Ford Service Bulletin

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GENERATOR

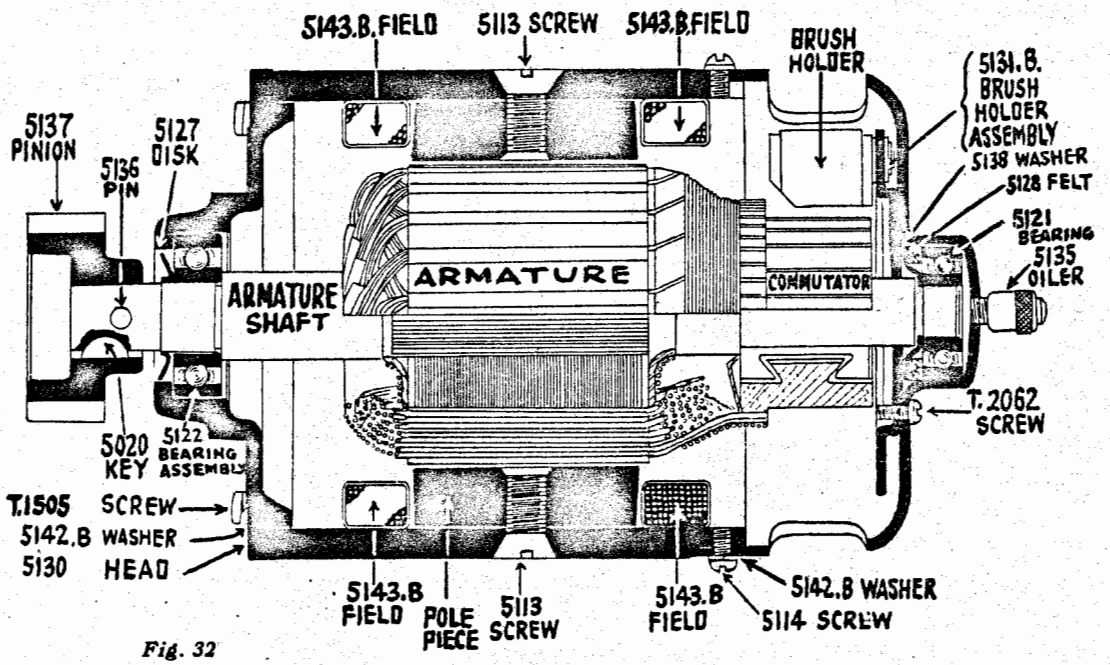


Fig. 32

Practically speaking there are only three things electrically which can affect a generator. Bearing this in mind you will find that it is a comparatively simple matter to diagnose generator trouble.

First—a ground may occur in either the armature, fields or brush holder assembly.

Second—a generator may be short circuited. The short circuit may occur in the armature or field.

Third—a generator may have an open circuit. This may occur in field or armature. A number of different things may occur mechanically that would cause generator to cease functioning.

The ball bearings on the shaft could break, the brushes could become worn down until they ceased to operate, field pole pieces become loosened, etc. These troubles, however, can be easily located as soon as the generator has been removed from the car.

NOTE: GROUND is caused by the insulation on wires becoming broken in such position as to allow current to leak into the body of the generator or armature.

SHORT CIRCUIT is caused by the insulation on two wires being broken in such a manner as to allow current to pass from one wire to the other.

OPEN CIRCUIT is caused by a broken wire.

Ford Mechanics' Section

(*Continued from page 86, October, 1924, Service Bulletin*)

Starting and Lighting System — Generator

Under heading "Producing Electric Energy" in the August 1924 Service Bulletin we explained how electric energy is caused to flow in a coil of wire. This was further illustrated in connection with the Ford Magneto. The same explanation can be applied to the generator with the exception that the generator fields, which are temporary magnets, remain stationary, while the twenty-one coils mounted on an armature revolve between them.

