

S E C T I O N 1 2

E L E C T R I C A L S Y S T E M

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## ELECTRICAL SYSTEM

### DESCRIPTION

#### General

The electrical system is a 12 volt circuit of the conventional single-wire positive-earth return, i.e.:- the positive (+) terminal of the battery is "earthed" to the car. The dynamo is driven by the fan belt, provision being made for belt adjustment. An automatic compensated voltage regulator unit, incorporating the cut-out, ensures that the battery is kept in a charged state under all normal conditions of use. Two 25 amp. fuses are fitted in the accessories circuits.

The "flasher" type trafficators are operated through the normal bi-metallic relay switch remote from the drivers control switch, while the dual horns are coupled to the operating push button through a remote relay switch.

#### Dynamo

The two pole, ventilated dynamo is of the two-brush type operating in conjunction with the automatic compensated voltage regulator unit. It is secured at its forward end by fulcrum bolts to the camshaft drive cover, and at its rear end to a fulcrum bracket fitted to the left-hand side of the cylinder block. A slotted adjusting bracket locates the upper flange of the dynamo front plate and permits movement of the dynamo to take up driving belt stretch or wear. The

dynamo pulley incorporates an integral cooling fan; the rear end of the dynamo is vented so that cooling air drawn in by the fan flows through the armature tunnel, over the commutator and brush gear and is expelled at the rear.

#### Starter motor

The starter motor is a series wound four pole unit with an extension casing at its driving end, which carries an outrigger bearing for the armature shaft upon which is mounted the "Bendix" type of inertia pinion assembly.

The motor is mounted on the forward face of the flywheel casing on the right-hand side of the engine and revolves anti-clockwise when viewed from the front of the car.

Control of the starter motor is via a remote solenoid switch which is energised by the driver's starter push button.

#### Voltage regulator and fuse box

The voltage regulator and the cut-out are housed on a common base (covered by a single moulded cover) mounted on the bulkhead in the engine bay. Beneath the cover is the main terminal junction block. Two fuses, indicated by the markings "AUX" and "AUX.IGN" on the regulator unit cover protect the accessories as follows :-

Fuse	Independent of ignition switch	Controlled by ignition switch
None.	Clock. Head, side and tail lamps. Number plate lamp. Head lamp warning light. Panels lamps.	Ignition circuit and warning light. Starter push button. Dynamo.
AUX. IGN. No. 1	-	Brake stop lamp. Petrol gauge. Flashers. Windscreen wiper motor. Petrol reserve warning lamp. Reversing lamp.
AUX. No. 2	Horns.	-

All accessories protected by a fuse will be rendered inoperative when that fuse blows.

Caution:- Never replace a blown fuse with one of higher value, as this will only lead to damage of the accessories if a short circuit occurs. The fusing figure is visible on the coloured paper through the glass tube of the fuse.

The voltage regulator controls the dynamo output and is dependent on the load on the battery and its state of charge. When the battery is in a low state of charge, the dynamo output is high (20 amps. or more) which is shown on the ammeter. As the battery becomes charged, the charging rate is automatically decreased until it becomes a "trickle" charge of 1 to 2 amps. sufficient only to maintain the battery in good condition.

The regulator is designed to give a controlled initial boosting charge to the battery after a cold start in order rapidly to replace current taken by the starter motor.

Note:- It will sometimes be noticed that when the head lights are switched on while running, an abnormal discharge rate is indicated on the ammeter. This is quite in order when the battery is fully charged. The discharge rate will decrease within a short space of time, when the dynamo output will equal the amount of current consumed. The ammeter then shows 0 or a charge rate of 1 to 2 amps.

No adjustment to the regulator is normally required, but should any adjustment become necessary (see under Changing the Battery) it should be entrusted to a recognised "Lucas" agent, or a qualified car electrical specialist.

#### Cut-out

The cut-out is an automatic solenoid-operated switch in the dynamo/battery circuit. When the dynamo is running slowly or is stationary, the cut-out is kept open by a light spring and prevents the battery discharging itself through the dynamo. It is set by the manufacturer so that the contacts close when the dynamo voltage output is greater than that of the battery. No adjustment to the cut-out is normally necessary.

