Capt. Dorn

The 'AM

ARMY MOTORS

VOLUME I OCTOBER 15 1940 NUMBER 7

THE QUARTERMASTER MOTOR TRANSPORT SCHOOL
HOLABIRD QUARTERMASTER DEPOT
BALTIMORE MARYLAND

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Original Articles Are Welcomed.

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THE 'AM

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We're springing a new one on you in this month's 'AM. Whether it goes over or not depends, as does THE 'AM, on your approval and cooperation. It's a new section - a combined clearing house growl fest, listening post, gripe reliever and information bureau run on contest lines. You'll find the complete details on page 172. If it doesn't work we'll drop the whole thing, but we'd like to think that the monthly prize of a year's personal subscription to the man who sends us the best gripe, tip, question, or answer will keep the section booming.

Here's two more things you might like: We intend to publish a semi-annual index to THE 'AM so it will be easier for you to find some bit of information that you intended making a note of, but never did. It's a bit of a shock to the Editors to realize that THE 'AM has passed the half way mark of its first year of publication, but the work of preparing the index is balanced by the pleasure of knowing that your acceptance of THE 'AM has made the index necessary. We hope it will be in the mail with the next issue.

The other thing is the news that the series of texts on Army Motor Maintenance prepared at The Motor Transport School, Holabird Quartermaster Depot, has started rolling off the presses. A complete list of them is given on the last page with the information on who can order them and how. They are an attempt to bring Army Motor Maintenance up to date, and we feel sure you'll find them valuable instruction and reference material for official use.

THE LITTLE THINGS THAT COUNT

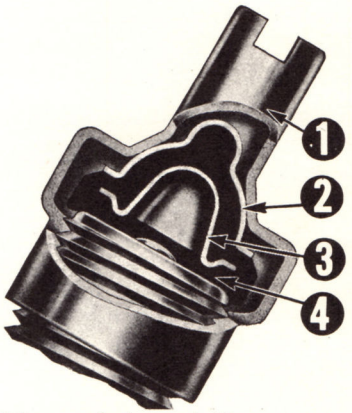
At first sight a tire looks like a fairly simple affair. You stick an inner tube into a casing, mount the two on a rim, pump the tube full of air to inflate the carcass, stick the whole thing on the end of an axle and ride along until you get a flat tire. At second sight, after you've dismounted a tire and torn it apart looking for a slow leak only to find that the leak was in the valve instead of the tube, a tire seems a more complicated arrangement, with a genius for going wrong at the worst time.

TIRE VALVE

The smallest thing on a tire, the valve, is perhaps the most important. Today the tire valve is actually an extension of the inner tube - really the most vital part of the tube because it contains the mechanism that controls the air. A good tube, without a valve, or with a poor valve, is useless. The casing or carcass of a tire protects the thin rubber that forms the tube from the wear and tear of road contact, snow, ice and other things that could damage it. But the most vital part of the tube, the part that sticks out of the rim, is unprotected by the casing, and damage to this exposed part can ruin a valuable tire and cause annoying and time wasting roadside delays.

VALVE CAP

No valve mechanism has ever been designed that won't eventually become damaged by foreign matter from within or without, and it's hard to find a dirtier place than the rim of a tire. Protection of some sort is essential to keep harmful dirt and muck out of the valve. The easiest, quickest and safest protection is the little valve cap that few people pay much attention to. Figure 1 gives a phantom view of this little



1. Valve cap body or shell.
2. Brass swivel plate allows cap shell to turn independently of rubber washer as cap is applied. This assures proper seating of washer and prevents distortion.
3. Brass dome-shaped plate provides chamber for safe clearance of valve core pin.
4. Molded rubber washer seals valve mouth when cap is screwed on firmly by hand. Rubber between brass plates 2 and 3 provides spring action to maintain positive seal.

FIGURE 1

cap that's so useful and important. After you inflate each tire, the tire valve cap should always be firmly screwed on with your fingers. The final twist seals the contact area between the cap washer and the valve mouth and anchors the cap securely in place. Even if the valve mechanism fails, the cap will keep the tire inflated and prevent a flat or a slow leak when you're rolling along in convoy.

OVERLOADS AND UNDERINFLATION

An overloaded vehicle with underinflated tires is like driving and drinking. They can only cause woe. The chart in Figure 2 proves that you can't get the maximum mileage built into a tire unless you maintain at all times the exact recommended air pressure.

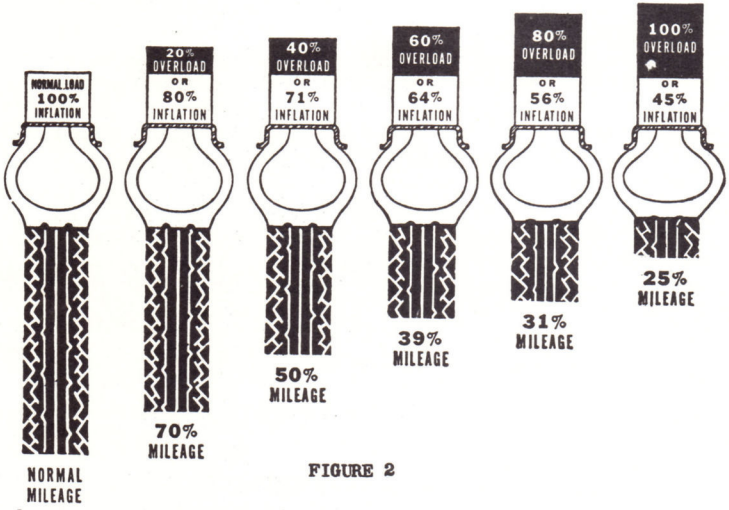


FIGURE 2

EQUALIZING LOADS FOR DUAL TIRES

The average profile of modern paved roads shows that they are crowned, and that the amount of curvature depends on the width of the pavement. Old roads usually have higher crowns than modern ones, and gravel and macadam roads generally have even higher ones. For the purpose of this discussion a crown of 2 inches for a road 20 feet wide was employed.

Crowned roads, Figure 3, cause inside tires to carry more than their share of the load, and consequently they cause excessive wear on both the inside and outside tires.

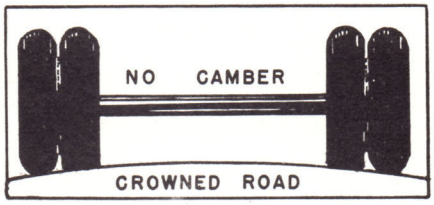
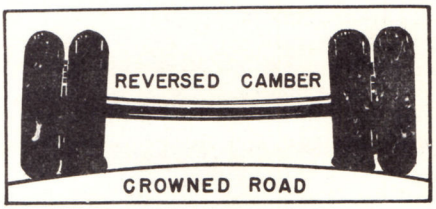


FIGURE 3

EFFECT OF REVERSED AXLE CAMBER

Since a vehicle load is suspended at two points on the axle, between the wheels, it causes reverse camber, or bends the middle of the axle downward; Figure 4. Consequently, the tire on

the inside of dual wheels will have a greater deflection and will have to support a correspondingly greater load than the outside tire. This unequal condition is greatly aggravated by excessive loads or sprung axles. A reverse camber may cause as much as 40 per cent more load on the inside than on the outside tires.



