SERVICE BULLETIN No. 55A-48

SOLENOID STARTER SWITCHES FOR PACKARDS

It has come to our attention that some solenoid starter switches of the SS-544 type apparently do not fit all the cars for which they are listed. This applies particularly to some models of Packard cars.

We have found that the apparent failure to fit the application is limited to the switches which have a terminal marked "B" (for Battery). On certain Packards there is a rigid metal connector arm that extends from the starter to one terminal of the solenoid switch. If you attempt to connect the battery cable to the "B" terminal of the switch, which would be the natural tendency, you will find yourself trying to connect the battery cable and the starter connector to the same terminal, which is obviously wrong.

The answer is that you disregard the "B" marking on on the switch and connect the starter connector to the terminal nearest to it and the battery cable to the other terminal. That is exactly what you do with a switch without the "B" marking, and it works whether or not the switch is so marked.

SERVICE BULLETIN No. 31-40

HOW NOT TO MOUNT RELAYS

To mount a horn relay or headlight relay upside down is equivalent to condemning it to an early death.

It is a fact that at some time or other every car is liable to get a thorough drenching in the motor compartment. The drenching may be caused by a driving rain, or a leaky hood-hinge, or more often, by our well known friend, the car wash.

When a relay is mounted right-side up or sideways, the water usually runs off and damage is avoided.

But, when a relay is mounted upside down and is subjected to the drenching, the water gets inside of it and collects and stays in the cover. This means that the relay winding and contacts are then submerged in water, and the inevitable result is a complete disintegration of the unit.

We have seen cases where the combination of electric current in the relay and the surrounding water in the cover produced an electrolytic action which caused the silver points of the relay to completely disappear as if they had been melted off.

Whenever you come across a car with a relay mounted upside down you can save your customer a great deal of trouble by re-mounting it sideways or rightside up.

SERVICE BULLETIN No. 41-42

THE ROTOR

The rotor is liable to give the least trouble in the ignition system. Nevertheless, certain precautions will help in eliminating unnecessary breakdowns in operation.

Rotors are equipped with contact springs and are subject to failure when the spring breaks due to corrosion. This happens when corrosive fumes are present inside of the distributor, due either to worn distributor shaft which permits the entrance of oil fumes into the distributor, or to lack of ventilation as described under distributor head troubles.

We find that most rotor failures are caused by breakage. Bakelite, while ideal for electrical purposes, is brittle and cracks easily. The breakage occurs mostly in the neck of the rotor, that is the part by means of which the rotor is fastened to the distributor shaft. This neck is comparatively thin, and it often happens that during the removal or installation of a rotor, it is cocked over to one side and then forced onto the distributor shaft. When this is done, the rotor neck will invariably crack.

It is therefore imperative that the rotor be removed from the distributor shaft by a slow, even pull upward and that it be installed just as carefully, by a slow, even, push downward.

Special care is to be taken in removing or installing a rotor when the distributor is hot. The metal of the distributor shaft is expanded when hot, and the rotor will always be tighter on a hot shaft. It is better to wait until the shaft cools off before rotor is either removed or installed.

SERVICE BULLETIN No. 32-41

WIPE THE SPARK PLUGS

Much time is often wasted in the checking of coils, breaker points and condensers—and these units are sometimes condemned—when the real trouble, although of a simple nature, is completely overlooked.

An accumulation of dust, mud, grit or dirty oil on the spark plug porcelains will cause enough leakage of the high-tension current to the motor block to seriously interfere with the entire ignition system of the car.

The same thing applies to the spark plug ignition cables.

Hard starting and, in extreme cases, complete ignition failure may be caused by these conditions.

It is strongly recommended that no job is to be considered complete unless the spark plug porcelains and the ignition cables have been thoroughly wiped until they are entirely dry and clean.

