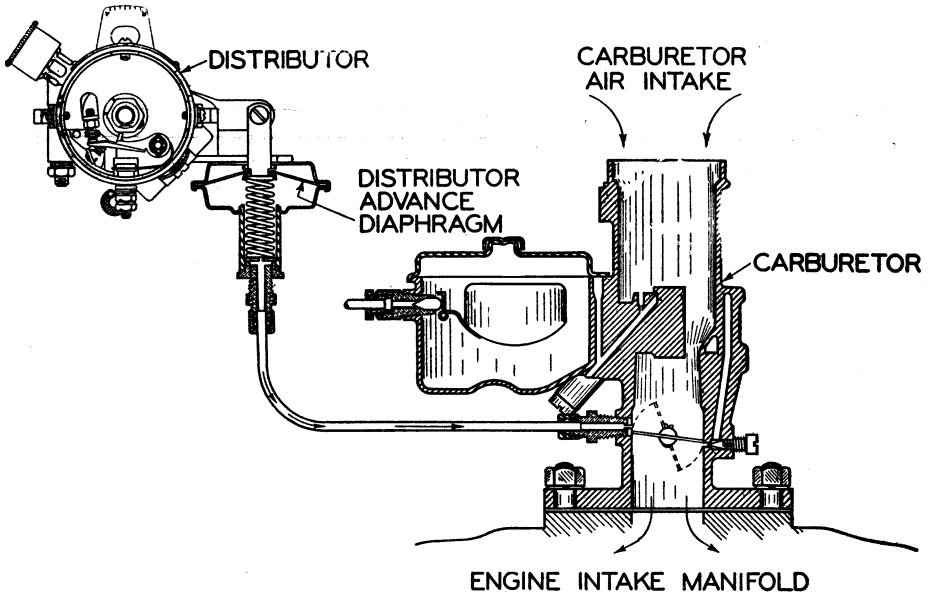

Fig. 37 Auto-Lite vacuum advance mechanism of type clamped around distributor so that entire distributor is rotated as vacuum conditions change

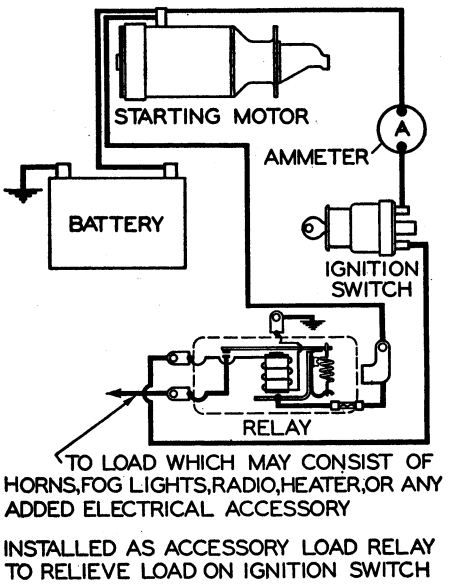

Fig. 38 Showing relay connected in ignition circuit to prevent overloading of ignition switch when accessories are connected through the switch

Ignition Wiring

The current carrying capacity of all ignition wiring should not be less than that specified by the vehicle manufacturers. All terminals should be securely soldered to the wires and all joints and connections should be clean and tightened with lock washers.

The connecting leads in the distributor should be installed so that the terminals are screwed down tight and in such a manner that they will not interfere with the cap or rotor.

When testing the leads for open circuits, a slight tension should be placed on them, or they should be moved back and forth to find broken wires inside the insulation, which may make contact temporarily during the test.

All leads inside the distributor should be bent away from contact with the housing or other moving parts so that the insulation will not chafe and cause failure due to rubbing or vibration.

The high tension wiring is subjected to high voltage and, therefore, insulation is important. Leakage may exist without being visible, causing poor engine performance. See the "Tune Up" chapter for inspecting and testing data. Special attention should be given to any part of the cables surrounded by metal manifold or brackets, as any weakness of the insulation inside the metal would cause current leakage and cross-firing, resulting in poor engine performance, especially in wet weather.

Metal manifolds and metal cable brackets should be grounded to the engine. Troublesome engine missing has sometimes been corrected by a good ground connection for these metal parts.

Ignition Switch

Ignition switches are usually designed to carry the ignition circuit only. When accessories such as heater, radio, fan, defroster, etc. are connected through the ignition switch, the switch is overloaded, causing overheating of the switch, which results in the reduction of the energy delivered to the ignition circuit.

When it is desirable to connect accessories to the ignition switch to prevent their being accidentally left on—which would discharge the battery—they should be connected through a relay, Fig. 38, to prevent overloading and consequent ignition switch trouble.

GENERATORS

A sectional view and an exploded view of typical automobile generators are shown in Figs. 1 and 2.

If the charging circuit does not perform to specifications, the trouble can easily be isolated without instruments as described in the TROUBLE SHOOTING section of the *Generator Regulator* chapter. It is worth repeating, however, that all that is necessary to prove whether or not the generator is at fault is to ground the field terminal momentarily. Then if no output is indicated on the dash ammeter, the trouble is in the generator. But if the ammeter shows a charge, the trouble lies in the regulator or wiring.

When There Is No Output

The first step is to remove the cover band and inspect the interior of the generator for:

1. Sticking brushes.
2. Worn rough or dirty commutator, Fig. 3.
3. Commutator out of round.
4. High mica between commutator segments, Fig. 3.
5. Thrown solder, Fig. 4, which indicates an open circuit between armature windings and commutator segments.

NOTE—Fig. 5 shows the construction of the new type Delco-Remy generator first used on some 1952 cars. This unit differs from the conventional type, Figs. 1 and 2, in that it employs an extruded frame. And since it has no cover band, inspection is made through the openings in the end frame. The use of a mirror will aid in the inspection.

