ELECTRICAL EQUIPMENT

CONTENTS

ELECTRICAL SYSTEM

Years of experience have proved Lucas electrical equipment to be very realiable and efficient. Periodical maintenance, however, must not be neglected if the best results are to be obtained from the system.

If trouble is experienced with any of the electrical equipment it is important that the exact source is quickly located by following an orderly course of investigation. Random probing among units of the system is useless and often incurs much unwarranted expense without locating the true source of trouble.

Trouble in the system can generally be immediately localised to a particular unit of the system by its very nature. Further localisation, in order to trace its exact source within the faulty unit, should then be carried out by following the series of testing operations laid down under the appropriate section.

It is important to note, however, that these **tests cannot be satisfactorily carried out unless the equipment recommended is available.** Further, it will be seen that special equipment is needed for dismantling and reassembling some units of the system and **should this equipment not be available dismantling must not be attempted.**

It is recommended that the fullest use is made of the very extensive Lucas Service System. New units and reconditioned exchange units are always available at these Service Depots.

The electrical system is a 12 volt earth return type. It can be broken down into the following units:—

1. Battery.
2. Generator, control box and fuse unit.
3. Starter and starter switch.
4. Ignition system (coil, distributor and plugs).
5. Lamps, switches, direction indicators, windscreen wipers, etc.

BATTERY

GENERAL

The battery is of the "clean-top" pattern, having submerged intercell connectors to minimise the risk of corrosion. Diecast cable connectors are fitted, retained with screws.

The battery fitted to the Alpine is positioned in a well under the floor behind the right-hand seat, and is accessible for topping up and testing after the cover plate has been removed.

The battery fitted to the Rapier is positioned in the engine compartment.

Batteries are supplied either filled and charged, unfilled and uncharged, or "dry-charged", that is with the cells in a charged condition but sealed and without electrolyte. Details of preparing unfilled, uncharged and "dry-charged" batteries are given in later paragraphs.

MAINTENANCE

Battery maintenance consists mainly of regular inspection and servicing.

1. Keep the battery and its surroundings clean and dry. Give particular attention to the top of the battery to prevent electrical leakage between the cell terminals.
2. Remove the vent plugs, and see that the vent holes are clear.
3. Check the electrolyte level and top up, when necessary. The correct level is just to the perforated splash guard. Do not over-fill or acid will escape through the vent holes with detrimental effect to the connections and adjacent parts of the car.

   The use of a Lucas Battery Filler will be found helpful in this topping-up process, as it ensures that the correct electrolyte level is automatically obtained and also prevents distilled

water from being spilled over the top of the battery.

Distilled water should always be used for topping-up. In an emergency, however, drinking water, clean rainwater or melted snow may be used. The following waters must not be used: salt water, chlorinated water, chemically softened water or stagnant water.

Caution.—Never use a naked light when examining a battery, as the mixture of oxygen and hydrogen given off by the battery when on charge, and to a lesser extent when standing idle, can be dangerously explosive.

If a battery is found to need an excessive amount of topping-up, the cause should be sought. If an excessive charge is suspected, check the regulator setting. If one cell in particular is at fault, examine the container for cracks.

Note.—Never transfer electrolyte from one cell to another.

4. With the diecast type of connector no corrosion difficulties arise. When fitting the connectors to the battery, first smear the inside of the tapered hole of the connector with silicone grease and push on the connector by hand.

   Insert the self-tapping screw and tighten with medium pressure only; fill in the recess around the screw head with more silicone grease. If the connectors are fitted dry, and driven home with too much force, they may be difficult to remove at a later date.

5. Examine the earth connection to ensure that it is clean and free from rust or corrosion.

6. Measure the specific gravity of the electrolyte in each cell in turn, with a hydrometer. The reading given by each cell should be approximately the same; if one cell differs appreciably from the others, an internal fault in the cell is indicated. This will probably be confirmed by the heavy discharge test described later.

   The appearance of the electrolyte drawn into the hydrometer when taking a reading gives a useful indication of the state of the plates; if it is very dirty, or contains small particles in suspension, it is possible that the plates are in a bad condition.

   Check the specific gravity of the electrolyte (Refer to Fig. 1) as an indication of the state of charge of the battery using a hydrometer.

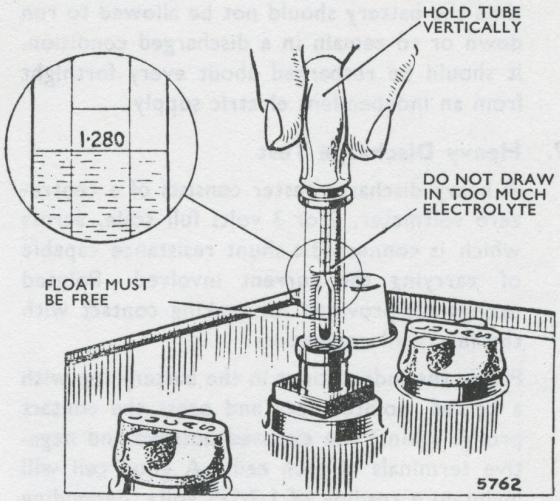


Fig. 1. *Taking hydrometer readings. Take readings at eye level*

The specific gravities and their indications are as follows:

Climate ordinarily below	80°F. (26·7°C).
Cell fully charged	1·270 — 1·290
Cell half charged	1·190 — 1·210
Cell fully discharged	1·110 — 1·130
Climate ordinarily above	80°F. (26·7°C).
Cell fully charged	1·210 — 1·230
Cell half charged	1·130 — 1.150
Cell fully discharged	1·050 — 1·070

The specific gravity of electrolyte varies with its temperature. The figures quoted above are for an electrolyte temperature of 60°F. (15·6°C). If the electrolyte tempreture is above 60°F. (15·6C.) add 0·002 to the hydrometer reading for each 5°F. (2·8°C.) rise to obtain true specific gravity. Similarly 0·002 must be deducted from the hydrometer reading for each 5°F. (2·8°C.) below 60°F. (15·6°C.).

If the level of the electrolyte is so low that a hydrometer reading cannot be taken, no attempt should be made to take a reading after adding distilled water until the battery has been on charge for at least thirty minutes.

Note.—If the car is out of use for any length of time the battery should not be allowed to run down or to remain in a discharged condition. It should be recharged about every fortnight from an independent electric supply.

7. **Heavy Discharge Test**

A heavy discharge tester consists of a centre-zero voltmeter, 2 or 3 volts full scale, across which is connected a shunt resistance capable of carrying the current involved. Pointed prongs are provided for making contact with the inter-cell connectors.

Pierce the indentations in the battery top with a heated, pointed tool and press the contact prongs against the exposed positive and negative terminals of each cell. A good cell will maintain a reading of 1·2-1·5 volts, depending on the state of charge, for at least 6 seconds. If, however, the reading rapidly falls, the cell is probably faulty and a new plate assembly may have to be fitted.

Remember that if the battery is subjected to heavy loads (i.e., long periods of night parking with lights on) without suitable opportunities for recharging, a low state of charge is only to be expected. A fault in the dynamo or regulator, or neglect during a period out of commission, may also be responsible for any trouble.

RECHARGING FROM AN EXTERNAL SUPPLY

If tests indicate that the battery is discharged, but is otherwise in good condition, it should be re-charged, either on the vehicle by a period of daytime running or on the bench from an external supply. If the latter, the battery should be charged at 5 amperes until the specific gravity and voltage show no increase over three successive hourly readings. During the charge the electrolyte must be kept level with the tops of the separator guard by the addition of distilled water. Re-charge rates are as follows:—

BT 7A Batteries (43 ampere-hour) 4 amps.
BV 9-11A Batteries (67 ampere-hour) 6 amps.

Do not allow the temperature of the electrolyte to exceed the maximum permissable temperature during charging, *i.e.*,

Climates below 80°F. (26·7°C.)	100°F. (37·8°C.)
Climates above 80°F. (26·7°C.)	120°F. (48·9°C.)

A battery in which all cells show a general falling off in efficiency will often respond to the process known as "cycling". This process consists of fully charging the battery as described above, and then discharging it by connecting to a lamp board, or other load, at the same rate. The battery should be capable of providing this current for at least 7 hours before it is fully discharged, as indicated by the voltage of each cell falling to 1·8. If the battery discharges in a shorter time, repeat the "cycle" of charge and discharge.

PREPARING NEW BATTERIES FOR SERVICE

Batteries for the home market are normally supplied dry and uncharged; in this event the instruction in para. (*a*) should be followed.

Batteries for export markets are supplied "dry-charged". Before fitting to the vehicle the battery must be filled with acid as described in paragraph (*b*); no initial charging is necessary, although, if time permits a short freshening charge is advantageous.

Preparation of Electrolyte

Electrolyte of the specific gravity given below is prepared by mixing distilled water and concentrated sulphuric acid, usually of 1·835 S.G. The mixing must be carried out either in a lead-lined tank or in suitable glass or earthenware vessels. Slowly add the acid to the water, stirring with a glass rod. Never add the water to the acid as the resulting chemical reaction causes violent and dangerous spurting of the concentrated acid. The approximate proportions of acid and water are indicated in the table.

To obtain specific gravity (corrected to 60°F. (1·56°C.) of:	*Add 1 vol. of acid of 1·835 S.G. (corrected to 60°F. (1·56°C.) to:*
1·260 (Climates below 80°F. (26·7°C.)	3·0 volumes of water
1·210 (Climates above 80°F. (26·7°C.)	4·0 volumes of water

Heat is produced by the mixture of acid and water, and the electrolyte should be allowed to cool before taking hydrometer readings—unless a thermometer is used to measure the actual temperature, and a correction applied to the reading as previously described—and before pouring the electrolyte into the battery. The total volume of electrolyte required is 4½ pints (2·66 litres) for BT 7A batteries and 7½ pints (4·3 litres) for BV 11A batteries.

(*a*) UNCHARGED BATTERIES

Filling the Cells

The temperature of the acid, battery and filling-in room must be not below 32°F. (0°C.). Carefully break the seals in the filling holes and half fill each cell with electrolyte of the appropriate specific gravity. Allow the battery to stand for at least six hours, in order to dissipate the heat generated by the chemical action of the acid on the plates and separators, and then add sufficient electrolyte to fill each cell to the top of the separator guard. Allow to stand for a further two hours and then proceed with the initial charge.

Initial Charge

The initial charging rate is 2·5 amperes for BT 7A batteries and 3·5 amperes for BV9-11A batteries. Charge at this rate until the voltage and specific gravity readings show no increase over five successive hourly readings. This will take from 40 to 80 hours, depending on the length of time the battery has been stored before charging.

Keep the current constant by varying the series resistance of the circuit, or the generator output. This charge should not be broken by long rest periods. If, however, the temperature of any cell rises above maximum quoted:

Climate below 90°F. (32°C).	100°F· (38°C).
Climate above 90°F. (32°C).	120°F. (49°C).

The charge must be interrupted until the temperature has fallen at least 10°F. (6°C.) below that figure. Throughout the charge the electrolyte must be kept level with the top of the separator guard by the addition of more electrolyte as required.

At the end of the charge carefully check the specific gravity in each cell to ensure that, when corrected to 60°F. (15·6°C.), it lies within the specific limits. If any cell requires adjustment, some of the electrolyte must be syphoned off and replaced either by distilled water or by acid of the strength originally used for filling-in, depending on whether the specific gravity is too high or too low. Continue the charge for an hour or so to ensure adequate mixing of the electrolyte and again check the specfic gravity readings. If necessary, repeat the adjustment process until the desired reading is obtained in each cell. Finally, allow the battery to cool and syphon off any electrolyte above the tops of the separators.

(*b*) "DRY-CHARGED" BATTERIES

Electrolyte of the appropriate specific gravity, either 1·270 or 1·210, is prepared as previously described.

Filling the Cells

Carefully break the seals or remove the tape (as applicable) and fill each with electrolyte to the tops of the separators, **in one operation.** The temperature of the filling room, battery and electrolyte should be maintained between 60°F. (15·6°C.) and 100°F. (38°C.). If the battery has been stored in a cool place it should be allowed to warm up to room temperature before filling.

Batteries filled in this way are 90 per cent. charged and may be used after a standing period of one hour. When time permits, however, a short freshening charge will ensure that

the battery is fully charged. Such a freshening charge should last for no more than 4 hours, at the normal recharge rate of the battery. During the charge the electrolyte must be kept level with the top edge of the separators by the addition of distilled water. Check the specific gravity of the acid at the end of the charge; if 1·260 acid was used to fill the battery, the specific gravity should now be between 1·270 and 1·290; if 1·210, between 1·210 and 1·230.

GENERATOR

GENERAL

The generator is a shunt-wound, two-pole, two-brush machine, arranged to work in conjunction with a Lucas regulator unit. A fan, integral with the driving pulley, draws cooling air through the generator, inlet and outlet holes being provided in the end brackets of the unit. The armature is supported at the drive-end in a ball race bearing and at the commutator-end in a porous bronze bush.

ROUTINE MAINTENANCE

Lubrication

Inject a few drops of engine oil into hole marked "OIL" at the end of the C.E. bearing housing (See Fig. 2). The felt ring acts as a reservoir.

Inspection of Brushgear

The brushgear should be inspected periodically (See page 7).

Belt Adjustment

See Section "B" of this manual.

PERFORMANCE DATA

(See General Data).

SERVICING

Testing in Position to Locate Fault in Charging Circuit

In the event of a fault in the charging circuit, adopt the following procedure to locate the cause of trouble.

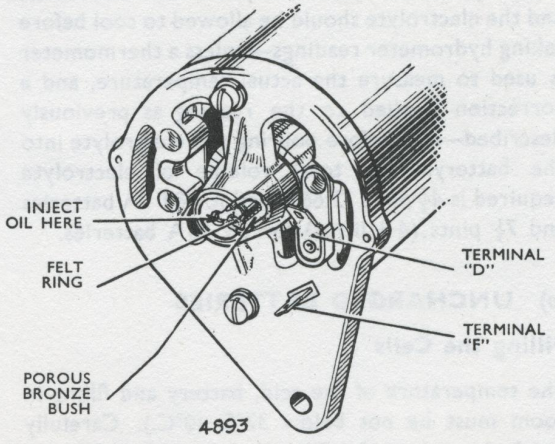


Fig. 2. *Generator lubrication*

1. Inspect the driving belt and adjust if necessary (see Section B).

2. Check the Lucar connections on the commutator-end bracket. The larger connector carries the main generator output, the smaller connector the field current (see Fig. 2).

3. Switch off all lights and accessories, pull off the connectors from the terminals of the generator and connect the two terminal blades with a short length of wire.

4. Start the engine and set to run at normal idling speed.

5. Clip the negative lead of a moving coil type voltmeter, calibrated 0-20 volts, to one generator terminal and the positive lead to a good earthing point on the yoke.
6. Gradually increase the engine speed, when the voltmeter reading should rise rapidly and without fluctuation. Do not allow the voltmeter reading to reach 20 volts, and do not race the engine in an attempt to increase the voltage. It is sufficient to run the generator up to a speed of 1,000 r.p.m. If the voltage does not rise rapidly and without fluctuation the unit must be dismantled for internal examination.

   Excessive sparking at the commutator in the above test indicates a defective armature which must be renewed.

Note.—If a radio suppression capacitor is fitted between the output terminal and earth, disconnect this capacitor and re-test the generator before dismantling. If a reading is now given on the voltmeter, the capacitor is defective and must be renewed.

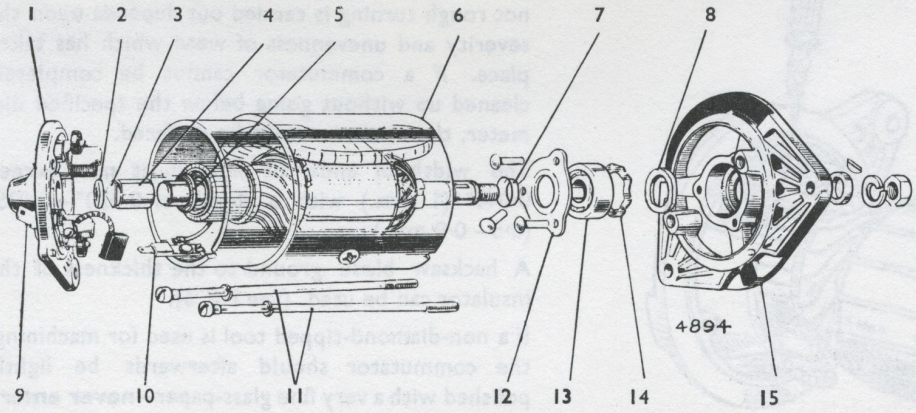
If the generator is in good order, remove the link from between the terminals and restore the original connections.

To Dismantle (See Fig. 3)

1. Take off the driving pulley and Woodruff key.
2. Unscrew and withdraw the two through bolts (11).
3. Withdraw the commutator-end bracket (1) from the yoke (6).
4. Lift the driving-end bracket and armature assembly from the yoke. Take care not to lose the fibre thrust washer (5) from the commutator end of the shaft.
5. The driving-end bracket, which on removal from the yoke has withdrawn with it the armature and armature shaft ball-bearing, need not be separated from the shaft unless the bearing is suspected and requires examination, or the armature is to be replaced; in this event the armature should be removed from the end bracket by means of a hand press.

Brushgear (Checking with yoke removed)

1. Lift the brushes up into the brush boxes and secure them in that position by positioning the brush springs at the sides of the brushes (see Fig. 4)(A).
2. Fit the commutator-end bracket over the commutator and release the brushes.
3. Hold back each of the brush springs and move the brush by pulling gently on its flexible connector. If the movement is sluggish, remove the brush from its holder and ease the sides by lightly polishing on a smooth file. Always refit brushes in their original positions. If the



1. Commutator end bracket
2. Felt ring
3. Felt ring retainer
4. Bronze bush
5. Fibre washer
6. Yoke
7. Retaining cup
8. Felt ring
9. Terminal 'D'
10. Terminal "F"
11. Through bolts
12. Bearing retainer
13. Driving end bearing
14. Corrugated washer
15. Driving end bracket

Fig. 3 *Exploded view of generator*

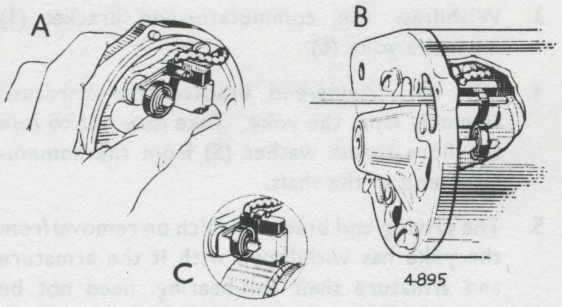


Fig. 4. *Assembling end bracket and brushes to generator*

brushes are badly worn, new brushes must be fitted and bedded to the commutator. The minimum permissible length of brush is $\frac{1}{4}$". (6 mm.).

4. Test the brush spring tension using a spring scale (See Fig. 5). The tension of the spring when new is 15/25 oz. (·42/·71 kgs.) when exerted on a new brush. Fit new springs if the tension is low.

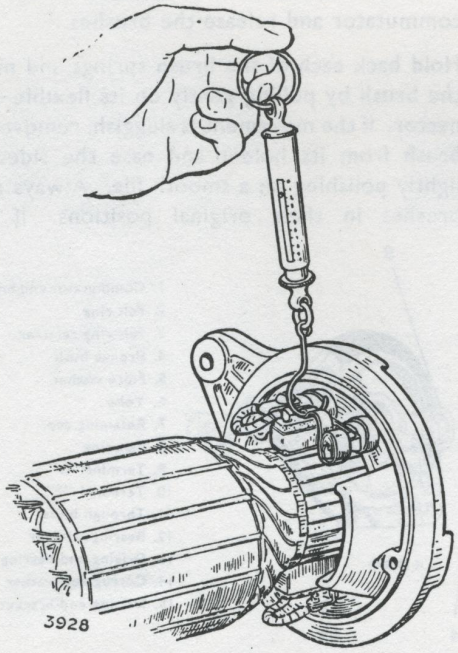
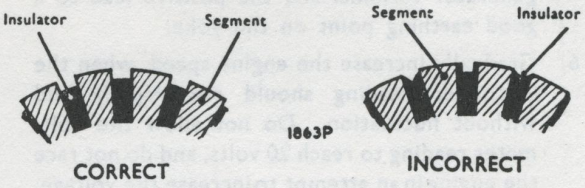


Fig. 5. *Testing brush spring tension*

Commutator

A commutator in good condition will be smooth and free from pits or burned spots.



