

SERVICING LUCAS ELECTRICAL EQUIPMENT

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CONSEQUENT upon design developments which have occurred and modifications made to service routine, the specifications of some of the Lucas standard components have changed since our last article on this subject. For this reason, we are presenting a revised Lucas Service Supplement sheet which, while giving the performance data of the new products, also details the differences in repair technique which have occurred.

The method of presentation remains the same, and for ease of reference, some of the tabular data, which is unaltered, is repeated, so that the information on these standard components is complete; and this issue, therefore, replaces the former publication.

As before, this Service Supplement is so arranged as to cross refer with the electrical data which appear on the seventh page of the vehicle data sheets. This data, in the latter case, is still presented in exactly the same fashion, except where special equipment is specified by the vehicle manufacturers. In that case, a full specification is given in the vehicle data sheet concerned.

The sections in this sheet are arranged as before, viz:

1. Brief Servicing Information

This section gives brief, but essential, servicing information on generators, control boxes, starting motors and coil ignition equipment. This will be found to compare with the information given in previous Service Supplement Sheets Nos. 17, 19, 21 (Electrical Servicing), but in this case revised to suit current production equipment. The well-known Lucas B.90 Scheme for obtaining replacement parts is explained in detail in these earlier articles, and at the present time there is no change in Lucas policy or the *modus operandi* of the scheme.

The testing and repair of electrical equipment requires the proper apparatus and should only be carried out by a skilled automobile electrician; and indeed it is for the benefit and guidance of such people that this article has been compiled.

2. Data on Current production Standard Units

This section details the units which can be considered as truly "standard," being widely used upon British cars in current production. It is not possible to include starter drive types or ignition timing control characteristics, which are therefore included, as usual, in the Car Service Sheets in the data tables which appear on the seventh page.

BRIEF SERVICING INFORMATION

Generators,
Models C39PV-2, C40-1,
C45PV-5 and C45PV-6

Routine Maintenance

Every 12,000 miles inject a few drops of Oiline BBB or any high quality medium viscosity (S.A.E.30) engine oil into the hole marked OIL at the end of the bearing housing in the commutator bracket.

At the same time inspect the brushgear, accessible when the commutator end bracket is removed. Brushes must be able to move freely in their holders. Always refit a brush in its original position to retain its bedding to the commutator. If the brushes are worn to an amount approaching the minimum permissible length quoted in the data, a new brush set must be fitted; further wear will lead to exposure of the embedded flexible connector at the running surface, and consequent damage to the commutator. Check brush spring tension.

The commutator should be free from oil and have a polished appearance.

Occasionally inspect the generator driving belt and if necessary adjust to take up any undue slackness by turning the generator in its mounting bracket. A belt movement of about $\frac{1}{2}$ in. midway between the pulleys is recommended.

Location of Generator Fault

If a fault in the generator is suspected, switch off all lights and accessories, disconnect the cables from the two generator terminals and connect these terminals with a short length of wire. Connect a 0-20 moving coil voltmeter between one of the terminals and earth, start the engine and gradually increase the engine speed up to about 1,000 r.p.m. The voltmeter reading should rise steadily. Do not allow the voltmeter reading to reach 20 volts—and do not race the engine in an attempt to increase the voltage.

If the voltmeter needle remains at zero, the brushgear must be examined and brush spring pressures checked. A low reading of a volt or less may indicate a faulty field system. Check the field resistance with an ohmmeter—the correct values are given in the data. An "infinity" ohmmeter reading indicates open-circuited field coils; a low resistance reading indicates defective field coil insulation. In either event, the field coils should be replaced or a substitute generator fitted.

If there is a reading of approximately 6 (i.e., half the normal voltage) the armature winding may be at fault, and this may be confirmed by burnt commutator segments. If armature testing facilities are not available, an armature can be checked by substitution.

Dismantling

To dismantle the generator it is only necessary to unscrew and withdraw the two through-bolts, when the commutator end bracket can be removed. The driving end bracket together with the armature can also be lifted out of the yoke; these two components need to be separated only if armature or bearing replacement is required.

