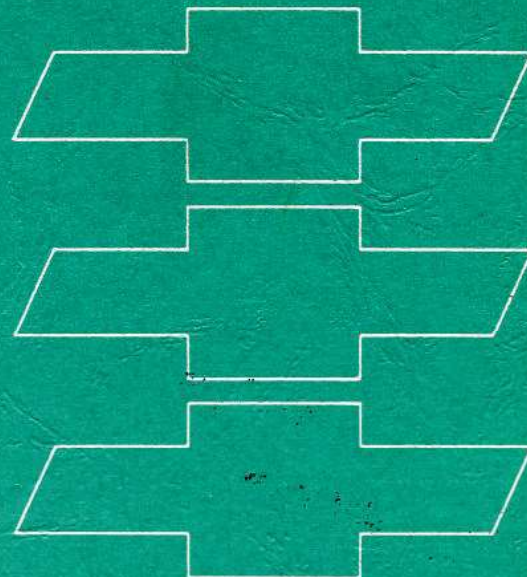
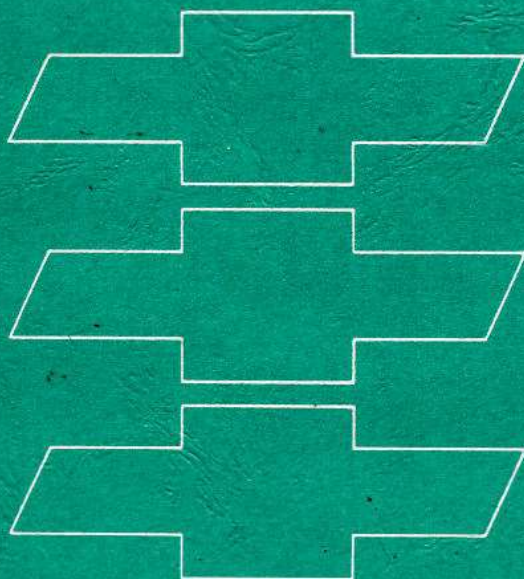


1965



CORVAIR



**CHASSIS
SHOP
MANUAL**

1965 CHEVROLET CORVAIR CHASSIS SHOP MANUAL

FOREWORD

This manual is designed to provide complete information on the maintenance and repair of various units, except the Body, of the 1965 Chevrolet Corvair Passenger Vehicles. Service information for 1965 body items for these vehicles is contained in the 1965 Body Service Manual. For service information on the 1965 Corvair Greenbrier refer to the 1961 Corvair Shop Manual and the 1964 Corvair Shop Manual Supplement.

An effort has been made to produce a manual that will serve as a ready reference book for the experienced service man and also cover step by step procedure for the guidance of the less experienced man.

The Section Index on this page enables the user to quickly locate any desired section. At the beginning of each section, a Table of Contents gives the page number on which major subjects begin. An Index is placed at the beginning of each major subject within the section.

Summaries of Special Tools, when required, are found at the end of major sections, while Specifications covering vehicle components are presented at the rear of the manual.

This manual should be kept in a handy place for ready reference. If properly used, it will enable the technician to better serve the owners of Chevrolet Corvair vehicles.

All information, illustrations and specifications contained in this literature are based on the latest product information available at the time of publication approval. The right is reserved to make changes at any time without notice.

CHEVROLET MOTOR DIVISION

General Motors Corporation
DETROIT, MICHIGAN

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SECTION 6Y

ENGINE ELECTRICAL

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BATTERY

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GENERAL DESCRIPTION

The source of electrical power for operating the electrical current consuming automotive components may be either the battery or generator or, under certain conditions, both the battery and the generator. It is the role of the battery to furnish electrical power for the electrical accessories when the engine and generator are not in operation. The battery not only furnishes the electrical power necessary for cranking the engine, but must also help in cases where generator output is not sufficient to handle the electrical loads.

The "dry charge" battery contains fully charged positive and negative plates separated by high-quality separators. The battery contains no electrolyte until it is activated for service in the field and therefore leaves the factory dry.

Venting of the Corvair battery is accomplished by two vent plug adapters and hoses which vent battery gas or vapors to the outside of the engine compartment (fig. 1b).

COMMON CAUSES OF FAILURE

When a battery fails, the cause of failure may lie outside the battery itself. For this reason when a battery failure is encountered, do not be satisfied to merely recharge or replace it. Find the cause of failure and prevent recurrence of the trouble. Listed below are some of the common causes of battery failure:

1. Defect in the generating system such as high resistance, slipping fan belt, faulty generator or regulator.
2. Overloads caused by defective starting or excessive use of accessories.
3. Driver habits or driving conditions such as using the vehicle only for short drives.

Liquid level in the battery should be checked regularly. If the liquid level is found to be low, colorless, odorless drinking water should be added to each cell until the liquid level rises to the bottom of the split ring in the cell filler well.

Inspect for signs of corrosion on battery, cables and surrounding area, loose or broken carriers, cracked or bulged cases, dirt and acid, electrolyte leakage and low electrolyte level. Fill cells to proper level with colorless, odorless drinking water.

The top of the battery should be clean and the battery hold-down bolts properly tightened. Particular care should be taken to see that the tops of the 12-volt batteries are kept clean of acid film and dirt because of the high voltage between the battery terminals. For best results when cleaning batteries, wash first with a dilute ammonia or soda solution to neutralize any acid present and then flush off with clean water. Care must be taken to keep vent adapters tight so that the neutralizing solution does not enter the cell. The hold-down bolts should be kept tight enough to prevent the battery from shaking around in its holder, but they should not be tightened to the point where the battery case will be placed under a severe strain.

To insure good contact, the battery cables should be tight on the battery posts. Oil the battery terminal felt washer. If the battery posts or cable terminals are corroded, the cables should be cleaned separately with a soda solution and a wire brush. After cleaning and installing clamps, apply a thin coating of petrolatum to the posts and cable clamps to help retard corrosion. See Figure 10 for correct installation of cable terminal clamps.

QUICK-IN-THE-VEHICLE TESTS

1. Visual Inspection
2. Light Load Test

VISUAL INSPECTION

Inspect for signs of corrosion on battery, cables and surrounding area, loose or broken carriers, cracked

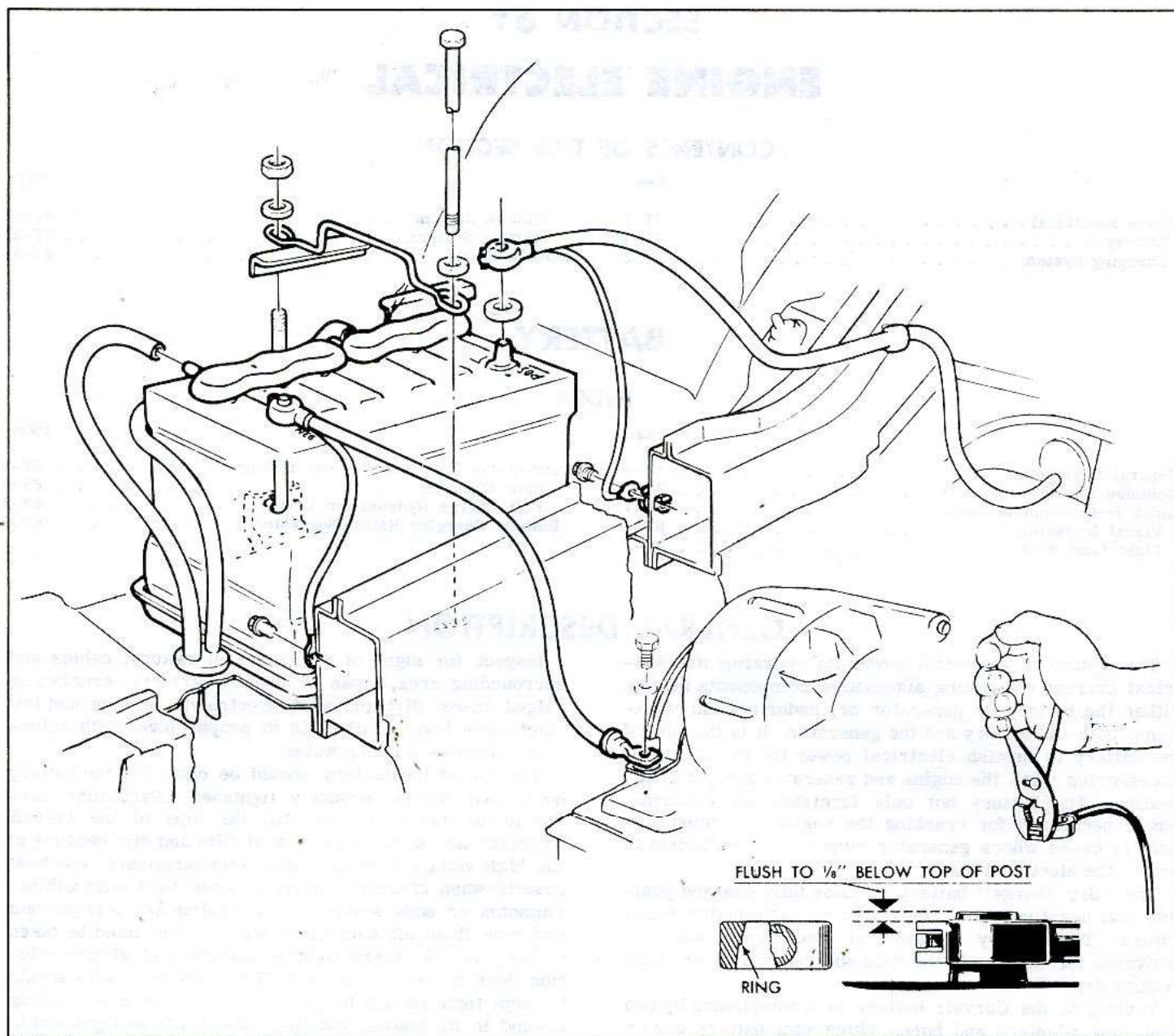


Fig. 1b—Battery Installation

cases, dirt and acid, electrolyte leakage and low electrolyte level. Fill cells to proper level with colorless, odorless drinking water.

LIGHT LOAD TEST

Check electrical condition of battery cells as follows:

1. Check electrolyte level in each cell, and, if needed, adjust to proper level by adding water.
2. Place load on battery by holding ignition switch in the "Start" position for 3 seconds or until engine starts. If engine starts, turn off ignition immediately.
3. Turn on headlights (low beam). After 1 minute, with lights still "ON", read voltage of each battery cell with voltmeter, noting exact voltages (.01 volt division). It is necessary to remember only the highest and lowest cell voltage.

Uniform Readings

If all cells read 1.95 volts or more and the difference between the highest and lowest cells is less than .05 volts, battery is good and sufficiently charged.

However, if any cell reads less than 1.95 volts and difference between the highest and lowest cells is less than .05 volts, battery is good but should be fully recharged for good performance. Refer to "Battery Charging Rates".

Non-Uniform Readings

If any cell reads 1.95 volts or more and there is a difference of .05 volts or more between the highest and lowest cell, the battery should be replaced.

Low Readings

If all cells read less than 1.95 volts, battery is too

low to test properly. FAILURE OF THE METER TO REGISTER ON ALL CELLS DOES NOT INDICATE A DEFECTIVE BATTERY. Boost charge battery and repeat Light Load Test (Refer to "Battery Charging Rates"). If battery is found to be good after boosting, it should be fully recharged for good performance.

If none of the cells come up to 1.95 volts after the first boost charge, the battery should be given a second boost. Batteries which do not respond after second boost charge should be replaced.

NOTE: If any battery found to be good by the Light Load Test does not perform satisfactorily in subsequent service, it should again be tested by the Light Load Test and if it still tests "good," it should be removed from the car and tested as outlined under OUT-OF-THE-VEHICLE CHARGING AND TESTING.

OUT-OF-THE-CAR CHARGING AND TESTING

The procedures outlined below under Slow Charging and The Full Charge Hydrometer Test should be used on:

Any battery originally found to be "good" by the Light Load Test, but which has since failed to perform satisfactorily in service and which still tests "good" by the Light Load Test.

CAUTION: The "Full Charge Hydrometer Test" is not valid unless battery has been tested and found to be good by the Light Load Test.

SLOW CHARGING

- Adjust electrolyte to proper level by adding water, then charge battery at 5 amperes until fully charged. Full charge of the battery is indicated when all cell gravities do not increase when checked at three intervals of one hour and all cells are gassing freely.
- Due to the low rate during slow charging, plenty of time must be allowed. Charge periods of 24 hours or more are often required.

FULL CHARGE HYDROMETER TEST

1. Make sure battery is fully charged as described under "Slow Charging" above. **HYDROMETER READINGS TAKEN ON PARTIALLY CHARGED BATTERIES ARE UNRELIABLE FOR THE FOLLOWING TEST:**
2. Measure specific gravity of electrolyte in each cell (fig. 2b) and compare readings with the following:
 - If cell readings range from 1.250 and 1.290, the battery is ready for use. (Readings should be corrected to 80°F for comparison.) All it needed was a full charge. Any variation in the specific gravity between

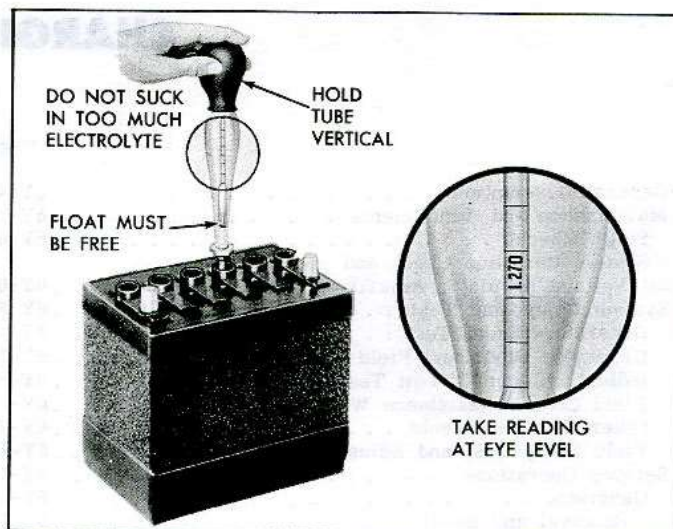


Fig. 2b—Testing Specific Gravity of Battery

cells within this range does not indicate a defective battery.

- If the specific gravity of any cell or cells falls outside this range, (1.250 to 1.290), replace the battery.

BATTERY CHARGING RATES (SUGGESTED)

1. For those batteries which require a boost charge for the "Light Load Test" procedure.
2. For those batteries which have become discharged and require charging. It should be recognized that slow charging is the best and only method of completely recharging batteries. However, since time is often of importance to the battery owner two other methods are offered for partial battery re-charge.
3. For those dry charged batteries being activated with electrolyte at a temperature under 60°F or those batteries which are expected to go into immediate operation in below freezing weather.

12 VOLT BATTERY RE-CHARGE (100 Amp/hr or Less Capacity)

TYPE OF CHARGE	LENGTH OF TIME	CHARGING RATE
Boost Charge for Light Load Test	20 Minutes	50 Amps
Slow Charge	24 Hours	4 Amps
Fast Charge	1-1/2 Hours	40-50 Amps
Quick Boost	30 Minutes	40-50 Amps
Dry Charge Warm-up Boost	10 Minutes	15 Amps

CHARGING SYSTEM

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GENERAL DESCRIPTION

The charging system includes the battery, generator, regulator, telltale light, ignition switch and necessary wiring to connect these components. The Delcotron is offered as a standard equipment, with two capacities available on all models.

The Delcotron continuous output A.C. generator (fig. 1c) consists of two major parts, a stator and a rotor. The stator is composed of a large number of windings assembled on the inside of a laminated core that is attached to the generator frame. The rotor revolves within the stator on bearings located in each end frame. Two brushes are required to carry current through the two slip rings to the field coils wound concentric with the shaft of the rotor. Six rectifier diodes are mounted in the

slip ring end frame and are joined to the stator windings at three internally located terminals.

Diodes are mounted in heat sinks to provide adequate heat dissipation. The six diodes replace the separately mounted rectifier as used in other types of application. The diodes change the Delcotron A.C. current to D.C. current.

The function of the regulator in the charging system is to limit the generator voltage to a pre-set value by controlling the generator field current. The double-contact regulator assembly (fig. 2c) consists of a double contact voltage regulator unit and a field relay unit. This unit uses two sets of contact points on the voltage regulator unit to obtain desired field excitation under variable