PROPER MATING OF DUAL TIRES

When it is not possible to use tires of the same make, tread design and with the same amount of wear, the overall diameters of the two tires should not vary by more than half an inch. A badly worn and a new tire should never be run together on the same dual wheel regardless of position. To do so may bring the entire load on the new tire. Slightly worn tires should always be placed on the inside of duals, and new tires on the outside.

WHEN HANDLING THINNER

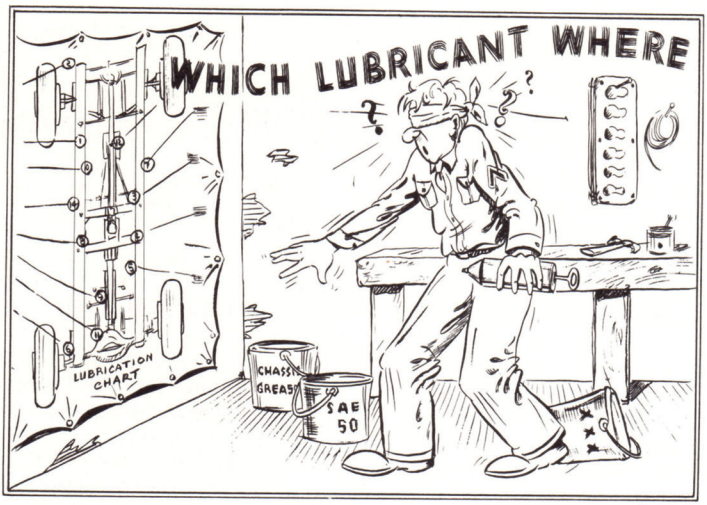
in the paint shop it is a good idea to remember that a severe jar has been known to explode it.

A QUICK WAY TO DETERMINE

whether the trouble is in the low speed jet of a carburetor, the next time you have an engine that runs roughly and unsteadily at low speeds, is to interchange the wires from No. 3 and No. 4 spark plugs, start the engine and race it for just a second. The resulting backfire will blow out any foreign matter and the engine will idle smoothly (if the trouble is in the slow speed jet). This is not a permanent cure because the foreign matter will still be in the carburetor but it is a short way to find the trouble.

IF YOU WANT TO FLIRT

with fire every day in the year isolate the paint spray corner from the rest of the shop by a canvas screen that allows little or no ventilation. If you want to keep the spray from floating through the air and settling on other vehicles, inclose the paint department in something a little more fireproof than canvas and be sure that it is properly ventilated, or disastrous explosions can result.



Back in the old days some grease smeared on an axle shaft with a convenient stick was called a pretty fair job of lubrication. Forty years ago there were about three types of lubricant used on motor vehicles: engine oil, cup grease, and steam cylinder oil, familiarly known as 600-W.

Many things have changed since then. The high speeds and greater bearing loads of today have called for better lubricants, each of them designed for a specific duty. Today's vehicles use as many as ten different lubricants.

Knowing "which lubricant where" is just as important as knowing the parts that need lubricating.

Putting the wrong lubricant in the right place at the right time is almost as bad these days as putting *no* lubricant in the right place at the right time.

Take gear lubricants for example: there was a time when the old 600-W was poured into transmissions, differentials and steering gears alike, with little thought as to whether it was suitable. Today, fluid gear lubricants are provided for ordinary service; extreme pressure (EP) where gear tooth pressures are above normal; and hypoid lubricants for hypoid rear axle gears and the transmissions of some overdrive units. Mixing two different types of these specialized gear lubricants is as bad as "mixing liquor with gasoline" and may cause as much damage.

High engine speeds, increased temperatures, closer clearances between bearing surfaces and the use of new materials in the construction of cylinder blocks, valves, pistons and bearings have made necessary an engine oil which will stand up to what is now considered ordinary, but what would have been considered extraordinary operating conditions in the old days.

Chassis lubricants, special lubricants for water pumps, universal joints, wheel bearings, steering gears and spring covers have all come into being to meet some particular lubricating requirement. Satisfactory vehicle operation demands that the right lubricants be used in the right places at the right time.

POINTS ON POINTS

When you lift the distributor cap of an 8 cylinder engine and look at the small points that make and break the primary circuit more than 60,000,000 times in a 5,000 mile run, it's easy to appreciate that the accurate operation of these points means the difference between good and bad performance, normal and poor fuel mileage, a smooth, snappy and a rough, sluggish engine, and quick get-away and lazy acceleration.

THE IGNITION DISTRIBUTOR

With its delicate mechanism stands between the battery - source of supply - and the spark plugs which fire the fuel charge in the engine cylinders. No matter how good the battery or the ignition coil and cables or the spark plugs, the sparks that bring life to the engine depend pretty much upon the breaker points. Points not only have to break the primary or battery circuit to produce the sparks, but they must do so at exactly the right time.

The distributor must be mechanically and electrically correct if the engine is to perform well and develop maximum power and flexibility at all speeds. A worn cam or bearing or a bent shaft can easily affect the accurate operation of this unit.

Breaker points are usually set with a feeler gauge to a specified opening, but it is just as important to know how long they remain closed. When they are closed, the ignition coil builds its magnetic field so it can induce a spark in the secondary circuit when the points open and the coil discharges.

DWELL OR CAM ANGLE

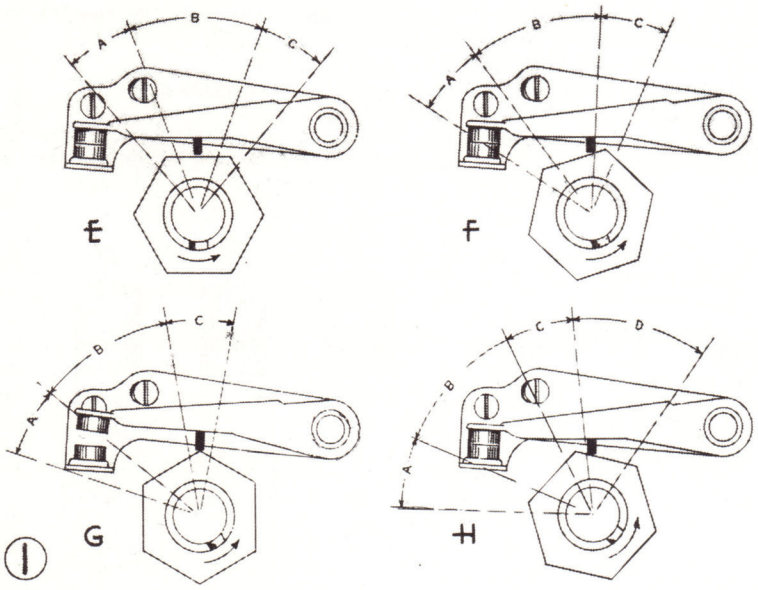
The distributor cam has several important functions. Its "dwell" or "cam angle" determines how long the points remain closed so the coil can become energized. The cam is also designed to open the breaker points at the speed required for proper action of the coil and condenser.

