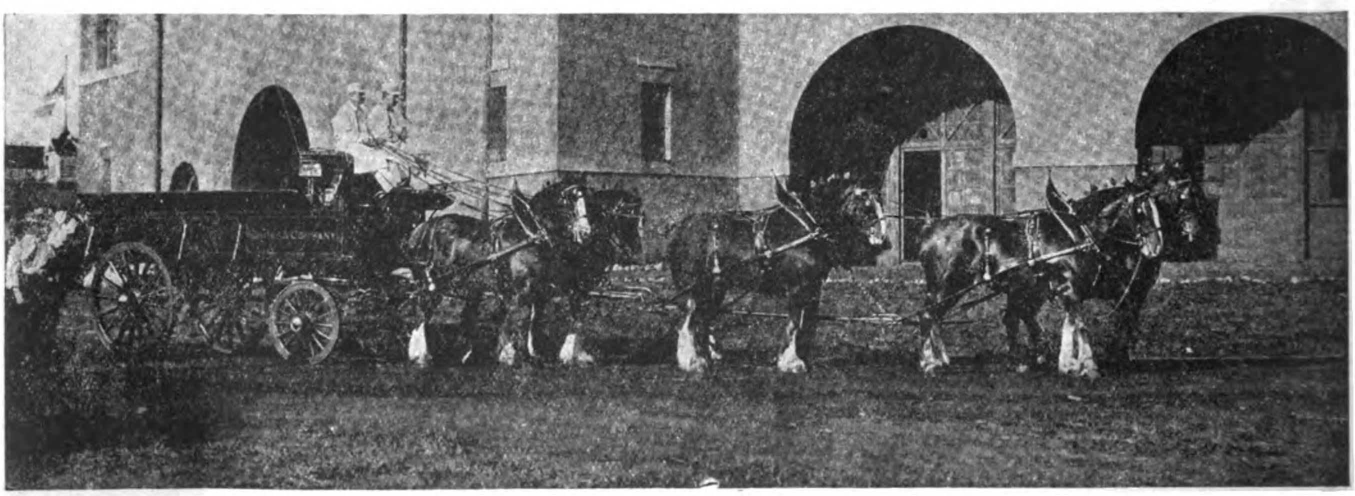
Animals such as these demand more than passing attention from even the motor enthuiasts.

HERE ARE SHOWN BELGIAN, CLYDESDALE, AND ENGLISH DRAFT ANIMALS WITH PRIZE WINNING RECORDS









Handy Shop Kinks for the Oxy-Acetylene Welder

Practical Hints and Suggestions for Saving Time, Trouble and Inconvenience When Manipulating the Welding Torch

DAVID BAXTER

LIKE all other craftsmen the oxy-acetylene welder has evolved many tricks of his trade; some devised on the spur of the moment as it were; others invented by careful study and patient experiment. And still others so entirely obvious as to be almost unavoidable, in fact the natural outcome of an operation.

Many of the kinks are merely time and labor savers while others have their intrinsic value in their quality of assisting the welder to do better work.

Take for instance the matter of welding rods or filling metal; here is a simple article to which the average welder gives but scant attention. He may think it as merely a rod of metal used solely to weld broken or separate parts together, or to fill the grooved fracture. The chances are that he thinks of it only as a straight rod of metal, varying in size and length according to the kind of job he is to weld. He follows the manufacturers instructions pretty closely in regards to selecting a rod of certain diameter for a weld of specified depth. Further than that he gives the matter of filler rods but scant attention, except to specify pure, soft, material when ordering it from the supply house.

And not all beginners perhaps, but probably most of them, take the manufacturers word for it that the filler rods are pure or soft; or have other qualifications as the case may be.

Welding Rods of Special Shape

The filler rod need not always be a straight bar of metal of given diameter, but may be bent or welded to any desired angle or curve or reverse curve, such as shown in one of the photos. In fact it is often a big advantage to employ a bent rod instead of the regulation straight one. An instance in point being in overhead welding or where the weld is located in a complicated or inaccessable corner. For example, where the operator is forced by the nature of the job to stand in one position but desires to feed the filler metal from the opposite angle. In such an event he may merely heat a portion of the rod and bend it back toward himself in a sort of reverse angle.

Or he may be welding in the deep narrow pocket of a casting where it is tiresome and awkward to employ a straight rod. Then he merely heats a spot on the rod and bends it to a right-angle by which he may feed the new metal to the weld either straight down or from the side.

FIG. 1.—THE FILLER ROD NEED NOT ALWAYS BE A STRAIGHT BAR OF METAL

Of course this bending is used on ductile metal such as bronze or steel. But if he is using cast iron, aluminum, etc., he has only to prepare special rods by welding shorter pieces to the long rod at any desired angle. Several samples of these filler rod ideas are shown in the picture.

Other Rod Kinks

A variation of this is to weld heavier pieces to the handle rod, or lighter pieces to it as the case may be. It is on overhead and verticle welds where the bent or angle rod is fullest appreciated.

In relation to this, it may be well to mention the idea of welding all scraps or short bits of welding rods to other longer pieces; or the idea of welding a number of short pieces together to form a rod long enough to use. In other words, when a rod gets so short that it is too hot to hold it should not be thrown away but welded to a long piece and entirely used up. This may be done during the progress of the job or the pieces may be saved to weld together at odd times. In any event none of the bits of filler metal should be thrown away.

And it sometimes happens that the welder runs out of a certain size rod right in the middle of a particular job. In this event he has only to employ another filler rod kink: to tack two light rods together side by side by spot welding them at intervals along their length, or to spot weld a light rod to the side of a heavy one for some special job. In a pinch this is a good trick but as a general rule it is not good practice since the the double rod offers more chance for oxidization, especially in bronze and aluminum work, where a light wire is twisted around a heavier one.

Another filler kink sometimes employed on heavy jobs is to place a number of the rods so one end will be heating in the preheater while the job is heating; or while one rod is being used the ends of several others may be heating. But in either event the welder will have to use an asbestos pad or some other device for holding the rods as they will be too hot to handle, even with gloves. The idea is to furnish a more continuous rapid supply of filler to the deep weld groove. It is obvious that the preheated rods will melt easier and therefore faster than a cold one; making the idea particularly useful on very heavy jobs, because then an unusually heavy rod can be utilized; in fact a filler that is seldom if ever used, such as a five-eights rod.

In further connection with the

welding of extremely long, heavy jobs, another filler kink should be cited. It consists simply of breaking several filler rods into pieces about an inch long and placing them at intervals along the weld; not down in the V-groove but up along the edge of it where they may be rolled into the weld as needed. In this way the preheating job will heat the bits of filler rod so they will be red hot by the time the welding reaches them. At which interval they are merely rolled into the melting groove and fused with it, under the flame, assisted by the puddling movement of the rod in hand. This idea, too, hinges on the theory that red hot metal will melt easier and faster than of cooler rod. Larger quantities of the filler are handled than the usual capacity of the flame. And thus the welding time is shortened, with an added advantage of shortening the time necessary to keep the job in the preheating fire as a casting is sometimes ruined by overheating previous to welding.

In addition to the kinks given above the welder may save a lot of the discomfort of welding a long, hot, job by welding several regulation rods into one long rod, say six feet long. In conjunction with an extension torch he may then stand back far enough from the weld to escape most of the heat of radiation. All of which tends to better work because he is not so liable to slight the weld by hurrying like he would with a short rod.

Many other welding rod kinks could be mentioned here but the forging should be sufficient to start the novice to think that the filler is something more than a straight rod of metal.

Now, in line with personal comfort another device may not be out of place if mentioned here. This is to arrange a portable electric fan so it will blow directly upon the torch operator. Its breeze dispels the heat of the casting to a very appreciable degree. However, the welder should be careful not to place the fan so it will blow directly upon the casting as it is liable to overbalance the expansion and contraction and result in a fresh crack.

The Handy Grinder

Another kink, which is a time and labor saver; every welding shop should have a portable electric grinder. It is not only convenient for grinding finished welds on heavy or complicated castings that can not be ground on an ordinary stationary emery grinder, but it is almost indispensible for grinding the grooves in cracks to be welded. Grooves may be cut with a portable grinder that would be risky business with hammer and chisel on account of danger of breaking the casting. Then,

FIG. 2.—THE GRINDER IS A HANDY AID FOR THE OXY-ACETYLENE WELDER

too the portable grinder is a great deal faster than other methods.

But this kind of grinder does not need to be restricted to portable usage. A stationary stand is easily constructed for it. An example of which is shown in one of the photos which accompany this arcticle. This kink consists of welding severel pieces of angle iron in the form of brackets or legs and bolting them to a convenient place on the work bench as shown. Then this grinder can be used as an ordinary emery wheel or it may be taken to the job at will.

Hot Finishing

Another shop kink is illustrated Fig. 3. This is what has been termed "hot finishing" a weld and consists simply of scraping the molten metal of the weld, smooth and level with the surrounding metal of the casting. An old discarded file is probably the best for the purpose but any flat piece of iron with a square edge will serve. The instrument is kept in a place that is convenient to the welding so that it may be used on any job. Then as soon as a few inches of the weld are complete, with surplus metal piled along the seam, the filler rod is dropped and the file taken up. Before the molten weld has time to fully congeal the file is placed flat upon the adjoining casting and given a quick sidewise movement to strike the melted metal level and smooth, "A quick swipe" might describe the operation better.

The movement should be gauged so it will remove all of the surplus metal at one time as it will "chill" very rapidly and thus forstall a second attempt to strike it level. If the first attempt is not successful the operator must re-melt the rough portions and repeat the "swiping" operation. However, it is, in many cases, poor practice to tarry over a weld. In fact it is fatal to the success of many welds to pause several times during the execution of them.

But on the simpler forms of the heavier welds the hot finishing may be employed with good results. After striking off the first section of the weld the file is quickly dropped and the filler rod taken up again to resume the melting and filling. Then when another few inches are over-filled, the file is again taken up to swipe this section level. The alternate welding and striking is employed to the end of the weld. It lends a pleasing appearance to the weld and saves a deal of time on lots of jobs, and is especially valuable where it is not desired to grind or otherwise dress the casting.

On the heavier jobs where there is no danger of contraction checks the hot finish may be applied after the entire weld is completed. In this event the rough spots or high places in the weld are re-melted and struck off with the flat side of the file after the manner described above. The rough portions are dealt with one at a time until the weld is finished. However, this hot finishing is somewhat superficial in some instances. It is entirely successful only on cast iron, since steel and other metals tend to drag or crumble and will therefore not strike smoothly.

A variation of this method of dressing welds is to scrape the surface of the casting where it joins the weld. The square end of the file is handy for this, too. No attempt is made to remove any metal projections. Just the oxide and flux slag are scraped off. This stuff will come off easier while the metal is bright red than it will after the job is cold.

This process is executed as the welding proceeds or after it is complete. The dirt is vigorously scraped loose by a rapid, pushing movement of the file, without re-melting the weld metal. Although it may be essential at times to re-heat the

FIG. 3.—FINISHING THE WELD WHILE HOT SAVES TIME AND LABOR—AN OLD FILE IS WELL SUITED FOR THIS SCRAPING

metal considerably, with little practice the novice soon becomes quite adept in judging when to hot-finish and how to do it.

To Remedy Back-Firing Torch

Since this is not a discussion of any one class of shop kinks let us take one entirely different from the others described here:

This is an idea for removing obstructions from the torch when it gets to back-firing and nothing else appears to do any good. Both hose connections are loosened and taken entirely off the torch. Then the oxygen hose is placed over the welding end of the tip as shown in Fig. 4 after first opening both torch valves. The regulator valve should of course be closed before removing the hose. The oxygen pressure is then blown in sudden gusts through the torch. It is seen that this pressure flows backward through the tubes and chambers with a tendency to remove any loose obstruction therein. In most cases the torch may be cleaned out thoroughly by this method. Bits of rubber from the hose lining or other dust or carbon drawn into the interior of the torch can usually be blown out this way and thus remedy a stubborn case of back-firing.

These are only a very few shop kinks for the practical welder but their value will be double if they make him think out as many for himself.

False Economy and Business Sense

H. G. KRAMER

That old saying about, "the horse shoe being lost for want of a nail" probably never applied with stronger force to the craft of the general smith and repairman then today.

If you are seeking a reputation as a high-grade repairman and general smith it is not going to pay you to use poor materials. And generally speaking the item of labor enters so largely into the service rendered by this great craft of ours that the slight difference in the cost of materials makes a very slight difference in the final charge for the job. Of course there is a big difference in some work but as a rule the above is the case.

Therefore, use materials that are in thorough keeping with the job in hand. If your job is to be first class in every respect use materials that are first class in every way. If on the other hand the work is more or less of a make shift or is to be temporary in character use materials that will do the work expected of them.

This reminds me of a little happening that will illustrate my point exactly. Some weeks ago I was in the hardware store when a man rushed in somewhat hurriedly and asked if the store keeper had any water pails. Of course he did and he attempted to show the man a number of grades. But the man said: "Oh, I want just as cheap a pail as you have in stock. You see I am taking a couple of horses out on the railroad and I want a pail to water them with. All I want is a pail that will last long enough for the trip and one I can afford to throw away after the trip."

