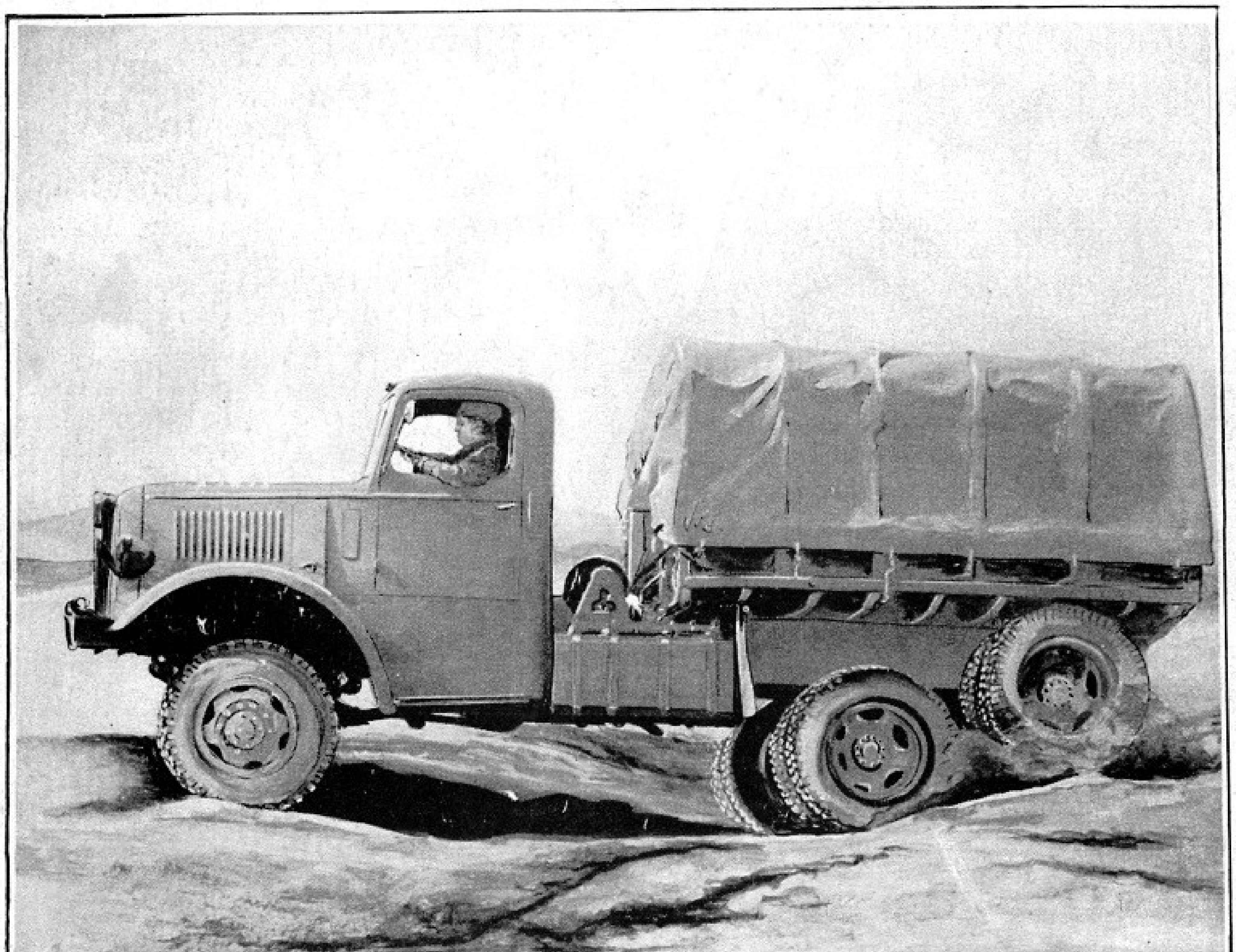
THE 'AM
(ARMY MOTORS)



THE QUARTERMASTER MOTOR TRANSPORT SCHOOL
HOLABIRD QUARTERMASTER DEPOT
BALTIMORE MARYLAND

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Original articles are welcomed.

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THE 'AM

VOLUME 1 May 15, 1940 NUMBER 2

Perhaps the most gratifying comment we have had on the first issue of THE 'AM was a letter from an officer in the Reserve Corps offering to pay for a year's subscription. We were pleased, justifiably we think, that THE 'AM had proved of sufficient value to warrant paying for it. However, the gratification was tinged with annoyance that we hadn't made it absolutely clear that THE 'AM is distributed entirely without charge to the arms and services engaged in motor maintenance and operation.

At the moment THE 'AM cannot be mailed to individuals, but efforts have been made to place all motorized military organizations on our mailing list. If through oversight some organization has been neglected, future copies will be mailed on request.

The fact that THE 'AM is issued without charge to those concerned with vehicle operation and maintenance will not, we hope, suggest the old proverb, "Easy come - Easy go". We trust that THE 'AM is proving of concrete value by containing at least one helpful suggestion or tip in each issue for each reader. If it doesn't - you know what to do: Tell us.

You will notice a new department in this issue: "Digests - And Comments - Of Current Technical Magazines". This department is intended to keep the 'ams in touch with the latest developments in motor maintenance by covering some of the more important of the many articles we find impossible to republish.

SO YOU SEE, PRIVATE JONES

Private Jones was rolling one of the latest trucks down the highway. "Nice buggies these new ones", he thought, "the front driving axle seems to keep them moving along right smartly. They don't seem to sway so much either, must be built a bit closer to the road. The Army going streamlined, eh? Not a bad idea at all - had to use a ladder to climb into some of those old babies".

The rest of the convoy was stretching ahead, and as he glanced back now and again he saw the maintenance truck swinging around the curves behind him. Whoa! Something going wrong up ahead - he could see the vehicles gradually bunching up like a closing accordian as they slowed down and stopped. Some kind of a parley was going on up front by the looks of things; after a few minutes the convoy started snaking ahead again slowly. As Jones drove up to the halting place he saw the rest of the convoy swinging sharply to the right, off the highway. Jones was waved on by a guide who shouted, "Detour - take it easy - bad goin'!" as he passed him. "Good enough", thought Jones, "we will see what this baby can do when the goin' gets tough".

It got tough so rapidly that Jones stopped complaining about other people's business and concentrated on his own business of keeping the truck in the middle of the heaving gumbo track that was worse than a cross country trail. Whoomp! down she went into a hole that probably had been a bump when the first truck hit it but that felt like a shell crater now. Uuhn! she stuck. The air in the cab got hot as Jones gave his opinion of the truck manufacturer.........."Why in 'ell don't they lift these buggies another four inches......you'd think they was making baby carriages instead of Army trucks......they belly down and stick in the mud like a turtle.........with nineteen million bucks to spend you'd think they'd do something about this..................."

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Nineteen million bucks is right, Jones, but even with that pile of dough you can't walk into a truck dealer, plunk down your money and walk out with a $7\frac{1}{2}$ ton (6 x 6) prime mover for anti-aircraft artillery. Even ordinary commercial trucks are not produced and sold like passenger cars; that is, there is no one particular model regularly produced and stocked by a manufacturer or his dealer. Trucks are assembled "tailor made fashion" to meet the purchasers' needs as to type of body, length of chassis, combinations of transmissions and axles and even types of engines. Besides these usual commercial variations, the Army requires still further deviation from standard commercial chassis in such major features as bodies, all-wheel driving axles and dual rear axles for six-wheel vehicles.

Before the Army can even start thinking of issuing invitations for bids on new vehicles, it has to decide what kind of vehicle it wants. Sounds easy, eh? Just sit down and order a truck like a new pair of pants. Well, it isn't, Jones - not at all. The using arms and services, the Quartermaster Corps and the manufacturer must cooperate in drawing specifications for vehicles that are not only satisfactory to all concerned, but that can be produced economically. That is as difficult as dividing two doughnuts between three hungry kids. For example, the Cavalry might desire a $2\frac{1}{2}$ ton cargo truck with a top road speed in high gear of forty-five miles per hour, whereas the Field Artillery might want the same general type of vehicle with a top road speed of only thirty-five miles per hour and with a proportionately greater pulling power; or several using arms and services might be satisfied with a certain type of vehicle but one of them might require a special wheel spacing to permit the use of traction devices which are of no particular value to the other users. A compromise between these conflicting desires must be found before a vehicle acceptable to all can be produced.

With the nineteen million dollars that Jones was complaining about, the Army is purchasing approximately 16,000 vehicles of 32 different types. The specifications in the invitations for bids covering each type of vehicle or unit average twenty-five pages, and each page contains about 10 items or a total of approximately 2,500 items in each invitation.

If the specifications call for any basic changes in chassis design, the manufacturer, after the complete engineering layouts have been made on paper, must build a hand made model of the proposed vehicle. These models cost about $80,000 each, and not infrequently several models must be made before a satisfactory vehicle is obtained. If the design seems satisfactory, it costs the manufacturer anywhere from half a million to a million and a half dollars to make the necessary changes in the factory equipment, tools, dies, jigs, etc., in order to roll the vehicle off the delivery line by mass production methods.

However, before production starts on a vehicle the manufacturer must submit a pilot test model to the Engineering Department at the Holabird Quartermaster Depot. The pilot model is put through a 4,000 mile test that practically amounts to rolling it down the Grand Canyon. Every night when it returns from being run over a washboard road of concrete slabs, or through mud holes, or up hills, the Engineers give it a careful examination, testing and inspecting all the units and assemblies for fractures, leaks, broken parts or similar failures. If anything has gone wrong, the engineers from the manufacturer are called in and they, with the Army Motor Engineers, go over the specifications to correct the fault. After the corrections have been made, and these may run from a weak fuel line connection to complete change in an axle assembly, the pilot model continues under test until the engineers are satisfied that it will perform according to specifications. Not until then does that particular type of vehicle go into production.