To adjust or set the breaker points something must be known about the operation of a distributor. Referring to Figure 1, it will be seen at "E", that the points are closed and that the fiber rubbing block is off the cam. If the cam is turned in the direction of the arrow it lifts the rubbing block so that the breaker points are about to open, "F". Revolving the cam further, "H", Figure 1, a spot is again reached where the breaker points are closed, and the cycle is repeated again.

In Figure 1, "A" and "C" are the angles through which the cams rotate to open the breaker points. The "dwell" or "cam angle" is the length of time in degrees of cam travel that the points are closed. It is represented by "B" and "D", in Figure 1.

RUBBING BLOCK WEAR

It is evident from Figure 1 that wear on the fiber rubbing block attached to the breaker arm will materially affect the opening and closing of the breaker points. Thus, if the rubbing block becomes shorter, due to wear, naturally the breaker points are not opened as quickly and the dwell or cam



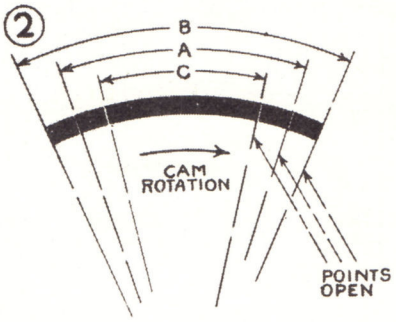
angle becomes longer. That is, the distance "B", Figure 1, becomes greater. And, by the same reasoning, distance "C", which represents the length of time the points are open, becomes less. Anything but the correct cam angle or point opening changes ignition considerably. Too much cam angle, or distance "B", Figure 1, is as bad as having too little.

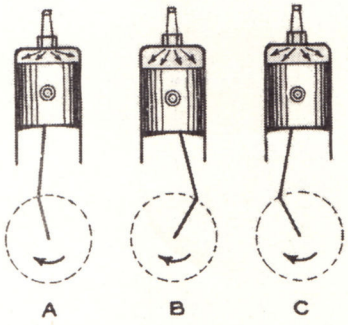
First of all, the correct point opening is necessary to give the coil and condenser enough time to completely discharge. They can't discharge if a worn rubbing block or distributor shaft has changed the point opening from, say 0.022 in., to 0.014 in. It must be understood that the breaker points are not open until the spark or flame "drag-out" across the points is "out". The points may have to open a few thousandths of an inch, which takes several degrees of cam travel, before this flame goes out. If the point opening has been reduced by wear, there is danger that the breaker points may actually become welded. With proper point opening, or correct cam angle, the coil and condenser action is normal.

POINT OPENING

But there is another thing to be said about proper point opening. If the cam angle is too long, that is, if the points are closed for too long a period, ignition is delayed. This is why even a new vehicle needs a little tuning after a few thousand miles. The rubbing block wears and ignition is delayed just enough to take a little of the original "zip" out of the engine. Why this is so will be understood from Figure 2. With the correct cam angle, "A", (assuming that the ignition timing is correct) the spark will take place at the right moment when the piston is just ahead of top dead center. If the cam angle is too great, "B", the points open too late and the piston already has

gone down on the power stroke. The engine is not as lively, of course. Should the point opening be too great, or the cam angle too small, "C", Figure 2, the spark takes place too early, and there is not enough time for the coil to become energized because the points have not been closed long enough.





CONTACT SURFACE

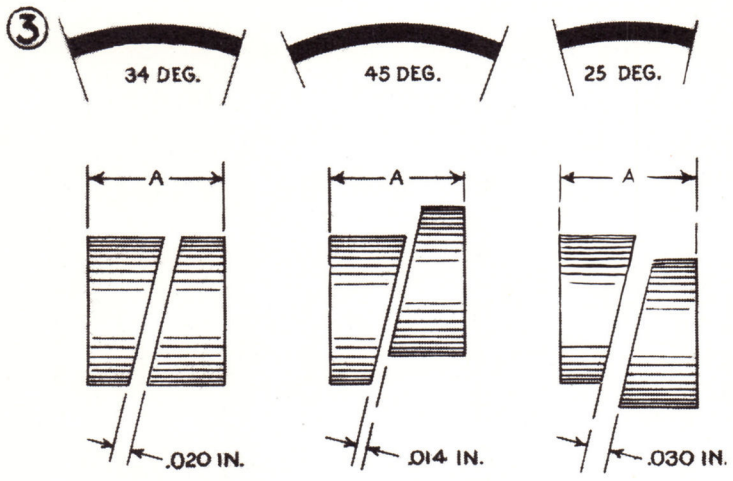
The way in which the breaker points come together has much to do with smooth engine performance and general behavior of the ignition system. Assume that the surface of the point is flat and at a slight angle to the axis of the points, as shown at the left in Figure 3. The points may open a distance, "A", which might be 0.020 in., or a cam angle of 34 deg. Now, suppose the breaker arm is bent or worn at its bearing so it is raised slightly in operation, as shown in the center illustration, Figure 3. Note that the opening has been reduced to 0.014 in. and the cam angle increased to 45 deg. Again, if the arm should drop, as shown in the right hand illustration, the point opening may go to 0.030 in. and the cam angle be reduced to 25 deg.

Unfortunately breaker points usually build up a hump on one point and crater on the other, as shown in Figure 4. This aggravates the conditions in Figure 3.

SETTING POINTS

A word about setting breaker points. If the shop has one of the several types of distributor test fixtures in which the complete unit is mounted and operated for conditions of wear, governor action, vacuum retard, cam angle, etc., much time is saved and the unit can be reconditioned for standard operating requirements very quickly.

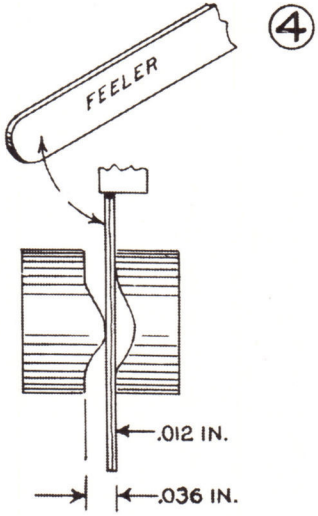
In the absence of such a test unit, the mechanic must use feelers for the breaker point opening. Flat feelers are not desirable for this because of the possible chance of error. We have seen that proper point opening plays a big part in obtaining correct cam angle. Assuming that the distributor shaft is not worn, that the cam is in good order, that the breaker points are new, and that there is proper spring tension on the points, etc., it is reasonable to believe that the cam angle will be sufficiently correct if the mechanic carefully adjusts the point opening with a feeler gauge.



However, note in Figure 4 that a flat feeler can indicate an incorrect point opening. The actual opening may be considerably greater than that indicated by the feeler. This is because of the hump or buildup on one of the points. It is better to use feelers made of round stock,

Always make sure that the breaker arm is free on its hinge pin and that the contact points line up properly. Always bend the stationary contact - never the breaker arm between the rubbing block and point. The rubbing block can be lined up squarely with the cam by inserting a piece of carbon paper and white paper between the rubbing block and cam. By turning the cam an impression is made on the white paper showing which way the arm must be bent between the hinge pin and rubbing block. It is not necessary to get an impression of the full face of the rubbing block - only one edge is enough.

