

# LUCAS



## **ELECTRICAL EQUIPMENT**

**FOR CARS AND LIGHT COMMERCIAL VEHICLES**

***MAINTENANCE INSTRUCTIONS  
AND GENERAL INFORMATION***



## GUARANTEE

All usual and reasonable precautions have been taken to ensure excellence of materials and workmanship, and in the event of any defect which is not caused by wear and tear, misuse, accident, or negligence, being disclosed within twelve months of its being put into use, we will either supply new parts or components in exchange for those defective, or repair such defective parts or components, free of charge. We do not undertake to dismantle or reassemble, or bear the cost of dismantling or reassembling any such part or component on the vehicle or chassis. This undertaking shall be deemed to exclude any and every other obligation whatsoever and all liability for any loss or damage, howsoever or whensoever caused or arising, except the cost of replacement or repair in accordance with this undertaking.

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# INTRODUCTION

Lucas Electrical Equipment is designed and manufactured to give long periods of service with the minimum of attention. As with other parts of the car, however, occasional minor adjustments, lubrication of moving parts and cleaning should be carried out at regular intervals to ensure that the equipment functions with its utmost efficiency.

SECTION ONE of this Manual describes the small amount of routine attention which is required by the equipment.

SECTION TWO gives general information about various items of equipment. It also includes instructions on lamp setting and on the carrying out of replacements, such as bulbs and high tension cables, which may become necessary from time to time.

SECTION THREE gives the recommended procedure for carrying out a systematic examination should an electrical fault be suspected.

Copies of wiring diagrams for most Lucas equipped vehicles can be obtained on request to the Advertising Department, Great King Street, Birmingham, 19. These diagrams are issued free on receipt of the appropriate information, namely, Make, Model and Year of vehicle.

At the end of this Manual are listed the addresses of our Sales and Service Depots at home, together with the names of our Overseas Companies and details of the Lucas Service facilities that are available on a world-wide basis.

## SECTION ONE

# LUBRICATION AND GENERAL MAINTENANCE

## AFTER THE FIRST 500 MILES

### DISTRIBUTOR

#### Checking Contact Breaker Setting

The contact breaker gap should measure 0.014"—0.016" when fully opened. Access to the contact breaker is gained by springing back the two side clips and lifting off the moulded cover. To check the setting, turn the engine slowly by hand until a point of maximum opening is reached and insert a feeler gauge between the contacts. Due to the initial bedding-in of a new contact set, the gap may need resetting. Some simple form of adjustment is therefore provided. This adjustment involves repositioning the plate to which the fixed or stationary contact is riveted. The plate is secured either by one or by two screws. To reset the gap, keep the engine in a position giving maximum contact opening and slacken the screw or screws securing the fixed contact plate. Reposition the plate until a 0.014"—0.016" gauge can be inserted as a sliding fit between the contacts, then retighten the screw or screws.

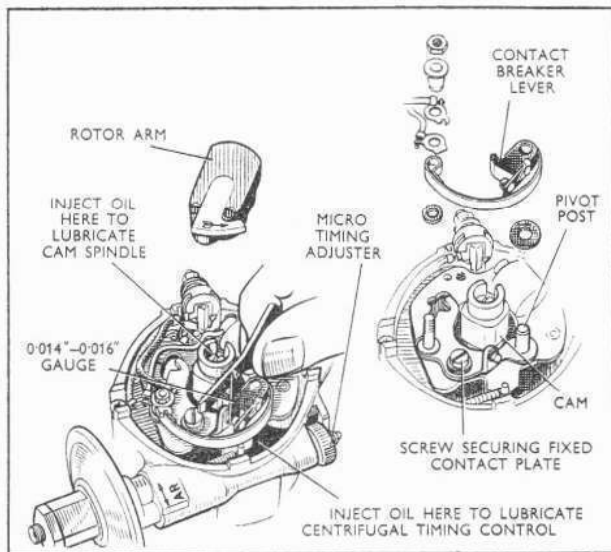


Fig. 1. Method of measuring contact breaker gap and of detaching moving contact lever on 4-cylinder distributors

To facilitate setting, some distributors incorporate a screwdriver adjusting device, such as a notched lever or a slotted cam located in an oval aperture. Examples of these are shown in Figs. 1 and 2 respectively.

After adjustment it is advisable to re-check the gap to ensure that no movement has taken place whilst tightening the screw or screws.

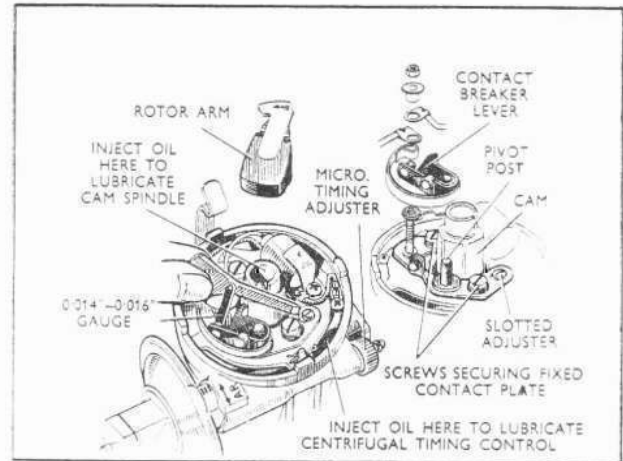


Fig. 2. Method of measuring contact breaker gap and of detaching moving contact lever on 6-cylinder distributors

## EVERY 1,000 MILES

### BATTERY

#### Topping-up

Every 1,000 miles or monthly, whichever is the lesser, remove the filler plugs from the battery and check the electrolyte level. If necessary, add distilled water to bring the electrolyte level with the separator guard, if fitted, or with the top edges of the inter-plate separators. This addition will replace water lost by evaporation.

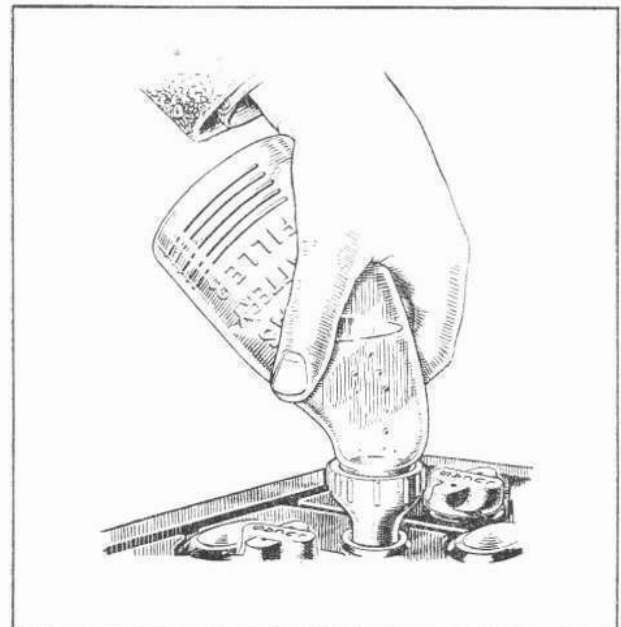


Fig. 3. Using a Lucas Battery Filler to top-up battery

### **IMPORTANT: Do not overfill.**

The use of a Lucas Battery Filler enables the correct electrolyte level to be obtained automatically. Its use is particularly recommended if visible examination of the cell interiors is difficult. A Lucas Battery Filler is shown in Fig. 3.

When topping-up, use only distilled water. Never over-fill the cells and never hold a naked light near the cell tops. Keep the cell tops dry.

In very cold weather it is advisable to run the vehicle for a while immediately after topping-up. This will help to mix the distilled water and electrolyte and so prevent freezing and possible damage to the battery.

## **DISTRIBUTOR**

### **Lubrication**

If a screw-type greaser is fitted below the body of the distributor, give the cap a half turn clockwise to lubricate the shaft bearing.

When the greaser can no longer be turned in a clockwise direction, the cap should be unscrewed and refilled with Acheson's graphited grease, grade GC, or with an equivalent grease.

## **EVERY 6,000 MILES**

Carry out the procedure recommended for every 1,000 miles and, in addition, the following:

### **DISTRIBUTOR**

Remove the moulded cover and withdraw the rotor arm. A tight rotor arm can be withdrawn using a pair of suitable levers carefully applied at opposite points below the rotor moulding — never against the metal electrode.

#### **Lubrication**

**Important: Do not allow oil or grease on or near the contacts when carrying out the following lubrication.**

#### *Cam Bearing*

To lubricate the cam bearing, inject a few drops of thin machine oil into the rotor arm spindle. Do not remove or slacken the screw located inside the spindle — a space is provided beneath the screwhead to allow the lubricant to reach the cam bearing.

#### *Cam*

Lightly smear the faces of the cam with Mobilgrease No. 2 or with clean engine oil.

#### *Pivot Post*

Place a drop of clean engine oil on the exposed tip of the pivot post.

#### *Centrifugal Timing Control*

Inject a few drops of thin machine oil through a convenient aperture in the contact breaker base plate.

#### **Cleaning**

##### *Moulded Cover*

Clean the moulded cover inside and outside with a

soft dry cloth. Pay particular attention to spaces between the terminals. Check that the small carbon brush inside the moulding can move freely in its holder.

#### *Contact Breaker*

Whilst the rotor arm is removed, examine the contact breaker. Rough, burned or blackened contacts can be cleaned with fine carborundum stone or emery cloth. After cleaning remove any grease or metallic dust with a petrol-moistened cloth.

Contact cleaning is facilitated by removing the lever to which the moving contact is attached. To do this, remove the nut, insulating piece and electrical connections from the post to which the contact breaker spring is anchored. The contact breaker lever can then be lifted off the pivot post and the spring off the anchor post.

After cleaning and trimming the contacts, smear the pivot post with Ragosine Molybdenised Non-creep Oil or with Mobilgrease No. 2. Reassemble the contact breaker and check the setting as described under "After the First 500 Miles".

Refit the rotor arm, carefully locating its moulded projection in the spindle keyway and pushing it on as far as it will go.

Refit the moulded cover and spring the two side clips into position.

## **GENERATOR**

### **Lubrication**

Inject a few drops of high quality medium viscosity engine oil into the hole marked OIL at the commutator end of the generator. See Fig. 5.

## **IGNITION COIL**

### **General Care**

Clean the ignition coil, paying particular attention to the terminal moulding. At the same time, check the terminals for loose connections and tighten as necessary.

## **"TRAFFICATORS"**

### **Lubrication**

Switch on the "Trafficators" and apply one drop of thin machine oil to each side of the bearing on which the arms are pivoted, as shown in Fig. 4.

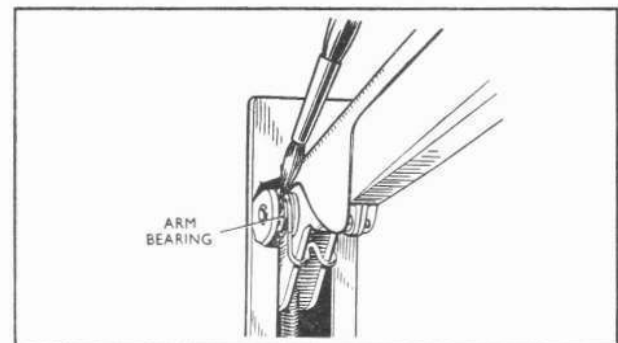


Fig. 4. Lubricating a "Trafficator" arm bearing

## SECTION TWO

# GENERAL INFORMATION

## THE BATTERY

### General Care

The battery top should be kept clean and dry and the connections and fixing bolts secure. Before fitting a cable connector, smear the inside of the tapered recess with petroleum jelly. A cable connector must never be hammered on to the terminal post, nor should the self-tapping screw be used in an attempt to tighten the connector — if necessary, a light tap with the handle

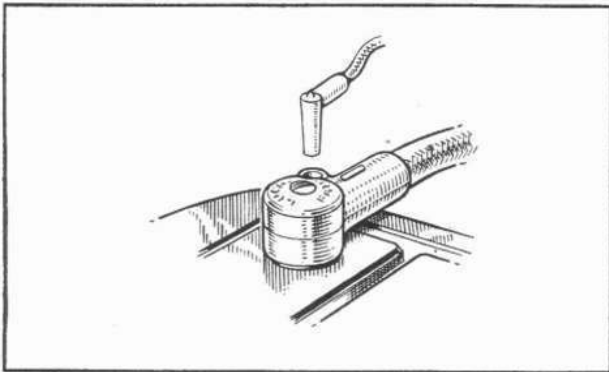


Fig. 7. A taper-fitting battery cable connector with taper-fitting auxiliary connector

of a medium-sized screwdriver before the screw is fitted will suffice. The purpose of the screw is to maintain a tight joint after a connector has been fitted. If the connector is fitted dry and driven on too tightly, difficulty may be experienced in subsequent removal. A connector for the battery negative terminal is shown in Fig. 7, the small peg connector providing the main auxiliaries feed. On some cars, however, this feed is taken from the battery cable connection at the starter switch.

