ELECTRICAL • • • • • • SECTION 15

CONTENTS

SUBJECT	PAGE
GENERAL INFORMATION	169
Description	169
Testing Equipment	171
Warranty	171
WIRING DIAGRAMS	171
Wiring Harness	171
Testing Methods	171
BATTERY	173
Construction	173
Inspection and Maintenance	173
Battery Tests	174
Battery Replacement	175
GENERATING SYSTEM	175
Quick Checks of Generating System	175
Generator Description	176
Generator Inspection and Maintenance	176
Generator Replacement	178
Generator Overhaul	178
Generator Regulator Operation	180
Regulator Inspection	181
Regulator Adjustments	181
Regulator Specifications	186
STARTING SYSTEM	186
Starting Motor Solenoid Switch	186
Starting Motor Inspection and Maintenance	187
Starting Motor Replacement	188
Starting Motor Overhaul	188
IGNITION SYSTEM	190
Ignition System Operation	190
Inspection and Maintenance in the Vehicle	192
Ignition Tune-Up and Tests	194
Distributor Replacement	196
Distributor Overhaul	197
OVERDRIVE ELECTRICAL SYSTEM	200
Operation of Overdrive Electrical Controls	201
General Circuit Tests	202
Kick-down Switch Tests	202
LIGHTING SYSTEM	202
Light Bulb Replacement	203
Switches	204
MISCELLANEOUS ELECTRICAL	204
Horns and Horn Relay	204
Gauges and Indicators	205
Fuses	206

GENERAL INFORMATION

The major portion of the electrical system on early model Henry J vehicles was supplied by Auto-Lite. Later models are equipped with Delco-Remy units to a large extent. The information throughout this section will be applicable to both systems. Wherever the systems differ, the text will clearly indicate the differences.

DESCRIPTION

The electrical equipment may be divided into five major units or groups. All are related in that they draw energy from the generator or the battery. These units, or systems, include the storage battery and the generating, starting, ignition, and lighting equipment. In addition, various controls, indicating equipment, and accessories are electrically operated. A brief description of each system is given below. More detailed information on each system is given in this section along with the removal, testing, inspection, adjustment and repairs of various parts.

a. Battery

As indicated by its name, the primary purpose of the "storage battery" is to store energy for starting the engine and for operating various instruments and accessories when the engine is not running or is running below generator "cut-in" speed. If the demand for current is at any time greater than the generator output, the battery makes up the difference.

b. Generating System

This system includes the generator with its regulator and the connecting wiring. The generator converts mechanical energy into electrical energy to

supply electricity to the system and to keep the battery charged. Since the generator speed is proportionate to engine speed, the regulator is needed to control generator output and maintain the desired voltage and to prevent overcharging the battery, overloading the generator, or burning out lights and accessories.

c. Starting System

This group includes the starting motor, solenoid starting switch, starter button and the interconnecting wiring. When the button is pressed the solenoid switch closes the circuit through which current flows from the battery to operate the starting motor. The starting motor shaft is geared to the flywheel to crank the engine.

d. Ignition System

The purpose of the ignition equipment is to deliver a surge of high-voltage electricity to each spark plug at the correct time to fire the compressed charge of fuel and air inside the cylinder. Included are five elements: Ignition switch, ignition coil, distributor (including breaker points, condenser and automatic advance mechanisms), spark plugs and the connecting high tension and low voltage cables or wiring. The battery or generator supplies the energy to the system.

e. Lighting System

Included with the various lamps that receive their electrical energy from the generator or battery are the cables or wiring, switches and protective fuses. Among the lights are: Head, parking, stop and tail, direction indicating, instrument panel, license lamp, headlamp beam indicator, courtesy and oil pressure and ampere indicating lights.

f. Miscellaneous Equipment

Among the items of miscellaneous electrical equipment are: The electrical controls of the overdrive, electrically operated gauges to indicate fuel level and engine temperature, oil pressure and ampere indicators, turn signal indicators, radio, heater, cigar lighter, and various other accessories.

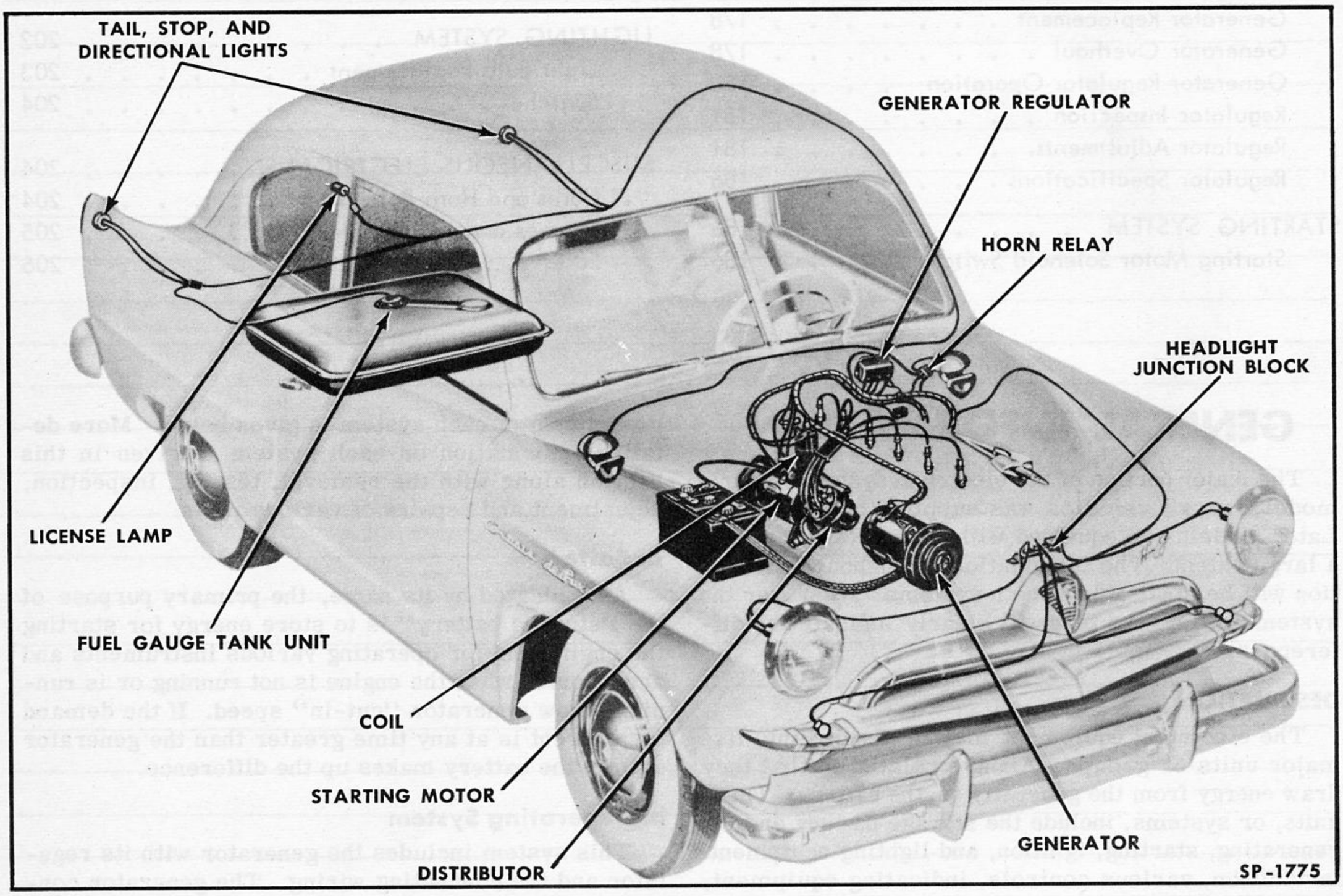

Fig. 254—Typical Electrical System

TESTING EQUIPMENT

In testing the electrical circuits and units, it is essential to have certain testing equipment available. Most commercial testing equipment is supplied with complete instructions which should be CAREFULLY FOLLOWED to avoid damage to the equipment or to the electrical system in the vehicle.

The necessary basic device is a voltmeter such as Ignition and Lighting Voltmeter C-537. The voltmeter is used to measure voltage at various points by placing the positive (+) lead against a good ground and the negative (-) lead on the point to be checked. This is placing the meter in parallel in the circuit.

An ammeter, used to measure the amount of current flow in a circuit, is often helpful. It is connected in series with the circuit by disconnecting the line and placing the ammeter in the circuit with the negative (-) terminal "toward the battery." Two other very useful and yet simple test lights shown in Fig. 255 are easily assembled. The 110-volt test light is especially suited for checking the continuity of circuits and locating "shorts", "open circuits" and "grounds." The 6-volt test light can be used for quick voltage checks. If accurate voltage readings are necessary, however, a voltmeter should be used.

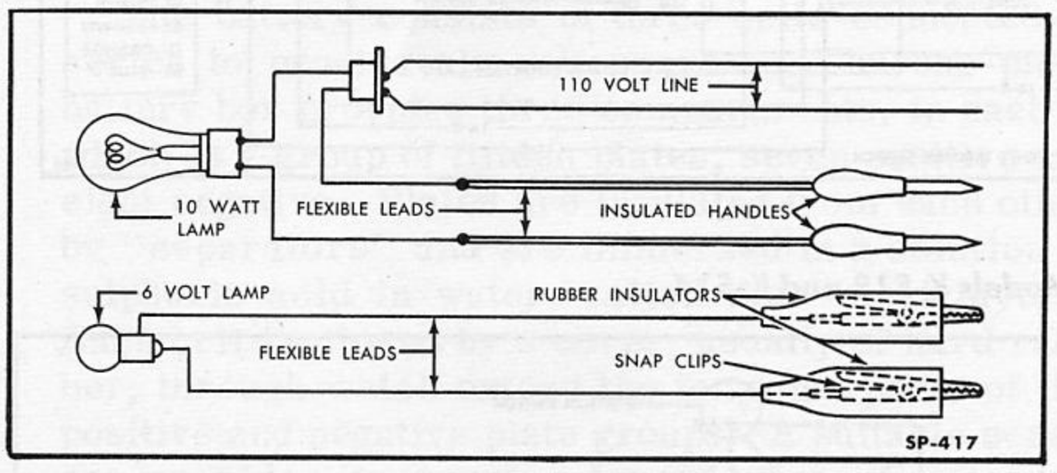

Fig. 255—110-Volt and 6-Volt Test Lights

WARRANTY

Some electrical equipment is warranted by the manufacturer of the equipment in addition to the Kaiser-Frazer uniform warranty. Electrical equipment that fails during the first 90 days or 4,000 miles should be removed from the vehicle and returned to the nearest authorized service station of the manufacturer of that particular unit. The following is provided for reference:

a. Delco-Remy

Defective generators, regulators, starting motors, distributors, ignition coils, and horns supplied by Delco-Remy should be taken to the nearest United Motors Service Station.

b. Auto-Lite

Any generators, regulators, starting motors, distributors or ignition coils supplied by Auto-Lite should be returned to the nearest Official Auto-Lite Service Station.

c. King-Seeley

King-Seeley Corporation supplies oil pressure indicators. fuel gauges, temperature gauges, instrument regulators and speedometers. Defective units should be taken to the nearest King-Seeley Service Station.

If the Auto-Lite or King-Seeley service station is not available, the Kaiser-Frazer Field Service Representative will recommend proper handling of such electrical equipment. The Kaiser-Frazer Dealer not having properly trained personnel and adequate facilities for testing, repairing, and rebuilding electrical equipment should take such equipment to the authorized service station of the equipment manufacturer, whether or not the units are within warranty.

WIRING DIAGRAMS

The schematic wiring diagrams for Henry J vehicles are shown in Fig. 256, 257 and 258. The diagrams do not include the overdrive circuit which is described under "Overdrive Electrical System" in this section or the accessory wiring diagrams which are part of the installation instructions received with the units.

WIRING HARNESS

Most of the cables or insulated wires of the electrical system are made up into "harnesses" wherever possible. The wires are held together by a wrapping which protects the insulation and makes easier installation. The individual wires have a colored fabric covering for quick identification. The coverings on certain size wires are also marked with black or white "tracer" threads. Number 18 wire has no tracers, number 16 has one tracer, 14 has two tracers, 12 has three tracers and 10 has no tracers.

TESTING METHODS

Whenever a wire in the electrical system is suspected of being defective, and it cannot be checked visually, proceed as follows:

1. Disconnect wire at both ends. Check wiring diagram, and if wire is spliced in harness, disconnect ends leading to other units.

2. With both ends suspended (not touching metal), check between one end and ground with a 110-volt tester. If tester lights up, wire is "shorted" to ground. If tester does not light up, proceed with next step.

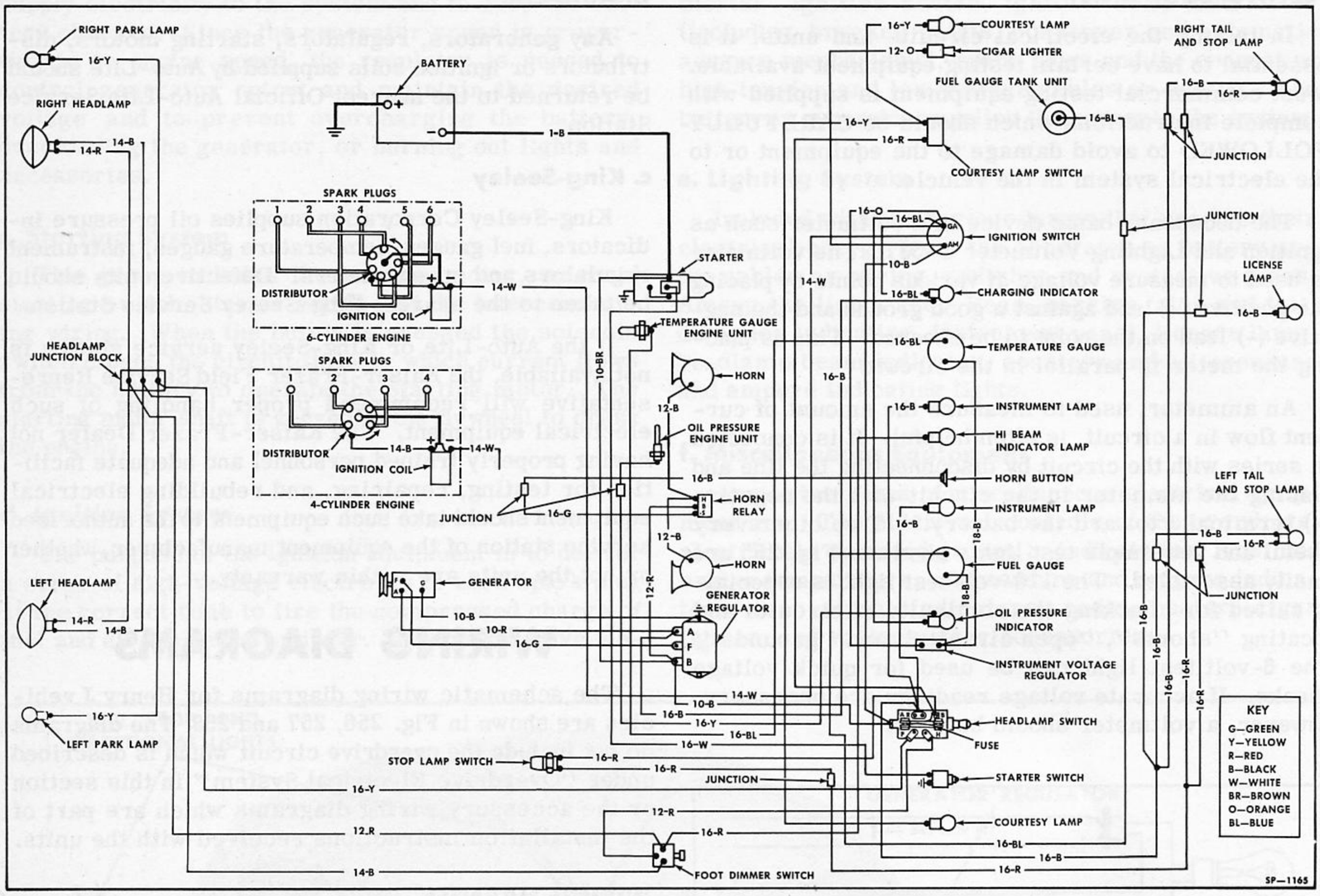

Fig. 256—Wiring Diagram—Models K-513 and K-514

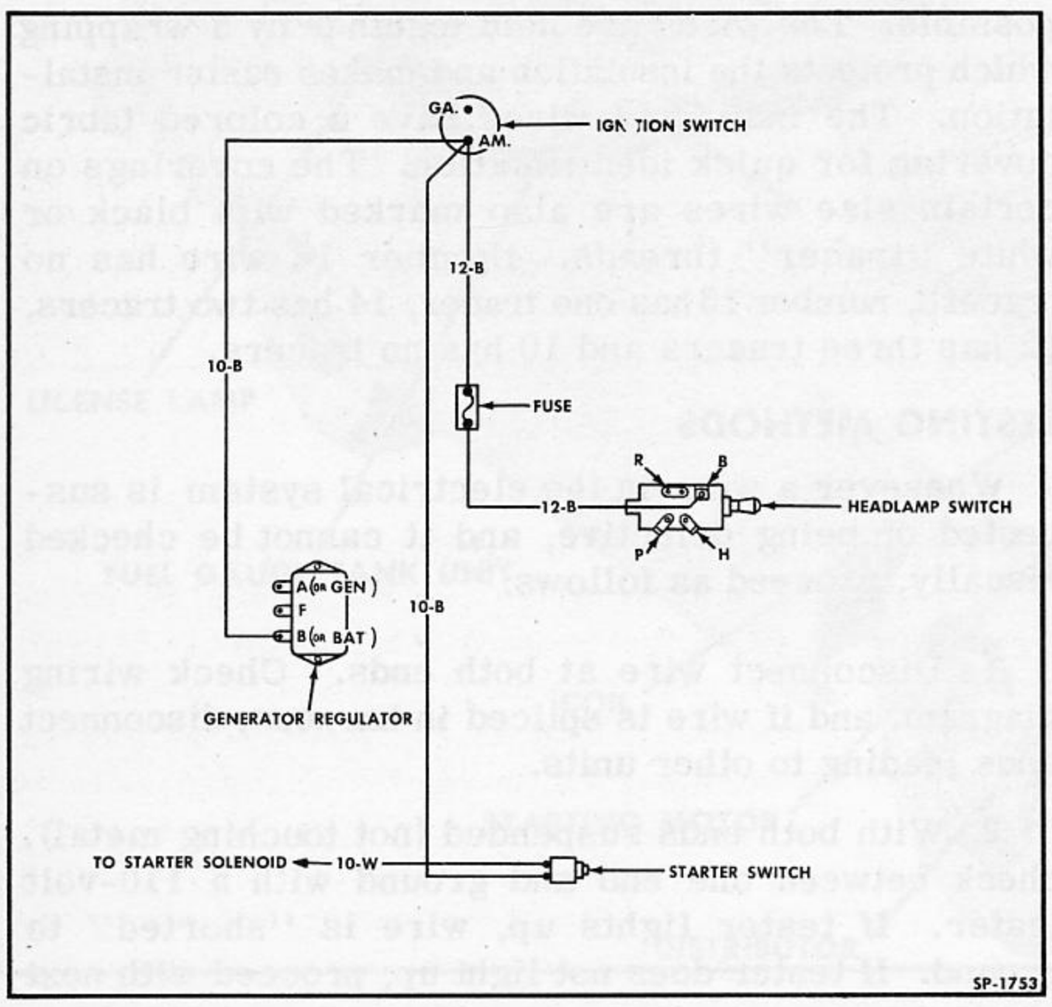

Fig. 257—Wiring Diagram Deviations—Models K-523 and K-524

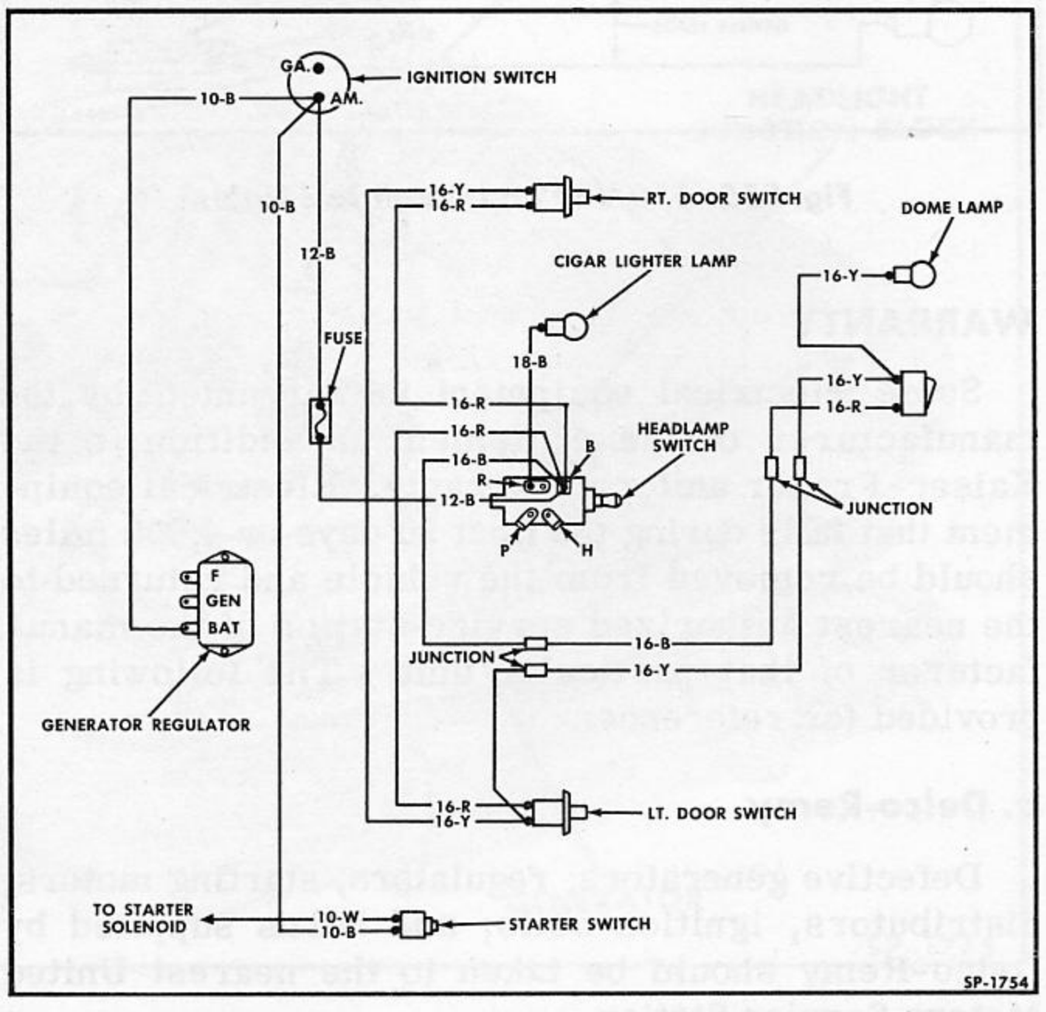

Fig. 258—Wiring Diagram Deviations—Models K-533 and K-534

3. Connect one end of wire to ground and check between opposite end and ground with a 110-volt tester. Tester should light up if wire is not "open".

4. If wire is defective, it should be replaced. In some cases, where the wire is in a harness, it may be simpler to tape the ends of the defective wire, leaving it in the wire harness, and install a new wire of the same size as the original wire.

BATTERY

The battery is mounted on a steel support, under the hood, and is fastened down by a retainer held by two wing nuts, shown in Fig. 259. The battery provides electrical energy to the starting motor and the ignition system to start the engine. With the engine running at normal speeds the generator should satisfy the electrical requirements of the ignition system, lamps and various accessories. When the engine is stopped, or runs too slowly, or when the demand for current is greater than the generator output, the battery supplies the needed current, or makes up the difference.

CONSTRUCTION

The battery consists of three cells connected in series to provide six volt current. The one-piece battery box provides three compartments, in each of which is a group of fifteen plates, seven positive and eight negative. Plates are insulated from each other by "separators" and are immersed in a solution of sulphuric acid in water, called the "electrolyte." Each cell is closed by a cover, usually of hard rubber, through which extend the terminal posts of the positive and negative plate groups. A suitable screw cap provides an opening for addition of water or checking the electrolyte and for venting off gases during charging.

When charging current flows through the battery from the generator (or a battery charger) the sulphuric acid, which has combined with the material in the plates, is driven into solution. This increases its specific gravity until it reaches 1.275 to 1.300 in a fully charged battery. When the battery delivers current, the electro-chemical action reverses, that is, the acid leaves solution and combines with the materials in the plates, reducing the gravity of the electrolyte.

INSPECTION AND MAINTENANCE

Inspect the battery every 1000 miles during cold weather and every 500 miles, or two weeks, during warm weather (and even more frequently under conditions of extreme heat). Check the level of the liquid in the cells, the tightness and appearance of the terminals at the battery posts and tightness of the retainer and the hold-down wing nuts.

a. Adding Water

Add pure (distilled preferred) water to each cell to bring the level to approximately 3/8 inch above the plates. Instructions on the filler cap tell how to use the star gauge liquid level control feature provided to prevent overfilling. Although the recommendation that only distilled water be used has long been made, it has become very general practice to use ordinary tap water. In general, little harm will be done to the battery by using any water that is colorless, odorless, tasteless and suitable for drinking. WARNING: Never add acid, unless it is known that acid has been spilled from the battery. Follow the battery manufacturer's instructions when adding acid to water to make up electrolyte, or to change its specific gravity.

Fig. 259—Battery Installation

b. Terminal Corrosion

Check condition of the cable terminals and the battery posts. They must be clean and tight to prevent excessive electrical resistance. Detach corroded terminals. Use a stiff brush to remove corrosion from both terminals and posts. Neutralize any surface acid by washing the posts and terminals with ammonia, or a solution of sodium bicarbonate (baking soda) or sodium carbonate (washing soda) in water. Rinse with clear water and dry. Install clamps to terminals and tighten. Apply light coating of petrolatum or light grease on terminals to prevent corrosion.

c. Freezing

A fully charged battery is safe against freezing at -90° F. A discharged battery will freeze at +20° F. If water is added to a battery in below-freezing weather either drive the car or run the engine above generator charging cut-in speed for 20 minutes to mix the fresh water with the electrolyte.

d. Maintaining Idle Batteries

Batteries in stored cars or in service stock require care to keep them in good order. Before any battery is stored, check to determine that the cells are filled to proper level and that the acid gravity is up to at least 1.225. Recharge every 60 days, or oftener if gravity falls below 1.225. Follow carefully any special instructions regarding initial charging and recharging that the battery manufacturer supplies with new batteries.

c. Batteries for Tropical Climates

For continued high-temperature operation in tropical climates, batteries are customarily filled with electrolyte having specific gravity of 1.225 when fully charged. This milder electrolyte slows down the deterioration of separators and plates. Follow the directions of the battery manufacturer in caring for low-gravity batteries.

BATTERY TESTS

Conventional battery testing equipment, used as the manufacturer directs, will indicate battery condition, or state of charge. The charging rate as shown by the amp indicator on the instrument panel, starter cranking speed, or the extent to which the lights dim when the starter is operated, may also indicate battery condition.

a. Hydrometer Test

The battery liquid in each cell of a fully charged battery should show 1.270 - 1.300 specific gravity at a temperature of 80° F. when tested with a hydrometer. A thermometer is built into a good hydrometer to indicate the temperature of the battery liquid when it is tested. For each 10° F. the battery liquid temperature is below 80° F., subtract four points (.004) from the hydrometer reading, and for each 10° above 80° F., add four points. When the gravity falls below 1.200 recharge or replace the battery.

b. Voltage Tests

To check cell voltage under load, connect a low-reading voltmeter across the terminals of the battery cells, one at a time. Crank the engine with the starter and note the voltage indicated while the starter is cranking. Voltage lower than 1.7 for any cell, or variation between cells of more than .1 volt indicates need of checking the battery further.

A test across three cells before the individual tests and after the individual tests should show little difference in reading — and the reading should be above 5.1 volts with the battery and engine at temperature between 60° and 80° F. Under no-load conditions each charged cell should test between 2.1 and 2.0 volts and the whole battery between 6.3 and 6.0 volts.

c. Generator Charging Rate

Failure of the charging rate to taper off during continued running of the engine with lamps and accessories turned off may be the result of bad battery condition. If the battery is low, due to long cranking or to bad internal conditions, the generator, at normal driving speeds, may deliver charging current up to the current limit for which the regulator is adjusted. As soon, however, as the battery comes up to a state of full charge the charging rate should drop to a few amperes. Failure of the battery charging rate to reduce indicates need of inspection and tests. Refer to "Regulator Tests and Adjustments" in this section for additional information.

d. Circuit Resistance Tests

Excessive resistance in cables in terminal connections, or elsewhere in the starter circuit may cause abnormal voltage losses with resulting loss of cranking ability. Abnormal resistance may also interfere with proper charging. To determine voltage losses, check with a low reading voltmeter from the negative (-) battery terminal to the starting motor terminal, from the positive (+) battery terminal to the vehicle frame, and from the starting motor housing to the vehicle frame. Crank the engine with the starter motor and note the readings. If any of the readings is more than 0.2 volt, disconnect cable, clean terminals and replace cable if necessary.

e. High-Rate Charging

"Boosters" are commonly used to recharge batteries at very high rates, as high as 50 or 60 amperes. In general, any charging rate or operating condition that keeps battery temperature above 110° F. shortens battery life.

Any battery that is nearly discharged or that is sulphated or has poor separators and loosened active material may be suddenly ruined by fast charging, unless close attention is given to temperature and gassing during charging. Any charging rate that does not raise battery temperature above 100° or 110° F. will not damage a battery that is in good condition. WARNING: NEVER ALLOW AN OPEN FLAME OR SPARKS NEAR A CHARGING BATTERY AND NEVER USE A FLAME TO THROW LIGHT INTO A CELL

FOR INSPECTION. During charging, hydrogen and oxygen gases are generated in the cell and will explode violently if exposed to flame. Under normal operation, the gases escape into the air and are not a hazard.

f. Cold Operation

At extremely low temperatures, stiffened engine oil makes engines more difficult to crank. At the same time the cold reduces battery output. If the charging ability of a battery is rated 100 percent at a normal 80° F. temperature, this battery provides only 64 percent cranking ability at 30° F., 40 percent at 0° F., and 33 percent at -10° F.

BATTERY REPLACEMENT

To remove the battery, disconnect the positive and negative cables; remove the retainer wing nuts and lift off the battery retainer. Then lift the battery from the support. When installing a battery be certain that the posts and cable terminals are clean, and terminal clamps tight. Then coat terminals with petrolatum or grease.

GENERATING SYSTEM

The generating system includes the generator, the generator regulator, interconnecting cables and a circuit to conduct charging current to the storage battery. The generator is the source of all electrical energy in the vehicle. When the car is driven at normal speeds the generator should supply all the regular requirements of the electrical equipment and accessories, plus enough to quickly replace the energy the battery supplied for starting the engine.

QUICK CHECKS OF GENERATING SYSTEM

The first step in analysis of generating system complaints is to make a quick check for the conditions listed below. The amp indicator light on the instrument panel can be used during the checks, but it is suggested that an ammeter be placed in the line to the generator armature terminal for more accurate indication of charging rate.

a. Fully Charged Battery and Low Charging Rate

This indicates normal proper operation.

b. Low Battery and High Charging Rate

This indicates normal proper operation.

c. High Charging Rate and Fully Charged Battery

This results from failure of the regulator to reduce generator output. Damage to the battery and to any other electrical equipment may result. Possible causes are:

1. Improper voltage regulating setting.
2. Defective voltage regulator unit.
3. Grounded generator field circuit (in either generator, regulator or wiring).
4. Poor ground of the regulator base.
5. High battery temperature (or damaged battery) which reduces the resistance the battery offers to charging, even if the regulator is normal.

