ELECTRICAL • • • • • • SECTION 15

CONTENTS

GENERAL INFORMATION

This section supplies information for the electrical equipment used in the Kaiser and Frazer models. Much of the information applies to all the models covered by this manual and exceptions to this are clearly indicated.

Following a brief description of the various separate systems which together comprise the complete electrical system, information is provided on inspection and maintenance, tests and adjustments, removal and installation and overhaul of the various units.

a. WARRANTY. Since electrical equipment that is warranted by the respective manufacturers in addition to the Kaiser-Frazer uniform warranty, and that fails during the first 90 days or 4,000 miles, is to be removed from the car and returned to the nearest authorized service station of the electrical equipment manufacturer, the following is provided for reference.

1. **Delco-Remy** supplies the generator, regulator, starting motor, distributor, ignition coil and some horns and radios used on Kaiser models.

2. **Electric Auto-Lite Company** supplies the generator, regulator, starting motor, distributor, ignition coil, and some horns used on Frazer models —also non-electrical oil pressure and water temperature gauges and the ammeter and speedometer. Electrical equipment except for horns has also been supplied by Electric Auto-Lite Company for some Kaiser vehicles.

3. **King-Seeley** Corporation supplies the ammeter, speedometer, fuel gauge units, and the oil

pressure and water temperature units for Kaiser models.

4. **Sparks-Withington** has supplied part of the horns used on both Kaiser and Frazer cars.

b. REPLACEMENT OR ADJUSTMENT UNDER WARRANTY. For replacement or repair under warranty take Delco-Remy electrical equipment to the nearest United Motors Service Station, take Auto-Lite equipment to the nearest Official Auto-Lite Service Station, and King-Seeley equipment to the nearest King-Seeley Service Station. Return Sparks-Withington equipment to Kaiser-Frazer.

If no Auto-Lite or King-Seeley service station is available the Kaiser-Frazer Field Service Representative will recommend proper handling of such electrical equipment. The Kaiser-Frazer Dealer who does not have 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.

DESCRIPTION AND OPERATION

Kaiser-Frazer electrical equipment may be divided into five major units or groups. All are related in that they draw their energy from the generator or the battery. These units, or groups, include the storage battery and the generating, starting, ignition, and lighting equipment. In addition, various controls, indicating equipment, and accessories are electrically operated. Cables or insulated wires, often bound together to form a "harness," are required to conduct electric current to and from the battery and to electrical units and equipment.

a. BATTERY. As indicated by its name, the primary purpose of the "storage battery" is to store energy for starting the engine, for operating various instruments and accessories when the engine is not running or is running below generator "cut-in" speed. If the generator speed is too low to deliver sufficient current, or 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 voltage 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, maintaining the desired voltage and preventing overcharging of the battery, over-

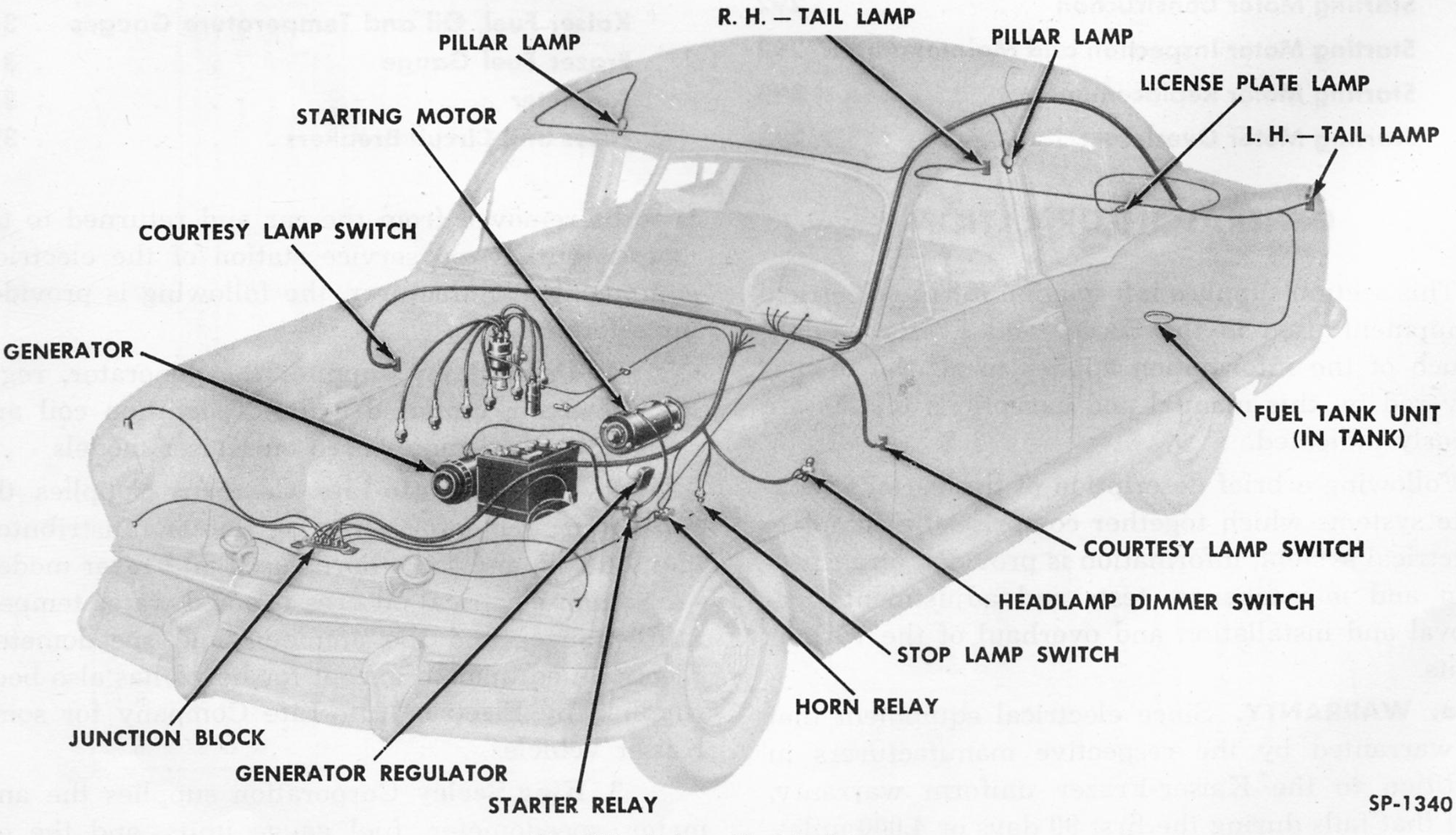


Fig. 381—Kaiser Electrical System

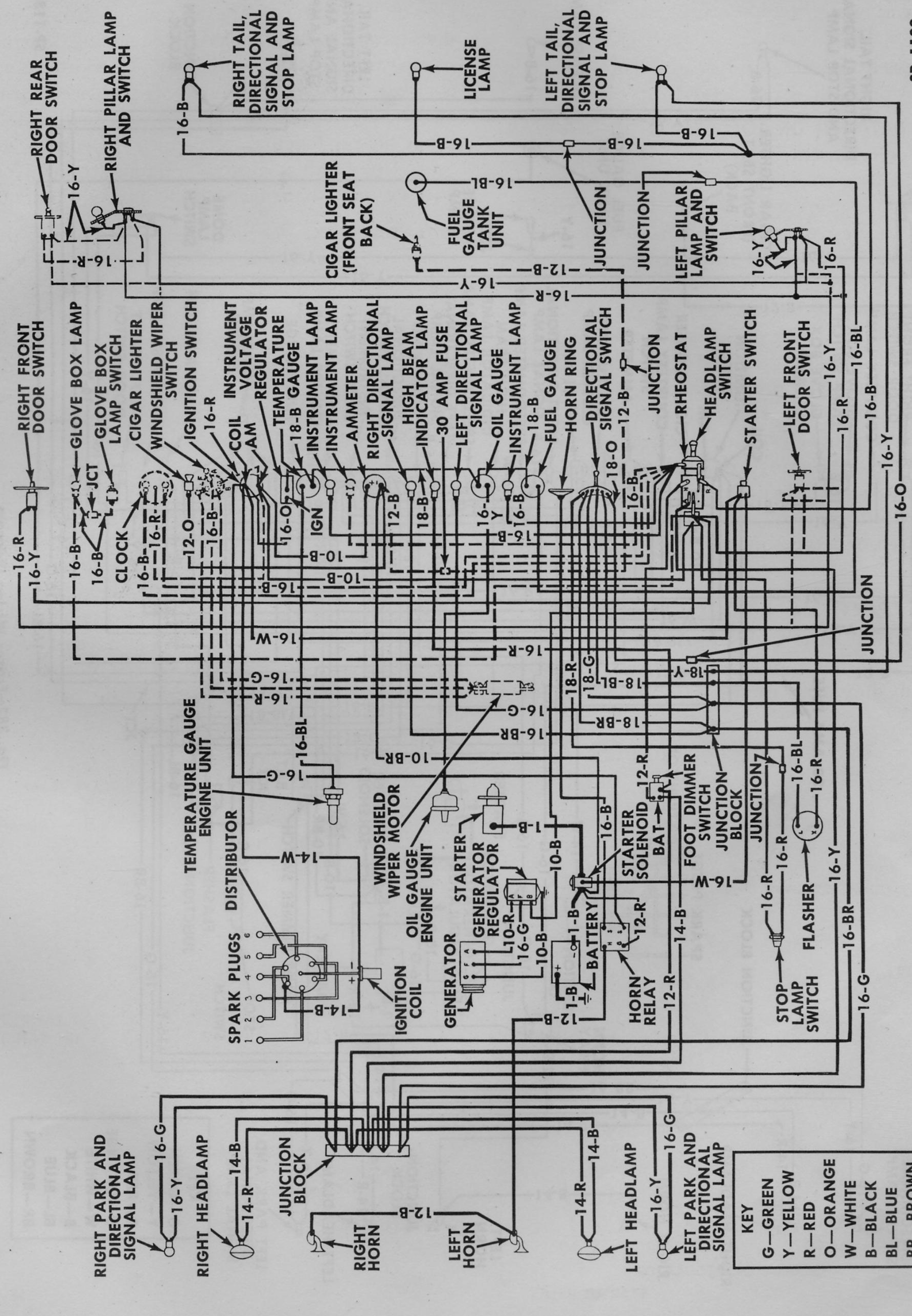


Fig. 380—Kaiser Wiring Diagram

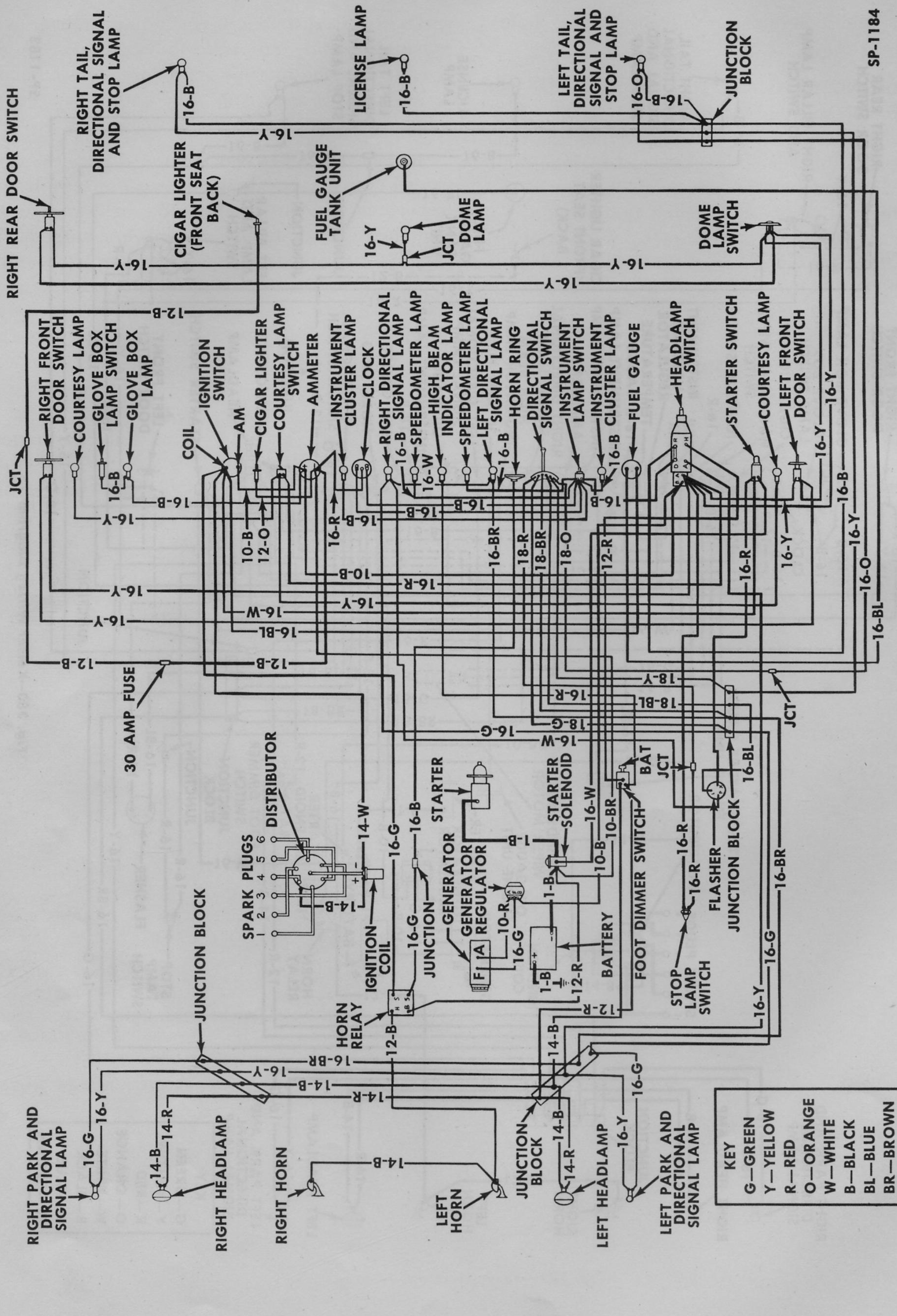


Fig. 382—Frazer Wiring Diagram

loading of the generator, or burning out of 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 the starting motor to cause it 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 in 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 circuit breakers or fuses. Among the lights are: head, parking, stop and tail, direction indicating, instrument panel, ignition switch, range selector lever quadrant (Hydra-Matic), headlamp beam indicator, dome, pillar, courtesy and map.

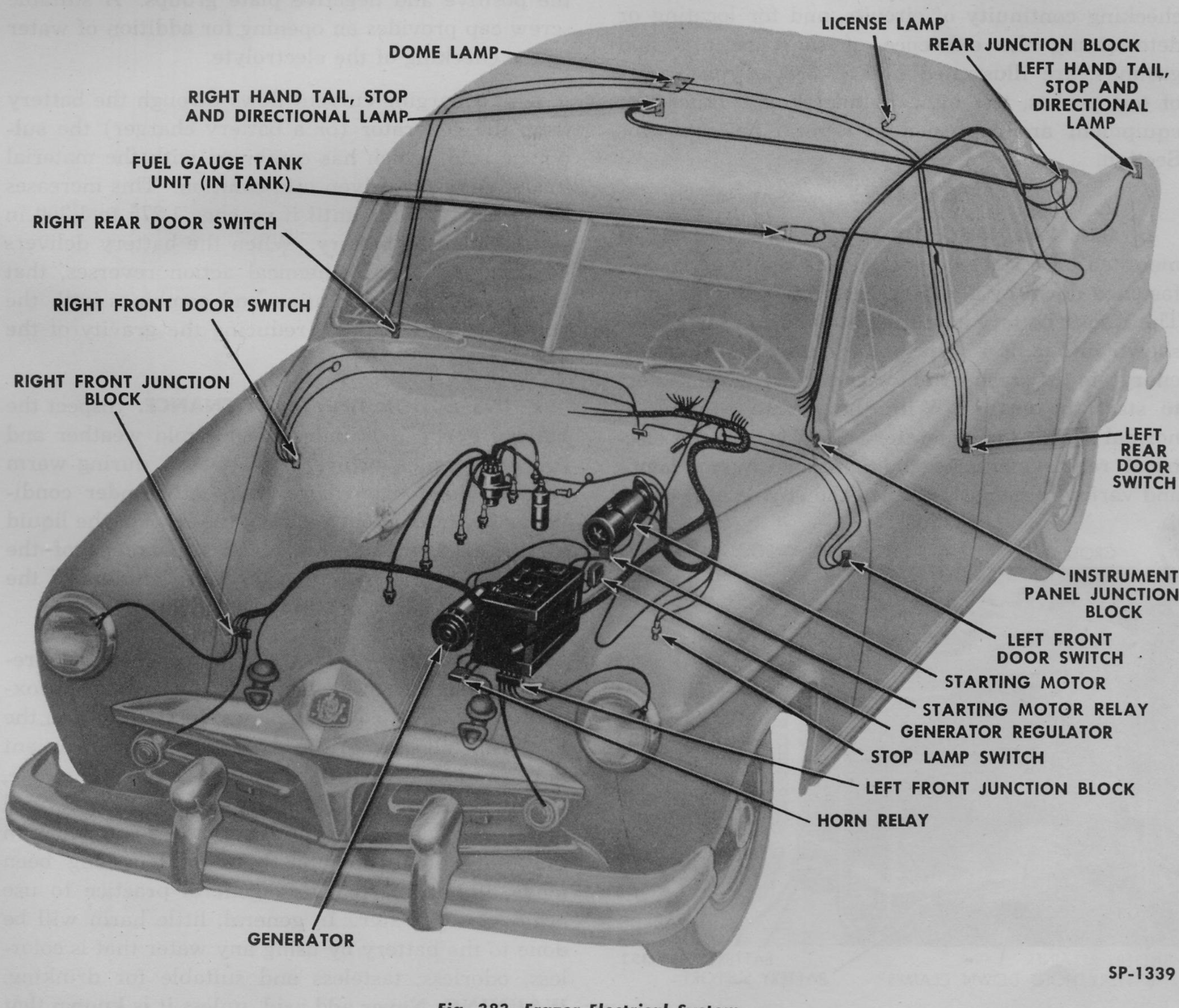


Fig. 383—Frazer Electrical System

f. MISCELLANEOUS EQUIPMENT. Among the items of miscellaneous electrical equipment are: the electrical controls of the overdrive, which provide the means for automatic engagement of the overdrive gears, plus means to enable the driver to control the overdrive when he wishes; neutral safety switch (Hydra-Matic); electrically operated gauges to indicate fuel level; oil pressure and engine temperature gauges (Kaiser models); turn signal indicators; radio; heater; cigar lighter; and various other accessories.

WIRING DIAGRAMS

Schematic diagrams of electrical wiring in Kaiser and Frazer models are shown in Figs. 380, 381, 382, 383 and 435. Test probes and 6-volt test light for checking continuity of circuits, and for locating or determining the existence of short circuits and grounds, are illustrated in Fig. 389. Typical uses of test probes, test light, voltmeter, and other test equipment are explained in several parts of this Section.

BATTERY

a. GENERAL INFORMATION. The battery is mounted on a steel support, under the hood, and is fastened down by a retainer held by two wing nuts. The Kaiser battery mounting is similar to the Frazer shown in Fig. 384. 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.

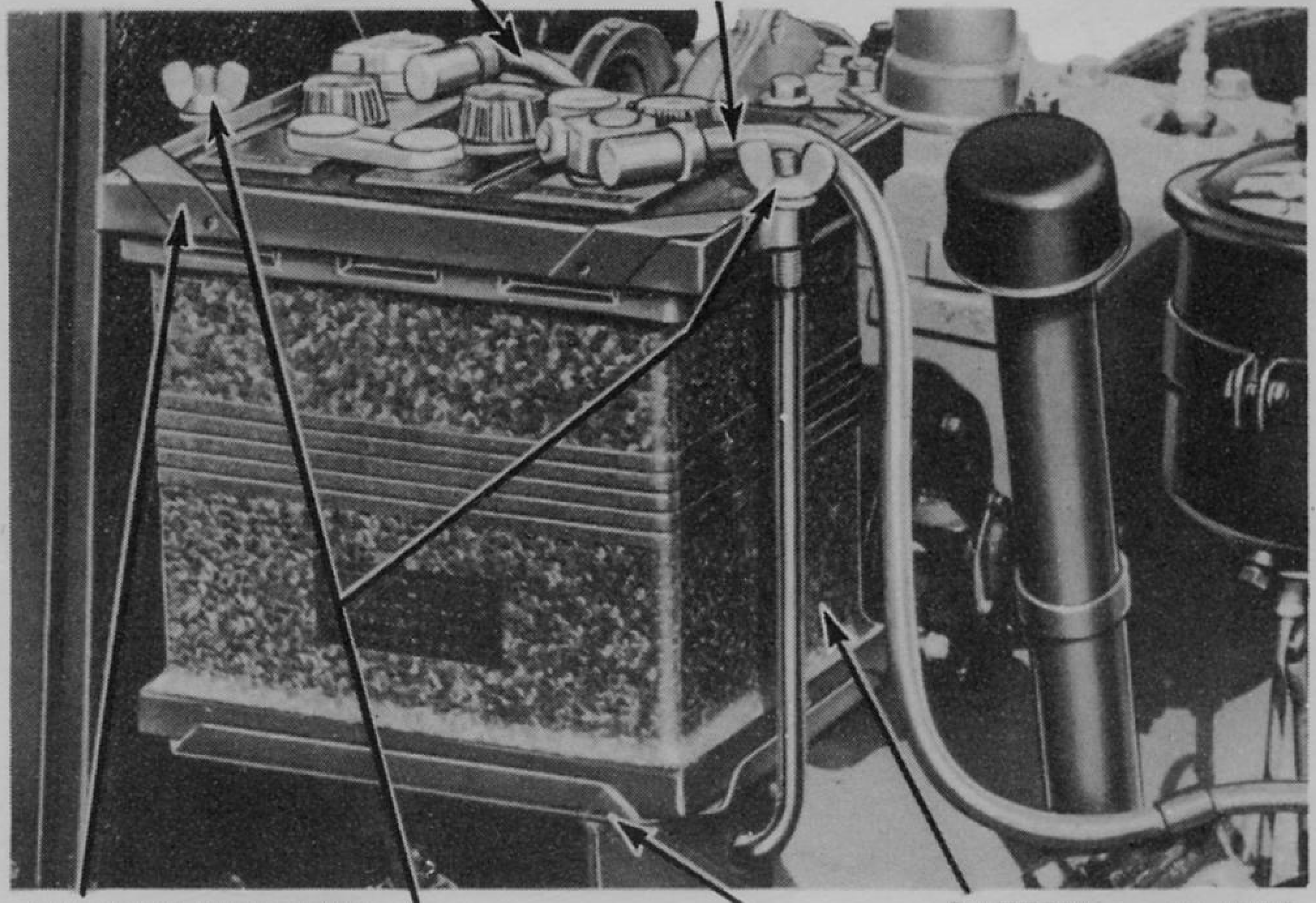


Fig. 384—Battery Installation—Frazer

b. CONSTRUCTION. To provide six volt current the battery consists of three cells, connected in series. 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 the checking of the electrolyte.

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.

c. INSPECTION AND MAINTENANCE. Inspect the battery every 1000 miles during cold weather and every 500 miles, or every 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.

1. Adding Water. Add pure (distilled preferred) water to each cell to bring the level to approximately ⅜ inch above the plates. Instructions on the filler cap tell how to use the cap to cover the vent to prevent overfilling (or how to use the star gauge, lead washer or other battery liquid level control feature provided). 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 adjust gravity.

2. 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 bircarbonate (baking soda) or of sodium carbonate (washing soda) in water. After drying, coat the clean posts and terminals with petrolatum or light grease, to prevent corrosion. Then tighten securely.

3. Freezing. A fully charged battery is safe against freezing at 90° F. below zero. A discharged battery will freeze at 20° F. above zero. 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 insure mixing of the fresh water with the acid.

4. 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.

5. 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 (wood) and plates. Follow the directions of the battery manufacturer in caring for low-gravity batteries.

d. 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 ammeter 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.

1. Hydrometer Test. Tested with a battery hydrometer, the battery liquid in each cell, if fully charged, should show between 1.270 and 1.300 specific gravity at a temperature of 80° F. Built into a high grade hydrometer is a thermometer 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.

2. 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 by using a screwdriver, or short wire, as a jumper between the hot terminal and the switch (smaller center) terminal of the solenoid switch. 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. If difference between cells is more than .1 volt repeat the test.

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.

3. Generator Charging Rate. Failure of the charging rate, as indicated by the ammeter on the instrument panel, 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, later in this Section, for additional information.

4. Circuit Resistance Tests. Excessive resistance in cable terminal connections, or in cables, or elsewhere in the starter circuit may cause abnormal voltage losses with resulting loss of cranking ability. Abnormal resistance at terminals or elsewhere in charging circuits may interfere with proper charging. Methods of making voltage drop tests are covered in the instructions for operation of the test equipment used.

5. 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, particularly if the rate is high or when a battery is nearly fully charged, hydrogen and oxygen gases are generated in the cell. Even if the hydrogen amounts to only four percent, hydrogen mixed with oxygen and air explodes violently and an explosion will throw acid. Under normal operation, the gases escape into the air and are no hazard.

6. 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.

e. BATTERY REPLACEMENT (Fig. 384). 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. Follow the directions given under BATTERY INSPECTION AND MAINTENANCE for cleaning and coating with petrolatum or grease.

GENERATING SYSTEM

a. GENERAL INFORMATION. This system includes the generator and its voltage regulator together with 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 of the car, plus enough to replace quickly the energy the battery supplied for starting the engine.

The 35-ampere generator (Delco-Remy 1102733) with mating regulator (Delco-Remy 1118302) are supplied for **Kaiser** models by Delco-Remy. However, a **limited number of Kaiser** automobiles have been built with Auto-Lite electrical units, including a 35-ampere generator (Auto-Lite Model EO-10203) and regulator (Auto-Lite Model VRP-4004F2).

The standard equipment 35-ampere generator (Auto-Lite Model GDZ-4818A) and regulator (Auto-Lite Model VRP-4004F2) for **Frazer** models are supplied by Auto-Lite. **As special equipment, Frazer** models having power operated window regulators and top lifting mechanism are supplied with Auto-Lite generator (Model GGU-6001B) and regulator (Model VAV-4002C) of 45-ampere capacity.

For all service information on the Auto-Lite generator and regulator used in Kaiser models use the instructions and procedures applying to Frazer models.

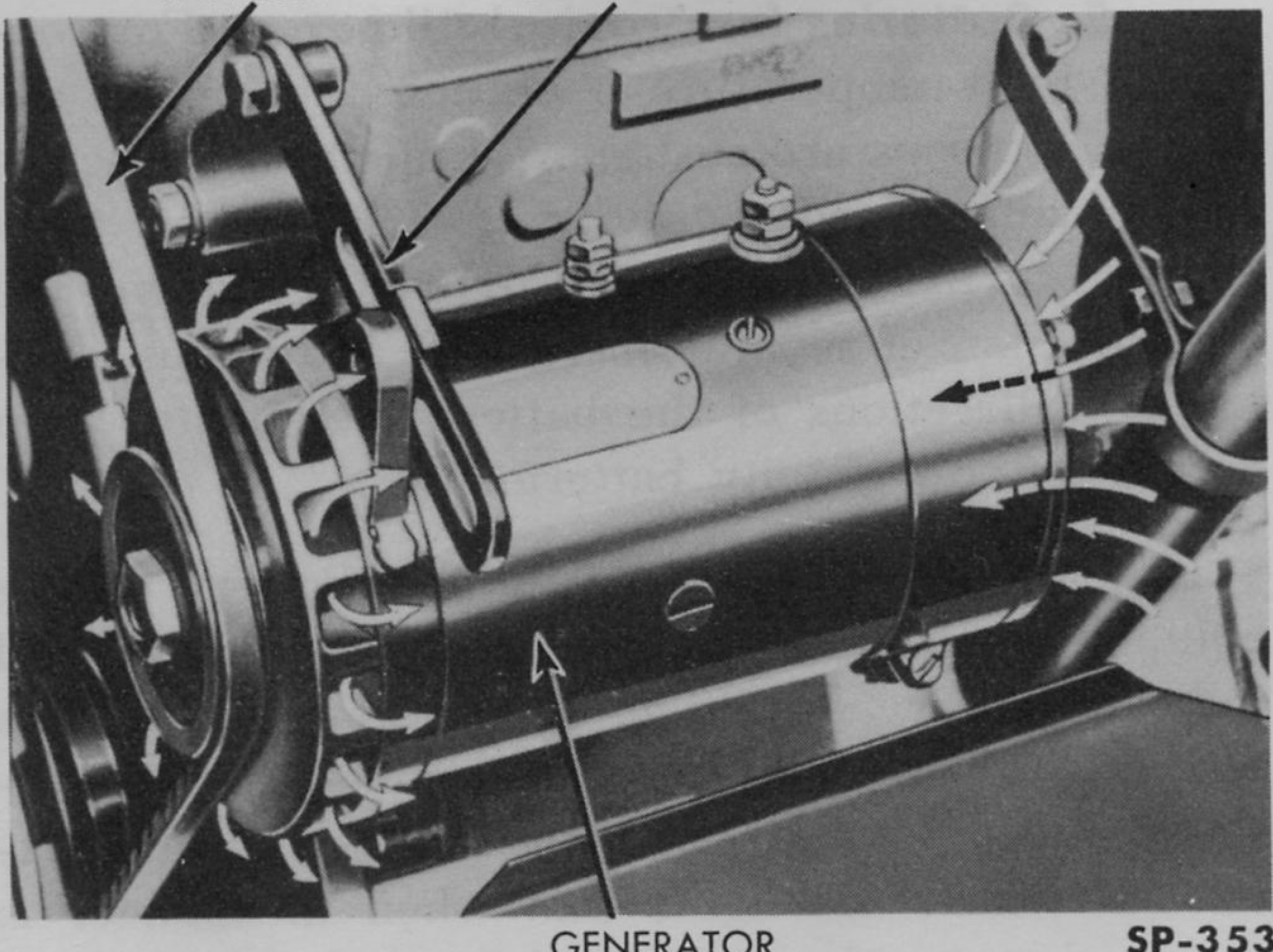


Fig. 385—Frazer Generator Installation

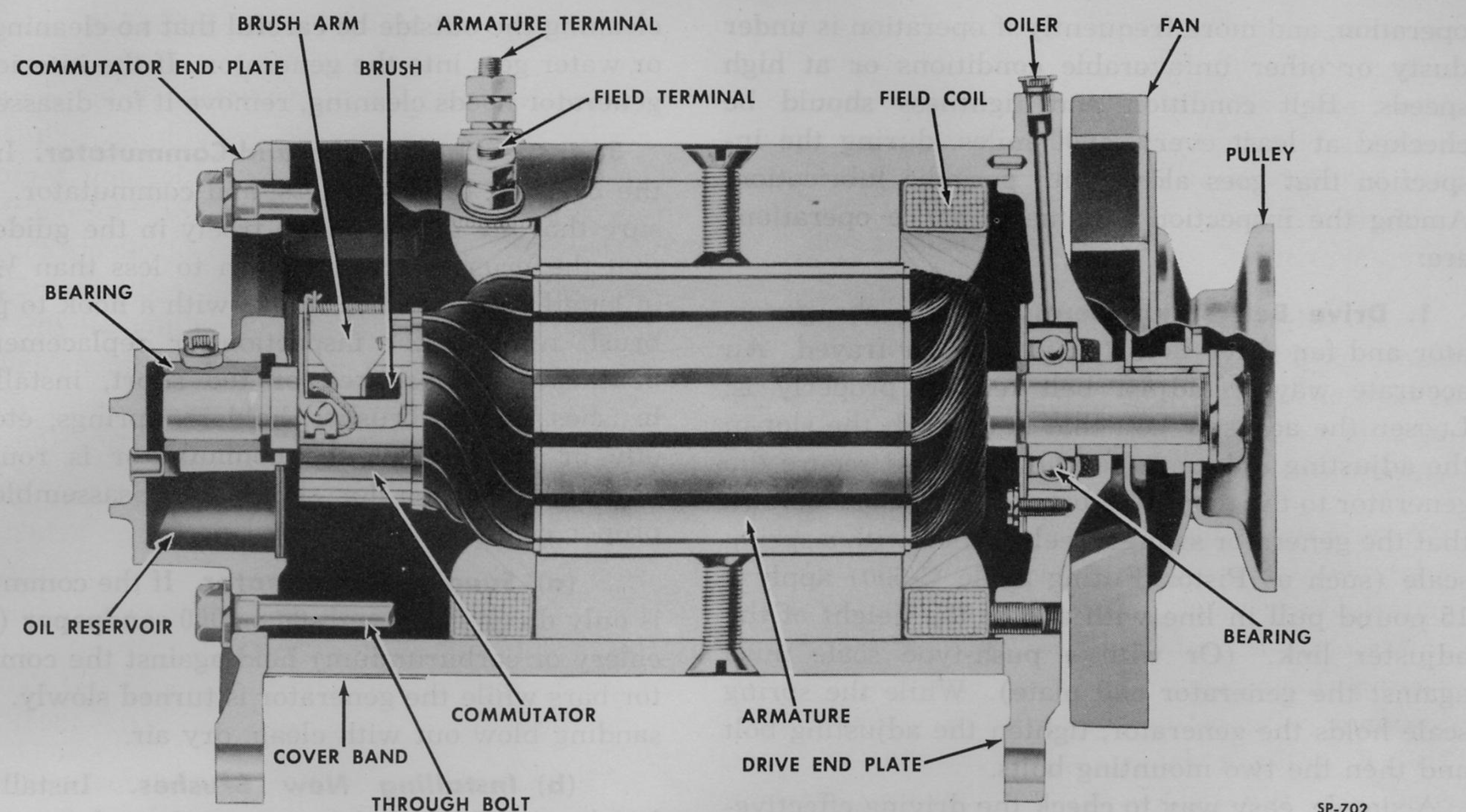


Fig. 386—Kaiser Generator—Sectional View

b. GENERATOR CONSTRUCTION. The generators are of the two-brush, shunt-wound, belt-driven type. Mounting is on the left side of the engine and the Kaiser mounting is similar to the Frazer mounting which is illustrated in Fig. 385. Cooling is by air drawn forward through the generator by a fan built into the generator drive pulley. The front end of the armature shaft, as shown in Figs. 386 and 387 is supported by a ball bearing, and the rear end by an oil-impregnated, porous bronze, bushing that is pressed into the brush-holding (rear) end plate.

c. GENERATOR INSPECTION AND MAINTENANCE. Inspect the generator and the related regulator and wiring every 10,000 miles of normal car

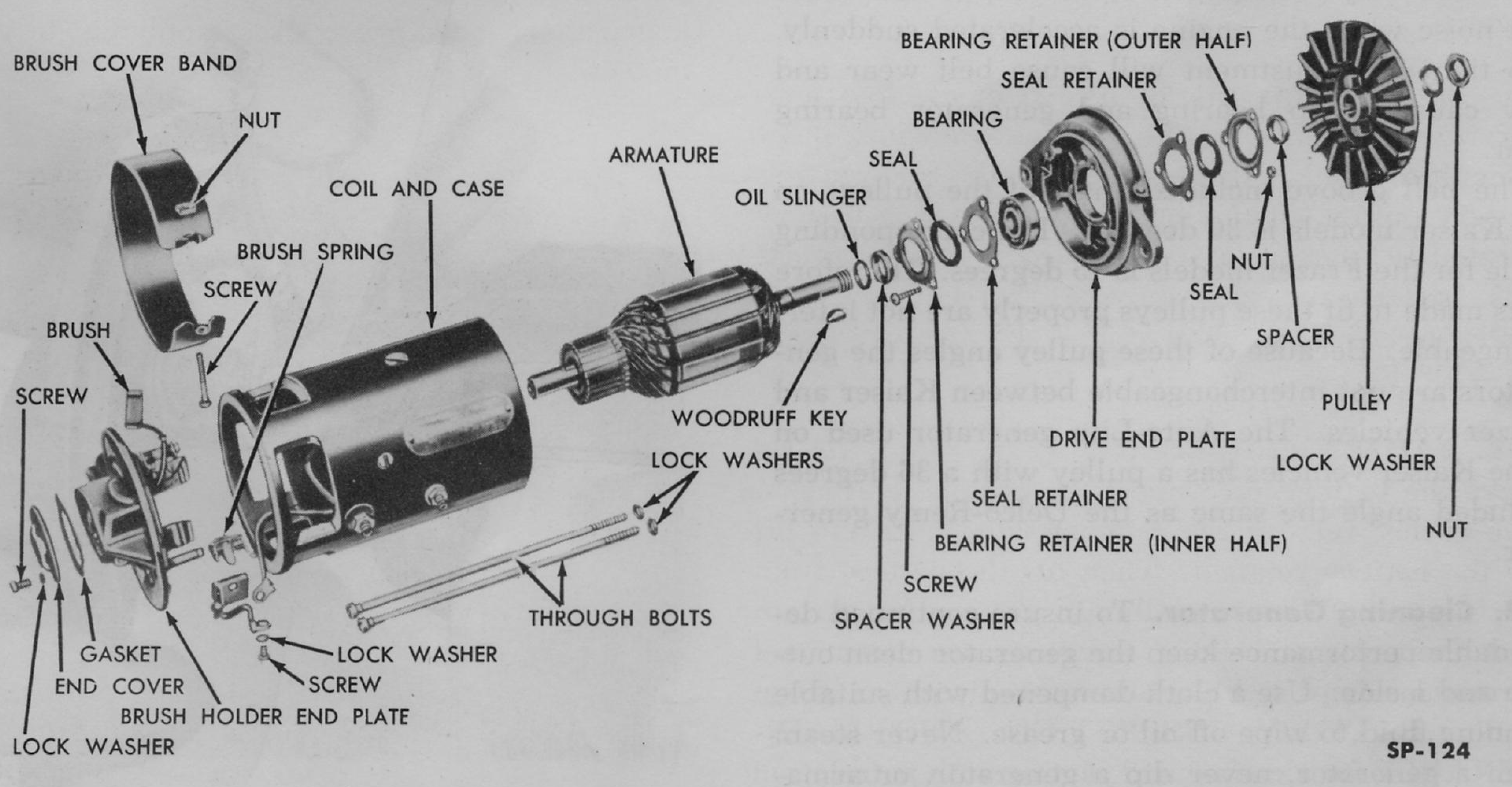


Fig. 387—Frazer Generator—Exploded View

operation, and more frequently if operation is under dusty or other unfavorable conditions or at high speeds. Belt condition and tightness should be checked at least every 2,000 miles, during the inspection that goes along with periodic lubrication. Among the inspection and maintenance operations are:

1. Drive Belt Adjustment. Replace the generator and fan drive belt if it is worn or frayed. An accurate way to adjust belt tension properly is: Loosen the adjuster bolt that is through the slot in the adjusting link and the two bolts that secure the generator to the mounting bracket, and make certain that the generator swings freely. Then with a spring scale (such as Piston Fitting Scale C-690) apply a 15 pound pull in line with and at the height of the adjuster link. (Or with a push-type scale push against the generator end plate). While the spring scale holds the generator, tighten the adjusting bolt and then the two mounting bolts.

A simple, easy way to check the driving effectiveness of the belt is to use a small torque-indicating wrench, with a socket that fits the generator drive pulley retaining nut, to measure the torque required to slip the pulley in the belt. A torque of 4 to 5 foot pounds will slip a properly adjusted belt. A 6 foot pound torque adjustment is recommended for a new belt. Pull in the direction to tighten the nut, do not push and loosen it. Too loose a belt will slip and wear and may reduce generator output and cause belt noise when the engine is accelerated suddenly. Too tight an adjustment will cause belt wear and may cause pump bearing and generator bearing wear.

The belt groove included angle of the pulleys on the Kaiser models is 36 degrees. The corresponding angle for the Frazer models is 45 degrees. Therefore belts made to fit these pulleys properly are not interchangeable. Because of these pulley angles the generators are not interchangeable between Kaiser and Frazer vehicles. The Auto-Lite generator used on some Kaiser vehicles has a pulley with a 36 degrees included angle the same as the Delco-Remy generator.

2. 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, never dip a generator, or armature, or field coils or brushes in cleaning fluid. In cleaning the outside be careful that no cleaning fluid or water gets into the generator. If the interior of a generator needs cleaning, remove it for disassembly.

3. Inspecting Brushes and Commutator. Inspect the brushes, brush-holders, and commutator. Make sure that the brushes slide freely in the guides and that the brushes are not worn to less than ½ inch in length. Lift the brush arm with a hook to permit brush removal for inspection or replacement. If brushes are oil-soaked or too short, install new brushes. 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, or overhaul.

(a) *Sanding Commutator.* If the commutator is only dirty, clean with 00 or 000 **sandpaper** (never emery or carburundum) held against the commutator bars while the generator is turned slowly. After sanding blow out with clean, dry air.