There are times when the conditions surrounding a job requires cheap material. And when such conditions arise it is foolish for a man to put anything but cheap material in the job. But when the best of materials are needed it is also equally foolish to put anything but the best on the job. In other words do not permit the shoe to be lost for the want of a nail. That is false economy. And the same holds good of the other extreme which permits a man to put material of a quality that is not justified by the job. But in all of this bear

FIG. 4.—BLOW WITH OXYGEN TUBE BACKWARD THROUGH TORCH TO REMOVE OBSTRUCTIONS

in mind the fact that you cannot build a reputation for the best work on poor materials. Don't attempt to flim-flam any folks by sneaking poor materials into a job when they expect the best. It is like sneaking a letter without a stamp on it, into the box after the mail-man has passed. It will be found out on the next trip. Most folks will stand a fair charge for good work.

Another matter that I want to talk about is the work you do for strangers. Somehow or other there is a feeling in the stranger's mind that he is easy prey when he is unfortunate enough to be caught with a break down miles from home and he is at the mercy of the man he asks to help him out. This is very natural as the man realizes that the repair man has things pretty much his own way under the circumstances. And I am sorry to say there are some shop men who take advantage of the circumstances.

Now there may be some chance for an argument in the minds of some readers of these lines, but in my estimation there is but one right course to follow and that course is not the one which excuses the chap who charges all the traffic will bear.

In my estimation the correct plan for charging for the work you do for the stranger is to charge him fairly for your time, labor and materials. If you have been compelled to stop work on a regular job to accommodate him, that accommodation is worth something and it is something he should be willing to pay for. If you have been called to open shop for him after or before regular hours that accommodation is also worth something, but do not overcharge for that accommodation or for the work performed.

There is a man I know who is located in a little town in Pennsylvania who has people coming to him from not only all parts of his own state but from three adjoining states as well. He has built up a reputation among strangers that has in turn built up an inter-state trade for him. He specializes in motor work and while he does not work cheaply his charges are fair and honest for work that is honest.

That is my ideal of the way to treat strangers, and while all of us cannot hope to build up a national reputation we do not know when the recommendation of some stranger for whom we have worked will bring us more work. It is certainly far better to have the stranger tell how well he was treated than to have him tell how well he was "done". Try not to send the stranger away with the idea that he has been over-charged. Don't send him on his way with the thought that he has been "soaked". And on the other hand don't be so easy in your charges that he will think you are a "mark". This is simply a plea for fairness. Most folks, as I said before, will stand and will gladly pay a fair charge for good work. And the folks that won't stand for a fair charge aren't worth bothering with—they aren't worth your time and trouble.

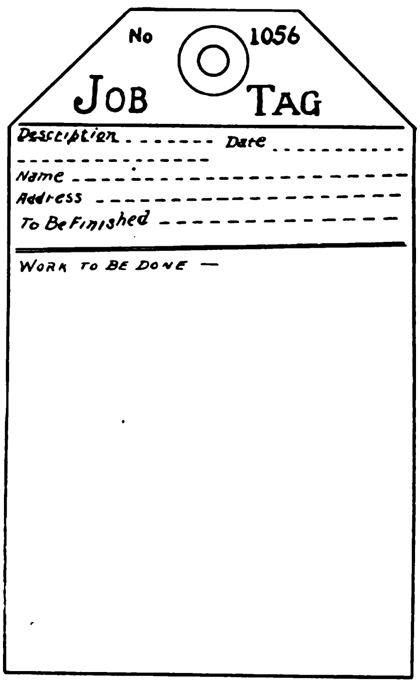
Just remember this—It is a thousand times better to have a man come one mile out of his way to give you a job then it is to have him go ten miles farther on to avoid your shop.

How I keep Records on Automobile Repair Work

H. A. JOHNS

Editor's Note:—This is the 2nd article by Mr. Johns. The first appeared in the issue for November, and in that article, Mr. Johns told the story of his start in the automobile business. The third article of this series will appear in an early issue and it is planned to have Mr. Johns favor us on a number of different phases of automobile work. In this present article, Mr. Johns points out several soundly, practical matters in connection with automobile repair work, and strongly emphasizes the importance of keeping careful records.

It seems hardly necessary to say a single word on the subject of accounting records and the reason for keeping them. I suppose, however, there are still some in the craft, who believe that as long as they have a pocket from which to take money for their supplies and another into which they can pour the money they receive from the jobs they do, they need have little worry about modern bookkeeping methods and accounting systems. And while there is no reason for a complicated and elaborate system of books, there is every reason for a system that is simple and that will tell the shop owner what he should know about his business. There is probably no department in



THE JOB TICKET IS ATTACHED TO EVERY PIECE OF WORK

the modern repair shop that will lose more money for the owner if not properly and intelligently operated than the automobile repair department. And by intelligent operation, I mean operated with proper and true information on the very important details of cost and expenses. And these very important details cannot be made known unless some sort of system is followed in the accounting of the work done and the supplies used.

Of course there is no end of system that can be installed for the proper checking up of the average auto repair job and other readers, no doubt have just as practical and just as simple systems as the one described. But the point I wish to make in connection with the forms I use, is that they are about as simple as it is possible to make them, and yet are throughly efficient in giving and gathering the information most wanted.

In the first place, just a word about the very simple system which we use in our shop. We began with a system that was considerably more elaborate than the few forms described here, but through several years of practical application and the elimination of those forms found unnecessary, we have finally worked out a system that in my estimation is about as simple as it is possible to make it, and still have it give you the information you must have.

In working out any system it should be planned from the standpoint of the results to be obtained and the information that is wanted. In other words the first reason and the principle reason for the keeping of the particular records described are for the purpose of intelligently and correctly calculating the charges for the work done. For unless you have correct information on the costs of a job you cannot correctly charge for the work done.

The elements that enter into the course of a job are; first the materials used; second, the cost of the labor. The first item will include materials taken from stock as well as those which are secured especially for the work. The item of labor will of course include all regular time expended on the job, and any other work which should be counted as over time.

There is still a third item which may or may not apply, depending upon the shop equipment and the range of work done. This third item is the work done outside of your own shop. This is a very important item with some shops and you will note that space is allowed for charges of this nature on the form shown.

Originally our system consisted of a job tag, which was tied to the job; an envelop upon the outside of which a summary of the work was made, and inside of it all requisition slips, time slips, and all other papers were kept. This was a very thorough system and enabled us to keep strict account of the jobs and our costs, but during the several years it has been simplified into the few forms shown and described.

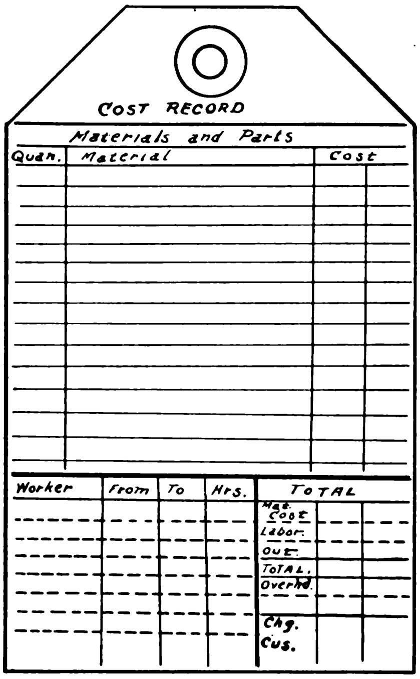
Some one will ask about the space for the description at the top of the job tag. This is necessary because of the fact that some customers have two or three machines, and some folks cannot remember whether the work you did was on the Maxwell touring or the Ford sedan.

Another reason for the indentification of the vehicle is the fact that Mr. Jones has a Ford touring car for family use, and another Ford machine with which he takes milk to the creamery. Grocer Brown also has a delivery Ford as well as one that he uses for taking the family out on Sunday. It is very important that you be able to tell him upon which of these machines youb job of $49.63 was performed.

A form not shown here which is used in connection with the job tag or ticket, is a requisition slip. These requisition slips are made out and are attached to the job tag with a wire clip. As the jobs have numbers the requisition slip is marked with the job number, so that in charging up the job you will know just what material was used and requisitioned for the job. In this way, there is not very much chance for error in not charging for material or supplies. Of course in the average small shop, a requisition slip is not necessary, but we have retained it in our establishment because it simplified our perpetual inventory record. This record, by way, enables us to tell at any time just what stock we have on hand, and by going through the inventory record, we can tell just what material we need to order when the jobber's man calls.

And a word in connection with the requisitioning of stock:—Our stock room is under lock and key. All materials are kept here and any materials wanted, must be gotten from the room with a requisition slip. This enables us to keep strict tab on all stock, parts, and material. While we have a very fine bunch of men in our shop as a regular thing, we find it necessary to employ one of these roving chaps once in a while and these fellows are generally not of a high standard. Our system however, prevents any of them getting away with the stock room, and materials today are to high-priced for permitting anything of this kind.

Of course, on other work where an entire vehicle is not involved, the job tag or ticket is attached to the part which the work is to be performed and in this way, when a job ticket is attached to each job



THIS IS THE BACK OF THE JOB TAG

that goes through the shop, a complete record of our repair work is gotten from the tickets.

Another advantage in connection with the numbering of these job tickets will appeal strongly to the average systematic smith. In the first place, taking note of the numbers from the beginning of one week to the beginning of the next week will enable you to easily figure how many jobs have passed through your shop. And the same applies to monthly totals. This in turn will enable you to keep records by months for different years and also to easily compare the corresponding months in different years.

The number on these tags also enable you to know whether all jobs have been charged. Records should be kept of all numbered tags and a notation made in the job book if any tags are destroyed or lost.

Of course, it is understood by the reader that this is a description of just one part of the accounting system used, but from this short description of the automobile job record, the reader can easily get an idea of what our other system consists and also| the extreme simplicity of our system. Yet we are able to keep strict account of every job that goes through the shop with a record of cost for material; cost, of labor and all incidentals and these figures enable us to make a fair and honest charge for the work performed.

Protecting the Cooling System During Cold Weather

With the approach of cold weather, it is necessary to give some thought to the question of anti-freezing solutions for the radiator and cooling system.

Repairmen should caution owners against attempting to get along without an anti-freezing solution and explain that even if the water is drained after every trip, there is a possibility of the radiator becoming frozen. In very cold weather, or when driving against a cold wind it is possible to freeze the radiator after circulation starts. Also if one or more tubes are blocked up with dirt the water will not drain off.

The ideal anti-freezing compound is, first, one that will prevent freezing of the radiator liquid without injuring either engine or radiator; second, that will not lose its non-freezing properties after continued use, and third, that does not materially change the boiling point of water when dissolved in it.

Kerosene has a lower freezing point and a higher boiling point than water but the inflammability of its vapor makes it dangerous to use, and its high and uncertain boiling point might lead to the serious overheating of the engine, or even to the melting of the solder in the radiator. It has marked solvent action on rubber parts. These facts clearly indicate that kerosene should not be used as a non-freezing solution.

"There are three substances in general use for making anti-freeze solutions. Alcohol is probably the most popular of all anti-freeze agents. Glycerine has proven very effective but its cost during the war made its use almost prohibitive to the ordinary owner. Calcium-chloride is perhaps the most easily prepared solution of all and, for that reason, is widely used. But it is absolutely wrong as Calcium-chloride is a mighty dangerous solution to use. The commercial product, sold in solid form or in aqueous solutions as an anti-freeze mixture, is highly injurious because of the action on the components of the cooling system. Such alkaline solutions are productive of an electrical action wherever two dissimilar metals are utlized, such as the brass tubing of a radiator and the solder used at the joints, the iron water jackets and the brass or copper plates.

Most of the anti-freezing solutions sold under trade names have a calcium chloride base. The calcium chloride compounds exert a greater corrosive action than water on the engine jacket and on the solder in the radiator. Tests have shown that calcium chloride solutions will completely remove solder from copper and brass. Another troublesome effect with calcium chloride solutions is experienced if small leaks occur in the radiator, and the solution comes in contact with the spark plugs and ignition wires, as a short circuit is liable to result. Calcium chloride compounds should be used with caution, if at all, on account of their corrosive action.

The alcohol solutions do not exert a greater corrosive action than water alone. Solutions made from either wood or denatured alcohol seem to be the most desirable anti-freezing solutions to use. The table below shows the approximate point at which the different alcohol solutions freeze:

20% solution freezes at 15° above zero.
30% solution freezes at 8° below zero.
50% solution freezes at 15° below zero.

A solution composed of 60% water, 10% glycerine and 30% alcohol is very often used, its freezing point being eight degrees below zero. Although glycerine tends to retard evaporation the alcohol will evaporate much faster than water. The solution will become weak and ineffective unless more alcohol is added from time to time.

A summary of the opinions of motor car manufacturers as to the value of various antifreeze solutions shows a decided preference for alcohol and glycerine. Neutral alcohol does not act on metal or on the rubber connections. But the alcohol in the solution will evaporate more rapidly than the water. The solution should be watched carefully and the alcohol replenished from time to time.

