

GENERATOR

MODEL 165 GENERATOR

GENERAL

The Model 165 has a six-volt generator-battery electrical system with negative ground return.

Power is produced by a 6 pole, 4 brush, shunt generator. The armature assembly is driven by the fly-wheel generator shaft, rotating in a magnetic field produced by the field coils and pole shoes in the generator frame. Resulting current induced in the armature windings is picked up from the commutator segments by 4 brushes.

The generator output is controlled by a voltage regulator, which regulates the generator field strength. The generator itself has no adjustment for control of output. The voltage regulator functions to increase battery charging rate when battery is low or when lamps are lighted, and to decrease charging rate when battery is near fully charged. The voltage regulator requires no regular interval attention. A cutout relay is combined with the voltage regulator as a single unit.

CHECKING GENERATOR

If the generator or voltage regulator is suspected of being faulty as indicated by the battery becoming discharged, check the electrical system in the following sequence to determine which part is not functioning properly.

1. Remove red wire at voltage regulator "GEN" terminal. Using a 0-15, D.C. ammeter, connect one lead to the terminal, the other to the red wire. Turn on head lamp and start engine. Open throttle to an engine speed equivalent to 20 - 25 MPH. road speed. The ammeter should show a charge when generator is warmed to operating temperature.

2. If generator does not show a charge on ammeter, after above test, remove green wire from "F" terminal on regulator and touch it to engine base. If ammeter shows a charge of five amperes or more, the defect is in the voltage unit of voltage regulator or the regulator is not grounded. Carefully check the regulator and battery holder to be absolutely sure of a good ground.

3. Check regulator against wiring diagram to see that it is wired properly. Momentarily short the voltage regulator "GEN" and "BAT" terminals by touching a piece of wire or screwdriver shank across them. This will polarize the generator and energize the pole shoes with residual magnetism. When the generator is not polarized with the battery, the generator will not charge and the relay contact points will arc. If operated in this condition the regulator points will burn. Operate engine (after polarizing

generator) as described in step one. If generator does not charge, proceed to step four.

4. Remove ammeter lead from regulator "GEN" terminal and attach it to battery positive terminal. Touch "F" terminal green wire to engine base. With regulator out of generator circuit and ammeter still showing no charge with engine operating as previously, trouble is in the generator.

5. Before removing and completely disassembling generator, check the brushes and brush springs and polish the commutator with No. 00 sandpaper. Make sure brushes are not worn to the point where the brush wire limits contact with the commutator.

If upon further checking generator is still not functioning properly, disassemble the generator as necessary, following sequence described in "Disassembling Generator," and follow subsequent checking and repairing procedures.

TESTING FIELD COILS

Initial testing of generator field coil circuit can be made with generator frame in place. Disconnect red and green wires from regulator terminals and remove the positive brushes from frame (the brushes connected to same terminal as red wire).

1. Connect a fully charged six-volt battery with ammeter in series to the red and green wires removed from regulator. The complete field circuit should draw two amperes.

CAUTION

Overloading ammeter by showing a short circuit will damage it. An overload is indicated by needle going beyond range of scale. Contact must be broken immediately to avoid damage to meter. In making all tests, make only a momentary contact to determine if a short exists. If needle doesn't go beyond calibrated scale, it is safe to make sustained contact.

2. When a short is indicated in above test or if reading is higher or lower than specified amounts, remove red and green wires and field coil leads from terminals and take reading directly from field coil leads.

3. Carefully check red and green wires if reading is correct as taken in step two. If wires are found to be serviceable and a short did exist in step one, check the frame terminals. They should be insulated from each other and from the generator frame. Check positive brush holders. They must be insulated from generator frame.

4. When test of field coils independent of terminals and leads does not show correct reading, the generator frame should be thoroughly cleaned. See "Disassembling Generator."

5. When an open (no reading) or low reading is obtained after cleaning, inspect connections on field coil leads and each of the five twisted connections between field coils.

6. If no poor connections were found in step five, cut off fused tip and untwist the connections between coils and check each of the coils with a two-volt power source - not six-volt. One cell of an automobile battery can be used. Individual coils should draw about 3.3 amperes at two volts. Accurate readings depend upon using a fully charged battery.

7. Replace ammeter in six volt circuit with small lamp bulb. Connect one test lead to generator frame, the other to one lead of each field coil, individually. If the bulb lights, that coil is grounded and must be replaced. Replace all open (no reading), shorted (high reading) or grounded (bulb lights) coils as described in "Disassembling Generator." It is not advisable to attempt coil repair.

TESTING ARMATURE

Remove armature as described in Disassembling Generator."

TEST FOR GROUND. Contact commutator segments with one test lead (use circuit with light bulb as described in "Testing Generator Frame"), and armature core with the other. If circuit is completed, armature is grounded. Clean armature and blow off with compressed air, particularly between segments. Repeat test. If ground still exists, replace armature.

TEST FOR SHORT. Place armature in growler and hold piece of hack saw blade in loose contact with core. With growler turned on, rotate armature slowly one or two full turns. If armature is shorted, hack saw blade will be attracted and will vibrate at one or more points around armature. Clean armature as described under "Ground" and retest. If short still exists, replace armature.