If the trouble is not due to high temperature or bad battery, disconnect the lead from the regulator field terminal. If generator output at medium speed remains high the generator field circuit is grounded, either in the generator or in the wiring harness. If, however, disconnecting this lead causes generator output to drop, the regulator or regulator setting is at fault.

d. Low Battery and Low or No Charging Rate

This could be due to:

1. Loose connection or damaged wires.
2. Defective battery.
3. High circuit resistance.
4. Improper regulator setting.
5. Oxidized regulator contact points.
6. Defects within the generator.

If the trouble was not caused by loose connections or damaged wires continue as follows: To determine whether the generator or regulator is at fault momentarily ground the field terminal of the regulator (with harness lead still attached) and increase the generator speed. If the output does not increase, the generator is probably at fault. Check according to the instructions under "Generator Tests in the Vehicle" in this section.

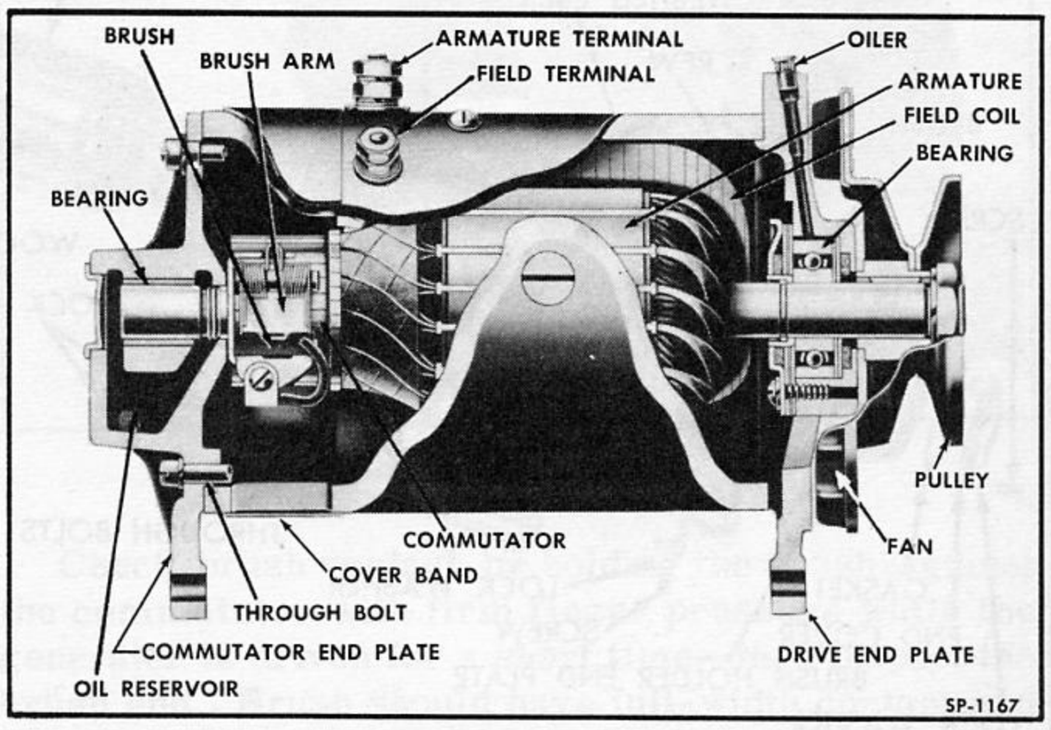

Fig. 260—Auto-Lite Generator—Sectional View

If the generator output increases it may be due to failures within the regulator, which are explained later in this section. The probable causes are:

1. Voltage or current regulator setting too low.

2. Oxidized regulator contact points causing excessive resistance in the generator field circuit, and resulting in low output.

3. Generator field circuit open within the regulator, at connections or in regulator windings.

e. Burned Resistances, Windings or Contacts

The causes may be open circuit operation of high resistance in the charging circuit. Whenever burned resistances, windings or contacts are found check the car wiring carefully before installing a new regulator.

f. Burned Relay Contacts

This might be due to reversed generator polarity. After any check or repairs on the generator or regulator, establish correct polarity as explained under "Generator Replacement" in this section.

If the quick checks made according to the foregoing paragraphs, or if tests made with modern electrical diagnosis equipment, according to the instructions supplied by the manufacturer of such equipment, fail to show any evidence of improper regulator performance it is advisable to leave the regulator alone, rather than attempt any adjustment.

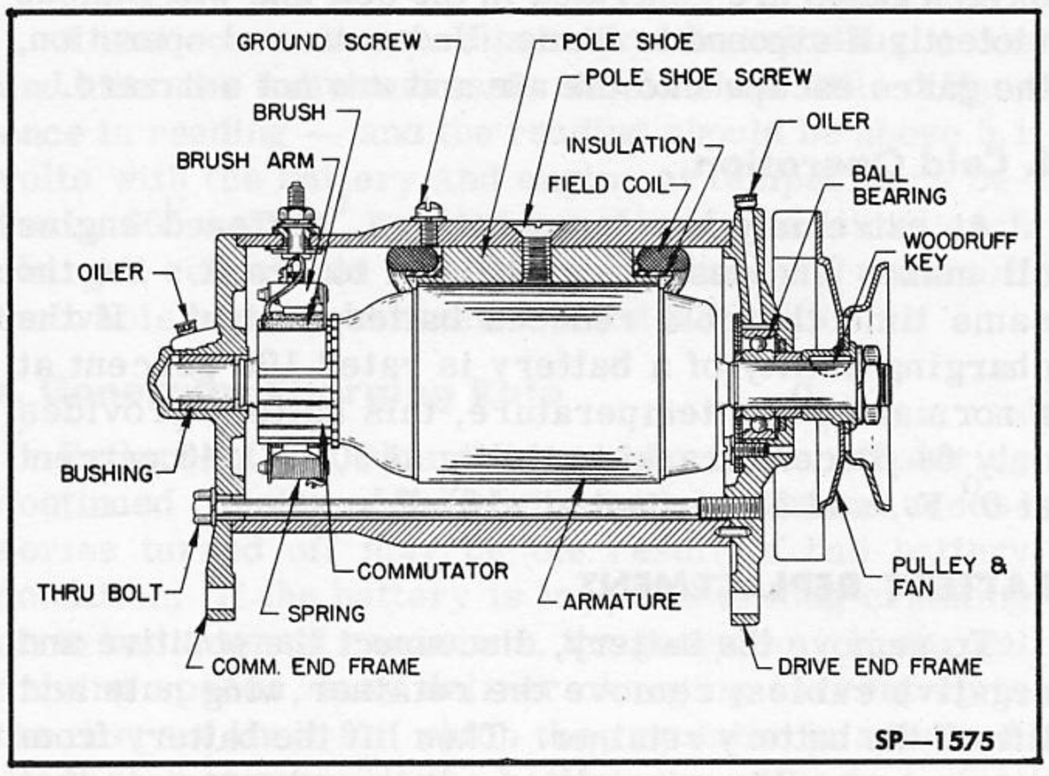

Fig. 261—Delco-Remy Generator—Sectional View

GENERATOR DESCRIPTION

The 6-volt, 35 ampere capacity generator is of the two-brush, shunt-wound type. It is mounted on the right side of the engine and is driven by the fan belt.

The generator drive pulley has a built in fan which pulls air forward through the generator for cooling.

GENERATOR INSPECTION AND MAINTENANCE

Inspect the generator and the related regulator and wiring every 10,000 miles of normal vehicle operation.

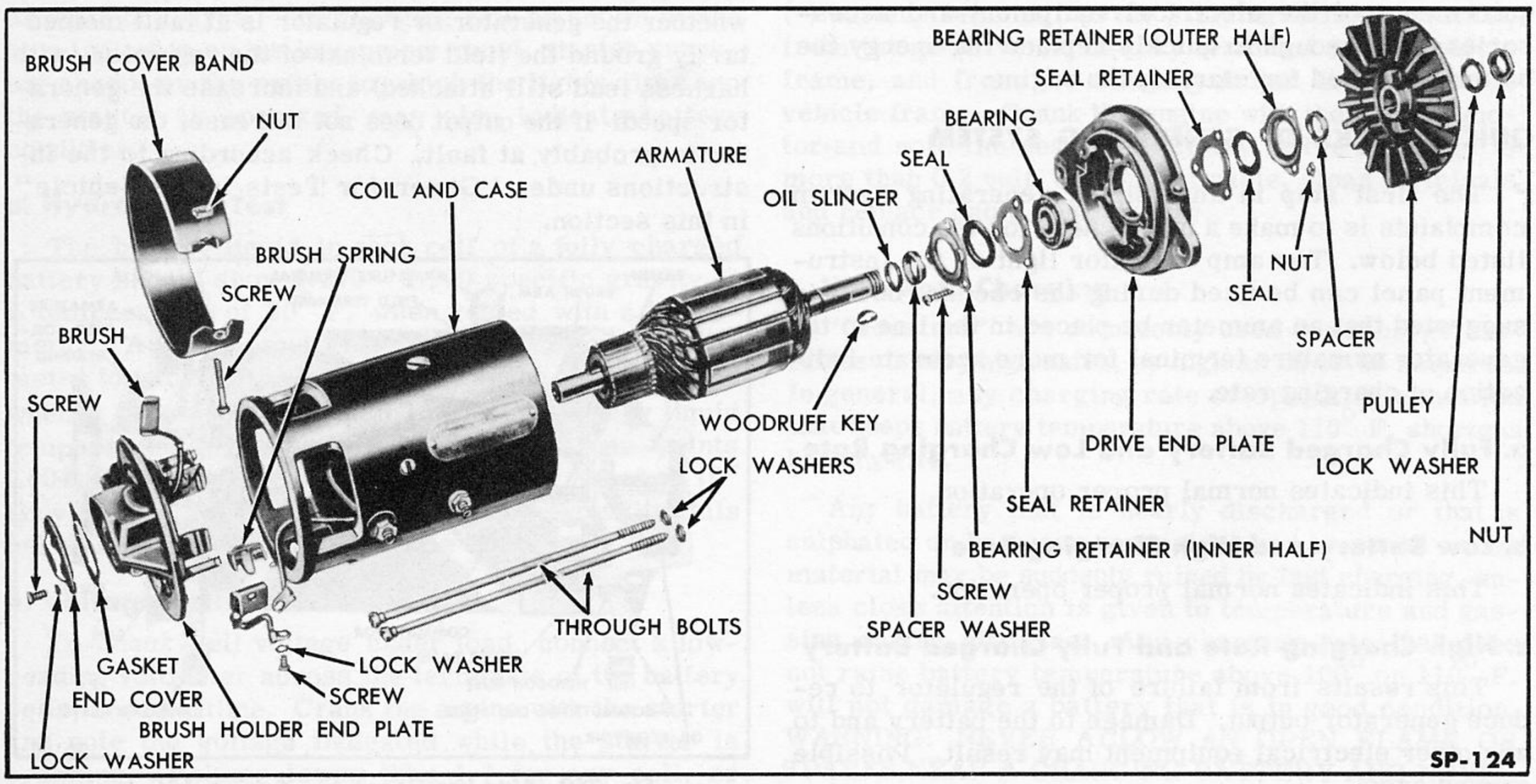

Fig. 262—Typical Generator—Exploded View

More frequent inspection is required if vehicle is subjected to high speeds, dusty roads or other unfavorable conditions. Clean the generator and make repairs when necessary as detailed in the following paragraphs.

The generator should be oiled as specified in Section 17, "Lubrication" and the fan belt condition and tightness checked at 2,000 mile intervals. The inspection and maintenance operations are as follows:

a. Fan Belt Adjustment

Replace the fan belt if it is worn or frayed. If the belt is not worn or if a new belt is installed, the belt tension should be adjusted so thumb pressure exerted midway between fan and generator pulleys deflects the belt 1/2 inch as shown in Fig. 263. To adjust the belt, loosen generator mounting bolts and adjusting link bolt at generator. Swing generator away from engine and tighten adjusting link bolts when belt tension is correct, then tighten mounting bolts.

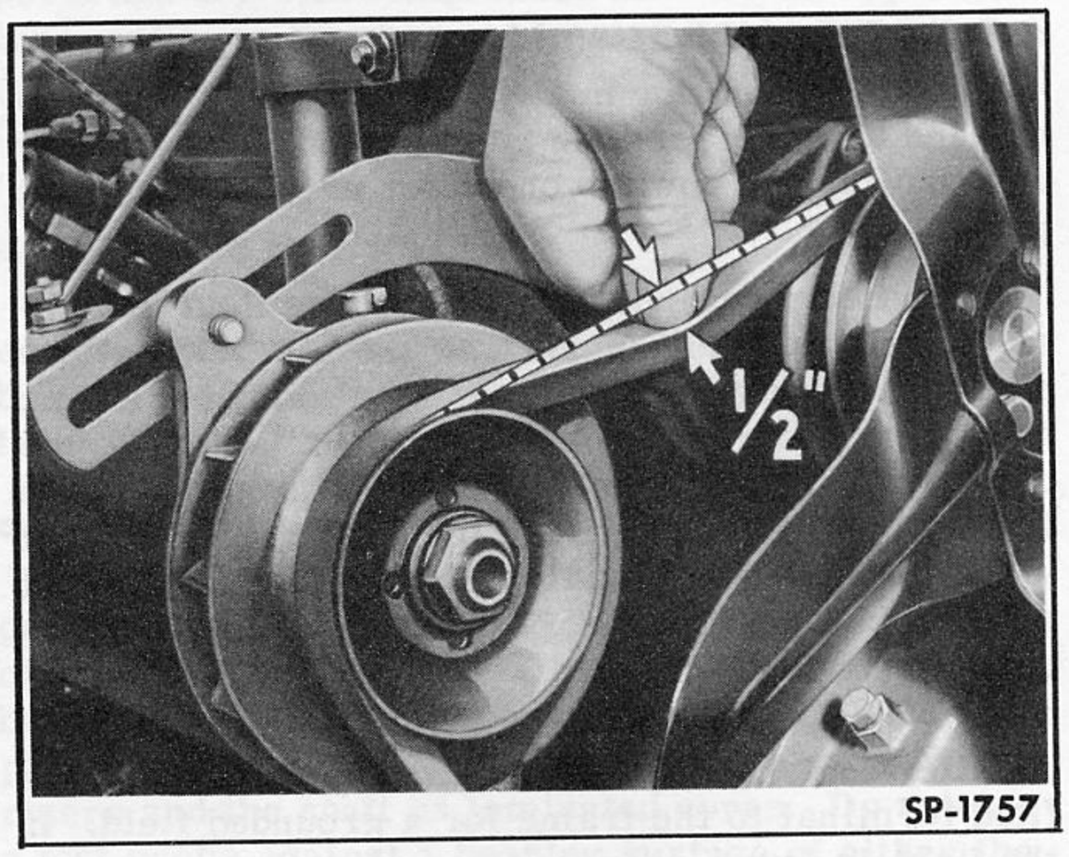

Fig. 263—Fan Belt Adjustment

b. Cleaning Generator

To insure continued dependable performance, keep the generator clean outside and inside. Use a cloth dampened with suitable cleaning fluid to wipe off oil or grease. Never steam clean a generator, or dip a generator, armature, field coils or brushes in cleaning fluid. When cleaning the outside be careful that cleaning fluid or water does not get into generator. If the interior of a generator needs cleaning, remove it for disassembly.

c. Inspecting Brushes and Commutator

Remove the brush cover band and inspect the brushes, brush-holders, and commutator. If brushes are oil-soaked or worn to less than 1/2 their original length, install new brushes. Lift the brush arm with a hook to permit brush removal for inspection or replacement. Make sure brush holders work freely. If the brushes, holders, springs, etc. are oily or gummed or the commutator is rough or burned, the generator should be disassembled for proper cleaning and overhaul.

If the following operations are necessary, perform them as detailed below:

1. SAND COMMUTATOR. If the commutator is only dirty, clean it with 00 or 000 sandpaper (never emery or carborundum) held against the commutator bars while the generator is turned slowly. After sanding blow out with clean, dry air.

2. INSTALL NEW BRUSHES. Install new brushes with beveled faces seated on the commutator. To fit a brush to the commutator use a strip of 00 or 000 sandpaper, cut the same width as the finished part of the commutator. Lift the brush and slide the paper under the brush, with the sand side toward the brush. Pull the strip in the direction to keep the brush in the normal guided position (Fig. 264). Be careful not to bevel the edge of the brush and do not sand away too much of the end.

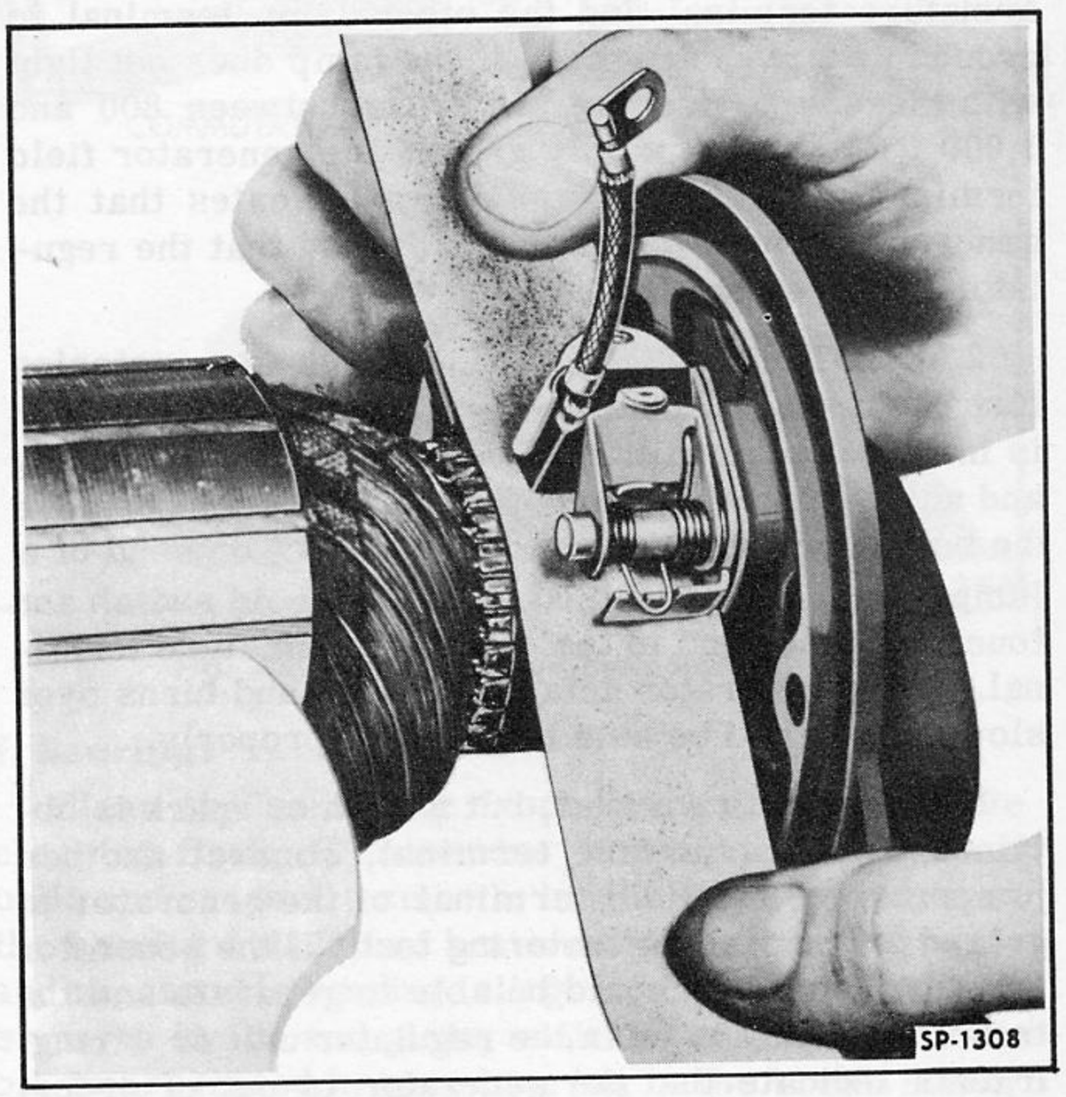

Fig. 264—Sanding Generator Brush

Check brush contact by holding the brush against the commutator with firm finger pressure while the generator is driven for a short time—then inspect the brush end. Brush should have full-width contact and 75 percent area contact. Such run-in for getting prop-

er contact is necessary before checking or adjusting output.

3. CHECK BRUSH SPRINGS. The manufacturer's specification for brush spring tension is 28 ounces for models with Delco-Remy equipment and 35-53 ounces for models equipped with Auto-Lite units. Check tension with a tester such as Spring Tension Checking Scale MTU-36. Too much tension causes increased brush and commutator wear. Too little tension may reduce generator output and cause arcing and burning of the commutator and brushes.

d. Wiring and Terminal Connections

Check the tightness of terminals at the generator and regulator and the condition of the wiring insulation.

e. Generator Tests in the Vehicle

Several tests can be made on the generator while it is still in the vehicle. Some of these tests are described below.

1. OUTPUT TEST. If generator inspection shows no evidence of generator trouble and it is believed that the regulator is at fault, a simple generator output test can be made without generator removal. Connect one terminal of a 6-volt test lamp to the generator armature terminal and the other lamp terminal to ground. Start the engine. If the lamp does not light with the engine turning at speeds between 800 and 1,000 RPM, momentarily ground the generator field terminal. Lighting of the lamp indicates that the generator is functioning normally and that the regulator requires checking.

2. "MOTORING" TEST. A generator motoring test is sometimes made to determine if the generator is in operative condition. Loosen generator mounting and adjusting link bolts at the generator and remove the belt from the drive pulley. Connect one end of a jumper to the hot terminal of the solenoid switch and touch the other end to the generator armature terminal. If the generator acts as a motor and turns over slowly, it should be able to generate properly.

If it does not turn over, but a flash or spark is obtained at the armature terminal, connect another jumper from the field terminal of the generator to ground and repeat the motoring test. If the generator now turns over it should be able to generate and the trouble is likely to be in the regulator unit or wiring. If tests indicate that the generator is out of order, remove it for disassembly and test of components.

3. EXCESSIVE OUTPUT TEST. If the generator delivers more amperes than the output specified on the nameplate or the voltage rises too high (which might burn out the lights), disconnect the cable between the generator and the regulator. If the generator output remains high with this cable detached, there is a ground in the field winding or lead to the field terminal, and the generator should be removed.

GENERATOR REPLACEMENT

To replace the generator, disconnect the wires from the generator terminals, remove the generator mounting bolts and adjusting link bolt at generator and lift generator out. To install, reverse this procedure and adjust the drive belt tension as described under "Fan Belt Adjustment" in this section. Before starting the engine, assure correct GENERATOR POLARITY by using a jumper wire from the hot terminal of the solenoid switch to make a momentary flash contact with the generator armature terminal. This surge of current will correctly polarize generator.

GENERATOR OVERHAUL

When the generator is to be overhauled for cleaning, inspection or new parts, proceed as follows after the generator is removed from the vehicle.

a. Tests Before Disassembly

Hold the generator in a vise. Turn the drive pulley by hand to check for free rotation and lift the pulley and shaft up and down to check for excessive bearing play.

Connect a jumper from the generator field terminal to the generator frame and flash 6-volt battery current through generator armature terminal to frame. If the generator does not "motor over", remove the cover band and put paper between the ungrounded brush and the commutator, or hold the brush out of contact with the commutator, and make a field continuity test with probes against the field terminal and the ungrounded brushholder.

After determining field continuity, check from the field terminal to the frame for a grounded field. If the field is found open or grounded the generator should go to the generator manufacturers service station or to a well equipped electrical equipment department for rebuilding.

b. Disassemble Generator

Disassemble the generator as follows:

1. Remove drive pulley nut and remove pulley with Generator Pulley Puller C-453, as illustrated in Fig. 265.

2. Remove the two through bolts and remove drive end plate and armature together.

3. Remove armature, bearing retainer, seal parts and oil slinger.

4. Remove the terminal screw from the ungrounded brush and detach the lead that extends to the generator "A" terminal.

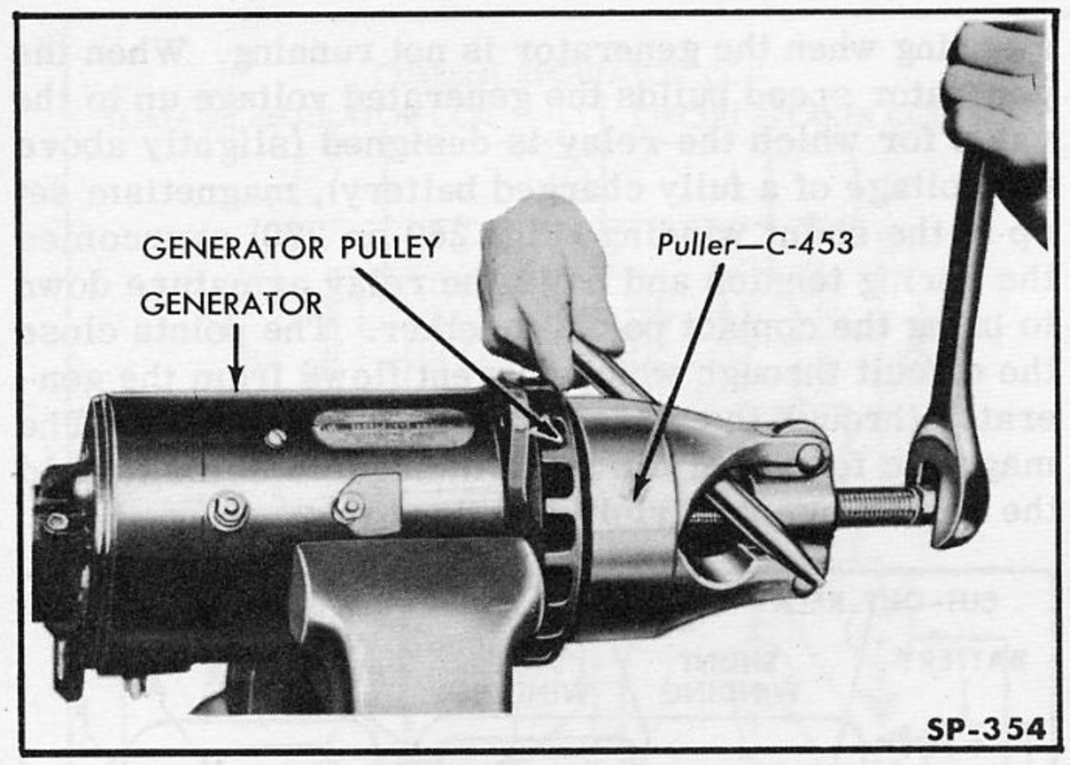

Fig. 265—Removing Generator Drive Pulley

5. Remove the brush holder end plate. Clean all parts and dry with compressed air. Do not dip windings, coils, or brushes in cleaning fluid. Wipe these parts with a cloth dampened with suitable cleaning fluid and dry.

c. Test Brush Holders

Test brush holders for contact with brush holder end plate with the 110-volt tester. One brush should be grounded and the other should be insulated from the end plate.

d. Test Armature

Inspect the armature for visible evidence of trouble, particularly the appearance of insulation on windings, of commutator bars, and of the soldered connections between windings and commutator bars. With test probes, check for a ground between commutator bar risers and the shaft or laminated cores. Do not use a test probe against a bearing surface of either the commutator or shaft.

Next, place the armature on a growler and turn the growler switch on. Rotate the armature slowly and hold a hacksaw blade or other thin steel strip over the armature core. Vibration of the blade indicates a shorted coil.

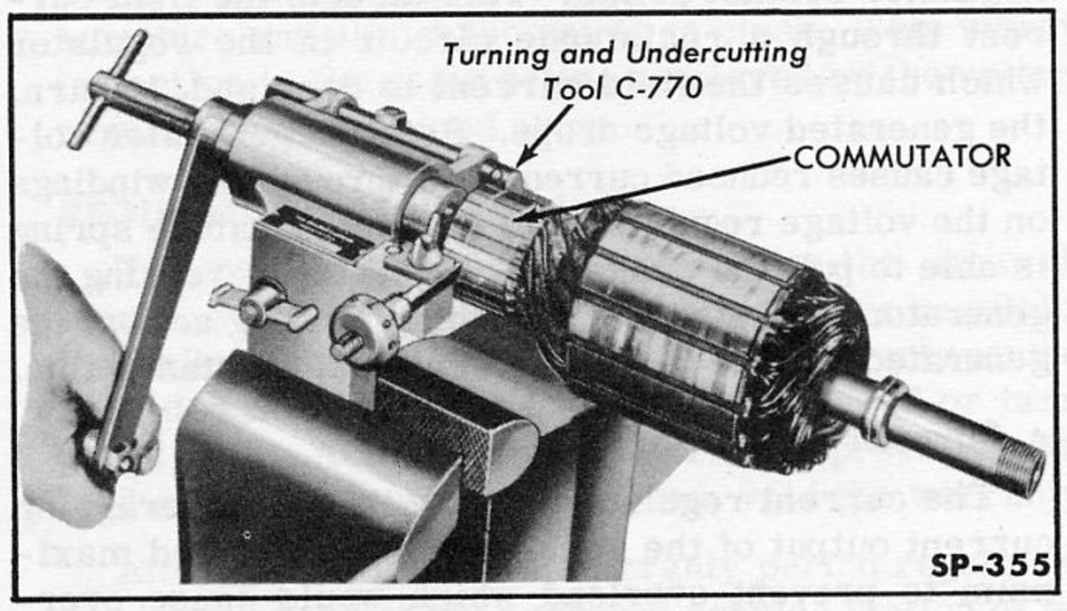

Fig. 266—Turning Generator Commutator

If the armature has a shorted or grounded coil, install a new armature. Follow the growler manufacturer's instructions regarding meter check of armature windings.

e. Turning and Undercutting Commutator

If the commutator is rough or worn, turn it down using Armature Turning and Undercutting Tool C-770 (Fig. 266), or a suitable lathe. Remove only enough material to clean up commutator. After turning a generator commutator, undercut the mica between the bars 1/32 inch, using Armature Turning and Undercutting Tool C-770 (Fig. 267). Be certain the undercut is square and there are no burrs. Polish the turned commutator with 00 or 000 sandpaper (never emery or carborundum) and blow away any loose sand and copper.