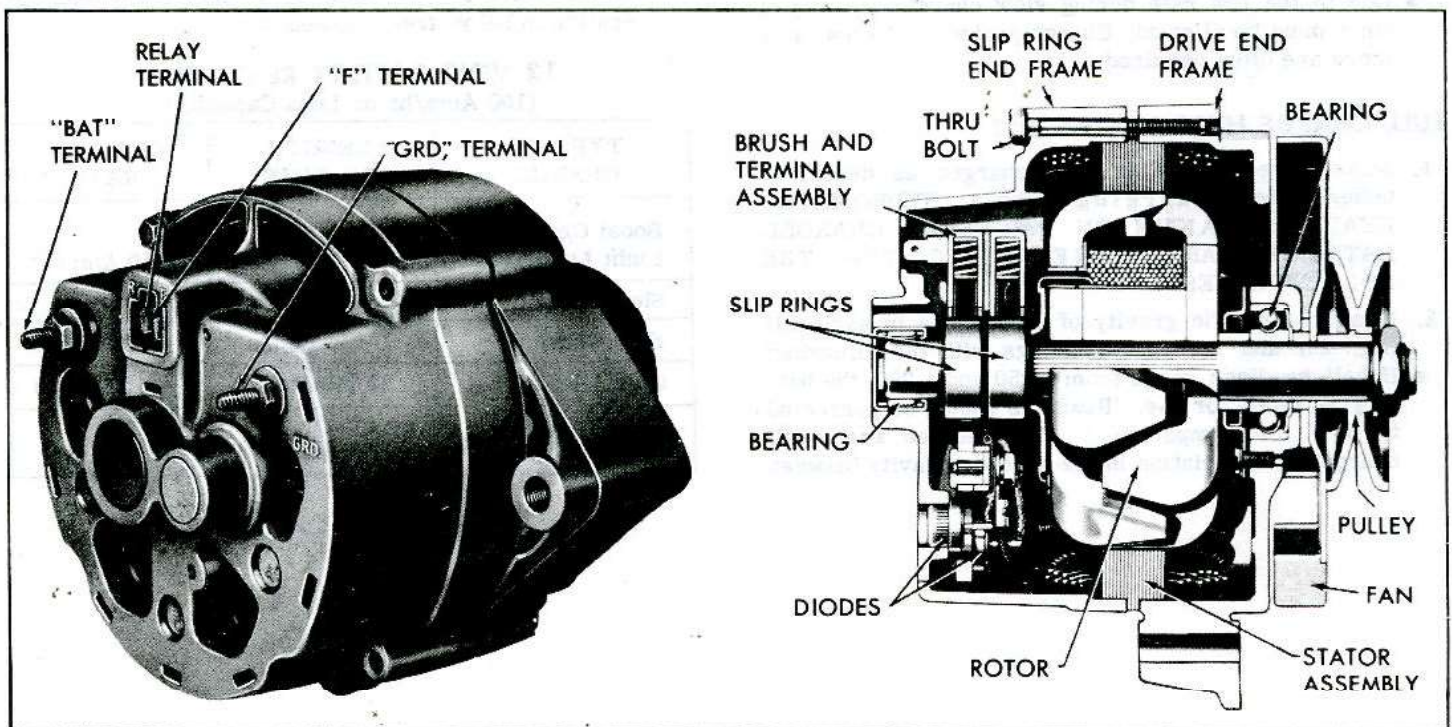


Fig. 1c—5.5" Delcotron

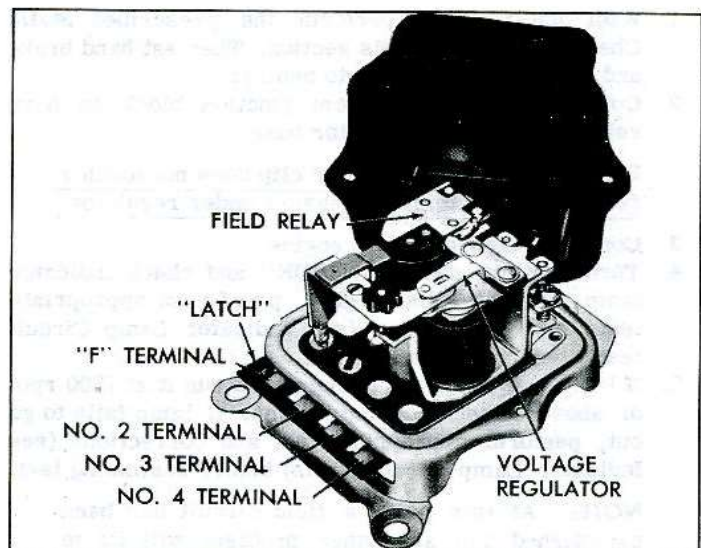
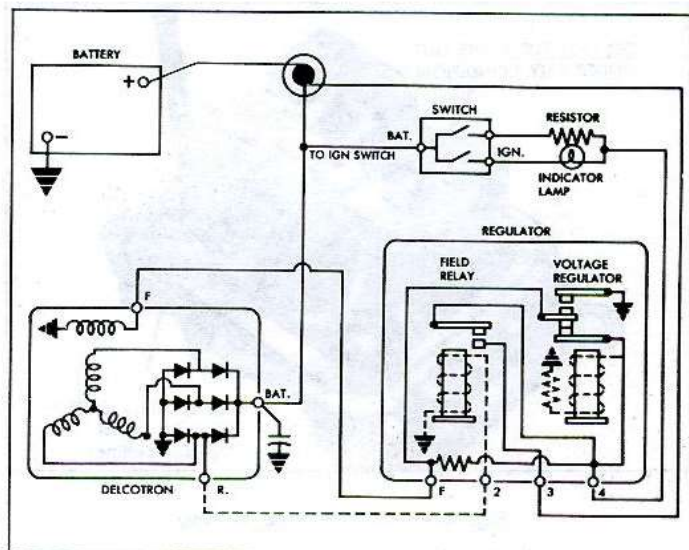


Fig. 2c—Two Unit Voltage Regulator

conditions. When the higher output Delcotron unit is used, the regulator incorporates an external field discharge diode in the field circuit as shown in Figure 3c. A wiring diagram of the regulator internal circuits is illustrated in Figure 2c.



The field relay unit allows the lamp to light (as a bulb check) with the ignition key on and engine not running. When the engine is started and the generator begins to charge, the indicator light goes out indicating that the system is operating normally.

MAINTENANCE AND ADJUSTMENTS

At regular intervals, inspect the terminals for corrosion and loose connections, and the wiring for frayed insulation. Check mounting bolts for tightness. Check the drive belt for alignment, proper tension and wear. Because of the higher inertia and load capacity of the rotor used in A.C. generators, PROPER BELT TENSION is more critical than on D.C. generators.

Since the Delcotron and its companion regulator are designed for use on negative polarity systems only, the following precautions must be observed. Failure to observe these precautions may result in serious damage to the charging system.

1. When installing a battery, always make absolutely sure the ground polarity of the battery, generator and regulator is the same.
2. When connecting a booster battery, make certain to connect the correct battery terminals together.
3. When connecting a charger to the battery, connect the correct charger leads to the battery terminals.
4. Never operate the generator on an uncontrolled open circuit. Make absolutely certain all connections in the circuit are secure.
5. Do not short across or ground any of the terminals on the generator or regulator.
6. Do not attempt to polarize the generator.
7. Do not disconnect lead at generator without first disconnecting battery ground cable.

Trouble in the A.C. charging system will usually be indicated by one or more of the following conditions:

1. Faulty indicator lamp operation.

2. An undercharged battery (usually evidenced by slow cranking speeds).
3. An overcharged battery (usually evidenced by excessive battery water usage).
4. Excessive generator noise or vibration.

Described in this Section are a series of on-the-vehicle quick checks which are designed to assist the service technician in locating troubles within the various components of the engine electrical system. Additional checks, adjustments and overhaul procedures of these components are also described in the "Charging Systems—Service

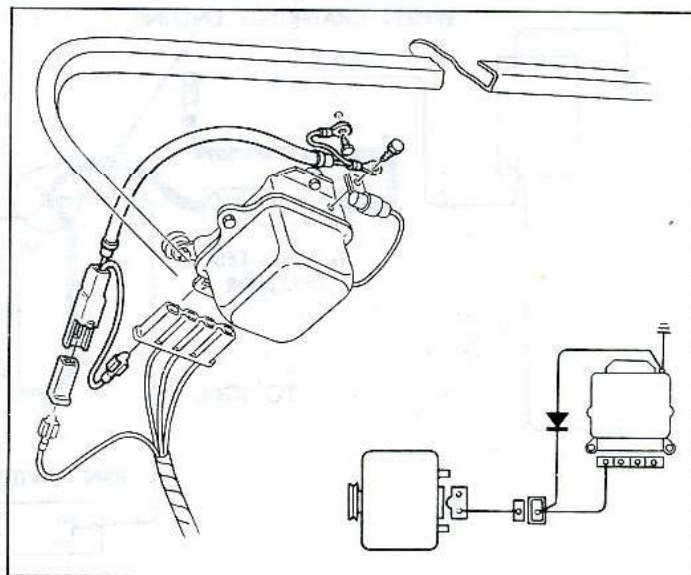


Fig. 3c—External Field Discharge Diode

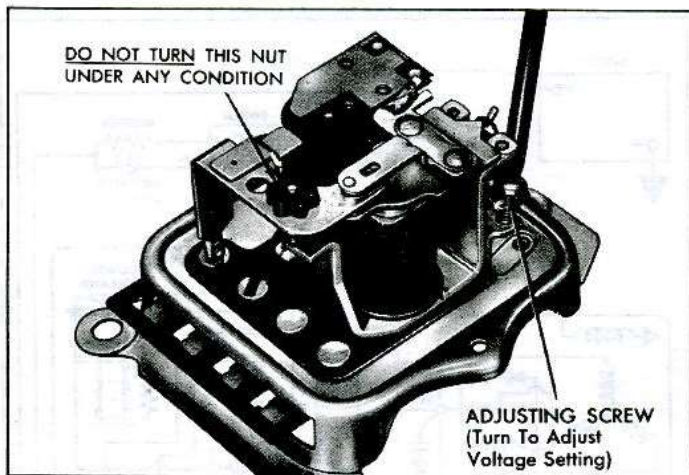


Fig. 4c—Adjust Voltage Setting

Operations Section" and should be referred to as necessary.

SYSTEM CONDITION CHECKS

STATIC CHECKS

Before making any electrical checks, perform the following static checks.

1. Check for loose or broken blower belt.
2. Check for defective battery. (Refer to Battery.)
3. Inspect all connections, including the slip-on connectors at the regulator and Delcotron.

NOTE: Do not short field to ground to check if generator is charging since this will seriously damage the charging system.

SYSTEM CONDITION TEST

This test is used to indicate the overall condition of the charging system (both good and defective) and to isolate the malfunctioning unit if the system is defective.

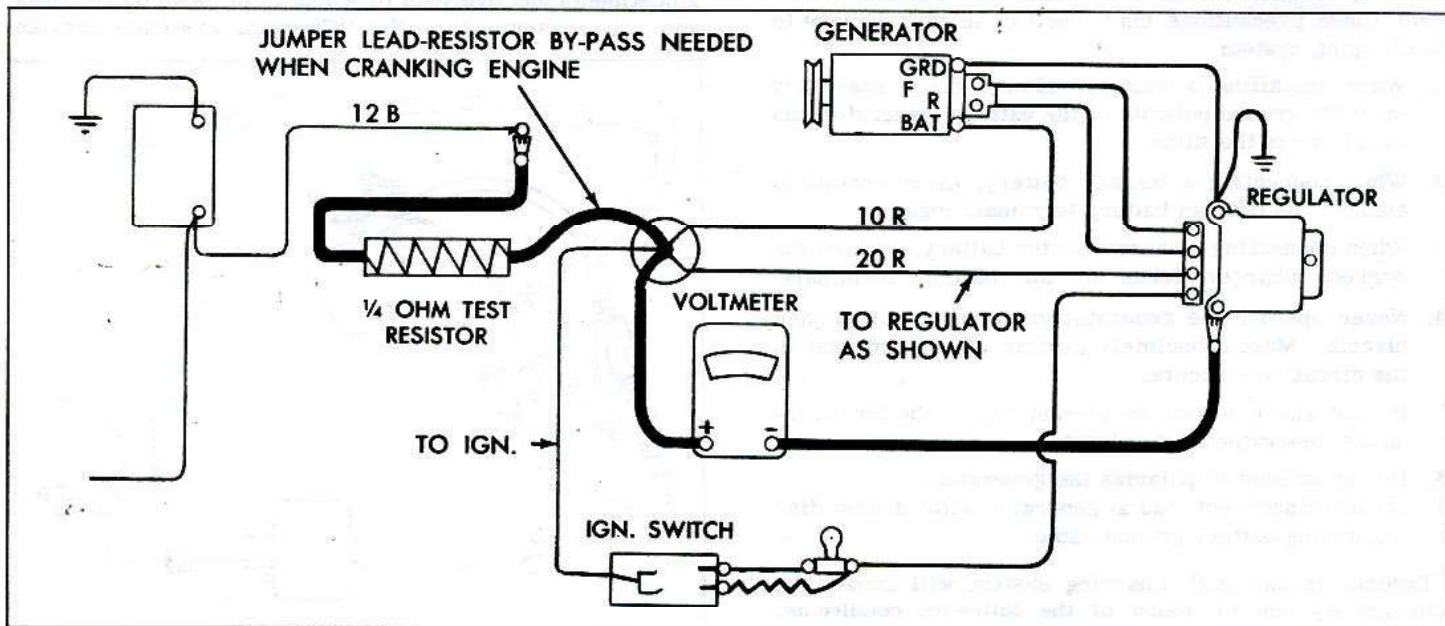


Fig. 5c—Voltage Setting Test Connections

1. With ignition off, perform the prescribed Static Checks outlined in this section. Then set hand brake and shift transmission into neutral.
2. Connect a voltmeter from junction block on horn relay to ground at regulator base.

CAUTION: Be sure meter clip does not touch a resistor or terminal extension under regulator.

3. Connect a tachometer on engine.
4. Turn ignition switch to "ON" and check indicator lamp. If lamp fails to glow, perform appropriate tests and corrections (see Indicator Lamp Circuit tests) before continuing test.
5. If lamp glows, start the engine and run it at 1500 rpm or above. Check indicator lamp. If lamp fails to go out, perform appropriate test and corrections (see Indicator Lamp Circuit tests) before continuing test.

NOTE: At this point a field circuit has been established and any other problem will lie in generator or regulator.

6. Turn on high-beam headlights and heater blower motor to high speed, run engine at or above 1500 rpm (for a few minutes, if necessary) and read the voltage on meter.

NOTE: Voltage will not greatly exceed 12-1/2 volts until the battery develops a surface charge, a few minutes generally, unless the battery is severely discharged or is hot.

If reading is:

- a. 12-1/2 volts or more, turn off electrical loads, stop engine and proceed to Step 7.
- b. Less than 12-1/2 volts, perform "Delcotron Output Test—Voltmeter Method".
 1. Delcotron tests bad—refer to "Service Operations" and repair Delcotron, then repeat Step 6.
 2. Delcotron tests good—disconnect regulator connector, remove regulator cover and reconnect the connector. Then repeat Step 6 and

turn voltage adjusting screw (fig. 4c) to raise setting to 12-1/2 volts. Turn off loads, stop engine and proceed to Step 7. If 12-1/2 volts cannot be obtained, install a new regulator and repeat Step 6.

7. Connect a 1/4 ohm-25 watt fixed resistor (purchased commercially) into the charging circuit at junction block as shown in Figure 5c.

NOTE: Between both leads and the terminal.

ADJUSTING REGULATOR VOLTAGE

8. Run engine at 1500 rpm or above for at least 15 minutes of warm-up, then cycle regulator voltage control (by disconnecting and re-connecting regulator connector) and read voltage.

If voltage is 13.5 to 15.2, the regulator is okay.

If voltage is not within 13.5 to 15.2 volts, leave engine running at 1500 rpm or above and:

- a. Disconnect four terminal connector and remove regulator cover. Then re-connect four terminal connector and adjust voltage to 14.2 to 14.6.
- b. Disconnect four terminal connector and reinstall regulator cover, then reinstall connector.
- c. Continue running engine at 1500 rpm for 5-10 minutes to re-establish regulator internal temperature.
- d. Cycle regulator voltage by disconnecting and re-connecting regulator connector. Read voltage. A reading between 13.5 and 15.2 indicates a good regulator.

CAUTION: Be sure four terminal regulator connector is disconnected when removing or installing cover. This is to prevent regulator damage by short circuits.

DELCOTRON OUTPUT TEST (Fig. 6C)

Voltmeter Method

1. Disconnect the four-terminal connector from the regulator.
2. Disconnect the two-terminal connector from the Delcotron F and R terminals.

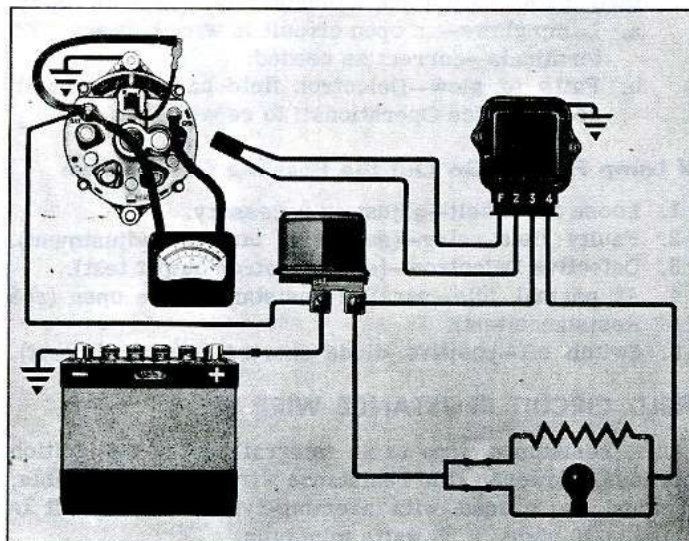


Fig. 6c—Output Test Connections (Typical)

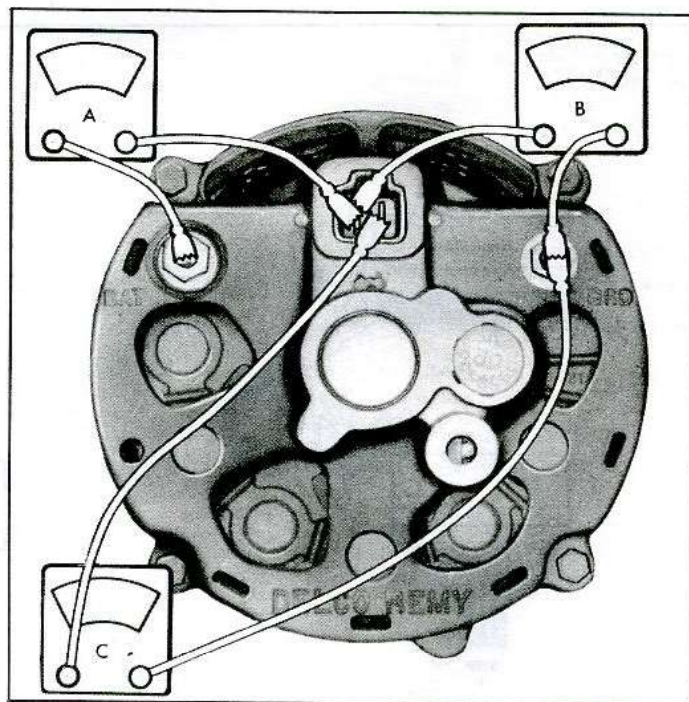


Fig. 7c—Delcotron Diode and Field Test

3. Connect a jumper wire from the Delcotron BAT terminal to the Delcotron F terminal. This provides full field excitation.
4. Connect a voltmeter from the Delcotron BAT terminal to the Delcotron GRD terminal.
5. Start engine and turn on high beam headlights and either high speed heater blower motor or medium speed on the air conditioner blower motor. Run engine 1500 rpm or above and note whether voltage exceeds 12.5 volts. If voltage exceeds 12.5 volts within a few minutes, Delcotron output is O.K. Stop engine, turn off all electrical loads, and reconnect wiring.

CAUTION: If battery is in a normal state of charge, voltage will exceed 12.5 volts as soon as engine speed is increased. Engine speed should be increased slowly to prevent voltage from exceeding 16 volts during test.

6. If voltage is less than 12.5 volts, perform other Delcotron tests and repairs outlined in Service Operations.

DELCOTRON DIODE AND FIELD TEST (Fig. 7C)

NOTE: These tests will indicate good, shorted or open field or shorted diode but will not indicate a failed open diode. If output was low and following tests show good, refer to service operations to determine cause and repair.

1. Disconnect battery ground cable at battery.
2. Positive diodes (Test A) connect an ohmmeter between "R" terminal and "BATT" terminal and note reading, then reverse the leads at same terminals and note this reading. Meter should read high resistance in one direction and low in the other.
3. Negative diodes (Test B) connect ohmmeter between "R" terminal and "GRD" and note reading, then reverse the leads and note this reading. Meter should read high in one direction and low in the other.