If the inspection shows that any of the above conditions are present, the generator must be removed from the car for servicing. But if none of these con-

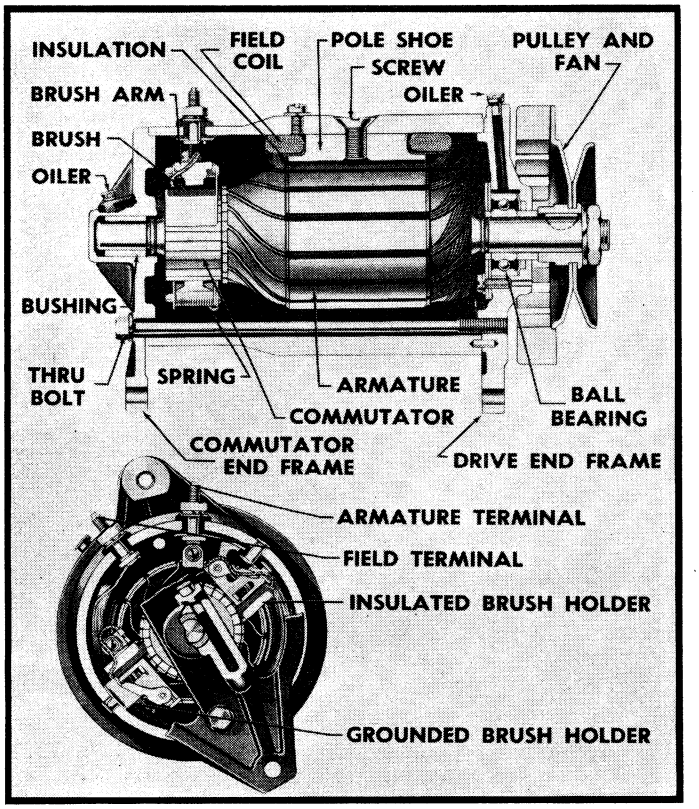

Fig. 1 Typical automobile generator driven by fan belt

ditions is apparent, the generator should be removed and tested to locate the cause of the trouble.

GENERATOR TESTS

In the tests which follow, all that is needed is a set of test points or clips and a 110-volt test lamp.

1. Raise the grounded brush, Fig. 6, and insulate it from the commutator with a piece of cardboard. Using the test points or clips, check for a ground from the "A" terminal to the generator frame. If the test bulb lights, raise and insulate all the brushes with cardboard. Then check in turn, the insulated brush holder, Fig. 7, the armature commutator, Fig. 8, and the fields, Fig. 9, to locate the ground.

Service Note

If the generator is of the type in which the field is grounded internally, as is the case with Ford generators as well as some Delco-Remy and Auto-Lite units, disconnect the field ground lead before making the first test. If a grounded field is found in a generator of this type, check the generator regulator contact points since this may have permitted an excessive field current which will have burned the points.

2. If the generator does not show a ground check the field circuit for an open circuit as shown in Fig. 10.
3. If the field is not open, check for shorts in the field circuit. Use a battery and ammeter connected in series with the field circuit as shown in Fig. 11. Proceed with care in this test since a shorted field may draw an excessively high current. If the field current draw is in excess of the specifications for the generator being serviced, new field coils should be installed.
4. If the trouble has not yet been located, check the armature for open circuits. Open circuits in the armature are usually obvious since the open-circuited commutator bars will arc every time they pass under the generator brushes so that they soon will become burned.
5. A further check for open circuit in the armature requires that the armature be removed from the generator and tested by slowly rotating the armature, checking between adjacent bars with test points and a light in series with a battery of the proper voltage, Fig. 12. Any open circuited coils will prevent the lamp from lighting.
6. If the trouble still has eluded you, the armature should be checked for short circuit, using a growler, Fig. 13. The armature is placed in the growler and slowly rotated, while a thin strip of steel, such as a hacksaw blade, is held above the armature core. The steel strip will vibrate above the area of the armature core in which short-circuited armature coils are located.

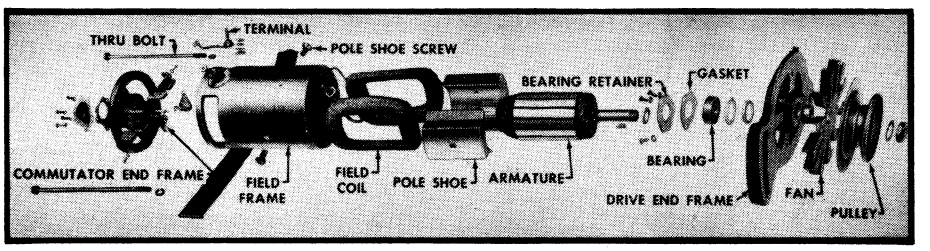

Fig. 2 Exploded view of generator similar to that shown in Fig. 1

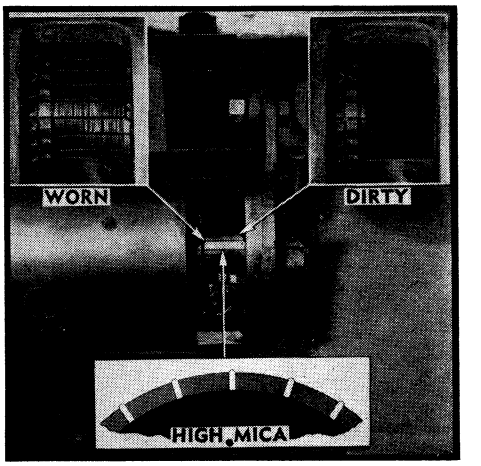

Fig. 3 Showing an example of a worn and dirty commutator and a commutator with high mica

Unsteady or Low Output

If the generator produces a low or unsteady output, the following factors should be considered:

1. A loose drive belt will slip and cause a low or unsteady output.
2. Brushes which stick in their holders, or low brush spring tension will prevent good contact between brushes and commutator. This will also cause arcing and burning of the brushes and commutator.
3. If the commutator is dirty, but otherwise in good condition, clean off all grease with a cloth soaked with carbon tetrachloride and then polish the commutator with a strip of 00 sandpaper placed over a wooden block having a smooth square end, Fig. 14. Do not use emery cloth as particles of emery may become embedded in the commutator and cause local hot spots which will cause the ruination of the armature. Carefully blow out all dust before replacing cover band.
4. If the commutator is out-of-round or has high mica, the commutator must be turned in a lathe and the mica undercut.