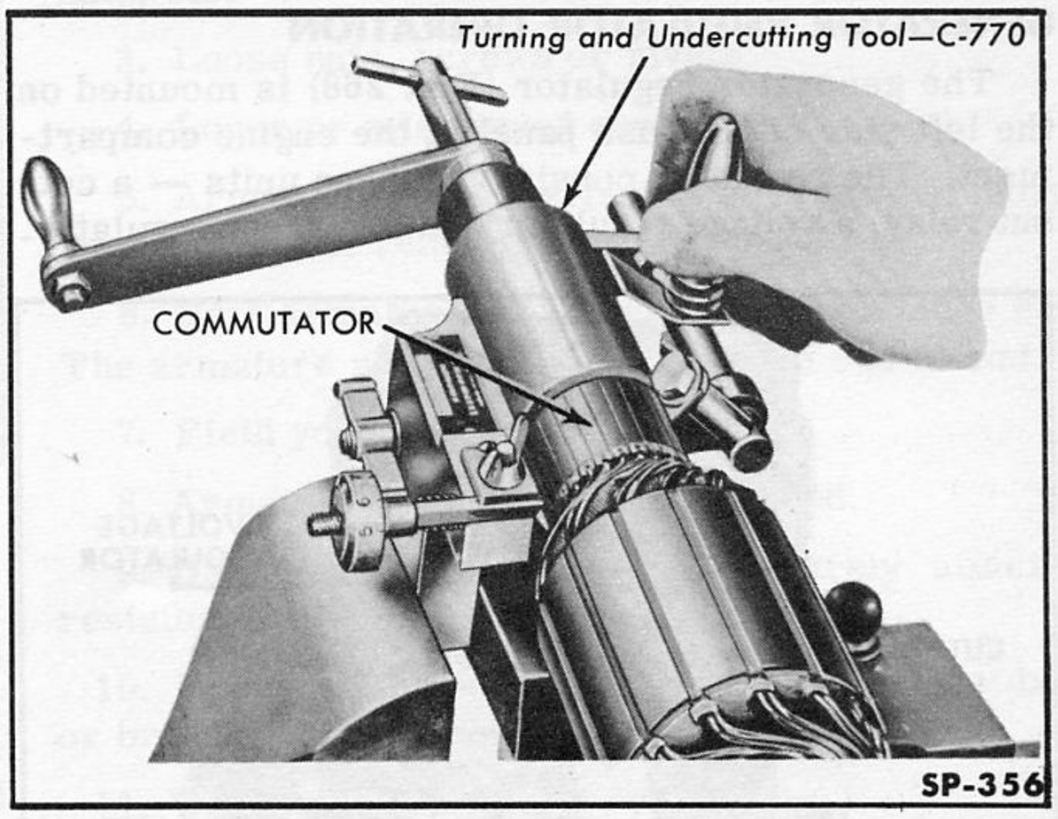

Fig. 267—Undercutting Commutator Mica

f. Bearings

Clean the generator front bearing with suitable cleaning fluid. If looseness is not apparent and if balls and races are smooth, bright, and unpitted, pack the bearing half full of heat-resistant bearing grease and reassemble bearing, slingers, oil seal and retainer parts in the end plate, with the armature. If the oil-impregnated bronze bearing in the brush holder end plate is worn, drive or press it out and press in a new bearing with a sizing shoulder mandrel—or install a new brush holder end plate. The end of the shoulder mandrel should be well polished and .0005 inch larger than the finished armature shaft. Do not ream an oil-impregnated bronze bearing. Put a new porous bronze bearing in oil before installing and put

a few drops of oil on an old bronze bearing before assembling the generator.

g. Assemble Generator

Assemble generator after the brushes have been removed from their holders to avoid damage. Line up dowel holes to install end plates in proper position. If brushes are to be replaced, install new brushes, fit brushes, check spring tension and check brush contact with commutator as described under "Generator Inspection and Maintenance" in this section.

h. Generator Final Test

If a test bench is available, test the assembled generator as recommended in the instruction manual of the testing equipment manufacturer, or as directed in the Delco-Remy Operation and Maintenance Handbook or the official Auto-Lite Maintenance and Operation Manual. If such equipment is not available, make a motoring test as described under "Generator Inspection and Maintenance" in this section.

GENERATOR REGULATOR OPERATION

The generator regulator (Fig. 268) is mounted on the left side of the dash panel in the engine compartment. The regulator consists of three units — a cut-out relay, a voltage regulator and a current regulator.

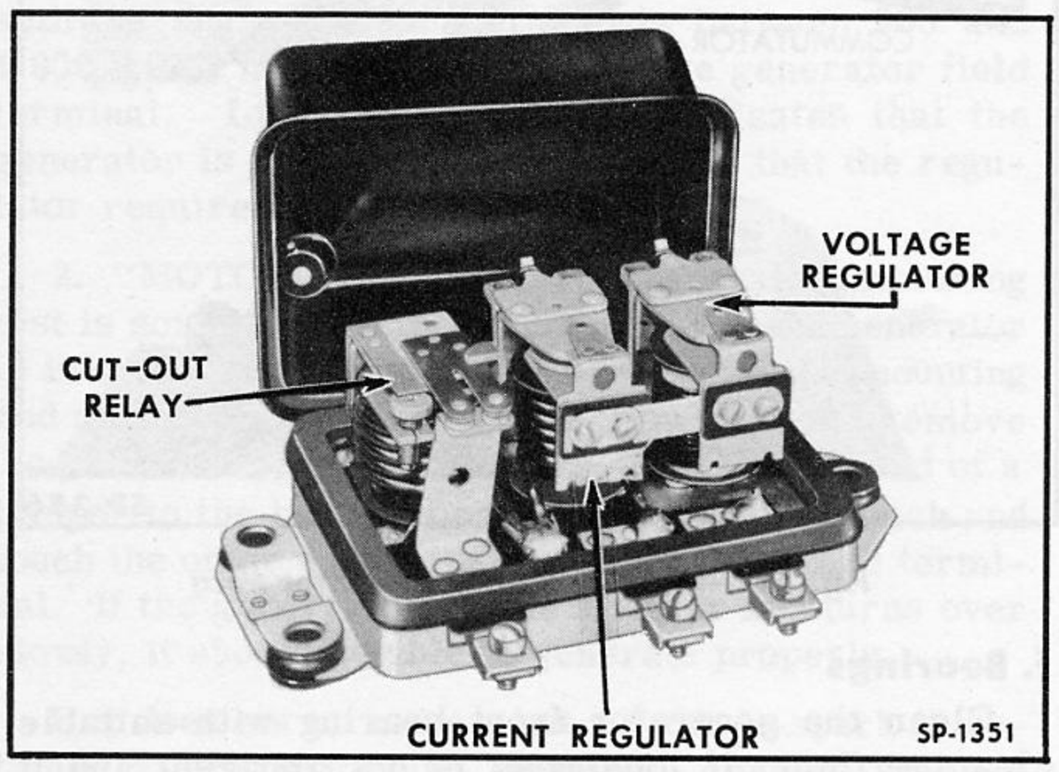

Fig. 268—Typical Generator Regulator

a. Cut-Out Relay

The cut-out relay is sometimes called a "circuit breaker." It acts as an automatic switch to close the generator to battery circuit when the generator speed and voltage are high enough to charge the battery. When the generator voltage is too low to charge the battery the relay points open, breaking the circuit to prevent the battery from discharging through the generator.

The cut-out relay contact points are held open by a spring when the generator is not running. When the generator speed builds the generated voltage up to the value for which the relay is designed (slightly above the voltage of a fully charged battery), magnetism set up in the shunt winding (Fig. 269 or 270) overcomes the spring tension and pulls the relay armature down to bring the contact points together. The points close the circuit through which current flows from the generator through the series winding to the battery. The magnetic forces of the two windings combine to hold the contact points firmly together.

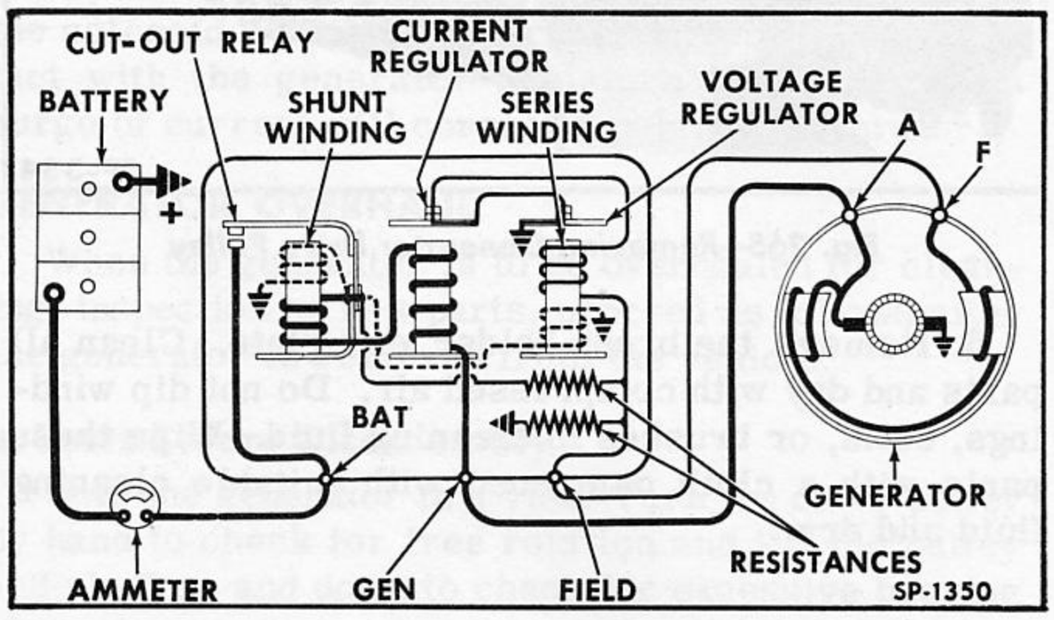

Fig. 269—Delco-Remy Generator Regulator Circuit Diagram

When the generator slows down and its terminal voltage falls below that of the battery, the relay armature spring opens the contact points.

b. Voltage Regulator

The voltage regulator unit limits the generator voltage and maintains an almost constant generator terminal voltage to prevent overcharging the battery, burning out lights, or damage to electrical equipment and accessories.

When the generator voltage reaches the value for which the regulator was designed, the magnetism caused by the windings on the regulator core pulls the armature against spring tension and separates the regulator contact points. This directs the field current through a resistance circuit in the regulator which causes the field current to drop and, in turn, the generated voltage drops. Reduced generator voltage causes reduced current flow through the windings on the voltage regulator unit and the armature spring is able to pull the points back together, increasing the generator field strength. By this vibrating action, the generated voltage is held to an almost constant value.

c. Current Regulator

The current regulator unit limits the amperage or current output of the generator to a specified maximum to prevent overload which would cause overheating and damage to the generator. In many instances, when lights and accessories are on and the

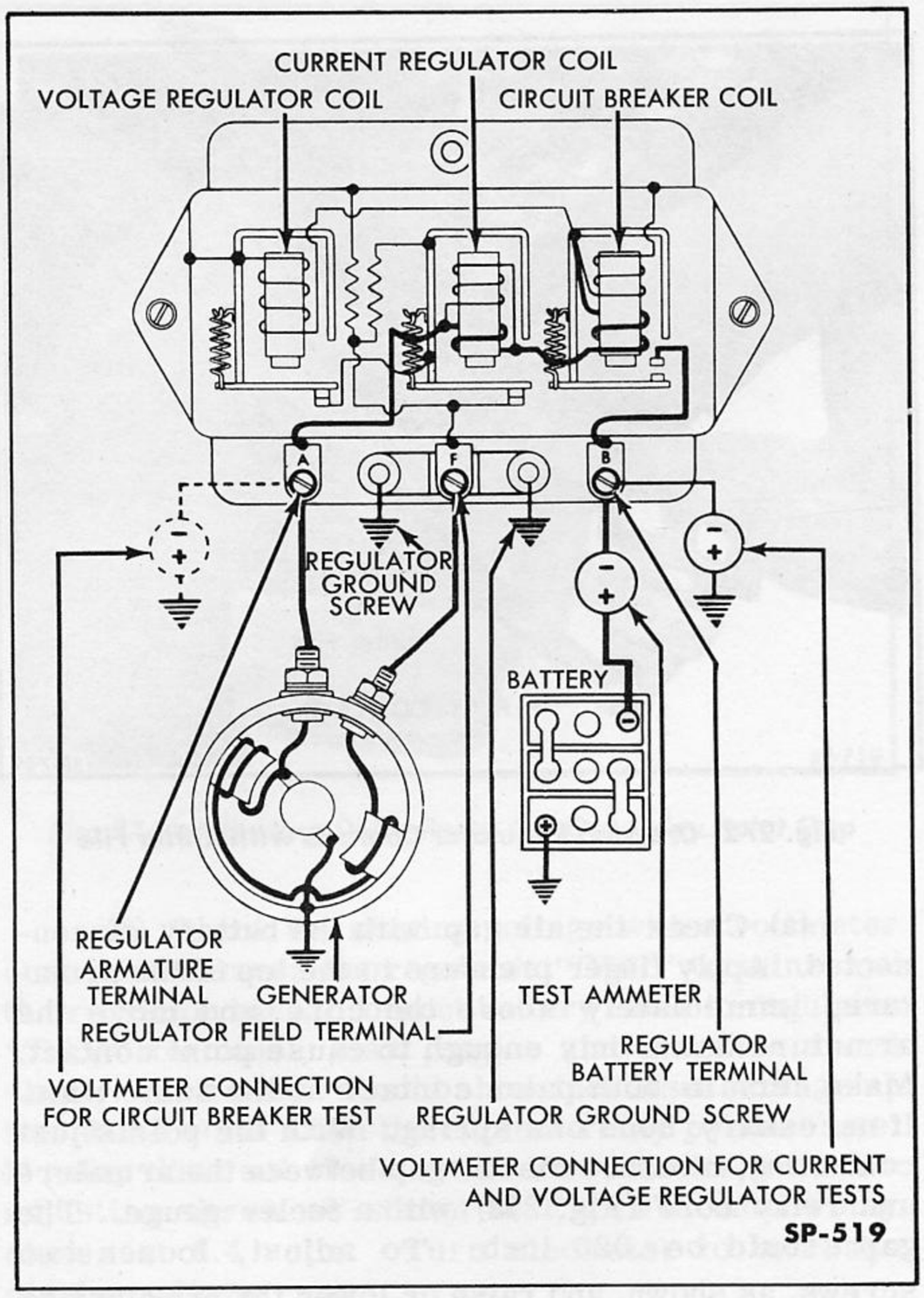

Fig. 270—Auto-Lite Generator Regulator Circuit Diagram

battery is in a discharged condition, the voltage remains at a low value but the current increases to meet the load demand. When current reaches a specified value, the current regulator armature is pulled down to open the contact points and direct field current through a resistance circuit in the regulator. This lowers the generator output which, in turn, reduces the magnetic force on the current regulator armature and allows the points to close. This vibrating action is the same action employed by the voltage regulator as explained above.

REGULATOR INSPECTION

The regulator manufacturer, under the warranty terms, will exchange or repair any voltage regulator that fails in normal service within the warranty period, provided the regulator has not been opened or tampered with. Auto-Lite regulators are provided with lead cover seals which, if broken, void the warranty.

After expiration of the warranty period regulators can be repaired at the approved service station of the manufacturer, if necessary. Certain tests, inspections and adjustments, however, can be made with the regulator in place on the vehicle or on a test bench. Carefully follow the instructions of the test equipment manufacturer and the specifications and instructions of the manufacturer of the regulator. Each regulator is designed, calibrated and adjusted by the electrical equipment manufacturer for use with only the specified mating generator. Units should not be mis-matched.

Make the checks detailed under "Quick Checks of Generating System" in this section. If the regulator operation does not appear satisfactory, remove the cover carefully to avoid contact between the cover and inside parts. If the regulator is off the vehicle, be careful not to damage the carbon or wire resistors. Make close visual inspection for the following:

1. Loose connections—such as might result from poor soldering.

2. Evidence of abnormally high temperatures at coil windings, contacts, insulation, external terminals, etc.

3. Loose nuts, screws or rivets.

4. Loose or misaligned contacts.

5. Armature stop interfering with proper movement of cut-out relay armature.

6. Bent armature, at either contact or hinge end. The armature should be straight from end to end.

7. Field yoke bent.

8. Armature hinges bent or distorted.

9. Damaged, incorrect, or insecurely attached resistors.

10. Incorrect (interchanged) armature springs; bent or broken spring brackets.

11. Corrosion due to salt or acid.

12. Evidence of water inside the cover.

13. Broken or ineffective gasket or poor cover fit.

REGULATOR ADJUSTMENTS

Adjustments can be made with the regulator on the vehicle, although it is preferred that the regulator be removed and placed on a test bench. Before checking regulator operation, run the engine, or test bench generator, to warm the regulator. If necessary, turn on lamps or accessories to cause the generator to deliver a current of 15 amperes through the regulator for 15 minutes. When checking settings, or making adjustments, have the warm regulator in the same position as on the vehicle. Recheck all adjustments with the cover in place.

Because of slight internal differences and the resulting necessary differences in adjustment procedures and specifications, the Delco-Remy generator regulator adjustments are covered separately from the Auto-Lite regulator adjustments in the following procedures.

a. Delco-Remy Regulator Adjustments

The following procedures should be used to adjust Delco-Remy generator regulators:

1. CHECK AND CLEAN CONTACT POINTS. With the regulator cover removed and the battery disconnected, carefully inspect the points on each regulator unit. The mating surfaces of regulator contact points that have been giving good service normally present a silver gray appearance, and require no filing. If contacts are burned, dirty, or rough, dress them with a thin, fine-cut ignition point file (Fig. 271), or an abrasive contact point dresser (never with sandpaper, carborundum or emery cloth). File the rounded contact carefully to avoid removal of too much metal. Move the file or dresser parallel to the length of the armature.

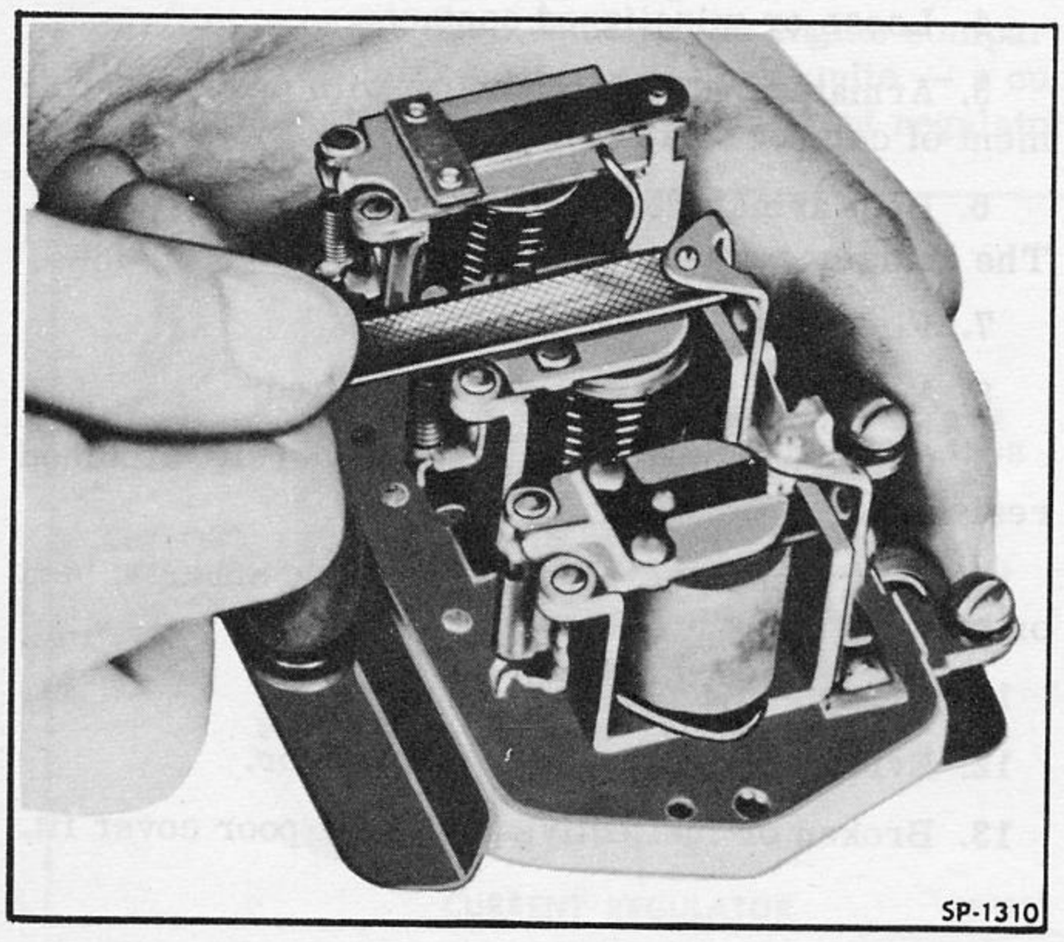

Fig. 271—Dressing Regulator Contacts with Fine File

Clean any depressions in a flat contact with a "riffler" or spoon file (Fig. 272). It may be necessary to loosen or remove a bracket to permit easy, proper cleaning of a depression in a point that was originally flat.

After filing, draw a piece of linen tape moistened with carbon tetrachloride between the points, then a dry tape to leave the points clean and dry.

2. CHECK AND ADJUST CUT-OUT RELAY. The cut-out relay requires three checks or adjustments--the air gap, the point opening and the closing voltage.

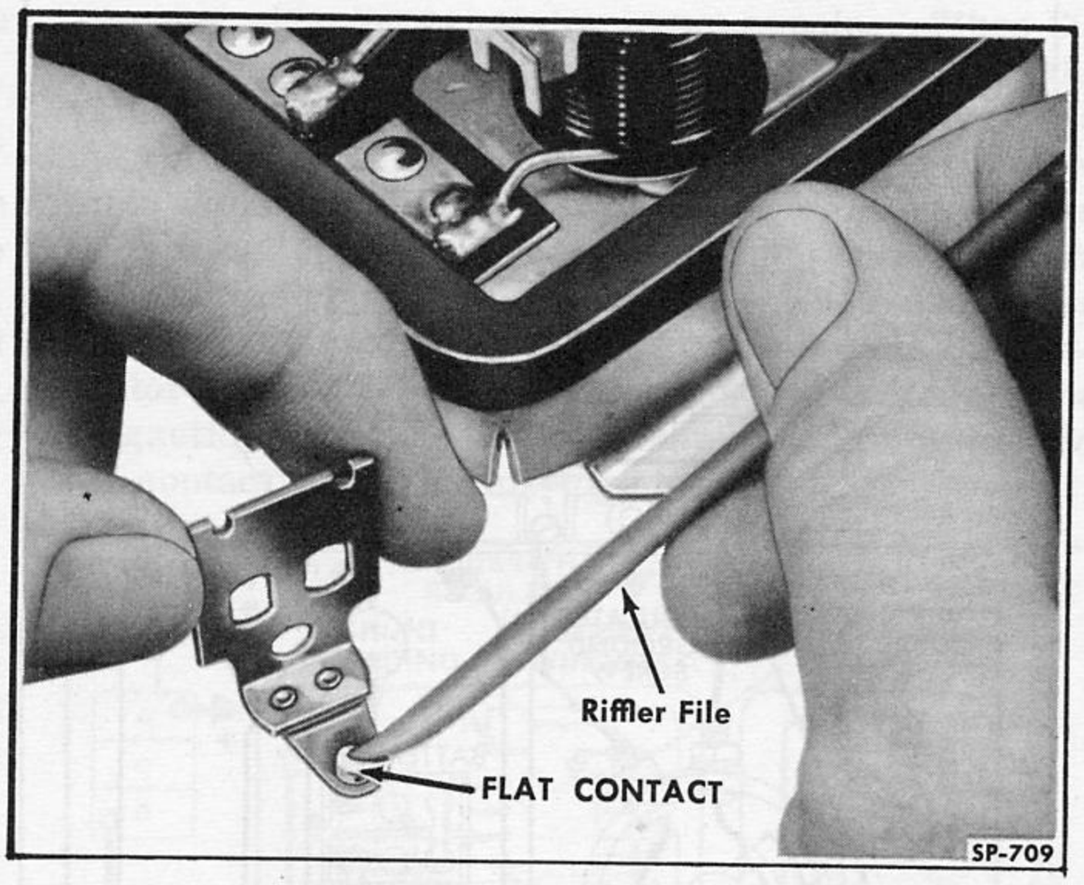

Fig. 272—Dressing Regulator Contacts with Riffler File

(a) Check the air gap with the battery disconnected. Apply finger pressure to the top of the armature, immediately above the core and move the armature down only enough to cause point contact. Make certain both pairs contact at the same time. If necessary bend one spring. With the points just contacting, measure the air gap between the armature and relay core (Fig. 273) with a feeler gauge. The gap should be .020 inch. To adjust, loosen two screws, as shown, and raise or lower the armature as required. Recheck the gap after tightening screws.

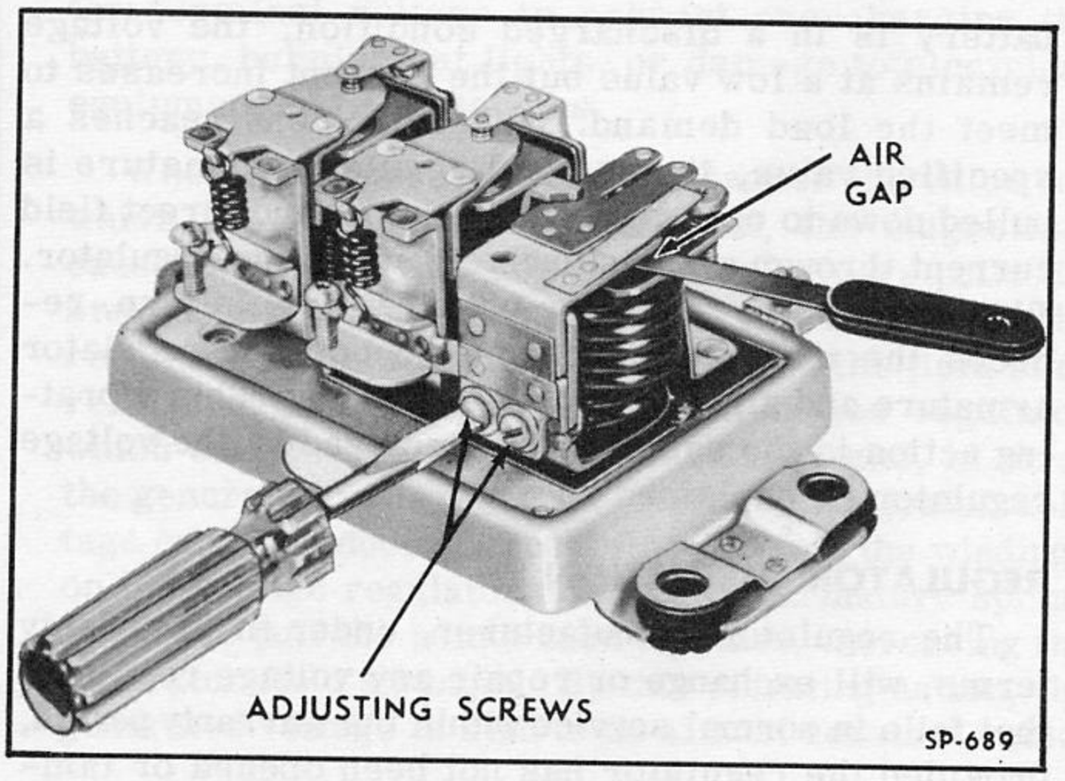

Fig. 273—Adjusting Delco-Remy Cut-Out Relay Air Gap

(b) Check the point opening with the battery disconnected. The point opening should be .020 inch. Adjust by bending the upper armature stop as shown in Fig. 274.

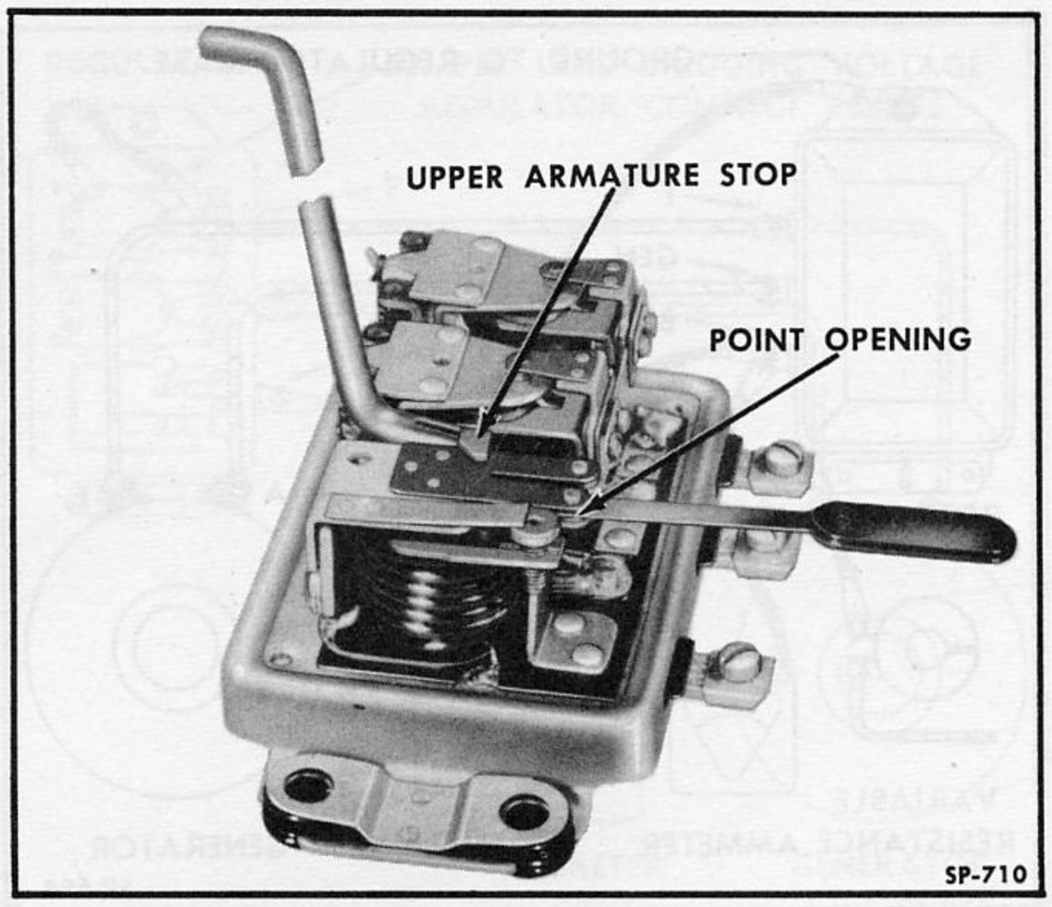

Fig. 274—Adjusting Delco-Remy Cut-Out Relay Point Gap

(c) Check the closing voltage with a voltmeter connected between the regulator "GEN" terminal and the regulator base. Connect battery cable to regulator "BAT" terminal, start engine and increase speed slowly. Voltmeter should show increased voltage up to 5.9-6.7 volts when the cut-out relay points close. If relay does not close within these limits, turn the adjusting screw as shown in Fig. 275 until relay closes at 6.4 volts. Turn clockwise to increase closing voltage.