#### Battery

The battery is housed beneath the bonnet in the recess to the rear of the front wheel on the left-hand side of the car. Its positive terminal is earthed, while the negative terminal is connected direct to one terminal of the starter solenoid by heavy duty cable. The main feed is taken from the same terminal (by a cable of normal dimensions) to the end terminal of the main terminal junction block on the bulkhead.

### Ammeter

The ammeter is in circuit with all electrical accessories except the starter motor. The instrument is positioned on the dashboard and forms part of the central combined instrument.

### Brake lamp switch

The brake lamp switch is operated by a spring-loaded plunger connected to the foot brake pedal and is located on a bracket mounted on the frame cross member behind the pedal box and approximately below the front of the driver's seat.

### Reverse lamp switch

The reverse lamp switch is mounted on the right-hand side of the gearbox. It is of the plunger type and operated by the reverse gear selector mechanism on engagement of reverse gear.

### Windscreen wipers

#### Standard models

The windscreen wipers are an optional fitting; they may be fitted to the existing brackets and pilot holes. The pilot holes are normally blanked by screws.

#### De-luxe models

The windscreen wiper motor and gearbox is mounted underneath the dashboard



on the extreme right-hand side of the car. A cable rack transmits motion to two wheel boxes beneath the scuttle facia, which operate the wiper blades. To operate the wipers, pull out the knob marked "W" positioned centrally on the dashboard immediately below the trafficator switch. Push the knob in to stop the wiper blades.

#### Horns

The dual horns are mounted on brackets which are welded to the front face of each front wheel bay, behind the head lamps. The push button in the centre of the steering wheel energises a solenoid relay switch mounted immediately above the left-hand horn unit.

#### Panel lamps

There are five panel lamps each comprising a bulb holder and a bulb of 2.5 watt. The lamps are controlled in unison by a rheostat control knob marked "L" on the right-hand side of the dashboard. The lamp bulbs are located as follows :- one each behind the combined instrument, oil temperature gauge, water temperature gauge, r.p.m. indicator and speedometer.

#### Warning lamps

These are all situated on the instrument panel as follows :-

##### Ignition warning lamp

On the extreme right-hand side of the instrument panel below the water temperature gauge; the bulb is fitted behind an amber glass.

#### Fuel warning lamp

To the right of the steering column beneath the r.p.m. indicator, its bulb being behind a blue glass, and indicates when approximately 2 to  $2\frac{1}{2}$  Imperial gallons ( $2\frac{1}{2}$  to 3 U.S.A. gallons) (9.09 to 11.56 litres) remain in the tank.

#### Headlamp warning lamp

To the left of the steering column beneath the r.p.m. indicator, its bulb being behind a red glass.

#### Trafficator warning lamp

When the trafficators are in operation a warning light comes into operation. It is situated to the extreme left of the instrument panel above the speedometer, the bulb being behind a green glass.

#### Head lamps

Each head lamp incorporates a Lucas light unit which comprises a domed front glass and reflector. The light unit is secured to a mounting flange integral with the lamp shell. Each lamp is located in a recess to the left and right respectively of the radiator air intake grille.

Three cables are fed into the head lamp shell through a floating adaptor socket. Referring to Fig. 5, the back-shell supports the bulb and completes the circuit between the bulb and the floating adaptor.

#### Side lamps

As illustrated in Fig. 6, the side lamps are mounted inside tubular fairings

in the front wings. Each lamp is fitted with a twin filament bulb, the brighter filament being for the "flashing" trafficator system.

#### Stop and tail lamps

These units are housed in tubular fairings as illustrated for the side lamp in Fig. 6. Each lamp is fitted with a twin filament bulb, the brighter filament serving the dual purpose of trafficator (flasher) and stop light. De-luxe models have chromium plated fairings.

#### Rear number plate and reverse lamps

The rear number plate lamps and reverse lamp are housed in a single casing on the lower edge of the boot door. The centre bulb functions automatically as reverse gear is engaged. The two remaining bulbs come into operation when the side and head lamps are switched on.