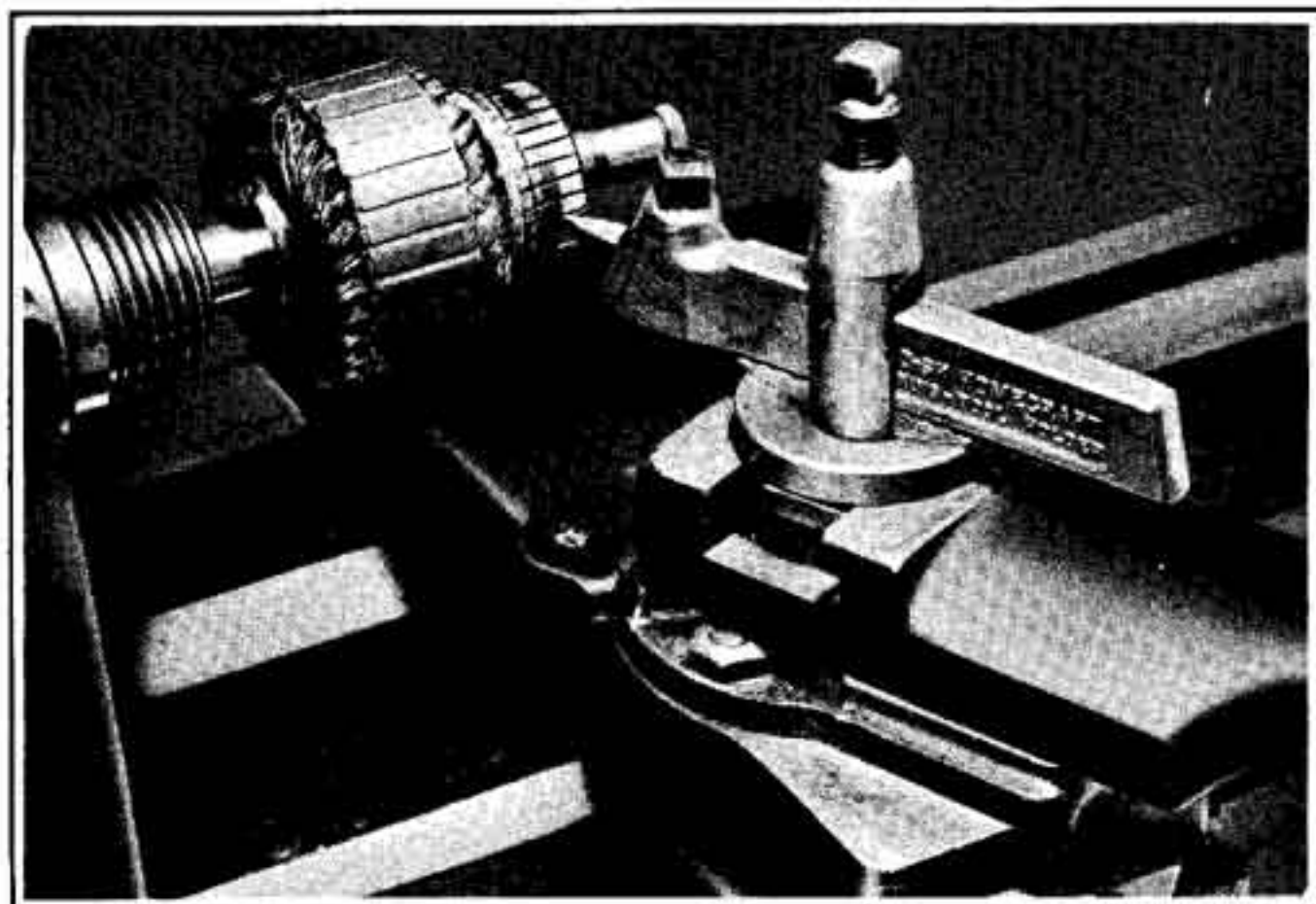


Figure 5E-8. Turning Down Commutator

TEST FOR CIRCUIT OPEN. Connect an ammeter and $3/4$ ohm resistance in a test circuit. Ampere draw when test probes are shorted together should be $6-3/4$ to $7-1/4$ amperes. Contact adjacent commutator bars with test probes and note ammeter reading. It should be between $5-1/4$ and $5-1/2$ amps. When reading is appreciably lower (usually about two amps), open circuit exists. No reading indicates more than one open. A high reading ($6-1/2$ to 7 amps), indicates a short. Carefully work completely around commutator, testing across adjacent bars. If low reading is found, examine the armature winding leads connected to bars being tested. Usually open armature consists of a loose or disconnected bar lead. Loose leads can be resoldered to commutator bar risers.

REPAIRING COMMUTATOR

If commutator is worn irregular or shouldered, it should be turned down on a lathe as shown in Fig. 5E-8 and finished with No. 00 sandpaper (never use emery cloth). Use Armature Commutator Turning Arbor, Part No. 96170-50, mounted in lathe chuck. Turn down to clean up only - no more.

Mica insulation between commutator segments should be undercut to a depth of about .025. Unless mica is properly undercut, brushes will not seat and arcing will result.

Undercutting can be done on an undercutting machine or with a piece of hack saw blade thinned to thickness of mica insulation. When undercutting is complete, smooth commutator with No. 00 sandpaper and check for short. There is a possibility of developing a short during the turning and undercutting operations.