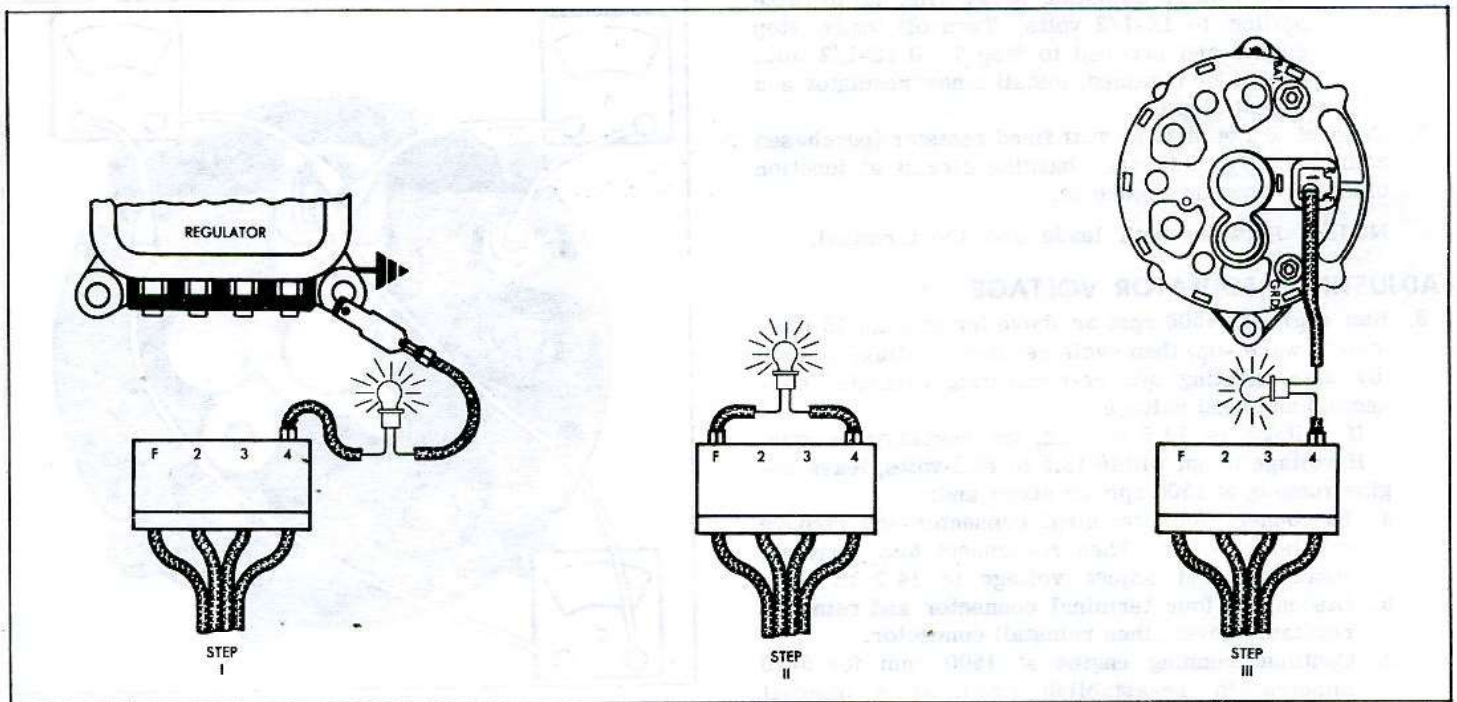


Fig. 8c—Indicator Lamp Circuit Tests

NOTE: A high or low reading in both directions indicates a defective diode.

4. Open Field Check:

- Connect an ohmmeter from "F" terminal to "GRD" terminal stud and note reading on the lowest range scale. Meter should read 7 to 20 ohms.
 - If meter reads zero or excessively high resistance, the Delcotron is faulty.
5. If above tests indicate a defective Delcotron, remove and completely check Delcotron as outlined under "Service Operations".

INDICATOR LAMP CIRCUIT TESTS

The indicator lamp circuit (fig. 8c) provides initial field excitation (causing lamp to glow). The light is cancelled by closing the field relay which applies battery voltage to both sides of bulb (bulb goes out).

The indicator light should glow when ignition switch is "ON" and go out almost immediately when engine starts.

If Lamp Fails to Glow the Possible Causes Are:

- Faulty bulb.
- Faulty bulb socket.
- An open circuit in wiring, regulator, or field.
- A shorted positive diode—(may also cause glow with ignition switch "OFF").

Test as Follows:

- Disconnect connector from regulator and connect a jumper lead from connector terminal "4" to ground (fig. 8c, Step 1). Turn ignition switch to "ON" momentarily and note indicator lamp:
 - Lamp fails to glow—check for faulty bulb, socket or open circuit between switch and regulator connector. Repair as needed.

- Light goes on—failure is in regulator, Delcotron or wire between "F" terminals on regulator and Delcotron. Go to Step 2.
2. Disconnect jumper lead at ground end and connect between connect "F" and "4" terminals, (fig. 8c, Step 2) then turn switch to "ON" momentarily and note lamp:
- Lamp glows—problem is in regulator. An open circuit in regulator or relay is stuck closed. See "Service Operations" for repair.
 - Fails to glow—problem is in wire between "F" terminals on generator and regulator or in field windings. Go to Step 3.
3. Disconnect jumper at connector "F" terminal and connect "F" terminal on Delcotron (fig. 8c, Step 3), then turn switch on momentarily and note lamp:
- Lamp glows—an open circuit in wire between "F" terminals—correct as needed.
 - Fails to glow—Delcotron field has open circuit, see "Service Operations" to repair.

If Lamp Fails to Go Out the Possible Causes Are:

- Loose drive belt—adjust as necessary.
- Faulty field relay—(see relay test and adjustment).
- Defective Delcotron—(see Delcotron output test).
- At normal idle—parallel resistance wire open (see Resistance test).
- Switch off—positive diode shorted (see Diode test).

FIELD CIRCUIT RESISTANCE WIRE TESTS

The resistance wire is an integral part of the ignition harness. However, the resistance wire is not solderable; it must be spliced with a crimp-type connector. It is rated at 10 ohms, 6.25 watts minimum.

The check for an open resistor (connected to the ignition switch "ACC" terminal) is as follows:

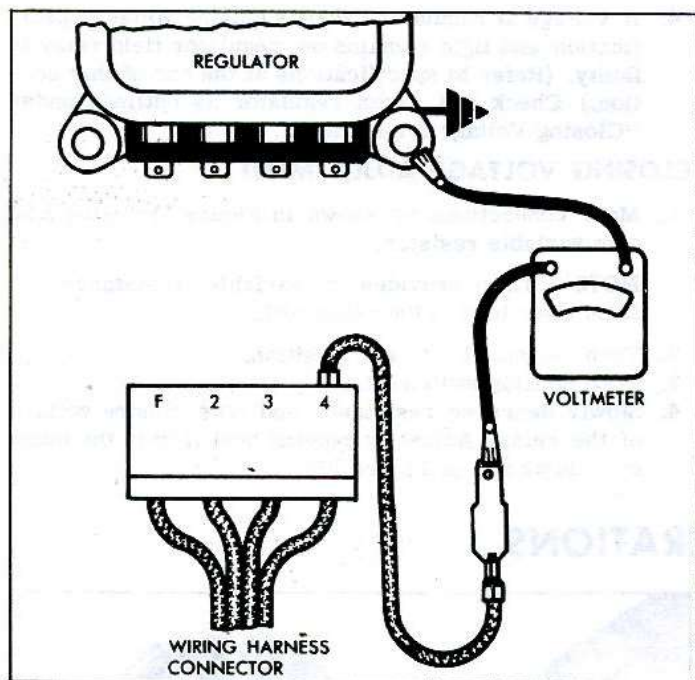


Fig. 9c—Circuit Resistance Wire Test

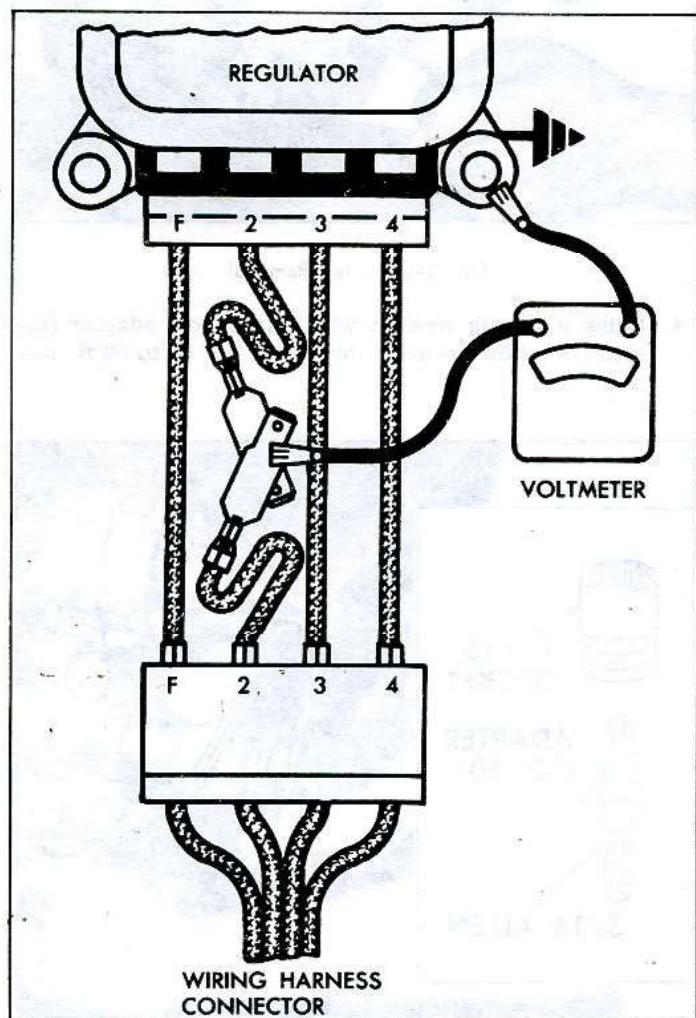


Fig. 10c—Checking Field Relay

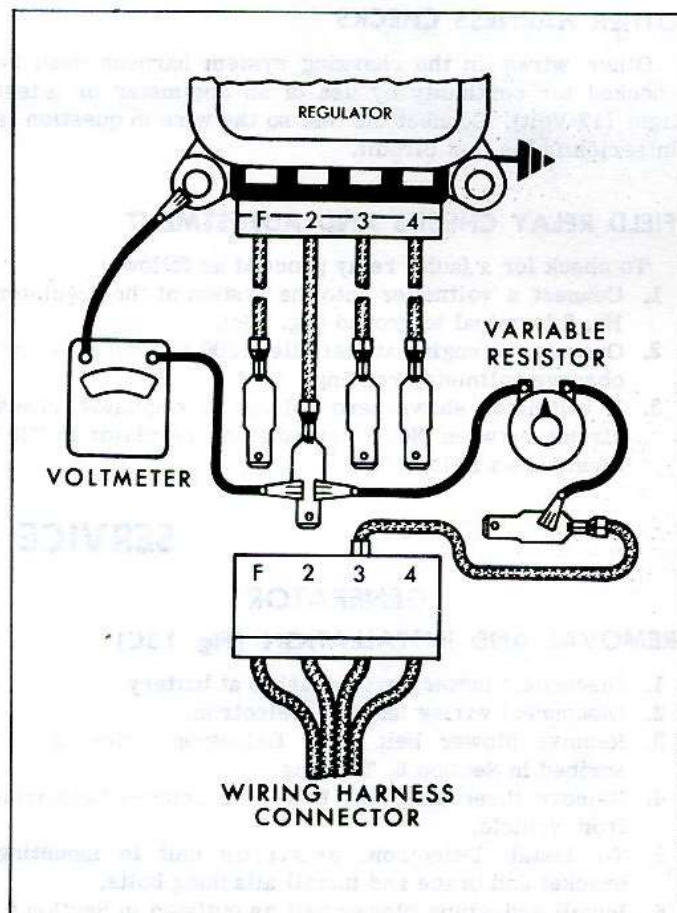


Fig. 11c—Checking Field Relay Closing Voltage

1. Connect a test lamp from the wiring harness connector terminal to ground as shown in Figure 9c (Step 1).
2. Turn the ignition switch to the "ON" position and note test bulb.
3. If the test lamp does not glow, the resistor is open.

NOTE: The telltale lamp does not glow during this test because series resistance of the 2 bulbs causes amperage to be low.

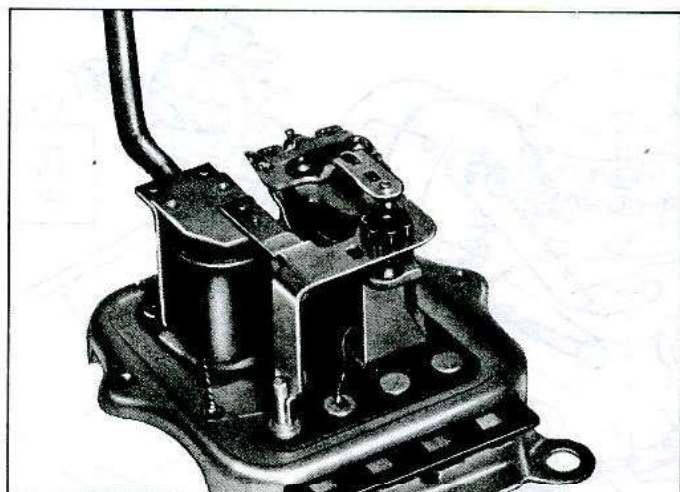


Fig. 12c—Adjusting Field Relay Closing Voltage

OTHER HARNESS CHECKS

Other wires in the charging system harness need be checked for continuity by use of an ohmmeter or a test light (12 Volt). Connect the test so the wire in question is in series in the test circuit.

FIELD RELAY CHECKS AND ADJUSTMENT

To check for a faulty relay proceed as follows:

1. Connect a voltmeter into the system at the regulator No. 2 terminal to ground (fig. 10c).
2. Operate the engine at fast idle (1500 to 2000 rpm) and observe voltmeter reading.
3. If voltmeter shows zero voltage at regulator, check circuit between No. 2 terminal on regulator to "R" terminal on Delcotron.

SERVICE OPERATIONS

GENERATOR

REMOVAL AND INSTALLATION (Fig. 13c)

1. Disconnect battery ground cable at battery.
2. Disconnect wiring leads at Delcotron.
3. Remove blower belt from Delcotron pulley as described in Section 6, Tune-up.
4. Remove three attaching bolts and remove Delcotron from vehicle.
5. To install Delcotron, position unit to mounting bracket and brace and install attaching bolts.
6. Install and adjust blower belt as outlined in Section 6, Tune-up.
7. Connect wiring harness to rear of Delcotron.
8. Connect battery ground cable at battery and check operation of unit.

PULLEY REPLACEMENT

Single Groove Pulley

1. Place 15/16" box wrench on retaining nut and insert a 5/16" allen wrench into shaft to hold shaft while removing nut (fig. 14c).
2. Remove washer and slide pulley from shaft.
3. To install, slide washer and pulley onto shaft and tighten self locking retaining nut.

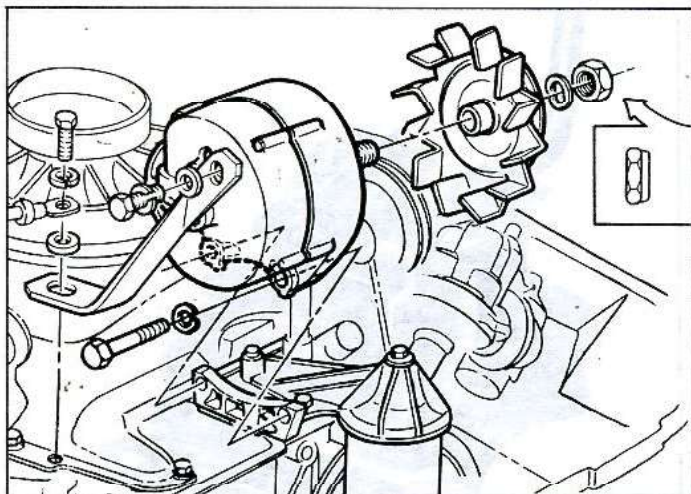


Fig. 13c—Delcotron Assembly

4. If voltage at regulator exceeds closing voltage specification and light remains on, regulator field relay is faulty. (Refer to specifications at the end of this section.) Check and adjust regulator as outlined under "Closing Voltage Adjustment".

CLOSING VOLTAGE ADJUSTMENT

1. Make connections as shown in Figure 11c using a 50 ohm variable resistor.

NOTE: This provides a variable resistance from a hot lead to the relay coil.

2. Turn resistor to "open" position.
3. Turn ignition switch off.
4. Slowly decrease resistance and note closing voltage of the relay. Adjust by bending heel iron in the manner illustrated in Figure 12c.

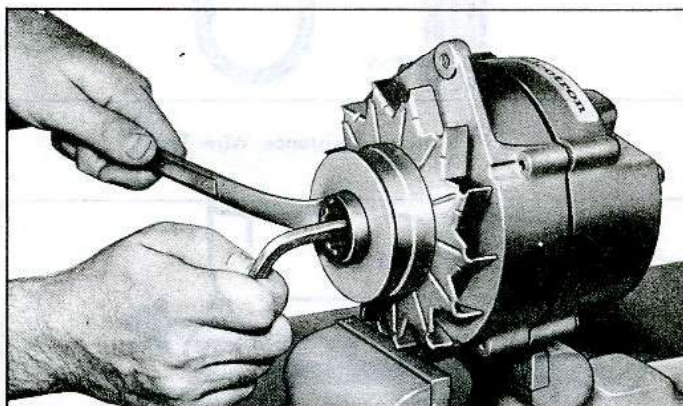


Fig. 14c—Pulley Removal

4. Using a torque wrench with a crow-foot adapter (instead of a box wrench), torque the nut 50 to 60 ft. lbs. (fig. 15c).

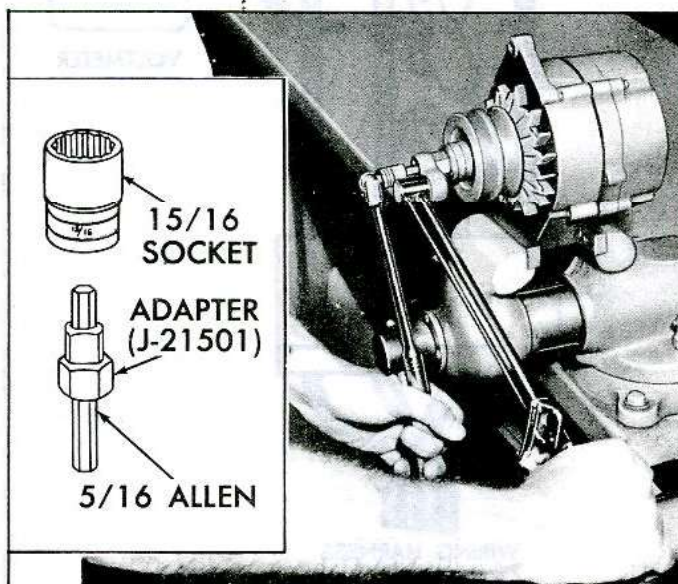


Fig. 15c—Torquing Pulley Nut

NOTE: Be sure wave washer is completely depressed.

DISASSEMBLY

1. Hold generator in a vise, clamping the mounting flange lengthwise.
2. Remove 4 thru bolts then break loose the end frames by prying at bolt locations.
3. Remove the slip-ring end frame and stator (as an assembly) from drive end and rotor assembly.
4. Place a piece of tape over the slip ring end frame bearing to prevent entry of dirt or other foreign matter.