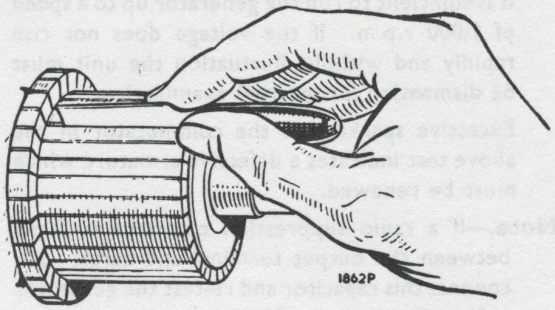


Fig. 6 *Undercutting commutator insulation*

Clean the commutator with a petrol-moistened cloth. If this is ineffective, carefully polish with a strip of fine glass paper while rotating the armature.

The commutator is of moulded construction and can be re-skimmed during service, but care must be exercised to ensure that the finished diameter is not less than 1·450" (36·8 mm.). The process of re-skimming consists of rough turning, undercutting and diamond turning—in that order. Whether or not rough turning is carried out depends upon the severity and unevenness of wear which has taken place. If a commutator cannot be completely cleaned up without going below the specified diameter, the armature must be replaced.

The width of undercut slots must not exceed 0·040" (1 mm.) with a depth of 0·020"—0·035" (0·5– 0·9 mm.).

A hacksaw blade ground to the thickness of the insulator can be used. (See Fig. 6).

If a non-diamond-tipped tool is used for machining, the commutator should afterwards be lightly polished with a very fine glass-paper—**never emery cloth.**

Armature

Indication of an open-circuited armature winding will be given by burnt commutator segments. If armature testing facilities are not available, an armature can be checked by substitution.

To separate the armature shaft from the drive-end bracket, press the shaft out of the drive-end bracket bearing. When fitting the new armature, support the inner journal of the ball bearing, using a mild steel tube of suitable diameter, whilst pressing the armature shaft firmly home (See also "To re-assemble", page 10).

Field Coils

Measure the resistance of the field coils, without removing them from the generator yoke, by means of an ohm meter connected between the field terminal and the yoke.

Field resistance is 5·9 ohms.

If an ohm meter is not available, connect a 12-volt d.c. supply between the field terminal and generator yoke with an ammeter in series. The reading should be approximately 2 amperes. Zero reading on the ammeter or an "Infinity" ohm meter reading indicates an open circuit in the field winding.

If the current reading is much more than 2 amperes, or the ohm meter reading much below 5·9 ohms, it is an indication that the insulation of one of the field coils has broken down.

In either event, unless a replacement generator is available, the field coils must be replaced. To do this, carry out the procedure outlined below:—

1. Drill out the rivet securing the field coil terminal assembly to the yoke, and remove the insulated sleeve from the terminal blade to protect it from the heat of soldering.
2. Unsolder the terminal blade and earthing eyelet.
3. Remove the insulation piece which is provided to prevent the junction of the field coils from contacting with the yoke.
4. Mark the yoke and pole shoes so that the latter can be fitted in their original positions.
5. Unscrew the two pole shoe retaining screws by means of a wheel-operated screwdriver (See Fig. 7).
6. Draw the pole shoes and coils out of the yoke and lift off the coils.

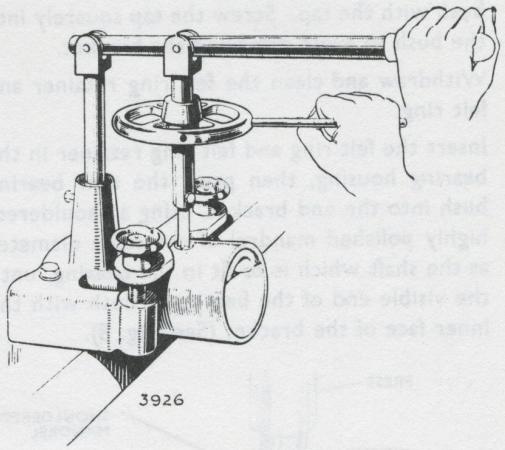


Fig. 7. *Unscrewing pole retaining screws*

7. Fit the new field coils over the pole shoes and place them in position inside the yoke. Take care to ensure that the taping of the field coils is not trapped between the pole shoes and the yoke.
8. Locate the pole shoes and field coils by lightly tightening the fixing screws.
9. Fully tighten the screws by means of the wheel-operated screwdriver.
10. Solder the terminal blade and earthing eyelet to the appropriate coil ends.
11. Refit the insulating sleeve and re-rivet the terminal assembly to the yoke.
12. Refit the insulation piece behind the junction of the two coils.

Bearings

Bearings which are worn to such an extent that they will allow side movement of the armature shaft, must be renewed.

To replace the bearing bush in the commutator-end bracket, proceed as follows:—

1. Remove the old bearing bush from the end bracket. The bearing can be withdrawn with a suitable extractor or by screwing a $\frac{5}{8}$" tap into the bush for a few turns and pulling out the bush with the tap. Screw the tap squarely into the bush to avoid damaging the bracket.
2. Withdraw and clean the felt ring retainer and felt ring.
3. Insert the felt ring and felt ring retainer in the bearing housing, then press the new bearing bush into the end bracket, using a shouldered, highly polished mandrel of the same diameter as the shaft which is to fit in the bearing, until the visible end of the bearing is flush with the inner face of the bracket (See. Fig. 8).

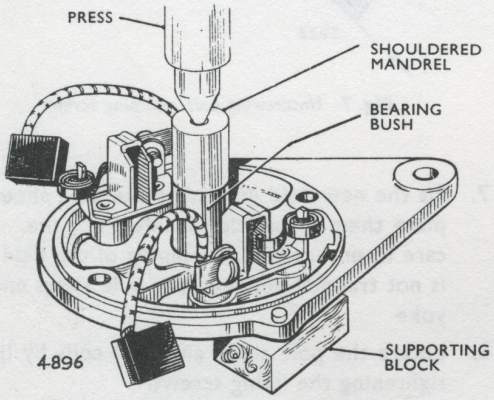


Fig. 8. *Fitting commutator end brush*

Porous bronze bushes must not be opened out after fitting, or the porosity of the bush may be impaired.

Note.—Before fitting the new bearing bush, it should be allowed to stand for 24 hours completely immersed in engine oil; this will allow the pores of the bush to be filled with lubricant.

The ball bearing at the driving end is renewed as follows (See Fig. 3):—

1. Drill out the rivets which secure the bearing retaining plate (12) to the end bracket and remove the plate.
2. Press the bearing (13) out of the end bracket and remove the corrugated washer (14), and felt ring (8).
3. Before fitting the replacement bearing, see that it is clean and pack it with high melting point grease.
4. Place the felt ring and corrugated washer in the bearing housing in the end bracket.
5. Locate the bearing in the housing and press it home.
6. Fit the bearing retaining plate.
7. Insert new rivets from the pulley side of the end bracket and open the rivets over the plate by means of a punch to secure the rigidly in position.

To Reassemble

1. Fit the drive end bracket to the armature shaft The inner journal of the bearing must be supported by a tube, approximately 4" (10·16 cm.) long, $\frac{1}{8}$" (3 mm.) thick and internal diameter $\frac{5}{8}$" (1·6 cm.). **Do not use the drive end bracket as a support for the bearing whilst fitting an armature.**
2. Fit the yoke to the drive-end bracket.
3. Push the brushes up into the brush boxes and secure them in that position by positioning each brush spring at the side of its brush (See Fig. 4, (A).
4. Fit the fibre thrust washer(s) and commutator-end bracket to the yoke so that the dowel on the bracket locates with the groove in the yoke. Take care not to trap the brush connectors.
5. Insert a thin screwdriver through the ventilator holes adjacent to the brush boxes and gently lever up the spring arms until the brushes correctly locate with the commutator (See Fig. 4,) (A) and (B).
6. Refit the two through bolts.
7. After reassembly lubricate the commutator-end bearing (see page 6).

CONTROL BOX

Equipment and General

We have tested and recommend the Avo Model 12 (obtainable from Avo Ltd., 92-96 Vauxhall Bridge Road, London S.W.1.) which has been designed specially for automotive use and enables a very wide range of checking operations to be carried out with a single instrument.

The control box houses the generator voltage regulator unit and the cut-out.

Although combined structurally, the regulator and cut-out are electrically separate. Both are accurately adjusted during manufacture, and the cover protecting them should not be removed unnecessarily.

The Regulator

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

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

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

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

By means of a temperature compensation device the voltage characteristic of the generator is caused to conform more closely to that of the battery under

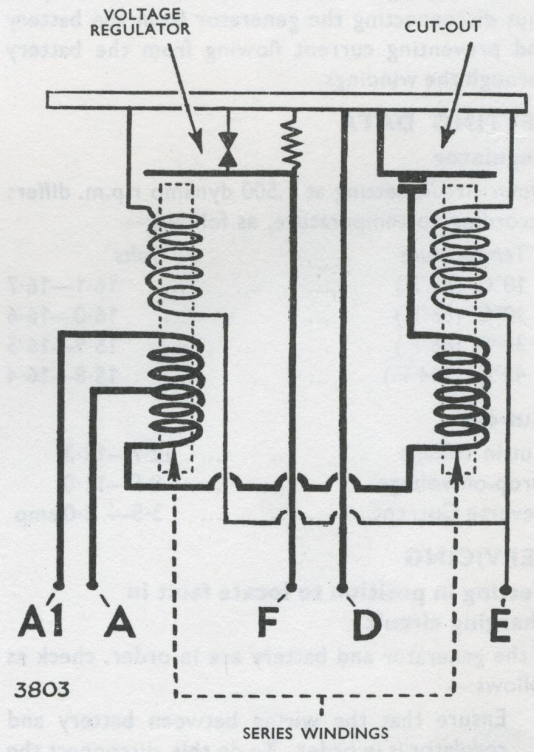


Fig. 9. *Control box internal connection*

all climatic conditions. In cold weather the voltage required to charge the battery increases, whilst in warm weather the voltage of the battery is lower. The method of compensation takes the form of a bi-metallic spring suspension for the armature of the regulator which causes the operating voltage of the regulator to be increased in cold weather and reduced in hot weather, and thereby to compensate for the variations in charging current which would otherwise occur due to the changing characteristics of the battery.

The Cut-out

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

SETTING DATA

Regulator

Open circuit setting at 1,500 dynamo r.p.m. differs according to temperature, as follows:—

Temperature	*Volts*
10°C. (50°F.)	16·1—16·7
20°C. (68°F.)	16·0—16·6
30°C. (86°F.)	15·9—16·5
40°C. (104°F.)	15·8—16·4

Cut-out

Cut-in voltage	12·7—13·3
Drop-off voltage	8·5—11·0
Reverse Current	3·5— 5·0 amp

SERVICING

Testing in position to locate fault in charging circuit

If the generator and battery are in order, check as follows:—

1. Ensure that the wiring between battery and regulator is in order. To do this, disconnect the wire from control box terminal "A" and connect the end of the wire removed to the negative terminal of voltmeter.

   Connect the positive voltmeter terminal to an earthing point on the chassis. If a voltmeter reading is given, the wiring is in order and the regulator must be examined.
2. If there is no reading, examine the wiring between battery and control box for defective cables or loose connections.
3. Re-connect the wire to terminal "A".

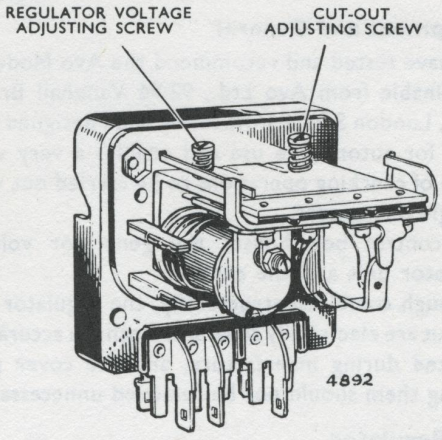


Fig. 10. *Cut-out and regulator assembly*

Regulator Adjustment

The regulator is carefully set during manufacture and, in general, it should not be necessary to make further adjustments. If, however, the battery does not keep in a charged condition, or if the generator output does not fall when the battery is fully charged, the setting should be checked and, if necessary, corrected.

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

(1) *Electrical Setting*

It is important that only a good quality MOVING COIL VOLTMETER (0-20 volts) is used when checking the regulator. The electrical setting can

be checked without removing the cover from the control box.

Withdraw the cables from control box terminals "A" and "A1" and connect these cables together.

Connect the negative lead of the voltmeter to control box terminal "D" and connect the other lead to terminal "E".

Slowly increase the speed of the engine until the voltmeter needle "flicks" and then steadies. This should occur at a voltmeter reading between the appropriate limits given according tothe ambient temperature.

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

Stop the engine and remove the control box cover. Turn the voltage adjusting screw in a clockwise direction to raise the setting or an anti-clockwise direction to lower the setting. Turn the screw only a fraction of a turn at a time. Repeat as above until the correct setting is obtained.

Adjustment of regulator open-circuit voltage should be completed within 30 seconds, otherwise heating of the shunt winding will cause false settings to be made.

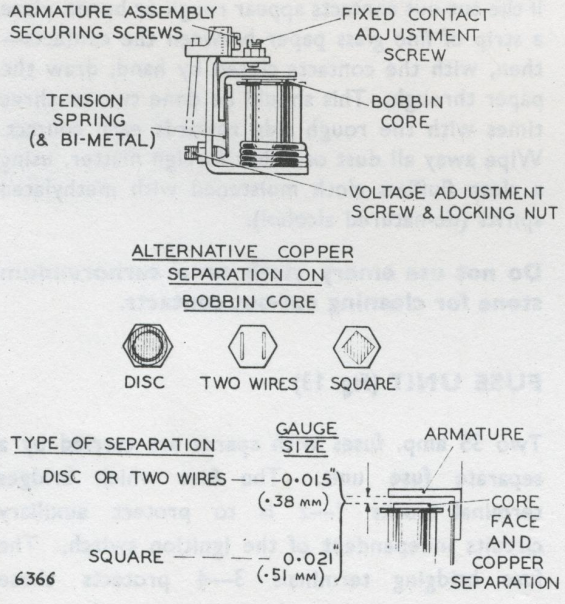


Fig. 11. *Setting of regulator*

Remake the original connections.

A generator run at high speed on open circuit will build up a high voltage. Therefore, when adjusting the regulator do not run the engine up to more than half speed or a false setting will be made.

(2) *Mechanical Setting*

The mechanical or air-gap settings of the regulator, shown in Fig. 11, are accurately adjusted before leaving the works and, provided that the armature carrying the moving contact is not removed, these settings should not be tampered with. If, however, the armature has been removed, the regulator will have to be reset. To do this proceed as follows:—

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

Slacken the voltage adjusting screw until it is well clear of the armature tension spring.

Slacken the two armature assembly securing screws.

Insert a gauge of appropriate thickness (Refer to Fig. 11) between the armature and the copper separation. The gauge must be wide enough to cover the core face completely. Take care not to turn up or damage the copper disc, wires or square.

(3) *Cleaning Contacts*

After long periods of service it may be found necessary to clean the regulator contacts. Clean the contacts by means of fine carborundum stone or fine emery cloth.

Carefully wipe away all traces of dust or other foreign matter with methylated spirit (de-natured alcohol).

Cut-out Adjustment (Fig. 12)

(1) *Electrical Settings*

If the regulator is correctly set but the battery is still not being charged, the cut-out may be out of adjustment. To check the voltage at which the cut-out operates, remove the control box cover and connect the voltmeter between terminals "D" and "E". Start the engine and slowly increase its speed until the cut-out contacts are seen to close,

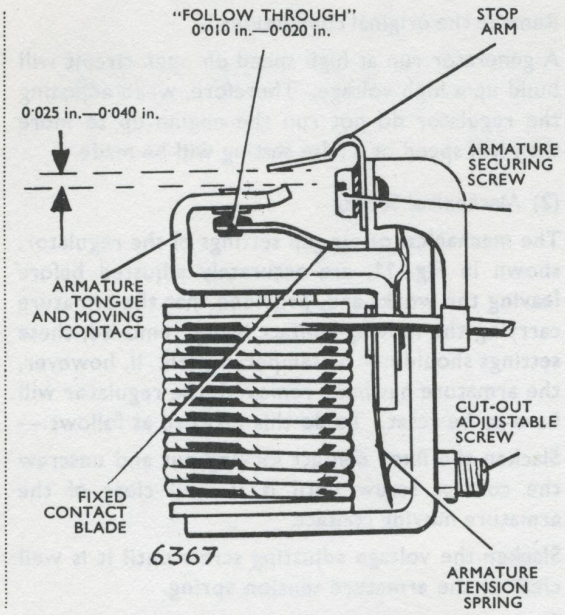


Fig. 12. *Mechanical setting of cut-out*

noting the voltage at which this occurs. This should be 12·7—13·3 volts.

If operation of the cut-out takes place outside these limits, it will be necessary to adjust. To do this, turn the cut-out adjusting screw (see Fig. 12) in a clockwise direction to raise the voltage setting or in an anti-clockwise direction to reduce the setting.

Turn the screw only a fraction of a turn at a time. Test after each adjustment by increasing the engine speed and noting the voltmeter readings at the instant of contact closure. Electrical settings of the cut-out, like the regulator, must be made as quickly as possible because of temperature-rise effects.

If the cut-out does not operate, there may be an open circuit in the wiring of the cut-out and regulator unit, in which case the unit should be removed for examination or renewal.

(2) *Mechanical Setting*

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

Unscrew the cut-out adjusting screw until it is well clear of the armature tension spring.

Slacken the two armature securing screws.

Press the armature **squarely** down against the copper-sprayed core face and re-tighten the armature securing screws. No gauge is necessary.

Press the armature **squarely** down against the core face and, using a pair of snipe-nosed pliers, adjust the gap between the armature stop arm and the tongue to between 0·025 in. and 0·040 in. by carefully bending the stop arm.

Adjust the fixed contact blade to give a "follow through", or blade deflection, of between 0·010. in. (0·254 mm.) and 0·020 in. (0·508 mm.) when the armature is pressed **squarely** down against the core face.

Re-set the cut-out adjusting screw as described under Para. (1).

(3) *Cleaning Contacts*

If the cut-out contacts appear rough or burnt, place a strip of fine glass paper between the contacts—then, with the contacts closed by hand, draw the paper through. This should be done two or three times with the rough side towards each contact. Wipe away all dust or other foreign matter, using a clean fluffless cloth moistened with methylated spirits (de-natured alcohol).

Do not use emery cloth or a carborundum stone for cleaning cut-out contacts.

FUSE UNIT (Fig. 13)

Two 35 amp. fuses with spares are carried by a separate fuse unit. The fuse which bridges terminal blocks 1—2 is to protect auxiliary circuits independent of the ignition switch. The fuse bridging terminals 3—4 protects those circuits controlled by the ignition switch.

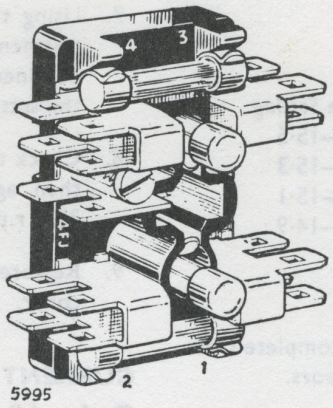


Fig. 13. *Fuse unit*

CONTROL BOX

MODEL R.B. 340

GENERAL

Equipment

We have tested and recommend the Avo Model 12 (obtainable from Avo Ltd., 92–96 Vauxhall Bridge Road, London, S.W.1) which has been specially designed for automotive use and enables a very wide range of checking operations to be carried out with a single instrument.

Preliminary Checking of Charging Circuit

Before disturbing any electrical adjustments, examine as under to ensure that the fault does not lie outside the control box:—

1. Check the battery by substitution or with an hydrometer and a heavy discharge tester.
2. Inspect the generator driving belt. This should be just taut enough to drive without slipping.
3. Check the generator by substitution or by disconnecting the generator cables and linking the larger generator terminal "D" to the smaller terminal "F" and connecting a first grade moving coil 0—20 voltmeter between this link and earth and running the generator up to about 1000 r.p.m. when a rising voltage should be shown.
4. Inspect the wiring of the charging circuit and carry out continuity tests between the generator, control box and the ammeter.
5. Check earth connections, particularly that of the control box.
6. In the event of reported undercharging, ascertain that this is not due to low mileage.
   Note—Should the control box fail to respond correctly to any adjustment given in the following instructions, it should be examined at a Lucas Service Depot or by an official Lucas Agent.