This will be more readily understood by reference to Figure 1, which shows at "F", for example, that only one edge of the block is in contact with the cam surface.

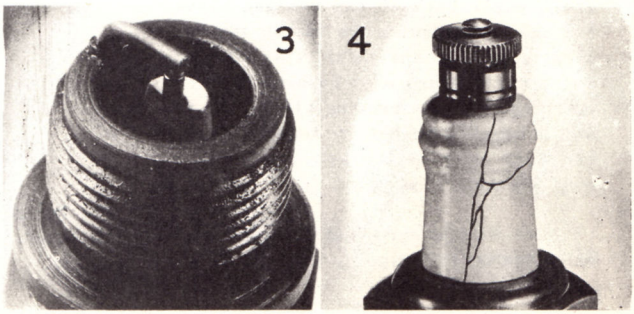


TROUBLE SHOOTING

SPARK PLUGS

THE ILLUSTRATIONS ON THESE PAGES COVER THE FOUR MAIN CAUSES OF SPARK PLUG FAILURES.

REGULAR SERVICING WILL GUARD AGAINST THESE CONDITIONS AND MAINTAIN SPARK PLUG EFFICIENCY.



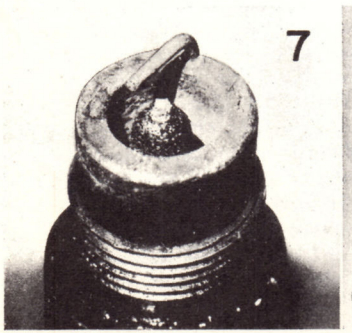
1 AND 2, DIRTY. Black carbon and colored or blistered deposits, typical of new car operation during the "running in" period. The oxide coating causes intermitent missing, especially at high speeds and on hard pulls. These plugs should be cleaned and continued in service.

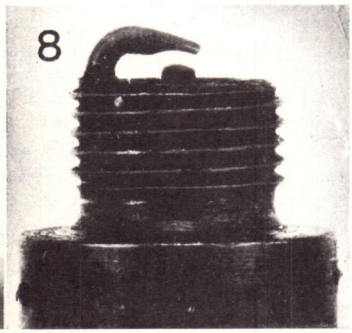
3 AND 4, BROKEN PORCELAIN. Caused by being struck with a wrench, usually a poorly fitting wrench when plugs are removed or installed. Illustration on the left shows the result of attempting to bend center electrode when adjusting point gap.

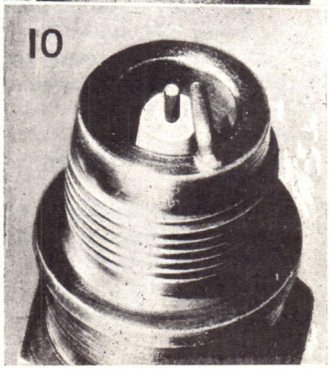
5 AND 6, WORN OUT. Plugs like these are not suitable for further service. While operating conditions govern the life of a spark plug, 10,000 miles is about the average.

7 AND 8, WRONG GAP. This can be caused either by normal wear or by using a plug of the wrong type for that engine, resulting in too rapid wear. Re-gapping and cleaning will restore usefulness.

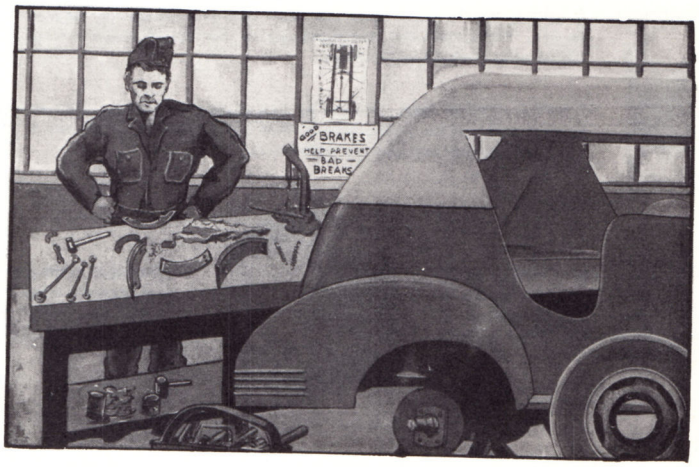
9 AND 10, CLEANING. Use a modern spark plug cleaner. The entire lower end of the insulator should be white if the plug is properly cleaned. Re-gap the firing points with a round wire gage, setting to recommended limits. Use new gaskets when reinstalling plugs. These "before and after" pictures tell the story of how to get the most out of your spark plugs.







USE YOUR HEAD -- ANALYZE BRAKE TROUBLES



When something out of the ordinary shows up in brake troubles, use your head before diagnosing it in the usual way. The remedies for ordinary brake troubles are usually self evident but you can waste a lot of time and a lot of effort on unusual jobs, doing them over several times before you finally strike the correct solution.

This article is going to try to give you the "dope" on unusual facts about brake operation which we hope will be valuable in solving some of the stickers that crop up in even the best regulated shop.

TIRE AND WHEEL ALIGNMENT

Badly misaligned tires must slip and a slipping tire will be the first to skid when brakes are applied. Faulty wheel alignment will cause unbalanced brake operation even though the brakes appear to be properly equalized on the tester. Improper toe-in can make an equalizing job fail. Diving, as well as shimmy or wandering can be caused by improper caster, due to front axle roll.

The kick shackles used on one end of one front spring on some passenger vehicles can cause variation in brake action between opposite wheels. When a kick pulls the vehicle to one side it may be remedied by giving less brake to the front and rear wheels on the same side as the kick shackle is located. If a tester is used it is advisable to give the front wheel on the side of the shackle 100 lbs. less than the other front wheel. On vehicles with hydraulic brakes the effect of the kick shackle can be decreased by limiting the spring flexing in a horizontal plane by, for example, increasing the rigidity of the spring. When a kick shackle allows an axle to shift too much the usual result

is diving or grabbing; weak springs cause the same result.

SPRINGS AND MOUNTINGS

Springs and their mountings can also effect dragging. An axle may shift or roll excessively when brakes are applied, because of a loose spring or axle supports. Unbalanced brakes, noise, grab, and on mechanical brakes, fading can be caused by loose U-bolts, spring clips and front ends.

Any looseness on mechanically operated brakes that permits the front axle to pull back, instead of the brakes being firmly applied, results in loss of pedal travel. At the rear end of a vehicle, loose radius rods or loose ball joints will allow the axle to pull forward, with the same result.

Shock absorbers are intended to work with the springs. If they are weak or loose they may cause dive, grab or noisy brakes. Weak shock absorbers on "knee action" units greatly influence brake application and are almost always noisy. Loose or incorrectly set knee action units are also noisy and can cause diving and grabbing.

