SECTION F-2
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EQUIPMENT

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WORKSHOP INSTRUCTIONS

CONTROL BOXES

MODELS
RF95, RF96, RF97 and RB106-1

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CONTROL BOXES

MODELS RF95, RF96, RF97 AND RB106-1

INCORPORATING C.V.C. REGULATOR TYPE LRT9

1. GENERAL

The control box houses the generator voltage regulator unit and the cut-out ; also, in the case of model RF95, two fuses connected in the circuits of the accessories. Models RF95 and RF96 are for general car use, while model RF97 will usually be found on tractors. Model RB106-1 is similar to model RF96, but it is designed to permit a slightly higher maximum current from the generator: it may be used only with the latest ventilated generators (see SECTION A-2).

Although combined structurally, the regulator and cut-out are electrically separate. Both are accurately adjusted during manufacture, and the cover protecting them should not be removed unnecessarily. Connections to models RF95, RF96 and RB106-1 are by means of the normal grub screw terminal, while model RF97 utilises a non-interchangeable plug-in terminal block.

THE REGULATOR

The regulator unit is arranged to work in conjunction with the shunt-wound generators described in SECTION A. The regulator is set to maintain a predetermined generator voltage at all speeds above the regulating point, the field strength being controlled by the automatic insertion of a resistance in the generator field circuit. When the generator voltage reaches a predetermined value, the magnetic field due to the shunt or voltage winding becomes sufficiently strong to attract the armature. This causes the contacts to open, thereby inserting the resistance in the field circuit.

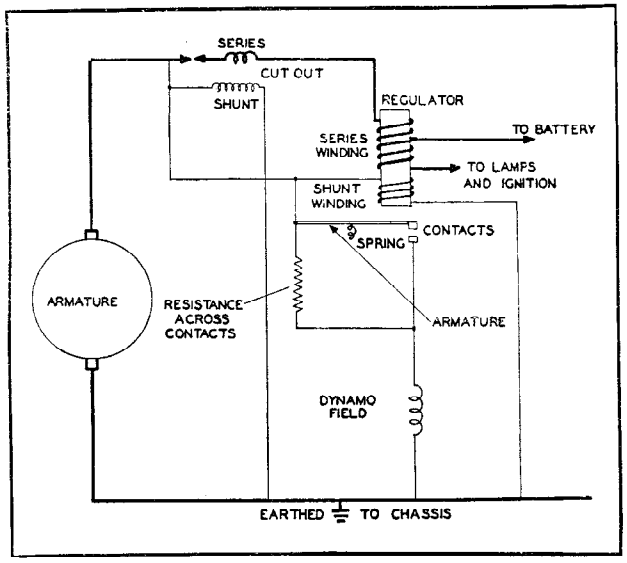

Fig. 1.
Diagram of C.V.C. charging circuit

The consequent reduction in field current lowers the generator voltage and this, in turn, weakens the magnetic field due to the voltage coil. The armature is allowed to return to its original position, thus closing the contacts, so that the voltage returns to the predetermined maximum. The cycle is then repeated, and the armature is set into vibration.

As the speed of the generator rises above that at which the regulator comes into operation the amplitude of vibration increases and the periods of interruption increase in length, with the result that the mean value of the generator output undergoes practically no increase once the operating speed has been attained.

The series or current winding provides a compensation on this system of control, for if the control were arranged entirely on the basis of voltage there would be a risk of very seriously overloading the generator when the battery was in a low state of charge, particularly if the lamps were simultaneously in use. Under these conditions, with a battery of low internal resistance, the generator would be forced to give an output to bring the voltage of the system up to the same value as if the battery were fully charged. This would necessitate an extremely heavy current, far beyond the normal capacity of the machine. The series winding assists the voltage coil, so that when the generator is delivering a heavy current into a discharged battery the regulator comes into operation at a somewhat reduced voltage, thus limiting the output accordingly. On control boxes RF95, RF96 and RB106-1, a split series winding is used, the centre tapping carrying the battery charging current while the complete winding carries lighting and ignition loads.

