

Maintenance Instructions



LUCAS

ELECTRICAL EQUIPMENT

for motor-cycles

JOSEPH LUCAS LIMITED • BIRMINGHAM • ENGLAND

FOREWORD

This book gives general information on the items of electrical equipment on motor cycles and scooters fitted with Lucas alternators, and describes the occasional minor adjustments, cleaning, and lubrication of moving parts which should be carried out to ensure that its high degree of reliability and efficiency is maintained.

Two alternator systems are currently in use. The first, which may be 6 or 12-volt, is normally specified for Road models, and comprises alternator, rectifier, battery, coil ignition and lighting equipment. The second, for Competition machines without batteries, provides ignition, and direct lighting if required.

Information is also included on magnetos fitted to machines on which the alternator is used only for battery charging. In addition, the recommended procedure is set out for a systematic examination to be adopted in the event of the electrical equipment not functioning correctly.

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BATTERY CHARGING AND COIL IGNITION SYSTEM

Lucas generators for motor cycles are 6-pole alternators consisting of a permanent magnet rotor rotating within a laminated wound stator. The rotor is driven by an extension of the engine crankshaft and is built into the crankcase or chain case.

These units are used on both 6 and 12-volt machines, in the latter instance operating in conjunction with a Zener Diode Charge Control Unit. The alternator output is converted to direct current for battery charging by means of a silicon semiconductor bridge rectifier.

Normal Running

Under normal running conditions electrical energy in the form of rectified alternating current passes through the battery from the alternator. On all 6-volt and some 12-volt installations, the alternator output is reduced when no lights are in use. When the lighting switch is turned, the output is automatically increased to meet the additional load. On some machines an increase occurs both when the parking light is switched on and again when the main bulb is brought into use; on other machines, only when the main bulb is switched on.

Emergency Starting.

On some motor cycles an EMERGENCY starting position is provided on the ignition switch, for use if the battery has become discharged and a normal start cannot therefore be made. Under these conditions the alternator is connected direct to the ignition coil, allowing the engine to be started independently of the battery. It should be noted that with the ignition switch at EMG and the engine running, the battery receives a charging current, so that its terminal voltage begins to rise. This rising voltage opposes the alternator voltage, and on single-cylinder machines, in the event of a rider omitting to return the ignition key to IGN after an emergency start has been made, misfiring may occur. This will cease on turning the ignition key to the normal running position IGN.

Alternative Battery Charging Rates for 6-volt Machines.

Under normal running conditions the alternator maintains the battery in a fully charged state. In winter, however, if only short journeys are undertaken or long periods of parking with lights are necessary, it may be found that the charge rate is insufficient to maintain the battery in an adequate state of charge. In this event, the charge rate can be increased by interchanging two of the alternator cables where these are joined (by means of snap-connectors) to the main harness. To do this, switch off the lighting and ignition switches and disconnect the Green-with-Black and Green-with-Yellow cables by pulling them from their snap-connectors. The Green-with-Black alternator cable must now be connected to the Green-with-Yellow harness cable and the Green-with-Yellow alternator cable to the Green-with-Black harness cable.

If, due to a change in running conditions, the battery is found to be overcharged, as indicated by excessive gassing of the battery and a frequent need for topping-up, the original connections must be restored colour to colour.

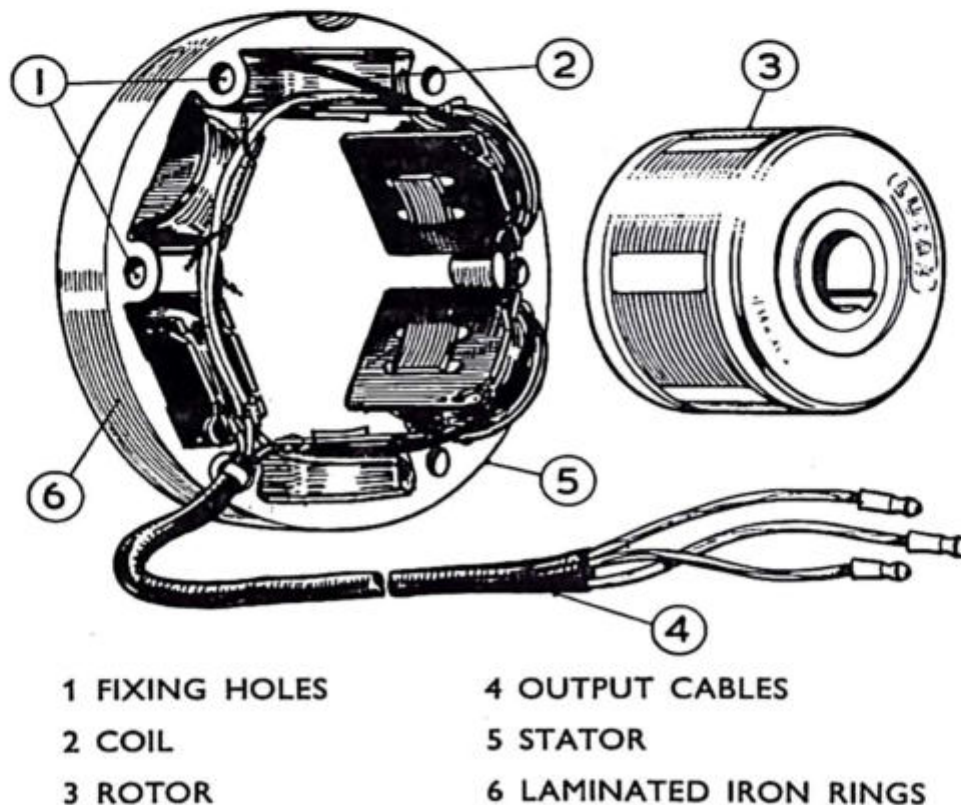
A.C. IGNITION SYSTEM FOR COMPETITION MACHINES

This system is independent of a battery supply and its characteristics combine the advantages of magneto and coil ignition.

Windings on either three or four of the stator limbs of the alternator supply a pulse of energy to the primary winding of an ignition coil each time the contact breaker opens. These low tension pulses are converted by means of a specially designed ignition coil to the high tension voltages required at the sparking plug. Battery-less Competition machines may have lighting coils on only two limbs to supply current for a direct lighting set. When stop lights are used with direct lighting, these are fed either from a third independent coil or from two coils of a four-coil ignition winding.

N.B. Never try to improve the ignition timing of an A.C. Ignition machine. Settings are critical and optimum performances are determined by the engine and ignition system designers at the development stage.

THE ALTERNATOR



- | | |
|----------------|------------------------|
| 1 FIXING HOLES | 4 OUTPUT CABLES |
| 2 COIL | 5 STATOR |
| 3 ROTOR | 6 LAMINATED IRON RINGS |

Fig. 1. A Typical Alternator.

Alternator model RM18 is normally fitted to small capacity high engine speed motor cycles, while model RM19 is usually employed on larger capacity lower engine speed machines, and in A.C. Ignition Systems. For special purpose models fitted with two-way radio, or other additional current-consuming equipment, alternator model RM20/19 provides the increased output necessary to balance the greater electrical loading.

Model 9AF is the scooter alternator and carries a finned flywheel cast integral with the rotor.

The alternator consists of a spigot-mounted 6-coil laminated stator (which may be encapsulated) with a rotor carried on and driven by an extension of the crankshaft. The rotor has an hexagonal steel core, each face of which carries a high-energy permanent magnet keyed to a laminated pole tip. The pole tips are riveted circumferentially to brass or aluminium side plates, the assembly being cast in aluminium and machined to give a smooth external finish.

There are no rotating windings, commutator, brushgear, bearings or oil seals and consequently the alternator requires no maintenance apart from occasionally checking that the snap-connectors in the output cables are clean and tight.

If rotor removal is necessary, there is no need to fit magnetic keepers to the rotor poles. When removed, wipe off any swarf which may have been attracted to the pole tips and put the rotor in a clean place until required for refitting.

THE RECTIFIER

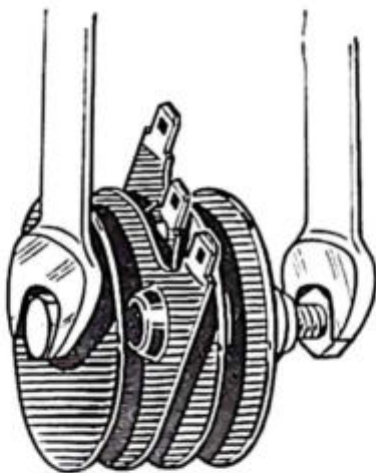


Fig. 2.

Method of securing Rectifier
Before turning the securing nut, the head of the bolt must be held firmly by means of a second spanner as shown.

The rectifier is a silicon semiconductor device which allows current to flow in one direction only. It is connected to provide full wave rectification of alternator output current.

The rectifier requires no maintenance beyond checking that the connections are clean and tight. The nuts clamping the rectifier plates together must not under any circumstances be slackened. A separate nut is used to secure the rectifier to the motor cycle and it is important to check periodically that the rectifier is firmly attached to its mounting bracket.