(b) *Installing 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. 388). Be careful not to bevel the edge of the brush

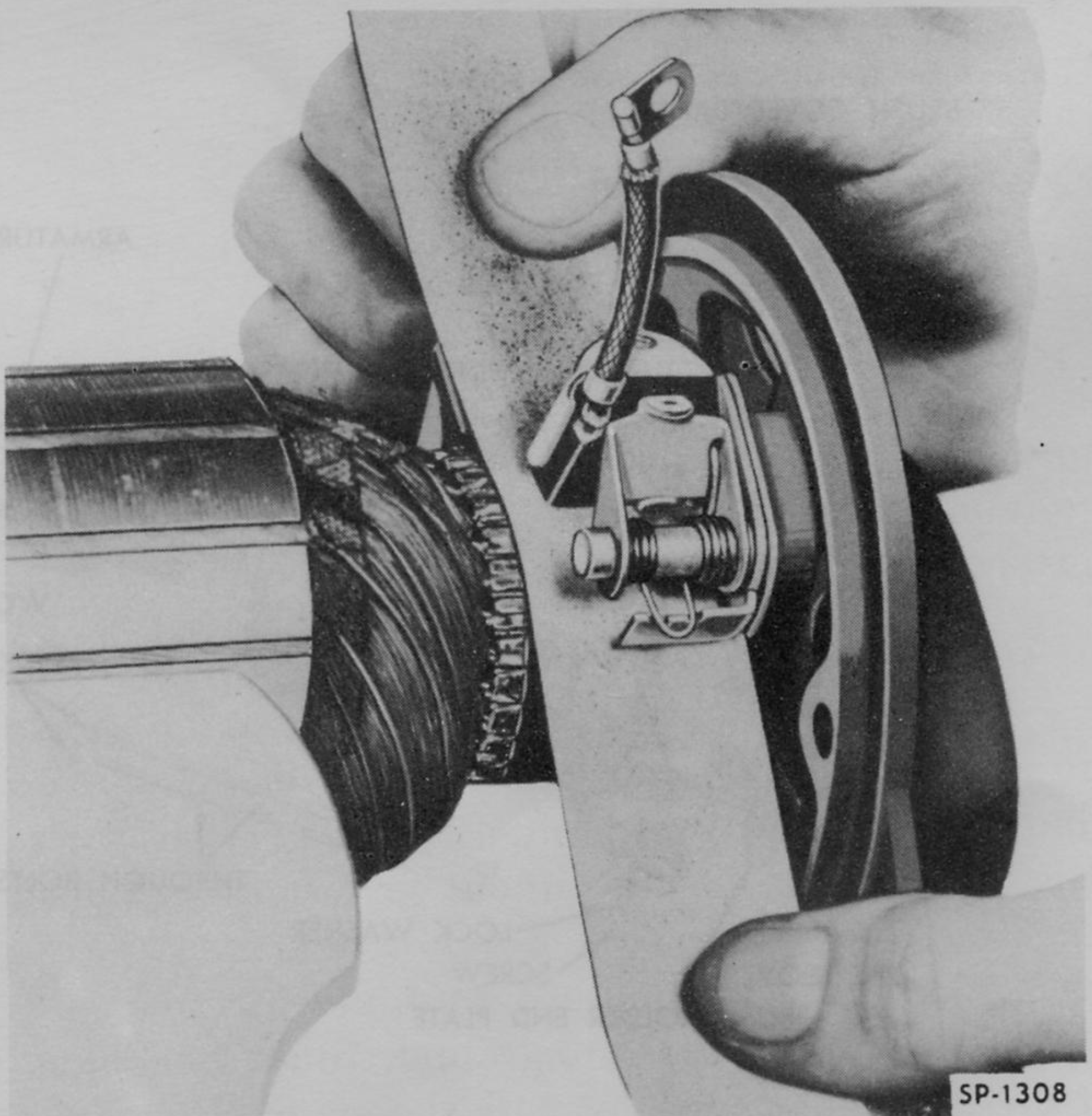


Fig. 388—Sanding Generator Brush

and do not sand away too much of the end.

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. Such run-in for getting proper contact is necessary before checking or adjusting output. After the seating and short run-in a new brush should have full-width contact and 75 percent area contact.

(c) *Checking Brush Springs.* The manufacturer's specification for brush spring tension is 24-28 ounces for models with Delco-Remy equipment and 35-53 ounces for models equipped with Auto-Lite units. 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.

4. Wiring and Terminal Connections. Check the tightness of terminals at the generator and regulator and the condition of the insulation of connected wiring and cables. Use a voltmeter or a suitable test lamp. Test probes connected with a 110-volt light, and a 6-volt test lamp with suitable test leads, for checking continuity of circuits and for locating or determining the existence of grounds, are illustrated in Fig. 389. The manuals for bench test

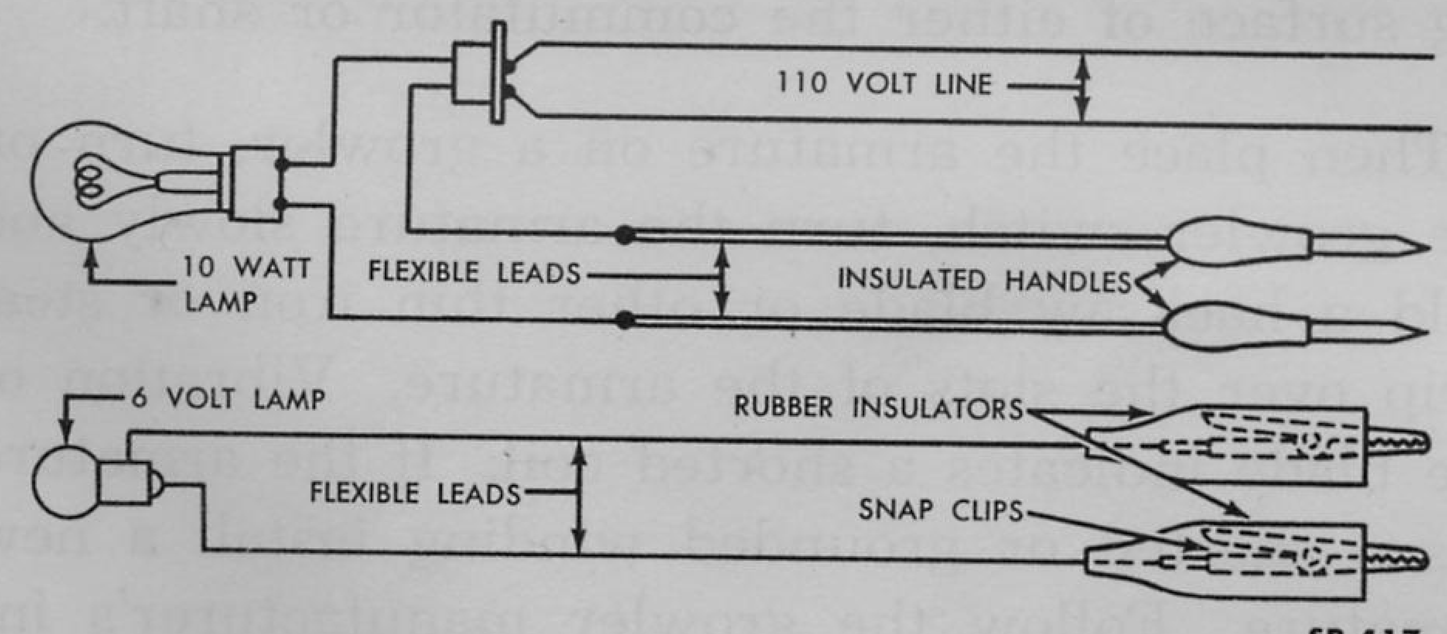


Fig. 389—110-Volt and 6-Volt Test Lights

equipment contain instructions regarding the use of voltmeters and other instruments for detecting resistance (particularly at bad terminal connections).

5. Generator Tests in the Car.

(a) *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 "A" or armature (output) 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.

(b) *"Motoring" Test.* A generator motoring test is sometimes made to determine that the generator is in operative condition. Loosen the 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 "A" or output (larger) terminal of the generator. If the generator "motors" over slowly it should be able to generate.

If it does not motor over, but a flash or spark is obtained at the "A" terminal, connect another jumper from the field terminal of the generator to ground and repeat the contact of the hot jumper with the "A" terminal. If the generator now motors over it should be able to generate and the trouble is likely to be in the regulator unit or wiring—which should establish the field to ground circuit which energizes the field. If tests indicate that the generator is out of order remove it for disassembly and test of components.

(c) *Checking Excessive Output.* If the generator delivers more amperes than the output specified on the nameplate or the voltage rises too high (which might burn out lights), disconnect from the field terminal of the generator, the cable that leads to the "F" terminal of the regulator. This should open the circuit from the field (which is internally connected to the hot or negative brush of the generator) through the regulator to ground and should, therefore, prevent current generation. If the generator delivers with this cable detached there is a ground in the field winding or lead to the field terminal, and the generator should be removed.

d. GENERATOR REPLACEMENT. Disconnect the cables or wires from the generator terminals. Remove the adjusting link bolt at the generator and the two bolts below the generator that attach it to the mounting bracket and lift the generator out. To install, reverse the removal operations and adjust the drive belt tension as directed under DRIVE BELT ADJUSTMENT. Before starting the engine assure correct generator polarity by using a jumper wire from the hot terminal of the solenoid switch to make an instantaneous flash contact with the generator "A" terminal.

e. GENERATOR OVERHAUL. A generator can be disassembled, the component parts cleaned and tested, and needed new parts installed to the extent covered in the following procedure with a very small investment in special tools. Among the items required are: test points connected with a low wattage 110-volt lamp, and a 6-volt test lamp with insulated leads and snap terminals (Fig. 389); a voltmeter reading 0-10 (Ignition and Lighting Voltmeter C-537); a commutator turning and undercutting tool (Armature Turning and Undercutting Tool C-770); and an inexpensive growler.

1. 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 armature or output 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 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 service station of the electrical equipment manufacturer or to a well equipped electrical equipment department for rebuilding.

2. Generator Disassembly (Figs. 386 and 387).

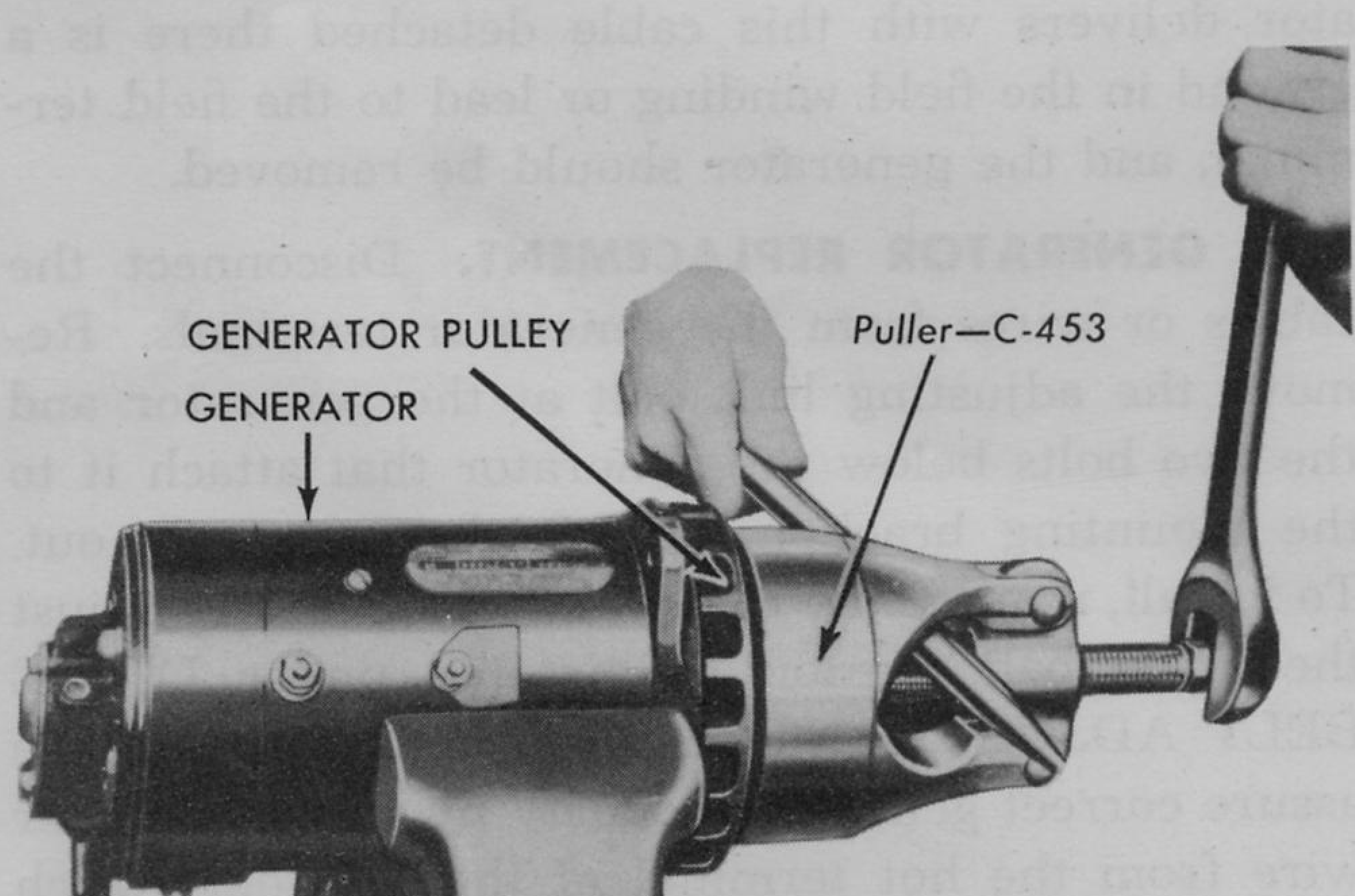


Fig. 390—Removing Generator Drive Pulley

Remove the drive pulley nut and the pulley with Generator Pulley Puller C-453, as illustrated in Fig. 390. Remove the two through bolts and remove the drive end plate and armature together. Remove the armature and then the bearing retainer and seal parts and the oil slinger. Remove the terminal screw from the ungrounded brush and detach the terminal of the lead that extends to the generator armature (output) terminal. Remove the brush holder end plate. Clean all parts and blow dry with compressed air. Do not dip or apply cleaning fluid to any winding, coil, or brush. Wipe these parts with a cloth dampened with suitable cleaning fluid, wipe dry or blow with air, or both.

(a) *Test Brush Holders.* Use test probes (Fig. 389), one point on the insulated holder and the other to the ground, on the end plate for possible grounded holder. Test the other holder to be sure it is grounded.

(b) *Test Armature.* Inspect for visible evidence of trouble, particularly the appearance of insulation of the 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 laminations. Do not use a test probe against a bearing surface of either the commutator or shaft.

Then place the armature on a growler, turn on the growler switch, turn the armature slowly and hold a hacksaw blade or other thin iron or steel strip over the slots of the armature. Vibration of the blade indicates a shorted coil. If the armature has a shorted or grounded winding install a new armature. Follow the growler manufacturer's instructions regarding meter check of armature windings.

(c) *Turning and Undercutting Commutator.* If the commutator is rough or worn turn it down, removing no more copper than necessary to clean up, using Armature Turning and Undercutting Tool C-770, (Fig. 391), or a suitable lathe. After turning a generator armature, undercut the mica between the bars $\frac{1}{32}$ inch, using Armature Turning and Undercutting Tool C-770 (Fig. 392). Be certain that the undercut is square and that there are no burrs. Polish the turned commutator with 00 or 000 **sandpaper** (never emery or carburundum) and blow away any loose sand and copper.

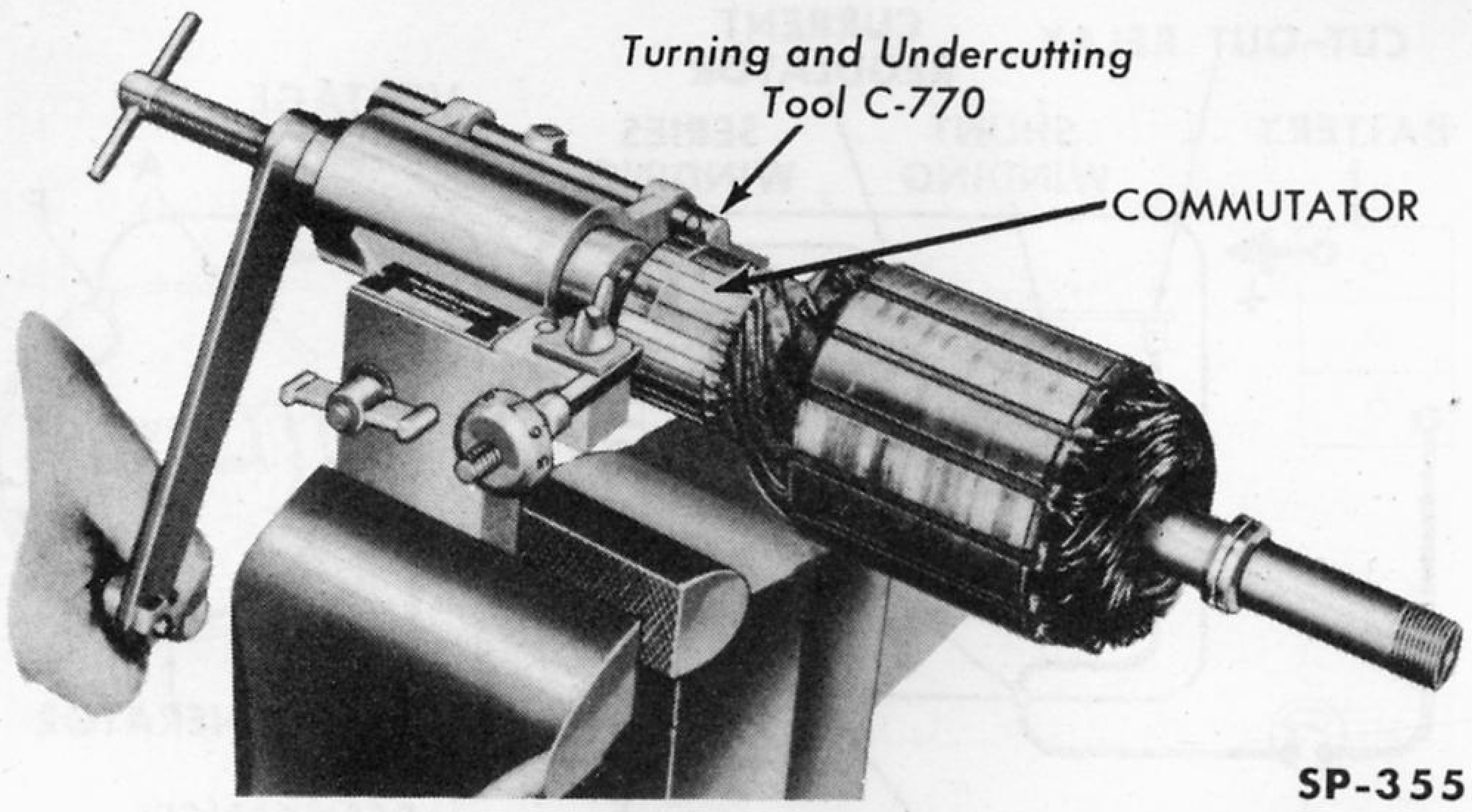


Fig. 391—Turning Generator Commutator

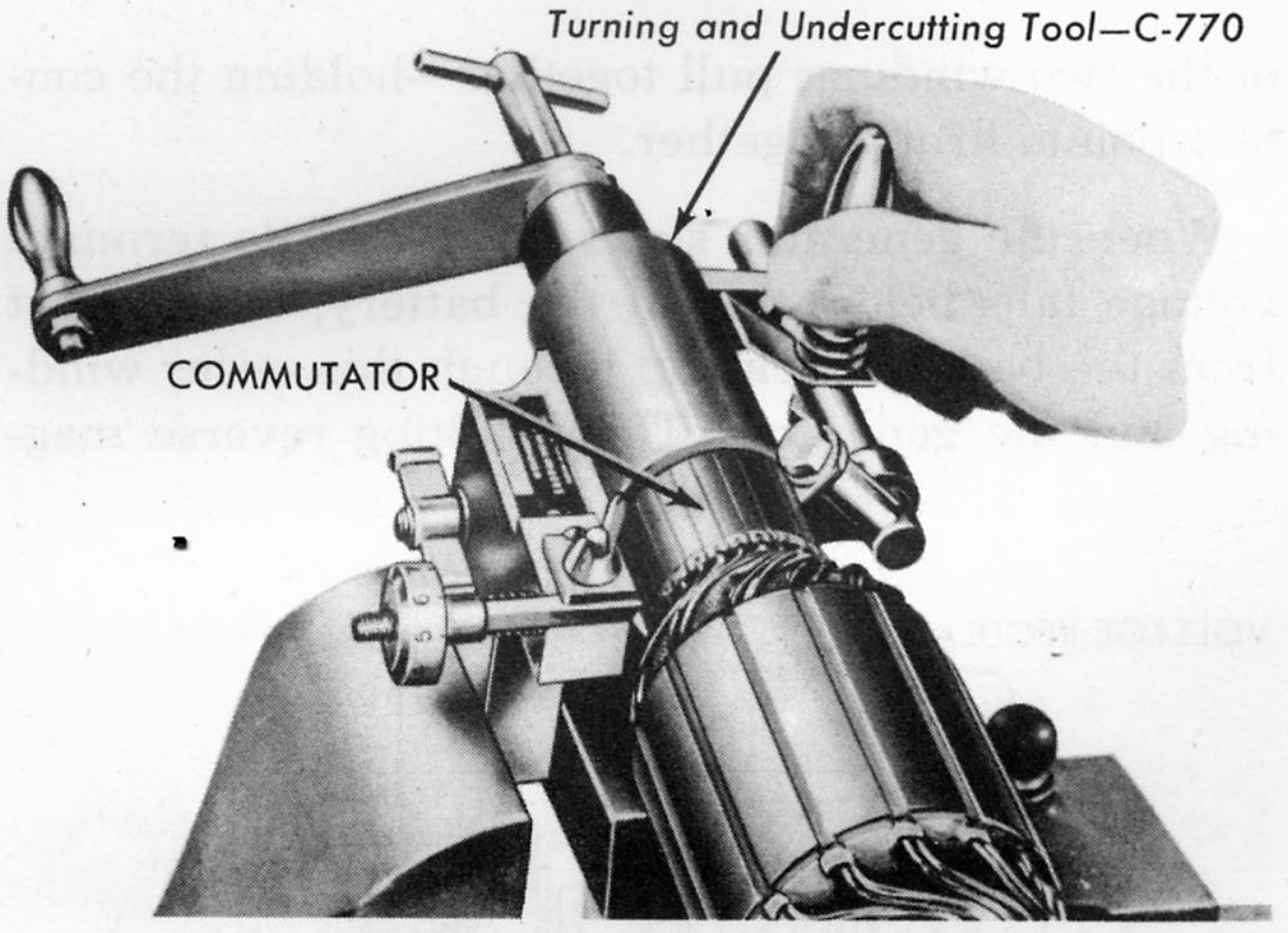


Fig. 392—Undercutting Generator Commutator

(d) *Bearings.* Clean the generator front bearing with suitable cleaning fluid. If no looseness is felt and if balls and races are smooth, bright, and unpitted, pack half full of heat-resistant bearing grease and reassemble the bearing and the slingers, oil seal and retainer parts in the end plate, with the armature. If the oil-impregnated bronze bearing in the rear (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.

3. Generator Assembly. Watch for the dowel holes to insure getting the end plates in proper position when assembling. Remove the brushes from their holders or guides if the brush-holder end plate is in place when the armature is inserted—or if the commutator end plate is put back with the armature in place. Install new brushes if the old brushes are worn to ½ inch long (or any generator overhauled to go into stock for future use for replacement). Fit brushes as instructed under GENERATOR INSPECTION AND MAINTENANCE, and check brush spring tension and brush contact with the commutator.

4. Generator Final Test. If a test bench is available, test the assembled generator as recommended in the instruction manual of the manufacturer of the test bench, 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.

f. GENERATOR VOLTAGE AND CURRENT REGULATOR. The generator regulator (Figs. 393 and 394) is mounted under the hood, on the left splash shield, immediately behind the battery. Location of the regulator in Kaiser models is similar to the Frazer which is shown in Fig. 395. In this regulator are three units, each having its own function.

1. Cut-Out Relay Operation. This unit, sometimes called a "Circuit Breaker" acts as an automatic switch to close the generator to battery circuit when the generator speed and resulting voltage are high enough to charge the battery. When the generator voltage is too low to charge the battery the

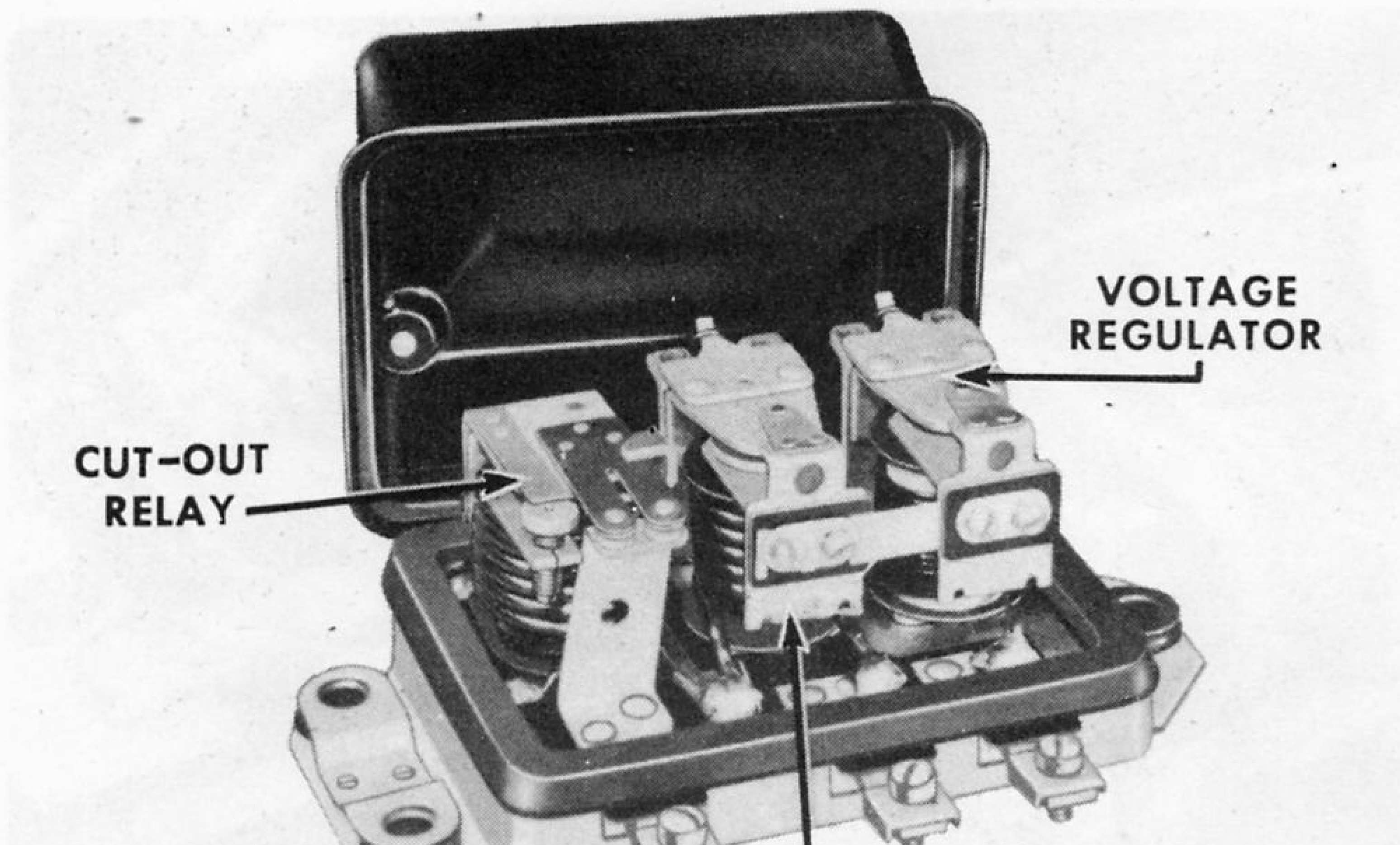


Fig. 393—Kaiser Generator Voltage and Current Regulator

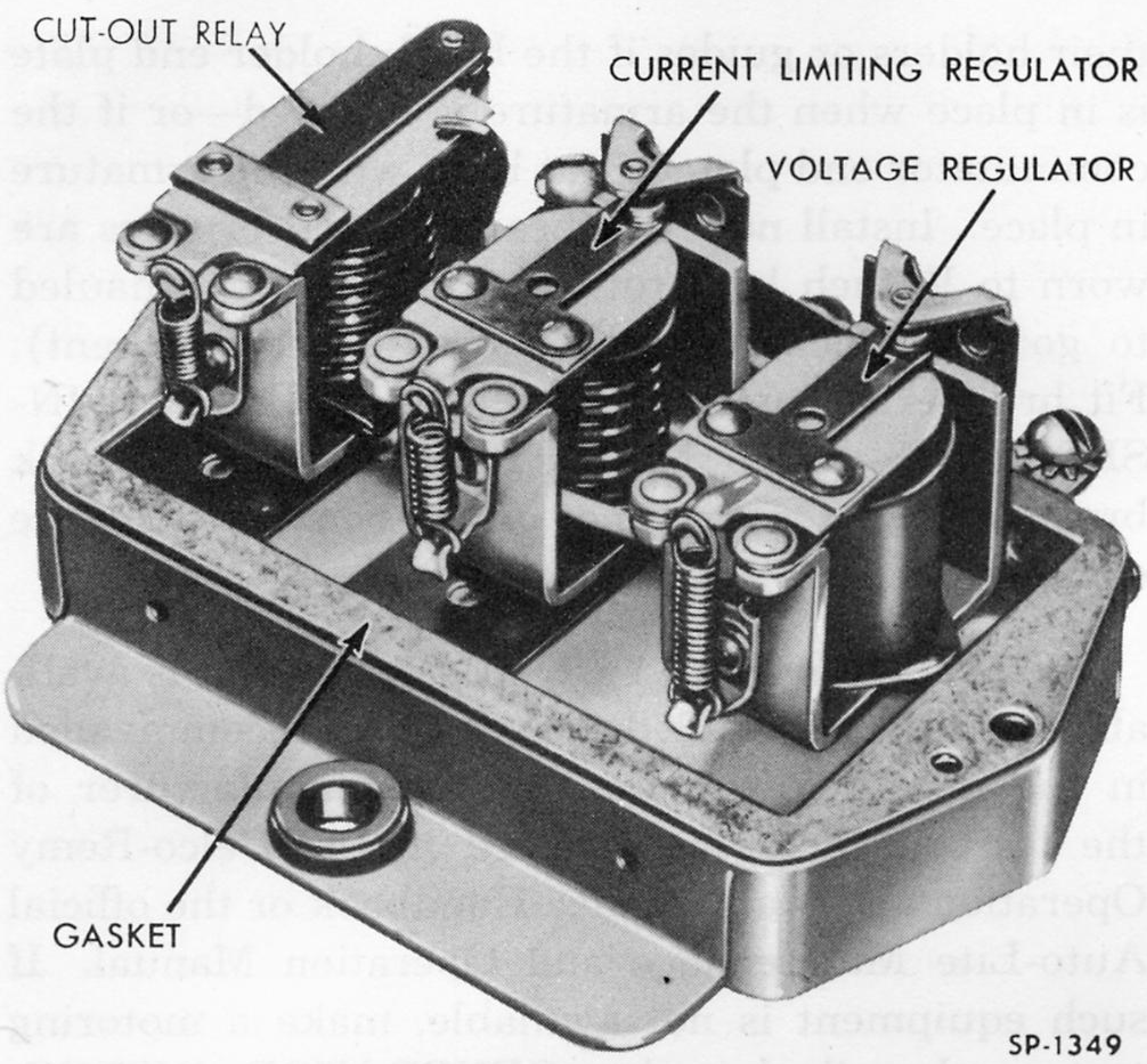


Fig. 394—Frazer Generator Voltage and Current Regulator

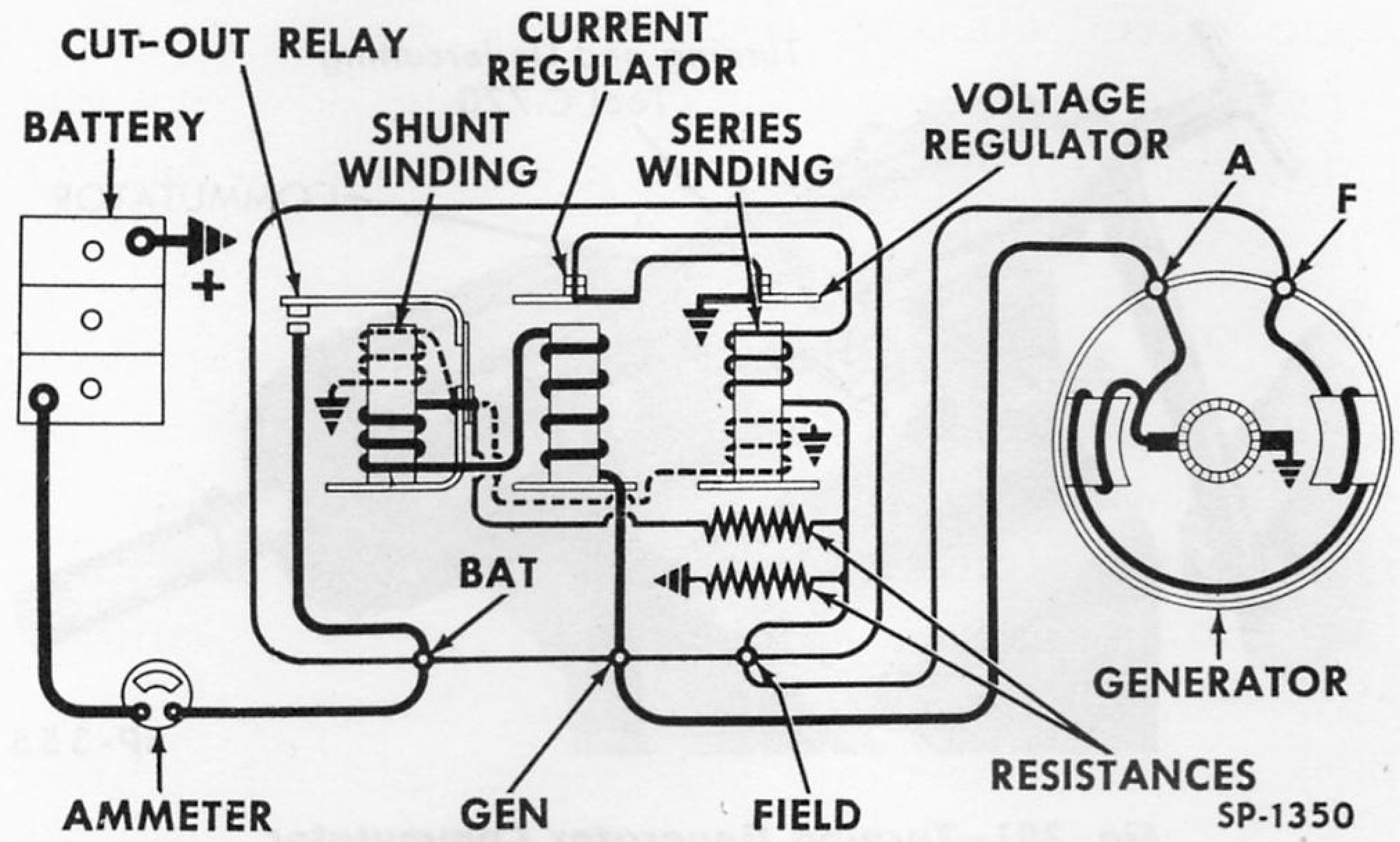


Fig. 396—Kaiser Generator Regulator Circuit Diagram

breaker opens, breaking the circuit to prevent the battery from discharging through the generator.

The cut-out relay contact points are held apart, or open, by a spring when the generator is not running. When the generator speed builds the generator 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. 396 or 397) pulls the armature, overcomes the spring tension and brings the contact points together. The points close the circuit through which current flows from the generator through the series (course) winding to the battery. The magnetic effects of the two windings pull together—holding the contact points firmly together.

When the generator slows down and its terminal voltage falls below that of the battery, the current from the battery backs up through this series winding and the generator. The resulting reverse mag-

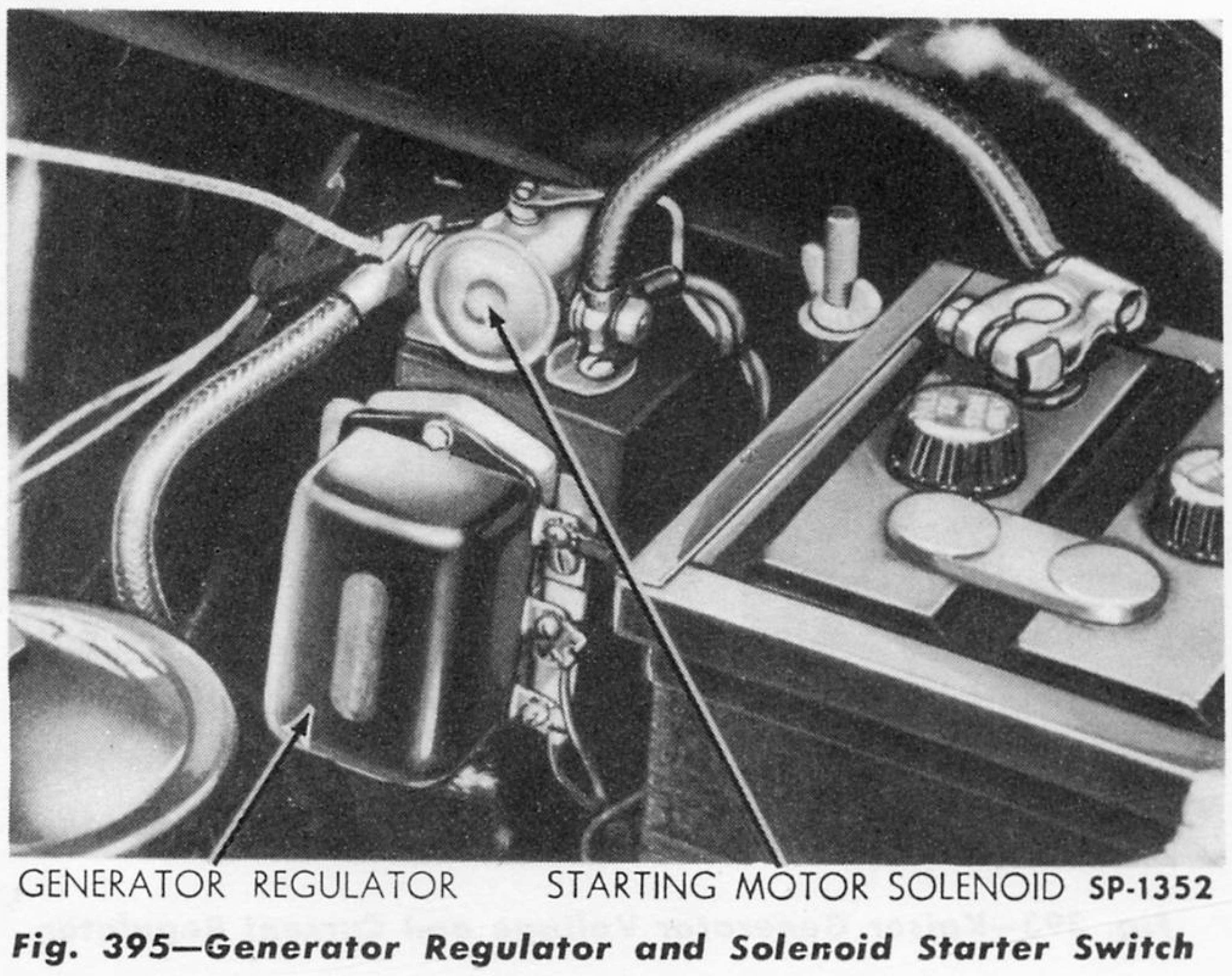


Fig. 395—Generator Regulator and Solenoid Starter Switch

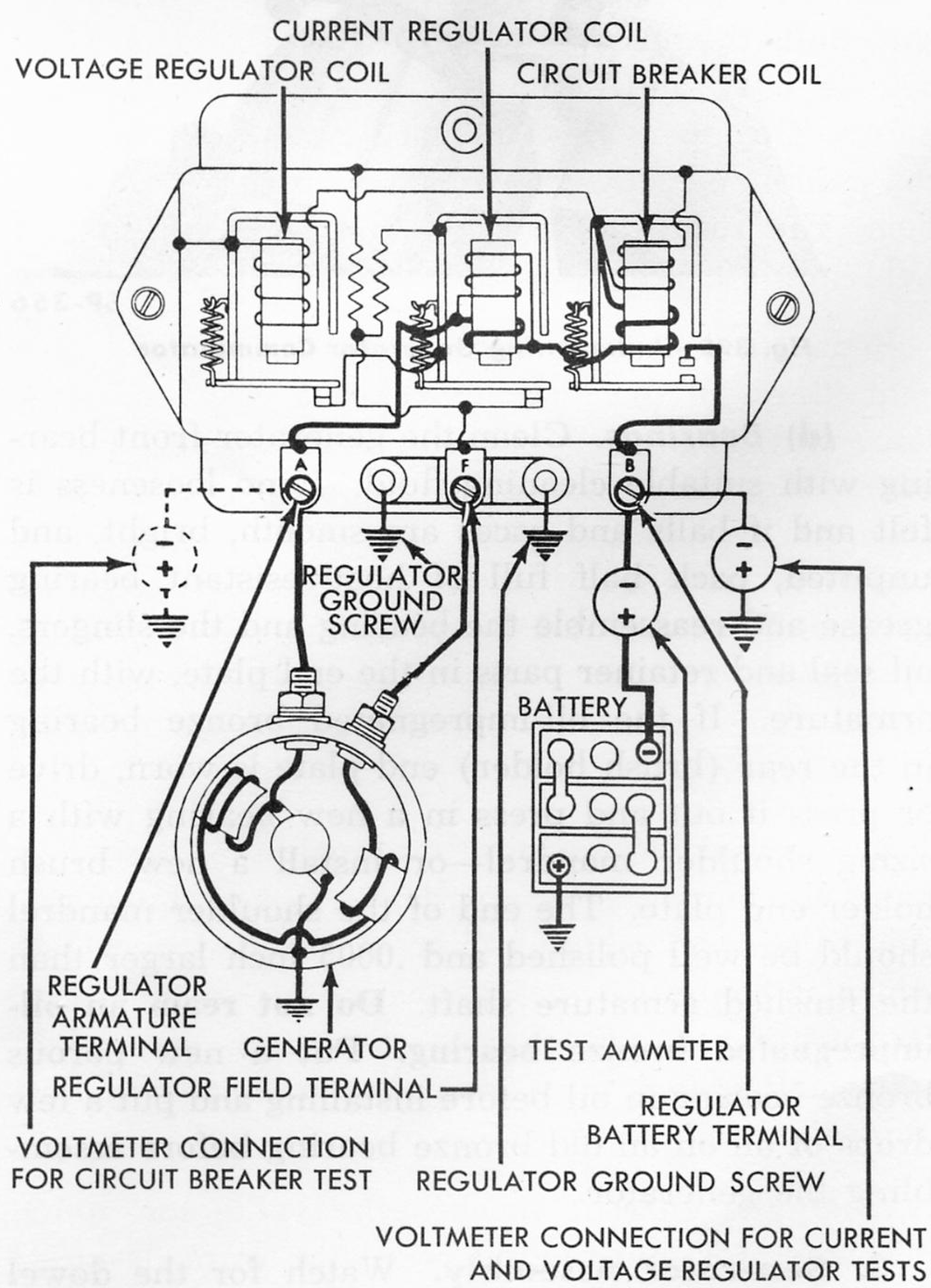


Fig. 397—Frazer Generator Regulator Circuit and Test Connections

netic effect opposes that of the shunt winding. When the generator terminal voltage falls to some point between 4.8 and 4.1 volts the spring separates the contact points.