So you see, Private Jones, what's involved when you ask to have a truck lifted four inches further off the ground so you can get it out of a mud hole.

RUBBER CYLINDERS

Did you ever buy one of those little rubber faces they sell in novelty stores; the kind that sticks out its tongue at you when you squeeze it?

Well, that is just about what a cylinder head tries to do when you tighten the bolts without taking care that the pressure is even all the way around. The distortion is not as great as that of the little rubber face, but it is there just the same, and the job may "stick out its tongue" at you when new piston rings or newly seated valves fail to hold compression.

A popular exhibit at industrial fairs is a delicate instrument that measures the "bend" in a heavy steel rail. By pushing down on the rail with your hand you can make the needle of the instrument move slightly as it measures the mechanical distortion. If you allow the heat of your hand to warm the top of the rail it will rise slightly and deflect the indicator needle as it measures the distortion caused by the heat.

This shows how easily metal can be distorted. If a mechanic with a lot of "beef" in his biceps tries to tighten cylinder head bolts without using a torque or "tension" indicating wrench, the results may not be perceptible to the eye, but they will be disastrous to the engine.

Accuracy in tightening studs and nuts with equal tension on cylinder heads, spark plugs, main and connecting rod bearings, brake drums, etc., is a definite maintenance requirement on modern motor vehicles.

Distortion has been aggravated in modern engine design by the creation of lighter blocks of tougher metal, lighter reciprocating parts, higher speeds, higher operating temperatures, closer fits, higher standards of performance and more critical adjustments. In former years, little or nothing was heard of distortion, not wholly because it was not considered by engineers, but because there was less of it, and because its effect was obscured in the early automobile by the hundred of other directly traceable causes of engine failures.

Now, however, performance has reached such high standards that even slight inaccuracies in adjustments, clearances and tolerances greatly detract from engine efficiency.

Thermal distortion is caused by heat, and mechanical distortion by inequalities in the tension of the bolted assemblies at different points. Investigation of thermal distortion has lead to cam ground pistons and full length water jackets. Other improvements will probably come with further study of this type of distortion.

Mechanical distortion can be caused to a surprising extent by overtight nuts, bolts and studs.

To prove the flexibility of a block and the possibilities of distortion, place an inside mike lengthwise in a cylinder and adjust it so that it just stays in position. Then squeeze the block crosswise with the hands and the mike will fall through.

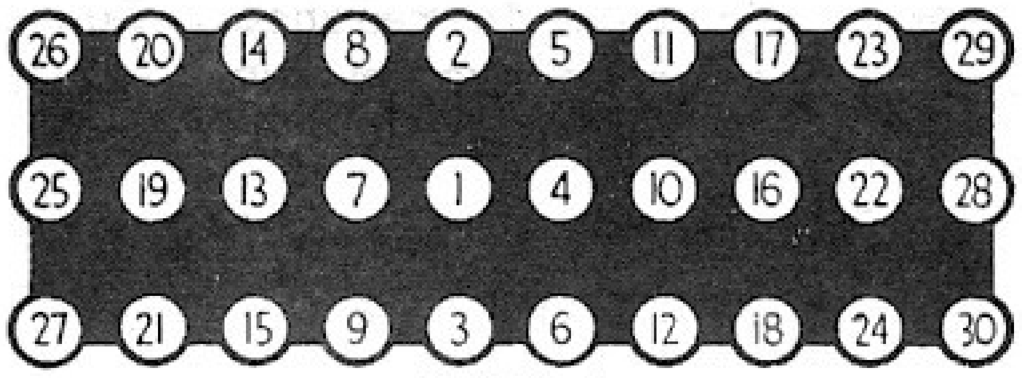
A popular demonstration of the result of distortion is made with six pistons in a block, fit to .0015 clearance. Before the head is bolted into place each of the pistons can be moved up and down smoothly in its cylinder. Putting on the head and drawing down the bolts, no matter how carefully, with a plain socket wrench causes so much distortion that two or more of the pistons cannot be moved in the bores. But when the head studs are drawn down with equal tension with a torque indicating wrench the pistons move as freely as before. No mechanic can put the same tension on all studs without an accurate indicating device, no matter how good he thinks he is or how hard he tries.

Distortion in blocks and heads can cause scuffed or scored pistons, blown gaskets, sticking rings, blow-by and even burned out main or rod bearings. Unequal tension on main bearings or rod bearing cap bolts has been known to cause rapid bearing wear and premature replacement. It is very easy to change the gap setting of the new type small spark plugs by putting too much tension on the plug threads. Humps in brake drums are frequently caused by uneven pressure on the attaching stud. The clutch assembly bolts which are not equally tightened will throw the clutch out of alignment sufficiently to cause erratic action.

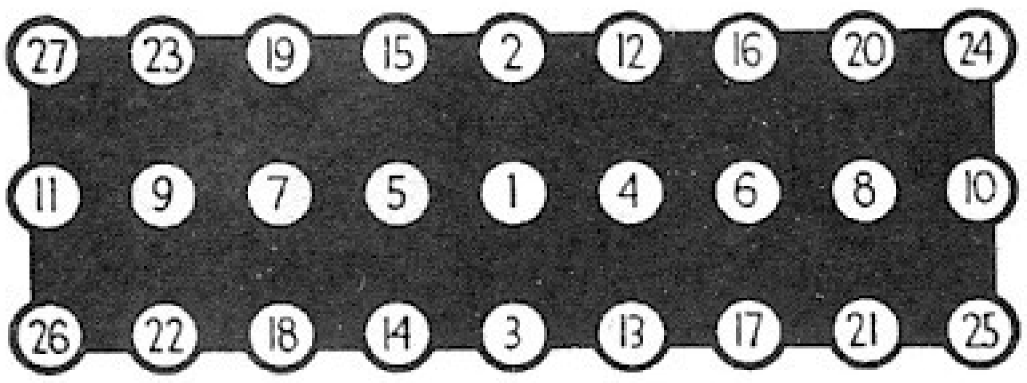
In fact, in the modern motor vehicle, all studs and nuts should be tightened with a torque indicating wrench if the best results are to be obtained, not only from the units and assemblies concerned but from the vehicle as a whole.

The following are some practical examples of the application of a torque indicating wrench.

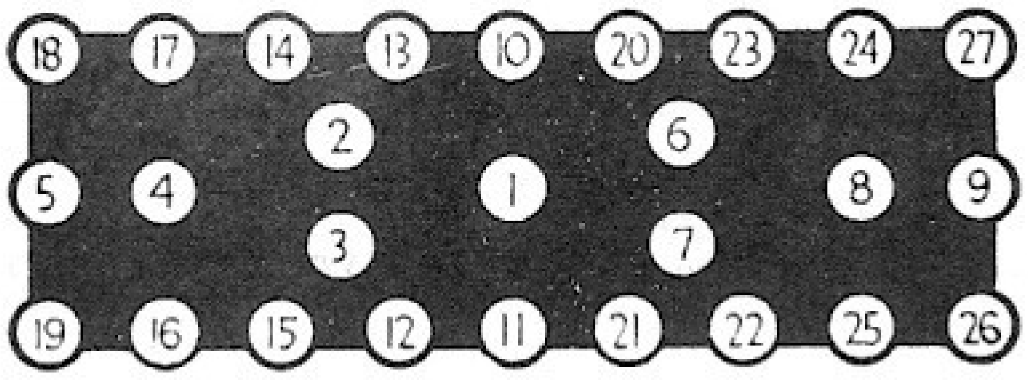
All cylinder head stud nuts should be tightened uniformly and in the proper order. Five general types of stud arrangement are shown in Figure 1. Select the type similar to the head being tightened and follow the sequence recommended



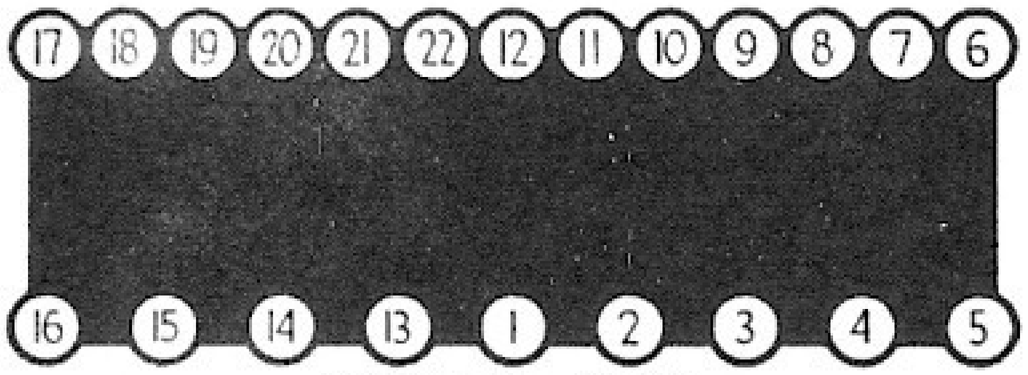
TYPE I
CHRYSLER 6-8; DODGE 6; DE SOTO 6; HUDSON 6; PLYMOUTH 6; WILLYS; NASH 6-8.



