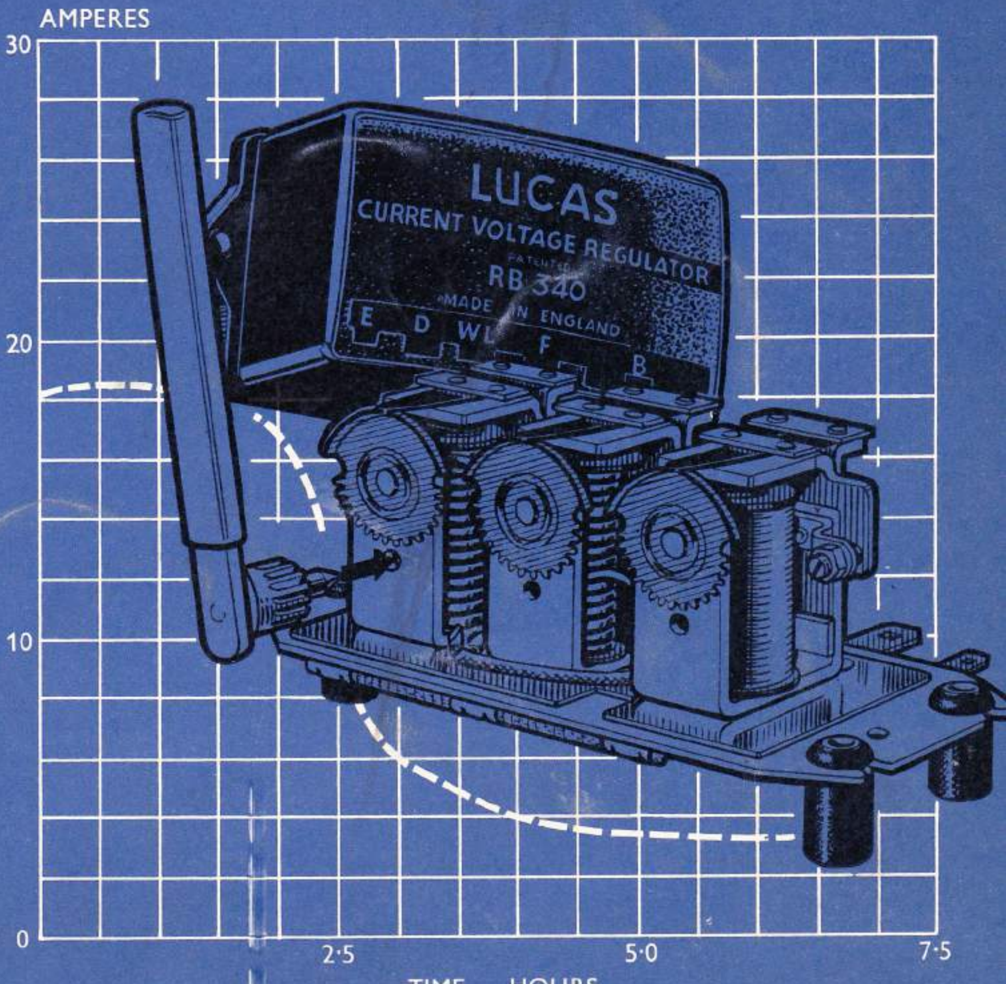
GENERATOR OUTPUT CONTROL

LUCAS

OPERATION · CONSTRUCTION · SERVICING



LUCAS

TECHNICAL SERVICE

GENERATOR OUTPUT CONTROL UNITS

OPERATION—CONSTRUCTION—SERVICING

JOSEPH LUCAS (SALES & SERVICE) LTD · BIRMINGHAM 18

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INTRODUCTION

Both the Lucas Compensated Voltage and Current Voltage regulating systems are covered in the accompanying pages of this publication.

In the explanation of the working of Lucas generator output control units, certain abstruse technical considerations have been deliberately omitted, but these factors do, of course, have to be considered by Lucas engineers when designing the equipment. It should also be emphasised that our recommendations in regard to regulator open-circuit voltage settings should always be strictly adhered to if satisfactory working of the equipment is to be obtained.

Regulators are designed to suit the electrical equipment of each individual vehicle, *i.e.*, type of generator, lamp and accessory load, etc., and for this reason are **not** interchangeable as a whole. Always refer to a Lucas Interchangeability List before fitting a replacement.

The mention of any unit, or parts of a unit does not imply the availability of either the complete unit or spare parts for service purposes.

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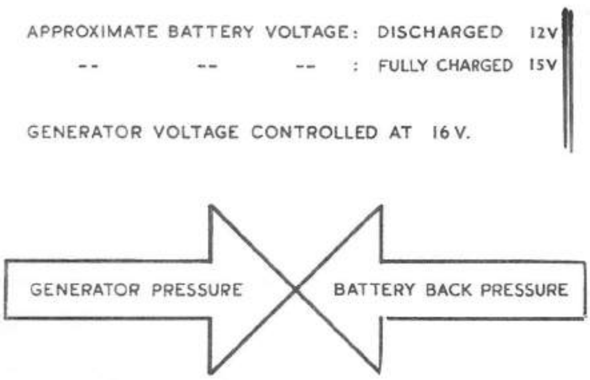
Working Principles

GENERATOR OUTPUT CONTROL

The generator with which we are concerned is a plain, shunt-connected machine. The main characteristic of this type of generator is that its output rises with increasing speed and is by itself totally unsuitable for application to the motor vehicle. Remembering that on modern vehicles the speed at which the generator is driven may be anything between 600—6,000 rev./min. the output could easily rise above the safe limits of the machine. Some control of the output is therefore necessary, when it is applied to a vehicle as the source of the battery charging current, if it is to function efficiently at all road speeds. To function efficiently it must not only be controlled over the speed range but also give an output which varies according to the load on the battery and its state of charge.



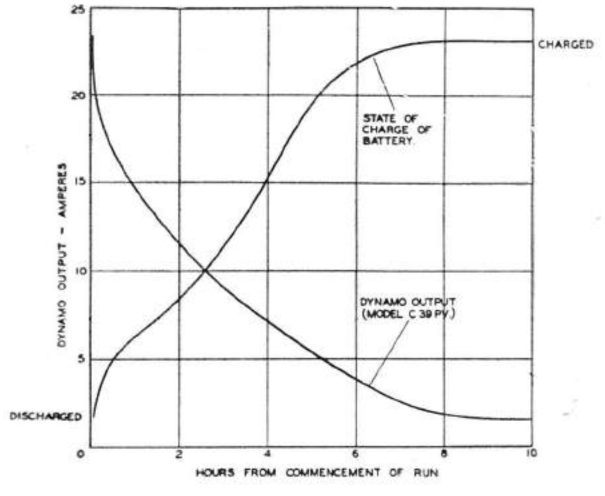
CONSTANT VOLTAGE CONTROL

The answer to the problem of how to control the generator output, so that at all times the battery is being correctly charged and the generator kept within its rated output, is the fact that the battery voltage (and consequently the back E.M.F.) varies according to its state of charge. If now we could control the generator terminal voltage at a pre-set figure over a wide speed range, we should have a variable voltage at one end of our charging system and a constant voltage at the other. The current flowing in this charging circuit would therefore vary with the varying terminal voltage of the battery, i.e., with its state of charge. The difference between the battery terminal voltage and the generator terminal voltage would be appreciable when the battery was in a low state of charge, getting progressively less as the battery reached its fully-charged state. If the pre-determined voltage at the generator terminals has been correctly set, in theory we shall arrive at a state where the battery terminal voltage in its fully charged condition will exactly equal the generator terminal voltage. At this point, no current will flow through the charging circuit, as the back E.M.F. of the battery will equal the terminal voltage of the generator.

CHARGING CHARACTERISTICS

The graph below shows how the charging rate falls as the battery reaches its fully-charged state, becoming a trickle charge, in this case of 1 or 2 amps., after 10 hours.

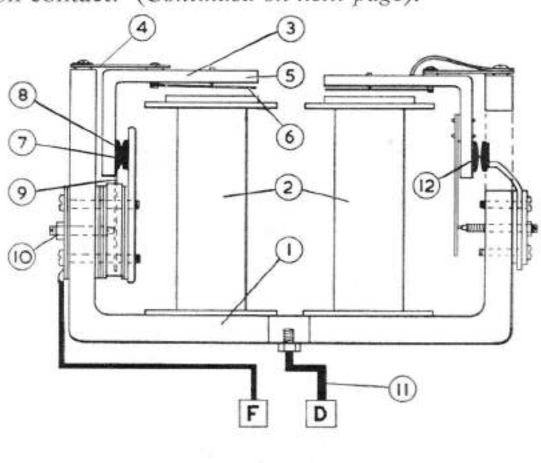
It is also clear that with this system of regulation "Voltage Control" the battery receives a high charge from the generator when it needs it most.



THE CONSTRUCTION OF THE CONTROL UNIT

As shown in the illustration below, the voltage control unit comprises an iron frame or "Yoke" (1) on which is mounted two iron bobbin cores (2) one (left) the voltage regulator and the other (right) the cut-out switch.

Consider the voltage regulator unit: a pivoted (bell-crank) armature (3) is attached by means of a spring blade (4) to the top of the iron frame. The horizontal member (5) lies immediately over the bobbin core and when this core is magnetised the flat member will be drawn down to it. In order to prevent it clinging to the core by residual magnetism a brass plate (6) or a copper button prevents iron to iron contact. (*Continued on next page*).



THE CONSTRUCTION OF THE CONTROL UNIT *(continued)*

On the vertical member of this armature a contact point (7) is fixed to line up with a stationary contact (8) insulated from the main bracket. Also on the vertical member of the armature is a spring blade (9) and this blade lines up with an adjusting screw (10). By means of this adjusting screw the pressure between the two contact points may be varied.

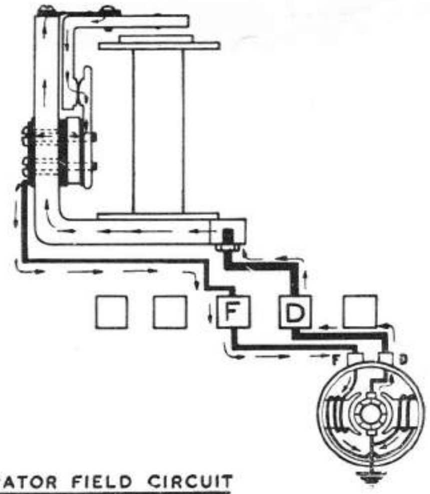
The main D terminal of the generator connects to the bracket as shown (11) and the generator field terminal F connects to the insulated contact point (8). When at rest the two contact points will be closed, thus completing the circuit between the generator armature and field.

The contact point assembly of the automatic cut-out switch (12) is of a generally similar construction but a single opening and closing operation disconnects and connects the generator from the battery. In the rest position the cut-out points are open whereas the field regulator points are closed.

THE GENERATOR FIELD CIRCUIT

The output of the shunt-wound generator is only obtained when the field circuit is joined in parallel with the armature circuit, i.e., when terminals D and F are connected together. By breaking this D/F connexion, that is, breaking the field circuit, the generator output will immediately fall off.

The illustration on the right shows the regulator frame and its connexion to the generator. By following the circuit from the generator D terminal, through the right-angle frame and moving contact to the fixed contact, and back to F at the generator, it can be seen that D is effectively joined to F through a pair of contacts. Spring tension holds the contacts together, thus keeping the D/F circuit closed.



GENERATOR FIELD CIRCUIT

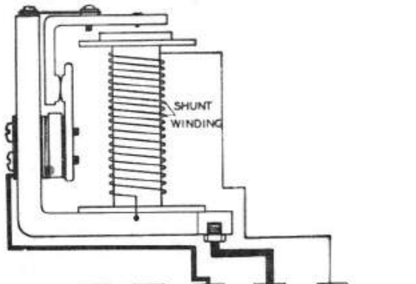
REGULATOR SHUNT COIL

The breaking of the contacts is controlled by an electro-magnetic relay whose winding is connected across the generator between terminal D and earth, that is, in parallel with the generator armature. Thus, as the generator voltage rises, this shunt winding will be energised, magnetising the core, and a point will be reached when the magnetic pull of the core is strong enough to overcome the spring tension and separate the contacts.

Immediately the contacts separate, breaking the field circuit, the voltage of the generator falls. In turn, the bobbin will lose its magnetic pull, release the moving contact and, with the field circuit again completed, the generator output will rise.

When in operation this becomes an alternate rapid opening and closing of the contacts at a frequency of between 15 and 30 times per second enabling a very fine regulation of the generator voltage to be obtained.

The voltage necessary to create sufficient magnetic effect to separate the contacts can now be controlled by the spring tension on the contacts themselves. Thus we can control our generator voltage at a pre-set figure by adjustment of the spring tension. And what is more, this control is independent of the speed at which the generator is being driven.



REGULATOR SHUNT COIL

THE REGULATOR POINTS RESISTANCE

Unfortunately, however, to break the field circuit when a fairly heavy current is passing causes considerable arcing across the contacts. Therefore a resistor must be placed in parallel with the contacts to protect them against the heavy inductive surges which occur as they open.

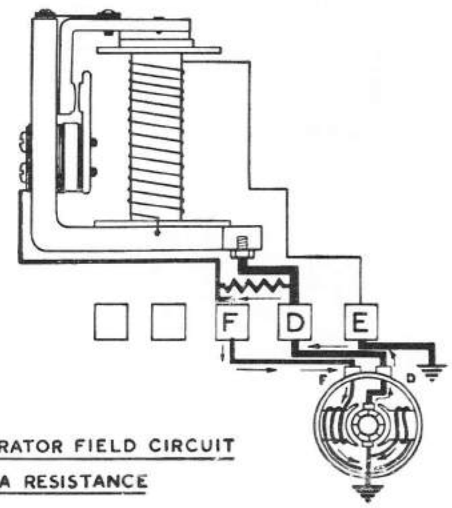
When the regulator contacts are closed the resistance is short circuited; it provides however an alternative path between D and F when the contacts are open, thus quickly limiting the induced field current.

THE CHARGING CIRCUIT

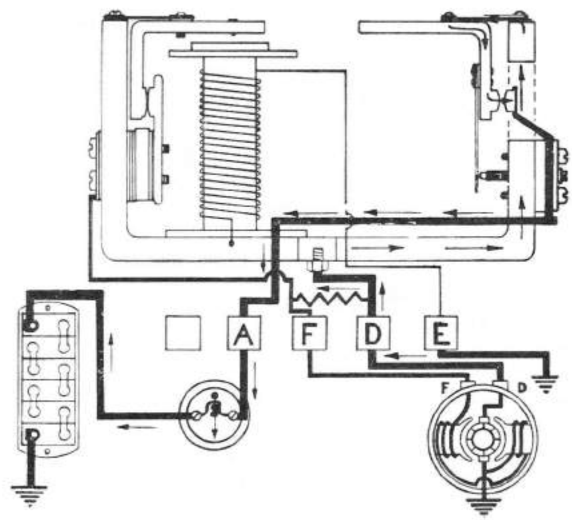
Let us now build-up a charging circuit from what we have discussed so far. All we need is an ammeter in series with our battery, and some sort of switch to disconnect the battery from the generator when charging stops. Otherwise the battery would discharge itself through the generator windings.

The switch is represented here by a pair of contacts, on the right of the illustration below.

Follow the circuit from the generator D terminal, along the extended regulator frame, through the switch and then through the ammeter to the battery. The circuit is completed via the battery and generator earths.



GENERATOR FIELD CIRCUIT
VIA RESISTANCE



THE CUT-OUT

In practice of course all this switching is done automatically by another electro-magnetic relay called a "cut-out". The winding for this cut-out is wound on a separate bobbin on the frame and connected across the generator between terminal D and earth. It is, then, a shunt or voltage winding as was the regulator shunt winding — but we stress that the regulator and cut-out are two separate units.

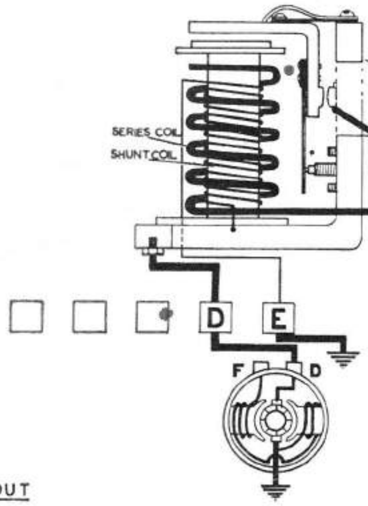
You will notice that the entire regulator frame is at generator potential; in more practical terms, the connexion from D of the generator is actually attached to the frame.

When the generator voltage rises sufficiently, the cut-out contacts are closed against spring tension by the magnetic pull from the cut-out bobbin and the circuit between the generator and the battery is thus closed.

When the generator speed or voltage is low or the engine stationary, the contacts will break, thus preventing current from the battery flowing back through the generator armature windings.

There is one important point to remember: all the charging current from the generator passes through the cut-out contacts and through a heavy "series" or current winding on the cut-out bobbin. This current assists the magnetic pull of the shunt winding, preventing the cut-out contacts from chattering once they have closed.

Also, when the generator stops charging, the momentary reverse current from the battery flows through this series winding, creating a magnetic field which opposes and therefore cancels the existing field, thus accelerating the opening of the contacts.

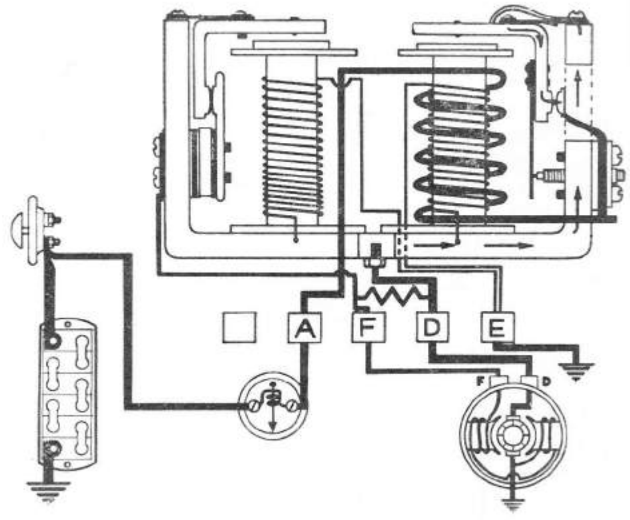


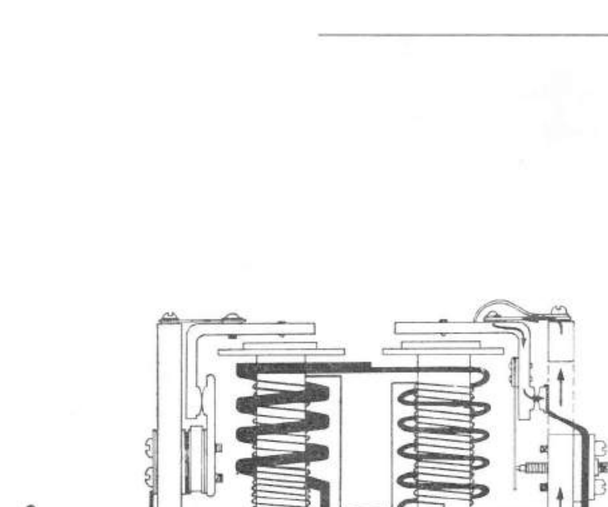
CUTOUT

CHARGING CIRCUIT: "CONSTANT VOLTAGE CONTROL"

The regulator and cut-out assembly, that is, the control box, would now look like this. Follow the circuit through, starting at the D terminal of the generator, from there to the D terminal of the box and then to the regulator frame, through the cut-out when the contacts close, through the heavy series winding on the cut-out and across to terminal A. This terminal is connected via the ammeter to the battery. The circuit is completed by the battery and generator earths.

Unfortunately, this simple "*constant voltage control*" system has one snag: it presupposes the use of a generator of very great generating capacity. Consider the case of a battery in a low state of charge, its terminal voltage will be low. If, in addition, a load is put on the battery, switch the headlamps on for instance, the voltage will fall still lower. Under such conditions, the generator will still endeavour to maintain the pre-determined voltage set by the regulator and consequently an extremely heavy current will flow in the charging circuit, owing to the substantial difference between the battery and generator voltages. In practice this current would be sufficient to burn out the armature of a standard automobile generator.