CAUTION: Brushes may drop onto rotor shaft and become contaminated with bearing lubricant. Clean brushes prior to installing with a non-toxic cleaner such as tri-chlorethylene.

5. Remove the three stator lead attaching nuts and separate stator from end frame.
6. Remove brush holder screws and brush holder assembly.
7. Remove heat sink from end frame by removing "batt" and "grd" terminals and one attaching screw (fig. 20c).
8. Remove slip ring end frame bearing (if necessary) by removing inner seal and slide.
9. Remove drive pulley as outlined previously, then remove rotor and spacers from end frame assembly.
10. Remove drive end frame bearing retainer plate and bearing assembly from frame.

CLEANING AND INSPECTION

With generator completely disassembled, except for removal of diodes, the components should be cleaned and inspected. Be sure testing equipment is in good working order before attempting to check the generator.

1. Wash all metal parts except stator and rotor assemblies.

2. Clean bearings and inspect for sealing, pitting or roughness.
3. Inspect rotor slip rings, they may be cleaned with 400 grain polishing cloth. Rotate rotor for this operation to prevent creating flat spots on slip rings.
4. Slip rings which are out of round may be trued in a lathe to .001" maximum indicator reading. Remove only enough material to make the rings smooth and concentric. Finish with 400 grain polishing cloth and blow dry.
5. Slip rings are not replaceable—excessive damage will require rotor assembly replacement.
6. Inspect brushes for wear. If they are worn halfway, replace. Inspect brush springs for distortion or weakening. If brushes appear satisfactory and move freely in brush holder, springs may be reused.

TESTING ROTOR

The rotor may be checked electrically with a 110-volt test lamp or an ohmmeter.

Grounds

Connect test lamp or ohmmeter from either slip ring to the rotor shaft or to the rotor poles. If the lamp lights or if the ohmmeter reading is low, the field windings are grounded (fig. 16c).

Opens

Connect one test lamp or ohmmeter lead to each slip ring. If the lamp fails to light or if the ohmmeter reading is high, the windings are open (fig. 16c).

Short Circuits

The windings are checked for shorts by connecting a 12 volt battery and an ammeter in series with the two slip rings. Note the ammeter reading. An ammeter reading above the specified field amperage draw indicates shorted windings. Refer to Specifications at the end of this section.

TESTING STATOR

Grounds

Connect a 110-volt test lamp or an ohmmeter from any stator lead to the stator frame. If test lamp lights or if ohmmeter reads low, the windings are grounded (fig. 17c).

Opens

If lamp fails to light or if ohmmeter reads high when successively connected between each pair of stator leads, the windings are open (fig. 17c).

Short Circuits

A short in the stator windings is difficult to locate without special test equipment due to the low resistance of the windings. However, if all other electrical checks are normal and the generator fails to supply rated output, shorted windings are indicated. Sometimes, a shorted winding will show evidence of charring.

TESTING DIODES

Two methods may be used to check diodes for shorts

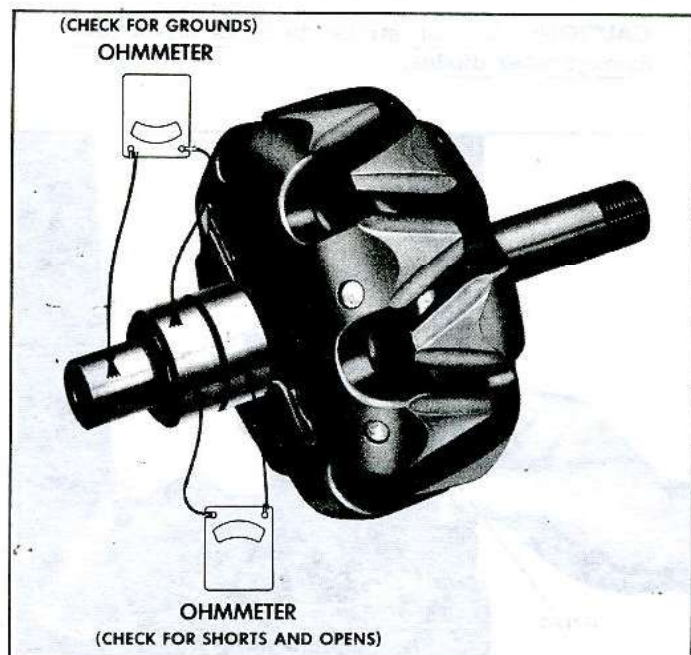


Fig. 16c—Checking Rotor for Grounds or Opens

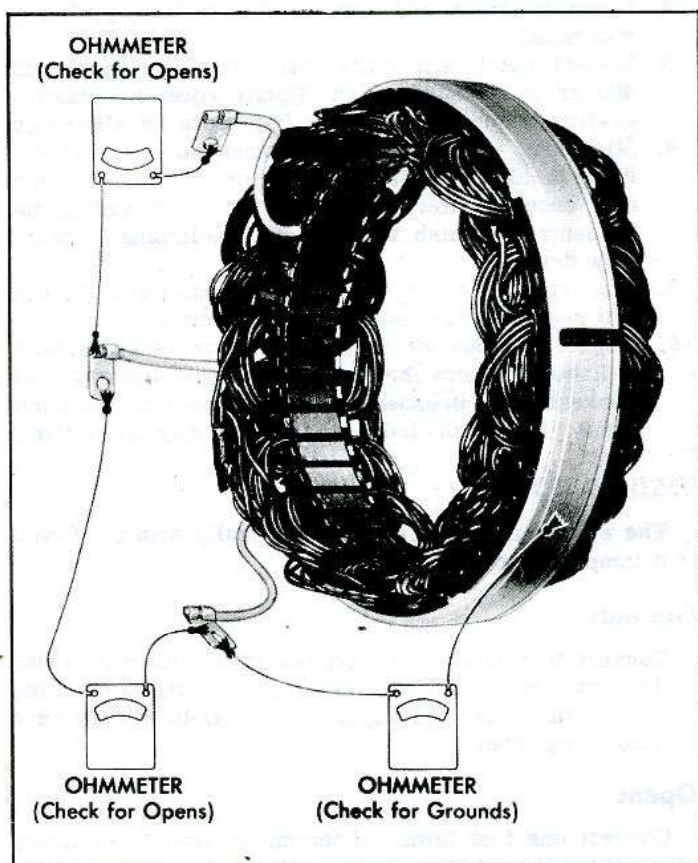


Fig. 17c—Checking Stator for Grounds or Opens

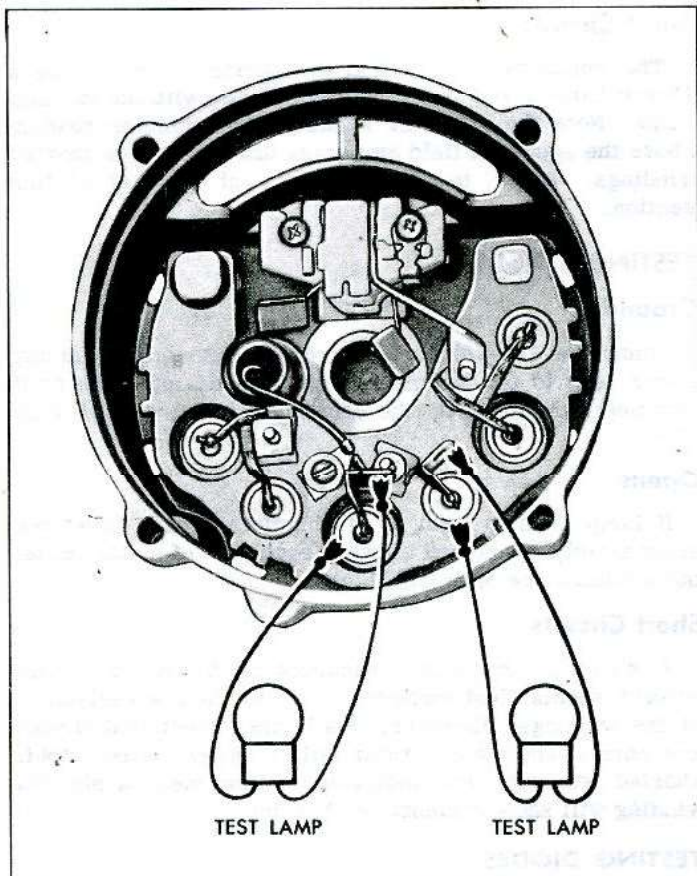


Fig. 18c—Checking Diodes

or opens, a test lamp of not more than 12 volts or an ohmmeter.

CAUTION: Do not use a 110-volt test lamp to test diodes.

Test Lamp Method

Diode in Heat Sink

With the stator previously disconnected, connect one of the lamp leads to the heat sink and other lead to the diode lead (fig. 18c). Observe condition of lamp. Reverse the lamp leads and observe condition of lamp. A good diode will allow the lamp to light in only one of the test directions. If lamp lights in both directions or fails to light at all, the diode is defective.

Diode in the End Frame

Connect one lamp lead to the end frame and the other lamp lead to the diode lead (fig. 18c), and observe lamp condition. Reverse the lamp lead connections and observe the lamp condition. A good diode will allow lamp to light in only one direction. If lamp lights in both directions or fails to light at all, the diode is defective.

Ohmmeter Method

Use an ohmmeter with a 1-1/2 volt cell and use the lowest range scale.

Connect the ohmmeter leads at each diode (as previously described using a test lamp) first in one direction and then the other (fig. 18c). Note the readings. If both readings are identical (very high or very low), the diode is defective. A good diode will give one high and one low reading.

REPAIRS

Diode Replacement

1. Support end frame with support Tool J-9717-2 and press out diode with diode removal Tool J-9717-1 and an arbor press (fig. 19c).

CAUTION: Do not strike diode as shock may damage other diodes.

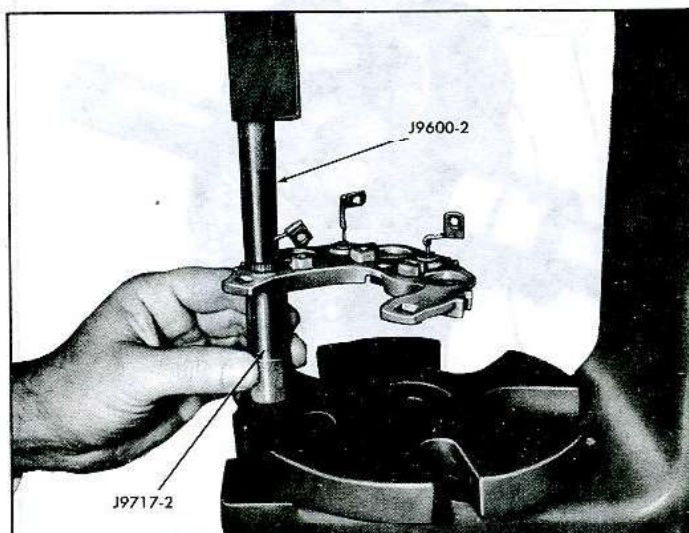


Fig. 19c—Installing Diodes with Press Tools

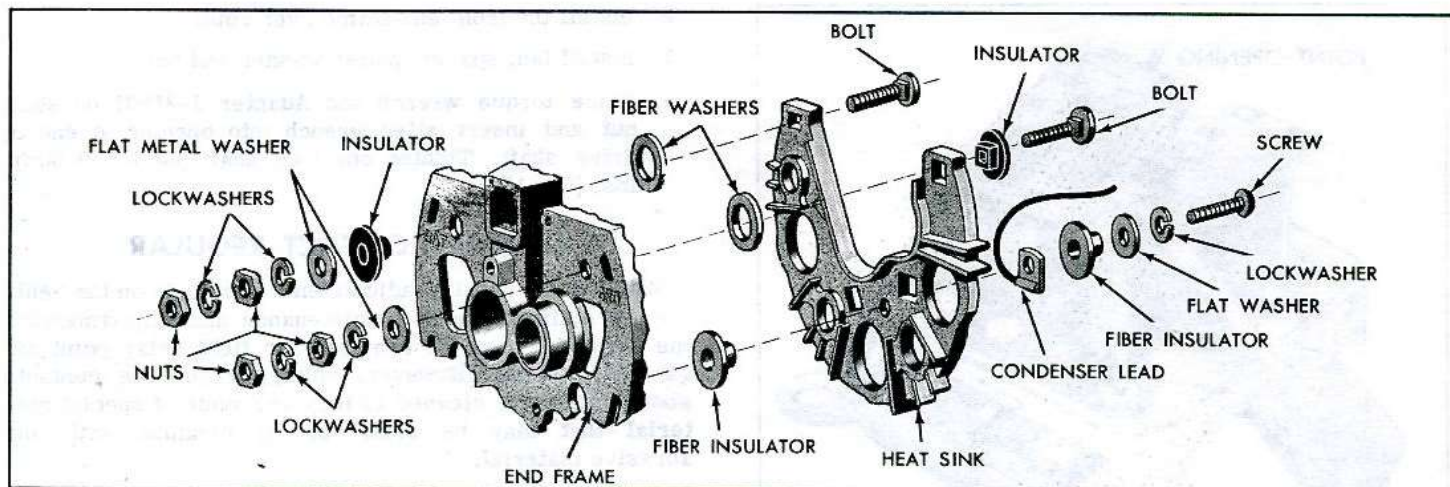


Fig. 20c—Heat Sink—Parts Location

2. Select diode with proper color marking.

NOTE: Diodes in the heat sink are positive (red markings) and those in the end frame are negative (black markings).

3. Support outside end of frame around diode hole on a flat, smooth surface and press diode into position with J-9600-2 and an arbor press. Make sure diode is square with end frame and started straight (fig. 19c).

CAUTION: Avoid bending or moving diode stem as excessive movement can cause internal damage and result in diode failure.

Heat Sink Replacement

1. Detach heat sink from end frame by removing the two terminal bolts. Note carefully the proper stack-up of parts so that the "BAT" and "GRD" terminal bolts can be reassembled in the same manner (fig. 20c).
2. Replace diodes, if necessary, as outlined in Diode Replacement.
3. Assemble heat sink to the end frame, following carefully the proper stack-up of parts as noted in Step 1.

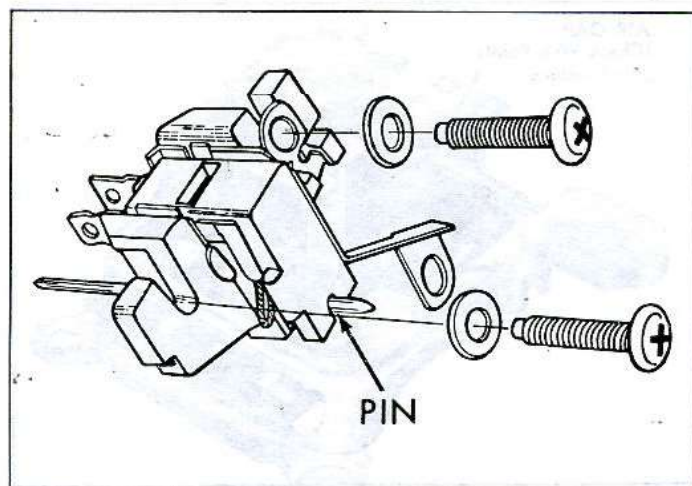


Fig. 21c—Brush Assembly—5.5" Delcotron

Brush Replacement

5.5" Delcotron—Fig. 21C

1. After through bolt removal and Delcotron separation, remove stator lead nut that also holds relay terminal connector.
2. Remove 2 mounting screws and brush holder assembly.
3. Position new brush holder assembly and install retaining screws.
4. Connect relay terminal wire lead and install stator lead nut.

End Frame Replacement

1. Remove heat sink as outlined in Heat Sink Replacement.
2. Attach brush holder assembly to the new end frame noting carefully proper parts stack-up (fig. 22c) and insert pin or wire through the hole to hold the brushes in the holder. After the unit has been completely assembled, withdraw the pin or wire from the end frame hole to allow the brushes drop down onto the slip rings.

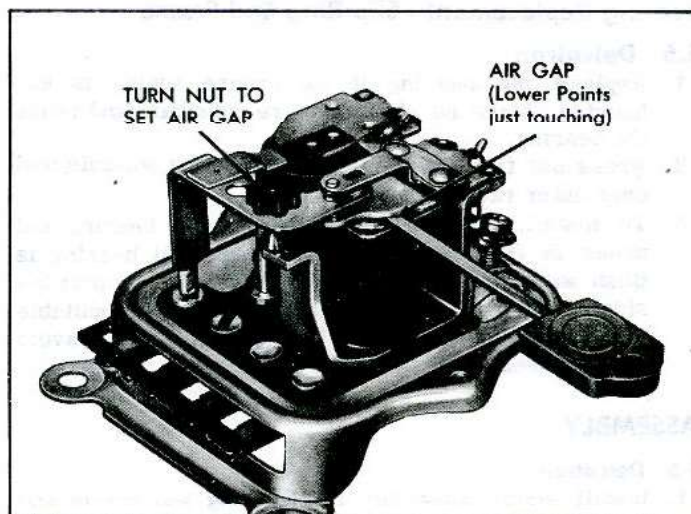


Fig. 22c—Checking Voltage Regulator Air Gap

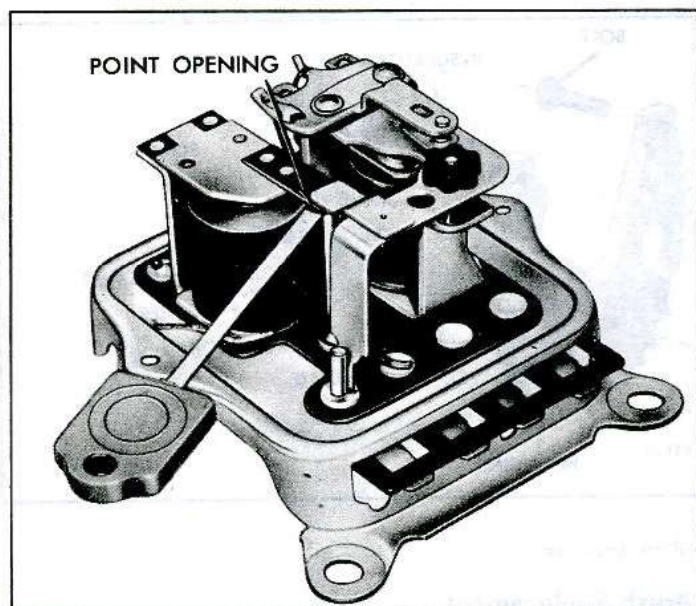


Fig. 23c—Checking Field Relay Point Opening

3. Replace heat sinks to end frame as outlined in Heat Sink Replacement.

Bearing Replacement—Drive End Frame

1. The drive end frame bearing can be removed by detaching the retainer plate bolts and separating retainer plate from end frame, and then pressing bearing out using suitable tube or pipe on outer race.

NOTE: 5.5" Delcotron uses staked retainer plate bolts.