#### GENERAL DATA

System...	...	...	...	...	...	12 volt positive-earth return.
Dynamo...	...	...	...	...	...	Lucas C. 39. PV/2. Brush spring tension 20 to 25 oz. (0.57 to 1.42 kg).
Starter motor..	...	...	...	...	...	Lucas M. 35G/1 Type WG. 3. Anti-clock rotation (viewed from commutator end). Brush spring tension 32 to 40 oz. (9.07 to 11.35 kg.).
Starter solenoid switch	...	...	...	...	...	Lucas, Type ST. 950.
Ignition coil..	...	...	...	...	...	Lucas B. 12.
Regulator unit.	...	...	...	...	...	Lucas Type RF. 95/2L2.

Battery.. ... .. Lucas G.T.W. 9A/2.  
Capacity - 51 ampere hours.

Switches :-

Lighting and ignition... .. Lucas Type P.L.C. 6.  
Panel light rheostat ... .. Lucas Type CH.R. 1.  
Horn button. ... .. Lucas Model WG/16/47.  
Horn relay.. ... .. Lucas Type No.SB.40/1.  
Flasher unit ... .. Lucas Type No.FL. 3.  
Double relay for flashers ... .. Lucas Type No.D. B. 10.  
Wiper arm L.H. ... .. Lucas No. 737557.  
Wiper arm R.H. ... .. Lucas No. 737453.  
Wiper blade. ... .. Lucas No. 738724.

Combined Instrument

Fuel gauge.. ... .. X. 53936/32 )  
Oil pressure gauge ... .. X. 53936/23 ) X. 56007/35  
Ammeter ... .. S. K. 65001/3)

Petrol gauge float unit ... .. Smiths X. 86003.

Lamps :-

Head.. ... .. Lucas Type F. 700.  
Side.. ... .. Lucas Type No.488.  
Combined stop and tail.. ... .. Lucas Type No.488.  
Combined number plate and reverse... Lucas Type No.469.

Warning lamps :-

Flasher (green)... .. Lucas Type No.WL. 11.  
Main beam (red)... .. Lucas Type No.WL. 11.  
Ignition (amber).. ... .. Lucas Type No.WL. 11.  
Petrol level (blue) ... .. Lucas Type No.WL. 11.

## MAINTENANCE

### Dynamo

At 12,000 mile (20,000 km.) intervals

Lubricate the rear bearing.

Check the condition of the brush gear and commutator and blow out any excess carbon dust with a dry air blast.

### Starter motor

At 12,000 mile (20,000 km.) intervals

Check the condition of the brush gear and commutator and blow out any excess carbon/copper dust with a dry air blast.

### Battery

See under Servicing on page 19. If the car is laid up, charge the battery to its fully charged state, and then give it a refreshing charge every two weeks.

### General

At the periods given above, check all exposed cables and terminals for fretting, fraying or slackness, and rectify any faults immediately.

## DYNAMO

### Lubrication

The bearings are packed by the manufacturer with high melting point grease,

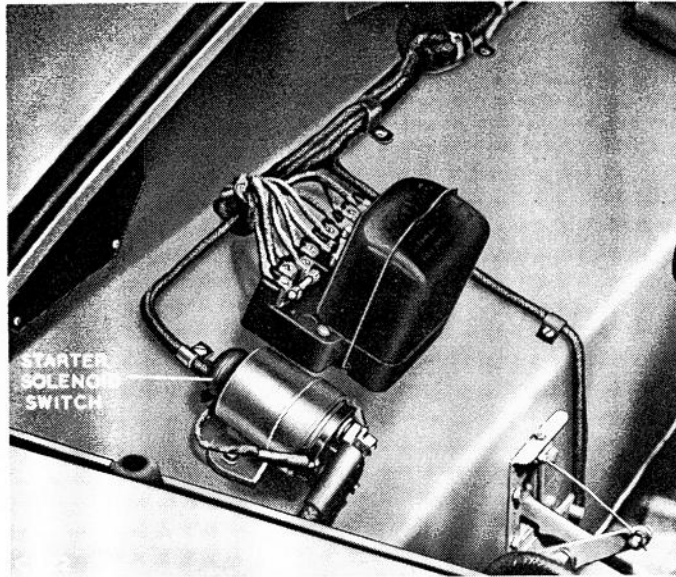


Fig.1 Starter solenoid switch and fuse box.