If 96% alcohol is used, the following solution will be found adequate for all ordinary temperatures:

Alcohol by Vol. Volume	Water by Volume—Approx.	Specific Gravity	Will freeze at
1 part	3 parts	0.97	10° above zero
1 part	2 parts	0.96	Zero
1 part	1 part	0.935	20° below zero

Neutral glycerine does not act on metal but does act on rubber connections. If used the hose connections should be examined frequently to prevent disintegration and consequent leaks. It can be prepared as follows:

Glycerine by	Water by Volume	Specific Gravity	Will freeze at
1 part	3 parts	1.08	10° above zero
1 part	2 parts	1.10	Zero
2 parts	3 parts	1.13	20° below zero

The unbleached variety of glycerine, which may be procured at practically any drug store, is not only cheapest but best".

On the Ford Machines

The circulating capacity of the Model T motor with the present type radiator is 2 gallons, 7½ pints; with the former type radiator 3 gallons, 1¾ pints. It can readily be determined from these figures the amount of alcohol to use.

When storing a car for the winter, first drain the circulating system. Then put about a quart of alcohol in the radiator, allowing it to run through. This will prevent the freezing of any water that on account of stoppage in the tubes did not drain out.

As with the car radiator, it is also necessary to put an anti-freezing solution in the radiator of the Fordson tractor during cold weather. The capacity of the tractor cooling system is 12 gallons.

Due to the rush of cold air through the air washer, it is necessary to give some attention to that part during extremely cold weather. Some operators run the tractor with the float removed or raised in the air washer. Others have been known to replace the water with kerosene. Water should be used as late in the season as possible, draining it at night to prevent freezing. Kerosene, if used at all, should only be put in when the temperature is around zero.

A Concrete Floor for the Shop

The Tools, the Materials, the Preparation of the Floor Bed and How to Lay the Mixture

In many ways the cement floor for the smith and repair shop is practically ideal. There are some disadvantages to cement and not the least of these is its unyielding and hard surface which is rather hard on the feet of workers who are compelled to stand for any length of time at their machines. This disadvantage however may be overcome by having plank flooring in and about the forges or by making small wooden platforms for the forgemen and machine operators to stand on.

The preparation of the floor bed and the laying of the cement mixture is such an easy job that most any practical man can successfully lay a cement floor. It is well however, before proceeding with the actual work, to have the entire job well-planned and laid out so that no changes will be necessary in the flooring for some time. In other words, the location of new machines and their foundations should be taken into consideration so as to make just as few alterations in the floor after finishing as possible. Changes in a cement floor after it is finished, make patching necessary and this is always unsightly, and makes a perfect surface impossible.

A plain earthen floor well leveled and beaten down will possess many advantages, but more dis-advantages from a sanitary and general cleanliness point of view, efficient cleansing being practically impossible. A wooden floor has the disadvantage at the present time of expense, and the ultimate disadvantages of rot (both wet and dry). A brick floor is perhaps ideal, but, like wood, at the present time is expensive, and a concrete bed is necessary (otherwise the bricks soon get loosened) if the job is to be a success. In the long run a concrete floor properly laid is by far the most suitable, enduring and economical, and is a task not too great for the powers or the skill of an ordinary individual. It can be kept dry, is easily cleaned, and is practically everlasting.

But there are concrete floors and concrete floors. It is common to see them starred with cracks and almost alpine in their diversity of surface, faults almost invariably due to a lack of thoroughness in the preparation of the bed. A mere layer of cement on bare earth is a delusion and a snare. It may remain level for a short time perhaps, but sooner or later its surface becomes a mass of holes and prominences, diversified by a labyrinth of cracks.

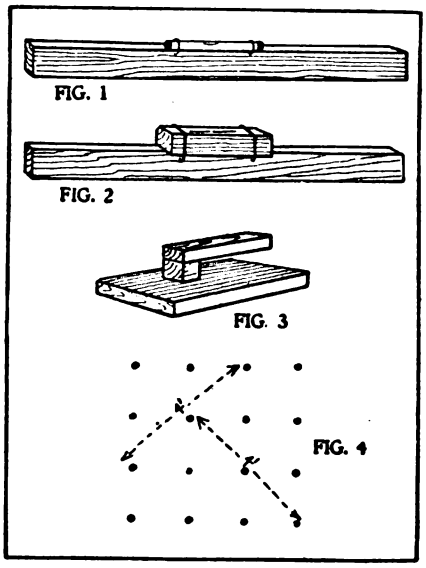
A concrete floor has such practical and enduring advantages that it is a job well worth doing efficiently. To ensure a lasting success, the aforesaid thorough preperation of the bed on which the concrete has to be laid is absolutely necessary, and the result amply repays the extra care, time and trouble bestowed.

The materials used, especially the sand, also demand consideration, or future trouble will crop up.

Two simple tools, beyond the ordinary garden spade or shovel, are necessary, namely, a spirit level and a simple form of the plasterers' trowel. These, however, are easily made by the average shopman. If the spirit level is not at hand, it can be made by taking a straight piece of glass tubing about 6 in. or 7 in. long, and stopping up one end with sealing-wax or even candle-wax. Nearly fill the tube with water, and then similarly seal up the other end. This is then affixed to a piece of wood about 4 ft. by 1 ft. by 3 in., cut as straight and true as possible (see Figs. 1 and 2).

The plasterer's trowel can be made from a piece of wood about 4 in. by 7 in. by 1 in., with a handle fixed to it as in Fig. 3. The undersurface should be perfectly smooth and dead flat, and the wood as hard and straight-grained as possible.

A few words as to the materials used are here necessary. With regard to the cement not much, however, can be said, for one has commonly to put up with what is supplied by the builders' merchants. A reliable dealer, however, generally supplies a reliable article and is commonly to be trusted. The sand used for mixing with the cement is, however, a matter that can be dealt with. Good sharp sand, free from all vegetable, animal, loamy or clayey substances, is to be preferred. It should be tested by rubbing between the fingers, and should leave little or no dirt or dust, etc., on the finger-tips, the grains of sand also being hard and sharp. Very fine soft sand is not suitable. If doubt is felt with regard to its freedom from the impurities mentioned it will be wise to wash it. This is easily done by taking a pail half-full of the sand, and then filling up with water. Stir thoroughly for a minute or two and then allow to settle, afterwards pouring off the water, which will take most of the impurities with it. The residue is then quite safe to use. It may here be pointed out that clay is a particularly vicious form of impurity in any concrete work, and if possible should be thoroughly eliminated.



LAYING A CONCRETE FLOOR IS A SIMPLE OPERATION
FIG. 1.—A SHOP-MADE LEVEL.
FIG. 2.—ANOTHER FORM OF LEVEL.
FIG. 3.—TROWEL.
FIG. 4.—HOW THE PEGS ARE SET FOR LEVELING.

The preparation of the bed now demands attention. First level the ground by filling up the hollows and beating in the earth. The trained eye alone of the professional would perhaps do this satisfactorily, but to be on the safe side the amateur should use the spirit level. Stick a number of wooden pegs in the ground, so that the top of each peg is on a level with the required height of the floor, and at such distances apart that the spirit level will just reach from one to the other. Fig. 4 shows a good method of arranging them. To ensure perfection as far as possible the spirit level should be laid across the pegs not only latitudinally and longitudinally, but also diagonally.

The question of drainage can here be allowed for. A slight fall towards the door is perhaps best, for water may enter the shop at some time or other and it certainly will occasionally require sluicing down, and the door is the best place for its exit.

When the pegs are satisfactorily adjusted they are left for future guidance. The whole is then covered with a mixture of large and small stones, broken rubble such as broken bricks, crocks, ets., up to the level of the pegs, and then rammed in as tightly and evenly as possible, after which a layer of smaller stuff or even sand is added. This is likewise well rammed in and levelled. (The spirit level should here be much in evidence.) The whole is then well watered, using an ordinary watering-can and sprinkler. The latter operation can be repeated several times. The whole is then ready for the concrete.

Now if the floor is a large one and it is desired to finish it in one operation, an assistant will be required. To mix up the concrete, lay and level and yet have the next batch of stuff ready before the last is dry is almost impossible for one person. So it is well to obtain a helper to have the next batch ready as soon as the preceeding one is laid, otherwise ugly and unsightly joins will appear.

Now for mixing the cement and sand to form the concrete. This can be done in an old pail, but is somewhat laborious, and thorough mixing that way is difficult to obtain. An ordinary wheelbarrow is perhaps best, especially the light metal one so often used.

The proportions for a floor are (by volume) 5 parts of sand to 1 part of cement. This is richer in cement than is ordinarily used, but it is as well to be more generous if a floor is to be covered, for it will have to stand much severer wear and tear than a wall. With an ordinary spade well mix the two, adding water during the process until the mixture is of a thick creamy nature and as homogeneous as possible. This can then be transferred by means of the spade to the floor and smoothed down somewhat. With the home-made plasterer's trowel then proceed to level more perfectly, following as far as possible the tops of the pegs. Keep the tool perfectly flat, and work it round and round with circular movements. Then apply the spirit level, so that greater perfection is obtained. It is well always to leave a little of the concrete in the barrow, so that small hollows may be filled up, and the whole operation should be performed as quickly as possible or the concrete will set too hard to work fluently. If that should happen a little more water should be applied to the surface. The pegs may be removed as the work proceeds. The same operation is then repeated until the whole of the floor is covered.

The whole will take a few days to dry sufficiently for wear. The slower it dries the harder will be the resulting floor. Where drying appears to proceed too rapidly it is advisable as soon as the floor is set to water well, using a sprinkler. This should be done several times if the weather is at all warm. Should there be a chance of frost occurring before the whole is set, it is advisable to protect it by covering with old mats or sacks, otherwise chipping of the surface may occur.

If, as may well be the case, one is limited for time it is advisable to cover at one operation only as much as can easily be finished, first of all enclosing the space to be concreted by thin slips of wood. These may be taken away when that section is set, and used to enclose the next section of floor.

The plan of covering a floor with small concrete flagstones has likewise its advantages. A flat box 2 in. high and 1 ft. square is first made of fairly strong wood. The bottom is covered with stones and the concrete mixture then poured in, rammed down well, and allowed to set. After a day or two it may be removed from the box (concrete contracts on drying) without much fear of breaking, although it is necessary to be very careful in this respect. It should then be laid out to weather and harden. Once the mould is made, the operation of making one flagstone should take under half an hour. The remainder can then be made at leisure.

When sufficient have been made to cover the floor they may be laid on the levelled earth. The advantages of this latter method are that the floor may be made almost at leisure and convenience, and in addition, should the shop require to be shifted the floor also can easily be removed. This is, of course, manifestly impossible when the floor is made in one piece.

In laying a cement floor while attempting to carry on business at the same time it would be a simple matter to cement just part of the floor at a time. It may also be desirable to have the immediate vicinity of the forges floored with wooden planking and this is of course easily arranged.

Hardening and Tempering Miners Drills

H. Dawson

The great difficulty with most smiths in hardening and tempering miners drills is to do the work so that these drills will not crack after they have been used a short time. Generally speaking, the man who can harden and temper these tools properly is considered an expert, and if he is located in a mining district, he can command a good price for his services.

Usually every one who is successfully in doing work of this kind, has some little knack or stunt which he considers a secret of his success with mining tools. There are probably methods other than those which I am going to describe as my own but these have been very successful in my particular experience.

The first thing to do of course, is to forge or dress the drill, then prepare a good clean fire of well burnt coal. This first should be clean and free burning with plenty of well coked coal surrounding the center of the fire. Inasmuch as sulphur is very injurious to steel, there should be just as little trace of sulphur in the fire as is possible. If the coal is not a smithing coal of first quality, it will probably be best for the smith to use charcoal. After the tool has been properly dressed, it is placed in the fire and heated to a cherry red. It is then removed from the fire and plunged into a cooling bath of soft water and salt. In putting the tool into the cooling bath place the cutting edge down and leave until cold. In order to draw the temper, it is necessary that the tool be polished so that the color may be easily determined. Place the tool into the fire again with the cutting edge sticking out about three inches. Apply the blast gently and draw to the desired color. Of course, it is necessary to know the kind of rock that is to be drilled in order to give the tool the proper temper. For hard rock, such as granite, draw the color to a dark straw. If the rock to be drilled is soft draw the color to a light blue.

Now just a word in connection with the breaking of drills. The main cause of this trouble is uneven heating. This in my estimation is the secret of success in the hardening and tempering of drills. If the heat is uniform, you will have very little trouble in properly hardening and tempering drills for use on practically any kind of rock.

It is of course, impossible to harden and temper a drill properly, unless you know the kind of rock that it is to be used on.

In working drills that are very small, I find it excellent to use a blow torch for heating. In doing so however, it is necessary to turn the drill in order to heat it evenly on all sides and thus prevent any stains from taking place in the steel. Bear in mind that uneven heating causes stains in the steel structure and these stains are responsible for the breaking of drills.

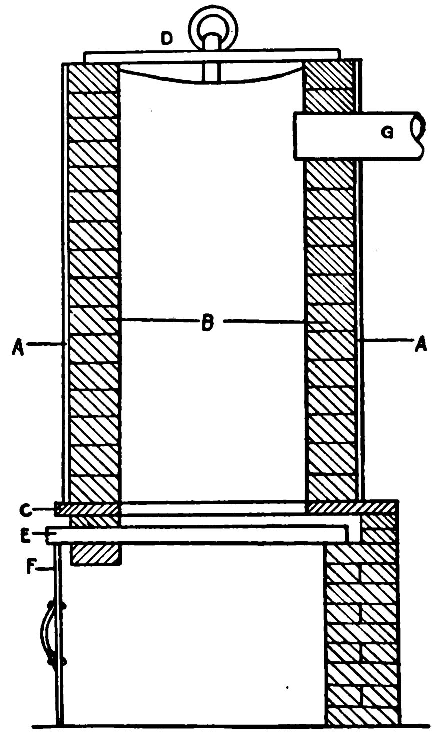
An Easily Built Furnace for Melting Brass

S. H. Romer

A number of readers have recently inquired, regarding an easy method for melting brass and bronze for the purpose of casting such small parts as bearings and the like. Of course, for the occasional job brass or bronze may be melted in the forge fire by placing a small sized crucible right in the forge fire. However, for the shop man who has any considerable amount of this sort of work, a simple furnace will be found very much practical.