2. Refill bearing one-quarter full with Delco-Remy No. 1948791 grease or equivalent. Do not overfill.
3. Press bearing into end frame using tube or pipe as in Step 1.
4. Install retainer plate and bolts. Stake bolts to retainer plate. Use new retainer plate if felt seal is hardened or excessively worn.

Bearing Replacement—Slip Ring End Frame

5.5" Delcotron

1. Replace the bearing if the grease supply is exhausted. Make no attempt to re-lubricate and reuse the bearing.
2. Press out from inside of housing, using suitable tool over outer race of bearing.
3. To install, place a flat plate over the bearing and press in from outside of housing until bearing is flush with the outside of the end frame. Support inside of end frame around bearing bore with a suitable tool to prevent distortion. Use extreme care to avoid misalignment.

ASSEMBLY

5.5" Delcotron

1. Install stator assembly in slip ring end frame and locate diode connectors over the relay, diode and stator leads, and tighten terminal nuts.

2. Install the front end frame over rotor.
3. Install fan, spacer, pulley washer and nut.
4. Place torque wrench and Adapter J-21501 on shaft nut and insert allen wrench into opening at end of drive shaft. Tighten one lock shaft nut to 50-60 ft. lbs. (fig. 15c).

DOUBLE CONTACT REGULAR

While most regular adjustments are made on the vehicle as outlined under "Maintenance and Adjustments", the regulator may be removed for field relay point air gap adjustment. However, voltage regulating contacts should never be cleaned as they are made of special material that may be destroyed by cleaning with any abrasive material.

NOTE: A sooty or discolored condition of the contacts is normal after a relatively short period of operation.

REMOVAL AND INSTALLATION

To remove the regulator assembly, disconnect the battery ground cable and the wiring harness connector at the regulator then remove the screws securing the regulator to the vehicle. Reverse removal to install.

MECHANICAL ADJUSTMENTS

Electrical settings must be checked and adjusted after making mechanical adjustments. Before installing regulator cover, make sure the rubber gasket is in place on the regulator base.

Voltage Regulator Adjustment

Air Gap: Measure the air gap with a feeler gauge placed between the armature and core when the lower contacts are touching as shown in Figure 22C. To adjust the air gap, turn the nylon nut located on the contact support.

NOTE: Only an approximate voltage regulator air gap setting need be made by the "feeler gauge" method.

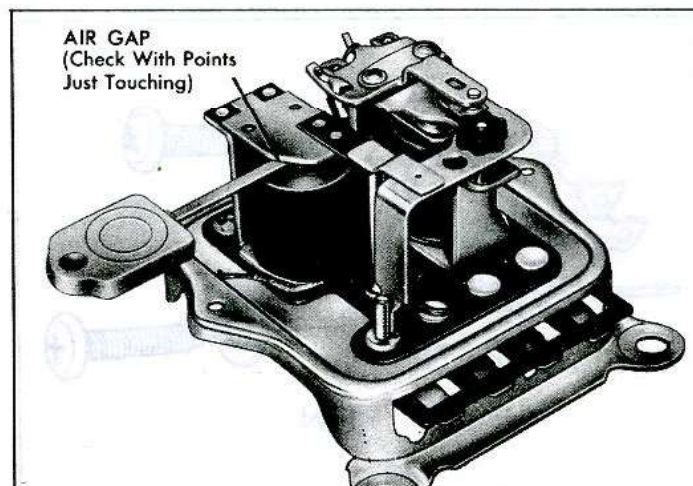
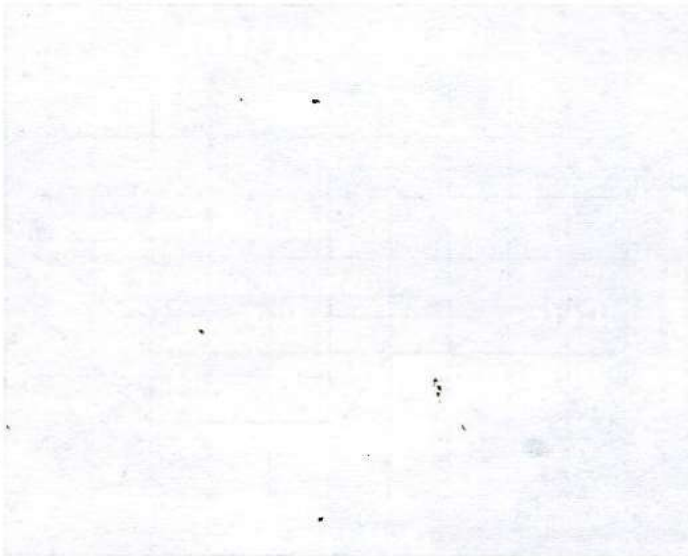


Fig. 24c—Checking Field Relay Air Gap

Field Relay Adjustment

1. Point Opening: The point opening is checked as illustrated in Figure 23c. If adjustment is necessary, carefully bend the armature stop.
2. Air Gap: Check the air gap with the points just

touching (fig. 24c). The air gap normally need not be adjusted. If the point opening and closing voltages are within specifications, the relay will operate satisfactorily even though the air gap may not be exactly according to specifications. If adjustment is necessary, carefully bend the flat contact spring.



The distributor and spark plug are the only moving parts in the charging system. The distributor is the only part that is adjusted. The distributor is adjusted by bending the distributor armature stop. The distributor armature stop is bent by using a screwdriver. The distributor armature stop is bent by using a screwdriver. The distributor armature stop is bent by using a screwdriver.

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MAINTENANCE AND ADJUSTMENT

CONTACT POINT REPLACEMENT

Refer to Figure 23 through 25.

1. Remove distributor cap and hold-down screw. Remove cap and place it on a work area.
2. Remove points and distributor lead wires from the distributor.
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10. Remove points and distributor lead wires from the distributor.

IGNITION SYSTEM

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GENERAL DESCRIPTION

The distributor and spark plugs are the only ignition system components that require periodic service. The remainder of the ignition system requires only periodic inspection to check operation of the units, tightness of the electrical connections, and condition of the wiring. When checking the coil, test with a reputable tester.

Distributors are equipped with a cam lubricator and should have the lubricator replaced at the same time the contact point set is replaced. It is not necessary to lubricate the breaker cam when using a cam lubricator however, the breaker cam should be wiped clean and lightly lubricated when installing a new lubricator. Do not attempt to lubricate the element - Replace when necessary. When installing a new lubricator, adjust its position so the circumference of the lubricator just touches the lobe of the breaker cam.

Distributor shaft lubrication is accomplished by a reservoir of lube around the mainshaft in the distributor body.

The distributor used on the turbo-supercharged engines is different from other engine model distributors in that a pressure retard unit replaces the ordinary advance unit. This unit retards the spark during the time the manifold is pressurized, partially opposing centrifugal advance at high engine rpm. The curve is as shown in Figure 1i.

Service operations are the same as on regulator distributor except for those operations relating to the vacuum advance unit.

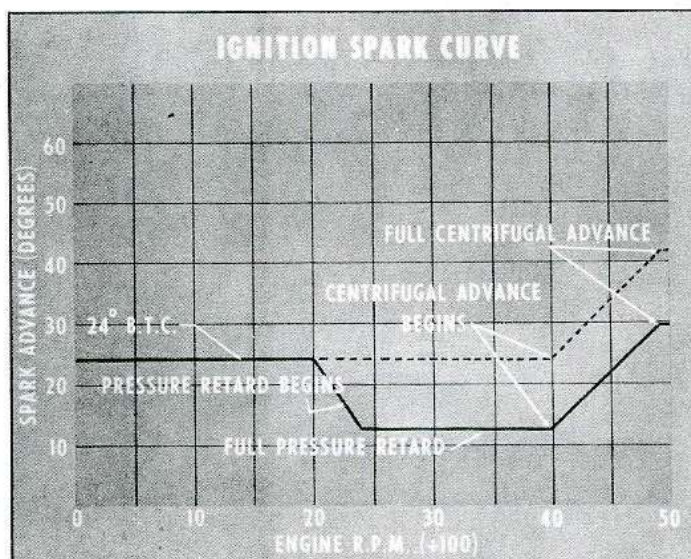


Fig. 1i—Distributor Spark Curve

Spark plugs - should be removed, inspected cleaned and regapped at tune-up. Defective plugs should be replaced, see Servicing of Units Off the Vehicle.

MAINTENANCE AND ADJUSTMENT

CONTACT POINT REPLACEMENT

Refer to Figures 2i through 4i

1. Release distributor cap hold-down screws, remove cap and place it out of work area.
2. Remove rotor and dust shield.
3. Pull primary and condenser lead wires from contact point quick-disconnect terminal (fig. 2i).
4. Remove contact set attaching screw, lift contact point set from breaker plate (fig. 2i).
5. Clean breaker plate of oil smudge and dirt.
6. Place new contact point assembly in position on breaker plate, install attaching screw.

CAUTION: Carefully wipe protective film from point set prior to installation.

NOTE: Pilot on contact set must engage notching hole in breaker plate.

7. Connect primary and condenser lead wires to quick disconnect terminal on contact point set.
8. Check and adjust points for proper alignment and breaker arm spring tension (fig. 3i). Use an aligning tool to bend stationary contact support if points need alignment.
9. Set point opening (.019" for new points) (fig. 4i).
10. Rotate cam lubricator 90° (fig. 2i).

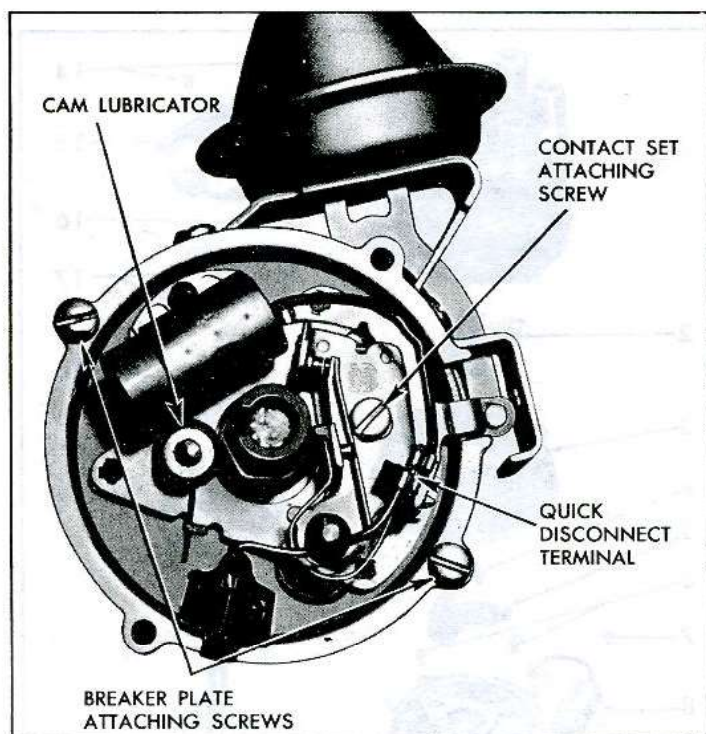


Fig. 2i—Breaker Plate and Attaching Parts

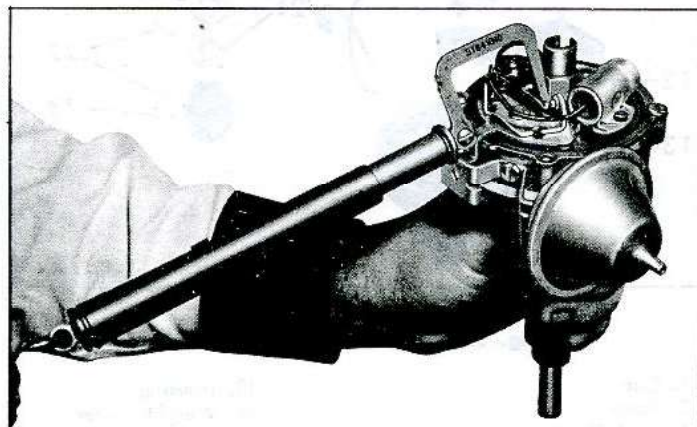


Fig. 3i—Checking Breaker Arm Spring Tension

11. Reinstall dust shield, rotor, position and lock distributor cap to housing.
12. Check and set ignition timing. (See Engine Tune-Up, Section 7.)

CONDENSER REPLACEMENT

Refer to Figure 2i

1. Release distributor cap hold-down screws, remove cap and place it out of work area.
2. Remove rotor and dust shield.
3. Disconnect condenser lead wire from contact point quick disconnect terminal.
4. Remove condenser attaching screw, lift condenser from breaker plate. Wipe breaker plate clean.
5. Install new condenser using reverse of procedure outlined above.

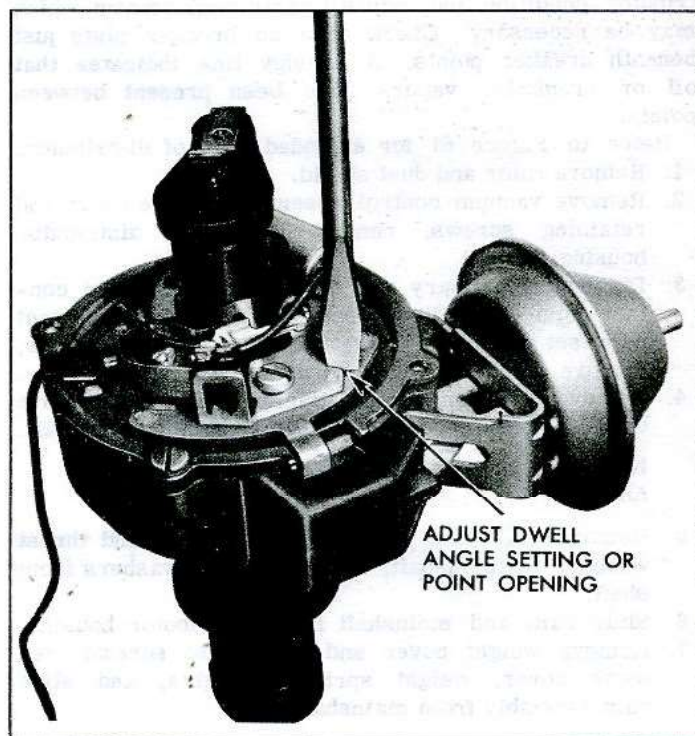


Fig. 4i—Setting Point Opening

SERVICE OPERATIONS

DISTRIBUTOR

REMOVAL

1. Release distributor cap hold-down screws, remove cap and place it out of work area.

NOTE: If necessary to remove secondary leads from distributor cap, mark position on cap tower for lead to No. 1 cylinder. This will aid in reinstallation of leads in cap.

2. Disconnect distributor primary lead from coil terminal.

3. Scratch a realignment mark on distributor in line with rotor segment (fig. 2i).
4. Disconnect vacuum line from vacuum control assembly (retard unit on turbo-charged engines), remove distributor hold-down bolt and clamp, remove distributor from engine. Note position of vacuum advance assembly relative to engine for correct reinstallation (fig. 5i).

CAUTION: Avoid rotating engine with distributor removed as ignition timing will be upset.

DISASSEMBLY

With the distributor removed from vehicle it is advisable to place it in a distributor testing machine or synchroscope.

CAUTION: When mounting the distributor in any distributor testing machine or synchroscope, extreme care must be taken not to score or otherwise damage the lower distributor shaft with the testing machine drive mechanism. A protective adapter, with bushing, available from the manufacturers of such testing machines for use with the Corvair distributor, must be used over the lower 1-3/8" of the distributor shaft.

Test the distributor for variation of spark, correct centrifugal and vacuum advance and condition of contacts. This test will give valuable information on distributor condition and indicate parts replacement which may be necessary. Check area on breaker plate just beneath breaker points. A smudgy line indicates that oil or crankcase vapors have been present between points.

Refer to Figure 6i for exploded view of distributor.

1. Remove rotor and dust shield.
2. Remove vacuum control assembly linkage cover and retaining screws, remove unit from distributor housing.
3. Disconnect primary and condenser leads from contact point quick disconnect terminal, remove contact point set attaching screw, condenser attaching screw, remove point set and condenser from breaker plate.
4. Remove breaker plate attaching screws, remove breaker plate from distributor housing (fig. 2i).

NOTE: Do not disassemble breaker plate any further.

5. Remove roll pins retaining driven gear and thrust washers to mainshaft, slide gear and washers from shaft.
6. Slide cam and mainshaft from distributor housing.
7. Remove weight cover and stop plate screws, remove cover, weight springs, weights, and slide cam assembly from mainshaft.

