SECTION 10-D

GENERATING SYSTEM

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SERVICE BULLETIN REFERENCE

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10-23 THE GENERATING SYSTEM

The generating system restores to the battery the energy used in cranking the engine. It also supplies current to carry the electrical load of the ignition, lights, signalling devices, and accessories, at operating speeds above 25 MPH up to the limit of the generator's capacity. At speeds below 25 MPH the output of generator is not sufficient to carry the electrical load of all units, therefore the battery supplies the additional current required.

The generating system consists of the generator (par. 10-24), generator regulator (par. 10-25), charge indicator, battery (par. 10-14), the wires and cables connecting these units, and the battery ground cable and ground through engine crankcase which completes the circuit. See figure 10-15.

The charge indicator indicates charging current going into the battery and the current leaving battery, except when cranking the engine or blowing the horn. The charge indicator does not indicate charging rate of generator since current supplied by generator to electrical units other than the battery and horns does not pass through the indicator.

10-24 DESCRIPTION OF GENERATOR

The generator is a two-brush, two-pole shunt wound unit. *1948 Model* generators are capable of delivering 34 to 36 amperes when hot. *1949 Series 50-70* generators are capable of delivering 40 amperes when hot.

The maximum output of generator is controlled by the current regulator; however, the generator does not normally deliver the maximum output because the voltage regulator controls output in accordance with the requirements of the battery and the current consuming units in operating. See figure 10-11 and 10-12.

The generator pulley drives a fan which draws a draft of air through the generator to carry away the heat produced during operation. This ventilation permits the generator output to be increased to higher values than would be possible in a non-ventilated generator of the same size.

The armature shaft is supported by an annular ball bearing in the drive end frame and a bronze bushing in the commutator end frame. The bearing and the bushing are provided with hinge cap oil cups for periodic application of a few drops of light engine oil. The two brushes are mounted on a brush plate attached to the commutator end frame and are held in contact with the commutator by spring loaded brush arms. One brush is grounded to the frame while the other brush is insulated from the frame and connected to the field coils and the armature terminal post ("A") on the field frame. The

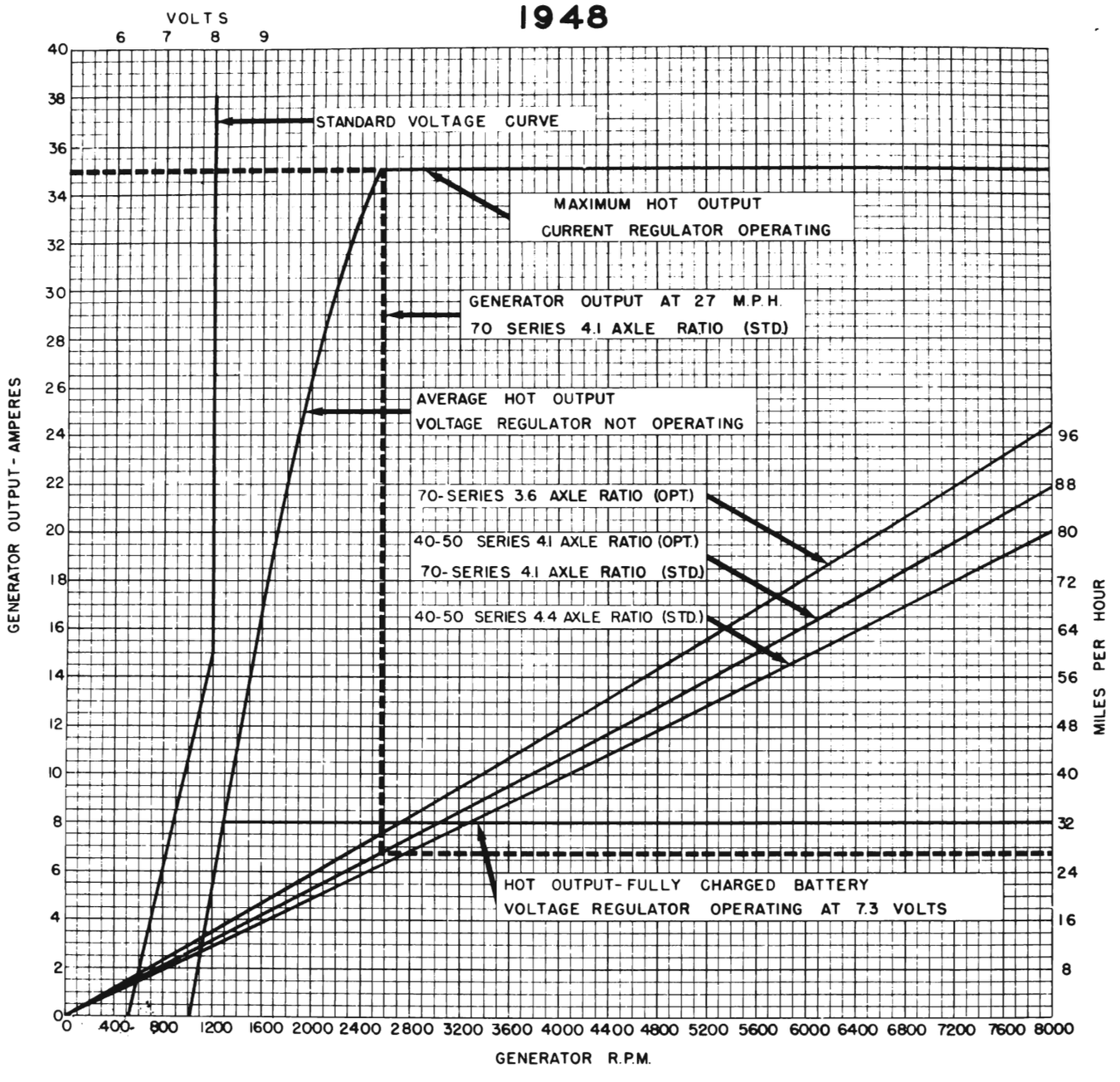

Figure 10-11—Generator Output Chart—1948 Models

two field coils are held in place by two pole shoes which are attached to the field frame by large screws. See figure 10-13.

The generator is suspended on a bracket on left side of crankcase and is driven by the fan belt. The method of mounting permits generator to be moved in or out to adjust tension of fan belt.

The high output rating of the generator used on all series eliminates the need for special service generators except for certain police installations where unusual low speed performance is required. Delco-Remy has available, through United Motors Service, a generator package suitable for this kind of installation.

10-25 DESCRIPTION OF GENERATOR REGULATOR

The generator regulator is mounted on the front side of dash and is cushioned by rubber to dampen the noise which is caused when the regulators operate. The regulator is grounded to the dash through two of the attaching bolts.

The generator regulator contains a cutout relay, current regulator, and voltage regulator, all mounted on one base and enclosed by a sheet metal cover. See figure 10-14. These three devices are magnetic switches whose functions and operations are as follows:

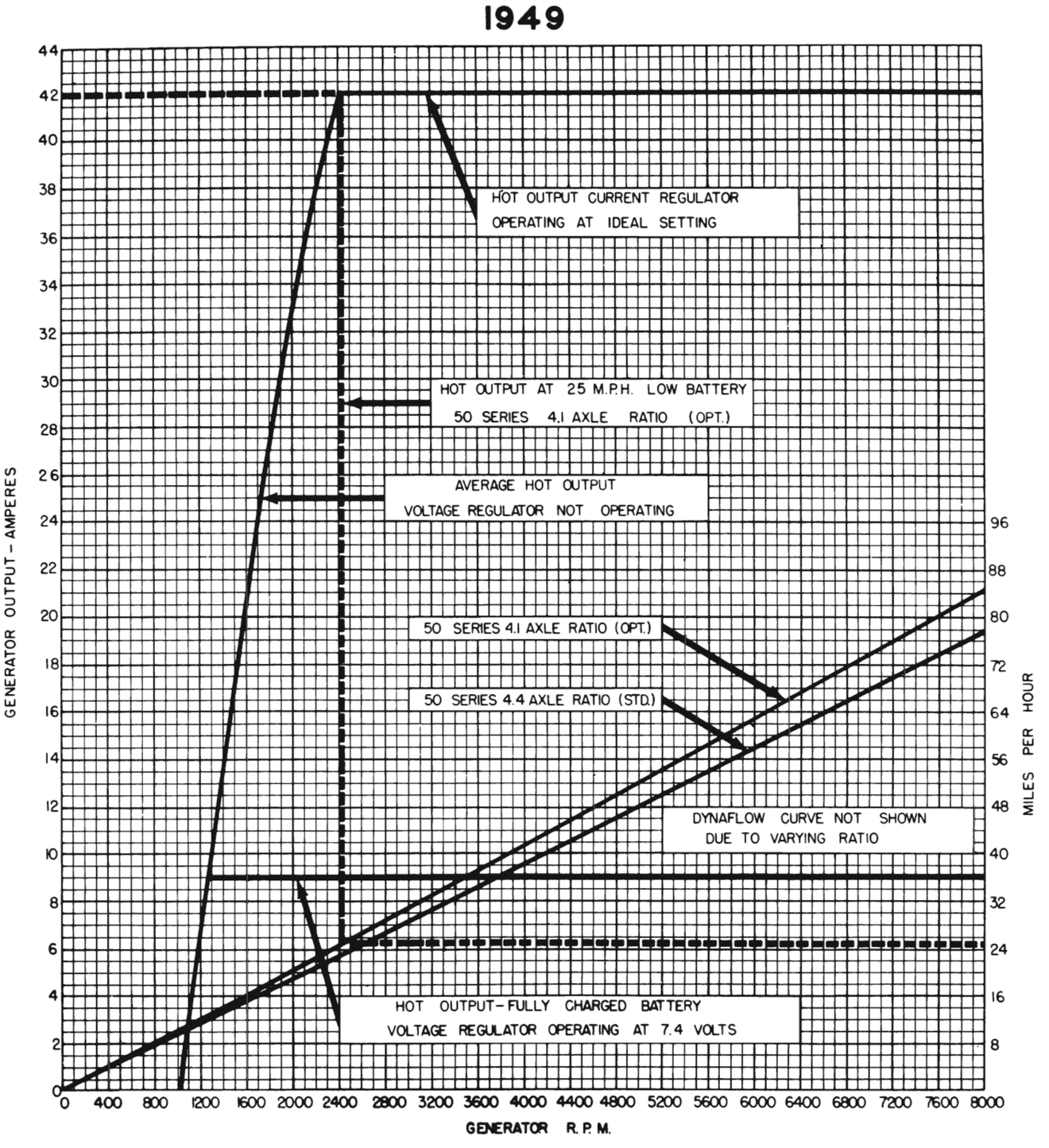

Figure 10-12—Generator Output Chart—1949 Series 50-70

a. Cutout Relay

The cutout relay opens the circuit to prevent the battery from discharging to ground through the generator whenever the engine is stopped or generator is operating at such low speed that its voltage is less than voltage of battery. When the voltage of generator is slightly greater than battery voltage the relay closes the circuit so that generator can furnish current to the electrical system.