VOLTAGE REGULATOR

Open Circuit Settings

Ambient Temperature	*Voltage Setting*
10°C. (50°F.)	14·9—15·5
20°C. (68°F.)	14·7—15·3
30°C. (86°F.)	14·5—15·1
40°C. (104°F.)	14·3—14·9

Method of Adjustment

Checking and adjusting should be completed as rapidly as possible to avoid heating errors.

1. Withdraw both cables from control box terminals "B" and join them together with a suitable "jumper lead".

2. Connect the voltmeter between control box terminal "D" and a good earthing point. A convenient method of making this connection to terminal "D" is to withdraw the ignition warning light feed from control box terminal "WL" and to clip the voltmeter lead to the small terminal blade thus exposed—this terminal being electrically common with terminal "D".

3. Start the engine and run the generator at 3000 r.p.m.

4. Observe the voltmeter pointer.

The voltmeter reading should be steady and lie between the appropriate limits given, according to the temperature. An unsteady reading, i.e., one that fluctuates more than ±0·3 volts, may be due to unclean contacts. If the reading occurs outside the appropriate limits, an adjustment must be made. In this event, continue as follows:—

5. Stop the engine and remove the control box cover.

6. Re-start the engine and run the generator at 3000 r.p.m.

7. Using the correct tool, turn the voltage adjustment cam until the correct setting is obtained—turning the tool clockwise to raise the setting or anti-clockwise to lower it.

8. Check the setting by stopping the engine and then again raising the generator speed to 3000 r.p.m.

9. Restore the original connections and refit the cover.

CURRENT REGULATOR

On-Load Setting

The current regulator on-load setting is equal to the maximum rated output of the generator, which is 25 amperes.

Method of Adjustment (Refer to Fig. 13A)

The generator must be made to develop its maximum output, whatever the state of charge of the battery might be at the time of setting. The voltage regulator must therefore be rendered inoperative, and this is the function of the bulldog clip used in keeping the voltage regulator contacts together.

1. Remove the control box cover.

2. Using a bulldog clip, short out the voltage regulator contacts.

3. Disconnect the cables from control box terminals "B" and connect a first-grade 0–40 moving-coil ammeter between these cables and terminal "B". (Both cables must be connected to the same ammeter terminal).

4. Switch on all lights.

5. Start the engine and run the generator at 500 r.p.m.

6. Observe the ammeter pointer.

The ammeter pointer should be steady and indicate a current of 24—26 amps. An unsteady reading, i.e., one that fluctuates more than ±1 ampere, may be

due to unclean contacts. If the reading is too high or too low, an adjustment must be made. In this event, continue as follows:—

7. Using the correct tool, turn the current adjustment cam (clockwise to raise the setting or anti-clockwise to lower it) until the correct setting is obtained.

8. Switch off and restore the original connections.

9. Refit the cover.

CUT-OUT RELAY

Electrical Settings

1. Cut-in Voltage: 12·6—13·4

2. Drop-off Voltage: 9·3—11·2

Method of Cut-in Adjustment

Checking and adjusting should be completed as rapidly as possible to avoid heating errors.

1. Connect a first-grade 0–20 moving coil voltmeter between control box terminal "D" and a good earthing point. A convenient method of making this connection to terminal "D" is to withdraw the ignition warning light feed from control box terminal "WL" and to clip the voltmeter lead to the small terminal blade thus exposed—this terminal being electrically common with terminal "D".

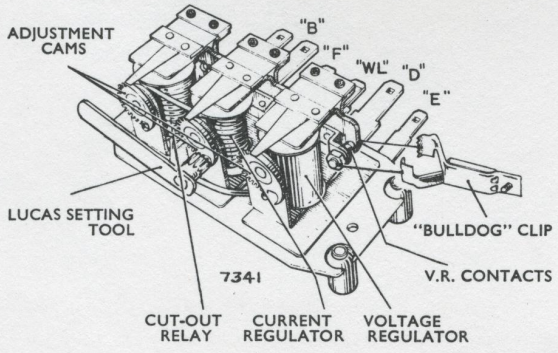
2. Switch on an electrical load, such as the headlamps.

3. Start the engine and slowly increase the engine speed.

4. Observe the voltmeter pointer. The voltage should rise steadily and then drop slightly at the instant of contact closure. The cut-in voltage is that indicated immediately before the pointer drops back. If the cut-in occurs outside the correct limits, an adjustment must be made. In this event reduce the engine speed to below cut-in value and continue as follows:—

5. Remove the control box cover.

6. Using the correct tool, turn the cut-out relay adjustment cam until the correct setting is obtained—turning the tool clockwise to raise the setting or anti-clockwise to lower it.



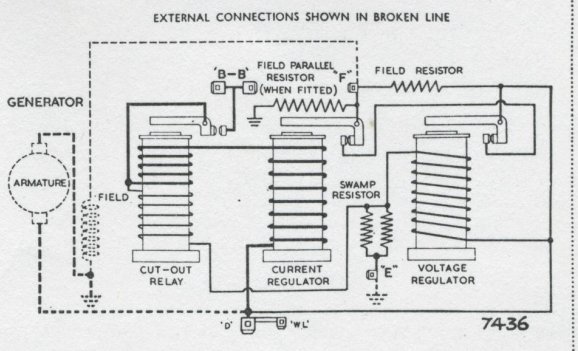


Fig. 13A. *Current-voltage control box and internal wiring diagram*

7. Repeat the above checking procedure until the correct setting is obtained.

8. Switch off, restore the original connections and refit the cover.

Method of Drop-off Adjustment

1. Disconnect the cables from control box terminal "B" and connect a first-grade 0–20 moving-coil voltmeter between this terminal and earth. Join the cables removed from "B", using a suitable "jumper lead".

2. Start the engine and run up to approximately 3000 r.p.m.

3. Slowly decelerate and observe the voltmeter pointer.

Opening of the contacts, indicated by the voltmeter pointer dropping to zero, should occur between 9·3—11·2 volts. If the drop-off occurs outside these limits, an adjustment must be made. In this event, continue as follows:—

4. Stop the engine and remove the control box cover.

5. Adjust by carefully bending the fixed contact bracket. Closing the contact gap will raise the drop-off voltage. Opening the gap will reduce the drop-off voltage.

6. Repeat 2 and 3 and, if necessary, re-adjust until the correct drop-off setting is obtained.

7. Restore the original connections and refit the cover.

CLEANING CONTACTS

Regulator Contacts

To clean the voltage or current regulator contacts, use fine carborundum stone or silicon carbide paper followed by methylated spirits (denatured alcohol).

Cut-out Relay Contacts

To clean the cut-out relay contacts, use a strip of fine glasspaper—never carborundum stone or emery cloth.

STARTER MOTOR

GENERAL

The starter motor is a four-pole, four-brush machine having an extended shaft to carry the engine engagement gear or starter drive. This motor is controlled by a solenoid switch mounted on the battery carrier and operated by the ignition key on the instrument panel. In an emergency or for testing purposes, the solenoid can be operated by hand by pressing the rubber cap covering the plunger.

ROUTINE MAINTENANCE

The starter motor fixing bolts should be checked for tightness periodically.

Remove the metal band cover. Check that the brushes move freely in their holders by holding back the brush springs and pulling gently on the flexible connectors. If a brush is inclined to stick, remove it from its holder and clean its sides with a petrol-moistened cloth. Be careful to replace brushes in their original position in order to retain the "bedding" qualities. Brushes which have worn so that they will not "bed" properly on the commutator must be renewed.

The commutator should be clean, free from oil or dirt and should have a polished appearance. If it is dirty, clean it by pressing a fine dry cloth against it while the starter is turned by hand by means of a spanner applied to the squared extension of the shaft. If the commutator is very dirty, moisten the cloth with petrol.

SERVICING

Testing in position

1. Switch on the lamps and operate the starter control. If the lights go dim, but the starter motor is not heard to operate, an indication is given that current is flowing through the starter motor windings but that the armature is not rotating for some reason; possibly the pinion is meshed permanently with the geared ring on the flywheel. In this case the motor must be removed from the engine for examination.

2. Should the lamps retain their full brilliance when the starter switch is operated, check the circuit for continuity from battery to starter motor via the starter switch, and examine the connections at these units. If the switch is found to be faulty, a new switch must be fitted. If the supply voltage is found to be applied to the motor when the switch is operated an internal fault in the motor is indicated and the unit must be removed from the engine for examination.

3. Sluggish or slow action of the starter motor is usually caused by a poor connection in the

wiring giving rise to a high resistance in the motor circuit. Check as described above.

4. If the motor is heard to operate, but does not crank the engine, indication is given of damage to the drive.

Bench Testing and Examination of Brushgear and Commutator

1. If it is necessary to remove the motor from the engine first proceed as follows:—

   Disconnect the cable from the positive battery terminal to avoid any danger of causing short circuits.

   Disconnect the heavy cable from the starter motor.

2. After removing the starter motor from the engine, secure the body in a vice and test by connecting it with heavy gauge cables to a 12 volt battery. One cable must be connected to the starter terminal and the other held against the body or end bracket. Under these light load conditions, the starter should run a very high speed—approximately 10,000 r.p.m.

3. If the operation of the motor is unsatisfactory, remove the cover band and examine the brushes and commutator. Hold back each of the brush springs and move the brush by pulling gently on its flexible connector. If the movement is sluggish, remove the brush from its holder and ease the sides by lightly polishing on a smooth file. Always replace brushes in their original positions. If the brushes are badly worn so that they will not bear on the commutator or if the brush flexible connector is exposed on the running face they must be replaced.

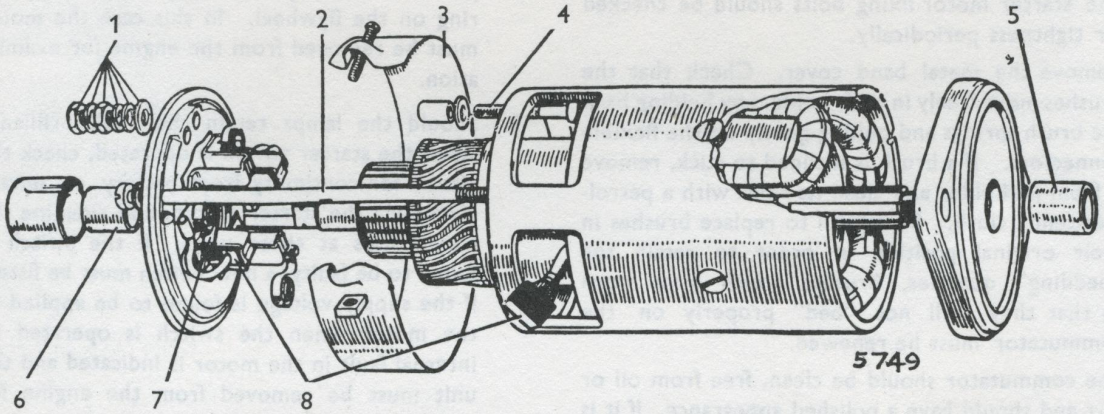
   Check the tension of the brush springs with a spring scale. The correct tension is 15 to 25 ozs. (·42/·71 kg.). A new spring should be fitted if the tension is low.

   If the commutator is blackened or dirty, clean it by holding a petrol-moistened cloth against it while the armature is rotated.

4. Re-test the starter as described under (2). If the operation is still unsatisfactory, the unit must be dismantled for detailed inspection and testing.

To Dismantle (See Fig. 13)

1. Remove the cover band, hold back the brush springs and lift the brushes from their holders.
2. Remove the terminal nuts from the terminal post.



1. TERMINAL NUTS AND WASHERS
2. THROUGH BOLT
3. COVER BAND
4. TERMINAL POST
5. BEARING BUSH (DRIVE END)
6. BEARING BUSH (COMMUTATOR END
7. BRUSH SPRINGS
8. BRUSHES

Fig. 13. *Exploded view of starter motor*

3. Remove the two through bolts from the commutator-end bracket, and take off the commutator-end bracket from the yoke.
4. Remove the drive-end bracket complete with armature and drive from the starter motor yoke. If it is necessary to remove the armature from the drive-end bracket it can be done by means of a hand press after the drive has been dismantled.

Replacement of Brushes

If the brushes are worn to $\frac{5}{16}$" in. length, they must be renewed.

Two of the brushes are connected to terminal eyelets attached to the brush boxes on the commutator-end bracket and two are connected to tappings on the field coils (see Figs. 14 and 15).

The flexible connectors must be removed by unsoldering and the connectors of the new brushes secured in their place by soldering. The brushes are pre-formed so that bedding to the commutator is unnecessary.

Commutator

A commutator in good condition will be smooth and free from pits and burned spots. Clean the commutator with a petrol-moistened cloth. If this is ineffective, carefully polish with a strip of fine glass paper while rotating the armature. To remedy a badly worn commutator, dismantle the starter drive (as described under "Starter Drive") and remove the armature from the end bracket. Now mount the armature in a lathe, rotate at a high speed and take a light cut with a very sharp tool. Do not remove any more metal than is necessary. Finally polish with very fine glass paper. The **insulators** between the commutator segments **must not be undercut.**

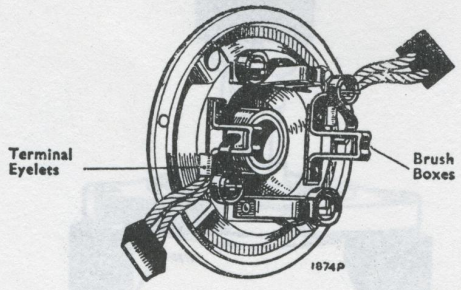


Fig. 14. *Commutator end bracket brush connections*

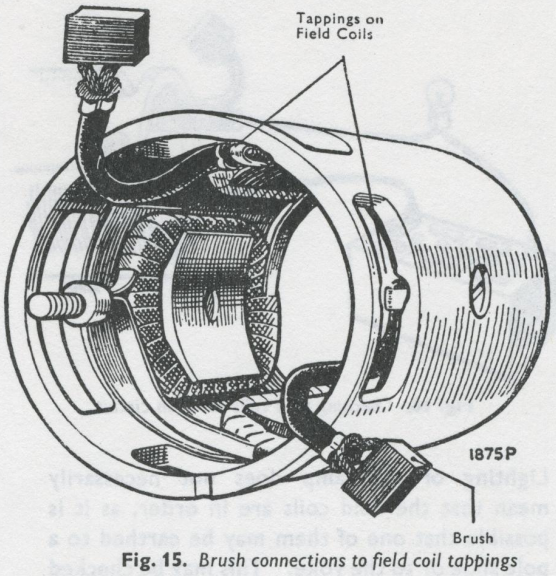


Fig. 15. *Brush connections to field coil tappings*

Armature

Examination of the armature may reveal the cause of failure, e.g., conductors lifted from the commutator due to the starter drive being engaged while the engine is running and causing the armature to be rotated at an excessive speed. A damaged armature must in all cases be renewed—no attempt should be made to machine the armature core or to true a distorted armature shaft.

Field Coils

1. Test the field coils for continuity by connecting a 12 volt battery with a 12 volt bulb in series between the tapping points of the field coils at which the brushes are connected. Failure of the lamp to light indicates an open circuit in the wiring of the field coils. (Fig. 16).

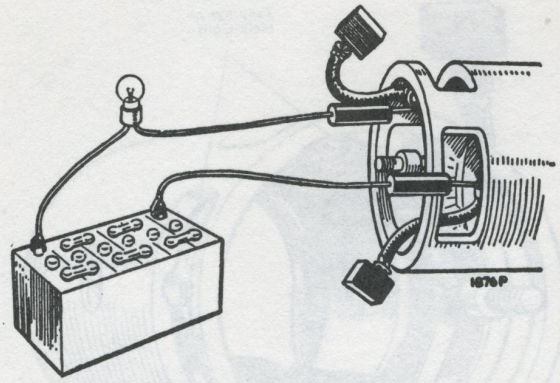


Fig. 16. *Checking field coils for open circuit*

2. Lighting of the lamp does not necessarily mean that the field coils are in order, as it is possible that one of them may be earthed to a pole shoe or to the yoke. This may be checked with a 110 volt test lamp, the test leads being connected to one of the field coil tapping points and to a clean part of the yoke. Should the lamp light it indicates that the field coils are earthed to the yoke.

In either case, unless a replacement starter motor is available, the field coils must be replaced. To do this, carry out the procedure outlined below, using a pole shoe expander and a wheel-operated screwdriver.

Remove the insulation piece which is provided to prevent the intercoil connectors from contacting with the yoke.

Mark the yoke and pole shoes in order that they can be fitted in their original positions.

Unscrew the four pole shoe retaining screws by means of the wheel-operated screwdriver.

Draw the pole shoes and coils out of the yoke and lift off the coils.

Fit the new field coils over the pole shoes and place them in position inside the yoke. Take care to ensure that the taping of the field coils is not trapped between the pole shoes and the yoke.

Locate the pole shoes and field coils by lightly tightening the fixing screws.

Insert the pole expander, open it to the fullest extent and tighten the screws.

Finally tighten the screws by means of the wheel-operated screwdriver.

Replace the insulation piece between the field connections and the yoke.

Bearings

Bearings which are worn to such an extent that they will allow excessive side play of the armature shaft must be replaced. To renew the bearing bushes proceed as follows:—

1. Press the bearing bush out of the end bracket.
2. Press the new bearing bush into the end bracket using a shouldered, highly polished mandrel of the same diameter as the shaft which is to fit in the bearing (Fig 18) Porous bronze bushes must not be opened out after fitting, or the porosity of the bush may be impaired.

Note.—Before fitting a new porous bronze bearing bush it should be completely immersed for 24 hours in clean thin engine oil. In cases of extreme urgency this period may be shortened by heating the oil to 100°C. when the time of immersion may be reduced to 2 hours.

Reassembly

The reassembly of the starter motor is a reversal of the dismantling procedure.

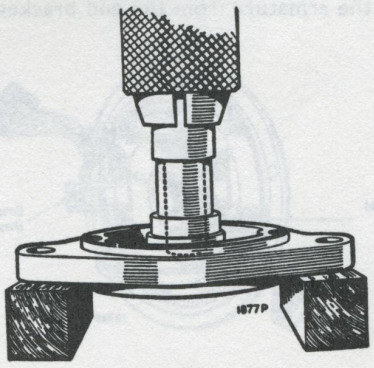


Fig. 17. *Fitting bearing bush*

STARTER DRIVE

GENERAL

The pinion and barrel assembly is mounted on a screwed sleeve, which is carried on splines on the armature shaft. The sleeve is so arranged that it can move along the shaft against a compression spring to reduce the shock loading at the moment engagement takes place.

When the starter switch is operated the armature shaft and screwed sleeve rotate. Owing to the inertia of the pinion and barrel assembly the latter is caused to move along the sleeve until the pinion comes into engagement with the flywheel ring. The starter will then turn the engine.

As soon as the engine fires and commences to run under its own power the flywheel will be driven faster by the engine than the starter. This will cause the pinion and barrel assembly to be screwed back along the sleeve, so drawing the pinion out of mesh with the flywheel teeth. In this manner the drive safeguards the starter against damage due to being driven at high speeds.

A pinion restraining spring is incorporated in the drive. This spring prevents the pinion vibrating into mesh when the engine is running.

ROUTINE MAINTENANCE

If any difficulty is experienced with the starting motor not meshing correctly with the flywheel, it may be that the drive requires cleaning. The pinion and barrel assembly should move freely on the screwed sleeve; if there is any dirt or other foreign matter on the sleeve it must be washed off with paraffin.

In the event of the pinion becoming jammed in mesh with the flywheel, it can usually be freed by turning the starter motor armature by means of a spanner applied to the shaft extension at the commutator end.

DISMANTLING AND REASSEMBLY

Having removed the armature as described in the section dealing with starting motors, the drive can be dismantled as follows (see Fig. 18):—

Remove the split pin (A) from the shaft nut (B) at the end of the starter drive. Hold the squared starter shaft extension at the commutator end by means of a spanner and unscrew the shaft nut (B). Lift off the main spring (C) and buffer washer (D) and remove the retaining ring (E) from inside the end of the pinion and barrel assembly (F). Corrugated washer (L), control nut (G), sleeve (H) and restraining spring (J) will now slide off. Withdraw the splined washer (K) from the armature shaft and remove the pinion and barrel.