SERVICE BULLETIN No. 33-41

1941 CHEVROLET REVERSING SWITCH

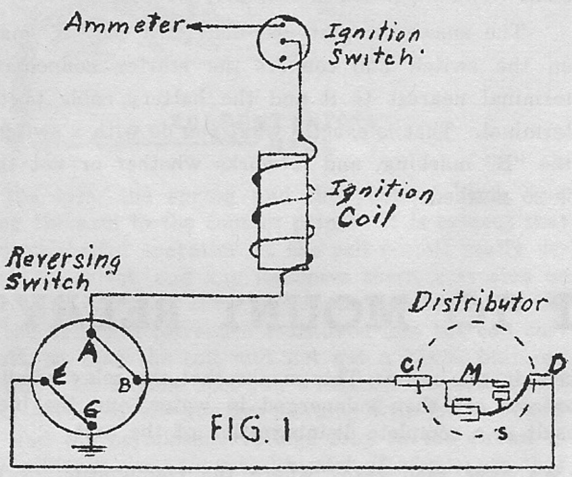


FIG. 1

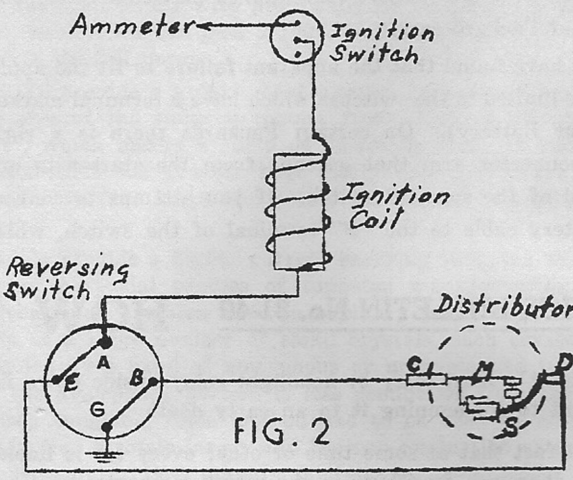


FIG. 2

Distributor breaker points in normal operation will become pitted as a result of the make-and-break action of the primary current flowing through them. The current transfers tungsten metal from one point to the other, a tiny bit each time the points break. With continued operation, the transfer of metal gradually leaves a cavity in one point and builds up a projection on the other.

The only known theory for correcting this condition is to reverse the direction of the current through the points, so that the metal is transferred back from the projection into the cavity, thus leveling the tungsten surfaces.

In a 1941 Chevrolet, this principle is employed in order to prolong the life of the points. A reversing switch is used in the distributor circuit, which automatically reverses the current through the points each time the starter pedal is used.

Referring to Fig. 1, this is what happens: from the primary winding of the coil the current flows to A of the reversing switch, through the contact plate inside the switch to B, then to terminal C on the distributor, through the movable breaker arm M, through the stationary contact S, to distributor terminal D, back to terminal E of the reversing switch, and through the contact plate inside the switch to ground G.

When the starter pedal is depressed, a link connected to the starter pedal operates the reversing switch and causes the contact plate in the switch to assume the position shown in Fig. 2.

Now the current from the primary of the coil goes to terminal A of the switch, through the contact plate inside the switch to E, then to the distributor terminal D, through the stationary contact S to the movable arm M, to distributor terminal C, then to B of the reversing switch and through the contact plate to ground G.

Thus, in the first case the current flows from the movable breaker arm to the stationary contact, while in the second case the direction is the other way—from the stationary contact to the removable arm.

A departure from the conventional distributor construction is required for this arrangement: the stationary contact, which has heretofore been grounded to the distributor is now insulated.

This method of eliminating point pitting is not 100% effective, as it depends upon the driving habits of the individual drivers, some of whom may use the starter often, while others, driving long distances at a stretch, will reverse the current less often. Yet it is a step in the right direction and will reduce, if not eliminate pitting.

CAUTION

When a 1941 Chevrolet comes in with the ignition dead, the trouble may be in the reversing switch. Cases have been reported where the switch failed to snap over, so that the contact plate in it did not make contact, thus causing an "open" in the ignition circuit just as if the coil or points had failed.

A quick elimination test of the reversing switch can be made in a couple of minutes in this manner:

(1) Disconnect the wire from the reversing switch terminal marked "1" and connect it to the nearest ground.

(2) Disconnect the wire from distributor terminal C.

(3) Disconnect the wire from the switch terminal marked "coil" and connect it to the terminal C on the distributor.