2. Voltage Regulator Operation. This unit limits the generator voltage to prevent overcharging of the battery, burning out of lights or damage to electrical equipment and accessories. Proper charging voltage causes a high charging rate (limited, however, by the current regulator) when the battery has been partially discharged, as while cranking the engine. The charging rate tapers down as the battery comes up toward full charge. In fact, the low charging rate reached as the battery nears full charge indicates correct voltage regulator setting. Further, if the regulator and generator are in good order a continued high, instead of tapering, charging rate points to an unsatisfactory battery condition.

When the generator voltage reaches the value for which the regulator was designed, the magnetism caused by the winding or windings on the regular core pulls the armature against spring tension (Fig. 396 or 397) and separates the regulator contact points. This opens the low resistance circuit through the points and leaves a resistance in series with the field. The resulting reduction in field current and field strength reduces the generator voltage.

Reduced generator voltage causes reduced current through the winding of the voltage regulator unit. The spring is then able to pull the points back together, increasing the generator field strength. By vibrating, the voltage regulator points maintain an almost constant generator terminal voltage. However, if a heavy load tends to reduce the generator voltage (and to some extent the generator field strength) the voltage regulator may stop vibrating.

3. Current Regulator Operation. This unit limits the amperage or current output of the generator to a specified maximum to prevent overload, which if continued, would overheat the generator. Overheating would shorten generator life, might even melt solder, burn insulation and cause almost immediate failure.

When the current reaches the value for which the generator and mating regulator were designed the entire generated amperage, flowing through the coarse series winding of the current regulating unit (Fig. 396 or 397), creates a field of sufficient strength to pull the armature against the spring tension and separate the contact points. This opens the low resistance circuit between the generator field and ground and leaves a second, higher, resistance in series with the field, reducing field strength and therefore generator output.

The reduced output amperage, flowing through the current limiting coil series winding, becomes insufficient to hold the contact points apart. The spring brings them back into contact, supplying, again, increased field current. These points vibrate so rapidly that the output remains almost constant, at the value for which the current regulator is designed and adjusted.

4. Temperature Compensation. By the use of such features as the heat-sensitive nickel alloy magnetic by-pass, or heat sensitive bi-metallic hinge elements, regulators are so compensated that the generator delivers higher output when cold than when warmed up to normal operating temperature. The details of such compensation are explained in the shop manuals of the manufacturers of the electrical units.

Temperature compensation provides the advantage of a higher charging rate while the equipment is still cold, to replace more quickly battery energy that has been used in starting a cold engine. Such compensation makes it important to warm up the generator and regulator to normal running temperature before checking or adjusting generator output.

g. REGULATOR TESTS

1. General Information. The manufacturer, under the term of the warranty, 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. The Auto-Lite regulators used on Frazer models are provided with lead cover seals, the breaking of which voids the warranty.

After expiration of the warranty period regulators can be repaired at the approved service station of the manufacturer. However, certain tests and simple adjustments can be made, and contact points can be inspected and dressed, with the regulator in place on the car—by a mechanic who knows how. Most adjustments can be made more easily at the test bench. Follow carefully 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. To mis-match units invites serious trouble.

2. Quick Checks of Regulator and Generator Performance. Before checking these units check the battery and battery cable terminals. If the generator does not "charge," inspect the terminals of the wires or cables that connect the generator and regulator. The manuals for bench test equipment contain instructions regarding the use of instruments and the test probes and test lamps illustrated in Fig. 389 for detecting excessive resistance, for testing circuit continuity and for finding grounded circuits.

Analysis of complaints may indicate or suggest any of the following basic conditions:

(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 with Fully Charged Battery. This results from failure of the regulator to reduce generator output as it should. 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 regular field "F" 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 Charging Rate or No Charging. 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 "F" 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 CAR.

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) Too low voltage or current regulator setting.

(2) Oxidized regulator contact points, which cause excessive resistance in the generator field circuit, causing low output.

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

(e) Burned Resistances, Windings or Contacts. The causes may be open circuit operation or high resistance in the charging circuit. Whenever burned resistances, windings or contacts are found check the car wiring carefully before installing another regulator.

(f) Burned Relay Contacts. This might be due to reversed generator polarity. After any check or work on the generator or regulator establish correct polarity as explained under GENERATOR REPLACEMENT.

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 to attempt any adjustments.

3. Regulator Inspection. The following applies particularly to regulators which simple tests have shown not to satisfy performance specifications. Remove the cover carefully to avoid contact between the cover and inside parts. If the regulator is off the car be careful not to damage the carbon or wire resistors. Make close visual inspection for the following:

(a) Loose connections—such as might result from poor soldering.

(b) Evidence of burning or of abnormally high temperatures at coil windings, contacts, insulation, external terminals, etc.

(c) Loose nuts, screws or rivets or absence of lock washers at nuts and screws.

(d) Loose contacts.

(e) Misalignment of contacts.

(f) Armature stop interfering with proper movement of cut-out relay armature.

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

(h) Field yoke bent.

(i) Armature hinges bent or distorted.

(j) Damaged, incorrect, or insecurely attached resistors.

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

(l) Corrosion due to salt or acid.

(m) Evidence of water having been inside the cover.

(n) Broken, ineffective or missing gasket or bad cover fit.

h. REGULATOR ADJUSTMENTS. Make **mechanical** checks and adjustments only with the battery disconnected, preferably with the regulator removed from the car. **Electrical** checks and adjustments can be made with the regulator either on the car, or off: Before checking regulator operation, run the engine, or test bench generator, to warm the regulator. If necessary, turn on lamps or accessories (or connect a suitable additional load) to cause the generator to deliver through the regulator a current of 15 amperes for 15 minutes. When checking settings, or adjusting, have the warm regulator in the same position as on the car. **Recheck all adjustments with the cover in place.**

Because of slight internal differences and the resulting necessary differences in adjustment procedures and setting specifications, the Kaiser generator regulator adjustments are covered separately from the corresponding Frazer adjustments in the following procedures. For information on the Auto-Lite regulator used on some Kaiser vehicles use the instructions and procedures applying to Frazer models.

Information that applies equally to the Kaiser unit (Delco-Remy model 1118302) and to the comparable Frazer units (Auto-Lite models GDZ-4818A, 35 ampere; and GGU-6001B, 45 ampere) has been supplied in previous paragraphs of this Section. The general information supplied includes the functions of the three component units of the regulator, quick checks of performance, visual inspection and instructions for warming up the generator and regulator before checking or adjusting.

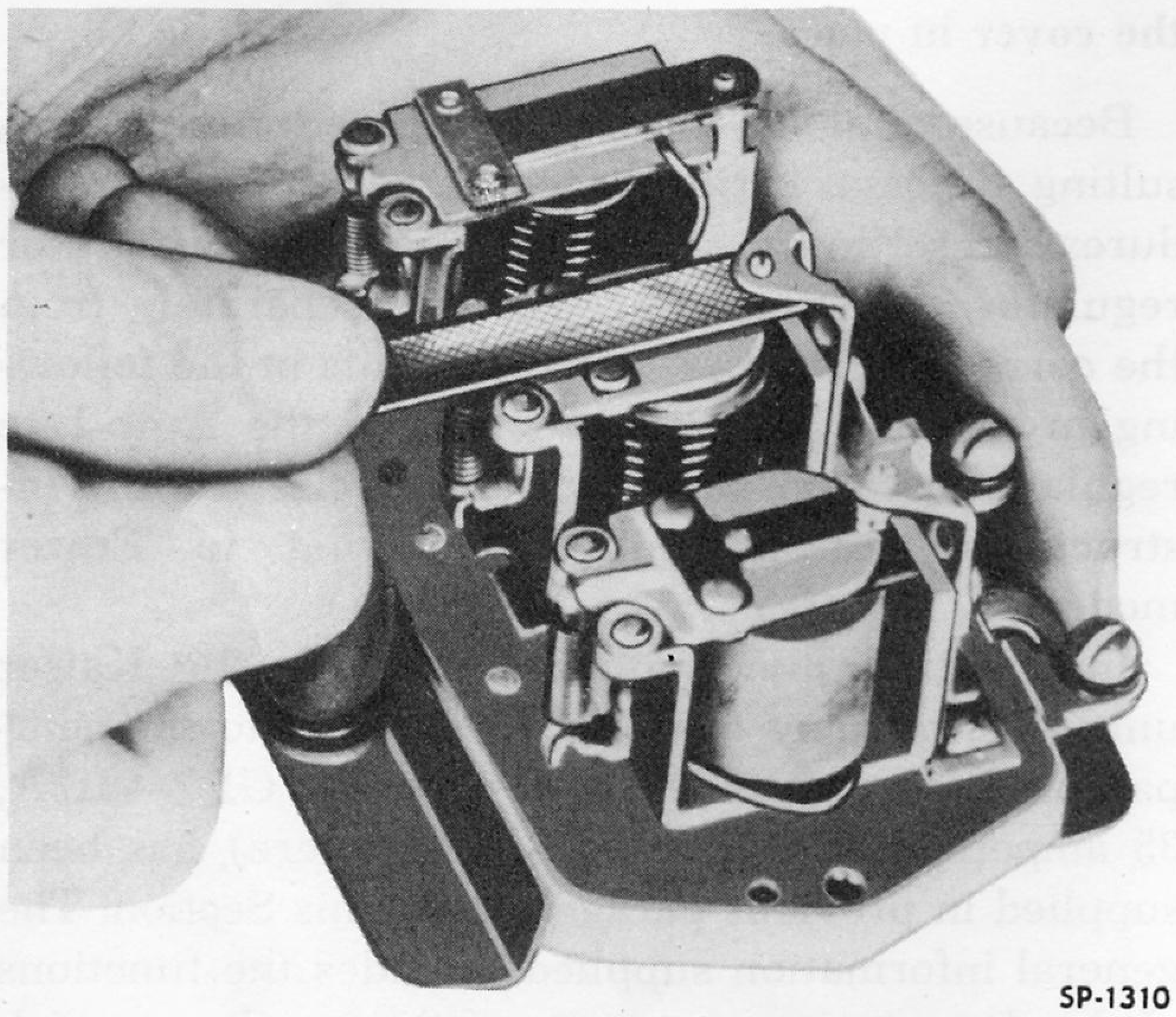
1. Kaiser Generator Regulator Adjustment.

The following paragraphs deal in detail with checking, adjusting, and repairing the Kaiser regulator.

(a) Contact Points. The special contact points of the regulator may not operate indefinitely without some attention. However, under normal service the points should not be disturbed or adjusted as long as external tests indicate that the regulator performance satisfies specifications. Often they require no attention through the life of the vehicle.

Practically all regulator trouble, if detected promptly, can be eliminated by simple cleaning of the points (if they need it) and readjustment. Dirty, oil or oxidized contact points arc or burn, reducing, or preventing generator output.

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 or dirty, or rough, dress them with a thin, fine-cut ignition point file (Fig. 398), or an abrasive contact point dresser (never with sandpaper, or with carburundum 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.

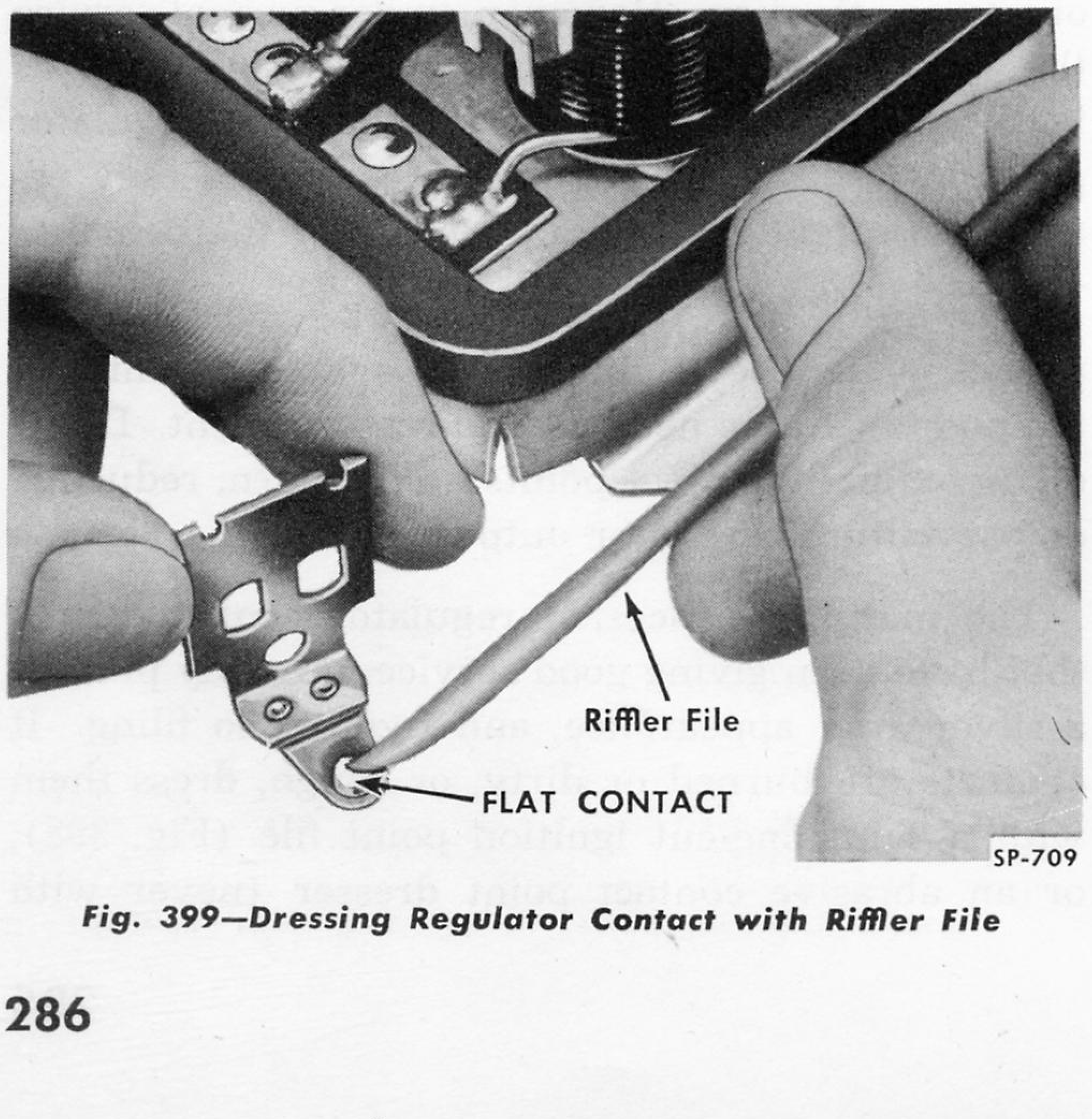


SP-1310

Fig. 398—Dressing Regulator Contacts with Fine File

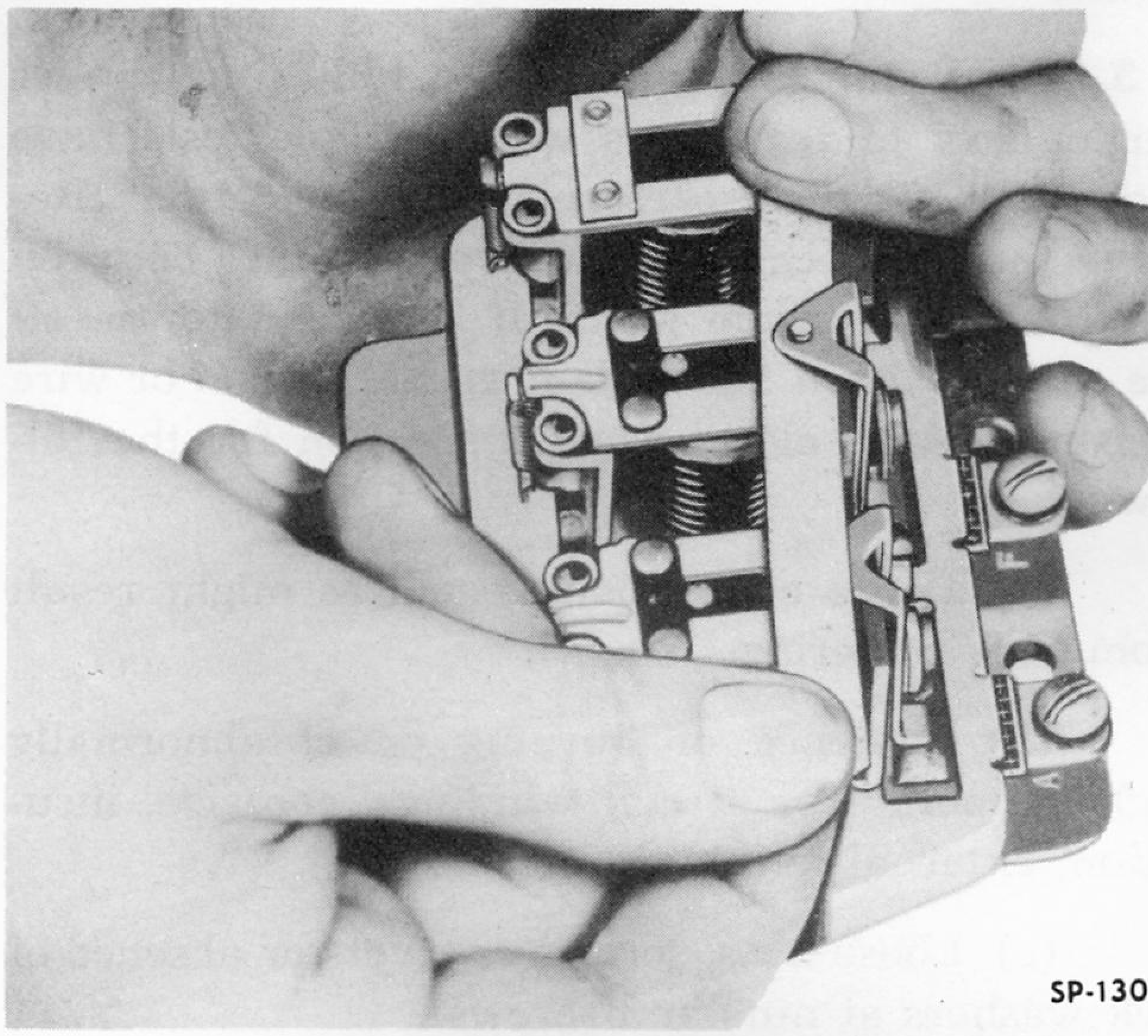
To clean any depression in a flat contact use a "riffler" or spoon file (Fig. 399). It may be necessary to loosen and move, or to remove, a bracket to permit easy, proper cleaning of a depression in a point that was originally flat.

After filing, draw between the points a piece of linen tape (Fig. 400) moistened with carbon tetrachloride, then a dry tape, to leave them dry as well as clean.



SP-709

Fig. 399—Dressing Regulator Contact with Riffler File



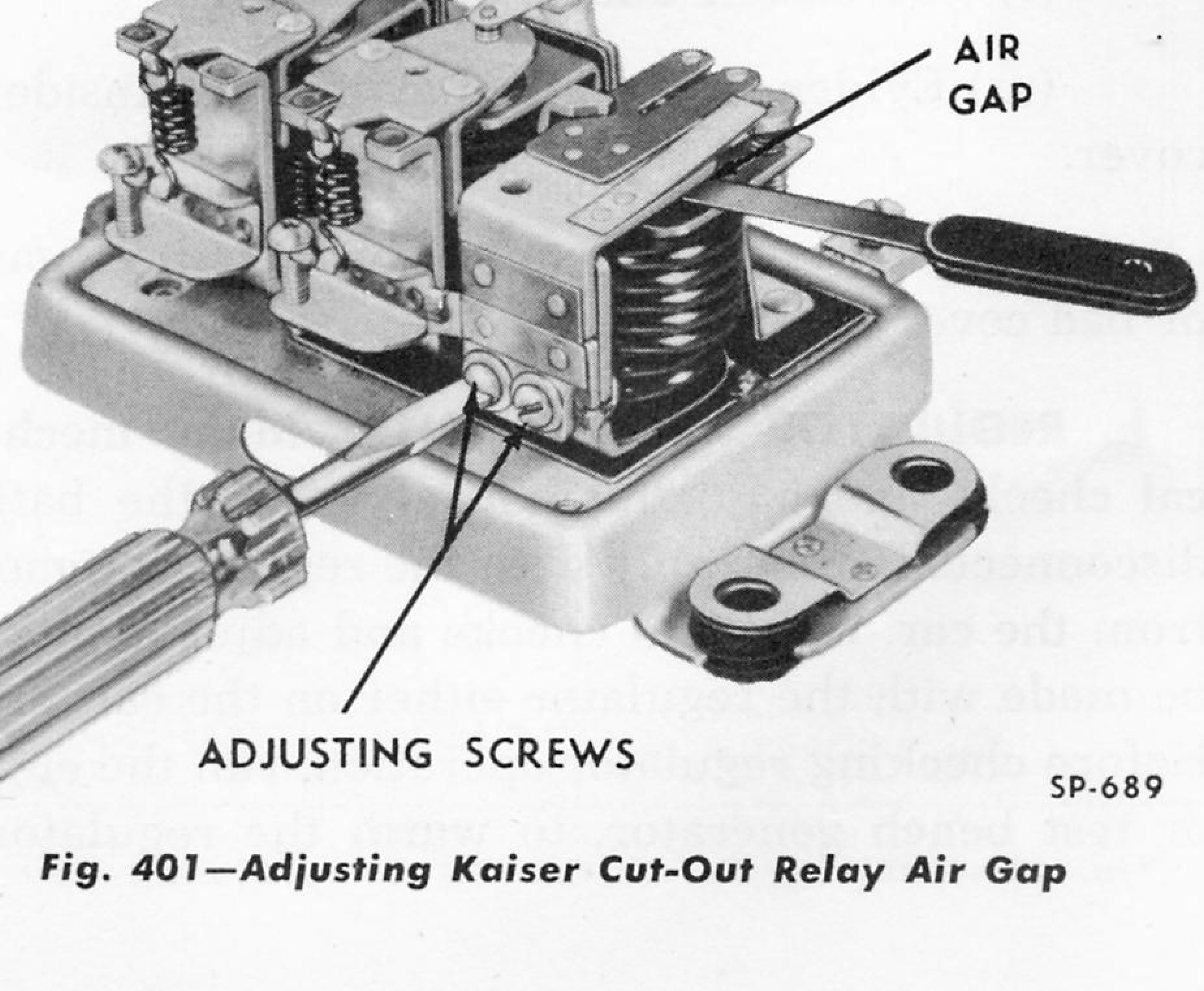
SP-1309

Fig. 400—Cleaning Regulator Contacts with Linen Tape

(b) *Kaiser Cut-out Relay.* This relay or circuit breaker requires three checks or adjustments:

(1) Air Gap. To check, apply finger pressure to the the top of the armature, immediately above the core. Move the armature down only enough to cause point contact. Make certain that both pairs contact at the same time. If necessary bend one spring. **Never close these relay points by hand with the battery connected.** With these points just contacting, measure the air gap (Fig. 401) with a feeler gauge. The gap should be .020 inch.

To adjust, loosen two screws, as shown, and raise



SP-689

Fig. 401—Adjusting Kaiser Cut-Out Relay Air Gap

or lower the armature as required. Recheck the gap after tightening the screws.

(2) Point Opening. The gap between the free contacts should be .020 inch. Adjust by bending the upper armature stop (Fig. 402).

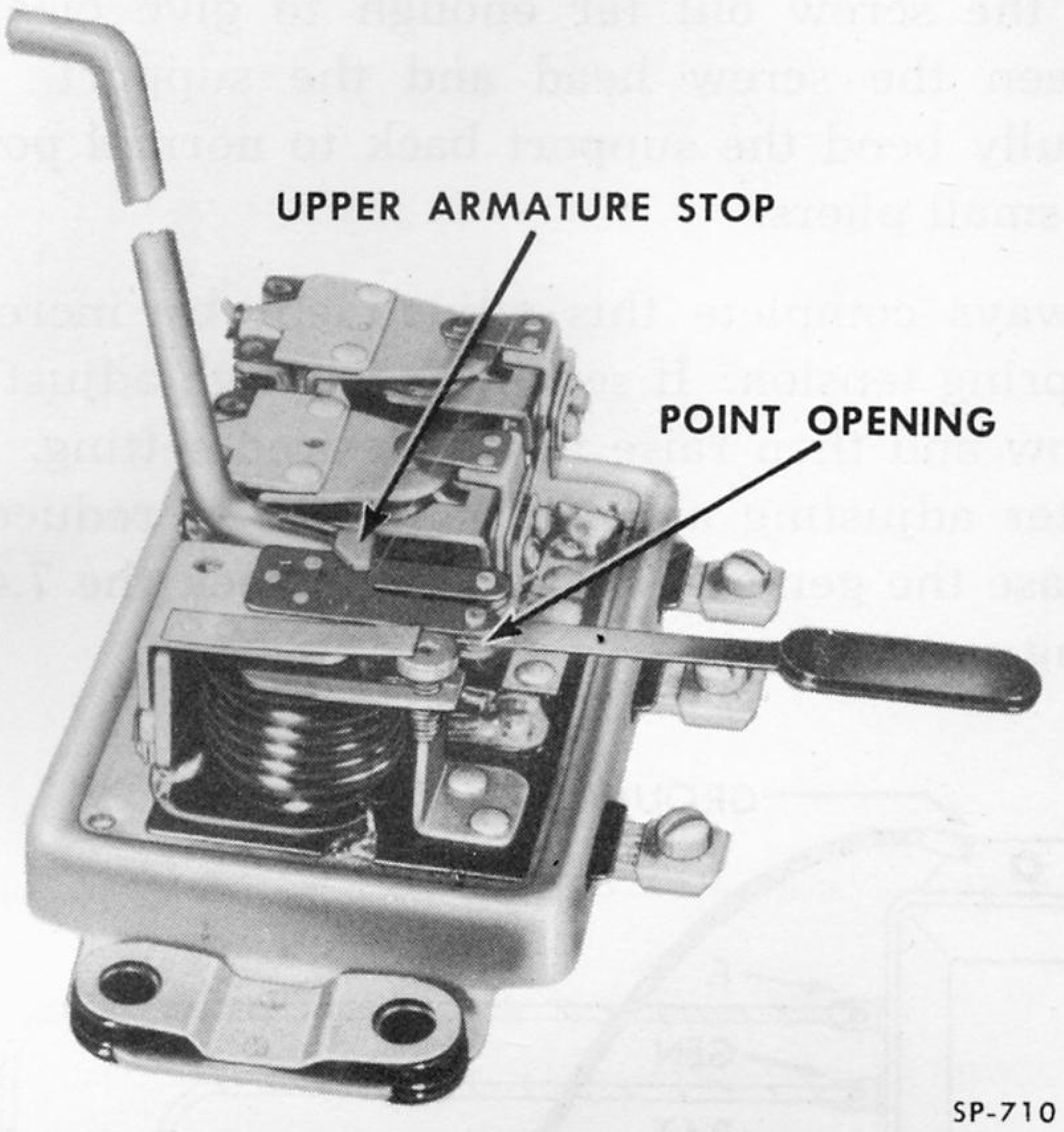


Fig. 402—Adjusting Kaiser Cut-Out Relay Contact Point Gap

(3) Closing Voltage. To check, connect a voltmeter, (0-10 reading) as shown in Fig. 403 between the GEN terminal and the regulator base. Slowly increase the generator speed while watching the voltmeter. Closing should be between 5.9 and 6.8 volts. If below or above these limits, adjust to

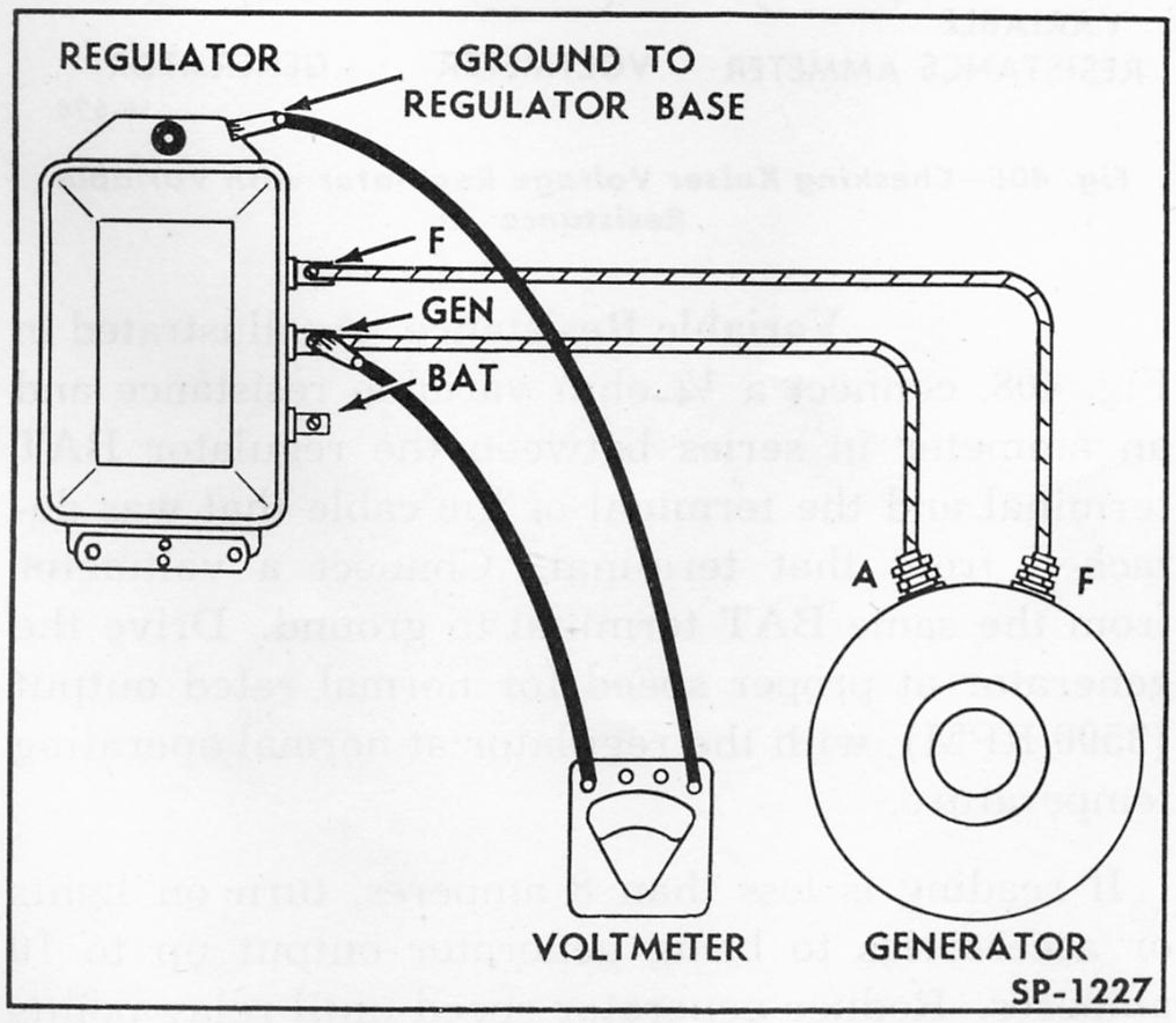


Fig. 403—Checking Kaiser Cut-Out Relay Closing Voltage

cut in at 6.4 volts by turning the closing voltage adjusting screw (Fig. 404). Clockwise turning raises the closing voltage.

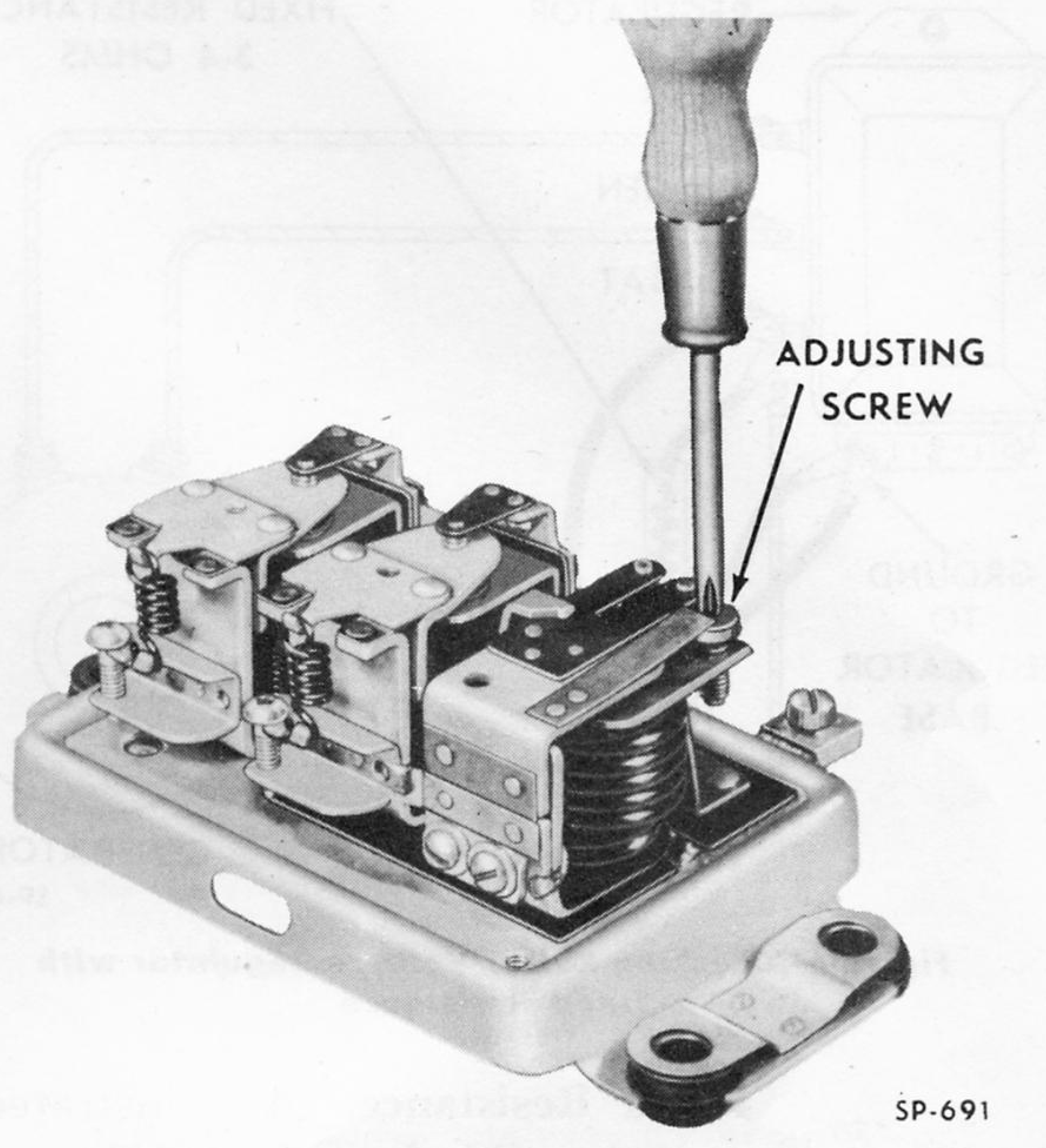


Fig. 404—Adjusting Kaiser Cut-Out Relay Closing Voltage

(c) *Kaiser Voltage Regulator.* The unit requires two checks or adjustments:

(1) Relay Air Gap. To check, push the armature down to the core and release until the contact points just touch. Then measure the air gap (Fig. 405). The gap should be .075 inch. To adjust loosen the contact mounting screws and move the mounting as required. Recheck after tightening the screws.