"COMPENSATED VOLTAGE CONTROL"

The Lucas "COMPENSATED Voltage Control System" overcomes this difficulty by automatically varying the OPERATIONAL voltage setting of the regulator, so that the difference between the generator and battery terminal voltages is never great enough to cause such a heavy current to flow that the generator would be damaged.

THE REGULATOR SERIES WINDING

In practice, this variation in the operating voltage of the regulator is brought about by adding another winding to the regulator bobbin. In other words, the charging circuit now continues from the cut-out series winding, not direct to terminal A, but through an additional "Series" winding on the regulator bobbin. This winding thus carries all charging current flowing from the generator to the battery and is wound so that its magnetic field assists that of the voltage or shunt coil of the regulator in pulling apart the regulator contacts. The heavier the current flowing, the greater will be the magnetic pull of the bobbin, and the sooner the contacts will open. Thus in effect we have lowered the voltage at which regulation occurs: our generator will then be working at an operational voltage which is varied according to the current flowing into the battery.

As the battery becomes discharged and its voltage falls the charging circuit voltage or "LINE VOLTAGE" will also fall. The action of the COMPENSATING or SERIES winding on the regulator is thus to limit the charging current to the maximum safe output of the generator.

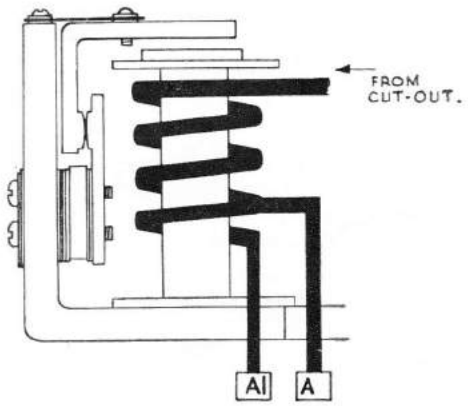
THE REGULATOR "LOAD TURNS"

If, when the battery is discharged, all the lights, etc., are switched on, a further drop in the line voltage will take place. To compensate for this, one or more additional turns will be added to the series winding and taken to a terminal marked A1 as shown. These are called LOAD TURNS and only become effective when the lights and any other external load are switched on.

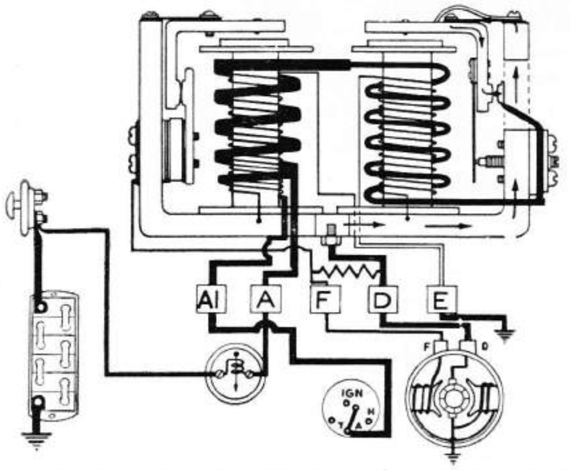
In appearance all the regulator units are similar and mechanically this is so. Also with a very few exceptions the regulator settings are the same.

So, in order to make this standard unit universally applicable to all types of generators and all models of vehicles it is necessary to vary the number of turns in the compensating and load windings. The compensator windings must be made to suit the generator and the load winding to suit the external loads, that is, the lighting, etc., for different vehicle layouts.

Thus each type of control box has an identification number which relates it to the correct generator and also the vehicle application. For this reason the control units must not be interchanged except as recommended in Lucas Interchangeability Lists.



REGULATOR SPLIT SERIES WINDING



THE MAIN CHARGING AND LOAD CIRCUITS (SHOWN IN HEAVY LINES)

CHARGING CIRCUIT: COMPENSATED VOLTAGE CONTROL

The illustration on the left shows the complete charging circuit incorporating a compensated voltage control regulator.

To trace the circuit start at the generator armature which is connected to the D terminal on the generator. This terminal is connected to the D terminal at the control box and a metal connecting strip joins the D terminal to the regulator frame, causing the frame to be at generator potential. Follow the arrows from this point, along the frame, through the moving contact, then to the fixed contact when the cut-out points close. The current is then able to flow through the series winding of the cut-out and through the main regulator series winding, being taken off at the tapping to the A terminal. The circuit then continues to the battery by way of the ammeter.

The circuit is completed through the vehicle chassis and so to the earthed brush of the generator.

The current for the load circuit is taken from the very bottom of the regulator series winding to the terminal A1 and from there to the main lighting and ignition switch.

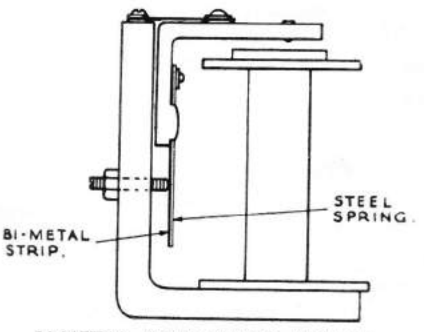
TEMPERATURE COMPENSATION

The regulators themselves, in addition to having compensating and load turns, are also TEMPERATURE compensated. This, like the regulator setting, is common to them all, but is not in any way adjustable.

Put in its simplest form, this temperature compensation aims primarily to make the generator voltage-setting follow the comparative battery voltage as it rises and falls due to marked temperature changes.

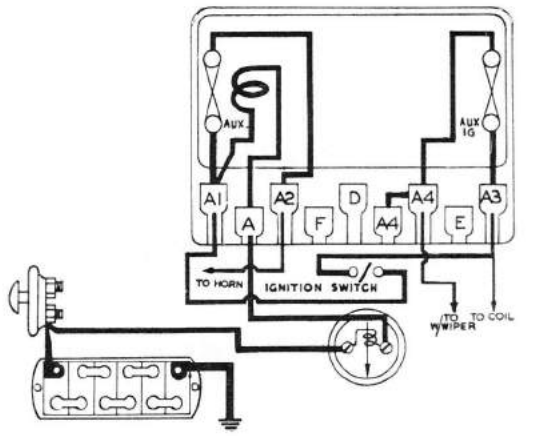
As the charge proceeds, the generator will heat up quickly. The temperature compensating feature enables an extra high charge rate to be applied to the battery with a cold generator and be maintained until the generator reaches its maximum working temperature, when the generator voltage is automatically reduced by the compensator and the charge proceeds at a normal rate.

To this end, as shown in the illustration, a bi-metal strip is fitted behind the contact tensioning spring. This consists of two strips of metal with different co-efficients of expansion welded together and the combination, when heated, will give a differing degree of expansion, causing the combination to bend as the temperature rises and resume its normal shape when the temperature falls. Having then applied such a combination of metals to the regulator adjusting spring, a spring tension is obtained which will vary automatically with the temperature of the equipment. The controlling voltage of the regulator will thus be higher when it is cold than when it is hot.



BI-METAL STRIP FITTED BEHIND CONTACT TENSIONING SPRING

Like the regulator, operation of the cut-out is temperature-controlled by means of a bi-metallic tensioning spring.



AUXILIARY IGNITION AND ACCESSORIES CIRCUIT

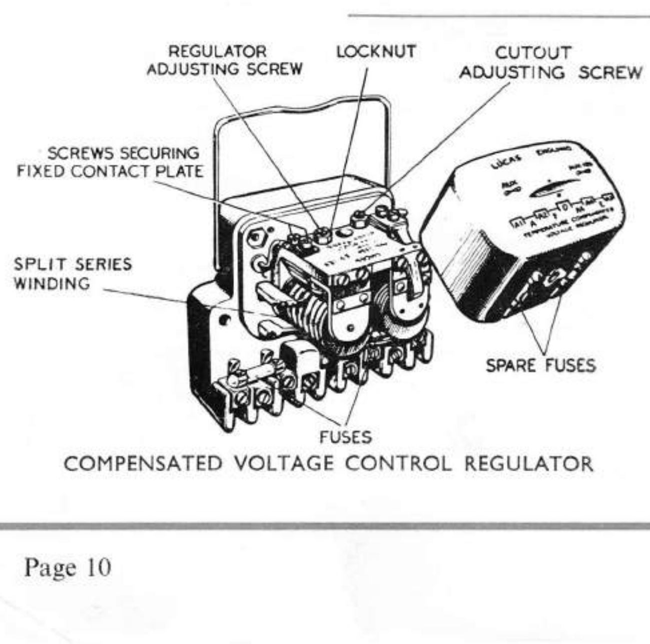
AUXILIARY CIRCUITS

The regulator unit itself is now complete, but there are other features of the control box which must be considered.

On some control boxes, additional terminals are provided to cater for accessories fitted on the vehicle, such as trafficators, windscreen wipers, etc.

Extra terminals on this type of box are, first: the A2 terminal. This, as you can see, is connected from the A1 terminal through a fuse marked "AUX" (auxiliary). Any accessories connected to this terminal will be fed from the battery via the ammeter through the load turns on the regulator bobbin, with a fuse in circuit.

Next, the A3 and A4 terminals. The A3 terminal is fed from the ignition switch, and is thus "live" only when the ignition switch is on. Both A4 terminals are then fed through a fuse from A3. Thus auxiliaries connected to A4 will only operate when the ignition is switched on. The feed to the ignition switch itself is from A1, i.e., through the LOAD turns.



COMPENSATED VOLTAGE CONTROL REGULATOR

THE COMPLETE CONTROL BOX

Most of the features discussed are indicated in this illustration, which shows the two auxiliary fuses, and the right angle bracket or yoke on which both regulator and cut-out are mounted, regulator left, cut-out right.

The regulator split-series winding is pointed out; and the screws for adjusting the spring tension on the regulator and cut-out.

Control Boxes — Symbols, Types and Application

IDENTIFICATION SYMBOLS

RB106/1	Regulator Box, incorporating LRT9/2 regulator. Shrouded terminals.
RB106/2	As RB106/1, but with built-in regulator.
RB107	Regulator Box, incorporating built-in regulator sealed cover.
RB108	As RB107, but with riveted cover. Some versions have rubber mounting studs.
RB310	Current Voltage Control Box, 3 terminals (B, F, D).
RB340	Current Voltage Control Box, 5 terminals (E, D, WL, F, B). Toothed adjustment cams.
RF95/2	Regulator Box, incorporating LRT9/2 regulator. External fuses.
✗RF95/3	As RF95/2, but incorporates built-in regulator.
RF96/2	Regulator Box, incorporating LRT9/2 regulator. No fuses.
RF97	Regulator Box, incorporating LRT9/2 regulator. Sealed cover.

RF95, 96, RB107, RB108, RB106/1 AND RB106/2 CONTROL BOXES

We can now review the Control Boxes themselves. In this particular section we will deal with compensated voltage control units only.

To begin with, what are their characteristic features? With the exception of the RF95/3, RB107, RB108 and RB106/2 the LRT9 regulator is used with a variety of series windings, but the voltage settings are sometimes special for particular applications.

THE RF95 CONTROL BOX

This control box comprises of a bakelite moulding upon which is mounted the LRT9 regulator and the cut-out assembly. The heavy series turns on the regulator are divided into the main and load compensating windings.

Two 35 amp. fuses are provided for the accessory circuits. The one fuse (right) is fed through the ignition switch. The second (left) has a direct supply through the load winding of the regulator.

The field points resistance are in the form of a cartridge placed on the underside of the base.

The terminal layout is indicated in the picture.

Later units of this type incorporate the RB built-in regulator and are known as the RF95/3.

THE RF96 CONTROL BOX

This control box also has a moulded base assembly upon which is mounted a similar LRT9 regulator and cut-out. Again various split-series windings are employed.

The 96 is a more recent design than the 95 and is primarily intended for use with the heavier output generators, in particular the RA5.

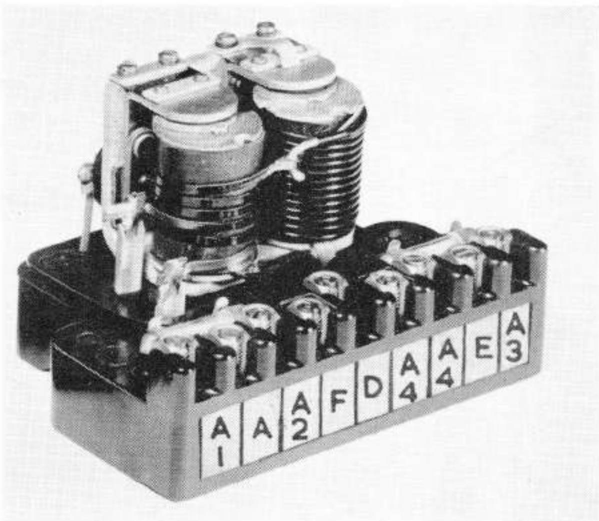
The split-series winding generally has fewer turns when used with the heavier output generators.

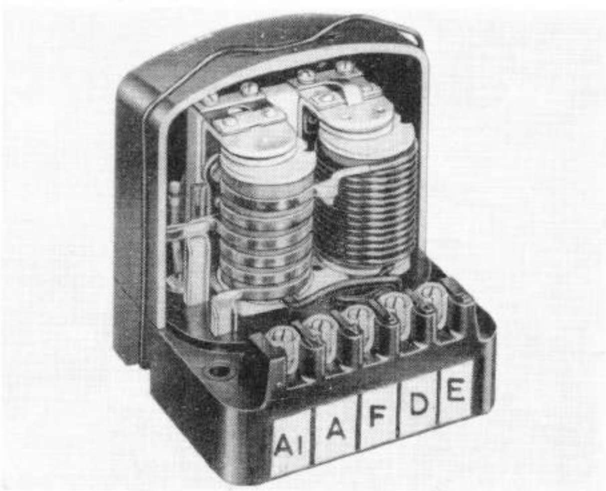
The simplified terminal board of the box is at once noticeable. (See illustration below).

Only terminals required by the regulator and cut-out are provided; commencing from the left.

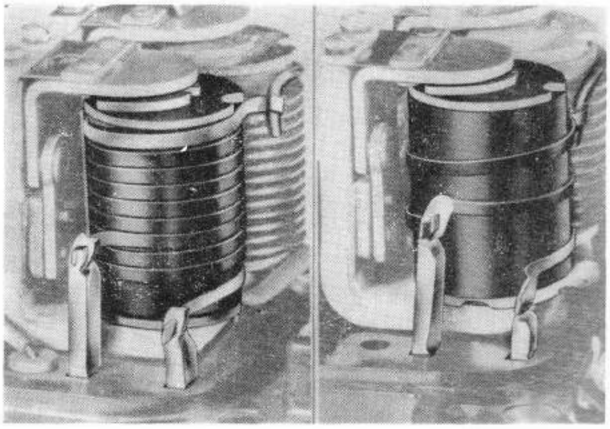
- A1 The supply for all external load; comes from the load turns of the split-series winding.
- A Comes from the main compensating turns of the series winding.
- F Wired to the generator field terminal.
- D Wired to the generator main terminal.
- E For the earth connexion from the LRT9 assembly.

One or more independent fuse boxes can be fed from the A1 terminal according to car manufacturers' requirements.





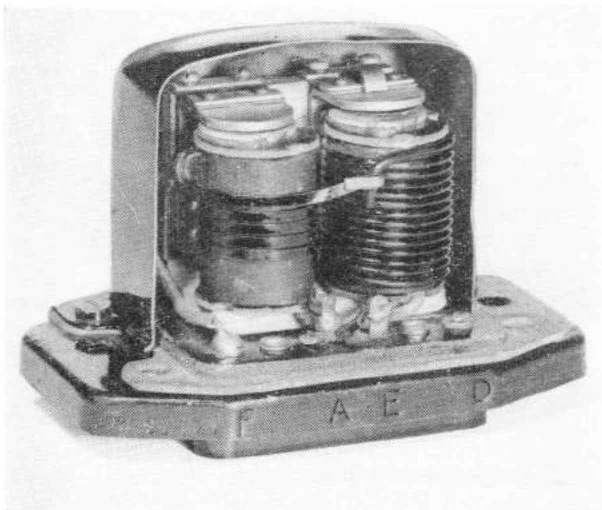
THE REGULATOR SPLIT-SERIES WINDING



You may have noticed that the number of series turns on the regulator bobbin varies considerably, generally, the higher the output rating of the generator, the fewer the series turns required. With the RA5 for instance, the high output generator which was used by Rolls Royce and Bentley, the regulator split-series winding has only 1 main turn, and 1 load turn.

At the other extreme, the regulator used with the fully enclosed, low output generator on the "Fordson" tractor has 6 main and 3 load turns.

THE RF97 CONTROL BOX



This is a fully enclosed metal box assembly, and was designed expressly for use in exposed working conditions. It was thus well suited for marine and tractor work.

The LRT9 regulator-cut-out assembly used is fitted with a "Pellet" type resistance mounted on the back of the regulator frame and inside the box. Connexions to the box are made by means of "plug-in" terminals, thus keeping the unit watertight and dustproof.

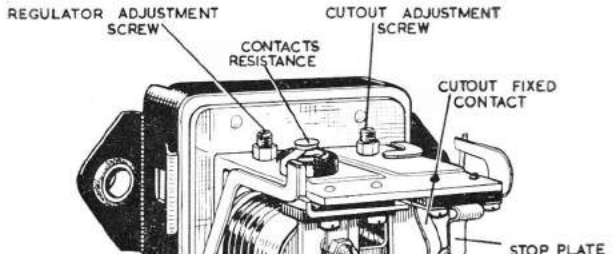
The regulator series winding, you will notice, is not a split winding. In other words, the box is not designed to provide compensation for a lighting and accessory load, but for use where the generator output is mostly required for charging the battery only.

The unit is sealed by means of a Langite Gasket visible in the picture and the cover is riveted down.

In the event of it being necessary to open the box the rivets have to be drilled out and the cover re-assembled and properly re-tightened by means of 2BA or similar screws and nuts.

The change from a cartridge to a pellet type resistance was introduced to enable the resistance to be included within the sealed cover and thus prevent corrosion and damage from exposure.

The unit is produced in both 12 volt and 6 volt and mostly applied to tractors.



THE RB107 CONTROL BOX

This control box was designed to replace the RF97. It was designed to give greater ease of adjustment and maintenance when fitted to tractors and motor cycles and is specially applicable to marine work. Its electrical operation is the same as other compensated voltage control regulators.

The main constructional changes concerned the cut-out and regulator. Both were redesigned and the contacts positioned above the bobbins.