Reassembly

Reassembly is a reversal of dismantling but the following points should be noted:

When fitting the drive end bracket to the armature shaft, the inner journal of the bearing must be suitably supported. Mild steel tube approx. 4 in. in length and $\frac{1}{2}$ in. wall thickness is suitable, the internal diameters being $\frac{3}{8}$ in. for C39PV-2 and C40-1 generators and $\frac{1}{2}$ in. for C45PV-5 and C45PV-6.

To refit the commutator end bracket, the brushes must first be held clear of the commutator by partially withdrawing the brushes from their brush boxes until each brush is trapped in position by the side pressure of its spring. The brushes can be released on to the commutator with a small screwdriver or similar tool when the end bracket is assembled to within about half an inch of the yoke. Before closing the gap between end bracket and yoke, see that the springs are in proper contact with the brushes.

Note:—In the case of the C40-1 (ventilated) generator, the brushes can be lowered on to the commutator after the end bracket is fitted by inserting a screwdriver through the ventilation holes in the end bracket.

CONTROL BOXES

Models RB106-2 and
RB310

1. Adjustment of Settings.

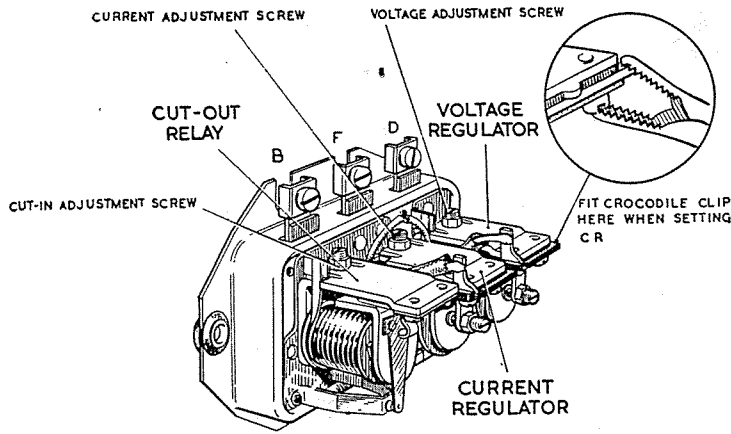
Unless a first grade 0-20 moving coil voltmeter is available it is not advisable to attempt to alter electrical setting. Checking and adjustment must be completed as rapidly as possible to avoid errors due to heating.

Mechanical settings are carefully set before the unit leaves the factory and should not be disturbed. If the operation is still not satisfactory after adjustment of electrical setting a replacement unit should be fitted.

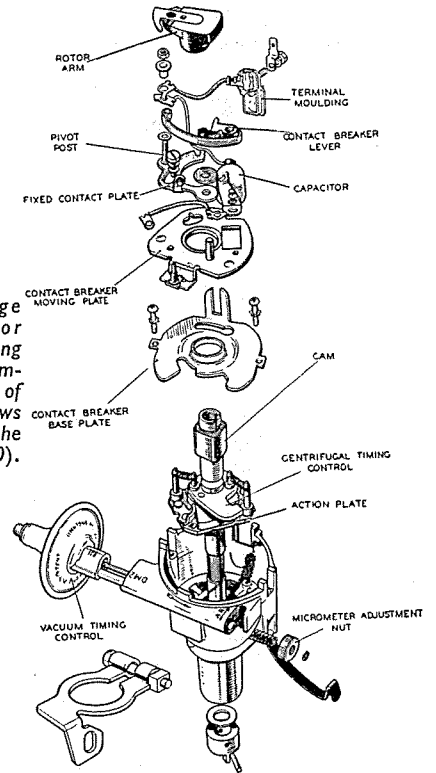
(a) Model RB106-2.

(i) **Checking regulator electrical setting.** Connect the voltmeter referred to above between control box terminals D and E. Disconnect cables connected to terminals A and A1, join the cable ends together and start the engine.