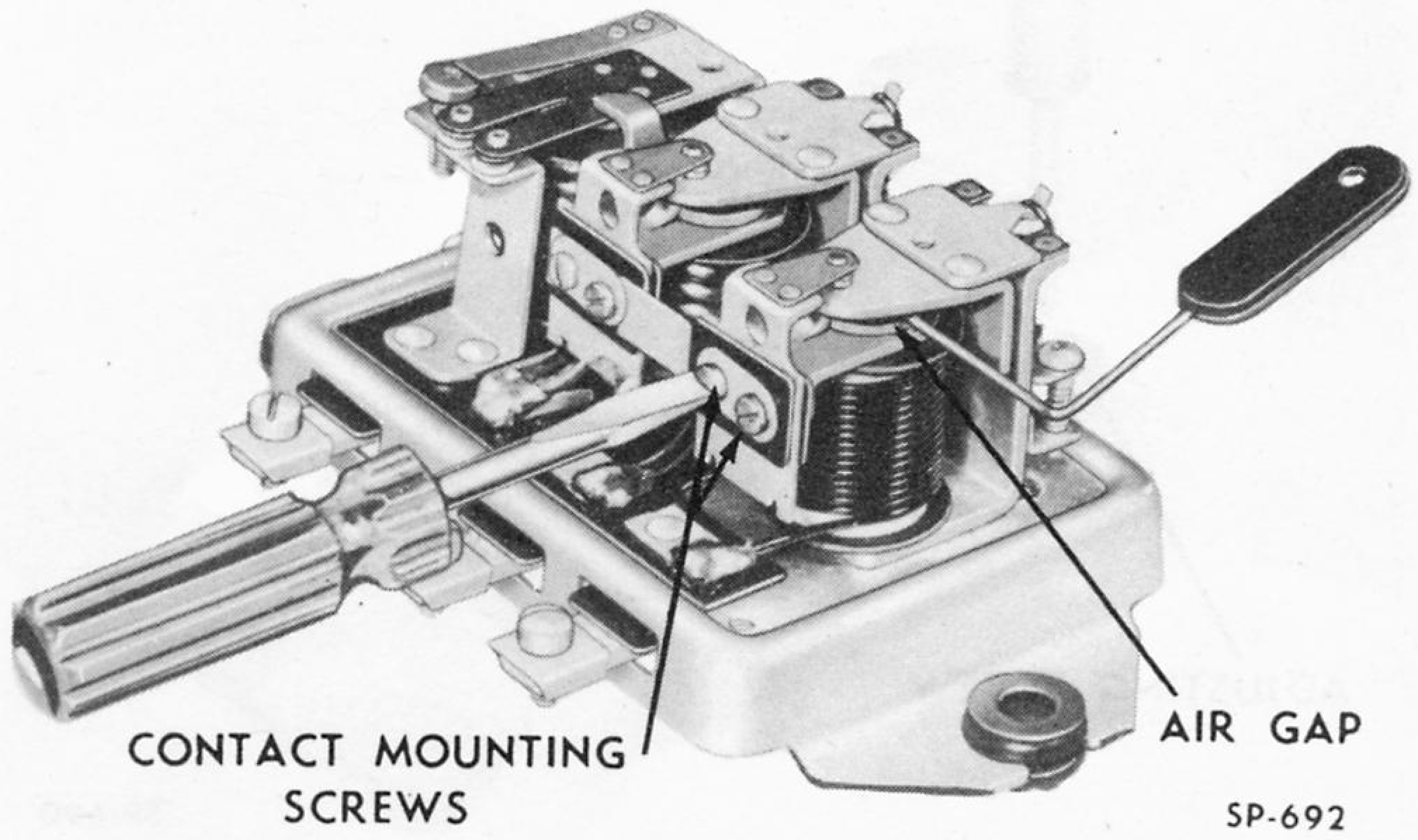


Fig. 405—Adjusting Kaiser Voltage Regulator Air Gap

(2) Relay Voltage Setting. There are two methods of checking the voltage setting:

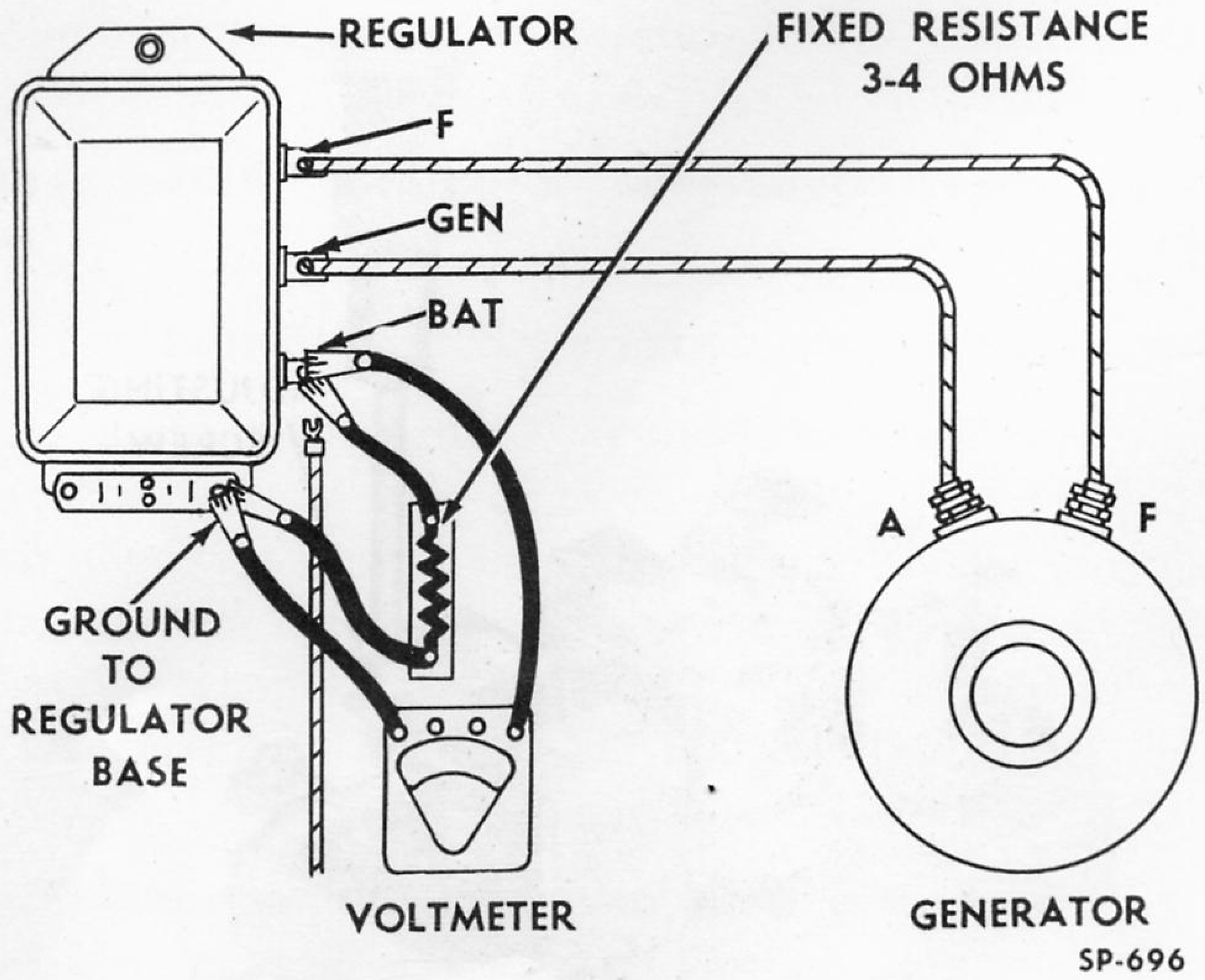


Fig. 406—Checking Kaiser Voltage Regulator with Fixed Resistance

Fixed Resistance. As illustrated in Fig. 406, disconnect the cable from the BAT terminal of the regulator. Protect the cable terminal to assure against contact with ground. Connect a voltmeter and, in parallel, a fixed resistance between the BAT terminal and ground. The resistance must be ¾ ohm, and capable of carrying 10 amperes without resistance change due to heating. Drive the generator at proper speed for normal rated output (3500 RPM), with the regulator at normal operating temperature and cover in place. Voltage should be between 7.0 and 7.7 volts. If below or above these

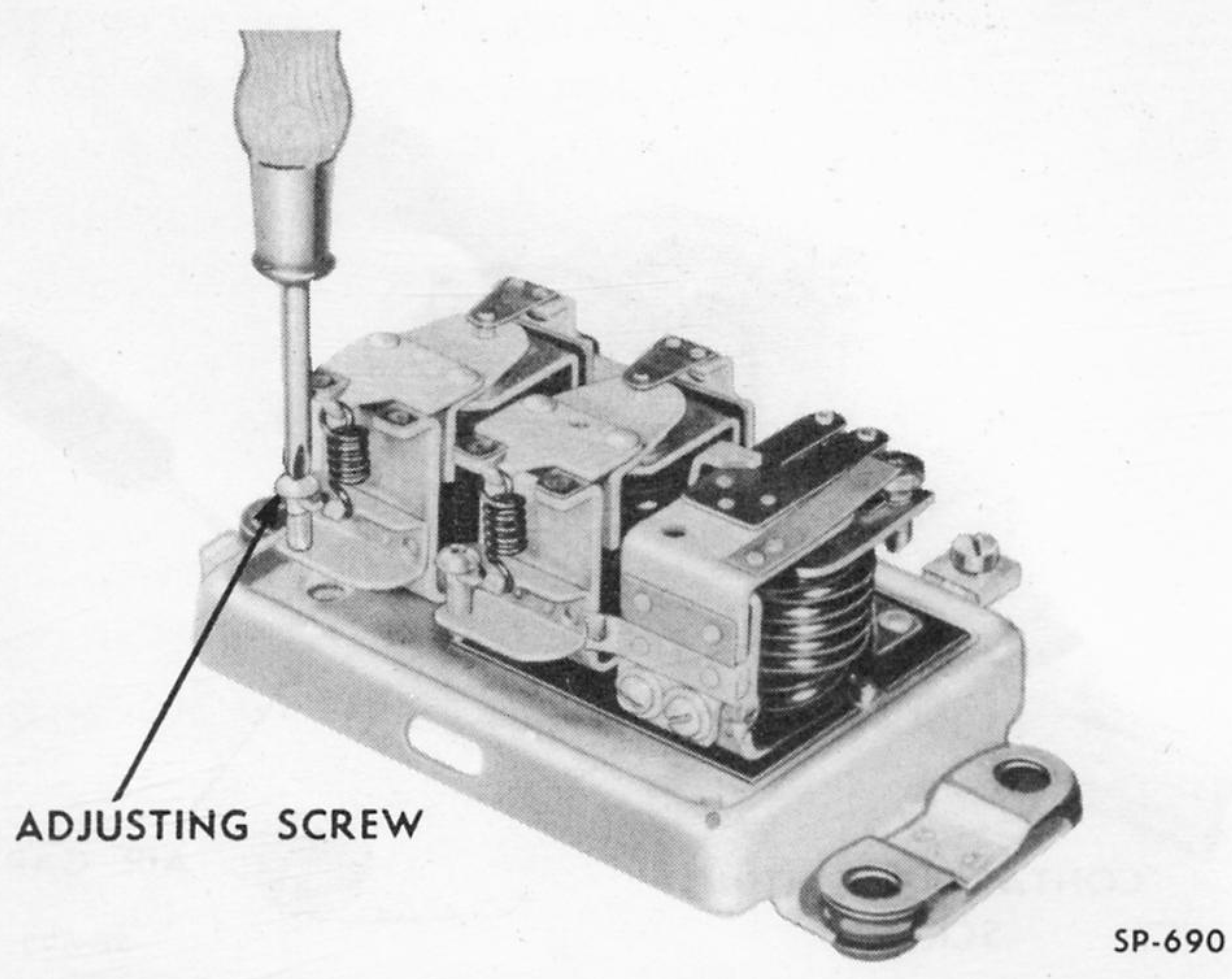


Fig. 407—Adjusting Kaiser Voltage Regulator Voltage

limits turn adjusting screw (Fig. 407) to 7.4 volt setting. Clockwise turning raises the voltage. After each adjustment check with cover installed.

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

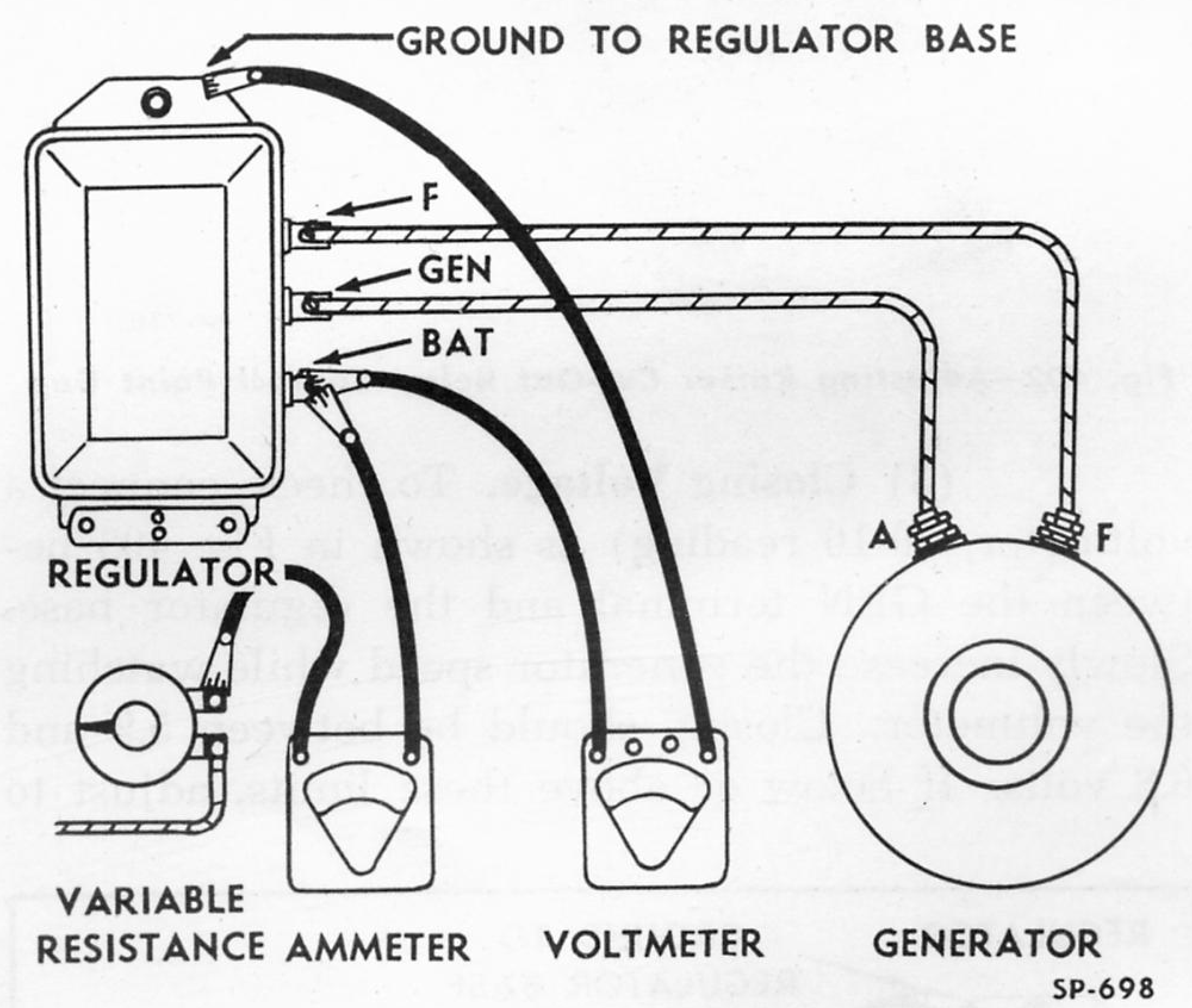


Fig. 408—Checking Kaiser Voltage Regulator with Variable Resistance

Variable Resistance. As illustrated in Fig. 408, connect a ¼ ohm variable resistance and an ammeter in series between the regulator BAT terminal and the terminal of the cable that was detached from that terminal. Connect a voltmeter from the same BAT terminal to ground. Drive the generator at proper speed for normal rated output (3500 RPM), with the regulator at normal operating temperature.

If reading is less than 8 amperes, turn on lights or accessories to bring generator output up to 10 amperes. Reduce generator speed until relay points open. Then watch the voltage while bringing the generator up to specified charging speed, with cover in position. Adjust the regulator spring tension as directed under FIXED RESISTANCE above.

(d) *Kaiser Current Regulator.* This unit requires two checks or adjustments:

(1) Air Gap. Check and adjust as directed under KAISER VOLTAGE REGULATOR RELAY AIR GAP to the same setting, .075 inch.

(2) Current Setting. Connect the ammeter (0-50 or 60 reading) as illustrated in Fig. 409, from the regulator BAT terminal to the terminal of the cable detached from that regulator terminal. Bridge the voltage regulator, as shown, with a

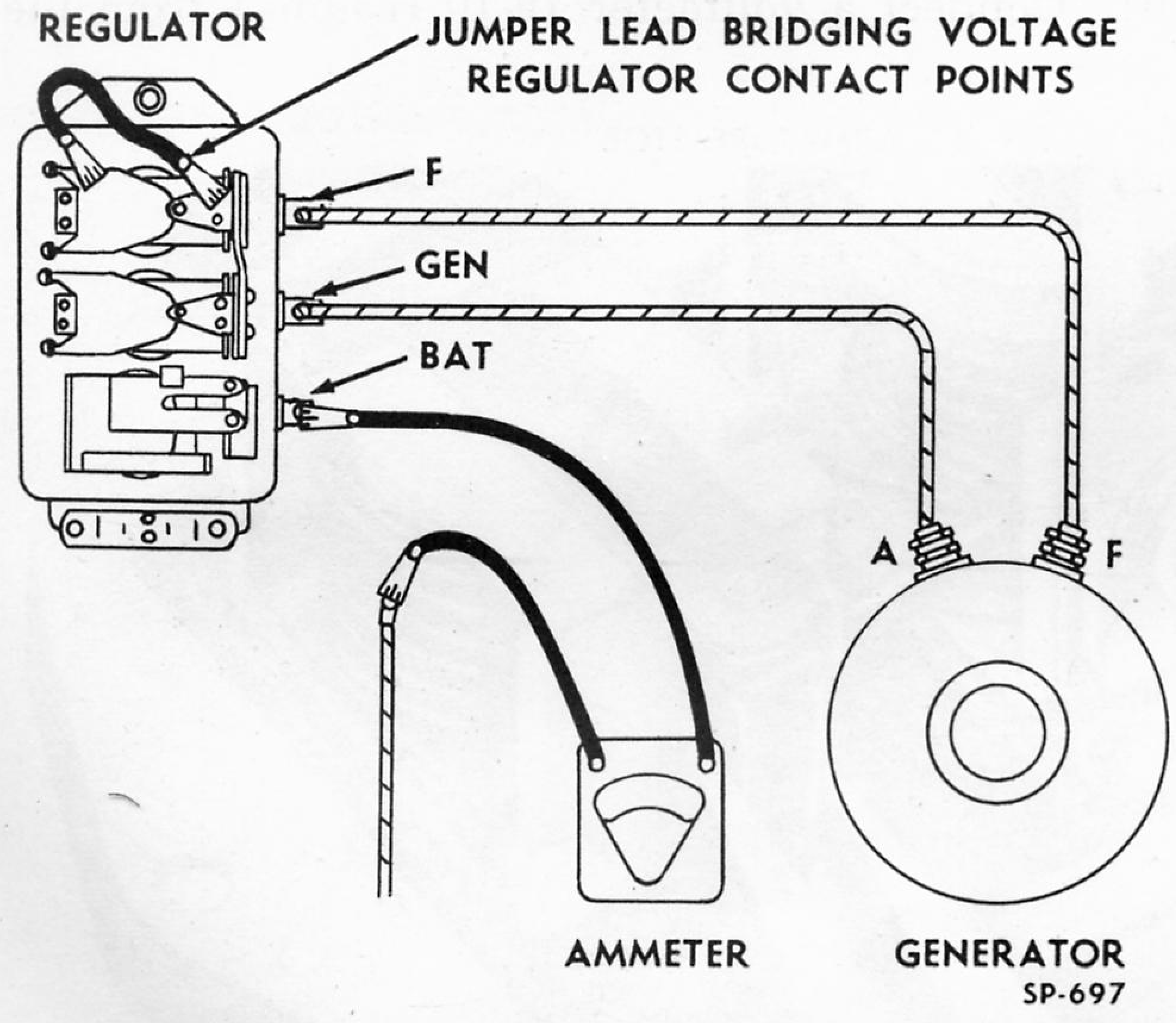


Fig. 409—Checking Kaiser Current Regulator Setting

jumper from the upper contact point support to the armature, to prevent voltage regulator operation during the check of the current regulator.

Turn on lights and accessories to prevent high voltage during the test. With the regulator at operating temperature, increase the generator speed gradually until the current reading becomes constant. The setting should be between 32 and 40 amperes, 36 amperes preferred.

Turn the adjusting screw clockwise to increase output. If the spring support becomes bent from turning the adjusting screw too far, follow the corrective procedure given under FIXED RESISTANCE above, one of the methods of setting voltage regulator voltage.

(e) *Kaiser Regulator Specifications.* For the electrical equipment specialist who may desire more complete specifications and test data, tabular specifications for both Kaiser and Frazer Generator Regulators are supplied later in this Section under GENERATOR REGULATOR SPECIFICATIONS.

2. Frazer Generator Regulator Adjustment.

The following paragraphs deal in detail with checking, adjusting and repairing Frazer regulators.

(a) *Contact Points.* Before attempting any checks or adjustments, examine the mating surfaces of the sets of contact points. Dress or clean the points only if necessary. Follow the instructions under CONTACT POINTS under the general heading KAISER GENERATOR REGULATOR ADJUSTMENT.

(b) *Frazer Regulator Test Connections.* Fig. 397 illustrates diagramatically the circuits and instrument connections for checking Frazer regulators. Disconnect the cable from the regulator B or BAT terminal and connect an ammeter (reading up to 50 or 60 amperes) as shown. Connect a voltmeter (reading up to 10 volts) as shown.

(c) *Frazer Cut-out Relay.* There are three adjustments:

(1) Armature Air Gap. Measured close to the hinge (Fig. 410) with the pin gauge of Generator Regulator Tool Kit C-828, this gap should be between .031 and .034 inch, with the armature against its stop. Adjust by bending the armature stop. Be certain there is no interference between the edge of the armature and the stop.

(2) Closing Voltage. The closing or cut-in voltage is controlled by the tension of the armature spring. To secure the specified value, 6.4 to 6.6 volts, bend the spring bracket with the bending tool from Generator Regulator Tool Kit C-828, as illustrated in Fig. 411. Increased tension raises the cut-in voltage. The contact point gap affects the cut-out voltage and reverse current.

(3) Relay Contact Point Gap. These contact points should be properly aligned and the gap should not be less than .015 inch. Adjust by expanding or contracting the stationery bridge, as illustrated in Fig. 412. Increasing the contact point gap lowers the opening voltage and raises the point opening reverse current. Proper opening voltage is

4.8 to 5.6 volts, with a reverse current of 4 to 6 amperes.

(d) *Frazer Voltage Regulator.* To check the setting and adjust:

(1) Test Connections. Connect a voltmeter (0-10 reading) from the B or BAT terminal of the regulator (Fig. 397) to the regulator frame (ground).

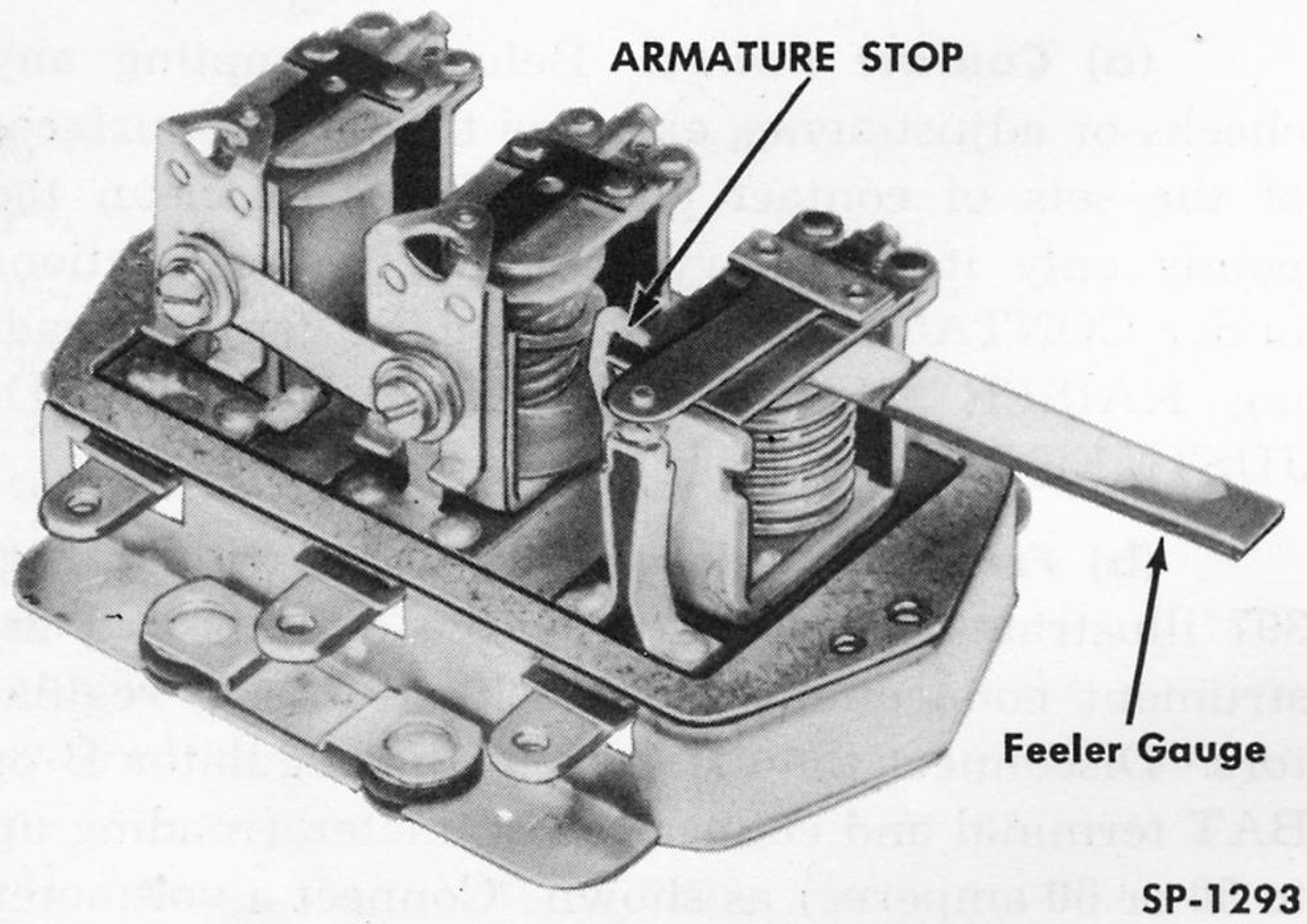


Fig. 410—Checking and Adjusting Frazer Breaker Armature Air Gap

(2) Temperature and Speed. Have the generator and regulator at normal operating temperature. Run the engine at a speed equivalent to 30 MPH in high gear, or the bench test generator at 2500 RPM. The charging voltage should show be-between 7.2 and 7.5 volts with the cover in place on the regulator.

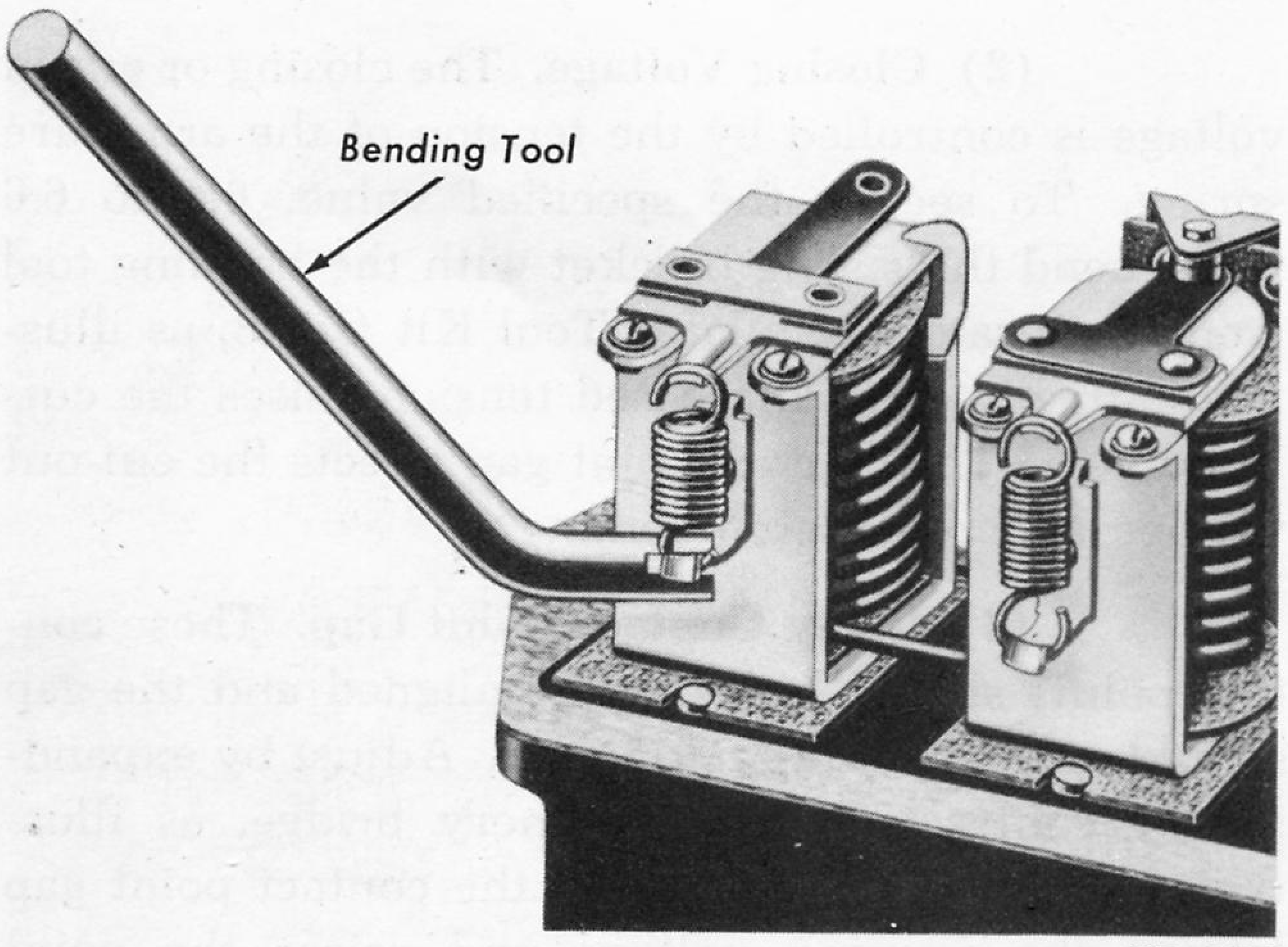


Fig. 411—Adjusting Frazer Regulator Spring Tension

(3) Voltage Adjustment. To adjust the voltage, bend the voltage regulator armature spring bracket with the bending tool from Generator Regulator Tool Kit C-828, as illustrated in Fig. 411. Increasing the tension increases the voltage. The proper setting, with the cover in place, is 7.35 volts.

(4) Voltage Regulator Air and Contact Gaps. Any need of checking or resetting either of these gaps is unlikely. The proper specifications are given under GENERATOR REGULATOR SPECIFICATIONS later in this Section.

(e) *Frazer Current Regulators.* To check setting and adjust:

(1) Test Connections. Voltmeter and ammeter connections should be as illustrated in Fig. 397. Connect a voltmeter (0-10 reading) from the B or BAT terminal of the regulator to the regulator frame (ground). Connect a variable resistance or lamp bank across the battery terminals.

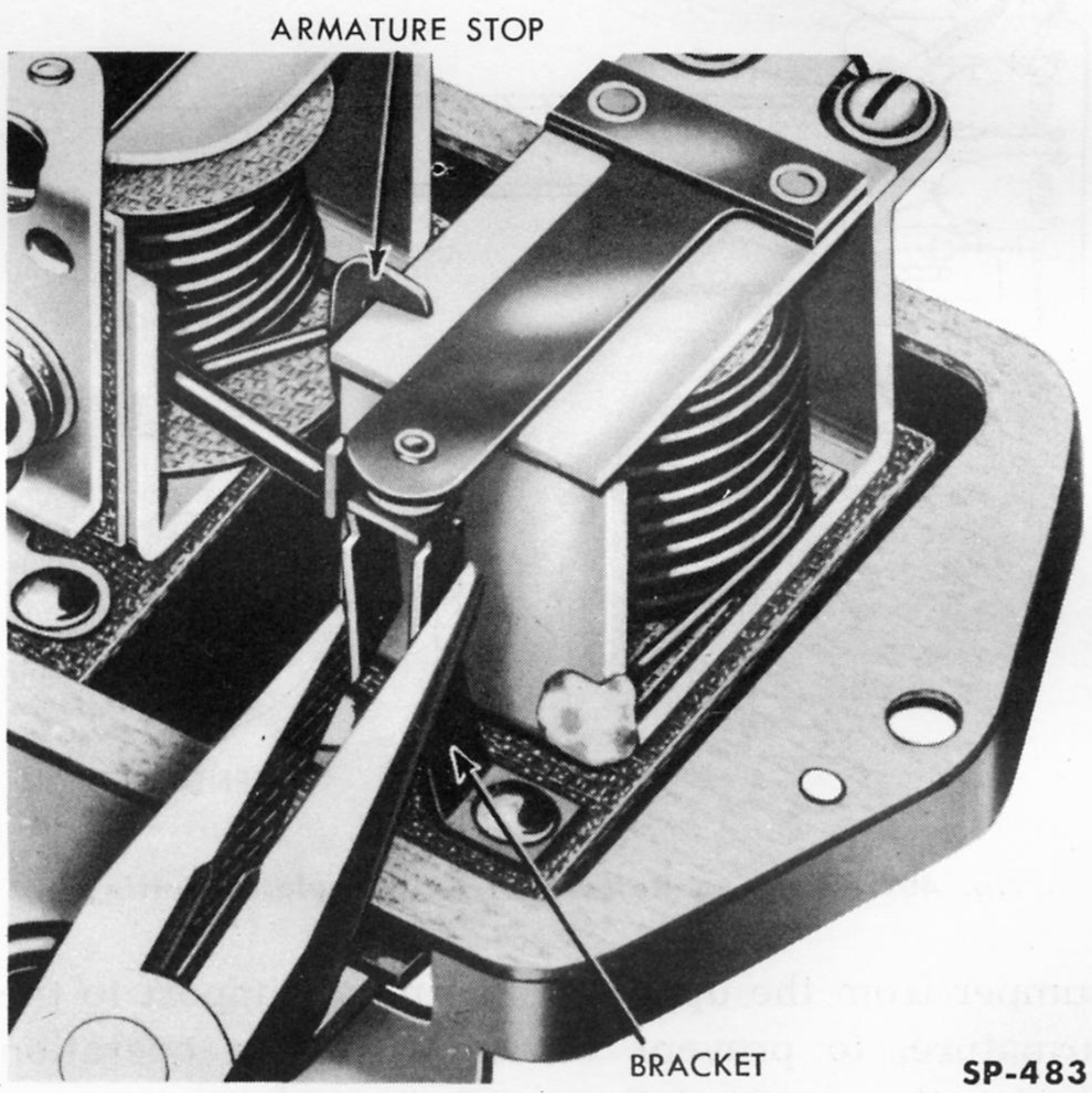


Fig. 412—Adjusting Frazer Circuit Breaker Contact Point Gap

(2) Temperature and Speed. Have the generator and regulator at normal operating temperature. Run the engine at a speed equivalent to 35 MPH in high gear, or the bench test generator at 3000 RPM. Adjust the resistance across the battery until the voltage falls to 6.6. At this voltage the current regulator should limit the generator output to the specified generator rating (between 34 and 36 amperes for the 35 ampere generator and between 44 and 46 amperes for the 45 ampere generator) **with the regulator cover in place.**

(3) Current Limit Adjustment. To adjust the amperage bend the current limiting generator armature spring bracket with the bending tool from Generator Regulator Tool Kit C-828, as illustrated in Fig. 411. Increasing the tension increases the current.

(4) Current Regulator Air and Contact Gaps. Any need of checking or resetting either of these gaps is unlikely. The porper specifications are given under GENERATOR REGULATOR SPECIFICATIONS below.

i. GENERATOR REGULATOR SPECIFICATIONS. The data and specifications in the accompanying table for the generator regulator used in Kaiser models and for the two regulators used on Frazer models, are for the guidance of the electrical equipment specialist who desires, in condensed, easy-to-find form, all the information needed for making thorough tests of these units.

GENERATOR REGULATOR SPECIFICATIONS

	Kaiser Models K-511 K-512	Frazer Models F-515	F-516
Regulator Make	Delco-Remy	Auto-Lite	Auto-Lite
Regulator Model	1118302	VRP-4004F2	VAV-4002C
Ground Polarity	POS	POS	POS
Rating	35 Amp	35 Amp	45 Amp

NOTE: Auto-Lite Regulator model VRP-4004F2 also used on a limited number of Kaiser model cars.

CIRCUIT BREAKER OR CUT-OUT RELAY

Points Close–Temp. (Cover in Place)	5.9–6.8V–	6.4–6.9V–	6.4–6.9V–
Points Open	------	4.4–4.8V– 4-6 Amp (Rev)	4.4–4.8V– 4-6 Amp (Rev)
Contact Point Gap	.020 in. min.	.015 in. min.	.015 in. min.
Armature Air Gap	.020 in.	.031–.034 in.	.031–.034 in.

CURRENT REGULATOR

Resistance Unit	Marked "45"	Marked "7" (6.5–7.5 Ohms)	Marked "15" (13.5–16.5 Ohms)
Armature Air Gap (Core to Arm. as points open)	.075 in.	.048–.052 in.	.048–.052 in.
Contact Point Gap (Armature Pressed against stop pin)	------	.012 in. min.	.012 in. min.
Operating Amperes	32–40 Amp. (Hot, Cover on)	34–36 Amp. (70°F. Cover on)	44–46 Amp. (70°F. Cover on)

VOLTAGE REGULATOR

Resistance Unit	Marked "45"	Marked "38" (36–40 Ohms)	Marked "60" (57–63 Ohms)
Armature Air Gap (Core to Arm. as points open)	.075 in.	.048–.052 in.	.048–.052 in.
Contact Point Gap (Armature Pressed against stop pin)	------	.012 in. min.	.012 in. min.
Operating Voltage	7.0–7.7 Volts (Hot, Cover on)	7.2–7.5 Volts (70°F. Cover on)	7.2–7.5 Volts (70°F. Cover on)

STARTING SYSTEM

a. GENERAL INFORMATION. When the starter button is pressed, with the ignition switch turned on, current from the coil terminal of the ignition switch flows through the winding of the solenoid switch. The magnetic field set up by this current closes the solenoid switch, forming a complete circuit, through heavy cables, to supply battery current to the starting motor to crank the engine. 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 is mounted at the left side of the engine, bolted to the flywheel housing. The Kaiser starting motor mounting is shown in Fig. 413 and the Frazer installation is similar.

b. SOLENOID STARTER SWITCH. This switch is mounted on the splash shield (Fig. 395). The solenoid winding produces the magnetic field to pull a

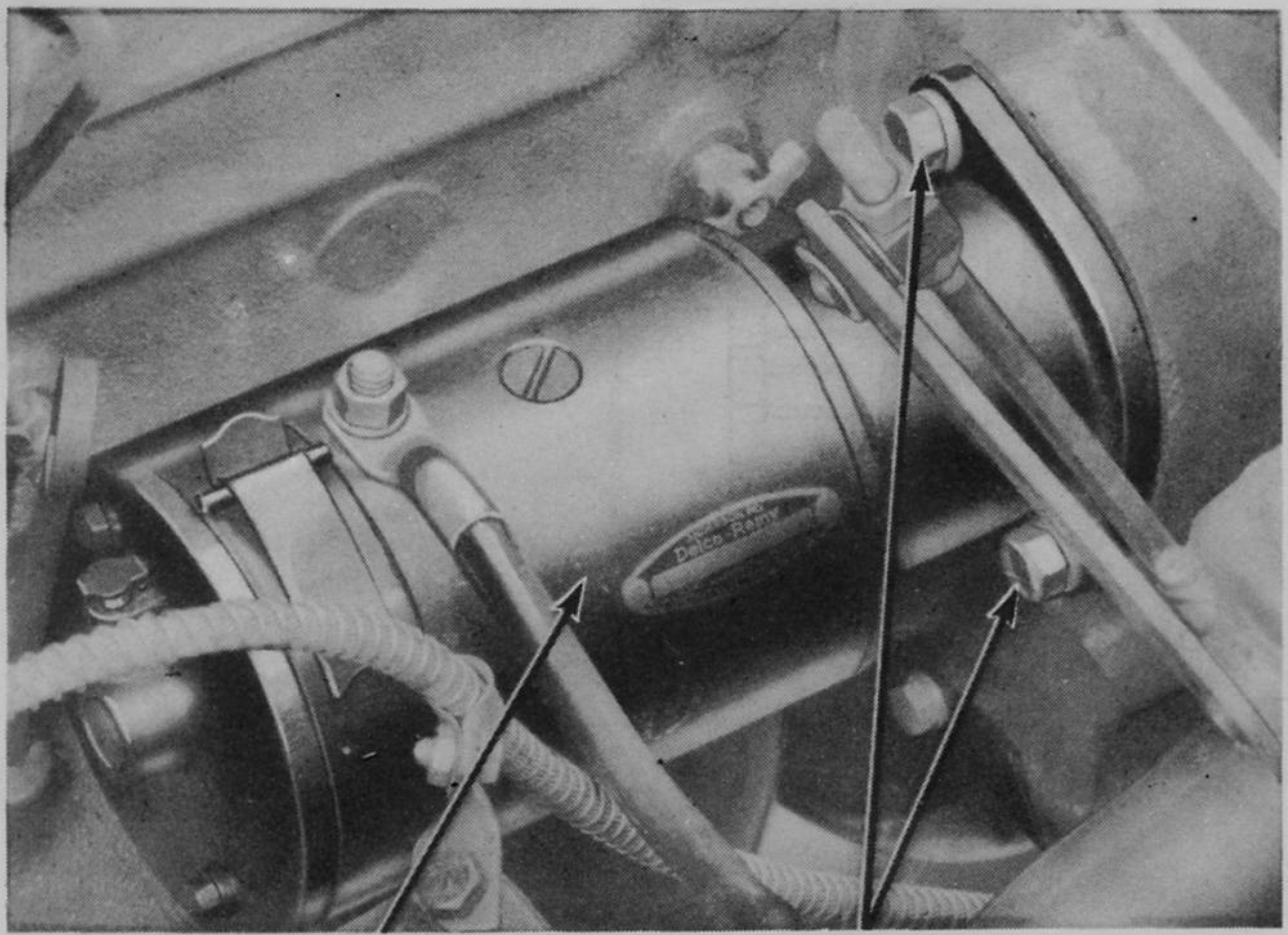


Fig. 413—Kaiser Starting Motor Installation

plunger and bring a contact blade into firm contact with the inner ends of the two terminal studs. The inner end of this solenoid winding is grounded.

To test the switch in the car, make a jumper contact between the large battery (hot) terminal of the solenoid switch and the smaller (middle) terminal. This should cause a click. If it does not, install a new switch. If the switch clicks, but fails to close the starting circuit from the battery through the starting motor, install a new switch. To test for resistance between the solenoid internal contacts, close the solenoid circuit and test with a voltmeter from one large terminal to the other, quickly, while engine is being cranked. The drop should be less than $1/10$ volt.

c. STARTING MOTOR CONSTRUCTION. The starting motors used on Kaiser and Frazer vehicles are four-brush, series wound units with Bendix pinion to mesh with the flywheel ring gear. Construction of the units is shown in Figs. 414, 415 and 416.

d. STARTING MOTOR INSPECTION AND MAINTENANCE. Every 1,000 miles, or oftener if water is added to the battery more frequently, inspect the battery cable terminals and battery posts for corrosion or looseness. On the first evidence of starting difficulty, first inspect the battery and make certain that all three cells are fully charged. Check all starter circuit cables and terminals. The manuals accompanying electrical test equipment contain instructions regarding the use of voltmeters for detecting resistance (which should be checked particularly at terminal connections). Inspection of the starting motor should include:

1. Cleaning. 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 clean a starting motor with steam or with solvent and compressed air equipment and never dip a whole motor or the armature or fields in cleaning fluid. In cleaning the outside be careful that no cleaning fluid or water gets into the interior. If the interior of a starting motor needs cleaning, remove it for disassembly.

2. 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 and pitted, or oily, or gummed —if the brushes are worn to need replacement, do not slide freely in their guides (Frazer), or the arms to which the brushes are attached (Kaiser) do not swing freely, that is if brushes are not held in good contact with commutator—if carbon dust, metal dust, or brown solder has accumulated—remove the motor for dissembly, cleaning and testing.