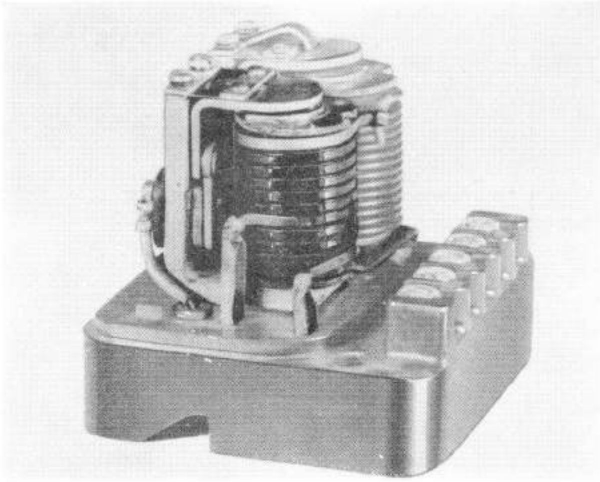
THE RB106/1 CONTROL BOX

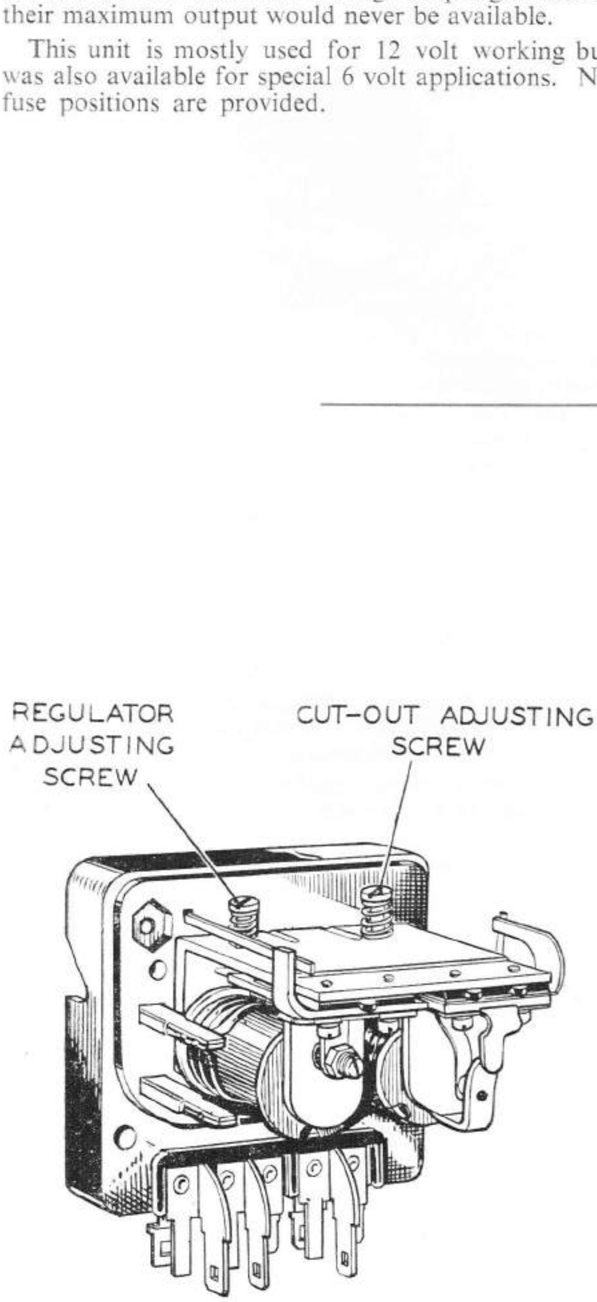
This control box is similar to the RF96, but was designed for use with the higher output generators C45PV5 and C39PV2. It may have a series compensating winding consisting of only one main turn and one load turn.

Neither the RB106/1 nor the RF96 are suitable for use with the lower output, fully enclosed generators, as the latter, in trying to maintain the regulation voltage with little series compensation, would be working outside their rated output and would thus over-heat.

On the other hand, if the older RF95 with more series turns were used with the high output generators, their maximum output would never be available.

This unit is mostly used for 12 volt working but was also available for special 6 volt applications. No fuse positions are provided.





THE RB106/2 — CONTROL BOX

The illustration on the left shows the latest pattern RB106/2 which is used on the majority of present-day cars. It has the same electrical operation as the RB106/1.

The main difference lies in the mechanical arrangement of the cutout and the voltage regulator. The contacts are now fixed above the bobbins.

As shown, "Lucar" terminal blades are being fitted in place of the grub screw type terminals previously employed.

In addition, the regulator and cut-out electrical setting adjusters are locked with a compression spring located behind the head instead of with a locking nut.

*A1 One 17.5 amp. and one 35 amp. blade.

*A As for A1.

F One 17.5 amp. blade.

*D As for A1. The 17.5 amp. is for W/Light connexion, the 35 amp. for main generator lead.

E One 17.5 amp. blade.

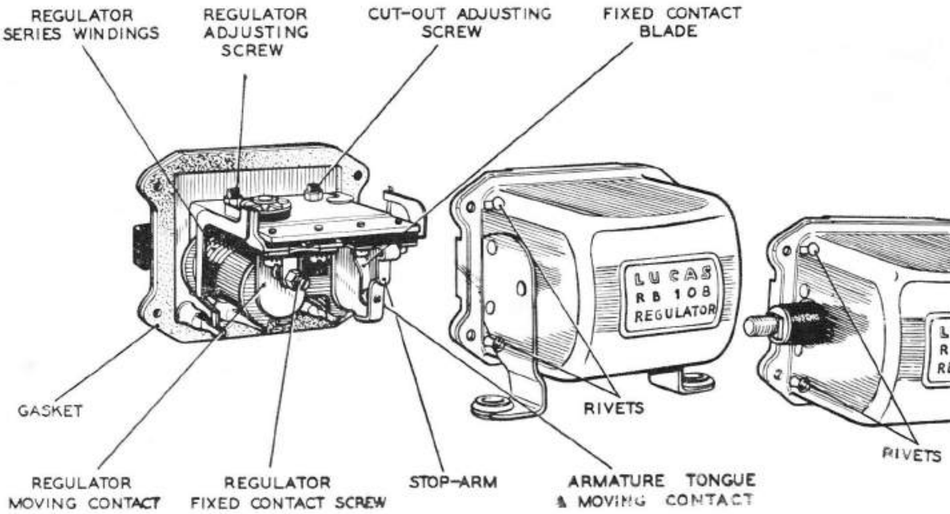
*Inhibitor tags are fitted in order to prevent crossed connexions at these terminals. The inhibitor is attached to the female portion on the wiring harness.

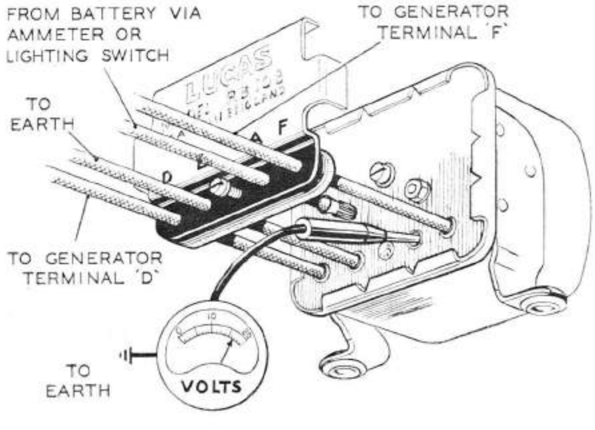
CONTROL BOX MODEL RB108

This unit is fitted to tractors, motor cycles and stationary engines. Internally, it is identical with control box model RF97 but externally, there are differences in the methods of securing the cover and of the mounting of the unit. Some units are fitted with the moulded rubber shockproof mounting studs. Others are arranged for foot or bracket mounting, see illustrations below.

On earlier units the cover was secured to the base by means of four rivets and rolling over of the edge of the cover. On present day units the cover is rolled over the base edges.

Because of the "rolled over" cover a new method of checking the O.C.V. was devised, see illustration below.





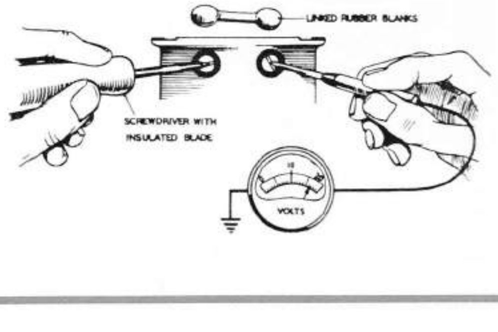
If the positive lead of test voltmeter can be fitted with a suitable probe to enable it to be inserted into the "A" terminal socket, then the open-circuit voltage can be checked without having to remove the cover, see illustration on left.

If, of course, any mechanical or electrical adjustment is necessary the cover will have to be removed.

LATER RB108 REGULATOR ADJUSTMENTS

We must add, however, that the latest RB108 Control Boxes have two holes in the cover. So that it is unnecessary to remove the cover to adjust the regulator and cutout assemblies.

However, when the Control Box is in position on the vehicle, the two holes are sealed with rubber bungs to prevent the entry of dust and moisture.



ADJUSTMENTS IN SERVICE

There is only a limited amount of service work possible for the motor engineer who will usually require to work with the components *in situ*.

The performance of the regulator may be affected by three factors:

(1) Maladjustment of electrical setting, usually the result of tinkering adjustments.

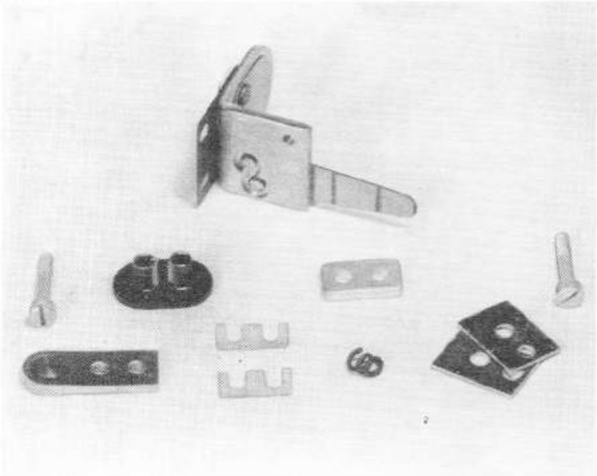
(2) Oxidation of the points due to normal usage.

(3) Incorrect air gaps invariably due to interference.

These faults can usually be corrected quite easily. The voltage can be set with the aid of a good Moving Coil Voltmeter as detailed in Part 3. The air gaps can be checked and the regulator points cleaned, as detailed in the following paragraphs.

LRT9 — REGULATOR CONTACTS SET

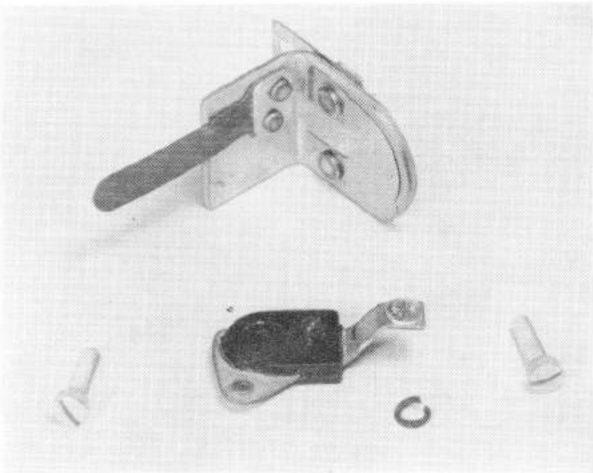
A word now about the Regulator Contact Sets themselves. There is only this one standard set used for the Voltage Regulator on all the LRT9 Regulator units.



Note. — The "E" shims shown in the above photograph are not used on later models of the LRT9, for adjusting the contacts gap. The correct gap being obtained by bending the fixed contact carrier with the aid of a suitably slotted bending tool.

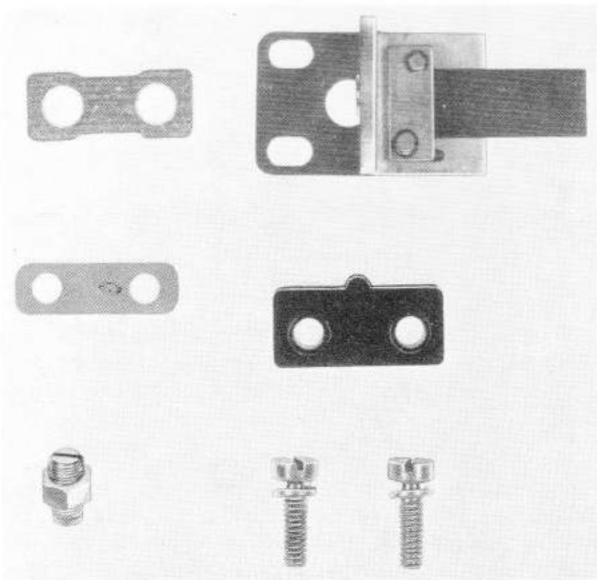
LRT9 — CUT-OUT CONTACTS SET

And here is the standard contact set for the Cut-out of the LRT9 unit.



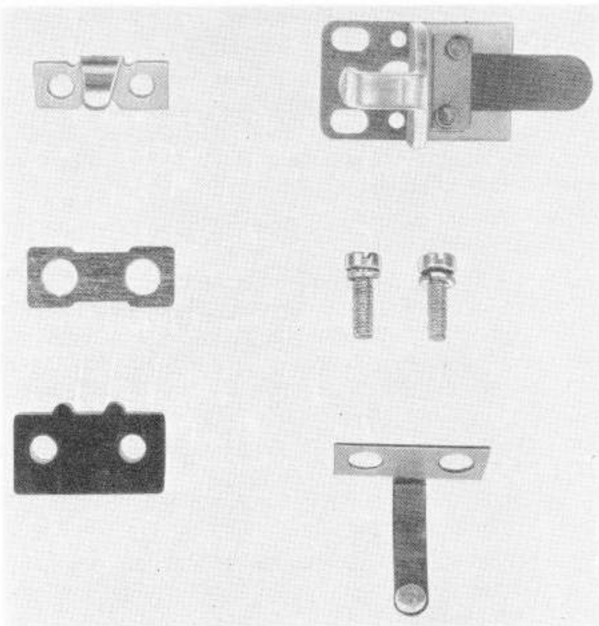
RB — REGULATOR CONTACTS SET

The contact set shown below is used on the latest type regulator fitted to the RF95/3, RB107, RB108 and RB106/2.



RB — CUT-OUT CONTACTS SET

And this is the contact set for the cut-out of this unit.



THE REGULATOR VOLTAGE SETTING

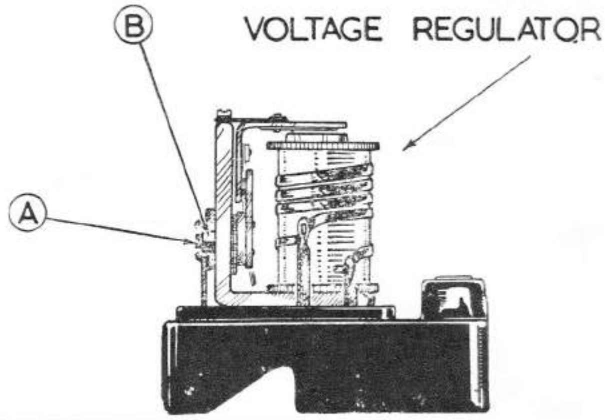
Adjustment of the voltage setting is very easily carried out by means of an adjusting screw, A, and lock nut, B, on earlier units. (A spring loaded screw is used on later production units).

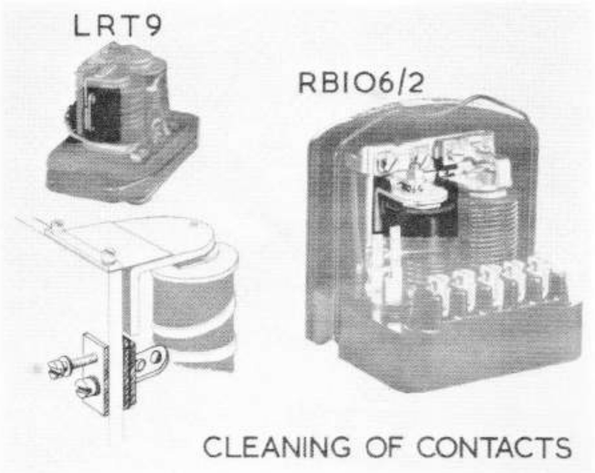
This dangerously simple adjustment can only be safely made with the control box connected to a generator. A good quality moving coil voltmeter should be used.

The operation as carried out in service is fully dealt with in "Testing the Charging System".

The regulator settings should always be checked before any interference with the contact points and air gaps.

There are standard settings for all conditions of working which will be outlined later.





CLEANING OF CONTACTS

CLEANING THE CONTACTS

The contacts on the latest type of control box are easily accessible, so that it is not necessary to adopt any special procedure before cleaning them.

Earlier control boxes, for instance, the RF95, RF96, RF97 and RB106/1 employed the LRT9 regulator, and it is impossible to clean the regulator contacts, until the contact plate is swung outwards.

The fixed contact plate is secured by two screws. These are both slackened, especially the upper screw (that is, the one farthest from the base plate). The contact plate is then swung outwards.

Different materials are required for cleaning the regulator and cutout contacts. The regulator contacts are made of tungsten, and should be cleaned with carborundum stone, or silicon carbide paper.

The cut-out contacts are made of silver, and should be cleaned with fine glass paper.

All dust should be removed with a cloth soaked in methylated spirits.

REGULATOR AIR GAPS (LRT9)

As indicated in this illustration letter "A" is the armature carrying the moving regulator point which is mounted on the spring blade and located by two screws in slotted holes. Thus the armature is moveable in relation to the regulator frame (B).

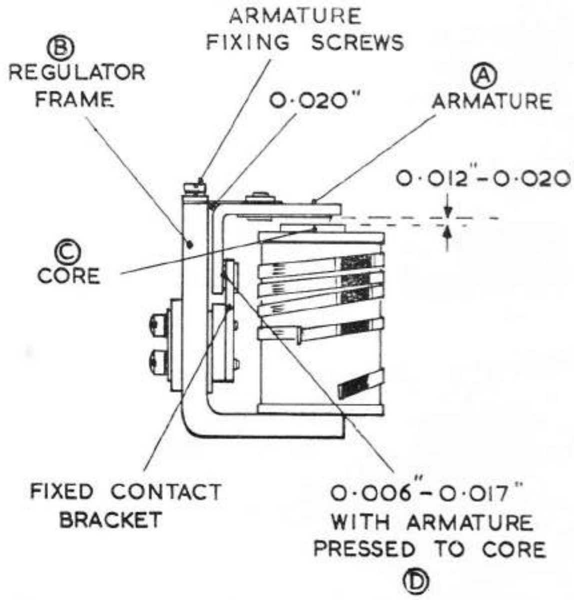
The bobbin core face is shown at (C) and the regulator points at (D).

There are three important dimensions:

(1) The air gap in the vertical plane between the regulator frame and armature which should be .020″. It is permissible for this gap to taper, either upwards or downwards, between the limits of .018″ and .020″.

(2) The bobbin core face to the horizontal member of the armature: which should be maintained at .012″ to .020″, with the gauge placed underneath the brass pip, or shim.

(3) With the armature pressed against the regulator frame, the contact point gap must be between .006″ and .017″.



Note. — On the latest pattern of the LRT9 regulator, adjustment of the contact gap is made by bending the fixed contact carrier with a suitably slotted bending tool. It will be found that shims are not now used for varying this gap, as on the earlier models.

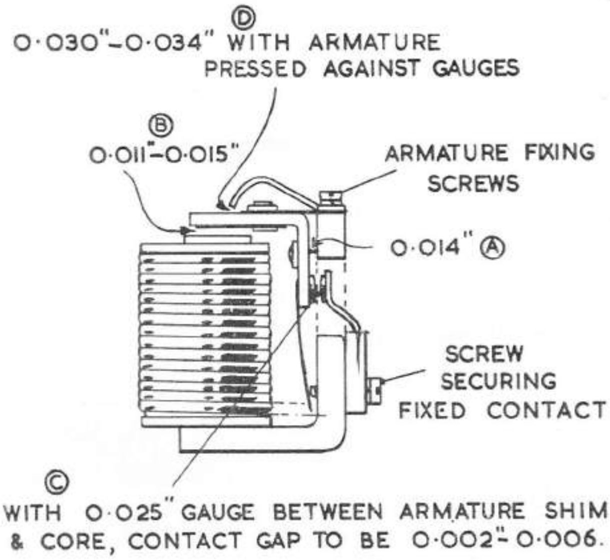
CUT-OUT AIR GAP AND ELECTRICAL SETTINGS (LRT9)

The cut-out switch seldom calls for any attention whatsoever.

It should be close at 12.7 to 13.3 volts for the 12 volt model and 6.3 to 6.7 volts on the 6 volt model and should re-open at between 8.5 and 10 volts on the 12 volt model or 4.5 to 5 volts on the 6 volt model, with a reverse current reading of between 3.5 and 5 amperes in both cases.

The correct air gaps are as indicated in this illustration:

A should be .014 inches.
B ,, ,, .011 to .015 inches.
C ,, ,, .002 to .006 inches.
D ,, ,, .030 to .034 inches.