DISASSEMBLING GENERATOR (Fig. 5E-9)

Remove three generator and sprocket cover screws and swing generator and sprocket cover down out of the way.

Remove four brush spring clips (1), brush springs (2) and brush spring insulators (3) from brush holders to relieve brush tension on commutator.

Remove generator frame mounting screws (4) and pull generator frame (5) from armature. Remove armature mounting screw (6) and lockwasher (7). Tap sides of circuit breaker cam (8) with soft metal hammer until it is loosened and remove. Use Generator Armature Puller, Part No. 95900-48, to remove armature (9) from flywheel shaft as shown in Fig. 5E-10. Do not remove armature without using tool or damage to part will result. Remove key (10) from keyway in flywheel shaft.

Remove red and green wires in cable from terminals on fiber terminal block. Remove brush leads and pull brushes (11 and 12) from holders. Turn out brush wire ground screw (13) and remove ground brushes (14 and 15) along with yellow wire from cable. Disconnect cable black wire from contact point terminal.

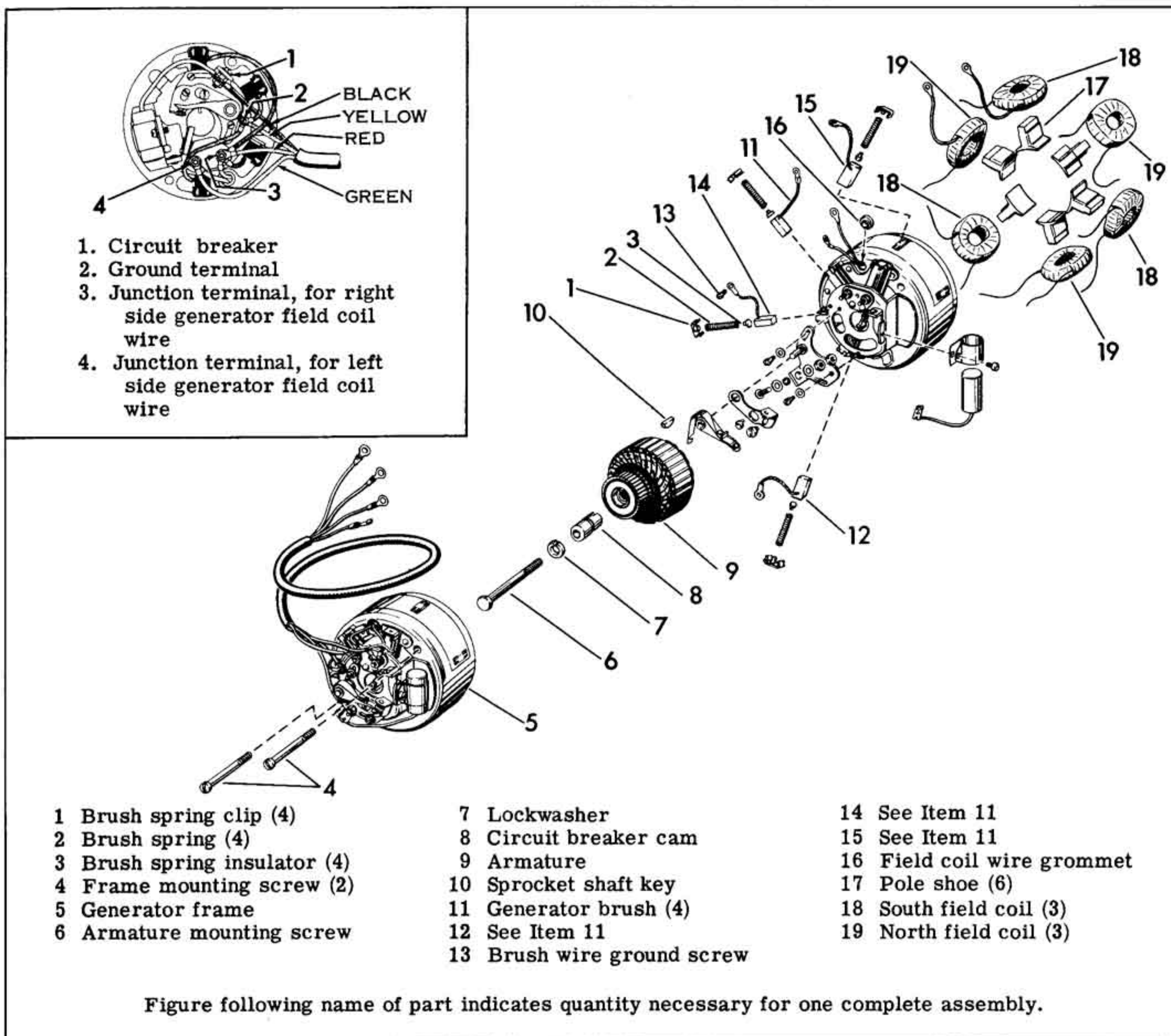


Figure 5E-9. Model 165 Generator - Exploded View

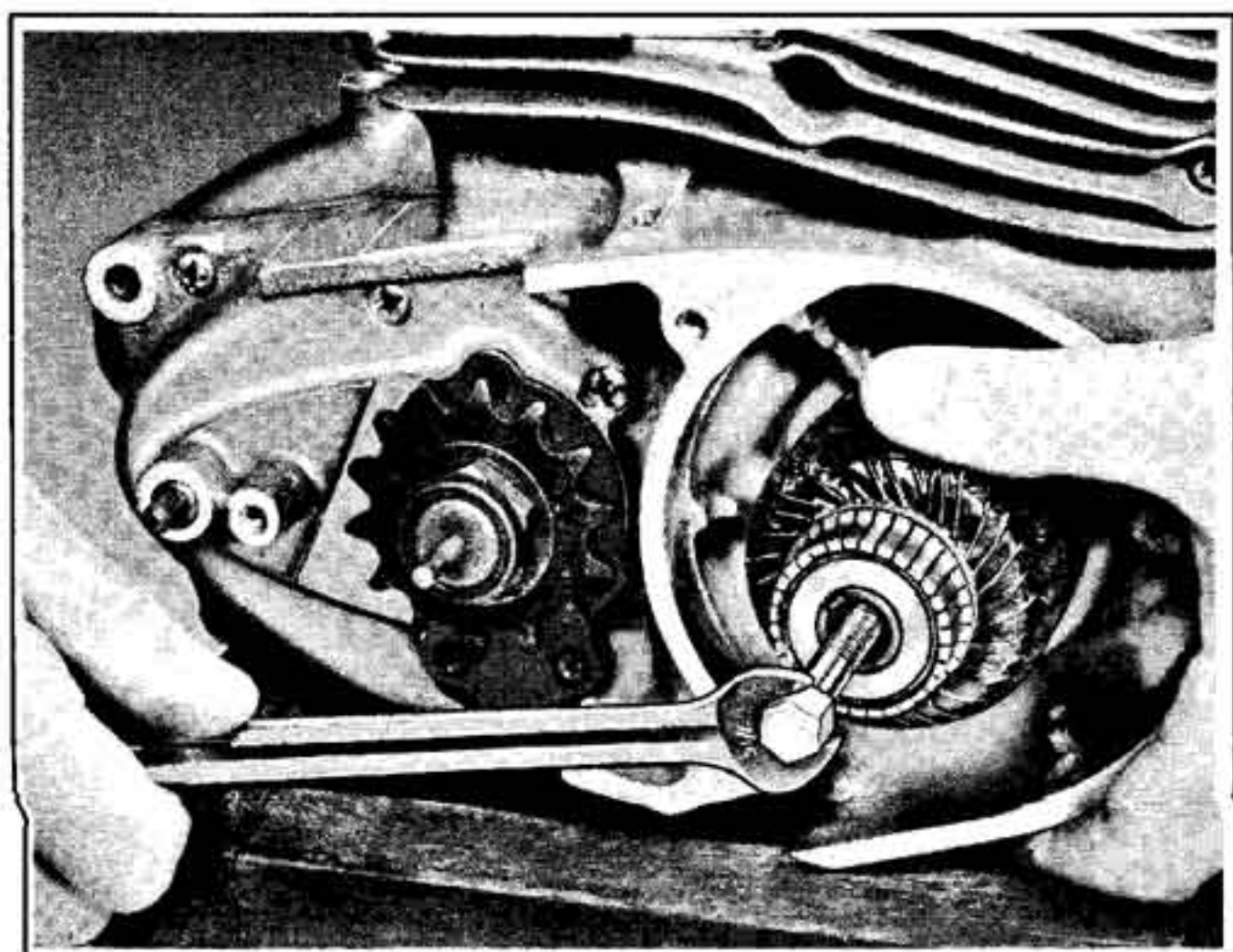


Figure 5E-10. Removing Generator Armature

Remove circuit breaker and condenser, if desired, although it is not necessary. (See "Circuit Breaker," Section 5F.)

Remove pole shoes (17) and field coils (18 and 19) only if necessary for repair or replacement. Remove shoes by striking portion of shoe extending through generator frame with metal hammer or rectangular drift and hammer. Used shoes may be re-installed if sufficient peening material remains intact after shoe removal.