### Construction

Twelve-volt batteries comprise six two-volt cells linked electrically by lead connectors. Each cell contains an odd number of interleaved lead plates or grids. Adjacent plates are of opposite polarity, the outer plates in each cell being negative. Car batteries usually contain seven, nine or eleven plates per cell and provide storage capacities of 43, 58 or 72 ampere-hours respectively at the 20-hour rate of discharge. The plates are insulated one from another by porous separators of special material and are immersed in dilute sulphuric acid known as the electrolyte. The specific gravity of acid used to fill batteries is determined by operating temperature. In climates where the shade temperature is normally below 80°F. (26.6°C.) the acid must be strong enough to reduce the

risk of a battery freezing when in a low state of charge, whilst in hotter climates (above 80°F.) the increased chemical activity which occurs necessitates an acid of reduced strength.

A cut-away view of a typical battery is shown in Fig. 8. When a separator guard is fitted, it takes the form of a strip of perforated material laid across the tops of the separators.

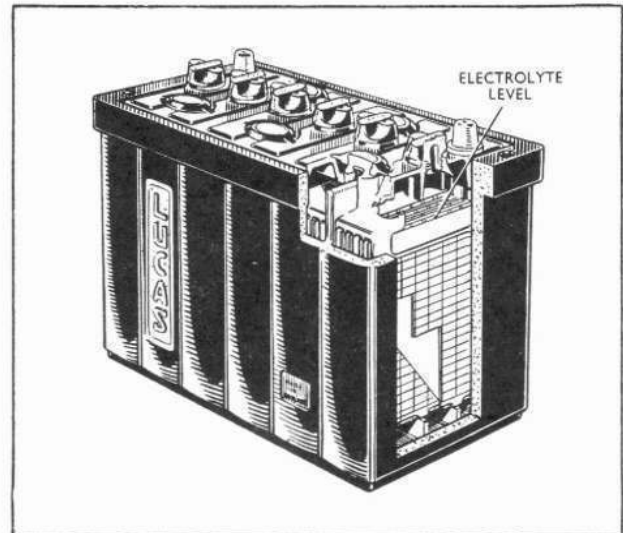


Fig. 8. Cut-away view of typical battery

### Service Replacement Battery

Fig. 9 shows the Lucas "S" type service replacement battery, with its completely clean top design and

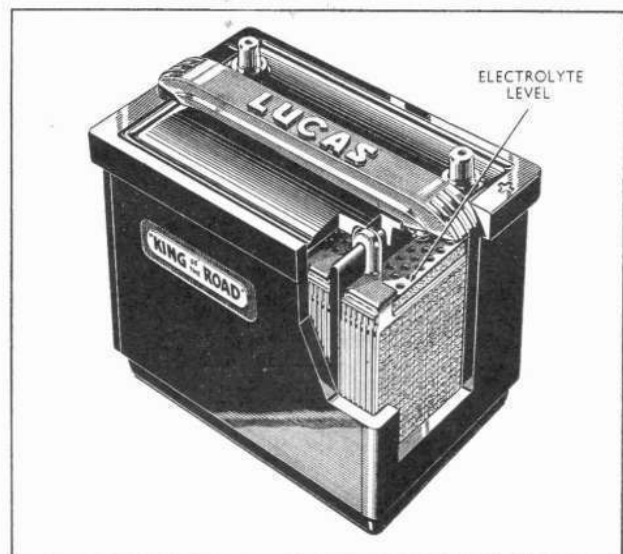


Fig. 9. "S7" Service replacement battery

patented one-piece manifold vent cover. When topping-up, it is only necessary to lift the cover, leaving the cell filler holes immediately accessible. All batteries of this type are provided with anti-splash separator guards.

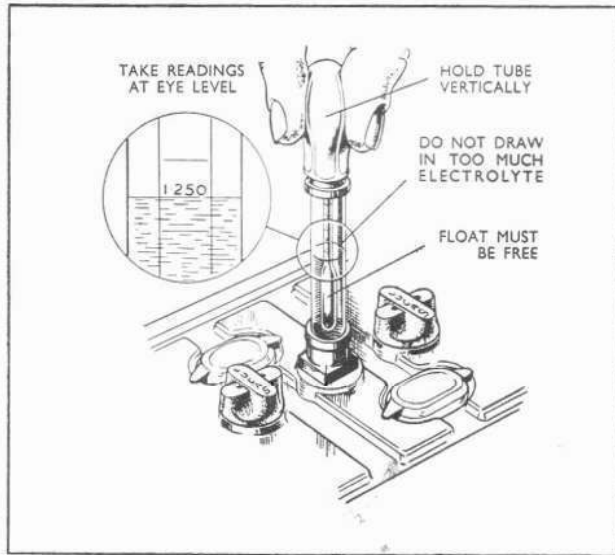


Fig. 10. Taking hydrometer readings

### Hydrometer Readings

Hydrometer readings indicate the condition and state of charge of a battery. Good cells will yield clear electrolyte free of particles in suspension and will, if fully charged, produce high specific gravity readings. It is therefore advisable to take hydrometer readings from time to time but, to avoid low misleading readings, such measurements should not be made immediately after topping-up. An hydrometer in use is shown in Fig. 10.

The readings shown below are given for shade temperatures normally below and above 80°F., i.e., for the alternative original filling acid strengths already mentioned.

Specific gravity is affected to a small extent by temperature variation but this has been allowed for in the figures quoted.

<i>Climates below 80°F.</i>	<i>Climates above 80°F.</i>
(i) 1.270 — 1.290	(i) 1.200 — 1.220
(ii) 1.190 — 1.210	(ii) 1.120 — 1.140
(iii) 1.110 — 1.130	(iii) 1.040 — 1.060

The indications given by these readings are as follows:

- (i) Cell fully charged.
- (ii) Cell about half discharged.
- (iii) Cell completely discharged.

The readings for all cells should be approximately the same. If widely varying readings are obtained, the battery should be examined at a Lucas Service Depot or by an official Lucas Agent.

### Storage

Never leave the battery in a discharged condition. If the vehicle is to be out of use for an appreciable period, the battery should first be fully charged and, subsequently, should receive a short freshening charge every fortnight.

# GENERATOR AND CONTROL BOX

## Control of Generator Output

The generator is a shunt-wound two-brush machine arranged to operate in conjunction with a regulator unit contained, together with the cut-out, in the control box. The regulator is either a compensated voltage control single-bobbin unit (Fig. 11) or a current-voltage control two-bobbin unit (Fig. 12). In the first type, "voltage" and "current" windings are

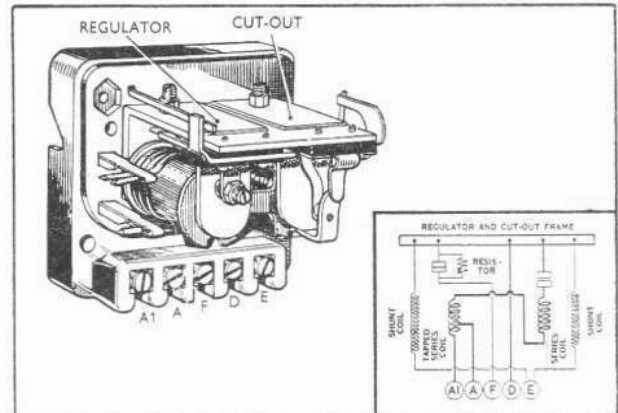


Fig. 11. A compensated voltage control box with cover removed and (inset) internal connections

wound on the same bobbin. In the second, independent bobbins are used, one regulator being responsive to changes in the system voltage and the other to load current.

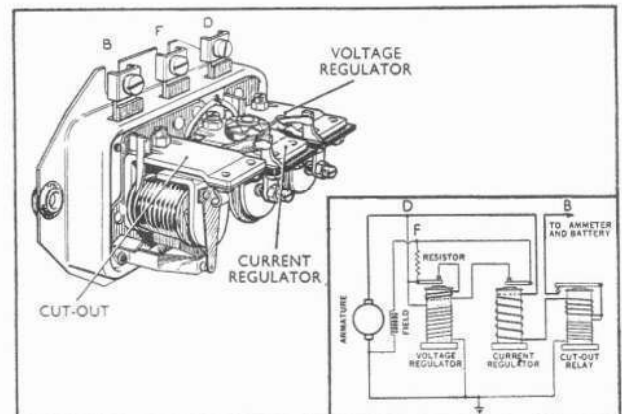


Fig. 12. A current-voltage control box with cover removed and (inset) charging circuit connections

Both systems of automatic regulation utilise the principle of increasing or decreasing the electrical resistance of the generator field circuit to reduce or increase, respectively, the generator output. This is effected by connecting a pair of vibrating contacts in parallel with a field resistor and results in an automatically varying charging current best suited to the state of charge of the battery and to the electrical loading.

The purpose of the cut-out is to connect the generator to the battery only when the engine speed



enables the generator to charge the battery. When the speed drops to a low value, the cut-out contacts open and prevent a continuous reverse current flowing through the generator windings.

Control boxes are accurately adjusted before leaving the factory and should not be disturbed.

### Generator Driving Belt

Occasionally inspect the generator driving belt which must be just taut enough to drive without slipping in the pulley. If necessary, slacken the generator fixing bolts and turn the generator in its mounting bracket to take up any excess slackness.

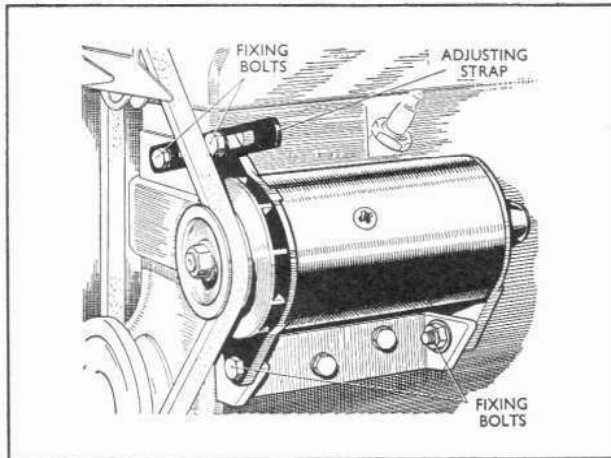


Fig. 13. Generator driving belt adjustment

Overtightening or misalignment is harmful to the generator bearings. The four generator fixing bolts which need to be slackened to make this adjustment are shown in Fig. 13.

### Wiring

As with all other electrical circuits, cable connections to the generator and control box must be kept tight. With compensated voltage control, it is particularly important to see that both ends of the earthing cable connecting control box terminal "E" to the bodywork or chassis are secure.

### Ammeter Readings

Many cars are equipped with an ammeter to provide visual evidence of the state of the charging system. When all is well, a high charge will be registered for a few minutes after starting the engine but this will then reduce to a trickle charge and remain so during continuous running.

Occasionally, short periods of discharge may be observed after switching on the headlamps. This usually happens following a long spell of daylight running when the battery voltage is slightly higher than normal. Such periods of discharge are quite natural and continue until the voltage-balance of the system is regained.

A fault in the charging system will be indicated if, with the vehicle running steadily in top gear, the ammeter consistently registers negative, intermittent or zero charges.

### Ignition or No-charge Warning Light

The ignition warning light serves the dual purpose of reminding the driver to switch off the ignition before leaving the vehicle and of acting as a no-charge indicator. With the ignition switch closed, the warning light should be illuminated only when the engine is stopped or turning over very slowly. As the engine accelerates, the light should dim and eventually go out at a fairly low engine speed. Failure of the light to behave in this fashion will indicate a broken generator belt or other fault in the charging system.