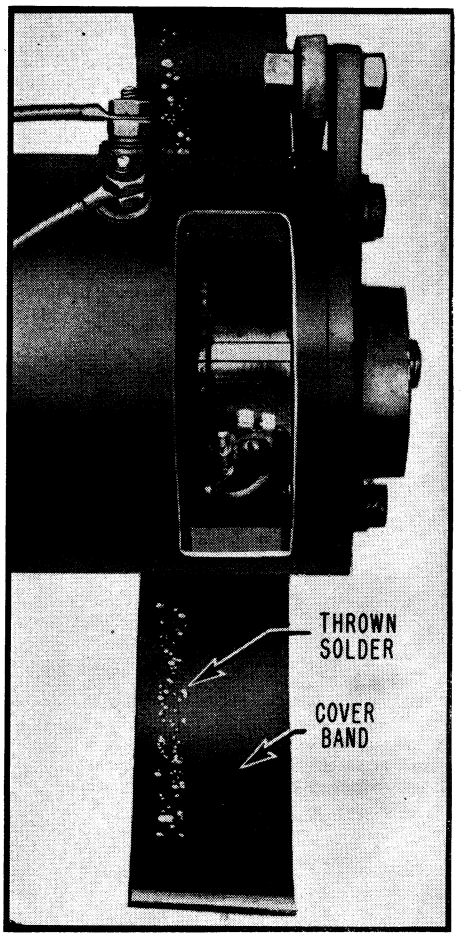

Fig. 4 Thrown solder on cover band, caused by excessive heat, indicates an open circuit between armature windings and commutator segments

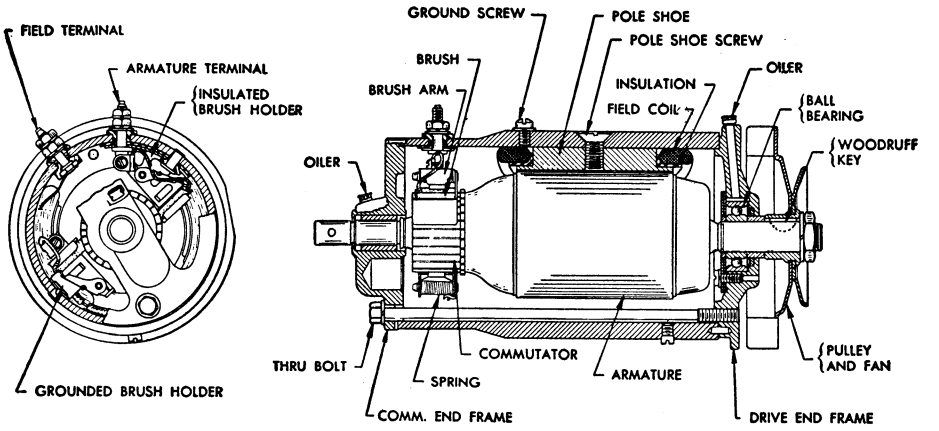

Fig. 5 Construction of new type Delco-Remy generator with an extruded frame. There is no cover band so inspection is made through openings in commutator end frame. The use of a mirror will aid in the inspection

Excessive Output

The procedure to follow in cases of excessive output of the generator depends upon whether the generator field circuit is grounded externally through the regulator, or internally in the generator itself.

In the externally grounded system, the trouble can be located as shown in Fig. 9. In the internally grounded system, about the only cause for excessive output would be a short circuit between the field circuit and insulated main circuit. This can be corrected by relocating and taping up the leads.

Noisy Generator

Noise emanating from a generator may be caused by a loose mounting, drive pulley, worn or dirty bearings or improperly seated brushes. In connection with worn bearings, it often happens that they cause the armature to rub against the pole shoes.

Dirty bearings may sometimes be saved by cleaning and relubrication, but worn bearings must be replaced.

Brushes can be seated as explained further on. If a brush holder is bent it may be difficult to reseat the brush so that it will function properly without excessive noise. Such a brush holder will require replacement.

Polarizing Generator

After a generator has been repaired and reinstalled on a vehicle or at any time after a generator has been tested, it must be repolarized to make sure that it has the correct polarity with respect to the battery it is to charge. Failure to do this may result in burned circuit breaker contacts, a run-down battery

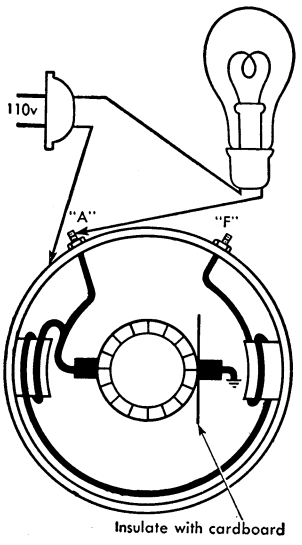

Fig. 6 Testing for short circuit in generator. If bulb lights, short is in field coils, armature or brush holder