The cutout relay has a series or current winding of a few turns of heavy wire, and a shunt or voltage winding of many turns of fine wire, both assembled on the same core. The shunt winding is connected between generator armature and ground so that generator voltage is impressed upon it at all times. The series winding is connected so that all generator output current must pass through it. It is connected to a flat steel armature which has a pair of contact points through which current passes to the battery and other electrical units. The contact points are held open by armature spring tension when the unit is not operating. See figure 10-15 or 10-16.

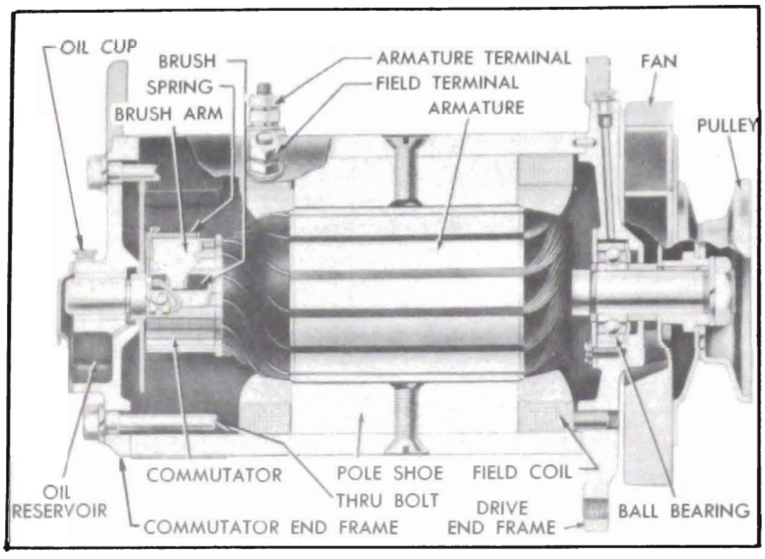

Figure 10-13—Generator, Sectional View—All Series

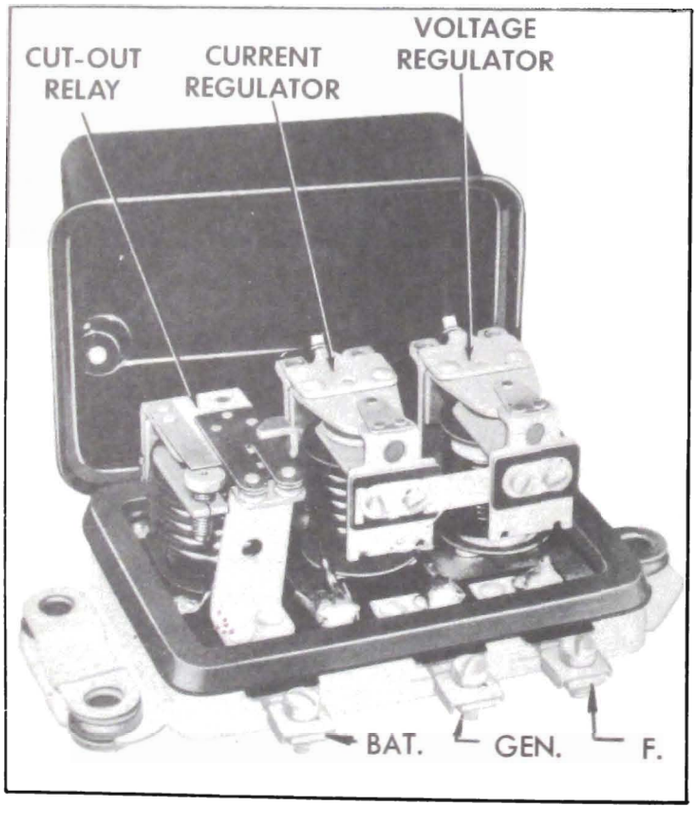

Figure 10-14—Generator Regulator—1949 Model

When the generator begins to operate, voltage builds up and forces current through the shunt winding, thereby magnetizing the core. When the voltage reaches the value for which the relay is set, the magnetism is strong enough to overcome the armature spring tension and pull the armature toward the core, thereby closing the contact points. Generator current now flows through the series winding of relay in the right direction to add to the magnetism holding the points closed, and passes on to the battery and other electrical units in operation.

When the generator slows to engine idling speed, or stops, current begins to flow from the battery back through the generator, reversing the current flow through the series winding. This reduces the magnetism of the relay core to the extent that it can no longer hold the contact points closed against armature spring tension. The points are separated and the circuit broken between the generator and battery.

b. Current Regulator

The current regulator automatically controls the maximum output of the generator. When the current requirements of the electrical system are large and the battery is low, the current regulator operates to protect the generator from overload by limiting its output to a safe value.

The current regulator has one series winding of heavy wire through which the entire generator output flows at all times. This winding connects to the series winding in the cutout relay, described above. Above the winding core is an armature, with a pair of contact points which are held together by spring tension when the current regulator is not operating. When current regulator is not operating and the contact points are closed, the generator field circuit is directly grounded so that generator may produce maximum output, unless further controlled by the voltage regulator described below. See figure 10-15 or 10-16.

When the generator output increases to the value for which the current regulator is set, the magnetism of the current winding is sufficient to overcome the armature spring tension. The armature is pulled toward the winding core so that the points are separated. The generator field circuit must then pass through a resistance, which reduces the flow through the field coils and thereby reduces the output of generator. This reduces the magnetic strength of the current winding so that spring tension again closes the contact points, directly grounding the generator field circuit and increasing generator output. This cycle is repeated 150 to 250 times a second, and the action limits the generator output to the value for which the regulator is set.

The current regulator has a bi-metal hinge on the armature for thermostatic temperature control. This automatically permits a somewhat higher generator output when the unit is cold, and causes the output to drop off as the temperature increases.

The current regulator operates only when the condition of battery and the load of cur-

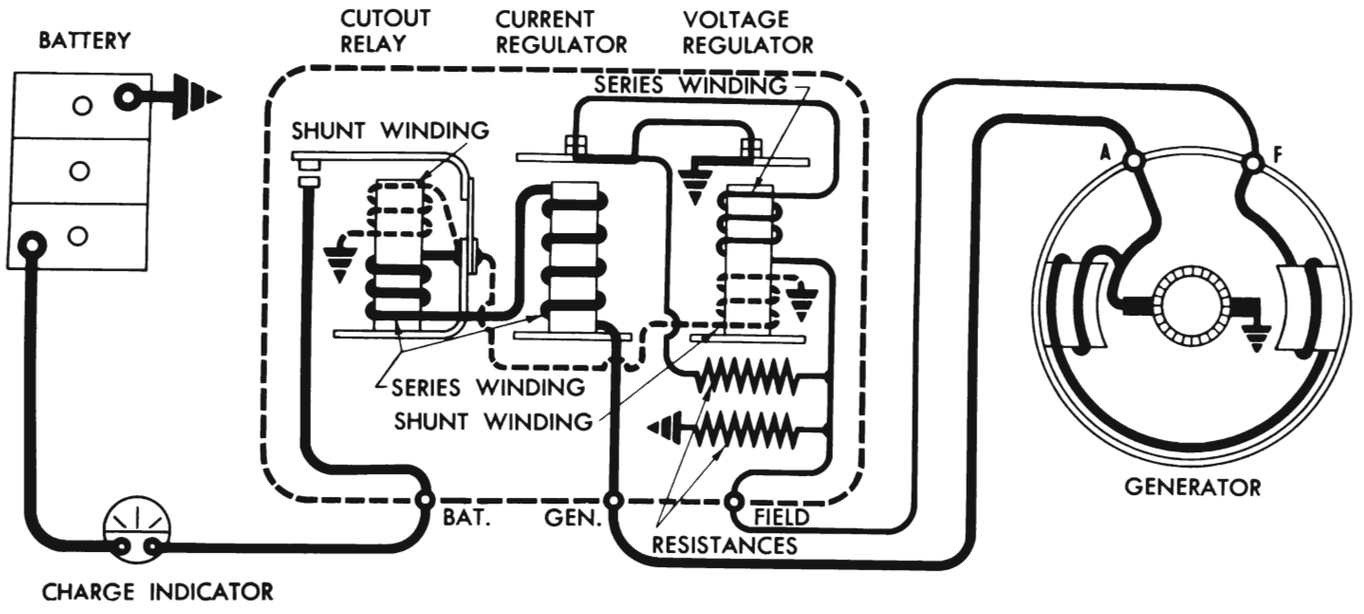

Figure 10-15—Generator Regulator in Generating Circuit—1948 Models

rent-consuming units in operation require maximum output of the generator. When current requirements are small, the voltage regulator controls generator output. Either the current regulator or the voltage regulator operates at any one time; both regulators never operate at the same time.

c. Voltage Regulator

The voltage regulator keeps the voltage in the charging circuits at a constant value, thereby regulating the charging rate of the generator in accordance with the requirements of the battery and the current-consuming electrical units in operation. When the battery is low, the generator output is near maximum but as the battery comes up to charge, and other requirements are small, the voltage regulator operates to reduce the generator output, thereby protecting the battery from overcharge and protecting the electrical system from high voltage.