The furnace shown in the accompanying engraving is very simple and easily constructed, and may be erected by any practical man who is in need of a furnace of this kind. The shopman will find it convenient to place this furnace in the corner of the shop, where it will be out of the way when not in use. This furnace may be used to suit practically any requirements, but should the shop owner desire a furnace of large capacity, he will find it convenient to construct it below the floor level. This will greatly facilitate the handling of the crucible when it is ready to be withdrawn from the furnace. However, should the furnace be required for but a small sized crucible, the smaller crucbile can then be easily handled and the furnace can be built with the ash-pit on the level with the floor.

Having decided on the size of the furnace it is constructed as follows: A box of sheet iron AA is lined with fire brick as at B. This entire structure rests on a plate C, which in turn is supported on a foundation built of fire bricks and forming the ash-pit. A cover D is fitted over the top of the furnace and should be lined with fire clay or other protective material. The grate E is supported at one end by a brick foundation, and at the other end by a supporting bar as shown: The ends of this bar fit into the sides of the ashpit. The door F is a piece of sheet-iron placed at the mouth of the ashpit to cut off the draft for use when using forced draft and also for the easy removal



THE FURNACE IS VERY EASILY BUILT BY LINING A SHEET IRON CYLINDER WITH FIRE BRICK

of the ashes. There is a pipe G for the purpose of carrying out the smoke and gases after combustion has taken place in the furnace. This pipe may be of cast iron and lined with fire clay to protect it from the heat of the furnace. The pipe or flue should be sufficiently large to allow the gases to escape easily and connect with a chimney of a size sufficient to create a good draft in the furnace.

It is of course understood that all joints in the furnace should be carefully blocked with fire clay so that none of the gases generated in the furnace will escape into the shop. The flue pipe should fit snugly into the sheet iron box AA and the fire bricks should be fitted snugly about this flue pipe.

After making sure that the furnace is rightly built, and all crevices and joints are carefully luted with fire clay it should of course be allowed to dry out and set thoroughly before using.

After this the furnace is ready to be charged. This is done by building a fire in the furnace and having it well underway before placing the crucible in position. There should be at least a depth of 8 or 10 inches of good hot fuel on the grate before the crucible is placed. The crucible is now packed but not jammed full of metal and placed upon the bed of hot fuel by means of a crucible tong such as shown at H. These tongs should grasp the crucible easily and firmly. After placing the crucible evenly on the fuel, the tongs are removed and the fuel is gently packed in between the crucible and the furnace lining and to an inch or two of the top of the crucible. The furnace is now closed, and the sheet iron door F, is removed to create as much gas as possible.

If forced draft is used, this sheet iron door is left in position, and the end of the blast pipe inserted in the ashpit and turned upwards towards the grate. As the crucible needs adjusting from time to time the tongs are again brought into place, the crucible is lifted and the fuel at the side allowed to settle under it and new fuel is packed around it. This keeps a sufficient body of burning fuel, beneath the crucible to insure the melting of the metal.

In melting any metal, care must be exercised not too keep it in the furnace any longer than is absolutely necessary. Over-heating or heating beyond the proper temperature is never productive of good results, and as a usual thing, ends in some injury to the metal. The easiest method for the beginner to determine the proper temperature for pouring is to insert a rod into the melting metal. Should it come out clean, with no metal clinging to it, the crucible should be removed from the furnace and the metal poured.

It is usually good practice in the melting of brass or bronze or any of the alloys of brass to sprinkle the surface of the metal with finely pulverized charcoal. This will to a certain extent prevent the formation of oxide and insure a metal of better quality.

Tell Your Tractor Owning Customers

Never race the motor.

Don't measure the depth of gasoline with a dirty stick.

Don't let the tractor get to squeaking—keep it up tight.

By keeping plowshares sharp you will save a great deal of fuel.

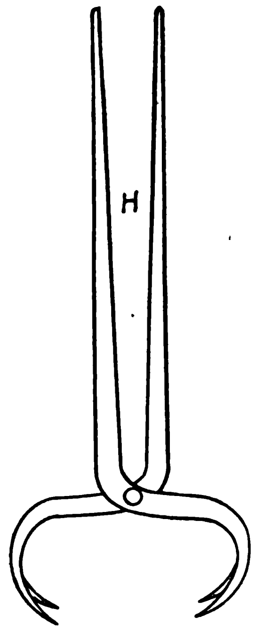
Don't overload, don't neglect needed repairs.

Don't use common black oil on small bearings. Such oil is not suited to the purpose.

Don't expect the seeming impossible of your tractor as you will be bound to be disappointed.

Don't drive with a slipping clutch. Study its construction and master the methods of its adjustment.

No matter how busy he thinks he is, the successful operator is never



THE TONGS SIMPLIFY THE HANDLING OF THE CRUCIBLE

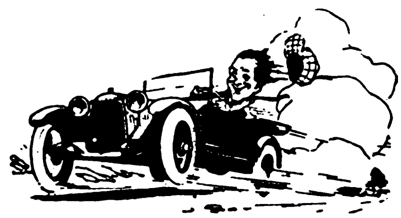
too busy to keep his bearings tight.

A little bit of caution on the part of the operator when in a bad field will often save him a great deal of trouble.

Always lock a nut if making an adjustment and do not neglect to replace cotter pins which you may have withdrawn.

To bring in his machine for repairs before it is beyond repair and while he can bring it to the shop. A small repair in time may save a large repair later, to say nothing of the possible loss in time and inconvenience.

High Spots



WORK: A SONG OF TRIUMPH

Angela Morgan

Work!
Thank God for the might of it,
The ardor, the urge, the delight of it—
Work that springs from the heart's desire,
Setting the brain and the soul on fire—
Oh, what is so good as the heat of it,
And what is so glad as the beat of it,
And what is so kind as the stern command,
Challenging brain and heart and hand?

Work!
Thank God for the pride of it,
For the beautiful, conquering tide of it,
Sweeping the life in its furious flood,
Thrilling the arteries, cleansing the blood,
Mastering stupor and dull despair,
Moving the dreamer to do or dare.
Oh, what is so good as the urge of it,
And what is so glad as the surge of it,
And what is so strong as the summons deep,
Rousing the torpid soul from sleep?

Work!
Thank God for the swing of it,
For the clamoring, hammering ring of it,
Passion of labor daily hurled
On the mighty anvils of the world.
Oh, what is so fierce as the flame of it?
And what is so huge as the aim of it?
Thundering on through dearth and doubt,
Calling the plan of the Maker out,
Work, the Titan; Work, the friend,
Shaping the earth to a glorious end,
Draining the swamps and blasting the hills,
Doing whatever the spirit wills—
Rending a continent apart,
To answer the dream of the Master heart.
Thank God for a world where none may shirk—
Thank God for the splendor of work!
—Outlook

The world's Record for automobile travel is one mile in 44 seconds.

Over Thirty Thousand automobiles are said to have been stolen last year. Of these over twenty-one thousand were recovered.

What's the matter with forming a society for the Prevention of Cruelty to Fords?

Did you forget to send in your renewal order for the American Blacksmith, Auto & Tractor Shop?

Nine million autos and trucks it is said are available in this country for the transportation of passengers and food in case of emergency.

To develope the sense of touch blindfolded pupils are being taught to examine articles with one hand and to draw them with the other.

And that reminds us, when are you going to write that little story for these columns? Let's have it, hot from the anvil.

They say Old Dame Opportunity only knocks once at any man's door. And sometimes she almost has to knock the door down before we wake up.

A good fighter never knows when he is licked. And let me say, right here and now, the man who fights the good fight, gets a lot of satisfaction out of the scrap itself.

Try giving your trade a fair discount for cash if you are having credit troubles. It may solve the problem for you. At least it is worth trying.

Thirteen new makes of cars will be exhibited at the automobile shows during the present show season. And some folks say that the automobile has reached its limit and is going backward.

No man can expect to get all of the business all of the time, but are you sure you are getting all of the business that you are rightly entitled to? You will never know for sure until you go after it.

The shop, its condition and its equipment is likely to give anyone a pretty good idea of the owner. Does your shop give customers a correct idea of you?

If some chaps used as much energy in working as they do in their efforts to avoid work they would find success staring them in the face.

August showed the greatest gasoline consumption of any month since this fuel has come into existance. The record breaking total was 503,512,463 gallons. How the stockholders of Standard Oil, et al are to be pittied.

A Welding Outfit? No sir, not much. None of those new-fangled contraptions for Tom Tardy. He's going to wait till they are perfected, so he says. But then Tom never was more than twenty years behind times.

What are you doing to cut down your costs, to cut out needless expense, to make your shop more efficient? In other words, are you getting into position for a running start down the long stretch of prosperity that looms up ahead of us?

The man who works like a horse usually gets a horse's wages—three square meals a day and a place to sleep. Its the man who works with mind as well as body who gets the extras. Mere brawn alone will not carry a man very far along the path of mechanics today. Mixing brains with the work is the correct formula.

Well, Well, Well, Who'd a thought it? All the big nations coming to Washington at Uncle Sam'es bid to talk about throwing their shootin' irons into the river. This peace-on-earth business is mighty appropriate to the Christmas Season, so here's hoping they get together. The world is hankering now for peace and prosperity.

What do you think of "Our Journal"? We want your frank opinion of it. We want to know if you think we are improving it's appearance, if you like the new cover design, if you like the new articles we are publishing, if you think we are going along the right lines. Let us hear from you with a letter written straight from the shoulder. If you have any suggestions to make that you think will improve the paper let us have them.

The way a man keeps shop is usually the way the shop keeps the man. And it all comes right back to the old, old saying about getting out of anything just what you put into it. No man was known to get any more out of his shop then what he put into it. Sometimes it would seem as though some folks got more then they were entitled to from all appearances but you will generally find that they are putting into their tasks a great deal more then the average person realizes.

Every stop to think that the price you pay today for the American Blacksmith, Auto & Tractor Shop is just the same as it has been for 20 years past? The paper it is printed on costs double what it did a few years ago. So does the printing. All our wages and supplies are much higher. The postage is about three times as great. But we have kept the same old price, one little dollar a year. If you approve our doing this, the best way to show your appreciation is by sending your renewal order and remittance promptly each year.

It isn't salesmanship that sells a fifty-dollar article for thirty. Anybody can do that. True salesmanship is the selling of an article for what it is worth—a cut price means either poor goods or poor selling abilty. Study the new "How to Sell" Department and learn how to properly present the arguments in selling accessories and supplies. This new department will take up the sales arguments of actual parts and supplies. The series of articles will be a practical sales course for the practical shop man.

Same price today as when it started twenty years ago—we refer to "Our Journal". It is still one dollar a year despite the great advances in paper costs, printing and all other production costs. And then too a dollar is pretty small change these days. It won't buy nearly as much as it did twenty, ten or even five years ago, yet we have kept the price at the same old figure. The best evidence of the sincere appreciation of "Our Folks" for this policy is the promptness with which they are sending in their renewals. We surely appreciate this and are making every effort to make the paper better and more valubale every month.

The stranger who solicits your subscription to "Our Journal" may be honest. But it is safest to send your order direct to the company at Buffalo, N. Y., and then you will be sure to get full credit for your remittance and be sure you are not supporting one of the numerous gentry who depend upon there ready wit and glib tongue to keep them in food and clothes. The American Blacksmith, Auto & Tractor Shop has no agents or special representatives to solicit your subscription or to collect your dues. If any man represents himself as an agent for "Our Journal", show him the notice on the editorial page at the beginning of the reading section.

"I HATE TO BE A KICKER,
I generally stand for peace,
But it's the wheel that does the squeaking
That gets it's share of grease."

Making Welding Jobs Easy*

How to Successfully Weld Iron and Steel at the Forge

GUSTAUVE H. RADEBAUGH

To be Successful in Making Welds the kind of a forge, fire, flux and form of scarf must be used that is best adapted to the job.

Welding Essentials

Three important essentials govern the welding of iron and steel: (a) the kind of fire: (b) the shape of the ends of the metal prior to making weld; (c) the kind of fluxes used. All of these are so important that if difficulties are encountered when welding, investigate the job for improper practice related to any of these essentials and no doubt your obstacle can be overcome.

Fuel

Coke, coal and charcoal are used in a forge for heating steel or iron for welding. Bituminous coal in sulphur is the most common fuel used. In preparing the fire for welding see to it that the fuel is free from lead, bronze or brass that may have gotten mixed in the fuel from previous brazing or babbitting operations. Do not try to weld with a "green" fire, see to it that the coal is well coked. The fire used for welding should have a thick bed between the tuyeres and the work. The necessity for this precaution is to hold to a minimum the amount of air that strikes the steel when being heated.