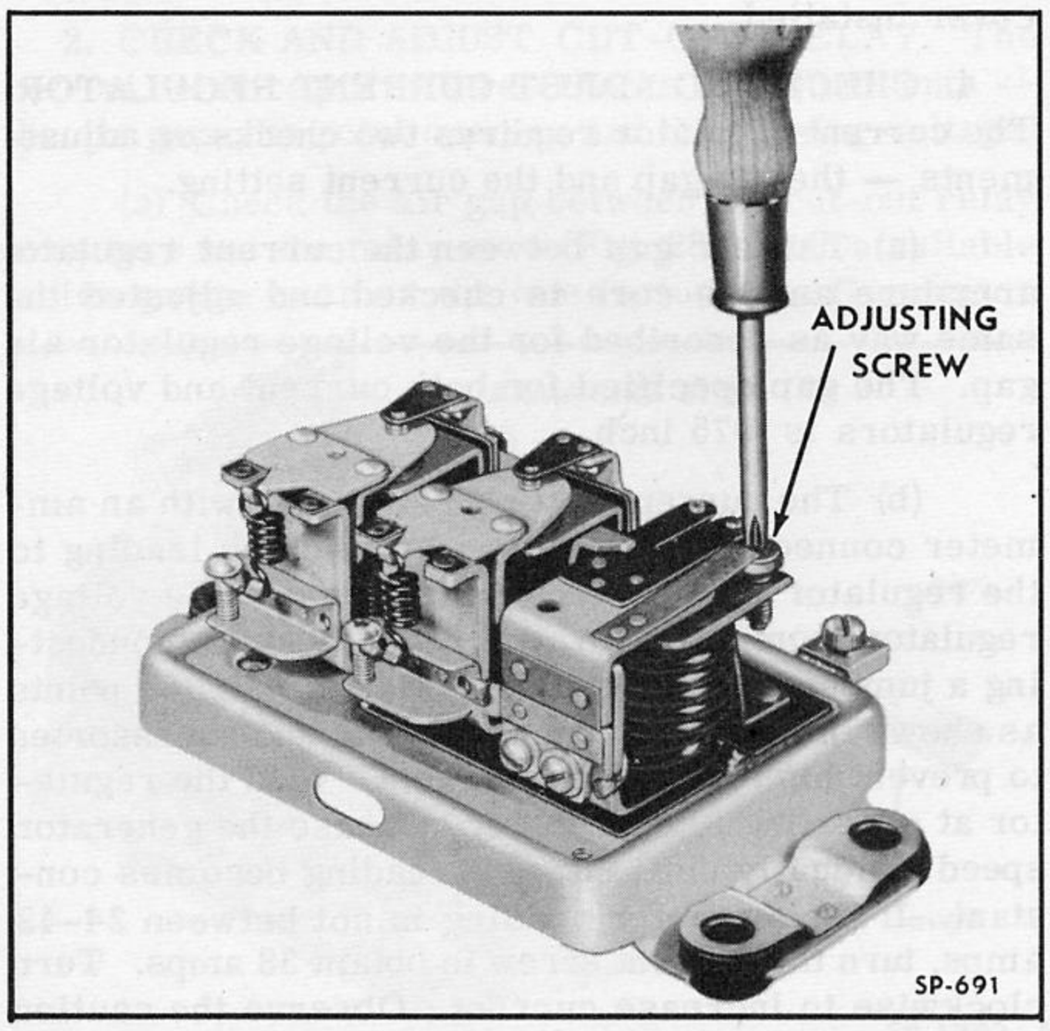

Fig. 275—Adjusting Delco-Remy Cut-Out Relay Closing Voltage

3. CHECK AND ADJUST VOLTAGE REGULATOR. The voltage regulator requires two checks or adjustments — the air gap and the voltage setting.

(a) To check the air gap, push the voltage regulator armature down to the core and release until the contact points just touch. Then measure the air gap (Fig. 276). The gap should be .075 inch. To adjust loosen the contact mounting screws and move the mounting as required. Recheck after tightening the screws.

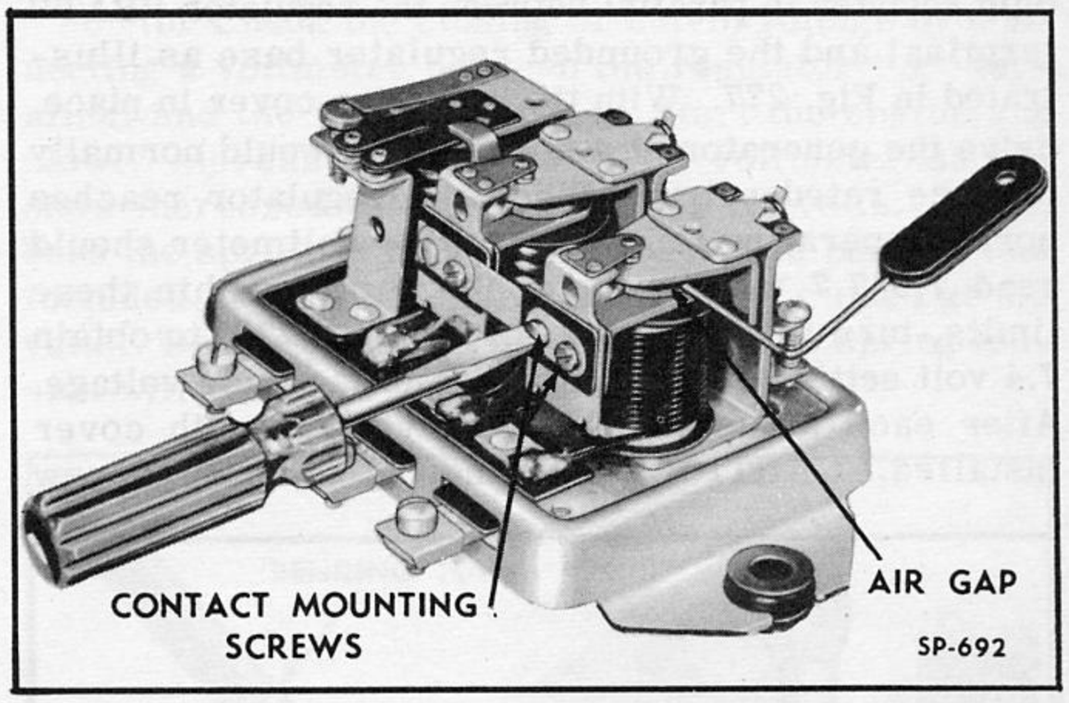

Fig. 276—Adjusting Delco-Remy Voltage Regulator Air Gap

(b) Check the voltage setting by either the "fixed resistance" method or the "variable resistance" method:

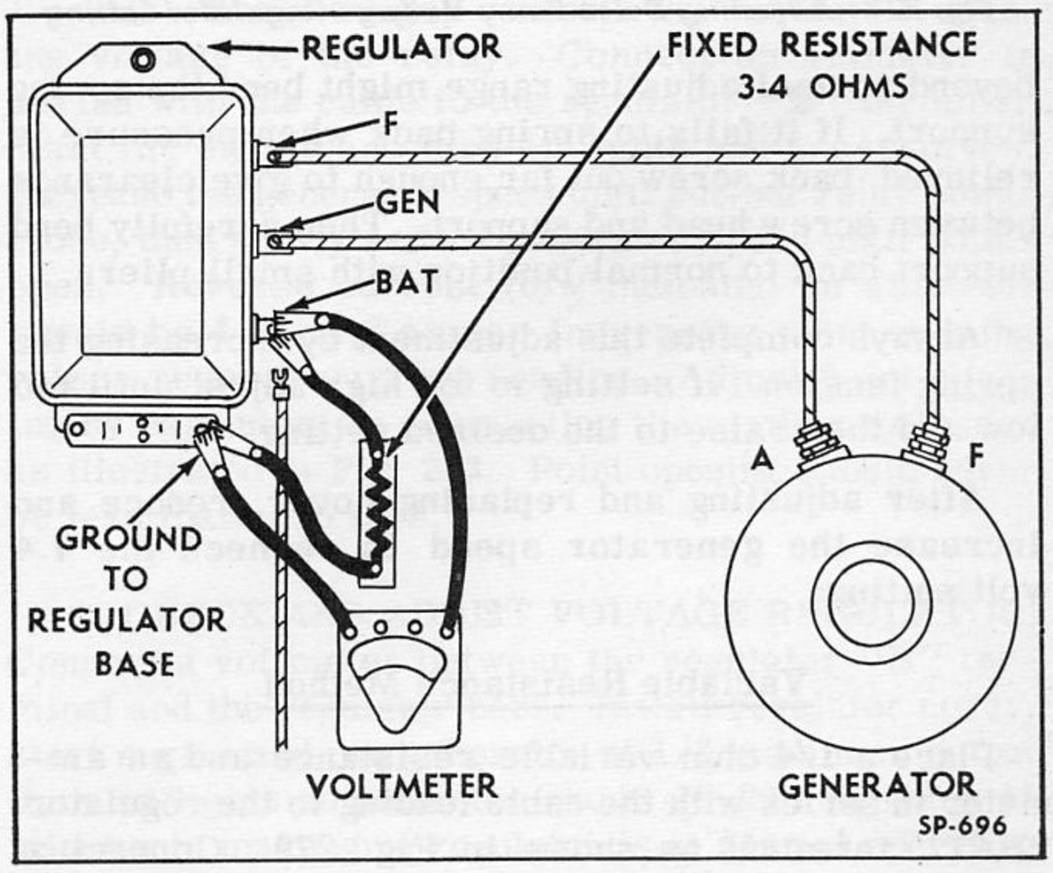

Fig. 277—Checking Delco-Remy Voltage Regulator with Fixed Resistance

Fixed Resistance Method

Obtain a 3/4 ohm resistor that is capable of carrying 10 amperes without resistance change due to heat. Disconnect the cable from the regulator "BAT" terminal. Connect a voltmeter and the 3/4 ohm resistor in parallel between the regulator "BAT" terminal and the grounded regulator base as illustrated in Fig. 277. With the regulator cover in place, drive the generator at a speed which would normally produce rated output. When the regulator reaches normal operating temperature, the voltmeter should read 7.0-7.7 volts. If voltage is not within these limits, turn the adjusting screw (Fig. 278) to obtain 7.4 volt setting. Turn clockwise to increase voltage. After each adjustment, check voltage with cover installed. CAUTION: Turning the adjusting screw

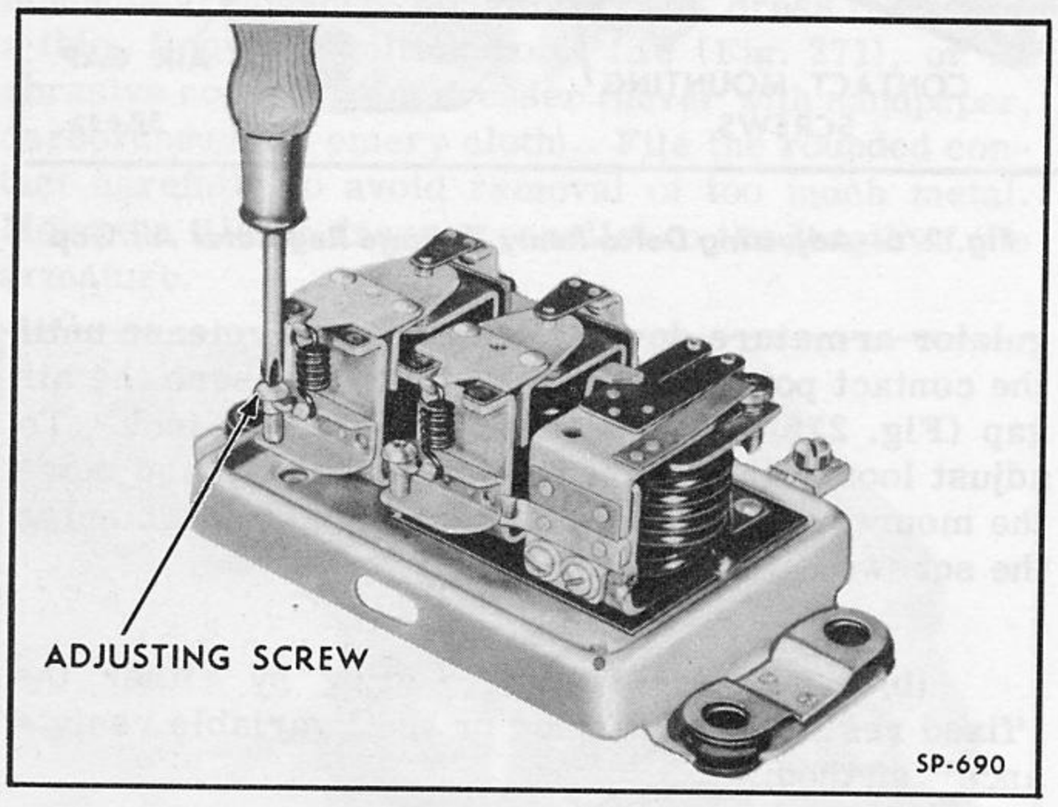

Fig. 278—Adjusting Delco-Remy Voltage Regulator Setting

beyond normal adjusting range might bend the spring support. If it fails to spring back when pressure is relieved, back screw out far enough to give clearance between screw head and support. Then carefully bend support back to normal position with small pliers.

Always complete this adjustment by increasing the spring tension. If setting is too high adjust until too low and then raise to the desired setting.

After adjusting and replacing cover, reduce and increase the generator speed to recheck the 7.4 volt setting.

Variable Resistance Method

Place a 1/4 ohm variable resistance and an ammeter in series with the cable leading to the regulator "BAT" terminal as shown in Fig. 279. Connect a voltmeter between the regulator "BAT" terminal and ground. With the regulator cover in place, drive the generator at a speed which would normally produce

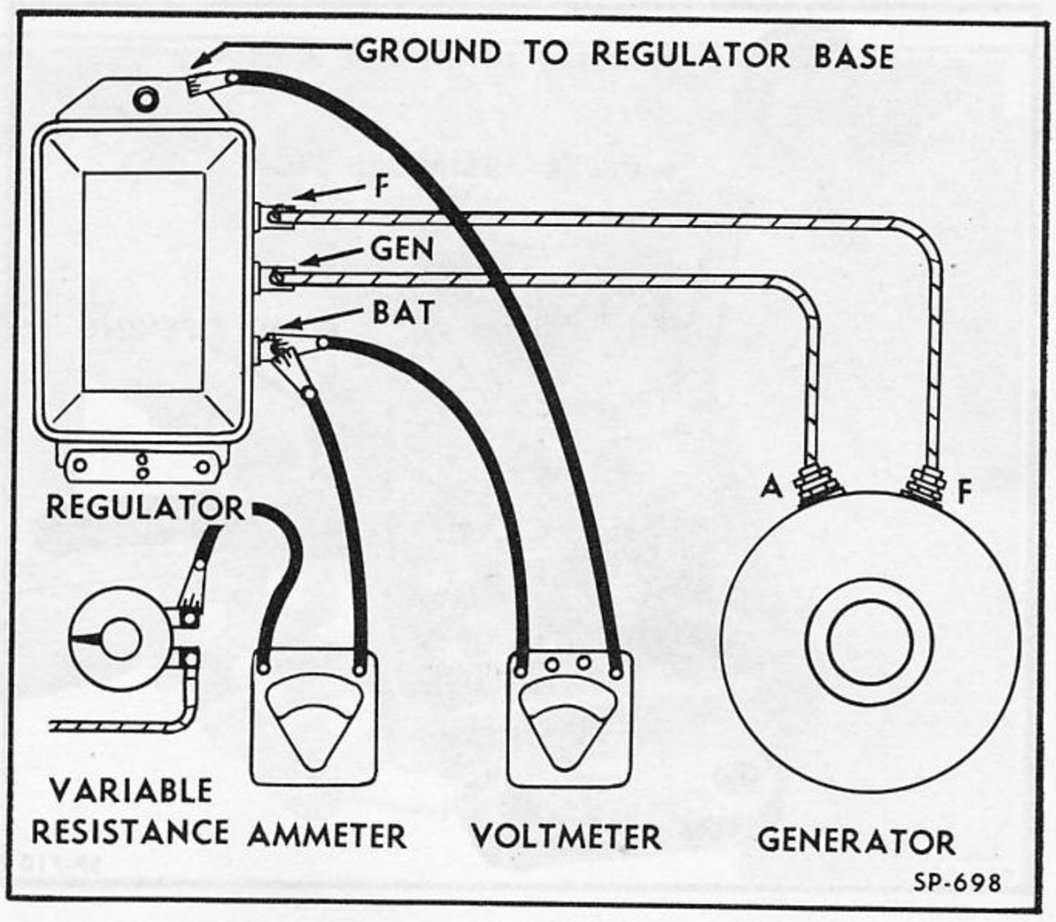

Fig. 279—Checking Delco-Remy Voltage Regulator with Variable Resistance

rated output and allow the regulator to reach normal operating temperature. If ammeter reading is less than 8 amperes, turn on lights or accessories to increase generator output and adjust resistance until output is 8-10 amperes. Reduce generator speed until relay points open. Then watch the voltage reading while bringing the generator back to speed. If voltage is not between 7.0-7.7 volts, remove cover and turn the adjusting screw (Fig. 278) to obtain 7.4 volt setting. After each adjustment, check voltage with cover installed.

4. CHECK AND ADJUST CURRENT REGULATOR. The current regulator requires two checks or adjustments — the air gap and the current setting.

(a) The air gap between the current regulator armature and the core is checked and adjusted the same way as described for the voltage regulator air gap. The gap specified for both current and voltage regulators is .075 inch.

(b) The current setting is checked with an ammeter connected in series with the cable leading to the regulator "BAT" terminal. Prevent the voltage regulator from operating during the test, by connecting a jumper wire across the voltage regulator points as shown in Fig. 280. Turn on lights and accessories to prevent high voltage during test. With the regulator at operating temperature, increase the generator speed gradually until current reading becomes constant. If the ammeter reading is not between 34-42 amps, turn the current screw to obtain 38 amps. Turn clockwise to increase current. Observe the caution noted under the "Fixed Resistance Method" of checking voltage regulator above.

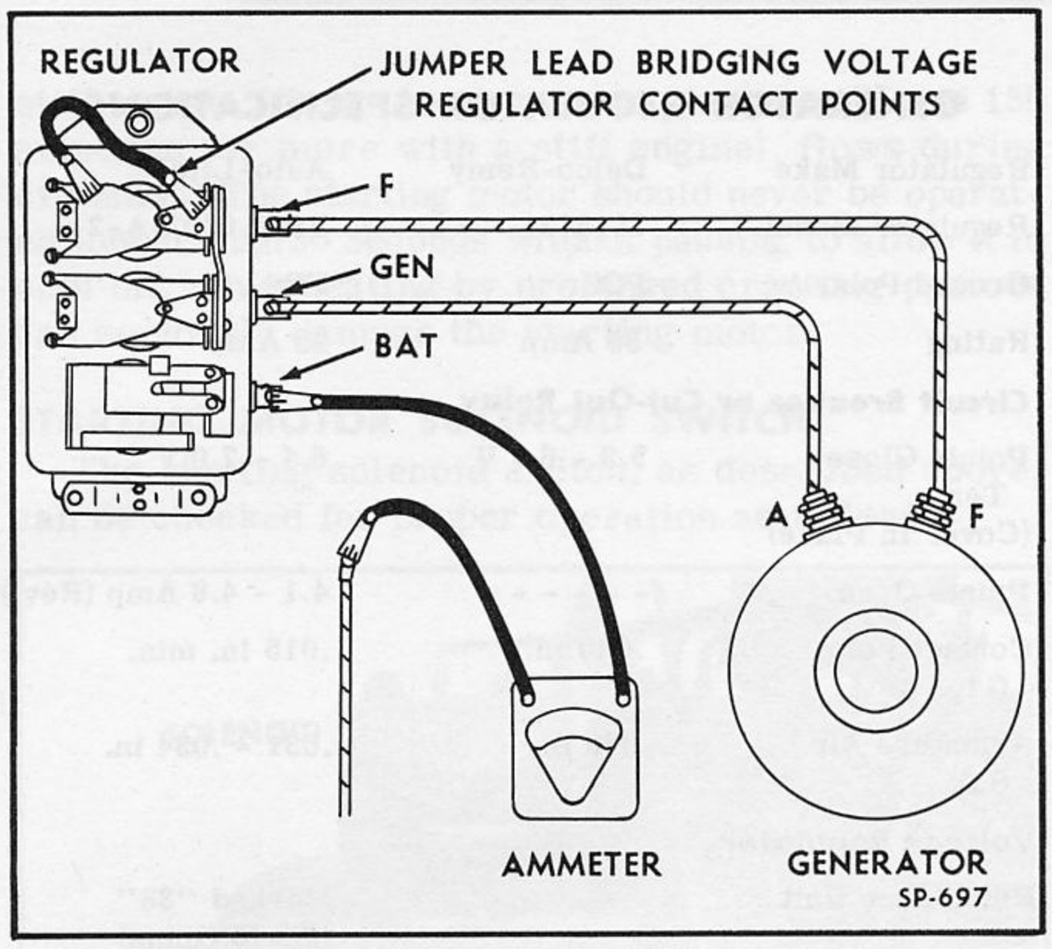

Fig. 280—Checking Delco-Remy Current Regulator Setting

b. Auto-Lite Regulator Adjustments

The following procedures should be used to adjust Auto-Lite generator regulators. The voltmeter and ammeter hook-ups for the following tests are shown in Fig. 270 on the Auto-Lite regulator circuit diagram.

1. CHECK AND CLEAN CONTACT POINTS. The regulator contact points should be checked and cleaned if necessary as described previously under "Delco-Remy Regulator Adjustments."

2. CHECK AND ADJUST CUT-OUT RELAY. The cut-out relay requires three checks or adjustments — the air gap, the point opening and the closing voltage.

(a) Check the air gap between the cut-out relay armature and the relay core (Fig. 281) with a suitable feeler gauge such as the one included in Generator Regulator Tool Kit C-828. The air gap near the hinge should be .031 - .034 inch with the armature against the stop. Adjust by bending the armature stop. Be certain there is no interference between the edge of the armature and the stop.

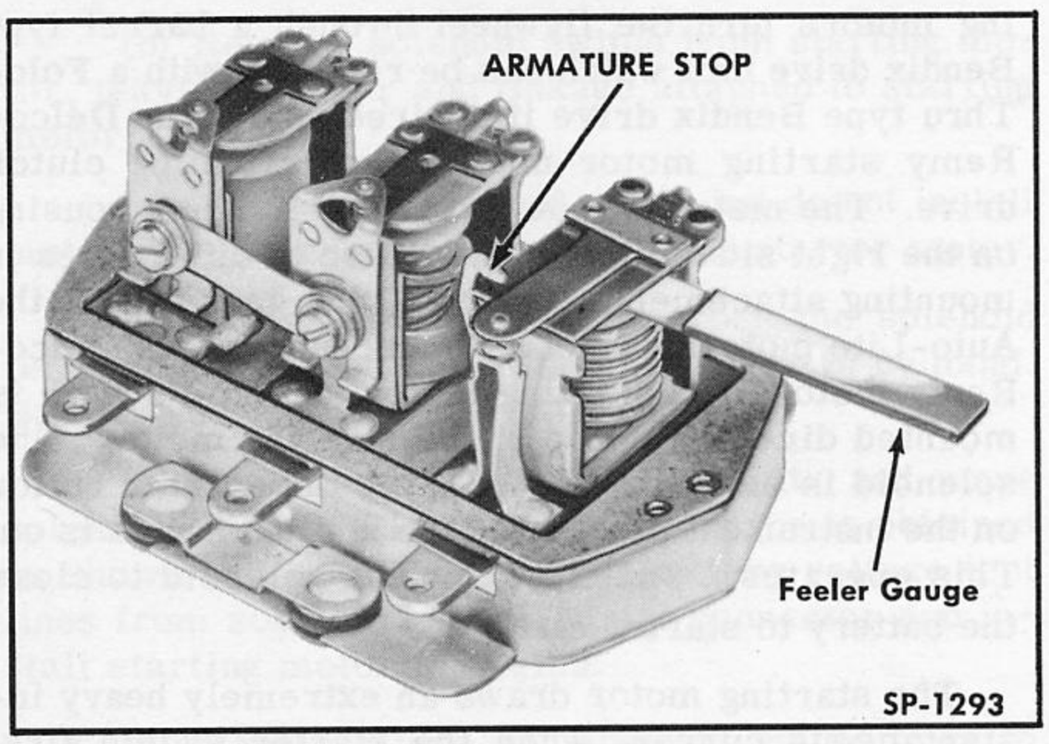

Fig. 281—Checking Auto-Lite Cut-Out Relay Air Gap

(b) Check the closing or cut-in voltage by connecting a voltmeter between the regulator "A" terminal and the regulator base. Start the engine and slowly increase the speed. The voltmeter should show increased voltage up to 6.4 - 7.0 volts. If not, bend the spring bracket (Fig. 282) with a bending tool included in Tool Kit C-828 until relay closes at 6.8 volts. Bending bracket down to increase spring tension will raise the cut-in voltage.

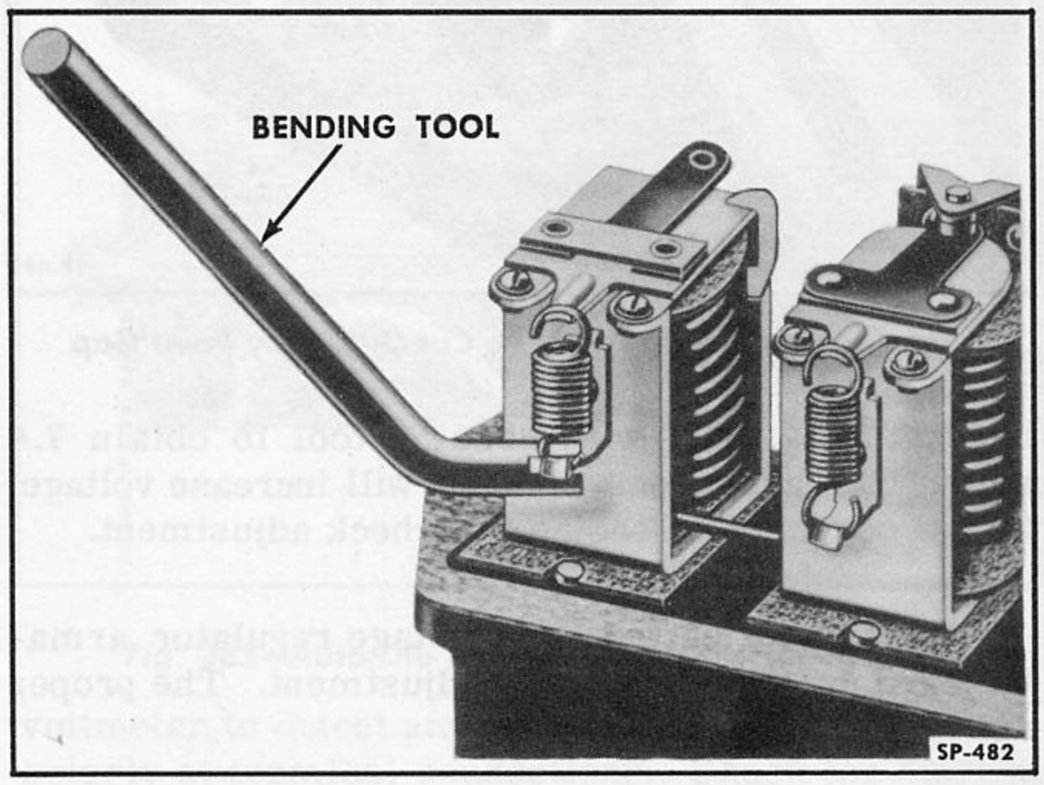

Fig. 282—Adjusting Auto-Lite Regulator Spring Tension

(c) The point gap controls the cut-out or opening voltage of the relay. Connect an ammeter in series with the cable to the regulator "B" terminal, start the engine and turn on lights and accessories. Increase the generator speed until cut-out relay points close, then slowly reduce generator speed until points open. Reverse current flow indicated on ammeter should be 4.1 - 4.8 amps. Increasing point opening raises reverse current reading. Adjust point opening by expanding or contracting the stationary bridge as illustrated in Fig. 283. Point opening should never be less than .015 inch.

3. CHECK AND ADJUST VOLTAGE REGULATOR. Connect a voltmeter between the regulator "B" terminal and the regulator base. Install regulator cover, start engine and run generator at 1/2 maximum output (turn on lights so ammeter shows 15-20 amps) for 15 minutes to make sure regulator is at normal operating temperature. Increase engine speed and note voltage reading which should be 7.2 - 7.5 volts. If voltage is not within limits, remove cover and bend spring

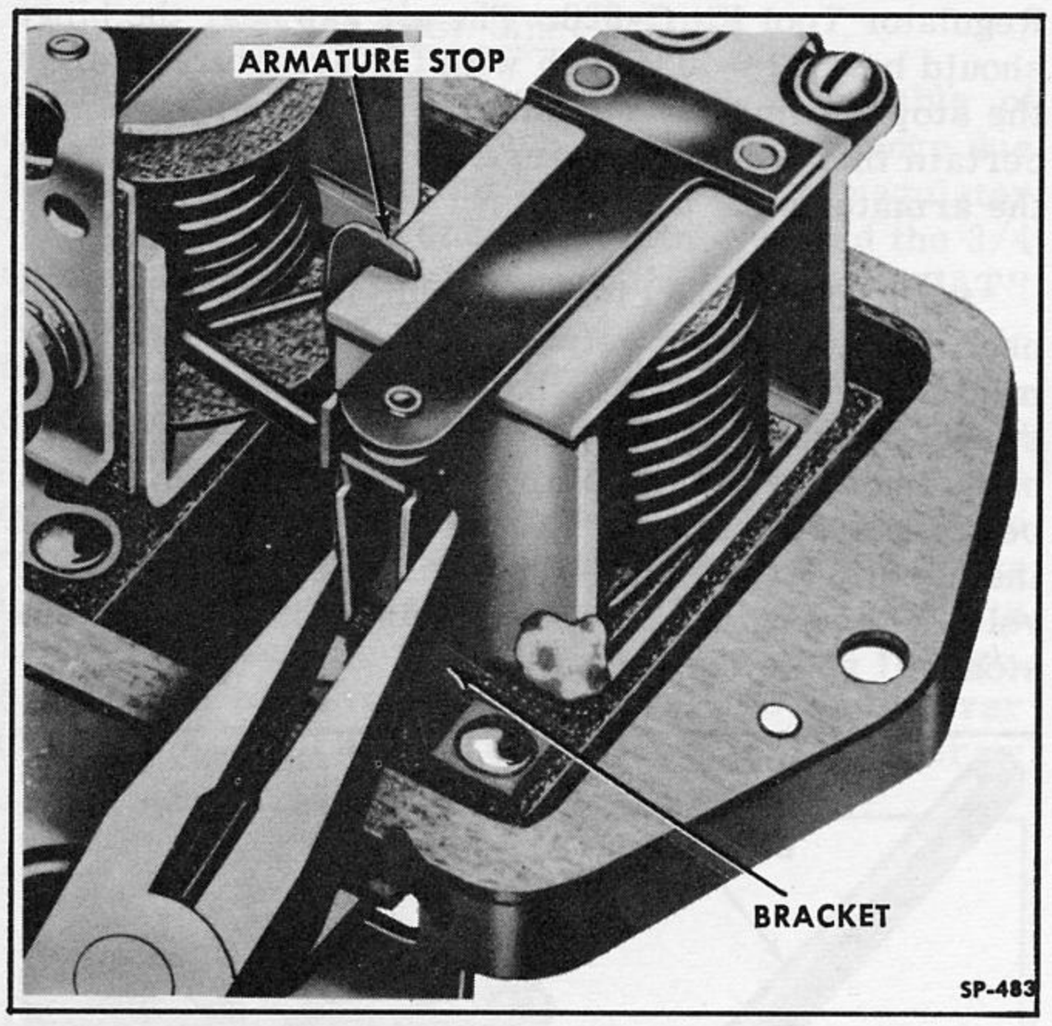

Fig. 283—Adjusting Auto-Lite Cut-Out Relay Point Gap

bracket (Fig. 282) with bending tool to obtain 7.4 volts. Increasing spring tension will increase voltage. Install cover, start engine and check adjustment.

The air gap between the voltage regulator armature and core seldom needs adjustment. The proper setting is .048 - .052 inch.

4. CHECK AND ADJUST CURRENT REGULATOR. The current regulator is checked with the voltmeter and ammeter in the circuit as illustrated in Fig. 270. Place a variable resistance across the battery and adjust the resistance until voltage falls to 6.9 volts, after engine is started. With the regulator cover in place and the regulator at normal operating temperature, increase engine speed to equivalent of 35 MPH in high gear, or the bench test generator to 3000 RPM. The current regulator should limit the generator output to 34-36 amps. To adjust output amperage, bend the current regulator armature spring bracket with a bending tool (Fig. 282). Increasing spring tension increases the current.