Fields

The generator fields are made up of four soft iron pole pieces set 90° apart. These pole pieces are wound with 113 turns of No. 19 insulated wire and the assembly connected in series. Fig. 33. The field assembly is mounted in a casing, Fig. 33 and held rigidly in position by four screws one screw in each pole piece. As before stated the fields are temporary magnets and depend upon electrical energy to magnetize them. They do, however, maintain a very small amount of magnetism which is called resident magnetism and is sufficient to excite the armature coils, which will cause a small amount of current to flow through the fields which will then quickly build up to full charging strength. The fields are so wound that like poles will be opposite, see Fig. 33.

Armature

The armature which revolves between the fields is made up of a shaft on which is mounted thin discs of soft iron. These discs are cut to hold the twenty-one coils of No. 17 wire with ten turns each wound lengthwise and connected to a commutator in series. The commutator is made up of twenty-one brass strips or segments insulated from one another and from the shaft. This assembly is pressed on the brush end of the armature, see Fig. 32. The purpose of commutator is to provide a gate through which the impulses of the twenty-one armature coils may be taken off by the brushes, Fig. 33.

Brushes

The brushes are for the purpose of taking the current from the armature as it revolves between the fields. They are made of carbon strips and mounted in aluminum guides on a brush holder assembly. The brushes are pressed against the commutator by small springs to insure a perfect contact with the segments. In the Ford generator we use three brushes. The two lower brushes, Fig. 33, are the main brushes one pos. + and one neg. — or ground brush. The brushes as set in their proper position in relation to the armature coil positions and the fields and take off the current at the exact moment each coil impulse is produced. The two main brushes are mounted stationary on a brush holder assembly, the pos. + brush is insulated from the holder and is connected direct to the generator top terminal. The neg. — or ground brush is mounted directly on the holder which allows the current to return through the generator body back into the armature, thereby making a complete circuit. The upper brush is the smaller of the three brushes, is called the third brush and is connected direct to the fields.

Action of Third Brush

The third brush like the lower pos. + brush is pos. + also and insulated from the brush holder assembly. However unlike the lower brushes it has no set position and may be moved on the brush holder in such a way as to bring it into or out of the most economical position for taking off current. When it is moved toward the lower pos. + brush it will be in more direct line with the neg. — brush and in a more advantageous position to collect current causing a stronger flow through the fields. When it is moved towards the neg. + or grounded brush it looses much of its efficiency and also cuts down the efficiency of the generator by weakening the field magnetism. In other words a third brush regulating generator is not as efficient as a four or two set brush type. However, these types cannot be regulated which causes