*This is Mr. Radebaugh's third article in his service on Standard Mechanical Practices in the Auto and Tractor Smith Shop. The fourth article in the series will appear in an early number.

If air from the blast coming through the tuyeres comes in contact with the steel the heated steel absorbs oxygen, which causes a scale to form on the steel known as oxide of iron. This scale when present makes welding impossible.

To prevent this formation do not use a strong air blast when bringing the stock up to a welding heat.

Styles of Welds

There are five common methods of forming the ends of stock prior to making a weld. They are classified as follows: the scarf weld, the lap weld, the butt weld, the cleft or split weld, and the jump weld. A reference to the sketch Fig. 1 shows the form of these different welds. In all of these welds, but the lap weld, the surface of the laps are crowned. This is very important. The ends if brought together when hot stick in the center and upon being forged together, the slag and dirt sticking to the metal is forced from the center outward leaving the hot metal free from any oxide of iron. In making the lap weld the hammering should begin in the center as this has a tendency to work all slag free from the welding surface. It is understood that a defective weld will be caused if the job is not entirely free from this scale.

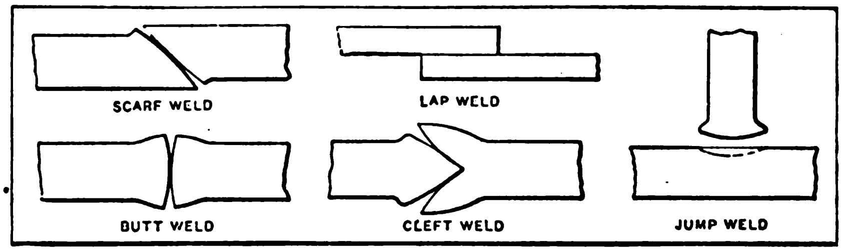


FIG. 1.—THERE ARE FIVE COMMON METHODS OF FORMING THE ENDS OF STOCK PRIOR TO WELDING

Flux

Flux is used in welding for two purposes Oxidation of scale formation is prevented by the flux melting and covering the heated surface, and it also aids in dissolving any oxide that may have formed. Wrought iron, unless it is very thin, can be welded without flux because it can be heated to such a high temperature that the oxide is melted. When welding machine steel or tool steel it is necessary to use flux. Sand and borax are the two most common fluxes used in machinery or soft steel which is the common grade of steel used. Wrought iron is not used to any great extent. Some smiths use the borax, plain, others mix it with equal quantities of fine clean sand also putting in 25% iron filings. Another good practice is burn the borax before it is used as better results will then be obtained. Heat the borax in a cast iron jar until melted then pour on a bench plate or any flat surface so it will form a sheet. Small pieces can be broen off for use or it can be pulverized as desired. There are many good welding compounds on the market, but for welding the ordiary machine steel, sand and is about as effective as any.

Trade Secret Flux

A flux that has been offered as a trade secret and sold on the market is made by this formula:—Copperas, 2 oz.; salt peter, 1 oz.; common salt, 6 oz.; black oxide of manganese, 1 oz.; prussiate of potash 1 oz. Pulverize these ingredients and mix with them 3 lbs. of clean white sand. If this flux will not work the fire is not as it should be or the operator does not use the proper judgment in getting his welding heats.

Flux for Tool Steel

For tool steel use a flux made of one part sal-amoniac and twelve parts borax. For welding tool steel to iron or soft steel, flux made from the following formula is used; 500 parts by weight of borax; 70 parts sal-amoniac; 70 prussiate potash, 35 parts clean unrusted iron filings. Pulverize and add water until a thick paste results. Heat until very thick, stirring constantly, after cold pulverize and it is ready to use.

Building the Right Kind of a Fire for Welding

In arranging the fire for welding remove all the old coals and ashes from the forge fire bowl. Sort out all the caked or coked coal as in Fig. 2 taking care to remove all the ashes from the fire bowl and

*Editor's Note:—This is number three of Mr. Radebaugh's series of articles on "Standard Mechanical Practices." The First one appeared in the October number. The fourth article will appear in an early number.

from the top of the forge. A block four inches square and 10 inches long is now placed over the tuyere iron. Green coal that has been thoroughly soaked with water is placed around this block (Fig. 3.) at a depth varing to the size of the forge but never less than 4 inches and tampted down with the back of the coal shovel. The block is now removed and the fire started by filling hole with oily waste, shavings etc. The baked or coked coal removed from the previous fire is broken up and placed on the new fire. With a very light blast the coke is fired. Continue this piling on of the coked coal until a good solid thick fire is secured and it is burning at a bright, clear heat.

FIG. 2.—THE COKED COAL FROM THE OLD FIRE SHOULD ALWAYS BE SAVED AS IT MAKES A HOTTER AND BETTER FIRE FOR WELDING

Heating the Job

The job is now heated and the ends formed for the welds. Soft steel should be worked at a yellow heat as the steel can be forged to shape at this heat much easier. After the two ends have been properly formed for the weld, being sure that the surfaces that are to be welded together are crowned as shown in the sketch, the job is ready to be heated for welding. Place the pieces to be welded in the fire, cover well with coke (not green coal) heat slowly and steadily until the steel shows a bright yellow. This is the time to make the first application of the flux either by removing the piece from the fire, (this is not recommended but is done by smiths) or with a flux spoon made from a 3/8-inch rod.

The Welding Heat

The heat is more rapidly increased and more flux added until a sparkling white heat is reached. When the steel has a glazed appearance and is sparkling freely, remove quickly from the fire and after a shake or a light tap on the anvil to remove oxide, stick the laps together and with extremely light rapid blows from the hammer at first and heavier blows as the weld proceedes, the job is completed. Do not work the steel too cold. If the weld cannot be finished down in one heat, reheat and work at the usual forging temperature.

Breaking in the New Tractor

While this job is usually one that the tractor owners or operator has to do, it is a very good idea for the smith and repair shop man to know something of the points to be kept in mind when a new machine is to be broken in.

Many owners of new tractors carelessly damage their outfit by running it unwisely when it is new. The bearings and all friction surfaces are tightly fitted and if it be operated under too heavy a load at the beginning, it does not have an opportunity for the little self-adjustment necessary in these parts. For the first few days that the tractor is operated all the bearings should be watched very carefully to see that they do not become hot and special care should be taken to see that plenty of oil is applied, so that there is no danger of seizing or scoring.

The gears and steering mechanism of the new tractor are usually very stiff on account of paint. The best lubricant to loosen this while the machine is being broken in is a mixture of pine grease and kerosene, the former to do the lubricating while the latter will help to remove the paint.

Carelessness Causes Trouble And Accidents

It is difficult to understand why a man will spend several hundred dollars for a tractor or some other machine and then, through sheer carelessness and indifference proceed to run it without oil, cooling water, or with parts loose or out of adjustment, when he must realize that such treatment will cause damage, if not utter ruin. Yet there are hundreds of cases where this very thing happens. In fact, it seems to be almost an exception to find a tractor which is given first-cless care in all respects, says Tractor Farming.

A factory expert recently spent two days in visiting the tractors which his company had sold in a certain locality. There was a large number of these machines in use on farms in the neighborhood and he went from farm to farm in an automobile, inspecting approximately thirty machines in the two days. The machines in question were equipped with an air-cleaner which was designed to remove dirt from the air by passing the air through water. The instruction book which went with each tractor, as well as instructions printed on the air cleaner itself, stated very plainly that the water reservoir in the cleaner should be kept filled with water.

Yet among all the machines which the expert visited in two days he found only one which had water in the air-cleaner.

This is just one of the many examples which might be cited to show how the average tractor neglects his machine. And it is safe to say that a little later on when the pistons, rings and cylinder walls of those tractors are badly worn because of the dust which has been taken in through the air cleaners with dry reservoirs, the owners will lay a large share of the blame on the manufacturers, just as frequently happens when the wrong kind of oil has been used or an engine has been overheated because the operator neglected to keep water in the cooling system.

Of course, all of this carelessness on the part of the tractor owner brings him eventually to the repair shop for help, but it is part of good service to point out these matters to the tractor owner and to tell him why his machine has failed. The tractor owner cannot be reformed in a day or year—he has left his mower, his reaper and his other machines out in the weather and open field too often to change over night, but a word on the subject is a campaign in the right direction.

A Few Notes on Tires

"BRUN SWICK"

There is perhaps no single factor that has more to do with the life of the average tire then the inflation of it. There should be no guessing about this very important matter. You should know. Kicking the tire or pounding it with a wrench or hammer will not tell you if the tire is properly inflated. A tire gauge is the only thing to use. Any other means of trying to determine if a tire is properly inflated or not is nearly a guess, and a guess is not accurate enough if the best possible service is to be gotten out of the tire. Therefore use a pressure gauge when you inflate a tire and impress the importance of the matter on your customers.

In getting the proper pressure in the tire do not attempt to memorize a tire pressure table. This is all unnecessary if you will simply remember that the proper pressure for any tire is twenty pounds for each inch of tire diameter. For example, if a tire is six inches in diameter it will require 120 pounds of air pressure. If it is a four inch tire it will need to be inflated to eighty pounds pressure. Twenty pounds to the inch is easily remembered and when that is remembered it should not be difficult to give the tire the required air pressure.

Another matter that will greatly aid in lengthening the life of the average tire is the changing of the tires from one wheel to another as they wear. Most motorists are fully aware of the fact that placing the tires of the rear wheels on the front ones will greatly prolong their life. And most thrifty autoists are in the habit of doing this when the rear and front wheels are of the same size. A further step in such conservation of the tires is the practice of changing tires from the right wheels to those on the left and vice-versa. When the tires on the left side in front show wear put them on the right side putting the best side on the outside. A change is as good for tires as for an individual.

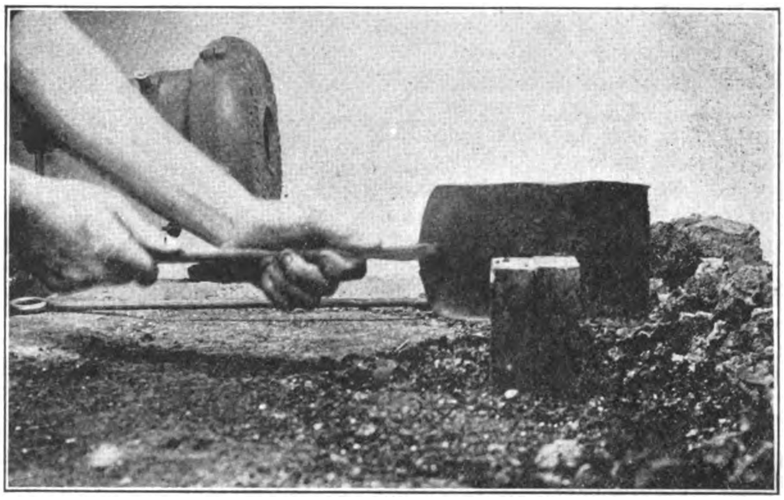


FIG. 3.—THE BLOCK ENABLES THE SMITH TO START HIS FIRE DIRECTLY OVER THE TUYERE. THIS IS A COMMON AND EASY WAY OF STARTING A NEW FIRE

The Care of Tires in Winter

J. C. HOOD

During the past few years there has not been the tendency toward laying up the car as in years past though many motorists still put up their cars during the cold weather. And when this is done it will be of value to the shop man to know just what is best for the tires of cars so stored, for I am a firm believer in giving customers all the service information you can.

Most all car owners know of course that it is best to jack up the car if the tires are not removed from the wheels, but the practice recommended by most, if not all the tire companies is the complete removal of the tires from the wheels. This permits of the tires being stored in the proper way without much difficulty.

After the tires have been removed from the wheels they should be carefully examined for cuts, bruises and abrasions. Any such should have proper attention before the tires are stored. If any of the fabric is exposed immediate vulcanization will in all probability save the tire for a great many more miles of good service. For as you well know fabric that is exposed and not properly covered will in time result in the complete destruction of the tire.

After all tires are put in proper condition, cuts repaired and breaks properly fixed, the tires are ready for storing. First wash the outside of the casings with gasoline removing all oil and grease which is left on the tire will soften the rubber and shorten its use considerably. After thoroughly drying, the casings should be wrapped in burlap and then placed in a dry room where the temperature will be of a uniform degree during the storage period and preferably of a temperature ranging of from thirty to forty degrees.

It is of course understood that a dark room is best for the storing of rubber and in no event should the tires be subjected to the direct rays of the sun.

In the storing of tubes, the same general instructions apply. Tubes should be partly inflated, not enough however to stretch the rubber but just enough to give the tube its proper shape. And when so inflated the tubes should be laid flat of course, and no attempt made to stand them up or to hang them up.

And while on the subject of tire and tube storage it may be well to say a word about the care of rims from which the tires have been removed. The rims should be thoroughly cleaned. All rust should be removed from the rims and they should be treated to a coat of common stove polish. This will keep them in perfect rustless condition until the tires are again put back on in the Spring.

Milk of Human Kindness Still Up To Standard

In these days of rush and hurry and thoughtlessness, it is good to be able to take note of an instance of good old-fashioned kindness and neighborliness such as is reported from a Minnesota community.