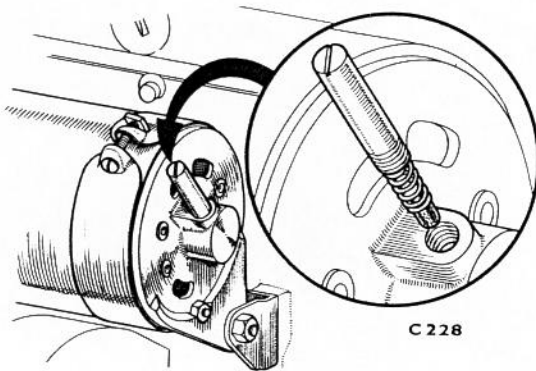


Fig.2 Dynamo Lubricator.

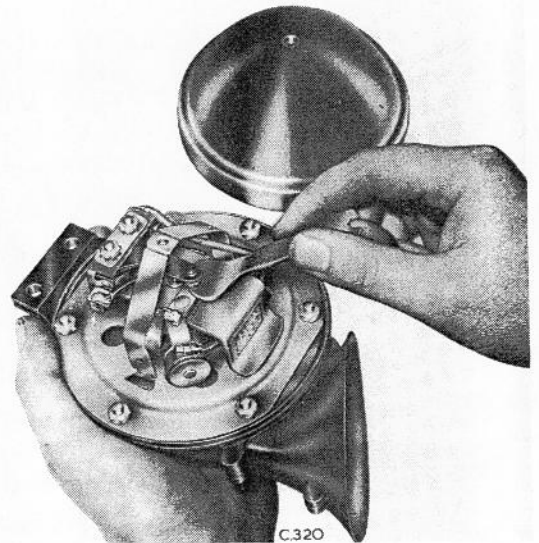


Fig.3 Horn adjustment

but provision is made for re-packing the rear bearing. Do this as follows at the periods given under "Maintenance".

Unscrew and remove the lubricator, see Fig. 2 and extract from it the felt pad and spring. Half-fill the lubricator with petroleum jelly then replace the spring and the felt pad and screw the lubricator into position.

### Servicing

At regular intervals, remove the dynamo and check the following :-

1. Remove the cover band and, using a spring balance, check the tension of the brush springs.
2. Lift the brush springs from the heads of the brushes. Check the fit of the brushes in their boxes by pulling carefully on their copper-braided connections. They should be a free sliding fit without trace of "binding" or sticking.
3. Remove the brushes from the boxes, taking care to note their positioning in the boxes. Examine the brushes for condition of their commutator contact faces and check their length. If the contact faces are chipped or damaged or if the brushes are worn excessively, they should be replaced. Reduction in length beyond a safe limit is usually indicated by the brush spring tension being below the recommended minimum weight when checked with the spring contacting the head of the brush.
4. Examine the commutator for cleanliness, wear, burning and the level of the insulation between commutator segments. If worn excessively or burned, or if the insulation is level with the segments, the dynamo should be returned to a Lucas service depot or agent for repair. If the commutator is apparently in serviceable condition, clean it with a blast of clean, dry compressed air to remove all carbon dust then wipe it with a petrol-moistened cloth.
5. Clean the brushes and brush boxes in a similar manner then refit the brushes in their original positions. If the operator is skilled in the repair of electrical equipment, defective brushes may be replaced with new ones of the correct type, obtainable from any Lucas service depot or agent. This procedure entails bedding the new brushes to the armature. Where it is not desired to perform this work, the brushes may be replaced and bedded at a Lucas service depot. With the brushes in their boxes, check the brush spring tension.

Refit the dynamo to the engine and adjust the fan belt tension, then re-connect the control box leads to the dynamo. The yellow lead must be connected to the main terminal and the yellow lead with green tracer connected to the field terminal.

### STARTER MOTOR

#### To free a jammed pinion

In the event of the starter pinion becoming jammed in mesh with the flywheel ring, it can usually be freed by applying a spanner to the squared end of the armature shaft and turning in a clockwise direction viewed from the front of the engine. The shaft end is accessible by first removing the protective cap.

If jamming becomes persistent, remove the starter motor from the engine and check the armature shaft for concentricity. If mal-alignment is slight, remove the armature and straighten the shaft by judicious use of a hand press, otherwise reject the armature and fit a new one. Check that the teeth of the "Bendix" pinion and the flywheel ring teeth are free from scuffing or rough spots; dress as necessary with a "Carborundum" or "Aloxite" stone.