The voltage regulator consists of two windings assembled on the same core, an armature and a set of contact points, and a fixed resistance. The voltage winding consists of many turns of fine wire connected so that generator voltage is impressed on it at all times. The series winding, having a few turns of heavy wire, carries the generator field current direct-

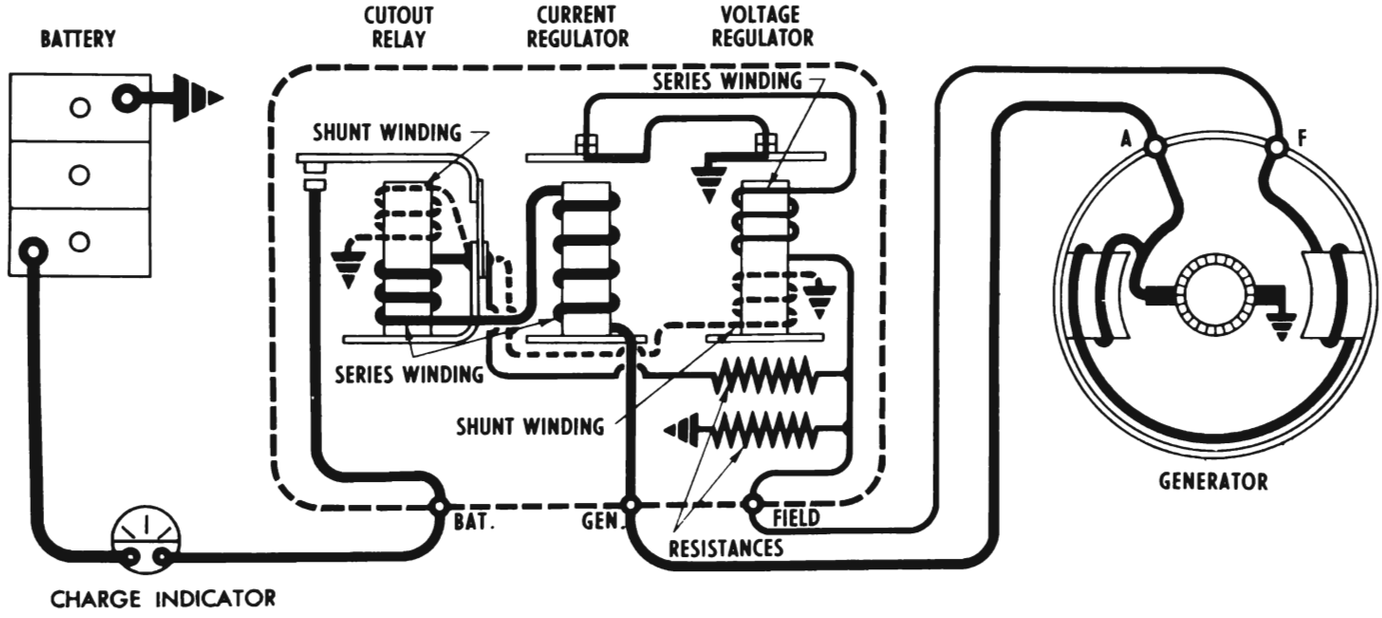

Figure 10-16—Generator Regulator in Generating Circuit—1949 Series 50-70

ly to ground when the regulator contact points are closed. A contact point on the armature, which is located above the winding core, is held in contact with a stationary contact point by armature spring tension when the voltage regulator is not operating. See figure 10-15 or 10-16.

When the generator voltage reaches the value for which voltage regulator is set, the combined magnetic pull of the voltage and series windings is sufficient to overcome the armature spring tension, so that the armature is pulled toward the core and the contact points are separated. The instant the points separate, the field current flows to ground through the resistance. This reduces the current flow through the field coils and decreases generator voltage and output.

As soon as the field current stops flowing through the series winding, the magnetic pull of this winding collapses. In addition, the reduced voltage in the circuit causes a weakening of the magnetic field of the voltage winding in the regulator. The resulting loss of magnetism permits the springs to pull the armature away from the core and close the contact points again, thereby directly grounding the generator field so that generator voltage and output increases.

This cycle is repeated 150 to 250 times a second, causing a vibrating action of the armature, and holds the voltage to a constant value. By maintaining a constant voltage, the voltage regulator continues to reduce the generator output as the battery comes up to charge. When the battery reaches a fully charged condition, the voltage regulator will have reduced the generator output to a relatively few amperes.

The voltage regulator has a bi-metal armature hinge for thermostatic temperature control. This automatically permits regulation to a higher voltage when the unit is cold, and a lower voltage when hot, because a high voltage is required to charge a cold battery.

As previously stated, the current and voltage regulators do not operate at the same time. When current requirements are large, the generator voltage is too low to cause voltage regulator to operate, therefore the current regulator operates to limit maximum output of generator. When current requirements are small, the generator voltage is increased to the value which causes voltage regulator to operate. The generator output is then reduced below the value required to operate the current regulator, consequently all control is then dependent on the operation of voltage regulator.

d. Resistances

The current and voltage regulator circuits use a common resistance which is inserted in the field circuit when either regulator operates.

A second resistance is connected between the regulator field terminal and the relay base, which places it in parallel with the generator field coils.

The sudden reduction in field current occurring when either the current or voltage regulator contact points open, is accompanied by a surge of induced voltage in the field coils as the strength of the magnetic fields change. These surges are partially dissipated by the two resistances, thus presenting excessive arcing at the contact points.

One of the resistances is connected differently in the 1948 and 1949 models. Compare figures 10-15 and 10-16.

10-26 PERIODIC INSPECTION AND TEST OF GENERATOR—ON CAR

As a general rule, the generator should be inspected and tested every 5000 miles to determine its condition; however, the type of service in which some generators are used may make more frequent inspection advisable. High speed operation, excessive dust or dirt, high temperatures and operation of generator at or near full output most of the time are all factors which increase bearing, commutator and brush wear.

a. Inspection of Generator

The following inspection will disclose whether the generator is in proper condition for service or in need of removel for repairs.

1. Remove commutator cover band and inspect it for thrown solder. Thrown solder indicates that the generator has overheated, probably from excessive output. Since thrown solder results in loose or broken connections between armature windings and commutator riser bars, which usually causes burned commutator bars, the generator must be removed for repairs. (Par. 10-28).

2. Inspect commutator. If it is rough, worn, out of round, or has high mica between the bars it will require turning down and undercutting of the mica. Generator must be removed for this work.

3. Check condition of brushes; make sure they are not binding in holders and that they are resting on the commutator with sufficient tension to give good, firm contact. Brush leads and screws must be tight. If the brushes are worn down to one-half their original length, compared with new brushes, the generator must be removed for installation of new brushes. CAUTION: *When inspecting brushes do not pull them out of holders against spring tension by pulling on brush leads. This may loosen the leads in brushes, causing excessive resistance, heating and open circuits to develop. Do not snap brush arms down on brushes as this may chip or crack them.*

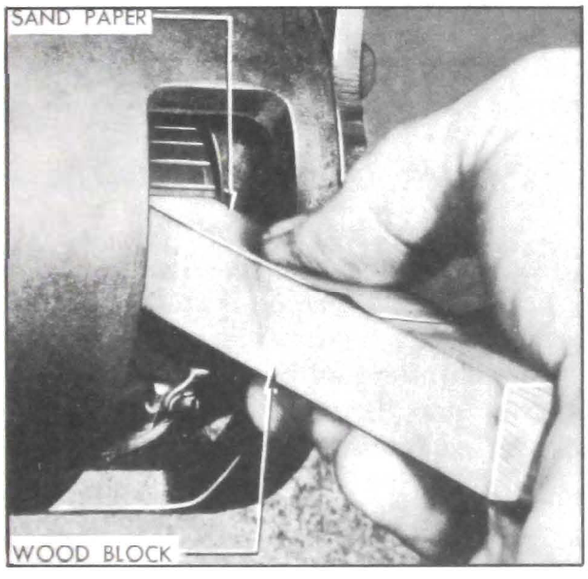

Figure 10-17—Cleaning Generator Commutator

4. If commutator and brushes are in good condition but dirty, they can be cleaned without removal of generator. Clean off any grease with a cloth soaked with carbon tetrachloride or other non-inflammable solvent. While engine is running, polish commutator with a brush seating stone or with a strip of 2/0 sandpaper placed over a wooden block having a smooth square end. See figure 10-17. *Never use emery cloth*, because it will cause arcing, burning and rapid wear of commutator and brushes. After cleaning commutator blow out all dust from generator.