A serious accident which befell a farmer, confining him to the hospital for two months, left all his fall work undone. Utterly discouraged, he was astonished one morning at the approach of an army of neighbors, men and women, who took possession of the farm. A parade of men with teams clattered into the corn field. Twelve men, the carpenters of the bunch, set about repairing the buildings. Before the end of the day all the corn had been husked and stored in the newly-repaired cribs.

Seven tractors were turned loose in the stubble under the guidance of competent operators, and in a few hours the farmer's worry about his fall plowing was all over.

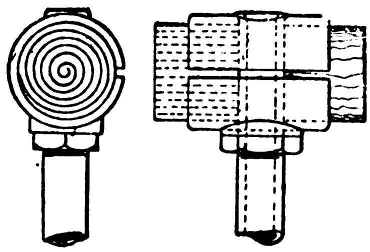
The femine contingent, cleaned the house from attic to cellar, and from the supply of food brought with them, prepared the dinner for the hungry horde of workmen.

How to Make a Soft Faced Hammer

There is frequent need in the shop of today for a hammer with a soft face which will not mar the work upon which it is used. How often do we find surfaces that have been hopelessly injured by the careless use of a hard hammer, when a soft faced hammer would have accomplished the real end sought and without the thoughtless maring of a fine surface.

A simple method of making a hammer for striking work which must not be touched with a metal hammer is described by Fred Horner in Work.

Cut a piece of steel tube, put a cross-hole through, split it at one side with the hack saw, and then insert a length of tubing to form a handle. The end of this tubing is swelled over to form a head, and the tightening is effected by screwing up the nut shown, with a washer concaved to fit against the curve of the tube. This action binds the elastic tube firmly on the soft "faces" inserted in the apertures at each end. In the upper hole is shown a coil of raw-hide, and in the lower a piece of wood. To prevent the coil from getting out of shape, a washer should be placed at the bottom of the hole, or alternatively, the coil may be cut concave to fit around the tubing forming the handle. Fibre may be used



A SIMPLE MEANS OF MAKING SOFT HAMMER FACES

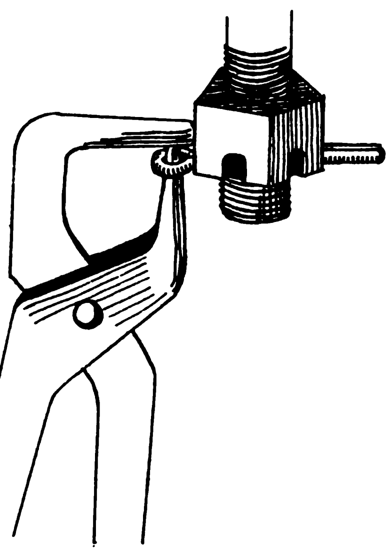
instead of wood if preferred for one face. Practically any material may be used with this practical type of hammer; rubber, fibre, wood felt, raw hide, leather or any other substance depending upon the surface to be struck.

Snow Plow for Small Tractors

G. E. Fuller

Even the garden tractor becomes restless in the winter time and becomes anxious for activity.

In order to satisfy it, a small snow plow has been devised with a double steel blade held by a substantial frame in a V shape, the



A TOOL FOR THE QUICK AND EASY REMOVAL OF COTTER PINS

whole being firmly attached to the frame of the tractor itself. By properly arranged levers it can be held at any desired height so that if the snowbank is too much for it at the first attempt, the top can be shaved off, then with the plow lowered to the ground the remainder can be removed. It is a useful arrangement for clearing walks and drives around the house, farmstead and estate. Practically and smith and repair man can rig up an arrangement of this kind for the small tractor. The types and styles of these machines are so different that it is hardly possible to describe a plow attachment that would be suited for all. In connection with the use of a small tractor so fitted, it would no doubt be possible for the owner or operator to arrange with neighboring property owners upon a reasonable basis so that operating and up-keep would at least be met.

A Cotter Pin Puller

J. Baldwin

A tool for the quick and easy removal of cotter pins will save considerable time, trouble and cussing for the shop man when working on motor cars and tractors. Usually some make-shift device is used for cotter pin removel resulting in bruised knuckels and damaged temper. With the tool illustrated cotter pins are easily and quickly taken out and the repair job of whatever nature thus greatly helped.

It is hardly necessary to say anything about the making of this handy tool as the engraving is practically self explanitory showing the tool itself and how it is used.

If a pair of adjustable pliers are used for making this tool, weld a lip or extention as shown to one jaw, after drawing out the other jaw to a long taper so it will enter the eye of all sizes of cotter keys.

THE "REAL HENRY CLAY"

One winter morning Henry Clay, finding himself in need of money, went to the Riggs Bank and asked for the loan of $250 on his personal note. He was told that while his credit was perfectly good, it was the inflexible rule of the bank to require an indorser. The great statesman hunted up Daniel Webster and asked him to indorse the note.

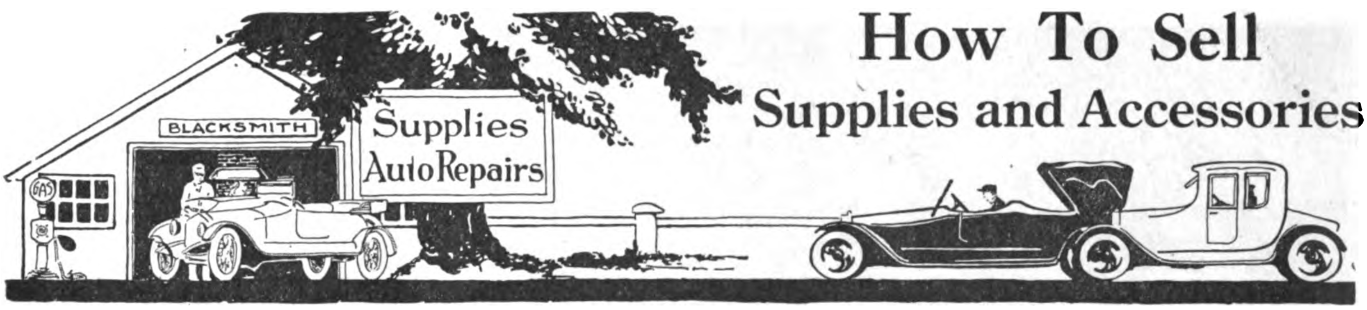
"With pleasure," said Webster. "But I need some money myself. Why not make your note for five hundred, and you and I will split it?"

This they did. And today the note is said to be in the Riggs Bank—unpaid.

Is It?

"Do you always do your marketing here?"

"Yes, I've dealt with these people for years. It's so much nicer to be robbed by some one you know."



How To Sell Supplies and Accessories

This department tells you how to sell supplies and accessories. The selling points on actual items of equipment are here presented in actual sales talks. Here you will find selling arguments which will help toward sales and profits.

Bill Seller Intalls a New Spring.

Incidentally He Explains Some Spring Theory and Practice

Bill Seller was busy going over his stock list of "wants" when he glanced up from his work to observe a big touring car limping slowing up to the shop door. He immediately dropped his lists on the desk (Bill is a stickler for prompt and quick service) and was out at the side of the car before the driver had brought it to a complete stop.

"Howd'y Folks" greeted Bill in his cheery manner which, backed by his bright smiling face, always puts the prospective customer at his ease. "How can I help you?"

"We've broken a spring" said the driver," and we must be getting on to Nextown—can you fix it?"

"You just bet I can" came back Bill heartily. "We won't keep you here any longer than absolutely necessary and we have a spring in stock waiting to be put on your car," and with this Bill assisted the lady and two childern from the car and called Joe, his helper, to unstrap the back trunk so the rear end could be gotten at more conveniently.

"Here, here, not so hurriedly" said the driver, who was also car owner, husband and father. "What kind of spring have you and how do I know it's any good?"

"Well, in the first place," began Bill, "I handle the Blank spring. I carry a complete stock and have one that will fit your car exactly. Blank began making springs long before Ford ever thought of flivvers. And Blank springs were used on carriages and wagons when my father, and my grandfather before him, ran the little old shop that stood right on this same spot. I'm stocking and installing Blank springs because I know they are made right, have the right material in them and made by men who know their business.

"Let me tell you something about springs. There isn't a thing on the outside of a spring that will tell you anything about the inside. There is nothing in the appearance of a spring that will tell you a thing about its riding qualities or its life. But the riding qualities and the life of a spring are its most important points.

"Now consider this: The leaves of a spring are never stationary when in service. They are continually being bent up and down. Every depression, every bump and every wave of the road is keeping the springs on a continuous stress of bending and straightening, and if prolonged indefinitely the spring will break. Or, as probably happened in your case, when you drop one wheel into a sharp depression with a load close to the limit of weight for that spring it will break.

"Of course, there is a lot to the making of springs. There are factors almost without number that must be considered in connection with their proper shaping forging and tempering. But no amount of skill in shaping, forging and tempering. But no amount of skill in shaping, forging and tempering will make up for lack of good material in the first place."

"Blank springs are full of quality and honesty from the selection of the stock to the finishing of the spring. The Blank people have been in the business of making springs too long to allow for anything other than honest material and honest workmanship to go into any spring that bears the "Blank" mark.

"You see my experience and knowledge is not limited to my few years of actual existance on this earth. I have drawn on the experience of a father and several grandfathers—several generations of practical smithing craftsmen in fact—to tell what is what regarding springs.

"And another matter in connection with Blank springs—you can get them almost anywhere. Should that other spring break down—you will be able to find another man without a great deal of travelling, who will put on the same type and size of spring that my men are putting on your car now."

"I'll never need a new spring on that side" returned the driver, who had kept a discreet silence during Bill's talk which had been interspersed with occasional short, snappy instructions to his very efficient aides.

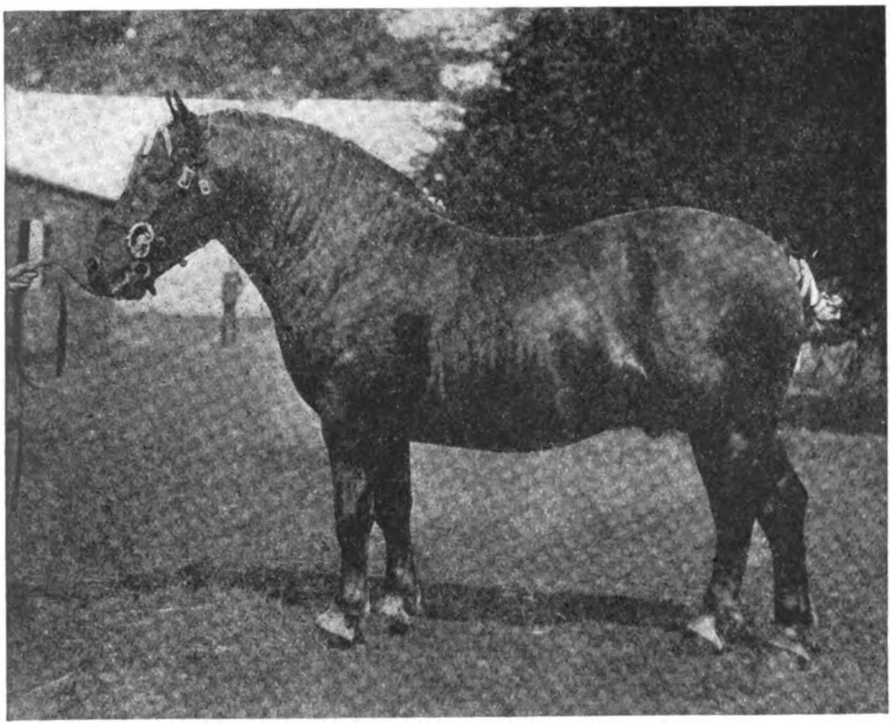
"Why not?—that one broke, didn't it?" Came back Bill, with just a touch of impatience at what he took to be stubborness on the part of the driver.

"Yes, that one broke" agreed the driver "but the spring on the other side is a Blank spring too." And with that the driver laughed in which Bill joined heartily for he quickly saw that he had been baited into disclosing some knowledge of his trade.

The Craftsmen of Today and Yesterday

CHAS. BARNETT

Your editorial, "The Repair Man of Today and Yesterday", brings to the minds of some of the older smiths, the proposition we are up against. Inasmuch as the demand for the forge and anvil mechanic far exceeds the supply today, and as we look forward to the years



NO MACHINE HOWEVER PERFECT CAN REPLACE AN ANIMAL SUCH AS THIS IN THE EYES AND AFFECTIONS OF THE TRUE ANIMAL LOVER

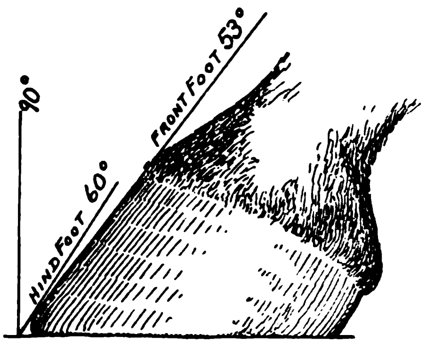
just ahead, we see the supply diminishing, and the demand growing no less. When I say "Mechanic", I don't mean the man that can just simply heat a piece of iron and bend it. I mean the man that can take care of the plow work, and if necessary, make a share, one that knows what to do if a plow takes too much land, or not enough; how to point, lay and temper. There will always be horses to shoe, and a man should know his business when it comes to taking care of the most important part of the most essential tractor power in existance today, "The Horse", because it doesn't matter how much machinery we get, we have got to have "Old Faithful", and they must have shoes.