REGULATOR CONTACTS RESISTOR

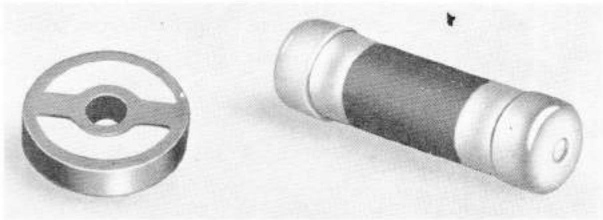
There are three standard types of contacts resistor used on the previously mentioned regulators to protect the contacts from damage by arcing.

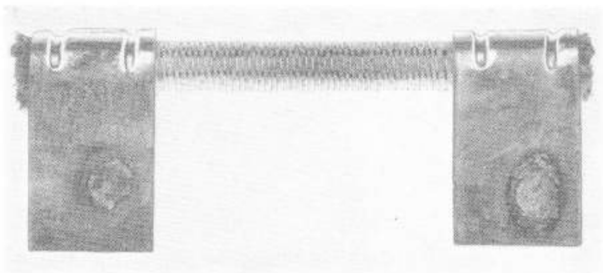
The CARTRIDGE type on the right is nominally rated at 63 ohms and is used on 12 volt regulators. The 6 volt version is nominally rated at 38 ohms.

The CARBON PELLET type on the left is generally built into sealed control boxes such as we use on tractors and motor cycles.

It is mounted on the back of the regulator frame and has a nominal resistance value of 38 ohms for 6 volt sets and 63 ohms for 12 volt sets.

The WIRE WOUND type below is nominally rated at 60 ohms for 12 volt units and 30 ohms for 6 volt units. This is used on the latest RB106/2.





RB107, RB108 AND RB106/2 CONTROL BOXES — REGULATOR AIR GAP SETTINGS

Adjustment of the regulator is obtained by altering the spring tension on the blade of the contact set by means of the adjusting screw B and lock nut A on earlier units or by means of a spring loaded screw on current units.

The air-gaps which are slightly different from the LRT9 can be re-set as follows:

Unscrew the fixed contact adjustment.

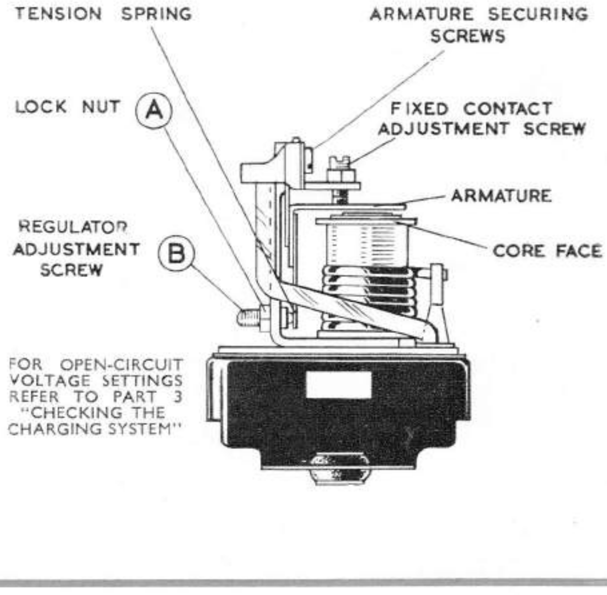
Unlock armature securing screws.

Insert .021″ feeler gauge between armature and core face.

Press armature down squarely against the gauge and re-tighten armature fixing screws.

With gauge still in position, screw the fixed contact down until it just touches the moving contact and tighten lock nut.

Reset the voltage in the normal manner.



RB107, RB108 AND RB106/2 CONTROL BOXES — CUT-OUT AIR GAP AND ELECTRICAL SETTINGS

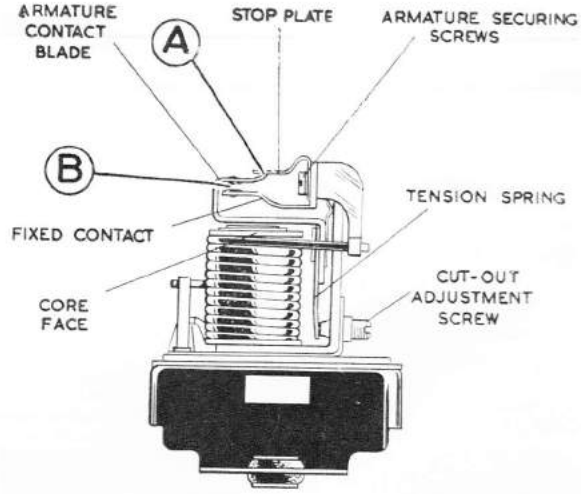
It is unlikely that the cut-out switch will require any attention or adjustment, but for general information the electrical settings are similar to those for the LRT9 Units:

	Cut-in Voltage	*Drop off Voltage*	*Reverse Current*
12 volt models	12.7 – 13.3	8.5 – 11.0	3.0 – 5.0
6 volt models	6.3 – 6.7	4.8 – 5.3	3.0 – 5.0

Note: By means of the bi-metal compensation device, cut-out settings remain substantially constant over a wide range of temperatures. Any small variations in setting due to changes in temperature result merely in proportionately small increases or decreases in the generator cutting-in speed. No temperature correction factors need therefore be applied to the above settings.

The gaps should be:

A = .025″ – .040″ with the armature pressed down.
B = .015″ – .020″ with the armature released. The cut-out fixed contact follow through should be between .010″ – .020″.



FUSES

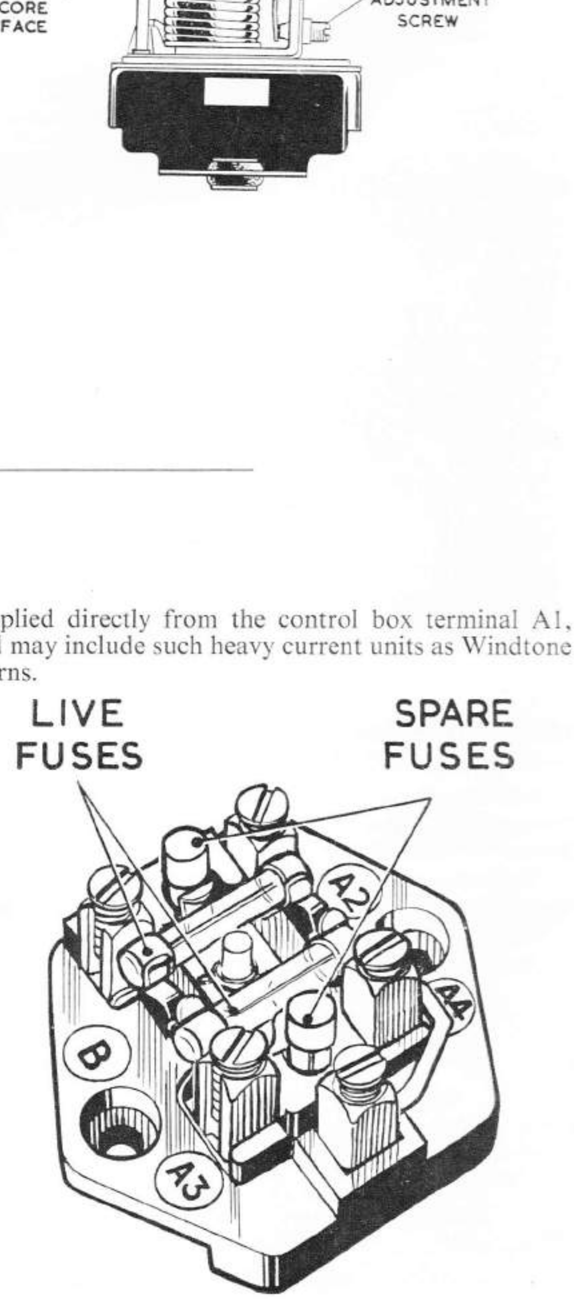
The modern system of assembled wiring looms has offered such protection to the *main* circuit wiring that safety fuses are not generally installed in these circuits.

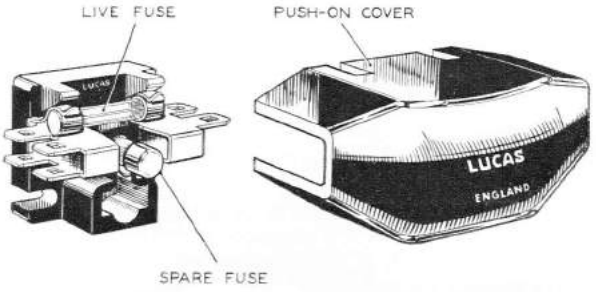
The most vulnerable points will be the accessory circuits, particularly when additional accessories are fitted.

It will have been observed that on the RF series of control boxes two accessory fuses are incorporated: one fuse generally known as the A4 fuse will protect those accessories which are directly controlled by the ignition switch. The other, the A2, will provide for the remainder of the accessories, not under the master control of the ignition switch.

The RB106 box has no fuses. With this box, it is convenient to employ a separate twin fuse base for the accessories as shown in this picture. Or, when required by the car manufacturer multiple fuse boards can be used.

The fuse base shown is the type FS6 which is normally equipped with a 35 and a 50 amp. fuse. The 35 amp. fuse on the right will protect those items connected through the ignition switch; the 50 amp. fuse on the left will serve the miscellaneous accessories supplied directly from the control box terminal A1, and may include such heavy current units as Windtone Horns.





FUSE UNIT MODEL 5JF

This unit incorporates the Lucar terminal blade and is for use in conjunction with the standard RB106/2.

As standard the unit incorporates a 35 amp. fuse.

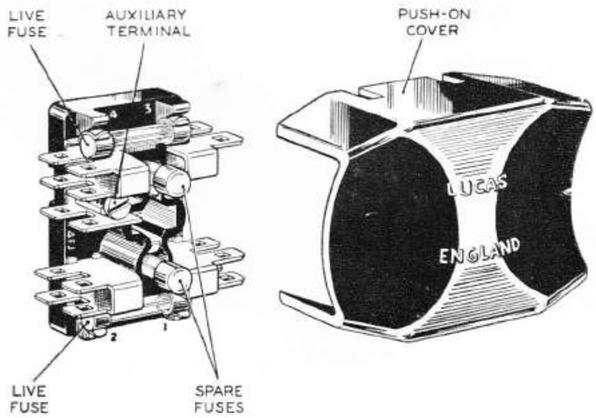
It provides for connecting six 17·5 amp. connectors.

FUSE UNIT MODEL 4JF

This unit is also used in conjunction with the "Lucarised" RB106/2, when two-way connexions are required.

It incorporates either two 35 amp. fuses or, one 35 amp. and one 50 amp. fuse, depending on the application.

Provision is made for connecting several 17·5 amp. connectors. A single grub-screw type terminal is also provided.

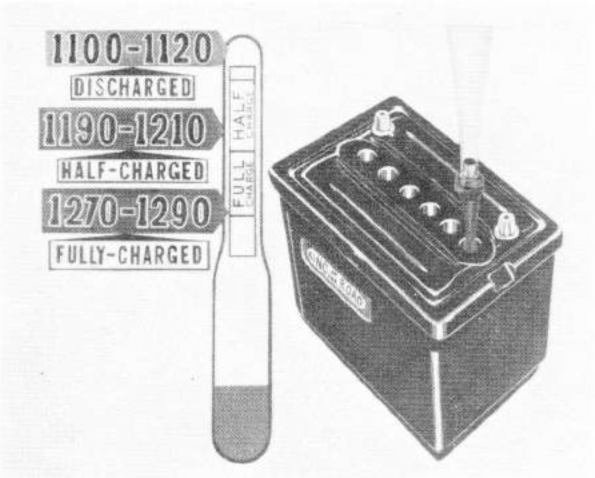


Checking the Charging System

SYSTEMATIC CHECKING

It must be understood that the circuit as a whole will not function correctly unless each of the individual units is in order, not forgetting of course the wiring between them.

In checking for a fault on the charging system, therefore, proceed according to a set plan; it is no good tackling the job haphazardly. The fault must be localised to a particular section, at the same time verifying the rest of the charging circuit on the vehicle.



HYDROMETER TEST

First check the specific gravity of the electrolyte in each cell. Remember, specific gravity is affected by temperature variation and the figures quoted in the table below are corrected to 80°F. (26.6°C.). Specific gravity readings taken at electrolyte temperatures other than this must be corrected before a true indication of the state of charge, of battery under test, can be determined.

Cell	*Home trade and climates ordinarily below* 80°F. (26.6°C.)	*Climates frequently over* 80°F. (26.6°C.)
Fully charged . .	1270—1290	1210—1230
About half-charged . .	1190—1210	1130—1150
Completely discharged	1110—1130	1050—1070

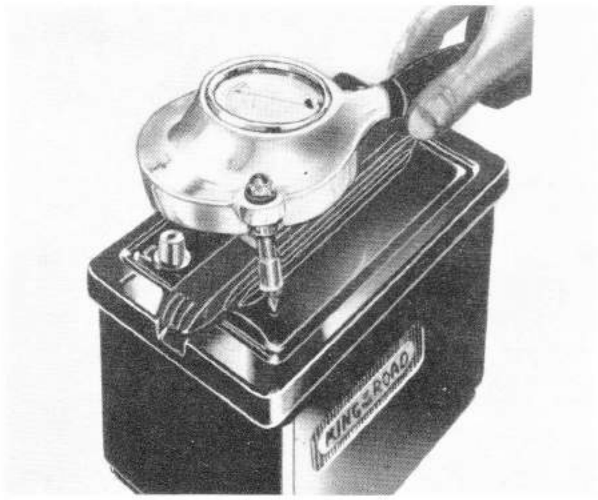
The battery should normally be at least half-charged.

THE HEAVY DISCHARGE TEST

The hydrometer test gives a fairly accurate account of the state of charge of each cell, but a further test must be made to make sure that the battery will supply heavy currents at the required voltage, the heavy starting currents for instance. For this purpose, a "heavy discharge tester" is used which puts an electrical load on each cell. The load, or resistance, takes at least 150 amperes from the cell in the case of batteries whose capacities at the 10 hour rate are below 75 aH, thus reproducing conditions similar to those existing when the starter motor is operated. If the hydrometer test showed the cell to be charged and if, under these test conditions, the voltage remains constant at approximately 1.5 to 1.6 volts, we can be sure the cell is serviceable. A rapidly falling voltage reading indicates a weak cell. The drop tester should be held in position for about 15 seconds per cell.

The same type of tester is used for motor cycle batteries, but a smaller load, this time of 12 amps. is adequate. A load of 300 amps. must be used for batteries whose capacities at the 10 hour rate is 75 aH and above.

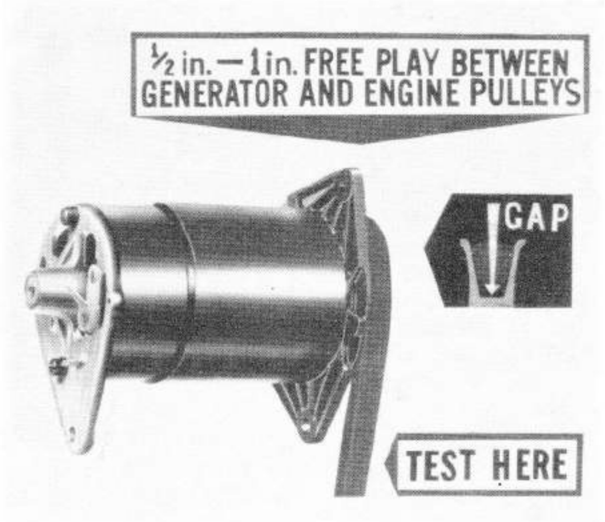
Having made certain that the battery is serviceable, next test the source of the charging current, the generator.

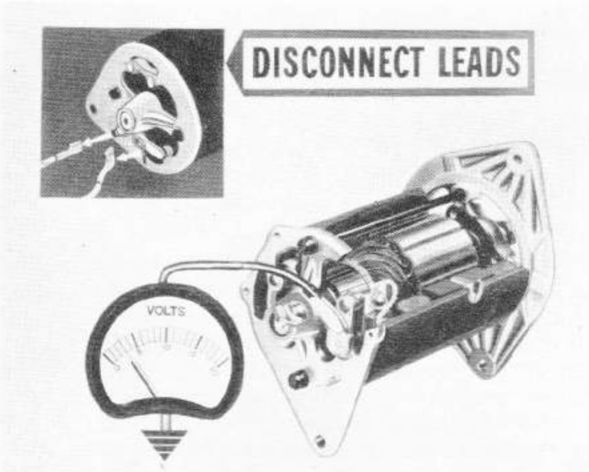


CHECKING THE DRIVING BELT AND GENERATOR BEARINGS

The first operation should always be to check the driving belt. After all the generator can hardly be expected to give of its best if it is not being driven correctly. There should be about half an inch movement in the belt, tested at this point. And remember that a belt that is excessively tight not only strains the generator bearings, but is also liable to damage the water pump gland. Make sure too that the belt is not frayed or oily, as this will cause slipping when the generator is under any appreciable load.

One last point, the "V" belt must not be bottoming in the pulley. If it is, either the pulley or the belt is worn. A check should also be made at this stage for side play or end float in the bearings. Make sure too that the generator leads are tight at the terminals.





TESTING THE ARMATURE AND BRUSH CIRCUIT

The first electrical test will be to see that the armature is operative and the brushes properly contacting the commutator.

The generator leads must be disconnected as you can see and a voltmeter connected between the D terminal and earth.

The generator should then be run up to charging speed approximately 3,000 rev./min. when a reading of between 2 and 3 volts should register on the voltmeter.

This reading is applicable to both 12 and 6 volt units.

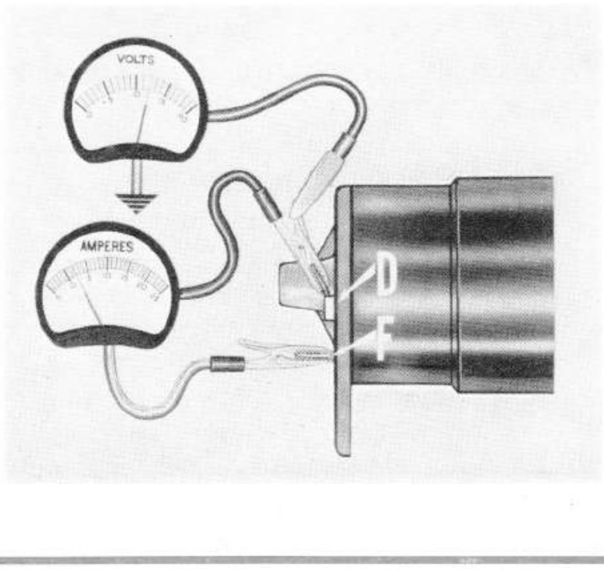
The earth lead can be attached at any convenient point preferably the one shown.

TESTING THE FIELD CIRCUIT

The next step is to ascertain that the field coils and leads are operative and not in any way earthed, shorted or open-circuited.

Connect an ammeter between the D and F terminals still leaving the voltmeter connected as in the previous test. Increase the engine speed slowly until the reading on the voltmeter is 6 or 12 volts, i.e., the normal battery voltage of the vehicle system. At this point the ammeter should not read more than 2 amps.

The ammeter reading should be the same for either system. Suppose the ammeter had registered 3 or 4 amps., instead of 2 amps. This reading could be caused by either an internal short or an earth on the field coils, which reduces the resistance of the field circuit and hence increases the current flowing in it. A zero ammeter reading would indicate an open field circuit.



CHECKING THE GENERATOR CABLES

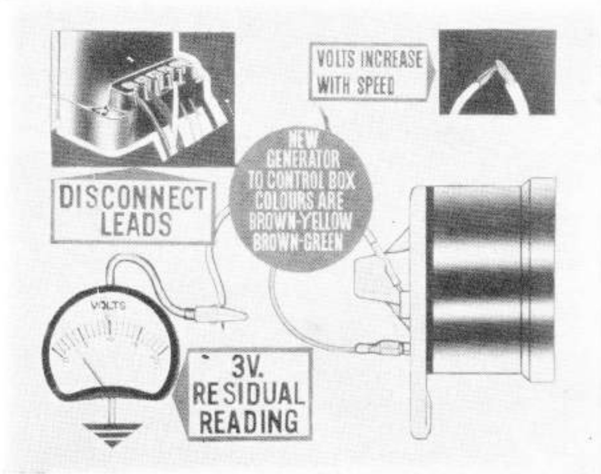
If the generator is in order the next step is to check the generator cables electrically, unless a complete visual examination is possible.