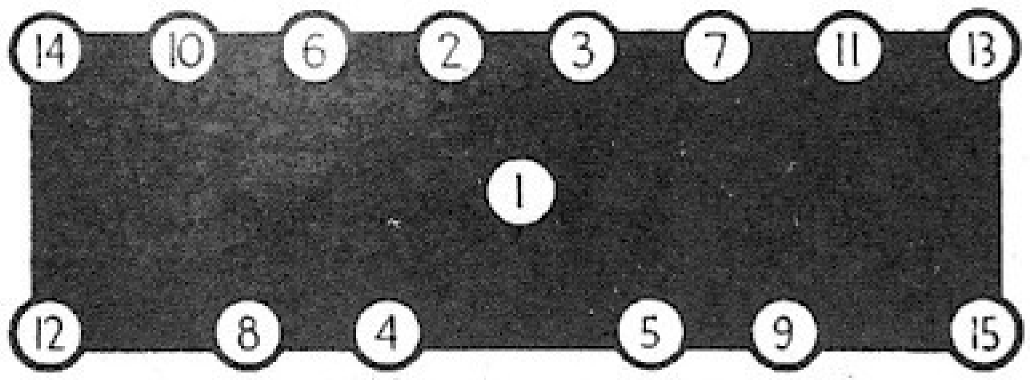
TYPE II
HUPMOBILE; OLDSMOBILE 6-8; PACKARD 6-8-12; STUDEBAKER 6-8; LINCOLN-ZEPHYR.



TYPE III
PONTIAC 6-8; FORD V-8; HUPMOBILE 6-8; MERCURY; GRAHAM 6; NASH-LAFAYETTE.



TYPE IV — BUICK 8.



TYPE V — CHEVROLET 6

Figure 1

CAST IRON HEADS - Stud nuts should be brought to uniform tension pressure when head is cold, then run engine until normal operating temperature is reached and while hot, pull all stud nuts up to proper tension.

ALUMINUM HEADS - Tighten stud nuts to proper tension and run engine until normal operating temperature is reached. Let engine cool down and when cold tighten stud nuts to proper tension.

Readings are in pound feet.

For using various types of torque wrenches, apply the following conversion factors:

1. Ammco Tension Wrench -

   Multiply pound feet by 2.85 to get Ammco readings.

2. Bonney Tension Wrench -

   Reads directly in pound feet.

3. Kwik Way Hydro Wrench -

   Multiply pound feet by 12 to get Kwik Way readings.

4. Snap-on Torqometer -

   Multiply pound feet by 2.85 to get Torqometer readings.

5. Storm Tension Wrench -

   Multiply pound feet by 3.7 to get Storm readings.

6. Sunnen Tension Wrench -

   Multiply pound feet by 12 to get Sunnen readings.

EXAMPLE -- Lincoln-Zephyr cylinder head, 39-42 pound feet.

Ammco Conversion 2.85
39 x 2.85 = 110
42 x 2.85 = 120
Ammco Reading 110 to 120

The tabulation listed on the opposite page is given as a general guide for proper tension pressures.

CHEVROLET	Pound Feet
Cylinder Head Bolts	65 - 70
Rocker Arm Support Bolts	26 - 30
Main Bearing Bolts	103 - 109

FORD

Cylinder Head (Models A, B, and V-8 "85" with Cast Iron Head)	49 - 53
Cylinder Head (V-8 "85" Aluminum Head)	42 - 46
Cylinder Head (V-8 "60" Aluminum Head)	28 - 32
Spark Plug Tensions:	
Models A and B	32 - 35
18mm. in Cast Iron Heads	28 - 32
18mm. in Aluminum Heads	25 - 28
14mm. in Cast Iron Heads	25 - 28
14mm. in Aluminum Heads	21 - 25

TRUCKS AND BUSES

AUTOCAR

Cylinder Head	53
Connecting Rods	53
Main Bearings, Center and Rear	60
Main Bearings, Front and Intermediate	70

CHEVROLET
(All Models except Diesel)

Cylinder Head Bolts	65 - 70
Rocker Arm Support Bolts	26 - 30
Main Bearing Bolts	103 - 109

CORBITT

Cylinder Head	105
Connecting Rods	263
Main Bearings, Center and Rear	193
Main Bearings, Front and Intermediate	210

DIAMOND T
(Models 80, 301, 304 and 307)

Cylinder Head	53
Connecting Rods	39
Main Bearings, Center and Rear	60
Main Bearings, Front and Intermediate	70

Pound Feet

DIAMOND T (Continued)
(Diesel Models - Notice the increased torque necessary)

Cylinder Head	158
Connecting Rods	140
Main Bearings, Center and Rear	77
Main Bearings, Front and Intermediate	95

DODGE

Connecting Rod Nuts and Cap Screws	53 - 58
Main Bearing Nuts and Cap Screws	74 - 80
Counterweight Attaching Screws	65 - 70
Cylinder Head Nuts	53 - 58
Cylinder Head Cap Screws (Plain Head)	60 - 65
Cylinder Head Cap Screws (Cupped Head)	67 - 72
Crankshaft Damper Attaching Screws	14 - 18
Starting Crankjaw	109
Flywheel Nuts (Bolt Material M.S. 387: H.T. 10A11 or Pro. Std. No. 517)	47 - 58
Flywheel Nuts (Bolt Material M.S. 410: H.T. 10A13 or Pro. Std. No. 512)	54 - 60

INDIANA
(Models 12 x 4 and 14 x 4)

Cylinder Head	53
Connecting Rods	53
Main Bearings, Center and Rear	60
Main Bearings, Front and Intermediate	70

(Models 16 x 6 and 18 x 6)

Cylinder Head	53
Connecting Rods	105
Main Bearings, Center and Rear	105
Main Bearings, Front and Intermediate	123

POISON GAS!

This country is not at war, but not all of us appreciate the fact that it is being continually subjected to a gas attack that is really serious. Carbon monoxide - that treacherous, colorless, odorless gas that pours out of automobile exhausts - is one of the greatest hazards of the gasoline age.

Incomplete combustion of gasoline is responsible for carbon monoxide. Theoretically, to provide complete combustion, the fuel mixture should consist of 15 pounds of air to 1 pound of gasoline. Unfortunately, this mixture is not only almost practically impossible, but it is also too lean for the automobile engine to develop its maximum power. By modifying this ratio to somewhere between $12\frac{1}{2}$ to $13\frac{1}{2}$ pounds of air to 1 pound of gasoline, an air-fuel mixture is obtained that produces good all around performance, and gives between 77 to 86 per cent. completeness of combustion. It is generally advisable to adjust the carburetor so that about 80 per cent. complete combustion is obtained. This ratio, which provides the best practical operating performance, guards against burning valves, stalling, backfiring in either the muffler or carburetor, and other engine difficulties.

Exhaust gas analyzers play an important part in eliminating excessive carbon monoxide by enabling the mechanic to determine the air fuel ratio obtained by the carburetor. They permit the carburetor to be set at a point which will produce the least amount of carbon monoxide with the maximum engine performance.

When using an exhaust gas analyzer it should be kept in mind that a lean reading does not necessarily mean that the fault lies with the carburetor. There may be air leaks at the valves or manifold. Naturally, these points should be checked and corrected before the carburetor is adjusted. The entire exhaust system should be carefully checked. Nothing should be overlooked from the exhaust manifold (to be sure that there are no cracks and that the gaskets are tight) right down to the tail pipe bracket.

Unless the exhaust leak is a serious one, it is sometimes difficult to find. Probably the easiest method of checking for leaks is to raise the car on a lift and run some kerosene through the carburetor. Then, with the tail pipe partly plugged (not too much or the muffler may blow out), start the engine, and smoke will be forced out of any holes that may be present.

Tapping the muffler lightly with a hammer, or repeated rapid acceleration of the engine will sometimes reveal loose baffles within the muffler; they usually rattle and clatter.

Leaks are not only dangerous to the occupants of the car, but mufflers or tail pipes that are partly clogged with rust have a decidedly detrimental effect on car performance. When the passage for exhaust gas is partly clogged, back pressure is set up which prevents correct power development and retards top speed performance. A vacuum gage will show this condition; open the throttle quickly and let it snap back in the closed position. The reading on the vacuum gage will drop immediately and then return quickly to its former reading if the system is free: but if it is clogged the needle will not return to its original reading as quickly.

* *

RUBBER IN AUTOMOBILES

Each 1940 car uses an average of 50 to 80 pounds of rubber, exclusive of tires and tubes - an increase of 40 to 70 pounds over the average car in 1925.

Today there are more than 200 rubber parts in the modern car in addition to the tires and tubes, and in some models this runs as high as 300. Some of the parts now made of rubber are: window mountings, floor mats, accelerator and clutch pedals, arm rests, fan belt, body shims, windshield wipers, radiator and heater hose, engine mountings, frame and axle bumpers, spring shackles, and the latest addition - - rubber seat cushions.

CONSTANT VELOCITY UNIVERSAL JOINTS

A constant velocity universal joint transmits a smooth rotation from a driving shaft to a driven shaft at any working angle without the usual speeding up and slowing down action that is customary in a shaft driven by a universal joint of the simple pin, yoke, or spider type.

Simple universal joints are unsuitable for front wheel drives because the variable speeds of the driven shaft cause a severe whipping action in the steering gear when making a turn.

Constant velocity universal joints are of either the disk or the bell type. (See illustrations on next page.) Disk joints, attached to a companion flange of six fitted bolts and equipped with telescoping metal seals, are capable of a fifteen degree deflection and can be used with sliding or permanently fitted splined drive shafts.

Bell joints, which permit a thirty-seven degree deflection, have a somewhat smaller overall diameter. They have a driven shank, which is forged integrally with the bell housing and splined drive shaft. These limited angles of deflection are the reason for using stop bolts on front driving axles. They are usually set at thirty degrees and never over thirty-seven degrees to prevent excessive cramping angles when steering a vehicle. Strained angles of deflection will cause bell fractures and other failures within the joint.

Constant velocity joints are particularly useful in all types of motor vehicles, from the lightest passenger car to the heaviest truck. With the increased use of independently sprung wheels, front drive steering axles, and four, six and other multiple drives, the need for a constant velocity and strong high angle universal joint is becoming more urgent every day. They have a wide range of uses in machine tools, industrial machinery, power winches, etc.

General instructions pertaining to these front axle steering drive ends are published in "Motor Transport Technical Service Bulletins No. P1 and No. P2", Office of The Quartermaster General.