5. Check fan belt for condition and proper tension (fig. 10-18), and make certain that all generator mounting bracket and brace bolts are tight. A loose fan belt will permit belt slippage, resulting in rapid belt wear and low or erratic generator output. An excessively tight belt will cause rapid belt wear and rapid wear of generator and water pump bearings. NOTE: *If belt requires adjustment, first loosen belt so*

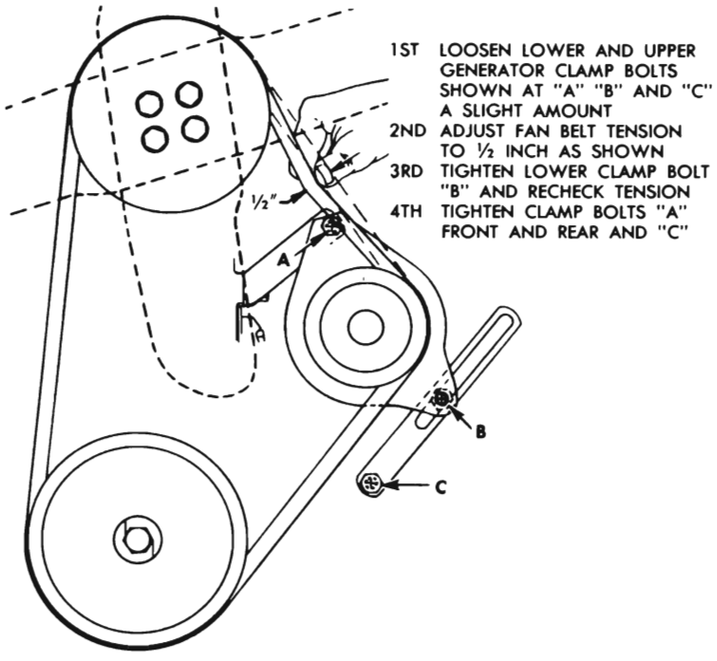

Figure 10-18—Fan Belt Adjustment

that pulley is free, then check pulley for tightness and check generator bearings for freeness of rotation and excessive side play. Tight or excessively worn bearings should be cleaned or replaced

6. Inspect and manually check all wiring connections at generator, regulator, charge indicator, and cranking motor solenoid switch to make certain that connections are clean and tight. Clean any loose connections before tightening, to insure good contact. Inspect wiring for broken insulation, broken strands, and loose terminals. Make any corrections necessary to eliminate excessive resistance.

b. Testing Generator Wiring Circuit and Generator Output

After the inspection given above, it is advisable to test the generator wiring circuit for excessive resistance, and to test the generator to make certain it has proper output.

1. Disconnect wire from generator regulator terminal marked "BAT" and connect an ammeter in series with this terminal and the disconnected wire.

2. Connect jumper wire between regulator terminal marked "F" and base plate of regulator so that current and voltage regulators cannot operate.

3. Start engine and with all electrical units turned off, slowly increase speed until ammeter registers 20 amperes. Quickly check voltage across battery posts and also between generator "A" terminal and ground. If generator

voltage is more than 3/4 volt greater than battery voltage, with 20 amperes flowing, it indicates that excessive resistance exists at some point in generator to battery wiring. The cause of high resistance must be located and eliminated to insure proper charging of battery.

4. Slowly increase engine speed until ammeter registers as follows, which should be reached at approximately the speed shown when generator is HOT, or at slightly lower speed when cold:

Model Year	*Amperes*	*Engine RPM*
1948	34 to 36	1400
1949	40	1250

CAUTION: *Do not exceed engine speeds indicated when F terminal is grounded.*

5. If the specified amperage cannot be obtained at approximately the speed indicated, the generator does not have proper output. It should be removed for a bench test (par. 10-27) and the necessary corrections should be made before making any adjustments on the generator regulator.

10-27 BENCH TEST OF GENERATOR

The following inspection and test of generator, after removal from car, may be used to determine the cause of unsatisfactory output before generator is disassembled.

1. Remove cover band and inspect condition of brushes and commutator as described in paragraph 10-26. If brushes and commutator are in satisfactory condition and the cause of trouble is not apparent proceed to the following steps.

2. Place piece of cardboard between commutator and grounded brush. Using test lamp and points, check for grounds with test points on "A" terminal and generator frame. If lamp lights, the generator is internally grounded. Locate the ground by insulating the other brush also, and checking the brush holders, armature, commutator and field separately.

3. If generator is not grounded, check the field for open circuits by placing one test lamp point on the "F" terminal and the other point on the brush holder to which the field is connected. If lamp does not light the field has open circuit. If the open circuit is due to a broken lead or bad connections, it can be repaired but if the open circuit is inside one of the field coils the coil must be replaced.

4. If the field is not open, check for a short circuit by connecting a 6-volt battery and an ammeter in series with the field coils. Proceed with care since a shorted field may draw excessive current which might damage the ammeter. On *1948 models,* an ammeter reading of 1.75 to 1.9 amperes indicates field is satisfactory; a higher reading indicates a short circuit. On *1949 Series 50-70,* the ammeter reading should be 1.90 to 2.03 amperes.

5. If a grounded or shorted field is found check the generator regulator contact points since either condition may have permitted an excessive field current which will have burned the contact points. Burned contact points require removal of regulator for cleaning or replacement of points (par. 10-30).

6. If the cause of trouble has not been located it will be necessary to disassemble generator for test of armature, as described in the following paragraph.

10-28 GENERATOR REPAIRS—ON BENCH

The generator brushes may be replaced without disassembling the generator, but all other internal repairs require disassembly.

If commutator has burned bars or is worn eccentric, new brushes will wear out very quickly if commutator is not trued up at time brushes are installed.

a. Replacement of Generator Brushes

When inspecting or replacing generator brushes, do not pull them out of their holders against spring tension by pulling on the brush leads. This may loosen the leads in the brushes, causing excessive resistance, heating, and open circuits to develop. Do not snap brush arms down on brushes as this may clip or crack them.

Make sure that brushes are free in the holders and that springs have proper tension. Excssive tension will cause rapid brush and commutator wear, and low tension will cause arcing and burning of brushes and commutator. Hook a spring scale on end of brush arm and measure pull required to just lift arm off brush, pulling at right angle to brush arm. Tension should be 24 to 28 ounces, and may be adjusted by bending the brush spring as required.

New brushes must be seated to make good contact with armature, using a brush seating stone. This is a soft abrasive material which, when held against a revolving commutator, disintegrates so that particles are carried under the brushes and wear their contracting faces

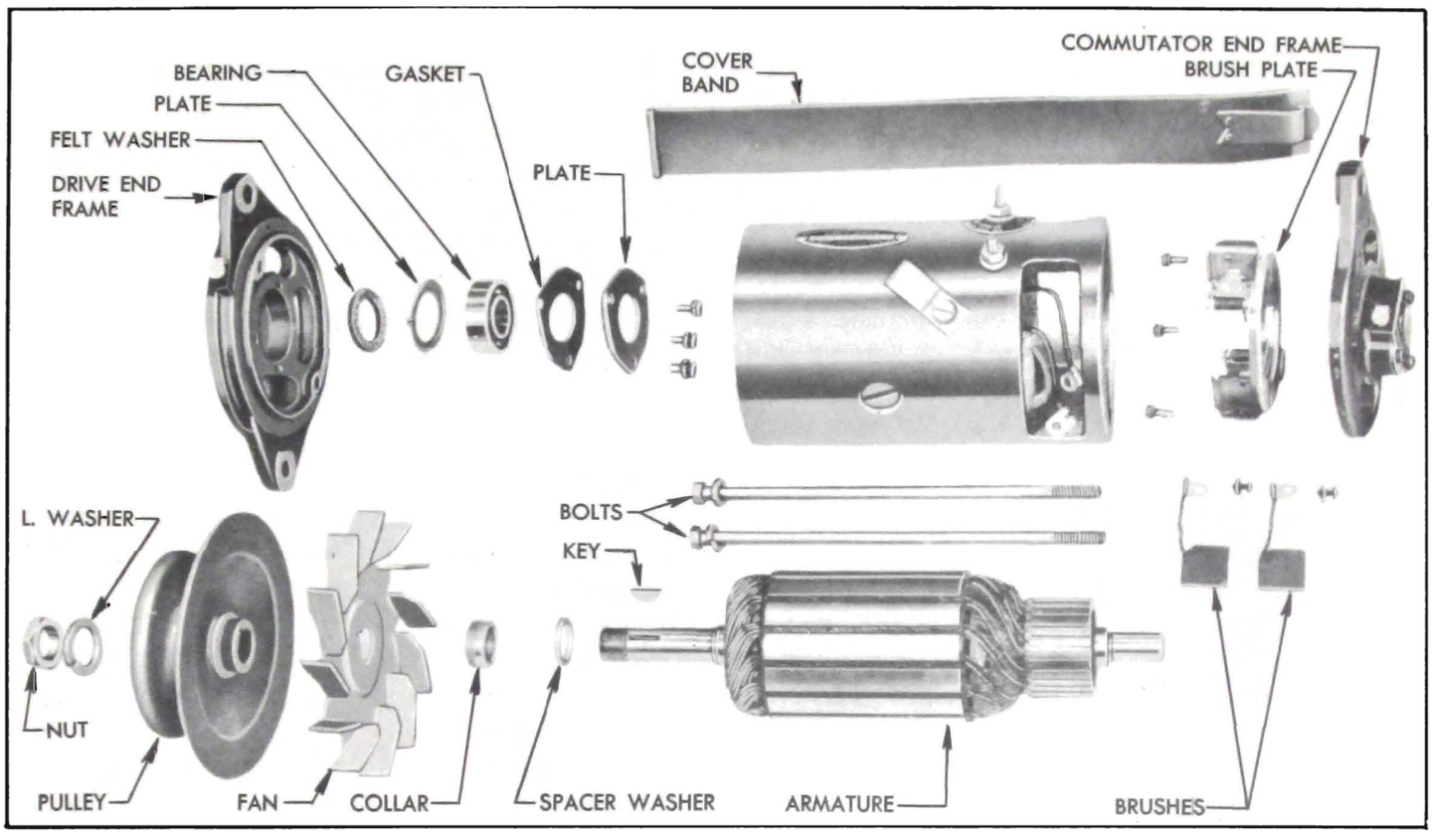

Figure 10-19—Generator Disassembled

to the contour of the commutator in a few seconds. Blow all dust out of generator after the brushes are seated.

b. Disassembly, Cleaning and Inspection

When it is necessary to disassemble generator for any reason, make a complete clean up and test to make sure all parts are in satisfactory condition. See figure 10-19 for identification of parts.