ZENER DIODE CHARGE CONTROL FOR 12-VOLT MACHINES

The Zener diode is a silicon semiconductor device which acts as a by-pass valve to divert surplus charging current from the battery. It requires no maintenance beyond checking that connections are clean and tight. The 'earthing' stud, which secures the diode to the heat sink plate, must not be subjected to a tightening torque greater than 17 lbf. in. The earth wire must be fitted under the fixing nut, *not* between the diode and heat sink.

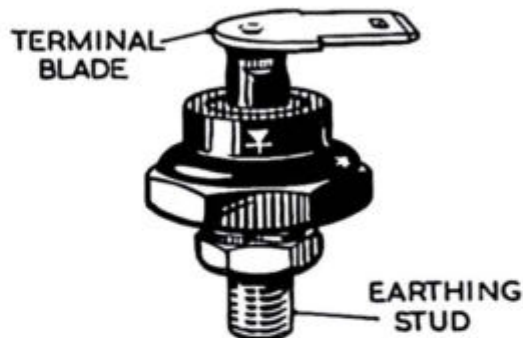


Fig. 3. Zener Diode.

THE BATTERY

Topping-Up.

During charging, water is lost by gassing and evaporation and each week the electrolyte level of each battery cell should be checked and, if necessary, topped up.

Remove the battery lid, unscrew the filler plugs and, if necessary, add distilled water carefully to each cell to bring the electrolyte just level with the line on the container denoting maximum filling level of, if there is no such line, level with the separator guard.

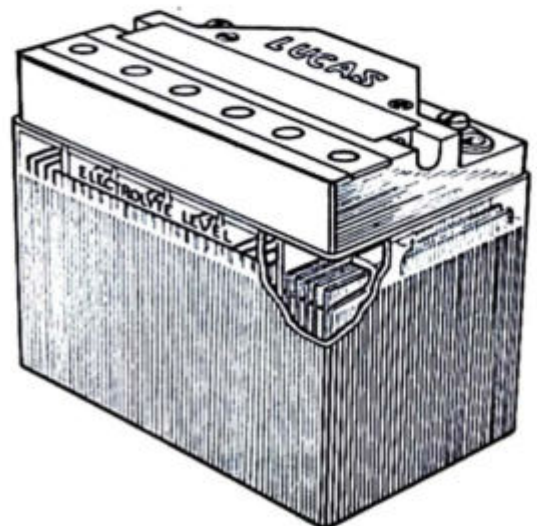


Fig. 4. Battery Model PU5A.

DO NOT USE TAP WATER.

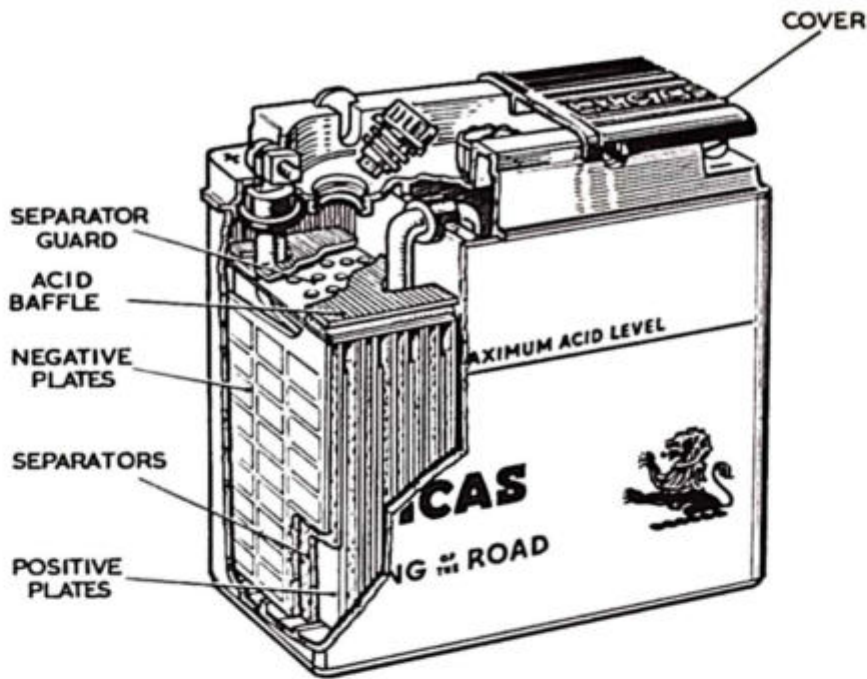


Fig. 5. Battery Model ML9E.

Maintenance.

Occasionally wipe away all dirt and moisture from the top of the battery and ensure that the terminals are clean and tight.

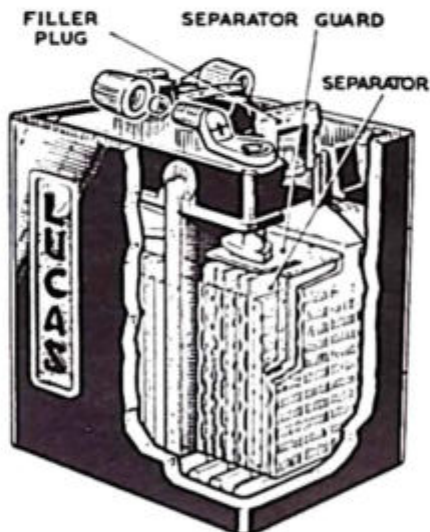


Fig. 6. Battery Model PU7E/11.

Never leave the battery in a discharged condition. If the motorcycle is to be out of use for a considerable period have the battery fully charged and each fortnight give it a short freshening charge to prevent any tendency for the plates to become permanently sulphated.

Battery Earth.

The equipment is designed for use with positive (+ve) earth systems. If battery connections are reversed, the equipment will be damaged.

CONTACT BREAKER UNITS

Models 4CA and 6CA incorporate centrifugally operated ignition timing advance mechanism. These units may have either single or twin contact breakers, and in the latter arrangement each contact breaker controls its own ignition coil.

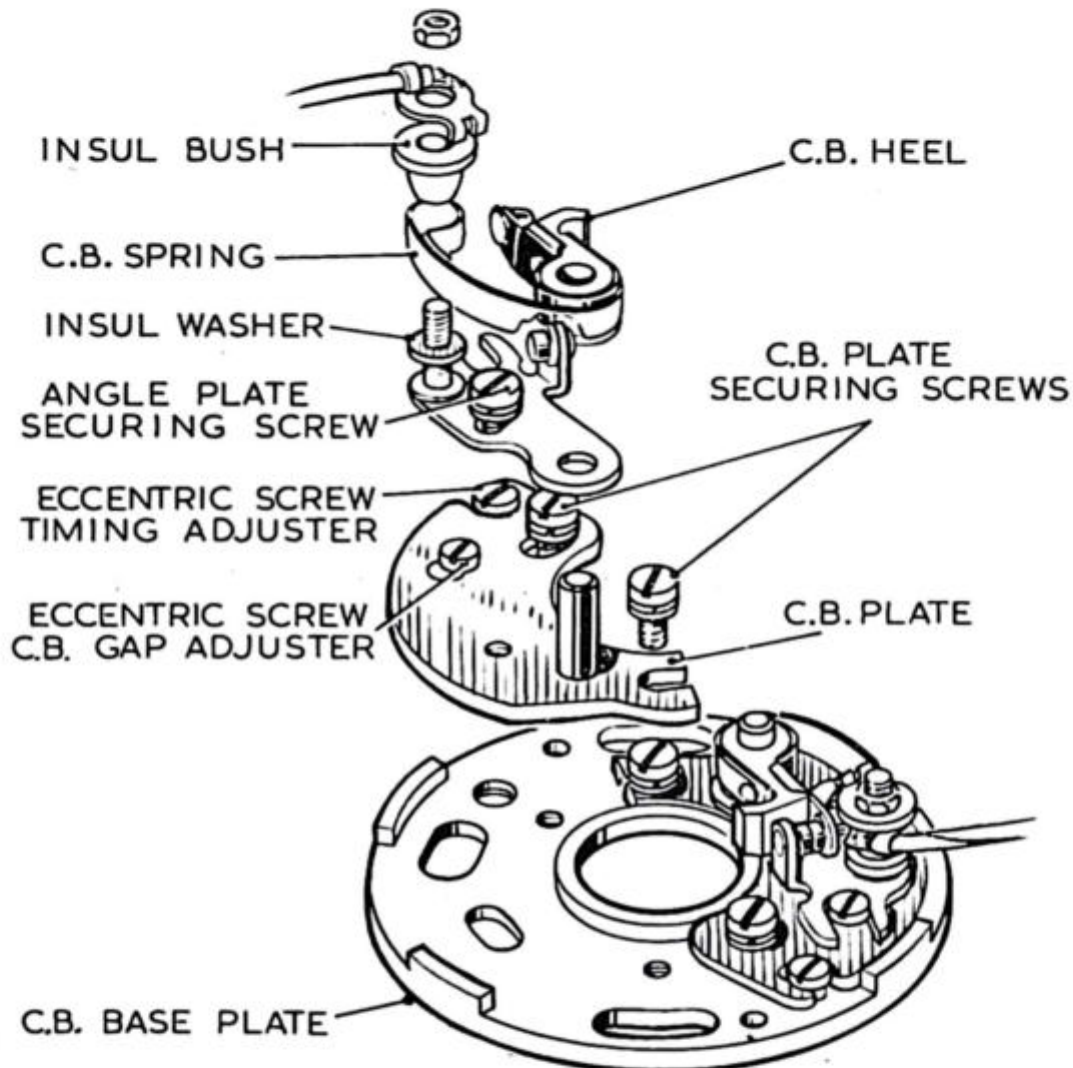


Fig. 7. Contact Breaker Model 6CA.