If the engine now operates, the switch should be replaced. Otherwise, the coil and points should be checked.

SERVICE BULLETIN No. 37-41

NEWEST TYPE CHEVROLET REVERSING SWITCH

In service bulletin No. 33-41, we described the 1941 Chevrolet reversing switch, its purpose and method of operation.

Considerable trouble was experienced with this switch, due mainly to its mechanical action. It was possible for the switch lever to snap too far forward, producing an "open" in the ignition circuit.

To remedy this, Chevrolet now furnish a switch complete with new linkage parts to replace their original switch and linkage, with a stop on the switch to control the forward motion of the lever, so that it cannot snap beyond the proper position.

With this arrangement it is not necessary to adjust the forward movement of the switch lever, as the new linkage automatically takes care of it.

The test for possible defects in the switch, described in service bulletin No. 33-41, also applies to this new switch.

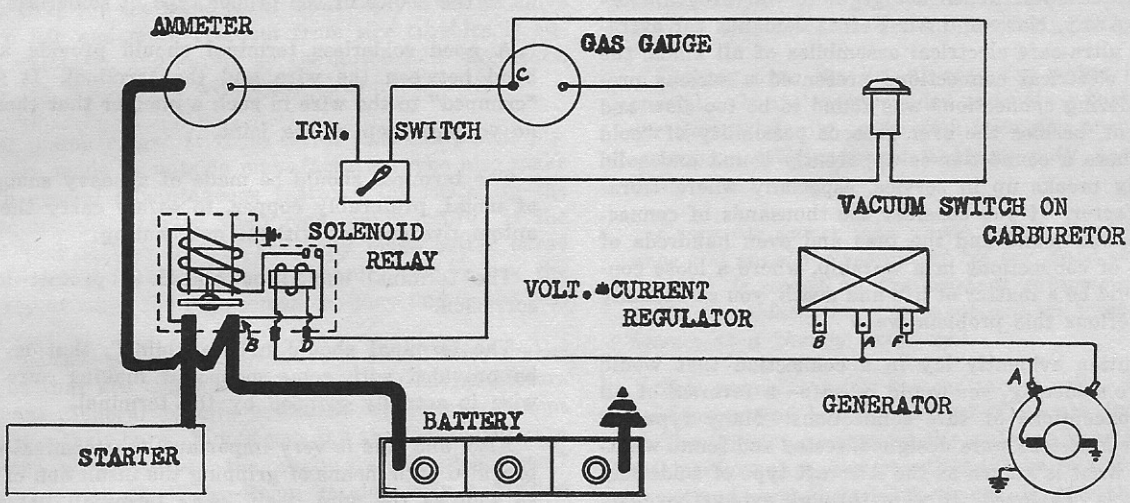
At the same time, it should be noted that in all 1941 Chevrolet installations it is important to check the position of the positive battery cable to make sure that it is not in the way of the starter shift lever when the car is being started, so as not to interfere with the action of the reversing switch linkage.

SERVICE BULLETIN No. 36-41

STARTER REFUSES TO OPERATE IF GENERATOR BRUSHES ARE WORN

A somewhat mysterious trouble may be encountered in servicing 1939 to 1941 Buick starters. With all starter-operation units in good operating condition and no opens or shorts in the starter circuit wiring, the starter may still refuse to turn over, and much time may be lost in unnecessary overhauls or replacements of units or wiring.

Strange as it may sound, the refusal of the starter to operate on these cars is, in many cases, due to worn generator brushes.



The 1939 to 1941 Buicks are equipped with special solenoid starter switches and vacuum-operated switches. The purpose of the solenoid switch is to put the starter into operation; the vacuum switch is a safety feature which automatically disconnects the starter as soon as the engine starts and develops a vacuum. Connecting the starter circuit through the generator brushes is an additional safety feature against starter operation after the engine has started.