3. Sanding Commutator. If the commutator is only slightly dirty, not oily, burned, or pitted, it is

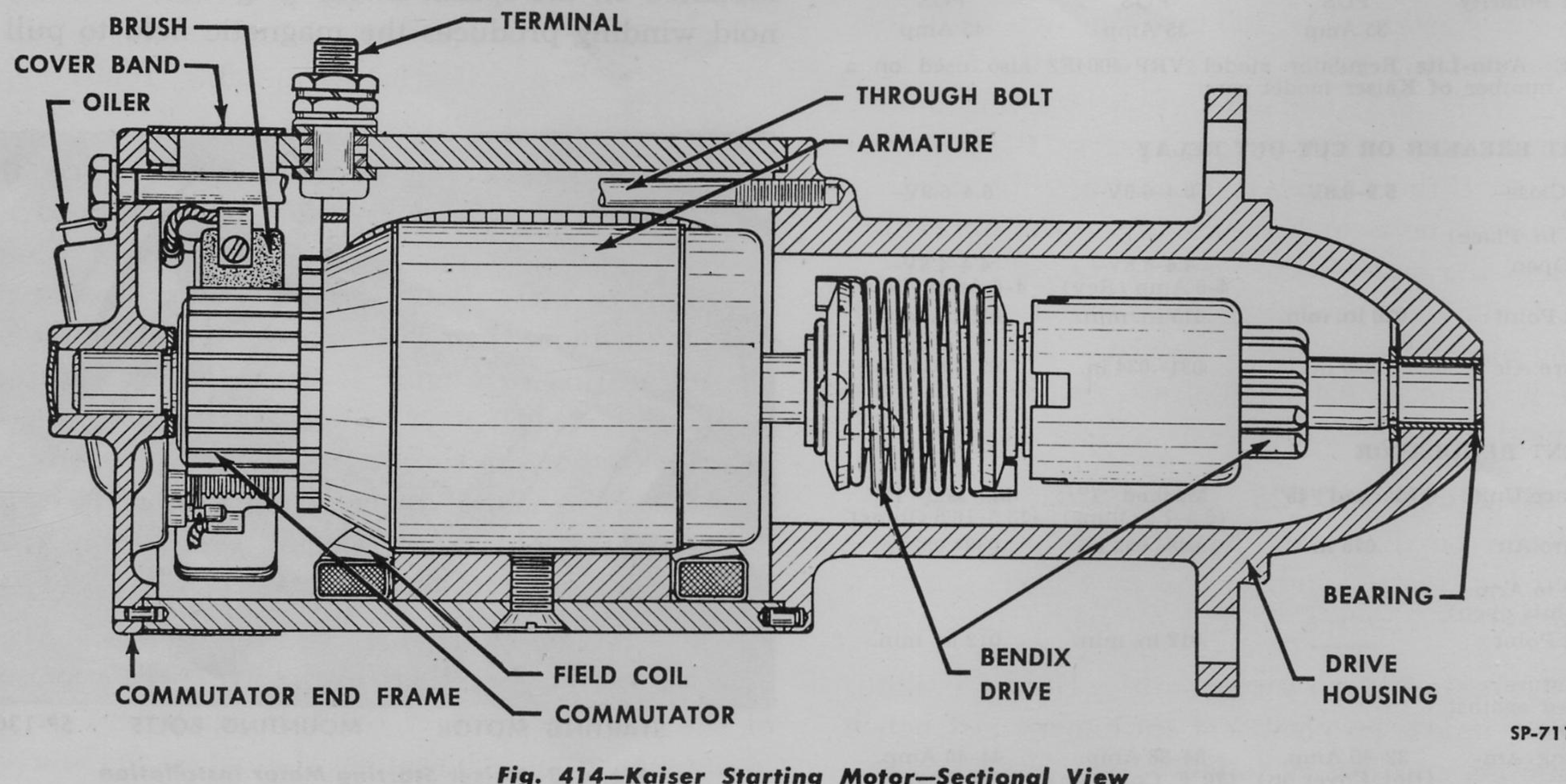


Fig. 414—Kaiser Starting Motor—Sectional View

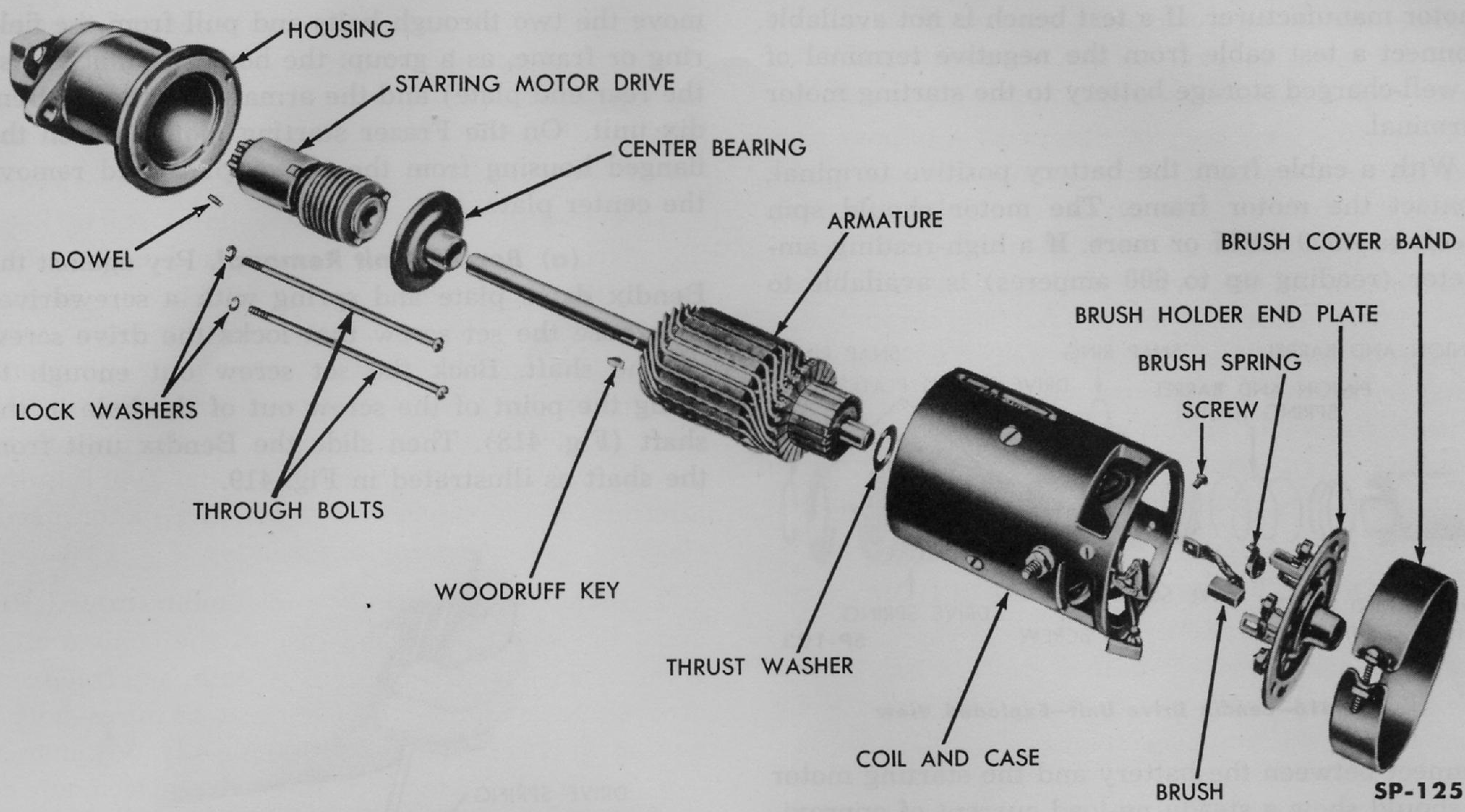


Fig. 415—Frazer Starting Motor—Exploded View

possible to clean it in place on the engine with 00 or 000 **sandpaper** held against the bars while the motor is turned, after which sand should be blown out with air. However, it is more convenient to remove the starting motor for cleaning the commutator—and necessary for installing and fitting brushes.

e. STARTING MOTOR REPLACEMENT. Disconnect the heavy starter cable. Remove the two bolts that hold the starting motor flange against the flywheel housing, (Fig. 413) and lift out the starting motor. To install the starting motor reverse the removal procedure. If there is evidence that any interference has occurred between the ends of the Bendix pinion teeth and the ends of the teeth of the flywheel ring gear, it may be necessary to install between the starting motor flange and the mating face of the flywheel housing a .050 inch thick spacer gasket of vellumoid, fiber or bakelite, or a steel shim.

f. STARTING MOTOR OVERHAUL. A starting motor can be dissassembled, the component parts cleaned and tested, and needed new parts installed to the extent covered in the following procedure.

1. Tests Before Disassembly. Hold the motor in a vise, unless an electrical equipment test bench is available, and test as follows:

(a) *Check Bendix Unit.* Hold the armature and turn the Bendix pinion forward and backward. It should move freely on its threaded sleeve along the shaft, except for the slight resistance offered by the light anti-drift spring (Fig. 416). When the pinion reaches its stop in the most extended position, it must be locked to and driven by the armature shaft. Look for a broken or distorted drive spring, chipped pinion teeth, loose screws, or other evidence of bad order. In overhauling, replace any worn or damaged parts.

(b) *Check for Bearing Play.* Turn the armature by hand and try the shaft in the drive housing bearing for play due to bearing wear. Check also, for end-play. If the drive housing bearing radial play is more than .004 inch replace the outboard bearing during overhaul. If the armature end-play is more than .050 inch replace thrust washers, or use thicker thrust washers, to reduce the end-play to .025—.035 inch. If there is more than .004 inch radial play at the front bearing replace the front bearing or commutator end plate.

(c) *No-Load Test.* If a test bench is available follow the directions in the instruction manual of the manufacturer of the test equipment or the Maintenance and Operation Manual of the starting motor manufacturer. If a test bench is not available connect a test cable from the negative terminal of a well-charged storage battery to the starting motor terminal.

With a cable from the battery positive terminal, contact the motor frame. The motor should spin freely at 4900 RPM or more. If a high-reading ammeter (reading up to 600 amperes) is available to

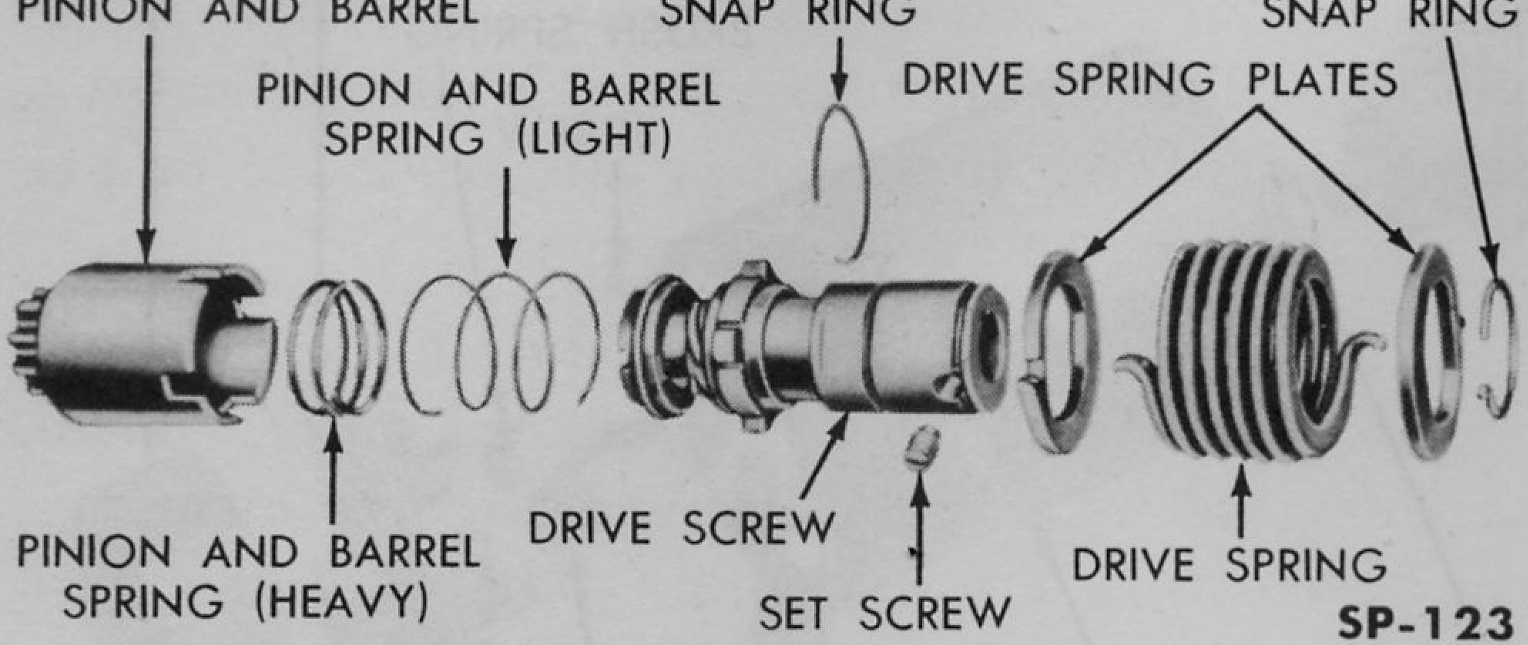


Fig. 416—Bendix Drive Unit—Exploded View

connect between the battery and the starting motor it should show a steady no-load current of approximately 65 amperes at 5.5 to 5.7 volts. Watch for any sparking at brushes during the no-load test.

2. Starting Motor Disassembly (Fig. 414 or 415). Remove the brush cover band. With a pair of suitable small hooks, or long nose pliers, lift the brush springs from their holders (Fig. 417). Remove the brush pigtail screws or bend the brush pigtails (or the stranded wires attached to the brushes) so that they will hold the brushes out of the way. Remove the two through bolts and pull from the field ring or frame, as a group: the housing (that is also the rear end plate) and the armature with the Bendix unit. On the Frazer starting motor detach the flanged housing from the center plate and remove the center plate.

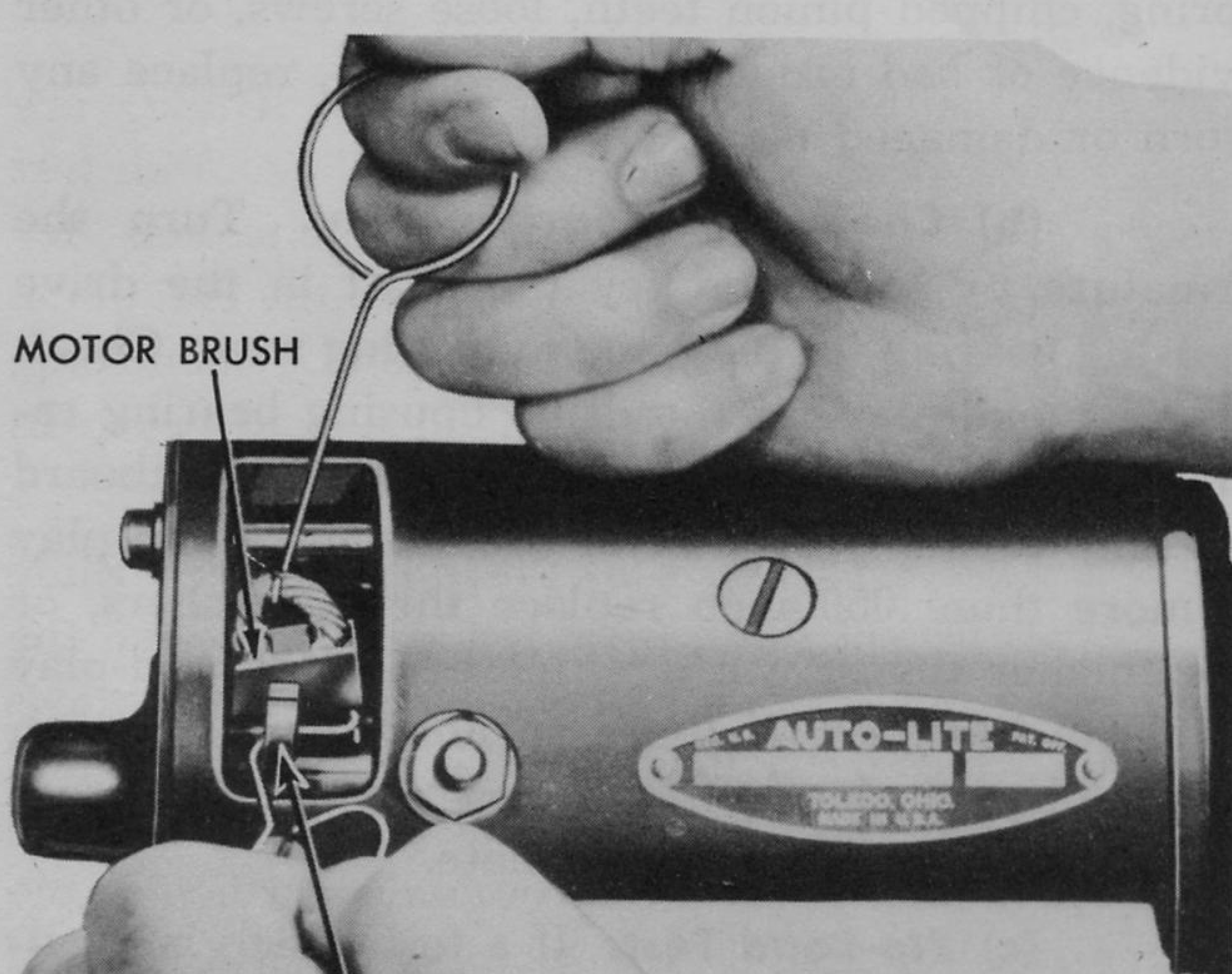


Fig. 417—Removing Starting Motor Brushes

(a) Bendix Unit Removal. Pry against the Bendix drive plate and spring with a screwdriver to expose the set screw that locks the drive screw on the shaft. Back the set screw out enough to bring the point of the screw out of the hole in the shaft (Fig. 418). Then slide the Bendix unit from the shaft as illustrated in Fig. 419.

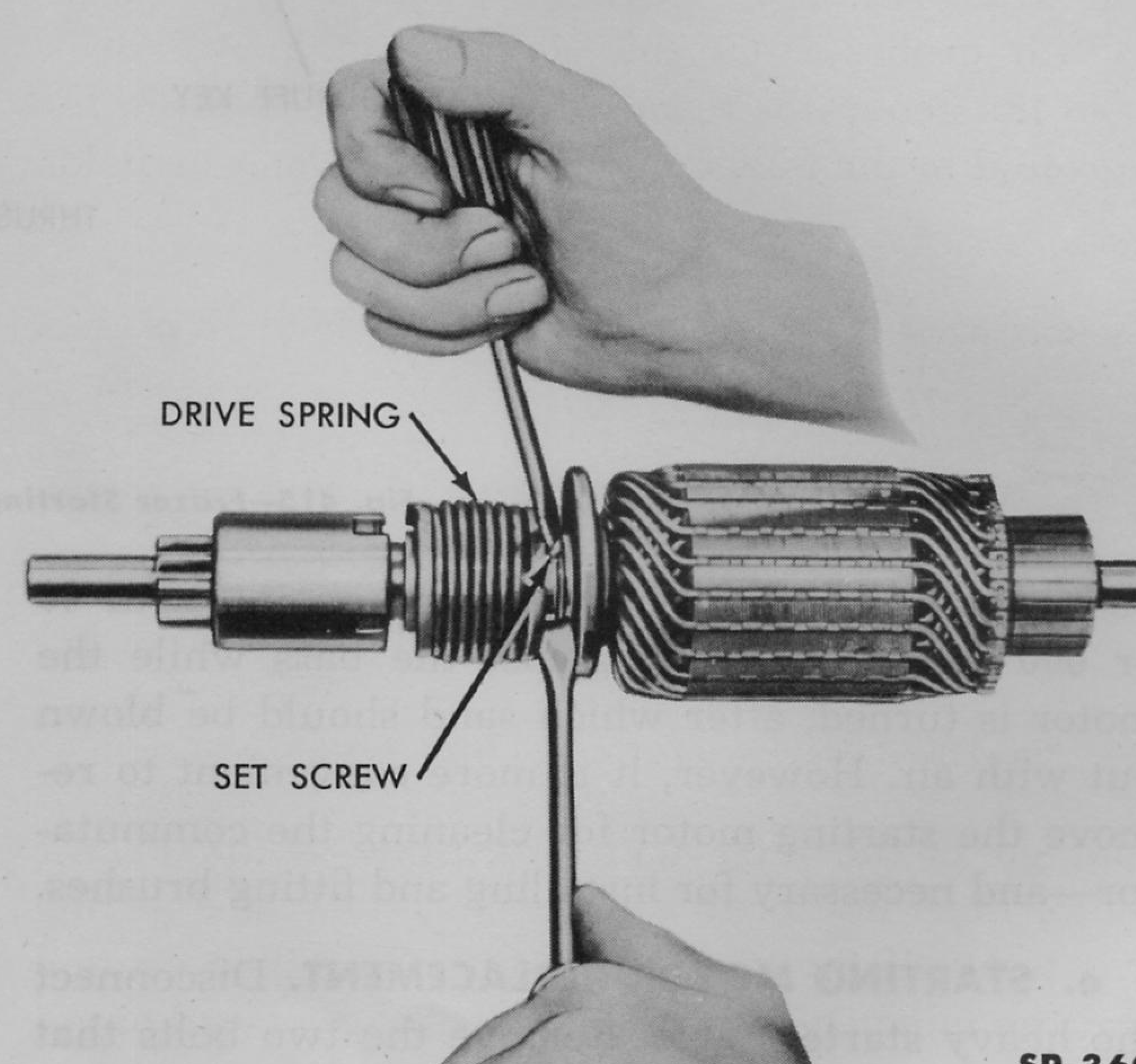


Fig. 418—Removing Bendix Drive Set Screw

(b) Bendix Unit Overhaul (Fig. 416). Remove the drive spring plate retaining snap ring from its groove in the drive screw. Hold the drive spring compressed, with pliers, and turn the drive screw to shaft set screw down until flush. Then remove the drive inner snap ring and detach the pinion from the worm. Remove the barrel springs. Examine the pinion worm and collar. Replace worn parts. Do not attempt to disassemble the drive screw assembly. Clean all parts with suitable cleaning fluid.

To assemble, put the pinion and barrel and springs back on the drive screw in the order shown in Fig. 416, and fasten them in place with the snap ring. Turn the set screw down in the drive screw until its head is flush. Assemble a driving spring plate, the drive spring and the remaining drive spring plate on the drive screw and install the snap ring. Compress the drive spring with a screwdriver and back the set screw out to allow the whole Bendix unit to slide onto the armature shaft during starting motor assembly.

(c) *Cleaning and Checking Frame and Field Coils.* Inspect for worn or frayed insulation, corroded or burned terminal stud, loose, corroded, or burned terminals; and for loose or corroded connections. Clean the frame and field coils thoroughly with a cloth dampened with cleaning fluid. Do not get cleaning fluid on the brushes. Blow with air and wipe with dry cloths.

With probes from the 10-volt test lamp, check from the generator terminal to ground, to check for a ground in the field coils. (The leads from the fields

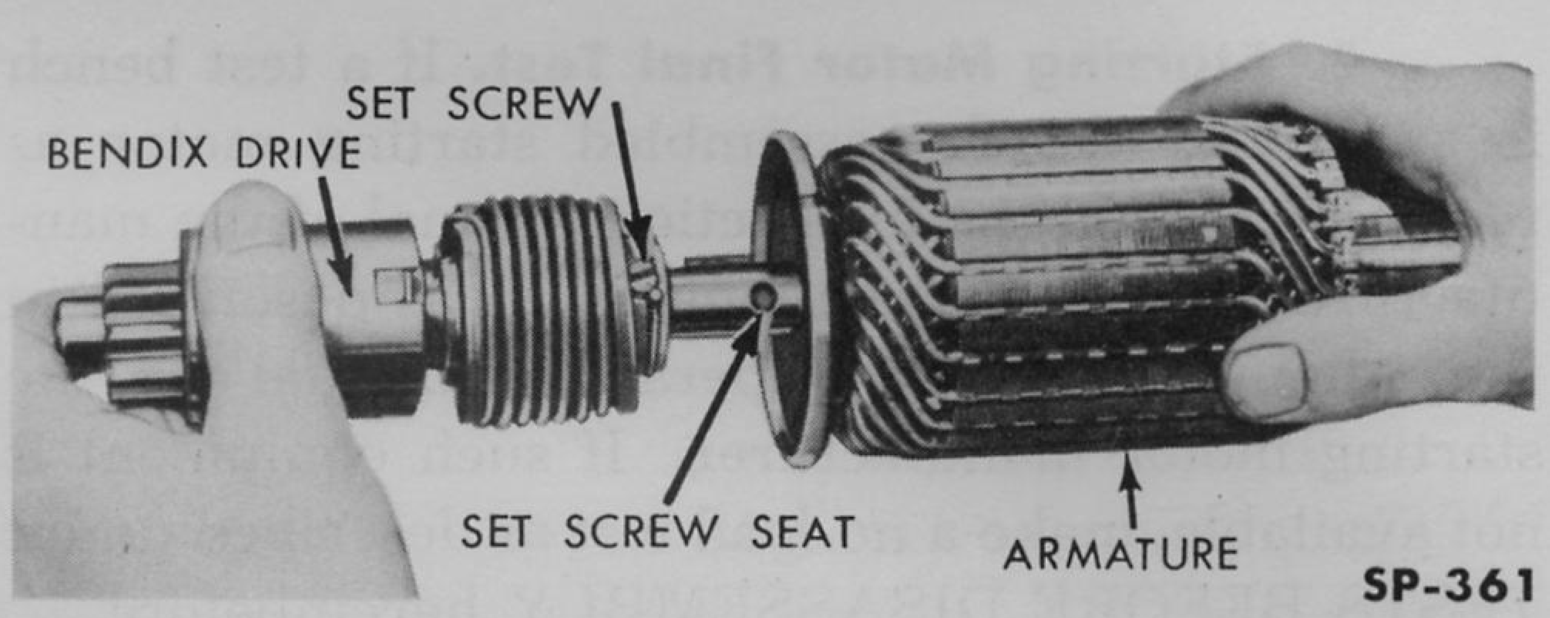


Fig. 419—Removing Bendix Unit from Armature Shaft

that go to the ungrounded brushes of the Frazer motor must not make contact with the frame during this test). If the lamp lights there is a field ground and the motor field or fields must be replaced or re-insulated.

To locate a ground remove the terminal stud and the fields. There is almost no likelihood of open starting motor field windings, except for a slight possibility at the soldered joints at the ends of the wirings. These can almost always be detected easily by careful inspection. Any test for open field coils must be made on each coil independently. (When the coil terminals are soldered in place there should be continuity through two parallel circuits).

(d) *Cleaning and Checking Armature.* Clean the armature with a cloth moistened with suitable cleaning fluid and wipe dry or blow dry with air. Inspect to make sure that all the coils are secure in their slots and that the winding terminals are securely staked and soldered in the risers of the commutator bars. Note the condition of the commutator. Look for any bars that seem burned. If the commutator is too badly burned, grooved or worn, install a new armature.

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

To test for any short 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.

(e) *Turning 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 Tool C-770 or a lathe. Tool C-770 is shown in Fig. 391 being used to turn down the generator commutator. The tool is used in the same manner to turn down the starting motor commutator. **Do not undercut the commutator of the Frazer starting motor.** Undercut the mica between the commutator bars of the Kaiser starting motor. Polish the commutator with 00 or 000 **sandpaper** (never emery or carburundum).

(f) *Cleaning and Checking Brushes and Holders.* Remove the Frazer brushes from their holders and from the commutator end plate. Remove the screws that fasten the Kaiser brushes to the swinging (reaction type) holders. Clean the commutator end plate and brush holders with suitable cleaning fluid. Blow 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 $\frac{5}{16}$ inch long, replace the brushes. Try the fit of a new brush in all holders to assure free sliding.

(g) *Installing and Fitting Brushes.* Slide the Frazer brushes into their holders and fasten the pigtail terminals with the proper machine screws and lock washers. Fasten the Kaiser brushes and pigtails securely to the swinging holders. (As the longer pigtails from the ungrounded brushes of the Frazer starting motor are soldered to the ends of the field windings, these brushes, when replaced, should be tried in their holders and fitted to the commutator before the pigtails are soldered.

With all four brushes out of their holders or held back, slide the commutator end plate over the commutator end of the armature (with the fiber thrust washer in place). Place a strip of 00 or 000 **sandpaper** (never emery or carburundum) the width of the finished part of the commutator over the commutator with sand side toward the brush. Insert one brush in its holder and bring the end of the spring against the brush. Hold the armature between **padded** vise jaws. Move the end plate a short distance clockwise to carry the brush along the sandpaper. Remove and inspect the brush. Repeat with the other brushes. Remove the sandpaper and blow out any sand and brush powder. Hold the brushes firmly against the commutator with extra pressure to add to that of the spring, and turn the end plate clockwise.

Then inspect each of the brushes to assure full end contact with the commutator. Leave the Frazer grounded brushes attached. Remove the ungrounded brushes from their holders, keeping track of which brush goes in which holder or tie the brushes or arms back.

(h) *Soldering Ungrounded Frazer Brush Pigtails.* With a soldering iron, heat the solder connection where the pigtails from the old brushes are attached to the terminals of the field windings and pull out the pigtails. Spread the openings slightly to make easier the insertion of the ends of the new pigtails. After they are inserted squeeze the spread terminals to close them more securely on the pigtail ends. Then run resin-core solder into the joints to make good electrical connections.

(i) *Checking Bearings.* Replacement of the oil-impregnated porous bronze bearings in the commutator and end plate, center plate and in the Bendix housing of the Frazer motor, is almost never necessary. If either of these bearings is worn to more than .004 inch radial clearance replace the plate, unless facilities for pressing and a proper sizing shoulder mandrel are available. To replace the outboard or rear bearing in the drive housing, press out the worn bushing and press in the new one with a shoulder mandrel, the pilot of which is approximately .0005 inch larger than the armature shaft. **Do not ream an oil-impregnated bronze bearing.** Put a few drops of oil on each armature bearing before assembling the motor.

3. Starting Motor Assembly. The assembly operations are practically the same as the disassembly, but in reverse order. Slide the center bearing into place on the armature shaft (Fig. 414 or 415) and insert the woodruff key. Then, with the set screw (Fig.416) backed out, slide the Bendix drive unit assembly into place on the shaft and tighten the set screw. Slide the housing in place, noting the locating dowel.

With the four brushes drawn back, or removed from their holders, slide the commutator end plate into place, noting the dowel pin and hole. Put back the two through bolts and tighten the bolts equally.

Put each brush into its holder and bring the end of each brush spring into contact with its brush. Check each spring pressure. It should be 24-28 ounces on the Kaiser motor and 42-53 ounces on the Frazer motor, with a new brush. Increase or decrease the spring pressure by carefully bending or twisting the spring holders.

4. Starting Motor Final Test. If a test bench is available, test the assembled starting motor as recommended in the instruction manual of the manufacturer of the test equipment, or as described in the Maintenance and Operation Manual of the starting motor manufacturer. If such equipment is not available, make a no-load test as described under TESTS BEFORE DISASSEMBLY hereinbefore.

IGNITION SYSTEM

a. GENERAL INFORMATION. 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 charge of fuel and air that has been compressed in the cylinder. In the two circuits of the ignition system are several elements. The primary or low tension circuit (through which flows low-voltage current from the generator or battery) includes the ammeter, the primary winding of the ignition coil, the breaker points (the points being protected and coil aided by the condenser) and the cables or wires that connect these units. The secondary, or high tension, circuit includes the secondary winding of the ignition coil, a high tension cable to the center of the distributor cap, the distributor rotor, the high tension cables to the spark plugs, and the spark plugs (the secondary circuit being closed through ground and some part of the primary circuit).

b. DISTRIBUTOR DESCRIPTION AND OPERATION. The construction and the arrangement of the parts of the standard distributor for Kaiser models

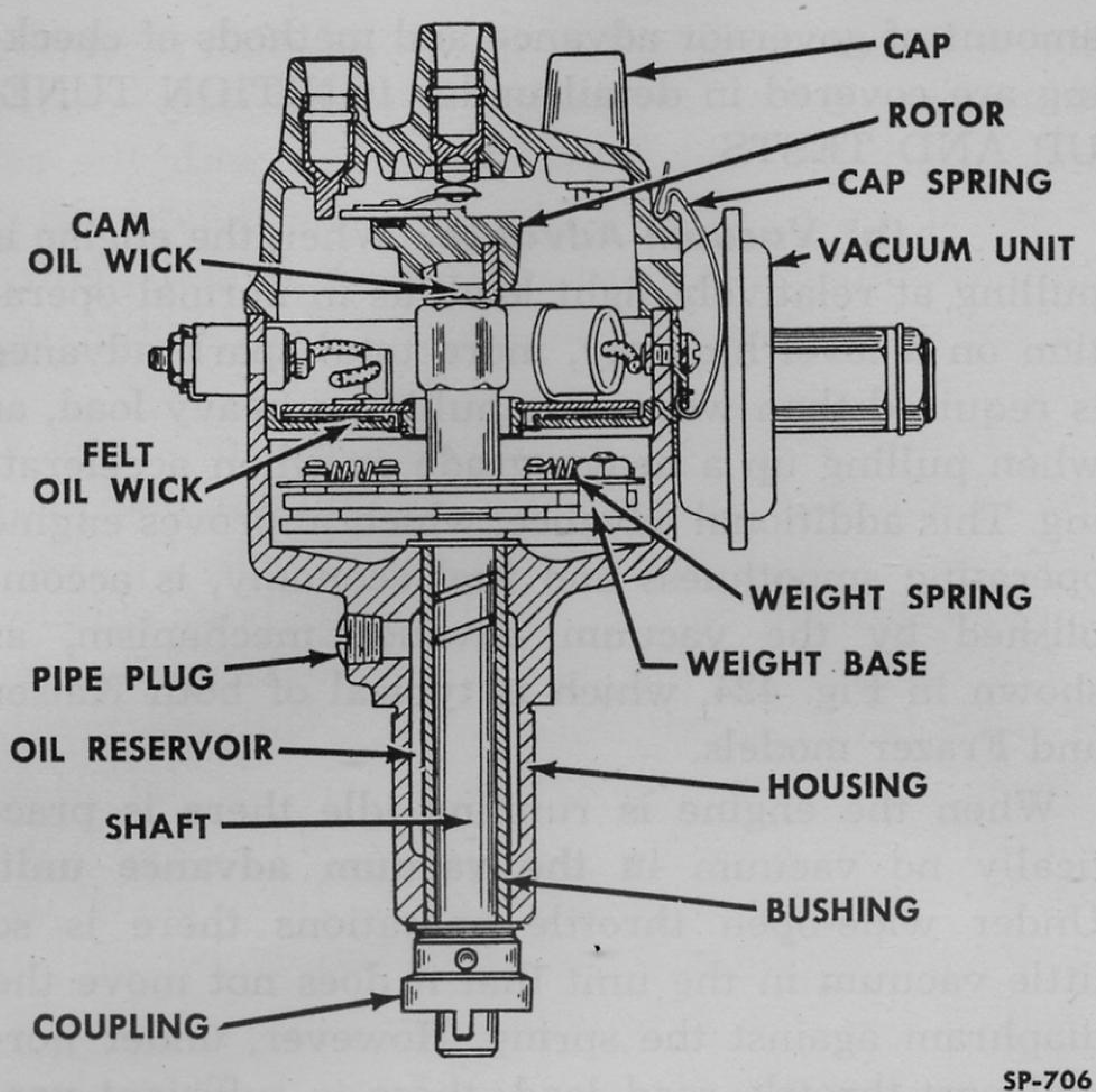


Fig. 420—Kaiser Distributor—Sectional View

(Delco-Remy model 1110224) are illustrated in Figs. 420 and 421. The distributor used on Frazer models (Auto-Lite model 1GS 4214) is illustrated in Figs. 422 and 423. A limited number of Kaiser model automobiles also were equipped with the Auto-Lite distributor used in the Frazer models. The following paragraphs explain the function of the various distributor parts:

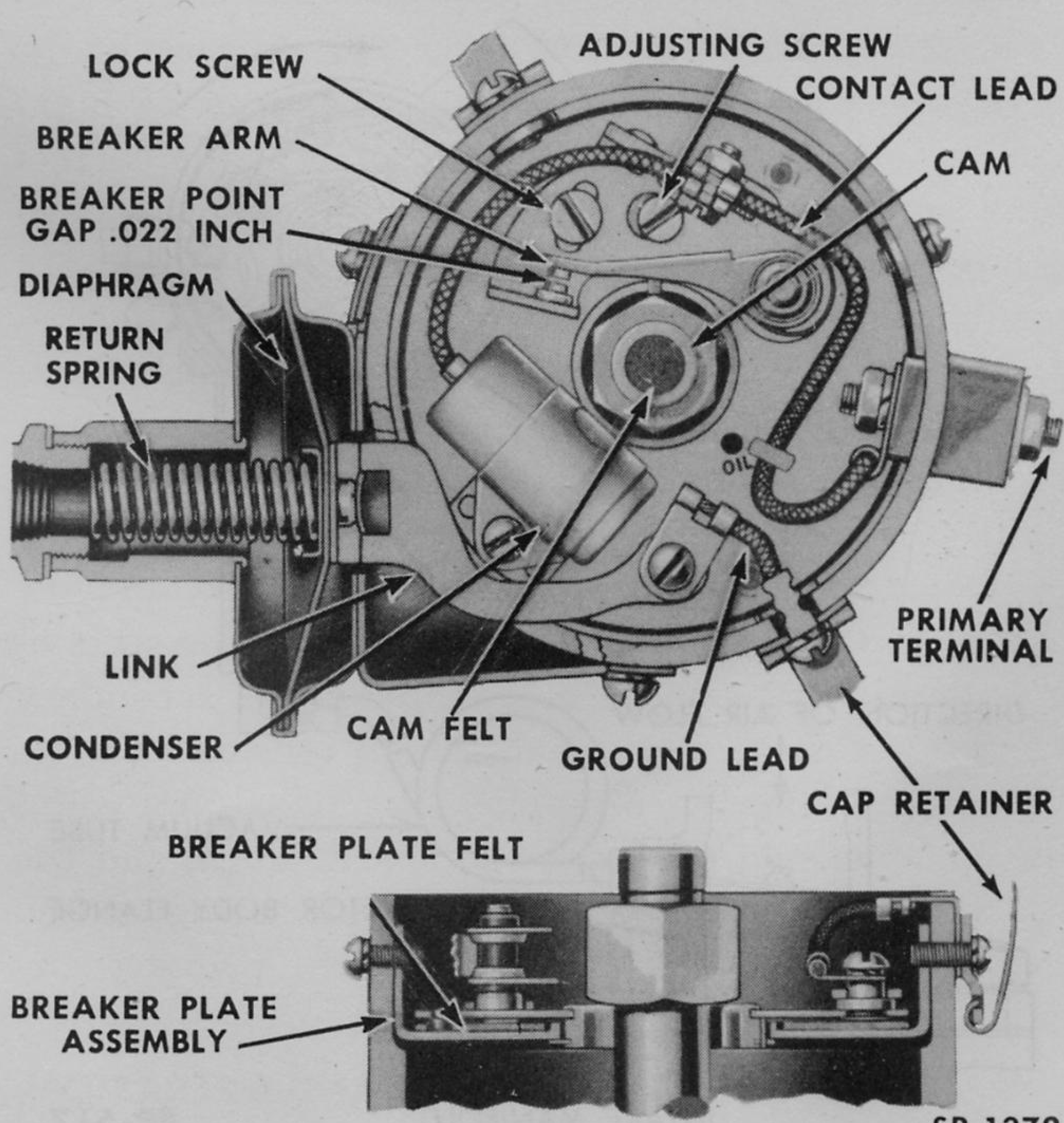


Fig. 421—Kaiser Distributor—Cap and Rotor Removed

1. Breaker Points. Six times in each revolution of the camshaft (three times in each revolution of the engine crankshaft) the breaker points, mounted on the breaker plate, interrupt the low tension (6-volt current flowing through the primary winding of the ignition coil.