The warning light utilises a bulb which, though identical in appearance to a flashlamp bulb, is usually of higher rating. Access to the bulb for replacement purposes is gained either by unscrewing the front bezel or by withdrawing the bulbholder from the rear of the panel, depending on the particular design. Some sketches of typical panel warning lights are included in an illustration on page 12.

## FUSES

Most cars are fitted with a fuse unit of the type shown in Fig. 14 in which are located two live fuses and two spares.

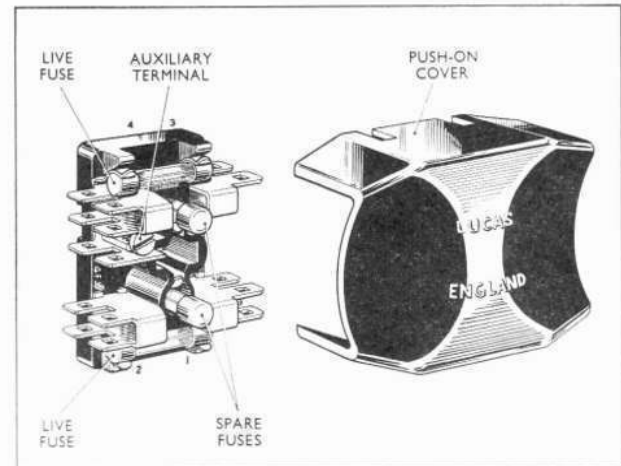


Fig. 14. A two-way fuse unit

### Fuse bridging terminals '1' (or 'B' or 'A1') and '2' (or 'A2'):

This fuse is usually of 35 amperes rating. Its function is to protect the circuits of such accessories as the horns, interior lights, cigar lighters and other items from which service may be required whether or not the ignition be switched on. (Although electric clocks and inspection lamp or battery charger sockets also come within this category, these units are not as a rule connected through a fuse.)

### Fuse bridging terminals '3' (or 'A3') and '4' (or 'A4'):

This fuse is usually of 35, 50 or 60 amperes rating and protects the circuits of accessories controlled by the ignition switch. These include direction indicators, fuel gauges, heaters, oil pressure warning lights, reverse and braking lamps, electric screen washers and wipers.

Some fuse units are fitted with moulded covers. Methods of access to the fuses are shown in the illustrations. The unit shown in Fig. 15 contains one live and one spare fuse whilst that in Fig. 16 contains four live and two spare fuses.

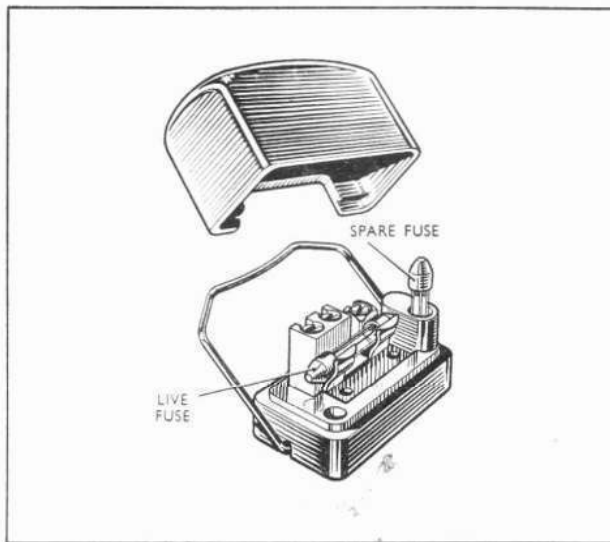


Fig. 15. A single-way fuse box with cover removed

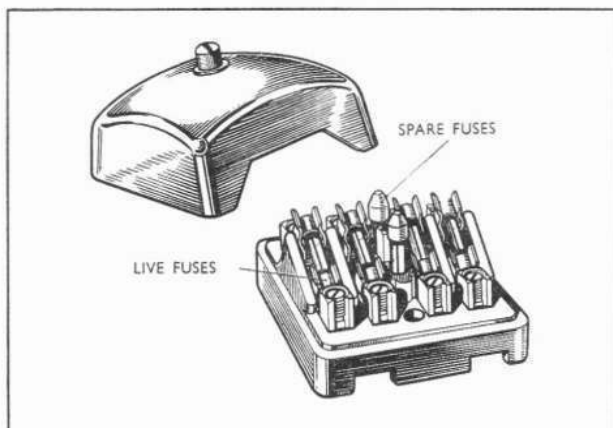


Fig. 16. A four-way fuse box with cover removed

Further information concerning fuses and fuse replacement will be found on page 24.

## RELAYS

Relays are electromagnetically operated switches enabling quite large currents to be controlled by smaller pilot currents. For this reason, the use of relays reduces to a minimum the amount needed of heavy gauge cabling as, for example, in many horn installations where only light cables are connected to the horn push or ring. Relays also effect the automatic switching of complex circuits. Relays for this purpose are sometimes used when brake light filaments serve also as rear flashers. See page 12.

Relays are accurately adjusted and sealed before leaving the factory. The terminal connections should

be checked occasionally and tightened if loose. No other attention is required.

A typical horn circuit relay is shown in Fig. 17.

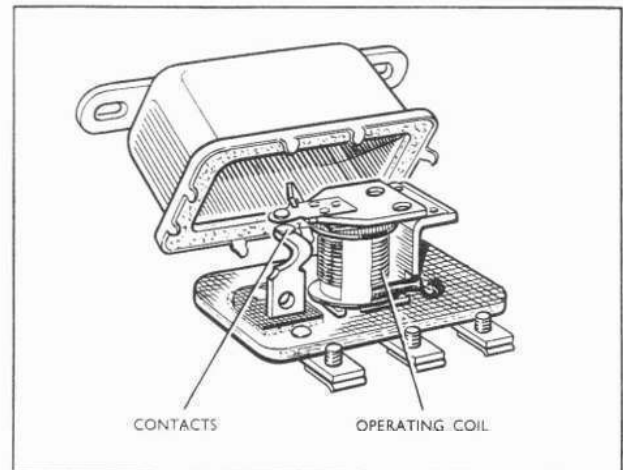


Fig. 17. A typical relay with cover removed

## STARTING MOTOR

### Correct Starting Procedure

The starting motor is frequently ill-used. To obviate this, the following points should be observed when starting:

- (i) See that all controls are properly set.
- (ii) Operate the starter switch firmly.
- (iii) As soon as the engine fires, release the starter switch.

If the engine fails to start reasonably quickly, release the starter switch and allow the engine to come to rest before again operating the switch.

Do not abuse the starting motor, switch and battery by repeated and prolonged attempts at starting but seek expert advice.

### Freeing a Jammed Pinion

Some starting motors are equipped at the commutator end with a squared extension of the armature shaft. This extension is protected by a thimble-shaped push-fit cover. In the event of the starting motor pinion becoming jammed in mesh with the flywheel it can usually be freed by turning the squared extension with a spanner.

If a squared extension is not provided, a jammed pinion can usually be freed by engaging an intermediate gear and rocking the vehicle to and fro.

### Pre-Engaged Starting Motors

Pre-engaged starting motors are fitted mainly to diesel engines to ensure positive engagement between the pinion and flywheel ring gear — it being a characteristic of such engines, particularly when starting under low temperature conditions, to make a number of isolated firing strokes that would cause the pinion of an inertia-engaged drive as used with petrol engines to be thrown out of mesh. A lever-operated drive

assembly is carried on a straight-splined extension of the armature shaft—movement of the lever and drive being effected either manually through a flexible cable or some other form of linkage, or electromagnetically by means of a solenoid and plunger mechanism mounted above the starting motor yoke. With both manual and solenoid operated types it is so arranged that the pinion is almost fully engaged before the starter switch contacts can close and connect the starting motor to the battery. On starting, a special built-in clutch prevents the starting motor from being driven by the engine. In addition, overload protection is often included to minimise the shock of backfire or of re-engagement at an instant of engine “rock-back”.

## SWITCHES

The occasional tensioning adjustment described below under “Wire-Pull Starter Switches” is the only maintenance needed by any Lucas switch.

### Wire-Pull Starter Switches

Starter switches of the wire-pull type should be adjusted so that, with the starter knob in the non-operative position, the steel wire is just taut—it must be neither slack nor over-tight. See Fig. 18.

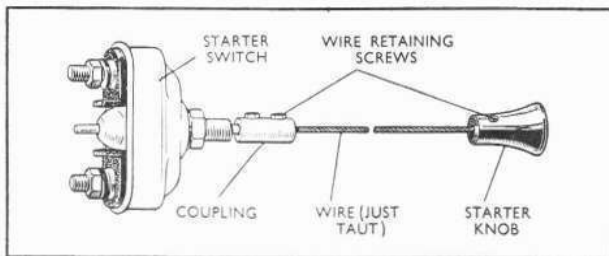


Fig. 18. A tension adjustment to wire-pull starter switch

### Dimmer Switches

Panel light switches often incorporate a rheostat or dimmer by which the driver can adjust the brilliance of his instrument lighting.

### Brake Light Switches

Brake switches control the rear stop lights and are either mechanically or hydraulically operated. In the

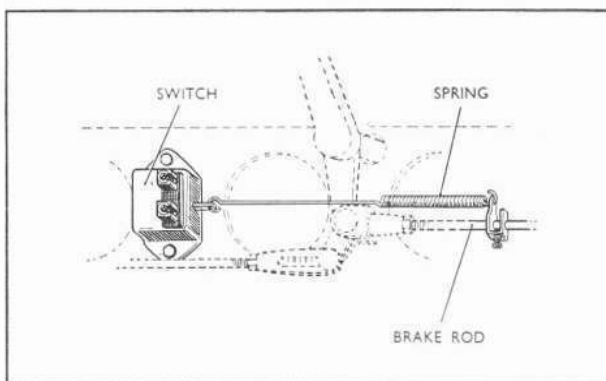


Fig. 19. A mechanically operated brake light switch

first type, shown in Fig. 19, the switch mechanism is linked through a spring to the brake pedal so that application of the brake causes the switch contacts to close. The second type, shown in Fig. 20, is screwed into the brake line and contains a diaphragm acted upon by the increase in fluid pressure which occurs when the brakes are applied.

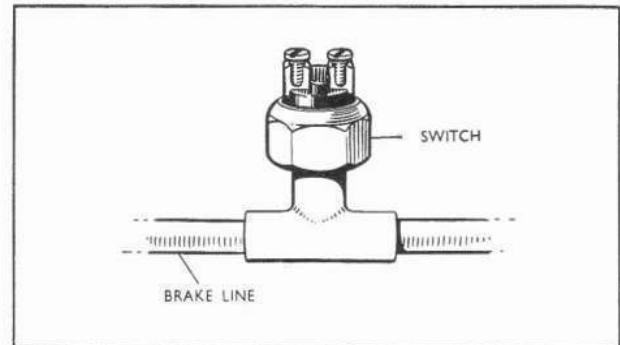


Fig. 20. An hydraulically operated brake light switch

## “TRAFFICATORS”

### Fitting a New Bulb

Withdraw the small screw from the end of the metal arm cover. Access to the defective bulb is gained by lifting the arm cover, which is hinged at the upper end by a small locating tongue.

The bulb is a 3-watt festoon type.

### Fitting a New Arm

Remove the arm cover and bulb. Slacken the small clamping screw shown in Fig. 21 at the upper end of the arm. Lift out the bulb contact wire and hold it clear of the defective arm. Withdraw the arm.

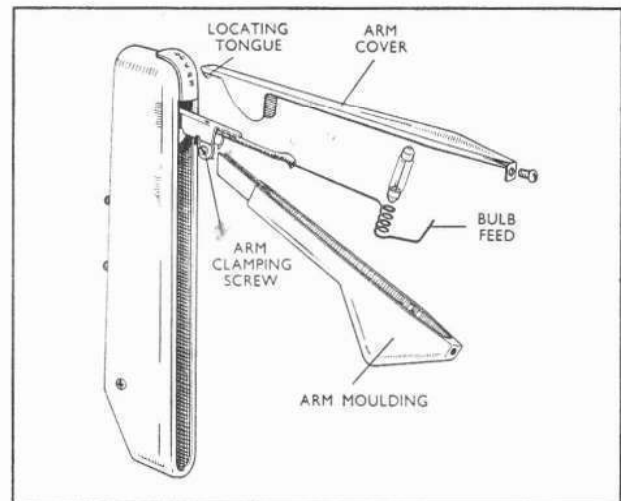


Fig. 21. How to fit a new “Trafficator” bulb or arm

Fit the new arm and tighten the clamping screw. Fit the contact wire and bulb. To refit the arm cover, slide the cover inwards until the securing tongue locates at the top of the arm and then draw the cover outwards and downwards until the screw can be inserted in the lower end of the arm moulding.