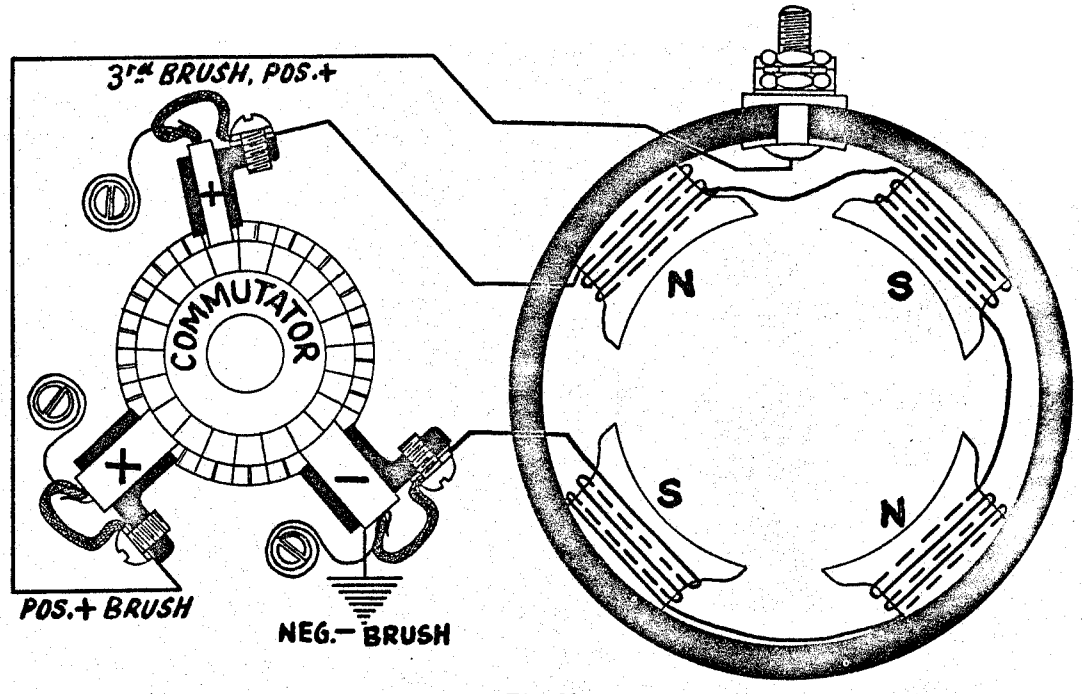


Fig. 33

the charging rate to vary to such an extent that they are not practical for automobile adoption.

With a third brush regulated generator we can set the third brush in a position where the desired maximum output will remain constant over and above say 1400 R. P. M. with the exception that at excessively high speed the rate will fall off slightly due to field distortion. This distortion might be likened to operating a motor a certain speed, then increasing the speed without advancing the spark.

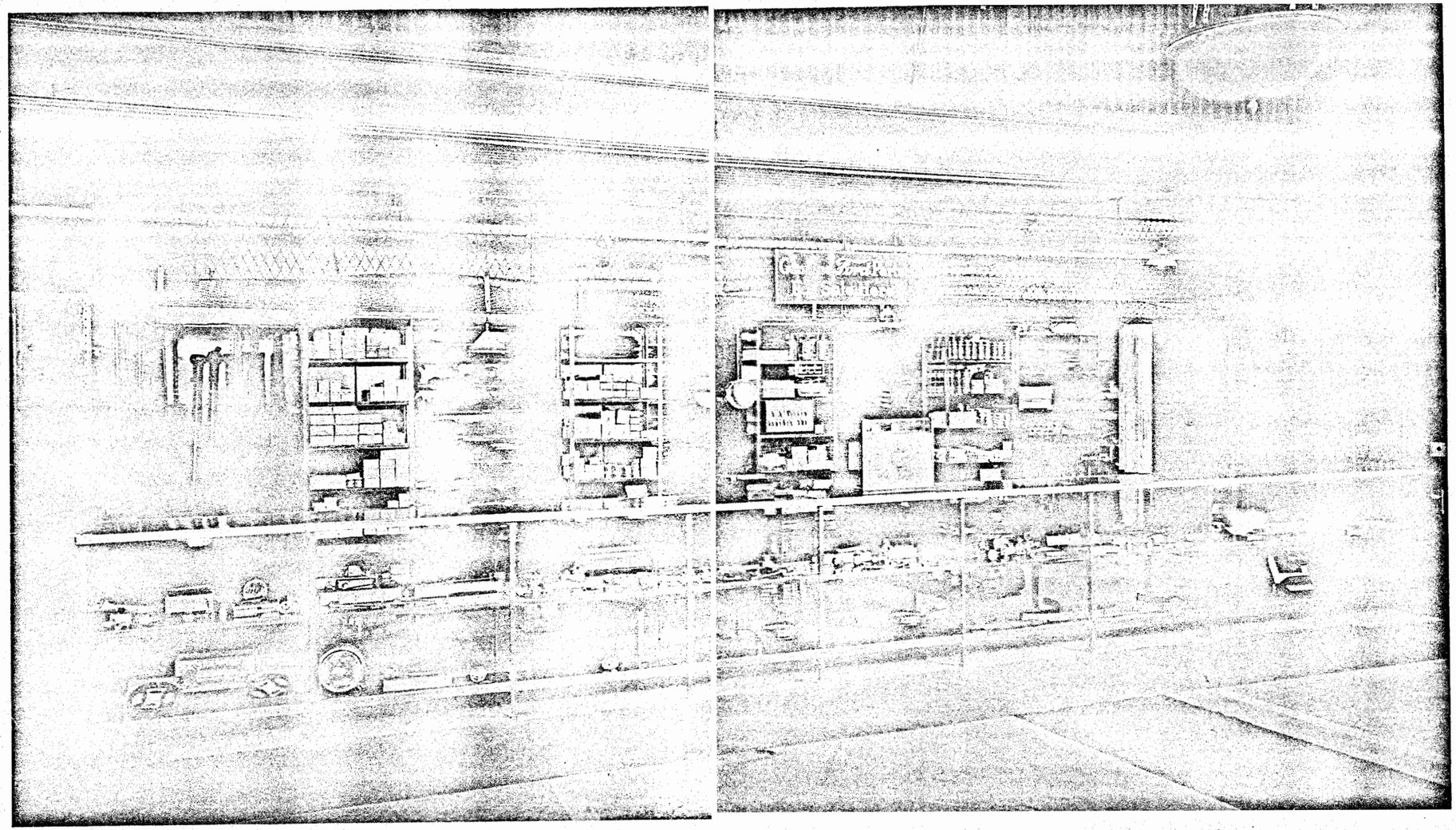
In the third brush type of generator we have two distinct current paths. One through the lower positive brush, through the upper generator terminal, through the battery, lamps, ignition and horn to ground and return through the grounded or neg. — brush. The second path leads from the third brush through the fields and returns through the ground brush, see Fig. 33. Let us suppose that the generator was caused to be operated with the top terminal disconnected, this would cause the third brush to collect all the current taken from the armature pass directly through the fields. The field resistance would cause this current and voltage to increase and build up until it became great enough to melt or burn the wires which would make the generator cease to function. For this reason we always ground the generator from the terminal to the cutout mounting screw when shipped new from stock. It is very important that this precaution be taken whenever the car is to be put in operation with the battery disconnected.