The condenser, mounted opposite the breaker points on the breaker plate, protects the points from being burned or any arcing of the current they

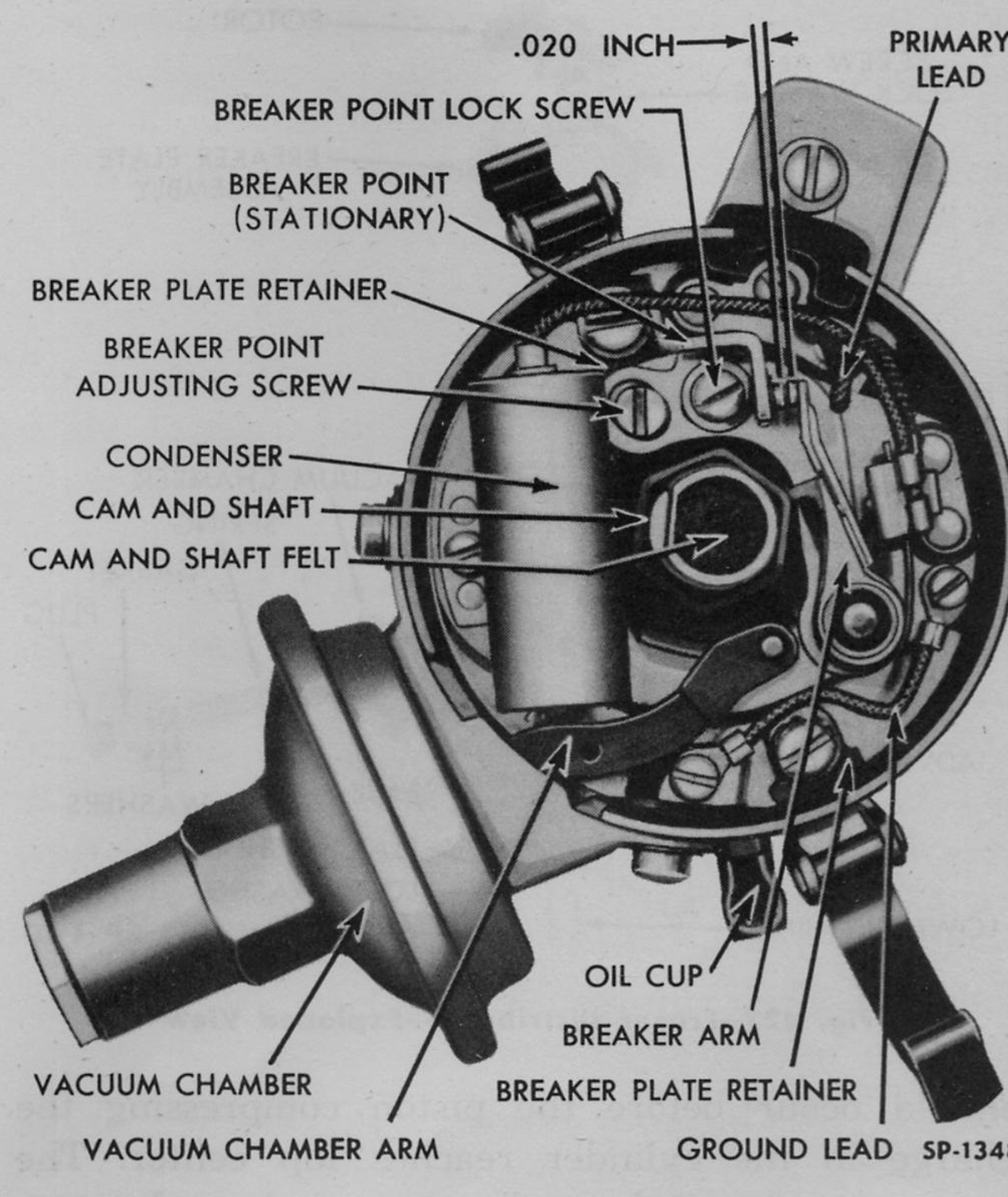


Fig. 422—Frazer Distributor—Cap and Rotor Removed

interrupt. The condenser also causes the coil to produce a hotter spark (by speeding the collapse or breakdown of the magnetic field in the coil).

2. Rotor. The surge of high tension current comes through the heavily insulated cable to the center of the distributor cap. The rotor switches this current cables leading to the different spark plugs, one after another, in the order the engine is built to fire its cylinders.

A spring mounted on the rotor of the Delco-Remy distributor of Kaiser models maintains electrical contact with the lower end of the fixed center electrode in the cap. In the center of the Auto-Lite distributor cap for Frazer models is a carbon brush backed up by a spring to maintain electrical current with the metal plate on top of the rotor.

3. Automatic Spark Advance. In order to get full power and good fuel economy the spark

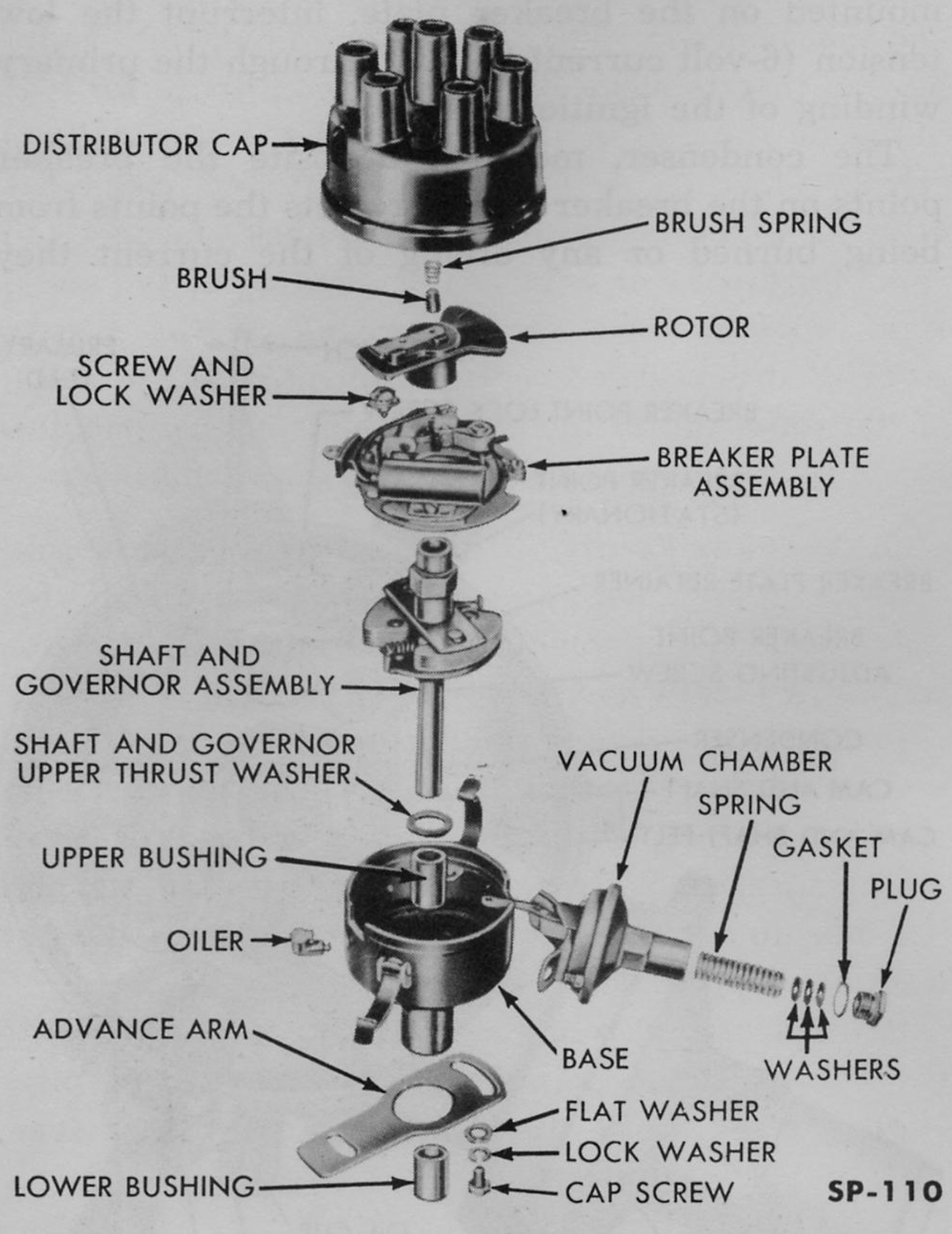


Fig. 423—Frazer Distributor—Exploded View

should occur before the piston compressing the charge in the cylinder reaches top center. The amount of this "advance" required depends upon engine speed and upon engine load. The spark advance is controlled automatically in two ways, by a centrifugal governor and a vacuum advance unit, as follows:

(a) *Governor or Centrifugal Advance.* As engine speed increases, the amount of spark advance should be increased to allow for the time required, after the instant of the spark, for the flame to travel through the compressed charge. As the engine speed increases, the governor weights swing outward against the tension of the governor springs. As they swing outward they turn the cam forward with respect to the rotation of the distributor shaft. Thus, higher engine speed causes earlier spark. The amount of governor advance and methods of checking are covered in detail under IGNITION TUNE-UP AND TESTS

(b) *Vacuum Advance.* When the engine is pulling at relatively light load, as in normal operation on a level highway, more total spark advance is required than when it is pulling a heavy load, as when pulling up a heavy grade or when accelerating. This additional advance, which improves engine operating smoothness and fuel economy, is accomplished by the vacuum advance mechanism, as shown in Fig. 424, which is typical of both Kaiser and Frazer models.

When the engine is running idle there is practically no vacuum **in the vacuum advance unit.** Under wide-open throttle operations there is so little vacuum in the unit that it does not move the diaphram against the spring. However, under normal part-throttle road load, there is sufficient vacuum to move the diaphragm against the compressed spring. The arm of the vacuum unit then pulls the breaker plate, rotating it enough to cause the earlier spark desired for more efficient engine operation.

The amount of advance the device is intended to provide, and methods of checking to insure proper performance are given under IGNITION TUNE-UP AND TESTS.

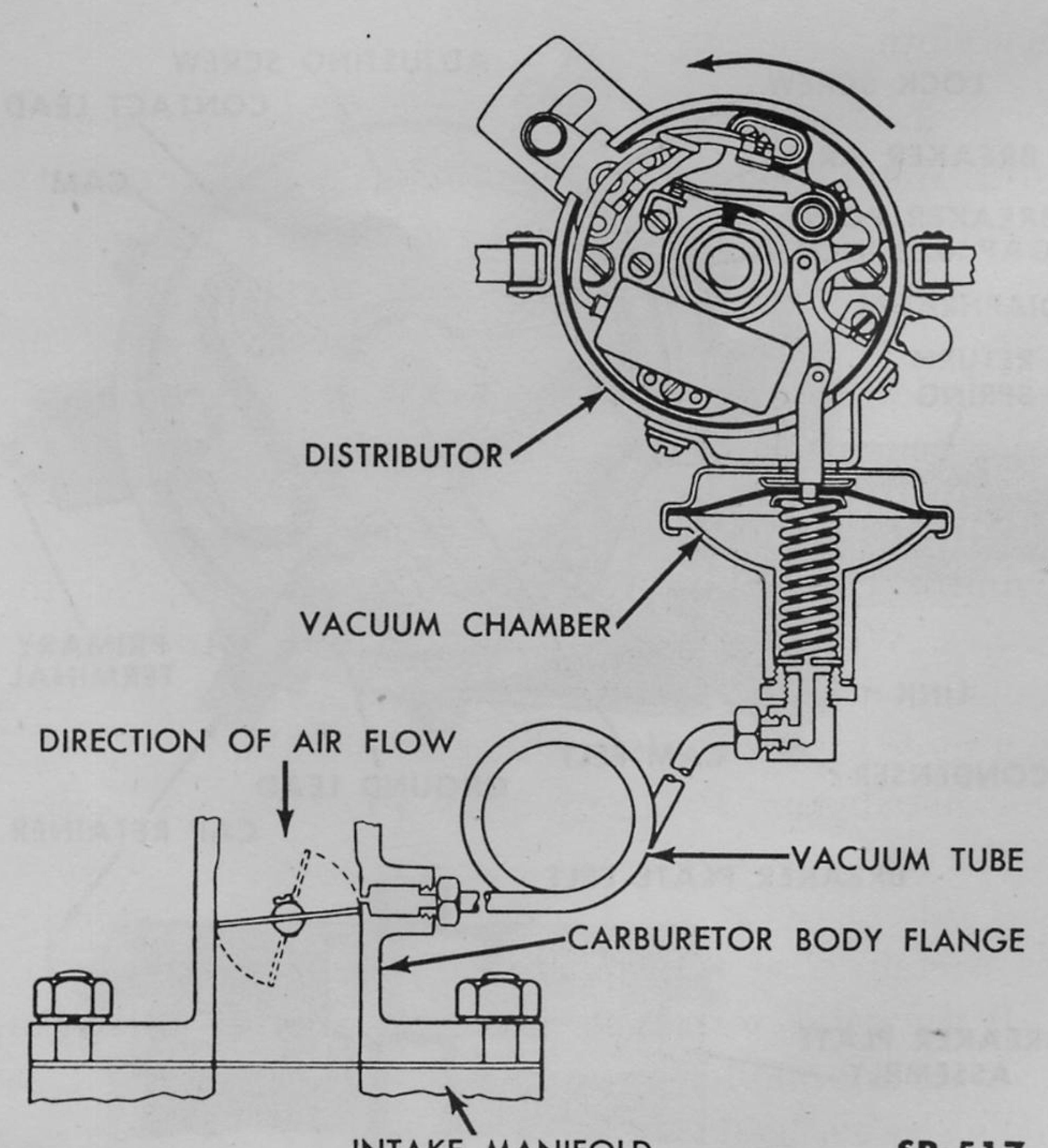


Fig. 424—Distributor Vacuum Advance Unit

c. 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 done better 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.

1. Spark Plugs. Blow the dust from around the spark plugs. Remove the spark plugs. Be certain that they are of the specified heat range. Inspect the spark plugs for loose electrodes, cracked or burned porcelains or badly burned electrodes. If plugs are in bad condition discard them, and replace as necessary. Clean the plugs carefully, inside and out, and reset the gaps, by bending the outer electrodes, to .032 inch. Use new gaskets when installing the spark plugs, to assure long, satisfactory service, use only the spark plugs recommended.

2. Cables. Inspect the cables and if the insulation is cracked or otherwise damaged replace the cables. If the cables are dirty wipe with a cloth dampened with cleaning fluid and wipe dry with a dry cloth.

3. Coil. Wipe away any oil or dirt 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 is not in good condition, bench test or install a new coil.

4. Distributor Cap and Rotor. Remove the distributor cap. Slide the rubber nipples up on the cables. Wipe the cap, inside and out, with a cloth moistened with cleaning fluid and wipe dry with a dry cloth. Inspect the cables where they plug into the distributor. Pull one or two out for inspection. If the end terminals are clean, free from corrosion and otherwise in good order push all the cables to be certain that 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, and that the distributor shaft turns counter-clockwise as viewed from the top.

Inspect the cap inside and out for any cracks or evidence that spark has been following the surface and has burned the distributor. Look for badly burned inserts inside. Try the carbon brush for free fit inside the cap of the Frazer distributor. If it is oily or sticking, remove it, wipe it dry, clean the bore in which it fits and put it back. Inspect the rotor for cracks or evidence of burning of the metal strip. Examine the contact spring of the Kaiser rotor. If it is cracked replace the rotor. If the metal of the rotor end of the metal inserts in the distributor is badly burned replace both rotor and cap.

5. Breaker Points. If dust, oil, or a gummy condition is found, wipe the interior of the distributor with a cloth moistened with cleaning fluid, wipe with a dry cloth and blow 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.

(a) Breaker Point Adjustment. Turn the engine slowly until one point of the cam lifts the breaker arm to give maximum point opening. (The engine can be turned by making instantaneous contact between the hot terminal of the solenoid switch and the center terminal, or can be turned by the fan with the spark plugs out). Check the gap with a feeler gauge or dial gauge. It should be .022 inch for the Kaiser (Delco-Remy) distributor and .020 inch for the Frazer (Auto-Lite) distributor.

Before attempting breaker point adjustment check for distributor shaft bearing play. Push the upper end of the cam alternately toward and away from the breaker arm fiber contact. A play of more than .003 or .004 inch, if present, is perceptible and will cause visible increase in the point gap. A method for accurate checking and the limits are given under DWELL ANGLE TEST under IGNITION TUNE-UP AND TESTS.

To adjust the points loosen the breaker point lock screw (Fig. 421 or 422) and turn the eccentric adjusting screw to get the right gap. Tighten the lock screw and recheck the gap. If the points do not meet squarely bend the bracket, not the breaker arm.

(b) *Breaker Point Replacement* (Fig. 421 or 422). With the cap and rotor off, remove the breaker arm spring clip and clip screw, and the condenser pigtail and lead terminals. 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 clamp screw and lift the contact point and bracket from the eccentric screw.

To install breaker points, reverse the removal procedure and lubricate the pivot and the arm as directed in Section 17, "Lubrication." Then adjust the points as directed under BREAKER POINT ADJUSTMENT, above. Check the contact point pressure with a scale graduated in ounces, hooked over the breaker arm at the contact point and held at right angles to the contact surface. This check is illustrated in Section IA "Engine Tune-Up," Fig. 6.

To adjust breaker point pressure of the Kaiser (Delco-Remy) distributor bend the breaker arm spring carefully. Adjust the Frazer (Auto-Lite) breaker arm spring by loosening the screw holding the end of the spring in or out as necessary. Retighten the screw and recheck the pressure. Proper pressure is 17 to 20 ounces. 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.

6. 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. So great is the importance of exact spark advance control to good general engine performance and to high fuel economy that the use of such special ignition test equipment is necessary to assure desired results.

(a) *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 any binding is found remove the distributor for overhaul.

(b) *Vacuum Advance.* By pushing against the condenser with the fingers, turn the distributor breaker plate clockwise and release it. The vacuum advance spring should pull the plate back to the retarded position if the plate turns freely. The method of checking breaker plate play and "drag" is explained under DISTRIBUTOR ASSEMBLY AND ADJUSTMENT.

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.

7. Distributor Lubrication. Every 2,000 miles, lubricate the distributor as directed in Section 17, "Lubrication."

d. IGNITION TUNE-UP AND TESTS. To assure continued peak performance and economical operation "tune-up," that is check and adjust the entire ignition system, at least in the spring and fall, 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 both tests that can be made in the car and those requiring modern test bench equipment.

1. 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 dealing with inspection and maintenance.

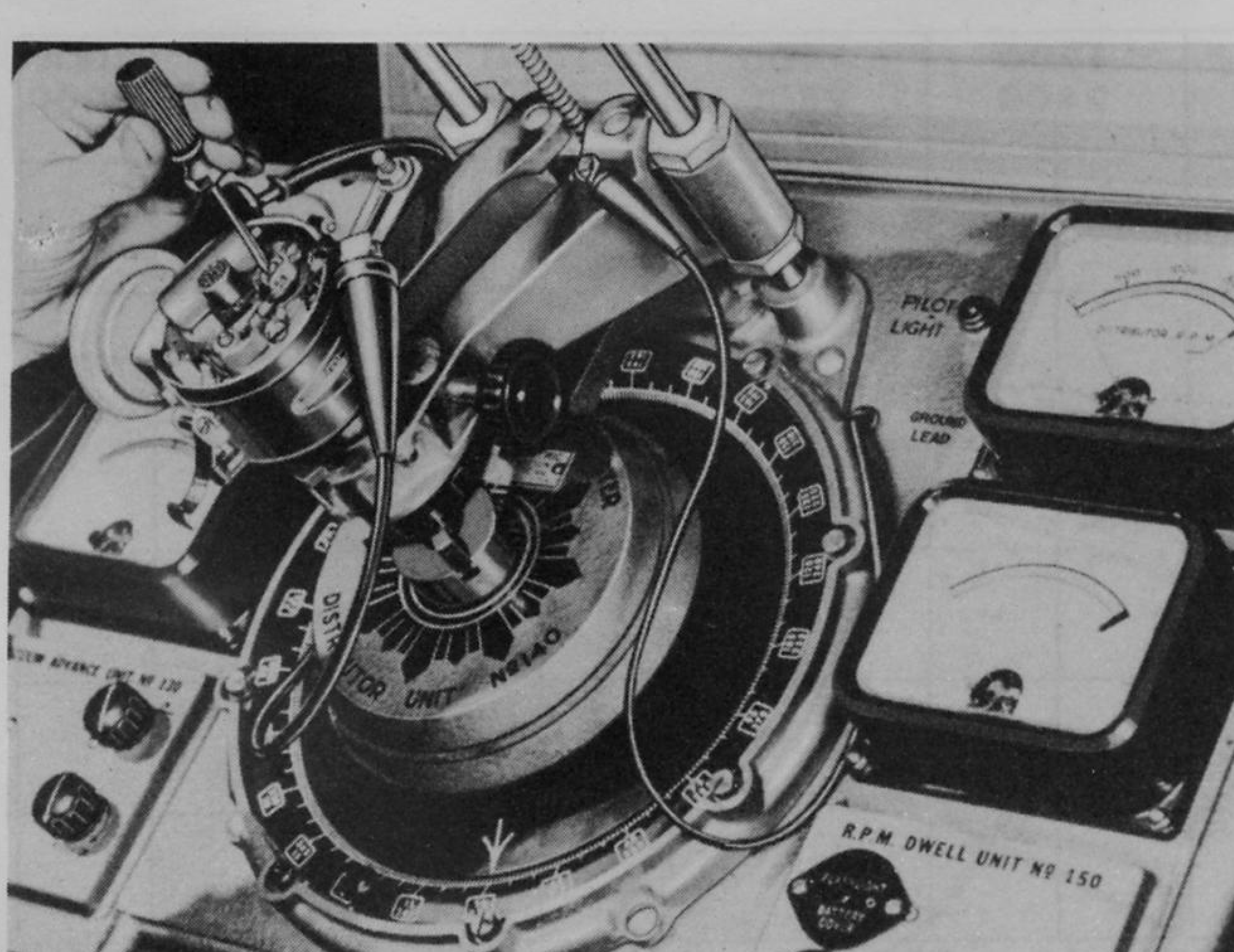
2. Distributor Bench Test Equipment. Modern ignition bench test equipment provides a convenient, effective means of duplicating the various conditions under which the distributor operates on the engine. It provides instruments to indicate proper and improper performance of various parts of the ignition 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.

3. 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 or time during which current flows through the primary winding of the coil. 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 all six cylinders.

(a) *Breaker Contact Resistance.* Before making a dwell angle test, check the breaker contact resistance (and primary circuit resistance) as directed in the test bench instrument 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.

(b) *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 (Fig. 425) or with the distributor installed on the car.

With the test equipment properly connected and adjusted, the dial should indicate at engine idling speed and up to distributor RPM a dwell angle of 31 to 35 degrees for the Kaiser (Delco-Remy) distributor and 36 to 40 degrees for the Frazer (Auto-Lite) distributor. Points set too close (that is with too large a dwell angle) will burn and pit. Too wide a point gap will cause a weak spark at high speed. **NOTE:** If the dwell angle needle vibrates during

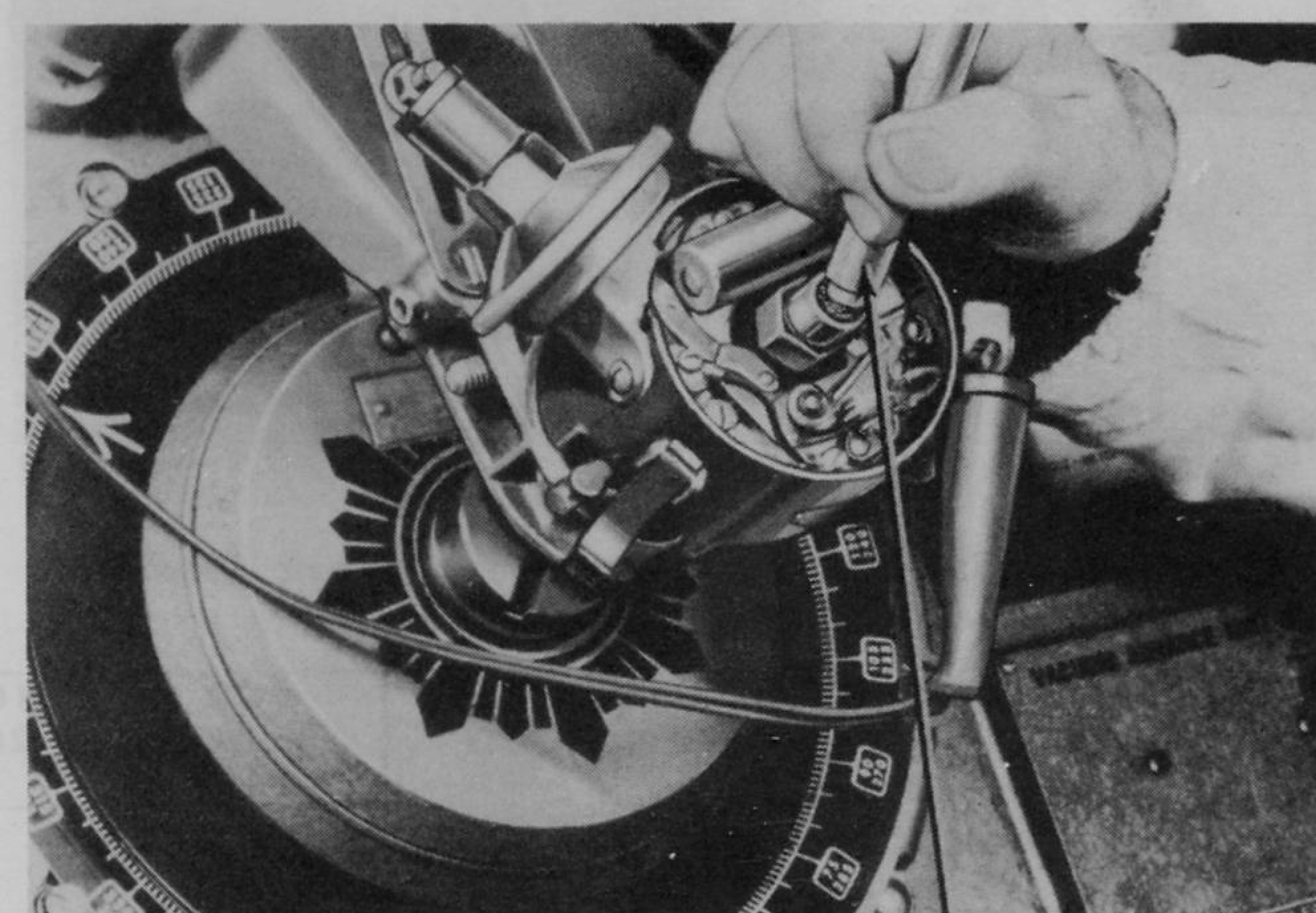


SP-362

Fig. 425—Checking and Adjusting Dwell Angle

test, check for loose fit of the distributor shaft in its bearings.

4. 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, or piece of plastic rod or brass, as shown in



Wood Dowel SP-291

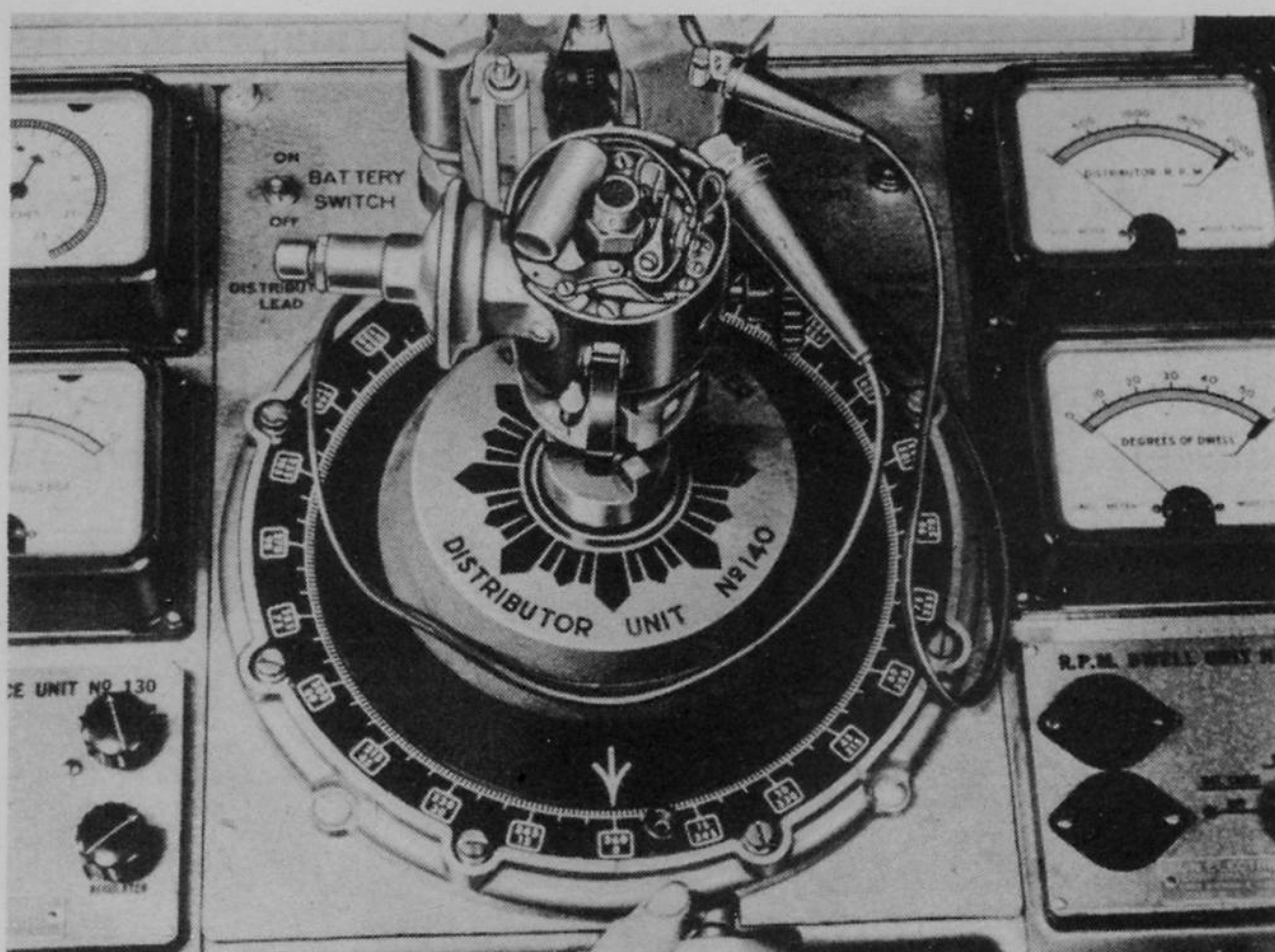
Fig. 426—Checking Distributor Shaft and Bearing Wear—Frazer

Fig. 426, 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. Fig. 434 later in this Section illustrates the use of a dial gauge to measure radial clearance. If too much bearing wear is found rebuild the distributor, replacing the worn parts.

5. Centrifugal (Governor) Advance Tests. Fig. 427 shows a distributor mounted in a test stand for checking centrifugal advance. It is possible, however, to check centrifugal advance with the distributor on the engine. Fig. 428 shows ideal spark advance specifications and figures for several speeds are tabulated in Section 1A, "Engine Tune-Up."

(a) *Bench Tests.* As indicated by the curves, centrifugal advance for the Kaiser (Delco-Remy No. 1110224) distributor starts at .75 distributor degree (1.5 crankshaft degrees) advance at approximately 300 distributor RPM (600 engine RPM) and increases in proportion to the speed to 10 distributor degrees (20 crankshaft degrees) at 1600



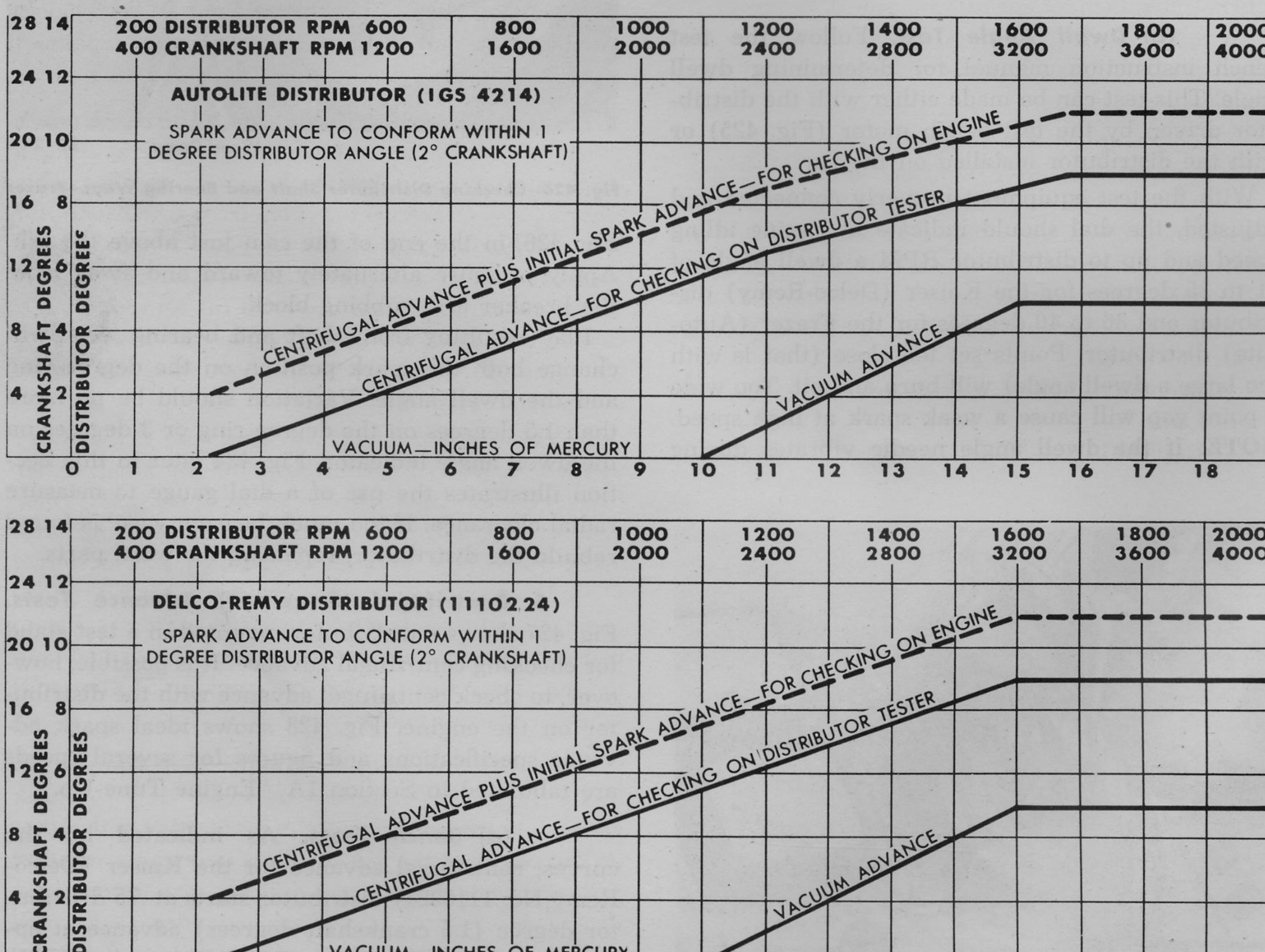
SP-292

Fig. 427—Checking Distributor Centrifugal Spark Advance

distributor RPM (3200 engine RPM) after which it remains constant for higher speeds.

The corresponding Frazer centrifugal advance curve (Auto-Lite distributor model IGS 4214) starts at approximately 325 distributor RPM (650 engine RPM) and reaches 9 distributor degrees (18 crankshaft degrees) at 1700 distributor RPM (3400 engine RPM).

The initial spark setting specified by Kaiser-Frazer is to fire 4 crankshaft degrees before top dead center. The dotted centrifugal advance curves in Fig. 428 represent the actual advance with respect to the dead center mark on the vibration damper measured with the distributor installed on the engine. Centrifugal advance figures for intermediate speeds can be taken from the curves or from the table.



SP-1185

Fig. 428—Distributor Spark Advance Curve

Replacement of parts or adjustment to correct errors found in centrifugal advance are covered under DISTRIBUTOR OVERHAUL.

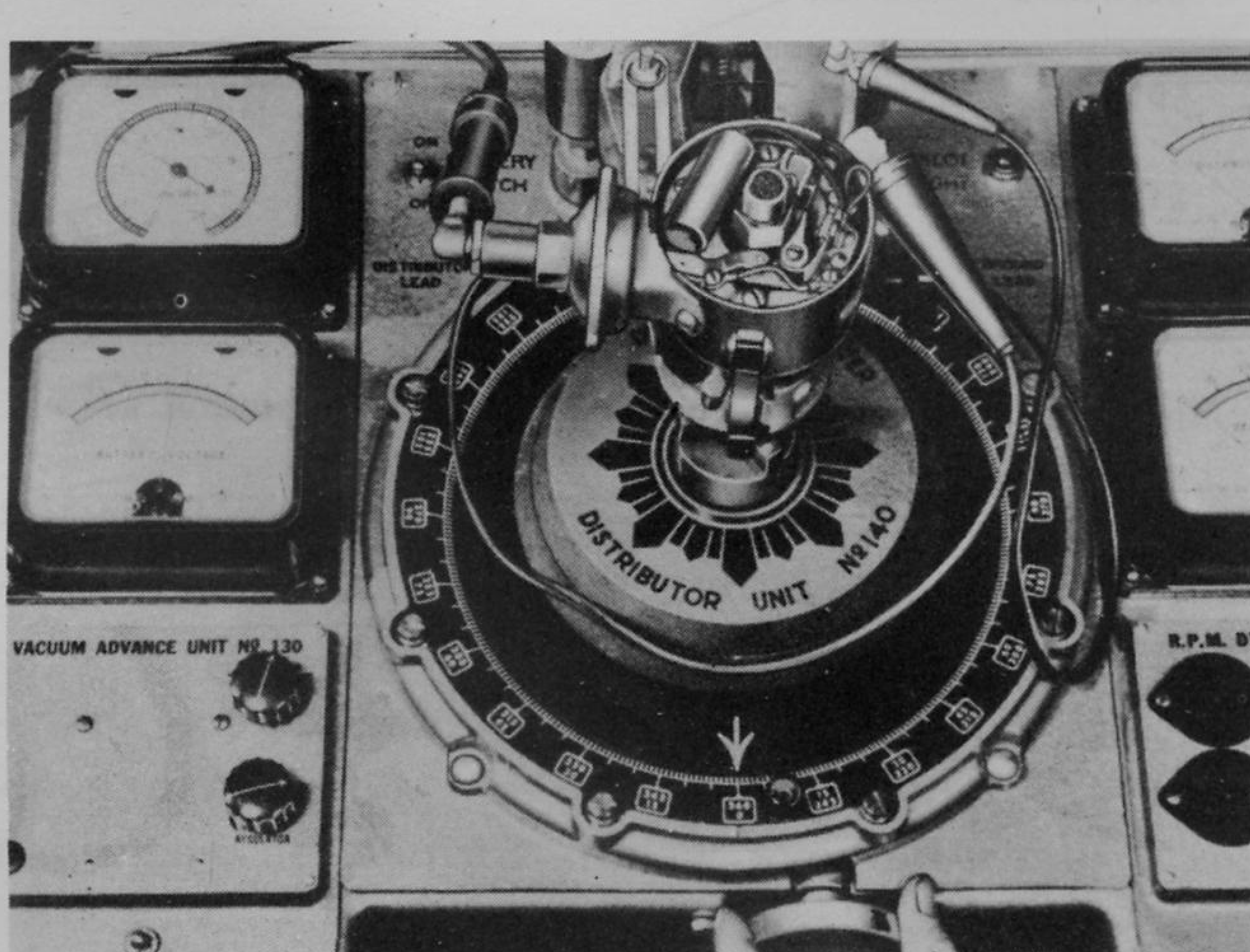
(b) *Checking Centrifugal Advance in the Vehicle.* Centrifugal advance can be checked while the distributor is on the engine with a portable tachometer and Timing Light C-693. First with the engine at normal running temperature disconnect the vacuum tube from the distributor and set the carburetor for the lowest possible smooth idle (below 450 RPM).

With the timing light, following the instructions in Section 1A, "Engine Tune-Up," check the angle of the retarded spark. Place marks on the rim of the vibration damper to show the proper spark timing at different speeds.

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 advance against the dotted line curves of Fig. 428.

6. Vacuum Advance Tests. Fig. 428 shows that for either the Kaiser or Frazer distributor vacuum advance starts at 10 inches of mercury and increases in proportion to the increased vacuum to 5 distributor degrees (10 crankshaft degrees) at 15 inch vacuum reading. A distributor mounted in a test stand for checking vacuum spark advance is shown in Fig. 429.

Replacement of parts or adjustment to correct errors found in vacuum advance are covered under DISTRIBUTOR OVERHAUL.



SP-363

Fig. 429—Checking Distributor Vacuum Spark Advance

7. Condenser Test. A faulty condenser is sometimes indicated by badly burned breaker points, weak spark, and difficult starting, or failure of the engine to start. Modern testing equipment checks 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 ¼ 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 as a condenser of incorrect capacity will critically affect breaker point life.

8. Coil Tests. Checking the coil in the vehicle and using special testing equipment are explained separately in paragraphs which follow:

(a) *Checking Coil in the Vehicle.* A quick check to determine whether a coil is delivering a spark is often made by detaching a spark plug cable from a plug, or the center cable from the distributor cap, and holding it with the terminal approximately ¼ inch from a convenient ground on the engine. When the engine is cranked with the ignition switch turned on the spark intensity may be low, due to the reduced voltage while the battery is delivering heavy current to the starter.

To check the coil performance with full battery voltage, make and break the points by hand, either by moving the breaker arm, or by turning the rotor back and forth against the spring tension of the automatic centrifugal advance mechanism. Failure to get a good hot spark when the breaker points thus interrupt the primary current to the coil may indicate bad coil terminal connections, or cables, or bad condenser. Trial substitution of a new coil often tells whether the old one was bad.

(b) *Checking Coil With Test Equipment.* Modern testing equipment makes it easy to check accurately the performance of an ignition coil, either on the car or at the bench. Tests determine whether primary and secondary windings are continuous, that they are not shorted or grounded to the coil case, and that the output of the coil is ample for satisfactory ignition.

Tests can be made not only when the coil is cold but also at or above normal under-the-hood operating temperatures. Make both primary and secondary 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.

e. DISTRIBUTOR REPLACEMENT. To remove the distributor, disconnect the vacuum tube 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.