The assembly of the drive is a reversal of the dismantling procedure.

Note.—Should either the control nut or screwed sleeve be damaged, then a replacement assembly of screwed sleeve and control nut must be fitted. These components must not be renewed individually.

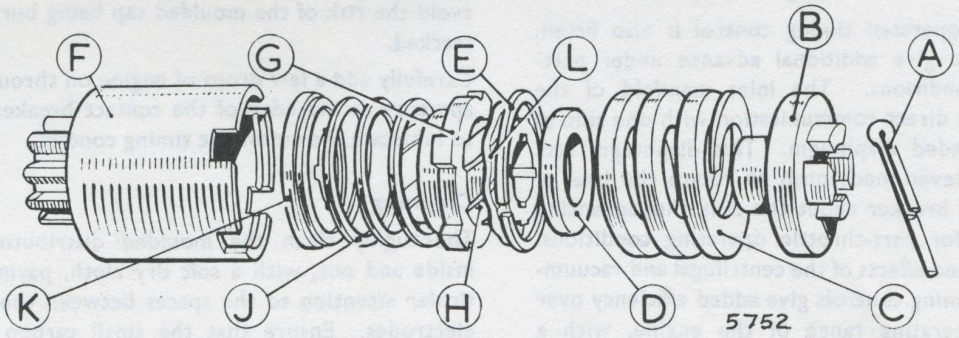


Fig. 18. *Exploded view of starter drive*

DISTRIBUTOR

GENERAL

The coil ignition equipment comprises a high tension induction coil and a combined distributor, contact breaker and automatic timing control assembly driven at half engine speed *via* the camshaft. Current flowing through the primary or low tension winding of the coil sets up a strong magnetic field about it. This current is periodically interrupted by a cam-operated contact breaker, driven from the engine, and the subsequent collapse of the magnetic field across the secondary winding of the coil induces a high voltage in it. At the same time, a rotor arm in the distributor connects the secondary winding of the coil with one of four metral electrodes, from which cables lead to the sparking plugs in the engine cylinders.

Thus, a spark is produced in the cylinder under compression at the optimum moment for combustion of the mixture.

Mounted on the distributor driving shaft, immediately beneath the contact breaker, is an automatic timing control mechanism. It consists of a pair of spring-loaded governor weights, linked by lever action to the contact breaker cam. At slow engine speeds, the spring force retains the cam in a position in which the spark is slightly retarded. Under the centrifugal force imparted by high engine speeds, the governor weights swing out against the spring pressure, to move the contact breaker cam and thereby advance the spark, to suit engine conditions at the greater speed.

A vacuum-operated timing control is also fitted, designed to give additional advance under part-throttle conditions. The inlet manifold of the engine is in direct communication with one side of a spring-loaded diaphragm. This diaphragm acts through a lever mechanism to rotate the heel of the contact breaker about the cam, thus advancing the spark for part-throttle operating conditions. The combined effects of the centrifugal and vacuum-operated timing controls give added efficiency over the full operating range of the engine, with a corresponding economy in fuel consumption.

Special ignition for cold climate countries.

The ignition coil is a 7-volt unit, and during normal running the excess voltage is dropped across a ballast resistor in series with the coil primary winding. For starting, an additional contact on the solenoid starter switch shorts out the ballast resistor, thus ensuring that the terminal voltage, and hence the performance, of the coil at this time remains practically unaffected by the drop in battery voltage. As soon as the engine starts, and the solenoid switch is opened, the ballast resistor is automatically reconnected into the primary circuit.

ROUTINE MAINTENANCE (See Fig. 20)

In general, lubrication and cleaning constitute normal maintenance procedure.

Lubrication

Take great care to prevent oil or grease from getting on or near the contacts.

Lightly smear the cam and the pivot on which the contact breaker works with lubricant as specified.

Lift off the rotor arm by pulling vertically and apply to the spindle a few drops of engine oil to lubricate the cam bearing. It is not necessary to remove the exposed screw, since it affords a clearance to permit passage of oil.

Replace the rotor arm carefully, locating its moulded projection in the keyway in the spindle and pushing it on as far as it will go, in order to avoid the risk of the moulded cap being burned or tracked.

Carefully add a few drops of engine oil through the aperture at the edge of the contact breaker plate to lubricate the automatic timing control.

Cleaning

Thoroughly clean the moulded distributor cap, inside and out, with a soft dry cloth, paying particular attention to the spaces between the metal electrodes. Ensure that the small carbon brush moves freely in its holder.

Examine the contact breaker. The contacts must be quite free from grease or oil. If they are burned or blackened, clean them with very fine carborundum stone or emery cloth, then wipe with a petrol-moistened cloth. Cleaning is facilitated by removing the contact breaker lever. To do this remove the nut, washer, insulating piece and connections from the spring anchor post. The contact breaker lever arm may now be removed from its pivot. After cleaning, check the contact breaker setting. Turn the engine by hand until the contacts show the maximum opening. This should measure ·015 in. (·38 mm.) If the measurement is incorrect, keep the engine in the position giving the maximum opening, slacken the screw securing the fixed contact plate and adjust its position to give the required gap (Fig. 19). Tighten the screw. Re-check the setting for other positions of the engine giving maximum opening.

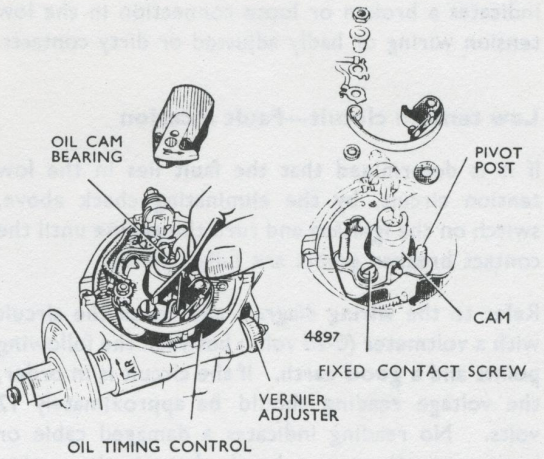


Fig. 19. *Distributor maintenance*

SERVICING

Before starting to test, make sure that the battery is not fully discharged, as this will often produce the same symptoms as a fault in the ignition circuit.

Testing in position to locate cause of uneven firing

Run the engine at a fairly fast idling speed.

Short circuit each plug in turn with the blade of an insulated screwdriver placed across the terminal to contact the cylinder head.

Short circuiting the defective plug will cause no noticeable change in the running note. On the others, however, there will be a pronounced increase in roughness.

Having thus located the defective cylinder, stop the engine and remove the cable from the sparking plug terminal.

Restart the engine and hold the cable end about $\frac{3}{16}$" (5 mm.) from the cylinder head. If sparking is strong and regular, the fault lies with the sparking plug, and it should be removed, cleaned and adjusted, or a replacement fitted.

If however, there is no spark, or only weak irregular sparking, examine the cable from the plug to the distributor for deterioration of the insulation, renewing the cable if the rubber is cracked or perished.

If the cable is fitted with radio or television suppressor, this should also be checked for damage or open circuit.

Clean and examine the moulded distributor cap for free movement of the carbon brush. If tracking has occurred, indicated by a thin line, usually between two or more electrodes, a replacement distributor cap must be fitted.

Testing in position to locate cause of ignition failure

Spring back the clips on the distributor head and remove the moulded cap. Lift off the rotor, carefully levering with a screwdriver if necessary.

Check the contacts for cleanliness and correct gap setting as described previously.

Connect an ammeter in the low tension wiring, switch on the ignition and turn the engine. Observe the ammeter reading, which should rise with the closing and fall to zero with opening of the contacts if the low tension wiring is in order. When the reading does not fluctuate, a short circuit, or contacts remaining closed, is indicated. No reading

indicates a broken or loose connection in the low tension wiring or badly adjusted or dirty contacts.

Low tension circuit—Fault location

If it is determined that the fault lies in the low tension circuit, by the eliminating check above, switch on the ignition and turn the engine until the contact breaker points are fully opened.

Refer to the wiring diagram and check the circuit with a voltmeter (0-20 volts) between the following points and a **good** earth. If the circuit is in order, the voltage reading should be approximately 12 volts. No reading indicates a damaged cable or loose connections, or a break- down in the section under test.

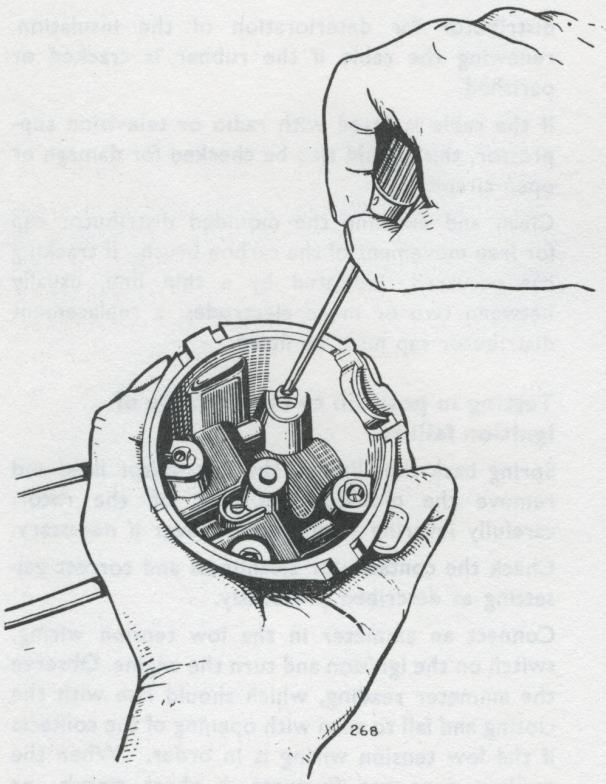


Fig. 20. *Ignition coil high tension cable*

(1) *Battery to control box*

Connect the voltmeter between the control box terminal "A" and earth. No reading indicates a faulty lead or loose connection.

(2) *Control box*

Check the voltage to earth at the control box terminal "A1". No reading indicates a broken connection in the series winding.

(3) *Control box to ignition switch*

Connect the voltmeter between the ignition switch terminal, to which the lead from the control box is connected, and a good earth. No reading indicates a faulty lead or loose connections.

(4) *Ignition switch*

Check the voltage between the other terminal of the ignition switch and earth. No reading indicates a fault in the switch.

(5) *Ignition switch to ignition coil*

Remove the lead from the ignition coil "SW" terminal, and connect the voltmeter between the free end of the cable and earth.

This portion of the circuit is made by way of the control box or fuse unit "3" terminal and a voltage check should be made at this point also.

Remake the connection to the coil.

(6) *Ignition coil*

Disconnect the lead from the "CB" terminal of the coil and connect the voltmeter between the "CB" terminal and a good earth. No reading indicates a fault in the primary winding of the coil, necessitating coil replacement. If, however, the correct reading is obtained, remake the cable connection to the coil terminal.

(7) *Ignition coil to distributor*

Disconnect the low tension cable to the distributor and connect the voltmeter between the end of the cable removed and earth. No reading indicates a faulty lead or loose connection. Reconnect the cable to the distributor.

(8) *Contact breaker and condenser*
Connect the voltmeter across the contact points. If no reading is obtained, re-check with the condenser removed. If a reading is now given, the condenser is faulty and must be renewed.

(9) Measure the contact breaker spring tension. This should be 18-24 oz., (·51-·68 kg.) measured at the contacts.

High tension circuit

If, after carrying out these tests, the fault has not been located, remove the high tension lead from the centre terminal of the distributor. Switch on the ignition and turn the engine until the contacts close. Flick open the contact breaker lever while the high tension lead from the coil is held about $\frac{3}{16}$ in. (5 mm) from the cylinder block. If the ignition equipment is in good order, a strong spark will be obtained. If no spark occurs, a fault in the circuit of the secondary winding of the coil is indicated and the coil must be replaced.

The high tension cables must be carefully examined, and renewed if the rubber insulation is cracked or perished, using 7 mm. rubber covered ignition cable. To connect a new cable to the ignition coil, pass the cable through the knurled moulded nut, bare about $\frac{1}{4}$ in. (6 mm.) of the end of the cable, thread the wire throught he brass washer (removed from the original cable) and bend back the strands. Finally screw the nut into its terminal (Fig. 20).

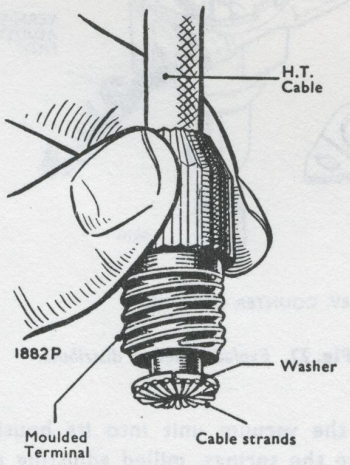


Fig. 21. *Distributor high tension cable terminal*

To make the connections to the terminals in the distributor cap, remove the cap and slacken the screws on the inside of the moulding. Cut the cables to the length required and push firmly home into the holes in the moulding. Tighten the screws, which will pierce the rubber insulation to make good contact with the cable core (Fig. 21).

The cables from the distributor to the sparking plugs must, of course, be connected in the correct firing order.

Contact breaker mechanism

Check and adjust as described above.

Ensure that the moving arm moves freely on the pivot. If sluggish, remove the arm and polish the pivot pin with a strip of very fine emery cloth. Replace the arm and lubricate with a spot of clean engine oil.

Dismantling

In order to ensure that the various components are refitted correctly, a careful note should be made of the positions of the items as they are removed. Note the relationship between the driving dog and the rotor electrode and maintain this relation when reassembling the distributor. The amount of dismantling necessary will obviously depend on the repair required.

Spring back the securing clips and remove the moulded cover. Lift the rotor arm off the spindle, carefully levering with a screwdriver if it is tight.

Disconnect the vacuum unit link to the moving contact breaker plate, and remove the two screws at the edge of the contact breaker base. The contact breaker assembly, complete with external terminal, can now be lifted off (see (1) below). Remove the circlip on the end of the micrometer timing screw, and turn the micrometer nut until the screw and the vacuum unit assembly are freed. Take care not to lose the ratchet and coil type springs located under the micrometer nut.

The complete shaft assembly, with centrifugal timing control and cam foot can now be removed from the distributor body (see (2) below).

(1) *Contact breaker*

To dismantle the assembly further, remove the nut, insulating piece and connections from the pillar on which the contact breaker spring is anchored. Slide out the terminal moulding. Lift off the contact breaker lever and the insulating washers beneath it. Remove the screw securing the fixed contact plate, together with the spring and plain steel washers, and take off the plate. Withdraw the single screw securing the capacitor and contact breaker earthing lead. Dismantle the contact breaker base assembly by turning the base plate clockwise and pulling to release it from the moving contact breaker plate.

(2) *Shaft and action plate*

To dismantle the assembly further, take out the screw inside the cam and remove the cam and cam foot. The weights and springs of the centrifugal timing control can now be lifted off the action plate.

Bearing renewal

The single long bearing bush used in this distributor can be pressed out of the shank by means of a shouldered mandrel. If the bearing has been removed the distributor must be assembled with a new bush fitted. The bush should be prepared for fitting by allowing it to stand completely immersed in engine oil for at least 24 hours. Press the bearing into the shank, using a shouldered polished mandrel of the same diameter as the shaft. Under no circumstances should the bush be overbored by reaming or any other means, since this will impair the porosity and thereby the effective lubricating quality of the bush.

Reassembly (Refer to Fig. 22)

The following instructions assume that *complete* dismantling has been undertaken.

1. Place the distance collar over the shaft, smear the shaft with clean engine oil, and fit it into its bearing.

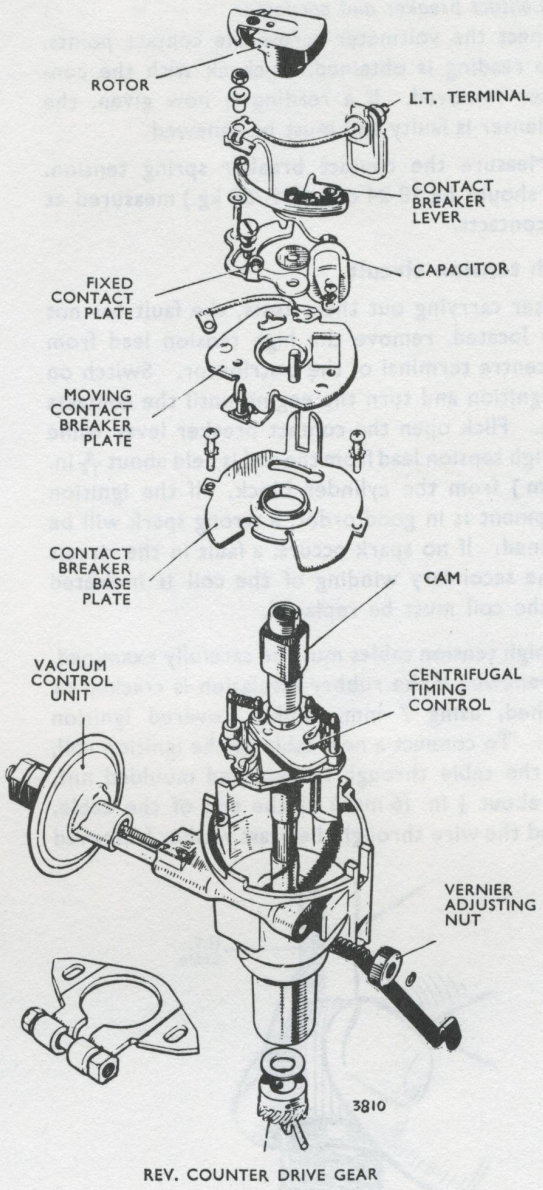


Fig. 22. *Exploded view of distributor*

2. Refit the vacuum unit into its housing and replace the springs, milled adjusting nut and securing circlip.

3. Reassemble the centrifugal timing control. See that the springs are not stretched or damaged. Place the cam and cam foot assembly over the shaft, engaging the projections on the cam foot with the weights and fit the securing screw.

4. Before reassembling the contact breaker base assembly, lightly smear the base plate with clean engine oil.

   Fit the moving contact breaker plate to the contact breaker base plate and secure using a reversal of the dismantling procedure. Refit the contact breaker base into the distributor body. Engage the link from the vacuum unit. Insert the two base plate securing screws, one of which also secures one end of the contact breaker earthing cable.

5. Fit the capacitor into position. Place the fixed contact plate in position and secure lightly. One plain and one spring washer must be fitted under the securing screw.

6. Place the insulating washers, etc., on the contact breaker pivot post and on the pillar on which the end of the contact breaker spring locates. Refit the contact breaker lever and spring.

7. Slide the terminal block into its slot.

8. Thread the low tension connector and capacitor eyelets on to the insulating piece, and place these on to the pillar which secures the end of the contact breaker spring. Refit the washer and securing nut, *ensuring that the eyelets do not foul the H.T. cover and prevent the vacuum advance mechanism from functioning.*

9. Set the contact gap to 0·015 in. (·38 mm.) and tighten the fixed contact securing screw.

10. Refit the rotor arm, locating the moulded projection in the rotor arm with the keyway in the shaft, and pushing fully home. Refit the moulded cover.

Renewal of contacts

If the contacts are so badly worn that renewal is necessary, they must be renewed as a pair and not individually. The contact gap must be set to 0·015 in. (·38 mm.); after the first 500 miles (800 kg.) running with new contacts fitted, the setting should be checked and if required the gap should be reset to 0·015 in. (·38 mm.). This procedure allows for the initial "bedding-in" of the heel. Ensure that the L.T. eyelets do not foul the H.T. cover and prevent the vacuum advance mechanism from functioning.