WHEEL BEARINGS

Loose wheel bearings are responsible for a great deal of noise, dragging and pulling to one side. In making a brake adjustment the wheels should be clear of the floor so a test for dragging can be made after the adjustment is changed. Under this condition the only weight supported by the bearings is that of the wheel and the bearing clearance is at the bottom. However, when the vehicle is lowered the weight is supported by the bearings and the bearing clearance has shifted to the top. If correct braking is to be obtained the shoes must be centralized in the drums. Another source of noise and dragging is wear in the steering knuckle pivots (king pins) and bushings.

LINKAGE

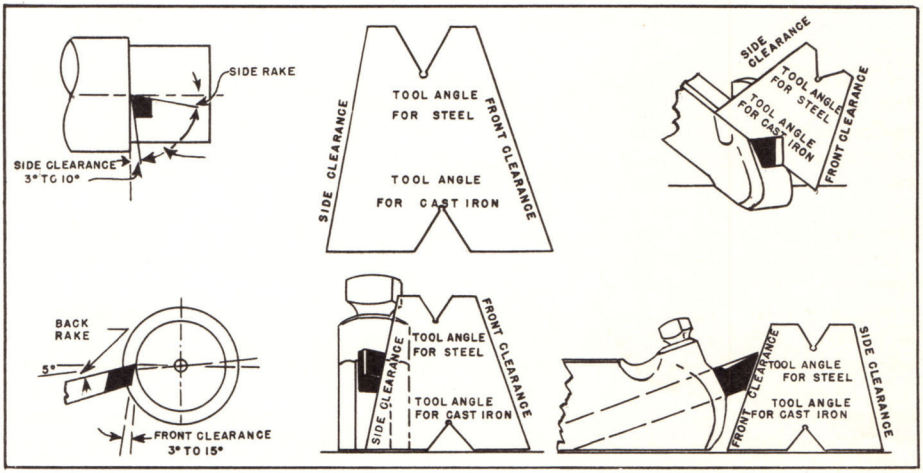
Just because mechanical brakes are erratic on application is not definite evidence that the brakes themselves are at fault. The linkage may be frozen, it may bind, or a cross shaft may twist or bend and upset the correct transfer of pedal movement for the brakes. If a cross shaft bends or twists under the strain of a hard pedal operation the full pedal pressure is not evenly transmitted to the brakes.

If the linkage is incorrectly set the brakes fail to hold. Loose conduit supports, stretched cables and kinked or bent rods result in fading brakes. Linkage that is too tight or cables that stick in the conduits cause dragging brakes. On hydraulic brakes a loosely mounted master cylinder will cause a low pedal.

Tires also have a great influence on brake application. An underinflated tire will lock more readily because the actual wheel diameter is less. A tire in poor condition will lock more easily than a tire in good condition. Poorly paired tire treads, on opposite wheels, cause diving and grabbing.

We are advising you to use your head on unusual brake jobs but it's not a bad idea to use your head all the time. Find the mechanic who does the unusual and you have a Thinker - the one who places his head in action first and saves his head and hands a lot of work.

SHARPENING LATHE TOOLS



As a carry-over from "Selecting and Using A Lathe" in the last issue of THE 'AM, here is some dope on sharpening tools for the lathe you may or may not have learned to operate in the meantime:

In order that the cutter bit or lathe tool may cut freely it must be ground with the correct side clearance, front clearance, side rake and back rake. These angles are shown in the illustrations.

SIDE CLEARANCE

is ground on the side of the cutter bit to permit the cutting edge to advance freely without having the heel of the tool rubbing against the work. Figure 1. The amount of side clearance varies from 3 degrees to 10 degrees depending on the amount of feed used and the nature of the work.

FRONT CLEARANCE

is ground on the end of the cutter bit to permit the cutting edge to cut freely as it is fed to the work. Figure 2. The amount of front clearance varies from 3 degrees to 15 degrees depending on the nature of the work and the height of the cutter bit.

BACK RAKE

is cut on the top of the cutter bit, as shown in Figure 2, to facilitate free cutting.

TOOL ANGLE

is the included angle of the cutting edge which is formed by the top and side of the cutter bit, as shown in Figure 1. When turning soft steel the tool angle should be about 61 degrees. For hard steel and cast iron the tool angle should be 71 degrees. For chilled cast iron the tool angle may be as great as 85 degrees.

When grinding a tool or checking the angles a guage can easily be made from heavy gauge sheet iron, Figure 3.

MASS MAINTENANCE

The Sanitation Department of New York city operates 3,677 pieces of motor equipment kept in 59 different garages scattered throughout the city. The equipment consists of hundreds of 10 ton collection trucks and 3,500-gallon flushers, several dozen delivery trucks, huge snow loaders, snow sweepers, sand spreaders, 153 passenger cars, 7 draglines, 4 tractor wagons and 37 tractor bulldozers. Keeping this varied assortment of equipment running year in and year out at a cost of $140 per vehicle per year requires special methods and considerable ingenuity. The short hauls are largely stop and go, over the city streets, up and down incinerator ramps and through heavy landfills.

Some of the maintenance and repair methods are extremely interesting, one of the most interesting being the test bench for starters.

TEST BENCH FOR STARTERS

It has been found that reconditioned starters, though developing the required foot-pounds on the usual testers, sometimes fail after they have been put back on trucks. The foreman of the electrical shop figured out a test that licks the problem. Available devices for making a lock test consisted of measuring the no-load r.p.m. and the foot-pounds on a lock torque test. Making the test was awkward on some starters and always undependable. The machine built by the shop reverses the process by applying a fixed load to the starter and then measuring the amperage and the r.p.m.

Inverted in the bench is a Model A Ford block with flywheel to the left. Brackets hold the starter in such a position that its pinion gear will engage the flywheel teeth. The panel above the bench carries a tachometer dial, ammeter, and voltmeter, together with a chart showing the required ampere draw and r.p.m. under various loads.

At the right side of the bench, a drum has been splined to the crankshaft. To this the load can be applied by a hand-actuated brake band. Since the load in actual service varies according to the number of flywheel teeth, provision is made for varying the test load. This is done with a weighted lever behind the bench. The lever is graduated according to the num er of teeth on the flywheel the starter will have to turn in service. Shifting the weight to the proper notch places on the starter exactly the right load.

With this bench, manufacturers' specifications can be followed to the letter. If the starter has any secret weakness, the test quickly wrings a confession from it. A poorly soldered armature, for example, is shown up within a few seconds. Any starter that withstands the test can be depended upon to stand up on a truck.

The shop will soon place in use a greatly refined model of the device. The brake is hydraulic instead of manual, and the weighted lever is supplanted by a sliding bar, operated by a knurled knob. The new machine will be able to handle starters of various pitches, and the load developed will range up to 80 lbs.

Engines that have been overhauled must meet an equally severe test. Every one is run in for eight hours on a test stand and must prove on the dynamometer that all its horses have been restored. In connection with the motor stands, the shop uses a portable starter. The frame is caster mounted, and can be wheeled from one stand to another or pushed into a corner when not in use. In it, an air motor is mounted on a platform that can be raised or lowered according to the position of the crankshaft in various truck engines.