The circuit is as follows:—When the ignition key is turned on and the accelerator pedal is pressed all the way down, current flows from the battery to the main terminal "B" of the starter switch. From "B" it goes through the ammeter, through the ignition switch, to terminal "C" of the gas gauge, then to the vacuum switch on the carburetor. At this time the vacuum switch contacts are closed, and the current goes through them and to terminal "D" of the relay contained within the starter switch. It goes through the delay winding, then to terminal "A" of the voltage regulator, and continues to the "A" post on the generator. From there the current goes through the insulated brush within the generator, through the commutator, and then through the grounded generator brush to ground, thus completing the circuit.

When the circuit is thus completed, the starter switch relay becomes energized and its contacts close. This, in turn, energizes the solenoid winding of the starter switch, which causes the starter switch main contacts to close, turning over the starter and starting the engine.

As soon as the engine starts, two things happen: the vacuum developed in the engine actuates a diaphragm in the vacuum switch, opening the vacuum switch contacts and breaking the current in the starter switch relay. This throws the starter out of operation, so that no damage is done if the driver keeps

his foot on the starter pedal after the engine has started.

Also, as an extra precaution against starter switch operation after the engine has started, the starter switch relay circuit is broken by the generator when the engine starts, as the generator now builds up voltage which opposes the flow of current through the starter switch relay winding. This weakens the pull of the relay and allows the relay points to open, putting the starter out of operation.

It is now obvious that should either of the two generator brushes be badly worn so as to no longer make contact with the commutator, the starter will not turn over.

We would therefore recommend the following quick test in cases of starter trouble on 1939 to 1941 Buicks.

Remove from the "A" terminal of the voltage regulator the lead that comes from the solenoid switch and temporarily connect it to a good ground. If the starter now turns over, the trouble is in the generator brushes and the generator must be overhauled. If the starter still does not turn over, the trouble is not in the generator and must be located somewhere in the starter circuit or unit.

Be sure to reconnect the lead to the "A" terminal of the voltage regulator as soon as the test is over.

SERVICE BULLETIN No. 43-45

LEARN FROM UNCLE SAM HOW TO SAVE TIME WITH SOLDERLESS TERMINALS

Among the many scientific and technological developments of World War II, an important place is held by the Aircraft type of solderless terminal.

Before this war, soldering was the only known and accepted means of providing a safe connection or joint in low voltage circuits. When our gigantic war program began, with Army, Navy and Air Forces demands for extra-quick and ultra-safe electrical assemblies of all kinds, the matter of electrical connections presented a serious problem. Soldering connections was found to be too slow and inconvenient, besides the ever present possibility of "cold joints", where a connection is apparently sound and solid but rapidly breaks up in service, especially where vibration is a factor. If you consider the thousands of connections in a war plane and the tens and even hundreds of thousands of connections in a warship, where a loose connection could be a matter of life and death, you can readily see how serious this problem was.

The solution evidently lay in a connection that would not require soldering, yet would be safe—a reversal of all pre-war conceptions of safe connections. Many types of solderless connectors were designed, tested and found wanting, until, what is known as the Aircraft type of solderless terminal was developed. It went through exhaustive tests in government laboratories and in actual performance before it was accepted by the various War Arms for use in service.

At the present time this type of connector or terminal is becoming available to the automotive mechanic, to whom it should prove a veritable boon. He will not have to worry about heating an iron, bringing it to the car and often reheating it where more than one connection is to be made: he will not have to worry about cold joints that have ruined many a generator and voltage regulator; he will save time in making his connections.

There will probably appear on the market many types of solderless terminals, and it behooves the automotive mechanic to be somewhat careful in his choice of the proper type. He may be offered terminals that look like the approved type which may be inferior in construction.

We know the critical importance of good primary connections in the low-voltage, high-amperage electrical system of the car, and should like to offer a few suggestion as to the choice of the proper type of solderless terminal.

A good solderless terminal should provide a positive bond between the wire and the terminal. It should be "crimped" to the wire in such a manner that there will be no voltage drop at the joint.

The terminal should be made of a heavy enough gauge of metal, preferably copper, to safely carry the primary automotive current without overheating.

The terminal should be plated to protect it against corrosion.

The terminal should not be "blind", that is it should be provided with some means of making sure that the wire is actually gripped by the terminal.