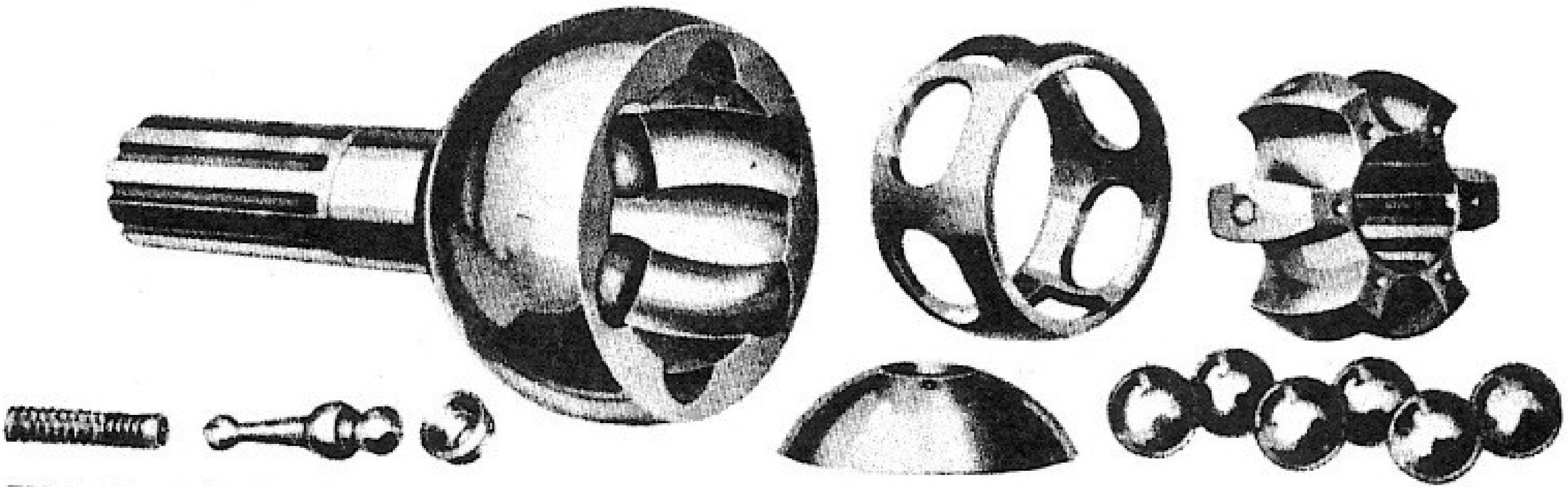


FIG. 1 Parts of Bell Joint.

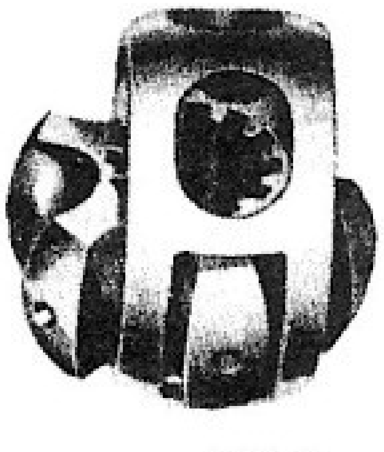


FIG. 2

Assembling inner race into cage by inserting one race tooth into rectangular cage opening and rolling inner race into place.

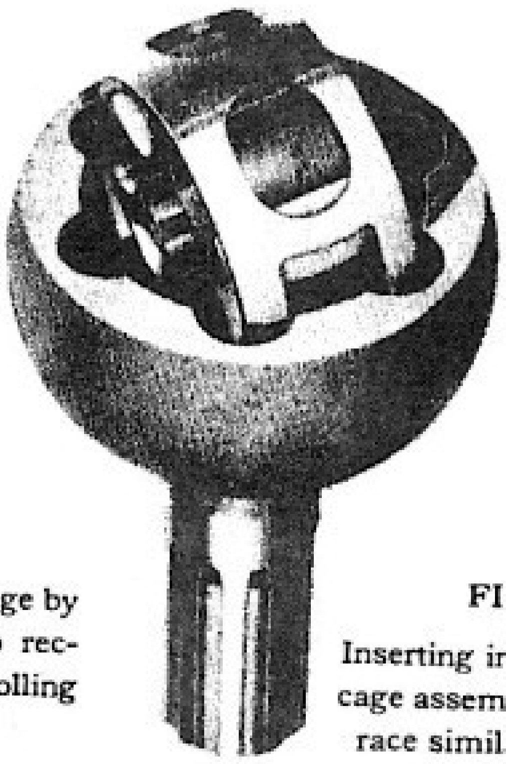


FIG. 3

Inserting inner race and cage assembly into outer race similar to Fig. 2

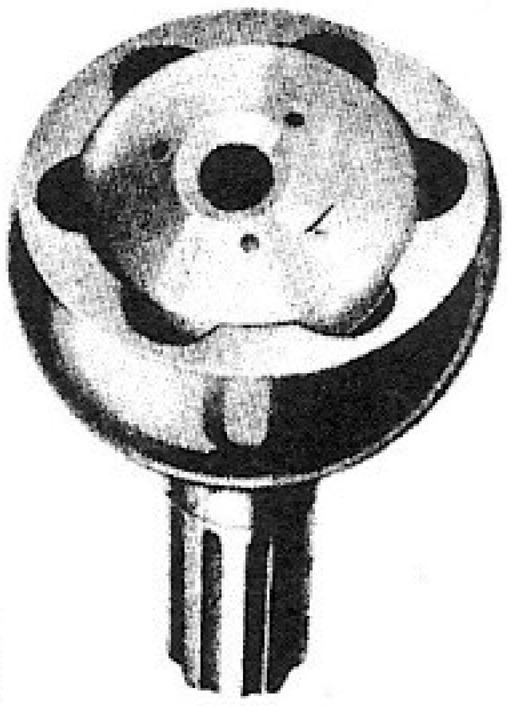


FIG. 4

Assembling pilot on top of tilted inner race and cage assembly.

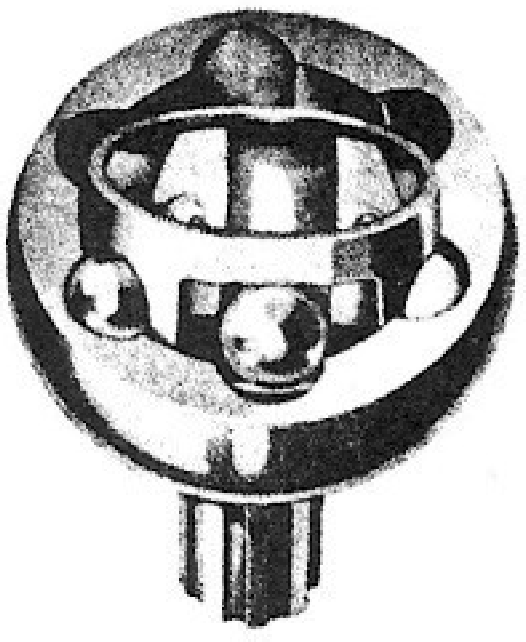


FIG. 5

Inserting six balls successively into properly tilted inner race and cage assembly.

ASSEMBLY–

The three main elements composing a constant velocity universal joint (two driving members separated by a close fitting ball cage) have spherical contact surfaces. When assembled, they form a self-contained unit. Balls inserted into the corresponding ball grooves of the driving members, and a simple pilot device complete the assembly. No tools are required for assembling the parts which hold each other securely by interlocking.

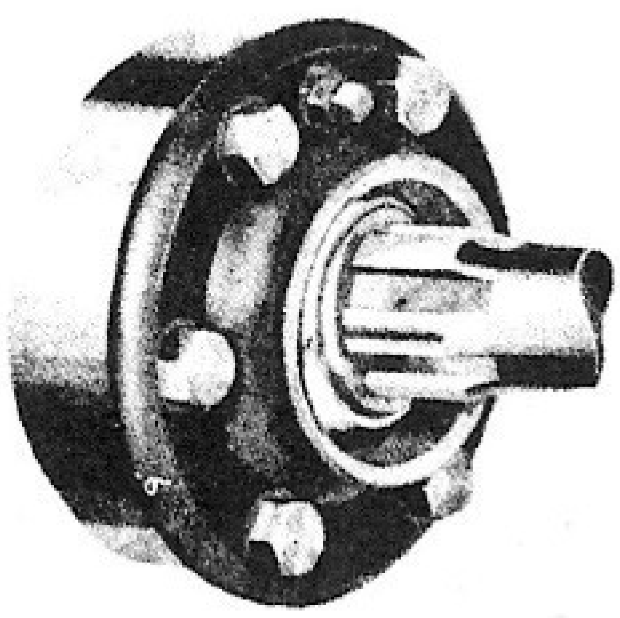


FIG. 6 Disc joint assembly.

CHECKING CURRENT AND VOLTAGE REGULATORS

Each year new electrical units are being added to the motor vehicle, increasing the demand placed upon the electrical system. Delco-Remy is supplying a new current and voltage regulator (Figure 1) to take care of this increased demand. As there are apt to be quite a few military motor vehicles equipped with these new regulators, it will be of interest and profit to understand how they are checked.