The current regulator armature to core air gap seldom needs adjustment. The proper setting is .048 - .052 inch.

REGULATOR SPECIFICATIONS

The data listed below for generator regulators used on Henry J vehicles is for guidance of the electrical equipment specialist who desires all of the regulator specifications in a condensed form.

GENERATOR REGULATOR SPECIFICATIONS

Regulator Make	Delco-Remy	Auto-Lite
Regulator Model	1118731	VRP-6001-A-2
Ground Polarity	POS	POS
Rating	35 Amp	35 Amp
Circuit Breaker or Cut-Out Relay		
Points Close-Temp. (Cover in Place)	5.9 - 6.7 V	6.4 - 7.0 V
Points Open	- - - - - -	4.1 - 4.8 Amp (Rev.)
Contact Point Gap	.020 in.	.015 in. min.
Armature Air Gap	.020 in.	.031 - .034 in.
Voltage Regulator		
Resistance Unit	- - - - - -	Marked "38" (36-40 Ohms)
Armature Air Gap (Core to Arm. as points open)	.075 in.	.048 - .052 in.
Operating Voltage (70°F., Cover on)	7.0 - 7.7 Volts	7.2 - 7.5 Volts
Current Regulator		
Resistance Unit	- - - - - -	Marked "7" (6.5 - 7.5 Ohms)
Armature Air Gap (Core to Arm as points open)	.075 in.	.048 - .052 in.
Operating Amperes (70°F., Cover on)	34-42 Amp	34-36 Amp.

STARTING SYSTEM

The starting system consists of a 4-brush series wound motor and a solenoid switch. Auto-Lite starting motors turn the flywheel through a barrel type Bendix drive unit which can be replaced with a Folo-Thru type Bendix drive if desired, while the Delco-Remy starting motor uses an overrunning clutch drive. The motor is mounted on the flywheel housing on the right side of the engine. Due to differences in mounting attachments, flywheel ring gears, etc., the Auto-Lite motors cannot be interchanged with Delco-Remy motors. A starting motor solenoid switch is mounted directly on top of the starting motor. The solenoid is energized by pushing the starter button on the instrument panel when the ignition switch is on. This operates a switch within the solenoid to close the battery to starter circuit.

The starting motor draws an extremely heavy instantaneous current when the starter switch first closes, sometimes more than 500 amperes with a

stiff engine. Then a heavy current, between 75 and 150 amperes (or more with a stiff engine), flows during cranking. The starting motor should never be operated longer than 30 seconds without pausing to allow it to cool off. Overheating by prolonged cranking periods can seriously damage the starting motor.

STARTING MOTOR SOLENOID SWITCH

The starting solenoid switch, as described above, can be checked for proper operation as follows:

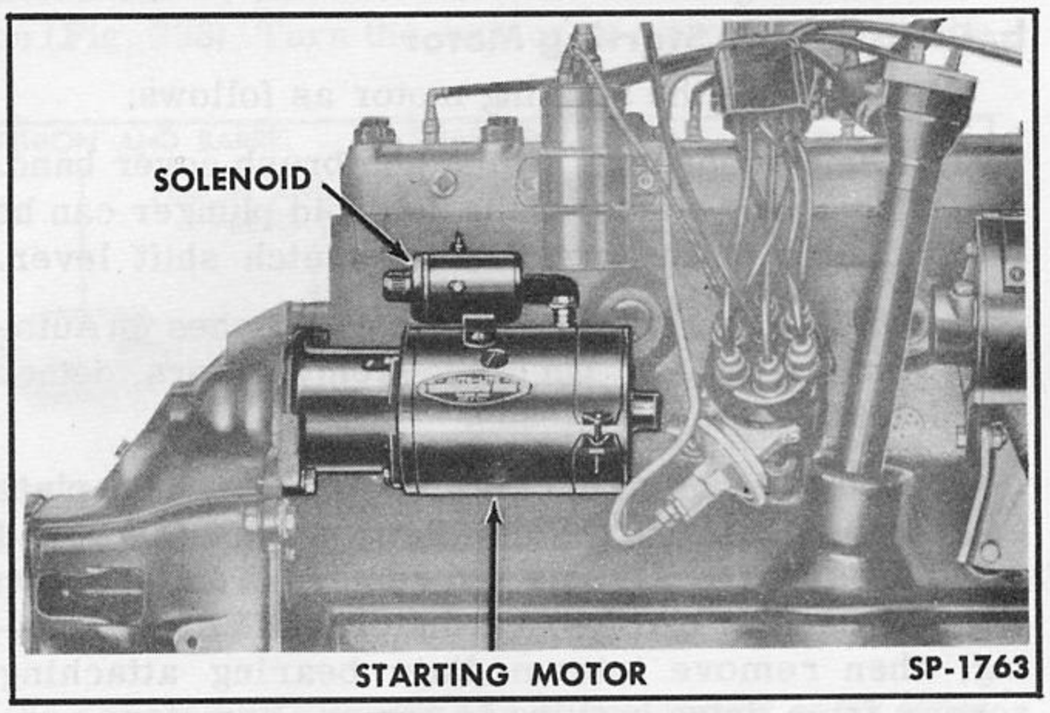

Fig. 284—Typical Starting Motor Installation

1. Make a jumper contact between the large "hot" terminal of the solenoid and the smaller control terminal (connected to the starter button). Solenoid switch should click and start the starting motor.

2. If solenoid does not click, check battery. If battery is fully charged, install a new solenoid switch. On Delco-Remy starting motors, adjust the position of the solenoid on the starting motor to obtain 3/16 inch pinion clearance as follows:

(a) Remove starting motor from engine.

(b) Remove solenoid switch from starting motor, leaving plunger and linkage attached to starting motor.

(c) Install new solenoid switch but do not install metal connector between solenoid and starter motor.

(d) Apply battery voltage across the solenoid terminals and push the solenoid plunger in by hand. Battery current will hold the plunger in.

(e) Loosen solenoid mounting bolts and move solenoid until 3/16 inch pinion clearance is obtained as shown in Fig. 286. Remove battery voltage test lines from solenoid, install metal connector and install starting motor to engine.

3. If solenoid clicks but starting motor fails to operate or operates too slowly, check voltage across the two large terminals with a voltmeter. If the voltage drop is more than 1/10 volt, install a new solenoid switch.

STARTING MOTOR INSPECTION AND MAINTENANCE

The battery cables and terminals should be checked for looseness or corrosion at least every 1,000 miles. On the first evidence of starting difficulty, always inspect the battery and make certain it is fully charged. Check all starter circuit cables and terminals. Use a voltmeter to detect any excessive voltage drop particularly at terminal connections. Check the starting solenoid switch as detailed above. If all items checked are satisfactory, inspect the starting motor as outlined below:

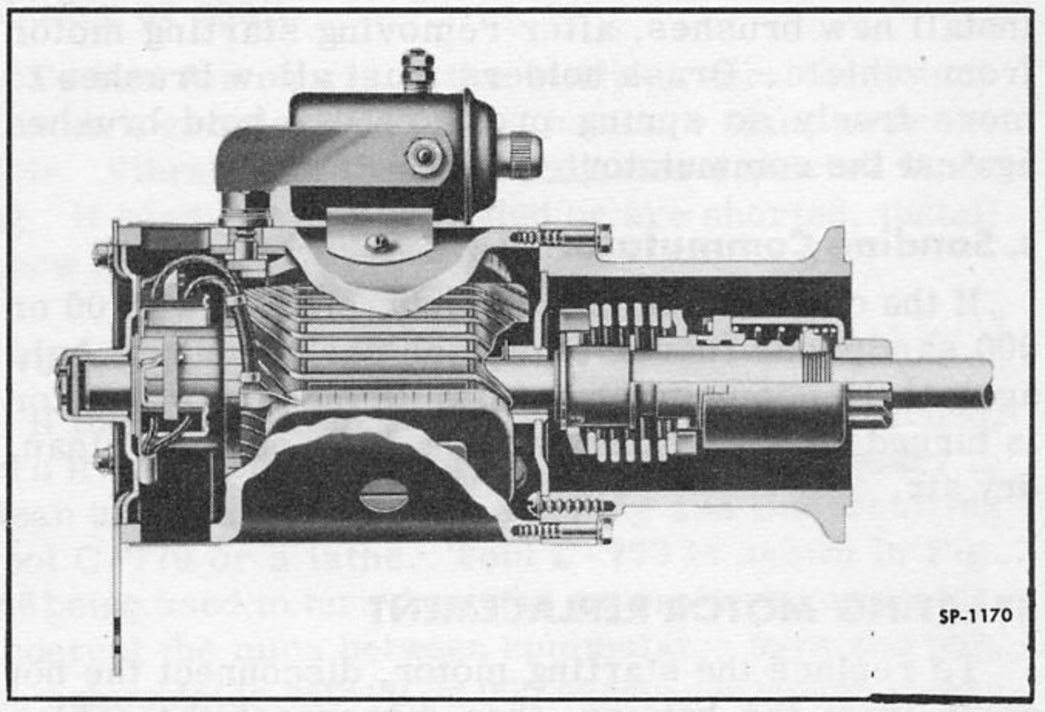

Fig. 285—Auto-Lite Starting Motor—Sectional View

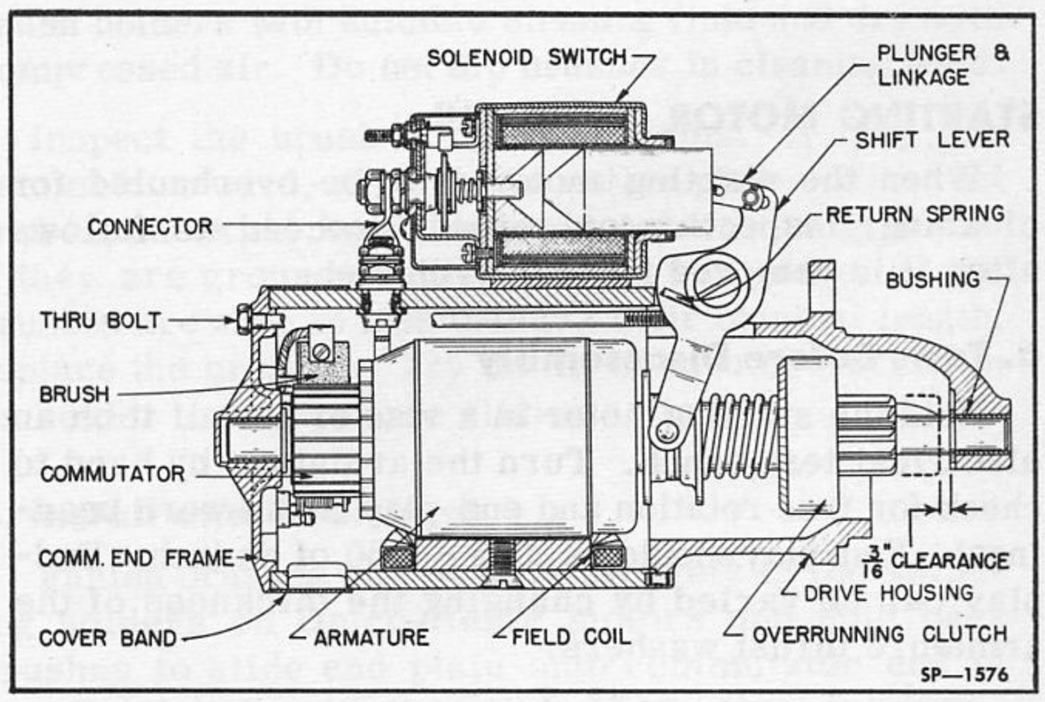

Fig. 286—Delco-Remy Starting Motor—Sectional View

a. Cleaning Starting Motor

To insure dependable starts, keep the starting motor clean outside and inside. Use a cloth dampened with cleaning fluid to wipe off any oil or grease. Never steam clean a starting motor or dip a motor,

armature or field coils in cleaning fluid. When cleaning the outside be careful that cleaning fluid or water does not get into the motor. If the interior of a starting motor needs cleaning, remove it for disassembly.

b. Inspecting Brushes and Commutator

Remove the cover band and inspect the commutator. If the surface is clean, brown, smooth, and free from grooves or evidence of burning, it requires no attention. If it is rough, pitted, oily or gummed, the commutator must either be sanded, or removed from the starting motor and turned down. If the brushes are oil-soaked or worn to less than 1/2 inch in length, install new brushes, after removing starting motor from vehicle. Brush holders must allow brushes to move freely so spring pressure can hold brushes against the commutator.

c. Sanding Commutator

If the commutator is only dirty, clean it with 00 or 000 sandpaper (never emery or carborundum) held against the commutator bars while the starting motor is turned slowly. After sanding, blow out with clean, dry air.

STARTING MOTOR REPLACEMENT

To replace the starting motor, disconnect the hot cable from the battery, then disconnect the cables from the starting motor solenoid switch. Remove the starting motor mounting bolts and lift the starting motor out of the vehicle. To install, reverse this procedure. The bushing for the rear end of the armature shaft on Auto-Lite starting motors is located in the clutch housing. Use care not to damage it during starting motor installation.

STARTING MOTOR OVERHAUL

When the starting motor is to be overhauled for cleaning, inspection or repair, proceed as follows after it is removed from the vehicle:

a. Tests Before Disassembly

Hold the starting motor in a vise or install it on an electrical test bench. Turn the armature by hand to check for free rotation and end-play (from worn bearings). End-play should be .005 - .050 of an inch. End-play can be varied by changing the thickness of the armature thrust washers.

Check the operation of the drive unit and the condition of the drive unit pinion and springs.

If a test bench is available, run the starting motor in a no-load test according to directions of the test equipment manufacturer or the starting motor manufacturer.

If a test bench is not available, connect starting motor, an ammeter (with a range up to 600 amperes) and a variable resistance in series to a battery. On Delco-Remy starting motors, adjust the resistance until 5.65 volts is obtained. At this voltage, a steady no-load current of 70 amperes or less should be turning the motor at approximately 5,500 RPM. On Auto-Lite starting motors, 5.0 volts should turn the motor armature 4000 RPM with a current flow of 65 amperes or less. Watch for sparking at brushes during the no-load test.

b. Disassemble Starting Motor

Disassemble the starting motor as follows:

1. Remove solenoid switch and brush cover band. On Delco-Remy starters, the solenoid plunger can be left attached to the overrunning clutch shift lever.

2. Lift brush springs and remove brushes on Auto-Lite starting motors. On Delco-Remy motors, detach brush leads from field leads.

3. Remove bolts attaching commutator end plate and drive housing to frame. Separate end plate and drive housing from frame and remove armature. On Auto-Lite motors, remove armature with drive housing, then remove intermediate bearing attaching screws from drive housing to remove armature.

4. Slide the overrunning clutch unit off the armature shaft on Delco-Remy motors. The Bendix drive unit on Auto-Lite can be removed from the armature shaft after loosening a set screw that locks the drive screw on the shaft. Pry the drive spring away from the plate as shown in Fig. 287 to expose the set screw.

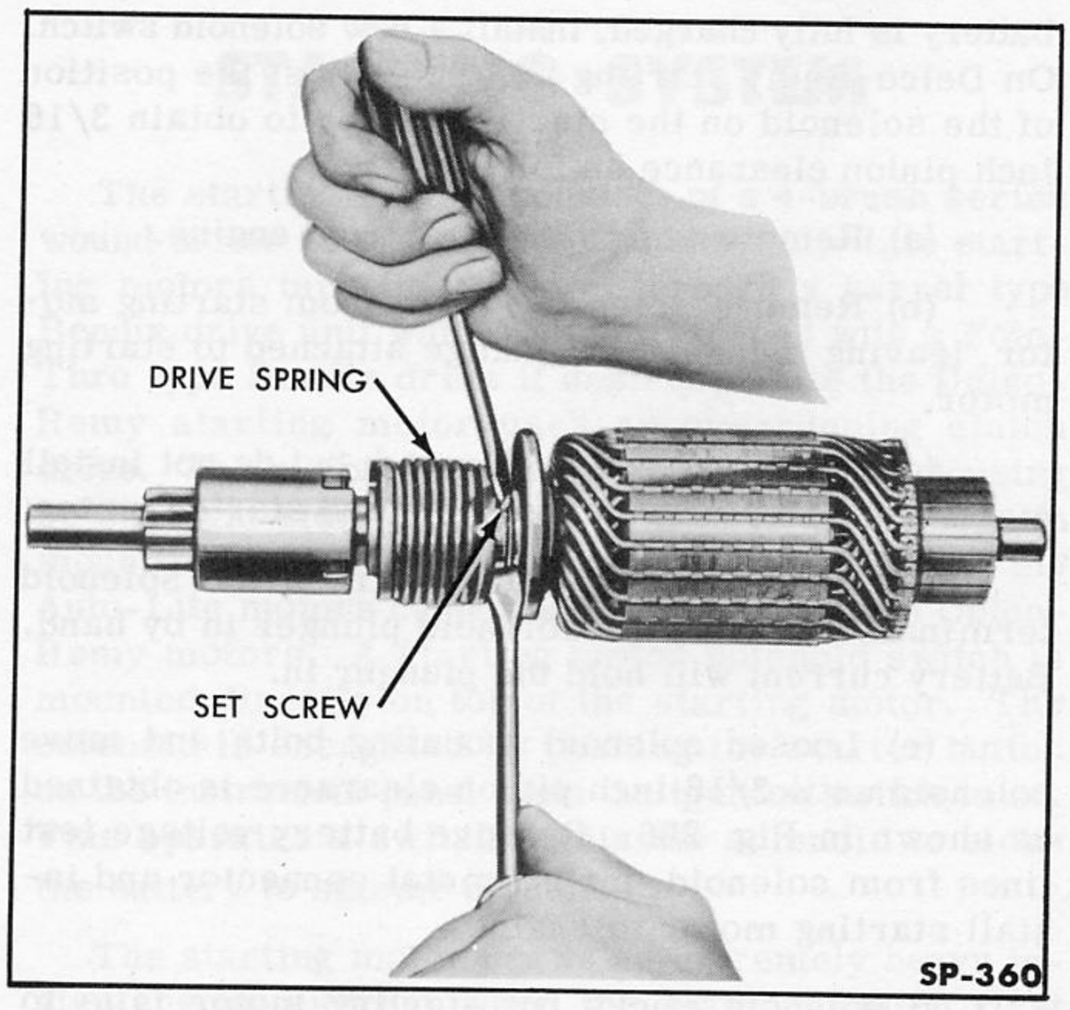

Fig. 287—Removing Bendix Drive Set Screw

c. Clean and Inspect Drive Unit

The overrunning clutch unit used on Delco-Remy motors should never be dipped into solvent or cleaned by degreasing methods since this will ruin the clutch. Wipe the clutch with a clean cloth. The drive pinion must rotate freely in the overrunning direction and must not slip in the cranking direction. If the overrunning clutch unit is not satisfactory, replace the entire unit.

The barrel type Bendix drive used on Auto-Lite motors can be disassembled for cleaning and inspection (Fig. 288) Turn the set screw down flush with the drive screw while prying the drive spring away from the plate. Remove lock ring, drive spring plates and drive spring from drive screw. Remove snap ring from inside pinion barrel and remove pinion and barrel assembly and spring from drive screw. Do not attempt to disassemble the drive screw assembly. Clean all parts with suitable cleaning fluid and replace worn parts. After assembling parts, turn set screw out far enough to enable the unit to slide onto the armature shaft.

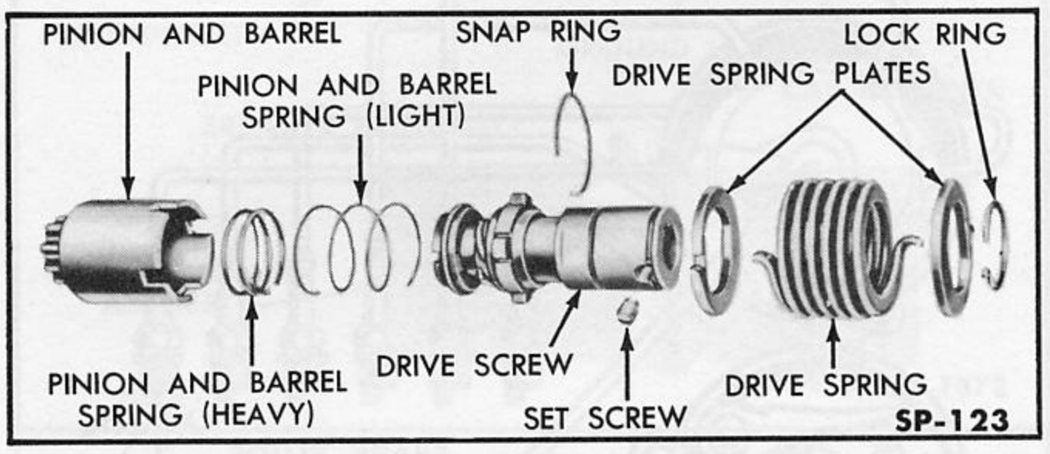

Fig. 288—Bendix Drive Unit—Exploded View

d. Clean and Inspect Frame and Field Coils

Clean the frame with a cloth dampened in cleaning solvent but do not soak insulation on field coils. Inspect for worn or damaged insulation and for loose or corroded terminal connections. Check for a ground in the field coils by touching the probes of a 110-volt tester between the battery terminal and an unpainted spot on the starting motor frame. Make sure the field leads (which connect to the ungrounded brushes) are not touching the frame during this test. If the test lamp lights, the field is grounded. The terminal stud and the fields must be removed to locate the ground.

An open in the starting motor field coil is unlikely, however, if it does occur, each field coil must be disconnected to be checked for continuity. Usually an open can be detected by visual inspection of soldered joints. Always install field poles in the exact position of their original installation.

e. Clean and Inspect Armature

Clean the armature with a cloth moistened with suitable cleaning fluid and wipe dry. Make sure that all coils are secure in their slots and terminals are securely staked and soldered in the commutator bar risers. If the commutator is badly burned, grooved or worn, install a new armature.

Test for grounded armature windings with one probe of a 110 volt tester against the laminations and the other probe in contact with the commutator bar risers. A light indicates grounded windings. Never use a test probe against the bearing surface of a commutator or shaft.

To test for shorts in the windings turn the armature on a growler and hold a hacksaw blade over the slots. Vibration of the blade indicates a shorted winding. If windings are grounded or are shorted, install a new armature.

f. Turn Down Commutator

If the commutator is not too badly worn or burned, turn it down, removing as little metal as necessary to clean up, using Armature Turning and Undercutting Tool C-770 or a lathe. Tool C-770 is shown in Fig. 266 being used to turn down the generator commutator. Undercut the mica between commutator bars and polish commutator with 00 or 000 sandpaper (never emery or carborundum).

g. Clean and Inspect Brushes and Holders

Remove the Auto-Lite brushes from their holders and from the commutator end plate. Remove the screws that fasten the Delco-Remy brushes to the swinging holders. Clean the commutator end plate and brush holders with suitable cleaning fluid and dry with compressed air. Do not dip brushes in cleaning fluid.

Inspect the brush holders or arms. If they are bent or corroded, replace the entire plate. With test probes, check the insulated brush holders for grounds. If they are grounded, discard the end plate. If the brushes are worn to less than 1/2 their original length, replace the brushes. Try the fit of each new brush in its holder to assure free sliding action.

h. Install and Fit Brushes

Fasten brushes and pigtails securely to the swinging holders on Delco-Remy motors and hold back brushes to slide end plate onto commutator end of armature shaft (with thrust washer in place on armature shaft). On Auto-Lite motors, fasten brush pigtail terminals to the end plate, install end plate on armature shaft, then insert brushes into holders. Do not solder ungrounded pigtails to field coil leads until after brushes are fitted.

To fit brushes, place a strip of 00 or 000 sandpaper (never emery or carborundum) the width of the finished part of the commutator between the commutator and a brush with the sand side toward the brush. Hold the sandpaper against the commutator and press against the brush while rotating end plate until brush is making contact across full width of face. Repeat on other brushes, then remove sandpaper, blow out any sand or carbon powder, remove end plate and inspect brushes. On Auto-Lite motors, solder ungrounded brush pigtails to field coils with resin core solder.

i. Check Brush Spring Tension

Use a small scale such as Spring Tension Checking Scale MTU-36 and a hook to test brush spring tension. On Delco-Remy motors, spring tension should be 24-26 ounces while Auto-Lite spring tension is 42-53 ounces. Carefully bend spring holders to adjust tension.

j. Check Bearings

If the oil impregnated bronze bearings are worn to permit excessive radial movement of the armature, they should be replaced. Press out the worn bushing and press in a new one with a shoulder mandrel. The mandrel pilot should be well polished and be approximately .0005 inch larger than the armature shaft. DO NOT REAM AN OIL-IMPREGNATED BRONZE BEARING. Put a new porous bearing in oil before installing and put a few drops of oil on each old bearing before assembling the motor.

The rear armature shaft bearing for Auto-Lite starting motors is located in the clutch housing.

k. Assemble Starting Motor

The starting motor can be assembled in the reverse order of its disassembly. Be sure end plates are installed in the same position on the frame as they were originally. After the motor is assembled, test the brush springs for proper tension as described above. It is also necessary to adjust the position of the solenoid on Delco-Remy motors to obtain proper pinion clearance of 3/16 inch between the drive pinion and the housing with the pinion in the cranking position (see Fig. 286). Clearance is checked by removing the connector between the solenoid and starting motor so the motor will not operate. Then apply battery voltage across the solenoid terminals and push the solenoid plunger in by hand. Battery current will hold the plunger in position while the solenoid mounting bolts are loosened to move the solenoid until 3/16 inch pinion clearance is obtained.

l. Starting Motor Final Test

Check the assembled starting motor by making a no-load test on a test bench or as described under "Test Before Disassembly" in this section.

IGNITION SYSTEM

The ignition system (Fig. 289) has a primary (low tension) circuit and a secondary (high tension) circuit. The primary circuit includes the ignition switch, the primary winding of the ignition coil, the breaker points and condenser, and the wires connecting these units. The secondary circuit includes the secondary winding of the ignition coil, the distributor rotor and cap, the spark plugs and the high tension cables between the coil, distributor and spark plugs.

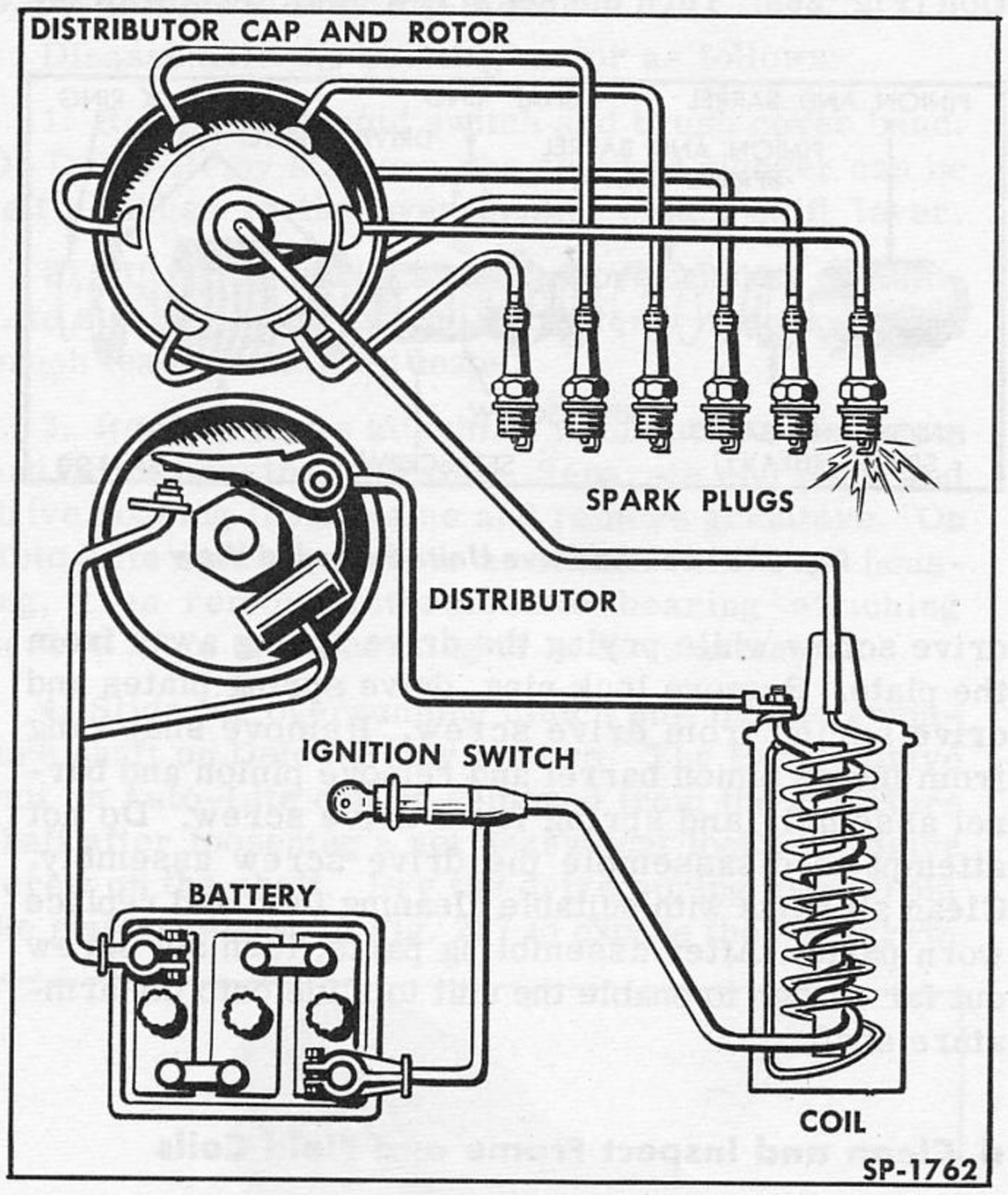

Fig. 289—Ignition System Diagram

IGNITION SYSTEM OPERATION

The ignition system is controlled by the ignition switch which, when turned on, connects one end of the primary winding of the ignition coil to the battery or generator voltage supply. The other end of the primary winding goes to the distributor and connects to the breaker arm. The distributor cam is geared directly to the camshaft and rotates at exactly 1/2 the engine speed. When the cam is rotating the breaker points open and close on each lobe of the cam. With the breaker points closed, the primary circuit is completed to ground and a surge of current flows through the primary winding of the coil until the breaker points open. A condenser is connected between the breaker arm and ground to protect the points from arcing and