CRACKED WATER JACKETS

In repairing cracked water jackets, the shop has developed a somewhat radical method. It has a corps of expert gas and arc welders and, like most shops, it used to leave cracked blocks up to the latter. For some of its salvaging efforts, it employed a metal sprayer, and the idea occurred to the chief of repair, that the method might work on blocks. As an experiment, the surfaces of a crack were roughened in a sand blast and soft iron sprayed into it. Water was then forced through the block under 36 lb. pressure. The new metal held. Today all such cracks are repaired with sprayed metal and failures are unknown.

The initial cost of sprayer is high, but it does a faster job than welding on the blocks and therefore a cheaper one. The sprayer has also been used to build up worn pump shafts which are then machined to size.

RECONDITIONING CLUTCHES

Driven plates in certain clutches are still reconditioned because more adjustment is possible with reconditioned plates than with new ones. The methods used depart from standard practice.

First an acetylene welder builds up the pressure ring with bronze to perhaps 1/4 in. The plate then goes to the machine shop where the new metal is cut down to the desired height. Instead of being ground, the face of the plate is then cut with a carboloy tool. Usually, .020 in. of metal is removed in one cut. The carboloy tool will dress 19 to 15 plates before it needs touching up, and has a total life of around 1,000 plates. The reconditioned plate is 0.60 in. oversize, which permits nine shims to be used instead of the original five, thus increasing the possible adjustment by 80 per cent.

TIRE REPAIR

Two ingenious machines of original design are found in the tire repair department. The tube patch vulcanizer is a model of simplicity and nice control; the machine that slips the truck casings off the rims accomplishes in seconds a job that once took back breaking minutes of sledge hammering.

Ten tubes can be handled simultaneously by the vulcanizer. The device is simply a rectangular frame of steel I-beams, with eight miniature presses around its perimeter. Temperature of the upper heated plate is kept constant at 287 deg. Fahr. by a rheostat. The cylinders are hydraulic jacks salvaged from old snow plows, altered to operate by air.

For ingenuity, the machine that pushes the big tires off their rims probably takes front rank. Extending from one side of it are 8 slightly curved steel fingers, arranged in a circle like a monstrous clutching hand. Cams, which are operated by a lever, tilt the fingers to contract or expand the circle formed by their free ends. At the other side is a horizontal hydraulic ram, on which adapters for various sizes of rims may be placed.

A tire that is to be dismounted is

rolled into the machine. The grippers are expanded and slid over the flange of the rim and then tightened. The ram, with five tons of "oomph" behind it, noses up against the rim, and the tire comes off as easily and as quickly as the peel comes off a banana. Both fingers and ram can be adjusted vertically to compensate for tire wear. The department's sledge hammers are gathering dust in a corner.

The water tank used to test tubes for leaks also uses a ram to push the bigger tubes under water. This ram, placed vertically over the tank, is operated by air and exerts a ton of pressure. At its lower end is a three-legged spider.

CYLINDER HEADS

Production line methods are applied in a striking manner to reconditioning overhead valve cylinder heads in the engine shop. This is an actual line and operations follow one another with clockwork precision as the head moves along.

The first man to get the head removes the rocker arms, springs and valves and passes the valves along to the refacing machine. Next the head is submerged in hot water to loosen carbon. The head then goes to the line, which consists of two parallel I-beams.

Here the first operations are brushing out the carbon and cleaning the water passages. Next the valve seats are ground, and the head is slid along to the next position. Valves have been refaced in the meantime. At the final stage, the reconditioned valves, with new springs, go back in the head, along with the rocker arms. The head is ready to rejoin the block. The line is the equivalent of seven separated benches.

TOE-IN ON 950x6 WHITES

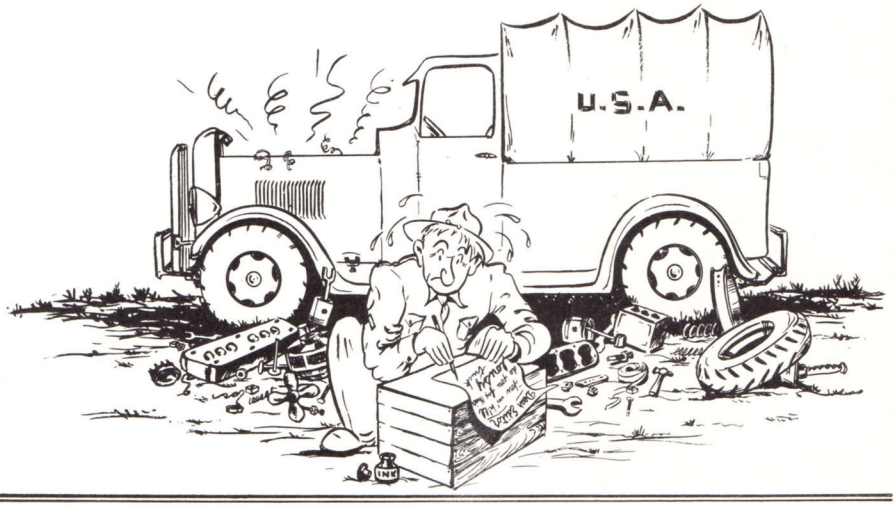
An approximate toe-in adjustment can be made by disconnecting a yoke and turning it not less than one complete turn in or out on the tie rod. For a finer adjustment, however, because of the construction of the axle, it is necessary to give the tie rod a complete turn. The tie rod has right hand threads of a different pitch on each end. A fine toe-in adjustment can be made by disconnecting one end of the rod at the pin end of the yoke; and loosening the binder bolts at each end. Then hold the yokes rigid and give the tie rod a complete turn. Turning in on the coarse thread and out on the fine decreases the toe-in and vice versa.

WHEN INSTALLING

or regulating a horn, adjust the horn in a horizontal position to get an accurate adjustment and operation. It's a good idea to keep a horn tightly bolted or it'll shake to pieces when the going is rough.

ON ALIGNMENT TROUBLES

remember this: Shimmy below 35 usually indicates too much caster; over 35: unbalanced wheels, or too flexible springs. Sometimes the installation of an extra spring leaf will effect a cure.



THE "GAS" ANALYZER

D'you have any ideas or arguments on Army Motor operations, maintenance or supply? If they're good ones it's worth a year's subscription to THE 'AM to let us have them. Here's the dope:

This month we're asking for ideas on the tool equipment for the 1st and 2nd Echelons. Maybe you don't like all the equipment authorized by the Tables of Allowances - maybe it's not sufficient for the work generally thrown at you in the field; maybe it contains too many tools of the wrong kind; perhaps you have some pet tool you'd like to see included because it's really good; or perhaps the tools are unsuited for the vehicles now being supplied. Give us an argument for, or against; we'll do the judging and publish the winning argument, sending a year's subscription to the writer.

Maybe you're not good at arguing, but you might have ideas that would work up into a swell story. Let's have them. Blow steam on anything from the echelons of maintenance to the rear ends of "Anybody's" trucks, from lubricating oil to windshield wipers, from "bugs" in the carburetor to squeals in the brakes. If the idea's a good one we'll work it up into a question, publish it and send you a year's subscription.