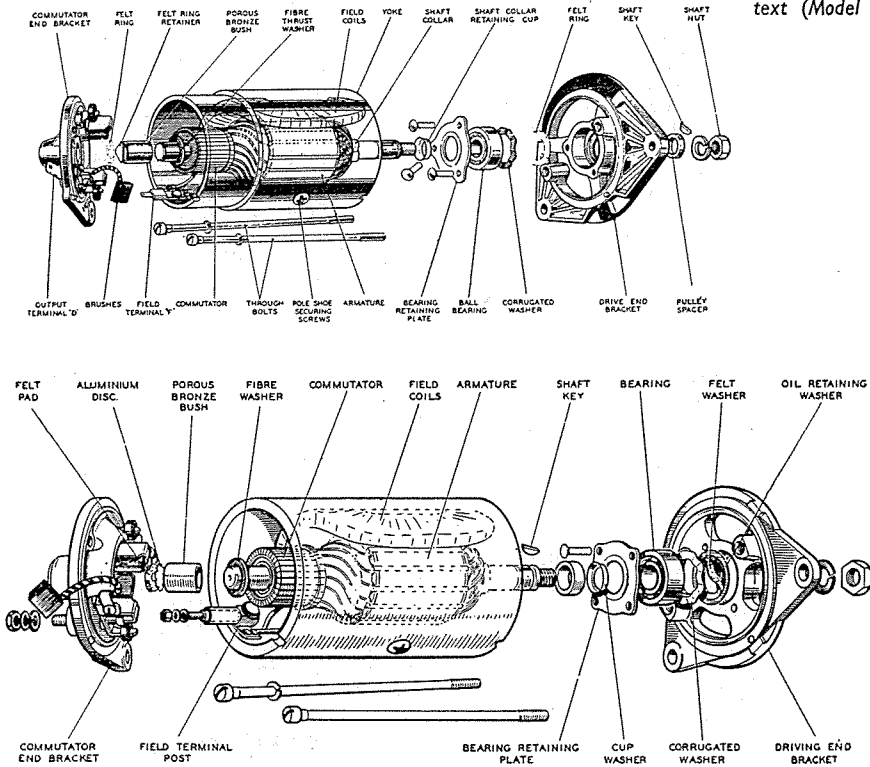
Run the generator at approximately 3,000 r.p.m. and observe the volt-



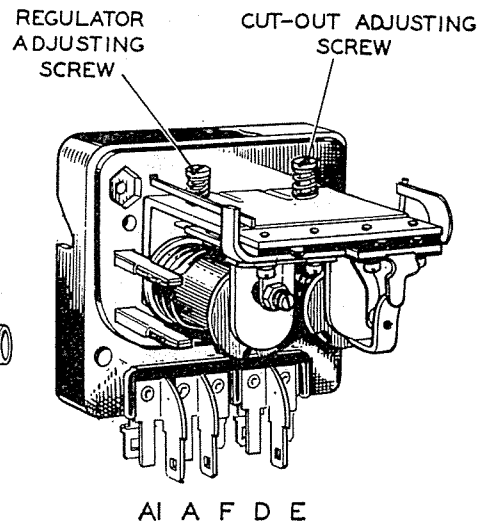
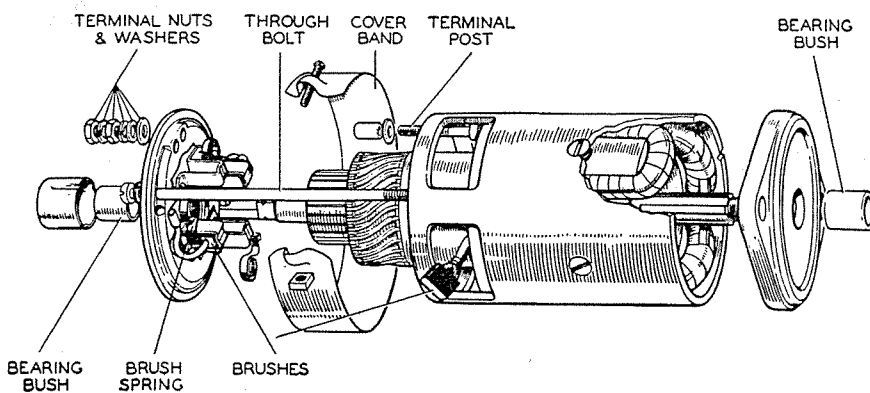
Current-voltage control regulator and cut-out showing location of main components and siting of adjustment screws referred to in the text (Model RB310).