CLEANING, INSPECTION AND REPAIR

Clean all parts except armature, field coils and brushes in grease solvent and blow dry with compressed air. Wipe remaining parts clean with cloth soaked in white gas and blow dry with compressed air.

Examine all parts carefully for wear. Give close attention to condition of insulators, armature windings, field coil wrapping and surfaces of pole shoes nearest armature. Compare brush length with unused brush. If worn to point where brush lead restricts brush contact with commutator, replace brushes.

If brush holder plate is warped, burned or loose on frame, it should be replaced. Chisel heads off plate rivets and drift rivets from plate and generator frame. Remove brush holder plate from generator frame. Drill out holes in the new brush holder plate with a No. 20 drill. Then, tap corresponding holes in the generator frame with an 8/32 in. tap. Secure new brush holder plate on generator frame using four screws, Part No. 2626 and four lockwashers, Part No. 7115.

During the entire repair operation be very careful not to damage the pole shoes mounted in the generator frame. Use extra lockwashers if the screws contact the pole shoes.

Replace worn or damaged felt cam wiper by riveting new part in plate. The felt should be kept clean at all times.

When field coils are to be replaced they must be assembled in alternate order with an "N" (north) coil to left of coil lead hole in generator frame, with frame positioned open side (engine side) up and lead hole on near side of frame.