Maybe you're not good at either arguing or starting arguments. All right, here's another angle for you. Say you've run across a puzzler that you can't lick. Send it to us; and if we think it's good we'll publish it, give you a year's subscription, and the writer of the best solution will also get a subscription.

On the other hand, maybe you're so good that you can't be licked. O. K., send us details of a tough one you've

cracked and we'll see if the rest of the readers can lick it.

In other words, this is a free for all covering every phase of Army Motor operations, supply or maintenance. You do the arguing and collect THE 'AMS we give based on our judgment. If you need a picture to illustrate your idea, send us a rough sketch and our artists will do it proud.

Here is the first argument of the series:

QUESTION NO. 1, OCTOBER 15, 1940.

The tools authorized for the First and Second Echelons of Maintenance by the Tables of Basic Allowances. What do you think of them? What's wrong with them? What's right with them?

RULES

1. In order to allow time for correspondence from outside the mainland of the United States, the first contest will close January 1st, 1941, and the results, with the winning answers, will be published in THE 'AM for January 15, 1941.

2. The decision of the Editors will be final.

3. No replies will be acknowledged or returned.

4. Replies will be held confidential and published under a pen name if desired.

MIXING ANTI-FREEZE SOLUTION

After putting anti-freeze in a cooling system and before driving the car, always run the engine until it warms up, opens the thermostat, and starts circulation between the engine and the radiator.

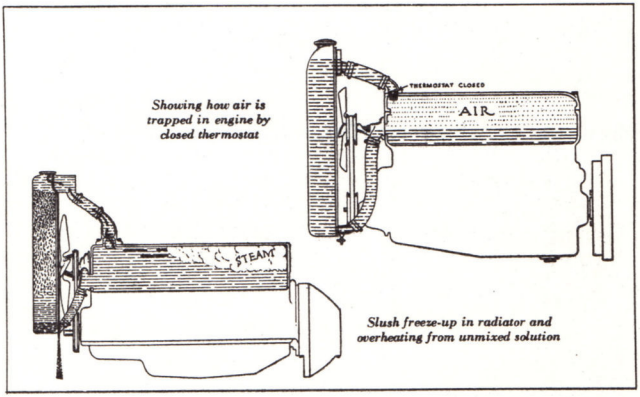
This is necessary to thoroughly mix the anti-freeze with the water before exposing the car to freezing temperatures, otherwise the unmixed liquid in the radiator may form a slush which stops circulation and causes overheating and loss of solution.

Another important reason for warming up the engine before driving the car is to release any air trapped in the engine water jacket by the closed thermostat. Though the radiator may appear to be full, the engine may be short as much as a gallon of solution, and if the car is driven in this condition serious overheating may result.

When the thermostat opens, the trapped air is released and the water jacket fills. This lowers the solution in the radiator and more water may be added to fill to the proper level.

The hot water heater should be vented to release any air trapped in it.

These precautions should also be observed when solution is found very low and whenever the system is drained.



Showing how air is trapped in engine by closed thermostat

Slush freeze-up in radiator and overheating from unmixed solution

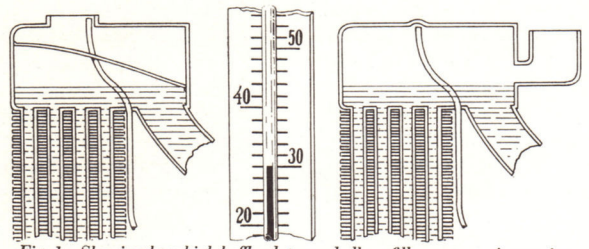


Fig. 1—Showing how high baffle plates and elbow fillers prevent inspection of solution level in radiator when solution is cold.

LOSS OF SOLUTION

To prevent loss of solution from expansion, first be sure that the engine is warmed up to normal operating temperature, then with the engine stopped, check the solution level, and never add any water as long as the solution can be seen in the radiator and the level is above the top of the water tubes. Never check the solution level when the engine is cold.

About 3 per cent of all anti-freeze complaints are caused by adding water to the radiator when it is not needed. In many cars you cannot see very deeply into the radiator, due to high baffle plates or "elbow" pipe filler necks.

If you check the solution when it is cold, you may not be able to see it and may think it is low when it really is not, Figure 1. Anti-freeze, as well as water, expands when heated and takes up

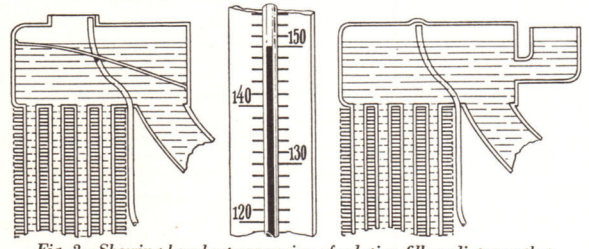


Fig. 2—Showing how heat expansion of solution fills radiator so that solution can be seen above baffle plate and in elbow filler.

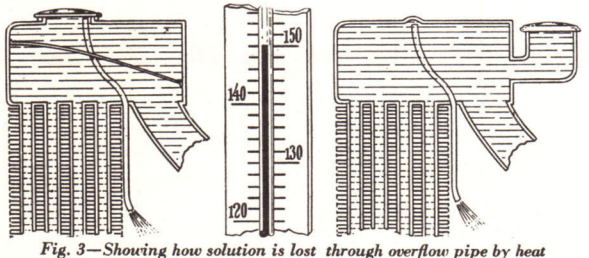


Fig. 3—Showing how solution is lost through overflow pipe by heat expansion when too much water is added with solution cold.

more room. This raises the solution level in the radiator to where it may be seen over the top of the baffle plates or in the filler neck, Figure 2. In the case of "elbow" type filler necks it is well to keep the solution level just in sight with the engine warmed up to normal operating temperature.

Expansion, when the solution warms up, may be as much as a quart or more, and the only place it can go is into the top tank of the radiator. Some top tanks hold only a few quarts. Therefore, if too much water is added when the solution is cold, the expansion when hot may overfill the radiator and solution will be lost out the overflow pipe, Figure 3. Then when you add more water the solution is weakened and further additions may lead to a freeze-up later on.

NOTICE TO SUBSCRIBERS

THE EXPANSION PROGRAM OF THE ARMY HAS COMPLICATED THE PREPARATION OF AN ADEQUATE 'AM MAILING LIST. IT WILL BE OF GREAT ASSISTANCE IF THOSE RESPONSIBLE FOR MOTOR MAINTENANCE ACTIVITIES WILL HELP US BY MAILING THEIR REQUESTS FOR COPIES IN ACCORDANCE WITH THE SUGGESTED OUTLINE BELOW. ONLY OFFICIAL REQUESTS WILL BE CONSIDERED, AND WE CANNOT GUARANTEE THAT ALL OF THESE WILL BE FILLED, BUT WE WILL DO OUR BEST.