Brush Holder Assembly

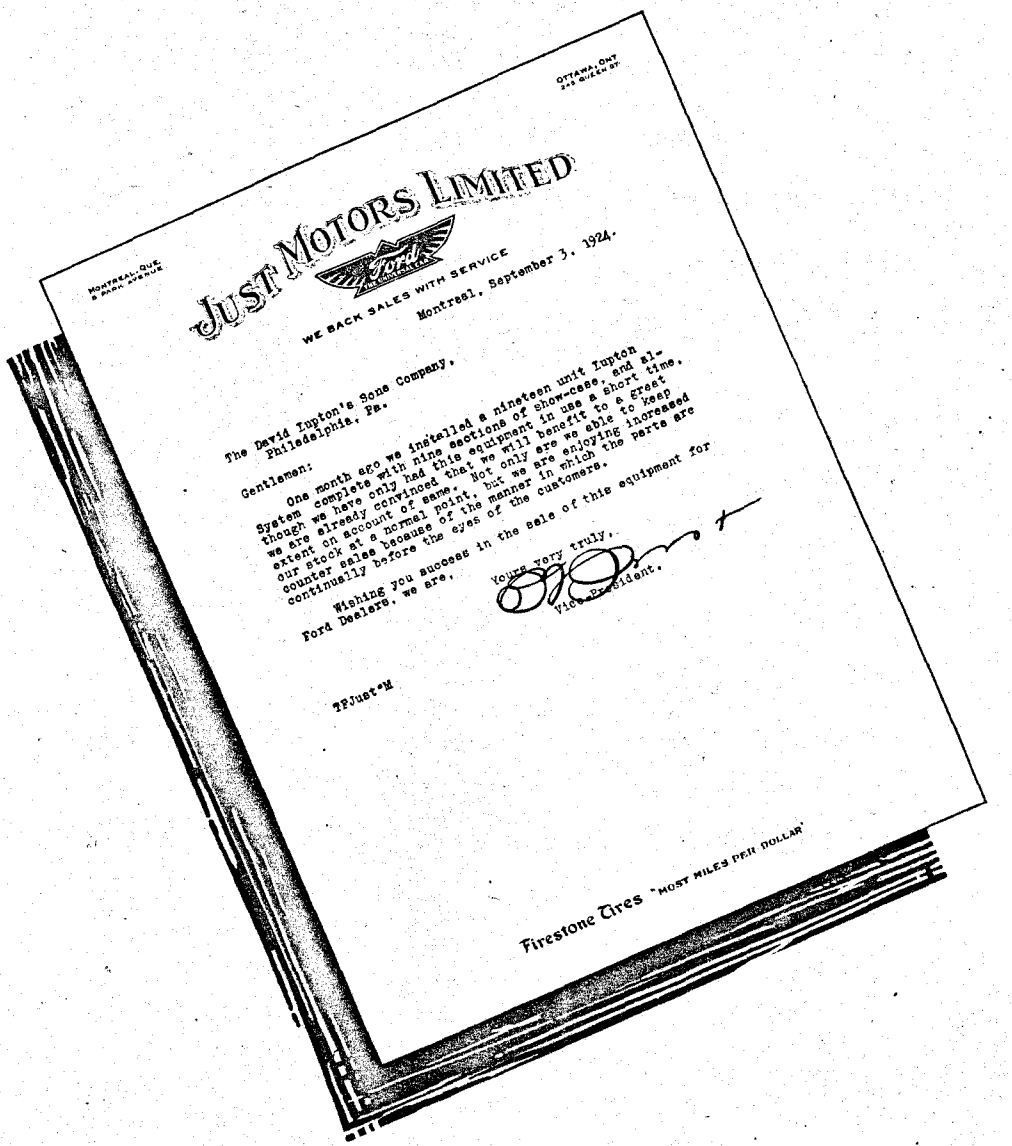
The brush holder assembly to which are attached the three brushes is mounted in the head of the generator and held in place by four screws which when loosened will allow the whole brush holder assembly to be moved to about one-half inch in one direction or the other. This adjustment makes it possible to get the exact proper setting of the two main brushes in relation to the field whenever generator is overhauled and rebuilt. In order to get this setting, the third brush is raised and the generator caused to be operated as a motor. If the armature turns, it is an indication that the brush holder assembly is not set in its proper position. In other words the proper position for the brush holder will be a neutral position for the armature so that it will not turn when motored. However, it should turn when turned by hand a little easier to the right than to the left. This is called setting the brush holder for netural and has a very important bearing on the charging rate of the generator.

(To be continued)

LUPTON'S INSTALLATION



SEE LETTER NEXT PAGE



The above facsimile of letter and stockroom photo on preceding page tell a true story of the advantage gained by the use of modern parts bins.

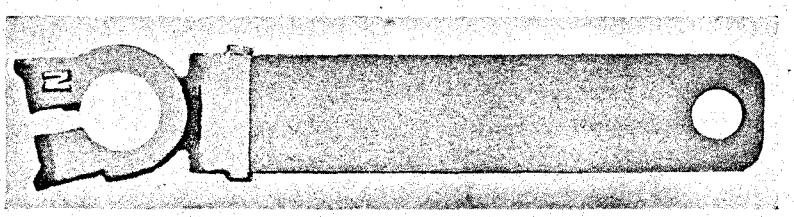


Fig. 34

New Design Battery Ground Connection No. 5049

We are now using the New Design Battery to ground connection No. 5049 (see Fig. 34). This new connection is made of copper laminations tinned and is fastened to the battery bracket arm pole No. 1320, nut No. 3934 and lock washer No. 4806-C.