With the engine in this position the distributor main drive shaft should have its offset (narrow) side toward the engine manifolds. Then reverse the removal procedure to install the distributor. Time the ignition system as described in Section 1A, "Engine Tune-Up" after the distributor is installed.

f. DISTRIBUTOR OVERHAUL. The following paragraphs cover rebuilding or reconditioning distributors at the bench, replacement of worn parts and other operations necessary to restore proper condition.

Because of design and construction differences and of extent to which the respective equipment manufacturers supply parts for rebuilding, the two different Kaiser and Frazer distributors will be treated separately in the following paragraphs.

1. Kaiser Distributor Disassembly. This distributor (Delco-Remy No. 1110224) is illustrated in Figs. 420 and 421.

(a) *Vacuum Advance and Breaker Plate Removal.*

(1) Unsnap the cap springs and remove the cap and rotor.

(2) Remove the nut and lock washer at inner end of primary terminal stud and detach the terminal of the pigtail leading to the breaker arm spring insulated bracket. Remove the terminal insulating parts.

(3) Remove the screw that holds the vacuum advance link and grounding pigtail terminal to the breaker plate stud.

(4) Remove the screws that hold the vacuum advance unit to distributor housing and remove the vacuum advance unit.

(5) Remove the screws holding cap spring brackets and ground pigtail to housing. Remove the cap springs and screw opposite vacuum advance slot in housing to release breaker plate assembly.

(6) Lift out breaker plate assembly.

(b) *Coupling and Centrifugal Advance Mechanism Disassembly.* File or grind off end of coupling pin and drive out pin. File away any burr left by pin removal. Lift out shaft and advance mechanism.

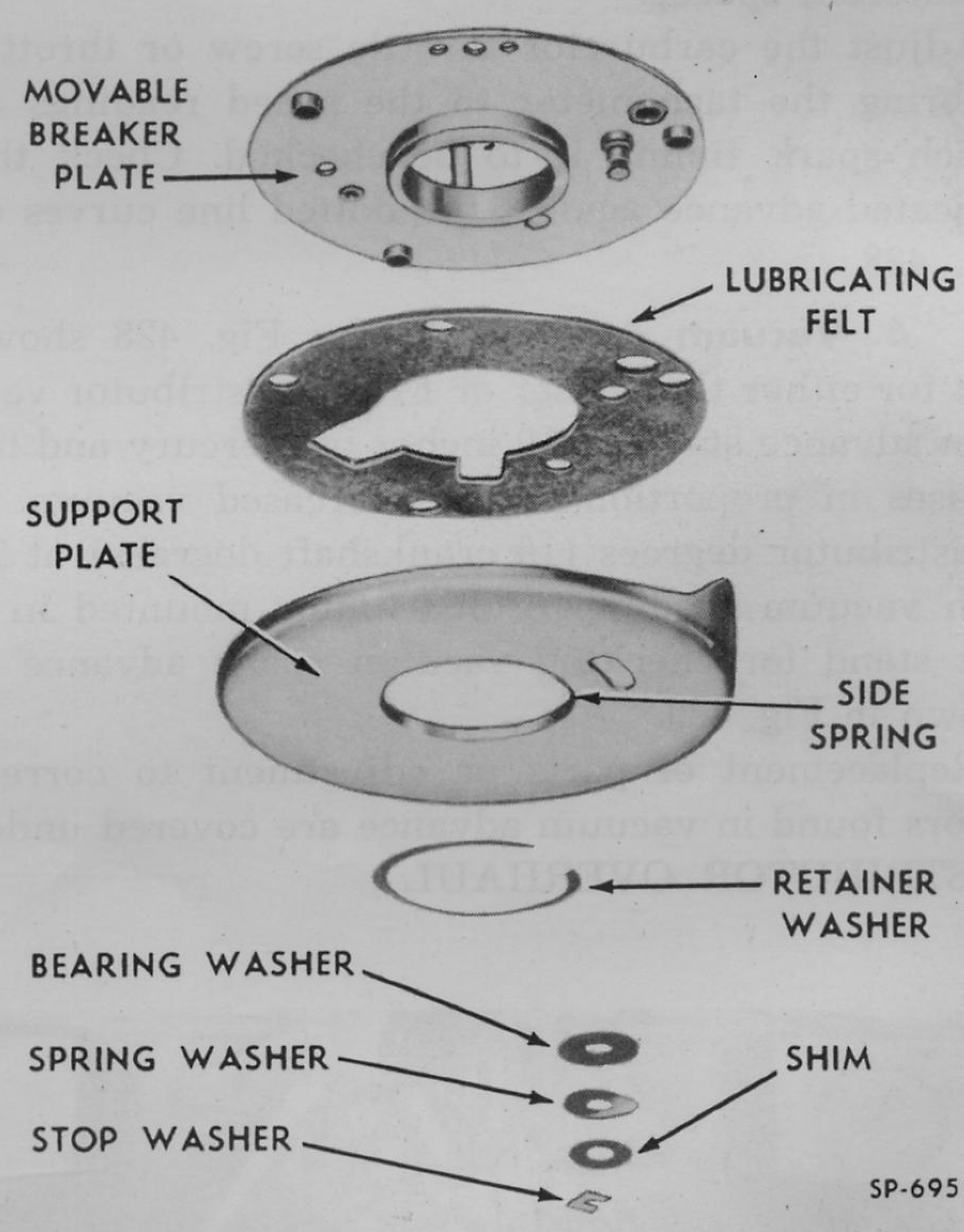


Fig. 430—Kaiser Distributor Breaker Plate—Exploded View

(c) *Centrifugal Advance Mechanism Disassembly.* Remove the nuts that fasten the hold-down plate. Remove weight springs, advance cam and weights.

(d) *Breaker Plate Disassembly.* Release C-shaped retaining washer, shim, spring washer and plastic bearing washer from stop stud extending down through support plate. Remove retainer washer from groove in movable breaker plate bearing. Lift out movable breaker plate and lubricating felt (Fig. 430).

CAUTION: Be careful not to dislodge or lose small slide spring carried in recess in center hole in support plate. This spring aids in preventing breaker plate side sway and contributes to the overall tension or drag of the breaker plate assembly.

(e) *Cleaning, Inspection and Test of Parts.* 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 or brush condenser or insulated conductors. Wipe such parts with cloth dampened with solvent and immediately wipe dry with a clean cloth.

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

(2) Clean breaker parts and breaker plate carefully. Do not dip felt in solvent. Examine the three plastic support points and the breaker arm stud for evidence of wear.

(3) If excessive wear is found replace entire breaker plate assembly. The breaker plate and support plate are not serviced separately.

(4) 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 CHECK AND ADJUST BREAKER DRAG.

(5) 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 predictable seepage of oil from the reservoir and upon use of oil of the prescribed viscosity.

2. Kaiser Distributor Assembly and Adjustment. Distributor reassembly, after the cleaning, inspection and substitution of new for worn or damaged parts is virtually the reverse of disassembly. Reassembly includes certain lubrication operations and is followed by testing.

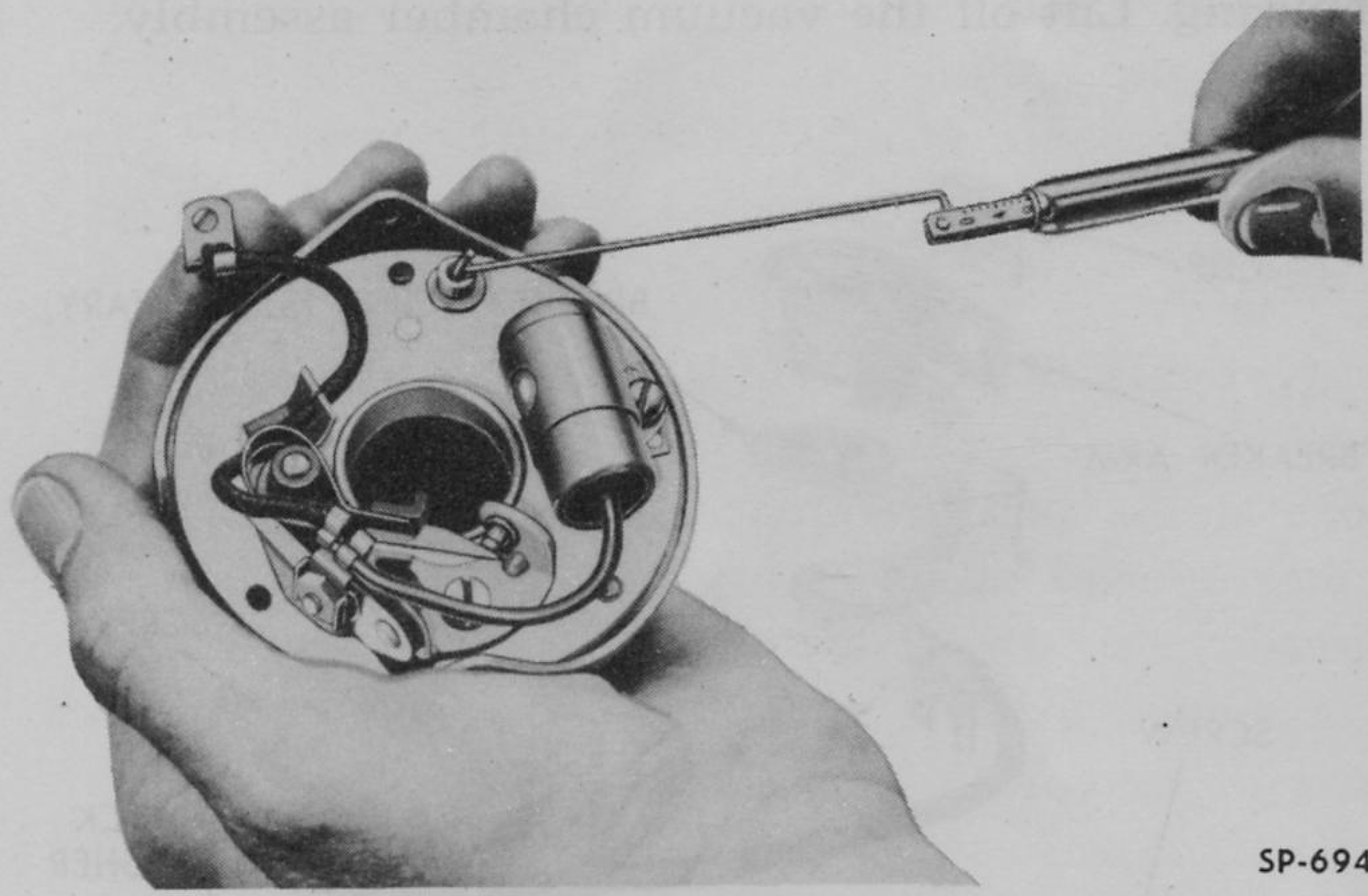
(a) *Check and Adjust Breaker Plate Drag.* After the breaker plate and support and related parts have been reassembled check the movable breaker plate drag as illustrated in Fig. 431. The drag should not be less than 8 or more than 16 ounces.

Adjust this drag by adding shims as necessary between the C-washer and the spring on the stud under the support plate (Fig. 430).

(b) *Lubrication During Assembly.* Lubricate the various bearing parts during assembly:

(1) Remove the plug from the reservoir surrounding the distributor shaft porous bushings and fill with SAE 20 engine oil. Apply sealer to the plug threads and install and tighten the plug.

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



SP-694

Fig. 431—Checking Kaiser Distributor Breaker Plate Drag

(3) Apply a thin film of SAE 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 SAE 10W oil at the breaker arm bushing, move the arm a few times and wipe away the excess oil.

(5) Apply 1 or 2 drops of SAE 10W oil to the lubricating felt between the movable breaker

plate and its support plate. This can be put in at the end of the elongated slot for the stud for the friction washers, or through the tapped hole for the screw that attaches the vacuum advance tank.

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

(c) *Final Test After Assembly.* After assembly test the distributor for proper performance on an approved distributor tester as outlined under IGNITION TUNE-UP AND TESTS.

3. Frazer Distributor Disassembly. This distributor (Auto-Lite model IGS 4214) is illustrated in Figs. 422 and 423.

(a) *Vacuum Advance and Breaker Plate Removal.*

(1) Release the two spring clips and remove the distributor cap and rotor.

(2) Remove the two screws and lock washers that attach the vacuum chamber to distributor housing. Lift off the vacuum chamber assembly.

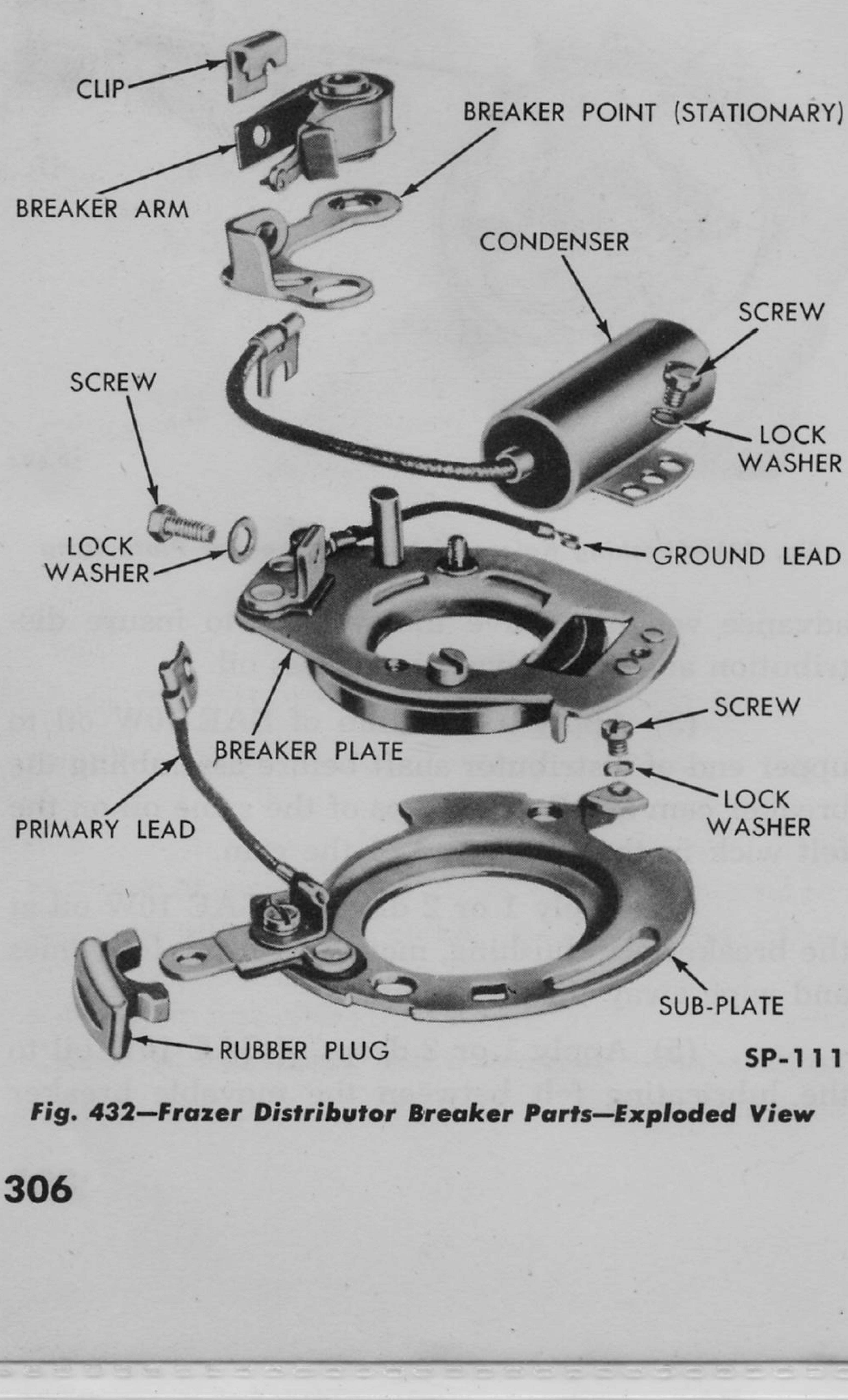


Fig. 432—Frazer Distributor Breaker Parts—Exploded View

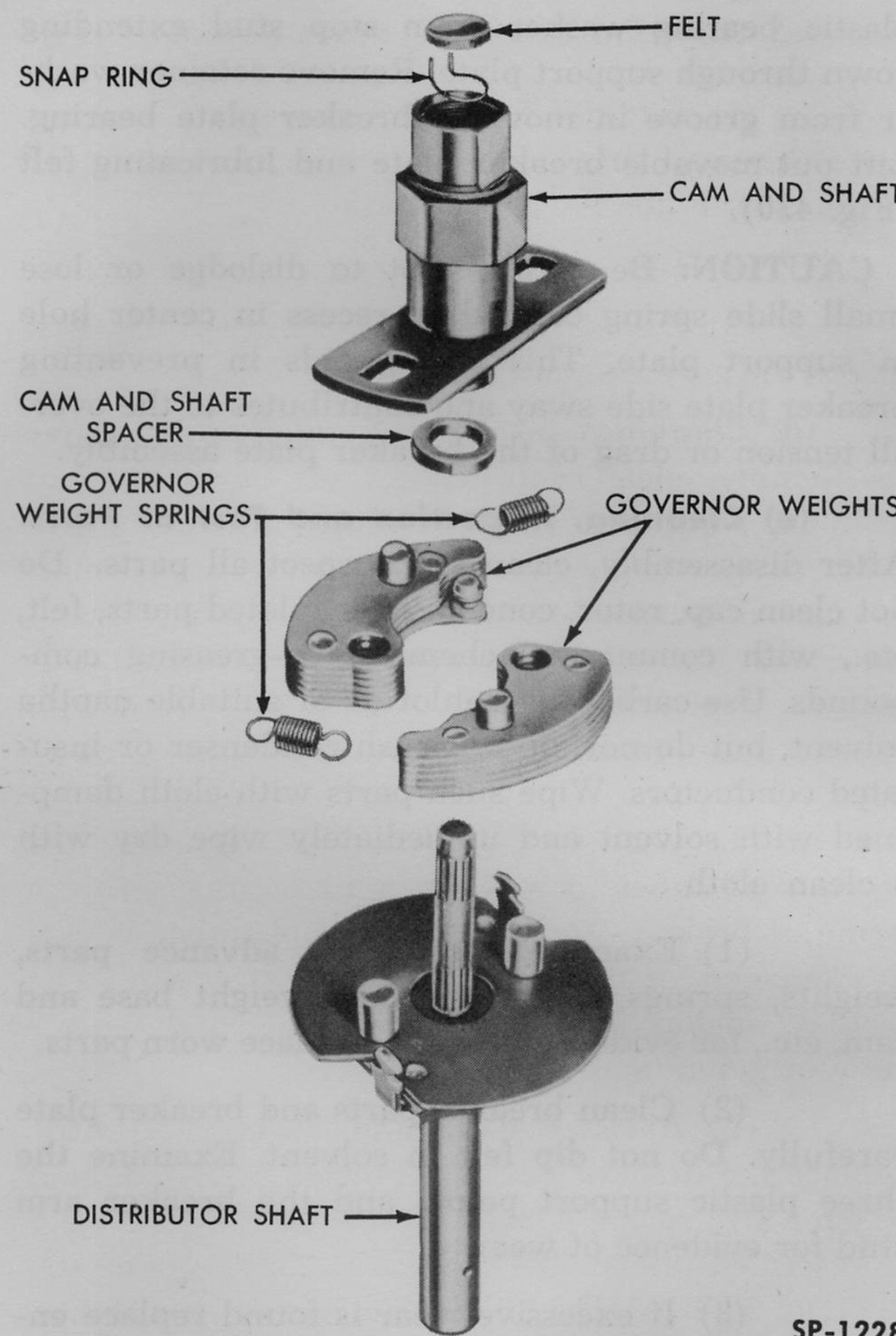


Fig. 433—Frazer Distributor Centrifugal Advance Parts—Exploded View

(3) Remove the two breaker plate to housing screws, lock washers and bearing clamps and lift out the breaker plate assembly.

(4) Remove the plug, gasket, adjusting washers and spring from vacuum chamber.

(b) *Breaker Plate Disassembly* (Fig. 432).

(1) Disconnect the breaker plate lead from breaker moving plate and breaker stationary or mounting plate.

(2) Remove the condenser attaching screw, the screw and clip from condenser pigtail terminal and the condenser.

(3) Lift off the breaker arm.

(4) Remove the screw that fastens the stationary contact bracket to the breaker plate and lift out the stationary (adjustable) contact.

(c) *Cam and Governor Parts Removal* (Fig. 433).

(1) Lift the felt from above cam and remove the snap ring that secures the cam assembly to the distributor governor shaft.

(2) Lift out the cam assembly.

(3) Disconnect the governor springs and lift out the governor weights.

(d) *Cleaning, 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 or brush condenser or insulated conductors. Wipe such parts with cloth dampened with solvent and immediately wipe dry with a clean cloth.

(1) Vacuum Chamber Parts. 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.

(2) Breaker Plate and Parts (Fig. 432). Replace the breaker points if burned or pitted, or if breaker arm spring is broken. Check the condenser as described under CONDENSER TEST under IGNITION TUNE-UP TESTS. Replace if it is faulty. Inspect primary and ground leads and replace if broken or if insulation is worn or frayed. 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. Replace plate if either terminal plate is grounded.

(3) Distributor Base and Shaft (Fig. 433). Replace the distributor base or housing if cracked or damaged. Check the fit of the distributor shaft in its bushings. Fig. 434 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.

(4) Distributor Shaft Replacement. File or grind one end of the pin down to the drive coupling and drive out the pin. File away any burrs left by pin removal. When the old coupling goes onto a new distributor shaft the new shaft must be drilled for the new pin.

(5) Distributor Base Bushings Replacement. Drive out old bushings with a mandrel that will not damage the distributor housing. Press in the new bushings with a shoulder mandrel, the polished pilot of which is long enough to reach through both bushings and is .0005 inch larger than diameter of the new shaft. **CAUTION:** Lower bushing should be flush with the lower end of the base, but upper bushing should be pressed down until .094 inch below upper edge of bearing bore.

Remove distributor oil cup and drill an oil hole the same size as oil passage through new bushing. Re-insert the mandrel to assure bearing alignment and size. **Do not ream or scrape an oil-impregnated bronze bushing.**

Before drilling new distributor governor shaft for drive coupling pin, install new upper and lower

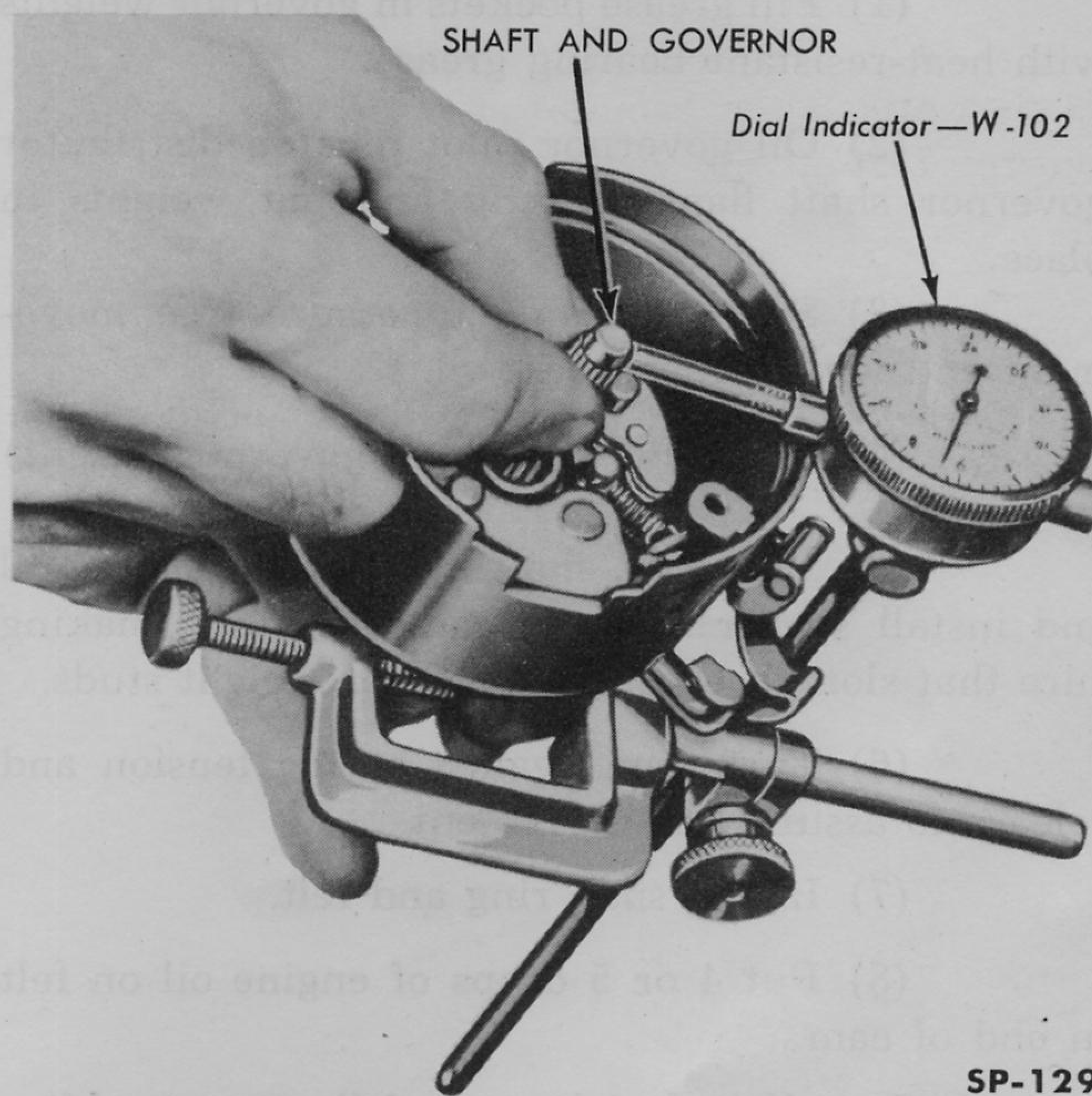


Fig. 434—Checking Distributor Shaft Side Play

thrust washers. Compare position of the coupling on new shaft with the position of hole in the old shaft. Turn the coupling so that 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 and for ease of shaft rotation. Then drive the pin through and peen ends. Either a feeler gauge or a dial gauge can be used to check end-play.

If no bushing replacement is needed but end-play is more than .025 inch, remove coupling and insert thicker thrust washers.

(6) Governor and Cam Parts (Fig. 433). 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.

4. Frazer Distributor Assembly and Adjustment. Distributor reassembly, after the cleaning, inspection and substitution of new for worn or damaged parts, is virtually the reverse of disassembly. Reassembly includes certain lubrication operations and is followed by testing.

(a) *Distributor Base and Governor Assembly* (Fig. 433).

(1) Fill grease pockets in governor weights with heat-resistant bearing grease.

(2) Oil governor pilot pins on distributor governor shaft flange lightly and put weights in place.

(3) Swing weights to assure free movement and wipe away excess oil.

(4) Connect centrifugal (governor weight) springs.

(5) Lubricate shaft lightly with engine oil and install spacer and the cam assembly, making sure that slots fit over the governor weight studs.

(6) Turn cam against spring tension and release to assure free movement.

(7) Install snap ring and felt.

(8) Put 4 or 5 drops of engine oil on felt in end of cam.

(b) *Centrifugal Advance Adjustment.* After completing distributor assembly, bench test the centrifugal advance performance as described under CENTRIFUGAL (GOVERNOR) ADVANCE TESTS under IGNITION TUNE-UP AND TESTS.

(1) Bend the distributor spring brackets as needed to make the centrifugal advance start at 325 distributor RPM. One spring should be slightly loose and the other tight when advance starts.

(2) Increase test bench speed and check point where full advance is reached. If necessary bend bracket of the looser of the two springs to control speed of full advance.

(3) Check amount of advance at several intermediate speeds, with speed increasing and with speed decreasing, to assure satisfaction of specifications.

(c) *Breaker Plate and Breaker Assembly* (Fig. 432).

(1) Install breaker movable plate on breaker sub-plate or mounting plate with the stop on upper plate entered in the mating rectangular opening in lower plate.

(2) Position contact bracket screw and lock washer.

(3) Place breaker arm over its pivot, lubricate with one drop of engine oil, and secure breaker arm spring to the primary post or bracket with breaker arm spring clip.

(4) Connect condenser lead or pigtail and primary lead to primary terminal bracket or spring bracket with screw and lock washer.

(5) Connect other end of the primary lead to primary terminal plate (coil wire terminal plate) on lower plate, with screw and lock washer.

(6) Connect ground lead to movable breaker plate and breaker mounting plate with screws and lock washers.

(7) Install new terminal slot cover at primary (coil wire) plate or terminal.

(8) Position two breaker plate bearing clamps (retainers) on breaker plate with indentations on the clamps facing downward and toward the center.

(9) Place breaker plate assembly in distributor base or housing and attach with two screws and lock washers.

(d) *Vacuum Advance Assembly and Adjustment.*

(1) Install in the vacuum chamber, the spring, adjusting washers and cap that were removed and a new cap gasket.

(2) Connect the vacuum advance arm to the stud on the breaker plate (Fig. 432).

(3) Attach the vacuum chamber to the distributor base or housing with two screws and lock washers.

(4) Make vacuum advance adjustment by changing number or thickness of the washers between the cap and the spring (Fig. 423).

(5) Check action of vacuum unit on the test stand, as explained under VACUUM ADVANCE TESTS, under IGNITION TUNE-UP AND TESTS.

(e) *Breaker Point Adjustment.*

(1) Adjust breaker points as directed under BREAKER POINT ADJUSTMENT under INSPECTION AND MAINTENANCE IN THE VEHICLE.

(2) A distributor test stand check of dwell angle and the uniformity of break for the different cylinders is recommended. Refer to BREAKER DWELL ANGLE CHECK under IGNITION TUNE-UP AND TESTS.

(f) *Breaker Arm Spring Adjustment.* Check breaker arm spring tension and make any adjustment necessary as specified under BREAKER POINT REPLACEMENT under INSPECTION AND MAINTENANCE IN THE VEHICLE.

(g) *Rotor and Cap.* Install rotor and distributor cap and fasten cap with spring clips.

(h) *Final Test After Assembly.* After assembly test the distributor for proper performance on an approved distributor tester as outlined under IGNITION TUNE-UP AND TESTS.

OVERDRIVE ELECTRICAL SYSTEM

a. GENERAL INFORMATION. The overdrive electrical system includes a knob-controlled lock-out (shift rail operated) switch, a governor switch, a kick-down switch, a relay and a solenoid, with the electrical cables or wiring harness necessary to inter-connect them and to supply current for their operation. Through the operation of these various switches, relays and the solenoid, the transmission overdrive is brought into operation, or prevented from operating.

The purpose of the overdrive, as explained in detail in Section 6, "Transmission and Overdrive" of this manual, is to provide a fourth forward gear ratio to reduce engine speed 30 percent for a given car speed. The construction of the overdrive unit is described and illustrated and the operation explained in detail in that Section. Only that part of the mechanical functioning of the overdrive necessary to tie in with the electrical control is covered in the following paragraphs.

b. OPERATION OF OVERDRIVE ELECTRICAL CONTROLS. If the overdrive lock-out control knob is pushed in as far as possible, the resulting movement of the cable connected shift rail permits the spring loaded lock-out switch to close. See Fig. 435. If the car is in motion at not more than approximately 28 miles per hour, the switch in the speed-sensitive overdrive governor is open.

At higher speeds the governor weights cause this governor switch to close. The electrical circuit is then from ground through the overdrive governor

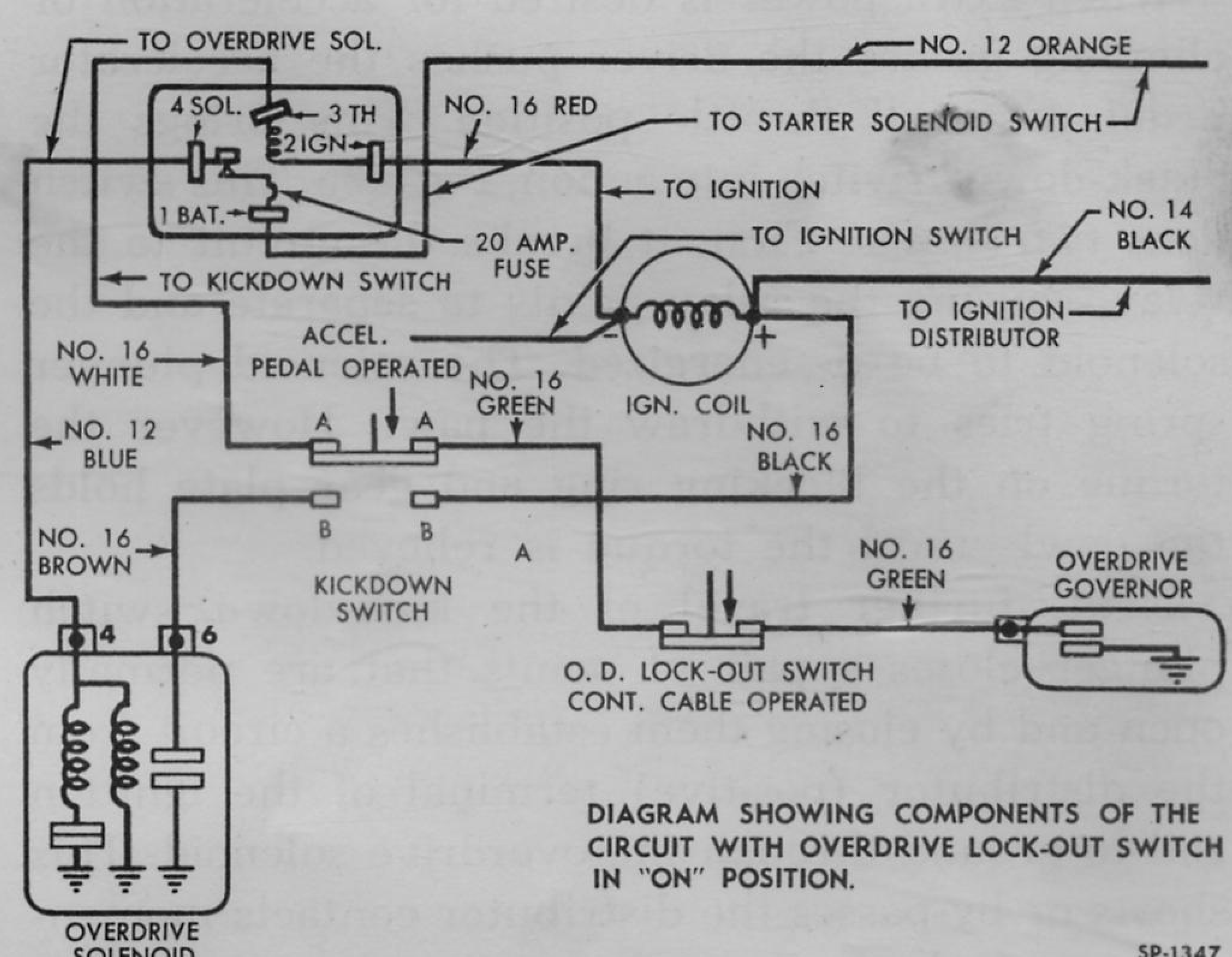


Fig. 435—Overdrive Electrical Control—Wiring Diagram

switch, through the overdrive lock-out switch (which is closed when the overdrive lock-out control knob is pushed in, through the kick-down switch, through 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 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 blocking ring on the stationary gear and 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. The way in which the reversed torque, during the instant the engine slows down, causes the gear plate and blocking ring to back off and allow the slot in the blocking ring to line up with the pawl is explained in Section 6, "Transmission and Overdrive." When the slot lines up with the pawl, the compressed spring in the solenoid pushes the pawl into the slot. This locks the gear plate and keeps the stationary gear from turning. 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. This brings the "kick-down" switch into action, Fig. 435. This switch does two things. First, it 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 blocking ring and gear plate holds the pawl—until the torque is relieved.

Next, further travel of the kick-down switch plunger closes a pair of points that are normally open and by closing them establishes a circuit from the distributor (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 by grounding the coil. This action is so fast that the engine misses only one to three explosions. As the driver eases off on the accelerator the kick-down switch returns to normal position. The car is in normal transmission operation—with the overdrive available whenever the driver lets up on the accelerator enough to establish torque reversal (provided car speed is still above approximately 28 miles per hour).

When the driver allows the car to slow down below approximately 21 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 lock-out control knob is pulled out as far as possible, the overdrive is completely locked out mechanically. Also the shifter rail opens the circuit to the relay coil, when the control knob is pulled out, so that 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 electrical controls of the overdrive to operate properly, keep in mind three points. Assuming the controls to be correctly wired and the wiring to be in good condition:

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, through the lock-out switch, through the kick-down switch, through the relay, to the negative terminal of the ignition coil, through the ignition switch, through the ammeter, 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 the kick-down switch and the plunger-operated contacts in the overdrive solenoid are both closed, as they are in series.

c. MAINTENANCE. Section 6, "Transmission and Overdrive" and Section 17, "Lubrication" contain information on the inspection, care, and lubrication of the mechanical parts of the overdrive mechanism and of the lock-out control between the knob and the transmission. The electrical controls ordinarily require little or no attention as long as they operate properly—except for inspection of the cables or wires for frayed, worn, or otherwise bad insulation and the terminals for tightness and freedom from corrosion. If controls fail to operate properly make the tests and necessary corrections described under GENERAL CIRCUIT TESTS and KICK-DOWN SWITCH TESTS which follow. These tests will determine whether the circuits to the various overdrive control units, and the units, are in good order, or which 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.

d. GENERAL CIRCUIT TESTS.

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.

3. Disconnect the white cable from the relay. Ground 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 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 does not then 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 from the lock-out switch on the transmission and ground the green wire. If no click is heard, replace the green cable between kick-down switch and lock-out switch.

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 28 MPH the lamp should light. At or slightly above approximately 21 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 660-740 RPM and should open during deceleration at 535-660 RPM. The difference between the speeds should be at least 90 RPM.

e. KICK-DOWN SWITCH 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, check the black cable between the kick-down switch and the ignition coil. Replace the cable if necessary.

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:

(a) On Frazer models the kick-down switch is out of adjustment. The switch actuating cam on the accelerator mechanism should just contact the switch plunger at wide open throttle. Additional accelerator pedal travel should depress the switch plunger. If not, re-adjust the switch to correct position. On Kaiser models the kick-down switch is not adjustable. If the accelerator pedal fails to operate the switch adjust the accelerator linkage as described in Section 2, "Fuel."

(b) If it is still inoperative, replace the kick-down switch.

4. Ground the overdrive solenoid "6" terminal (brown cable).

(a) Depress the accelerator pedal to the floor. The engine should stop. If the engine does not stop, check the brown cable between the overdrive solenoid and the kick-down switch. Replace it if necessary.

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

LIGHTING SYSTEM

a. GENERAL INFORMATION. The lighting systems on Kaiser and Frazer automobiles include those lights required by law, that is: headlights, headlight beam indicator, tail light, 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 and pilot lights, instrument lights, courtesy lights, dome light, fog lights, glove and luggage compartment lights, etc. The lighting system includes the cables or wires, the various switches, circuit breakers, fuses, etc., that supply and control the lighting current. When working on lights, switches, and wiring harnesses consult the wiring diagram (Fig. 380 or 382) that applies to the car.

1. Headlights. The modern sealed-beam type unit has its filaments, reflector, and lens sealed by the manufacturer to form a single unit. Such a unit has a glass reflector the inner surface of which is sprayed with vaporized aluminum. 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, with the interior filled with a special inert gas. Thus, sealed like the conventional incandescent lamp bulb, it is protected against moisture and dust, and against any tarnishing or inside fogging. High efficiency is therefore assured throughout the life of the unit. Proper focusing is permanent. The only cleaning necessary is wiping the front of the lens. When finally a filament burns out the glass unit is replaced (Fig. 436).

2. Other Lights. Parking lights, tail lights, directional signal and stop lights, compartment lights, instrument lights, etc.,—in fact 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 have two filaments, therefore double contacts. For information as to the candlepower of the various light bulbs refer to the applicable Kaiser or Frazer Parts List.

b. LIGHT BULB REPLACEMENT. When any light fails to go on when the proper control switch is turned on, decide whether it is easier to try installing a new bulb, or first to check some convenient near-by terminal to determine whether current is available at the bulb, that is whether there may be some fault in the switch or wiring. 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 to ground from the terminal of the junction block to which the red or black cables attach. With the 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.