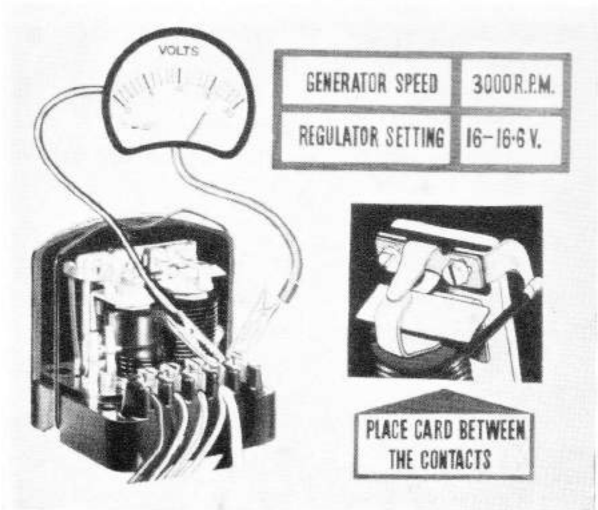
Repeat the last two tests to prove both the D and F cables as far as the control box.

First re-connect the cables at the generator and disconnect them at the control box terminals.

The picture shows the first test, namely the voltmeter between D and earth. If there is any doubt as to which is the D and F cables, obviously this test will prove the point. Only one of the two leads should give a voltage reading — the D lead. It will record the armature voltage previously obtained, if the lead is intact.

At this point it should be stressed, that if the D and F leads have been accidentally crossed, the regulator contacts will show very obvious signs of having passed excessive current. The points will be badly burnt and in some cases welded together. So be careful when re-connecting the leads.





CHECKING THE CONTROL BOX

The next check is at the control box, to see if regulation is taking place.

The regulation point, remember, is the voltage at which the generator is controlled. The check must be made with the battery open-circuited.

First insert a piece of dry card between the cut-out contacts. A voltmeter is then connected between earth and the regulator frame which you will remember is actually connected to the generator D terminal. Run up the generator to about 3,000 rev./min. The voltage reading will increase with rising speed, until the setting point of the regulator is reached. When the generator speed is raised to 4,000 rev./min. there should not be an increase in voltage of more than 0.5 for 6 volt machines, and 1.0 volt for 12 volt machines.

REGULATOR — STANDARD OPEN-CIRCUIT VOLTAGE SETTINGS

Ambient Temperature	*Pre-January, 1956, with .012″ bi-metal strip*		*Post-January, 1956, with .010″ bi-metal strip*	
	At 3,000 generator rev./min.		*At 3,000 generator rev./min.*	
	12 *volt*	6 *volt*	12 *volt*	6 *volt*
10°C. (50°F.)	16.3 — 16.9	8.1 — 8.5	16.1 — 16.7	8.05 — 8.45
*20°C. (68°F.)	16.0 — 16.6	8.0 — 8.4	16.0 — 16.6	8.0 — 8.4
30°C. (86°F.)	15.7 — 16.3	7.9 — 8.3	15.9 — 16.5	7.95 — 8.35
40°C. (104°F.)	15.4 — 16.0	7.8 — 8.2	15.8 — 16.4	7.9 — 8.3

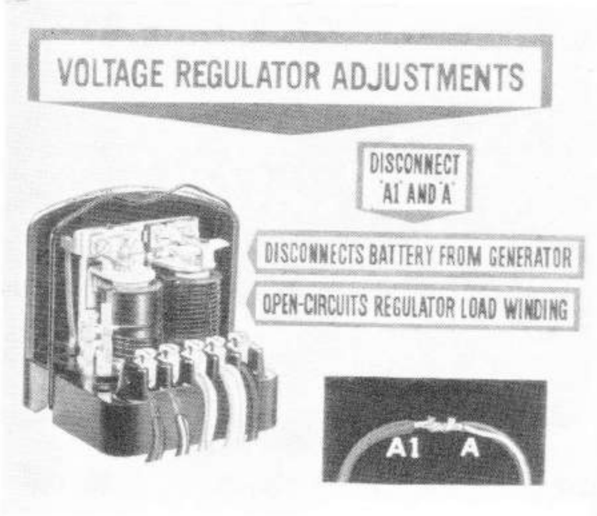
*Normal workshop temperature. Correction must be made if prevailing temperatures differ from the standard

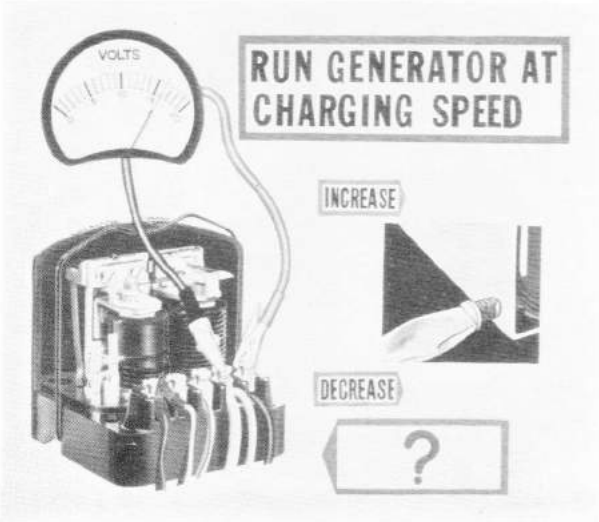
TO OPEN-CIRCUIT THE CONTROL UNIT — REMOVE "A" AND "A1" LEADS

The foregoing method of open circuiting the regulator will provide an approximate idea of the setting, but in order to get a true reading the following procedure should be adopted.

The A and A1 lead should first be removed from the terminals at the control box. This does two things: it disconnects the battery from the generator and puts the regulator load winding out of circuit. In other words, as we are only making a voltage adjustment, all we want in circuit is the voltage regulator shunt (Voltage-Coil). The series turns would affect the voltage setting and must be out of circuit if an accurate reading of the voltage setting is to be obtained.

The A and A1 leads will have to be twisted together after detaching from the control box terminals in order to provide a feed from the battery to the ignition coil to enable the engine to be run.





ADJUSTING THE REGULATOR SETTINGS

And now that the regulator is on open-circuit, its adjustment is very simple.

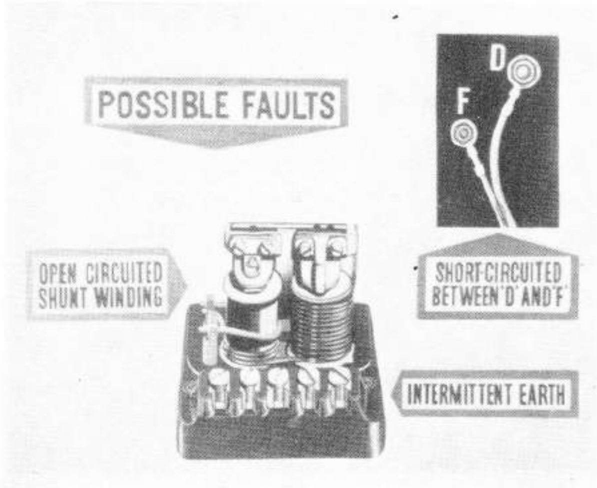
Run the generator at charging speed, 3,000 rev./min., with the voltmeter already connected between regulator frame (Gen. D) and earth. Turn the regulator adjusting screw clockwise to increase the voltage, or anti-clockwise to lower it. Reconnect A and A1 leads. Remove card from cut-out points.

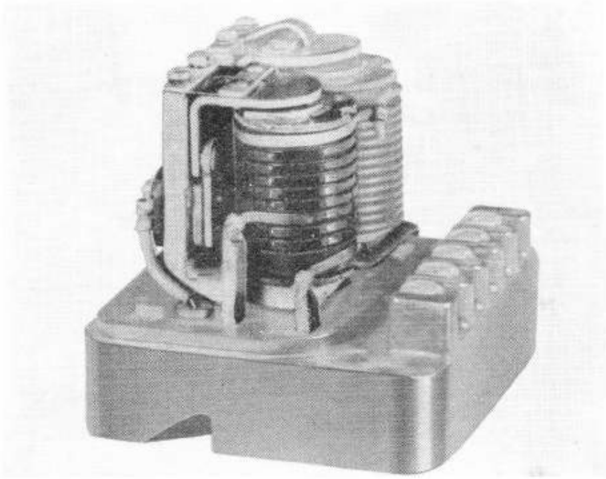
Do not set the O/C voltage to exceed the maximum of the tolerance given in the table of settings and temperatures.

POSSIBLE FAULTS — HIGH VOLTAGE READING

If turning the adjustment screw has no effect whatsoever on the O/C voltage and the reading is right off the scale, the most likely fault is a bad control box earth.

There are two other less likely possibilities: an open-circuit regulator shunt winding or a short between the D and F terminals. In all three cases there can be no regulation of the generator voltage. Regulation, you remember, depends on the shunt winding — and one end of this is connected to the control box earth terminal. Also, if the field and dynamo terminals are shorted at any point, neither the regulator points nor the resistance can ever be in circuit to limit the generator output voltage.





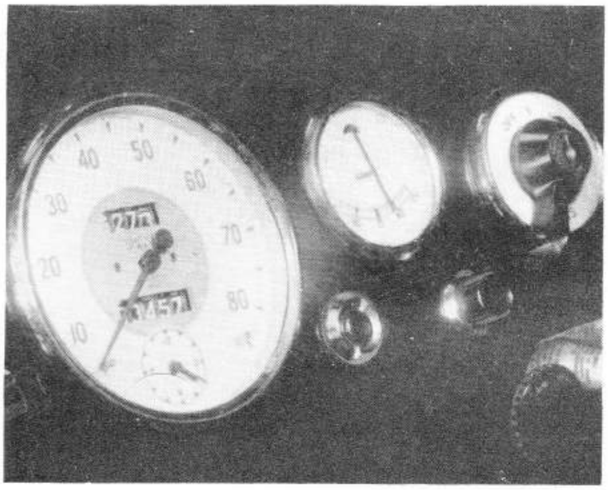
POSSIBLE FAULTS — LOW VOLTAGE READING

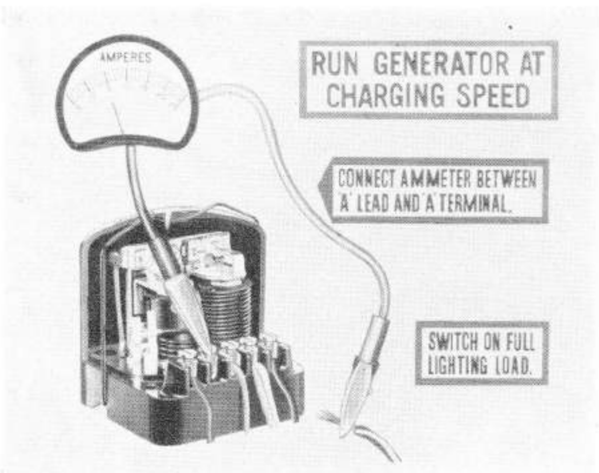
If on the other hand the regulator setting is found to be low and cannot be adjusted, take a look at the regulator contacts. In all probability they will be burnt and oxidised, thus making a good contact impossible and preventing the generator building-up its normal voltage.

If the burning is obviously excessive check the resistance or examine for crossed D and F leads either at the control box or generator.

WARNING LIGHT AND AMMETER

Finally check the operation of the warning light, the ammeter and the cut-out. And do not forget the wiring behind the panel, make sure there are no loose connexions or frayed leads. These can easily cause intermittent or complete failure of the charging system. The warning light for instance is connected directly to the control box D terminal and an earth on this cable would short circuit the generator output.





TO CHECK THE CHARGING CURRENT

If an ammeter is not fitted to the particular vehicle, the charging rate can easily be checked by connecting a test ammeter in series with the A lead. The most convenient point is at the control box.

To check the battery charging rate see that all switches are off, the charge should be approximately as shown in the table below.

Specific Gravity	*Amperes*
1270	5A or Lower
1250 or Lower	8A to 12 amps.
1200 or Lower	15 to 17 amps.

As a final check, switch on the full normal lighting load, i.e., Heads, Sides and Tail. With generator running at full charging speed the reading on the ammeter should lie between zero and approximately four amperes on the CHARGE side.

THE CHARGING CIRCUIT — COMPLETE

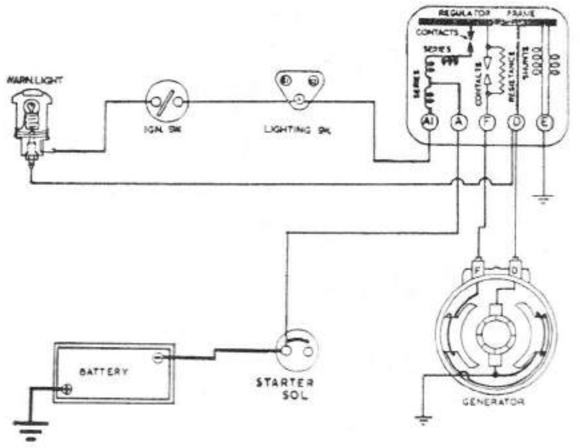
And just to remind you what we have been checking, here is a typical charging circuit.

The first check, you will remember, is made at the battery: the hydrometer and high rate discharge tests.

A check is then made at the generator and the D and F cables from it to the control box. First with a voltmeter between D and earth which checked the armature and brush circuit, and then an ammeter was added between the D and F terminals — to check the field current.

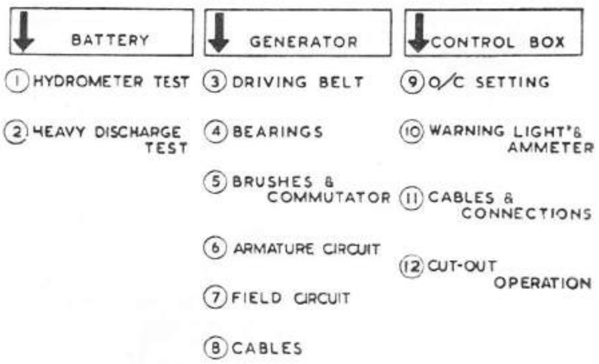
Then, at the control box, to check the regulator open circuit setting. To adjust this setting, the A1 and A leads are disconnected and joined together. We also made sure that the control box earth was good.

We then checked the operation of the cut-out and finally the warning light and ammeter. Remember too, the importance of good wiring and connexions throughout the circuit.



CHARGING CIRCUIT

CHECKING THE CHARGING SYSTEM



THE TEST ROUTINE

And finally, to summarise the whole procedure on the left is a list of the operations which should be carried out in the order shown.

Current-Voltage Regulators (RB 310, 6GC & RB340)

CURRENT-VOLTAGE CONTROL

The increasing number of electrical appliances now being fitted to the modern vehicle, many of which consume relatively heavy currents, has made necessary the introduction of a system of regulation more positive in its action than the compensated voltage system.

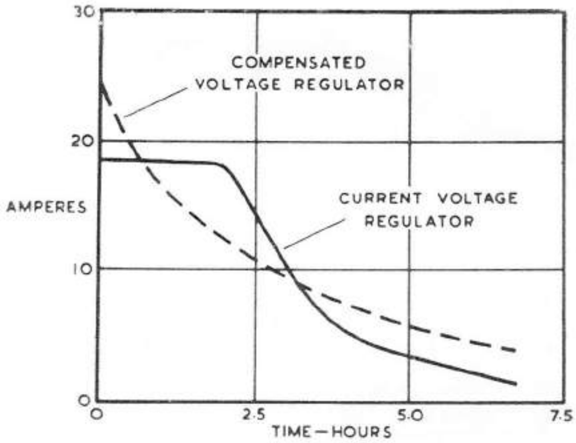
Current-voltage control of the generator *is* more positive because not only is the generator output controlled at a safe maximum, but this maximum output is used to full advantage, being available if necessary for a longer period at the beginning of the charge.

CHARGING CHARACTERISTICS

Assume our battery to be discharged, as shown by the broken line curve, with the Compensated Voltage Control System, charging commences at a relatively high rate, but quickly begins to taper off, after which, the charge steadily falls away as the battery voltage rises and finally becomes reduced to a "trickle charge".

With the Current-voltage Control System, however, the battery is charged at a uniform high rate, thanks to the *current regulator*, until the voltage of the circuit reaches a pre-determined figure, when the *voltage regulator* commences to operate and the charging current tapers off until finally only a trickle charge is delivered.

Having explained the essential differences between the two systems, let us look at our current voltage control boxes, the RB310, 6GC and RB340.

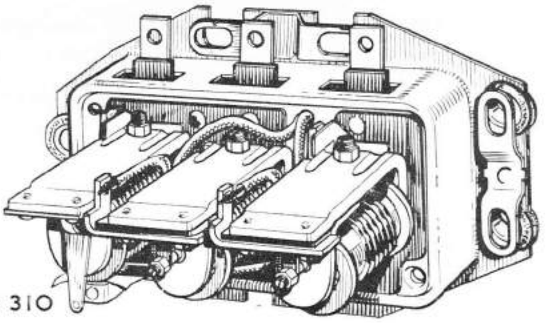


GRAPH COMPARING CHARGING CHARACTERISTICS ——— COMMENCING WITH DISCHARGED BATTERY

THE RB310 & 6GC CONTROL UNIT

These two units are identical mechanically, the only difference being that the 6GC consists of a type RB340 flat base assembly with RB310 working components. For the purpose of this description the diagrams we will consider will be of the RB310 unit.

The complete unit consists of a normal cut-out (on the left), but has two regulators: the current regulator in the centre, and the voltage regulator on the right. It is the series-wound current regulator which controls the sustained initial charging rate and the shunt-wound voltage regulator which takes command of the system when the current flowing in the charging circuit has diminished in value.



RB 310

HOW THE CONTROL UNIT FUNCTIONS

This control box comprises three components:

(a) A cut-out switch to connect and disconnect the generator and battery automatically.

(b) A current regulator which allows the generator to give its maximum continuous output for about one-third of the time necessary to recharge a flat battery.

(c) A voltage regulator which takes over control of the output for the last two-thirds of the battery charge and thus provides a charge tapering to a finish.

Each of the items which we have mentioned has its own separate circuit in the control unit:

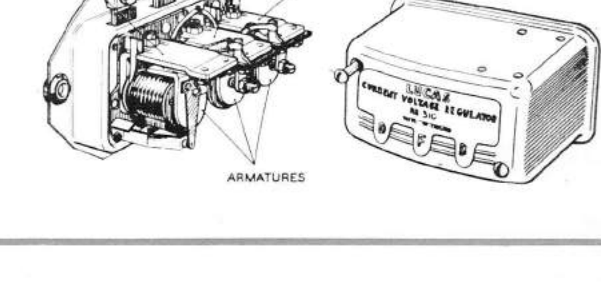
(1) The regulator and cut-out operating coil circuits.

(2) The main generator cut-out circuit.

(3) The field regulator circuit.

Let us study each component of the control individually after which it will be simple to follow out the overall method of operation and understand how the components combine.

First let us examine the mechanical build-up of the unit.



THE CONSTRUCTION OF THE CONTROL UNITS

The unit is built up from a metal base (1) upon which is fixed an insulating pad (2), mounting three iron angled frames each with an iron core (3) on which will be fixed a coil winding.

The Voltage and Current Regulator Units (on right and centre) are basically similar.

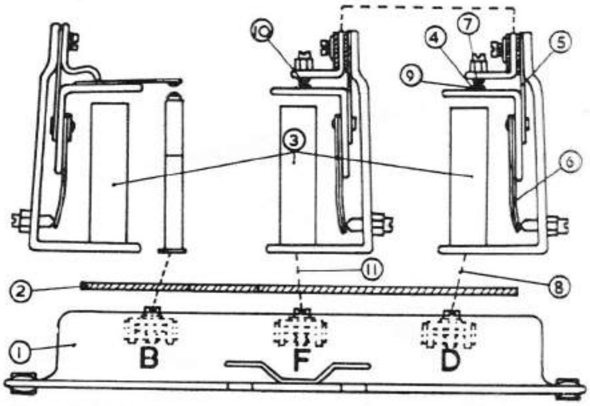
A pivot angle bracket (4) — the armature — on which is fastened one contact point is mounted by means of a spring blade (5) in metallic contact with the main frame. The horizontal member of the armature lies immediately over the bobbin core. On its vertical member a spring blade (6) is fixed downwards and coincides with an adjusting screw in the back of the frame. This armature is the moving member of the contact set. The fixed contact point is screw mounted on another and smaller bracket (7) and is also fixed to, but insulated from, the top of the main frame. By means of the setting and adjusting screws the pressure between the pair of contact points may be varied to provide the requisite voltage and current settings of the regulators.