By means of a temperature compensation device the voltage characteristic of the generator is caused to conform more closely to that of the battery under all climatic conditions. In cold weather the voltage required to charge the battery increases, whilst in warm weather the voltage of the battery is lower. The method of compensation takes the form of a bimetallic spring suspension for the armature of the

regulator which causes the operating voltage of the regulator to be increased in cold weather and reduced in hot weather, and thereby to compensate for the variations in charging current which would otherwise occur due to the changing characteristics of the battery.

THE CUT-OUT

The cut-out is an automatic switch connected between generator and battery. It consists of a pair of contacts held open by a spring and closed magnetically when the engine is running fast enough to cause the generator voltage to exceed that of the battery. The battery will then be charged by the generator. On the other hand, when the speed is low or the engine is stationary the contacts open, thus disconnecting the generator from the battery and preventing current flowing from the battery through the windings.

2. SETTING DATA

(a) CUT-OUT

	12 volt	6 volt
Cut-in voltage	12·7—13·3 volts	6·3—6·7 volts
Drop-off voltage	9—10 volts	4·5—5·0 volts
Reverse current	3·0— 5·0 amps.	3·0—5·0 amps

(b) REGULATOR — Setting on open circuit

	12 volt	6 volt
10°C. (50°F.) Cold climate ...	16·1—16·7 v.	7·9—8·3 v.
20°C. (68°F.) Normal temperature	15·8—16·4 v.	7·8—8·2 v.
30°C. (86°F.) Hot climate ...	15·6—16·2 v.	7·7—8·1 v.
40°C. (104°F.) Very hot	15·3—15·9 v.	7·6—8·0 v.

N.B.—A few instances occur from time to time where, due to special running conditions, regulator settings differ from the figures quoted above. Details will be found in SECTION F-1.

3. SERVICING

(a) TESTING IN POSITION TO LOCATE FAULT IN CHARGING CIRCUIT

If the procedure given in SECTION A shows the generator to be in order, proceed to check further as follows :—

(*i*) First ensure that the wiring between battery and regulator is in order. To do this, disconnect the wire from the A terminal of the control box and connect the end of the wire removed to the negative terminal of a voltmeter.

Connect the positive voltmeter terminal to an earthing point on the chassis. If a voltmeter reading is given, the wiring is in order and the regulator must be examined.

(*ii*) If there is no reading, examine the wiring between battery and control box for broken wires or loose connections.

(*iii*) Reconnect the wire to terminal A.

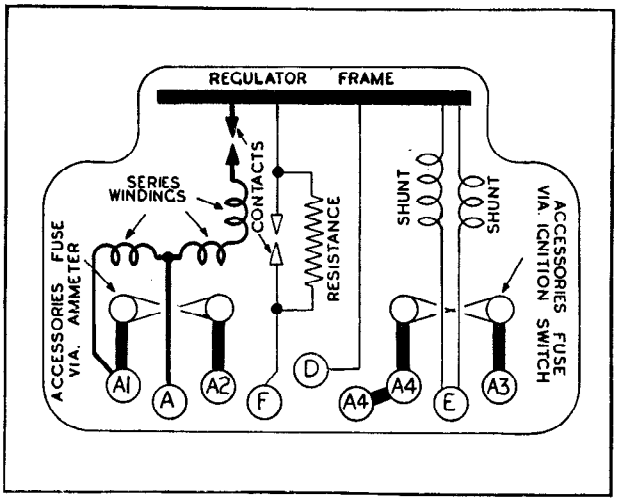

Fig. 2.
Internal connections of RF95 control box

(b) REGULATOR ADJUSTMENT

The regulator is carefully set during manufacture to suit the normal requirements of the standard equipment and in general it should not be necessary to make further adjustments. However, if the battery does not keep in a charged condition, or if the generator output does not fall when the battery is fully charged it may be advisable to check the setting and readjust if necessary.