# FLASHERS

Apart from an occasional bulb replacement, a flashing-light direction-indicator system needs no attention in service.

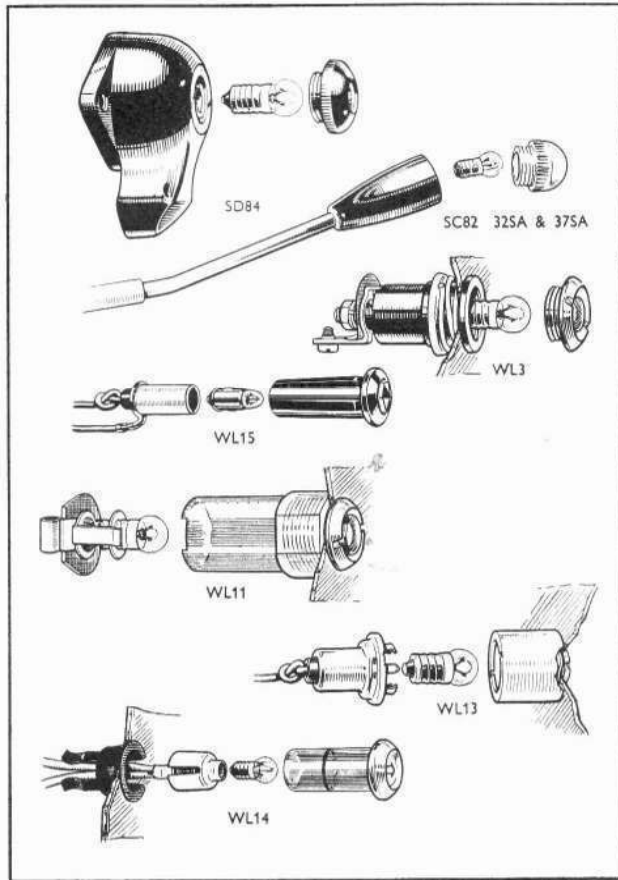


Fig. 22. Methods of renewing warning light bulbs

## Direction-Indicator Switch and Warning Light

This is a two-way-and-off switch for controlling the flasher lamps. If no panel warning light is fitted, a lamp is incorporated either in the switch body or at the end of the switch lever.

Access to the bulb is gained by unscrewing the bulb cover. Some alternative arrangements are shown in Fig. 22.

The bulb is either a 12-volt 2.2-watt M.E.S. type or (when the bulb is located at the end of the switch lever) a 12-volt 1.5-watt L.E.S. type.

## Flasher Unit

The flasher unit is housed in a small cylindrical container. Inside, a switch is operated automatically by the alternate heating and cooling of an actuating wire. Also incorporated is a small relay to flash the panel or switch warning light when the system is functioning correctly. Failure of this light to flash will indicate a fault. In this event a check should be made for defective bulbs.

## Brake Switch Overriding Devices

When the same pair of bulb filaments is used for both stop-light and rear direction-indication, it is

essential that a response to the flasher unit shall take precedence over any simultaneous application of the brake switch. For this purpose, either additional contacts are included in the direction-indicator switch or a special double-relay, contained in a small rectangular metal box, is fitted. This relay with its internal connections is shown in Fig. 23.

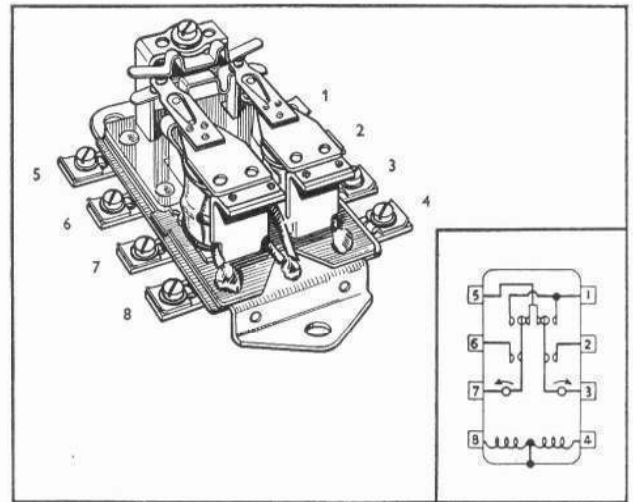


Fig. 23. Brake switch overriding relay with cover removed and (inset) internal connections

In the interests of clear signalling, the practice of combining flasher and brake light indicators has been discontinued on new vehicles.

# WINDSCREEN WIPERS

## General Information

Windscreen wiper motors need little or no attention in service. All moving parts are packed with grease during assembly and no adjustments are normally required.

Efficient wiping is dependent upon having a clean windscreen and the wiper blades being in good condition.

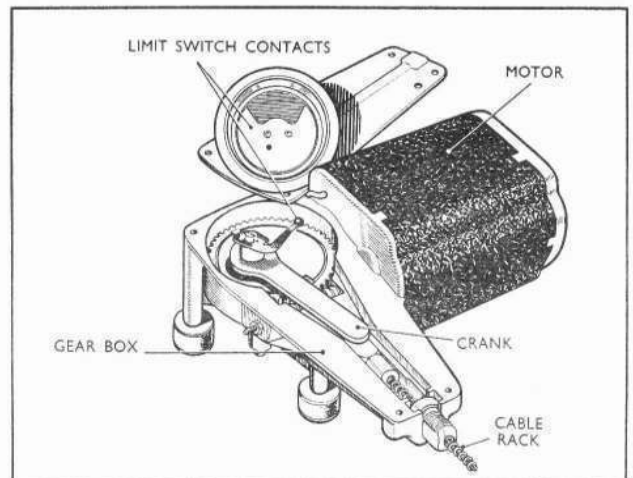


Fig. 24. Model DR2 windscreen wiper with gearbox cover removed

Use methylated spirits (denatured alcohol) to remove oil, tar spots and other stains from the windscreen. Silicone and wax-based polishes must not be used for this purpose.

Worn or perished wiper blades are readily removed for replacement.

### Models CW and FW

These models are designed for mounting directly to the windscreen surround and are usually fitted to vehicles having adjustable windscreens.

A small spring-loaded ball-type oiler is incorporated in Model CW for lubrication of the armature spindle. Occasionally inject a few drops of thin machine oil into this oiler.

### Models CR, DR, 6W and 6WA

#### Cable Rack Mechanism

With these models, the motor and gearbox unit is mounted under the bonnet and a cable rack mechanism is utilised to transmit the drive to the wiper arms. The rack comprises an inner core of steel wire around which is wound a wire helix. The rack passes through a protective metal tube which with CR models is of flexible construction, but rigid with models DR, 6W and 6WA (Fig. 25). A reciprocating motion is imparted to the rack by a crank in the wiper gearbox (Fig. 27). This motion is transmitted to the wiper arm spindle by the engagement of the rack with a gear in the scuttle-mounted wheelboxes. This gear is keyed to the wiper arm spindles and serves to convert the motion of the rack to the oscillatory movement required by the wiper arms.

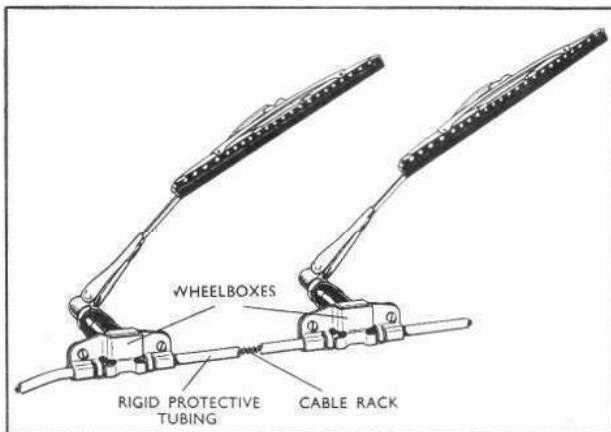


Fig. 25. Arms, blades and wheelboxes of typical DR or 6W installation with tubing cut away to show cable rack

### Models DL2, DL3 and DL3A

These models incorporate a link mechanism connecting a rotating crank on the motor with drop arms on the wiper arm spindles. The arrangement and number of links depends on where the motor is mounted and on the size and type of windscreen (Fig. 26).

#### Self-Parking

DR, 6W and DL models are usually arranged so that the wiping blades come to rest at the edge of the

windscreen irrespective of their positions at the instant of switching off.

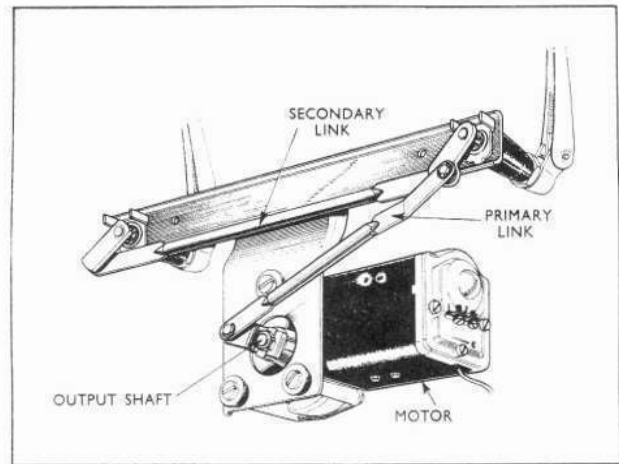


Fig. 26. Model DL2 wiper

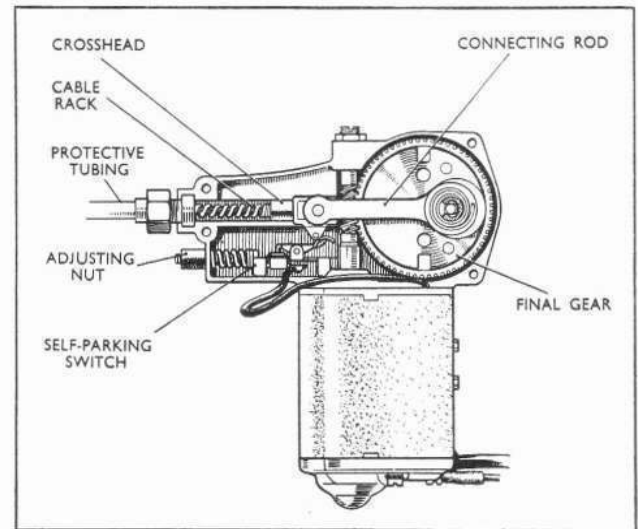


Fig. 27. Model DR3 wiper with gearbox cover removed

#### Thermostatic Protection Against Overloading

Some wiper circuits incorporate a current-temperature operated switch to protect the motor from serious overloading. If the blades are prevented from moving by, for example, packed snow or ice on the windscreen, the motor will be disconnected from the supply before damage can occur. Normal working will be resumed automatically when the motor has cooled, providing the obstruction has been removed.

The thermostatic switch is either located inside the motor or connected in the supply cables to it.

#### Two-speed Wipers

Some motors are arranged to provide a second and higher speed of wiping. This is intended to be used only for fast driving through heavy rain or light snow. The higher speed of wiping should not be used in heavy snow or with a dry or drying windscreen.

## Removing Wiping Blades

The two usual methods of blade-to-arm attachment are shown in Fig. 28.

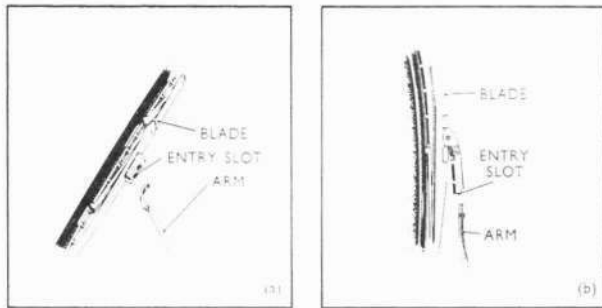


Fig. 28. Two methods of blade-to-arm attachment

## Removing Wiper Arms

To remove a wiper arm which is secured to the driving spindle as shown in Fig. 29 (a), rotate the hexagonal-headed collet nut until the arm is freed from the spindle.