Above shows an "exploded" view of the DM2 distributor with all parts shown in their respective order of assembly. Salient items are labelled for correct identity. Below shows a compensated voltage control regulator and cut-out unit, the RB106 model, with the adjustment screws clearly marked; as are also the terminal screws on the unit casing.



Above shows components of a typical Lucas generator in "exploded" form; and below, the parts of a starter motor similarly displayed.



| Symptom | Probable Faults |
|--|--|
| Excessive brush movement causing arcing at commutator. | Low brush-spring tension, worn or out-of-round commutator, "thrown" or high segment on commutator. |
| Excessive arcing at commutator. | Defective armature windings. |
| Armature does not rotate, no current consumption. | Open-circuited armature or field coils, badly burned commutator (no brush contact). |
| Armature does not rotate, high current consumption. | Earthed field winding or armature physically prevented from rotating. |
| Speed, torque and current consumption low. | High resistance in brushgear, e.g. faulty connections, dirty or burned commutator. |
| Speed and torque low, current consumption high. | Tight or worn bearings, insufficient end play, armature fouling pole shoe, bent shaft. |
| Speed and current consumption high, torque low. | Short-circuited field coils. |

meter reading. This should lie between the limits stated in the test data, appropriate correction being made for ambient temperature.

If the reading is outside these limits an adjustment is necessary. Remove the control box cover and, with the generator speed maintained at about 3,000 r.p.m. turn the regulator adjusting screw (clockwise to raise the setting, anti-clockwise to lower it) until the correct setting is obtained. A locknut will be found in some instances on the adjusting screw—this must be slackened before adjustment and retightened afterwards. Check the setting by reducing engine speed to idling and then again raising the generator speed to 3,000 r.p.m. Restore the original connections and refit the cover.

(ii) **Checking cutout electrical setting.**

Connect the voltmeter between control box terminals D and E. Switch on an electrical load (e.g. the headlamps).

Start the engine and slowly increase its speed, at the same time observing the voltmeter needle. When the cutout contacts close, a slight flick of the needle will be noticed, and this should occur within the cut-in voltage limits of 12.7-13.3 volts.

If the flick occurs outside these limits an adjustment must be made. Remove the control box cover and turn the cutout adjusting screw (clockwise to raise the setting or anti-clockwise to lower it) a fraction of a turn at a time, checking each setting by increasing the engine speed as before until the correct setting is obtained. A locknut may be found on the adjusting screw, as in the case of the regulator.

Remove the voltmeter connections and refit the cover.

(b) **Model RB310.**

(i) **Checking voltage regulator electrical setting.**

Disconnect control box terminal B, and connect the 0-20 moving coil voltmeter between terminal D and earth. Start the engine and run the generator at approx. 3,000 r.p.m., when the open circuit voltage reading should lie between the limits stated in the test data, appropriate

correction being made for ambient temperatures.

If the reading is outside these limits, stop the engine and remove the control box cover. Slacken the locknut (if fitted) of the voltage adjustment screw. Again run the generator at approx. 3,000 r.p.m. and turn the adjustment screw (clockwise to raise the setting or anti-clockwise to lower it) until the correct setting is obtained. Retighten the locknut (if fitted).

Check the setting by reducing engine speed to idling and then raising the speed again to 3,000 r.p.m. (generator). Restore the original connections.

(ii) **Checking current regulator electrical setting.**

To do this the generator must be made to develop its maximum rated output irrespective of the state of charge of the battery. The voltage regulator must therefore be made inoperative by short-circuiting its contacts with a clip large enough to bridge the outer armature assembly securing screw and the insulated fixed contact bracket (Fig. p. 3).

Disconnect the cable from control box terminal B and connect a first grade moving coil 0-40 ammeter between the end of this cable and terminal B.

With the generator running at approx. 4,000 r.p.m., the ammeter needle should be steady and indicate a current equal to the maximum rated output of the generator. If it does not, the unit must be adjusted by means of the current regulator adjustment screw in a manner similar to that described for the voltage regulator.

Remake the original connections.