Also, and this is very important, the terminal should be provided with means of gripping the insulation of the wire, as well as the wire itself. Any terminal that grips the wire only is unsafe for use on the car, as vibration quickly breaks the strands of the wire, one at a time. Very often in such cases the entire current is carried by a few strands of wire, and the system is affected even before the wire breaks off entirely. Be sure, therefore, that the solderless terminal you choose for your work grips the insulation as well as the wire.

Last, do not load yourself with a variety of types of terminals you will never use. Pick only the types required for automotive work of which there are only about five or six.

If you follow the above suggestions in choosing your solderless terminals, you can forget about the old solder-type terminals and do a better job in about half the time.

SERVICE BULLETIN No. 37-41

VALVE SPRING CHECKING

In tracing engine troubles it often happens that not enough attention is paid to valve springs.

The complaint may be bad pickup, missing at high speeds or rough idling. The usual procedure is to check the ignition coil, or, perhaps, replace it; clean or replace the breaker points and change condensers. Often the carburetor is re-adjusted, thus bringing in a new trouble instead of eliminating the cause.

The real trouble, however, is often due to incorrect valve spring tension, especially in cases where the engine has over-heated at some time or other. The mechanic may be entirely unaware that this has happened, as the car owner seldom realizes that even one case of overheating may seriously affect the valve springs and does not call the mechanic's attention to it.

It is suggested that in every case of improper engine performance when the cause of the trouble is not obvious or easily detectable, the valve spring tension be checked.

If you do not have the spring tension data or the proper instrument for checking the tension, we should recommend that you take the springs to your jobber who is in a position to check them and thereby save you time and trouble.

SERVICE BULLETIN No. 10-38

VOLTAGE REGULATORS

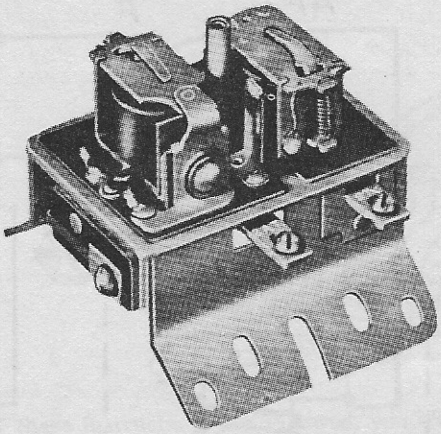
To understand the principles and the operation of generator voltage regulators, it is necessary to have a clear picture of the operation of the automobile generator.

In the generator, an armature revolves in a magnetic field created by current flowing through the field coils; the higher the field current, the stronger this magnetic field. A stronger magnetic field produces a stronger current in the armature and, consequently, in the charging circuit.

It is a fundamental law of electricity that in any circuit the amount of current in amperes is directly proportional to the voltage. If, therefore, the voltage in the field circuit increases, the current also increases and vice-versa. It is due to this law, that the un-regulated generator, as it was used on all cars up to 1934 produced an undesirable condition. As the battery became charged, its voltage rose and correspondingly with it the field coil voltage increased. This caused a heavier flow of current through the field coils, a stronger magnetic field and a greater generator current output. So, you can see, that in such a system a fully charged battery would receive a lot of current from the generator, while insuficient current would be delivered to a discharged battery.

It is obvious that this condition was undesirable, as it resulted in an overcharged battery in the case of the car owner who drove his car for long distances without much use of the starter or lights; besides, the constant high-voltage in the system burned out points and shortened the life of the bulbs. On the other hand, the city driver, for instance, whose frequent use of the starter put a heavy drain on the battery would find his battery starved and often unable to start the car.

To remedy this condition voltage regulators were developed. A voltage regulator, regardless of type, is an automatic switch that weakens or strengthens the field current according to the requirements of the battery. This is accomplished by means of



a resistance that automatically cuts into or out of the field circuit. While this is done in different ways in the different types of voltage regulators, the principle remains the same in all of them.

At this point let us make clear that **a voltage regulator does not increase the charging capacity of a generator**, as some believe. All it does is to allow the use of the maximum safe charging rate the particular generator is rated at, without fear of overcharging the battery or the necessity for adjusting the charging rate for different driving conditions or accessory loads.