The Lincoln Motor-Generator

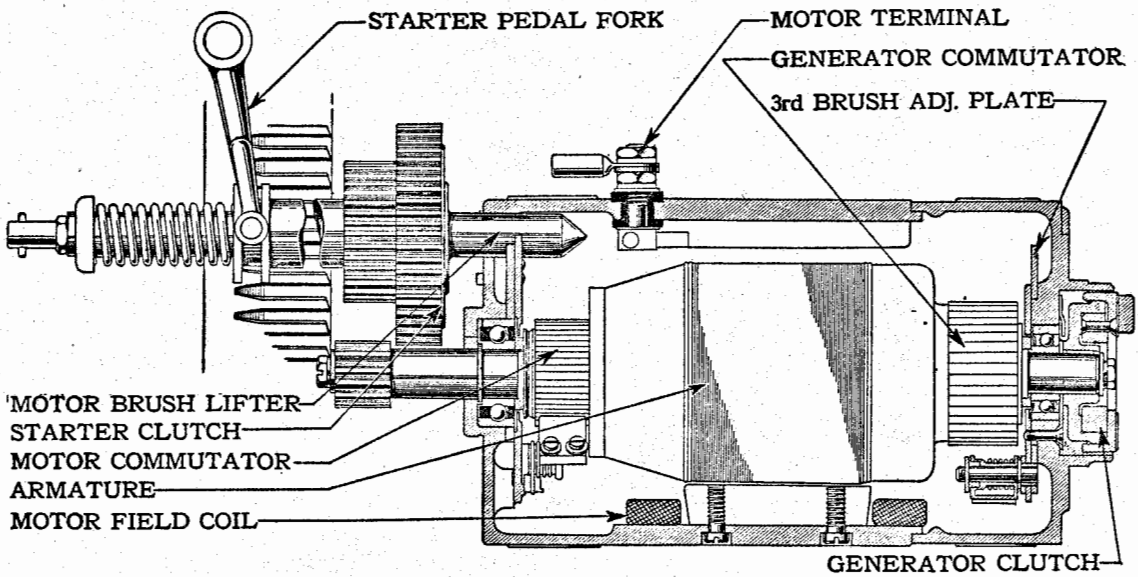


Fig. 35

The motor-generator supplies electrical energy for charging the storage battery, for supplying the lights, horn and ignition; and in addition, the same piece of apparatus operates as a motor to perform the cranking operation.

There are two sets of windings in both the field coil assembly and in the armature, one set for operation as a generator and one set for operation as a motor to crank the engine. The generator armature winding together with the generator winding in the field coil are connected in the circuit when the ignition switch is "ON" at all times, except when the starting pedal is depressed.

There is no electrical connection between the motor and generator windings on the armature, or between the series and shunt field coil windings.

When the engine is operating at slow speeds the generator voltage is not sufficient to provide current for lighting and ignition. The storage battery is then the source of ignition and lighting current. At low engine speeds also, current may flow from the battery through the generator windings and cause the armature to revolve faster than the engine drives it. Under this condition the over-running generator clutch at the forward end of the motor generator permits the armature to revolve faster than the driving shaft.

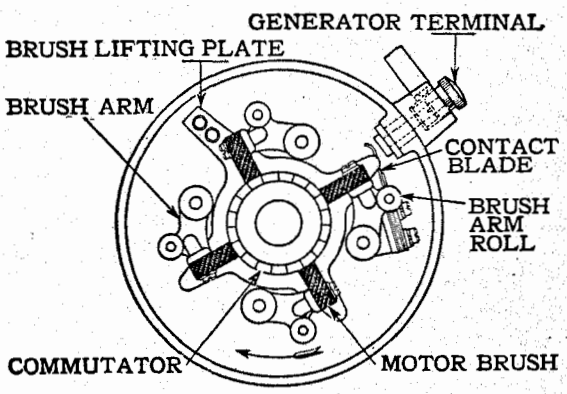
When cranking the engine the motor generator drives the flywheel through a pair of sliding gears which are at the rear of the motor-generator, and controlled by the starting pedal, see Fig. 35. An over-running clutch, called the starting clutch, is built within the hub of the larger of these gears to prevent the flywheel driving the generator armature at high speed through the starter gears after the engine starts running under its own power and before the starting pedal is released.