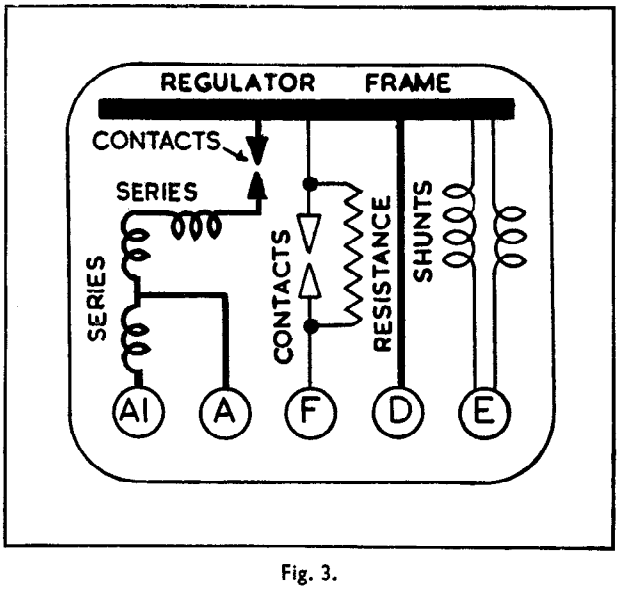

Fig. 3.
Internal connections of RF96 or RB106-1 control box

It is important before altering the regulator setting when the battery is in a low state of charge, to check that its condition is not due to a battery defect or to the generator belt slipping.

(*i*) ELECTRICAL SETTING

It is important that a good quality MOVING COIL VOLTMETER (0 — 20 volts) be available before attempting to adjust the regulator.

The electrical setting can be checked without removing the cover from the control box.

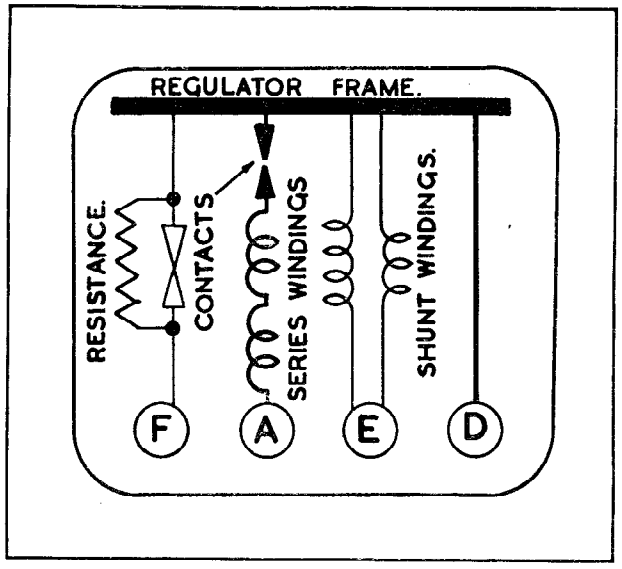

Fig. 4.
Internal connections of RF97 control box

With models RF95, RF96 and RB106-1, withdraw the cables from the terminals marked A and A1 at the control box and join the wires together.

With model RF97 control box, owing to the terminal arrangement it is necessary to remove the negative connector from the battery. If coil ignition equipment is fitted, run a temporary connection from the negative battery terminal to the SW terminal of the coil and, with the ignition switch in the OFF position, start the engine by hand.

Connect the negative lead of the moving coil voltmeter to the D terminal on the generator, and connect the other lead from the meter to a convenient chassis earth.

Slowly increase the speed of the engine until the voltmeter needle "flicks" and then steadies ; this should occur at a voltmeter reading between the limits given in Para. 2(b) on Page 2 for the appropriate temperature of the regulator.

If the voltage at which the reading becomes steady occurs outside these limits, the regulator must be adjusted.

Shut off the engine and remove the control box cover. (Note that in the case of model RF97 it will be necessary to remove the control box from its mounting, disconnect the plug-in connectors by removing the two fixing screws, and drill off the four rivets securing the cover to the base, using a cutter or a $\frac{1}{4}$" drill with a slow lead. Temporarily remake the connections. When refitting the cover to this unit, see that it locates on the rubber sealing washer and firmly secure the cover with four suitable bolts, washers and nuts).