If a man can do those things right, he can weld axles, auto springs or anything in iron or steel that can be welded at the forge. And knowing those things, with the ambition to do and a genuine likening for hard work, a good clear mental working faculty, a thorough desire to please every customer, and just enough gab to be a good mixer, one need never be idle, and can command an honest price for an honest job.

As to the man of today, I've had too many men trying to do too many things, and the result is there are too many jobs not successfully done. If I get a job of welding that can be done better with a welding torch, I send it to a man that has thoroughly learned that kind of welding. The point is this, If I can't do a job successfully, I am not going to ruin it to keep the other fellow from getting the job.

In looking back over thirty-six years of general blacksmithing at the forge and anvil, and as best I can into the future, I believe I have expressed my own sentiments as well as those of a vast majority of the older smiths.

There is so much to be said along this line, that I hope we have an expression from more of the older ones, and some of the younger as well, through our Wonderful Journal.



HOW THE CORRECT ANGLE OF THE FOOT IS DETERMINED

The Correct Angle of the Horses Foot

J. M. HALL

This is a subject closely connected with the proper shoeing of the horse, though many shoers even with a full knowledge of the importance of shoeing of man's best friend do not realize the importance of preserving the correct angle. Every practical shoer will agree with me however in my explanation here and in the fact that this very important feature deserves much consideration.

The matter which brings the subject to mind was the conversation I had the other day. In remarking to a shoer who was cutting down the heel of the horse, I referred to the matter by asking him if he was not drawing the animals foot too far back and thus making the angle of the foot too sharp.

"What do you mean by the angle of the foot?" asked the shoer.

I then proceeded to explain to him just what I meant. I pointed out that in my estimation, to cut down the heel of the foot too much, you naturally allow the foot to drop down too low at the heels and make the angle of the foot too acute. This throws the bones of the leg out of normal relationship.

From my observation, I believe that the authorities on shoeing generally agree that the angle of the front foot should be in the

THE TWO SMITHS OF HOUSTON WHO GAVE THE HUNDRED DOLLARS IN PRIZES TO THE WINNERS IN THE TOURNAMENT neighborhood of 53 degrees. That is the angle formed by the line of the wall from center of toe to center of hair line at top of hoof, and the base line of the foot should be approximately 50 degrees. The diagram will no doubt illustrate the idea better than my description.

Of course, it is understood that the angle will vary in different animals but this just shows that the common sense and judgment of the shoer is required.

In my estimation, the preservation of the angle of the foot is a very important consideration in fitting of the shoe. Any shoer who has given attention at all to the anatomy of the horse's foot and leg will readily understand how the foot brought too far forward or allowing it to drop too far down at the heels will be thrown out of normal. This change in the normal position of the bones will naturally result in peculiarities in the animals gait and eventually in serious foot troubles.

I would like to have the opinion of other readers on this subject, for while I am a firm believer in the subject as mentioned here, I am always willing to learn and will certainly appreciate ideas which other practical shoers are ready to explain on this subject, which in my estimation, is a most important one, in the consideration of the proper shoeing of the horse.

SOME OF THE PATIENTS WHO COMPETED IN THE HORSESHOE PITCHING CONTEST AT CAMP LOGAN HOSPITAL

Making a Pacing Horse Trot

W. W. WILLIAMS,

Prof. Mechanical Technology South Carolin Agri. and Mech. College.

I have been a reader of "Our Journal" for several years, and a well wisher of the same. I hold it in the highest regard. I read it to my classes from time to time for the wholesome information contained therein and noted in one of your past copies a question which aroused the interest of my senior class. This we have studied, and discussed both pro and con. That question was on how to make a pacing horse trot and we are now prepared to answer the same.

We experimented on a horse three and a half years old, that was bred from pacing stock. This horse had a record of 2:14. Our change has added to his speed and he was able to trot at 2:05. He wore a shoe of No. 2 average. We tried a good many patterns of shoes, and now have succeeded in finding the right one that made him immediately change from pacing to trotting.

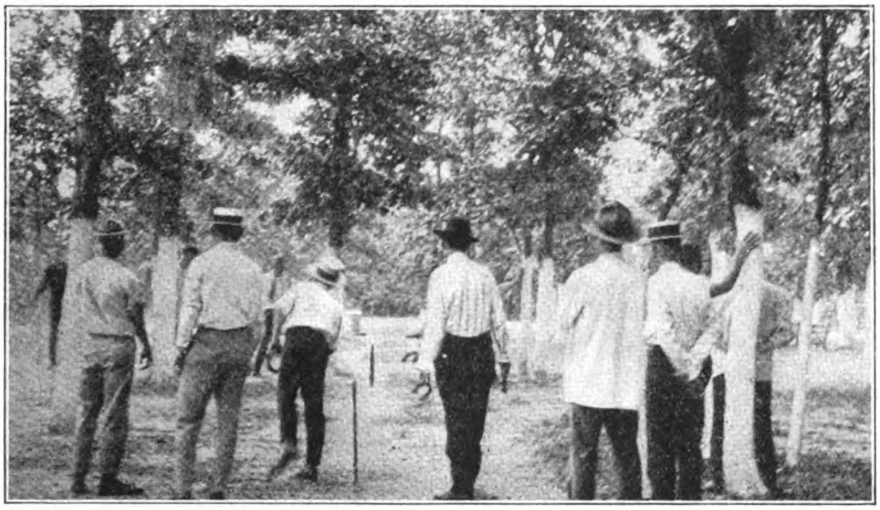
We trimmed his front hoof to a 45-degree angle and the back hoof to a 51-degree angle. The weight of the front shoes was 10 ounces, with the case of the shoe 6 ounces, and the heel 4 ounces, with a circle calk on the toe bearing two first 1/4 nails drawn to a very keen point. The back shoe weighed 6 ounces, case 4 ounces, and the outside 2 ounces with a square block on the toe. This pattern of shoe will make an immediate change, and if hoof will not permit trimming, use leather elevation. A lighter shoe can be used providing an equal change is made.

The Grand Horseshoe Pitching Tournament in Texas

Two hundred patients at United States Public Health Service Hospital No. 25 near Houston, Texas competed for $100 in prizes in a shoe-shoe tournament recently. The prizes were given by two blacksmiths in Houston and enough money was left over to buy four electric fans for the surgical ward.

Four courts were used and four games were in progress at the same time. The play began at 9:30 A. M. and ended at 4:30 P. M. The horseshoes were hand forged according to national regulations.

This is one of the many entertainments being "staged" by the American Red Cross at Camp Logan Hospital. Previous to the advent of the Red Cross there was absolutely no form of recreation for the sick men. Now a weekly newspaper, a Red Cross enterprise,



THE FIRST HORSESHOE PITCHED, OPENING THE TOURNAMENT FOR PATIENTS AT THE U. S. PUBLIC HOSPITAL NO. 25

creates interest in horse-shoe games, golf, baseball, in fact all sorts of sports that will keep the men contented and give them healthful outdoor exercise.

When You Ask Questions

This department of "Our Journal" has been a most important one ever since the beginning, and we want it to continue as one of the most important features of the paper. In order to make it so we wish to call the attention of "Our Folks" to a few things in connection with the asking of questions that will not only help the editors very materially in their consideration of the questions asked but will also help the readers to more complete information on the subjects they desire enlightenment upon.

In the first place we want each and every one of our readers to feel that this is their very own paper. We want you to feel free to at all times to discuss matters of trade and craft interest in these columns, to ask questions just as often as you feel in need of information, and to answer any and all questions that you feel competent to answer. This paper is publised for your benefit: it contains matter of interest to you and to your business, the more use you make of its columns the greater benefit will you receive from its columns.

Now a suggestion or two when asking questions. First; do not be afraid to give us too much information when you are seeking an answer to some problem that is puzzling you. Tell us all about the matter you are seeking information on. Explain your question fully. If it is some puzzle connected with a gas or a hay motor tell us all you know about the matter. Surely, if a question is worth asking it is well worth asking correctly. We are willing to give it space and time so do not think that you can take up too much space in detailing your troubles.

And another matter are the questions that require answers of considerable length. These we are willing to answer by securing complete articles on the subject. This of course takes time and some of our readers may think that the matter has gone without attention. Many questions cannot be answered briefly and if they are of such character as to interest any considerable number of our readers we are glad to publish a complete article on the subject, or even an entire series of articles.

In replying to questions asked it is not expected that the editors can reply intelligently to all matters from their own knowledge, so that they are compelled to call upon what has become known as a sort of Advisory Board to whom questions are referred from time to time. The members of this board are mechanics in all lines who are glad to share their experiences and their knowledge for the good of the trade and craft. Often the opinions of several of these men are requested and thus the experience of several experts is brought to the aid of the reader.

Your co-operation in the above matters will aid us greatly in making the Queries, Answers, Notes Department still more valuable and interesting to you.

Queries-Answers-Notes

THIS department is the place for discussing shop and business matters. Here you may ask for information on any topics or matters that interest you; bring to the attention of the progressive craftsmen of the day the subjects that should have their attention. You are requested to make use of this department as often as desired.

Wants to Build Spring Heating Furnace:—Will you please give me a plan for a spring heating furnace, I want to build one, and don't know just how to go about it, and any information you can give me will be of great help to me.

D. J. Brady, New Hampshire.

Gasoline Lamp Clogs:—I have a gasoline lamp and have had quite a bit of trouble with the generators getting clogged up. I would like to know if they can be cleaned and if so, please tell me how. This generator is a hollow, brass tube with a coil in it filled with asbestos.

James Ebrite, Ohio.

Welding Gasoline Tanks:—Can you tell me the chemical used in gasoline tanks and barrels, to make them safe for oxy-acetylene welding?

I have worked in welding shops in the cities and I know it is a white powder, but what kind it is I do not know.

F. J. P.,Wisconsin.

Air Line for Blast:—I run a garage and have a free air service with tank and lines. I am thinking of running the forge, with the air, but I don't know how to connect the air to the forge for the best results. Will you please help me if you can? I don't know whether to reduce down and let extra air inside of the line, or whether to stop it tight and depend upon all the air coming from the tank.

Aubrey Phelps, Tennessee.

Wants Information on Scored Cylinders—In connection with my blacksmith shop I have installed an acetylene welding plant. Having very good success in that line also getting a great deal of information from your valuable magazine in articles on that subject. Now I would like a little information about repairing scored cylinders if your expert can enlighten me through an article in some future number it will greatly oblige.

James A. Torrey, Massachusetts.

Motor Trouble Question:—I would like to have your advice on how to cure a sick car. I have an Elgin six cylinder Car, fitted with a Stromberg LB 1 carburetor. When car is standing still, the motor accellorates nicely, but as soon as the clutch takes hold the car jumps and jerks, and will not pick up good. New piston rings were put in and valves reground four months ago. The two spark plugs are always wet with gasoline. The sparks are good outside of cylinders, but fill up with gasoline when inside on the No. 3 and 4 cylinder. White smoke comes from muffler most of the time. What do you think the trouble is, and please tell me what can be done.

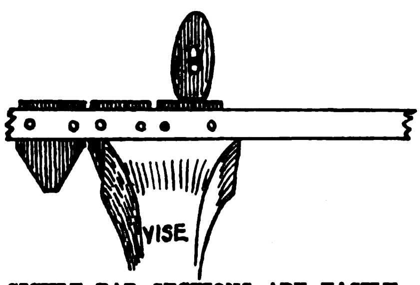
Reader.

Repainting a Wagon Cream Color:—It is desired to repaint a wagon cream color. Can you tell me how to proceed with the work. The wagon is owned by a flour mill and they wish to carry out the idea of cleanliness and sanitation in quite a decorative vehicle in cream color.

Fred Peters, Pennsylvania.

In Reply:—To re-paint the mill wagon cream color, first clean off all grease and dirt with turpentine, rub down with fine glasspaper, and touch any bare places and open joints with white-lead priming. Next day putty where necessary, and apply a coat of cream color composed of best keg white-lead 5 parts, red 1 part, and yellow 2 parts. Mix the dry pigments into a stiff paste with linseed oil, then add the white-lead. Next, to 5 lb. of the pigment is added ½ pt. of good-wearing body varnish that dries quickly. The mass is then thoroughly mixed, thinned with turps, and strained. Allow this coat at least twenty-four hours in which to dry, when it is gone lightly over with a piece of worn fine glasspaper. Apply a second coat of the cream color, and when dry, rub with a small wisp of horsehair to deaden the gloss, then line out and decorate. The lettering and lining colors ground in turps are bound with gold-size and thinned with more turps: ⅛ part size to the entire bulk. Coach-painters frequently mix the lining color with hard-drying varnish, first dipping the lining pencil in turpentine, then into the color, then working it on the palette until properly charged; but this method requires judgment so that the color will neither be too thin nor too thick. The first coat of varnish should be pale, hard-drying carriage varnish tinted with some of the cream color, and the second coat pale finishing varnish. The first coat requires flatting with ground pumice and water to take off the gloss.

To Tighten Demountable Rims:—In answer to P. E. Hand, New York, who inquired how to tighten demountable auto rims. If the rims are demountable the best method that I have found (if there is a oxy-acetylene welding outfit near) is



SICKLE BAR SECTIONS ARE EASILY REMOVED

to build up the rim where the lug rests on it. This will make a good job, for I have tried it a great many times, and it proved successful.