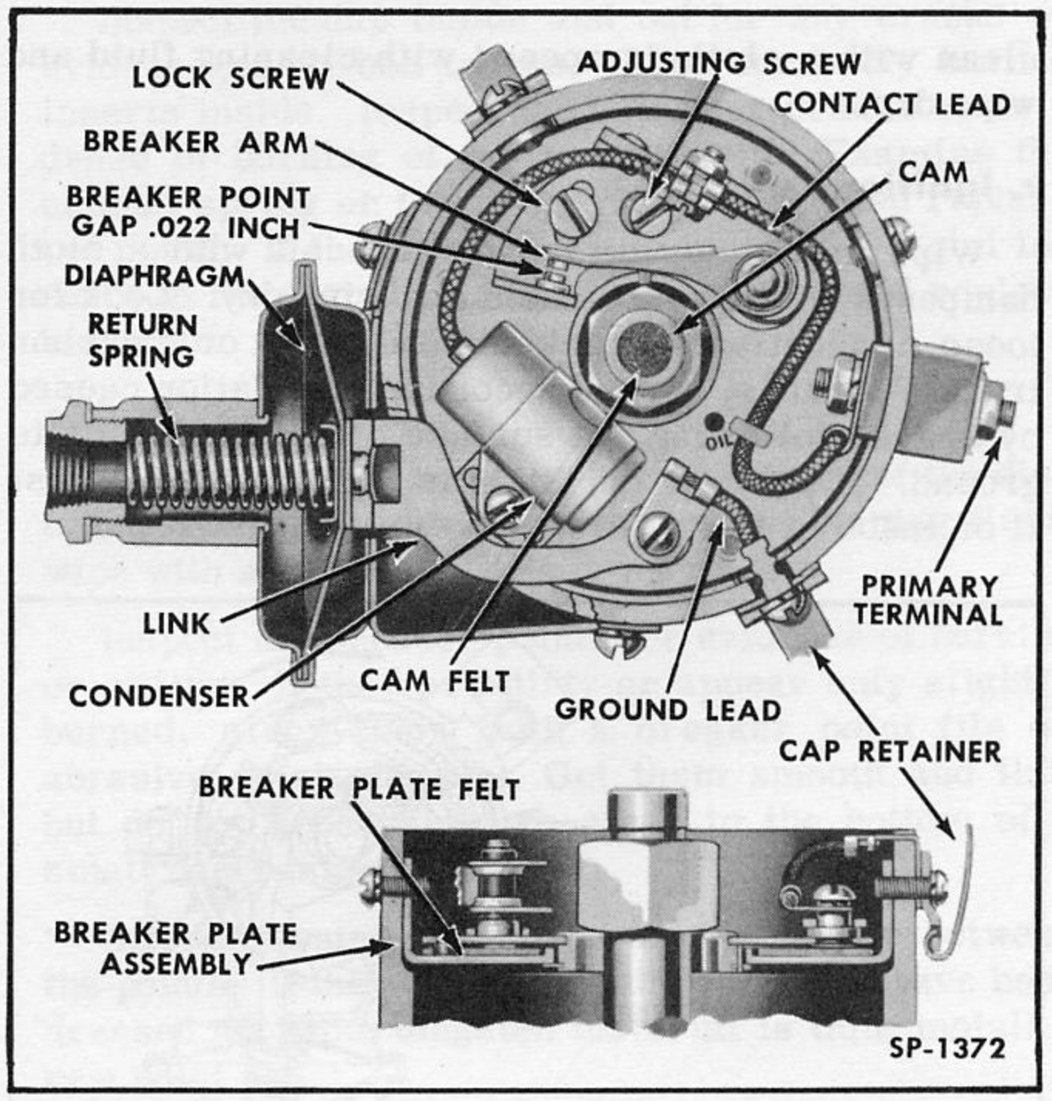

Fig. 290—Delco-Remy Distributor—Cap and Rotor Removed (6 Cylinder Shown)

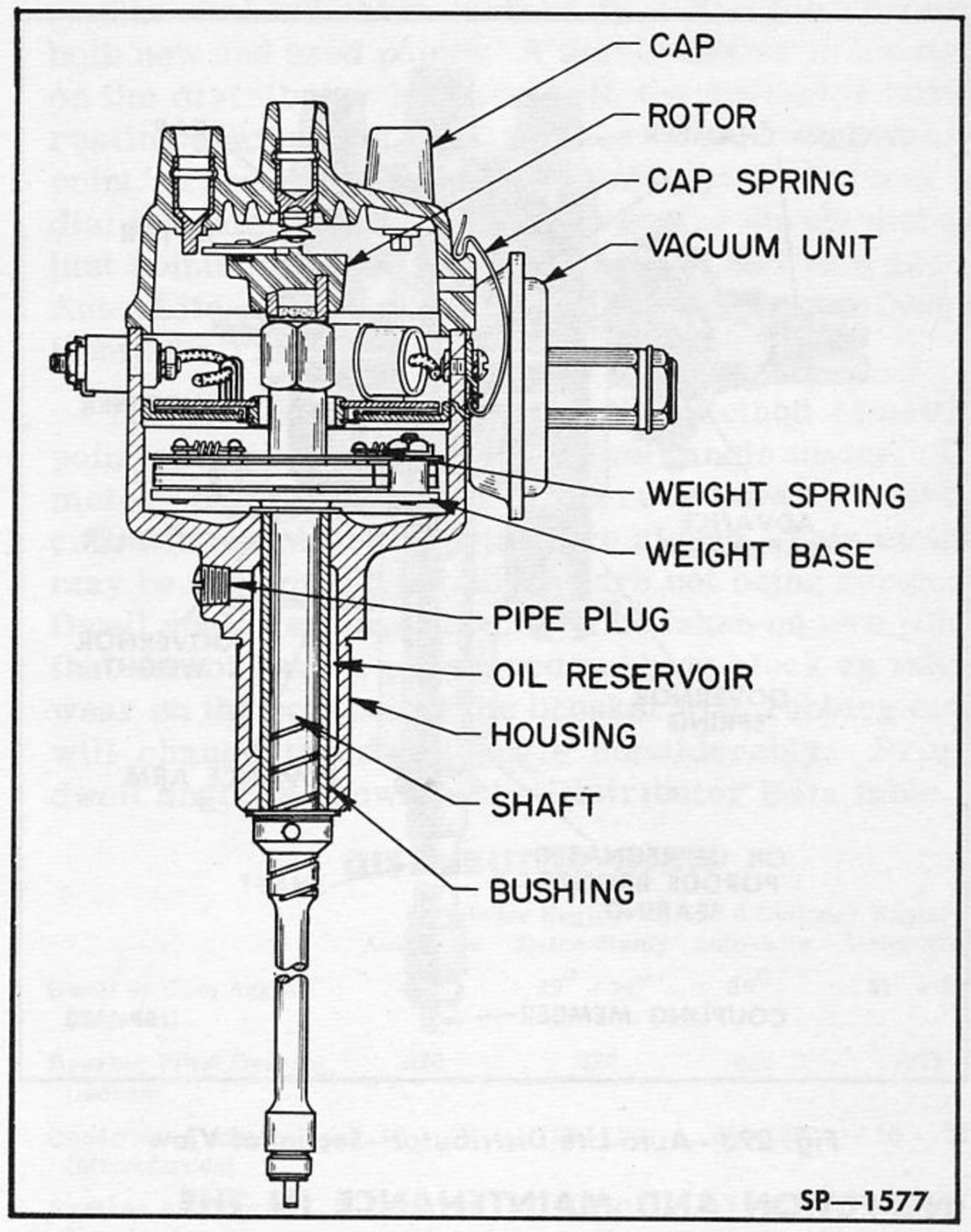

Fig. 291—Delco-Remy Distributor—Sectional View

burning and to speed the collapse or breakdown of the magnetic field in the coil.

The collapsing magnetic field in the coil causes a very high induced voltage in the secondary winding which is carried to the center terminals of the distributor, which is connected to the distributor rotor. The rotor directs the voltage to one of the distributor cap terminals which in turn is connected to a spark plug. The high tension voltage is necessary to produce a spark across the plug electrodes to ignite the fuel in that cylinder.

In order to obtain full power and good economy, the spark must be "advanced" according to varying engine speeds and loads. This advance is automatically controlled by a centrifugal governor and a vacuum advance unit. The centrifugal governor consists of weights attached to the distributor shaft which swing outward against spring tension as engine speed increases to cause the cam to turn forward thus obtaining an earlier spark. The vacuum advance unit (Fig. 294) consists of a vacuum diaphragm which is connected by a link to the breaker plate. When the engine is operating at idle or under a heavy load, there is so little vacuum in the vacuum advance unit that it does not move the diaphragm. Under normal part-load, however, the vacuum is sufficient to move the diaphragm and rotate the breaker plate slightly to cause an earlier spark.

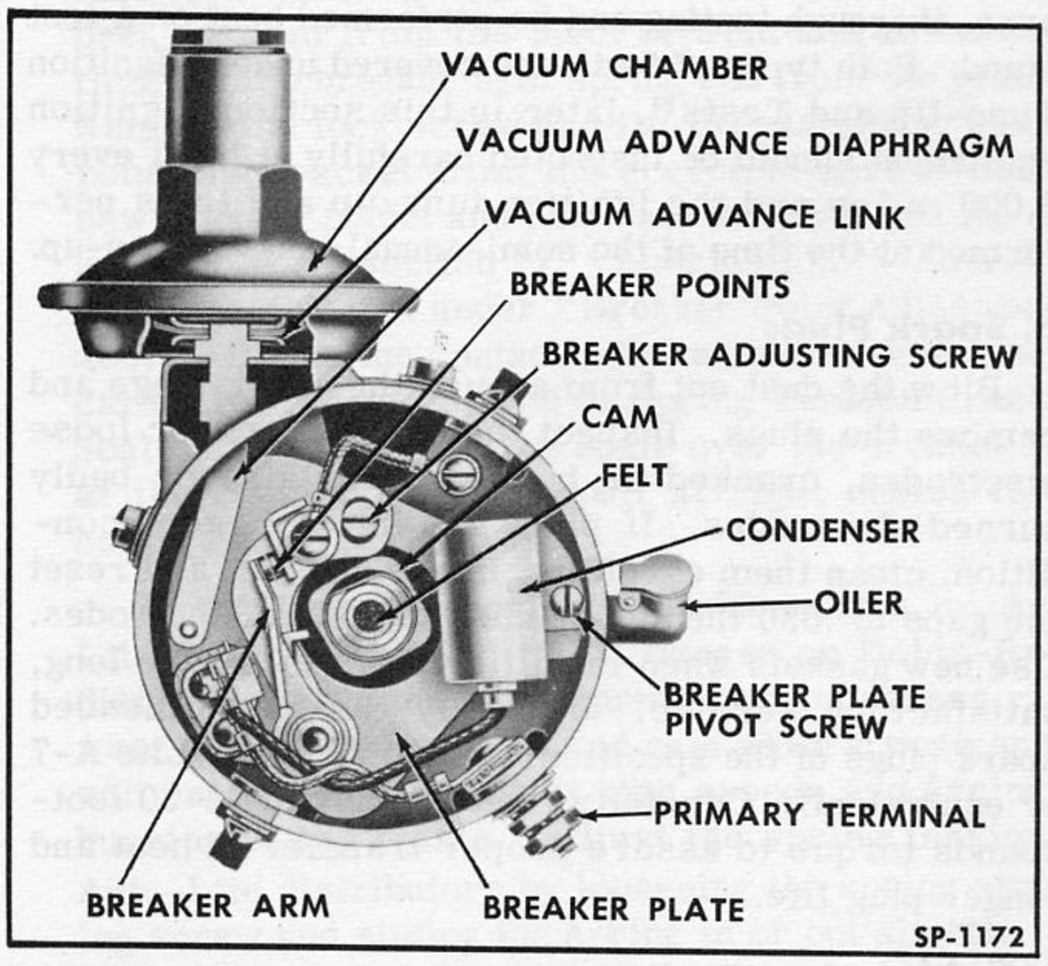

Fig. 292—Auto-Lite Distributor—Cap and Rotor Removed (4 Cylinder Shown)

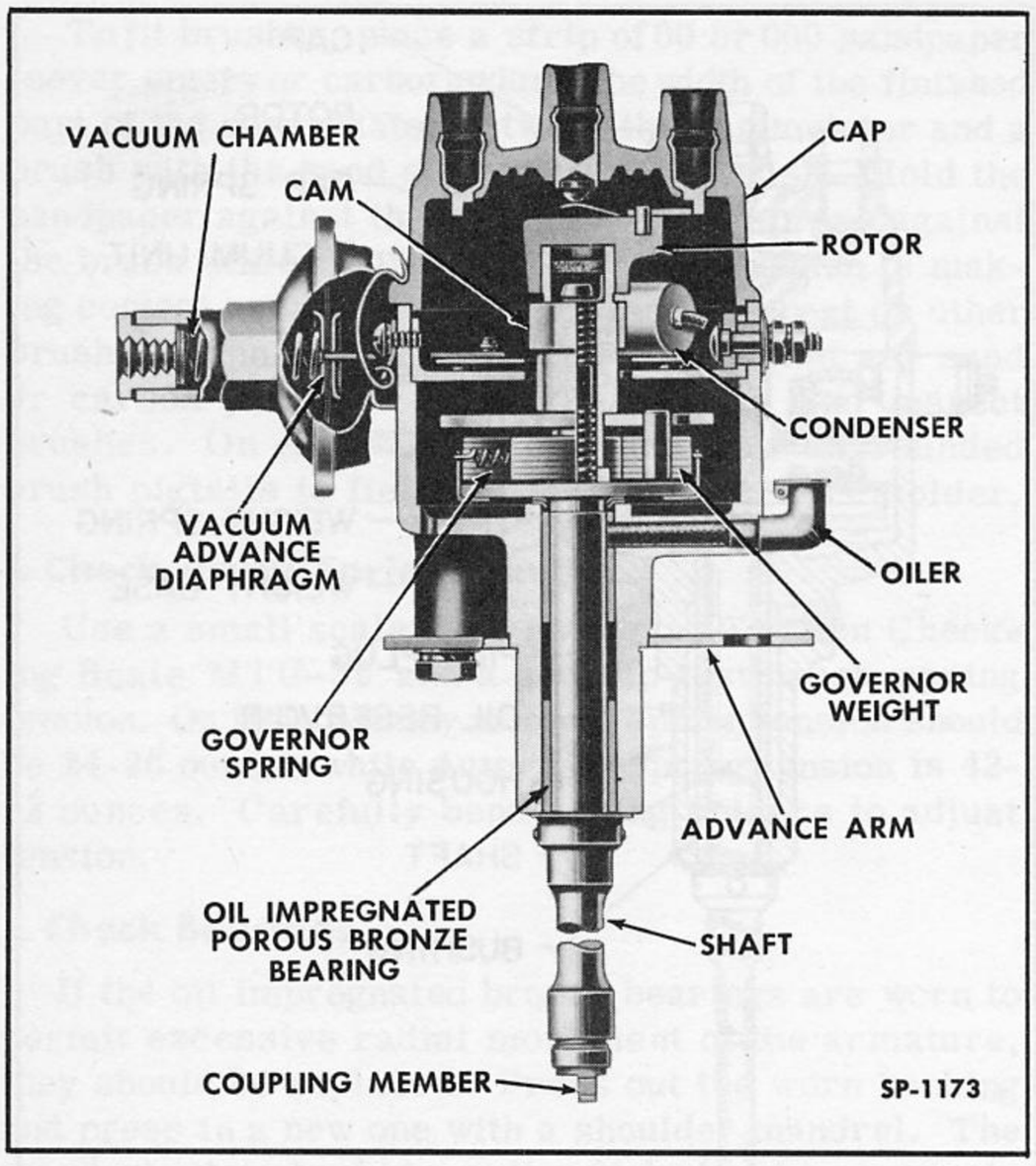

Fig. 293—Auto-Lite Distributor—Sectional View

INSPECTION AND MAINTENANCE IN THE VEHICLE

Certain maintenance, including inspection, cleaning and lubrication is possible without removing the distributor from the engine. Some performance tests can be made with the distributor on the engine. However, thorough testing can be performed best on a test stand. Both types of tests are covered under "Ignition Tune-Up and Tests", later in this section. Ignition equipment should be inspected carefully at least every 5,000 miles and the ignition tune-up and tests performed at the time of the semi-annual general tune-up.

a. Spark Plugs

Blow the dust out from around the spark plugs and remove the plugs. Inspect the spark plugs for loose electrodes, cracked or burned porcelains or badly burned electrodes. If plugs are in fairly good condition, clean them carefully, inside and out, and reset the gaps to .030 inch by bending the outer electrodes. Use new gaskets when installing plugs to assure long, satisfactory service. Use only the recommended spark plugs of the specified heat range (Auto-Lite A-7 or equivalent). Carefully tighten plugs to 26-30 foot-pounds torque to assure proper transfer of heat and longer plug life.

b. Cables

If ignition cable insulation is cracked or otherwise damaged replace the cables. If the cables are dirty clean with a cloth dampened with cleaning fluid and wipe dry.

c. Ignition Coil

Wipe any oil or dirt from the coil with a cloth dampened with cleaning fluid and wipe dry. Look for loose connections, cracked insulation, or "carbon tracks", that is, burned secondary insulation caused by sparks following the surface of the insulation to ground. If the coil condition is doubtful, bench test it or install a new coil.

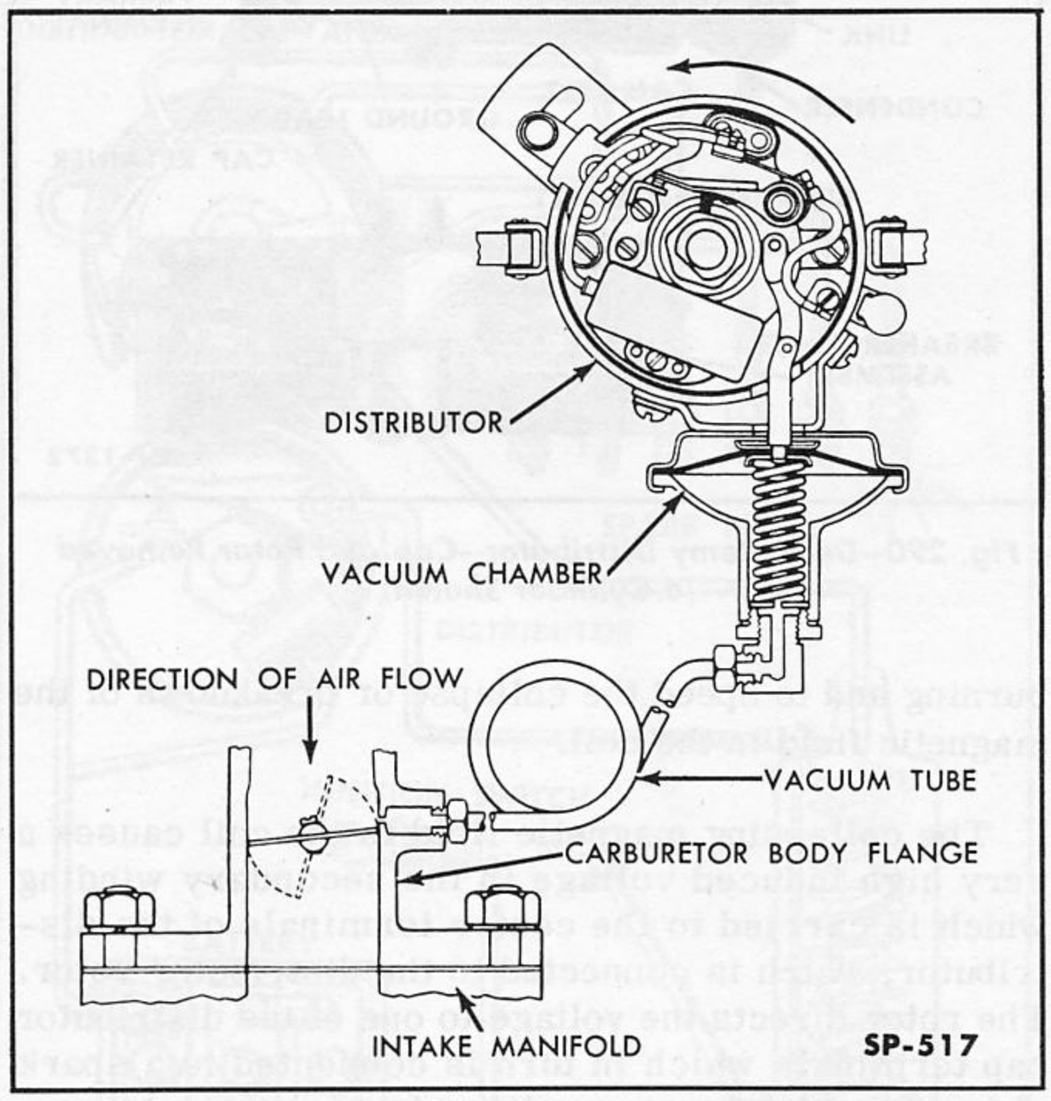

Fig. 294—Typical Distributor Vacuum Advance Unit

d. Distributor Cap and Rotor

Remove the distributor cap and slide the rubber nipples up on the cables. Wipe the cap, inside and out, with a cloth moistened with cleaning fluid and wipe dry. Inspect the cables where they plug into the distributor. Pull one or two out for inspection. If the end terminals are clean and in good condition, push all the cables to be certain they bottom in their sockets.

If the cable terminals are dirty, oily or corroded, pull all the cables from the distributor. First note which cable leads to No. 1 plug and mark that cap socket. Clean out the cap sockets with a cloth over the end of a screwdriver or suitable rod, or if necessary, with a wire brush made for the purpose. When replacing the cables remember that the firing order is 1-5-3-6-2-4 on six cylinder engines and 1-3-4-2 on four cylinder engines. The distributor shaft turns counter-clockwise as viewed from the top.

Inspect the cap inside and out for any cracks or evidence of carbon tracks. Look for badly burned inserts inside. Inspect the rotor for cracks or evidence of burning of the metal strip. Examine the contact spring on the rotor. If it is cracked replace the rotor. If the metal of the rotor or the metal inserts in the distributor cap are badly burned replace both rotor and cap.

e. Breaker Points

If dust or oil is found, wipe the interior of the distributor with a cloth moistened with cleaning fluid, wipe with a dry cloth, then dry with air.

Inspect the breaker points for evidence of burning or pitting. If they are dirty or appear only slightly burned, clean them with a breaker point file or abrasive point cleaner. Get them smooth and flat, but do not necessarily go clear to the bottom of a small depression.

After dressing, pull linen tape or paper between the points. If the points are badly burned or have been dressed until the tungsten material is thin, install a new point set.

1. BREAKER POINT ADJUSTMENT. Before attempting breaker point adjustment, check for distributor shaft bearing play. Remove the distributor cap and rotor and push the upper end of the cam alternately toward and away from the breaker arm fiber contact. A play of more than .005 inch will cause a visible increase in the point gap. Side play can also be checked with the distributor on a tester as described later in this section.

Check the breaker point alignment. If necessary, bend the stationary point bracket (never bend the breaker arm) until points meet squarely.

Adjust the contact point opening by loosening the breaker point lock screw and turning the eccentric adjusting screw to obtain the correct point opening. Always tighten the lock screwbefore checking opening. Distributor breaker point opening can be checked by three different methods — feeler gauge, dial indicator or dwell angle.

The feeler gauge method may be used on new points only. Used or filed points have small pits and scratches in the surface which make it impossible to get an accurate setting with a feeler gauge. Care must be taken to clean new points of any dirt or grease left on their contact surface by the feeler gauge. To check the point gap, rotate the engine until the breaker arm rubbing block is resting on a high point of the cam. Use the feeler gauge to check the amount of gap between the points. It should be .020 on Auto-Lite distributors and .022 on Delco-Remy distributors.

The dial indicator method is suited for checking both new and used points. A dial indicator is mounted on the distributor housing with the indicator button resting against the rear surface of the breaker arm point. Turn the engine until points are closed and set dial indicator to zero, then turn engine slowly and adjust points until dial indicator shows .020 inch gap on Auto-Lite distributors or .022 inch gap on Delco-Remy distributors.

The dwell angle (or cam angle) method of setting point openings is done with a dwell angle meter. The meter shows the number of degrees that the breaker cam rotates while the points are closed. This method may be used on old points that are not being replaced. Dwell angle readings should not be taken on new points that do not have a preshaped rubbing block as initial wear on the corners of the breaker arm rubbing block will change the dwell angle considerably. Proper dwell angle is shown in the Distributor Data table.

DISTRIBUTOR DATA

	4 Cylinder Engine		6 Cylinder Engine	
	Auto-Lite	Delco-Remy	Auto-Lite	Delco-Remy
Dwell or Cam Angle (degrees)	41°	25° - 34°	39°	31° - 37°
Breaker Point Opening (inches)	.020	.022	.020	.022
Condenser Capacity (Microfarads)	.20 - .25	.18 - .23	.20 - .25	.18 - .23
Breaker Arm Spring Tension (ounces)	17 - 20	17 - 21	17 - 20	17 - 21

2. BREAKER POINT REPLACEMENT. With the cap and rotor off, remove the breaker arm spring clip and clip screw, and the condenser pigtail and contact lead terminals. (See Fig. 290 and 292). Then lift the breaker arm from the pivot or stud and at the same time lift the breaker arm spring end from the bracket. Remove the lock screw and lift the stationary contact point and bracket from the eccentric screw. Install new breaker points and lubricate the pivot and the cam as directed in Section 17, "Lubrication." Adjust the points as directed under "Breaker Point Adjustment" above. Check the contact point pressure with a scale calibrated in ounces such as Spring Tension Checking Scale MTU-36. Hook the scale over the breaker arm at the contact point and pull at right angles to the contact surface (Fig. 295).

Spring tension should be 17-20 ounces on Auto-Lite distributors and 17-21 ounces on Delco-Remy distributors. Excessive spring tension causes rapid wear of the rubbing block and cam while a weak spring will cause engine miss at high speeds and arcing or burning of the points. Adjust the spring tension on Auto-Lite distributors by loosening the spring attaching screw and sliding the spring in or out slightly. On Delco-Remy distributors, adjust spring tension by carefully bending the spring.

A 6-volt test lamp with one terminal connected to the distributor primary terminal and the other to ground makes it easy to determine the exact point of break when using the spring scale.

f. Quick Check of Automatic Advance

Certain simple tests may indicate whether or not the automatic advance mechanism is operative. However, special test equipment is needed to determine accurately whether or not the automatic advance mechanism is operating according to specifications. The importance of exact spark advance control to good engine performance and to high fuel economy is so great that the use of such special ignition test equipment is necessary to assure desired results.

1. CENTRIFUGAL ADVANCE. With the distributor cap off, turn the rotor counter-clockwise against the governor weights. If the parts are free the governor springs will pull the governor weights back and return the cam to the retarded position. If a bind is found, remove the distributor for overhaul.

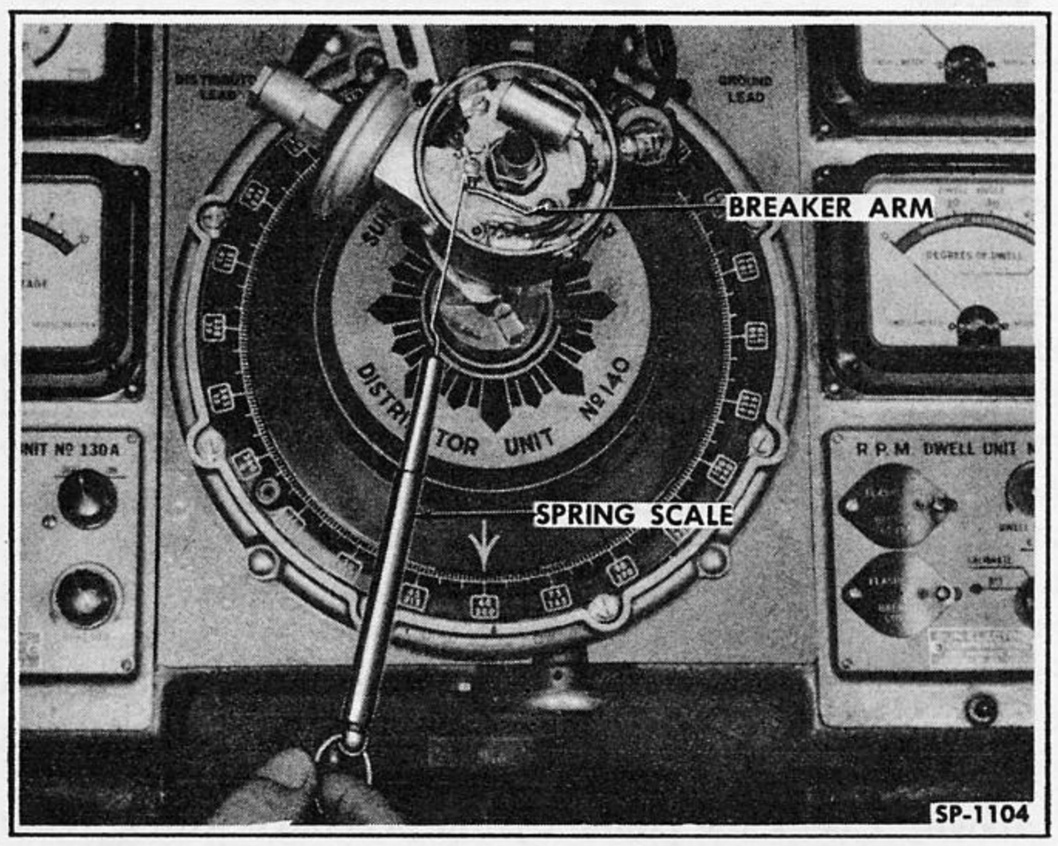

Fig. 295—Checking Breaker Arm Spring Tension

2. VACUUM ADVANCE. Push against the condenser with the fingers to turn the distributor breaker plate clockwise; then release it. The vacuum advance spring should pull the plate back to its original position freely. The method of checking breaker plate play and "drag" is explained under "Distributor Assembly and Adjustment" later in this section.

To make a quick check for leakage in the diaphragm, disconnect the vacuum line from the vacuum advance unit. Using a flexible hose such as is used for windshield wipers, apply suction with the mouth to test for a diaphragm leak.

g. Distributor Lubrication

Lubricate the distributor every 2,000 miles as directed in Section 17, "Lubrication."

IGNITION TUNE-UP AND TESTS

To assure continued peak performance and economical operation, check and adjust the entire ignition system at least in the spring and fall or more frequently under severe operating conditions. First check battery condition and engine compression. Too much variation in compression makes it impossible to tune an engine and gain peak performance. The following paragraphs cover tests that can be made in the car and those requiring modern test bench equipment.

a. Preliminary Inspection

Before attempting to test and tune-up the ignition equipment, inspect and do any necessary cleaning of the spark plugs, coil, distributor cap and rotor, breaker points, and cables or wiring as detailed in the previous paragraphs concerning inspection and maintenance.

b. Distributor Bench Test Equipment

Modern ignition bench test equipment provides a convenient, effective means of duplicating the various conditions under which the distributor operates on the engine. It provides instruments to indicate proper and improper performance of various parts of the ignition equipment, and the causes of such improper operation. As the instruction manuals accompanying such equipment are thorough, the following paragraphs will specify tests to be made, but will omit detailed instructions.

c. Breaker Dwell Angle Check

The term "dwell angle" (sometimes called cam angle) applies to the number of degrees of distributor cam rotation during which the breaker points remain in contact. Any change in the amount of gap between the breaker points changes the dwell angle. If the cam and the bearings that support and align the distributor shaft are not worn the breaker point dwell angle should be the same for each of the cylinders.

1. BREAKER CONTACT RESISTANCE. Before making a dwell angle test, check the breaker contact resistance (and primary circuit resistance) as directed in the test bench instruction manual. If the resistance is higher than the prescribed limits, the dwell test results may be inaccurate. To reduce resistance, clean the contact points and check lead and ground connections and primary wiring.

2. DWELL ANGLE TEST. Follow the test bench instruction manual for determining dwell angle. This test can be made either with the distributor driven

by the test bench motor or with the distributor installed on the vehicle.

With the test equipment properly connected and adjusted, the dial should indicate the proper dwell angle as shown in the Distributor Data Table with the distributor operating at idle speed. Points set too close (that is with too large a dwell angle) will burn and pit. Too wide a point gap (small dwell angle) will cause a weak spark at high speed. If the dwell angle varies more than two degrees as the speed is slowly increased to maximum, the breaker point spring tension and the distributor shaft and bearing should be checked.

d. Distributor Shaft and Bearing Wear Test

While distributor is mounted for dwell angle test, check for play in the distributor shaft and bearings. Drive distributor at low speed. Hold a wood dowel as shown in Fig. 296 in the end of the cam just above the felt. Apply pressure alternately toward and away from the breaker arm rubbing block.