1. Remove commutator cover band, disconnect leads at brushes and remove brushes.

2. Unscrew through bolts and remove the commutator end frame and field frame.

3. Hold armature in vise equipped with soft jaws, and avoid excessive tightening of vise. Remove pulley nut, lock washer, pulley, fan, key, collar, and drive end frame from armature shaft. Remove spacer washer.

4. Remove bearing retainer plate, gasket, bearing, plate and felt washer from drive end frame.

5. Thoroughly clean and inspect the ball bearing as described under Bearing Service (par. 1-13 & 1-14), and if satisfactory for use, pack it with high melting point ball bearing grease. Replace worn or rough bearing.

6. Remove dust cap from commutator end frame and clean out oil reservoir. Make sure that vent hole in dust cap is open. Install dust cap with new gasket.

7. Clean all other parts by wiping with clean cloths. The armature and field coils must not be cleaned in any degreasing compound since this might damage insulation so that a short or ground would subsequently develop.

8. If field coils are to be removed from frame, a pole shoe spreader (KMO 579) and pole shoe screwdriver should be used to avoid distortion of frame. See figure 10-65.

9. Carefully inspect all parts for wear or damage and make necessary repairs, or replace unserviceable parts. Any soldering must be done with rosin flux; *never use acid flux on electrical connections.* If brush springs are distorted or show evidence of overheating, replace them.

c. Testing and Repairing Armature

Before making any repairs to the armature, test it for open, shorted or grounded circuits.

Open circuits in armature are usually obvious since the open circuited commutator bars are usually burned as a result of arcing as they pass under the brushes. If generator has overheated and thrown solder, the open circuit will be at connections to commutator riser bars. Repair can be effected by resoldering leads to riser bars, using rosin flux.

Check armature for short circuits by placing it on a growler and slowly turning armature while holding a thin strip of steel (hacksaw blade) above armature core. The steel strip will vibrate when above the area of armature core in which any short circuited coils are located. Copper or brush dust in slots between commutator bars may cause shorts between bars which can be eliminated by cleaning out the slots. Shorts at cross-over of coils at the drive end can often be corrected by bending the wires slightly and reinsulating the exposed bare wire.

Test for grounds, using test lamp and points, by placing one test point on armature core and the other test point on commutator. If lamp lights, the armature is grounded. If grounds are at points where coils come out of slots in core, repairs can be made by placing insulating strips between core and coil which is grounded.

If armature is otherwise satisfactory but commutator is worn, burned, out of round, or has high mica between bars, the commutator should be turned true in a lathe. After turning, undercut mica $\frac{1}{32}$", then carefully clean all dirt and copper dust out of slots. Lightly polish the commutator with 2/0 sandpaper to remove any slight burrs left by undercutting operation.

d. Assembly of Generator

Assemble generator by reversing disassembly procedure. If field coils were removed, use pole shoe spreader (KMO 579) and pole shoe screwdriver to install them, to avoid distorting frame and to insure proper tightening of pole shoe screws. See figure 10-65.

10-29 TEST AND MINOR ADJUSTMENT OF GENERATOR REGULATOR — ON CAR

The generator regulator should be tested only when difficulty is experienced in keeping the battery charged, or when battery uses an excessive amount of water which is usually caused by a high charging rate. Before testing the generator regulator make certain that the generator and circuit wiring are in good condition by performing the inspection and test given in paragraph 10-26.

Each device in the regulator must be tested separately, in the order given below. The test equipment specified in each test must be reliable and accurate, and a tachometer should be used to check engine speeds where specified.

IMPORTANT. Mechanical checks and adjustments (air gap, point opening) must be made with battery disconnected and preferably

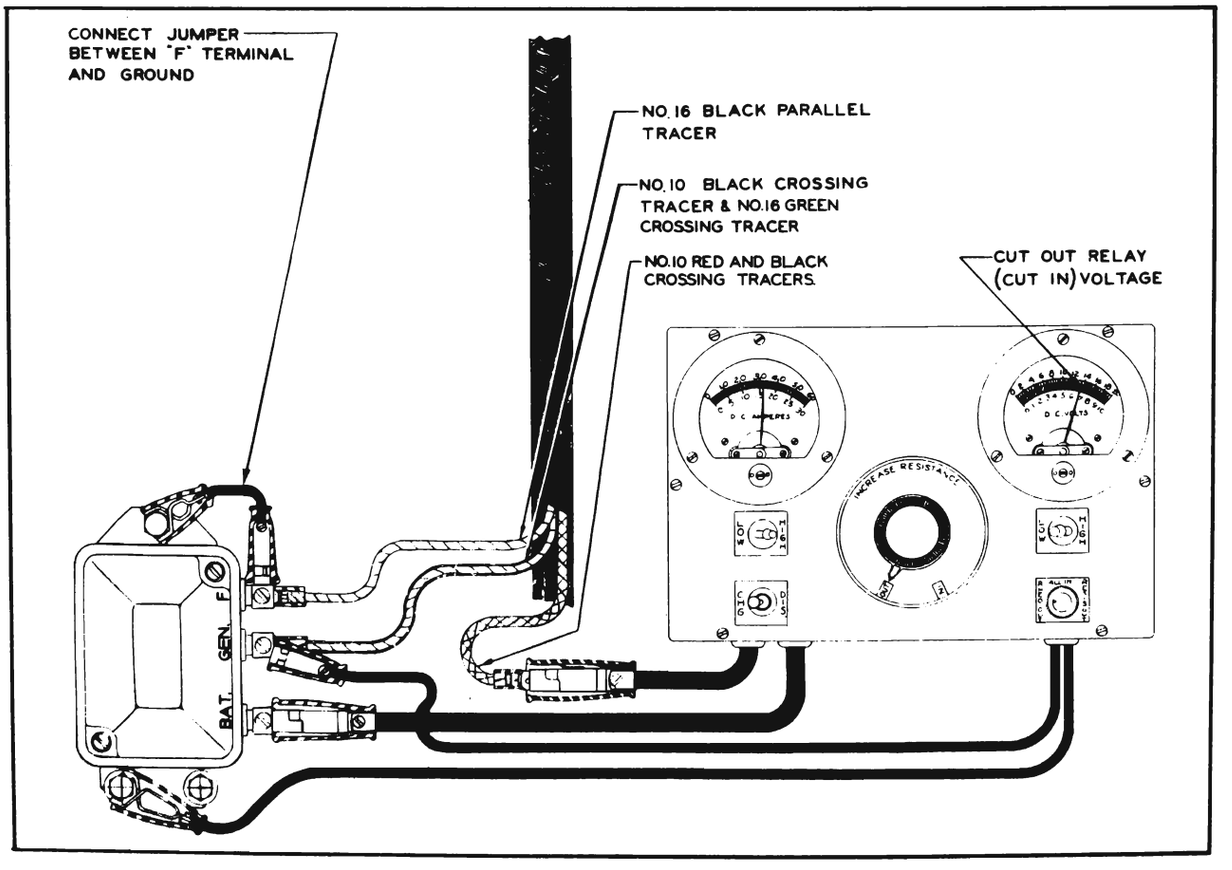

Figure 10-20—Cutout Relay Test

with regulator removed from car. Always make sure that rubber gasket is in place before installing cover. The gasket prevents entrance of dust, moisture, and oil vapors which might damage the regulator.

a. Cutout Relay Test and Adjustment on Car.

Regulator cover must be in place during test of cutout relay.

1. Disconnect wire from regulator terminal marked "BAT" and connect ammeter in series with terminal and disconnected wire. See figure 10-20.

2. Connect voltmeter test leads to terminal marked "GEN" and to ground on base plate of regulator.

3. Connect jumper wire between terminal marked "F" and ground on base plate of regulator so that voltage regulator cannot operate. This is advisable because an improperly adjusted voltage regulator may prevent the cutout relay from closing.

4. Start engine and warm it up until it is running on slow idle and adjust speed to 350 RPM. CAUTION: *Never run engine faster than 1400 RPM with "F" terminal grounded. A higher speed may cause damage to generator.*

5. Slowly increase engine speed, noting the voltmeter reading at the instant that circuit relay contacts close, which will be indicated by movement of ammeter hand. The voltmeter will read between 6.1 and 6.8 if closing voltage of relay is correctly adjusted.