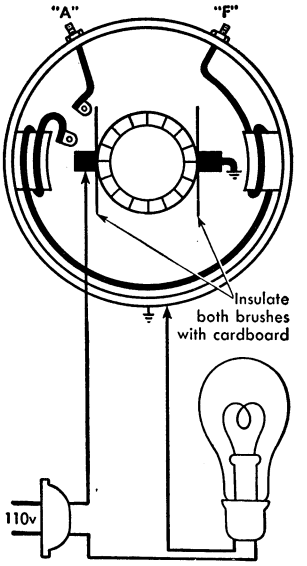

Fig. 7 With this hook-up, bulb will light if insulated brush holder is grounded

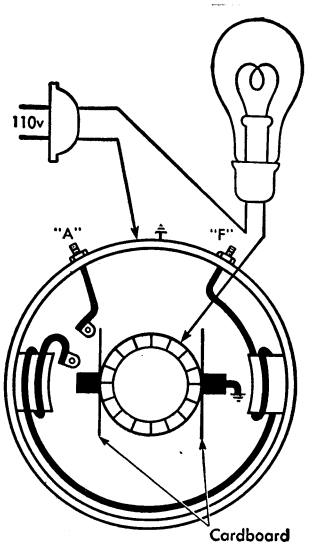

Fig. 8 With this hook-up, bulb will light if armature is grounded

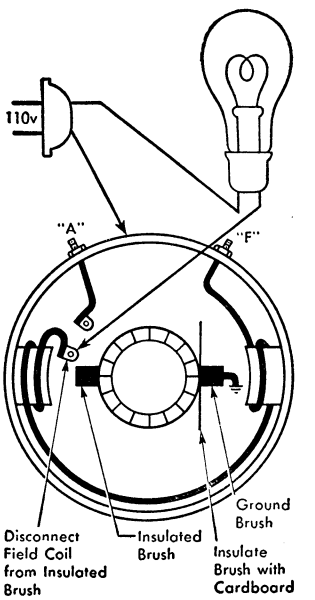

Fig. 9 With this hook-up, bulb will light if field coil or terminal is grounded

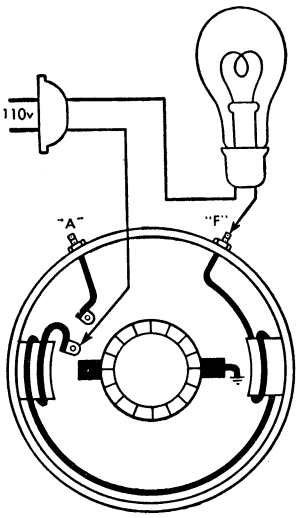

Fig. 10 With this hook-up, bulb will not light if field circuit is open

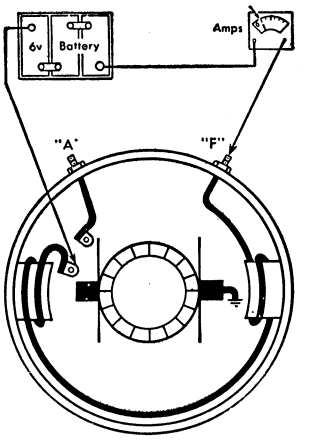

Fig. 11 With this hook-up, if field coils have an internal short, ampere draw will exceed specifications

and possibly serious damage to the generator itself. Polarizing should be done before connecting any wires to the regulator.

On Auto-Lite and Delco-Remy Standard Duty generators, ground the "F" terminal while touching a "hot" jumper wire to the "A" terminal.

On all Ford generators as well as Auto-Lite and Delco-Remy Heavy Duty units, the generator is polarized by touching a "hot" jumper wire to the "F" terminal.

Caution—On vehicles equipped with the new Delco-Remy regulator having dual contacts on the voltage regulator, insulate the brushes from the commutator before polarizing the generator.

PRECAUTIONS WHEN SERVICING GENERATORS

Battery—The battery should always be disconnected after disconnecting any wires in the generator circuit or any wires in the harness at the regulator. This is necessary to prevent the possibility of loose connections being grounded in such a way as to reverse the polarity of the generator.

Radio Condensers—When installing a radio suppression condenser on a generator, be sure it is connected to the generator armature terminal. Under no circumstances should it be connected to the field terminal, as this would result in rapid oxidation of regulator contact points.

Open Circuit Operation—Never run or test a generator on open circuit for more than a few seconds. If it should ever be necessary to operate the generator with the battery disconnected, the generator must be grounded and both the armature and field wires disconnected from the generator. The brushes should also be raised from the commutator or both the generator and regulator will be damaged.

Fig. 13 Checking armature for short circuit with a growler. As armature is rotated by hand, steel strip (hacksaw blade) will vibrate if short circuit exists

Field Pole Pieces—These pole pieces otherwise known as pole shoes, are made of soft steel machined very accurately to fit the inner circumference of the frame. The soft steel is of such composition that after they have once been magnetized, they will retain a small amount of magnetism and act as very weak permanent magnets. Therefore, it is important that these pole pieces be rigidly attached to the field frame as they are subjected to considerable magnetic pull when the generator is in operation.

The joint between the pole pieces and the frame should be clean and have a full area of contact to the frame in order to reduce resistance to the passage of magnetic lines in the field magnetic circuit.

Air Gap Between Pole Pieces and Armature—When a generator is manufactured, this air gap is established within practical operating limits with allowance for normal bearing wear and variations in assembly. This air gap should be as nearly uniform as possible between the armature and each pole piece so that there will be uniform magnetic pull upon the armature core and uniform resistance to the passage of magnetic lines between each pole piece and the armature core.

More air gap would decrease the magnetic lines, reducing generator output, and less air gap would increase the magnetic lines. Therefore, if the bearings are in the least doubtful, they should be replaced in order that a uniform air gap be maintained.

Field Coils—Field coils are connected in series with each other, with the polarity of the coils alternating. In other words, the first one would have a North Pole, the next would have a South Pole, and so on, continuing around the armature.

If there is any doubt about the correctness of the assembly, it can easily be checked with an ordinary compass, and with normal voltage in the field circuit. This could happen, for example, in the case of someone trying to save money by replacing only one field coil and obtain-

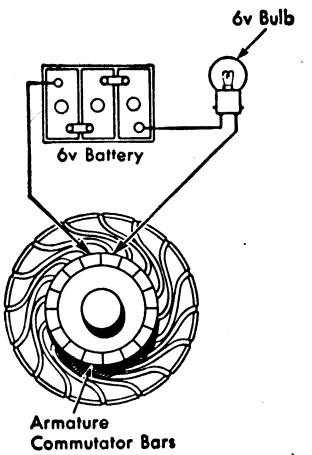

Fig. 12 Hook-up for testing armature for open circuit. When checking against commutator bars, no light will indicate open-circuited armature coils. With a 12-volt system, use a 12-volt battery and a 12-volt bulb

Fig. 14 Cleaning commutator with strip of sandpaper (00) placed over a wooden block

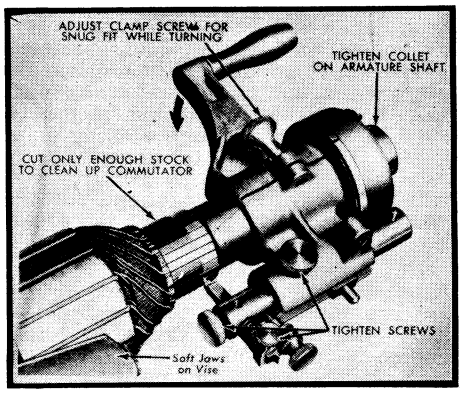

Fig. 16 Special tool used for turning commutator. If a lathe is used for this operation, be sure to mount the armature on the bearing surfaces — not on shaft centers