Note:- The teeth of the flywheel starter ring are of softer metal than the "Bendix" pinion; it is therefore more usual to find damage to the former. The teeth may be filed, if necessary, through the starter motor attachment aperture. Mark the flywheel with a chalk line and examine each tooth as the engine is turned by hand.

#### Servicing

At regular intervals, remove the cover band and lift the brush springs from



the heads of the brushes. Remove the brushes from the brush boxes, taking care to note the position in which they were fitted in order to ensure that each brush will be refitted correctly to its brush box. Examine the commutator; if serviceable, clean it and the brush boxes with a blast of clean, dry compressed air to remove all traces of carbon dust. Wipe the commutator, brushes and brush boxes with a clean petrol-moistened cloth then refit the brushes to their boxes and apply the springs. Check the spring tension with the springs contacting the heads of the brushes.

If any work other than this is required to make the starter serviceable, it should be returned to a Lucas service depot or agent.

## BATTERY

### First charge

It is most important that the following procedure of initial charging is followed strictly, otherwise the useful life of the battery may be seriously curtailed.

Some batteries have their filler plug apertures sealed; where this is encountered, break the sealing carefully. No harm is caused if broken parts of the seal fall into the battery, but it is advisable to remove as much as possible.

Half fill each cell with dilute sulphuric acid of the correct specific gravity ( $\frac{1}{2}$  pint to each cell). The specific gravity of the acid to be used is dependent upon the ambient temperature as given in the following chart.

Ambient Average temperature.	Specific gravity	
	Initial filling	Fully charged
Up to 80°F. (27°C.). Temperate climate	1.350	1.280 to 1.300
80°F. to 100°F. (27°C. to 38°C.). Sub-tropical climate	1.320	1.250 to 1.270
Over 100°F. (38°C.). Tropical climate	1.320	1.220 to 1.240

Allow the battery to stand for six hours then add sufficient acid of the correct specific gravity to each cell to bring the levels to just over the tops of the separators. Allow the battery to stand for a further two hours. Connect the battery to a charging board and charge at a rate of 3.5 amperes for 40 to 80 hours. The fully charged state will be indicated by the specific gravity and the voltage remaining constant; when this is achieved, remove the battery from the charging equipment, check the specific gravity reading and adjust it as necessary by the addition of acid or distilled water to obtain a reading in accordance with the chart.

#### Servicing

Examine the battery frequently to check the level of the electrolyte in each cell. The rate of evaporation of the electrolyte varies according to the use of the battery and the temperature in which it is operating; a higher rate of evaporation will occur in hot weather.

Warning:- Do not use a naked light when examining the cells, since the gas is explosive.

"Top up" the battery by removing the filler plugs and adding distilled water to each cell until the electrolyte just covers the tops of the separators. Tap water must not be used.

Note:- The cells are not interconnected; it is therefore necessary to examine and "top up" each cell. Do not allow the distilled water to contact metal (i.e. a metal funnel or container).

Cover the cable terminals and connectors with lanoline or pure petroleum jelly and maintain the contact surfaces in a clean condition. Check that the terminal connections are tightened securely on the terminals.

If the terminals or connectors have become corroded, clean them by brushing with a solution of ammonium carbonate until all traces of the corrosion have been removed, then wash the parts thoroughly in warm water and, finally, dry off. Do not use abrasives for cleaning. Refit and tighten the connectors, and cover the connectors and terminals with lanoline or pure petroleum jelly.

Occasionally take hydrometer readings to check the condition of each individual cell in accordance with the following table.

Note:- Do not take these readings immediately after "topping up" since they are not reliable until the distilled water has become thoroughly mixed with the acid.

If the cell readings vary considerably, it is advisable to have the battery checked by a qualified Lucas agent or car electrical specialist and the cause corrected before damage occurs.