6. Gradually increase engine speed until generator is charging approximately 5 amperes.

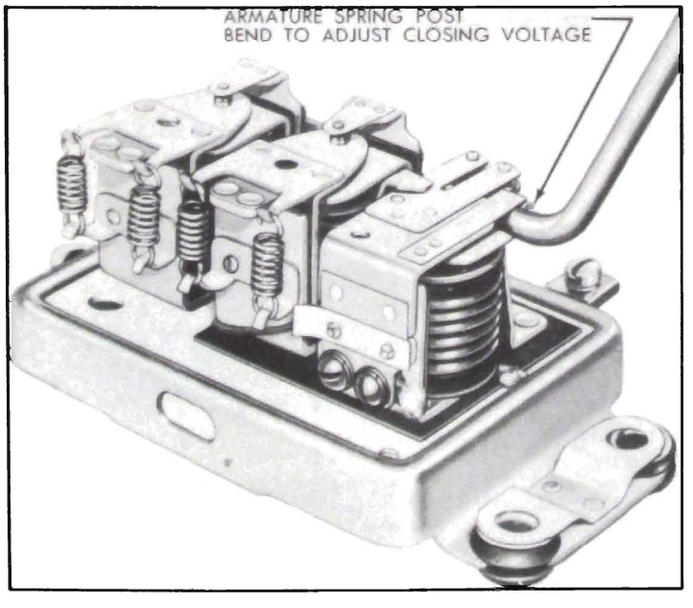

Figure 10-21—Adjustment of Cutout Relay Closing Voltage—1948 Models

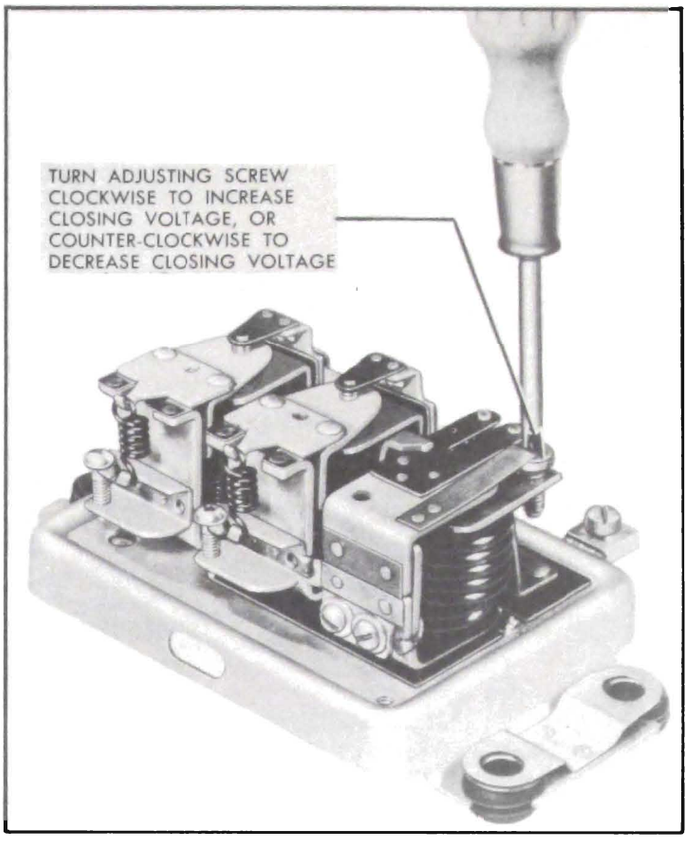

Figure 10-22—Adjustment of Cutout Relay Closing Voltage—1949 Series 50-70

Slowly reduce speed until relay contacts open, as indicated by ammeter hand returning to zero. Contacts should open only on reverse or discharge current of minus one to minus six amperes. Contacts should never open when ammeter shows charge; this would indicate a shorted winding in relay. If reverse current to open points is not correct it will be necessary to remove regulator and adjust air gap as described in paragraph 10-30.

7. If closing voltage is not within specified limits, remove regulator cover and adjust relay as follows:

(a) On *1948 Models*, bend armature spring post up to increase spring tension and closing voltage, or bend down to decrease closing voltage. Adjust to 6.4 volts. See figure 10-21.

(b) On *1949 Series 50-70* turn adjusting screw clockwise to increase spring tension and closing voltage, or turn counterclockwise to decrease closing voltage. Adjust to 6.4 volts. See figure 10-22.

(c) CAUTION: *Never close relay contacts by hand with battery connected to regulator. This will cause a high current to flow through regulator units and seriously damage them.*

8. Remove jumper wire and disconnect voltmeter. Leave ammeter connected for current regulator test which follows.

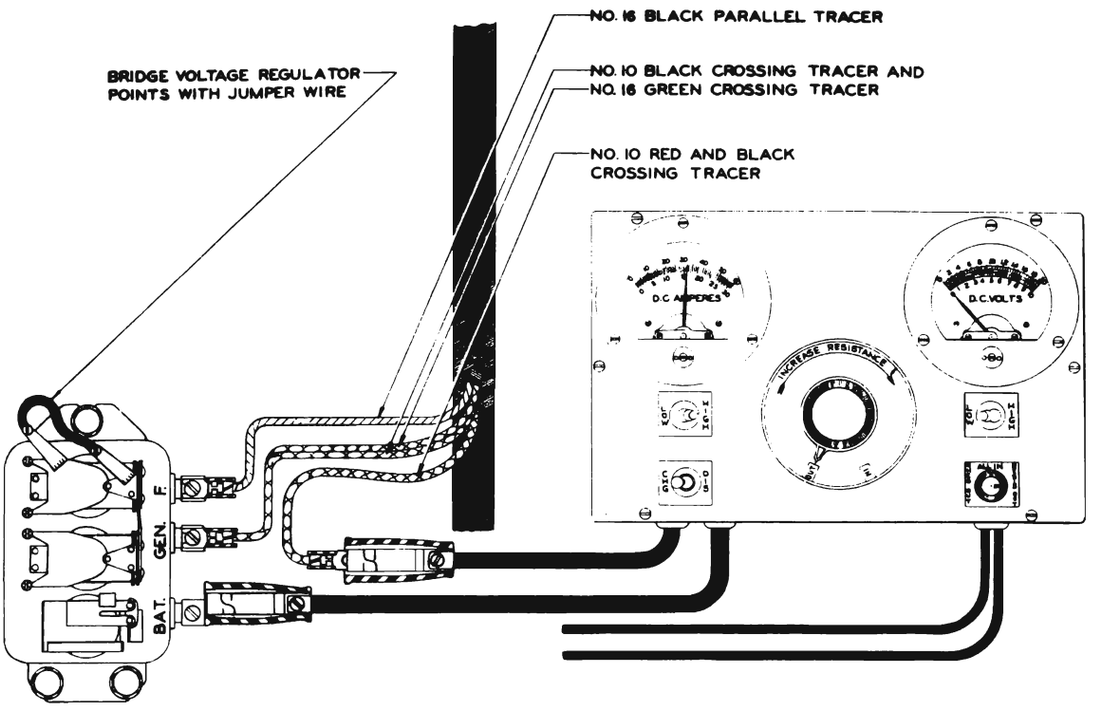

Figure 10-23—Current Regulator Test

b. Current Regulator Test and Adjustment on Car

CAUTION: *Since the current regulator is compensated for temperature, the regulator must be tested at operating temperature which is 150°, or very hot to the hand.*

1. With ammeter connected in series with regulator "BAT" terminal and the disconnected wire, start engine and increase speed to approximately 1400 RPM. If test instrument has a resistance in series with ammeter turn knob until all resistance is cut out.

2. Turn on car lights to permit increased generator output and run at this setting until regulator reaches operating temperature, then decrease speed to idle and stop the engine.

3. Remove regulator cover and connect a jumper wire between upper contact and armature of voltage regulator. See figure 10-23. This will prevent voltage regulator from operating and reducing charging rate of generator.

4. Start engine and slowly increase speed until generator output remains constant, which should occur at approximately 2000 RPM of engine. On *1948 Models*, ammeter will register 34 to 36 amperes if current regulator is hot and correctly adjusted. On *1949 Series 50-70*, ammeter will register 40 to 46 amperes.

5. If charging rate is excessively low, stop the engine and inspect the contact points for oxidized or burned condition, which would cause high resistance in generator field circuit and reduce generator output. Inspect contact points of cutout relay and voltage regulator also. If any contact points are oxidized or burned, the regulator must be removed for proper cleaning or replacement of contacts, (par. 10-30).

6. If contact points are in satisfactory condition and charging rate is not within specified limits, adjust armature spring tension as follows:

(a) *On 1948 Models,* confine adjustment to *one spring only.* Bend the spring hanger down toward regulator base to increase charging rate, or bend hanger up to decrease rate. Ad-

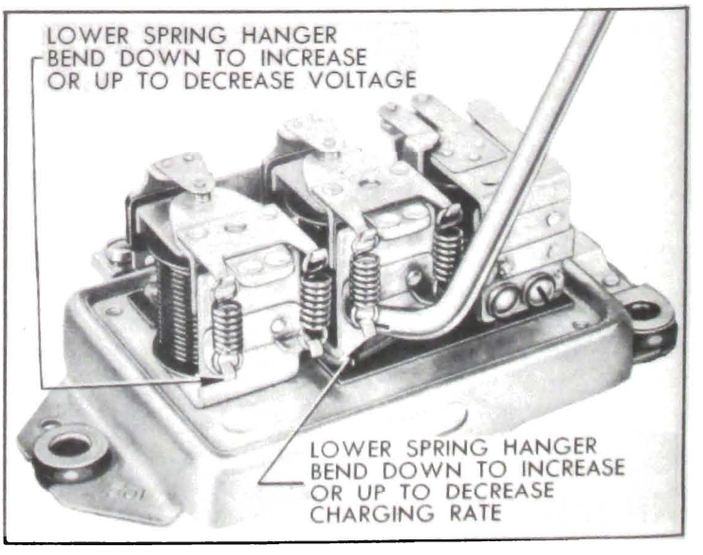

Figure 10-24—Current and Voltage Regulator Spring Tension Adjustments—1948 Models