Play resulting from shaft and bearing wear will change both the spark position on the degree ring and the dwell angle. Variation should be no more than 1.5 degrees on the degree ring or 3 degrees on the dwell angle indicator. If too much bearing wear is found, disassemble the distributor and replace the worn parts.

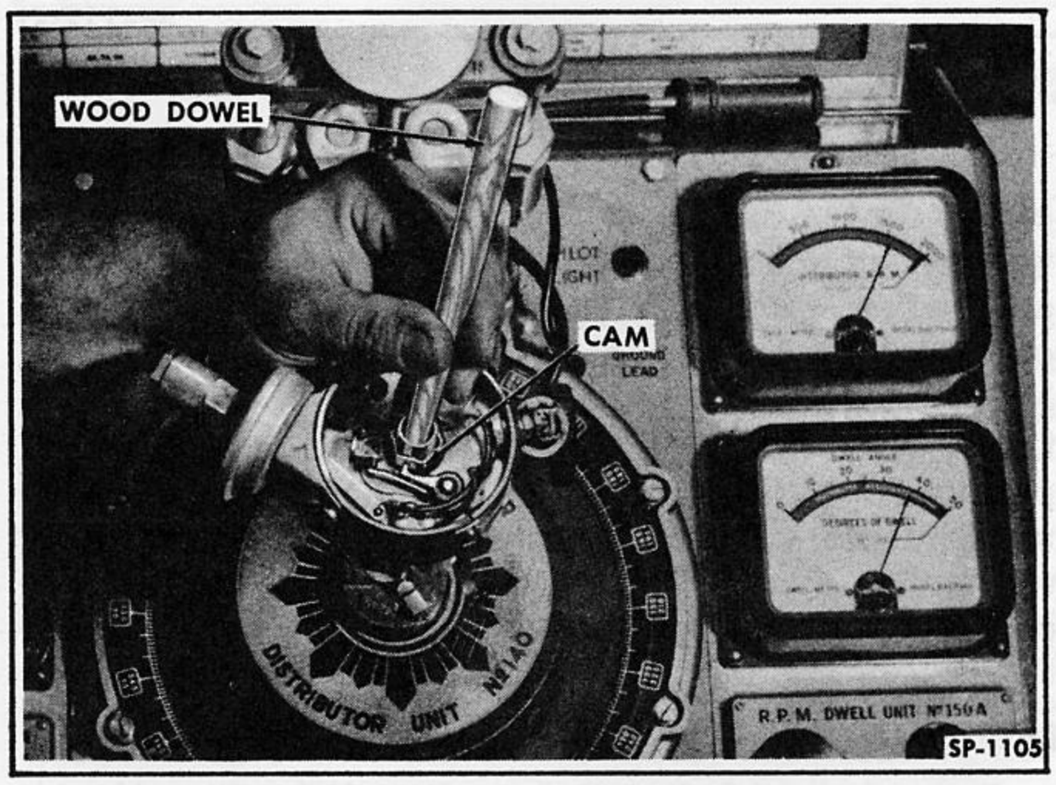

Fig. 296—Checking Distributor Shaft and Bearing Wear

e. Centrifugal Advance Tests on the Bench

Fig. 297 shows a distributor mounted in a test stand for checking centrifugal advance. Set the tester at various speeds and note the degrees of spark advance. Compare these with the specified spark advance. Figure 298 shows ideal spark advance specifications for Auto-Lite distributors and Fig. 299 shows ideal specifications for Delco-Remy distributors.

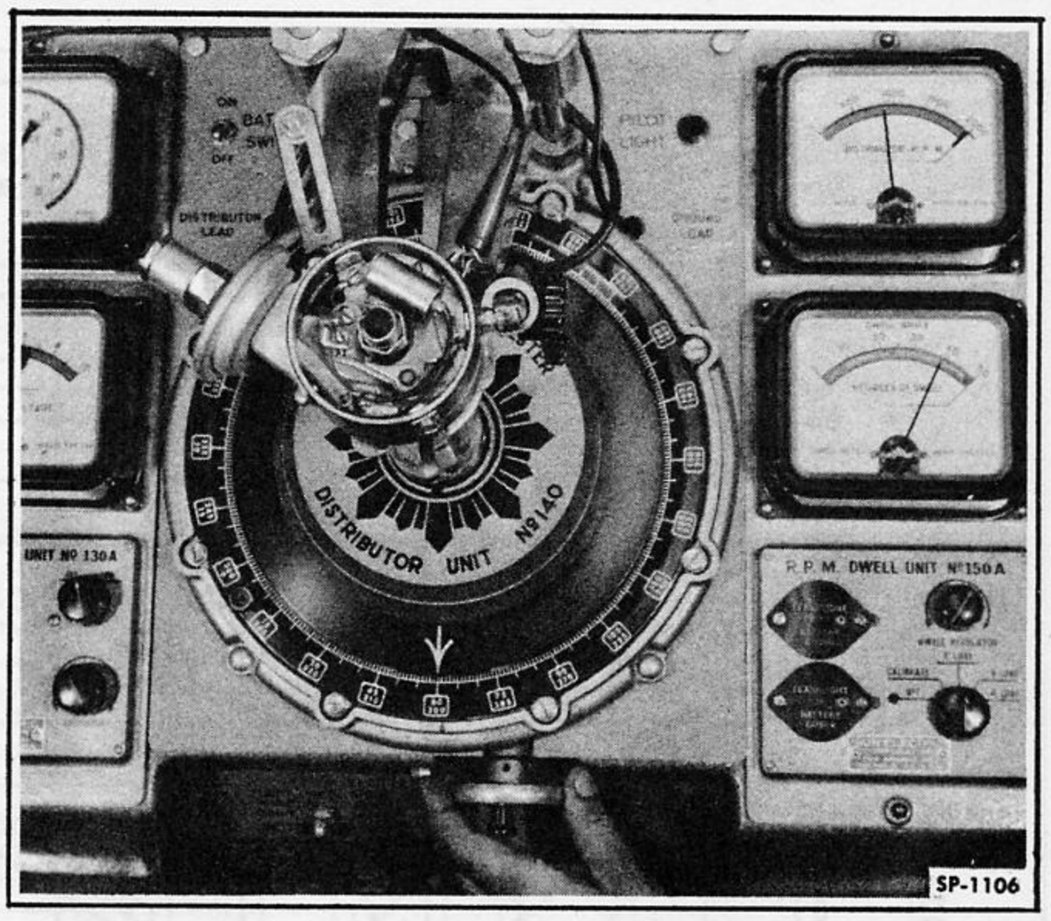

Fig. 297—Checking Centrifugal Spark Advance

Replacement of parts or adjustment to correct errors found in centrifugal advance are covered under "Distributor Overhaul" in this section.

f. Checking Centrifugal Advance in the Vehicle

Centrifugal advance can be checked while the distributor is on the engine if a test stand is not available by using a portable tachometer and Ignition Timing Light C-863. With the engine at normal running temperature disconnect the vacuum line from the distributor and set the carburetor for the lowest possible smooth idle.

Follow the instructions in Section 1A, "Engine Tune-Up" to check the initial spark timing with the timing light. On four cylinder engines, timing should be at 5°BTDC and on six cylinder engines it should be at 0°TDC. Adjust the carburetor throttle screw or throttle to bring the tachometer to the speed readings at which spark timing is to be checked. Check the indicated change in spark advance against the curves of Fig. 298 and 299.

g. Vacuum Advance Test

With the distributor mounted in the test stand and the vacuum hose attached, increase the vacuum slowly and watch the degree ring. The readings should closely follow the advance curves in Fig. 298 and 299.

Replacement of parts or adjustments to correct errors found in vacuum advance are covered under "Distributor Overhaul" in this section.

h. Condenser Test

A faulty condenser is sometimes indicated by badly burned breaker points, weak spark, difficult starting

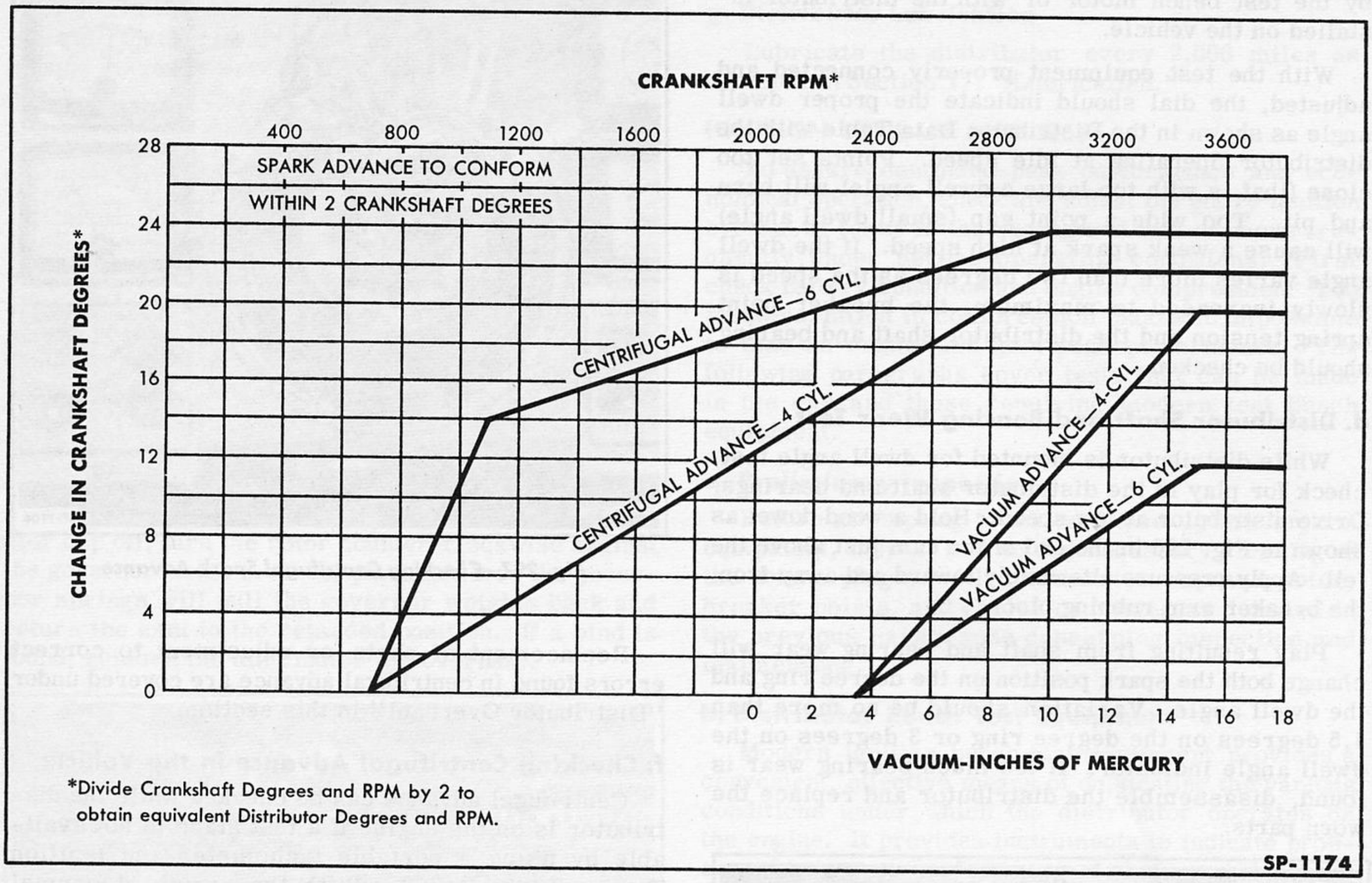

Fig. 298—Auto-Lite Distributor Spark Advance Curves

or failure of the engine to start. Modern testing equipment makes it possible to check a condenser for high resistance, insulation leakage and capacity.

If condenser testing equipment is not available, check the appearance of the spark from the coil with the old condenser and again after substituting a new condenser. Pull the cable from the center of the distributor cap and hold it approximately 1/4 inch from the cylinder head or other suitable ground while causing the breaker points to contact and break manually, with the ignition turned on.

Use only the authorized service part. A condenser of incorrect capacity will critically affect breaker point life.

i. Coil Test

A quick check on the coil can be made with the engine running by loosening a spark plug cable and holding it approximately 1/4 inch from a convenient ground. The coil should produce a good hot spark.

Modern testing equipment makes it easy to accurately check the performance of an ignition coil, either on the car or at the bench. Tests determine whether primary and secondary windings are open, shorted or grounded to the coil case, and that the output of the coil is ample for satisfactory ignition. Make tests as directed in the test equipment instructions. If no fault is found with the coil at room temperature, but its performance on the engine has been unsatisfactory, test, as directed, at higher temperature. The heating device heats the coil by passing controlled current through it for a specified time.

DISTRIBUTOR REPLACEMENT

To remove the distributor, disconnect the vacuum line and the low tension cable (which leads to the coil) and remove the distributor cap. Remove the bolt and the lock washer that hold the advance arm to the adapter. Lift out the distributor.

Before installing the distributor, if the engine has been turned with the distributor out, or if the position of the distributor main drive shaft has been disturbed, crank the engine to bring No. 1 piston to top dead center at the end of the compression stroke. The timing pointer should be at zero on the timing scale

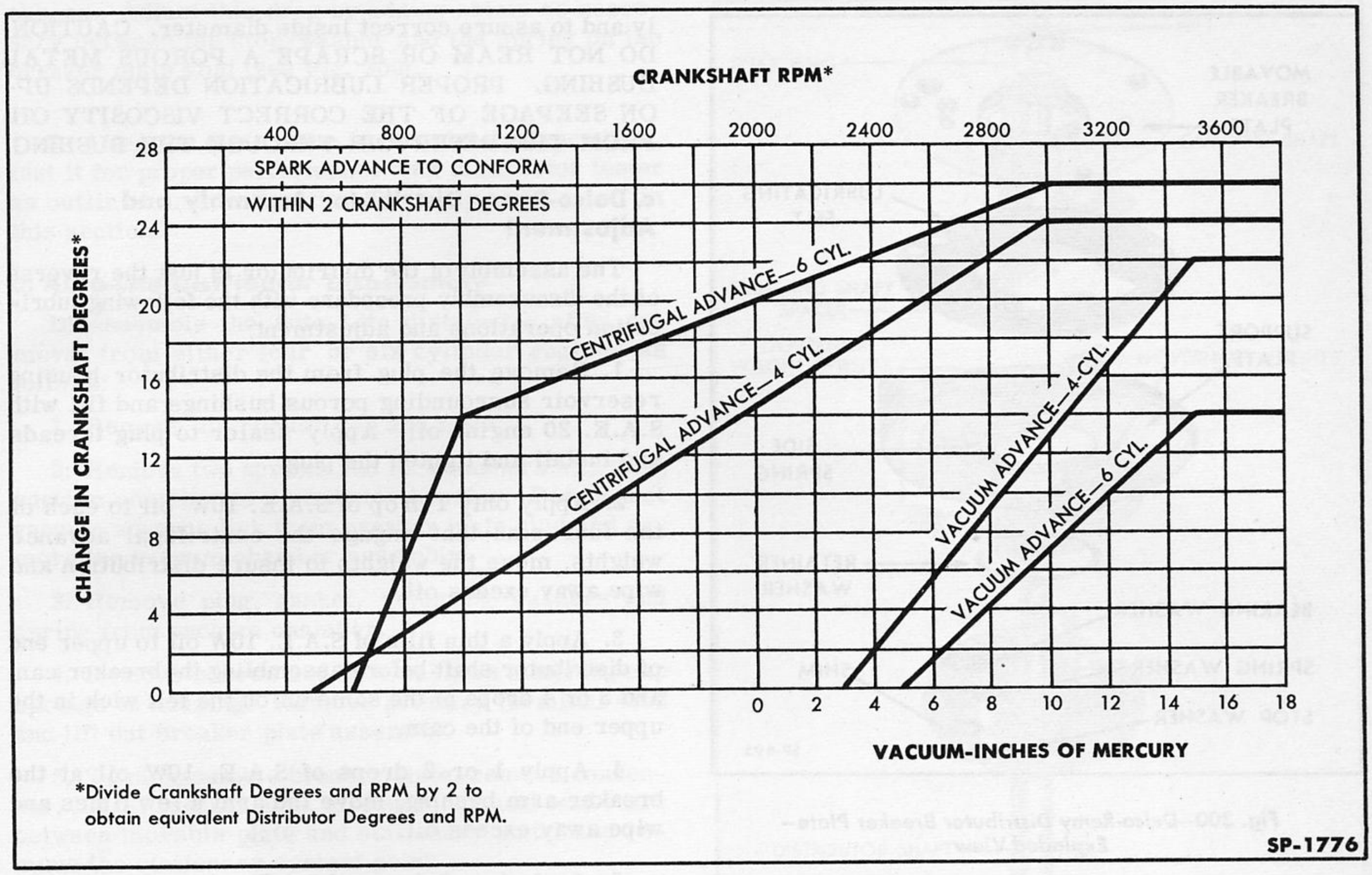

Fig. 299—Delco-Remy Distributor Spark Advance Curves

on six cylinder engines or at 5°BTDC on four cylinder engines.

With the engine in this position the distributor should be installed with the rotor turned to the No. 1 position. Time the ignition system as described in Section 1-A, "Engine Tune-Up" after the distributor is installed.

DISTRIBUTOR OVERHAUL

The distributor can be disassembled, cleaned, inspected and repaired after it is removed from the vehicle. The design and constructional differences between Auto-Lite and Delco-Remy distributors necessitate the different procedures given below:

a. Delco-Remy Distributor Disassembly

Disassemble the Delco-Remy distributor after removal from either four or six cylinder engines as follows:

1. Remove distributor cap and rotor.

2. Remove nut and lockwasher from inner end of primary terminal stud, detach contact lead and remove terminal insulating parts.

3. Remove screw holding vacuum advance link and ground lead to breaker plate.

4. Remove screws attaching vacuum advance unit to distributor housing and remove vacuum advance unit.

5. Remove screw opposite vacuum advance slot in housing and screws attaching cap springs to housing. Lift out breaker plate assembly. Remove condenser and points from breaker plate if desired.

6. To remove shaft from housing, file or grind off end of coupling pin and drive out pin. Remove any burrs left by pin. Lift out shaft and advance mechanism.

7. Remove centrifugal advance weights by removing nuts that fasten holdown plate. Then remove weight springs, weights and cam.

8. Remove the stop washer (Fig. 300), shim, spring washer and bearing washer from stop stud extending down through support plate. Remove retaining washer and separate breaker plate, lubricating felt and support plate. Do not dislodge or lose the small side spring in support plate.

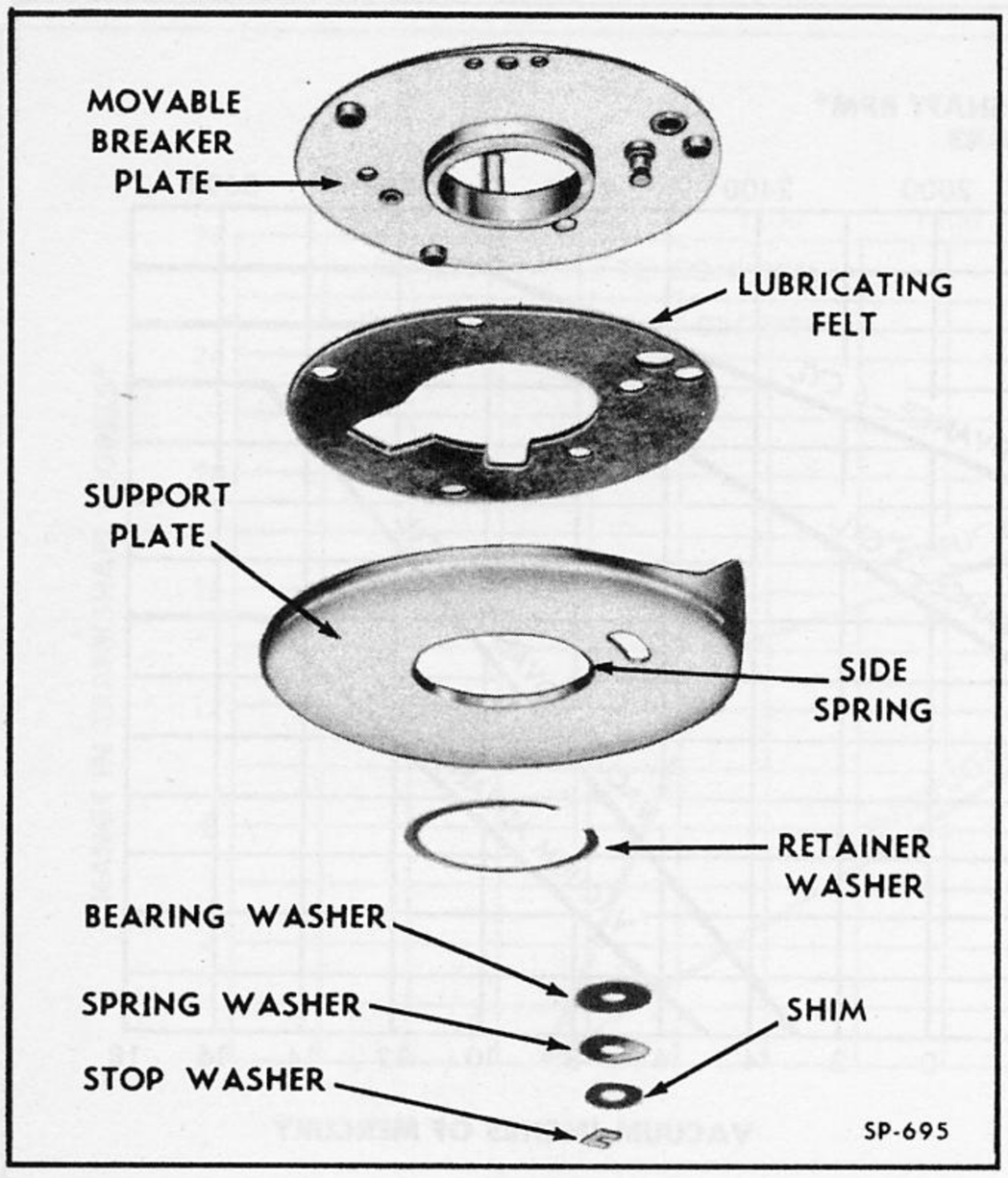

Fig. 300—Delco-Remy Distributor Breaker Plate—Exploded View

b. Delco-Remy Distributor Inspection and Repair

After disassembly, clean and inspect all parts. Do not clean cap, rotor, condenser, insulated parts, felt, etc. with commercial chemical de-greasing compounds. Use carbon tetrachloride or suitable naptha solvent, but do not dip condenser or insulated conductors. Wipe such parts with a cloth dampened with solvent and immediately wipe dry.

1. Examine centrifugal advance parts, weights, springs, plate, studs on weight base and cam for evidence of wear. Replace worn parts.

2. Examine the three plastic support points on the breaker plate and the breaker arm stud for evidence of wear. If excessive wear is found replace entire breaker plate assembly. The breaker plate and support plate are not serviced separately.

3. If breaker plate assembly is found loose enough to permit either tipping or rattling in operation, increase the spring tension and check the breaker plate drag as explained under "Delco-Remy Distributor Assembly and Adjustment" in this section.

4. Check both distributor shaft and bushing for wear. If shaft is worn replace both shaft and bushing. If only the bushing is to be replaced, a special sizing arbor is required to press the new bushing in properly and to assure correct inside diameter. CAUTION: DO NOT REAM OR SCRAPE A POROUS METAL BUSHING. PROPER LUBRICATION DEPENDS UPON SEEPAGE OF THE CORRECT VISCOSITY OIL FROM THE RESERVOIR THROUGH THE BUSHING.

c. Delco-Remy Distributor Assembly and Adjustment

The assembly of the distributor is just the reverse of the disassembly procedure with the following lubrication operations and adjustment:

1. Remove the plug from the distributor housing reservoir surrounding porous bushings and fill with S.A.E. 20 engine oil. Apply sealer to plug threads and install and tighten the plug.

2. Apply only 1 drop of S.A.E. 10W oil to each of the four pins that engage the centrifugal advance weights, move the weights to insure distribution and wipe away excess oil.

3. Apply a thin film of S.A.E. 10W oil to upper end of distributor shaft before assembling the breaker cam and 3 or 4 drops of the same oil on the felt wick in the upper end of the cam.

4. Apply 1 or 2 drops of S.A.E. 10W oil at the breaker arm bushing, move the arm a few times and wipe away excess oil.

5. Apply 1 or 2 drops of S.A.E. 10W oil to the lubricating felt between the movable breaker plate and its support plate.

6. Apply a very thin coat of good quality, non-bleeding, high melting point bearing grease to the faces of the distributor cam.

7. After the breaker plate and support have been assembled check the movable breaker plate drag as illustrated in Fig. 301. The drag should be 8-16

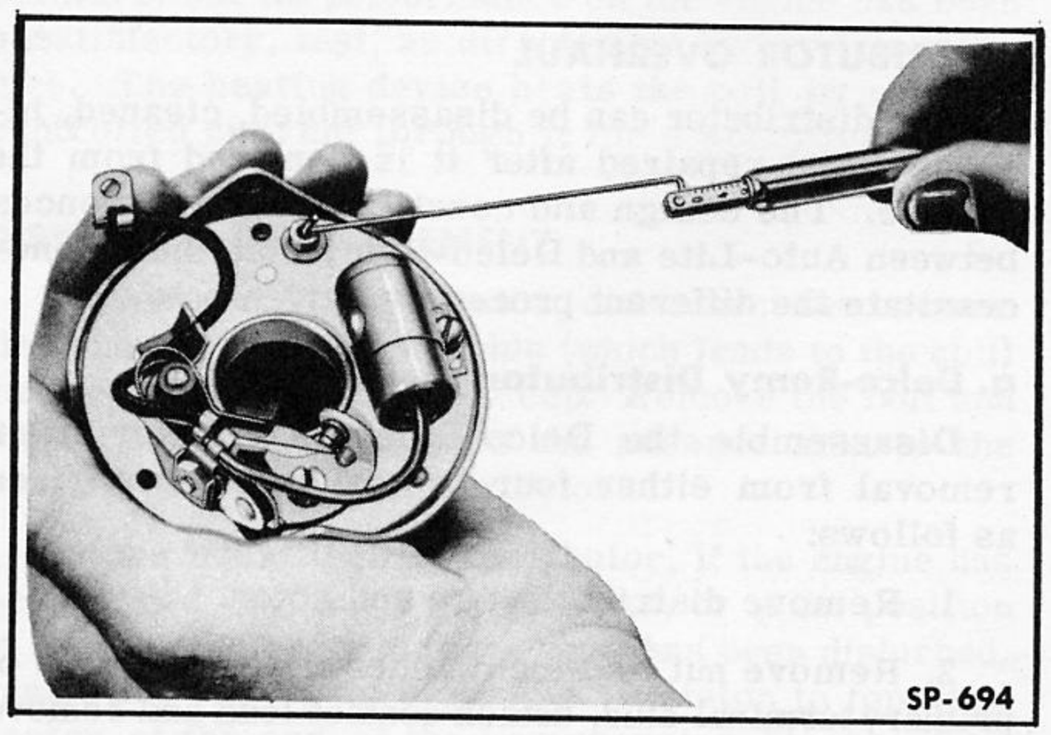

Fig. 301—Checking Delco-Remy Distributor Breaker Plate Drag

ounces. Adjust this drag by adding shims as necessary between the stop-washer and the spring on the breaker plate stud (see Fig. 300).

8. After the distributor is completely assembled, test it for proper performance on a distributor tester as outlined under "Ignition Tune-Up and Tests" in this section.

d. Auto-Lite Distributor Disassembly

Disassemble the Auto-Lite distributor after removal from either four or six cylinder engines as follows:

1. Remove distributor cap and rotor.

2. Remove two screws and lock washers attaching vacuum chamber to distributor housing. Disconnect vacuum advance link from breaker plate stud and remove the vacuum chamber assembly.

3. Remove plug, gasket, adjusting washers and spring from vacuum chamber.

4. Remove screws and lock washers attaching cap springs to housing. Remove primary terminal stud and lift out breaker plate assembly.

5. To disassemble breaker plate, remove condenser, lift off breaker arm, disconnect ground lead (wire between movable plate and stationary plate) and remove the stationary contact point.

6. Lift out felt from shaft above cam and remove snap ring (Fig. 302) that secures the cam assembly to the distributor shaft. Lift out the cam assembly.

7. Disconnect the governor springs and remove the governor weights.

8. To remove the distributor shaft, file or grind one end of the coupling pin and drive out pin. Remove any burrs left by pin. Lift out shaft assembly.

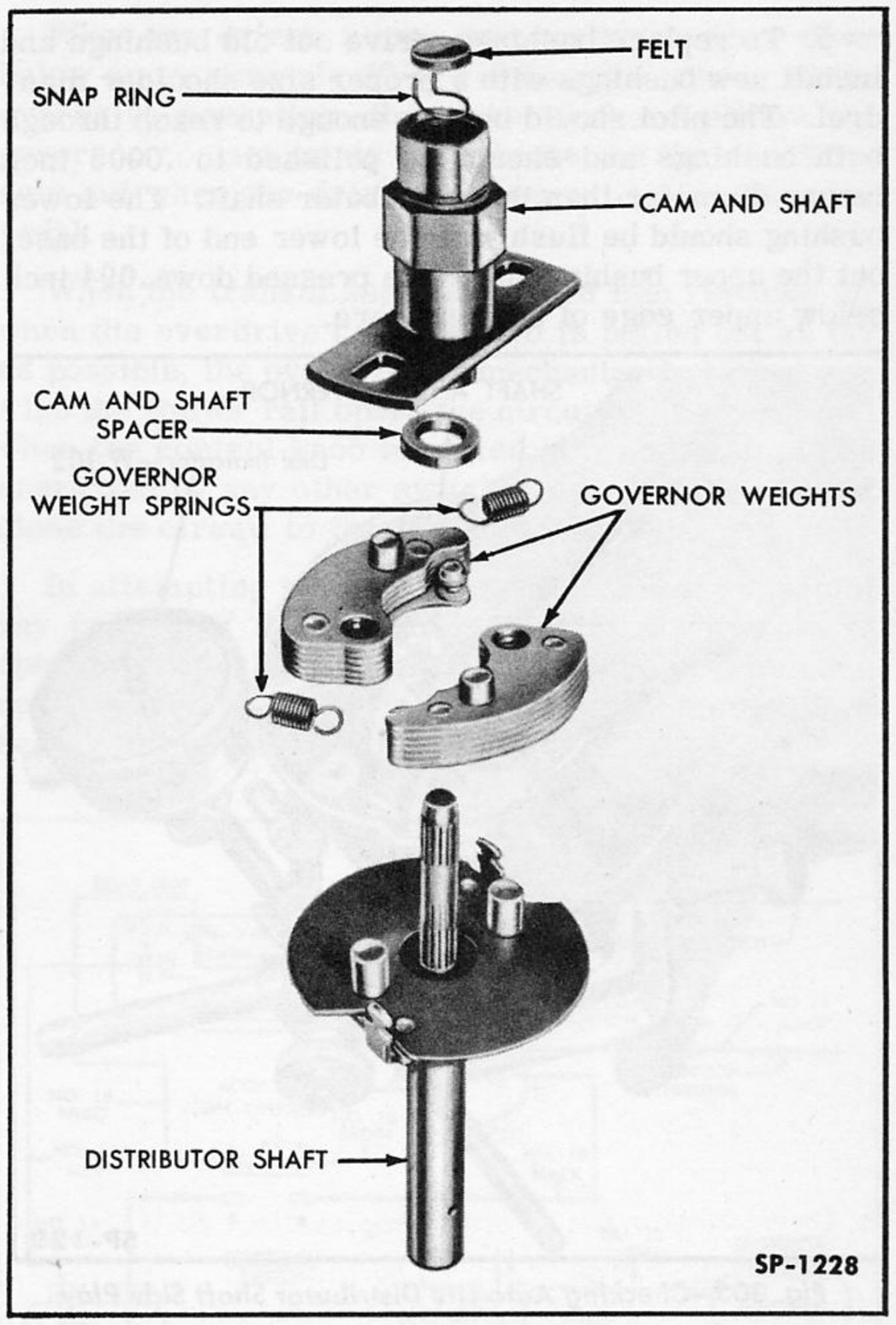

Fig. 302—Auto-Lite Distributor Centrifugal Advance Parts—Exploded View

e. Auto-Lite Distributor Inspection and Repair

After disassembly, clean and inspect all parts. Do not clean cap, rotor, condenser, insulated parts, felt, etc., with commercial de-greasing compounds. Use carbon tetrachloride or suitable naptha solvent, but do not dip condenser or insulated conductors. Wipe such parts with a cloth dampened with solvent and immediately wipe dry.