(iii) **Checking cutout electrical setting.**

Connect the 0-20 moving coil voltmeter between control box terminal D and earth and proceed as described in section (ii) for the RB106-2 control box above.

2. Cleaning Contacts.

When cleaning voltage or current regulator contacts, use fine carborundum stone or silicon carbide paper, followed by methylated spirits.

For cutout contacts, use only a strip of fine glass paper.

STARTING MOTORS

Models M35G-1 and M418G

Routine Maintenance

Every 12,000 miles the brushgear and commutator should be inspected, for which purpose it is usually easier to remove the starting motor from the engine. Remove the cover band and examine the brushgear and commutator in a manner similar to that described for the generator, renewing brushes if necessary and checking brush spring tension.

The pinion or barrel assembly should move freely on the screwed sleeve of the drive. If the sleeve is dirty, wash in paraffin, afterwards lubricating very lightly with thin machine oil. In the event of the pinion becoming jammed in mesh with the flywheel, it can usually be freed by applying a spanner to the squared shaft extension at the commutator end, accessible when the protecting cap is removed.

When reconnecting the motor, ensure that all electrical connections are clean and tight. Clean any which have become dirty and smear the contacting surfaces lightly with petroleum jelly.

Location of Starting Motor Faults

If the motor does not operate, or fails to crank the engine, switch on the headlamps and again use the starting button. If the lamps do not dim and the motor does not operate, check by means of a voltmeter or test lamp that the switching and supply circuits up to the motor are in order. A voltage at the motor supply terminal, when the switch is operated, indicates a probable internal fault in the motor. If the lamps dim, but the motor does not crank the engine, check first for an abnormally stiff engine, or a discharged battery, before removing the motor for examination.

If the appropriate test apparatus is available, check the light running speed and current, and also lock torque and current. An indication of the nature of a fault may be deduced from these tests, as shown in the table above.

Dismantling

Remove the cover band, hold back the brush springs and lift the brushes from their holders. Unscrew the nuts from the terminal post protruding from the commutator end bracket. Unscrew the two through-bolts and remove the commutator end bracket from the yoke. Remove the other bracket complete with armature and drive from the yoke.

Further dismantling will depend on the nature of any repair to be made. Re-assembly is a reversal of the dismantling procedure.

COIL IGNITION EQUIPMENT

Incorporating Distributor Models DM2 and DM6

Every 1,000 miles, give the cap of the greaser (DM6 models only) a half-turn clockwise, refilling when empty with Acheson's graphited grease, grade GC, or with Shell Retinax A.

Every 6,000 miles, on all models, inject a few drops of thin machine oil into the rotor arm spindle to lubricate the cam bearing. The screw which can be seen

GENERATORS

(a) Model C39PV-2
Two-pole, two-brush shunt wound, ventilated machine.
Rotation (drive end): Clockwise.
Brush spring tension: 22-25 oz.
Field resistance: 6.1 ohms.
Cut-in speed 1,050-1,200 r.p.m. at 13.0 generator volts.
Maximum output 19 amp. at 1,900-2,150 r.p.m. and 13.5 volts on resistance load 0.71 ohm.
Fit new brushes when worn to 11/32in.
Brush set. Part No. 227305.

(b) Model C45PV-5
Two-pole, two-brush shunt wound, ventilated machine.
Rotation (drive end): Clockwise.
Brush spring tension: 36-44 oz.
Field resistance: 6.0 ohms.
Cut-in speed: 1,100-1,250 r.p.m. at 13.0 generator volts.
Maximum output 22 amps. at 1,700-1,900 r.p.m. and 13.5 volts on resistance load 0.61 ohm.
Fit new brushes when worn to 7/16in.
Brush set. Part No. 238061.

(c) Model C40-1.
Two-pole, two brush, shunt wound, ventilated machine.
Rotation (drive end): Clockwise.
Brush spring tension: 30 oz. (max.) with new brush.
13 oz. (min.) with worn brush.
Field resistance: 6.0 ohms.
Cut-in speed: 1450 max. r.p.m. at 13.0 generator volts.
Max. output 22 amps. at 2250 (max.) r.p.m. and 13.5 volts on resistance load 0.61 ohm.
Fit new brushes when worn to either: 9/32in. when brush spring arm will be bearing on brush box, or 7/32in. depending on design of brush set. Part No. 227541.