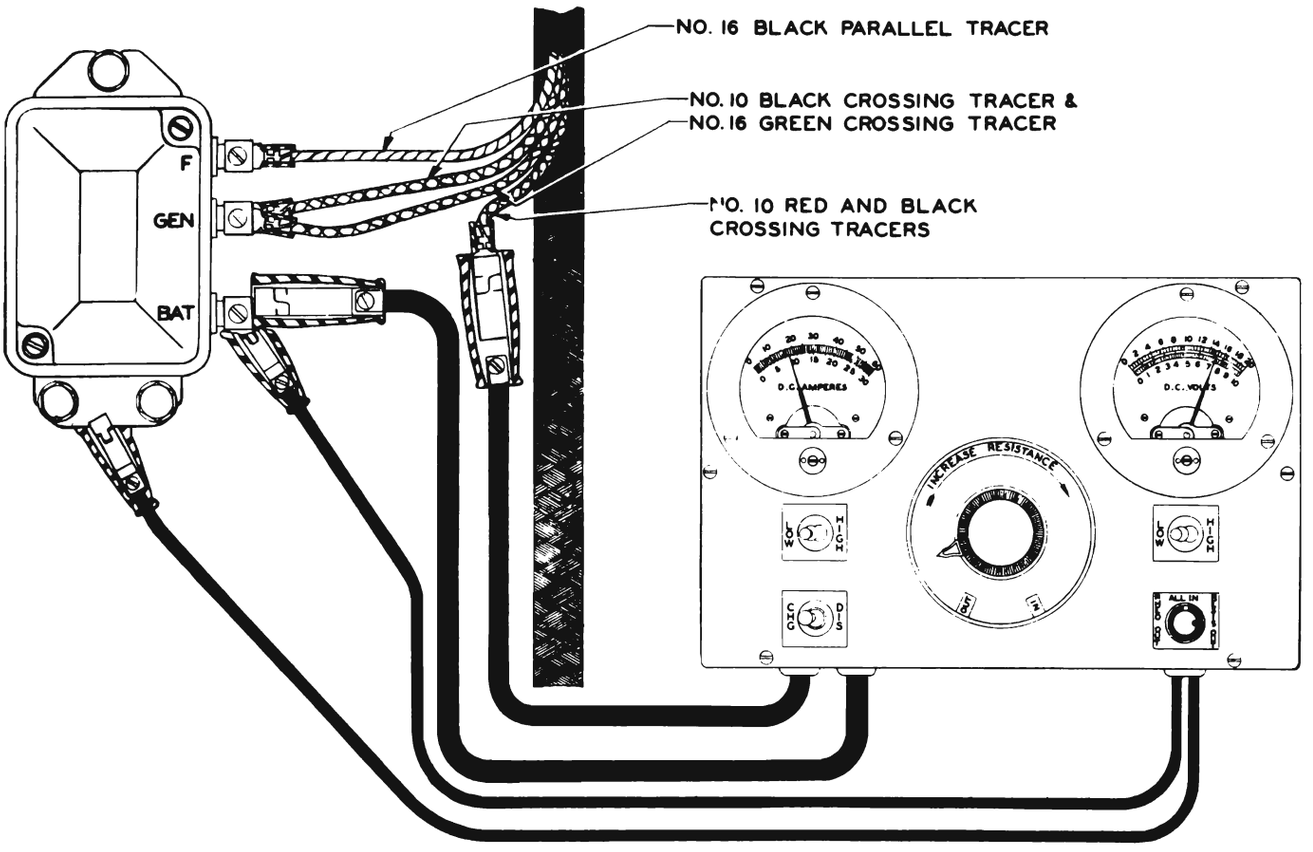

Figure 10-25—Voltage Regulator Test Connections

just to 35 amperes. See figure 10-24. If a slight adjustment of one spring does not provide proper setting, the regulator should be removed for a complete readjustment (par. 10-30).

(b) On *1949 Series 50-70,* turn adjusting screw clockwise to increase charging rate or counterclockwise to decrease charging rate. Adjust to 42 amperes. See figure 10-26. *The final setting must always be made by increasing the spring tension and charging rate, never by reducing the rate.*

If adjusting screw is turned clockwise beyond normal range required for adjustment, the spring support may be bent so that it fails to return when pressure is relieved. If this happens, turn the screw counterclockwise until sufficient clearance exists between screw head and spring support, then bend spring support upward carefully until contact is made with screw head. Make final adjustment as described above.

7. Stop the engine, remove jumper wire but leave ammeter connected. Install regulator cover *with gasket in proper position.*

c. Voltage Regulator Test and Adjustment on Car

CAUTION: *Since the voltage regulator is compensated for temperature, the regulator must be tested at operating temperature which is 150° or very hot to the hand. Regulator cover must be in place during test.*

1. With wire disconnected from "BAT" terminal of regulator, connect an ammeter and a ¼ ohm variable resistance in series between "BAT" terminal and the disconnected wire, and connect voltmeter between this terminal and ground on regulator base plate. See figure 10-25.

2. Start engine and increase speed to approximately 1500 RPM. Adjust resistance until ammeter reads 8 to 10 amperes. If less than 8 amperes is obtained, even with all resistance cut out, turn on car lights to permit increased generator output and adjust resistance to 8-10 amperes. Run at this setting until regulator reaches operating temperature.

3. When regulator becomes hot gradually reduce engine speed until cutout relay points open, then bring engine speed back to 1500 RPM and adjust resistance to give charging rate of 8-10 amperes. The voltmeter will read 7.2 to 7.7 volts if voltage regulator is properly adjusted.

4. If voltage is not within specified limits, remove regulator cover and adjust armature spring tension as follows:

(a) On *1948 Models,* confine adjustment to *one spring only.* Bend the spring hanger down toward regulator base to increase voltage or

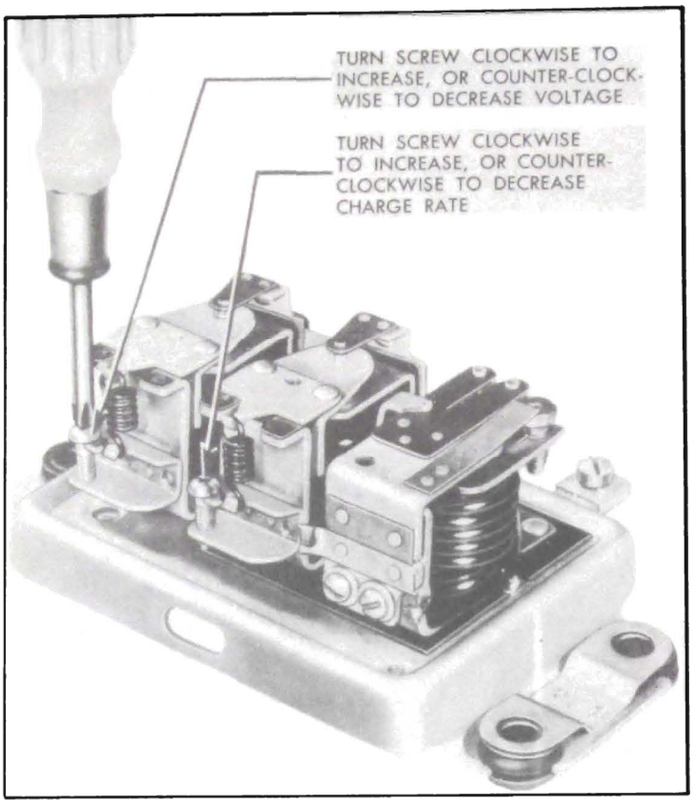

Figure 10-26—Current and Voltage Regulator Spring Tension Adjustments—1949 Series 50-70

bend hanger up to decrease voltage. Adjust to 7.4 volts. See figure 10-24. If a slight adjustment of one spring does not provide proper setting, the regulator should be removed for a complete readjustment.

(b) On *1949 Series 50-70,* turn adjusting screw clockwise to increase voltage or counterclockwise to decrease voltage. Adjust to 7.4 volts. See figure 10-26. *The final setting must always be made by increasing the spring tension and voltage, never by reducing the spring tension.*

If adjusting screw is turned clockwise beyond normal range required for adjustment, the spring support may be bent so that it fails to return when pressure is relieved. If this happens, turn the screw counterclockwise until sufficient clearance exists between screw head and spring support, then bend spring support upward carefully until contact is made with screw head. Make final adjustment as described above.

5. After each adjustment of spring tension, and before taking voltage reading, install regulator cover with gasket in proper position and run engine at 1500 RPM until regulator is hot. Gradually reduce engine speed until cut-out relay points open, then bring engine speed back to 1500 RPM. Adjust resistance until ammeter reads 8-10 amperes at 1500 RPM and take voltage reading.

6. Disconnect test equipment and connect wire to "BAT" terminal. Polarize generator before again starting engine (subpar. *d,* below). Set engine speed at 450 RPM.

d. Polarizing Generator

After any tests or adjustments of regulator, or replacement of regulator or generator, the generator on the vehicle must be polarized after all leads are connected but *before the engine is started.*

Momentarily connect a jumper lead or screw driver between the "BAT" and "GEN" terminals of regulator. This allows a momentary surge of current to flow through the generator which correctly polarizes it.

Failure to polarize the generator may result in severe damage to the equipment since reversed polarity causes vibration, arcing and burning of the relay contact points.

10-30 GENERATOR REGULATOR REPAIRS—ON BENCH

The contact points of a regulator will become oxidized and pitted after extended service and require cleaning. Contact points also may be burned because of faulty connections in the charging circuit, shorts or grounds in the generator field circuit, or installation of a radio by-pass condenser on the "F" terminal of generator or regulator.