The driver should make a practice of releasing the starting pedal as soon as possible after the engine starts, to insure long life of the lubricant within the starting clutch. The lubricator connection on the end of the starting shaft, see Fig. 35, should be lubricated every 250 miles giving it ¼ turn of the lubricator gun. Failure to keep the starting clutch properly lubricated and failure of the driver to refrain from the practice of keeping the foot on the starting pedal longer than necessary after the engine has started running under its own power, may result in sticking of the clutch. This condition may cause the armature to be driven at a dangerous speed, due to the gear ratio between the armature and the flywheel and the windings may be thrown from the armature. In cranking the engine the following events occur in the order given:

(a) When the ignition switch is turned "ON" current flows through the generator

windings "motoring" (causing the armature to revolve) the generator so that the starting gears can be easily brought into mesh when the starting pedal is pushed down. Failure of the generator to "motor over" may be due to poor brush contact on a dirty commutator; to a loose connection in the shunt field or charging circuit; to a slightly sticking generator clutch resulting from lack of lubrication; to a weak battery or to mechanical friction of parts within the motor-generator.

(b) Meshing the gears: The first part of the movement of the starting pedal shifts the starting gears into mesh between the flywheel and armature shaft pinion. In meshing these gears, do not try to force them if they should not mesh easily but simply release the starting pedal, thus giving the gears a chance to change their relative position. Then depress the starting pedal again.



TO RAISE BRUSHES MOVE BRUSH LIFTING PLATE IN DIRECTION OF ARROW.

Fig. 37

(c) Generator Switch: Further movement of the starting pedal operates the generator switch which breaks the circuit between the battery and generator windings, thus preventing the motor and generator windings from opposing each other, a condition which would cause a very slow cranking speed. The switch blade makes contact with the underside of the generator armature terminal post of the motor generator while unit is generating but must break contact during cranking. See Fig. 36.

(d) Cranking: The last part of the movement of the starting pedal operates the motor brushes dropping them into contact with the motor commutator and completing the circuit between the motor windings and the battery. The engine is then cranked. This requires a heavy discharge from the battery. There must be no loose or corroded connections, in this circuit, which includes the battery terminal connections, grounded lead from the battery to the frame of the car, motor connections and contact of the motor brushes.

Upon releasing the starting pedal the above operations are reversed leaving the generator windings in circuit for the generation of current.

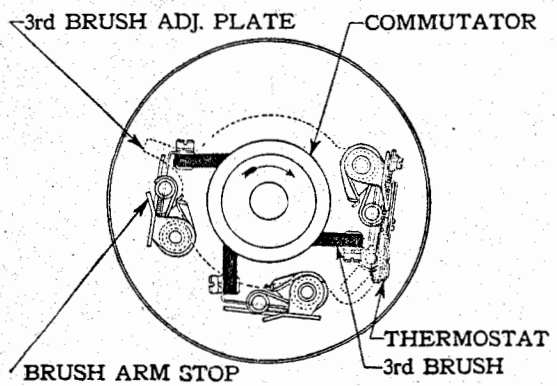


Fig. 36

Thermostatic Control:

This device operates in the case of an excessive charging rate to protect the generator from overheating and the storage battery from overcharging. The thermostat is mounted on the third brush arm in position readily influenced by radiated generator heat. See Fig. 37.

The thermostat consists essentially of a coil of resistance wire and a set of contacts. The blade holding one of the contact points is made from a piece of bi-metal consisting of a strip of brass welded to a strip of nickel steel. This combination warps at its free end when heated, due to the greater expansion of the brass side. The contacts, normally closed are caused to separate at a temperature of 195 to 205 degrees F. within the generator. When the contact is broken, the field current, which previously passed through the contacts is shunted through a resistance. The direct field circuit is restored as soon as the temperature has again become normal. No attention is required by the thermostat and its operation which is accompanied by a sudden drop of 45–90 per cent in the ammeter reading, should cause no concern. (To be continued.)

HOW ABOUT THAT

"WINTER SERVICE" CAMPAIGN?