LAMPS

HEADLAMPS

Early Models

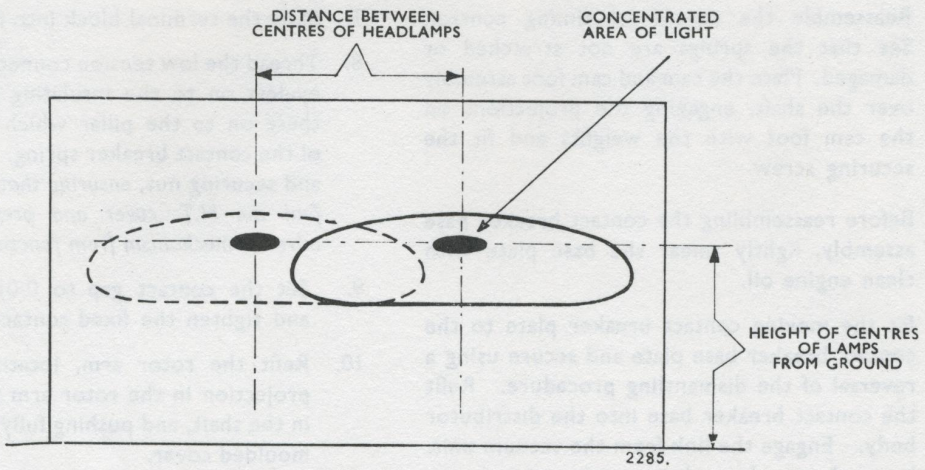
The headlamps are of the flush fitting type, incorporating Lucas Light Units, or combined reflector and front lens assemblies. "Pre-focus" bulbs are used, so that the bulb filament is always correctly located with regard to the reflector and lens and no adjustment of focusing is required. All lamps incorporate "block pattern" lenses. These lenses provide great accuracy of beam control, with a resultant improvement in road illumination and decrease in the dazzle caused to other road-users.

Anti-dazzle arrangements

Dipping of the headlamp beams for anti-dazzle purposes is achieved by the use of double-filament bulbs in both of the headlamps. The exact arrangement depends on the legal requirements of the country in which the car is to be used.

Beam adjustment (Refer to Fig. 23).

The headlamps are to be adjusted so that when the car is normally laden the main beams will be parallel with the road as well as with each other. This adjustment gives the best driving light and also ensures that the " dipped " beam complies with the appropriate British Ministry of Transport Lighting Regulations, so that they are incapable of dazzling any person who is standing on the same horizontal plane as the vehicle, at a greater distance than 25 feet (7·62 m.) from the lamp.



(A) FRONT OF CAR TO BE SQUARE WITH SCREEN
(B) CAR TO BE LOADED AND STANDING ON LEVEL GROUND
(C) RECOMMENDED DISTANCE FOR SETTING IS AT LEAST 25 FT.
(D) FOR EASE OF SETTING ONE HEADLAMP SHOULD BE COVERED

Fig. 23. *Headlight Alignment*

Whenever possible, the beams of headlamps are to be set using an optical-type beam setter, but when this is not possible, the headlamps can be set and a fair degree of accuracy attained by use of an aiming board (Refer to Fig. 23). When adjusting the headlamps, regardless of which method is employed, mask one lamp whilst carrying out adjustment on the other.

Adjustment of Setting (Refer to Fig. 24)

Slacken the screw securing the front rim and lift off the rim and dust-excluding rubber. Three spring-loaded adjustment screws are now exposed, by which the setting can be adjusted as required.

Check on the road and if necessary carry out further adjustment.

To remove glass and reflector assembly
(Refer to Fig. 24)

Take out the screw at the bottom of the rim with screwdriver. The lamp front can then be pulled off by hand. Grasp glass and reflector assembly with both hands, press rearwards and turn slightly in an anti-clockwise direction, which will release the three "key hole" apertures in its rear edge from the three spring-loaded screws. Do not turn or remove these screws, as this would upset the alignment of the lamp. Reverse procedure to reassemble. *The glass and reflector assembly is a sealed unit and no attempt is to be made to separate it.*

To renew bulbs (Refer to Fig. 24)

Remove lamp front and glass and reflector assembly as described above. Press the adaptor towards the rear of the reflector, meanwhile turning slightly to line up the two arrows marked on the adaptor and reflector. The adaptor can now be withdrawn and the bulb taken out. To reassemble adaptor to reflector, press on with arrows in line and turn to the right.

In territories where bulbs can be renewed, compress the two ends of the bulb retaining spring to clear the bulb flange. The bulb can now be removed.

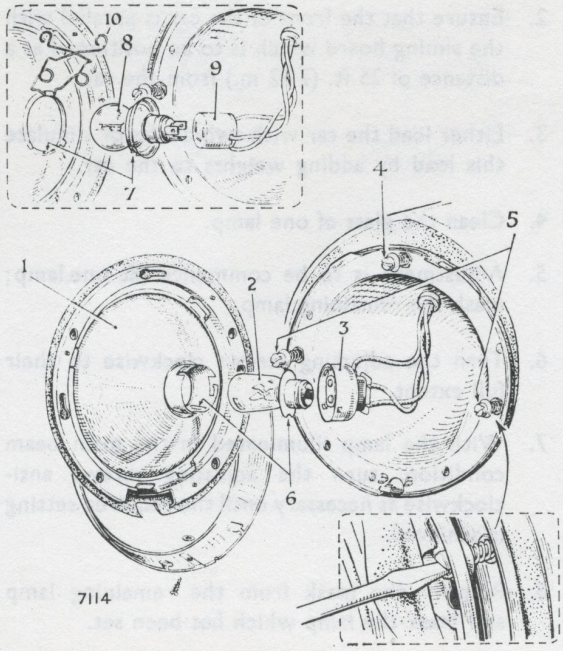


Fig. 24 *Headlamp Assembly (Early Models)*

KEY TO FIG. 24

1. REFLECTOR
2. BULB
3. BULB ADAPTER
4. VERTICAL ADJUSTMENT SCREW
5. LATERAL ADJUSTMENT SCREW
6. BULB LOCATION
7. BULB LOCATION
8. BULB } EUROPEAN TYPE
9. BULB ADAPTER } EUROPEAN TYPE
10. BULB RETAINER } EUROPEAN TYPE

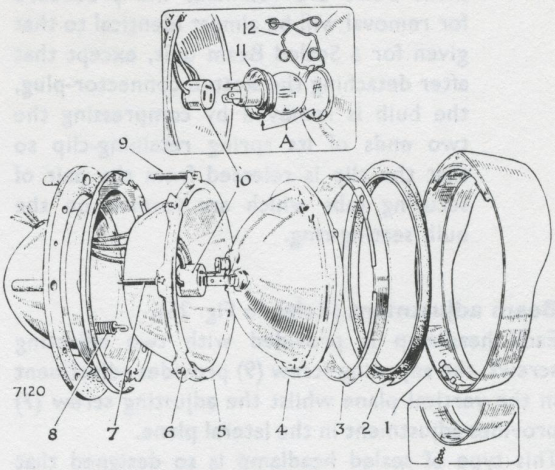


Fig. 24A *Headlamp Assembly (Later Models)*

KEY TO FIG. 25

1. FRONT RIM
2. SEALING RING
3. RETAINING RIM
4. SEALED BEAM LIGHT UNIT
5. SEATING RIM
6. RETAINING RIM SCREW
7. LATERAL ADJUSTING SCREW
8. TENSIONING SPRING
9. VERTICAL ADJUSTING SCREW
10. SLOTTED CONNECTOR-PLUG
11. BULB } EUROPEAN TYPE
12. BULB RETAINER } EUROPEAN TYPE
A LOCATION FOR BULB

HEADLAMPS

Later Models

The two headlamps employed incorporate the Sealed Beam light unit each of which is 7 in. (177.8 mm.) in diameter. The light unit is of "all glass" construction with an internally aluminised glass reflector which is fused to the front lens.
The two filaments, one for "main" beam and the other for "dipped" beam, are installed with absolute care and precision before they are finally sealed in the gas-filled chamber which comprises the light unit. The fact that the light unit is completely sealed, ensures that the reflecting surface is protected to the extent of producing continual reflective efficiency without deterioration.

In the event of headlamp failure and should the cause not be traced to loose and/or broken connections, the fault will lie in the lamp unit itself, in which case the light unit will require renewal.

To remove the Sealed Beam light unit (Refer to Fig. 25).

Remove the front (painted) rim which is secured either by one screw at the base or a concealed clip; in the case of the later, prise-off the rim from the base.

Remove the three cross-head screws securing the retaining rim, which are accessible on removal of the dust excluding rubber; the Sealed Beam unit

can then be withdrawn and detached from the slotted connector-plug.

Note: In certain countries where ordinary filament bulbs are retained, the procedure for removal will be almost identical to that given for a Sealed Beam unit, except that after detaching the slotted connector-plug, the bulb is removed by compressing the two ends of its spring retaining-clip so that the clip is released from the pair of securing tabs which are formed on the bulb seating-ring.

Beam adjustment (Refer to Fig. 25).
Each headlamp is provided with two adjusting screws, the adjusting screw (9) provides adjustment in the vertical plane whilst the adjusting screw (7) provides adjustment in the lateral plane.
This type of sealed headlamp is so designed that adjustment can be accurately undertaken using a spirit-level type beam setter. Three glass " aiming pads " take the form of projections moulded integrally around the outer front edge of the lamp glass, where their purpose is to provide a reference plane for beam aiming.
It is desirable to use a reputable brand of spirit-level type beam setter if the best standards of accuracy and speed are to be obtained. Advice is available on application to the Rootes Group Development Section at Coventry, in respect of all Factory approved equipment.
Should a spirit-level type beam setter not be available, the use of an optical-type beam setter can be employed, providing it is of the type (Lucas No. 571119).
If the use of neither type of beam setter is available, a fair degree of accuracy can be attained by use of an aiming board (Refer to Fig. 23).

BEAM SETTING USING THE AIMING BOARD

Proceed as follows:—

1. Ensure that the car is parked (handbrake on) on level ground.
2. Ensure that the front of the car is parallel with the aiming board which is to be positioned at a distance of 25 ft. (7.62 m.) from the car.
3. Either load the car with two adults or simulate this load by adding weights to the car.
4. Clean the glass of one lamp.
5. Adjustment is to be commenced at one lamp; mask the remaining lamp.
6. Turn the adjusting screws clockwise to their full extent.
7. With the lamp illuminated in the main beam condition, turn the adjusting screws anti-clockwise as necessary until the required setting is achieved.
8. Remove the mask from the remaining lamp and mask the lamp which has been set.
9. Clean the glass of the lamp.
10. Turn the lamp adjusting screws clockwise to their full extent.
11. With the lamp illuminated in the main beam condition turn the adjusting screws anti-clockwise as necessary until the required setting is achieved.
12. Recheck the setting of both lamps.

SIDE LAMPS—(Rapier—early models)

(See Fig. 26)
To renew bulbs, turn the lens anti-clockwise approximately 20° and lift off the rim and glass. When refitting, line up the flanges on glass and lamp body and turn clockwise.

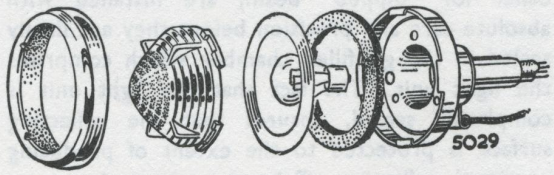


Fig. 26. *Side lamp details (Rapier)*

SIDE LAMPS AND FRONT FLASHER BULBS *Rapier IV models*

(Refer to Fig. 27)

To renew a defective bulb, remove the two screws and detach the white and amber lenses. Renew the defective bulb(s) and refit the lenses, making sure that the rubber seat is correctly located; secure the lenses with the two screws.

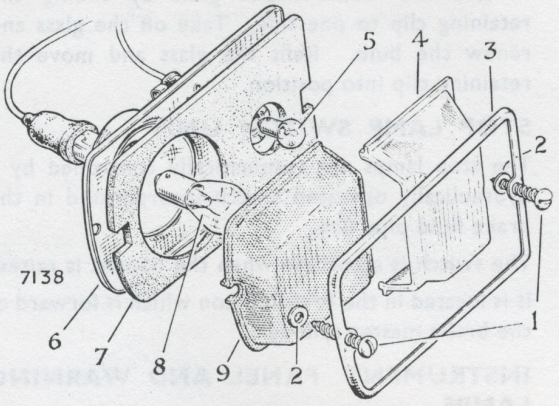


Fig. 27. *Side lamps and front flasher bulbs*

KEY TO Fig. 27

1. RETAINING RIM SCREWS
2. RUBBER WASHER
3. RETAINING RIM
4. CLEAR LENS
5. SIDE LAMP BULB
6. LAMP BODY
7. LENS SEATING
8. FLASHER BULB
9. AMBER LENS

SIDE LAMPS—(Alpine I, II and III models)

(See Fig. 28)

The rim and glass are retained by shaped lips formed in the rubber body. To renew bulbs, first remove the rim by easing back the rubber lip and then remove the glass by the same method. The lips can be carefully eased back by means of a screwdriver.

Reassembly is a reversal of the above instructions.

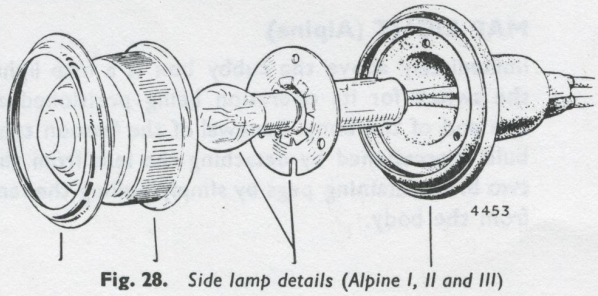


Fig. 28. *Side lamp details (Alpine I, II and III)*

SIDE LAMPS AND FRONT FLASHER BULBS *Alpine IV models*

(Refer to Fig. 29)

To renew a defective bulb, remove the three screws and detach the white and amber lenses. Renew the defective bulb(s) and refit the lenses, making sure that rubber seat is correctly located; secure the lenses with the two screws.

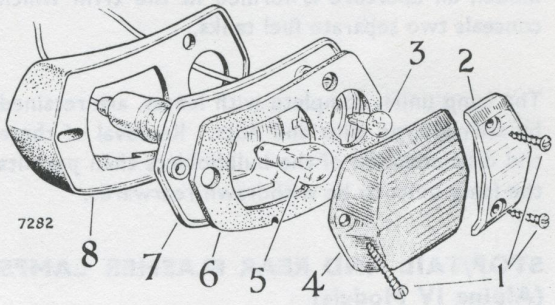


Fig. 29. *Side lamps and front flashers bulbs*

KEY TO Fig. 29

1. RETAINING SCREWS
2. CLEAR LENS
3. CAPLESS SIDE LAMP BULB
4. AMBER LENS
5. FLASHER BULB
6. LENS SEATING
7. LAMP BODY
8. RUBBER PLINTH

STOP/TAIL AND FLASHER LAMPS (Rapier)

Access for bulb renewal is available from within the boot. The detachable bulbholder assembly is retained by a single, central screw.

To renew lenses, remove bulbholder assembly from lamp body. Remove two nuts and washers and withdraw lamp unit outwards. Remove four self-tapping screws which retain lenses.

During reassembly, care must be taken to correctly position the rubber sealing washers.

STOP/TAIL AND FLASHER LAMPS (Alpine I & II)

Bulbs can be renewed after removal of the trim pad at the side of the boot (retained by spring clips) to gain access to the bulbholders, which are a push fit in the lamp bodies.

(Alpine III)

To gain access to defective tail lamp bulbs on this model, an aperture is formed in the trim which conceals two separate fuel tanks.

The lamp units, complete with lenses, are retained by stirrup-type clips and nuts. Removal of these and disconnection of the bulbholders then permits the lamp units to be withdrawn rearwards.

STOP/TAIL AND REAR FLASHER LAMPS (Alpine IV Models)

To renew the bulbs, pull the clip type bulb holder from the rear of the lamp unit (in the luggage compartment).

To remove the lamp units, remove the two securing screws from the rear of the unit. The lenses may be removed after removal of the lamp unit by unscrewing the four cross-headed screws. When reassembling, ensure that the rubber gaskets are correctly positioned (see Fig. 30).

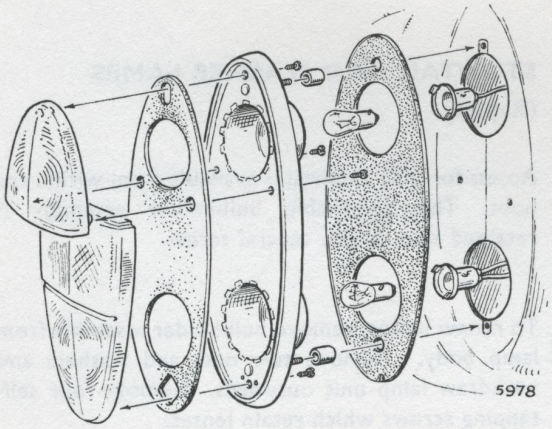


Fig. 30. *Exploded view of stop/tail and rear flasher lamps*

REAR NUMBER PLATE ILLUMINATING LAMP

Release the dome-shaped glass by sliding the retaining clip to one side. Take off the glass and renew the bulb. Refit the glass and move the retaining clip into position.

STOP LAMP SWITCH UNIT

The stop lamps are automatically controlled by a hydraulically operated switch incorporated in the brake fluid pipe line.

The switch is accessible when the bonnet is raised.

It is located in the branch union which is forward of the brake master cylinder.

INSTRUMENT PANEL AND WARNING LAMPS

The bulbholders are a push fit in the backs of the instruments and access is obtained from behind the facia panel. To remove a warning lamp bulb holder, push out the holder from the rear of the facia.

INTERIOR LAMP (Rapier and Alpine G.T.)

Firmly press one side of the plastic lamp cover inwards so that the retaining flanges of the cover are clear of the slots in the lamp housing and take away the cover. Renew the bulb.

When refitting the cover first enter the flanges in the slots on one side and then press it into position.

MAP LIGHT (Alpine)

Immediately above the cubby box is a map light, the switch for its operation being positioned at one end of the body. Renewal of the festoon type bulb is occasioned by detaching the lens from the two brass retaining pegs by simply pulling the lens from the body.

DIRECTION INDICATOR SIGNALS AND HEADLAMP FLASHER

Direction Indicators

The correct operation of direction signals requires that the bright filament in the parking and tail lamp bulbs (depending on the position of the switch) flash intermittently whether or not the headlamps, parking lamps, tail lamps or stop lamps are "on". A correctly operating direction signal will be indicated by a regular intermittent flashing of the green pilot lamp located on facia panel in front of the driver. If, when the direction indicator is switched on, the warning (or pilot) lamp does not flash in the usual manner but remains unlit, first check that this is not due to filament failure in either the front or rear lamp on that side. This can be checked by turning the switch to the opposite side—if the pilot lamp now flashes, the circuit is in order and bulb replacement is indicated. On the other hand, if the pilot lamp still does not flash, inspect the indicator lamps. If these are working normally, failure of the pilot lamp bulb is indicated. If, however, the indicator lamps are not functioning, It will be necessary to proceed to check the wiring and flasher unit.

The efficiency of the flasher unit can be readily checked by plugging in a known substitute.

The inoperative parking or rear flasher lamp bulbs should be checked for a burned-out bright filament. Where it is found that neither lamp has a burned-out filament the wiring between the defective lamp and indicator switch must be checked.

If the direction signal is entirely inoperative, check the fuse (A.4 on fuse box), flasher unit and circuit from the fuse box up through the steering column switch in the order named.

The flasher unit is located inside the car and is plugged into a socket on the underside of the facia. No servicing of the flasher is required, and where this unit breaks down in service it must be renewed.

It is important to note that the twin filament bulbs used in the side and tail lamps (Lucas 380 12 v. 21/6w.) are the same type. These bulbs have offset pins and cannot be fitted incorrectly.

Operation of Flasher Unit (See Fig. 31)

This unit depends for its operation on an electro-magnet in conjunction with the linear expansion of a piece of wire which becomes heated as current flows through it.

The expanding and contracting of the wire controls the speed at which the armature carrying the moving contact will move, as a result of the pull exerted by the electro-magnet and the sequence of operations is as follows:—

As current flows from terminal "B" to terminal "L" and the lamps *via* the resistance wire and electro-magnet, the wire heats up and expands.

This allows the armature carrying one of the contacts to be attracted to the pole piece of the electro-magnet closing contacts (A) and full voltage is then applied to the lamps *via* the windings of the electro-magnet. Contacts (B) are also closed completing the pilot lamp circuit.

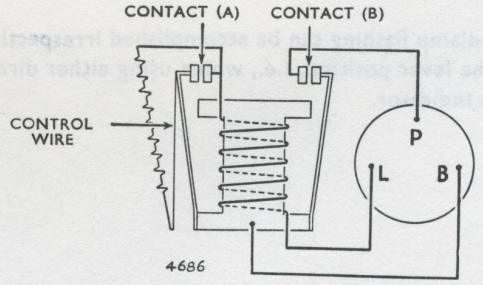


Fig. 31. *Showing internal connections of flasher unit*

While contacts (A) are closed the resistance wire is short circuited and cools off. The taut section of the resistance wire contracts and pulls back the armature to open contacts (A).