The majority of regulator troubles arise from dirty and oxidized contact points, which cause a reduced generator output. Cleaning of contact points, or replacements if badly burned, followed by adjustment of air gap and spring tension will correct faulty regulator operation in most cases. Cleaning of points and adjustment of regulator should not be attempted with unit on the car; remove regulator so that this work can be done properly.

a. Cleaning Regulator Contact Points

Loosen the upper contact support mounting screws on voltage and current regulators and tilt support to one side so that each point can be cleaned separately without danger of bending the upper contact spring. Use a thin, fine-cut file on the crowned point on contact support, and use a spoon or riffler file to clean out the cavity which is usually formed in the flat contact point on the armature. See figure 10-27. A

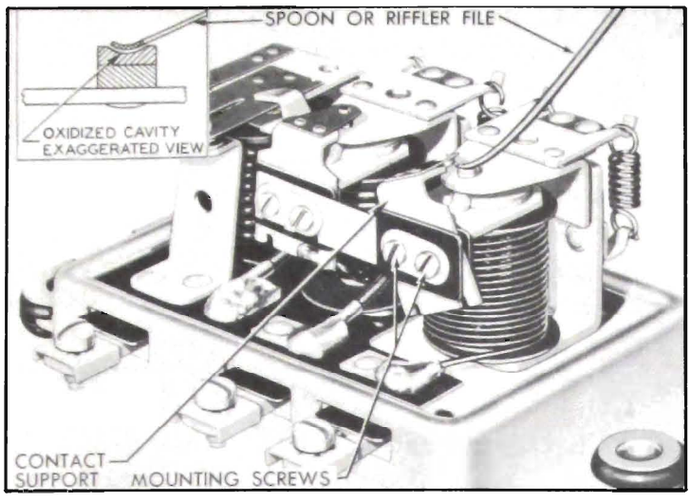

Figure 10-27—Cleaning Voltage Regulator Flat Contact Points

flat file will not clean out this cavity. File just enough to remove oxidation. *Never use emery cloth or sandpaper on contact points since particles of emery or sand left on points will cause them to arc and burn.*

After contact supports are returned to position, reset air gaps (subpar. d, below).

b. Replacing Upper Contact Supports

If new upper contact supports are required or if supports have been removed, they should be installed as shown in figure 10-28. Note that the connector strap is connected to voltage regulator contact support but is insulated from the current regulator contact support. Note position of the flat and tubular insulators. After installation of contact supports, reset air gaps (subpar. d, below).

c. Adjustment of Cutout Relay

The cutout relay requires three checks and adjustment: Air gap, point opening, and closing voltage.

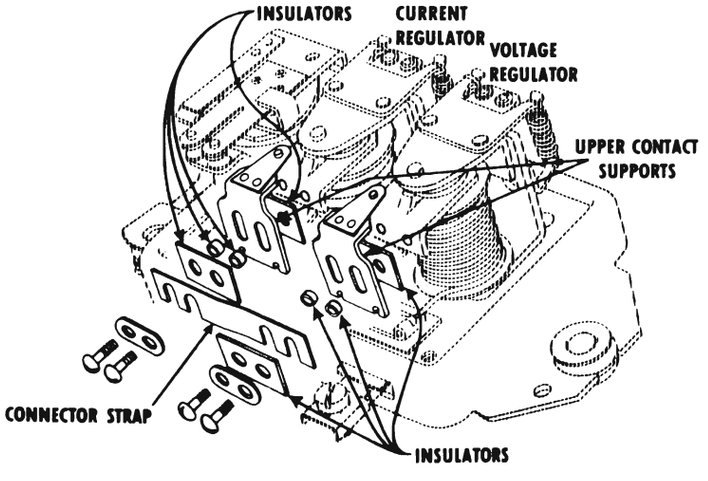

Figure 10-28—Relationship of Connector Strap, Insulators and Upper Contact Supports

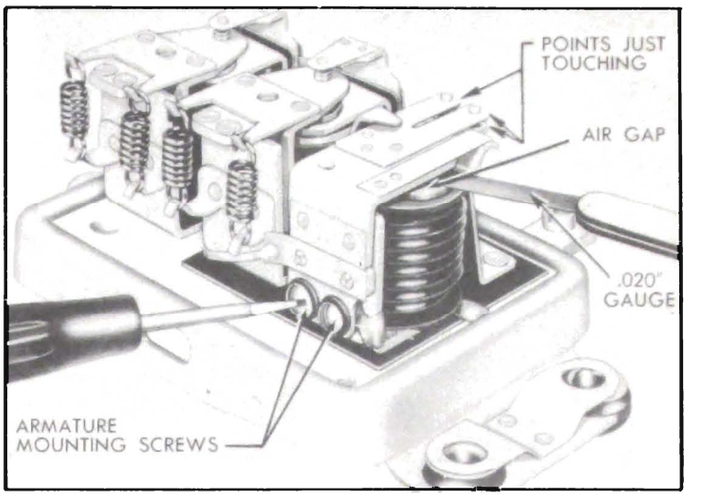

Figure 10-29—Adjustment of Cutout Relay Air Gap

1. Place finger on armature directly above core and move armature down until contact points just close. If both sets of points do not close simultaneously, bend spring fingers so that they do. *With points just closed,* measure air gap between armature and center of core; gap should be .020", measured with feeler gauge. Adjust air gap, if necessary, by loosening armature mounting screws and raising or lowering armature as required. Tighten screws securely and recheck air gap. See figure 10-29.

2. Check contact point opening with feeler gauges. Opening should be .020". Increase or decrease point opening, if necessary, by bending the upper armature stop. See figure 10-30.

3. Check and adjust closing voltage as described in paragraph 10-29, after installation of regulator on car, or while connected to a proper test generator and battery.

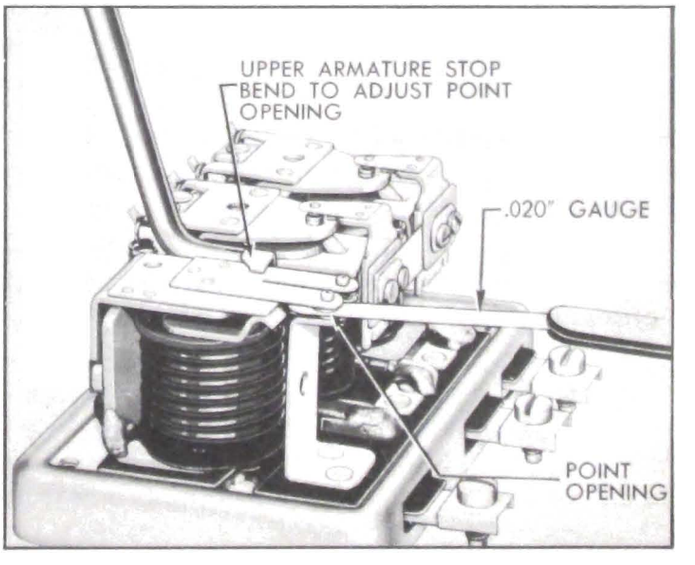

Figure 10-30—Adjustment of Cutout Relay Contact Point Opening

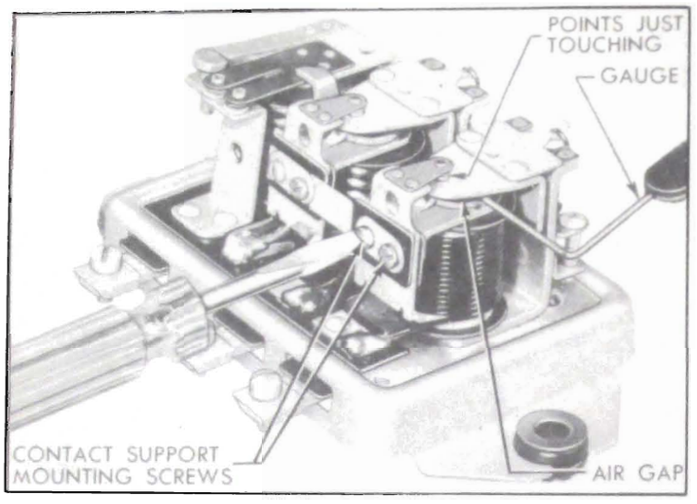

Figure 10-31—Adjustment of Voltage Regulator Air Gap

d. Adjustment of Voltage or Current Regulator

The voltage and current regulators require two checks and adjustment; air gap and voltage or current setting.

1. Push armature down to the core and slowly release it *until the contact points just touch,* then measure air gap between armature and center of core, using feeler gauge. Air gaps should be as follows:

1948 Current Regulator.....080"
1948 Voltage Regulator.....070"
1949 C & V Regulators.....075"

2. Adjust air gap on each unit, if necessary, by loosening contact support mounting screws and raising or lowering support as required. Be sure points are lined up when tightening screws, then recheck gap after adjustment. See figure 10-31.

3. Check and adjust voltage and current settings as described in paragraph 10-29, after installation of regulator on car, or while connected to a proper test generator and battery.

e. Replacement of Voltage or Current Regulator Armature Springs — 1948 Model

When either regulator unit is badly out of adjustment or requires new armature springs, the following procedure must be used to assure equal tension on both springs, since improper operation may result if one spring has greater tension than the other. Although all armature springs are identical there is some variation in tension when new, and some variation in position of spring hangers usually exists.

The regulator must be correctly connected to the proper type generator and battery. If regulator is connected to test generator and battery on the bench, the regulator must be mounted in the same position as it is installed on car. If regulator is reinstalled on car *be sure to polarize the generator before starting engine.* In either case, the regulator must be brought to operating temperature (150° or very hot to hand) before adjusting spring tension.

1. *On current regulator unit,* install one spring only. Connect an ammeter in series with "BAT" terminal of regulator and the wire leading to battery. Connect jumper wire between upper contact and armature of voltage regulator (fig. 10-23). With generator operating at 2600 RPM (1400 RPM of engine) adjust spring tension by bending lower spring hanger up or down until current regulator unit operates at approximately 17 amperes. Next install the other spring and adjust its spring tension to obtain 35 amperes hot, *without again touching the first spring.* Remove jumper wire.

2. *On voltage regulator unit,* install one spring only. Connect an ammeter in series with "BAT" terminal of regulator and wire leading to battery. Connect voltmeter test leads to terminal marked "GEN" and to ground on regulator base plate. Open voltage regulator points by hand, then slowly increase generator speed until voltmeter reads approximately 3 volts. Maintain this speed, release armature and adjust lower spring hanger to obtain 3.5 volts.

Install the other spring, temporarily install regulator cover and bring regulator up to operating temperature then adjust tension of second spring to obtain 7.4 volts *without again touching the first spring.* For this final adjustment use the procedure with variable resistance described in paragraph 10-29 (c).

3. *After installation of springs and adjustment* of either regulator, install regulator cover and gasket, bring regulator up to operating temperature and recheck settings with regulator *hot.*