1. Replace governor weights if holes are badly worn. Replace distributor governor shaft if plate or flange is bent or loose, or if pins are worn or not perpendicular to the plate. Replace cam assembly if cam is worn or scored or if slots for governor weights are worn.

2. Examine the vacuum chamber parts and replace the vacuum spring, if broken. Replace vacuum chamber if visibly damaged, or if it will not hold a steady reading at 18-20 inches of vacuum when checked with a vacuum gauge and pump.

3. Replace breaker plate if any of the threaded holes are stripped or if breaker arm pivot is not perpendicular to the plate or is worn, or if the breaker plate bearing is worn or corroded. Check the insulation of the primary terminal plates with a test lamp from the plate to ground.

4. Replace the distributor base or housing if cracked or damaged. Check the fit of the distributor shaft in its bushings. Fig. 303 illustrates the use of a dial gauge to measure the amount of radial play. If the play is more than .005 inch remove shaft and replace the bushings. If the wear has reduced the shaft diameter more than .001 inch, replace the shaft also.

5. To replace bushings, drive out old bushings and install new bushings with a proper size shoulder mandrel. The pilot should be long enough to reach through both bushings and should be polished to .0005 inch larger diameter than the distributor shaft. The lower bushing should be flush with the lower end of the base, but the upper bushing should be pressed down .094 inch below upper edge of bearing bore.

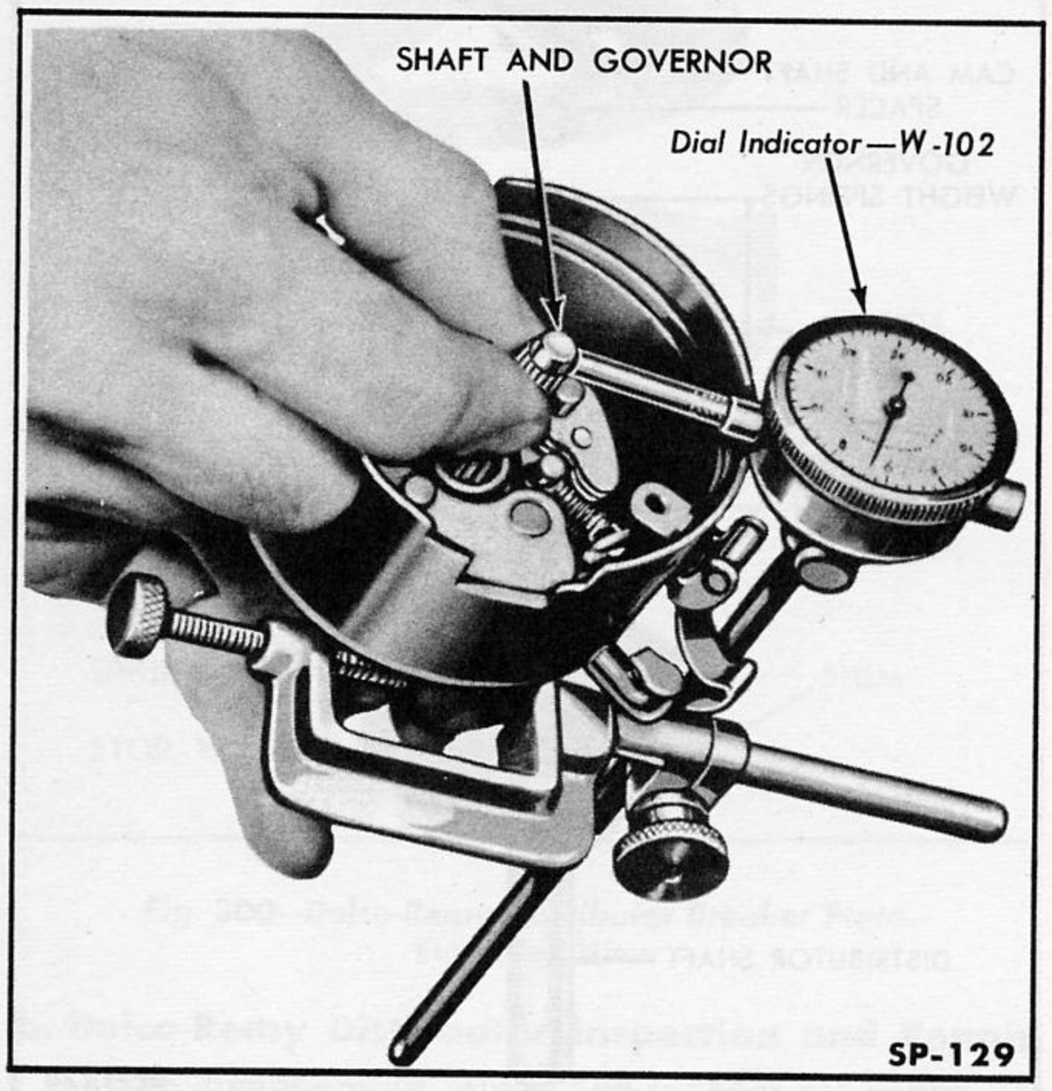

Fig. 303—Checking Auto-Lite Distributor Shaft Side Play

Remove distributor oil cup and drill an oil hole the same size as oil passage through new bushing. Reinsert the mandrel to assure bearing alignment and size. CAUTION: DO NOT REAM OR SCRAPE AN OIL-IMPREGNATED BRONZE BUSHING.

6. When installing a new shaft in the distributor housing, always use new upper and lower thrust washers. Place the old coupling onto new shaft and drill shaft for the new coupling pin.

7. Before installing a new distributor shaft in the housing and drilling for a new drive coupling pin, install new upper and lower thrust washers. Compare position of coupling on new shaft with the position of hole in old shaft. Turn the coupling so new drilled hole will be at same angle as old with respect to governor weight carrying plate. After starting the new pin, check for shaft end-play, (.003 - .010 inches) and for ease of shaft rotation. Then drive the pin through and peen ends. Either a feeler gauge or a dial indicator can be used to check end-play. If end-play is excessive, remove shaft and insert thicker thrust washers.

f. Auto-Lite Distributor Assembly and Adjustment

The assembly of the distributor is just the reverse of the disassembly procedure with the following lubrication operations and adjustments:

1. Fill grease pockets in governor weights with heat-resistant bearing grease; oil governor pilot pins on distributor governor shaft flange lightly; install weights and swing weights to assure free movement. Wipe away excess oil and connect governor weight springs.

2. Lubricate shaft lightly with S.A.E. 20 engine oil and install spacer and the cam assembly making sure that slots fit over the governor weight studs. Turn cam against spring tension and release to assure free movement.

3. Install snap ring and felt and put four or five drops of S.A.E. 20 engine oil on felt.

4. Lubricate breaker arm pivot with one drop of S.A.E. 20 engine oil. Apply a light film of high temperature grease to the sides and lobes of the breaker cam. Keep oil and grease away from contacts.

5. After completing distributor assembly, bench test the distributor for vacuum advance and centrifugal advance performance as described under "Ignition Tune-Up and Tests" in this section. Bend the distributor spring brackets as needed to make the centrifugal advance start and increase with the speed to conform with specifications. Adjust the vacuum advance by changing the number or thickness of washers between the vacuum chamber cap and spring (see Fig. 293).

OVERDRIVE ELECTRICAL SYSTEM

The overdrive electrical system includes a knob-controlled lock-out switch (operated by the shift rail), a governor switch, a kick-down switch, a relay, a solenoid and the necessary electrical cables or wiring harness. Through the operation of these various switches, the transmission overdrive is brought into operation, or prevented from operating. Only that part of the mechanical functioning of the overdrive necessary to tie in with the electrical control is covered in the following paragraphs. The mechanical features of the overdrive unit are covered in Section 6, "Transmission and Overdrive."

OPERATION OF OVERDRIVE ELECTRICAL CONTROLS

If the overdrive lock-out control knob is pushed in as far as possible, the resulting movement of the shift rail permits the spring loaded lock-out switch to close (see Fig. 304). If the vehicle is in motion at more than approximately 29 MPH, centrifugal force of the governor weights cause the governor switch to close. The electrical circuit is then from ground through the overdrive governos switch, the lock-out switch, the kick-down switch, the relay, and to the negative terminal of the ignition coil (which is connected to the ignition switch).

The current flowing through this circuit energizes the relay, causing its points to close. Current flows through a fuse, through the closed relay contact and through the primary winding of the overdrive solenoid. One end of the solenoid winding is grounded to the solenoid case. The magnetic field in the solenoid moves the plunger and compresses a spring which moves the locking pawl inward in the overdrive housing—where it is stopped by the blocker ring on the sun gear control plate.

This ring is held in blocking position by the torque of the transmission mainshaft until the driver lifts his foot from the accelerator pedal when the reversed torque allows the solenoid to push the pawl into the control plate. The planetary gears then step up the overdrive output speed, resulting in 30 per cent greater vehicle speed for the same engine speed.

When extra power is desired for acceleration or climbing grades the driver pushes the accelerator pedal past full throttle position to operate the "kick-down" switch. This switch breaks the circuit to the relay, causing the relay points to separate and the solenoid to be de-energized. The solenoid plunger spring tries to withdraw the pawl. However the torque on the control plate holds the pawl in position. Further travel of the kick-down switch plunger, however, closes a pair of points that are normally open and establishes a circuit from the positive terminal of the ignition coil to ground through the overdrive solenoid. This shorts or by-passes the distributor contacts momentarily and slows down the engine for an instant. The interruption of the torque frees the pawl and it is easily withdrawn by the solenoid spring. As the pawl is completely withdrawn plunger-operated points in the solenoid are opened, breaking the circuit through the kick-down switch which shorted out the ignition. This action is so fast that the engine misses only two or three explosions. The vehicle is now in normal transmission operation. When the driver eases off on the accelerator pedal, the kick-down switch returns to normal position and overdrive operation is again available (provided vehicle speed is over approximately 29 MPH).

When the driver allows the vehicle to slow down below approximately 23-1/2 miles per hour with the overdrive operating, the reduced speed allows the governor contact points to separate and the overdrive cuts out when the driver lets up on the accelerator pedal.

When the transmission is shifted into reverse, or when the overdrive control knob is pulled out as far as possible, the overdrive is mechanically locked out. Also the shifter rail opens the circuit to the relay coil when the control knob is pulled out, so it can not be energized by any other switch and therefore will not close the circuit to the solenoid.

In attempting to determine and correct causes of any failure of the overdrive electrical controls to operate properly, assuming the controls to be correctly wired and the wiring to be in good condition, keep in mind three points:

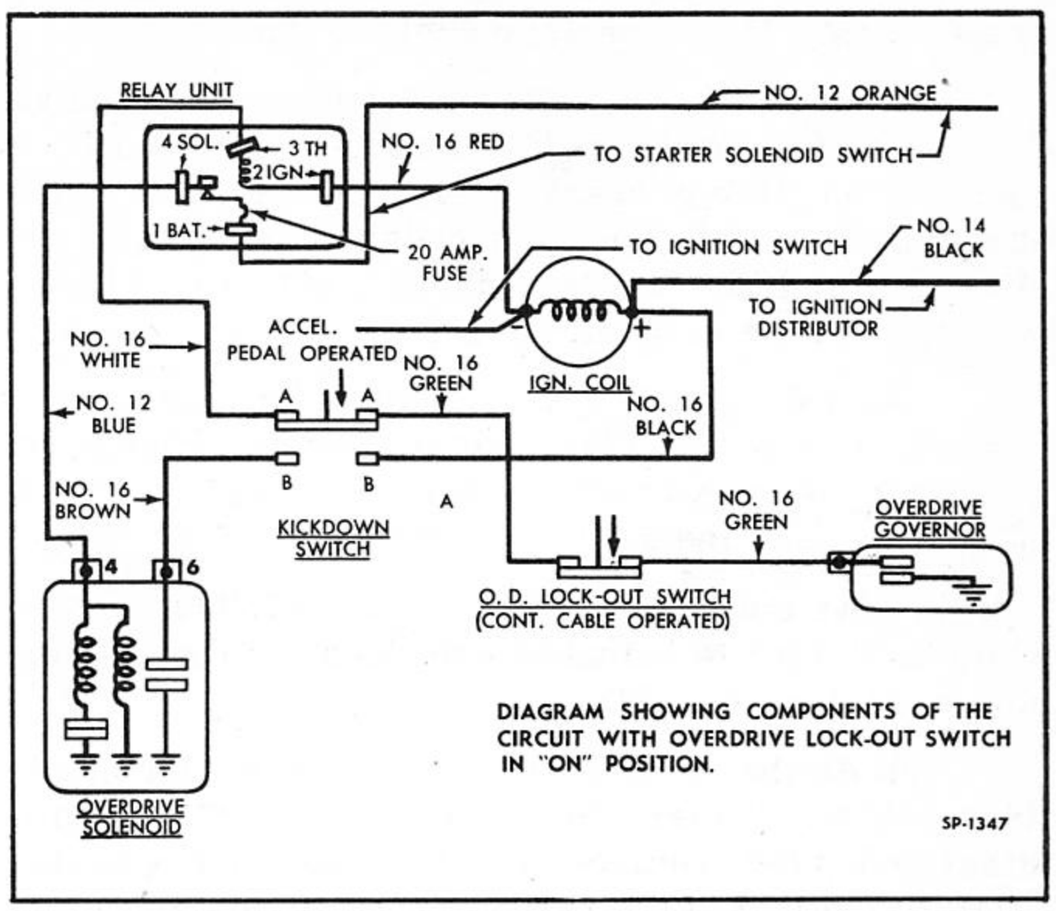

Fig. 304—Overdrive Electrical Control Wiring Diagram

1. The solenoid is energized when the heavy duty points of the relay are closed and is de-energized when these points are open. Thus the relay provides the only normal way of supplying or interrupting the supply of the battery current that operates the solenoid.

2. The relay is actuated only when the circuit is complete and battery current can flow through ground, through the governor switch, the lock-out switch, the kick-down switch, the relay, to the negative terminal of the ignition coil, through the ignition switch to the hot side of the starter solenoid switch, and to the negative terminal of the battery. Any one of these several switches can cause the relay points to open, but all must be closed to cause the relay points to close.

3. The ignition is "shorted out," that is the coil primary current by-passes the distributor breaker points, only when both the kick-down switch and the plunger-operated contacts in the overdrive solenoid are closed, as they are in series.

GENERAL CIRCUIT TESTS

If the overdrive unit fails to operate properly, the following checks can be made to determine if the various overdrive control units are at fault. Mechanical difficulties are covered in these tests only so far as they affect or are affected by the operation of the electrical controls.

1. Turn the ignition switch on and push the overdrive control knob in.

2. Test the relay fuse. If burned out, replace with a 20-ampere SFE fuse. Test at the fuse with a 6-volt test light to determine if battery voltage is available at this point. If not, replace cable to coil.

3. Disconnect the white cable from the relay. Ground the terminal "TH". Listen for a click in the relay. If no click is heard replace the relay. A click should be heard also in the overdrive solenoid. If no click is heard in the solenoid check with a test lamp for power at the following points:

(a) At the relay "BAT" terminal (orange cable). If there is no power, check the orange cable between the battery terminal and the starter solenoid hot terminal. Replace the cable if necessary.

(b) At the relay "SOL" terminal (blue cable) while the "TH" terminal is grounded. If there is no power, replace the relay.

(c) At the overdrive solenoid 1/4" terminal (blue cable). If there is no power with "TH" terminal grounded, replace the blue cable between the "SOL" terminal of the relay and the solenoid switch.

(d) If the solenoid still does not click, replace the solenoid.

4. Disconnect the green cable from the kick-down switch terminal. Ground the switch terminal. If no click is heard, replace the kick-down switch.

5. Disconnect the green harness cable between kick-down switch and lock-out switch from the lock-out switch on the transmission and ground the green wire. If no click is heard, replace the green cable.

6. Disconnect the green single cable from the opposite terminal of the lock-out switch. Ground this lock-out switch terminal. If no click is heard, replace the lock-out switch.

7. Disconnect the green cable at the governor terminal and ground the cable. If no click is heard, check the green cable between the governor and the lock-out switch and replace the cable if necessary.

8. After the green cable has been replaced, if a click is heard when the cable is touched to the governor terminal, the governor is defective. Replace the governor.

9. To test the governor for cut-in operation, disconnect the green cable from the governor terminal and connect the leads of the test light to the governor terminal and any convenient source of battery current. Raise the rear wheels off the floor, shift into high gear and accelerate the engine gradually, watching the speedometer and the test light. At or slightly below approximately 29 MPH the lamp should light. At or slightly above approximately 23.5 MPH on deceleration the light should go out. The difference between the two speeds should be at least 3.5 MPH.

If the governor is removed from the overdrive housing and checked on a distributor test stand, the points should close on acceleration at 770-840 RPM and should open during deceleration at 680-750 RPM. The difference between the speeds should be at least 90 RPM.

KICK-DOWN SWITCH TESTS

If the overdrive unit operates properly but the kick-down switch will not put the vehicle in normal transmission operation by depressing the accelerator, make the following tests:

1. Start and idle the engine.

2. Ground the kick-down switch terminal at the black cable. The engine should stop. If the engine continues to operate, replace the black cable between the kick-down switch and the ignition coil.

3. Ground the kick-down switch terminal at the brown cable and depress the accelerator pedal to the floor. The engine should stop. If the engine does not stop, adjust the accelerator linkage as described in Section 2, "Fuel." If the engine still does not stop, replace the kickdown switch.

4. Ground the overdrive solenoid "6" terminal (brown cable). Depress the accelerator pedal to the floor. If the engine does not stop, replace the brown cable between the overdrive solenoid and the kick-down switch.

5. Remove the ground from the overdrive solenoid "6" terminal. Depress the accelerator pedal to the floor. If the engine stops, the overdrive solenoid is inoperative and should be replaced.

LIGHTING SYSTEM

The lighting system on Henry J automobiles includes those lights required by law, that is: Head-

lights, headlight beam indicator, tail lights, and license plate light. Included, also, either as new car equipment or as accessories are many lamps that add to the convenience, comfort, and safety of driving. Among these are, parking lights, stop and directional signal lights, back-up lights, instrument lights, courtesy lights, dome light, fog lights, etc. The lighting system includes the cables or wires, the various switches, fuses, etc., that supply and control the lighting current. When working on lights, switches, and wiring harnesses consult the wiring diagrams shown in Fig. 256, 257 and 258.

The modern sealed-beam type headlight unit has its filaments, reflector, and lens sealed by the manufacturer to form a single unit. Such a unit has a glass reflector which is sprayed with vaporized aluminum on the inner surface. This provides a reflecting surface brighter and more efficient than silver. The filaments for the upper, or country driving, beam and the lower, or passing, beam are mounted in exactly the right positions and the lens is fused to the glass reflector. The interior is then filled with a special inert gas to protect it against moisture, dust, tarnishing and inside fogging. High efficiency is therefore assured throughout the life of the unit and proper focusing is permanent. The only cleaning necessary is wiping the front of the lens. When a filament burns out, the entire sealed-beam unit is replaced.

All lights except the headlights (and some special equipment fog lights and spot lights) carry conventional 6-volt light bulbs or lamps. Some are single contact and some having two filaments are double contacts. Refer to the Henry J Parts List for information on the candle power of the various light bulbs.

LIGHT BULB REPLACEMENT

If a light fails to go on when the proper control switch is operated, install a new bulb, or if it is easier, check some convenient near-by terminal to determine whether current is available at the bulb. For example, if a headlight fails to light it is easy to consult the wiring diagram and then make a test with 6-volt test light between ground and the headlamp junction block. With the headlamp switch turned on, and the dimmer switch in the proper position, the test light should light. Failure to light might indicate circuit or switch trouble.

Another method of checking is to turn off the headlight switch and use a jumper between the hot terminal of the starter solenoid and the terminals on the headlamp junction block, touching one terminal at a time. The terminal to which the red cables attach should light the upper headlight beam, the terminal for the black cables should light the lower beam and the terminal for the yellow cables should light the parking lights. If the lights fail to go on, the lamp should be replaced. If they do go on, the switch or circuit wirings should be checked.

a. Headlight Sealed-Beam Unit Replacement

If a quick check of the feed circuits indicates need for replacement of the sealed-beam unit, remove the headlight door (outer rim) which is attached by a screw at the bottom. Loosen the retaining ring screws and turn the retaining ring to remove. Lift out the sealed-beam unit (Fig. 305) and pull off the connector.

Fig. 305—Replacing Headlight Sealed-Beam Unit

b. Complete Headlight Removal

The complete headlight can be removed from the front fender if necessary. Disconnect the black and red cables from the headlamp junction block, remove the headlight door, remove the headlight to fender screws and lift out the headlight assembly.

c. Aiming Headlight Beams

Headlight beams can be aimed quickly and easily with test equipment made for the purpose. If such equipment is not available, proceed as follows:

1. Stop the car on a smooth, level floor 25 feet from a vertical wall, preferably of light color. Have the center line of the car at right angles to the wall. The car should not be loaded and the tires should be properly inflated to assure correct headlight adjustment.

2. Measure the height of the center of the headlights from the floor. Draw a horizontal line on the wall three inches lower than the headlight centers (H in Fig. 306). Mark a point on this line in line with the center line of the vehicle and draw a vertical line (C-C) through the point. Measure to the right and left of the vertical line (C-C) a distance (W) equal to half of the horizontal distance between the headlight centers and draw two vertical lines (L-L and R-R).

3. Remove the retaining screw and the headlight door (outer rim). Turn the headlights on to the driving or upper beam. Cover the left headlight and aim the right one by turning the adjusting screws (Fig. 305) until the light beam has the same relative pattern on the wall as shown in Fig. 306. Then cover the right headlight and adjust the left headlight beam in the same manner, centering the beam pattern on the left vertical line. Install the headlight doors and retaining screws.

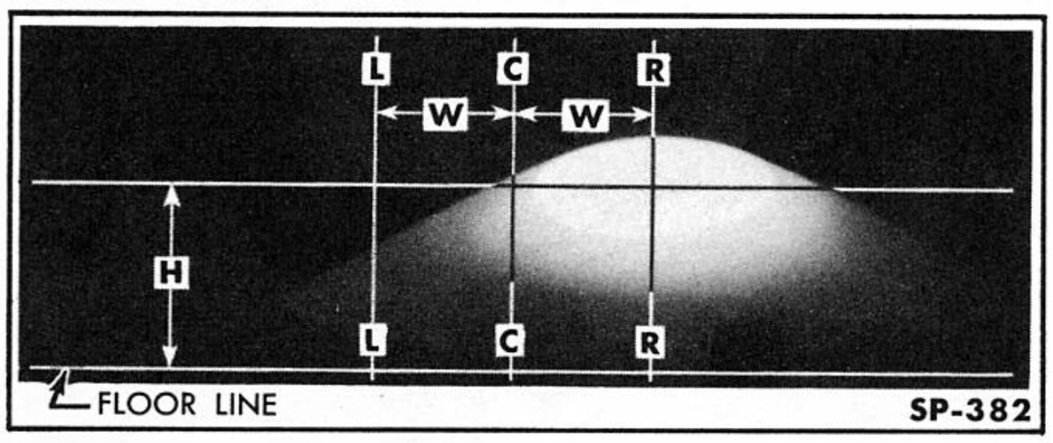

Fig. 306—Pattern of Properly Aimed Headlight

d. Other Lights

When lights other than the sealed-beam units in the headlamps (and some special equipment spot lights and fog lights) do not function, the easiest test usually is to substitute a new bulb for the old one. If the new bulb will not light, the circuit and switch for that particular light must be carefully checked.

SWITCHES

If preliminary checks or tests disclose that the light bulb is satisfactory, the switch should then be checked to determine if it is operating properly.

a. Headlight Switch

The pull-type headlamp switch is conveniently mounted on the instrument panel. The first out position of the knob is for parking, tail and instrument panel lamps; the second position, for head, tail, and instrument panel lamps. A 30 ampere fuse is provided for the headlamp switch as a safety feature. If a ground or short circuit occurs in the lighting system, the fuse will open the circuit and prevent damage to the wiring.

Whenever a fuse is blown, the shorted or grounded wire in the circuit must be located and repaired before installing another fuse.

If the fuse is not blown, the switch can be checked with a 6-volt test light by checking between the various terminals on the switch and ground. Voltage should be present at terminal "B" at any position of the switch. With the switch pulled out to the first position (for parking lights) terminals "B", "R" and "P" should be energized. With the switch pulled out to the next position (for headlights), terminals "B", "R" and "H" should be energized. If the tests show the switch to be out of order, disconnect the battery ground cable to guard against a short. Then remove the knob from the switch rod, using a small screwdriver to push the retaining spring toward the head of the knob, remove the switch retaining nut and detach the wires from the switch terminals noting the color code for correct reconnection.

b. Headlight Dimmer Switch

The foot switch used to select the desired headlight beam can be checked with the headlight switch on. Use a 6-volt tester and check between the center terminal (single red wire) to ground. The tester should light. Check the other two terminals to ground. Only one should be energized. Operate the foot switch and check the two side terminals again. Only the opposite terminal should be energized. Replace the switch if it is out of order.

c. Stop Light Switch

If the stop light switch (mounted on the frame near the steering gear) does not operate the stop lights, it can be quickly checked by placing a jumper across the terminals. If the stop light bulbs and circuits are in order, the lights should go on, indicating the switch is defective and should be replaced. If removed from the vehicle and tested at the bench, the switch should close at 60-110 pounds per square inch pressure.

d. Other Switches

Other switches in the lighting system such as dome lamp and door switches (if so equipped) can be checked by testing first on the hot side with a 6-volt tester. If the tester does not light, the circuit to the switch is defective. If the tester lights, check between the other terminal and ground with the switch on. If the tester does not light, replace the switch.

MISCELLANEOUS ELECTRICAL

The following paragraphs contain information regarding such electrical equipment as horns, horn relays, gauges and fuses.

HORNS AND HORN RELAY

The horn (or horns if so equipped) is of the vibrator type. A horn relay is used to act as a switch for

the horn feed circuit. The horn button or horn ring closes the relay circuit to energize the relay coil which closes the battery to horn circuit. Failure of the horn to blow may be caused by failure of the horn, the horn relay, the horn button or ring or the connecting wires.

a. Horn Test

Check with a test light from the battery terminal of the horn relay (red cable) to assure availability of current at this point. If tester does not light, check the red cable that leads back to the battery terminal of the generator regulator. Next, with a screwdriver or jumper, connect the battery terminal of the relay (red cable) to the horn terminal (black cable). This should cause the horns to blow. If it does not, touch a jumper wire between a hot terminal (battery or starter solenoid) and each horn terminal. Replace a horn that does not blow. If horn does blow, replace cable between horn relay and horn.

b. Horn Relay Test

If the horns operate properly, use a test lamp to check from ground to the relay terminals to which the green cable is attached. A light establishes continuity of circuit to this point. Then with a jumper, connect the green cable terminal of the relay to ground. This should make the relay click and should blow the horns. If this jumper to ground test blows the horns, but the horn ring does not, the circuit to the horn ring or the ring itself, must be at fault. Instructions for removal of the horn ring and the related parts, are provided in Section 10, "Steering."

c. Horn Replacement or Repair

Either horn, if in good order, should draw approximately 16 - 17 amperes at 6 volts (at horn terminal) and should blow smoothly at any voltage from 8 to 5. Adjustment is possible, but is not recommended unless proper test equipment is available. If adjustment changes the pitch of one horn even slightly, the tones will not blend properly when the horns are sounded. Do not attempt to repair a horn relay, always install a new one.

GAUGES AND INDICATORS

The temperature gauge, fuel gauge, amp (or charging) indicator and the oil pressure indicator are all actuated only when the ignition switch is turned on. The fuel and temperature gauges receive their power through an instrument voltage regulator to assure that voltage variations in battery or generator voltage will not affect their accuracy. Section 16, "Instruments and Accessories" supplies instructions for removal and installation of the units. The operation of each unit and testing procedures are detailed in the following paragraphs.

a. Instrument Voltage Regulator

An instrument voltage regulator is installed in the circuit between the ignition switch and the temperature and fuel gauges. The regulator uses a thermo bimetal interrupter which operates similar to a flasher unit. The regulator limits the average voltage supply to approximately 5 volts.

If temperature and fuel gauges both read consistently too high, check the instrument voltage regulator contact to ground (through the case). If it is grounded properly and the gauges still read high, replace the regulator. If both gauges consistently read too low and the battery is delivering proper voltage, replace the regulator.

b. Temperature Gauge

The temperature gauge consists of an engine or sending unit and the dash or receiving unit. The engine unit contains a small variable resistance pellet of a sintered material which has the property of decreasing resistance as temperature increases. The change in resistance affects the current flow in the circuit and changes the position of the gauge needle. To check, remove the engine unit and suspend it in water with a thermometer. Heat the water and check the gauge readings between 120° F. to boiling.

c. Fuel Gauge

The fuel gauge operates in exactly the same manner as the temperature gauge except the tank unit consists of a float which is attached to a slide rheostat. As the float rises (when fuel level is high) the slide rheostat is moved towards the minimum resistance point to allow more current to flow in the circuit thus deflecting the gauge needle toward the "full" mark.

To check the fuel gauge, disconnect the blue wire at connector in the rear compartment and hook it up to a new tank unit and float. Ground the new unit properly and, with the ignition on, move the float from empty to full positions and note the fuel gauge reading.

d. Oil Pressure Indicator

The oil pressure indicator consists of a pressure operated switch mounted on the engine and an indicating light in the instrument cluster. When engine oil pressure is low or zero and the ignition switch is on, the oil pressure indicator light should be on. When engine speed is increased slightly above idle speed to raise the oil pressure to approximately 13 psi pressure, the oil pressure engine unit should operate to open the circuit and the indicator light will go off. If the unit is defective, first check the indicator bulb. If it is good, replace the oil pressure engine unit.

e. Amp Indicator

The amp (or charging) indicator consists of an indicating light in the instrument cluster which is connected to the "A" or "GEN" terminal of the generator regulator.

The amp indicator light should go on when the ignition switch is turned on and when the generator cannot supply the entire current load (the battery is discharging).

If the generating system is in proper order, the light should go off when the generator starts to charge the battery.

FUSES

The Henry J is equipped with fuses to protect the complete lighting system and the overdrive, heater, radio and fog lamp if so equipped. If any units become inoperative, check the fuse first. If the fuse is blown, determine the cause of the high current BEFORE installing a new fuse. Fuse sizes are specified in the Henry J Parts List.

SERVICE BULLETIN REFERENCE