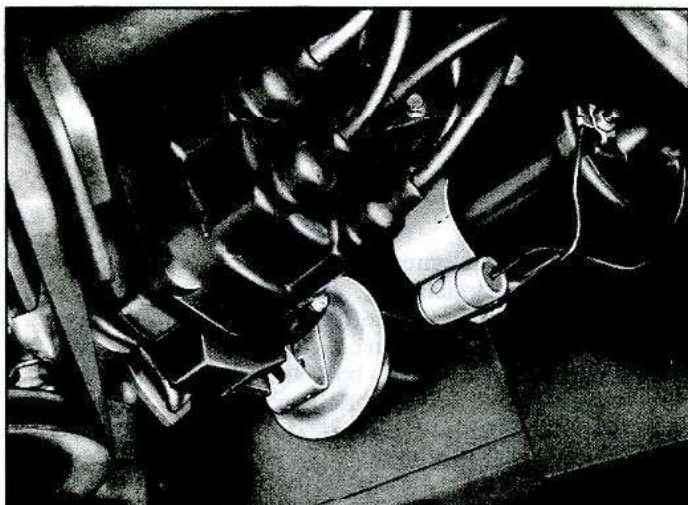


Fig. 5i—Distributor Installed

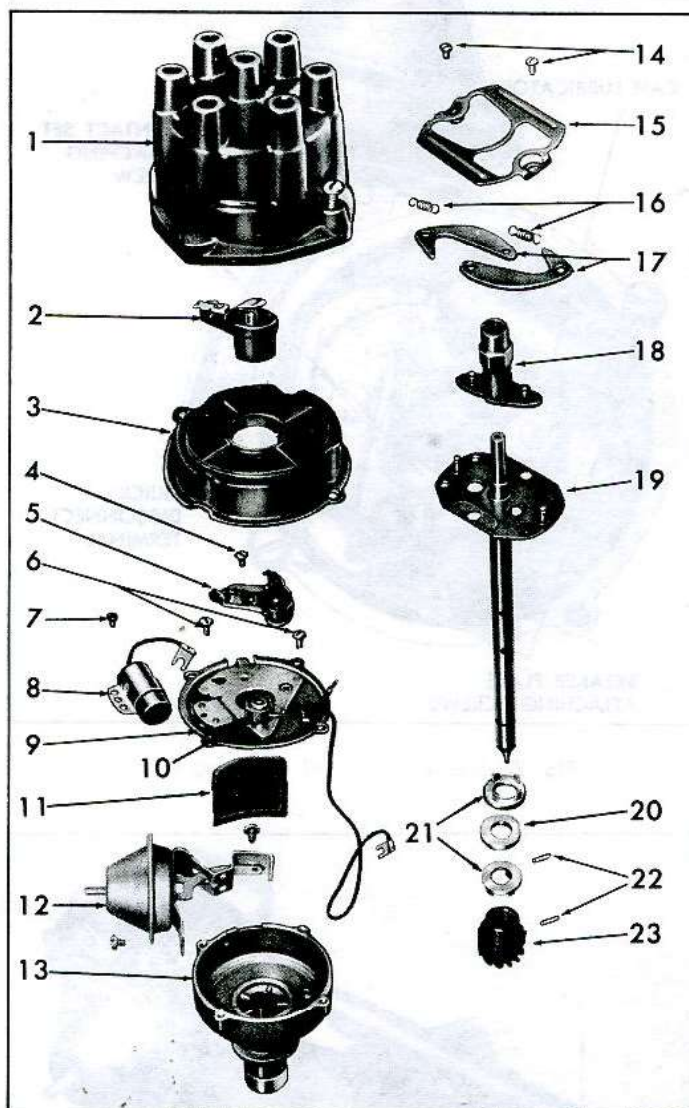


Fig. 6i—Distributor Exploded View

- | | |
|-----------------------------------|------------------------|
| 1. Cap | 13. Housing |
| 2. Rotor | 14. Weight Cover |
| 3. Dust Shield | 15. Weight Cover |
| 4. Contact Point Attaching Screw | 16. Weight Springs |
| 5. Contact Point Assembly | 17. Advance Weights |
| 6. Breaker Plate Attaching Screws | 18. Cam Assembly |
| 7. Condenser Attaching Screw | 19. Mainshaft Assembly |
| 8. Condenser | 20. Washer |
| 9. Breaker Plate Assembly | 21. Thrust Washers |
| 10. Cam Lubricator | 22. Roll Pins |
| 11. Vacuum Advance Linkage Boot | 23. Drive Gear |
| 12. Vacuum Control Assembly | |

CLEANING AND INSPECTION

1. Wash all parts in cleaning solvent except cap, rotor, condenser, breaker plate assembly, cam lubricator and vacuum control assembly. Degreasing compounds may damage condenser insulation or plastic insulators on the breaker plate assembly.
2. Inspect breaker plate assembly for damage or wear and replace if necessary.
3. Inspect mainshaft for wear, check its fit in the bushing in the distributor housing. If the shaft or

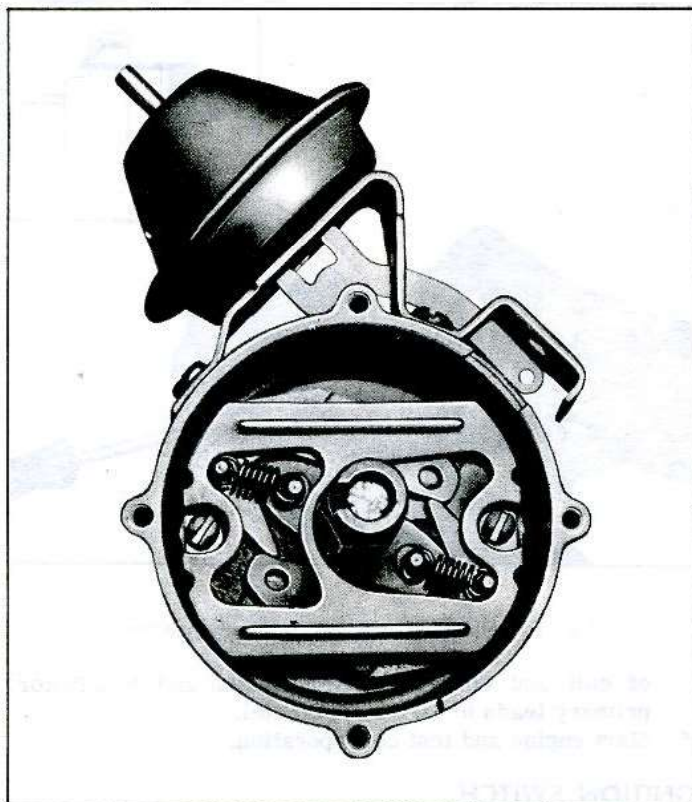


Fig. 7i—Weights, Weight Cover Installed

bushing is worn, the shaft and distributor body should be replaced.

NOTE: Distributor housing bushing not serviced separately.

4. Mount the shaft in "V" blocks and check the shaft alignment with a dial gauge. The runout should not exceed .002".
5. Inspect the governor weights for wear or burrs and free fit on their pins.
6. Inspect the cam for wear or roughness. Then check its fit on the end of the shaft. It should be absolutely free, without any looseness.
7. Inspect the condition of the distributor points (see Distributor Contact Points). Dirty points should be cleaned and badly pitted points should be replaced.
8. Test the condenser for series resistance, microfarad capacity (.16 to .23), leakage or breakdown, following the instructions given by the manufacturer of the test equipment used.
9. Inspect the distributor cap and spark plug wires for damage.

ASSEMBLY

Refer to Figure 6i for exploded view of distributor.

1. Replace cam assembly to mainshaft.

NOTE: Lubricate top end of shaft with light engine oil prior to replacing.

2. Install weights on their pivot pins, replace weight springs. Install weight cover and stop plate (fig. 7i).

3. Lubricate mainshaft, install it in distributor housing.
4. Install thrust washers and driven gear to mainshaft, insert retaining roll pins. Check to see that shaft turns freely.

NOTE: Install driven gear with mark on hub in line with rotor segment.

5. Position breaker plate assembly in housing and attach retaining screws (See Figure 2i).
6. Attach condenser and contact point set in proper location with appropriate attaching screws. Connect primary and condenser leads to contact set quick disconnect terminal.

NOTE: Contact point set pilot must engage matching hole in breaker plate.

7. Attach vacuum control or retard unit assembly to distributor housing using upper mounting holes and install vacuum advance linkage cover.
8. Install cam lubricator.
9. Install dust shield and rotor to cam assembly.

INSTALLATION—ENGINE NOT DISTURBED

1. Turn rotor approximately 1/8 turn counter-clockwise past mark previously scratched on distributor housing.
2. Work distributor down into position in engine block with distributor positioned as noted prior to removal—vacuum control unit in same relative position to engine.

NOTE: It may be necessary to move rotor slightly to start gear into mesh with crankshaft gear, but rotor should line up with the mark when distributor is down in place.

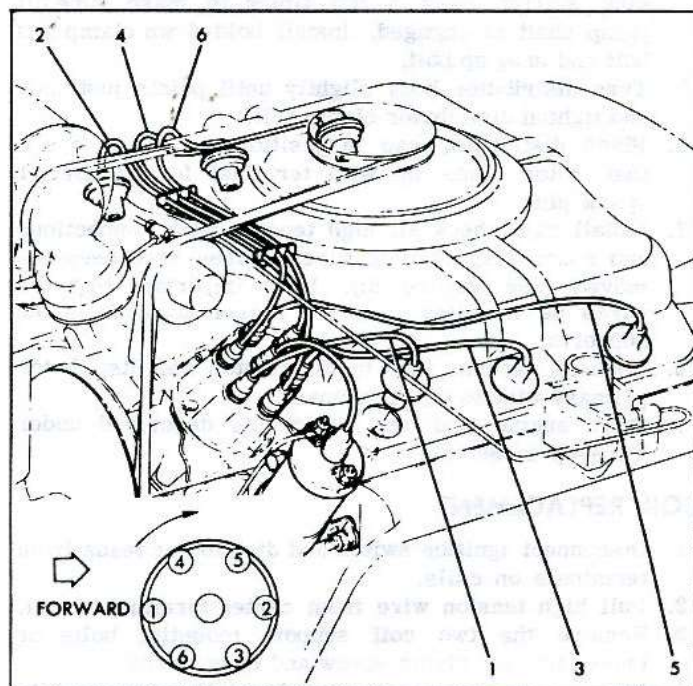


Fig. 8i—Distributor, Spark Plug Wires Installed

3. Replace distributor hold-down clamp and bolt. Connect primary lead to coil terminal. Replace distributor cap. Also install spark plug and coil secondary wires if removed (fig. 8i).

CAUTION: Care should be used in tightening distributor cap screws to prevent cracking the cap.

NOTE: Wires must be installed as indicated to prevent cross-firing.

4. Set points and time ignition as outlined under Engine Tune-Up, Section 7.
5. Connect vacuum hose to control unit.

INSTALLATION—ENGINE DISTURBED

1. Locate Number 1 piston in firing position by either of two methods described below.
 - a. Remove Number 1 spark plug and with compression gauge on plug hole crank engine until compression is indicated in Number 1 cylinder. Continue cranking until crankshaft pulley timing notch lines up with "O" timing mark on engine rear housing or . . .
 - b. Remove right bank rocker cover and crank engine until Number 1 intake valve closes and continue to crank slowly until "O" pointer lines up with timing notch on crankshaft pulley.
2. Position distributor to opening in block in normal installed attitude.
3. Position rotor to point toward harmonic balancer of engine (with distributor housing held in installed attitude), then turn rotor clockwise approximately 1/8 turn more toward left cylinder bank and push distributor down to engage crankshaft. It may be necessary to rotate rotor slightly until crankshaft engagement is felt.
4. While pressing firmly down on distributor housing, kick starter over a few times to make sure oil pump shaft is engaged. Install hold-down clamp and bolt and snug up bolt.
5. Turn distributor body slightly until points just open and tighten distributor clamp bolt.
6. Place distributor cap in position and check to see that rotor lines up with terminal for Number 1 spark plug.
7. Install cap, check all high tension wire connections and connect spark plug wires if they have been removed (See Figure 8i). It is important that the wires be installed in their proper location in the supports.
8. Connect vacuum line to distributor and distributor primary wire to coil terminal.
9. Start engine and set timing as described under Tune-up in Section 7.

COIL REPLACEMENT

1. Disconnect ignition switch and distributor leads from terminals on coils.
2. Pull high tension wire from center terminal of coil.
3. Remove the two coil support mounting bolts or loosen friction clamp screw and remove coil.
4. Place new coil in position and install attaching bolts or tighten clamp screw.
5. Place high tension lead securely in center terminal

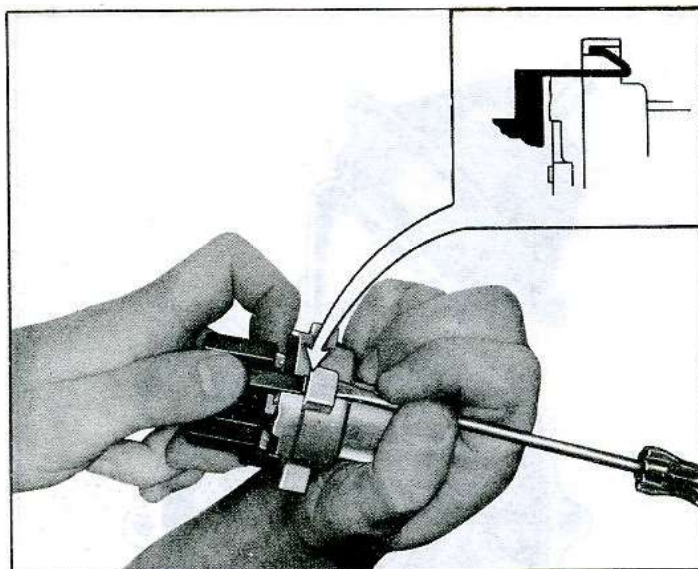


Fig. 9i—Unlocking Ignition Switch Connector

of coil and connect ignition switch and distributor primary leads to terminals on coil.

6. Start engine and test coil operation.

IGNITION SWITCH

Removal and Installation

1. Raise engine compartment lid and disconnect negative battery cable from battery.
2. Remove lock cylinder by positioning switch in "OFF" position and inserting wire in small hole in cylinder face. Push in on wire to depress plunger and continue to turn key counter-clockwise until lock cylinder can be removed.
3. Using suitable spanner wrench (Tool J-7607), remove the front attaching nut.
4. Pull the ignition switch out from under the dash and remove the wiring connectors.
5. To remove the "theft resistant" connector, the

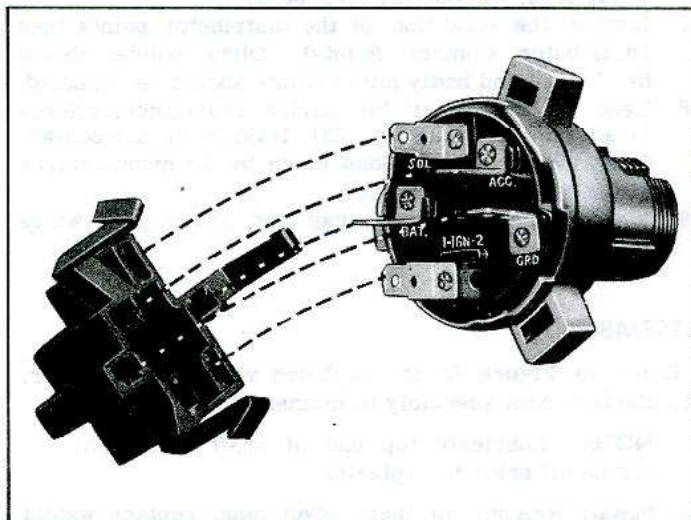


Fig. 10i—Switch and Connector Unplugged

switch must be out from under the dash as outlined in Step 4. Using a screw driver unsnap the locking tangs on the connector from their position on the switch as shown in Figure 9i. Unplug the connector.

6. Snap the connector into place on a new ignition switch (fig. 10i).
7. Place the switch into position from behind the dash and install the metal ignition switch nut.
8. Install the lock cylinder.
9. Install the battery cable to the battery and lower the engine compartment lid.

SPARK PLUGS

Removal

1. Remove spark plug wires.
2. Remove any foreign matter from around spark plugs by blowing out with compressed air.
3. Using a 13/16" spark plug socket, remove the spark plugs.

NOTE: To remove or loosen the center spark plugs, it will be necessary to disconnect or remove carburetor throttle rod and use a universal drive on spark plug socket. It may be desirable to use a special spark plug socket that is equipped with an internal "O" ring seal to grip the spark plug and avoid the possibility of dropping spark plugs into engine shroud assembly.

Cleaning and Regapping

Clean the spark plugs thoroughly, using an abrasive-type cleaner. If the porcelains are badly glazed or blistered, the spark plugs should be replaced. All spark plugs must be of the same make and number or heat range. Use a round feeler gauge to adjust the spark plugs gap to .035" (fig. 11i).

CAUTION: Before adjusting gap, file center electrode flat. In adjusting the spark plug gap, never bend the center electrode which extends through the porcelain center. Always make adjustment by bending the ground or side electrode.

Installation

1. Inspect spark plug hole threads and clean before installing plugs. Corrosion deposits can be removed with a 14 mm. x 1.25 SAE spark plug tap (available through local jobbers) or by using a small, soft wire brush in an electric drill. If a tap is used, coat it with plenty of grease to catch any chips.

CAUTION: Use extreme care when using tap to prevent cross threading. Also, crank engine several times to blow out any material dislodged during cleaning operation.

2. Install spark plugs to engine using new gaskets and tighten to 20-25 ft. lbs. torque.

NOTE: Do not use any "anti-seize" compound on spark plug threads as this will act as an insulator and not allow proper spark plug cooling. Be careful when installing plug to prevent gasket from falling into engine shroud assembly.

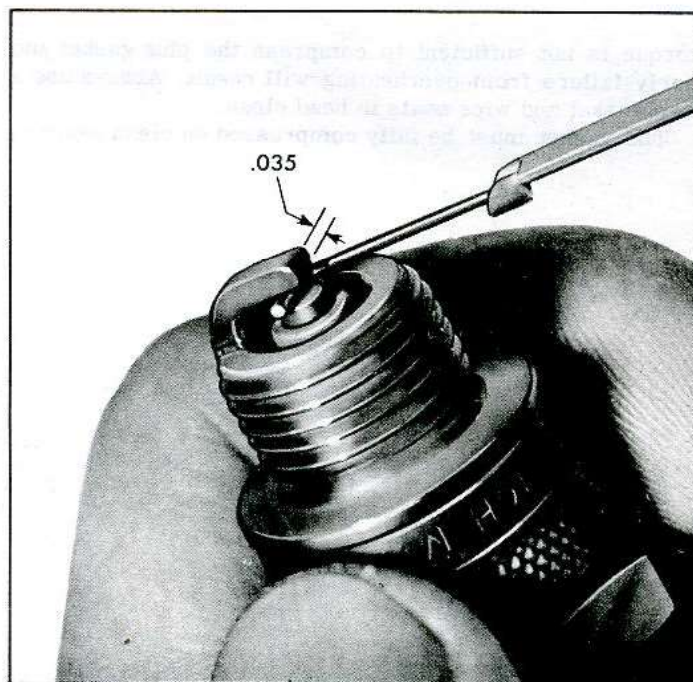


Fig. 11i—Setting Spark Plug Gap

It may be desirable to use a spark plug socket that is equipped with an internal "O" ring seal to grip the spark plug to start the plug into the cylinder head to avoid the possibility of dropping plugs into engine shroud assembly.

3. Secure wires and access covers.

NOTE: Be certain spark plug access covers are tightly in place. If as many as two are loose, all air pressure in cooling system will be lost and engine will overheat. In addition, a whistling sound may develop that could be difficult to locate.

4. Reconnect carburetor throttle rod.

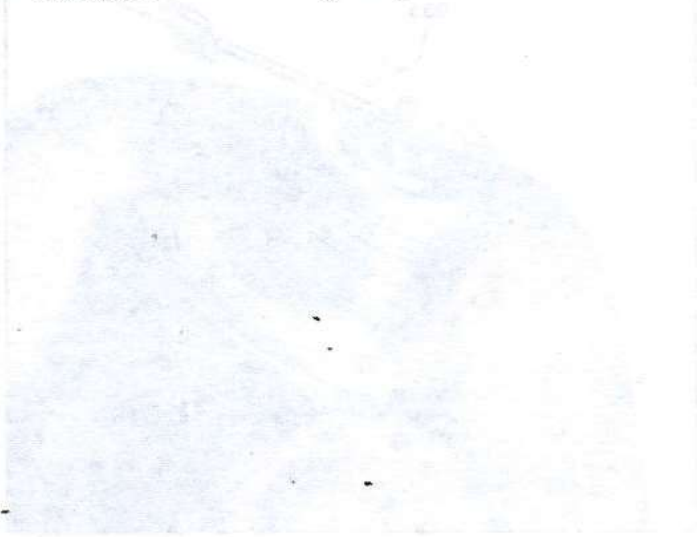
NOTE: Improper installation is one of the greatest single causes of unsatisfactory spark plug service. Improper installation is the result of one or more of the following practices:

- Installation of plugs with insufficient torque to fully seat the gasket.
- Installation of plugs using excessive torque which changes gap settings.
- Installation of plugs on dirty gasket seal.
- Installation of plugs to corroded spark plug hole threads.
- Installation of plugs using excessive torque or abuse which cracks porcelain or insulation.