The main D (Armature) terminal of the generator connects to the frame of the voltage regulator (8) and thus to the moving contact point (9). The fixed point (7) is interconnected with the fixed point of the current regulator (10) and the current regulator frame connects directly to the F (Field) terminal of the generator.

When at rest the two pairs of contacts will be closed thus completing the circuit between the generator armature line and the "field". In this condition the generator will charge, but immediately either of the contact pairs is opened by the magnetic pull from the coil bobbins, the field circuit will be opened and the generator will cease to charge.

When in operation this becomes an alternate rapid opening and closing of the contacts at a frequency in the order of 30 to 50 times per second, enabling a very fine regulation of the generator field to be obtained.

The contact point assembly of the automatic cut-out switch — left — is of general similar construction but a single opening and closing operation connects and disconnects the generator from the battery. In the normal position the cut-out points are open whereas both pairs of regulator points are closed.



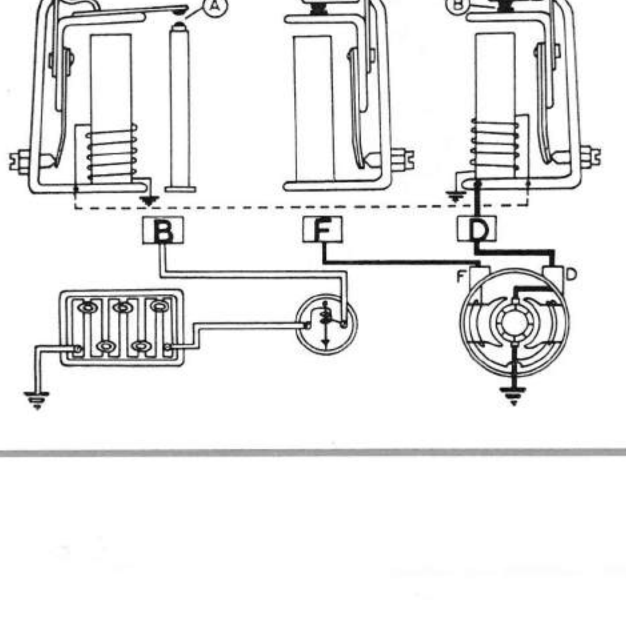
TEMPERATURE COMPENSATION

The main coils of the cut-out and voltage regulator consist of many turns of fine copper wire and, consequently, the ohmic resistance of these coils rises and falls as the temperature rises and falls — due in part to ambient working conditions and in part to the normal passage of current. In turn, this causes the operating current and therefore the magnetic pull on the armature to vary inversely with changes in temperature. Thus, to maintain the necessarily close operating limits expected of these units, some form of compensation is required.

The method adopted with cut-outs and all voltage regulators other than 24-volt units is to utilise a bi-metal strip either to supplement or to take the place of the armature tension spring — the hinge spring being of steel, copper coated in cut-outs and blue in voltage regulators. The effect of the bi-metal is to cause the spring force on the armature to reduce with rises in temperature and to increase with falls in temperature. This method also compensates for variations in battery voltage with temperature — a higher operating voltage being provided in cold weather.

With 24-volt units, it is customary to employ a wire wound series (or 'swamp') resistor in the voltage regulator shunt coil circuit to minimise the effects of temperature fluctuation — the resistor being of higher ohmic value than the coil and having a low temperature coefficient.

Current regulators are not compensated, the resistance of the operating coil being too low to vary significantly with changes in temperature.



OPERATING WINDINGS THE REGULATOR AND CUT-OUT

The electro-magnetic relays which operate the cut-out switch contacts (A) and the voltage regulator contacts (B) are energised or "excited" by coils of fine enamelled wire mounted on the respective bobbins and permanently connected across the generator main circuit, i.e., "in shunt".

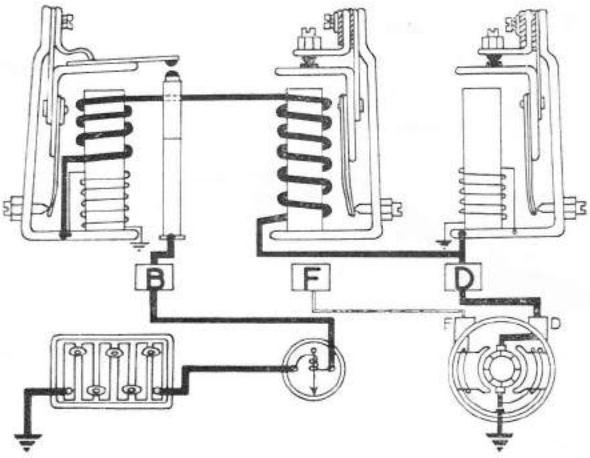
When the generator "builds" a sufficiently high voltage the current flowing in these windings induces a magnetic field in the cores of sufficient strength to pull down the armature and close the contact points, in the case of the cut-out, and separate them in the case of the voltage regulator.

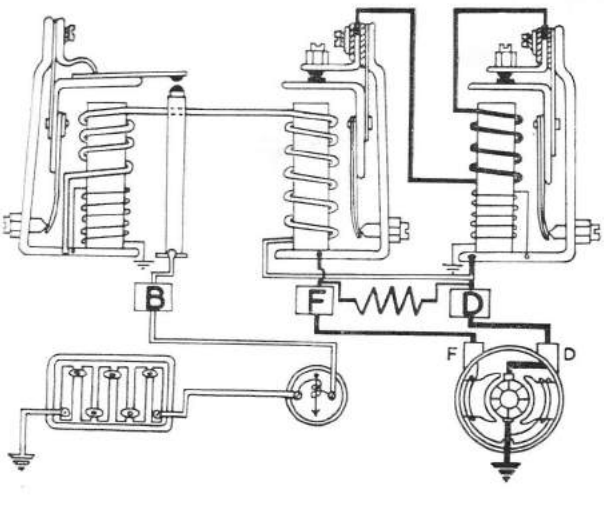
THE GENERATOR AND CUT-OUT CIRCUIT

The current path from the generator D terminal (or armature) is taken direct to the frame of the voltage regulator unit. From there a heavy gauge copper wire is taken to the current regulator and a specified number of turns of the conductor wound around the current regulator bobbin. The conductor is then taken to the cut-out bobbin where several turns are made before it connects to the moving cut-out point. From the fixed cut-out point the conductor terminates at the terminal (B) thus completing the current path from generator to battery.

The turns of this series winding on the cut-out bobbin are wound in the same direction as the previously mentioned shunt winding and so increase the pull, thus holding the contacts together tightly. The shunt coil closes the cut-out points at between 12.7 and 13.3 volts on the 12 volt system and current in the series winding holds them down.

When the generator ceases to charge and the voltage falls, these points should re-open at between 9.5 and 11.0 volts. A reverse current will commence to flow back from the battery into the generator windings. This reverse current de-magnetises the core and immediately throws the armature off, thus opening the contact points.





THE GENERATOR FIELD REGULATION CIRCUIT

To make the generator "build" it is necessary to connect the field coils to the generator main circuit, i.e., connect terminal F to D.

As shown in this picture the F terminal at the generator is connected to the frame of the current regulator. From the frame we pass to the moving contact point, from the fixed contact point through a number of turns of wire on the upper part of the voltage regulator and then to the fixed contact point of the voltage regulator. We continue from the moving contact on the voltage regulator to its frame which is the generator main connexion (D). Thus the field circuit is connected through two pairs of contact points "in series" and if either is opened the field circuit will be broken or "opened". When this occurs a heavy destructive arc takes place at the contact points and would quickly damage them. To reduce this, a resistance is connected between D and F as shown. This provides an alternative path for the field current, but in passing through this resistance however, it is considerably weakened.

The turns of wire shown at the top of the voltage regulator bobbin — right — form what is termed a "Frequency Coil" and simply serves to increase the vibration frequency of the armature, resulting in a steadier charging current.

It can now be seen that the action of the voltage regulator is controlled by the shunt coil and the bucking winding together.

The current regulator is entirely controlled by the heavy turns of wire which carry the total current from the generator.

Finally it should be observed that in the normal position both pairs of regulator contacts are closed; that, is, the field is fully connected.

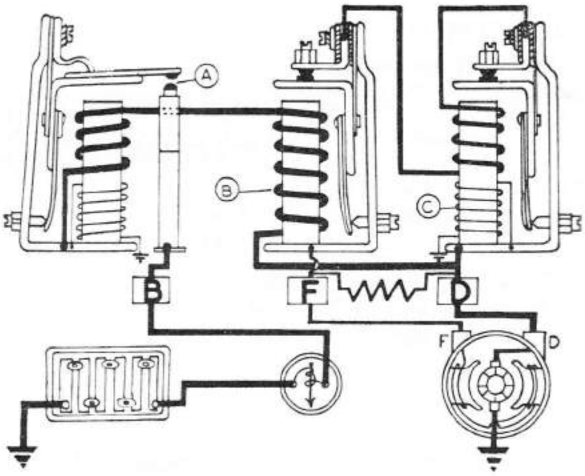
GENERAL METHOD OF OPERATION

Assuming a flat battery in circuit.

Immediately the generator is run it builds up a voltage. When this rises to between 12.7 and 13.3 in the case of the 12 volt unit the shunt coil of the cut-out is sufficiently energised to close the cut-out points (A) against the pressure of the adjusting spring.

Current will then flow to the battery and increase directly with generator speed. By the time the generator output reaches the permissible maximum, the current regulator coil (B) is sufficiently energised to pull down the current regulator armature against its spring setting and so open the contact points, breaking the field circuit. The generator voltage then drops, the exciting current in the coil weakens and the regulator points close again allowing the voltage to rebuild. This opening and closing cycle continues at between 30 and 50 operations per second, thus limiting the total generator output to a safe maximum.

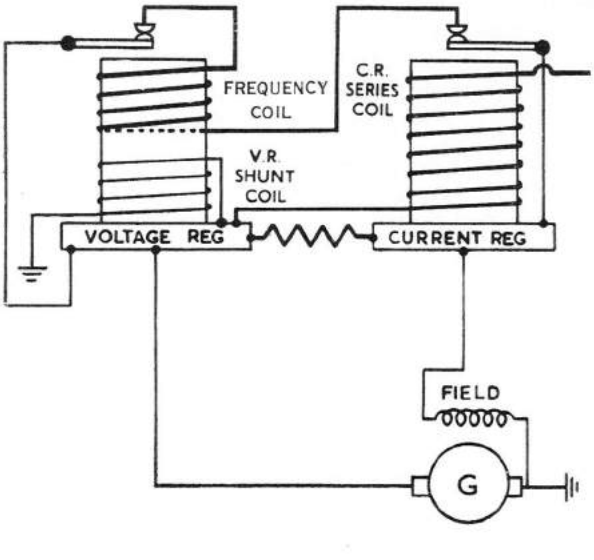
By the time the battery is something over one-third fully charged its terminal voltage will have risen, resulting in a general rise in the line voltage, i.e., between generator and battery. When the line voltage reaches the correct value the voltage regulator coil (C) is sufficiently energised to pull down its armature against the spring setting. This set of field contacts will open and then be put into a state of vibration which will reduce and limit the generator voltage. As the battery, and consequently the line voltage, continues to rise, the field point vibration will increase in amplitude and keep the generator voltage at a safe maximum.



In this condition the difference between generator and battery voltage continues to become less and the current from the generator is finally reduced to trickle charge proportions.

From the moment that the voltage regulator points come into operation, the current from the generator is so reduced that the current regulator will no longer operate, and its contact points will remain closed.

In practice, a changeover period often exists when both regulators are in operation.



THE FREQUENCY COIL

The frequency coil (sometimes referred to as a bucking coil), as you can see in the illustration, is wound in series with the two sets of contacts in the field circuit. It thus passes field current. The winding consists of a few turns of thick copper wire, so wound as to assist the shunt coil of the voltage regulator. In increasing the ampere-turns of the bobbin, it therefore influences the operation of the voltage regulator contacts, quickening the break and increasing the frequency of vibration. This serves to stabilise the operation as a whole, smoothing out and steadying the generator output.

CONNECTING POINTS AND ADJUSTMENTS

Let us now examine some of the constructional details of the RB310 current-voltage regulator.

The first point to note is that there are only three terminals: B, F and D, reading from left to right in the picture. The earthing of the box is done through the fixing screws to the metal base of the assembly. The fixing holes are provided with rubber cushioning.

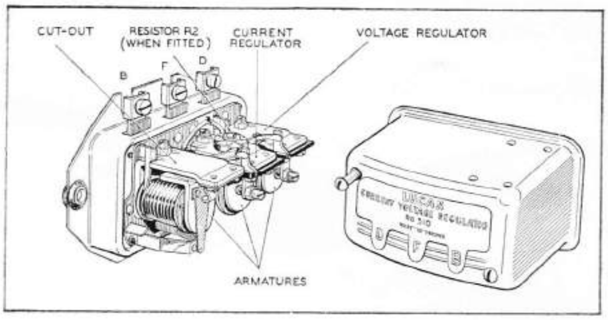
The 6GC is slightly different in this respect for it has an extra terminal "R" provided for earthing the base of the unit to the vehicle chassis. This is similar to the RB340 covered later in this book, and is fitted because the base assembly is normally insulated from the vehicle chassis by means of rubber fixing posts.

The cut-out is temperature-compensated by means of a bi-metal strip attached to the back of the armature tensioning spring.

The voltage regulator is also temperature-compensated by means of a bi-metal strip.

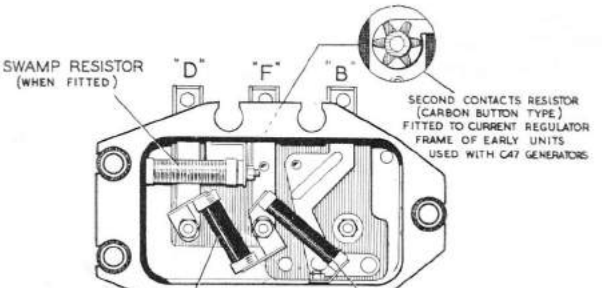
The current regulator has no temperature-compensation.

Adjustment screws for the armature tensioning



springs, that is, for adjusting the electrical settings, are located in the usual position at the back of the frames.

The mechanical settings for the two regulators are controlled by adjustment screws over the tops of the bobbins.



Resistor Values (Carbon) earlier RB310 units only

Contacts Resistor

6-volt units: 50 ± 4 ohms.
12-volt units: $63\pm1\frac{2}{3}$ ohms (except earlier units used with C47 generators which were fitted with two contacts resistors, R1 150±15 ohms, across the VR contacts, and R2 110±10 ohms, across the CR contacts).
24-volt units: 240±24 ohms.

Field Parallel Resistor

12-volt units: $38\pm\frac{7}{2}$ ohms.
24-volt units: 60±6 ohms.

Voltage Regulator Swamp Resistor

24-volt units: 120±6 ohms.

THE CONTACTS RESISTANCE

The voltage regulator, carbon rod, or wire wound points resistor is located under the base. It must of course be insulated from it, the latter being at earth potential. The current regulator resistance is, when fitted, located at the back of the regulator, and is of the carbon button type. The field parallel and swamp resistor, when fitted, are located under the base.

Resistor Values (Wire wound)

Contacts Resistor

12-volt units: 60±5 ohms.
24-volt units: 240±12 ohms.

Field Parallel Resistor

12-volt units: 40±4 ohms.
24-volt units: 40±3 ohms. (This resistor is series connected with a Lucas diode between "F" terminal and base (earth)).

Voltage Regulator Swamp Resistor

24-volt units: $30\pm1\frac{1}{2}$ ohms. (This resistor provides a swamp path to earth for both voltage regulator and cut-out shunt windings).

Resistance of Shunt Windings at 20°C. (68°*F.*):

12 and 24-volt units: Voltage regulator 103–115 ohms. Cut-out relay 58–65 ohms.

Note. — The above shunt winding resistance values for 24 volt units apply only to units in which both windings are connected to earth through a common swamp resistor.

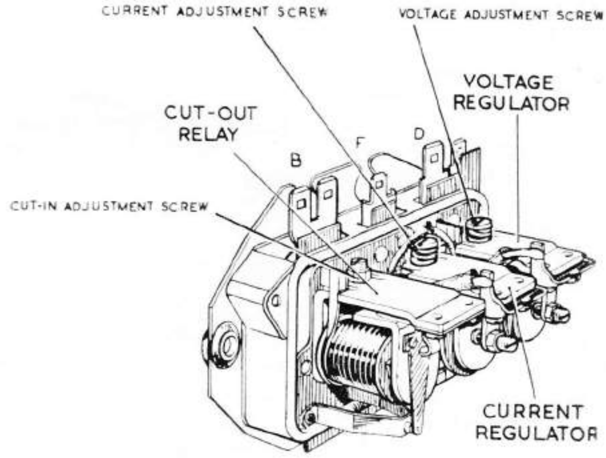
LUCARISED VERSION (RB310)

The later pattern RB310 incorporates Lucar terminal blades, spring-loaded adjustment screws and, in addition, a different method of cover fixing. The "ear-fixed" cover as it is called allows for shorter through fixing screws, without an insulating tube, to be used for fastening the cover in position. Also, the screws can be positioned more easily as the threaded hole which was originally drilled within the base of the unit is now positioned externally to line up with the "ears" on the cover.

B   Two 35 amp. blades.

F   One 17.5 amp. blade.

D   One 35 amp. blade and one 17.5 amp. blade.



CHECKING THE CURRENT VOLTAGE CONTROL REGULATORS

To check or adjust these units it is essential that a good quality moving coil voltmeter and ammeter should be available. It is also very necessary to see that these instruments are maintained in an accurate state.

Within our experience an extremely simple test set which may be made up, or purchased, as illustrated has been found the most satisfactory arrangement for use in the service garage.

In this set a $3\frac{1}{2}''$ Scale Moving Coil Ammeter calibrated 5–0–50 amperes and a similar voltmeter calibrated 0–40 volts have the correct size of very flexible leads and clips permanently connected ready for use, the assembly being accommodated in a sheet steel box with detachable cover, thus safeguarding the instruments against accidental damage in service.

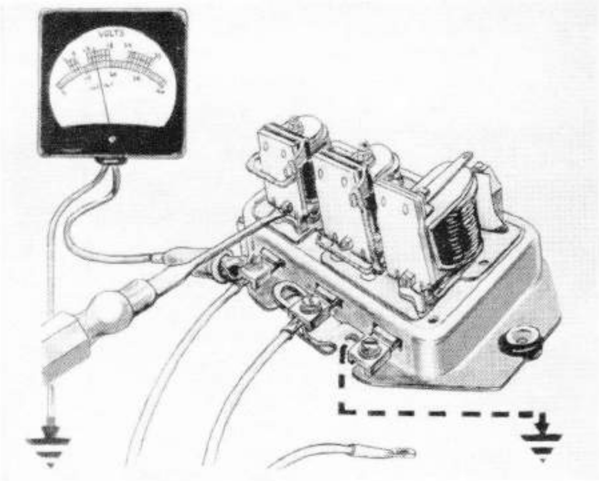
Without suitable instruments NO adjustments to these control boxes should be attempted.

In every case before interfering with the control unit preliminary checks on the battery, battery connexions, generator and generator driving belt, together with an inspection of the generator and control unit cables should be made. If these are in order proceed to test, firstly the voltage regulator and secondly, the current regulator as outlined.