Note:—In addition to the C.B. gap adjuster, model 6CA is fitted with an eccentric screw timing adjuster (see Fig. 7). This must be adjusted only in accordance with manufacturers instructions.

Contact Breaker Setting—after first 500 miles and thereafter every 6,000 miles.

To check the contact breaker gap, turn the engine over slowly until the contacts are seen to be fully open and insert a feeler gauge between the contacts. The correct gap setting is 0.014"—0.016" (0.35—0.4 mm.). If the gap is correct, the gauge should be a sliding fit.

To adjust the gap keep the engine in the position giving maximum contact opening and slacken the nuts securing the fixed contact plate (4CA) or angle plate securing screw (6CA). Adjust the position of the plate (the

6CA unit is fitted with an eccentric screw C.B. gap adjuster) until the gap is set to the thickness of the gauge, and re-tighten as necessary.

To facilitate gap adjustment, 4CA units are provided with a screwdriver notch at the edge of the fixed contact plate between two raised pips on the base plate.

Cleaning — every 6,000 miles.

Remove and clean the cover.

Examine the contact breaker(s). The contacts must be free from grease and oil. If they are burned or blackened, clean with a fine carborundum stone or very fine emery cloth, afterwards wiping away any trace of dirt or metal dust with a clean petrol-moistened cloth.

Cleaning of the contacts is made easier if the contact breaker lever carrying the moving contact is removed.

To remove the moving contact, unscrew the nut from the capacitor terminal and withdraw the contact from the pivot post (4CA) or remove the nut from the spring anchor post (6CA).

After cleaning, check the contact breaker setting.

Lubrication — to be carried out every 6,000 miles.

No grease or oil must be allowed to get on or near the contacts when carrying out the following procedure:—

Smear the surface of the cam very lightly with Mobilgrease No. 2, or if this is not available, clean engine oil (S.A.E. 30—40) may be used.

Place a spot of clean engine oil on the contact breaker pivot post(s).

Automatic Timing Control.

Turn the engine to bring the slot in the cam uppermost and apply one drop of clean engine oil to slot. This will diffuse over the end of the cam and lubricate the cam spindle.

The Ignition Coil.

The coil requires no attention whatever beyond keeping its exterior clean, particularly the terminal moulding, and occasionally checking that the connections are tight.

Renewing High Tension Cables on Battery Ignition Coils.

When the high tension cable shows signs of perishing or cracking it must be renewed.

To replace the high tension cable on machines fitted with 7 mm. pvc or neoprene-covered cable, proceed as follows:—

Pull the defective cable from the H.T. terminal

Remove the metal terminal clip from the cable by opening the securing tags.

Fit the clip to the new cable.

Push the new cable firmly into the H.T. terminal moulding.

Renewing High Tension Cables on A.C. Ignition Coils.

Pull the defective cable from the coil H.T. terminal.

Before inserting the new cable, smear the P.V.C. outer casing with Bostik No. 1 (clear) adhesive.

Ensure that the coil H.T. terminal pin is located in the cable conductor and push the cable fully home.

Some machines are equipped with high tension cables designed to suppress radio interference (these cables being green in colour). Since these are designed to suit individual machines and have special terminals it is essential that only correct replacements are fitted.

MAGNETO IGNITION

In a few instances a magneto may be fitted for ignition purposes: the function of the alternator is then only to charge the battery.

Model K2F magneto may have a centrifugally-operated automatic timing mechanism. Alternatively a manual timing control may be provided on some competition machines. Where a manual control is fitted it should be moved to the Retard position for starting or when the engine is labouring on full throttle. At all other times the control should be in the advance position.

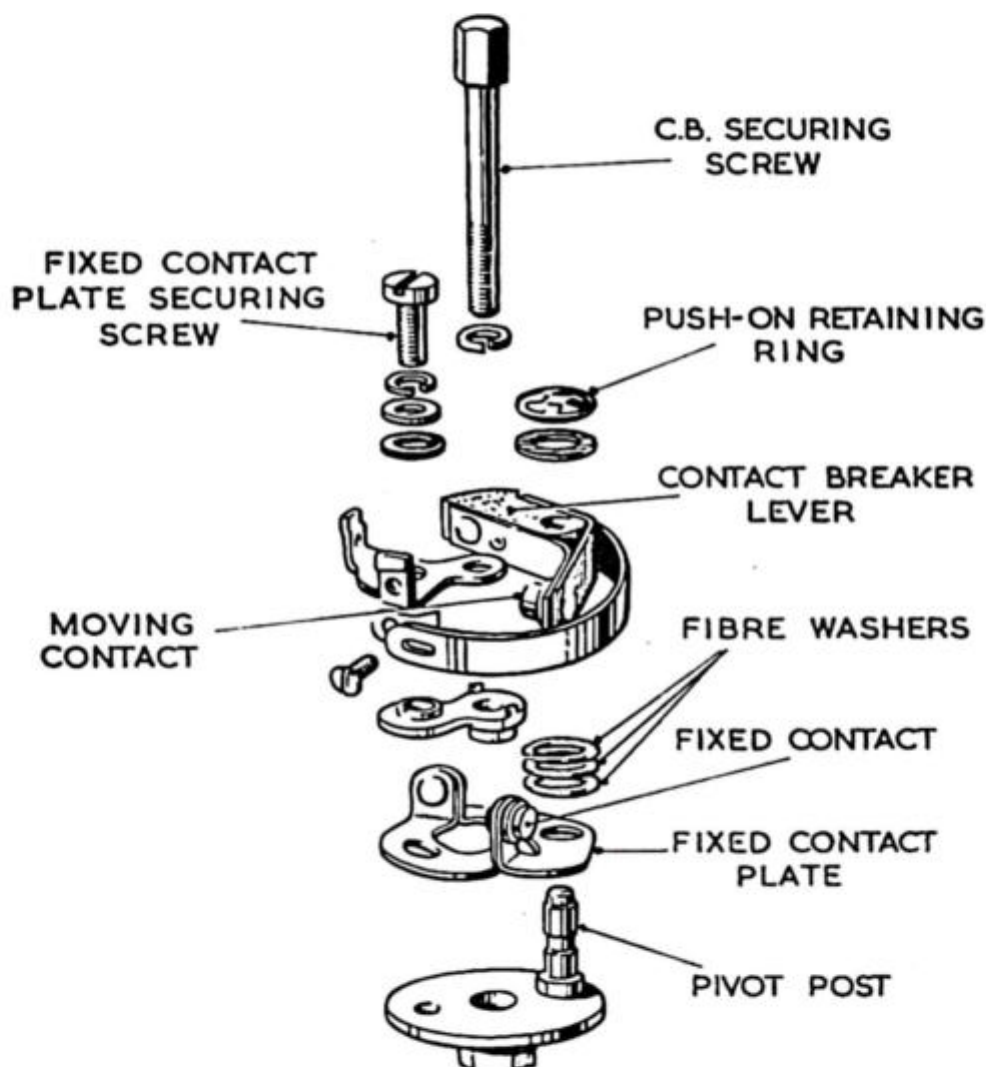


Fig. 8. Contact Breaker, dismantled.

EVERY 3,000 MILES.

Checking Contact Breaker Gap.

To check the contact breaker gap, remove the contact breaker cover and turn the engine over slowly until the contacts are fully open. A flat steel gauge of thickness 0.012"—0.015" (0.3—0.38 mm.) should be a sliding fit between the contacts.

Adjusting Contact Breaker Gap.

FIXED CONTACT PLATE SECURING
SCREW

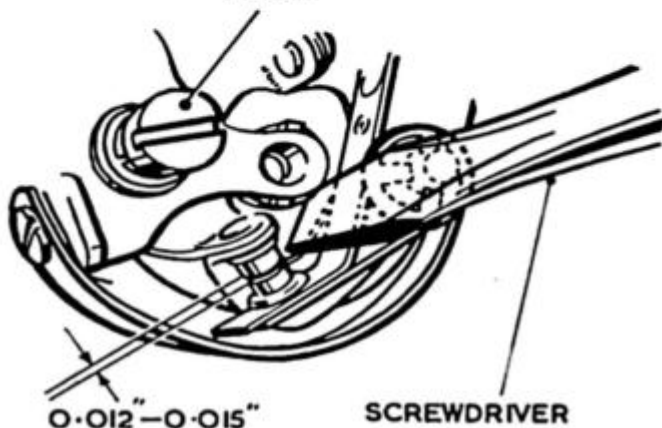


Fig. 9. Adjusting Contact Breaker gap.