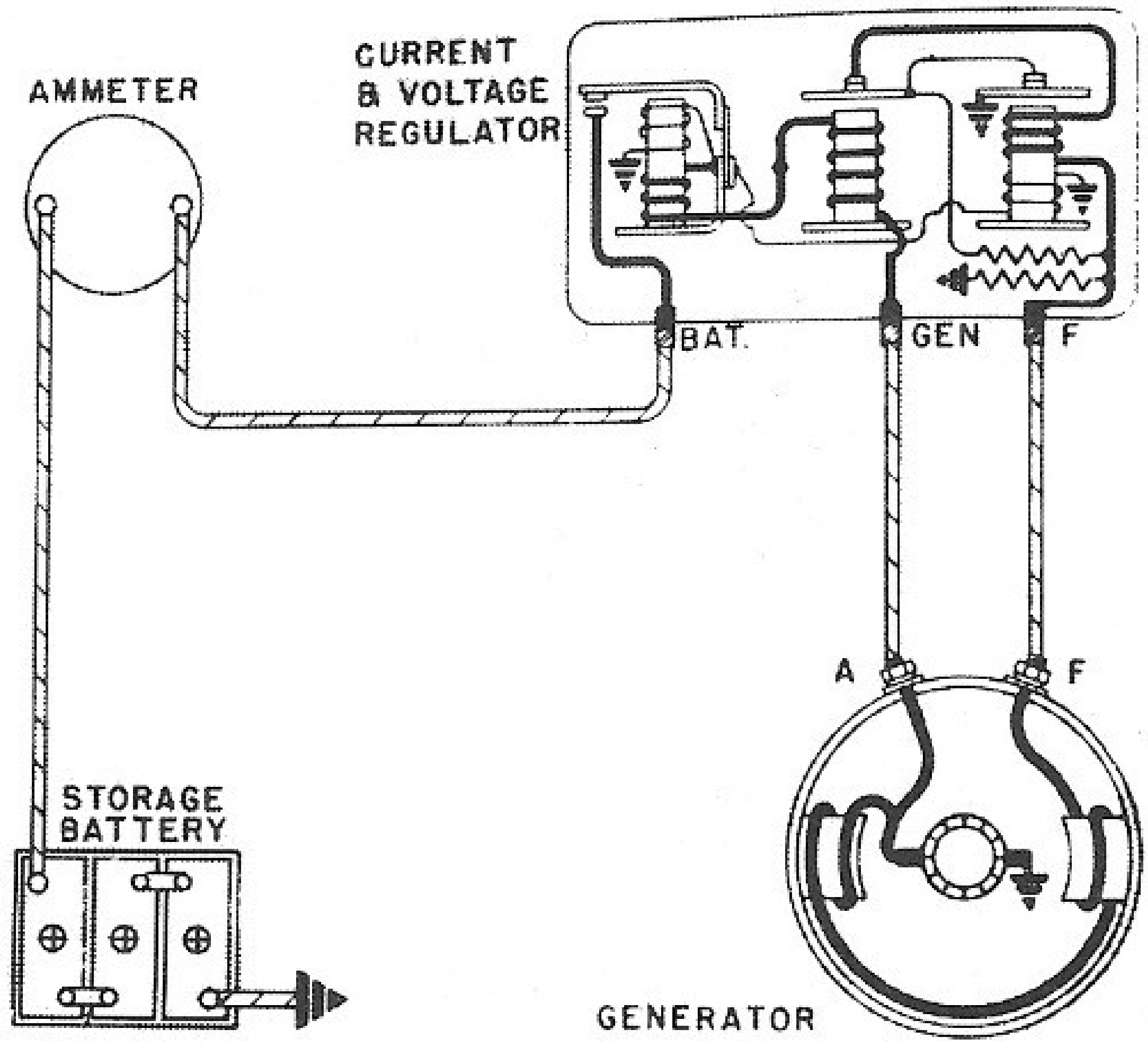


Figure 1

These regulators (Models 1118201 and 1118202) are precision built units, and must be adjusted accurately to the specified settings. The right instruments and gages make adjustment easy and eliminate guess work. The use of a heavy duty 3/4 ohm fixed resistance, as described later, simplifies the adjustment of the voltage regulator. Of course, the ammeter and voltmeter must be accurate because the new generators are capable of producing up to 34 amperes. It wouldn't do the battery or the other electrical units any good to have that amount of juice running around loose.

There are three separate units in the new regulator, and each must be checked and adjusted separately. They are the cut-out relay, the current regulator unit and the voltage regulator unit.

Before making any adjustments whatever on any of these units it is imperative that the regulator contact points are clean. Dirty or oxidized points cause low generator output and run-down batteries. The cleaning must be done with care - incorrectly cleaned points will effect only a temporary improvement and make accurate adjustment of the regulator impossible.

To clean the points, remove the upper contact support as shown in Figure 2. Use a clean, fine-cut contact point file, and clean each

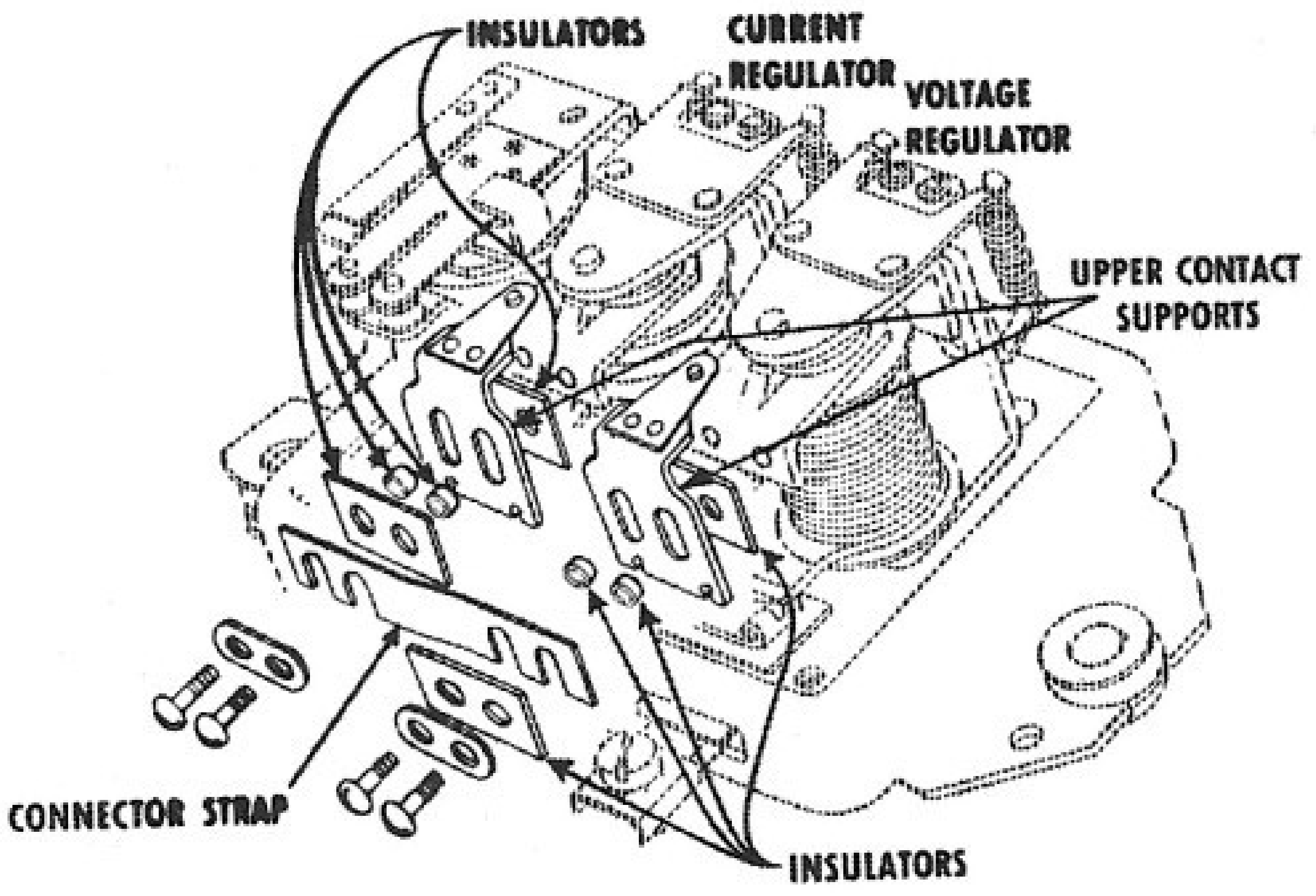


Figure 2

point separately. Do not use file excessively on the rounded (smaller) point. NEVER USE SANDPAPER OR EMERY CLOTH TO CLEAN THE POINTS. If the flat point is pitted, clean out the cavity with a "spoon" or rif-fler file to make a good, clean contact between the points. When re-assembling the unit make sure that the insulators (Figure 2) are cor-rectly located.

Cut-out Relay

To check the setting of the cut-out relay (Figure 3) connect the voltmeter from the "gen" terminal of the regulator to the regulator base. Slowly increase the generator speed until the cut-out relay closes, which should be between 6.2 and 6.7 volts. To adjust, bend up the spring post (Figure 3) to increase the spring tension and the closing voltage.

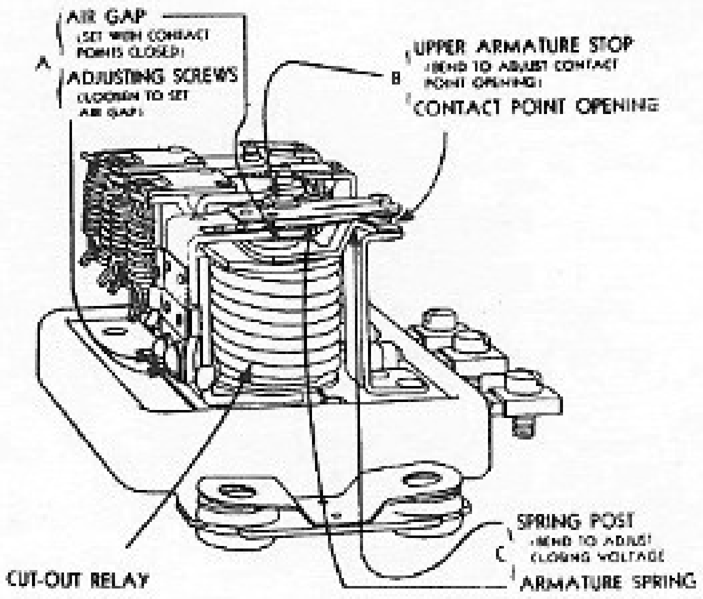


Figure 3

The air gap (Figure 3) should be .020 inch with the contact points closed. Check by moving the armature down until the points just close (regulator must be disconnected!) and then measuring between the winding core and the armature. If both sets of points do not close at the same instant, bend the spring fingers until they do. Adjust the air by loosening the two adjusting screws and raising or lowering the armature as required.