The pilot lamp on the facia panel will not flash unless sufficient current to light the bright filaments in side (parking) lamp and rear flasher lamp is passing through the windings of the electro-magnet to close contacts (B). The flashing pilot lamp,

therefore, gives the driver a clear indication that the direction signals are working correctly.

It will be noted that in order to maintain the desired rate of flashing (British Ministry of Transport regulations, 60-120 per minute) the filaments of the front and rear lamps are "pre-heated" via the resistance wire during "out" period of the flash.

Headlamp Flasher Switch

(Later Models)

The direction indicator switch also incorporates the switch for flashing the headlamps, this is achieved by moving the lever stalk towards the steering wheel and in so doing an insulated spring-loaded plunger, operated by the inner end of the lever, is depressed to make switch contact so that both headlamps illuminate and will remain so until upward pressure on the lever is released. When the lever is released the switch will return to the OFF position under the influence of its spring and the headlamps will extinguish.

Headlamp flashing can be accomplished irrespective of the lever position, i.e., whilst using either direction indicator.

CAUTION

In countries where the headlamp flasher operates on the main beam, it is inadvisable to use the flasher continuously when the headlamps are already in the "dipped" condition, as the excess heat generated by both filaments will greatly lessen the life of either the bulbs or lamp units, which ever is appropriate.

When the headlamp flasher system is functioning correctly, each application of the switch lever in the upward direction will illuminate both headlamps.

Should either headlamp fail to illuminate a check is to be made to ensure that the connections to the headlamp are secure, if on inspection the connections are found to be satisfactory the bulb or lamp unit is to be changed for one which is known to be serviceable.

In the event of both headlamps failing to illuminate when the switch is operated, for the Alpine III and IV, the circuit from the switch to terminal 1 on the fuse unit is to be checked. For the Rapier IV, the circuit from the switch to the starter solenoid, via the ammeter, is to be checked. If after test the switch is found to be defective, it must be renewed as the switch is irreparable.

HORNS

Lucas Windtone Horns (Fig. 32) Models WT 618 and 9H:

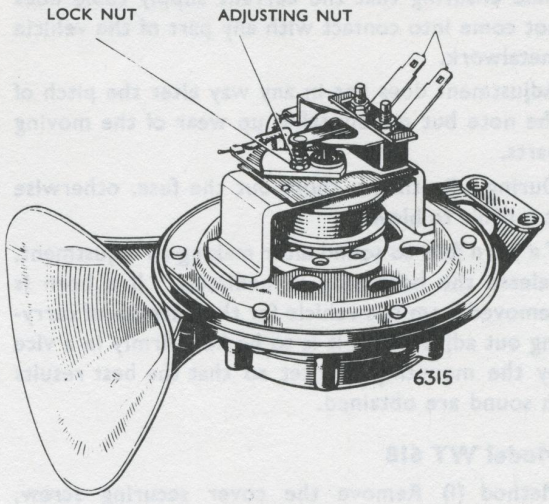
The horns operate on the principle of a resonating air column vibrated by means of a diaphragm which is actuated electro-magnetically by a self-interruptory circuit. The tonal quality of each horn is adjusted to give its best performance before leaving the manufacturers, consequently, it should require no further attention until it has given a long period of service. However, in the event of a single or both horns failing to sound satisfactorily, the cause can be diagnosed and rectified as follows:—

WARNING: Do not dismantle the horn(s) beyond the instructions given in the following paragraphs and on no account is the central locknut or slotted stem to be disturbed on the 9H model horn(s).

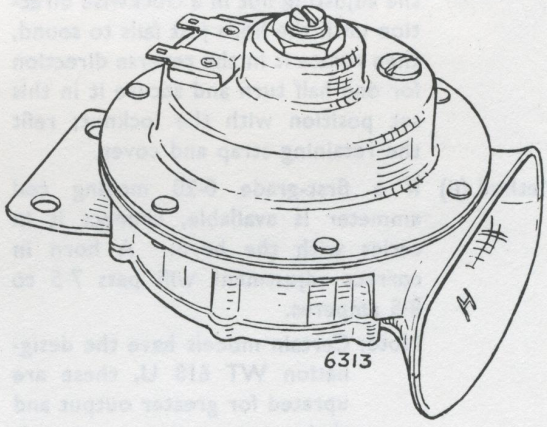
Maintenance

If the horns suddenly fail to sound after operating normally the cause is unlikely to be in the horns themselves. First ensure that the cause is not due to such defects as a loose or broken connection in the horn wiring circuit. A short circuit in the horn wiring will cause the fuse to blow. In this event, examine the wiring to locate the fault and rectify accordingly before renewing the fuse.

Failure of the horns to perform correctly can be attributed to either a discharged battery, faulty or loose connections or loose mounting bolts; check and remedy as found necessary. If on inspection these points are found to be in order, it is possible that the horns require adjustment.



The model WT 618 horn with cover removed



The model 9H horn

Fig. 32. *Lucas Windtone Horns*

Adjustment

Where twin horns are fitted disconnect one whilst carrying out adjustment on the other, at the same time ensuring that the current supply cable does not come into contact with any part of the vehicle metalwork.

Adjustment does not in any way alter the pitch of the note but merely takes up wear of the moving parts.

During adjustment, short out the fuse, otherwise it is liable to blow.

If a horn fails to sound after making an adjustment, release the horn ring immediately. If a horn is removed from the vehicle for the purpose of carrying out adjustment, it is to be held firmly in a vice by the mounting bracket so that the best results in sound are obtained.

Model WT 618

Method (i) Remove the cover securing screw, take-off the domed cover and remove the cover retaining strap and rotate the adjusting nut in a clockwise direction until the horn just fails to sound, then rotate it in the reverse direction for one half turn and secure it in this set position with the locknut; refit the retaining strap and cover.

Method (ii) If a first-grade 0-20 moving coil ammeter is available, connect it in series with the horn. A horn in correct adjustment will pass 7·5 to 8·5 amperes.

Note: Certain models have the designation WT 618 U, these are uprated for greater output and their current consumption is 13·5 to 15·5 amperes. In order to recognise the WT 618 U model horn, a printed label bearing a number is affixed either in the horn flare or on one end of the bridge which mounts the contact and coil assembly. These are No. 69087, 69090, 69127, 69128, 69131 and 69132.

Remove the cover securing screw, take-off the domed cover and remove the cover retaining strap. Slacken the locknut on the fixed contact stem and rotate the adjusting nut a few degrees at a time in a clockwise direction to reduce the current or in the reverse direction to increase it; this adjustment is quite critical.

Before testing the horn, retighten the locknut and ensure to do this after each trial adjustment, repeating the exact process until the best performance is achieved within the stated current range.

When the horns are operating satisfactorily, refit the cover retaining strap, the domed cover and secure the whole with the screw.

Model 9H

Method (i) Adjustment is provided by either a plain or a serrated screw which is located adjacent to the horn terminals. Rotate this screw in an anti-clockwise direction until the horn just fails to sound, then rotate it in the reverse direction for one quarter turn.

Method (ii) If a first grade 0-10 moving coil ammeter is available, connect it in series with the horn. A 9H model horn in correct adjustment will pass 3·0 to 3·5 amperes. Rotate the adjusting screw in a clockwise direction in order to increase the current and in the reverse direction to reduce it until the best performance is obtained within the stated current range.

Clear Hooter Horns (Fig. 33): The tonal quality of horns and their correct current consumption is accurately set before each unit leaves the manufacturers, therefore, the need for further adjustment after the horns have been fitted to the vehicle

should not normally be necessary. However, in an instance where a single or both horns fail to operate satisfactorily the exact cause can be quickly diagnosed and rectified as follows:—
NOTE: Early model horns can be dismantled for the purpose of examining the internal connections and contacts only, further dismantling beyond this

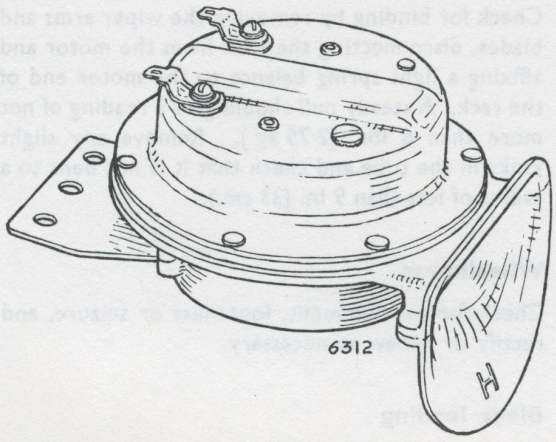


Fig. 33. *The Clear Hooter horn*

is not to be attempted. Later model horns are a riveted assembly and, therefore, cannot be dismantled. If the horns are removed from the vehicle for the purpose of tonal adjustment, they are to be held firmly in a vice by the mounting bracket so that the best results in sound are obtained.

Sound—loss of volume

Normally this condition is caused by insufficient current being drawn by the defective horn in which case the adjusting screw is to be rotated slowly clockwise until the volume of sound is restored, then rotate the adjusting screw slowly anti-clockwise to the point where the volume of sound is just maintained. At no time should the operating current exceed 3·5 amperes.

Intermittent operation

Usually this cause can be attributed to that of mal-adjustment or the presence of foreign matter between the contact points. In this instance the adjusting screw is to be rotated slowly in a clockwise direction for almost one half turn. Should the horn fail to sound after carrying out this adjustment the screw is to be rotated in the reverse direction until the horn operates at the correct volume, which should occur within 180 degrees either side of the original setting.

Complete failure of sound

In the event of a complete failure, examine the appropriate fuse and the electrical connections in the horn circuit for security and carry out a voltage check to establish whether the correct voltage is available at the horn terminals. If it was observed that a gradual deterioration in volume was apparent before the failure then the instructions outlined under the heading " Sound—loss of volume " are to be carried out. Should the horns have been operating satisfactorily prior to a sudden failure, the horn circuit is to be checked in order to establish the current capacity, should this be in excess of 3·5 amperes, the adjusting screw is to be rotated slowly in an anti-clockwise direction until the horns are restored to their correct volume of sound. If the current capacity is less than that specified the adjusting screw is to be rotated slowly in the reverse direction until the correct volume is obtained.

WINDSCREEN WIPER

GENERAL

The motor and gearbox are mounted on pillars cast as part of the gearbox. The rotary motion of the motor armature is converted to the reciprocating motion of a cable rack by means of a single-stage worm and nylon-gear reduction drive. A connecting rod and cross-head in the gearbox actuate the cable rack.

The flexible cable rack comprises an inner steel core carrying a wire helix, the whole being run within rigid connecting tubes between the gearbox and two wheelboxes. These wheelboxes, house a toothed wheel pressed on the wiper arm spindles. The toothed wheel engages with the cable rack, thus giving an oscillatory motion to the spindle.

A limit switch in the gearbox is connected in parallel with a control switch mounted on the instrument panel. The contacts of this limit switch are opened once per revolution of the final gear.

When the wiper control switch is switched to the "OFF" position the motor continues to drive until the limit switch contacts are opened. The switch is adjustable and can be set to alter the position of the limit switch and this determines the position at which the wiper blades park.

MAINTENANCE

The gearbox, rack and wheelboxes are packed with grease during manufacture, and require no periodic lubrication.

Worn or perished wiper blades should be renewed. To ensure correct operation under all conditions, it is essential that parts of identical pattern to the original equipment be fitted.

Oil, tar and other stains on the windscreen may be removed by the judicious use of methylated spirits (de-natured alcohol). Do not allow silicon or wax-based polishes on the glass.

SERVICING

Poor performance may be due to either mechanical or electrical faults, not necessarily connected with the motor itself. Checks should first be made for a binding rack, faulty wheelboxes, excessive blade loading and low supply voltage.

Cable rack and tube

Check for binding by removing the wiper arms and blades, disconnecting the rack from the motor and affixing a light spring balance to the motor end of the rack. A steady pull should give a reading of not more than 6 lbs. (2·75 kg.). Remove any slight kinks in the tube and check that it is not bent to a radius of less than 9 in. (23 cm.).

Wheelboxes

Check for misalignment, looseness or seizure, and rectify or renew as necessary.

Blade loading

Windscreen contamination can cause poor performance due to excessive friction. Clean, and renew blades if necessary.

Supply voltage

With the motor operating, use a high-quality moving coil voltmeter to check the voltage at the motor. If below 11·5 volts check the battery, switch (by substitution), wiring and connections. Rectify as necessary.

Motor—Light running current

Connect a high-quality moving-coil ammeter in series with the motor supply. With the cable rack disconnected, switch on the motor and observe the current and speed of operation. Current should be 2·7—3·4 amps. after running for one minute.

*Two types of limit (parking) switch (Refer to Fig. 34).

Limit (parking) switch—to adjust (Refer to Figs. 34 and 35).

DR3 wiper motor

With the wiper arms positioned on their serrated spindles so as to provide the best arc of wipe, the blades should be parked at the lower edge of the screen. If the blades fail to park in this position, adjustments can be made by rotating the knurled nut which projects from the cable rack outlet-end of the gearbox.

The knurled nut is to be rotated a little at a time until the correct parking position is obtained; **during this adjustment the windscreen is to be maintained in a wet condition.**

DR2 wiper motor

The switch portion of the gearbox cover is adjustable and can be set to alter the position of the limit switch with respect to the crank pin and this determines the position at which the wiper blades park.

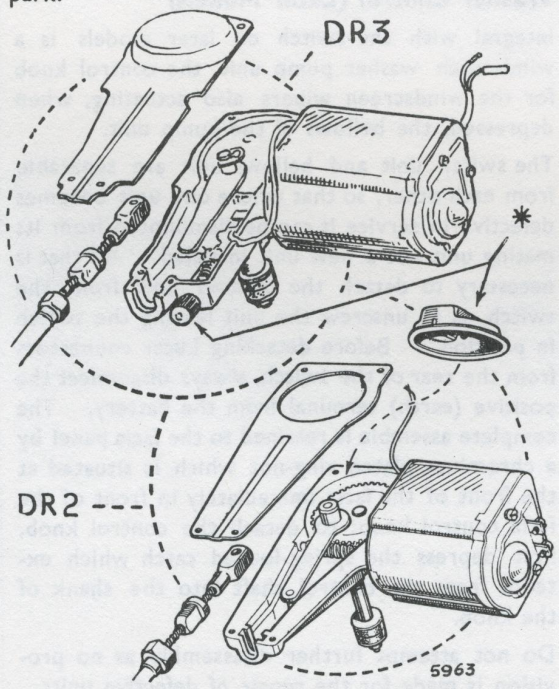


Fig. 34. *Limit (parking) switch adjustment*

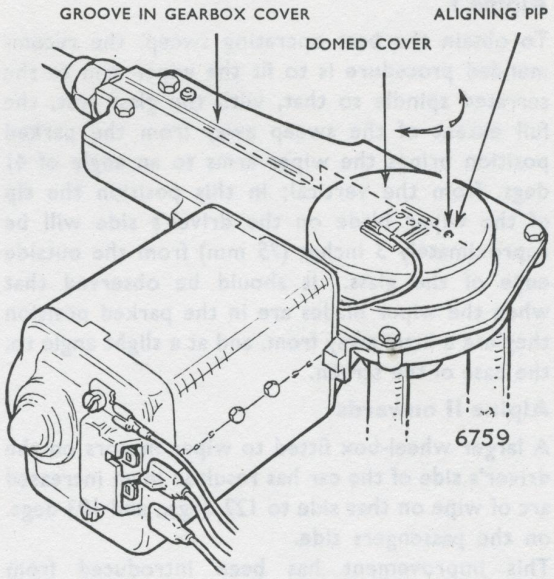


Fig. 35. *DR3A wiper motor*

DR3A wiper motor (Later models)

With the wiper arms positioned on their serrated spindles so as to provide the best arc of wipe, the blades should be parked at the lower edge of the screen. If the blades fail to park in this position, slacken the four gearbox cover-securing screws and rotate the domed cover until the setting pip, formed in the top of the cover, is aligned with the control groove in the gearbox cover.

The aligning pip must be on that side of the cover nearest the cable rack outlet in order to obtain parking with the crosshead away from the worm gear, or rotated through 180° to obtain parking with the crosshead towards the worm gear. **During this adjustment, the windscreen is to be maintained in a wet condition.**

Any attempt to obtain a parked position with the wiper blades against the screen moulding will result in noisy operation and a reduced arc of wipe. Slight adjustments to the parked position of the wiper blades may be carried out as described above.

Alpine I

To obtain the best operating sweep, the recommended procedure is to fit the wiper arm to the serrated spindle so that, with the glass wet, the full extent of the sweep away from the parked position brings the wiper arms to an angle of 41 degs. from the vertical; in this position the tip of the wiper blade on the driver's side will be approximately 3 inches (75 mm) from the outside edge of the glass. It should be observed that when the wiper blades are in the parked position they are a little away from, and at a slight angle to, the base of the screen.

Alpine II onwards

A larger wheel-box fitted to wiper motors on the driver's side of the car has resulted in an increased arc of wipe on that side to 122 degs., and 103 degs. on the passengers side.

This improvement has been introduced from Chassis Number B.9104616 R.H.D. B.9104783 L.H.D. (U.S.A. and Canada only) and B.9108012 L.H.D. (Remaining countries taking L.H.D. cars). To ensure the correct position of wiper arms on this model, proceed as follows:—

Remove both wiper arms and blade assemblies.

Switch ON the ignition and with the screen wet operate the windscreen wiper switch ON and OFF to position the serrated spindles in the parked condition.

Fit the wiper arms, complete with blades, on to the serrated spindles with the lower edge of the wiper blade positioned approximately $\frac{1}{4}$ inch (6 mm) away from the base of the screen.

Any attempt to obtain a parked position with the wiper blades against the screen moulding will result in noisy operation and a reduced arc of wipe.

Slight adjustments to the parked position of the wiper blades may be carried out as described above.

Wiper arms—to remove and refit

(See Fig. 36)

Lift spring retaining clip and slide arm from spindle.

Serratious provide 5° adjustment steps for the arm.

Refit arm and check sweep of operation as described on Pages 37 and 38.

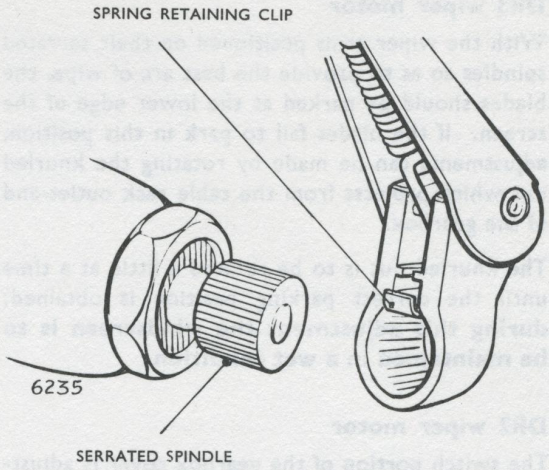


Fig. 36. *Wiper arm and spindle*

Combined Windscreen Wiper Switch and Washer Control (Later Models)

Integral with the switch on later models is a windscreen washer pump unit, the control knob for the windscreen wipers also actuating, when depressed, the bellows of the pump unit.

The switch unit and bellows unit are separable from each other, so that where one unit becomes defective in service it can be dismounted from its mating unit and a new unit installed. All that is necessary to detach the bellows unit from the switch, is to unscrew the unit leaving the switch in position. Before detaching Lucar connectors from the rear of the switch, always disconnect the positive (earth) terminal from the battery. The complete assemble is retained to the facia panel by a chromium plated ring-nut which is situated at the front of the facia immediately in front of the facia control knob; to detach the control knob, first depress the spring-loaded catch which extends from the control shaft into the shank of the knob.

Do not attempt further disassembly as no provision is made for the repair of defective units.

INSTRUMENTS AND CONTROLS

Instruments—to remove and refit

Always disconnect the battery positive lead before carrying out any work behind the instrument panel to avoid the risk of short circuits.

Each instrument is retained by a stirrup and knurled nuts, which are accessible from behind the panel. Disconnect wires, drive cable or pipe, remove bulbholder(s) and withdraw instrument forwards.