Nor must the voltage regulator be confused with the generator cutout. The cutout is an automatic switch that breaks the circuit between the generator and the battery and allows current to flow from the generator to the battery, but not from the battery to the generator. The regulator does not replace the cutout but must be used in addition to it. In all equipment installations, the regulator and the cutout are a combination unit, mounted on a common base and under one cover.

Types of Generator Regulators

There are at present several types of generator regulators:

1. The Two-Step Voltage Control.
2. The Vibrating Voltage Regulator.
3. The Current Regulator.
4. The Combination Voltage and Current Regulator.

The Two-Step Voltage Control

This type of voltage regulator provides only two charging rates. When the battery is discharged the regulator does not operate and allows the generator to deliver its maximum current. When the battery becomes charged and its voltage reaches a certain predetermined value, the regulator operates and inserts a resistance into the generator field, cutting down the field strength and the charging rate.

Referring to the drawing of a typical two-step control circuit, we find really two distinct circuits. One starts at the armature terminal of the generator (Arm.) and goes to the battery through the cutout as explained in Service Bulletin No. 7-37. The other circuit starts at the field terminal "F" of the generator and goes to point "B" where it tends to divide along two paths: one through the armature "A", points "P" and to ground; the other through the resistance "R" and to ground. There is also a connection from the battery, through the winding "W" of the regulator and to ground.

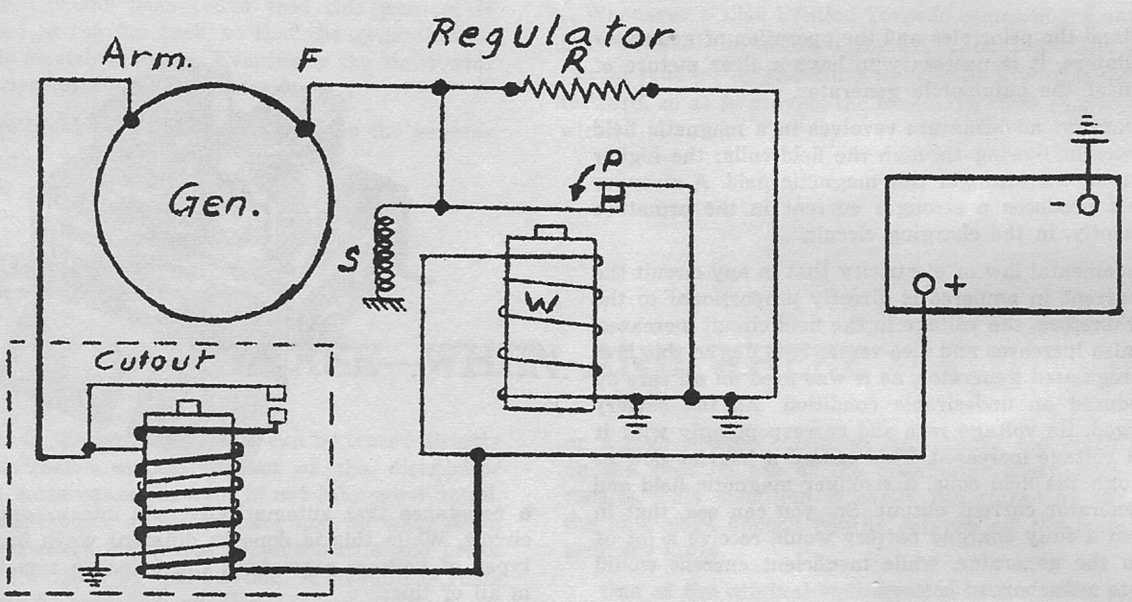
When the battery is discharged, its voltage is low and the current flowing through the winding "W" is too weak to overcome the tension of the spring "S" and pull down the armature "A". The points "P" remain closed and eliminate resistance "R". At this time, the field coils are connected directly to ground, and the current in them is at its maximum. The battery will therefore receive the full current output of the generator.

When the battery becomes fully charged, its voltage rises and it can now send sufficient current to the winding "W" to energize it to an extent that would pull down the armature "A". This separates the points "P" and compels the field current to flow from "F" through the resistance "R". Naturally, the introduction of this resistance into the field circuit, reduces the current in the field coils and the magnetic field. As a result, the charging rate drops and the battery receives very little charge.