All replacement coils are furnished with a yellow length of lead insulation and an eye-type terminal connector. South coils are marked with an identifying swatch of red paint and north coils with white paint.

Cup a south coil in the palm of right hand, (concave side up) with leads pointing away (toward the top). Slip a yellow insulator over left lead and solder connector to wire tip. Prepare a north coil in similar manner except install the insulation and connector on the right lead. Position the south coil with insulated lead to right (counterclockwise) of lead hole in generator frame. Position a north coil (discard the insulator and connector) with shoe in the frame shoe slot directly to the right of the first coil installed. Follow these with south and north coils (alternated), finishing with the north coil previously prepared at the left of the lead hole in generator frame. Slip pieces of insulation under field coils at points where frame mounting screws pass, space with frame mounting screw (4).

Position a length of 2-1/4 in. O.D. pipe horizontally in a vise. Carefully slip the generator frame, with coils and shoes in place, over the pipe. The frame should be slipped over the pipe far enough to completely support the pole shoes.

Grind a 1/4 in. wide chisel to a dull edge. Tap frame down around shoe until it bottoms on shoe shoulder. Carefully stake the four shoe corners over generator frame with the chisel. Peen the entire shoe surface with a light ball peen hammer. Repeat staking and peening operations on remaining five shoes, using the

pipe as an anvil.

Check armature clearance in frame which should be .014 in. (.007 in. on a side). If clearance is less than specified amount and shoes were all drawn into frame to shoulder, the shoes will have to be bored out until desired clearance is obtained.

Check each coil for current draw and ground before coil ends are twisted together. Connect coils in one of two following ways with the first method preferred:

1. Twist adjacent leads together, clip off 1/2 in. beyond edge of generator frame and fuse wire twist with torch.

2. Scrape coil leads free of varnish, twist adjacent leads together and solder connections.

Bend joined leads back between coils but be sure they do not touch generator frame. Install rubber grommet over coil leads and press into frame hole. Slip coil leads on respective terminal posts on fiber terminal strip. Do not cross lead wires to opposite terminals.

Final check of field coil polarity should be made as follows: Connect wires from a 6-volt battery to terminal strip posts - positive to south coil post and negative to north coil post. Hold compass outside generator frame - near the pole shoe of coil to be checked. If the south needle of compass swings toward pole shoe, coil is a south coil.

ASSEMBLING GENERATOR (Fig. 5E-9)

Assemble armature to flywheel shaft in reverse order of disassembly. Install key (10) and armature (9). Tap circuit breaker cam (8) until it starts into seat. Secure with lockwasher (7) and armature mounting screw (6). Tighten screw until tight. Attach dial indicator to crankcase so armature runout may be checked. Runout should not exceed .002 in. Greater runout will cause brushes to jump or float at higher speeds, inducing arcing, burning and excessive heat. Use a brass drift and small hammer to drift armature runout to within tolerance. Check concentric portion of circuit breaker cam (part nearest armature) for runout. It should be within .002 in. of true. Also, if necessary, drift cam. Recheck armature runout after drifting cam.

Place a tiny bit of grease on cam, a drop of oil on felt cam wiper, and assemble generator frame. Install insulators (3), brush springs (2) and clips (1).

Reconnect wires as shown in "Wiring," Section 5B.

Time engine as described in "Timing Engine," Section 5F. Install generator and sprocket cover.

HUMMER AND SUPER-10 MAGNETO-GENERATOR

The magneto-generator consists of two coils, two sets of breaker points, and a double point actuating cam and rotor assembly driven by the flywheel magneto shaft. When the engine is being cranked or is running, the rotor (a rotating, four-