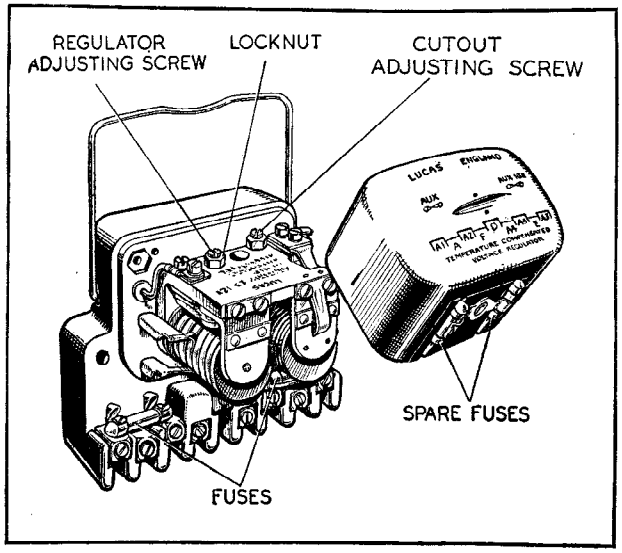

Fig. 5.
Control box, model RF95, with cover removed

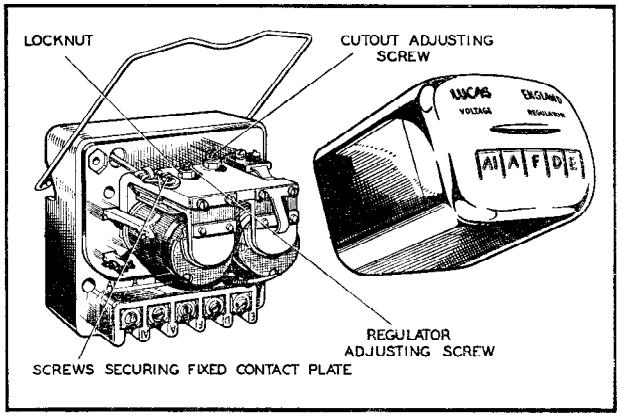

Fig. 6.
Control box, model RF96 or RB106-1, with cover removed

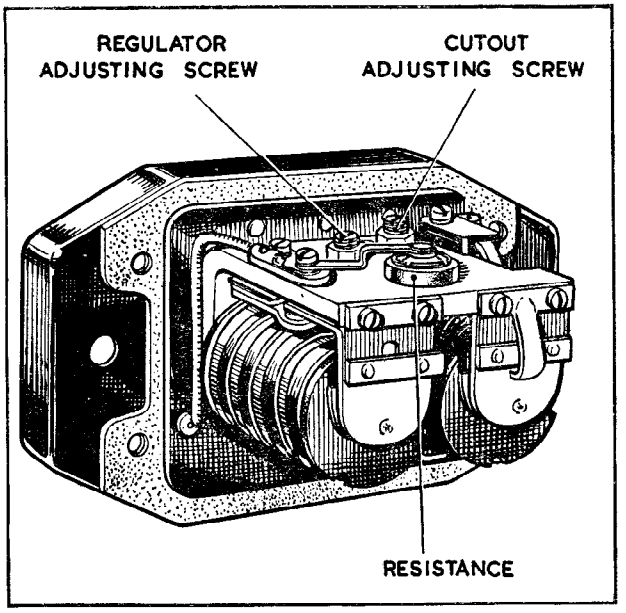

Fig. 7.
Control box, model RF97, with cover removed

Release the locknut (A) holding the adjusting screw (B) and turn the screw in a clockwise direction to raise the setting or in an anti-clockwise direction to lower the setting. Turn the screw a fraction of a turn only at a time and then tighten the locknut. Repeat as above until the correct setting is obtained.

Remake the original connections.