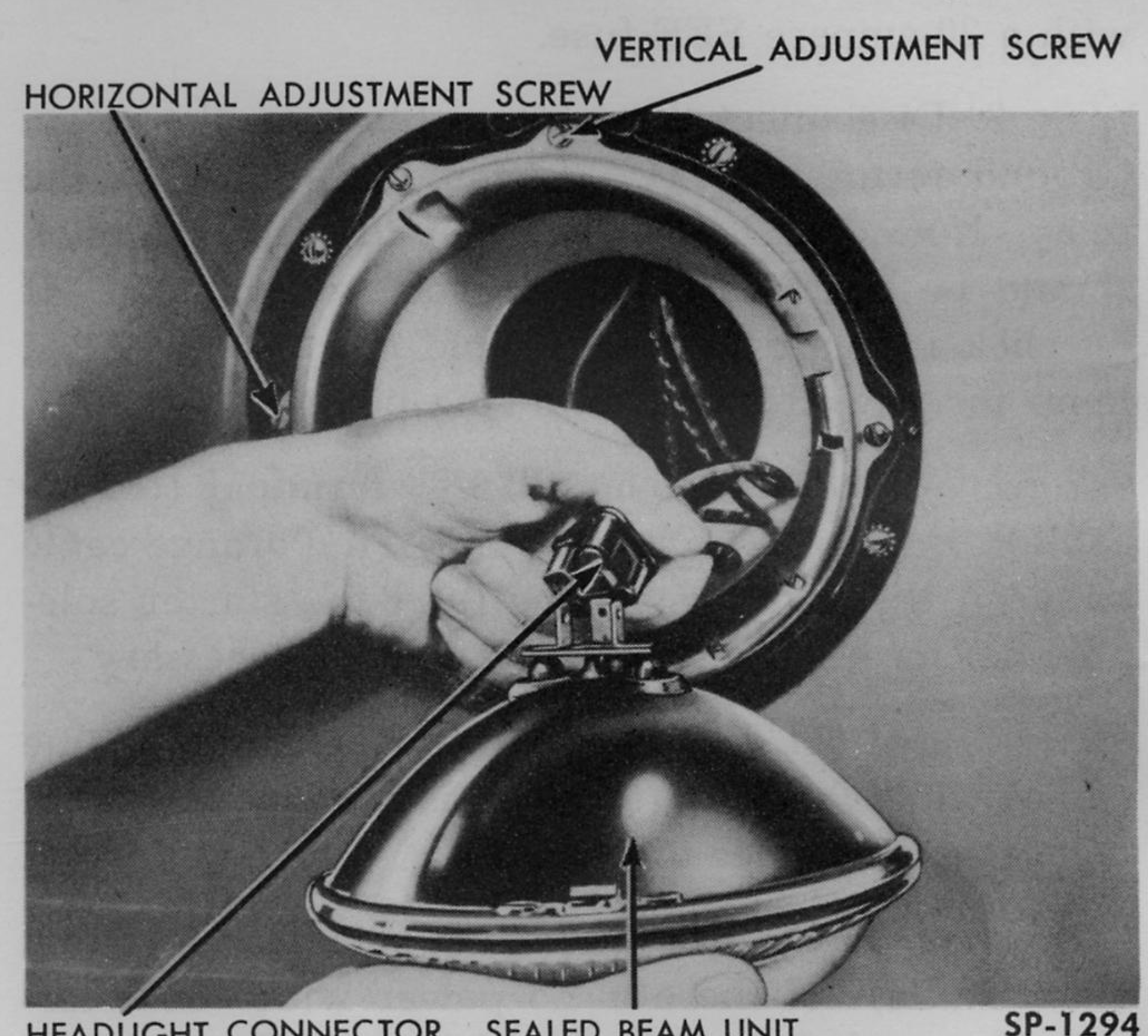


Fig. 436—Replacing Frazer Headlight Sealed Beam Unit

Then with the headlight switch turned off use a jumper from the hot terminal of the starter solenoid switch, or from the hot battery terminal of the horn relay, to the black cable terminal of the junction block. This should light the depressed beam.

For the upper or driving beam, make a similar test to the junction block terminal to which the red cables attach, and for a parking light, to the terminal to which the yellow cables attach. Make reasonably sure that electricity is flowing to the lamp before removing a bulb that is not readily accessible or easy to remove.

1. Headlight Sealed-Beam Unit Replacement. If a simple, quick test of the feed circuits indicates need of seal-beam unit replacement (or likelihood of circuit trouble at the unit connector or the lamp ground) remove the lens door (outer rim) screw and the door. Then loosen the retainer ring retaining screws and turn and remove the retaining ring. Lift out the sealed-beam unit (Fig. 436), and pull off the connector.

2. Complete Headlight Removal. If the entire headlight must be removed, disconnect the headlight wiring harness (black and red cables) at the junction block, remove the five mounting screws and lift out the assembly.

3. Aiming Headlights. Headlight beams can be aimed easily and quickly with test equipment made for the purpose. If such equipment is not available, check the aim and adjust as follows:

(a) Stop the car on a smooth, level floor or pavement 25 feet from a vertical surface, such as a door or wall, preferably of light color. Have the center line of the car at right angles to the vertical surface. The car should not be loaded and the tires should be properly inflated to assure correct adjustment.

(b) Measure the height of the centers of the headlights from the floor. On the vertical surface of the door or wall draw a horizontal line located by measuring a height from the floor (H, Fig. 437) which is three inches less than the height of the headlight centers. Mark a point on this line in line with the axis or center line of the car 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 (LL and RR).

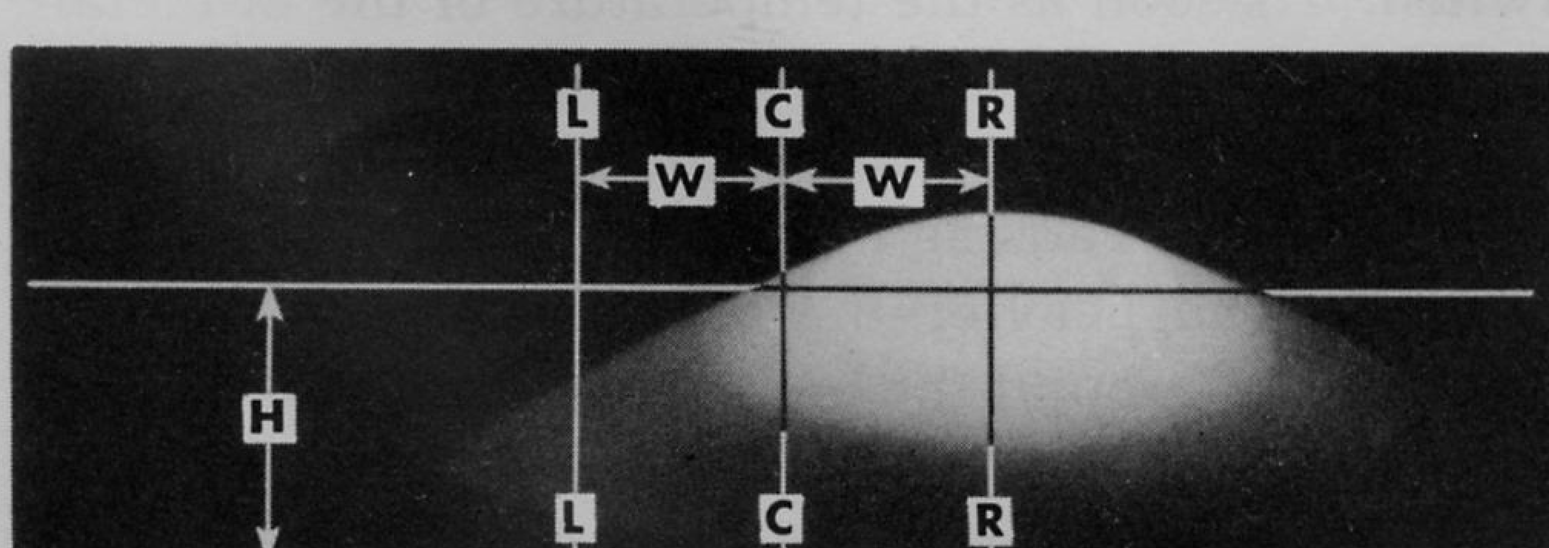


Fig. 437—Pattern of Properly Aimed Headlight

(c) Remove the retaining screw and the lamp door (forward ring). Turn the headlights on to the driving or upper beam. Cover the left headlight and aim the right one by turning the upper adjusting screw (Fig. 436) to tilt the beam up or down and the side screw to swing the beam to right or left. Adjust to obtain the relation between the light beam pattern and the lines on the wall as shown in Fig. 437. Then cover the right headlight and aim the left one, centering the beam pattern on the left vertical line (LL, Fig. 437).

(d) Install the headlight doors and retaining screws.

4. Front Parking and Directional Signal Lights. For the parking lights, check, at the front junction block, the terminals to which the yellow cables attach. Refer to the proper wiring diagram (Fig. 380 or 382). For the directional signal light, check the junction block terminals to which are attached the green cables **leading to the lights.** (There may be a brown harness cable connecting the parking light terminals of the two blocks).

A 6-volt test lamp from terminal to ground will indicate if the switch and circuit to the junction block are operating when the directional signal switch is in right or left turn position, corresponding to the lamp being checked. With the switch turned off, contact the junction block terminal with the end of a hot lead.

If the light does not light remove the two screws and take off the bezel and the lens and replace the bulb.

To remove the complete light assembly, disconnect the lead cables at the junction block and remove the nuts and lock washers. Pull the light assembly loose from the rubber pad.

5. Tail, Stop, License and Rear Directional Lights. The light bulb for each of these lights is removed from the inside of the rear compartment with the socket which is part of the connector and has no junction block. To replace the light bulb turn the socket at the light housing and pull the socket out of the housing (Figs. 438 and 439). Remove the bulb from the socket.

To test a bulb mounted in the above manner, make a jumper ground between the socket shell and a convenient ground. If the proper switch is closed and the circuit to the bulb is energized, a good bulb should light. If the bulb is blackened or burned out, install a new bulb and test.

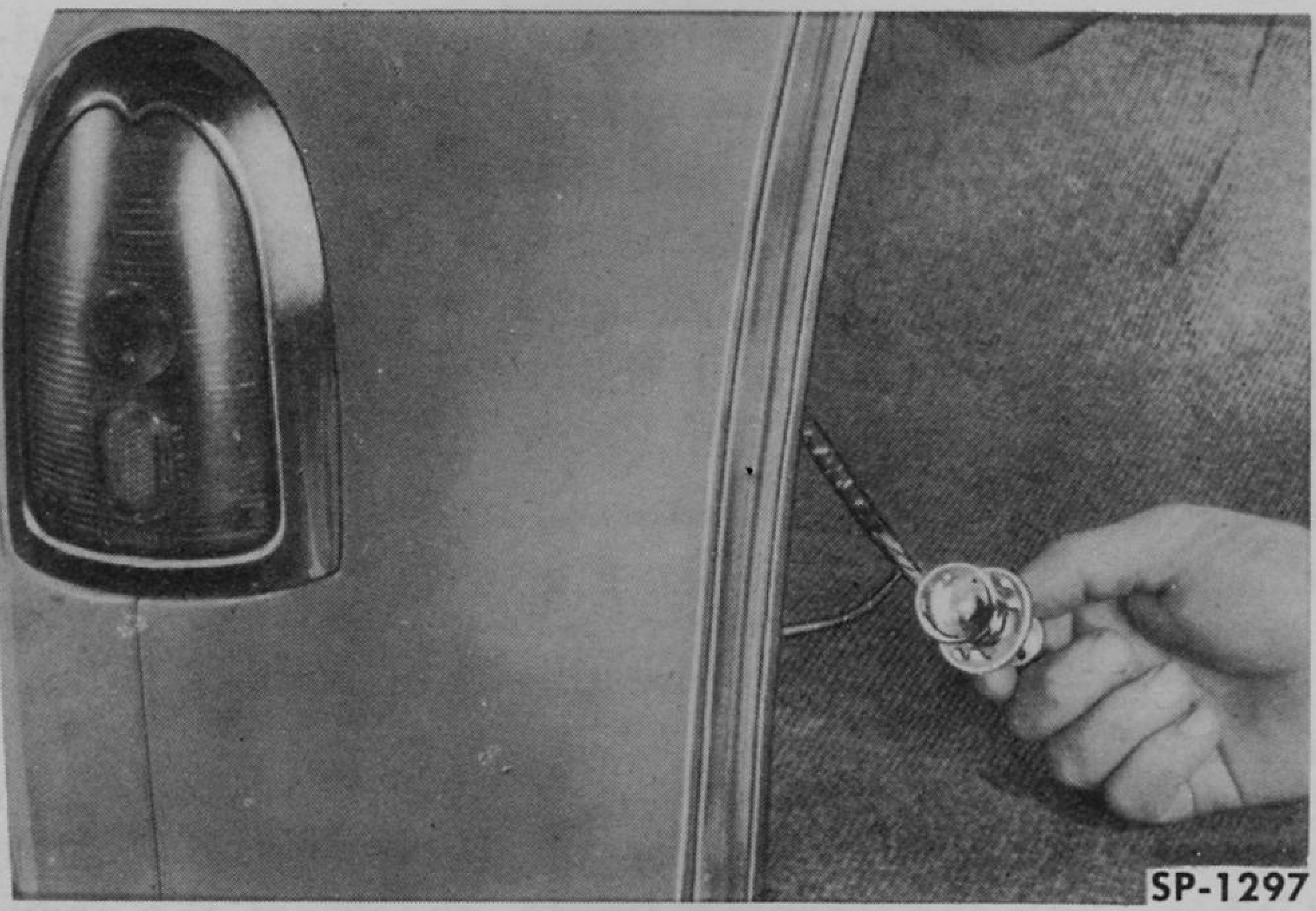


Fig. 438—Kaiser Tail Light Socket and Bulb

6. Glove and Rear Compartment Lights. The bulbs in these lights are in recessed reflecting housings and can be reached easily for replacement without removal of any lens or cover.

7. Dome, Pillar, Map and Courtesy Lights. The bulb in the dome or a pillar light is easily replaced after prying off the bezel with the lens. Rear compartment courtesy lights are in sockets easily snapped out of the light body. The map light bulb is reached for replacement after removing the bezel and lens on the steering column cover. Bulbs in the driver compartment courtesy lights are in sockets which can be snapped out of the light body without removing the bezel and lens.

Fig. 439—Frazer Tail Light Socket and Bulb

c. SWITCHES.

1. Headlight Switch and Circuit Breaker. The pull-type headlight switch (Fig. 440) is conveniently mounted on the instrument panel. The first out position of the knob is for parking, tail, and instrument panel lights; the second position, for head, tail, and instrument panel lights.

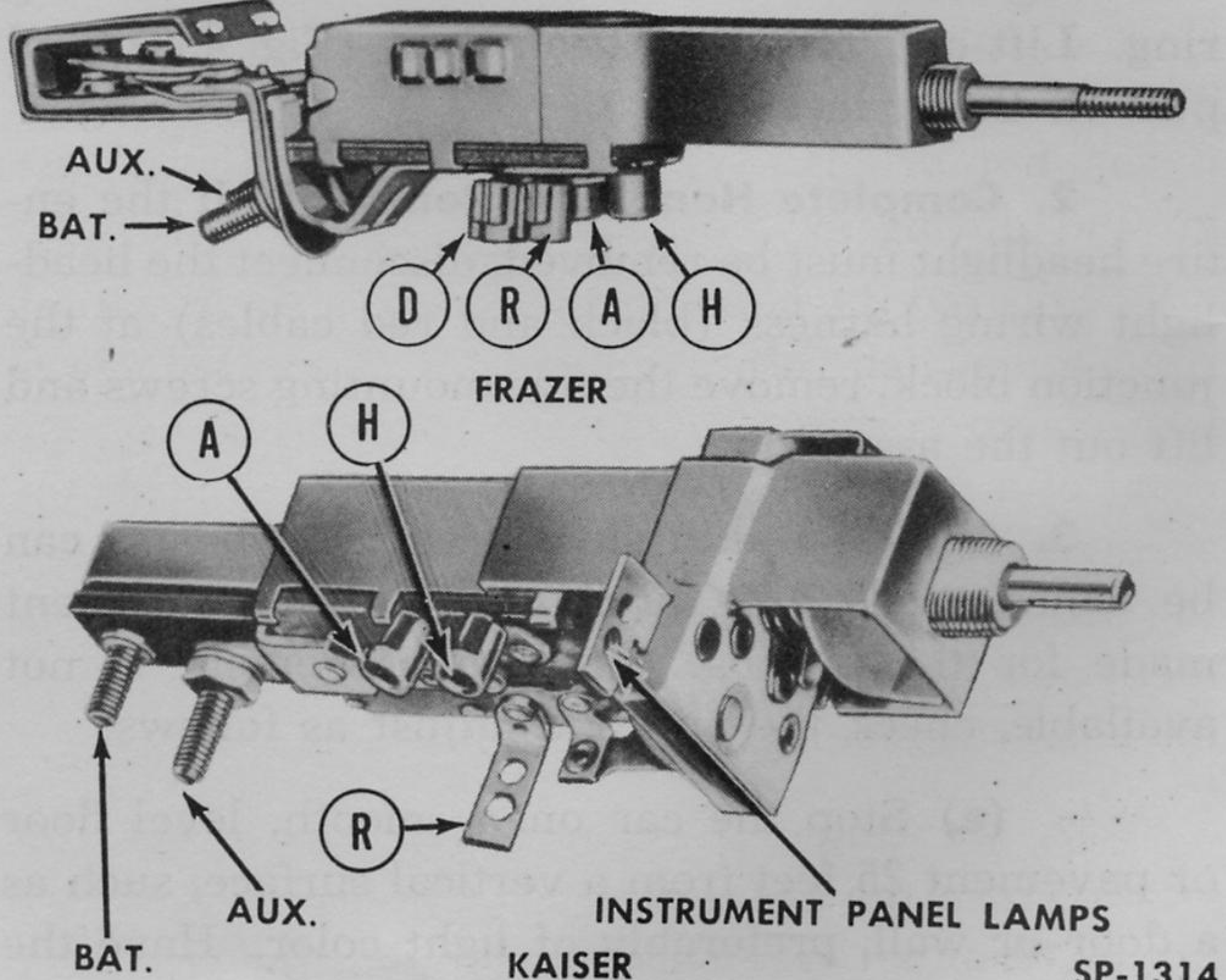


Fig. 440—Headlight Switch with Circuit Breaker

Built into the headlight switch is an overload circuit breaker which is an effective safety feature. An overload (more than 30 amperes) through this switch, such as through a grounded or short circuited cable, causes heating of a bi-metallic element and separation of contact points. The points "snap" apart, interrupting the flow of current through the switch. As soon as the temperature of the bi-metallic element falls the points snap together, again closing the circuit. Thus this switch acts like a "flasher" unit, causing the connected lamps to go on and off. The heavier the current flowing through the short or ground the more quickly the points will separate.

Combined with the Kaiser headlight switch (Fig. 440) is a dimmer switch for the instrument panel lights.

(a) Headlight Switch Test. If the headlight switch fails to operate tests can be made with a test light. First, with a test light from terminal to ground, check for current at the "BAT" terminal (Fig. 440) and then test for continuity through or grounds in the switch. With the switch off a test lamp with one side grounded should show no light at terminals "H," "A," "R," or "D." With the knob pulled half way out, that is to the parking position, light should be obtained from "H" and "D" or "R." If the overload breaker points shown no evidence of having been burned, test of the overload breaker is not neecssary.

(b) Headlight Switch Replacement. If any of the foregoing tests shows the headlight switch to be out of order, install a new one. The battery ground cable should be disconnected before the switch is removed to guard against a possible short if the hot or "BAT" terminal should touch any ground during switch removal.

To take out the headlight switch, remove the knob from the switch rod. If no set screw is used, there is a clamp spring. To release this spring use the point of a small screwdriver in the slot to push the spring back toward the head of the knob. Remove the nut that holds the switch assembly to the instrument panel. Detach the cables, noting the color code for correct reconnection.

2. Headlight Dimmer Switch. To check this switch, turn the headlights on. Connected from the center terminal (red wire) to ground, the test lamp should light if the headlight switch and cables are in good order. Check with a test lamp to ground, from one, then the other, outer terminal. One should light and not the other. Push the foot button and the other terminal should become energized. The two red cables connect with the headlight upper or driving beams and the beam indicator on the panel. The single black lead connects to the the headlights for the depressed or passing beams. If this switch is out of order, replace it.

3. Stop Light Switch. To test this pressure-operated switch, put a jumper, or screwdriver, across the terminals. This should light the stop lights if circuits and bulbs are in order. If they light with the jumper, but not when pressure is applied to the brake pedal, replace the switch. If tested at the bench, the switch should close the circuit at between 50 and 110 pounds per square inch pressure.

4. Dome, Courtesy, Map, and Compartment Light Switches. Each of these switches has a hot cable on one terminal. Check circuit continuity and determine which is the battery side of the switch with a test lamp from terminals to ground. Then connect from the load side of switch to ground through the test lamp. Operate the switch. If it closes the circuit the test lamp should light. If the switch does not close the circuit, install a new switch.

This applies to switches of the door-operated type as well as to switches intended for hand operation. The door switches are sometimes described as "normally closed," that is they are closed by internal spring action until the closing of the door pushes the plunger and "opens" the switch. In checking cables and wiring keep in mind that one light may have two or more control switches in parallel, one of which may close the circuit.

5. Ignition Switch. If the ignition switch is turned counter-clockwise and the key removed it will be locked OFF. In center position ignition is ON. If the key is removed with the switch in either the center position, (that is with ignition ON) or in clockwise OFF position, the switch can be turned ON or OFF without a key.

Accessories, such as radio and heater, installed after the car leaves the factory should not be connected through the ignition switch. Unless installation instructions (as for the Kaiser heater) specify connection through the ignition switch, such accessories should be wired to the output side of the ammeter or the input (BAT) terminal of the headlight switch. Serious damage to ignition equipment might be caused by leaving the ignition turned ON, for radio operation, with the engine not running.

6. Directional Turn Signal Switch. This switch, mounted on the steering column housing or jacket, controls the electric circuits through the flasher unit or interrupter and the turn signal and turn pilot or indicator lights. The sealed flasher unit contains a thermally controlled relay to open and close the circuits at an intended frequency.

The Kaiser and Frazer directional turn signal switches are basically the same in internal construction and in electrical operation, but are not interchangeable as units. The wiring connecting the directional signal switch with the flasher unit and with the pilot or indicator lights on the Kaiser difers from that on the Frazer, as shown in the wiring diagrams (Figs. 380 and 382).

(a) *Flasher Units and Circuits.* The simple Kaiser directional turn signal wiring (Fig. 380) places each directional turn pilot or indicator light, in the speedometer dial, in parallel with the front and rear directional turn signal lights on the same side of the car. The Frazer car turn signal pilot lamp bulbs are mounted in insulated sockets (Fig. 382) and the shells of both lamp bases are electrically connected together and to the P terminal of the flasher. Inside the sealed Frazer flasher unit a magnetically operated relay (thermally controlled) opens and closes the pilot circuit to cause the flashing of one or the other of the Frazer pilots, according to which lamp is connected through its cable through the junction block to the turn signal switch.

(b) *Flasher Operation.* So closely is the sealed flasher unit adjusted to its intended loads that proper operation is disturbed by the burning out of the 21 candle-power filament in any one of the four turn signal lamp bulbs. Also, the replacement of any one of the four signal lamp bulbs by one of the wrong candlepower, or the failure of a cable leading to any of the four sockets, will prevent proper flashing when the directional turn signal switch is moved to warn of an intended turn. Actually pilot light flashes of **normal** frequency tell the driver, when he moves the directional turn signal switch lever, that both the connected front lamp and connected rear lamp are operating. Higher (almost double) frequency indicates that one lamp is not operating.

(c) *Checking Directional Turn Signal Lamps.* With ignition switch on, turn signal switch to indicate turn in one direction, then the other. Watch pilot lights. Frequency should be normal and the same for both directions. If one directional pilot flashes at higher frequency than the other, check the lamps for that direction for bulb or circuit failure.

If a pilot lamp fails to light, but the signal lamps light and flash at proper frequency when the signal switch is turned, replace the 1 candlepower pilot lamp. The pilot lamp sockets can be snapped out of their mounting plates behind the speedometer dial for lamp replacement without removal of instruments.

If moving switch lever (with ignition switch on) to a turn indicating position does not light any signal or pilot lamp check circuits and flasher unit.

(d) *Checking Flasher Circuits.* Use a 1 candlepower test lamp with suitable leads, preferably with alligator clips. With one clip grounded, touch the other clip or probe to X (hot) terminal of flasher unit or mating socket of connector (Fig. 380 or 382). If ignition switch is on, lamp should light. If it does not light, check hot terminal of push button starter switch. Then, with flasher unit pulled part way out of connector, using a probe in lamp terminal clip if necessary, check L terminal of flasher. If flasher is working properly lamp should light, with signal switch in either turn position.

If it does not light, pull flasher out and with test lamp check internal circuit continuity between X and L terminals of flasher unit. To do this snap one terminal of test lamp (other being still grounded) onto one of the flasher unit terminals. Connect other flasher terminal to hot socket of connector. If lamp does not light discard flasher unit.

If flasher unit has failed, there may be ground or short circuit somewhere in some circuit leading to one flasher or pilot lamp. To test, connect leads from ends of a 10 ampere fuse, or leads from a 21 candlepower test lamp, to the sockets of the connector that mate with the X and L terminals of the flasher unit. If the fuse blows or the 21 candlepower light glows at full intensity trace circuits to lamps (and signal switch) for ground or short circuit. To isolate certain circuits or parts of circuits for test (Fig. 380 or 382) disconnect appropriate cable terminals at junction blocks.

CAUTION: If one flasher unit has burned out it is costly to try another and have it, also, burn out because of ground or short circuit somewhere in the wiring.

If flasher unit is found to be in working condition, put it back into the connector and with one lead from the 1 candlepower test lamp, the other lead from which is still grounded, contact junction block terminal to which are attached the blue leads from the flasher unit and the signal switch (Fig. 380 or 382). The lamp should light.

Next with signal switch set for right turn, contact test lamp terminal (the other terminal being still grounded) with instrument junction block panel to which three brown cables are attached, then to the terminal to which 2 yellow leads attach. If switch is in good order, lamp should light in each case.

Next turn signal switch for left turn and, as before, with test lamp contact the junction block terminal to which three green leads attach. Then separate connector in orange lead and contact the conductor connected with turn signal switch. In both cases, if switch is in order, lamp should light.

If after switch circuits have been tested at instrument panel any signal or pilot lamp fails to light after new lamp bulb installation check with test lamp from proper junction block terminal to ground to establish circuit as far as the junction block.

(e) *Turn Signal Switch Removal.* After the 6 cables have been disconnected at the junction block and connector remove the steering gear jacket trim cover (if vehicle is so equipped) and pull the steering wheel (Section 10, "Steering") to give access to the switch. Machine screws with lock washers hold the switch in place.

(f) *Emergency Circuit for Stop Light.* It may be desirable or necessary to operate the stop light with the directional turn switch removed. Normally current for the stop light passes through the signal switch. To detour current from the stop light switch direct to the stop light, mate the connector of the red cable to the left signal light with the connector of the red cable from the stop light switch.

WIRING

a. WIRING HARNESS. Most of the cables or insulated wires of the electrical system are made up into "harnesses." The loom, conduit, or wrapping protects the cables during the life of the car, and the color coding or marking serves to identify the different cables when any service work is required and any units or circuits are later to be connected or tested.

b. WIRING DIAGRAMS. Figs. 380, 382, 396, 397 and 435 are diagrams of the various electrical circuits and connections. Figs. 381 and 383 showing the wiring harnesses and major electrical units superimposed on phantom views of Kaiser and Frazer vehicles to show position. Cables of certain sizes in the harness have "tracer" threads, either black or white, which contrast with the insulation color, to indicate the size of the wire. If two cables of the same color leave the harness close together, the tracers make it easy to identify the circuit. For the sizes most commonly used the code tracers are: No. 18—none, 16—1, 14—2, 12—3, 10—none, 8—1, etc. The wiring diagrams show the code colors, and generally the sizes of cables, used in the various Kaiser and Frazer cars. The diagrams will be helpful when tracing circuits, making tests of circuits for grounds, shorts, or continuity, checking to determine that electrical equipment is operating properly, and to determine and remedy causes of improper operation.

c. CHECKING CIRCUITS. Often in this Section of the manual, instructions have been given regarding the use of equipment to test for grounds or short circuits, broken wires or open circuits, etc., both in the car wiring and in testing various electrical units and the components of disassembled units. The use of 110-volt current through a test lamp for continuity tests, and of a simple 6-volt test lamp, both illustrated in Fig. 389, have been mentioned frequently, as have, also, the use of a voltmeter and ammeters (of different scale readings or capacities). Such testing facilities and equipment are provided by modern electrical equipment test stands, but are sometimes used as single portable items of equipment, particularly if the more elaborate equipment is not available. The instructions with the equipment are usually adequate and should be followed carefully to prevent injury to either the test equipment or the electrical equipment of the car.

d. WIRING MAINTENANCE. Water tends to rot the fabric, and oil to damage the rubber, used in insulating cables. Any cable not properly secured to prevent vibration and allowed to rub against metal parts, or even other cables, may have its insulation worn through to the copper. Then a short or ground may burn fuses, or operate the protective circuit breaker in the headlight switch, may run the battery down, damage the ammeter, or even set the car on fire. Damaged insulation is sometimes repaired by the use of friction tape, or rubber tape followed by friction tape. Before taping any damaged wire, clean it thoroughly with a cloth dampened with suitable cleaning solvent and then wipe dry with a fresh cloth. When inspecting the wiring, check terminals for corrosion and try tightness with a screwdriver or wrench—but do not use too much force. In replacing cables always use the same size used in the original installation and called for on the wiring diagrams.

The high tension cables from the coil to the distributor and to the spark plugs should be kept clean. When, after long service, the insulation cracks allowing leakage of the high-voltage current, replace the cables.

MISCELLANEOUS ELECTRICAL

a. GENERAL INFORMATION. In the following paragraphs information is supplied regarding such electrical or electrically operated units and instruments as horns, horn relays, gauges, and circuit protective devices.

b. HORNS AND RELAYS. The dual horns used on Kaiser and Frazer cars are of the vibrator type. Each draws approximately 15 amperes. The current to operate the horns is drawn, not through the ammeter, but from the hot battery terminal of the starter solenoid switch. The feed circuit is closed through the points of the horn relay. The current for energizing the winding in the relay is drawn from the accessory terminal of the ignition switch and the circuit is closed by the horn ring or horn button. The higher pitched horn is tuned to 370 and the lower pitched horn to 296 cycles per second.

Failure of the horns to sound when the horn ring or button is pressed may be caused by failure of the horn ring assembly, of the horn, of the horn relay, or of the connecting cables or wires. Tests to determine the cause are given in the following paragraphs. To locate the fault, proceed as follows:

1. Horn Test. Check with a test light from the battery (red cable) terminal of the horn relay to assure availability of current at this point. If no current is available, check the red cable that leads back to the hot battery cable terminal of the starter solenoid. Next, with a screwdriver or jumper connect the battery (red cable) terminal of the relay to the horn (black cable) terminal. This should cause the horns to blow. If it does not, check the terminals at the horns. With the jumper, one end of which is connected to a hot terminal, contact the cable terminals at first one horn, then the other. Replace a horn that does not blow.

2. Horn Relay Test. If the horns operate properly turn the ignition switch to the on position. With a test lamp check from ground to the relay terminals to which the green cables are attached. A light at one of these points establishes continuity of circuit to this point. Then with a jumper, connect the other 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" in this manual.

3. Horn Replacement or Repair. Either horn, if in good order, should draw approximately 15 amperes at 6.2 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, install a new one.

c. KAISER FUEL, OIL AND TEMPERATURE GAUGES. These electrically operated King-Seeley "C V Telegages" differ from and are not interchangeable with units used on earlier models. They are actuated only when the ignition switch is turned

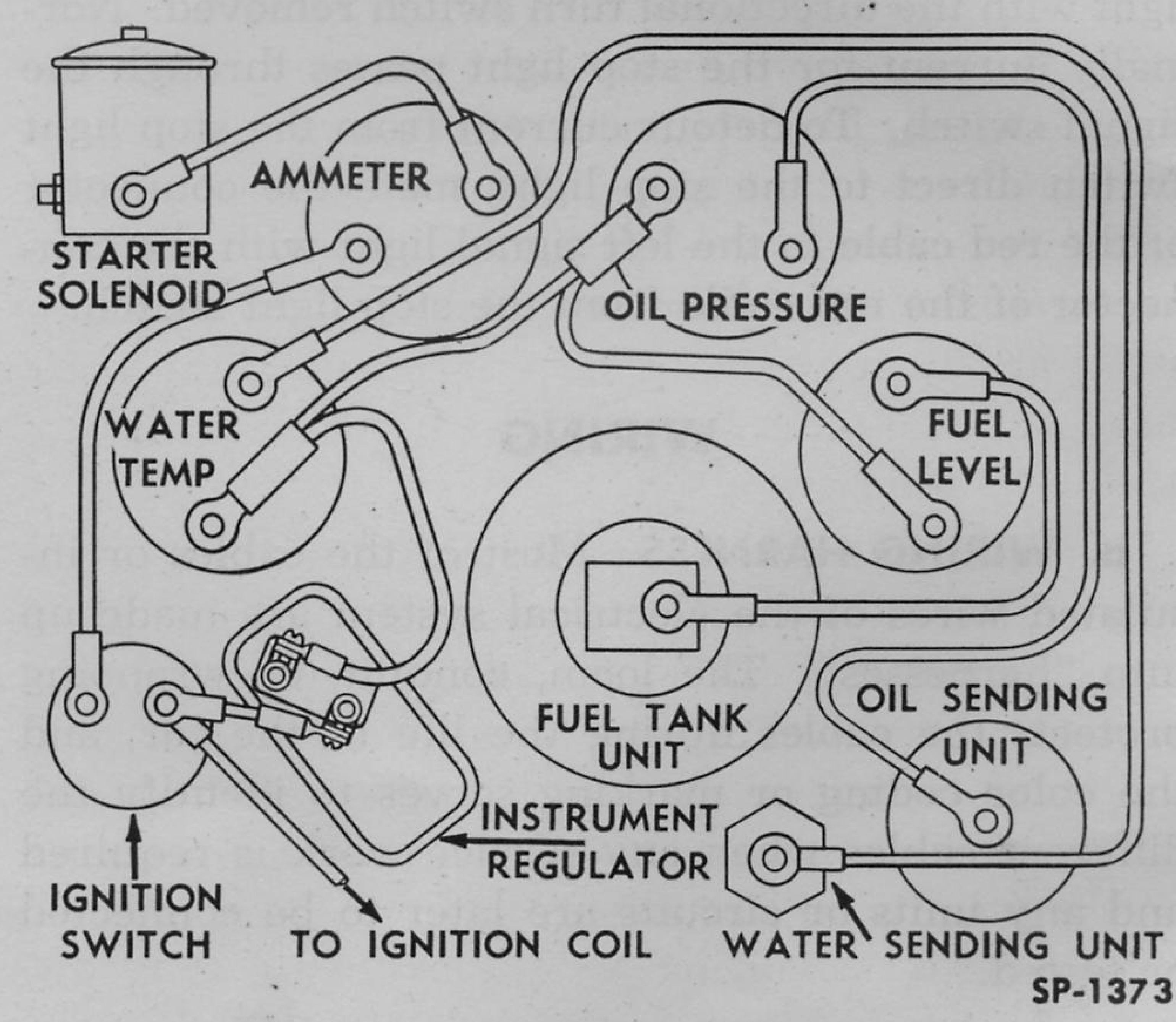


Fig. 441 —Kaiser Fuel, Oil and Water Temperature Gauge Wiring

on. Fig. 441 shows the electrical circuits connecting the gauge units. Section 16, "Instruments and Accessories" of this manual illustrates the gauge cluster and supplies instructions for removal and installation of the indicating units.

1. Operation. To assure that variations in battery or generator voltage will not affect the accuracy of the gauges, an instrument voltage regulator is provided. This device is mounted on the instrument cluster (Fig. 441). It uses a thermo-bimetal interrupter, somewhat similar in operation to a flasher unit, to limit the effective average voltage supplied to the three gauge circuits to approximately 5 volts.

Each of the three "sending units" induces into its circuit varied resistance controlled by the fuel level float position, engine oil pressure or engine temperature. A resistance in any sending unit of approximately 71 ohms passes sufficient current to move the hand on the receiving instrument dial in the instrument cluster up to its low reading position. A resistance of approximately 10 ohms gives full scale reading.

The fuel and pressure gauges employ wire resistance elements with sliding contacts. The compact temperature sending unit employs a small variable resistance pellet of a new sintered material that has the property of offering much greater resistance at low than at high temperature. Internally all three receiving or indicating units in the instrument cluster are similar.

2. Inspection and Maintenance. As indicated in the wiring diagram (Fig. 441) each of the three instrument sending units has its own lead or cable from its terminal to its receiving unit in the instrument cluster. The other terminals of the receiving units are all connected to one terminal of the regulator and the other regulator terminal is connected to the ignition switch.

If any of the three gauges fails to indicate properly, first with the ignition switch turned on, check circuit continuity at the sending unit terminal. Use a one candlepower light (No. 51, sealed beam indicator light, preferably with a long test cable ending in an insulated clip) between the terminal, with the sending cable still attached, and ground. The light should flash on and off at low brilliance. If it does not flash, disconnect the sending cable and test again from the detached cable terminal to ground. Flashing indicates continuity of the circuit.

If, with the circuit grounded through the light, the pointer on the receiving instrument moves toward maximum reading it is reasonable to assume that the sending unit is at fault, not the receiving instrument. If the light remains on continuously, or off continuously, check the instrument voltage regulator.

A simple, effective device for testing any one of the three sending units, with its circuit and its indicating instrument, is another fuel tank unit (new type) with two long cables. One cable should be attached to the terminal of the test tank unit terminal, the other to the unit shell or frame (for grounding). Each cable should have a clip or alligator terminal, preferably insulated. To test any sending unit, detach the cable terminal from the unit and attach the lead from the test gauge terminal to the terminal of the detached sending cable.

While in a position for easy reading of the receiving gauge, ground the other cable from the test sending unit. With the arm moved to "full tank" position the indicating gauge hand should move slowly to high or full scale position. With the arm moved back to "empty tank" position, the receiving gauge hand should move back to low scale reading. With the circuit opened the hand should drop below its low reading position. If the receiving instrument responds properly to this test, but not to the installed sending unit during normal operation, install a new sending unit. Check its performance through the normal operating range.

If the foregoing tests fail to cause the pointer on the receiving unit to respond properly—or if the first circuit continuity tests show no light at the cable terminal at a sending unit—check with the one candlepower test light, from the IGN terminal of the instrument regulator, and then from the other regulator terminal, to ground. The light should glow brightly from the IGN terminal and should flash intermittently from the other terminal. If there is reason to believe the instrument regulator unit is in bad order, disconnect the leads and connect in, for test, another regulator known to be good.

None of the King-Seeley "Telegage" units can be repaired. Substitute a new sending, receiving or voltage control unit for one that fails. Before returning any unit for replacement under warranty, test at the bench by comparing with a unit known to be good.

d. FRAZER FUEL LEVEL GAUGE. This fuel level gauge is electrically operated but both the sending (tank) unit and the indicating (instrument panel) unit are different from and not interchangable with the corresponding Kaiser fuel gauge units. The Frazer fuel gauge units operate only when the ignition switch is turned on. Frazer engine oil pressure and water temperature gauges are not electrically operated.

1. Inspection and Maintenance. As indicated in the general wiring diagram (Fig. 382) current for the fuel gauge circuit comes through the ignition switch. Check the circuit and the operation of the gauge units as follows:

(a) Remove the sending or tank unit access plate from the floor of the rear or luggage compartment. Turn the ignition switch on and note whether the fuel gauge instrument panel unit needle moves. If it does not, be certain there is fuel in the tank.

(b) Then with a voltmeter, or a 1 or 2 candlepower test light, check momentarily from the terminal of the blue wire, at the tank unit, to ground. (Do not use a jumper to ground or a 21 candlepower test light as the heavier current thus drawn through the instrument panel unit might damage it.)

(c) If there is no battery current reaching the tank unit terminal, go back to the instrument panel unit. Check from the ammeter terminal or hot terminal of the instrument panel unit to ground with the **small** test light or voltmeter to determine that current reaches the gauge, then from the other terminal to ground to determine that current passes through the instrument panel unit.

(d) If the instrument panel unit has failed, replace it. If the instrument panel unit appears in good order, or if the previous test showed that the blue wire was hot at the tank unit terminal, remove the blue wire from the tank unit. Using such a jumper, or jumpers, as necessary, connect to the tank end of the blue wire, a new Frazer fuel tank unit. Ground the flange of the new unit, then move the float arm slowly from the position it would occupy with an empty tank and watch the indicator of the instrument panel unit.

(e) If the instrument panel unit needle moves slowly and indicates properly, install a new Frazer tank unit. If the instrument panel unit does not indicate properly, install a new instrument panel unit.

(f) When a new Frazer tank unit is used to check the instrument panel unit, it is possible that the needle on the instrument panel unit may fail to follow the rising of the float from empty to full tank position, and may then suddenly move to full position. This response, only with the float at high position, may be caused by reversed terminals at the instrument panel unit.

NOTE: The construction of the fuel gauge tank units used in Frazer models is such that an ohmmeter can be used to test them. When testing, the ohmmeter hand should move smoothly as the float lever is slowly moved from one extreme to the other. The resistance gauge, controlled by float lever position, is from 10 to 90 ohms.

e. AMMETER. This instrument is used to indicate current flowing from the generator to the battery or current taken from the battery to operate electrical equipment. The ammeter does not indicate the current used by the starting motor for cranking the engine and the current used to blow the horns. The simplest way to check an ammeter is to connect a test ammeter in series and compare the readings at various charging rates (see paragraphs on generator and regulator testing, earlier in this Section) and at various discharge rates. If an ammeter does not register properly, install a new one.

f. FUSES AND CIRCUIT BREAKERS. The circuit breaker, which protects the light circuits, most of the circuits to electrically operated instruments and accessories, also some of the instruments and accessories, is described under HEADLIGHT SWITCH AND CIRCUIT BREAKER, under the general heading SWITCHES. Fuses are used to protect the overdrive solenoid, heater, radio, fog lamp and some other accessories. The electric windshield wiper motor on Kaiser Deluxe models is protected by an 8 ampere automatic self-resetting circuit breaker. Fuse sizes are specified in both the Owners' Manuals and the Parts Lists.