The contact point opening should be .020 inch. It is adjusted by bending the upper armature stop.

Before making any adjustment on the current or voltage regulators, bring the unit to operating temperature. Failure to do this will make accurate adjustment impossible.

Current Regulator

To check the setting of the current regulator, bridge the voltage regulator points from the frame to the upper point support with a jumper lead, and connect an ammeter into the charging circuit at the "bat" terminal, as shown in Figure 4. Since the voltage regulator is now inoperative, turn on the lights and other accessories to prevent high voltage in the system. Operate the generator at medium speeds. The current reading on the ammeter should be 34 amperes with the unit at operating temperature.

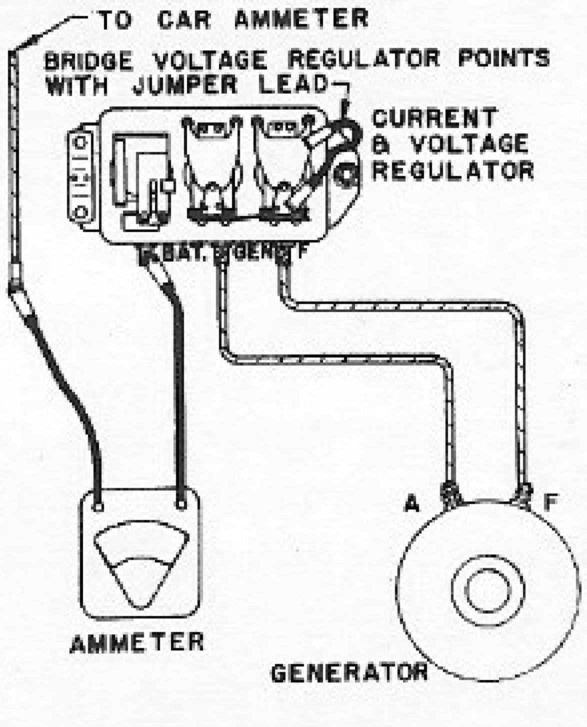


Figure 4

Adjust by bending the spiral spring hanger of one spring on the current regulator (Figure 5) down to increase, up to lower, the current setting. Normally, sufficient range of adjustment can be made on one spring only without touching the other spring. However, when the unit is badly out of adjustment, it will be necessary to remove one spring entirely, adjust the remaining spring to 17 amperes, then reinstall the second spring and complete the readjustment to 34 amperes on this second spring. This insures that each spring will carry one-half the total tension and that the armature will be balanced.

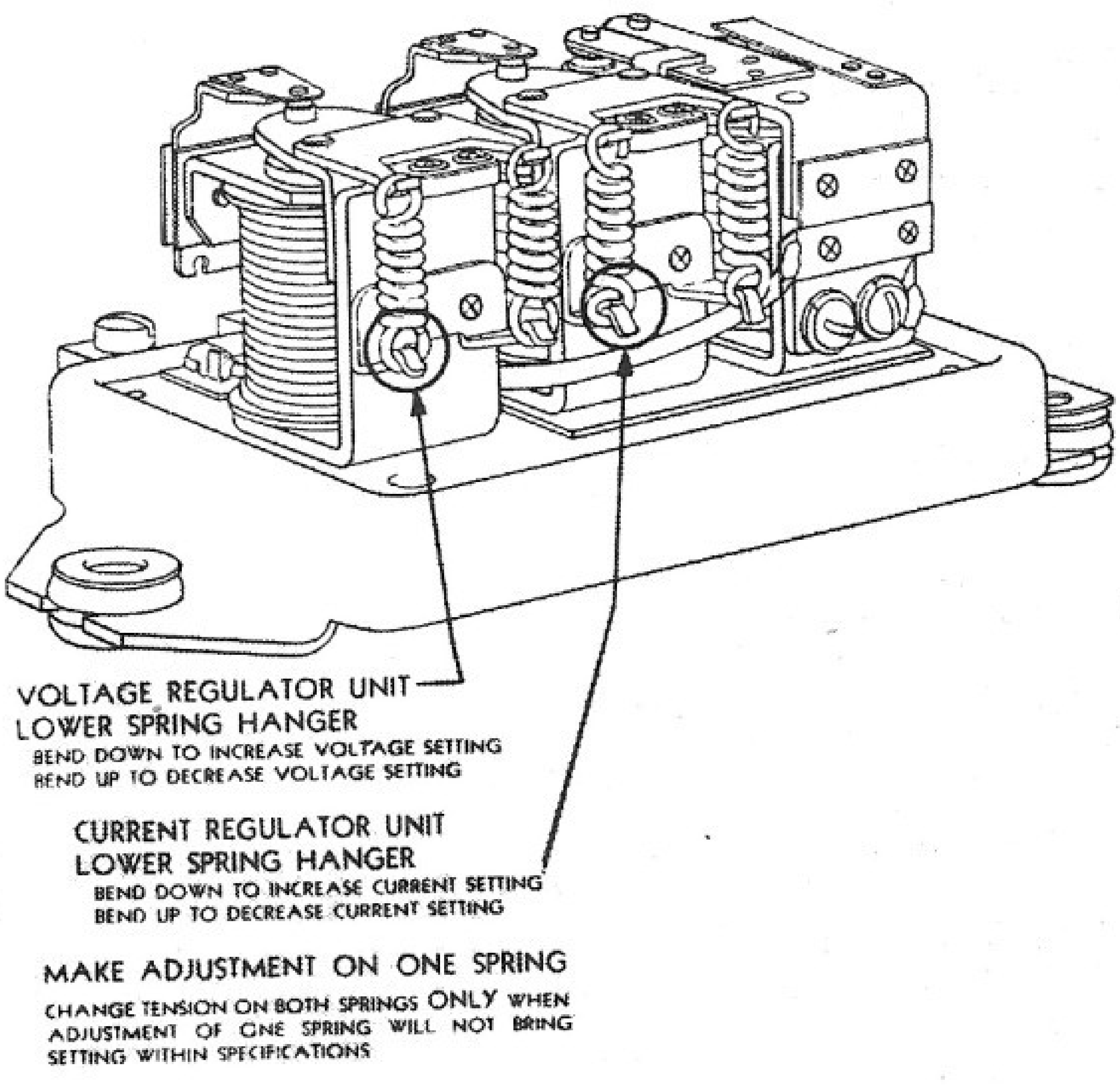


Figure 5

The air gap should be .080 inch. It is measured between the center of the core and the armature with the points just touching, as shown in the voltage regulator illustrated by Figure 6. A convenient way of adjusting the air gap is to insert the correct gage between the center of the winding core and the armature and hold the armature down against it. Then loosen the two contact mounting screws and move the contact mounting bracket up or down as necessary until the points just touch. Make sure the points are lined up properly, and tighten the screws well after adjustment.

Voltage Regulator

To check the setting of the voltage regulator (Figure 7); disconnect the "bat" terminal lead, and connect the voltmeter and a 3/4 ohm fixed resistance from this "bat" terminal to the regulator base. Operate the generator at medium speed and note the voltage setting, which should be between 7.2 and 7.4 volts with the unit at operating temperature.

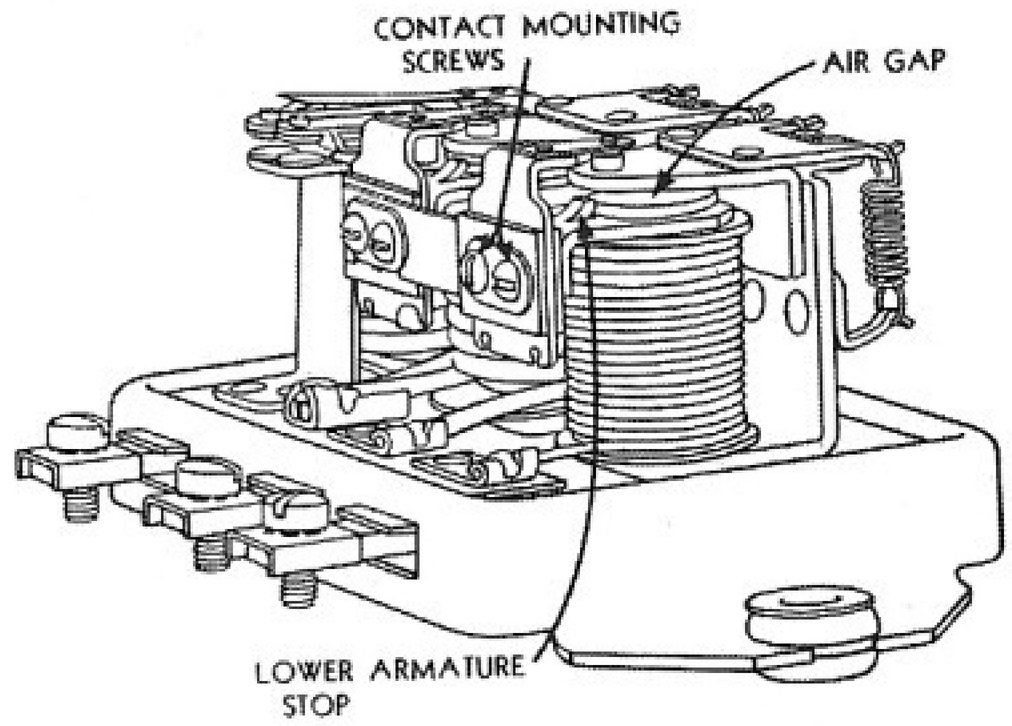


Figure 6

Adjust by bending the spiral spring hanger of one spring on the voltage regulator (Figure 5) down to increase, up to decrease, the voltage setting.