Whenever accessories such as heaters, radios, etc. are used, the battery voltage, of course, drops and the points close again, increasing the charging rate, as explained above.

In other words, the Two-Step Voltage Control is equivalent to providing the system with two generators: a high-output generator when the battery needs a lot of current, and a low-output generator when the battery requirements are low.

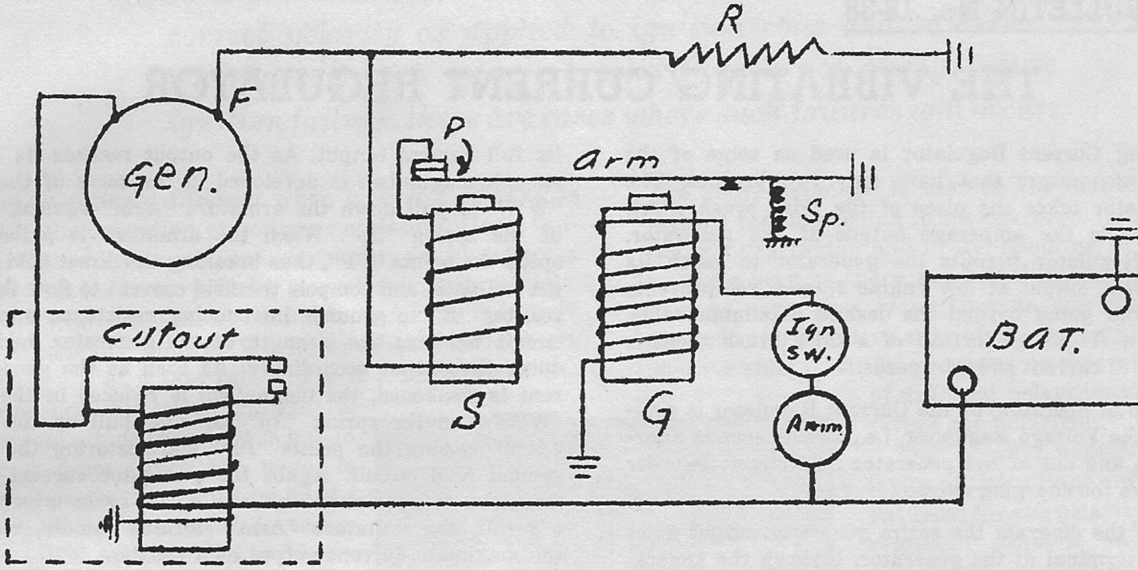
The operation of other types of voltage regulators will be explained in later Bulletins.



SERVICE BULLETIN No. 12-38

VOLTAGE REGULATORS

THE VIBRATING REGULATOR



The vibrating type of voltage regulator is similar to the two-step control, described in Service Bulletin No. 10-38, in that it uses a resistance that automatically cuts in and out of the generator field circuit. It differs from it in this manner: the two-step control provides only two charging rates—one for a charged battery and one for a discharged battery; the vibrating regulator furnishes a multitude of charging rates in accordance with the condition of the charge in the battery. In other words—the vibrating voltage regulator is equivalent to providing the system with a lot of generators, each one charging the battery at a rate that is best for it at the moment.

Referring to the diagram, the voltage regulator has two windings, each upon its own core. Winding "G" consists of many turns of fine wire and is connected across the battery through the ignition switch. (The regulator will control the voltage of whatever part of electrical system it is connected to, and the ignition switch is closest in voltage to the battery voltage).

Winding "G" is known as the voltage winding and is actually the governing winding of the regulator. Winding "S" is the series winding and consists of a few turns of heavy wire. It is used as an aid to the governing winding in speeding up the action of the regulator, as explained below.