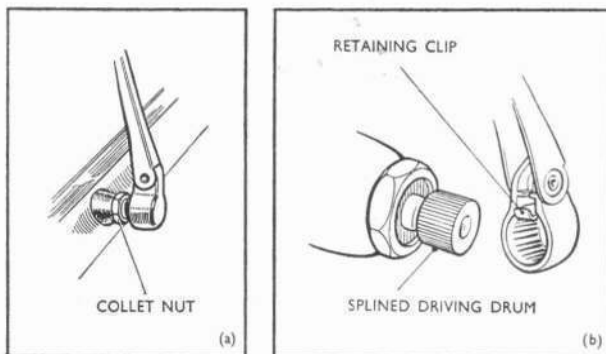


Fig. 29. Two methods of wiper arm-to-spindle fixing (a) CW, FW and CR Wipers (b) DR, 6W and DL Wipers

To remove an arm secured as shown in Fig. 29 (b), lift up the retaining clip with a small screwdriver or similar tool and withdraw the arm from the driving drum. As this method of arm fixing utilises a splined headpiece mating with a splined drum on the wheelbox spindle, it is important that no attempt is made *in situ* to turn an arm on its spindle. When necessary, the position of an arm can be adjusted by removing it as described above and re-engaging at a more suitable angle. The angular pitch of the splines is five degrees.

# HORNS

## General Information

Horns are adjusted to give their best performance before being passed out of the Works and are designed to give long periods of service without further attention.

When a horn fails or is unreliable, it does not necessarily follow that the horn itself is defective. The trouble may be due to a discharged battery, loose connection or break in the wiring to the horn. A short-circuit in this wiring will cause the fuse to blow

and silence both horns, when two are fitted. In this event, the wiring should be examined before the fuse is renewed. If a fault is not due to a blown fuse, the horn and any adjacent fixtures should be checked to see that they are rigidly secured to their mountings.

If the battery, wiring and fixtures are satisfactory, the horn may need re-adjusting, although this should not be necessary unless the horn has been in service for a long period.

## Adjusting Horns

Adjustment serves to take up wear of moving parts. It does not alter the pitch of the note emitted by the horn.

If adjustment has to be made to a pair of horns, the supply to one horn should be disconnected when attending to the other, care being taken to prevent the end of the disconnected cable from contacting any earthed part of the vehicle.

If a horn fails to sound after adjustment, release the horn ring or operating button instantly.

## Wind Tone Horns:

Withdraw the single cover securing screw and remove the domed cover and the cover retaining strap, as shown in Fig. 30.

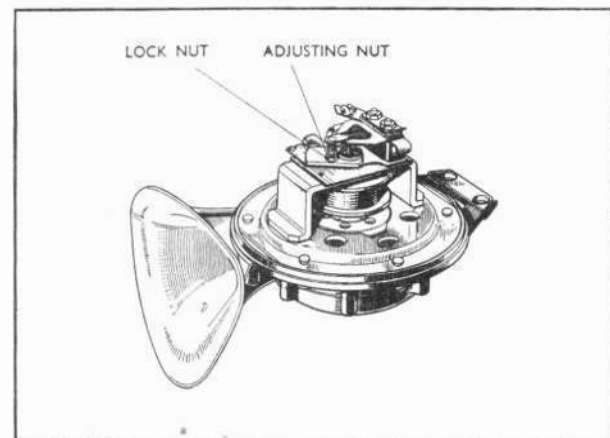


Fig. 30. A Wind Tone horn with cover removed to show details of contact adjustment

Slacken the locking nut on the fixed contact stem and rotate the adjusting nut clockwise until the contacts just separate (indicated by the horn failing to sound when the horn button or ring is depressed). Rotate the adjusting nut one-half turn in the opposite direction and secure it in this position with the locking nut. Refit the cover. If the performance of the horn is still unsatisfactory, the horn should be examined at a Lucas Service Depot or by an official Lucas Agent.

## High-Frequency Horns:

Two typical high-frequency horns are shown in Fig. 31. To adjust these, turn the adjustment screw in an anti-clockwise direction until, with the horn button or ring depressed, the horn just fails to sound. Then rotate the screw clockwise for one-quarter turn (i.e., for six notches).

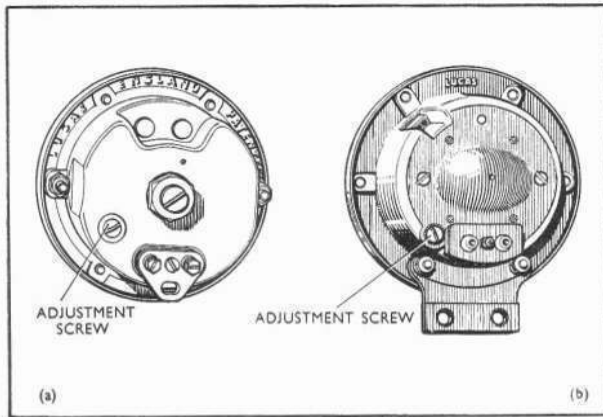


Fig. 31. Rear view of two typical high frequency horns showing adjustment screw

## DISTRIBUTORS

### Ignition Timing Controls

In an engine, the petrol-air mixture must be ignited at very precise instants with respect to the positions of the moving pistons. This is known as ignition timing.

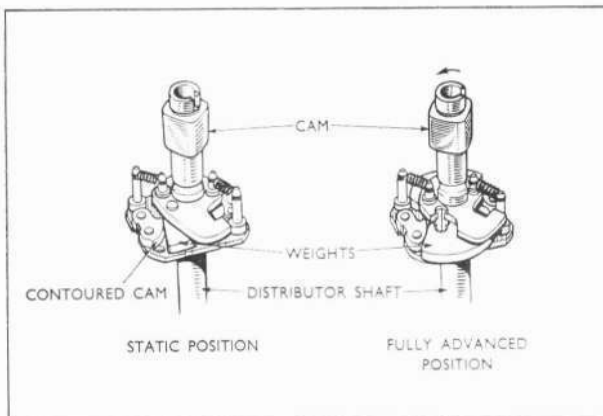


Fig. 32. A distributor centrifugal ignition-timing advance mechanism

In order that maximum power is developed over the full range of speeds and throttle openings, ignition timing controls are designed to operate automatically. As shown in Fig. 32, a centrifugally operated mechanism is employed to turn the contact breaker cam relative to the distributor shaft and thereby to advance the instant of firing with increase in engine speed. Most distributors also incorporate a vacuum advance mechanism, connected by a tube to the carburettor air intake manifold. A diaphragm within the mechanism is responsive to the changing degree of vacuum in the manifold with variation in throttle opening. As shown in Fig. 33, this diaphragm is linked to the contact breaker which, being free to move, can turn relative to the cam and so vary the instant of firing with engine load.

### Micrometer Timing Adjustment

Some distributors incorporate a small knurled knob by which fine adjustments to the ignition timing can

be effected. Known as micrometer timing of the ignition, this adjustment provides for changes in engine conditions and fuel. A micrometer adjuster is included in Fig. 33.

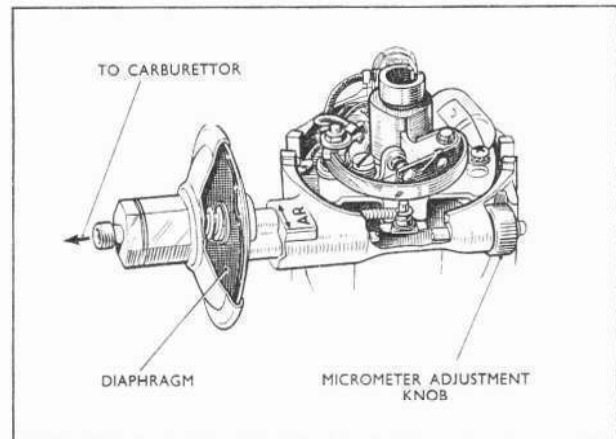


Fig. 33. A distributor vacuum ignition-timing advance mechanism showing micrometer adjustment knob

When the adjustment knob is turned (clockwise to Retard or anti-clockwise to Advance) the vacuum mechanism and the contact breaker move relative to the cam — the amount of movement being indicated on a small reference scale inscribed behind the diaphragm assembly.

If the firing is found to be slightly too far advanced or retarded, the knob can be turned until the best engine performance is obtained. The adjustment should be altered by not more than half a division on the scale at a time. The engine should then be started and the effect of the new timing position noted before making further adjustments.

### How to Renew High Tension Cables

The high tension cables are those which connect the distributor to the sparking plugs, including one from the centre of the ignition coil to the distributor. When the insulation on these cables shows signs of cracking or perishing, the cables must be renewed. Only 7 mm. P.V.C.-covered or neoprene-covered rubber insulated ignition cable should be used.

The methods of connecting high tension cable to the distributor and coil vary with different units. With coils, and also distributors in which the cables are taken vertically from the unit, remove the old cables but do not lose the moulded terminal nuts or split washers. The method of connecting a new cable is to thread the moulded terminal nut over the cable, bare the end of the cable for about  $\frac{1}{4}$ " , thread the wire through the split washer, bend back the strands radially (as shown in Fig. 34) and screw the nut into its terminal.

With other distributors, the cables are not bared at the end but are secured with pointed screws inside the moulded cover, as shown in Fig. 35. To fit new cables, slacken these screws and withdraw the old cables. The screw which secures the central cable is accessible when the carbon brush is removed. Cut the new cables to length and insert the ends into their

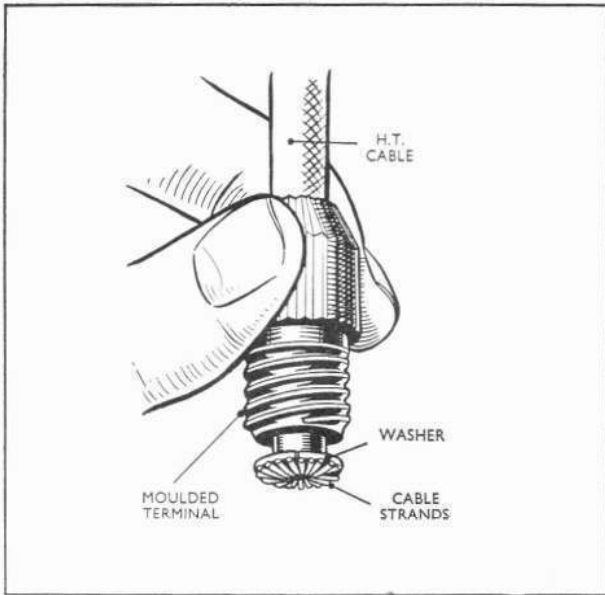


Fig. 34. H.T. terminal connection to ignition coil or to distributor with moulded cover having vertically arranged cable outlets

respective terminal locations. Re-tighten the screws, which will pierce the insulation and make contact with the cable core.

Special care must be taken to preserve the correct firing order when renewing high tension cables.

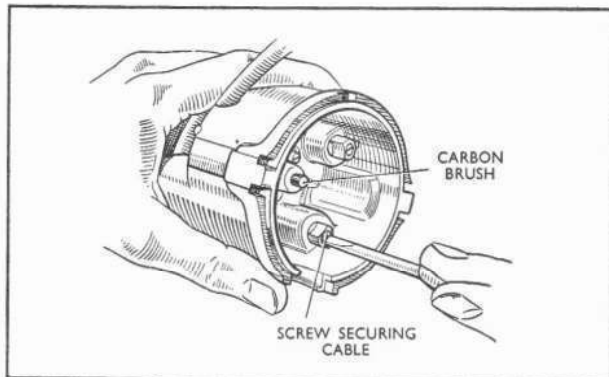


Fig. 35. H.T. terminal connections to distributor with moulded cover having horizontally arranged cable outlets

## HEADLAMPS

### 'Sealed Beam' Light Units

These, in effect, are large gas-filled, double-filament bulbs for use with the Double Dipping Headlamp System. They comprise an aluminised glass reflector, sealed-in filaments and front lens. These units, while being physically interchangeable with equivalent units of the replaceable bulb type, have longer life and are optically more efficient.