M. E. Goller, Pennsylvania.

Removing Sections From Sickle Bars:—Will some reader kindly tell me the best way to remove sections from sickle bars? I have considerable difficulty in removing the cutting sections and usually get the bar all out of shape. There must be some little stunt that I do not know about that will do the trick in very short time and keep the bar straight.

J. W. H., Illinois.

In Reply:—Your reader must be a new man at the business of repairing sickle bars for the little stunt of removing the cutting sections is an old, old one to most smiths who have had any amount of experience at the game. The accompanying sketch will demonstrate the idea perhaps better then any description. This is one of those jobs that will take a man a long time and give him a lot of trouble and often produce a lot of new cuss words unless he knows just how to go at the work. And I want to say right here that this is just where a journal such as "OUR JOURNAL" comes in strong. A man would probably work a long time before he would discover this stunt for himself.

In the sketch it will be seen that the sickle bar is placed in the vise with the edges of the bar resting on top of the vise jaws. Thus the sections are allowed to drop down between the jaws while the jaws of the vise are screwed up until they just hold the sections loosely. To cut the sections out the back of each section is hit sharply with a heavy hammer and it will thus practically cut itself out. The section shears the rivet, the bar is kept straight and the two parts of the rivet left in the bar will then drop out easily. Thus the entire set of sections is quickly removed and in about as much time as it takes to tell about it.

F H. B., New York.

Tempering Chisels and Axe Blades:—Can you tell me how to go about the tempering of cold chisels and axe blades, I have attempted to do work of this kind but do not think I am on the right road to success at this work.

J. G. Manser, Oklahoma.

In Reply:—Tool tempering is a job in itself and it is seldom that one runs across a job of this kind these days. Back in the old days it was very necessary for the smith to know how to go about a job of this kind, and it is good to know of a young smith who is interested in knowing how to do work of this kind.

In the first place it is best to know of some good bath solution for tempering properly. But don't get the idea that the bath is the whole thing in the tempering of tools. Some men try to tell you that all you need is a mixture of some sort which is usually a mixture they have to sell you for any where from one dollar to most any figure they think you are good for. Generally speaking however you will find that the mixture is a very simple one and one that would cost you but a few cents if you got it at the drug store. Here is a mixture that you will find very good for chisels and axe blades and something that will not cost you very much. In the proportion of two gallons of soft water take one ounce each of salt peter and sal ammoniac. Heat your tool to a cherry red and dip into the bath straight down keeping the tool in constant motion until cold. Now wipe dry and polish with a bit of emery cloth. Now place a piece of iron plate over the forge fire and allow your heat to come up under this. Place the chisel on the plate and draw to a pigeon blue.

Axe blades are best tempered in oil. Either linseed oil or fish oil may be used. In tempering draw to a purple, polishing first so that the color may be easily determined. D. S. Cook., New York.

Tractor Troubles:—Not long ago, I was called upon to look over a gasoline tractor. While it was running and pulling the machinery fairly well, the owner could see it wasn't operating as it should. Its speed on light loads varied considerably, and it wasn't delivering the power it should.

My first move was to remove and clean the spark plugs, which were badly fouled. The spark gap was too wide and was adjusted to 1-32 of an inch.

Next I checked the timing. The motor was a two-cylinder, horizontal twin motor, running at about 600 revolutions per minute, with high tension jump spark ignition. My rule for such motors is to advance the spark ahead of the head-end center about seven degrees for every 100 revolutions, or in this case, about 42 degrees. The timing proved O. K.

My next adjustment was of the gap of the breaker points. These should open to a maximum of about one-sixty-fourth of an inch.

The timing of the valves proved to require no change. On such a type of engine, I believe it best to have the exhaust valves open about 45 degrees before crank-end center and close about on dead center or between that and five degrees past dead center, to ensure complete exhaust of burnt gases. The inlet valves opened about 10 degrees after the exhaust valves closed, and closed at 30 degrees past crank-end center.

Inspection of carburetor located some of the trouble. The cork float was found to be "water logged", resulting in a variable action, frequently flooding the carburetor; the result was an excessively rich mixture, dense grey smoke from exhaust, sooting plugs and rapid formation of carbon in cylinder. To correct this trouble, I took out the float valve, let it thoroughly dry out, and then gave it a good coat of shellac, allowing the latter a full day to dry.

The final operation was to thoroughly clean out the carbon from the cylinders, and to touch up the valves. The result was a sweet running motor, that gave the customer all the satisfaction he was looking for.

B. B. A., New Jersey.

Melting Brass and Iron on Small Scale—Would like to know if there is some practical way of melting brass and bronze bushings without the use of a blast furnace. Also it is practical to melt iron on a small scale and could a brass furnace be used for same?

A. C. G., Missouri.

In Reply:—For melting brass take your crucible and put it in the forge, assuming that your forge is plenty large enough for this purpose, and build up a good fire around it, also building up around the crucible with fire-brick, coal or clay, so as to confine the heat as much as possible, you can do this work very nicely in the forge.

In applying the blast, be careful to have it even and uniform. Do not attempt to

NEW METALS IS ADDED AT POINTS WHERE LUGS REST

bring the blast up strongly, nor to have brass and brass alloy, brass oxidizes very rapidly on the surface, and this oxidation may be retarded to a very considerable extent by sprinkling the surface of the melted metal with finely powdered charcoal.

Now should you run into any considerable amount of this work, it would be necessary and much more practicable to install a brass melting furnace.

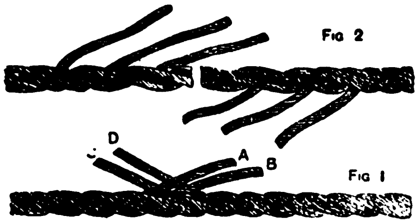
On the subject of the melting of iron on a small scale: where castings of any considerable accuracy are required, you will unquestionably get better results by going to the regular foundry for this kind of work. There is no question but that the experienced foundry can secure better results for you than would be possible with the more restricted and simple equipment which you would use.

S. S., Dept.

The Apprentice and the Trade:—It was certainly a great surprise to yours truly to read that notice regarding an apprentice in last month's paper. I had begun to think that the good old apprentice was a thing of the old forgotten past. It is certainly fine to read that there are still calls for apprentices in the good old trade and it just does my old heart good to realize that the motor vehicles haven't modernized the trade to such an extent as to do away with the picturesque apprentice.

I can still remember the days of long ago when I learned the trade and served my time with one of the grandest smiths it has been my pleasure to know. My first year at the trade, I was given the stupendous sum of fifty dollars—no not a month, but fifty dollars for the entire year. And the second year I received sixty dollars. The third year, and three years was the time that an apprentice was supposed to serve in those days, I received seventy-five dollars and the man I worked for gave me a set of hand-made tools which he had himself forged.

In those days a youngster was glad to learn the business under the guidance of



SPLICING WIRE ROPE

a man such as I worked for. This man had learned his trade in the same way and he knew how to treat a boy.

It has been years since I have seen a real apprentice in the shop though I have taught my share of the youngsters in my own county. Of course one is tempted to wonder where the future experts of the craft are coming from but the observing man will realize that there is an entirely different class of smith shop mechanic coming into line. To my way of thinking it is a good thing, for the line of work done in the average shop is considerably different then the line of work we did when I learned the trade or even when I ran a shop of my own.

It has of course been quite some time since I have lifted a hammer or poked a fire but I am always interested in the doings of the craft. I am glad to say that I had two fine boys to continue where I left off and that they are today doing fine at the business. They have of course been compelled to keep right up with the times and have gone after the auto, truck and tractor business in the right way. But it has paid them better then the smithing business ever paid me.

(An Old Vet.", Ohio.)

Splicing Wire Rope: — Will some one kindly tell me how to splice wire rope? I want to know how to get the pitch of the strands correct before unlaying them.

S. W. J., Tennessee.

In Reply:—The two-by-four method of splicing wire ropes, whilst not being the best for several reasons, is in principle similar to every other method of long splicing. In preparing the rope for laying in, the ends are intertwined so that there is a right-hand and left-hand end alternately, as by this method only can the two sides be pulled up sufficiently tight to get the lay at the junction correct without loss of twist. Any further operations with regard to the method of unlaying the strands are a matter of choice. Where all the strands are unlaid to the whipping and then intertwined before cutting they can, after being pulled up, be taken singly, one to the left and the next to the right, or two can be taken together as shown in Fig. 1, A and B being unlaid to the left and C and D laid in their place. It will be seen that though the strands are alternate they are together on each side. The best method of splicing is shown in Fig. 2, each alternate strand being unlaid close to the whipping. The solid part consists of three strands, the core being cut away close to the whipping on each side. The ends are then laid the short distance shown, then interleaved and pulled up to get the correct lay before commencing the laying in of the strands which proceeds on the usual lines.

S. S. Dept.

A Muffle for Springs:—A number of flat springs are to be tempered and I would like to know what type of furnace to build for the purpose.

H. E. Cheston, Missouri.

In Reply:—This reader evidently requires a hardening furnace and while the number or quantity of the springs is not stated the furnace here suggested will no doubt be found of sufficient size for his purpose. As shown in Fig. 1 it consists of a cylindrical casing made of 16-in. gauge sheet-iron for strength, with end caps and chimney ferrules as shown. A hole A is cut out for the burner flame. Another casing (Fig. 2) should be made of the same gauge metal as the cylinder. This is attached to the cylinder as shown in Fig. 3 to form a base for the furnace. No details of construction are given, the various parts being joined either with angle strip or bent edges. Before joining the two parts of the body together, rivet to the inside at intervals and along the edges strips cut and bent as in Fig. 4. These strips hold the fireclay and prevent it falling out when cracked. The inside should be covered with at last 1¼ in. of fireclay, pieces of firebrick being embedded at each end of the space at the bottom of the cylinder, to take the wear of the muffle as it is taken out or put in the furnace. The muffle may be a length of 3-in. or 4-in. diameter steel tube closed with an iron cap at one end, the other end being plugged with a fireclay-lined iron cap, after being charged. The fireclay lining opposite the hole B should be curved as shown by the dotted lines to deflect the flame on to the muffle in the furnace above. The burner, which would have to be fairly powerful, can be of the ordinary blowlamp type with a separate tank provided with an airpump. The chimneys would have to be partially covered up if a forced flame was employed. With a burner of the ordinary bunsen type the chimneys would have to be extended considerably.

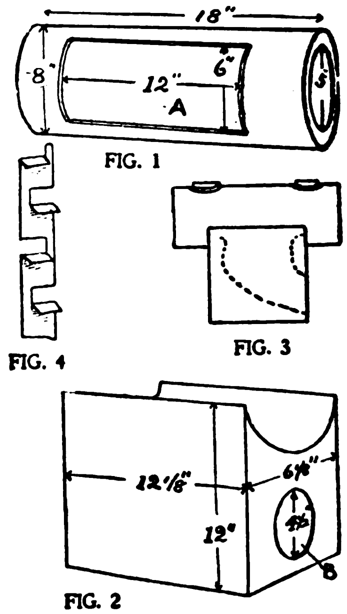
S. S. Dept.

More on Burning Out Carbon:—We are very much interested in the letter from one of your readers contained on page 372 of the November issue under the heading "Burning out carbon; a warning". As we manufacture carbon burning outfits and sell large quantities of them we are very much interested in a further discussion of this subject.

We have built up a reputation for selling our customers outfits and equipment which do good work and accomplish all that we claim for them. If your reader's statements are correct we would very seriously consider discontinuing the sale of this equipment, but we cannot believe that he is anywhere near the truth because there are thousands upon thousands of these equipments in use throughout the country not only in the up-to-date shops and garages, but in service stations maintained by the various automobile manufacturers. If there use was as detrimental to the car as your reader would lead you to believe it seems to us their use would have been discontinued long ago.

In discussing the subject we believe that it might be well to call attention to the chapter on the subject contained in M. Keith Dunham's book on "Automotive Welding with Oxy-acetylene Flame", page 148 in part reads as follows:

"Principle of Carbon Burning—The removal of carbon from the combustion head of automobile cylinders by the oxygen process is eminently practical, but its very simplicity many times leads to care-



A SIMPLE AND EASILY MADE MUFFLE FURNACE

lessness or misunderstanding which result the same as to poor welding jobs, in a condemnation of the process.

"Let it be said that the heat generated by the burning of the carbon is not greater than that in the combustion chamber when the motor is running—consequently THERE WILL BE NO DAMAGE TO THE VALVES, PISTON OR CYLINDER WALLS. It will remove all carbon from the chamber. It will not remove it from the cylinder walls; and if carbon is present here a new piston or a grinding of the cylinders, or both, is necessary; and the use of any carbon destroying method is impractical. THE PROCESS WILL NOT BURN SAND OR GRAPHITE and it will not regrind valves.

"It will be noted that oxygen alone is necessary for carbon burning. In the welding process, the acetylene is the fuel burnt by the oxygen, but in the oxygen carbon burning process THE CARBON IS THE FUEL, and it is necessary only to ignite it, and thereafter combustion is kept up, or to put it another way, the fire is kept burning by the oxygen."

The Bastian Blessing Company, Chicago.

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