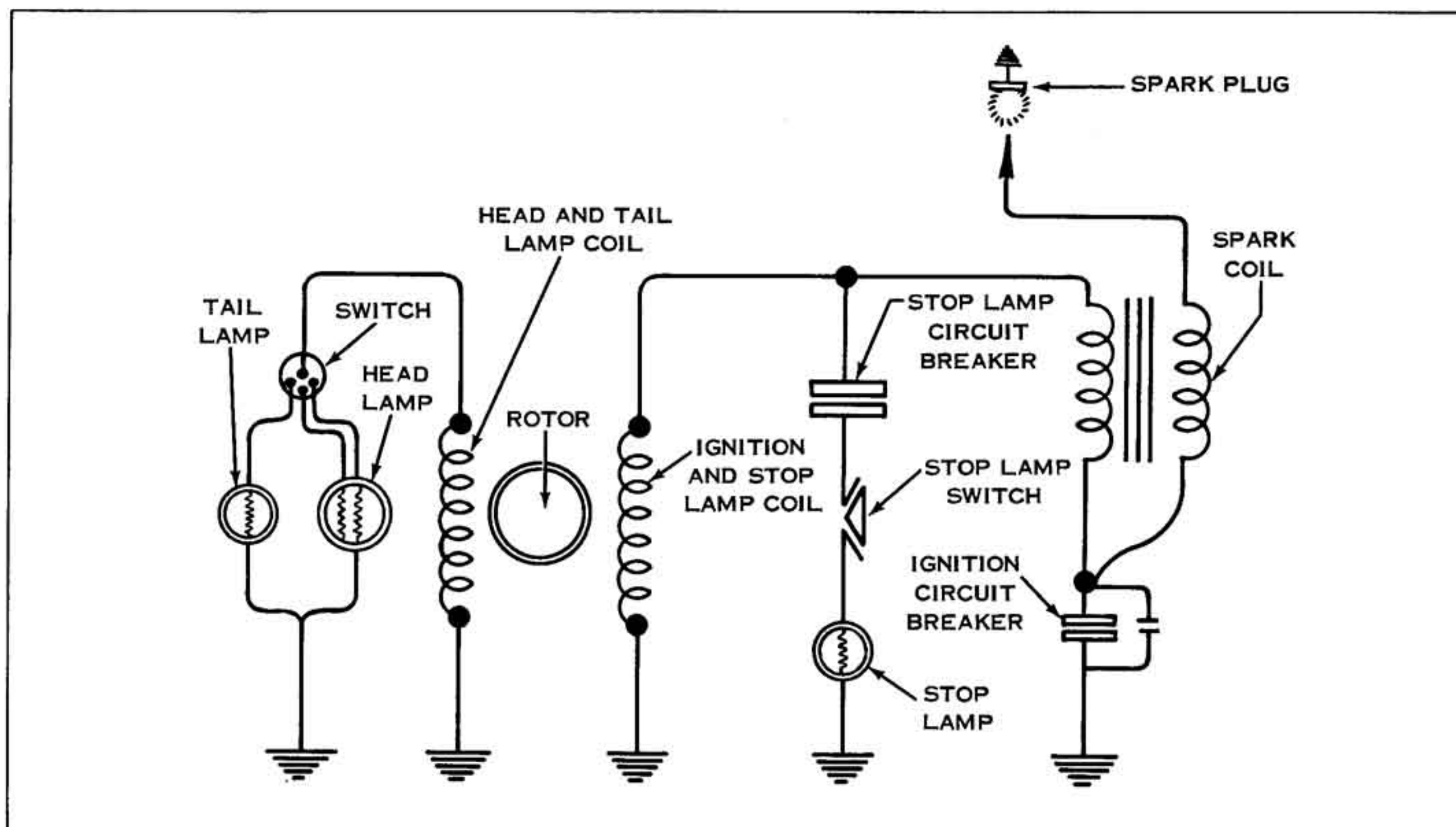


Figure 5E-11. Magneto-Generator Circuit

pole magnet) turns in close relation to a pair of laminated iron pole shoes, the outer ends of which carry the coils. This rotation induces an alternating current in the coils. Two separate circuits are energized. The first through the upper coil (as the unit is positioned in the housing) supplies current for operation of head lamp and tail lamp. The second circuit employs the lower coil and the two sets of breaker points to create ignition and stop lamp power. Breaker points and breaker cams are arranged so the outer set is closed, supplying power for stop lamp operation during the major part of each revolution when current is not needed for ignition purposes. Similarly, during the part of each revolution ignition breaker points function to generate current for ignition spark, during which time stop lamp breaker points are open. These circuits can be traced out in Fig. 5E-11.

TESTING MAGNETO-GENERATOR

Ordinarily the magneto-generator will operate over extremely long periods of time without the need for adjustment or repair other than occasional lubrication of felt cam wipers and cleaning and adjusting or replacing breaker points. See "Breaker Points," Section 5F, for wiper and point servicing information.

If engine operating or lighting difficulties are experienced, the magneto-generator output should be checked. When troubles appear to be isolated to head lamp and tail lamp operation, the upper coil may be malfunctioning. Ignition or stop lamp troubles may be caused by points (lower set for ignition, upper set for stop lamp) and lower coil. When any part of lighting system is inoperative, check wiring,

particularly connections, before disassembling and testing magneto-generator.

To check ignition, disengage spark plug cable and insert a metal rod, screw or nail into the spark plug cable terminal. Arrange cable end so tip of inserted metal object is 1/4 in. away from engine crankcase. Crank engine over at normal cranking speed. If a spark jumps the 1/4 in. gap, the trouble is not in the magneto-generator.

Should the magneto-generator fail to spark, inspect breaker points and condenser and service or replace as described in Section 5F.

After servicing breaker points, repeat above test to check magneto-generator output. If spark is still weak or not present, remove and check ignition coil as described in Section 5G. If coil proves to be serviceable, trouble is probably in magneto-generator lower coil.

Coils may be inoperative or have low output from one or more of three faults: (1), Grounded coil where insulation between coil and laminated core is worn through; (2), shorted coil where insulation is worn off individual windings within a coil causing current to pass through only a portion of coil windings, and (3), open circuit where physical break in coil winding or lead interrupts the current flow.

TEST FOR GROUNDED COIL. To check for grounded coil, disconnect both leads from suspected faulty coil. Connect a tail lamp bulb in series with a six-volt battery. Connect one test circuit lead to either coil lead, the other lead to magneto-generator frame.