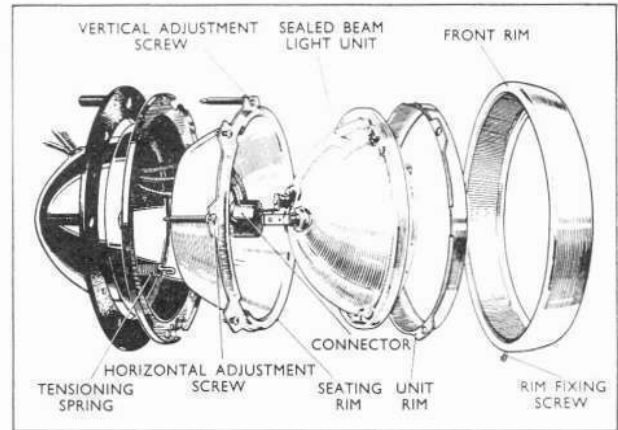


Fig. 36. Headlamp with 'Sealed Beam' Light Unit, showing beam adjustment screws, etc.

### Four-Headlamp System

This comprises four 'Sealed Beam Type' Light Units, one pair being specially designed for providing the Main or Driving beams and the other for providing the Dipped or Meeting beams. The latter pair include a second filament for supplementing the light from the Main beam units.

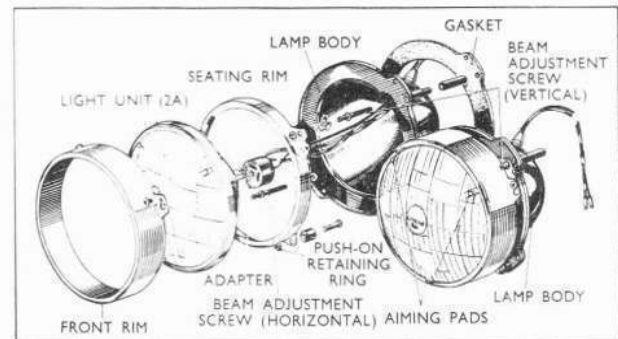


Fig. 37. Two Light Units (right-hand) of Four-Headlamp System, showing beam adjustment screws, etc.

### Light Units (Replaceable bulb types)

Many headlamps comprise a Lucas Light Unit with double-filament pefocus bulb, front rim and a dust-

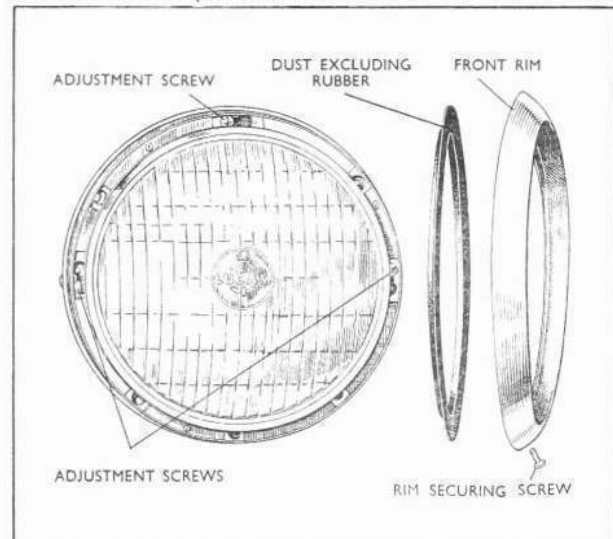


Fig. 38. Light Unit with front rim & dust excluder removed



excluding rubber ring, as shown in Figs. 38 to 40. Each Light Unit consists of an aluminised reflector permanently attached to a front glass which is lensed to form an optical system of flutes and prisms. The main and dip filaments of the bulbs are connected through the dip switch to provide double-dipping of the headlamps. Occasionally, a second bulb is incorporated in the Light Unit to provide parking illumination.

Since the spread of light and its position on the kerbside in the dipped position is a function of lensing and bulb design, special Light Units and bulbs are fitted to suit the lighting regulations of the country in which a car is used. Special care should therefore be taken when replacing either of these items to see that the correct replacement is fitted.

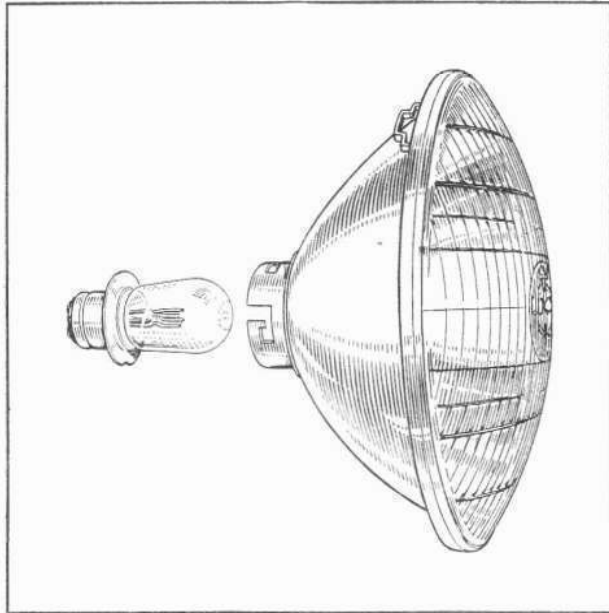


Fig. 39. Light Unit with prefocus bulb withdrawn

**How to Replace a Headlamp Bulb** (Not applicable to 'Sealed Beam' lamps)

Slacken the single rim securing screw and withdraw the rim. Rims of concave pattern require an initial anti-clockwise twist before withdrawal.

Lift off the dust excluding rubber ring. This is approximately L-shaped in section and is intended to be positioned with the toe of the "L" facing rearward.

Press the Light Unit inwards against the three spring-loaded adjustment screws and turn it anti-clockwise to disengage it through the keyhole slots.

Release the bayonet-fixed adaptor (a press-in, anti-clockwise motion) and withdraw the defective bulb. Note that a notch in the flange of the bulb is arranged to locate with a ridge in the bulbholder.

Fit the new bulb and refit the adaptor, Light Unit, dust excluder and front rim.

Exploded views of two typical replaceable bulb type headlamps are shown in Figs. 40 and 41. An equivalent view of an auxiliary driving lamp is shown in Fig. 42.

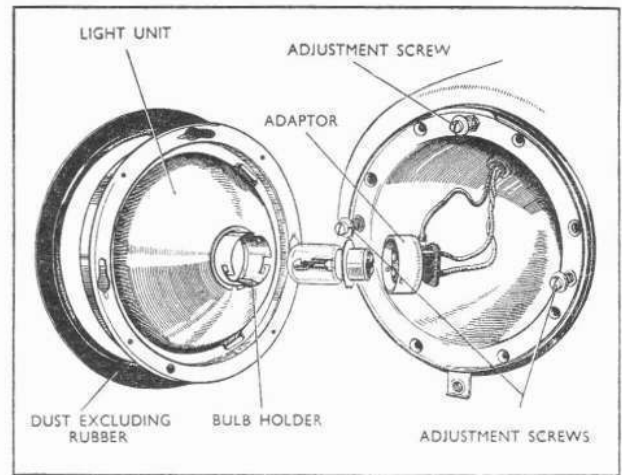


Fig. 40. Exploded view of headlamp showing method of bulb replacement and beam adjustment screws

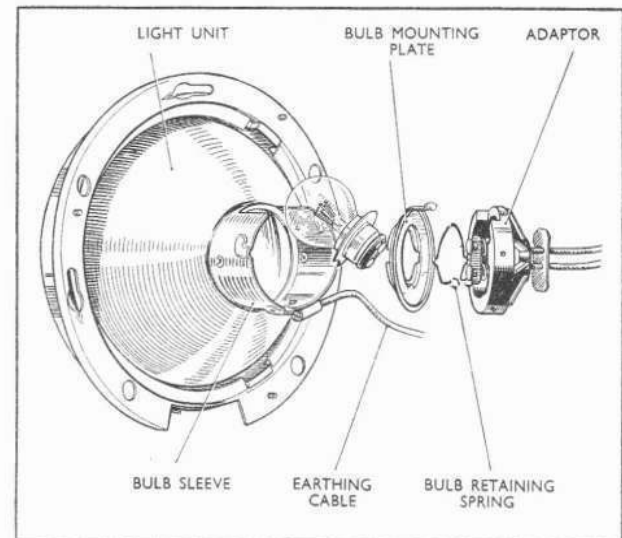


Fig. 41. Light Unit and prefocus bulb assembly as used with 60-watt bulbs

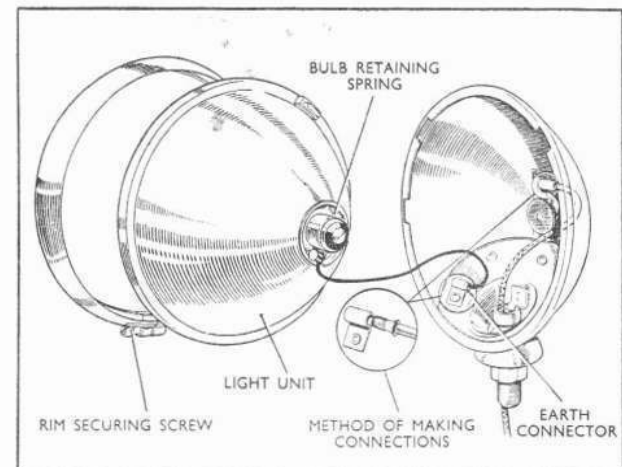


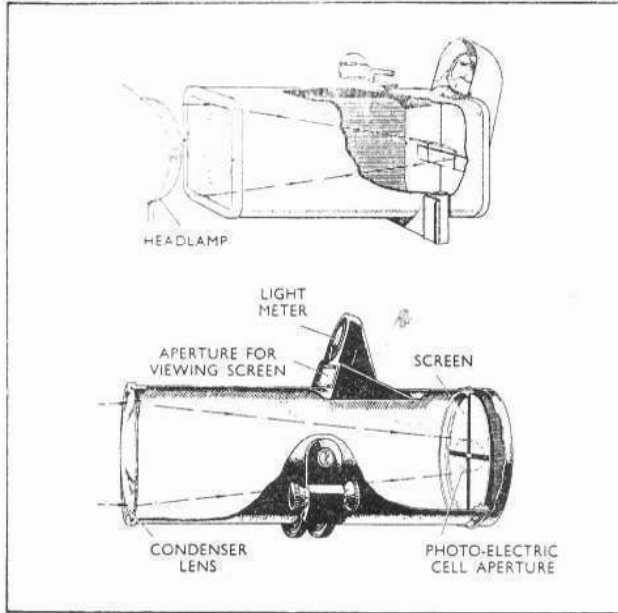
Fig. 42. Fog Lamp or Long Range Driving Lamp with Light Unit removed

After fitting a new bulb, the headlamp setting should be checked as described overleaf.

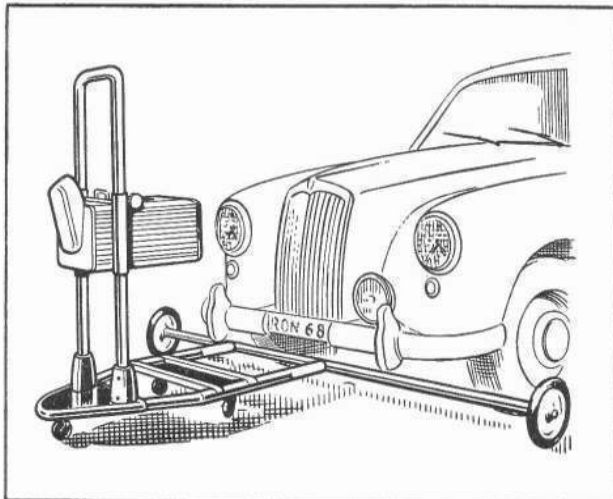
## Headlamp Setting

Headlamps should be set so that when a vehicle carries its normal load the driving beams are projected straight ahead, parallel with each other and with the road.