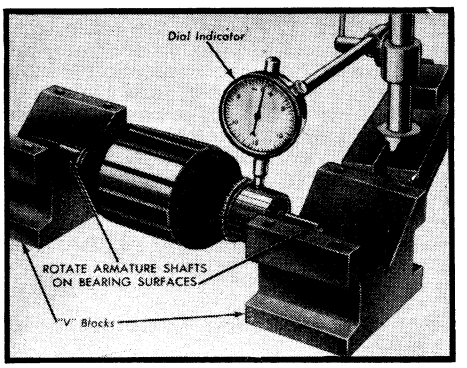

Fig. 17 After turning commutator, mount armature in V blocks and check commutator for runout with dial gauge. Runout should not exceed .001"

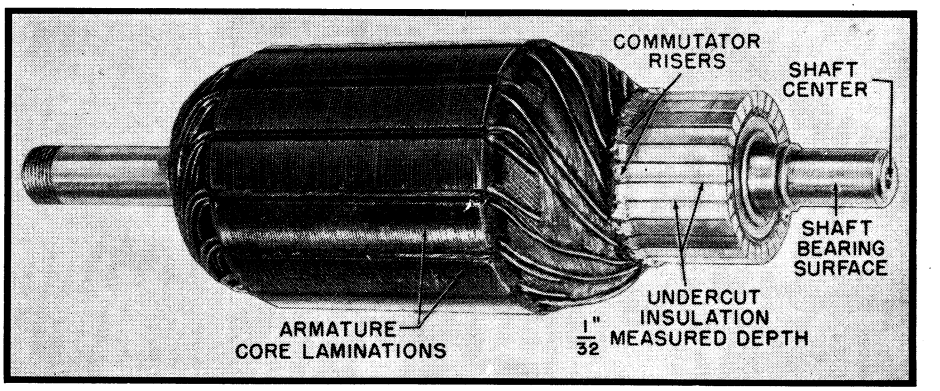

Fig. 15 Typical generator armature

ing it from a salvage establishment. Not only is the danger of the coil being of the wrong polarity present but it may be one having more or less turns than the field coil designed for the generator. Therefore, whenever one field coil requires replacement, the safest thing to do is to replace the set.

Armature—The armature core is made up of soft steel laminations in which slots are stamped on the outer circumference to carry the armature windings.

The surface of these laminations, Fig. 15, is treated to form an oxidized coating which serves as an insulation between the laminations, thereby reducing the stray currents which otherwise would be present. This coating serves also to lower the temperature of the core and increases the efficiency of the generator. Therefore, armature cores should never be turned or filed, as such treatment would cause short circuits between core laminations, increasing its operating temperature and reducing the efficiency of the generator.

Commutators—It is important that commutators be turned concentric with the armature shaft bearing surfaces. Armatures are manufactured with a concentricity of less than .0005" for the brush surfaces in relation to the shaft bearing surfaces.

Therefore, turn commutators by mounting them on the shaft bearing surfaces, not on the shaft centers. The bearings do not run on the shaft centers in the generator, Fig. 15.

Commutators should be turned at a speed of approximately 1200 rpm with a sharp tool set exactly on center, Fig. 16, so that a dead smooth surface can be produced with very little sandpapering.

When sandpaper is applied to a commutator, use a strip of 00 about 10" long. Hold the ends of the paper and let the center of the paper strip rub on the commutator surface. It is not good practice to hold the sandpaper directly against the commutator with the fingers.

After turning the commutator, its concentricity can be checked with a dial gauge, Fig. 17.

The mica insulation between commutator bars should be undercut $\frac{1}{32}$" measured depth, Figs. 17, 18, 19. Do not permit the undercutter shaft to rub on the commutator bars as this would produce flat spots on the commutator, reducing the contact area of the brushes.

The saw for undercutting should be about .002" wider than the insulation between the bars to insure a complete cutting of the insulation.

After undercutting, any burrs left on the edges of the bars should be cleaned off with a narrow scraper that can be drawn the full length of the undercut groove. Then the armature should be checked for short circuits and open circuits in a growler, Figs. 12 and 13.

Brush Holders—The proper alignment of brush holders is important to obtain maximum generator output with minimum arcing at the brushes. An easy way of checking the alignment of opposite brush holders is to lay a hacksaw blade across both brush holders. Press down on the center of the blade and note if both sides of both brush holders touch the blade. Correction can be made by bending the holder with a screwdriver between the end frame and holder.

Place the commutator end frame on the armature and install new brushes. The edges of the brushes should be parallel with the commutator bars.

Brushes—The seating of brushes is extremely important as it is recommended that brushes be fitted to the commutator with 00 sandpaper, drawn between the brush and commutator, *against the brush holder*, as shown in Fig. 20.

The general practice of placing a band of sandpaper on the commutator and turning the commutator in the direction of its normal rotation is not recommended, as in some generators the brush holders are mounted so that some brushes may operate against rotation and other brushes with rotation. In this case, one brush would be properly seated and the other would have a rounded contact surface, causing arcing. Usually, a strip of 00 sandpaper, approximately 10" long, pulled through once in the direction to move the brush against the brush holder results in a satisfactory brush seat.