TO CHECK AND ADJUST THE REGULATOR OPEN-CIRCUIT VOLTAGE (RB310 & 6GC)

We commence our adjustments at the voltage regulator. First disconnect the lead from the control box terminal "B" (marked "A" on earlier models) and connect the voltmeter between "D" terminal (generator armature) and earth. Then raise the generator speed slowly to approximately 3,000 rev./min. (for C39PV, C39PVR, C39Q, C40/1, C40L, C45PV, D5LF, GL45, G524G, 5A and GH45), 1,500 rev./min. (for C47, C48 and D5L), 2,000 rev./min. (for G5–12). The voltage should rise and steady itself with a slight flick. According to the temperature this reading should be as outlined in the table for voltage regulator electrical settings.

If any adjustment is required do not increase the speed above 3,000 rev./min. Unlock the adjustment screw on the back plate of the bracket and screw inwards to increase the voltage, and outwards to lower the voltage, when corrected re-lock the adjustment screw and reduce the speed to "idling".



VOLTAGE REGULATOR ELECTRICAL SETTINGS

The Standard Open Circuit Voltage Settings with the *generator running at approx.* 3000 rev/min (1500 rev/min C47 and C48), are as follows:

Ambient Temperature	*12 volt*	*6 volt*	*24 volt*
	volts	volts	volts
Cold Climate 10°C. (50°F.)	15.1 — 15.7	8.1 — 8.5	28.2 — 28.7
Temperate Climate 20°C. (68°F.)	14.9 — 15.5	8.0 — 8.4	28.0 — 28.5
Hot Climate 30°C. (86°F.)	14.7 — 15.3	7.9 — 8.3	27.8 — 28.3
Equatorial Climate 40°C. (104°F.)	14.5 — 15.1	7.8 — 8.2	27.6 — 28.1

7.0 — 7.3 volts at 68°F. (20°C.) for 6 volt regulators for "HOLDEN"

14.2 — 14.8 volts at 68°F. (20°C.) for regulators used with Rootes "EASIDRIVE" units (C45PV/6)

Setting or adjusting must be done as quickly as possible in order to preclude heating effects which would introduce errors into the setting.

When the *generator speed is raised to* 4,500 rev/min the voltage *must* not rise above:

16.2 volts at 68°F. (20°C.) for 12 volt regulator
8.9 volts at 68°F. (20°C.) for 6 volt regulator
31.0 volts at 68°F. (20°C.) for 24 volt regulator

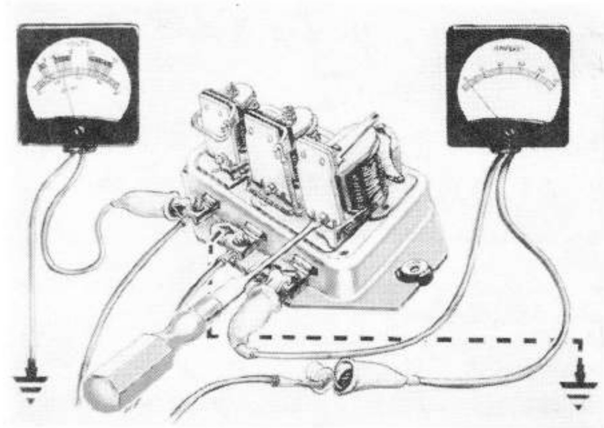
THE CUT-OUT SETTINGS

The cut-out should be adjusted next, for unless the cut-out points close properly, it is impossible to adjust the current regulator.

Leaving the voltmeter connected as in previous test, insert an ammeter between terminal "B" and the "B" cable. Switch on an electrical load, such as headlamps, and slowly increase generator speed from zero. Closure of the contacts, indicated by a slight drop in the voltmeter reading should occur between the following figures:

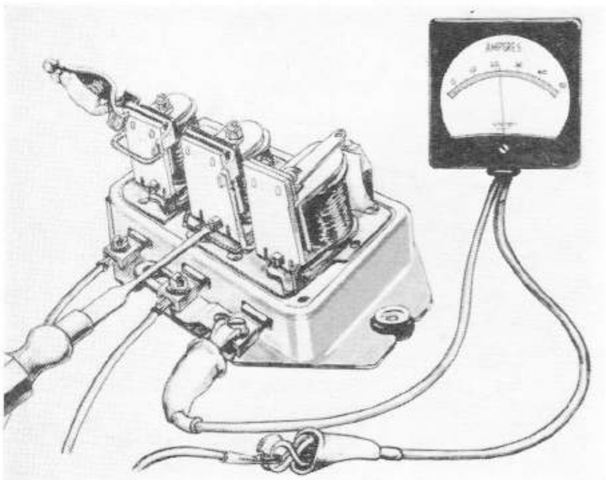
	Cut-in Voltage	*Drop-off Voltage*
	volts	volts
12 volts ..	12.7 — 13.3	9.5 — 11.0
6 ,, ..	6.3 — 6.7	4.8 — 5.5
24 ,, ..	26.5 — 27.0	19.0 — 23.0

The cut-out is adjusted by means of the screw at the back. This is screwed inwards. That is to say clockwise, to increase the voltage, and outwards (or anti-clockwise) to reduce it.



The drop-off voltage can be checked by disconnecting the lead from control box "B" terminal and connecting the voltmeter between this and earth.

Run the engine up to 3,000 rev./min., then slowly decelerate, noting the instant when the voltmeter drops to zero. This should occur between the limits given in the table.



TO CHECK AND ADJUST THE CURRENT REGULATOR

Finally the current regulator is adjusted. The voltage regulator contacts are short-circuited by means of a crocodile clip placed across the contact plate to the frame of the voltage regulator as shown. With the battery still disconnected from the "B" terminal, the test ammeter is again connected between the lead and the terminal, and again the complete load is switched on. The generator is then run to charging speed approximately 4,500 rev./min. (4,000 rev./min. for C48).

The current settings, for the standard generators, are as follows:

Generator	*Voltage*	*Setting*
	volts	amps.
C39PV–2	12	19 ± 1
C39P–2	12	$10\frac{1}{2}\pm\frac{1}{2}$
C40A	12	$10\frac{1}{2}\pm\frac{1}{2}$
C40–1 (5″ Fan)	12	22 ± 1
C40–1 (4½″ Fan) ..	12	20 ± 1
C40AL	12	$10\frac{1}{2}\pm\frac{1}{2}$
C40L	12	25 ± 1
C40LQ	12	25 ± 1
C42	12	$30\pm1\frac{1}{2}$
C42 (EASIDRIVE) ..	12	$35\pm1\frac{1}{2}$
C45PV–5	12	22 ± 1
C45PV–6	12	25 ± 1
C45PV–6 (EASIDRIVE)	12	$30\pm1\frac{1}{2}$
C45PVS–6	12	25 ± 1
C47	12	$30\pm1\frac{1}{2}$
C48	12	$35\pm^{0}_{2}$

The current setting is then checked against the figures given in the table for the appropriate generator fitted to the vehicle.

The output is then regulated by means of the screw in the backplate. Once again, the setting is increased by screwing inwards (or clockwise), and reduced by turning it outwards (or anti-clockwise).

Note. — Do not switch lights on after starting the engine otherwise the bulbs may burn out.

MECHANICAL SETTINGS FOR RB310 & 6GC

Adjustment of Air Gap Settings

Gauge Thicknesses

Air gap settings are accurately adjusted during assembly and should require no further attention. If, however, an armature is removed for any reason, care must be taken to obtain the correct setting on re-assembly. When setting an armature-to-bobbin core air gap, the correct size of gauge required is determined by the thickness of the non-magnetic separation used in the gap and also, in the case of voltage regulators, on the thickness of the bi-metal spring located behind the tensioning spring of the armature.

The above variable features are easy to identify and are as follows:

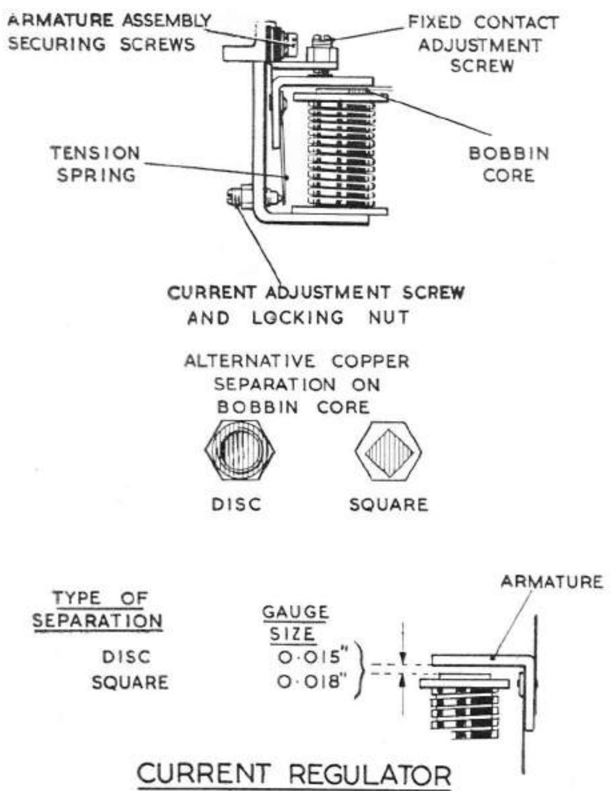
0.015″ separation is by means of a disc of copper.*
0.009″ separation is by means of a square of copper.
0.012″ bi-metal springs are bright and unplated.
0.010″ bi-metal springs are copper plated.

*Alternatively, two parallel copper wires were used in some units during 1956/7.

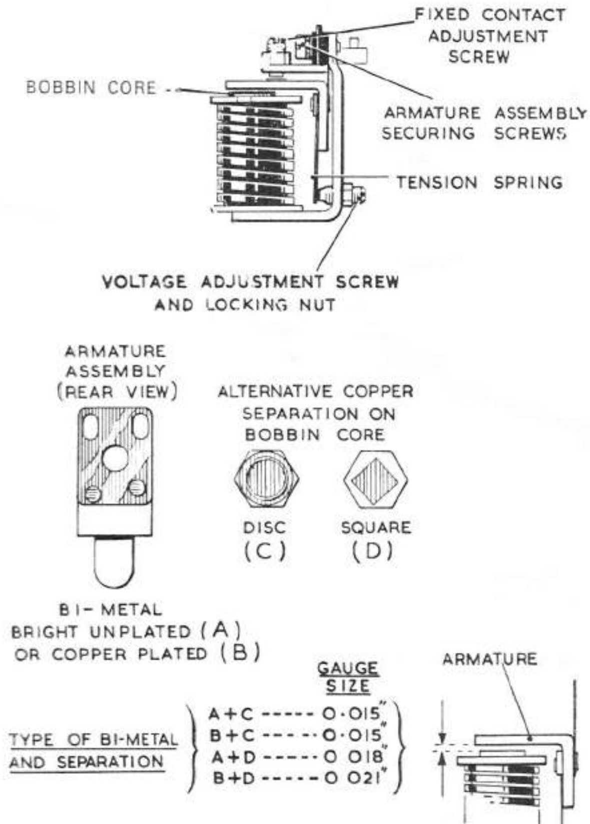
A flat steel gauge of 0.015″, 0.018″ or 0.021″ is used as follows:

Voltage Regulators:

Use a 0.015″ gauge for units fitted with a 0.015″ disc of copper* and a bi-metal spring of either 0.010″ or 0.012″ thickness.
Use a 0.018″ gauge for units fitted with a 0.009″ square of copper and a bi-metal spring of 0.012″ thickness.



CURRENT REGULATOR



VOLTAGE REGULATOR

Use a 0.021″ gauge for units fitted with a 0.009″ square of copper and a bi-metal spring of 0.010″ thickness.

Current Regulators:

Use a 0.015″ gauge for units fitted with a 0.015″ disc of copper.*
Use a 0.018″ gauge for units fitted with a 0.009″ square of copper.

Voltage and Current Regulator Mechanical Settings

Slacken the two armature assembly securing screws so that the armature is loosely attached to the regulator frame.

Slacken the fixed contact locking nut and unscrew the fixed contact adjustment screw until it is well clear of the armature moving contact.

Slacken the voltage (or current) adjustment screw locking nut and unscrew the adjustment screw until it is well clear of the armature tension spring.

Using a flat steel gauge of appropriate thickness (see above) and wide enough to cover the bobbin core, insert the gauge between the underside of the armature and the copper disc* or square. Take care not to turn up or damage the edge of the disc* or square.

Press the armature down squarely against the gauge and re-tighten the two armature assembly securing screws. With the gauge still in position, screw in the fixed contact adjustment screw until it touches the armature moving contact. Re-tighten the locking nut.

Carry out the electrical settings.

CUT-OUT RELAY MECHANICAL SETTINGS

Slacken the two armature assembly securing screws so that the armature is loosely attached to the cut-out frame. Slacken the adjustment screw locking nut and unscrew the adjustment screw until it is well clear of the armature tension spring.

Press the armature down squarely against the core face (copper sprayed in earlier units or fitted with a square of copper in later units), and re-tighten the two armature assembly securing screws. No gauge is necessary.

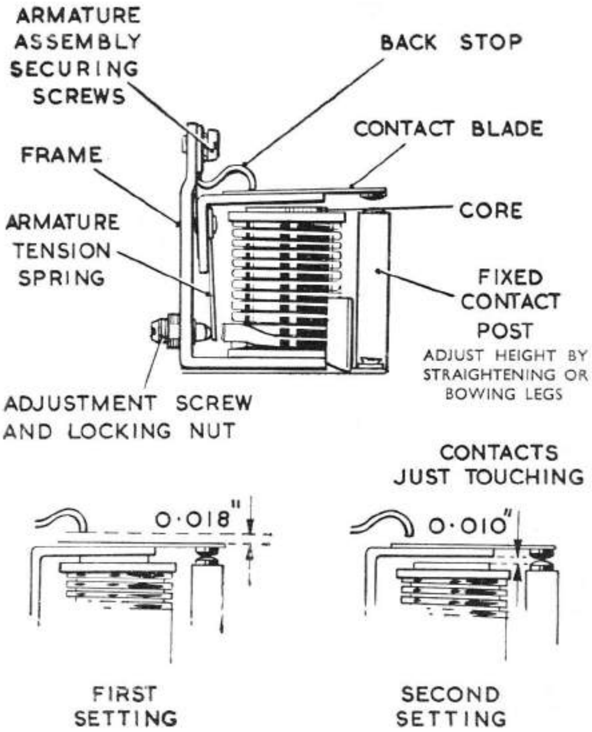
Press the armature down against the core face and adjust the armature back stop so that a 0.018″ gap is obtained between the tip of the back stop and the contact blade.

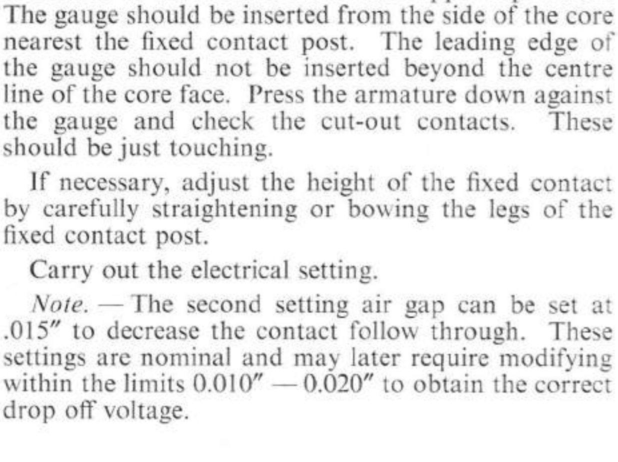
Insert a 0.010″ thick flat steel gauge between the underside of the armature and the copper separation. The gauge should be inserted from the side of the core nearest the fixed contact post. The leading edge of the gauge should not be inserted beyond the centre line of the core face. Press the armature down against the gauge and check the cut-out contacts. These should be just touching.

If necessary, adjust the height of the fixed contact by carefully straightening or bowing the legs of the fixed contact post.

Carry out the electrical setting.

Note. — The second setting air gap can be set at .015″ to decrease the contact follow through. These settings are nominal and may later require modifying within the limits 0.010″ — 0.020″ to obtain the correct drop off voltage.





SETTING THE CURRENT REGULATOR ON THE BENCH

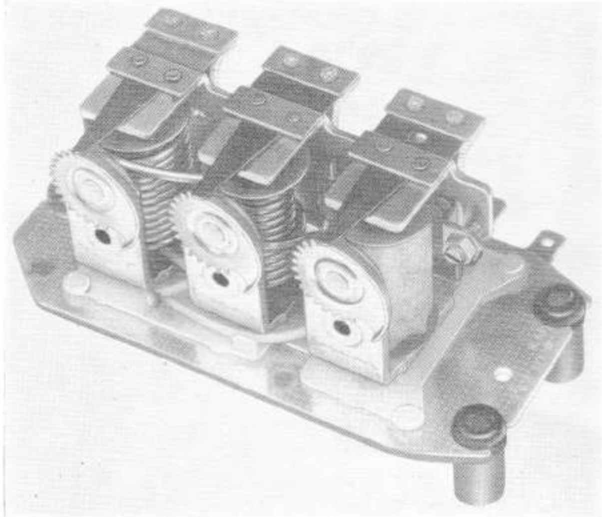
When setting the current regulator away from the vehicle, a test generator and an artificial load is needed. The load circuit should comprise a 51 ampere-hour battery, a 0 — 40 ammeter and rheostat capable of carrying up to 45 amperes without overheating. The connexions are shown in the illustration on the left. The control box, it will be noted, is shown with its terminals pointing vertically upwards. This is the position in which electrical settings are made during production and is the mounting position recommended to vehicle manufacturers. However, since settings can be affected by change of position, bench settings should be made with the control box mounted as on the vehicle. Adjust the rheostat until ammeter A1 indicates a current slightly in excess of the maximum rated output of the generator normally controlled by the regulator. Run the test generator at approximately 4,500 rev./min. and adjust the current regulator until the required setting is indicated by ammeter A2.

The permissible tolerances on current regulator settings are ± 1 ampere for generators of up to 25 amperes maximum output and ± 1½ amperes for generators of up to 35 amperes maximum output.

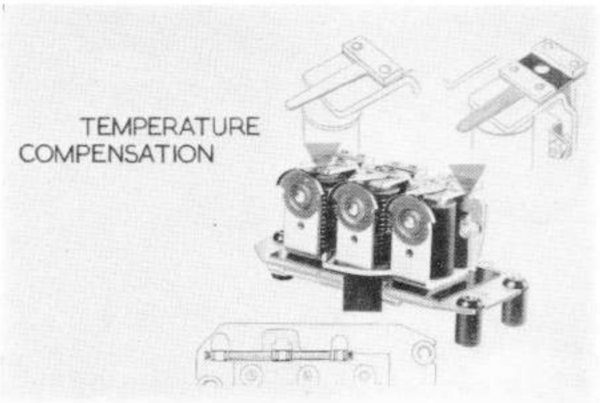
THE RB340 CONTROL UNIT — GENERAL DESCRIPTION

The model RB340 control box will eventually supersede the model RB310. Whilst the electrical functions of the RB340 are the same as the RB310 and 6GC, the mechanical arrangement of its regulators, and cut-out unit is different.

Also, the base which was previously a box type pressing now consists of a simple flat plate to which the resistors and Lucar connectors are riveted (see illustration). The contacts, which on the RB310 and 6GC are positioned above the bobbin-cores, are, on the RB340, situated parallel to the rear limb of their magnet frames. The cut-out, voltage and current regulator tensioning springs are riveted to the upper limb of the armature. Another notable feature of the assembly are the toothed adjustment cams carried on the front limb of each frame. With the aid of a special tool electrical adjustments are made by turning the cams to vary the spring tension acting on the associated armature, except for the cut-out drop-off voltage, which is effected by bending the fixed contact bracket.



The main service feature is the simplicity of making mechanical and electrical adjustments. Simple armature-to-bobbin-core air gap settings are the only mechanical adjustments to be made. The three armatures are riveted to the rear limb of U-shaped magnet frames thus their back air gap is fixed and non-adjustable.



TEMPERATURE COMPENSATION

As in the case of the RB310 and 6GC, the voltage regulator and the cut-out of the RB340 are temperature compensated, by means of bi-metal strips. But, in addition, the RB340 has a double swamp resistor, connected in series with the two shunt coils.