(d) C45 PV-6.
Two pole, two brush, shunt wound, ventilated machine.
Rotation drive end: clockwise.
Brush spring tension: 30-34 oz.
Field resistance: 6.0 ohms.
Cut-in speed 1300 (max.) r.p.m. at 13.0 generator volts.
Maximum output 25 amps at 2050 (max.) r.p.m. and 13.5 volts on resistance load of 0.54 ohm. Fit new brushes when worn to 11/32in. Brush set Part No. 54210090.

STARTING MOTORS

(a) Model M35G-1
Four-pole four-brush series-parallel field.
Rotation (drive end): Clockwise.
Brush spring tension: 30-34 oz.
Lock torque: 7.7 lb ft min with 330-350 amp. and 7.5-7.1 volts.
Torque at 1,000 r.p.m.; 4.5 lb ft with 215-235 amp and 9.1-8.7 volts.
Light running speed 9,500-11,000 r.p.m. with 45 amp.
Fit new brushes when worn to 3/8in.
Brush set. Part No. 251108.

(b) Model M418G
Four-pole, four-brush series parallel field.
Rotation (drive end): Clockwise.
Brush spring tension: 30-40 oz.
Lock torque: 17 lb ft with 440-460 amp and 7.4-7.0 volts.
Torque at 1,000 r.p.m.: 8.0 lb ft with 250-270 amp and 9.4-9.0 volts.
Light running speed 7,400-8,500 r.p.m. with 45 amp.
Fit new brushes when worn to 3/8in.
Brush set. Part No. 255659.

COIL IGNITION DISTRIBUTORS

(a) Model DM2P4.
Contact breaker gap setting: 0.014-0.016in.
Contact breaker spring tension, measured at contacts: 18-24 oz.
Contacts closed period: 60° ± 3°.
Contact set. Part No. 423 153.
Condenser capacity: 0.18-0.23 mfd.
Condenser min insulation resistance: 3 megohms.
Rotation (drive end): Clockwise.
Centrifugal and vacuum automatic timing controls.

(b) Model DM6.
Contact breaker gap setting: 0.014-0.016in.
Contact breaker spring tension, measured at contacts: 18-24 oz.
Contacts closed period: 35° ± 3°.
Contact set. Part No. 420 197.
Condenser capacity: 0.18-0.23 mfd.
Condenser min insulation resistance: 3 megohms.
Rotation (drive end): Clockwise.
Centrifugal and vacuum automatic timing controls.

CONTROL BOXES

(a) Model RB106-2
Cut-out.
Cut-in voltage: 12.7-13.3.
Drop-off voltage: 8.5-11.0.
Voltage Regulator.
Open-circuit setting at ambient temperature of 20° C (68° F) and generator speed of 3,000 r.p.m. 16.0-16.6 volts. For every 10° C (18° F) above 20° C subtract 0.1 volt from above setting. For every 10° C below 20° C, add 0.1 volt.

(b) Model RB310
Cut-out.
Cut-in voltage: 12.7-13.3.
Drop-off voltage: 9.5-11.0.
Voltage Regulator.
Open-circuit setting at ambient temperature of 20° C (68° F) and generator speed of 3,000 r.p.m. 14.9-15.5 volts. For every 10° C (18° F) above 20° C, subtract 0.2 volt from above setting. For every 10° C below 20° C, add 0.2 volt.
Current Regulator.
Set to operate at maximum rated output of associated generator. Permissible tolerance ± 1 ampere for generators of up to 25 amps. maximum output, and ± 1 1/2 amperes up to 35 amps maximum output.

BATTERIES

Capacity (ampere hours at 20 hour rate:—
7-plate: 43; 9-plate: 58; 11-plate: 72.
Specific gravity of electrolyte corrected to 60° F (15.5° C):

| | Climates normally under 90° F | Climates frequently* over 90° F |
|-------------------------|-------------------------------|---------------------------------|
| Fully charged ... | 1.270-1.290 | 1.210-1.230 |
| Half discharged ... | 1.190-1.210 | 1.130-1.150 |
| Complete discharged ... | 1.110-1.130 | 1.050-1.070 |

To correct S.G. readings taken at temperatures other than 60° F, deduct 0.002 from observed S.G. reading for every 5° F below 60° F and add 0.002 for every 5° F above 60° F.
*The specific gravity of the original filling acid is lower for the higher temperature range.