Refer to wiring diagram when refitting.

Horn Ring Assembly—To remove

Remove the three screws which secure the horn ring assembly in the hub of the steering wheel.

These screws are equally spaced around the hub and located in line with the lower edge of the spokes of the steering wheel. The complete assembly is now free to be withdrawn from the hub of the wheel.

It will be noted that a short cable which supplies the current to the ring has a snap connector end, and is plugged into the connector on the steering wheel.

To refit, reverse the above instructions.

Care should be taken to ensure that the plug of the snap connector is fully home before the horn ring assembly is replaced and secured.

Horn Ring Assembly—To dismantle

Remove horn ring assembly from steering column (see above).

Turn the assembly over and remove three 4 B.A. self-locking nuts with washers securing the lower horn contact plate and springs.

Take off contact plate and springs.

Remove three screws securing the hub mouldings to the horn rings.

To reassemble, reverse the above instructions. It is important, however, to ensure that the air gap between the contacts is maintained at ·020″ (·5 mm.).

Adjustment of the gap is effected by means of the three 4 B.A. self-locking nuts.

Direction Indicator Switch—To remove

No servicing of the direction indicator switch is required and if this unit breaks down in service a replacement unit should be fitted.

Remove two screws securing steering column cover.

Disconnect the battery at the positive (earth) terminal.

Disconnect the leads to the switch at the snap connectors located under the facia and in line with the steering column.

Remove two screws with washer securing the switch assembly to the steering column.

Refitting is a reversal of the above.

Care must be taken to ensure that the switch is fitted centrally with the self-cancelling stop, with the steering wheel in the straight ahead position. Reference must be made to the wiring diagram when reconnecting the leads.

ELECTRIC IMPULSE TACHOMETER

(Refer to Fig. 37)

Later Models

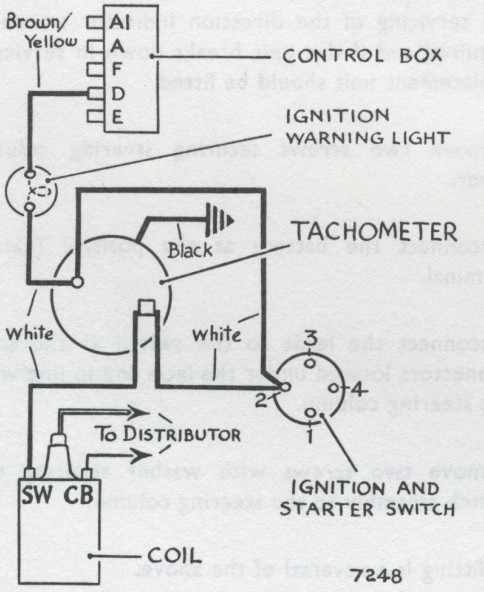
Fitted as standard equipment on later models is the electric impulse tachometer, this instrument is an advanced engine-speed indicator which measures revolutions per minute by "counting" electrical impulses called for by the ignition coil.

The tachometer has no mechanical take-off and operates in the following manner:—

The tachometer "counts" low-tension current impulses demanded by the ignition coil by means of a transistorised printed circuit unit contained within the instrument head. This in turn influences a D.C. voltmeter movement to which a pointer is attached, so that when the engine is running this moves round the instrument dial which is calibrated from 0-6,000 r.p.m. The accuracy of this instrument is not affected by variations in ignition timing, or gap settings of either the distributor or the plugs.

No servicing is required of the tachometer, therefore, where the instrument becomes faulty, a new instrument must be fitted as the unit can only be repaired by the manufacturers or their appointed agents.

Should the instrument cease to function, a check is to be made of the electrical connections to see if they are in order. If the connections prove to be correct, then the tachometer must be removed and replaced by a new unit.



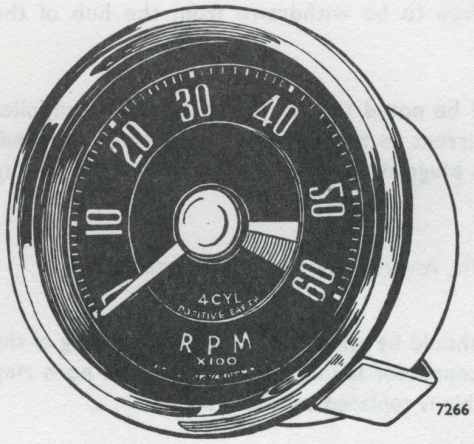


Fig. 37. *Tachometer and circuit diagram.* *(Earth wire on tachometer head for Rapier only.)*

Fuel and temperature indicators

(Refer to Fig. 38)

(Later Models)

The bimetal resistance equipment for fuel contents and temperature indication consists, in each case, of an indicator head and transmitter unit connected to a common voltage regulator. In both applications the indicator head operates on a thermal principle, using a bimetal strip surrounded by a heater winding and the transmitter unit is of a resistance type.

The system by which the equipment functions is voltage sensitive and the voltage regulator which serves both indicators is necessary to ensure a constant supply of a predetermined voltage to the equipment. The regulator is situated behind the instrument panel.

The mean voltage between terminal "I" and earth should be 10 volts. (See wiring diagram). Renew if faulty.

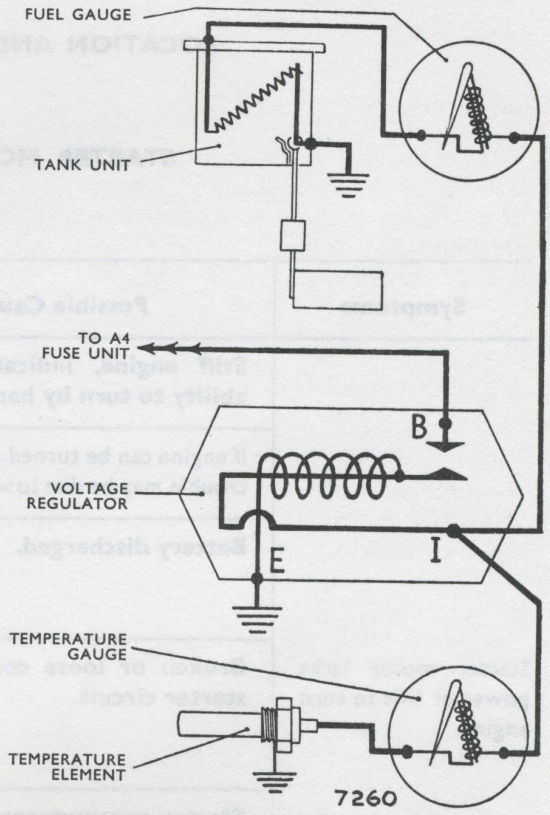


Fig. 38. *Fuel and temperature indicators and voltage regulator*

LOCATION AND REMEDY OF FAULTS

STARTER MOTOR TROUBLE

Symptoms	Possible Causes	Remedy
Starter motor lacks power or fails to turn engine.	**Stiff engine, indicated by inability to turn by hand.**	Locate and remedy cause of stiffness.
	If engine can be turned by hand then trouble may be due to:—	
	Battery discharged.	Start by hand. Charge battery either by a long period of day-time running or from independent electrical supply.
	Broken or loose connection in starter circuit.	See that connections to battery, starter and starter switch are tight, and that cables connecting these units are not damaged.
	Starter commutator or brushes dirty.	Clean.
	Brushes worn, or not fitted correctly.	Replace worn brushes. See that brushes "bed" correctly.
	Starter pinion jammed in mesh with flywheel.	Rotate squared end of starter shaft with spanner.
Starter operates, but does not crank engine.	**Pinion of starter drive does not engage with flywheel, due to dirt on screwed sleeve.**	Clean sleeve with paraffin.
Starter pinion will not disengage from flywheel when engine is running	Starter pinion jammed in mesh with flywheel.	Rotate squared end of starter shaft with spanner.

VOLTAGE CONTROL—GENERATOR TROUBLE

Symptoms	Possible Causes	Remedy
	Generator not charging when running at about 20 m.p.h. with no lights in use. Due to:—	
	Broken or loose connection in generator circuit, or regulator not functioning correctly.	Examine charging and field circuit wiring Tighten loose connection or replace broken lead. Particularly examine battery connections. Return regulator to Lucas Service Depot for attention.
	Commutator greasy or dirty.	Clean with soft rag moistened in petrol.
Battery in low state of charge, shown by lack of power when starting. (Hydrometer reading less than 1·200).	**Giving low or intermittent output, when car is running steadily in top gear.** Due to:—	
	Generator belt slipping.	Adjust belt (see Section B).
	Loose or broken connections in generator circuit.	Examine charging and field circuits wiring. Tighten loose connections or replace broken lead. Particularly examine battery connections.
	Brushes greasy or dirty.	Clean with soft rag moistened in petrol.
	Brushes worn or not fitted correctly.	Replace worn brushes. See that brushes "bed" correctly.
	Regulator not functioning correctly.	Have equipment examined by a Lucas Service Depot.
Battery overcharged, shown by burnt-out bulbs and very frequent need for "topping up". Hydrometer readings high.	**Giving high output,** Due to:—	
	Regulator not functioning correctly.	Return regulator to Lucas Service Depot for attention.

IGNITION TROUBLE

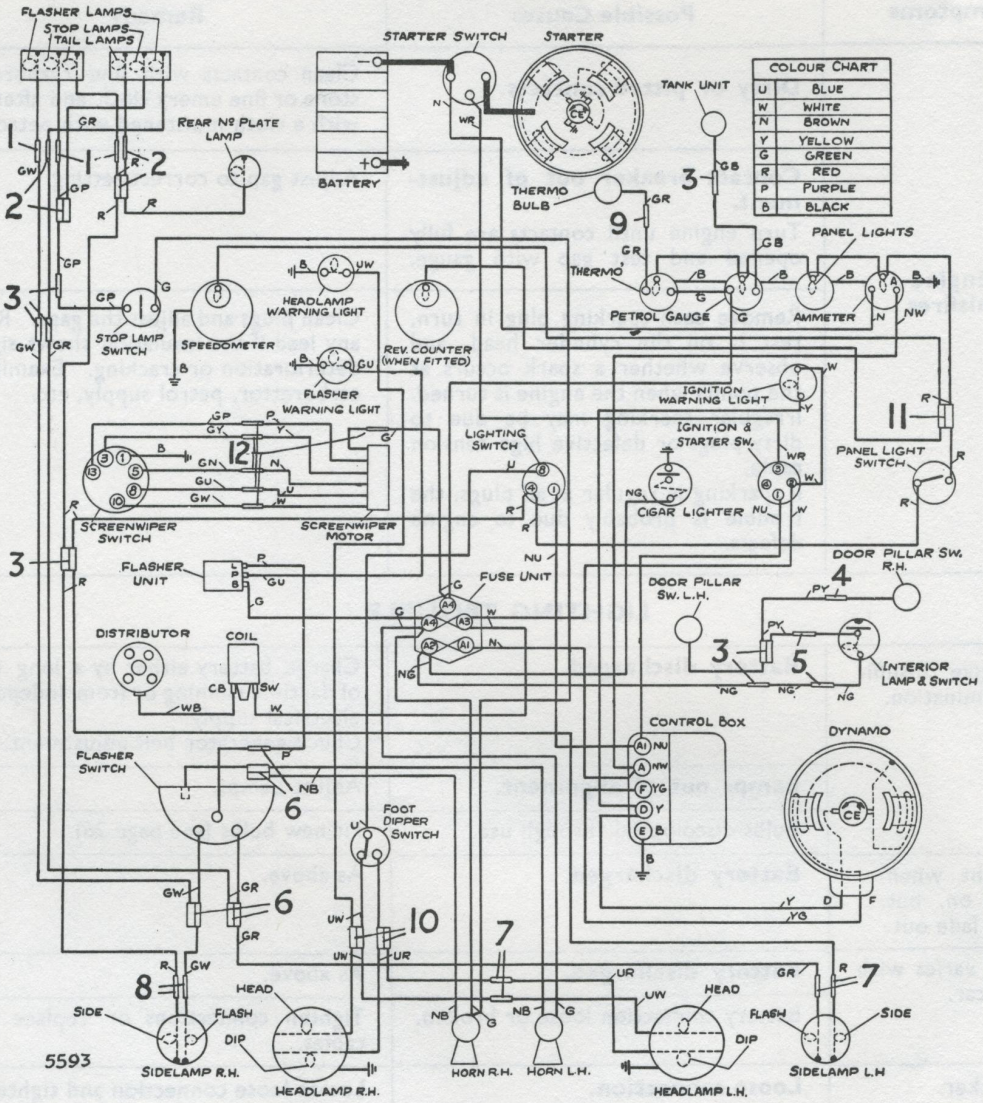
Symptoms	Possible Causes	Remedy
Engine will not fire.	**Battery discharged.** Starter will not turn engine and lamps do not give good light.	Battery should be recharged by running car for a long period during daytime. Alternatively, recharge from an independent electrical supply.
	Controls not set correctly for starting.	See that (1) ignition is switched on (2) there is petrol in the tank, and (3) everything is in order for starting.
	Test if coil sparks by removing lead from centre distributor terminal and hold it about $\frac{3}{16}$" away from some metal part of the chassis while engine is turned over. If sparks jump gap regularly the coil and distributor are functioning correctly.	Examine the sparking plugs, and if these are clean and the gaps are correct, the trouble is due to carburettor petrol supply, etc.
	If the coil does not spark, the trouble may be due to any of the following causes:— **Fault in low tension wiring.** Indicated by (1) No ammeter reading when engine is slowly turned and ignition switch is on; or (2) No spark occurs between the contacts when quickly separated by the fingers when the ignition switch is on.	Examine all cables in ignition circuit and see that all connections are tight. See that battery terminals are secure.
	Dirty or pitted contacts.	Clean contacts with fine carborundum stone or fine emery cloth and afterwards with a cloth moistened with petrol.
	Contact breaker out of adjustment. Turn engine until contacts are fully opened and test gap with gauge.	Adjust gap to correct setting.

Symptoms	Possible Causes	Remedy
Engine misfires	**Dirty or pitted contacts**	Clean contacts with fine carborundum stone or fine emery cloth and afterwards with a cloth moistened with petrol.
	Contact breaker out of adjustment. Turn engine until contacts are fully opened and test gap with gauge.	Adjust gap to correct setting.
	Remove each sparking plug in turn, rest it on the cylinder head, and observe whether a spark occurs at the points when the engine is turned. Irregular sparking may be due to dirty plugs or defective high tension cable. If sparking is regular at all plugs, the trouble is probably due to engine defects.	Clean plugs and adjust the gaps. Replace any lead if the insulation shows signs of deterioration or cracking. Examine the carburettor, petrol supply, etc.

LIGHTING TROUBLE

Lamps give insufficient illumination.	**Battery discharged.**	Charge battery either by a long period of daytime running or from independent electrical supply. Check generator belt adjustment.
	Lamps out of alignment.	Adjust Lamps.
	Bulbs discoloured through use.	Fit new bulbs (see page 26).
Lamps light when switched on, but gradually fade out.	**Battery discharged.**	As above.
Brilliance varies with speed of car.	**Battery discharged.**	As above.
	Battery connection loose or broken.	Tighten connections or replace faulty cables.
Lights flicker.	**Loose connection.**	Locate loose connection and tighten.
Failure of lights.	Faulty cable, connection or fuse blown (where applicable).	Examine wiring for faulty cables or connections and remedy. Fit replacement fuse. (see page 14A).
	Battery discharged.	Recharge battery.
	Loose or broken connection.	Locate and tighten loose connection, or remake broken connection.

RAPIER SERIES III and IIIA
WIRING DIAGRAM

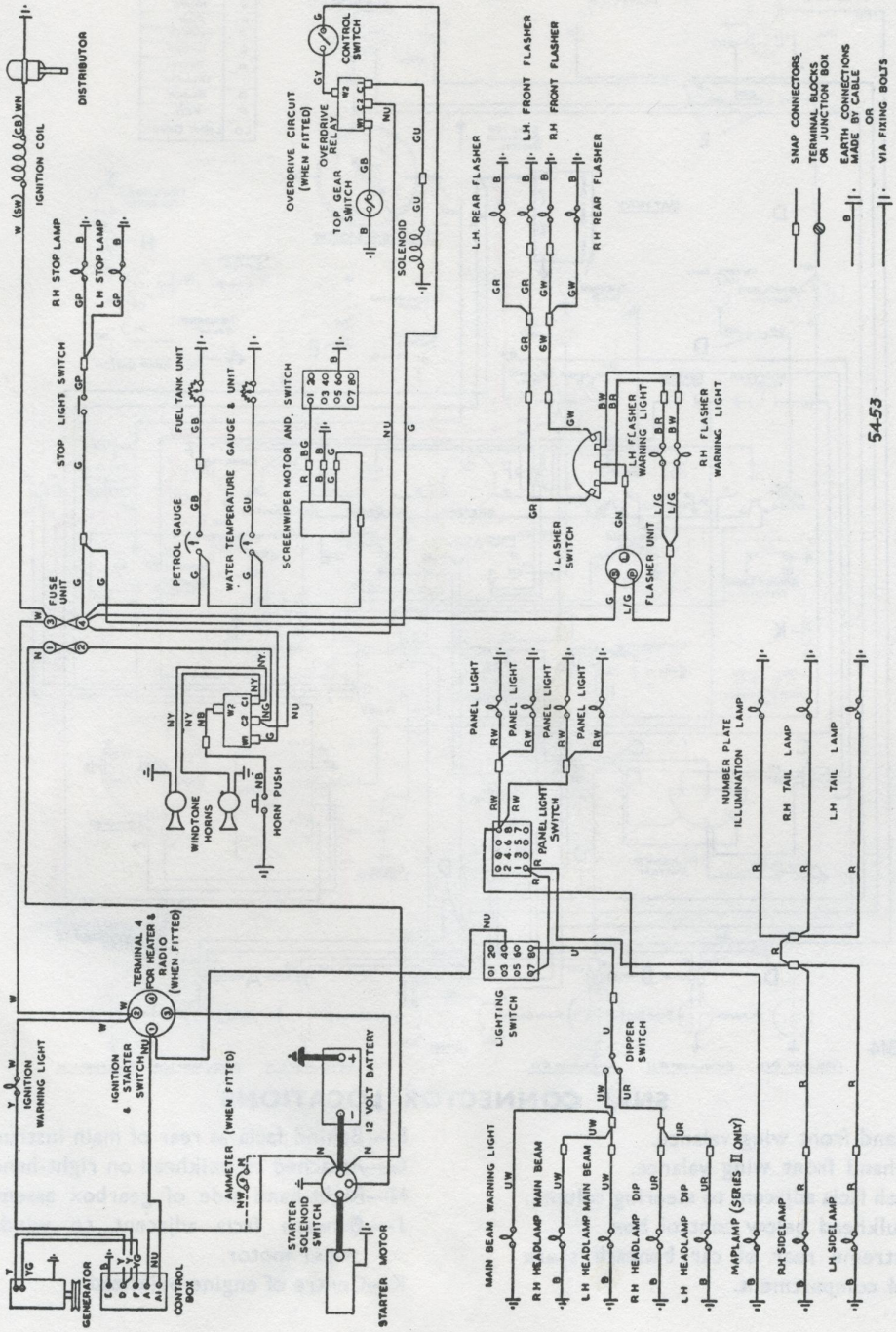


SNAP CONNECTOR LOCATIONS

1 Top right-hand corner of boot.
2 Top left-hand corner of boot.
3 Under left-hand side of facia.
4 Under right-hand side of facia.
5 Behind left-hand quarter trim pad.
6 Under facia in line with steering column.
7 On left-hand front wing valance.
8 On right-hand front wing valance.
9 Near thermometer element on water pump.
10 L.H.D. at left-hand front wing valance.
R.H.D. at right-hand front wing valance.
11 Behind facia near instruments.
12 Near windscreen wiper motor.