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DIGESTS - AND COMMENTS - OF CURRENT TECHNICAL MAGAZINES

"AUTOMOBILE DIGEST"
September 1940

"Plain Facts About Modern Gasoline". It might be worthwhile to read this article and learn something about the fuel that makes the wheels go 'round.

"A Tune-up On The Dynamometer". The dynamometer is not a substitute for the various operations required in obtaining a complete tune-up, but it does make these operations more effective by making them more accurate.

"High-lights Of Magneto Service". For a while it seemed as though magnetos would soon be a thing of the past like clincher tires and permanent hand cranks, but they are coming back into the picture wherever extreme reliability is desired, as it is on airplane engines. You never can tell what's coming next so it wouldn't do any harm to brush up on the fundamentals.

"Servicing Hydraulic Valve Lifters". What to do about noisy hydraulic lifters, weak valve lifter plunger springs, pitting and scoring, etc.

"Facts About Valve Guides". Some years ago few people worried about the fact that valves had guides. The old cars were noisy, but with a modern silent engine noisy guides have become a definite nuisance.

"Stabilizer Bars And How To Adjust Them". The stabilizer bar is intended to prevent body roll. In order to operate correctly, certain conditions have to be "just so".

"Alignment Problems In Unit Body Construction". The modern steel body is of welded construction. When alignment is necessary, due to accidents, straightening requires a somewhat different procedure than that used on the older types. It is necessary to take into consideration both chassis and body alignment.

"Wheel Alignment For 1940 Trucks". Specifications and characteristics to consider when servicing the front ends of trucks.

"Shop Kinks". Some kinks on shavings in a gas line; mysterious knocks; and an easy method of removing crank shaft bearings.

"AUTOMOTIVE INDUSTRIES"
September 15, 1940

"A Hydraulic Transmission Differential". A hydraulic transmission differential designed to overcome such defects of an ordinary gear

ACKNOWLEDGEMENTS

THE EDITORS WISH TO THANK THE FOLLOWING PUBLISHERS FOR THEIR COURTESY IN ALLOWING *"THE 'AM"* TO MAKE USE OF ARTICLES AND ILLUSTRATIONS FROM THEIR PUBLICATIONS.

THERE WERE NECESSARILY MANY ARTICLES THAT COULD NOT BE USED, BUT IT IS HOPED THAT THOSE PUBLISHED HERE WILL STIMULATE INTEREST IN THE SOURCE MATERIAL.

"Which Lubricant Where?", page 159, was based on "What Lubricant Where?"--MOTOR AGE, September 1940. The Chilton Co., Inc., Chestnut and 56th Streets, Philadelphia, Pennsylvania.
Subscription - $2.00 per year.

"Points On Points", page 160, was based on "How To Set Breaker Points", by B.M. Ikert - MOTOR AGE, January 1940. The Chilton Co., Inc., Chestnut and 56th Streets, Philadelphia, Pennsylvania.
Subscription - $2.00 per year.

"Spark Plugs", page 164, was taken from "Spark Plugs"--MOTOR AGE, August 1940. The Chilton Co., Inc., Chestnut and 56th Streets, Philadelphia, Pennsylvania.
Subscription - $2.00 per year.

"Use Your Head - Analyze Brake Troubles", page 166, was based on "Use Your Head - Analyze Brake Troubles", by W. F. Nottingham--AUTOMOBILE DIGEST, August 1940. Automobile Digest Publishing Company, 22 E. 12th Street, Cincinnati, Ohio.
Subscription - $2.00 per year.

"Sharpening Lathe Tools", page 168. was based on "Sharpening Lathe Tools" -- MOTOR AGE, September 1940. The Chilton Co., Inc., Chestnut and 56th Streets, Philadelphia, Pennsylvania.
Subscription - $2.00 per year.

"Mass Maintenance", page 169, was based on "Mass Maintenance", by J. E. Ford -- COMMERCIAL CAR JOURNAL, August 1940. The Chilton Co., Inc., Chestnut and 56th Streets, Philadelphia, Pennsylvania.
Subscription - $3.00 per year.

The Cooling Tips under Help, page 174, were based on articles in THE EVERREADY MANUAL, The National Carbon Company, Inc., New York, New York.

MOTOR TRANSPORT SCHOOL TEXTS

One set of the following texts will be supplied upon official request to the Editor, THE 'AM, Motor transport school, Holabird Quartermaster Depot, Baltimore, Maryland. Requests for additional texts or sets of texts must be approved by the Quartermaster General, Washington, D. C.

NEW TEXTS

THE MOTOR VEHICLE - 1 - (Automotive Nomenclature - Terminology - Military Motor Vehicles - Vehicle Units and Assemblies).

THE INTERNAL COMBUSTION ENGINE - 2 - (Principles of Operation - Types - Parts and their Functions, including Engine Lubrication and Cooling).

FUELS AND CARBURETION - 3 - (Gasoline Engine Fuels - Fuel Systems - Carburetion - Superchargers - Manifolds - Exhaust Systems).

AUTOMOTIVE ELECTRICITY - 4 - (Principles of Electricity and Magnetism - Storage Battery - Battery Ignition - Magneto Ignition - Starter, and Generator - Lighting System - Horn - Electrical Accessories).

AUTOMOTIVE BRAKES - 7 - (Mechanical - Hydraulic - Air - Electric - Power).

THE MOTORCYCLE - 9 - (Employment - Nomenclature - Operations - Inspection - Maintenance).

LUBRICATION - 10 - (Principles and Practices).

INSPECTION - 11 - (Command, Preventive and Technical).

MILITARY MOTOR TRANSPORTATION - 16 - (Principles of Operation).

TEXTS UNDERGOING REVISION

Of Which Old Copies Will Be Supplied.

AUTOMOTIVE POWER TRANSMISSION UNITS - 5 - (Clutch - Transmission- Transmission Driven Accessories (Winches - Hoists - Special Power Take-off Equipment) Auxiliary Transmissions - Transfer Mechanism - Propeller Shaft - Universal Joint - Final Drive - Differential - Methods of Drive - Chain - Hotchkiss and Torque Tube).

CHASSIS, BODY AND TRAILER UNITS - 6 - (Frames - Springs - Shock Absorbers - Steering Gear - Axles - Wheels - Tires - Bodies and Cabs - Trailer Hook-ups).

HAND, PRECISION AND POWER TOOIS - 12 - (Individual Mechanic's Tool Set - Unit Tool Sets - Power Tool Equipment).

TUNE-UP AND ADJUSTMENT (1st and 2nd Echelon) - 13 - (Trouble Shooting).

ECHELON SYSTEM OF MAINTENANCE - 15 - (Principles - Organization - Methods).

THE BLACKSMITH AND THE WELDER - 17 -

T HE RADIATOR REPAIRER AND THE SHEET METAL WORKER - 18 -

THE MACHINIST - 19 -

THE BODY FINISHER - 20 - (The Woodworker - The Upholsterer - The Painter).

ELEMENTARY PHYSICS, MECHANICS AND METALLURGY - 21 - (Gases - Pressures - Hydraulics - Shop Arithmetic - Simple Machines - Metals).