Ambient temperature	Hydrometer readings		
	Charged	$\frac{1}{2}$ Charged	Discharged
Temperate. Up to 80°F. (27°C.)	1.280 to 1.300	Approx. 1.210	1.150 or less
Sub-tropical. 80°F. to 100°F. (27°C. to 38°C.)	1.250 to 1.270	-	-
Tropical. Over 100°F. (38°C.)	1.220 to 1.240	-	-

### Changing the battery

When for some reason the battery is to be changed, observe the following conditions:-

1. The exchange battery must be the same type or possess the same internal electrical characteristics as the original.
2. If the condition at (1) is impracticable, have the adjustment of the voltage regulator checked, and if necessary adjusted, by a qualified person.

The voltage regulator is initially adjusted to give the correct dynamo output when in circuit with the battery supplied on a new car. The output current of the dynamo thus depends on the battery internal characteristics, and it follows that a battery with greater or less internal resistance will alter the dynamo output characteristics from that which originally obtained.

## HORNS

## General

All horns are adjusted to give their best performance before leaving the works and under normal circumstances will not require adjustment. If one or both horns fail to operate, or if their operation becomes erratic, check to determine the cause, which may be due to some outside source and not to a defect in the horns. The following list will help to trace the source of the defect.

Horns fails to operate.	Discharged battery, broken connection.
Horn operates erratically.	Discharged battery, loose connections, fixing bolts loose or some other component adjacent to the horn being loose. This last defect will alter the tone of the horn.
Horn operates without using the horn push-button.	Loose connection or short circuit of the horn wiring.

A horn may need adjustment if it is still defective after making the above examination and any necessary corrections. Adjustment will take up wear in the moving parts of the horn but will not affect the note pitch.

## Horn adjustment

Observe the following precautions when adjusting the horn :-

- (a) If an abnormal discharge is shown on the ammeter when the horn button is pressed, do not again operate the horns until the fault is rectified.
- (b) If the horn does not sound when the push-button is operated, release the button immediately to avoid possibility of damage to the horn.
- (c) While adjusting one horn, disconnect the supply lead of the other and ensure that the disconnected lead does not contact any part of the chassis.

1. Remove the fixing screw and detach the horn cover.
2. Slacken the locknut on the fixed contact and rotate the adjusting nut until the contacts are just separated. The correct initial setting will be indicated when the horn just fails to sound.
3. Turn the adjusting nut one half-turn in the opposite direction and secure it in this position by tightening the locknut.
4. Test the horn; if it fails to operate correctly, reassemble it and return to a Lucas service depot or service agent for examination. Do not attempt to dismantle the horn. If satisfactory, refit the cover and secure with the fixing screw.

#### SNAP CONNECTORS

Examine all snap connectors at six monthly periods and renew any that are perished, corroded or otherwise damaged. -If defective connectors are left in position, open circuits and (in some instances) short circuits may occur with the resultant failure of the relevant accessory circuit.

#### HEAD LAMPS

##### Replacing a bulb

Working through the aperture in the lower body panel, loosen the securing screw at the bottom of the lamp rim then lift out the rim, see Fig.4. Press on the light unit, twist it anti-clockwise and draw the light unit forward clear of the lamp shell. Detach the floating adaptor socket from the back shell; then withdraw the light unit clear of the car.

From the back of the light unit, press and twist anti-clockwise on the back shell to remove it, then lift the bulb from its holder in the back of the reflector; be careful that it does not drop out when the back shell is removed.