Many garages possess a Lucas Beam Setter, two patterns being illustrated in Fig. 43. These are scientific instruments enabling accurate beam setting to be effected, as shown in Fig. 44. Vehicle owners are strongly advised to make use of this service whenever

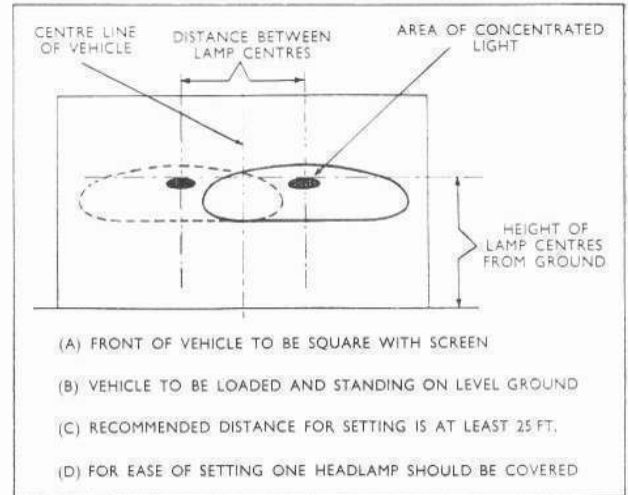


**Fig. 43.** The optical tubes of two Lucas Beam Setters possible. When such facilities are not available, the lamps can be set by marking off a smooth wall or screen and shining the lamps on it from a distance of twenty-five feet. Details are shown in Fig. 45 where, it will be noted, the main beams are shown aimed just below the horizontal at a distance of twenty-five feet.



**Fig. 44.** A Lucas Beam Setter in use

When setting, remove the lamp rims and (when fitted) the dust excluder rings. Cover one lamp whilst adjusting the other. Setting is effected by adjusting the spring-loaded screws. No focusing is necessary.

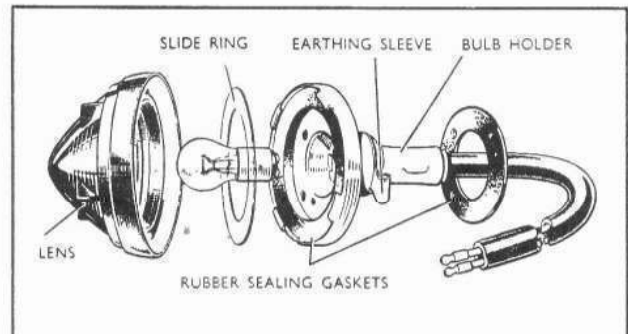


**Fig. 45.** How to set headlamp beams against a wall or screen

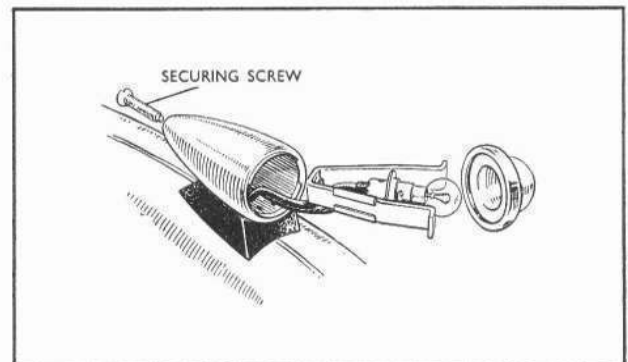
## SIDE, STOP-TAIL & NUMBER PLATE LAMPS

### Bulb Renewal

Access to the bulb is usually gained by removing the lamp front. This may be bayonet-fixed or secured with screws or held captive in rubber surrounds. Some typical examples of bulb removal are shown in Figs. 46 to 49.



**Fig. 46.** A bayonet-fixed lens. Press inwards and turn anti-clockwise to release lens



**Fig. 47.** Single-screw secured lens

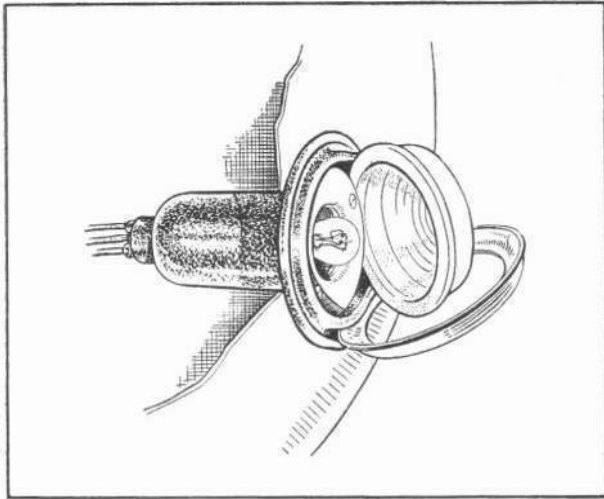


Fig. 48. A rubber-secured lens. Peel back rubber to release rim and lens

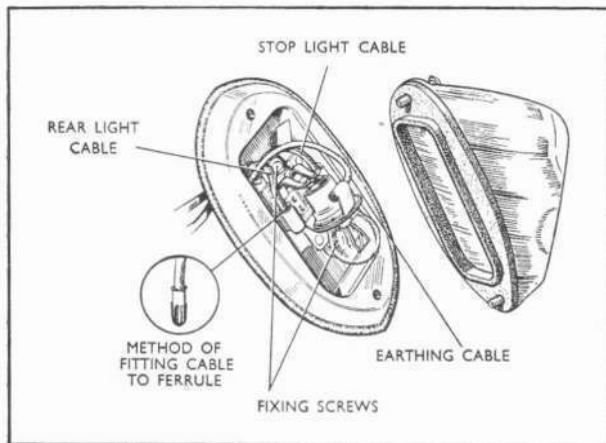


Fig. 49. Two-screw secured lens

## BULBS

The following list gives a selection of the more commonly used bulbs, their rating, type of end cap and Lucas Part No. This list is not intended to be comprehensive nor is any particular bulb necessarily used exclusively as shown in the list. The reader should refer to the official Bulb List for special purpose and other bulbs not given below.

The following abbreviations are used to denote type of metal cap:

- B.P.F.: British Prefocus.
- S.B.C.: Small Bayonet Cap, double contact.
- S.C.C.: Single Centre Contact, otherwise as S.B.C.
- M.C.C.: Miniature Centre Contact, as S.C.C. but smaller diameter.
- M.E.S.: Miniature Edison Screw, as used in flash-lamps.
- L.E.S.: Lilliput Edison Screw, as M.E.S. but smaller diameter.

### Headlamps

R.H.D. (dip left): 12-volt 50/40-watt, B.P.F. cap, Lucas No. 414.

L.H.D. (dip right): 12-volt 42/36-watt, B.P.F. cap, Lucas No. 355.

Continental Touring (Duplo): 12-volt 45/40-watt, B.P.F. cap, Lucas No. 371 (hooded dip filament and yellow envelope).

### Combined Side-and-Flasher, Stop-Tail or Stop-Tail-and-Flasher Lamps

12-volt 21/6-watt, non-reversible S.B.C. Lucas No. 380.

### Front Flasher, Rear Flasher, Stop and Reverse Lamps

12-volt 21-watt, S.C.C., Lucas No. 382.

### Side, Tail, Boot, Roof and Interior Lamps

12-volt 6-watt, S.C.C., Lucas No. 207.

12-volt 6-watt, M.C.C., Lucas No. 989.

### Number Plate Lamps

12-volt, 4-watt, M.C.C., Lucas No. 222.

### Long Range Driving Lamps

12-volt 48-watt, prefocus cap, Lucas No. 185.

### Fog Lamps

12-volt 48-watt, prefocus cap, Lucas No. 323.

12-volt 38-watt, prefocus cap, Lucas No. 325.

### Warning Lights and Panel Illumination

12-volt 2.2-watt, M.E.S., Lucas No. 987.

12-volt 1.5-watt, L.E.S., Lucas No. 280.

2.5-volt 0.2-amp., M.E.S., Lucas No. 970.

12-volt 2-watt, "peanut bulb", Lucas No. 281.

### Trafficators, Map Lights and Boot Lamps

12-volt 3-watt, festoon, Lucas No. 256.

### Ammeter Illumination and Model 56SA Switches

12-volt 2-watt, "peanut bulb", Lucas No. 281.

6-volt 0.6-watt, "peanut bulb", Lucas No. 282.

### Inspection Lamp

12-volt 6-watt, S.B.C., Lucas No. 209.

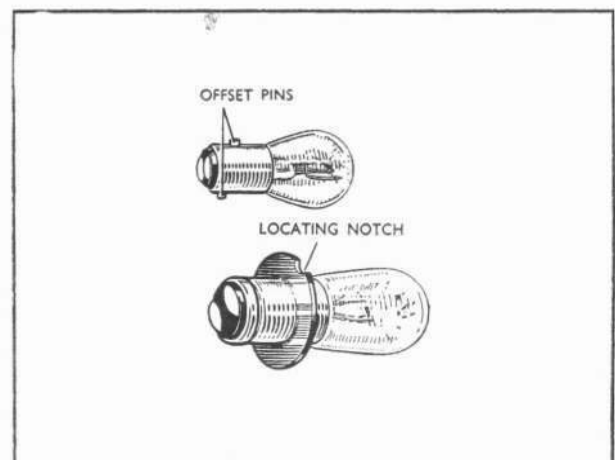


Fig. 50. Double-filament non-reversible bulbs

Some bulbs, such as are fitted in stop-tail lamps and headlamps, contain two filaments of differing power. It is, of course, important that such bulbs are fitted in their bulbholders the correct way round. To ensure this, these bulbs are made non-reversible by means of offset pins or by the method already mentioned in connection with headlamp bulb renewal. Two non-reversible bulbs are shown in Fig. 50.

## SCREENJET

### General Information

The ScreenJet is powered by a small permanent magnet motor coupled to a centrifugal pump. Following an initial momentary depression of the start button, subsequent operation and switching off is entirely automatic. The motor current at 12 volts is approximately one-and-a-half amperes whilst the duration of each operation should be about seven seconds. Some fifteen seconds should be allowed to elapse between operations to enable the auxiliary reservoir to refill completely and the full amount of water (22 c.c. approx.) to be ejected on to the windscreen.

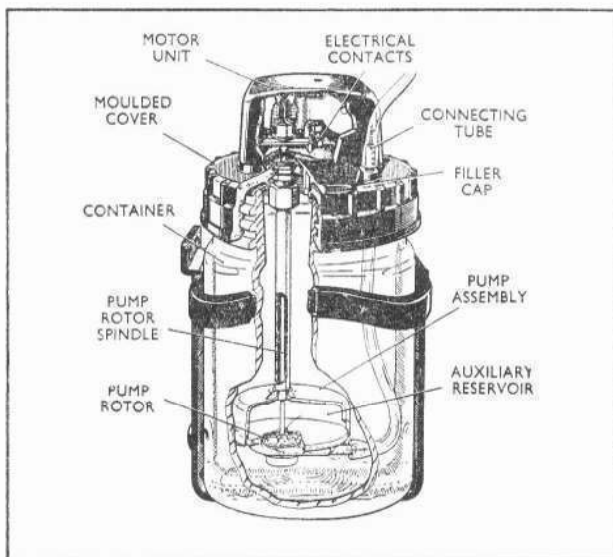


Fig. 51. Cut-away view of ScreenJet

### Maintenance

When the water level falls to the top of the auxiliary reservoir (see Fig. 51) refill the container with clean soft water to the level of the lower edge of the container neck. Keep the container free of sediment and the jet nozzles clear.

Occasionally apply one drop of thin machine oil to the felt washer shown in Fig. 52.

To avoid damage by frost, either empty the container or add methylated spirits (de-natured alcohol). For this latter purpose, the underside of the rubber filler cap is designed to form a measure. Add two measures of methylated spirits per container of water.

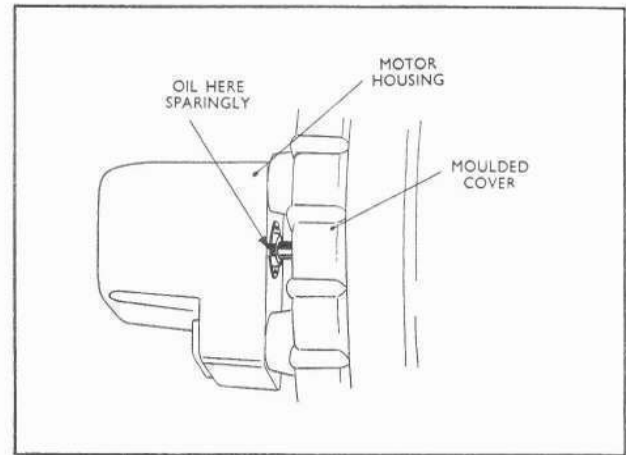


Fig. 52. Location of felt washer lubricator

## INTERFERENCE SUPPRESSION

### Statutory Requirements

Under certain regulations of the British Wireless Telegraphy Act 1949, control of interference with television and other very high frequency (V.H.F.) transmissions is obligatory. By these regulations, all spark ignition apparatus (such as coil or magneto ignition systems) and any offending small motors (such as electric windscreen wiper motors) must be adequately suppressed.