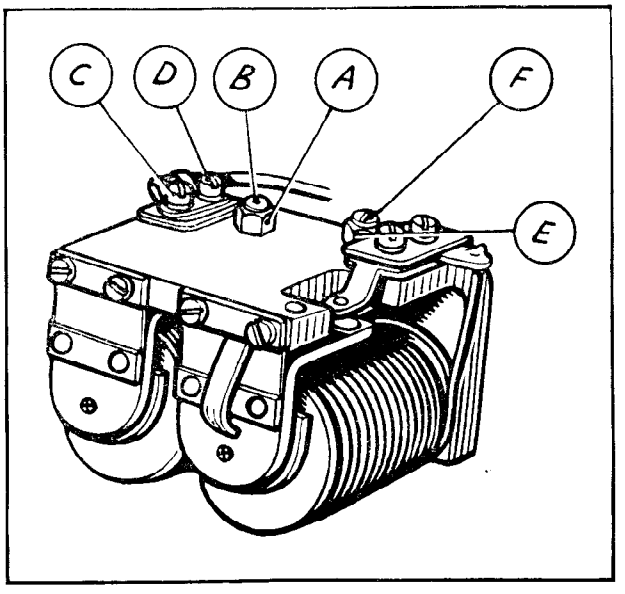

Fig. 8.
Cut-out and regulator assembly

When the generator is run at a high speed on open circuit, it builds up a high voltage. Therefore, when adjusting the regulator, do not run the engine up to more than half throttle or a false voltmeter reading will be obtained.

(*ii*) MECHANICAL SETTING

The mechanical setting of the regulator is accurately adjusted before leaving the works and provided that the armature carrying the moving contact is not removed, the regulator will not require mechanical adjustment. If, however, the armature has been removed from the regulator for any reason, the contacts will have to be reset. To do this proceed as follows :—

Slacken the two armature fixing screws.

Insert a ·018″ feeler gauge between the back of the armature and the regulator frame.

Press back the armature against the regulator frame and down on to the top of the bobbin core with gauge in position, and lock the armature by tightening the two fixing screws.

Check the gap between the underside of the arm and the top of the bobbin core. On earlier types of regulator, fitted with a stop rivet, this gap should be ·022″—·030″ (not under the stop rivet). On later types a shim is fitted to the underside of the

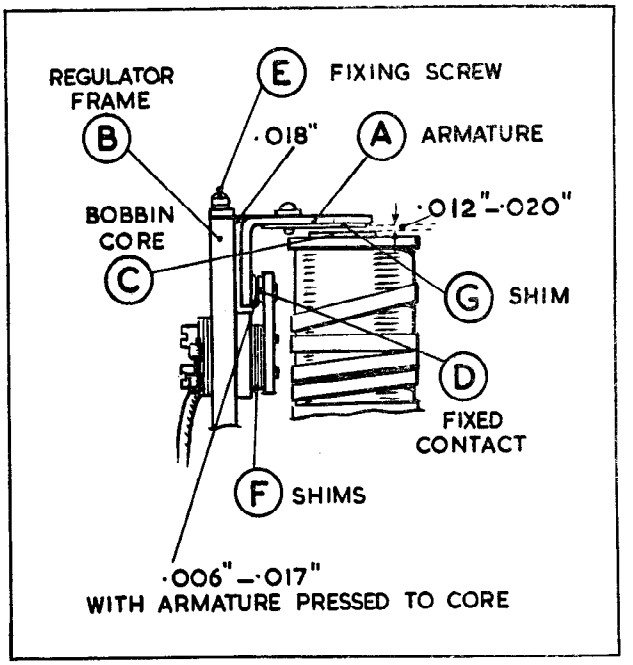

Fig. 9.
Mechanical setting of regulator

arm, and in these cases, the gap should be ·012"—·020". If the gap is outside these limits correct by adding or removing shims at the back of the fixed contact.

Remove the gauge and press the armature down, when the gap between the contacts should be ·006"—·017".

(*iii*) CLEANING CONTACTS

After long periods of service it may be found necessary to clean the vibrating contacts of the regulator. These are made accessible by slackening the screws securing the plate carrying the fixed contact. It will be necessary to slacken the upper screw (C) a little more than the lower (D) so that the contact plate can be swung outwards. Clean the contacts by means of fine carborundum stone or fine emery cloth.