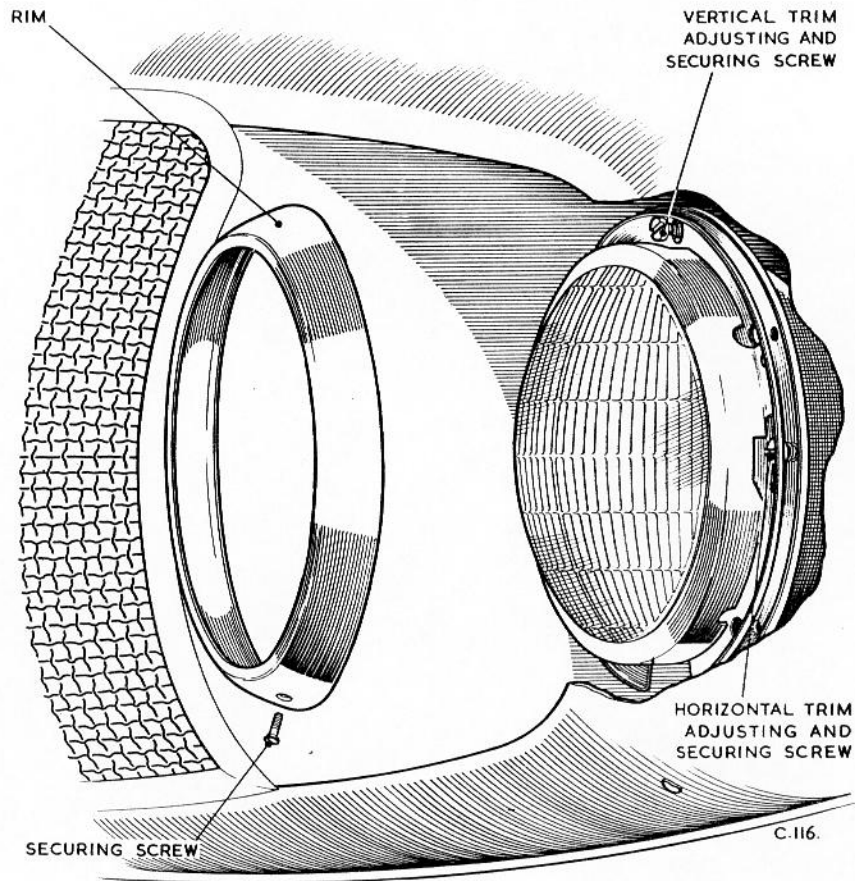


Fig. 4 Light unit with rim removed.

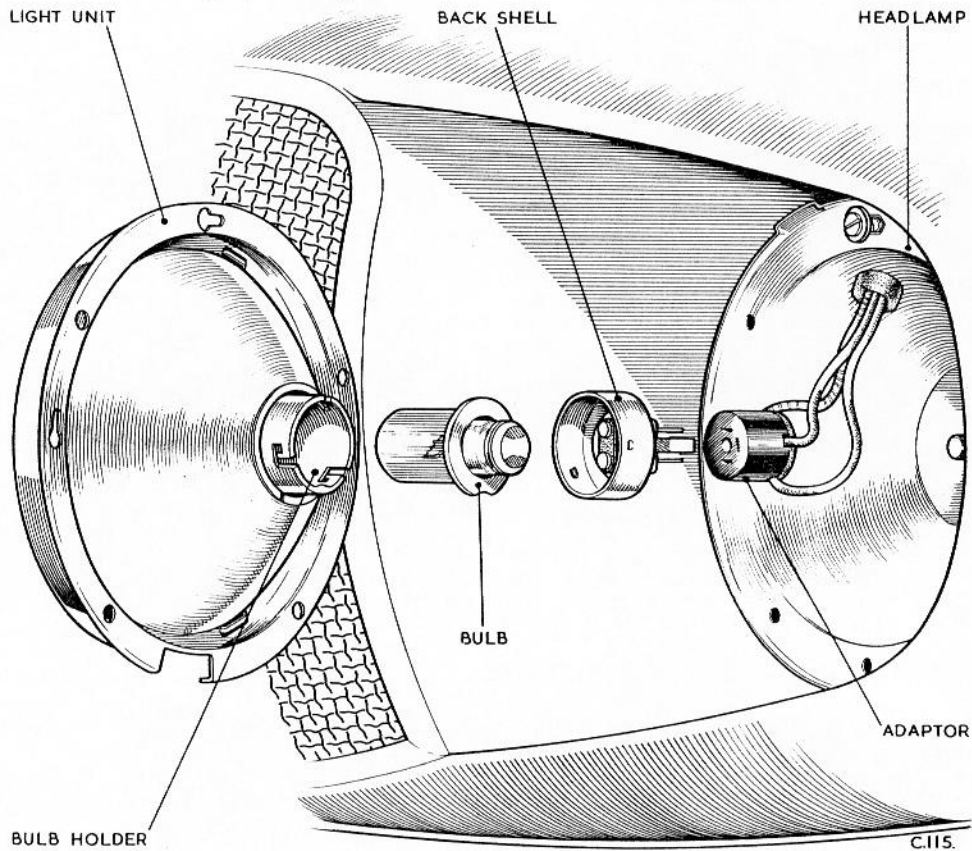


Fig. 5 Head lamp assembly

When replacing a bulb of the correct type, it can only be fitted one way, i.e. with the notch in the bulb collar locating on the corresponding "blip" in its holder, see Fig.5.