It is very important, after each adjustment, to replace the regulator cover, reduce the generator speed until the cut-out relay contact points open, and then bring the generator back to medium speed before taking the voltage reading, which should be 7.2 to 7.4 volts. Normally, bending one spring will give sufficient range for adjustment, and the other spring will not have to be touched. However, when the unit is badly out of adjustment, a special adjustment procedure must be followed to insure that each spring will carry one-half the total tension.

1. Remove one spring.

2. Connect voltmeter from the "gen" terminal to the regulator base.

3. Open voltage regulator points by holding the armature down and slowly increase generator speed until the voltmeter reads about 2.5 volts.

4. Close regulator points by releasing the armature and adjust the setting to between 3.5 and 3.7 volts.

5. Install the second spring and complete adjustment as outlined above, making the connections shown in Figure 7.

The air gap of the voltage regulator (Figure 6) should be .075 of an inch. It is adjusted in exactly the same way as that in the current regulator.

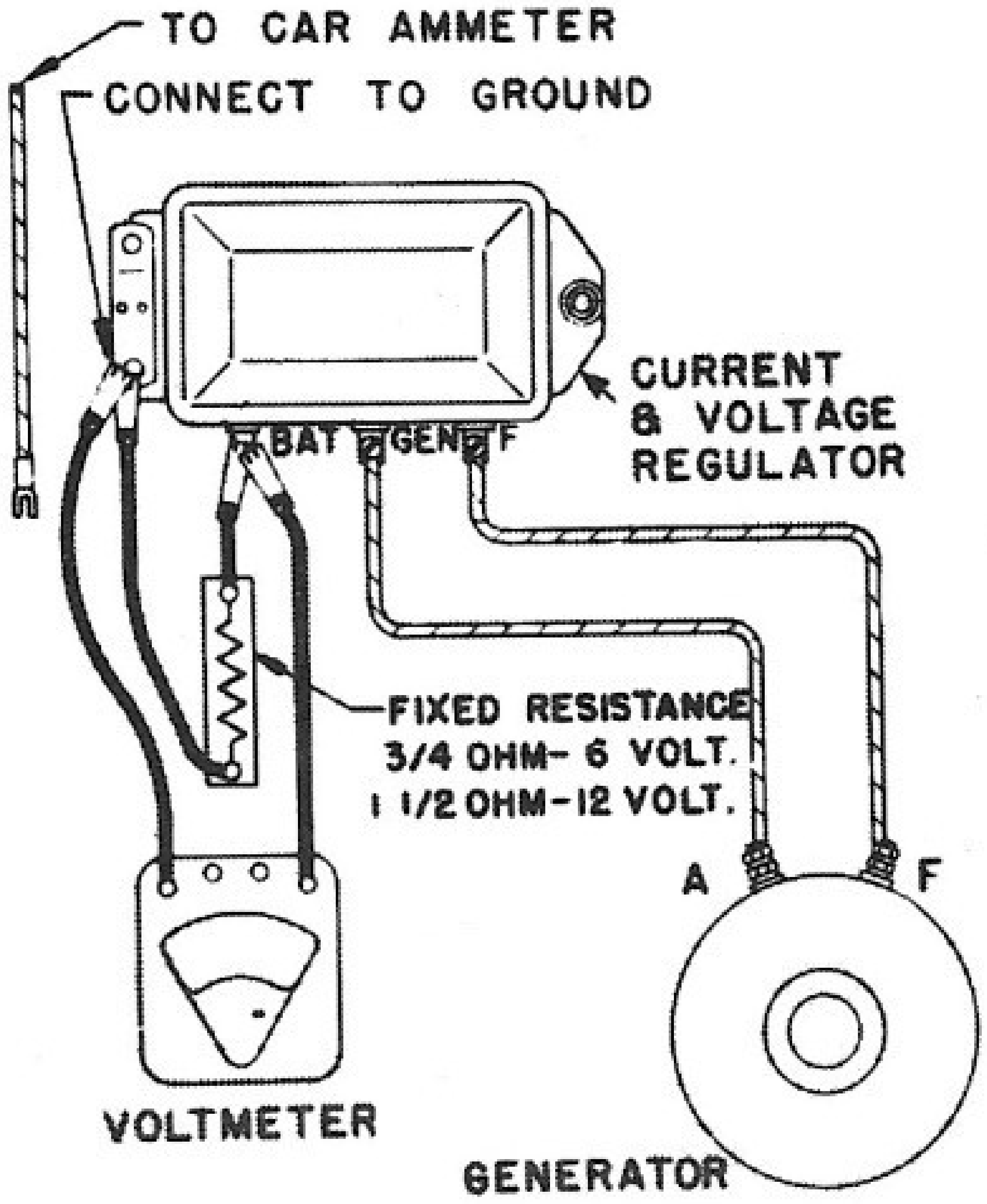


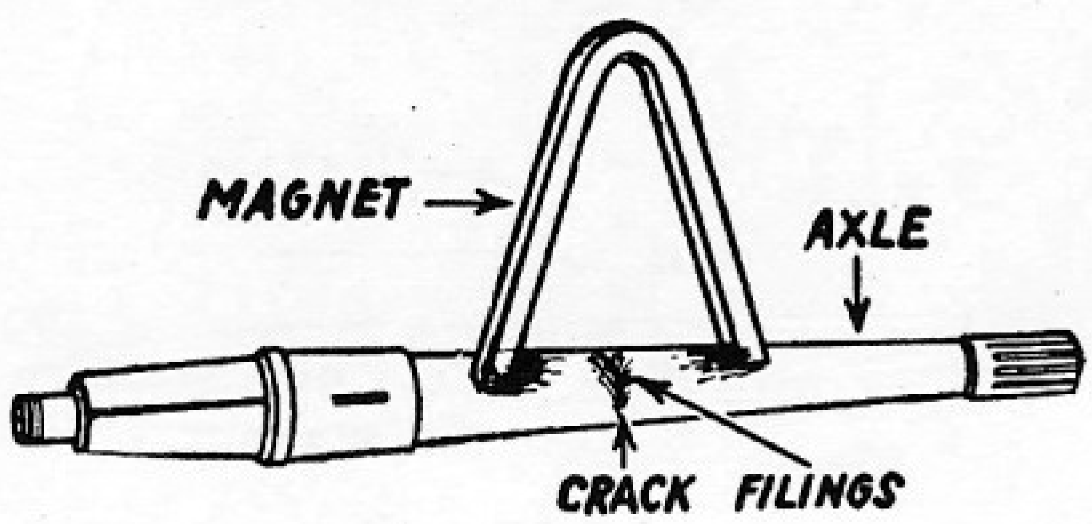
Figure 7

If good instruments and proper gages are used, the simple procedure outlined here will facilitate the adjustment of these new regulators.

DETERMINING EXTENT OF CRACKS

A magnet is much keener than the naked eye when it comes to determining if a crack has extended into the metal on cylinder blocks, axles, etc.

Put iron filings sparingly on and along both sides of the crack. Lower a V-type magnet so that the crack is directly between the two magnetic poles. The filings will cling to the magnet, but if the crack extends into the metal, the filings will stand on end.



KEEP THE CUTTINGS OUT

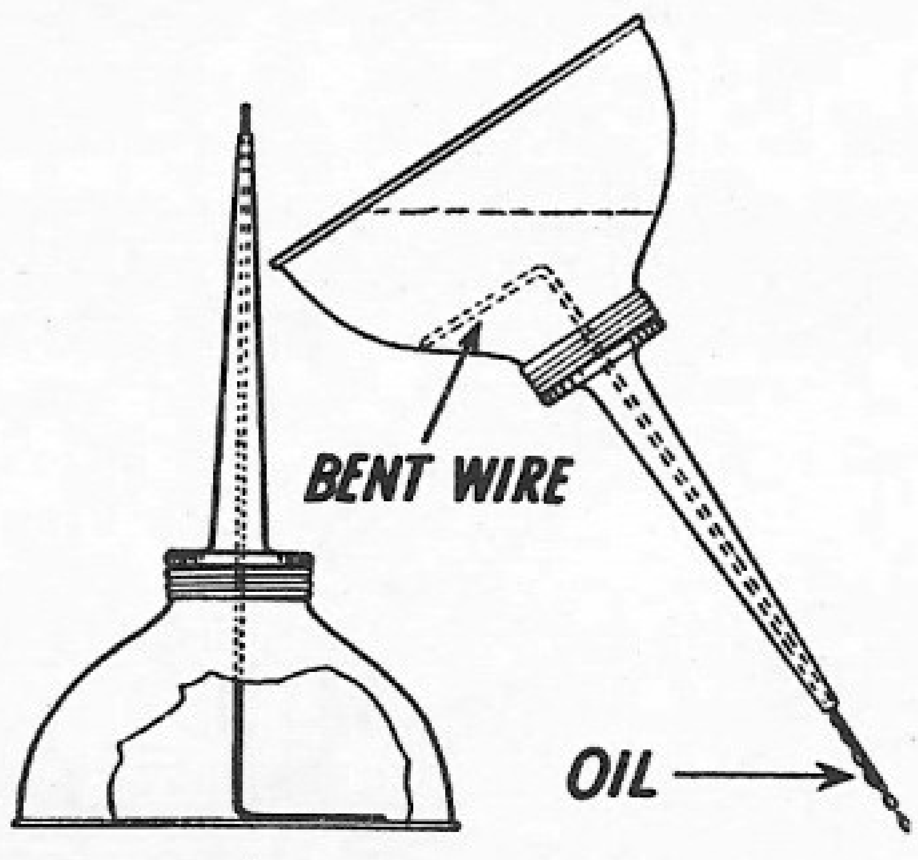
When installing new piston rings in an engine, it is necessary to remove the ridge at the top of the cylinder. To keep the cuttings from falling into the case, take an old piston ring, break off a quarter inch from one end and place a clean piece of cloth on the broken ring so it will look like a drum.