### H.T. Pick-up Brush Resistor

The small carbon brush (Fig. 35) inside the distributor moulding is usually of composite construction, the middle portion consisting of a resistive compound. Since this brush is in the H.T. circuit between the ignition coil and distributor, it often suffices to give the legal measure of suppression. In some cars, however, further suppressors are needed in the high tension cables and are fitted by the car manufacturers.

It should be noted that ignition resistors do not impair engine performance but can, in fact, lead to increased plug life.

### Car Radio

When car radio is installed, a higher order of suppression than the legal minimum is usually required to ensure satisfactory reception. This is effected by fitting, as required, resistors, capacitors, chokes or special units. To decide the number, electrical value, type and positioning of these components is a specialist's job and, as damage to the car electrical installation can result from incompetent fitting, this work should be carried out by skilled personnel.

## SECTION THREE

# LOCATION AND REMEDY OF FAULTS

### General Information

Although every reasonable precaution is taken in production to eliminate causes of trouble, failure may occasionally develop through lack of attention to the equipment, or damage to the wiring. The following pages set out the recommended procedure for a systematic examination should an electrical fault be suspected. The sources of many troubles are by no means obvious and in some cases considerable deduction from the symptoms is needed before the cause of the trouble is disclosed.

For instance, the engine might not respond to the starter switch. A hasty inference would be that the starting motor is at fault. But, as the motor is dependent on the battery, it could be that the battery is exhausted. This, in turn, could be due to the generator failing to charge because of a slipping driving belt.

As an aid to fault location, a schematic wiring chart is given in Fig. 53 in which the circuit relationships can be seen of all common — and some not-so-common — items of electrical equipment. In order to trace the wiring of a particular installation, the appropriate car wiring diagram should be consulted.

If, after carrying out an examination, the cause of the trouble is not found, the owner is advised to get in touch with the nearest Lucas Service Depot or Agent.

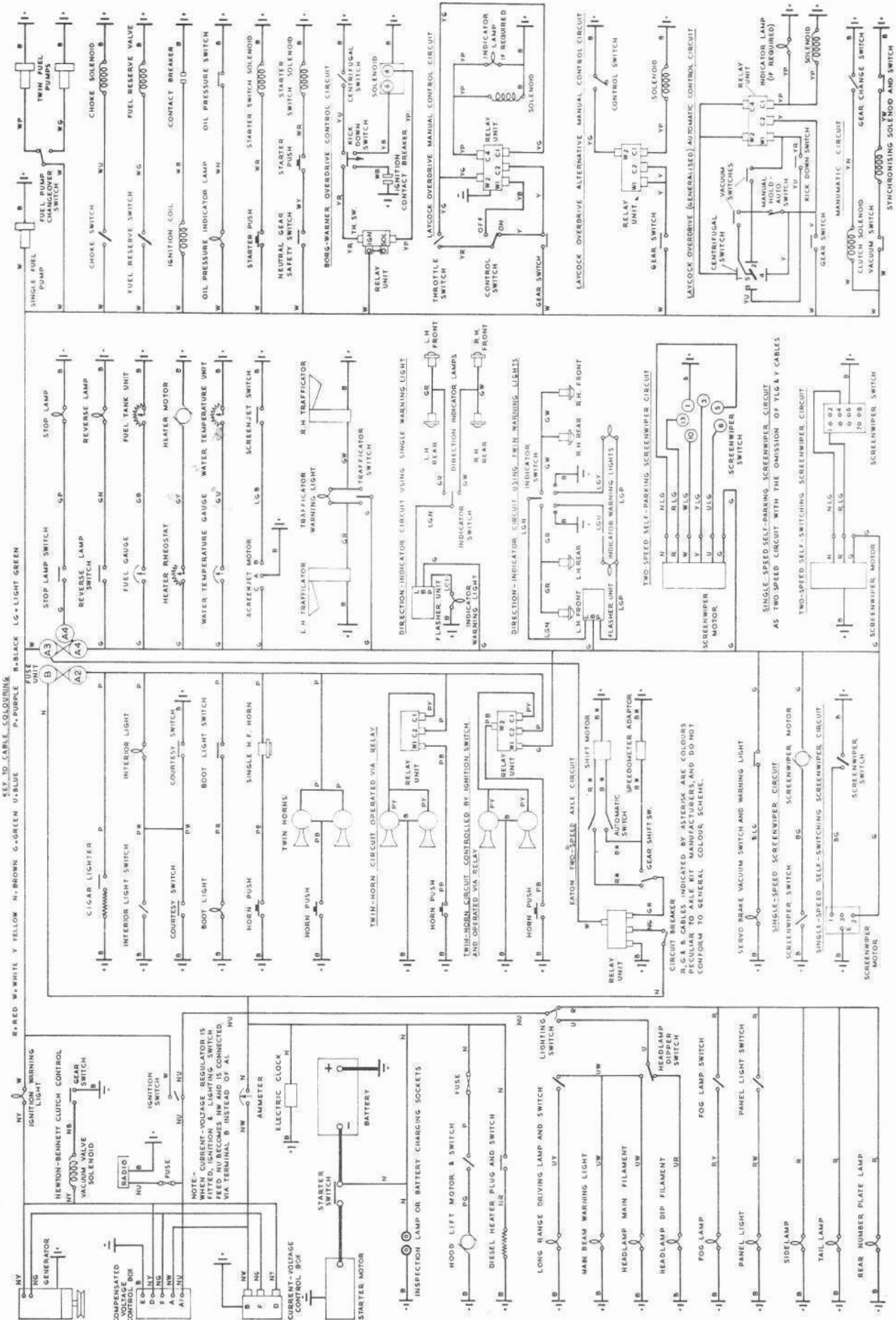
## IGNITION

### 1. Engine will not fire

- (a) See that the controls are correctly set for starting, ignition switched on, petrol turned on, etc.
- (b) Check that the battery terminals are secure and that the battery is in a charged condition, either by use of a hydrometer or by seeing if the starting motor will turn the engine. If the battery is discharged, it must be re-charged from an independent electrical supply.
- (c) Remove the cable from the centre distributor terminal and hold the end about  $\frac{1}{4}$ " away from some metal part of the chassis while the engine is slowly turned over. If sparks jump the gap regularly, the coil and distributor are functioning correctly, and the sparking plugs must be examined. If these are clean, and the gaps correct, the trouble must be due to the carburettor, petrol supply, etc.
- (d) If no spark is produced in the above test, check for a fault in the low tension wiring. This will be indicated by (i) no ammeter reading when the engine is slowly turned and the ignition switch is on, or a steady reading that does not fluctuate with the opening and closing of the contacts, or (ii) no spark occurring between the distributor contacts when quickly flicked open by hand. Examine all cables in the ignition circuit and see that all connections are tight. If a voltmeter is available, a point-to-point voltage check of the wiring should be made.
- (e) If the wiring is in order, examine the distributor contacts. If necessary, clean the contacts and adjust the gap.

# A SCHEMATIC WIRING CHART SHOWING THE CIRCUIT RELATIONSHIPS OF VARIOUS ITEMS OF ELECTRICAL EQUIPMENT CONNECTED IN ACCORDANCE WITH S.M.M. & T. STANDARD No. 131

W054 941 19



**Fig. 53.** NOTE: In some instances, it may be found that the cable colours do not conform entirely to the above chart. This applies particularly to the wiring of automatic transmission systems.

## 2. Engine Misfires

- (a) Examine the distributor contacts. If necessary, clean the contacts and adjust the gap.
- (b) 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, which must be cleaned and adjusted, or to defective high-tension cables. Any cable showing signs of deterioration or cracking should be renewed.
- (c) If sparking is regular at each plug when tested as described in (b), the trouble is probably due to engine defects, and the carburettor, petrol supply, etc., must be examined.

# CHARGING

## 1. Battery in low state of charge

- (a) This state will be shown by lack of power when starting, poor light from the lamps, and low hydrometer readings, and may be due to the generator either not charging or giving low or intermittent output. An ignition warning light will fail to dim and go out if the generator fails to charge and will flicker on and off in the event of intermittent output.
- (b) If an ammeter is fitted, check the reading when the car is running steadily in top gear. The reading will depend on the state of the battery, being high when the battery is discharged and falling to 2 or 3 amps. when the battery is charged. If the generator output appears to be too low, the equipment should be examined at a Lucas Service Depot or by an official Lucas Agent.
- (c) Inspect the generator driving belt. If necessary adjust the belt to take up undue slackness.
- (d) Examine the charging and field circuit wiring, tightening any loose connections, or replacing broken cables. Pay particular attention to the battery connections.

## 2. Battery Overcharged

- (a) This will be indicated by burnt-out bulbs, very frequent need for topping-up the battery and high hydrometer readings.

The control box should be checked at a Lucas Service Depot or by an official Lucas Agent.

# STARTING

## Starting Motor lacks power or fails to turn engine

- (a) If the vehicle is equipped with a starting handle, check that the engine can be turned over by hand. If it cannot be thus turned, the cause of the stiffness of the engine must be located and remedied. If the engine can be turned by hand, check that the trouble is not due to a discharged battery.
- (b) Examine the connections to battery, starting motor and starter switch. Ensure that these connections are tight and that the cables are in good condition.
- (c) It is possible for the starting motor pinion to jam in mesh with the flywheel, in which event it can usually be freed as described on page 10.
- (d) Have the starting motor examined by a competent automobile electrician.

# LIGHTING

## 1. Lamps give insufficient illumination

- (a) Test the state of charge of the battery. If this is low, recharge the battery either by a long period of daytime running or from an independent electrical supply.
- (b) Check the setting of the lamps.
- (c) Renew discoloured bulbs.

## 2. Lamps light when switched on, but gradually fade out

As para. 1 (a).

## 3. Brilliance varies with speed of car

- (a) As para. 1 (a).
- (b) Examine the battery connections, making sure that they are tight, and replacing faulty cables.

## 4. Lights flicker

Examine the lamp circuits for loose connections.

## 5. Failure of lights

Examine the wiring for a loose or broken connection, and remedy. Lighting circuit fuses or circuit breakers, when fitted, should not be overlooked when carrying out this examination.

# FUSE REPLACEMENT

The circuits protected by any one fuse can easily be determined by reference to the vehicle wiring diagram.

A blown fuse is indicated by the failure of all the units protected by it, and an examination of the fuse will at once confirm the diagnosis. When blown, the separated ends of the fuse wire will be visible inside the glass tube, as shown in Fig. 54.

Before replacing a blown fuse, inspect the wiring of the circuits that have failed for evidence of a short circuit, or other fault, which may have caused the fuse to blow.

It is important to use only the correct replacement fuse. The fuses are of the metal-ended glass cartridge type and contain a slip of coloured paper to denote the rating in amperes, as follows:

Fuse Rating (amperes)	Identity Colours
5 . .	Red printing on Yellow paper
10 . .	Green printing on Black paper
15 . .	Black printing on Light Brown paper
25 . .	Black printing on Pink paper
35 . .	Black printing on White paper
50 . .	Purple printing on Yellow paper
60 . .	Yellow printing on Red paper

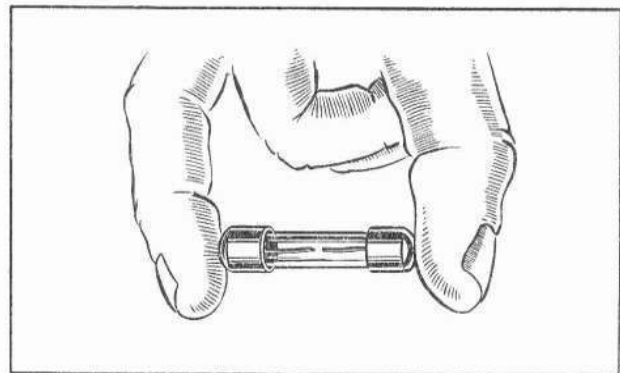


Fig. 54. The appearance of a blown fuse

If a fuse blows repeatedly, and the cause of the trouble cannot be traced, the equipment should be examined at a Lucas Service Depot or by an official Lucas Agent.



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