Carefully wipe away all traces of dirt or other foreign matter. Finally tighten the securing screws.

(c) CUT-OUT ADJUSTMENT

(*i*) ELECTRICAL SETTING

If the regulator setting is within the correct limits, but the battery is still not receiving current from the generator, the cut-out may be out of adjustment, or there may be an open circuit in the wiring of the cut-out and regulator unit.

Remove the cable from the terminal marked A on the control box (ensuring that the bared end does not come into contact with the chassis). Remove the voltmeter lead from the D terminal of the unit and connect it to terminal A. Run the engine as before : at a fairly low engine speed, the cut-out should operate, when a voltmeter reading should be given of the same value as that when the voltmeter was connected to terminal D.

If there is no reading, the setting of the cut-out

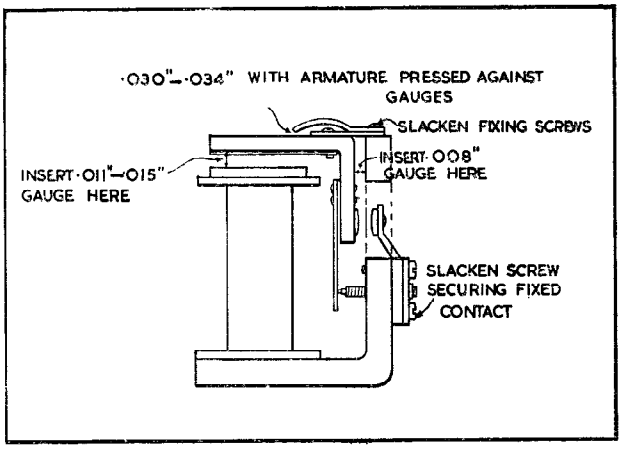

Fig. 10.
Mechanical setting of cut-out

may be badly out of adjustment and the contacts not closing. To check the voltage at which the cut-out operates, remove the control box cover, and connect the voltmeter between the D terminal and earth. Start the engine and slowly increase its speed until the cut-out contacts are seen to close, noting the voltage at which this occurs. This should be 12·7 — 13·3 volts for 12 volt sets or 6·3 — 6·7 volts for 6 volt sets.

If operation of the cut-out takes place outside these limits, it will be necessary to adjust. To do this, slacken the locknut on the cut-out adjustment screw and turn the screw in a clockwise direction to raise the voltage setting or in an anti-clockwise direction to reduce the setting, testing after each adjustment by increasing the engine speed until the cut-out is seen to operate, and noting the corresponding voltmeter reading.

Tighten the locknut after making the adjustment.

(*ii*) MECHANICAL SETTING

If for any reason the cut-out armature has to be removed from the frame, care must be taken to obtain the correct gap settings on reassembly. The correct settings can be obtained as follows:

Slacken the two armature fixing screws and also the two screws securing the fixed contact. Insert a .008" gauge between the back of the armature and the cut-out frame, and a .011"-.015" gauge between the core face and the armature. (A .005" brass shim is fitted to the underside of the armature, and the gap must be measured between the core face and the underside of this shim. On earlier cut-outs, fitted with a stop rivet instead of a shim, the gap between the core face and the armature itself—not the stop rivet—must be set to .016"—.020".)

Press the armature down and back against the two gauges and tighten the armature fixing screws. With the gauges still in position, set the gap between the armature and the stop plate arm to .030"—.034".

Remove the gauges and tighten the screws securing the fixed contact. Insert a .025" gauge between the core face and the armature (.030" for earlier cut-out with stop rivet.) Press the armature down on to the gauge. The gap between the contacts should now measure .002"—.006". Adjust the gap, if necessary, by adding or removing shims beneath the fixed contact plate.

(*iii*) CLEANING CONTACTS

If the cut-out contacts appear burnt or dirty, place a strip of fine glass paper between the contacts — then, with the contacts closed by hand, draw the paper through. This should be done two or three times with the rough side towards each contact. Do not use emery cloth or a carborundum stone for cleaning cut-out contacts.