The contact breaker unit is shown in Figs. 8 & 9. It has a fixed contact plate secured by a single screw passing through a slotted hole in the base. To adjust the gap, slacken this screw and, using a screw-driver in the manner shown in Fig. 9 move the fixed contact plate until the correct gap is obtained. Tighten the screw and re-check the gap.

Lubrication.

The cam ring is supplied with lubricant from a felt strip contained in a recess in the contact

breaker housing. Oil reaches the inner surface of the cam ring by way of a small circular wick passing through the thickness of the cam ring.

Remove the contact breaker cover. Take out the central hexagon-headed securing screw and carefully withdraw the contact breaker from the tapered magneto spindle.

Withdraw the cam ring. It is a sliding fit in the contact breaker housing.

Note:—If a manual ignition timing control is fitted, withdrawal and refitting of the cam ring will be made easier if the handlebar control lever is moved to the half-retard position, thus taking the cam ring from its stop peg.

Clean the cam and lightly smear the inside and outside surfaces with Mobilgrease No. 2.

Add a few drops of thin machine oil to the felt strip and to the circular wick.

Remove the contact breaker lever and smear the pivot with Mobilgrease No. 2, applying sufficient grease to fill the annular groove. The method of removing the contact breaker will be apparent from Fig. 8. Since the push-on retaining ring may need renewal after removal, an alternative form of lubrication for this pivot post is to apply a spot of clean engine oil to the tip of the post.

While this will obviate the necessity of removing the lever, great care must be taken to prevent oil getting on or near the contacts.

Refit the contact breaker lever.

Refit the cam ring, taking care when manual timing control is fitted that the stop peg in the contact breaker housing and the spring loaded plunger engage with their respective slots.

If an earthing brush is fitted at the back of the contact breaker base plate, see that it is clean and can move freely in its holder before refitting the contact breaker assembly in the cam ring.

Refit the contact breaker assembly, ensuring that the projecting key on the tapered portion of the contact breaker base plate engages correctly with the spindle keyway.

Centrifugal Timing Control.

The centrifugal timing control mechanism (if fitted) should be removed, cleaned and lubricated with clean engine oil.

EVERY 6,000 MILES.

Cleaning.

Remove the contact breaker cover and high tension pick-up mouldings. Thoroughly clean the inside and outside of the magneto using a clean dry fluffless cloth, if necessary moistening it with petrol to remove any grease from the high tension pick-up mouldings and contact breaker contacts. Ensure that the pick-up brush moves freely in its holder. Renew the brush if it is worn to $\frac{1}{8}$ " above the shoulder. Clean the slip ring track and flanges by pressing the cloth on them while the engine is cranked by hand.

Ensure that the gasket between the pick-up mouldings and the magneto body is in good condition before reassembling.

Examine the contacts when the contact breaker is removed for lubrication. If the contacts are pitted or piled, they should be trimmed with a carborundum stone, silicon carbide paper, or very fine emery cloth.

Contacts do not retain a polished appearance when in use and, if operating correctly, will have a dull grey appearance.

EVERY TWO YEARS.

About every two years, or when the engine is given general overhaul, the magneto should be examined at a Lucas Service Depot.

Renewing High Tension Cables.

When the high tension cable shows signs of perishing or cracking it must be renewed.

To replace the high tension cable on machines fitted with 7 mm. p.v.c. or neoprene-covered cable, proceed as follows:—

Remove the metal washer and moulded terminal nut from the defective cable. Thread the new cable through the moulded terminal nut and cut back the insulation for about $\frac{1}{4}$ in.

Pass the exposed strands through the metal washer and bend them back radially.

Screw the moulded terminal into the pick-up moulding.

Some machines are equipped with high tension cables designed to suppress radio interference (these cables being green in colour). Since these are designed to suit individual machines and have special terminal connectors, it is essential that only the correct replacements are fitted.

Magneto-to-Engine Timing.

The engine manufacturer's instructions must be followed when re-timing the magneto to the engine.

STARTING MOTOR

The electric starter fitted to certain 12-volt models is a series-wound machine having an extended armature shaft which carries the 'sun' wheel of an epi-cyclic reduction gear assembly.

Maintenance.

Occasionally inspect the switch terminal connection. This must be kept clean and tight.

No periodic lubrication is necessary, but when the machine is stripped down for overhaul the starting motor should be examined by a competent automobile electrician.

HEADLAMPS AND PARKING LIGHTS

Lucas motor cycle headlamps are all arranged to incorporate the Lucas Light Unit, which consists of a combined reflector and front lens assembly. A "prefocus" bulb is used with the Light Unit, ensuring that when the bulb is fitted, the filament is correctly positioned in relation to the reflector, and no focusing is necessary. The parking Light bulb holder is a push fit in the rear of the Light Unit reflector, as shown in Figs. 10 and 12.

On some machines a headlamp body is dispensed with and a nacelle type extension of the forks provides a housing for the Lucas Light Unit.

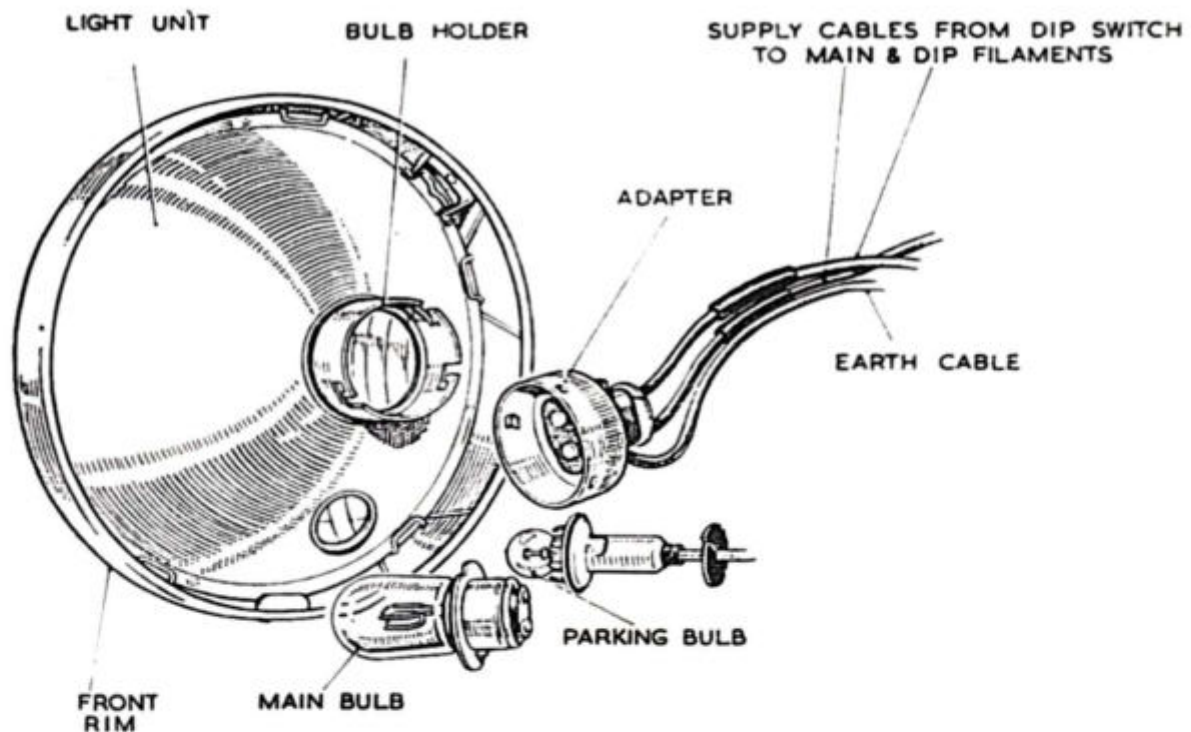


Fig. 10. Model F700P Light Unit and Rim removed from Lamp Body.

Setting.

Set the headlamp so that when the motor cycle carries its normal load the main or driving beam is projected straight ahead and parallel with the road surface.

Many garages possess a Lucas Beamsetter. This is a scientific instrument enabling accurate beam setting to be effected. Motor cycle owners are strongly advised to make use of this service whenever possible.

When such facilities are not available, the headlamp can be set by marking off a smooth blank wall and shining the lamp on it from a distance of 25 feet. Details are shown in Fig. 11.