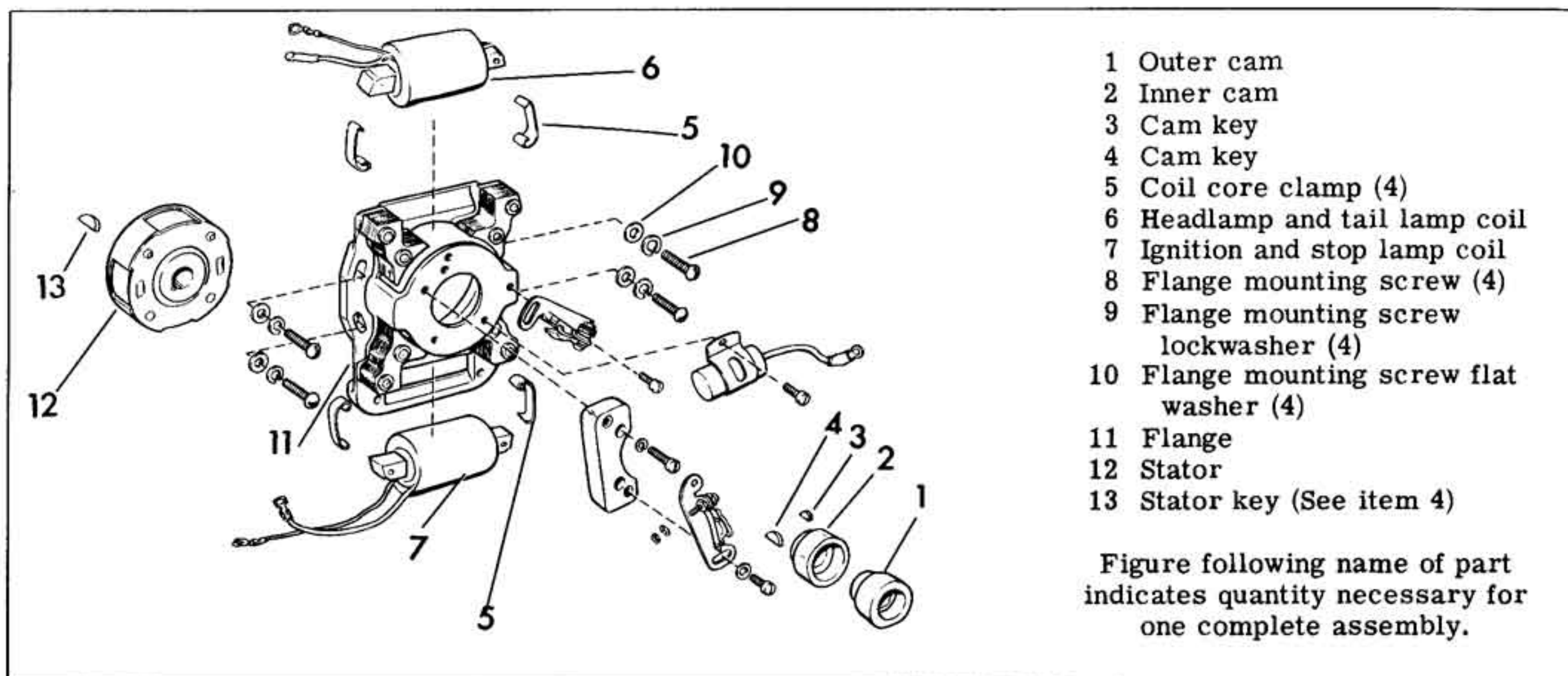


Figure 5E-12. Magneto-Generator - Exploded View

Make certain unused coil lead is not touching frame. If bulb lights, coil is grounded or shorted to frame.

Examine insulation between core and windings for a worn or frayed condition which may allow winding to touch core. If fault cannot be found and corrected, replace coil.

TEST FOR SHORTED COIL. A shorted coil cannot be accurately tested with any other than very sensitive meters. Without such instruments the best method is to check on a comparison basis, that is, compare brilliancy of bulbs in circuit supplied by coil being tested with new, known good coil and present, suspected faulty coil. If there is a marked difference in the brilliancy of the bulb, it may be assumed the coil has an internal short and must be replaced.

TEST FOR OPEN CIRCUIT COIL. Remove coil from magneto-generator. Connect test circuit (a tail lamp bulb in series with a six-volt battery) to two coil leads. If bulb does not light, coil has an open circuit and must be replaced.

Do not make this test with coil in place in magneto-generator. The field induced in the coil may be of incorrect polarity for near stator pole and thus may act to demagnetize stator pole permanent magnet.

CHECKING ROTOR

The rotor consists of four magnets arranged so poles of adjacent magnet ends are alike, creating like polarity between each pair. The result is a four-pole rotor with like poles on opposite sides.

When all other checking, testing and repair procedures fail to uncover reason for magneto-generator malfunction, the rotor should be checked for magnetism. If possible, the magnetic strength should be compared with that of an unused, new rotor. In rare instances, the magnets may become demagnetized

through careless handling, careless storage or naturally through years of service. When a low-energy magnet is found, rotor should be replaced.

DISASSEMBLING MAGNETO-GENERATOR (Fig. 5E-12)

Remove three magneto-generator and sprocket cover screws and swing cover down out of way.

Remove cams (1 and 2). Carefully use a small screwdriver to pry outer and inner magneto cams (1 and 2) off, removing cam keys (3 and 4).

Disconnect coil leads from terminals and pry large end of coil core clamps (5) off cores and remove headlamp and tail lamp coil (6) and ignition and stop lamp coil (7).

Remove four magneto-generator flange screws (8), lockwashers (9) and flat washers (10) and remove magneto-generator flange (11).