Let us take up the action of the regulator from the moment the motor was started. The starter has drained considerable current from the battery and the battery voltage is comparatively low and sends a small amount of current through the winding "G". There is not enough magnetism developed in the core of the winding "G" to pull down the armature "Arm" against the action of the spring "Sp". The points of "P" therefore remain closed, and the entire field current of the generator flows from "F", through the new turns of winding "S", through the points "P", armature "Arm" and to ground. While a small magnetic field is set up in the core of winding "S", this is still not enough to pull down the armature and the points remain closed. The ammeter now shows the maximum generator charging rate, and the regulator remains inoperative for the time being.

We have driven for a few minutes and the high generator charge has gradually replaced into the battery the current drained out of it by the starter. Consequently, the battery voltage has risen and the battery can push through more current through winding "G". The magnetic strength of the core of this winding keeps on increasing until it reaches the stage where it is strong enough, aided by winding "S", to pull down the armature. The points "P" then separate, so that the generator field current is compelled to flow from "F", through resistance "R" and to ground. Introducing resistance into the field circuit immediately weakens the field current and reduces the generator voltage and the voltage in the entire system, thus weakening the magnetic field of winding "G". Besides, at the moment the points opened, all current was cut off from winding "S" and its magnetic field collapsed.

With a weak magnetic field in winding "G" and no magnetism in "S", the pull upon armature "Arm" is reduced to the point that spring "Sp" can now pull it up and away from the windings, so that the points "P" close again. As the points close, the resistance "R" is again cut out of the field circuit, the charging rate again increases, the points open and the whole cycle is repeated. As a result of this action, the armature vibrates at a rapid rate, opening and closing the points 150 to 250 times a second. In any electrical circuit controlled by a rapid make-and-break arrangement like a vibrator, the voltage will adjust itself to some constant value between zero (voltage with vibrator points open) and maximum (voltage with vibrator points closed). This value depends on the rate of vibration, which, in turn, depends on the maximum voltage in the system. From this it is evident that the vibrating armature will keep the voltage in the charging system and, correspondingly, the charging current, at a constant level. The ammeter will show a charge somewhere between maximum and zero, depending on the state of charge in the battery.

In a further service bulletin we will describe current regulators and combination voltage-and-current regulators.

SERVICE BULLETIN No. 13-38

THE VIBRATING CURRENT REGULATOR

The Vibrating Current Regulator is used on some of the late types of generators that have only two brushes. The Current Regulator takes the place of the third brush which ordinarily controls the amperage output of the generator. The Current Regulator permits the generator to reach its maximum current output at low engine speeds, yet prevents the current from going beyond the desired maximum value. With a Current Regulator instead of a third brush there is no tapering off of current at high speeds.

The principle of operation of the Current Regulator is similar to that of the Voltage Regulator, i.e., a resistance is alternately cut into and out of the generator field circuit in order to lower or raise the charging current.

As shown in the diagram the entire generator output flows from the "A" terminal of the generator, through the generator cutout points "CP", through the windings "WW" of the Current Regulator, which consists of a few turns of heavy wire, through the ammeter and to the battery. At this time the tension of the spring "Sp" keeps the armature of regulator "Arm" in its upper position, and the points "PP" are closed. This provides a direct path to ground for the generator field current, which flows from terminal "F" of the generator, through the points "PP", through the armature "Arm" and to ground. With this arrangement, the generator delivers out its full current output. As the output reaches its maximum, enough magnetism is developed in the cores of the windings "WW" to pull down the armature "Arm" against the action of the spring "Sp". When the armature is pulled down it opens the points "PP", thus breaking the direct field circuit-to-ground path, and compels the field current to flow through the resistor "R" to ground. Introducing resistance into the field circuit weakens the strength of the generator fields and reduces the output accordingly. As soon as the generator current is weakened, the magnetism is reduced in the windings "WW", and the spring "Sp" can now pull up the armature "Arm" closing the points "PP" and restoring the direct-to-ground field circuit. Again the generator current output is increased to maximum and the whole cycle is repeated. As a result, the armature "Arm" vibrates rapidly, maintaining the maximum current output at a constant level.

The Current Regulator differs from the Voltage Regulator, as follows:

The Voltage Regulator varies the charging rate in accordance with the condition of the battery, is controlled by the voltage of the battery and provides a great number of charging rates.

The Current Regulator is set for just one charging rate—the maximum desired and is not controlled by the battery.