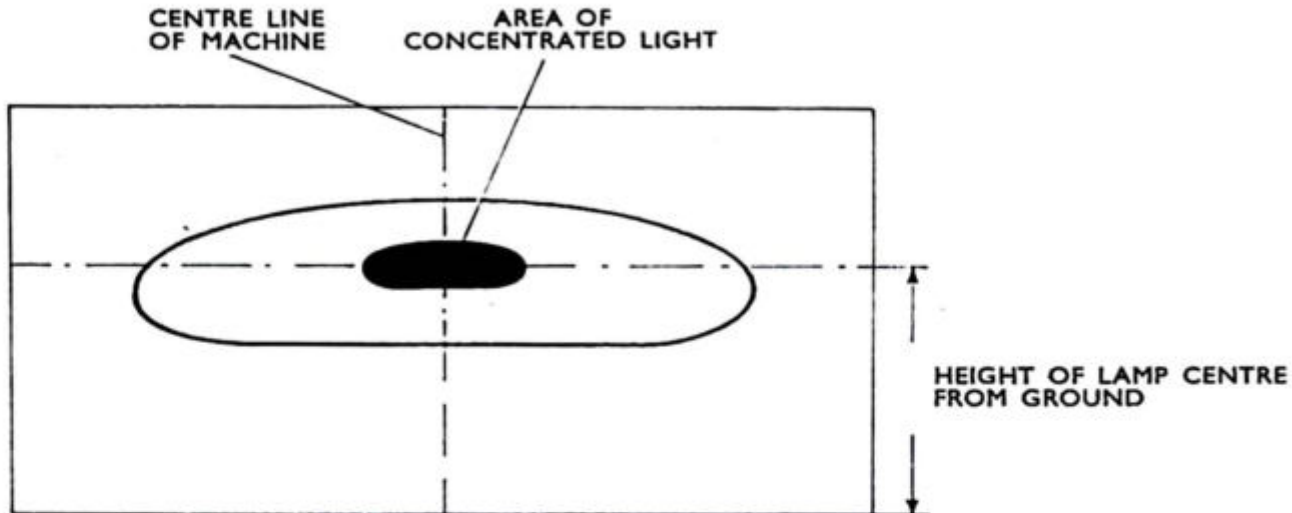


Fig. 11. Headlamp Main Beam Setting Diagram.

When Setting:—

- (a) Front of motor cycle to be square with screen.
- (b) Motor cycle to be carrying normal load and standing on level ground.
- (c) Recommended distance for setting is at least 25 feet.

On machines where the Light Unit is mounted in a nacelle or other special fitting, the motor cycle manufacturer's handbook should be referred to for instructions on setting the lamp.

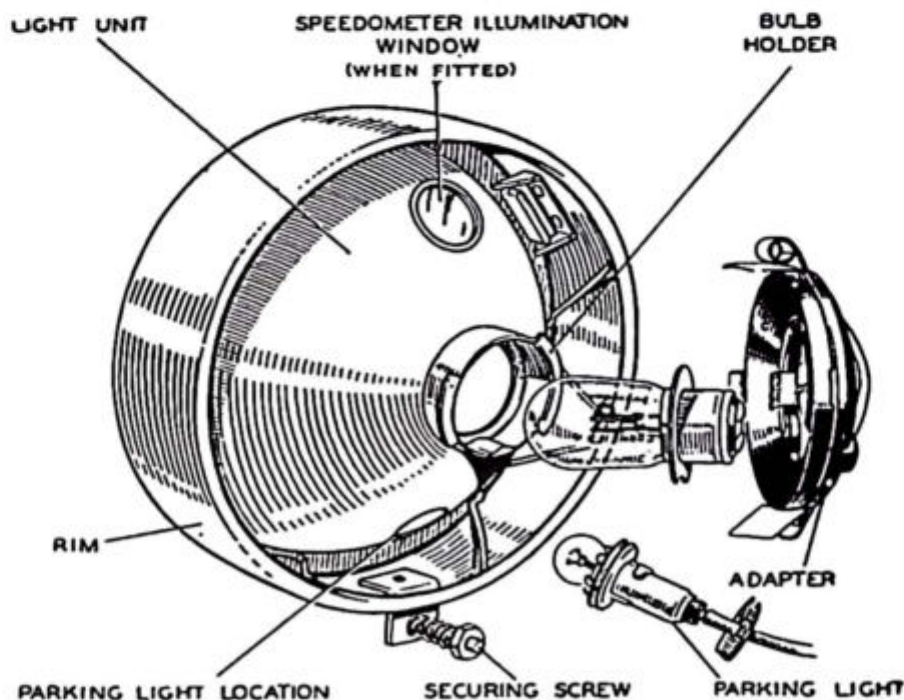


Fig. 12. Model F575P Light Unit and Rim removed from Lamp Body.

Removing Headlamp Front.

Slacken the rim securing screw located at the top or bottom of the lamp body. On model MCF575 headlamps the securing screw at the bottom of the lamp must be unscrewed completely to release the lamp.

It will then be possible to detach the front rim complete with Light Unit assembly. To replace, locate the Light Unit assembly in the lamp body, press the front on and secure in position by tightening the securing screw.

Replacement of Bulbs.

When the replacement of a bulb is necessary, it is important not only that the same size bulb is fitted, but also that it has a high efficiency and will focus in the reflector. Cheap and inferior replacement bulbs often have the filament of such a shape that correct focusing is not possible; for example, the filament may be to one side of the axis of the bulb, resulting in loss of range and light efficiency.

Lucas Genuine Spare Bulbs are specially tested to check that the filament is in the correct position to give the best results with Lucas lamps. To assist in identification, Lucas bulbs are marked on the metal cap with a number. When fitting a replacement, see that it has the same number as the original bulb.

To gain access to the headlamp bulb remove the front rim and Light Unit assembly as previously described. Push on the adapter and twist it in an anti-clockwise direction to take it off. The bulb can now be removed from the rear of the reflector. Place the correct replacement bulb in the holder, engage the projections on the inside of the adapter, press on and secure by twisting to the right.

To gain access to the parking light bulb remove the front rim and Light Unit assembly and withdraw the bulb holder from the reflector in which it is a push-fit.

REAR LAMPS

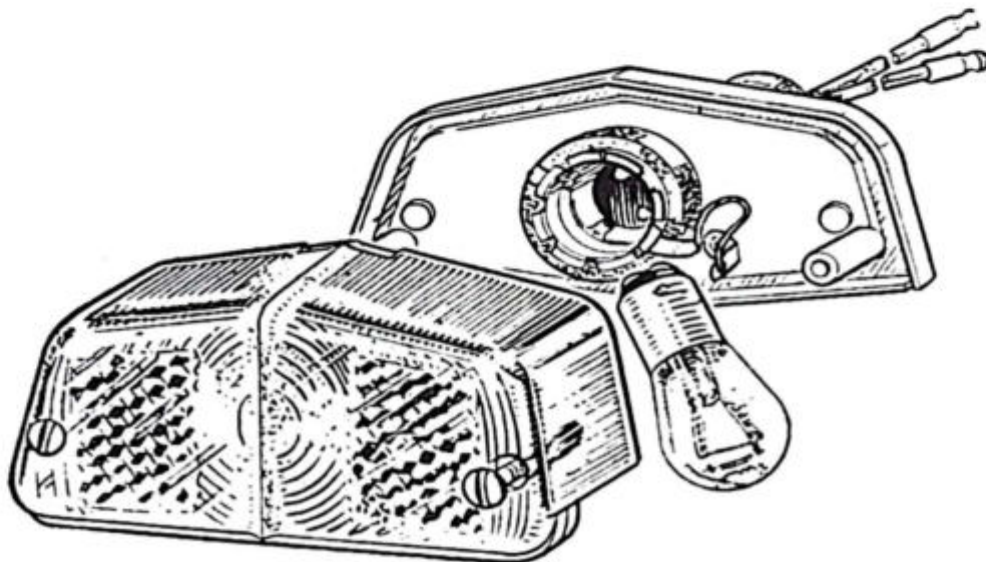


Fig. 13. Stop-Tail Lamp Model 564 incorporating Reflex Reflector.

Replacement Bulbs.

In the United Kingdom, the correct size of bulb to be used in rear lamps is based on the cubic capacity of the engine. Solo machines of 250 c.c. or less may be fitted with 3-watt bulbs. Combinations and machines exceeding 250 c.c. are required to be fitted with 6-watt bulbs.

Bulbs can be identified by number, usually stamped on the metal cap or on the bulb envelope. When changing a defective bulb, the replacement should bear the same number as the original.