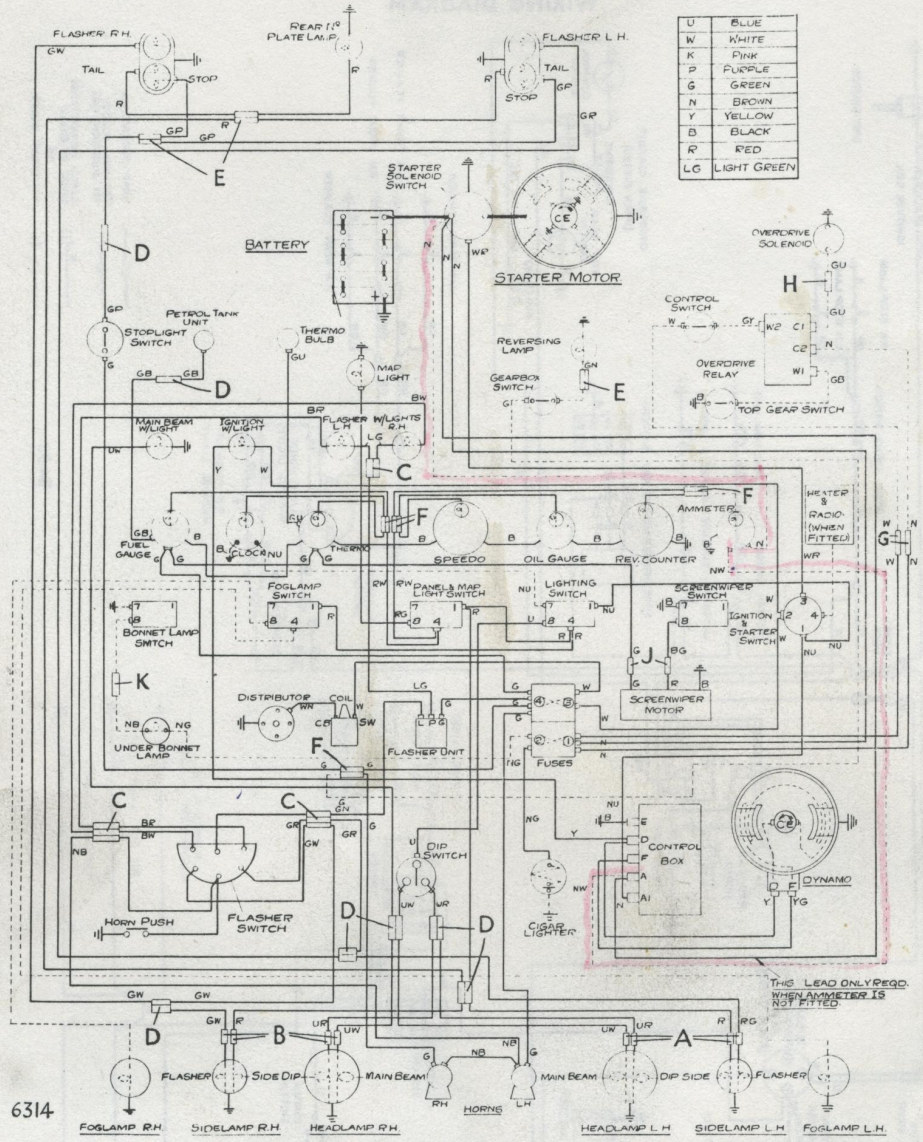
ALPINE SERIES I

WIRING DIAGRAM



For cable colours refer to chart on page 48.

ALPINE SERIES II
WIRING DIAGRAM

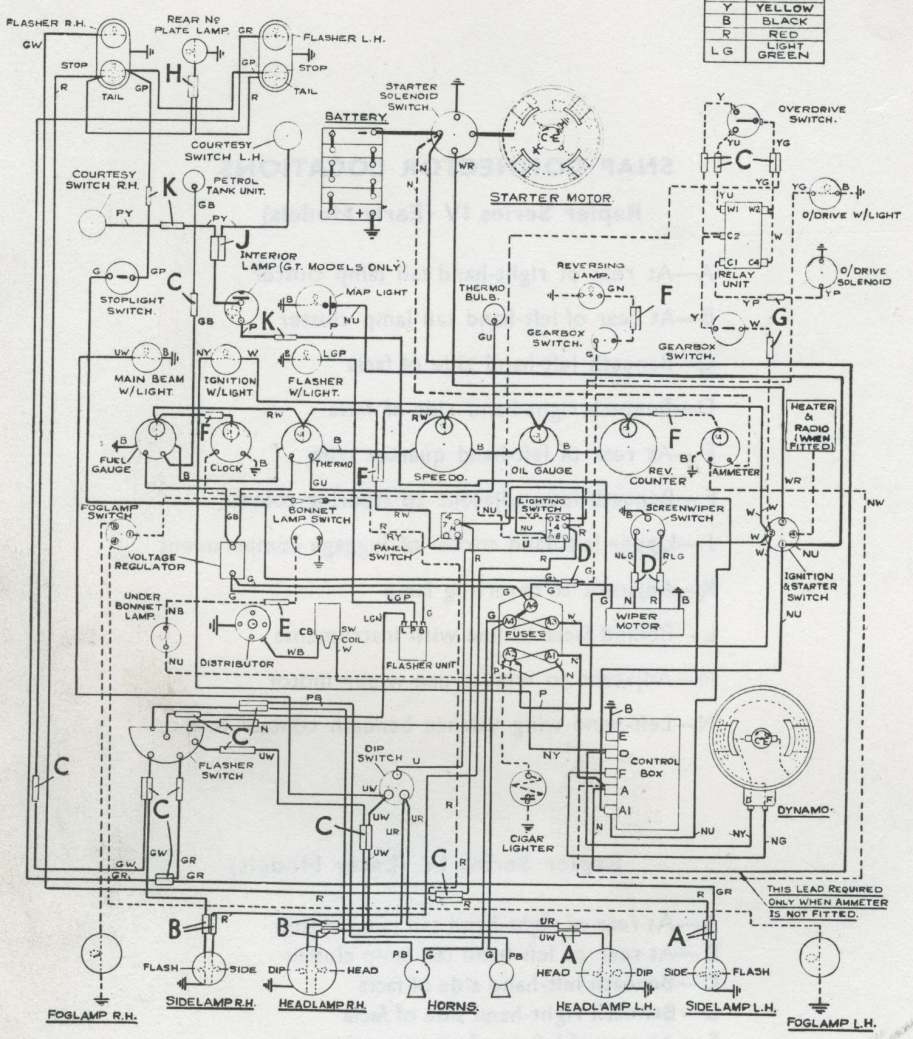


SNAP CONNECTOR LOCATIONS

A—Left-hand front wing valance.
B—Right-hand front wing valance.
C—Beneath facia adjacent to steering column.
D—On bulkhead below control box.
E—At extreme rear of car beneath spare wheel compartment.
F—Behind facia at rear of main instruments.
G—Attached to bulkhead on right-hand side.
H—Right-hand side of gearbox assembly.
J—Beneath facia adjacent to windscreen wiper motor.
K—Centre of engine bulkhead.

ALPINE SERIES III STANDARD AND G.T. MODELS WIRING DIAGRAM

COLOUR CHART	
U	BLUE
W	WHITE
K	PINK
P	PURPLE
G	GREEN
N	BROWN
Y	YELLOW
B	BLACK
R	RED
LG	LIGHT GREEN



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OPTIONAL EXTRAS SHOWN THUS :- ----------

LOCATIONS OF SNAP CONNECTORS

A—Left-hand front wing valance
B—Right-hand front wing valance
C—Beneath facia adjacent to steering column
D—Beneath facia adjacent to windscreen wiper motor
E—Centre of engine bulkhead
F—At rear of facia adjacent to instruments
G—At left-hand side of gearbox
H—At rear of car behind the boot lock
J—Beneath facia on left-hand side
K—Beneath facia on right-hand side

SNAP CONNECTOR LOCATIONS

Rapier Series IV (Early Models)

A—At rear of right-hand tail lamp cluster

B—At rear of left-hand tail lamp cluster

C—Beneath left-hand side of facia

D—Beneath right-hand side of facia

E —At rear of left-hand quarter trim

F —Beneath facia adjacent to steering column

J —Upper left-hand corner of luggage compartment

K—Adjacent to reversing lamp

L —Behind facia in line with instruments

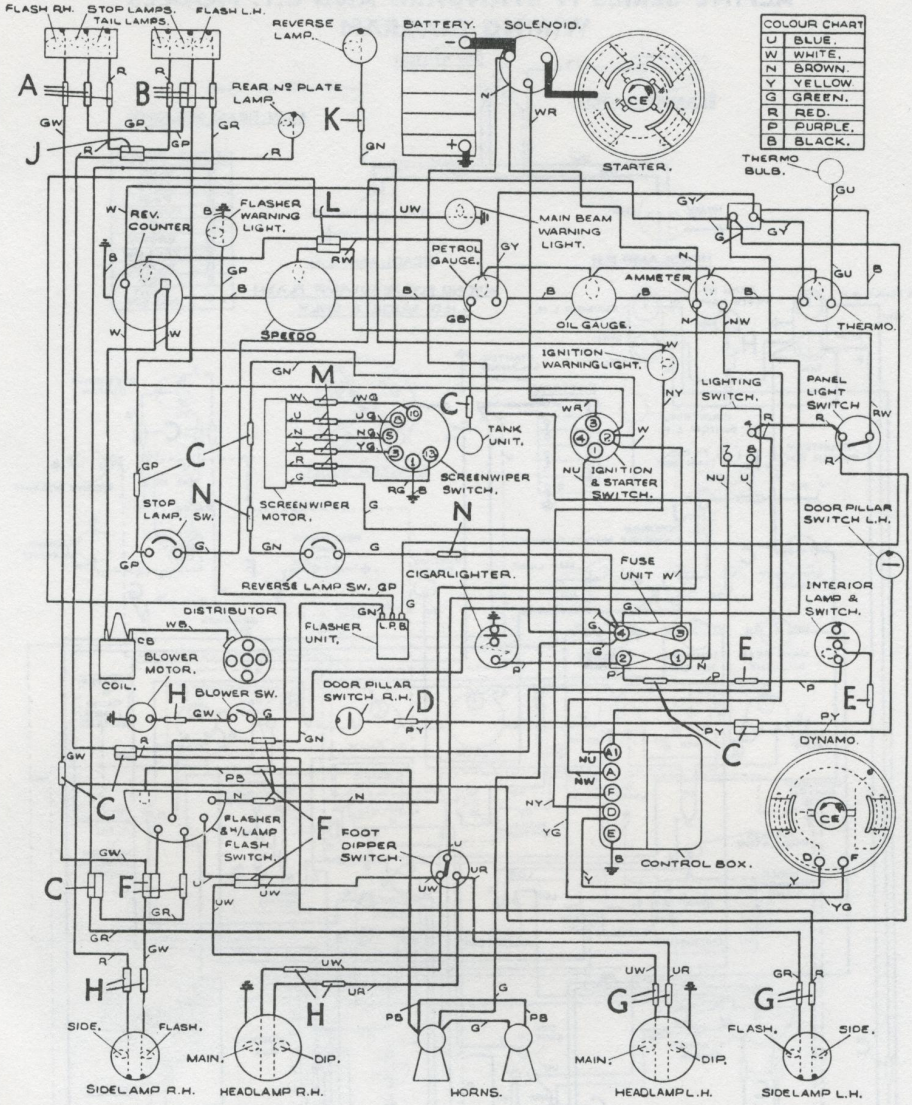
M—Adjacent to windscreen wiper motor

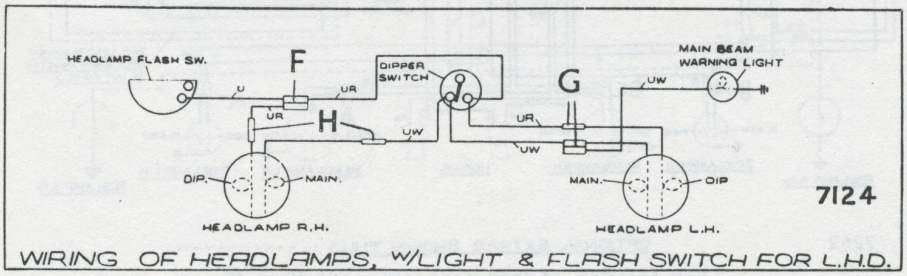
N—Left-hand wing valance beneath control box

Rapier Series IV (Later Models)

A—At rear of right-hand tail lamp cluster
B —At rear of left-hand tail lamp cluster
C—Beneath left-hand side of facia
D—Beneath right-hand side of facia
E —At rear of left-hand quarter trim
F —Beneath facia adjacent to steering column
G—On front wing valance at left-hand side
H—On front wing valance at right-hand side
J —Upper left-hand corner of luggage compartment
K—Adjacent to reversing lamp
L—Beneath facia in line with instrument
M—Adjacent to windscreen wiper motor
N—On front wing valance at left-hand side beneath control box

RAPIER SERIES IV (EARLY MODELS) — WIRING DIAGRAM

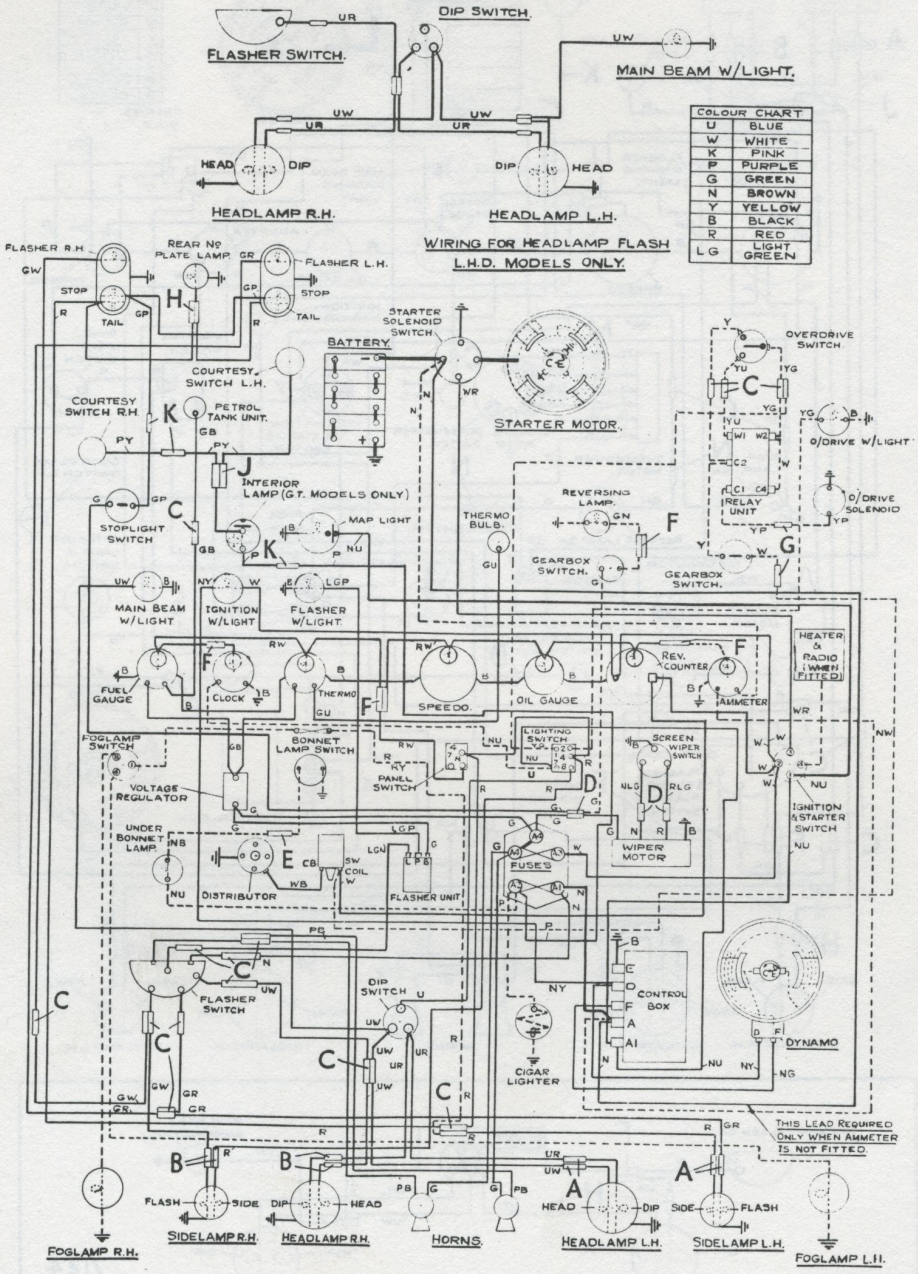




WIRING OF HEADLAMPS, W/LIGHT & FLASH SWITCH FOR L.H.D.

For location of snap connectors see Page 50

ALPINE SERIES IV STANDARD AND G.T. MODELS
WIRING DIAGRAM



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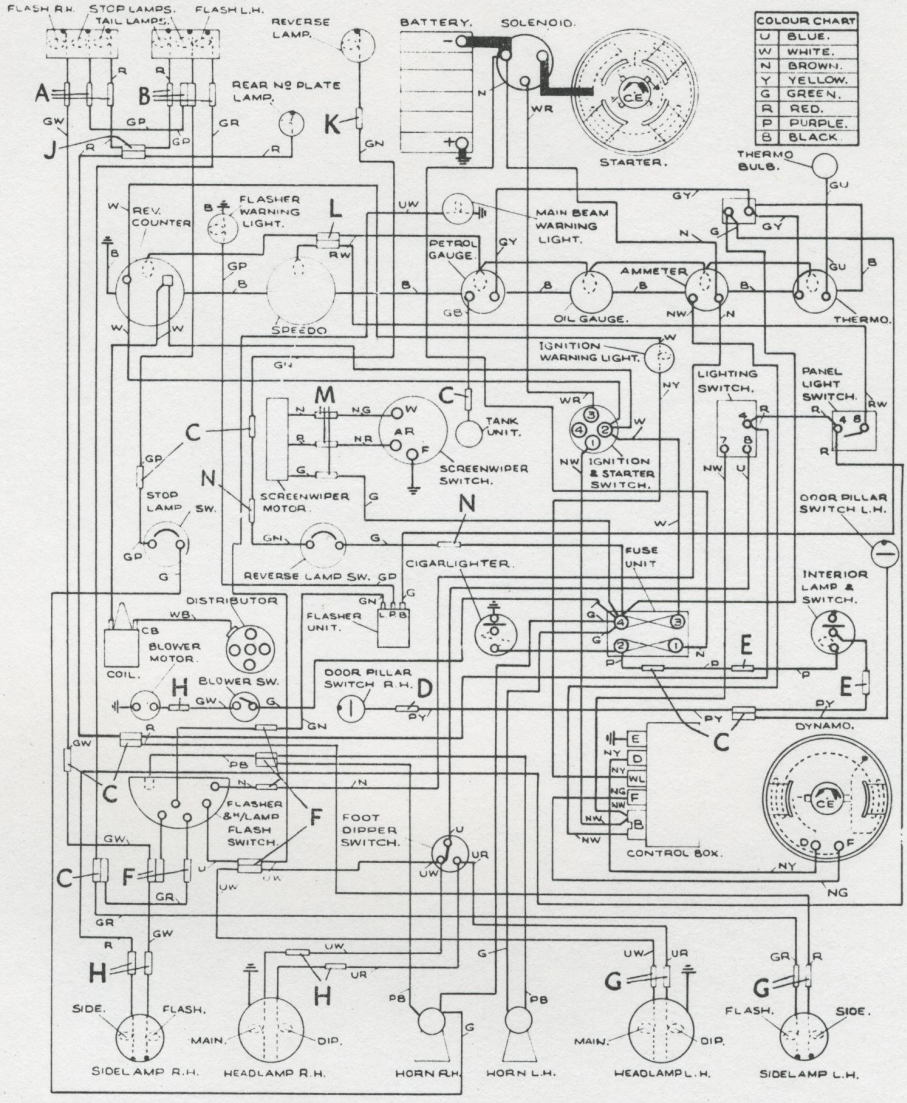
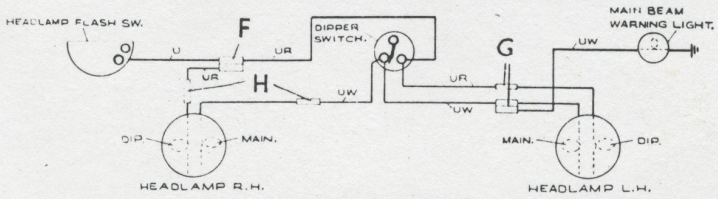
OPTIONAL EXTRAS SHOWN THUS :- ----------

For location of snap connectors see Page 49

RAPIER SERIES IV (LATER MODELS) — WIRING DIAGRAM





WIRING OF HEADLAMPS, W/LIGHT & FLASH SWITCH FOR L.H.D.

For location of snap connectors see Page 50