Use All Purpose Claw Puller, Part No. 95635-46, to pull stator (12) from magneto shaft. It may be necessary to grind a small amount of stock off the bottoms of the puller claws to make it fit the application. Remove stator key (13).

NOTE

For information regarding the removal, repair and replacement of breaker points or condenser, see "Circuit Breaker," Section 5F.

CLEANING AND INSPECTION

Wash all parts except coil in grease solvent. Blow dry with compressed air. Clean coils with a gasoline soaked cloth.

Examine all parts for any wear which would impair intended function of part. Check all wire terminals and connections for tightness and serviceability.

ASSEMBLING MAGNETO-GENERATOR (Fig. 5E-12)

Assemble magneto-generator in reverse order of disassembly, paying particular attention to following points:

Do not tap or hammer rotor into place on shaft. In fact, never unnecessarily jar or roughly handle the rotor for such jarring could destroy the magnetism thus reducing the current generating capabilities of the unit. Pull rotor onto shaft by using the inner and outer cams as drive collars and turning the magneto shaft nut onto shaft until rotor is seated.

To install the coil core clamps, push them into place by applying pressure on the curved portion. Do not hammer or tap into position.

Reconnect wires as shown in "Wiring," Section 5B.

Figure 5E-13 shows magneto assembled to engine.

Follow greasing and cam wiper oiling instructions described in "Circuit Breaker," Section 5F.

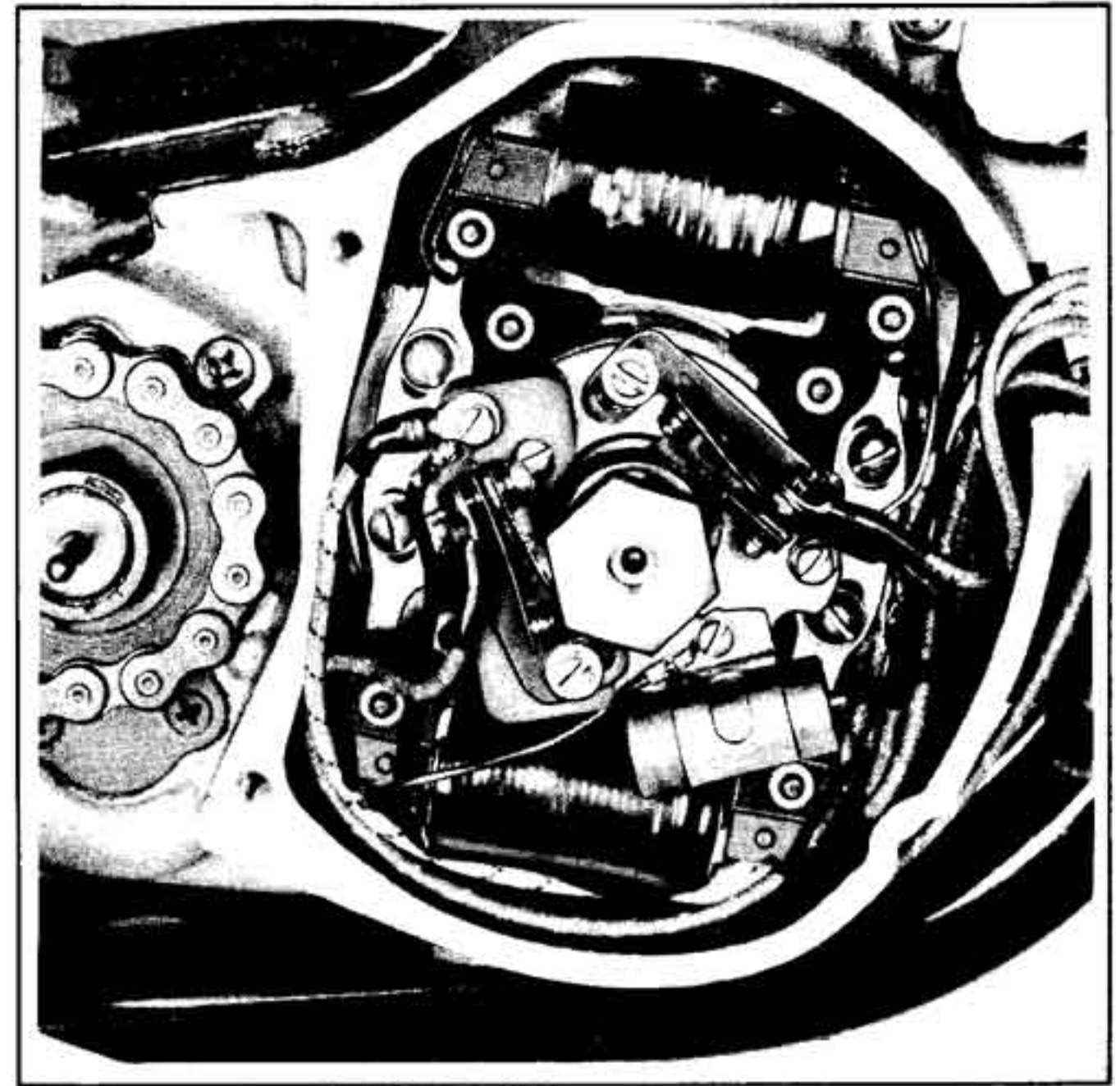


Figure 5E-13. Assembled View of Magneto-Generator