With the piston at the bottom of the stroke, insert the cloth covered ring in the cylinder. When the ridge has been cut out, turn the engine over and the piston will push the ring and cloth up to the top, carrying with it the cuttings. Result - no cuttings in the pan and a clean cylinder.

OILING HARD-TO-GET-AT-PLACES

Modern motor vehicles have many places requiring oiling that are tucked out of reach of the ordinary oil can.

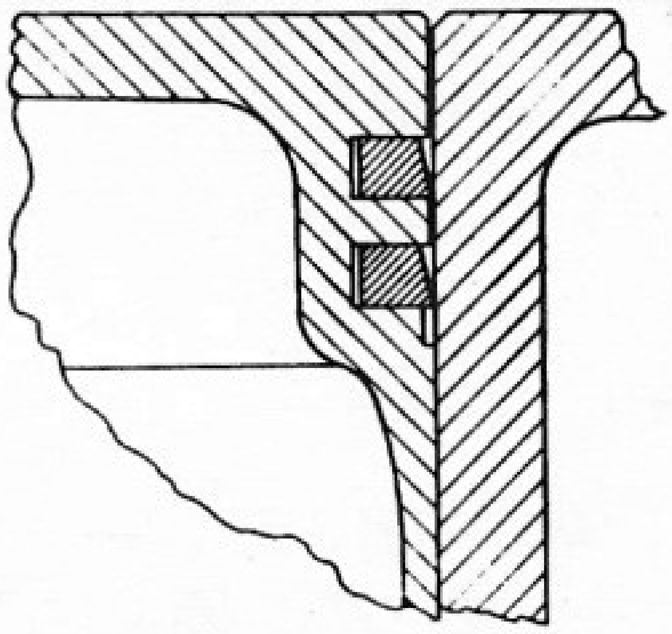
Take a piece of wire, bend it as shown in the illustrations and insert it in the spout of the oil can. Be sure that the wire is small enough to let the oil flow from the spout.



WHICH IS THE TOP SIDE OF A PISTON RING?

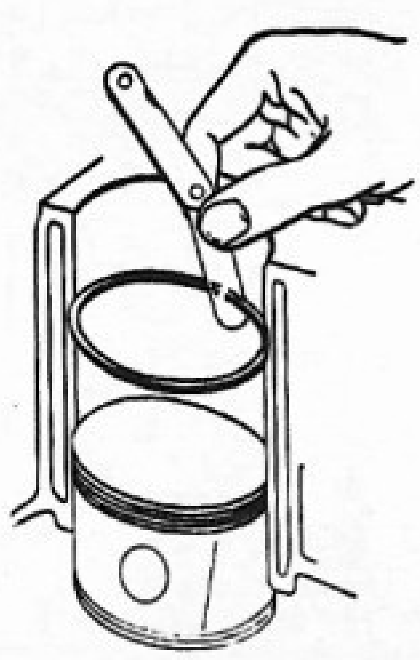
Perhaps it makes no difference with some piston rings. But other piston rings would cause serious complications if they were put in upside down. One such type, shown in Figure 1, has the face of the ring which touches the cylinder bore ground at a slight angle, so that it will wear in more quickly. This type has the advantage of sliding over the oil film on the way up and acting as a scraper on the way down. If reversed, it would do just the wrong thing; slide over the oil film on the way down and scrape it up into the combustion chamber when the piston is on the up stroke.

The amount of slant is exaggerated in Figure 1. In the actual



ring it is so slight that the eye can scarcely see that the ground surface of the ring is not parallel to the cylinder. Some manufacturers adopt the practice of stamping the word "top" on the side of the ring which should go up. The top of an unmarked ring which is ground at an angle can usually be determined by placing two rings together and holding a straight edge across the face of the rings.

Ring gaps can be checked as shown in Figure 2. In a worn cylinder, however, the bore will be slightly increased at the point shown, and it is better to check the ring gap at the unworn portion of the cylinder above the top of the ring travel.



One of the new $2\frac{1}{2}$ ton (6 x 4) cab over engine Mack trucks recently acquired by the Army. The double cab is of particular interest. The front of the cab holds the driver and assistant driver, and the rear of the cab holds a supplementary crew of three.

DIGESTS — AND COMMENTS — OF CURRENT TECHNICAL MAGAZINES

"AUTOMOBILE DIGEST", April 1940 --

"It's Here -- 30-60 Minute Battery Charging", page 15: The thirty-six hours required for battery charging has long been a source of costly delay in military operations. While this rapidly charging system has not met with full approval of engineers, it heralds a day when rapid battery charging may become a common practice.

"How Are The Crankpins?", page 16: An accurately produced bearing of the highest quality will fail to control oil flow if improperly fitted. Crankpins have an important part in bearing performance and life; too much care cannot be given to inspecting and reconditioning them.

"Let's Look At Valve Service", page 17: The ins and outs of refacing and reseating. It's no longer called valve grinding. Extreme accuracy is most important. This article tells you how to do it.

"Complete Service on 1940 Headlamps", page 20: "Sealed beam" headlights are used on almost all 1940 vehicles. There is nothing difficult about servicing them, but it is just as well to know how to do it correctly.

"10,000 Mile Carburetor Service", page 23: The modern carburetor must furnish at least five different air fuel mixtures to meet varying demands. Dirty and maladjusted carburetors mean poor performance. Every 10,000 miles carburetors need some attention; here is what to give them. Carburetor repairs should be confined to expert mechanics.

"Brake Lines - How To Service Them", page 24: Contrary to general opinion, servicing hydraulic brake lines requires a different procedure than similar work on fuel or vacuum lines. Brakes are so vital to safety that correct maintenance is imperative.

"1940 Alignment Adjustments", page 25: Conventional front ends with semi-elliptical springs, transverse springs, independent front wheel suspension employing coil springs, and transverse leaf springs all require alignment. This article clears up the difference between them.

"Shop Kinks", page 42: Kinks in servicing packless type water pumps; installing drive shafts; gaging the thickness of brake lining; and preventing bends in rubber vacuum hose.

"MOTOR AGE", April 1940 --

"Tune-Up Specifications", page 23: Detailed tune-up specifications on practically all passenger cars from 1935 to 1940, and on trucks from 1934 to 1940. A very useful article to read and remember.

"COMMERCIAL CAR JOURNAL", April 1940 --

"Truck Speed Chart", page 31. If you are interested in automotive theory, this article will show you how to determine vehicle speed for any given engine speed when the tire size and rear axle reduction are known.

"Truck Ability Chart", page 32: Some more vehicle theory for those interested. The article shows the grade climbing ability of a truck with a given load; the engine torque required to climb a given grade; the gear ratio required by a given grade; the wheel diameter permissable to climb a given grade; and the gross vehicle weight limit for a given grade.

* * * * * * * * * *

This issue of the Commercial Car Journal is a particularly useful one for mechanics. It gives very complete specifications for all phases of operation and maintenance covering tire capacities, sizes and pressures; Diesel fuel specifications; clutch, transmission, lubrication, engine, tension wrench, gasoline engine, Diesel engine, distributor test, starter test, generator test specifications; and a very convenient cross reference index.

ACKNOWLEDGEMENTS

"Rubber Cylinders", page 24, was based on:

"Rubber Cylinders" - MOTOR SERVICE MAGAZINE, February 1938.

FLEET EXTRA, January 1940; Sealed Power Corporation, Muskegon, Michigan.

"Why Tension Indicators?", AUTOMOBILE DIGEST, February 1938. Automobile Digest Publishing Company, Cincinnati, Ohio.
Subscription - $2.00 per year.

"Poison Gas", page 30, was based on "Poison Gas" - AUTOMOBILE TRADE JOURNAL, February 1940. The Chilton Company, Inc., Philadelphia, Pennsylvania.
Subscription - $1.00 per year.

"Rubber in Automobiles", page 31, was based on "Rubber in Automobiles" - AUTOMOBILE TRADE JOURNAL, January 1940. The Chilton Company, Inc., Philadelphia, Pennsylvania.
Subscription - $1.00 per year.

"Constant Velocity Universal Joints", page 32, was based on the ENGINEERING BULLETIN of The Gear Grinding Machine Company, Detroit, Michigan.

"Checking Current and Voltage Regulators", page 34, was based on "Checking Current and Voltage Regulators" by William H. Crouse - - AUTOMOBILE TRADE JOURNAL, February 1940. The Chilton Company, Inc., Philadelphia, Pennsylvania.
Subscription - $1.00 per year.

"Determining Extent of Cracks", page 40, was based on "Determining Extent of Cracks" by J. M. Knobbe - MOTOR SERVICE MAGAZINE, February 1938.

"Keep the Cuttings Out", page 41, was based on "Keep the Cuttings Out" - AUTOMOBILE TRADE JOURNAL, April 1940. The Chilton Company, Inc., Philadelphia, Pennsylvania.
Subscription - $1.00 per year.

"Oiling Hard-To-Get-At-Places", page 41, was based on "Hard-To-Get-At-Places" by T. A. Lester - MOTOR SERVICE MAGAZINE, December 1938.

"Which Is The Top Side Of A Piston Ring?", page 42, was based on "Which Is The Top Side Of A Piston Ring?" - MOTOR SERVICE MAGAZINE, January 1938.