Brushes should be carefully sandpapered to obtain as nearly as possible a full area of contact between the brush and commutator, otherwise it may be difficult to obtain normal output of the generator. The brushes and brush leads should be free to move in the brush holders to follow the commutator with uni-

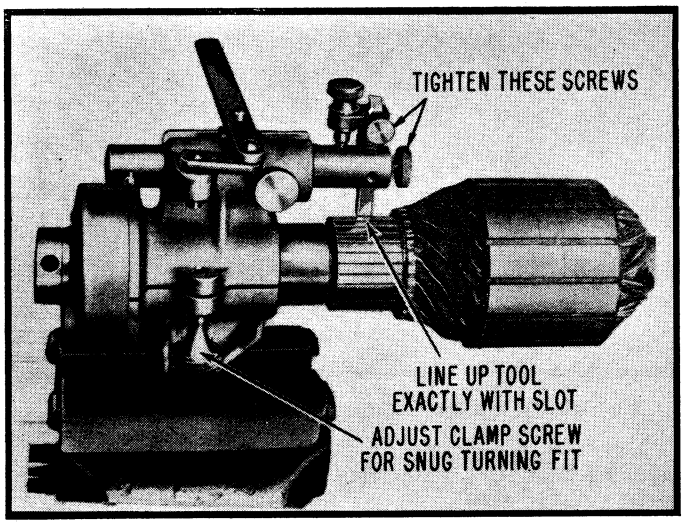

Fig. 18 Commutator mica insulation should be undercut 1/32" measured depth

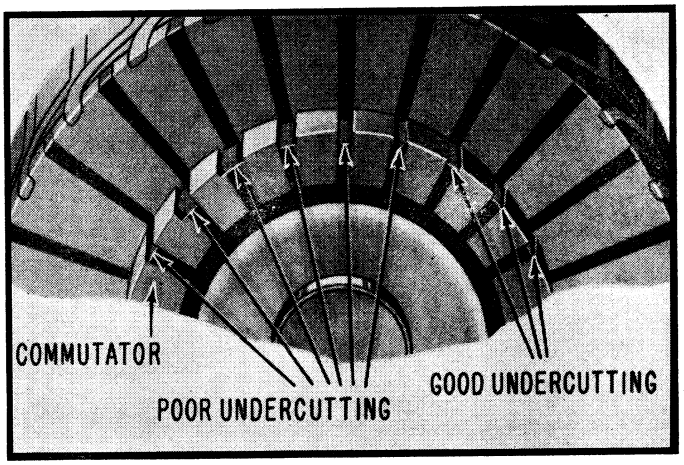

Fig. 19 Examples of proper and improper undercutting

form pressure as the brushes wear.

Brush spring tension should be measured with a good spring scale and adjusted according to the specifications of the generator. If the specifications call for a minimum and maximum limit, they should be adjusted to the maximum pressure so that as the brushes wear, any reduction in pressure will be within limits for a long period of time.

When measuring brush spring tension, use a strip of paper between the brush and commutator, maintaining a slight pull on the paper. Very gradually pull on the scale until the paper can be slipped from under the brush and take a reading on the scale.

Fig. 21 shows the relationship between typical brush holder spring tension arms and brush leads. The brush spring tension arm should rest on top of the brush as shown. If new brushes are too long, the commutator end should be sandpapered until the brush is shortened sufficiently for the spring tension arm to rest on top of the brush. Any filing or notching of the top of the brush is not recommended.

Generator Magnetism—After a generator is built at the factory, the first time it is run it will not generate current. It is necessary, therefore, to apply current from a battery to the field windings to provide magnetic lines to generate the current. After the field coils have been excited, the soft steel pole pieces will retain a small amount of magnetism (called residual magnetism) which makes them very weak permanent magnets.

After this procedure, when the generator armature starts to rotate, the residual magnetism in the field pole pieces is sufficient to generate a voltage in the armature conductors. This voltage applied to the field circuit increases the magnetism of the field, and the generator builds up the voltage for which it was designed.

Sometimes when a generator is completely disassembled, the pole pieces are not replaced in their original relation, and it may be necessary to excite the fields with a battery, the same as is originally done, in order to give the pole pieces the proper polarity in relation to each other.

In connection with the foregoing remarks, the pole pieces can lose their residual magnetism if the generator is bumped severely against another generator or other heavy metal object. In fact, this sometimes happens when a generator is roughly bumped against another generator on a shelf in a stockroom.

Generator Bearings—Generator bearings usually consist of a radial ball bearing on the drive end and an absorbent bronze bushing on the commutator end.

Ball bearings should not have in excess of .001" clearance between the outer race and housing in which it is installed and not more than .001" play between the balls and races. The balls should be round and there should be no tight spots when the outer race is held stationary and the inner race is rotated.

Plain bearings should not have in excess of .002" clearance between the shaft and bearing.

When assembling absorbent bronze bearings, always use the right size arbor as these arbors are designed to give the proper bearing fit. This it most necessary because absorbent bronze bearings must not be reamed because to do so will reduce their capacity to hold lubricant.

When assembling bearings or end frames that are equipped with oil wicks, always remove the wick and replace it only after the armature and end frame are assembled.

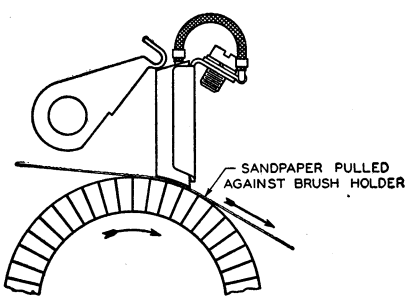

Fig. 20 Recommended method of seating generator brushes

Lubrication—When a generator is disassembled and cleaned, the absorbent bronze bearing should be soaked in medium engine oil before assembling, and the ball bearing should be packed one-half full with a high melting point grease. Care must be taken not to overlubricate any bearings, as the surplus oil will get on the commutator and brushes, which would seriously affect the operation of the generator.

Nearly all generators are provided with oilers at both ends. Hinged top oilers are located over the bearing and should be given 5 to 10 drops of medium engine oil every 5000 miles. Swinging type oilers are used only on the commutator end cap cover and should be filled with medium engine oil every 5000 miles. Cup-and-wick oiler is found under the bearing. The cup should be removed and filled with medium oil every 5000 miles.

Removing Generator from Engine

Loosen the drive belt adjustment and move the generator as required to take off the belt. Disconnect the leads from the generator terminals, or from the regulator if this unit is mounted on the generator. If the latter, tape the end of the battery lead to prevent it from grounding on the engine or frame. Remove the generator mounting bolts and lift the unit from the engine. On hinge type mountings it is usually easier to remove the adjusting strap bolt and swing the generator to expose the bracket mounting bolts.

Disassembling Generator

In servicing a generator, the normal procedure is to disassemble it only so far as is necessary to make repair or replacement of defective parts. For example, if the field coils are not short or open-circuited or grounded, they should

not be removed. However, the following procedure assumes that the generator requires complete disassembly. (Fig. 2 shows a layout of generator parts.)