The resistor has a higher resistance than the two shunt coils, and it is made of an alloy, which is not affected by changes in temperature. Thus, for all practical purposes, the resistance of the shunt windings, and the resistor will remain constant, although there are considerable changes in temperature.

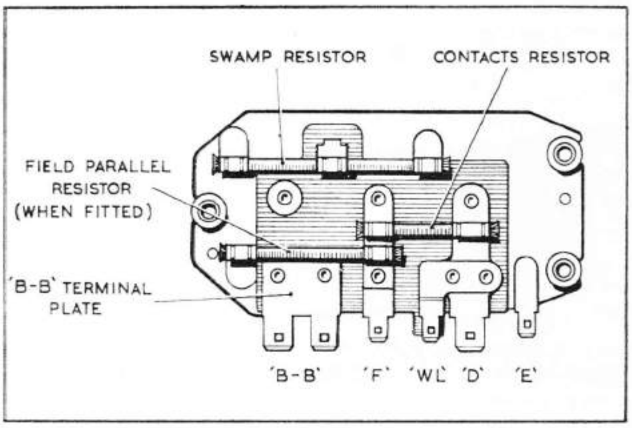
RESISTORS

As in the RB310 and 6GC, the resistors are positioned beneath the base. Contacts resistors and swamp resistors are fitted to all units but an additional resistor, the field parallel resistor, is fitted to units controlling C48 generators.

Resistor Values (Wire wound)

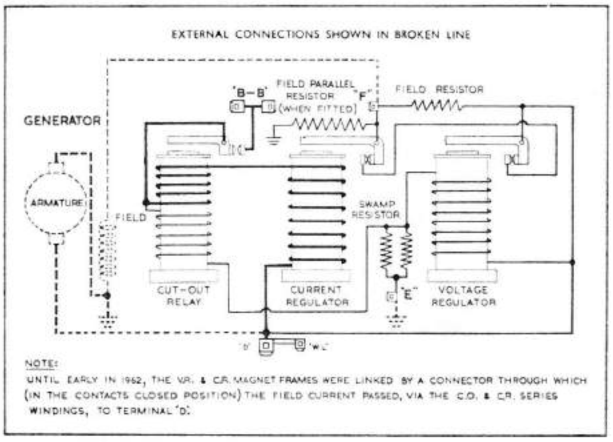
Contacts Resistor

	Resistance in ohms	Identification colour
As fitted in units controlling 12-volt generators having 4½ ohm field windings:	37–43	Yellow
As fitted in units controlling 12-volt generators having 6 ohm field windings:	55–65	Red
As fitted in units controlling generator model C48:	75–85	Violet



Note. — Coloured paints used for indicating ohmic values of these resistors are applied to one end of the fibreglass cores.

	Resistance in ohms	Identification colour
Swamp Resistor (12-volt units)		
Measured on unit between centre tag and base:	13.25–14.25	—
Replacement resistor measured between end tags before fitting to unit:	53–57	—
Field Parallel Resistor		
As fitted in units controlling model C48 generators:	95–105	Orange
Shunt Windings at 20°C. (68°F.)		
Voltage regulator (12-volt units):	10.8–12.0	—
Cut-out Relay (12-volt units):	8.8–10.5	—



SYSTEMATIC CHECKING

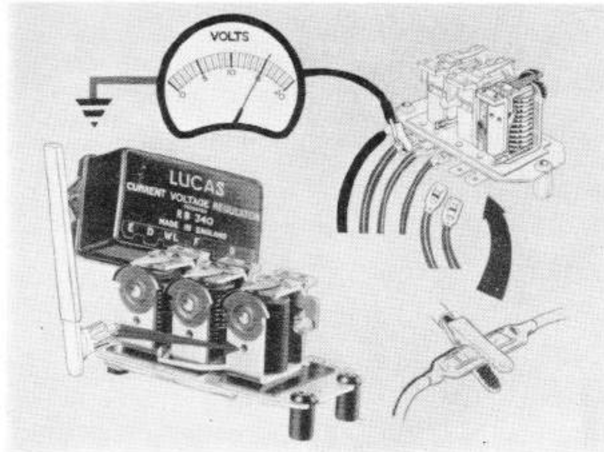
As the RB340 is electrically similar to the RB310 & 6GC the instruments and preliminary checks given on page 31 also apply.

We will assume that both the battery and generator have been tested, and have been found satisfactory. We now proceed to adjust the control box.

RB340 — VOLTAGE REGULATOR

We commence at the voltage regulator. The battery lead is disconnected from the "B" terminal, and a voltmeter is connected between the "D" terminal and Earth. (If more than one lead is on "B" terminal, join them together). Then, the generator speed is gradually increased. At first, the voltage rises with increasing speed. Then, the needle flicks back, rises again, and finally remains steady, although the speed continues to increase. The voltage regulation must always take place when the generator voltage remains steady (or is stabilised). That is why we normally specify the generator speed as 3,000 rev./min. (This applies to most standard generators).

However, C48 generators are steady at 1,500 rev./min. and C42 generators are steady at 4,500 rev./min.



Ambient Temperature	*Service Open-Circuit Voltage* **Checking** *Limits*	*Service Open-Circuit Voltage* **Setting** *Limits*
10°C. (50°F.) ..	14.5 — 15.8	14.9 — 15.5
20°C. (68°F.) ..	14.4 — 15.6	14.7 — 15.3
30°C. (86°F.) ..	14.3 — 15.3	14.5 — 15.1
40°C. (104°F.) ..	14.2 — 15.1	14.3 — 14.9

See notes on hot setting of units on page 40.

VOLTAGE REGULATOR SETTINGS

The method of setting the voltage regulator is the same as for the RB310 & 6GC. However, the actual settings are different. The RB340 should be set within the following limits.

The voltage is regulated by means of a special tool which locates with the toothed cams (see fig. above). When the setting is made, the speed should be reduced to "idling", and then gradually accelerated. The voltage should increase, until the voltage setting is reached, at the appropriate speed.

Note. — For every 18°F. (10°C.) **above** 20°C., subtract 0.2 volts from the limits, conversely, the same corrections must be added for every 10°C. **below** 20°C.

CUT-OUT SETTINGS AND ADJUSTMENT

Again as in the RB310 and 6GC the cut-out should be adjusted next, for unless the cut-out points close properly, it is impossible to adjust the current regulator.

The voltmeter can be left connected between the "D" terminal and earth as in the open circuit test, and the ammeter inserted between the "B" terminal and the "B" leads (these should be joined together if more than one is fitted as shown).

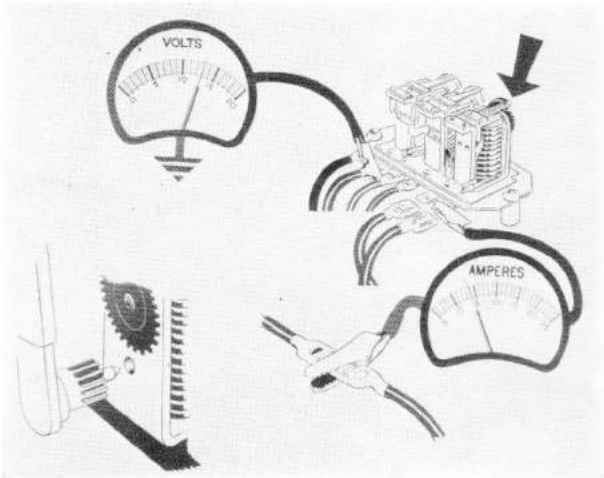
Switch on an electrical load, such as the headlamps and slowly increase the generator speed from zero. Observe the voltmeter pointer, it should rise steadily, as engine speed is increased and then drop slightly at the instant of the contacts closing. The cutting-in voltage should occur between the following limits.

Generator Voltage	*Cutting-in Voltage*	*Drop-off Voltage*
12 volts	12.7 — 13.3 volts	9.5 — 11.0 volts

If the cutting-in voltage does not occur within these limits, the setting is adjusted by turning the adjustment cam with the special tool.

When the tool is turned in a clockwise direction, the setting is raised. But, when it is turned anti-clockwise, the setting is lowered.

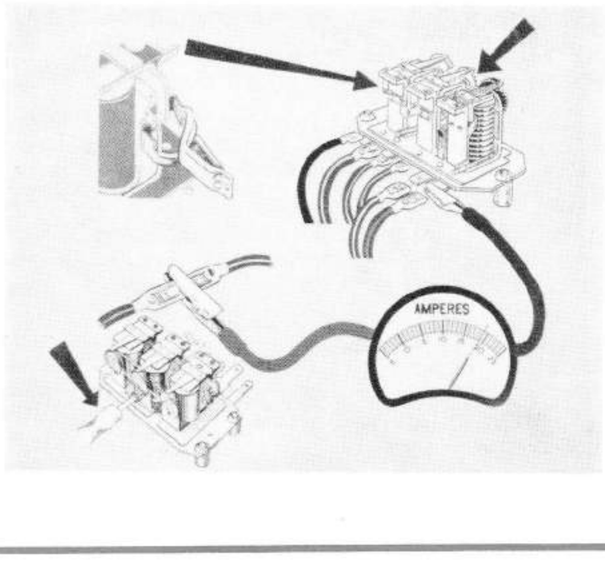
To check the drop-off voltage, disconnect the cable from the control box terminal "B" and connect the voltmeter between this and earth. Run the engine up to



approximately 3,000 rev./min. and then slowly decelerate and observe the voltmeter pointer.

Opening of the contacts will be indicated by the voltmeter pointer dropping to zero, and this should occur between the limits given in the table.

If this setting is found to be outside the given limits it can be adjusted by carefully bending the fixed contact bracket, closing the contact gap will raise the drop-off voltage and opening the gap will reduce the drop-off voltage.



CURRENT REGULATOR: ADJUSTMENTS

While the current regulator is being adjusted, the generator must develop its maximum rated output, irrespective of the state of charge of the battery. Hence, we make the voltage regulator inoperative, by short-circuiting the contacts by means of the crocodile clip as shown. Once again, the method of adjusting the current regulator is precisely the same as for the RB310 and 6GC.

The ammeter is still connected in the "B" lead. (Joined together if more than one lead), and the lamp load is switched on. Then, the generator is run at charging speed. (This varies with the type of generator). If a C48 is used, the generator speed should be 4,000 rev./min., but all other models should be driven at 4,500 rev./min.).

CURRENT REGULATOR SETTINGS

The current regulators should be set to the following values with the generator running at 4,500 rev./min. (4,000 rev./min. for C48).

Unsteady readings are probably due to dirty mechanical settings.

If, however, the reading is steady, but is higher or lower than the maximum rated output of the generator, the regulator setting must be altered, by turning the adjustment cam, with the special tool.

When, for instance, the tool is turned in a clockwise direction, the setting is raised. On the other hand, the setting is lowered, when the tool is turned anti-clockwise.

Generator	*Voltage*	*Setting*
	volts	amps.
C39PV–2	12	19 ± 1
C39P–2	12	$10\frac{1}{2}\pm\frac{1}{2}$
C40A	12	$10\frac{1}{2}\pm\frac{1}{2}$
C40–1 (5″ Fan)	12	22 ± 1
C40–1 (4½″ Fan)	12	20 ± 1
C40AL	12	$10\frac{1}{2}\pm\frac{1}{2}$
C40L	12	25 ± 1
C40LQ	12	25 ± 1
C40T	12	18 ± 1
C40T	12	22 ± 1
C42	12	$30\pm1\frac{1}{2}$
C42 (EASIDRIVE)	12	$35\pm1\frac{1}{2}$
C45PV–5	12	22 ± 1
C45PV–6	12	25 ± 1
C45PV–6 (EASIDRIVE)	12	$30\pm1\frac{1}{2}$
C45PVS–6	12	25 ± 1
C47	12	$30\pm1\frac{1}{2}$
C48	12	$35\pm^{0}_{2}$

MECHANICAL SETTINGS: INTRODUCTION

We have told you how the RB340 control box is checked and regulated, while it is still in position on the vehicle. However, during the course of the tests, you may have obtained fluctuating readings on the ammeter or voltmeter.

In general, fluctuating readings are due to three factors:—

(i) Oxidation of contacts.
(ii) Foreign matter in air-gaps.
(iii) Incorrect air-gap settings.

CLEANING THE CONTACTS

We will first consider oxidised contacts. This is a condition, which arises normally in service. Hence, all contacts should be cleaned periodically. Different materials are required for cleaning the regulator and cut-out contacts. The contacts for the voltage and current regulators are made of tungsten, and so should be cleaned with fine carborundum stone or silicon carbide paper. The dust and foreign matter should be wiped away by means of a fluffless cloth, which has been moistened with methylated spirits (de-natured alcohol).

The cut-out contacts are made of silver, and should be cleaned with a piece of fine glass paper. All dust should be removed with a cloth soaked in methylated spirits. On no account should carborundum stone or emery paper be used for cleaning the cut-out contacts, or the silver contacts will be damaged.

CURRENT AND VOLTAGE REGULATORS: AIR-GAP SETTINGS (EARLIER UNITS)

We will now consider how the air-gaps of the RB340 Current Voltage Control Box are set.

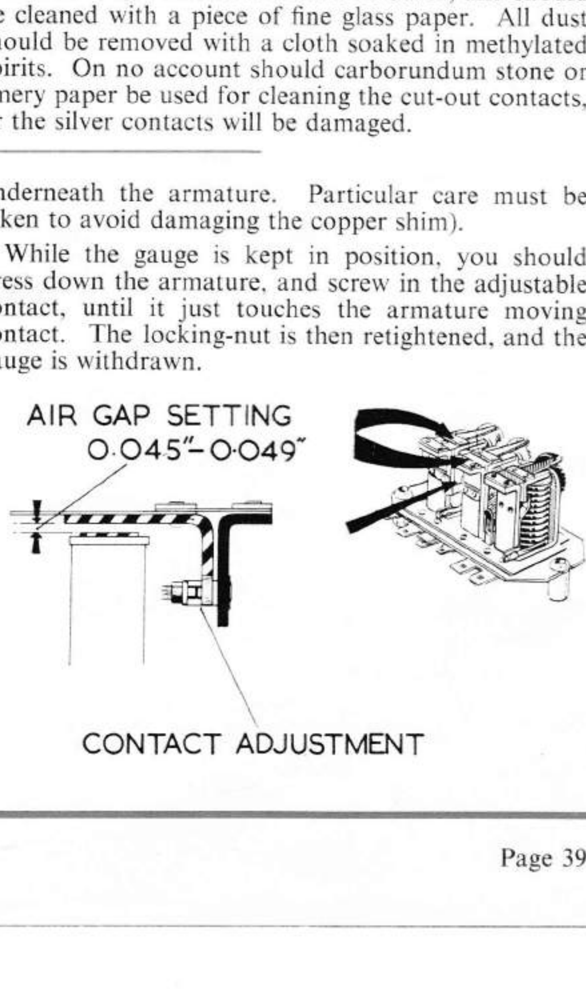
Once again we must remind you that the air-gaps and the fixed contact setting have been accurately set during production. However, if the settings have been disturbed in any way, they must be carefully reset.

Let us first describe the method for adjusting the regulator air-gaps.

As we have already stated, the RB340 has toothed adjustment cams, instead of the adjusting screws on other control boxes. A special tool is, therefore, needed, and the cams are turned as far as possible in an anti-clockwise direction. (That is, to the point giving minimum lift to the armature tensioning spring).

The adjustable contact is then screwed back, and a gauge of .045″ is inserted between the armature and the copper separation on the core face. (The gauge must be inserted, so that it reaches the two rivets underneath the armature. Particular care must be taken to avoid damaging the copper shim).

While the gauge is kept in position, you should press down the armature, and screw in the adjustable contact, until it just touches the armature moving contact. The locking-nut is then retightened, and the gauge is withdrawn.



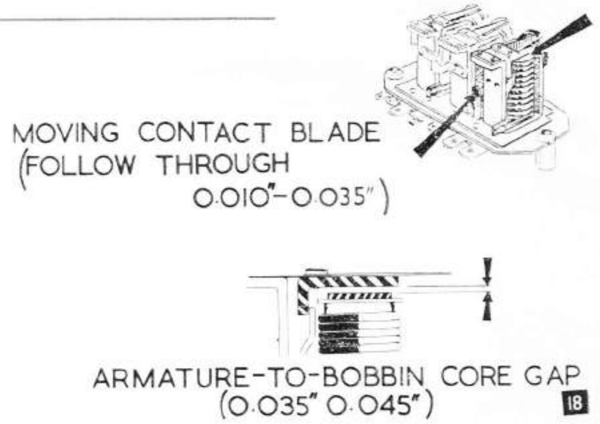
REVISED AIR-GAP SETTINGS FOR LATER UNITS

Later units manufactured since December, 1963 do not have the copper separation in the top gap of the voltage and current regulator. Therefore, when setting, the air-gaps of these units, a thicker gauge must be used to allow for the space formerly occupied by copper, the total gap measurement being unchanged. To do this, the gauge thickness of 0.045″ previously given must be increased by .007″ to 0.052″.

CUT-OUT AIR-GAP SETTINGS

Finally, we will describe how to set the air-gaps of the RB340 Cut-out.

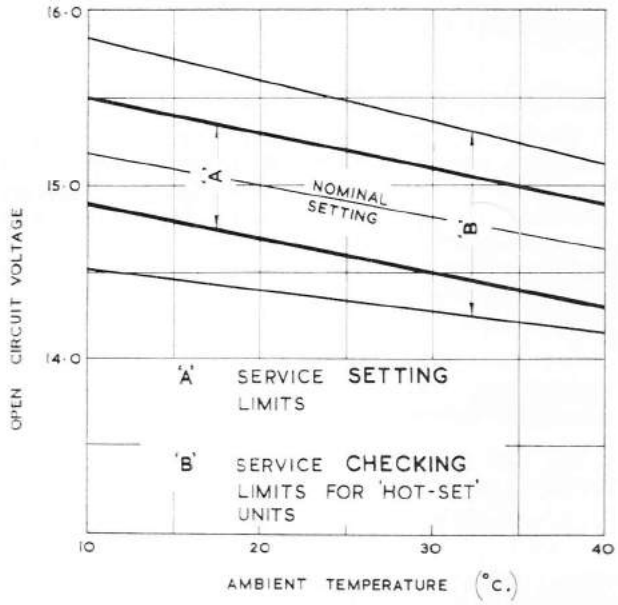
The armature is pressed down on the copper separation on the core face. Then, the fixed contact bracket is set so that the "follow-through" (or blade deflection) of the moving contact is within the limits .010″ — .035″, and the armature backstop is adjusted, until the air-gap between the armature and core is .035″ — .045″.



HOT SETTING OF UNITS DURING MANUFACTURE

During manufacture control boxes are heat-soaked at 70°C. (158°F.) before electrical settings of the voltage regulators are made. Then, while at this temperature, the voltage regulators are set to operate at a comparatively low voltage (14.1±0.3 volts, for 12 volt units). This method, known as "hot-setting", ensures that accurate and stable settings obtain at normal working temperatures.

On cooling to 20°C. (68°F.) the temperature compensation device causes units to regulate at higher voltages and between slightly wider limits (15.0±0.6 volts, for 12 volt units). Before units are despatched, "cold" checks are carried out at this lower temperature to see that open circuit voltage performances fall between these wider limits. It follows, therefore, that these wider, "cold checking", limits are the correct figures to use when **checking** factory-set units in service. Figures for service **setting,** however, must be to closer limits to ensure that adjustments carried out at lower temperatures shall result in correct regulation at higher temperatures.



Voltage regulator setting limits shown graphically, including checking limits of units set at 70°C. (158°F.)

CONCLUSION

Having obtained a pretty fair idea of the various forms of generator control units and their working it may be desirable to add a note of caution.

The successful servicing of these important components does not rest entirely upon an adjustment here and there. The success of any of the servicing operations outlined depends entirely on having made an adjustment which is stable and permanent in its subsequent working. For this reason only a limited amount of work can be successfully executed in the general garage. If the control unit, for example, will not respond to the adjustments outlined an exchange should be made and the original unit subjected to bench examination in a properly equipped electrical workshop.

LUCAS