Failure to install plugs properly will cause them to operate at excessively high temperatures and result in reduced operating life under mild operation or complete destruction under severe operation where the intense heat cannot be dissipated rapidly enough. Always remove corrosion deposits in hole threads before installing plugs. When corrosion is present in threads, normal

torque is not sufficient to compress the plug gasket and early failure from overheating will result. Always use a new gasket and wipe seats in head clean.

The gasket must be fully compressed on clean seats to



complete heat transfer and provide a gas tight seal in the cylinder. For this reason as well as the necessity of maintaining correct plug gap, the use of correct torque is extremely important during installation.

It may be desirable to use a spark plug socket that is equipped with an internal air ring and to keep the spark plug in contact with the head during the process of cranking the engine.

When the spark plug is removed from the head, it should be inspected for signs of wear. If the plug is worn, it should be replaced. The plug should be cleaned and oiled before installation.

The spark plug should be installed in the head and tightened to the correct torque. The torque should be checked after the engine has been run for a short time.

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STARTER CIRCUIT

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GENERAL DESCRIPTION

The function of the starting system, composed of the starting motor, solenoid and battery, is to crank the engine. The battery supplies the electrical energy, the solenoid completes the circuit to the starting motor, and the motor then does the actual work of cranking the engine.

The starting motor (fig. 1s) consists primarily of the drive mechanism, frame, armature, brushes, and field

windings. The starting motor is a pad mounted 12-volt extruded frame type, having four pole shoes and four fields, connected in series with the armature. The aluminum drive end housing is extended to enclose the entire shift lever and plunger mechanism, protecting them from dirt, splash, and icing. The flange mounted solenoid switch operates the overrunning clutch drive by means of a linkage to the shift lever.

MAINTENANCE AND ADJUSTMENTS

No periodic lubrication of the starting motor or solenoid is required. Since the starting motor and brushes cannot be inspected without disassembling the unit, no service is required on these units between overhaul periods.

RESISTANCE CHECKS

Although the starting motor cannot be checked against specifications on the car, a check can be made for excessive resistance in the starting circuit. Place a voltmeter across points in the cranking circuit as outlined

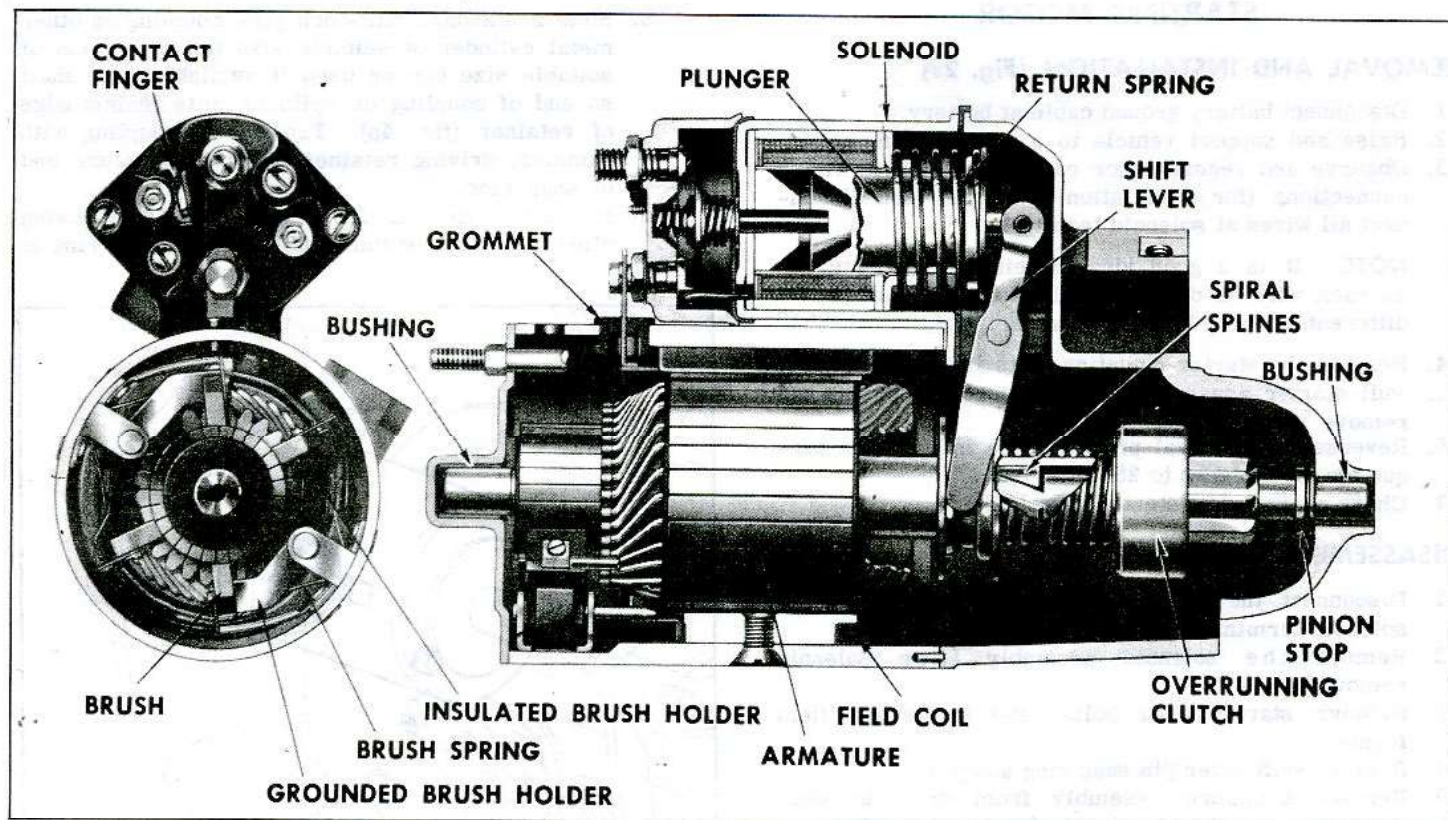


Fig. 1s—Starting Motor Cross Section (Typical)

below and observe the reading with the starting switch closed and the motor cranking (distributor primary lead grounded to prevent engine firing).

1. From battery positive post to solenoid battery terminal.
2. From battery negative post to starting motor housing.
3. From solenoid battery terminal to solenoid motor terminal.

If voltage drop in any of above check exceeds 0.2 volts, excessive resistance is indicated in that portion of starting circuit and the cause of the excessive resistance should be located and corrected in order to obtain maximum efficiency in the circuit.

CAUTION: Do not operate the starting motor continuously for more than 30 seconds to avoid overheating.

When the solenoid fails to pull in, the trouble may be due to excessive voltage drop in the solenoid control circuit. To check for this condition, close the starting switch and measure the voltage drop between the BATTERY terminal of the solenoid and the SWITCH (S) terminal of the solenoid.

1. If this voltage drop exceeds 3.5 volts, excessive resistance in the solenoid control circuit is indicated and should be corrected.
2. If the voltage drop does not exceed 3.5 volts and the solenoid does not pull in, measure the voltage available at the SWITCH terminal of the solenoid.

3. If the solenoid does not feel warm, it should pull in whenever the voltage available at the SWITCH terminal is 7.7 volts or more. When the solenoid feels warm, it will require a somewhat higher voltage to pull in.

STARTING MOTOR AND SOLENOID CHECK

The following checks may be made if the specific gravity of the battery is 1.215 or higher.

1. If the solenoid does not pull in, measure the voltage between the switch (S) terminal of the solenoid and ground with the starting switch closed.

CAUTION: If the solenoid feels warm, allow to cool before checking.

If the voltage is less than 7.7 volts, check for excessive resistance in the solenoid control circuit. If the voltage exceeds 7.7 volts, remove the starting motor and check (1) solenoid current draw, (2) starting motor pinion clearance, and (3) freedom of shift lever linkage.

2. If the solenoid "chatters" but does not hold in, check the solenoid for an open "hold-in" winding. Whenever it is necessary to replace a starting motor solenoid, always check starting motor pinion clearance.
3. If motor engages but does not crank or cranks slowly, check for excessive resistance in the external starting circuit, trouble within the starting motor, or excessive engine resistance to cranking.

SERVICE OPERATIONS

STARTING MOTOR

REMOVAL AND INSTALLATION (Fig. 2s)

1. Disconnect battery ground cable at battery.
2. Raise and support vehicle to a good working height.
3. Observe and record color coding of solenoid wiring connections (for installation purposes) then disconnect all wires at solenoid terminals.

NOTE: It is a good idea to reinstall the nuts as each wire is disconnected as thread size is different but may be mixed and stripped.

4. Remove the starter mounting bolts and lock washers.
5. Pull starter assembly forward to clear housing and remove starter.
6. Reverse the removal procedure to install then torque the mount bolts to 25-35 ft. lbs.
7. Check operation of starter on vehicle.

DISASSEMBLY

1. Disconnect the field coil connector from the motor solenoid terminal.
2. Remove the solenoid assembly (See Solenoid removal).
3. Remove starter thru bolts, end frame and field frame.
4. Remove shift lever pin snap ring and pin.
5. Remove armature assembly from drive housing.
6. Remove overrunning clutch from armature shaft as follows:
 - a. Slide thrust collar off end of armature shaft.

- b. Slide a standard half-inch pipe coupling or other metal cylinder of suitable size (an old pinion of suitable size can be used if available) onto shaft so end of coupling or cylinder butts against edge of retainer (fig. 4s). Tap end of coupling with hammer, driving retainer towards armature end of snap ring.
- c. Remove snap ring from groove in shaft using pliers or other suitable tool. If the snap ring is

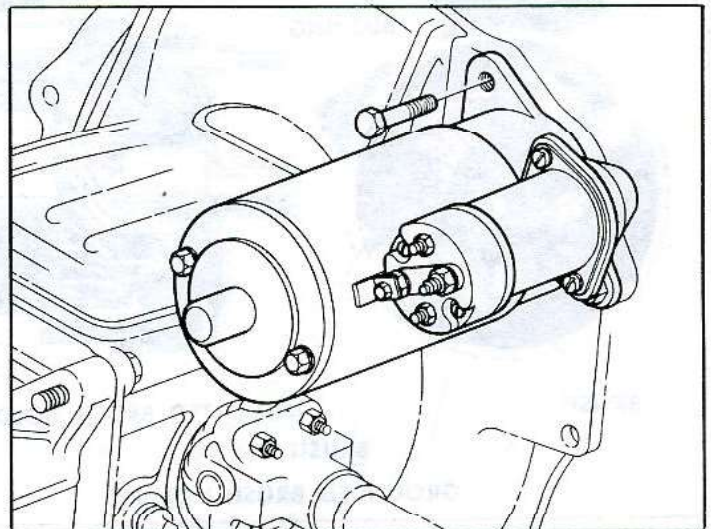


Fig. 2s—Starting Motor Installed

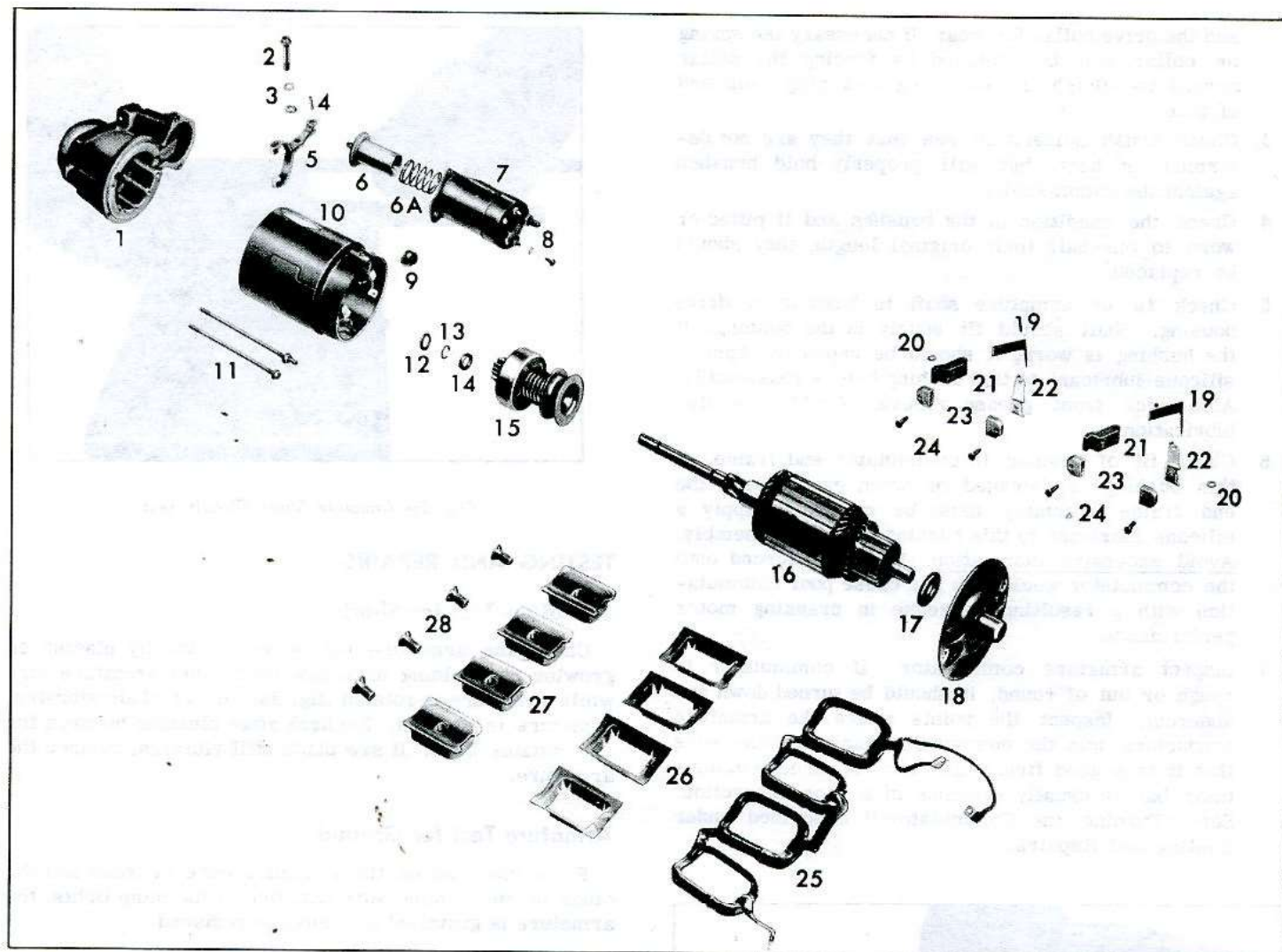


Fig. 3s—Starting Motor Parts Layout

- | | | | | |
|------------------------------------|----------------------------|---------------------------------|-----------------------------|----------------------------|
| 1. Drive Housing | 6A. Solenoid Return Spring | 11. Through Bolts | 17. Braking Washer | 22. Grounded Brush Holders |
| 2. Shift Lever Bolt | 7. Solenoid Case | 12. Thrust Collar | 18. Commutator End Frame | 23. Brushes |
| 3. Shift Lever Nut and Lock Washer | 8. Screw and Lock Washer | 13. Snap Ring | 19. Brush Springs | 24. Screws |
| 4. Pin | 9. Grommet | 14. Retainer | 20. Washer | 25. Field Coils |
| 5. Shift Lever | 10. Field Frame | 15. Overrunning Clutch Assembly | 21. Insulated Brush Holders | 26. Insulators |
| 6. Solenoid Plunger | | 16. Armature | | 27. Pole Shoes |
| | | | | 28. Screws |

too badly distorted during removal, it may be necessary to use a new one when reassembling clutch.

- d. Slide retainer and clutch from armature shaft.
7. Disassemble brush rigging from field frame.
 - a. Release "V" spring from slot in brush holder support.
 - b. Lift brush holders, brushes, and spring upward as a unit and remove from support pin.
 - c. Disconnect leads from each brush.
 - d. Repeat operation for other set of brushes.

CLEANING AND INSPECTION

With the starting motor completely disassembled except for removal of field coils, the component parts should be cleaned and inspected as described below.

Field coils need be removed only where defects in the coils are indicated by the tests described below, in which case the pole shoe screws should be removed and the pole shoes and field coils disassembled. Any defective parts should be replaced or repaired (see Repairs).

1. Clean all starting motor parts, but do not use grease dissolving solvent for cleaning the overrunning clutch, armature, and field coils since such a solvent would dissolve the grease packed in the clutch mechanism and would damage armature and field coil insulation.
2. Test overrunning clutch action. The pinion should turn freely in the overrunning direction and must not slip in the cranking direction. Check pinion teeth to see that they have not been chipped, cracked, or excessively worn. Check the spring for normal tension

and the drive collar for wear. If necessary the spring or collar can be replaced by forcing the collar toward the clutch and removing lock ring from end of tube.

3. Check brush holders to see that they are not deformed or bent, but will properly hold brushes against the commutator.
4. Check the condition of the brushes and if pitted or worn to one-half their original length, they should be replaced.
5. Check fit of armature shaft in bushing of drive housing. Shaft should fit snugly in the bushing. If the bushing is worn, it should be replaced. Apply a silicone lubricant to this bushing before reassembly. Also pack front grease groove. Avoid excessive lubrication.
6. Check fit of bushing in commutator end frame. If this bushing is damaged or worn excessively, the end frame assembly must be replaced. Apply a silicone lubricant to this bushing before reassembly. Avoid excessive lubrication. Lubricant forced onto the commutator would gum and cause poor commutation with a resulting decrease in cranking motor performance.
7. Inspect armature commutator. If commutator is rough or out of round, it should be turned down and undercut. Inspect the points where the armature conductors join the commutator bars to make sure that it is a good firm connection. A burned commutator bar is usually evidence of a poor connection. See "Turning the Commutator," described under Testing and Repairs.