1. Remove the nut from the end of the armature shaft which holds the pulley in place. It is bad practice to hold the generator in a vise while performing this operation as there is danger of distorting the generator frame. Instead, a suitable strap wrench can be made to hold the pulley by riveting an 18" length of a used fan belt to a piece of pipe. Wrap the belt around the pulley groove and hold it stationary while applying pressure with the pipe.
2. Use a suitable puller to remove the pulley.
3. Remove the screws holding the commutator end frame in place.
4. Take off the end frame and disconnect the field lead attached to one of the brush holders so that the end frame can be completely removed from the generator frame.
5. Remove the drive end frame together with the armature, being careful not to damage the armature windings or commutator by striking it against the pole shoes or field frame.
6. Remove the screws which hold the drive end bearing in place.
7. Remove the drive end frame by slipping it over the bearing. It is not advisable to remove the bearing from the shaft until after it has been examined. If the bearing is found to be in good condition, do not remove it from the shaft.
8. If the bearing is not in good condition, remove the pulley key from the shaft by raising it out of the keyway with a pair of diagonal cutting pliers. Then remove the bearing by pressing it off in an arbor press, being careful not to damage the armature winding.
9. If it is necessary to remove the field coils, the tools shown in Fig. 22, or their equivalent, should be used.
10. Check the commutator end bearing for wear and, if necessary, press the old bearing out and the new one in with the proper arbor. Never ream or scrape absorbent bronze bearings as to do so will reduce their capacity to retain lubricant.

Inspection & Assembly

In the following procedure, some of the operations are mentioned without

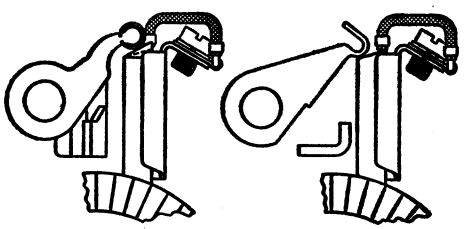

Fig. 21 Relationship between typical reaction type brush holder spring tension arms and brush leads. Tension arm should rest on top of brush

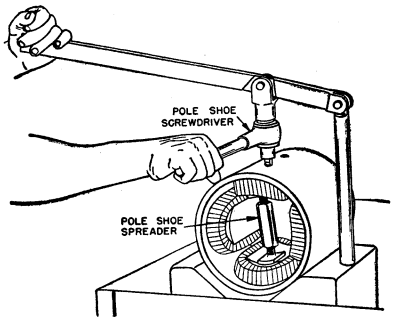

Fig. 22 Using pole shoe spreader and pole shoe screwdriver to remove and install pole shoes and field coils

giving any details because these details have already been covered under "Precautions When Repairing Generators".

1. Clean all parts with a cloth dampened with a suitable cleaning fluid and then dry them with compressed air. Do not immerse field coils, armature, felt washer or insulating parts in fluid or dry them with heat. Never steam clean a generator.
2. Examine all parts for wear or damage.
3. Examine all electrical connections for poor soldering or broken wires.
4. Examine the armature for damage to the core or windings. Examine particularly the core and slot fillers for indications of the armature rubbing the pole pieces. If the core fillers only have been rubbing, drive them into the slots with a narrow piece of copper or fibre. Then coat the fillers with shellac or insulating varnish to hold them in place.
5. If the armature core has been rubbed, filed or turned so that the laminations are short-circuited, the armature should be replaced.
6. Check the armature for short circuits in a growler, Fig. 13.
7. Turn the commutator, Figs. 16, 17.
8. Undercut the mica, Figs. 18, 19.
9. Use a thin scraper to clean out all chips and remove burrs between commutator bars.
10. Place the armature in a lathe and use 00 sandpaper to remove any scratches from the commutator brush surface.
11. Blow out dust and chips with compressed air.
12. Check the armature for short circuits in a growler to make sure that the armature is still O.K. after the turning and undercutting operations.
13. Check the insulated brush holder for a ground, Fig. 7.
14. Check the armature terminal and field terminal for ground, Fig. 9.
15. Check the brush holders for alignment with a hacksaw blade.
16. Place the drive end of the armature shaft in a wood block to hold the armature vertical and place the commutator end frame on the shaft.
17. Install new brushes. This can easily be done by using a hook made of stiff wire to hold the brush spring tension arm up while installing the brushes.
18. Adjust the spring tension by bending the brush spring to the high limit of the specifications for the generator being serviced. Use a suitable spring scale to measure the pressure of the brush on the commutator. With a thin strip of paper placed between the brush and commutator, pull up on the spring scale and slightly pull on the paper. When the pressure of the brush is reduced enough to allow the paper to be pulled out, read the indication on the scale.

NOTE—Fig. 23 illustrates the details of the commutator end frame on the new type Delco-Remy generator with extruded frame (see Fig. 5). Brush spring tension on this type generator is accomplished with the specially constructed spring scale shown in Fig. 24. Hook the end of the scale under the end of the brush tension arm and check the tension. Correct if necessary by bending the spring top or by installing a new spring.

19. Check the alignment of the brushes with the commutator bars. The trailing edge of the brushes should be exactly parallel with the bars.
20. Check the spacing of the brushes on the commutator. For a two-pole generator, they should be exactly 180° apart; for a four-pole generator, 90° apart. Count the commutator bars for spacing.
21. Fit the brushes to the commutator by using a 10" strip of 00 sandpaper approximately the width of the commutator. Pull the sandpaper between the brush and commutator (see Fig. 20) in a direction against the brush holder. Be sure the sandpaper conforms to the shape of the commutator to obtain 100% brush contact.
22. The brush spring tension arm should rest on top of the brush (see Fig. 21). If new brushes are too long, the commutator end should be sandpapered until each is shortened enough for the spring tension arm to be properly located on top of the brush. Do not file or notch the top of the brushes.
23. For third brush generators, be sure the third brush mountings are free to move for adjusting generator