With the replacement bulb in position, refit the back shell which can only fit correctly owing to the off-set bayonet lugs. Plug the light unit into the floating adaptor; the correct location is indicated by the third prong of the back shell which snaps into position.

#### Setting adjustments

No adjustment is necessary under the normal conditions of use, even after fitting a new bulb, but vertical and horizontal adjustment is provided.

To effect adjustment, proceed as follows :-

1. Set the car on level ground at an approximate distance of 20 to 30 ft. from, and facing, a blank wall.
2. Remove the lamp rims.
3. Switch on the lights and note the position of the light circles on the wall in relation to the height and spacing of the lamps on the car.
4. To raise the beam, screw the vertical trim adjusting screw clockwise and vice versa, see Fig.4.
5. To turn the beam horizontally, manipulate the spring-loaded horizontal trim adjusting screws as necessary.

When adjustment is satisfactory, refit the rims and tighten the pinch screws.



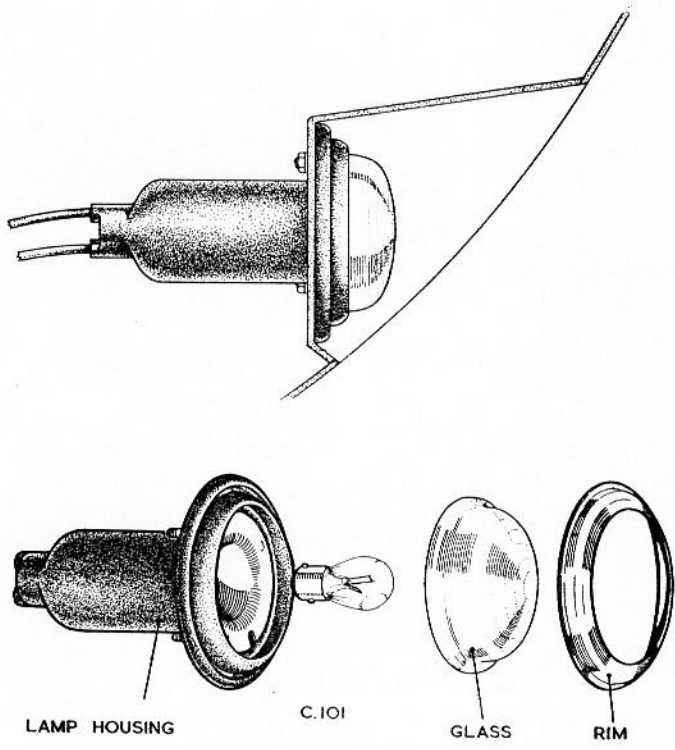


Fig.6 Side lamp details.

## SIDE LAMPS

### Replacing a bulb

1. Lift the bonnet and position its retaining stay.
2. Remove the securing nut and washers from the retaining plate inside the front wing, see Fig.6 then withdraw the retaining plate.
3. Manoeuvre the tubular fairing containing the complete lamp assembly from the front wing.
4. Remove the three nuts and washers from the flange face in the tubular fairing, then push out the rubber lamp housing.
5. Remove the outer rim, then the lamp glass from their respective rubber grommet-type flanges.
6. Remove the bulb and fit a serviceable replacement.

To refit the lamp, reverse the above procedure.

## STOP AND TAIL LAMP

### Replacing a bulb

1. Open the spare wheel stowage compartment.
2. Remove the three screws from the upper edge of the relevant side panel then remove the panel.
3. Remove the securing nut and washers from the retaining plate inside the rear wing, then withdraw the retaining plate.
4. Manoeuvre the rear fairing containing the complete lamp assembly from the rear wing.
5. Remove the three nuts and washers from the flange face in the tubular fairing, then push out the rubber lamp housing.
6. Remove the outer rim, then the lamp glass from their respective rubber grommet-type flanges.

7. Remove the relevant bulb and fit a serviceable replacement of the correct type.

To fit the lamp, reverse the above procedure.

#### REAR NUMBER PLATE AND REVERSE LAMPS

##### Replacing a bulb

The sequence of operation is the same as that given for the side lamps on page 27.