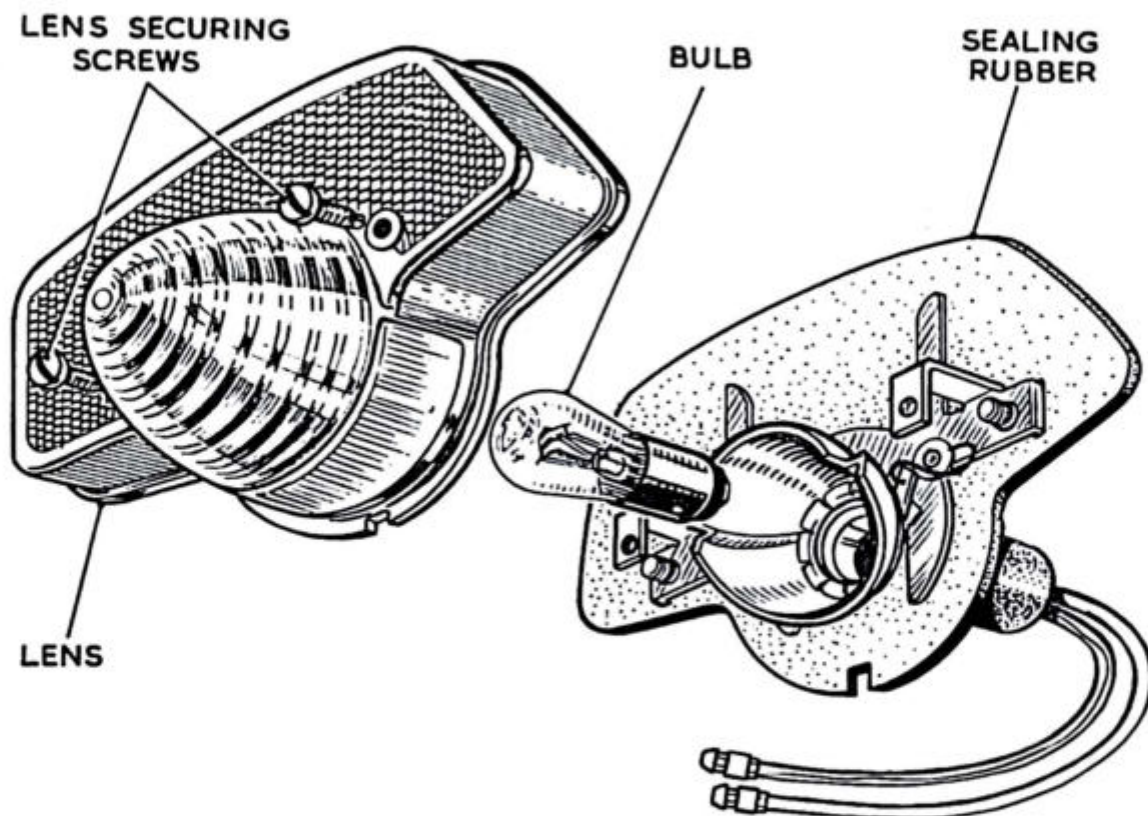


Fig. 14. Stop-Tail Lamp Model 679.

FLASHING DIRECTION-INDICATORS

The flashing indicator set fitted to certain machines comprises four indicator lamps, a flasher unit model FL5, together with its mounting spring, a warning light and an operating switch. In some applications, particularly on scooters, a model 94SA operating switch is used, which has a warning light incorporated. Failure of the warning light to flash indicates a fault in the system, such as failure of one of the indicator bulb filaments.

Checking Faulty Operation.

In the event of a fault occurring in the system the following procedure should be adopted:

- (i) Check the bulbs for broken filaments.
- (ii) Refer to the wiring diagram and check all flasher circuit connections.
- (iii) Switch on the ignition and check with a voltmeter that flasher unit terminal 'B' is at battery voltage with respect to earth.
- (iv) Connect together flasher unit terminals 'B' and 'L' and operate the direction-indicator switch. If the flasher lamps now light, the flasher unit is defective and must be replaced.

Replacement Bulbs.

Bulbs can be identified by number, usually stamped on the metal cap or on the bulb envelope. When changing a defective bulb, the replacement must bear the same number as the original.

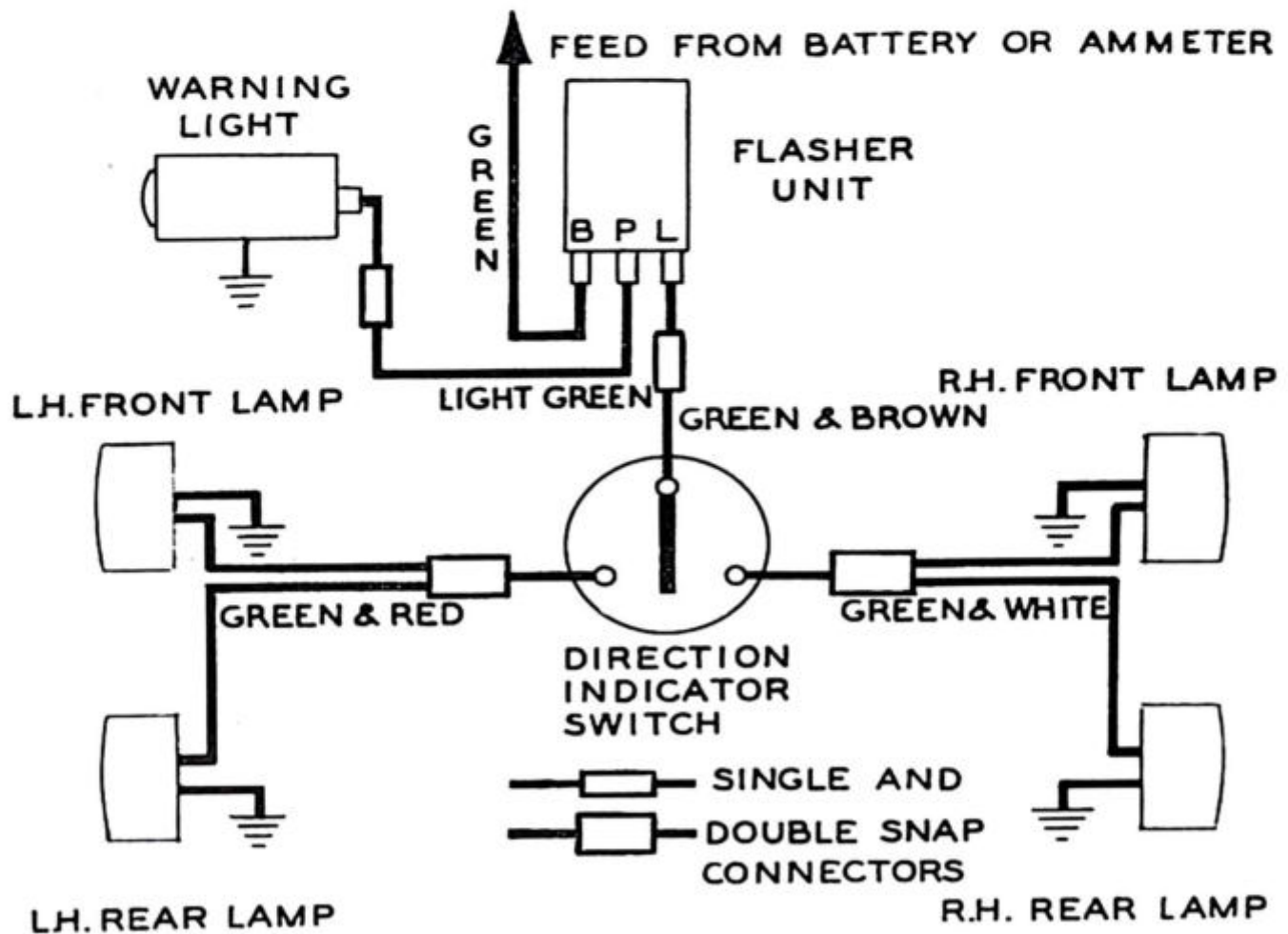


Fig. 15. Wiring Diagram of Flasher Circuit.

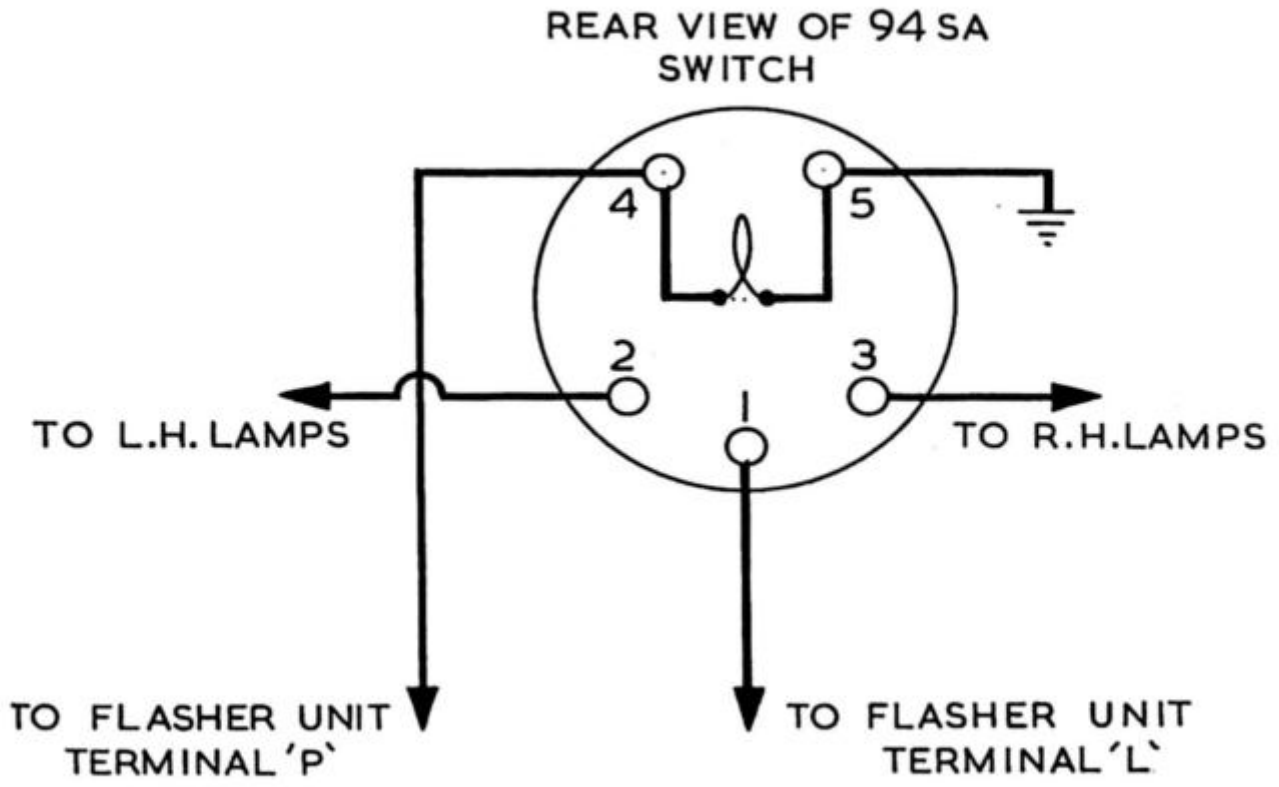


Fig. 16. Alternative Circuit using Model 94SA Switch with Built-in Warning Light.