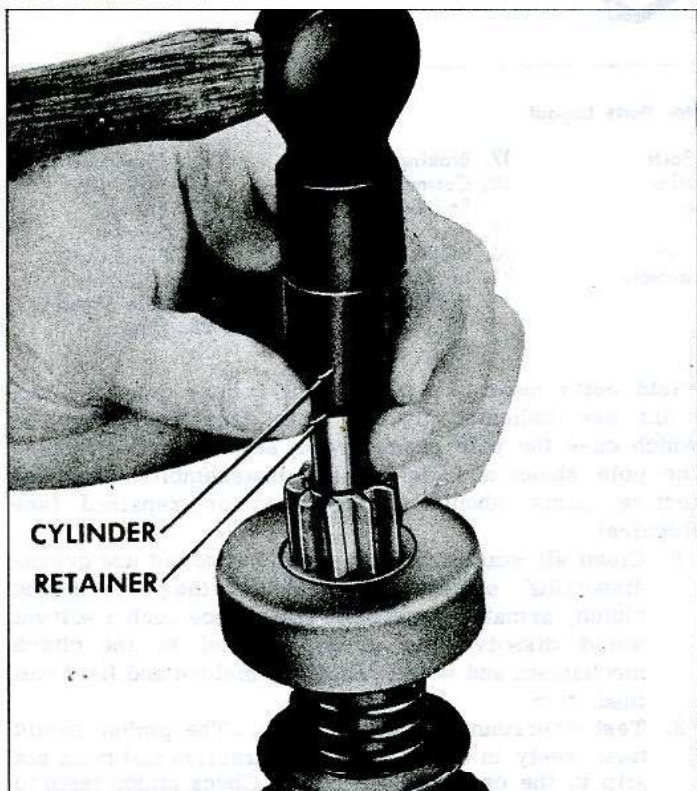


Fig. 4s—Driving Retainer off Snap Ring

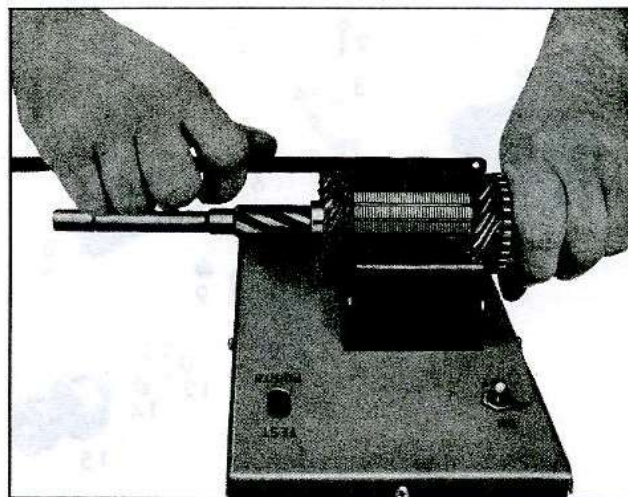


Fig. 5s—Armature Short Circuit Test

TESTING AND REPAIRS

Armature Test for Shorts

Check the armature for short circuit by placing on growler and holding hack saw blade over armature core while armature is rotated (fig. 5s). If saw blade vibrates, armature is shorted. Recheck after cleaning between the commutator bars. If saw blade still vibrates, replace the armature.

Armature Test for Ground

Place one lead on the armature core or shaft and the other on the commutator (fig. 6s). If the lamp lights, the armature is grounded and must be replaced.

Field Coil Test for Open Circuit

Place one lead on the insulated brush and the other to the field connector bar (fig. 7s). If the lamp does not light, the field coils are open and will require replacement.

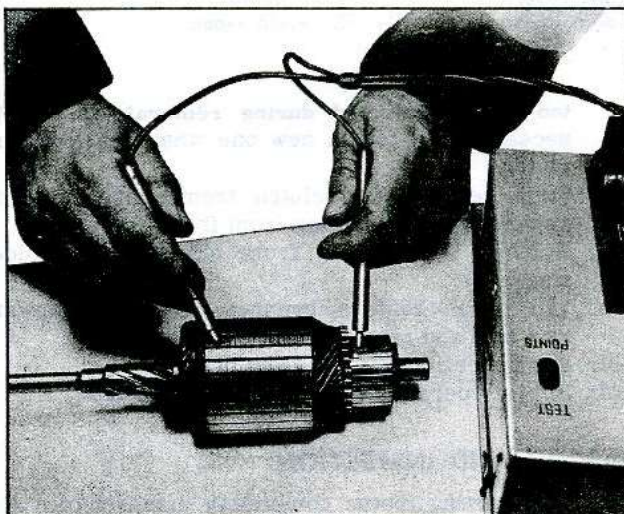


Fig. 6s—Armature Ground Test

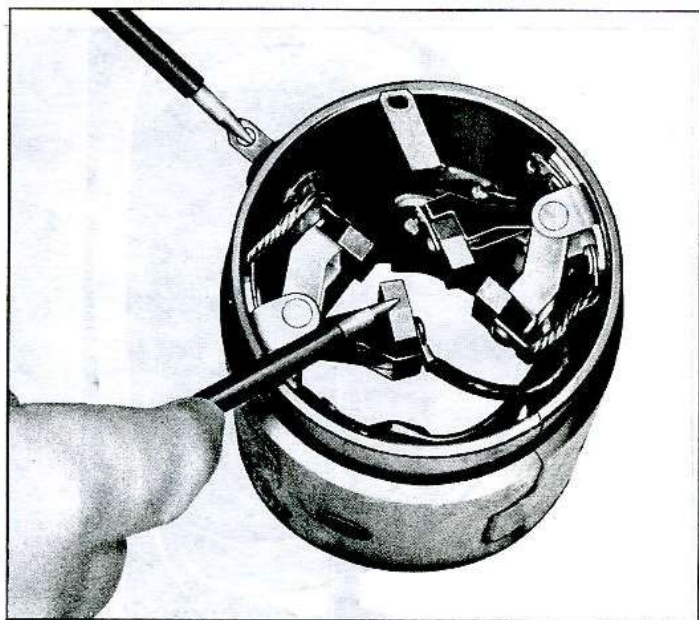


Fig. 7s—Field Coil Open Circuit Test

Field Coil Test for Ground

Place one lead on the connector bar and the other on the grounded brush (fig. 8s). If the lamp lights, the field coils are grounded.

Loose Electrical Connections

When an open soldered connection of the armature to commutator leads is found during inspection, it may be



Fig. 8s—Field Coil Ground Test

resoldered provided resin flux is used for soldering.

CAUTION: Acid flux must never be used on electrical connections.

When inspection shows commutator roughness, it should be cleaned as follows:

Turning the commutator

1. Turn down commutator in a lathe until it is thoroughly cleaned.

CAUTION: Do not cut beyond section previously turned.

2. Undercut insulation between commutator bars $1/32$ ". This undercut must be the full width of insulation and flat at the bottom; a triangular groove will not be satisfactory. After undercutting, the slots should be cleaned out carefully to remove any dirt and copper dust.
3. Sand the commutator lightly with No. 00 sandpaper to remove any slight burrs left from undercutting.
4. Recheck armature on growler for short circuits.

Brush Holder Replacement

If brush holders are damaged, they can be replaced by special service units which are attached with screws and nuts.

ASSEMBLY

After all parts have been thoroughly tested and inspected and worn or damaged parts replaced, the starter should be reassembled.

1. Assemble brush rigging to field frame.
 - a. Assemble brushes to brush holders.
 - b. Assemble insulated and grounded brush holder together with the "V" spring and position as unit on the support pin. Push holders and spring to bottom of support and rotate spring to engage the "V" in slot in support.

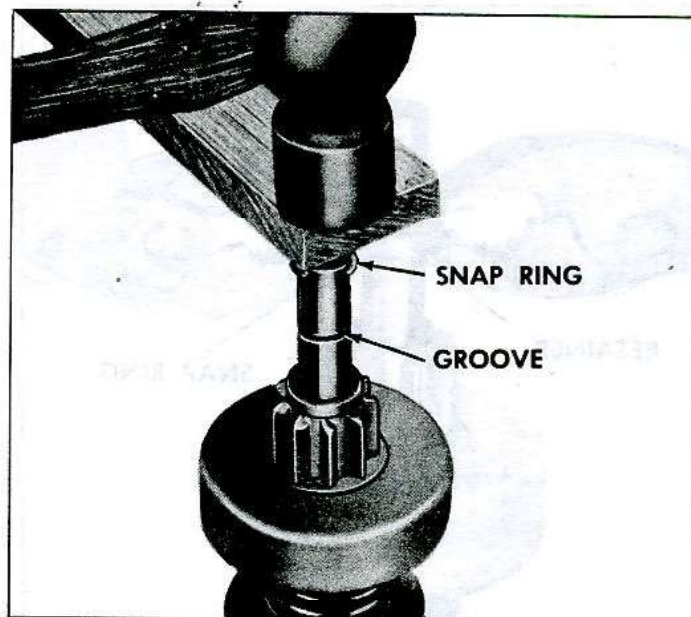


Fig. 9s—Forcing Snap Ring over Shaft

- c. Attach ground wire to grounded brush and field lead wire to insulated brush.
- d. Repeat for other set of brushes.
2. Assemble overrunning clutch assembly to armature shaft.
 - a. Lubricate drive end of armature shaft with a silicone lubricant.
 - b. Slide clutch assembly onto armature shaft with pinion outward.
 - c. Slide retainer onto shaft with cupped surface facing end of shaft (away from pinion).
 - d. Stand armature on end on wood surface with commutator down. Position snap ring on upper end of shaft and hold in place with a block of wood. Hit wood block a blow with hammer forcing snap ring over end of shaft (fig. 9s). Slide snap ring down into groove.
 - e. Assemble thrust collar on shaft with shoulder next to snap ring.
 - f. Place armature flat on work bench, and position retainer and thrust collar next to snap ring. Then, using two pair of pliers at the same time (one pair on either side of shaft), grip retainer and thrust collar and squeeze until snap ring is forced into retainer (fig. 10s).
3. Lubricate the drive housing bushing with a silicone lubricant. Make sure thrust collar is in place against snap ring and retainer and slide armature and clutch assembly into place in drive housing engaging shift lever with clutch.
4. Install shift lever pin and lock ring.
5. Position field frame over armature and apply special sealing compound between frame and solenoid case. Position frame against drive housing using care to prevent damage to the brushes.
6. Lubricate the bushing in the commutator end frame with a silicone lubricant. Place leather brake washer on armature shaft and slide commutator end frame onto shaft.

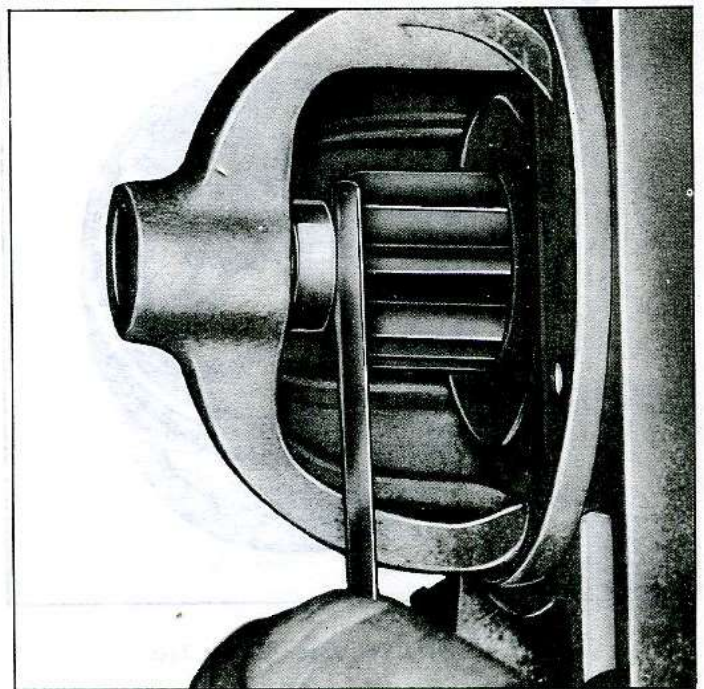


Fig. 11s—Checking Pinion Clearance

7. Reconnect the field coil connectors to the "motor" solenoid terminal.

After reassembly, a "Free Speed" check of the starting motor may be made if equipment is available. To make this check, connect a 12 volt battery in series with an ammeter to the starting motor terminal and ground. Use a mechanical drive type tachometer to determine the speed reached by the starting motor. Failure of the starting motor to perform according to specifications may be due to tight or dirty bushings, or high resistance connections.

Pinion Clearance

The pinion clearance should be checked (fig. 11s) after motor has been disassembled and then reassembled. If clearance is not within specified limits, (.010-.140) it may indicate excessive wear of solenoid linkage shift lever yoke buttons or improper assembly of the shift lever mechanism. Worn or defective parts should be

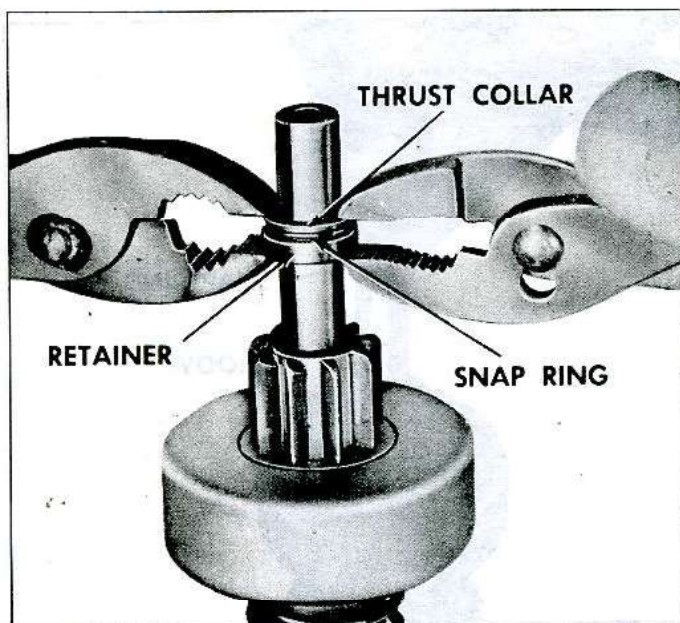


Fig. 10s—Forcing Snap Ring into Retainer

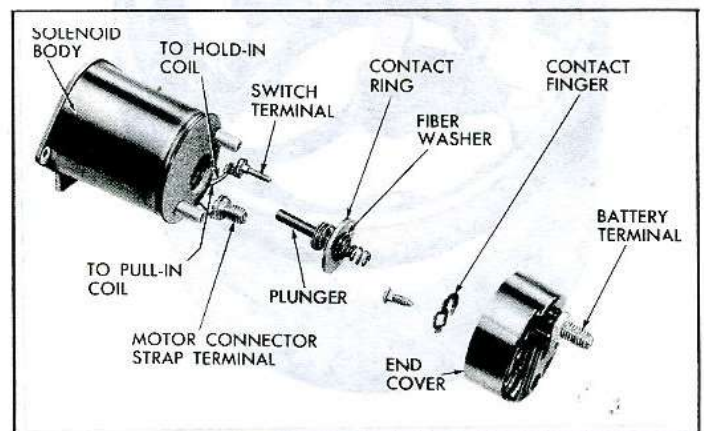


Fig. 12s—Exploded View of Solenoid

replaced since no provision is made for adjusting of pinion clearance.

SOLENOID

REMOVAL

1. Remove starting motor as previously described.
2. Remove the outer screw and washer from the motor connector strap terminal.
3. Remove the two screws retaining solenoid housing to end frame assembly.
4. Loosen through bolts and twist solenoid clockwise to remove flange key from keyway slot in housing; then remove solenoid assembly.

REPLACEMENT OF CONTACTS

1. With solenoid removed from motor, remove nuts and washers from Switch (S) and Motor connector strap terminals.

2. Remove the two solenoid end cover retaining screws and washers and remove end cover from solenoid body.
3. Compress solenoid plunger contact ring slightly and remove outer spring, retainer, fiber washer and contact ring (fig. 12s).
4. Remove nut and washer from battery terminal on end cover and remove battery terminal. Remove resistor by-pass terminal and contactor.
5. Remove motor connector strap terminal and solder new terminal in position.
6. Using a new battery terminal, install terminal washer and retaining nut to end cover. Install by-pass terminal and contactor.
7. Position end cover over switch and motor terminals and install end cover retaining screws. Also install washers and nuts on the solenoid switch and starting motor terminals.
8. Bench test solenoid for proper operation and reinstall using reverse of removal procedure.

SPECIAL TOOLS

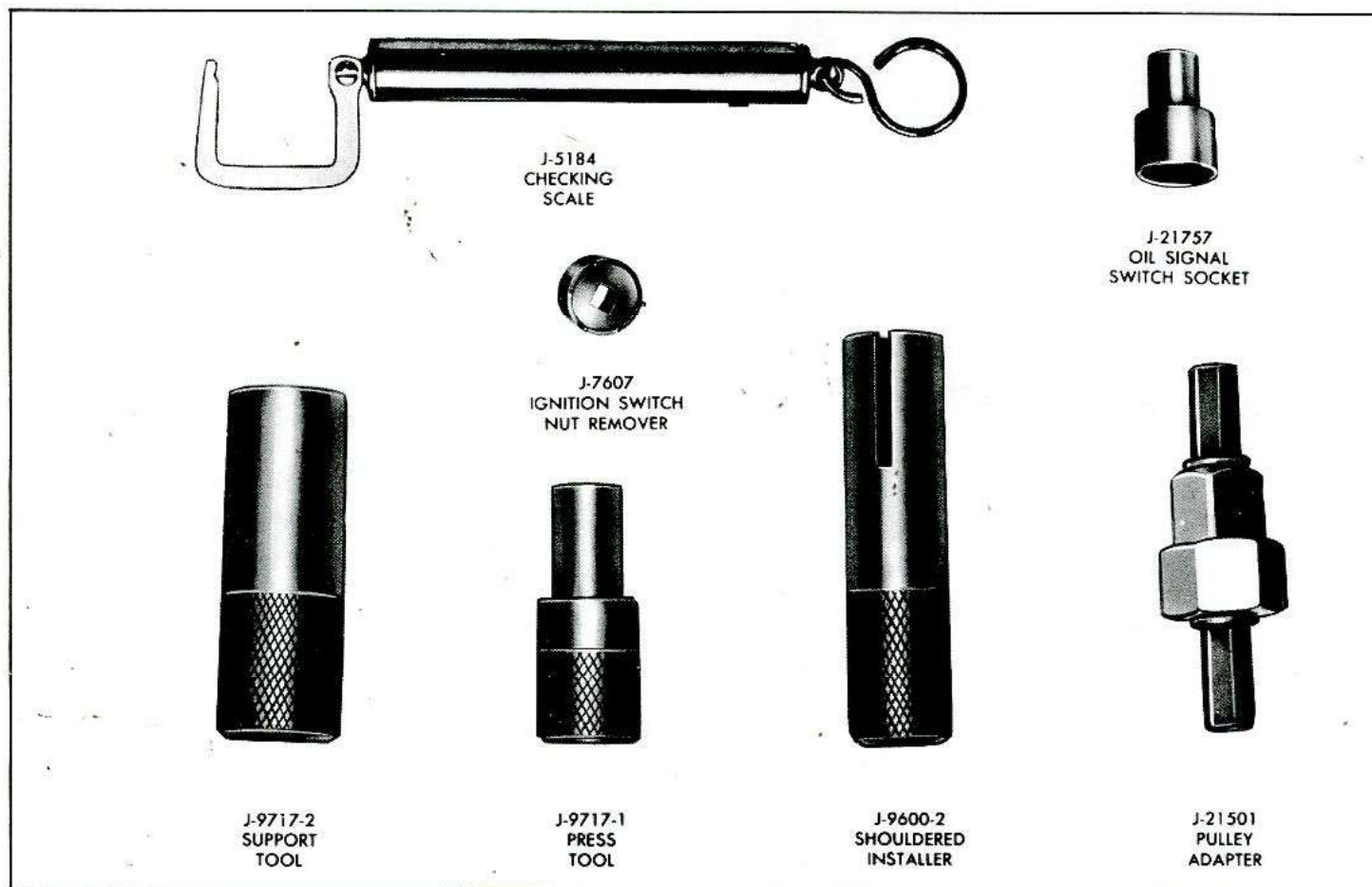


Fig. 13s—Special Tools

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