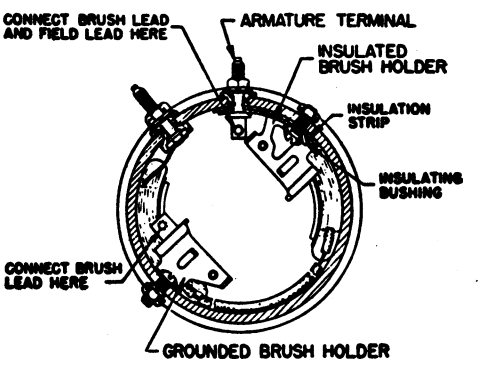

Fig. 23 Details of commutator end frame on new Delco-Remy extruded frame generator. This generator is shown in Fig. 5

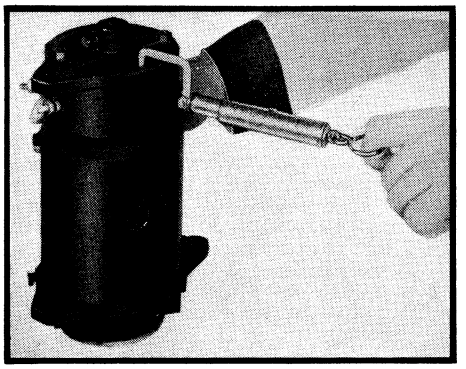

Fig. 24 Checking brush spring tension on new Delco-Remy generator with special type spring scale

output. This mounting must have sufficient friction to hold it in place after adjustments are completed.

24. Assemble the generator, being sure that all internal connections are clean and tight, and the armature is free to rotate in the bearings before the brushes are placed against the commutator.
25. Be sure the brush leads are bent so they will follow the brushes as they wear shorter. Be sure also that the leads do not run against any part of the armature.
26. Run the generator as a motor by connecting it as shown in Fig. 25. When the jumper wire from the field is grounded the armature should "motor" or rotate slowly. If it does not, something is wrong with the assembly, which must be located and corrected.
27. After running the generator for a few minutes, stop it and lift the brushes to examine the contact surfaces. If the brush shows that it is wearing in on one side only, slightly twist the brush tension arm to equalize the pressure on the brush to obtain uniform wear.
28. If a generator test bench is available, mount the generator on it, being sure the pulleys are in alignment. For a third brush type generator, no regulator is necessary. For a shunt type generator, connect it to a regulator of the same specifications it will have when on the car, being sure the polarity is correct. Run the generator at maximum speed, same as when on the vehicle. Then adjust the voltage and ampere output according to the highest voltage the specifications call for. Note the action of the brushes; if sparking occurs, check the brush seat, spring tension and brush spring tension arm. Make any necessary adjustment to obtain satisfactory commutation.

Service Note

If a generator test stand is not available, install the generator on the car, being sure the pulleys are in perfect alignment. Then check the output in the same manner as you would on a test stand, adjusting the current and voltage as described in the *Generator Regulators* chapter.

Installing Generator

If the regulator mounts on the generator, connect the lead from the insulated main brush to the armature terminal and connect the field lead to the field terminal. Then mount the regulator on the generator, being sure to use lock washers on the mounting screws as the regulator must be firmly mounted to assure a good ground on the generator.

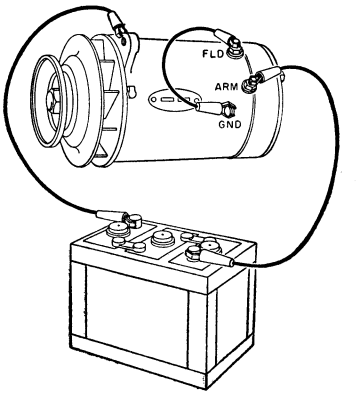

Fig. 25 Connections for running generator as a motor. Be sure to connect the generator with the same polarity that it will have when it is installed on the vehicle

Install the generator on the engine and connect the leads. Adjust the drive belt tension so that there is approximately one inch deflection in the center of its longest span.

After the generator is installed and before starting the engine, it should be polarized according to the instructions outlined previously.

GENERATOR REGULATORS

A generator regulator is designed for one purpose only and that is to regulate or control the charging rate in the generator-battery circuit. When a good battery is low, the regulator will automatically increase the charging rate until the battery becomes fully charged. As soon as the battery is charged up, the regulator will automatically cut down the charging rate.

The modern regulator consists of three units, Figs. 1 and 2. A cut-out relay (otherwise known as a circuit breaker), a voltage regulator unit, and a current regulator unit. The circuit breaker (or cut-out relay) is the same type that has always been used on cars; it automatically closes the circuit between the generator and battery when the engine is running a little above idling speed, and it opens the circuit when the engine is idling or stopped. In other words, it is simply a magnetic switch.

The voltage and current regulators, regardless of type, are automatic magnetic switches that weaken or strengthen the generator field circuit according to the requirements of the battery. This is accomplished by means of resistances that automatically cut into or out of the field circuit. In other words, when the battery is not fully charged, resistance is cut out of the circuit, thereby allowing the generator to recharge the battery. When the battery becomes fully charged, resistance is automatically cut into the circuit, reducing the charging rate of the generator so that the battery voltage is held within safe limits. This design provides a steady generator voltage, depending upon the proportionate time the resistance is in and out of the circuit. This method of control is inherently sensitive and, therefore, controls the voltage within very close limits.

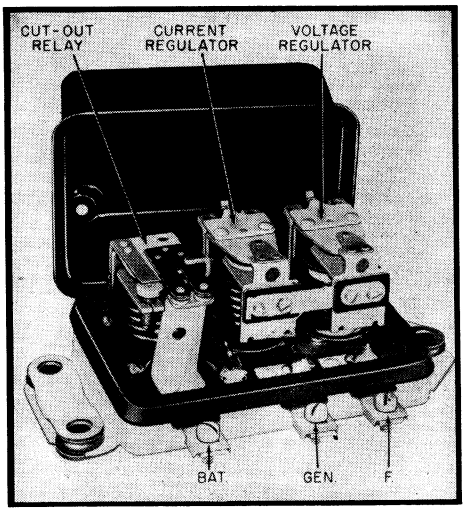

Fig. 1 Delco-Remy vibrating voltage and current regulator with cover removed

When a vibrating type regulator is used for a third brush generator it consists of two units, a circuit breaker and voltage regulator. For shunt-type gene-