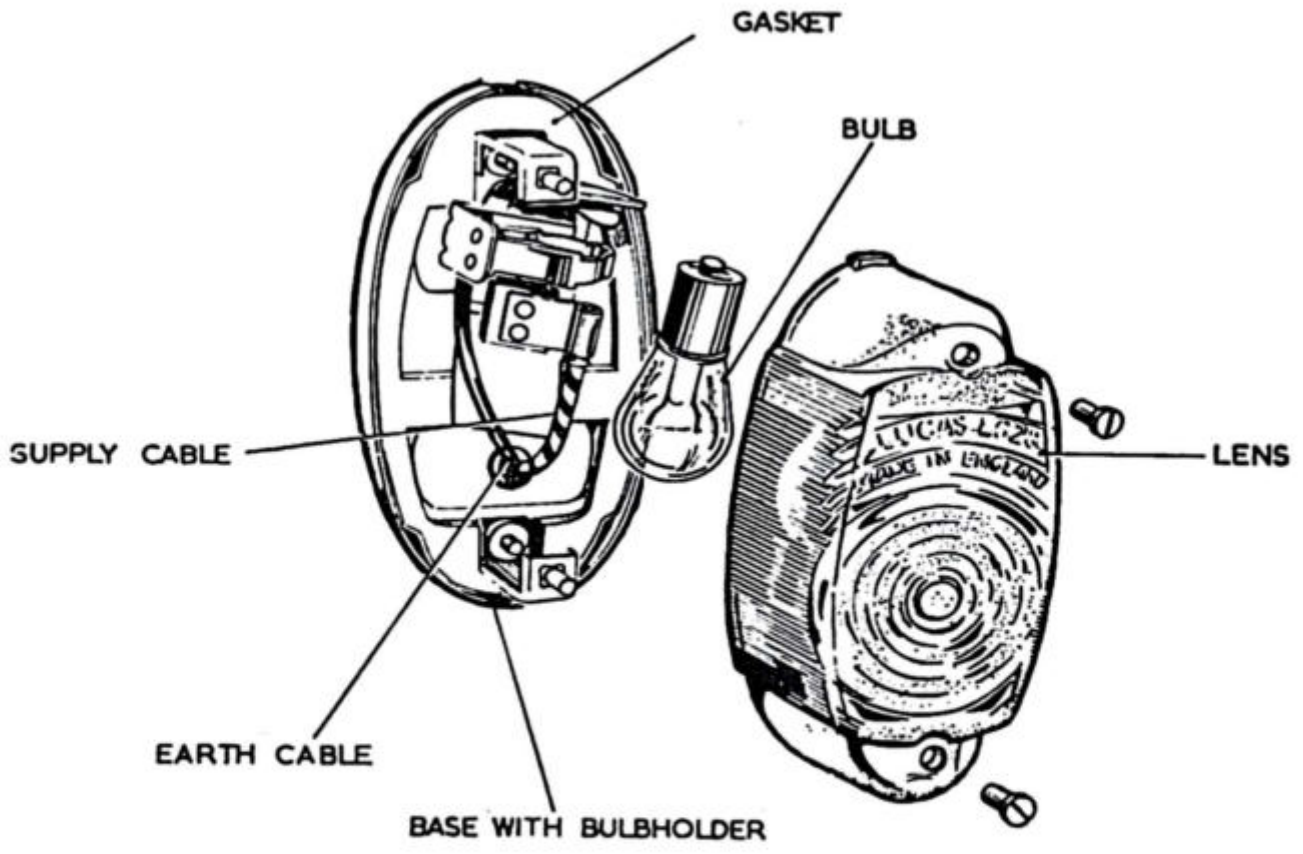


Fig. 17. Direction-Indicator Lamp Model 628.



Fig. 18. Warning Light Model WL15.

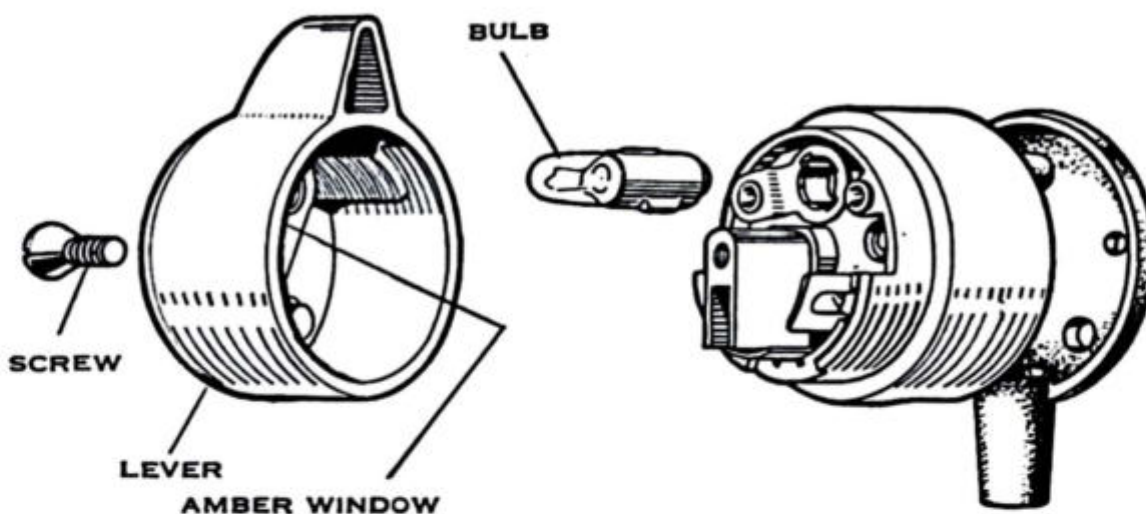


Fig. 19. Direction-Indicator Switch Model 94SA.

HOW TO CONNECT A FOGLEAMP

As explained on Page 3, on some machines the alternator can only develop its maximum output when the lighting switch is turned to the 'H' position. This is because the alternator windings are switched to obtain the required charge rate by means of special contacts built into the lighting switch, the rate being least in the switch position 'Off' and most in 'H'.

It follows that in these conditions a foglamp should never be directly connected across the battery, since the alternator output in lighting switch position 'P' may be insufficient to balance the additional load and the resulting drain on the battery would soon cause the light from the foglamp to dim.

The correct method is to connect an additional dip switch (i.e., a single pole, two-way switch) in series with the existing dip switch in order to be able to select for operation either the headlamp or the foglamp, when the main lighting switch is turned to position 'H'. To do this:

- (i) Disconnect the feed cable (normally blue) from the centre main terminal of the existing dip switch.
- (ii) Connect this cable to the centre main terminal of the new switch.
- (iii) Connect one of the two remaining terminals of the new switch to the centre main terminal of the existing switch.
- (iv) Connect the third terminal of the new switch to one of the foglamp terminals.
- (v) Connect the other terminal of the foglamp to earth.

An incidental advantage of this method of connection is that electrical overloading due to the simultaneous use of headlamp and foglamp is prevented and, further, the correct distribution of light to suit differing driving conditions is assured.

ELECTRIC HORNS

Horns are pre-set to give their best performance and, in general, no further adjustment is necessary.

If the horn becomes uncertain in its action, giving only a choking sound, or does not vibrate, it does not follow that the horn has broken down — the trouble may be due to a discharged battery, a loose connection, or short-circuit in the wiring of the horn. In particular, ascertain that the horn push bracket is in good electrical contact with the handlebars.

It is also possible that the performance of a horn may be upset by its mounting becoming loose.