FLASHER UNIT MODEL FL5

Rate of flashing: 60-120 flashes per minute.
Light/dark period ratio: 50/50 ± 15%.

WINDSCREEN WIPERS

(a) Model DR2. Single speed.
Light running current after 60 secs: 2.7-3.4 amps* (rack disconnected).
R.P.M. of final gear (light running): 44-50.
Field resistance: 8.0-9.5 ohms.
Max. permissible force to move cable rack in protective outer tubing (blades away from windshield and rack disconnected at gear-box): 6 lb.
* Actual running current depends on efficiency of rack installation and friction of blades on screen. In general, with blades removed from screen, running current is of order of 2.8-3.5 amps.

(b) Model DR3. Two speed.

| | Normal speed | High speed |
|---|--------------|-------------|
| Light running current after 60 secs (rack disconnected) ... | 2.7-3.4 amp* | 2.0-2.5 amp |
| R.P.M. of final gear (light running): ... | 45-50 | 60-70 |

Field resistance: 8.0-9.5 ohms.
Speed control resistance for high speed operation: 9.5-11.0 ohms.
Max. permissible force to move cable rack in protective outer tubing (blades away from windshield and rack disconnected at gear-box): 6 lb.

inside the spindle when the moulded rotor arm is removed should *not* be slackened—clearance is provided beneath the screw-head to permit the passage of oil to the cam bearing. The faces of the cam should be smeared lightly with Mobilgrease No. 2. Add a few drops of thin machine oil (S.A.E.30) through the aperture at the edge of the contact breaker base to lubricate the centrifugal timing control.

Also at 6,000 miles, clean the moulded distributor cover thoroughly, inside and out; see that the carbon brush moves freely in its holder; examine the contacts, if necessary cleaning them; check the contact breaker gap, resetting it to 0.014-0.016 in. Ensure that the contact breaker lever moves freely on its pivot. If sluggish, remove the arm and polish the pivot post with a strip of fine emery cloth, then smear the post with Ragosine molybdenised non-creep oil or Mobilgrease No. 2.

Location of Fault in Ignition Circuit

If firing is uneven, check which cylinder is affected by removing each plug connector in turn with the engine running at a fairly fast idling speed. Removal of the connection to the defective cylinder will cause no noticeable change in the running note, but there will be a definite increase in roughness when other plugs are disconnected. Having thus located the defective cylinder, hold the cable end about 3/16 in. from the cylinder head. If sparking is strong and regular the fault lies with the sparking plug. If there is no spark, or only weak irregular sparking, examine the cable insulation, renewing if cracked or perished. Clean and examine the distributor moulded cover for "tracking," indicated by a thin black line between two or more electrodes or between an electrode and the body, which will necessitate a replacement cover.

In the event of total ignition failure,

take off the moulded cover and rotor arm. Switch on the ignition and, whilst the engine is slowly cranked, observe the reading on the car ammeter, or on an ammeter connected in series with the coil supply cable. The reading should rise and fall with the closing and opening of the contacts. No reading indicates an open circuit in the low-tension wiring, or badly adjusted or dirty contacts. If a reading is given which does not fluctuate, a short circuit or contacts remaining closed is indicated. In the former instance, check circuit for broken or loose connections, including ignition switch, and check coil by substitution. In the latter case, check wiring for indications of short circuit, check capacitor on suitable tester or by substitution, check coil by substitution, and examine insulation of contact breaker.

If the low-tension circuit is in order, remove the high-tension lead from the centre terminal of the distributor cover. Switch on the ignition and turn the engine until the contacts are closed; then with the end of the h.t. cable from the coil held about 3/16 in. from the cylinder block, flick open the contacts. If the equipment is in order a strong spark will be obtained, and the cause of trouble should be looked for elsewhere, e.g., petrol supply.