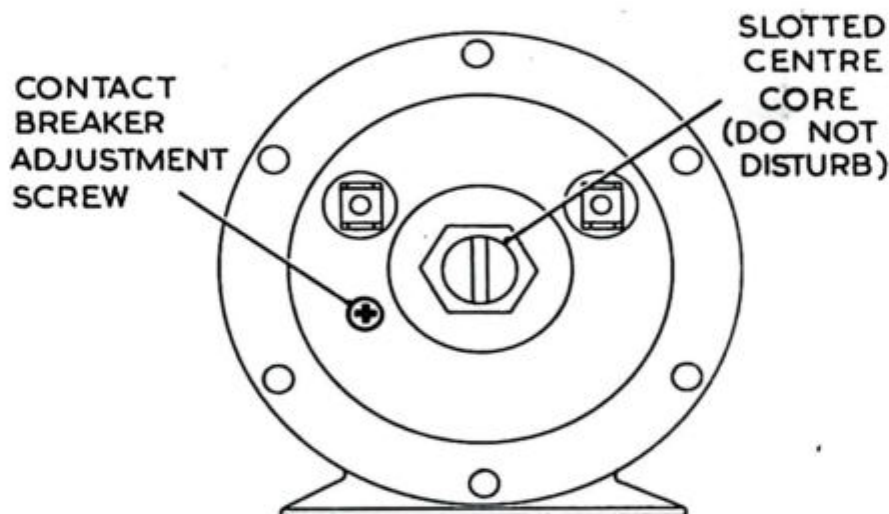


Fig. 20. Horn Model 9H showing Adjusting Screw.
(This screw is similarly positioned on the 6H and 8H models).

Adjustments of Models 6H, 8H and 9H.

The following adjustment will not alter the note of the horn. It will take up any wear of the moving parts, which, if not corrected, may result in roughness and loss of performance.

Operate the horn push and slowly turn the adjustment screw (located at the back of the horn body) until the horn just fails to sound. Release the horn push and turn the adjustment screw clockwise, one notch at a time, until the original performance of the horn is restored. This usually entails a clockwise motion of one quarter to three-quarters of a turn.

On no account must the centre core and locking nut be disturbed. If the original performance cannot be restored by adjustment, do not attempt to dismantle the horn, but return it to a Lucas Service Depot for examination.

LOCATION AND REMEDY OF FAULTS

Although every precaution is taken to eliminate all possible 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 to locate and remedy the causes of some of the more probable faults. The sources of many troubles are by no means obvious, and in some cases a considerable amount of deduction from the symptoms is needed before the cause of the trouble is disclosed.

When checking the continuity of circuits, a flashlamp battery and bulb should be used. On no account must the end of a live cable be flicked to earth against the motor cycle frame. This practice, known as "flashing", can cause heavy currents to flow round the alternator windings and result in the partial demagnetisation of the rotor and reduction of output. If a separate motor cycle battery is used, a low wattage test lamp must be included in the circuit.

If, after carrying out the 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.

BATTERY CHARGING SYSTEMS.

Engine will not start in IGN position.

- (a) Turn switch to EMG position, if provided. If the engine will now fire, the alternator and rectifier are operating correctly and the indication is a discharged battery; this can be confirmed by poor light from the lamps. Recharge the battery.
- (b) Remove the H.T. cable from the sparking plug terminal and hold the cable end about $\frac{1}{8}$ -in. away from some metal part of the engine while the latter is slowly turned over. If sparks jump the gap regularly the ignition equipment is functioning correctly. Check for engine defects or examine sparking plug.
- (c) If sparks do not occur in test (b), check for a fault in the low tension wiring, i.e., from battery to switch, coil and contact breaker. If the wiring proves to be in order, examine the contact breaker; if necessary clean the contacts and adjust the gap setting.
- (d) If, after carrying out these checks, the ignition system is still inoperative, have it examined by a Lucas Service Depot or Agent.

Engine will not start in EMG Position (if provided)

- (a) Remove the H.T. cable and test as described under (b) above: if sparks appear, then the trouble is due to engine defects, etc.
- (b) If the ignition equipment is not operative in the above test, check the snap connectors, rectifier connections and other wiring. All connections must be clean and tight.
- (c) Examine the contact breaker; if necessary clean the contacts and adjust the gap setting.

- (d) Make sure Ignition timing is correct to engine maker's specification.
- (e) See that the alternator rotor is fitted the correct way round on the engine shaft.
- (f) If the ignition system is still inoperative, have the equipment examined by a Lucas Service Depot or Agent.

Engine misfires.

- (a) Examine the contact breaker; if necessary, clean the contacts and adjust the gap.
- (b) Remove the sparking plug (or each plug in turn), rest it on the cylinder head and observe if a spark occurs at the plug points when the engine is turned. Irregular sparking may be due to dirty plugs, which may be cleaned and adjusted, or to defective high tension cables. Any cable on which the insulation shows 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 carburetter, petrol supply, etc., must be examined.
- (d) If misfiring occurs after the engine has been running for some time, check that the ignition switch is in the normal IGN position. If run continuously in the EMG position, the rising voltage of the battery may eventually cause misfiring to occur.

A. C. IGNITION.

Important.

1. Keep the contact breaker clean and its maximum opening correctly set to 0.014"—0.016".
2. Keep the sparking plug electrodes clean and correctly set.
3. Keep to the manufacturer's timing instructions.

Regarding notes 1 and 3 above, it is the magneto performance or spark energy developed by the alternator (in addition to the piston-to-spark relationship) that is involved. Since the rotor is keyed to the engine crankshaft, which, in turn, is coupled through the connecting rod to the piston, any movement of the piston whilst timing will affect the position of the crankshaft, and hence the magnetic timing position of the rotor. Thus the maximum magneto performance of the alternator can only be obtained with accurately set contact breaker and timing.

Engine will not start, difficult to start or misfires.

- (a) Remove the H.T. cable from the sparking plug and hold the cable end about $\frac{1}{8}$ " from the cylinder block. Sparks should jump this gap regularly when the engine is turned at kick-start speed.
- (b) If sparks are obtained, check the sparking plug, reset and clean, or renew as necessary.
- (c) If no sparks are obtained, inspect the H.T. cable and renew, as necessary, Check contact breaker gap setting.

- (d) If the sparking plug, H.T. cable and contact breaker gap setting are satisfactory, check for engine defects, faulty fuel supply, etc.
- (e) If, after carrying out these checks, the ignition system is still unsatisfactory, have the equipment examined by a Lucas Service Depot or Agent.

MAGNETO IGNITION.

Engine will not start or difficult to start.

- (a) See that the controls are correctly set for starting, petrol turned on, etc.
- (b) Turn off the petrol tap. Remove the sparking plug (or plugs), and place on the cylinder head. If a spark occurs regularly at the plug points when the engine is slowly hand-cranked, the magneto is in order. Look for engine defects and check ignition timing.
- (c) If a spark does not occur in (b), disconnect the high tension cable from the plug and hold the cable end about $\frac{1}{8}$ " from a metal part of the engine. If a spark occurs regularly when the engine is cranked, the plug is faulty. If there is no spark, disconnect the high tension cable at the magneto, replace with a new length of cable and test again as before.
- (d) Should there still be no spark, possible causes of trouble are: contact breaker gap out of adjustment or contacts dirty; contact breaker rocker arm sticking; or, with rotating armature magnetos, pick-up brush worn or broken, or slip ring track dirty. Remedy as described.

Engine misfires.

- (a) Check as in para. (b) and (c) above to eliminate engine defects, faulty high tension cable and sparking plug.
- (b) Check magneto as in para. (d) above.
- (c) If the fault persists, have the magneto examined by a Lucas Service Depot or Agent.

CHARGING CIRCUIT.

Refer also to "Alternative Battery Charging Rates for 6-Volt Machines" on page 3.

Battery in low state of charge.

- (a) This state will be shown by poor or no light from the lamps when the engine is stationary, with a varying light intensity when the motor cycle is running.
- (b) Have the condition of the battery checked, and recharge it if necessary.
- (c) Check wiring from battery to switch, rectifier and alternator, tightening any loose connections or replacing broken cables.
- (d) If the cause of the trouble is still not apparent, have the equipment examined by a Lucas Service Depot or Agent.

Excess Circuit Voltage.

- (a) This will be indicated by burnt-out or blackened bulbs, and possibly poor engine performance due to burned ignition contacts.
- (b) Examine all wiring for loose or broken connections.
- (c) Check the earthing of battery and rectifier.
- (d) Examine the battery, checking electrolyte level and removing any traces of corrosion.
- (e) If the ignition is affected (Battery Charging Systems only), clean the contact breaker contacts, or, if necessary, renew them.
- (f) If the fault persists, have the equipment examined by a Lucas Service Depot or Agent.

THE BATTERY POSITIVE (+ve) TERMINAL IS EARTHED TO THE MACHINE. UNDER NO CIRCUMSTANCES MUST THE NEGATIVE (-ve) TERMINAL BE EARTHED.

LIGHTING CIRCUITS.**Failure of lights (machine stationary).**

- (a) If only one bulb fails to light, replace with new bulb.
- (b) If all lamps fail to light have the condition of the battery checked, recharging it if necessary either by a long period of daytime running or by connecting to a suitable battery charger.
- (c) Examine the wiring for a broken or loose connection, and remedy.

Lamps light when switched on, but gradually fade.

Have the condition of the battery checked, recharging if necessary.

Brilliance varies with speed of motor cycle.

Have the condition of the battery checked, recharging if necessary.

Lights flicker.

Examine the wiring for loose connections, or short circuits caused by faulty cable insulation. Have the condition of the battery checked.

Headlamp illumination insufficient.

- (a) If the bulb is discoloured or filaments have sagged as a result of long service, a new bulb of the same type should be fitted.
- (b) Check the setting of the lamp.