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Part II

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THE HEADLAMPS

DESCRIPTION

Each headlamp incorporates a Lucas "Light Unit" consisting of a combined front glass and reflector assembly. It is provided with a seating rim by which means it is attached to the back shell by three spring loaded screws; these are also used for aligning the beams.

The bulbs fitted are of the double filament pre-focus type, one filament is set lower than the first and, providing the headlamps are switched on, can be brought into use by operating the foot dipper switch. No adjustment of the bulbs position, in the light unit, is provided and care should be exercised that only the correct replacements are fitted. The purpose of the double filament bulb is to satisfy anti-dazzle requirements, but single headlamp "dipping" can be effected by withdrawing the appropriate electrical cable from the harness in the R.H. corner of the radiator, the live end insulated and taped to the other cables.

The front glass of the "Light Unit" is air cooled by the car's slipstream and because of the heat generated by the glowing filaments, there is a danger of the front glass overheating and cracking when the car is stationary with the headlamps in use. It should be noted that if a lamp glass cracks the complete "Light Unit" must be replaced.

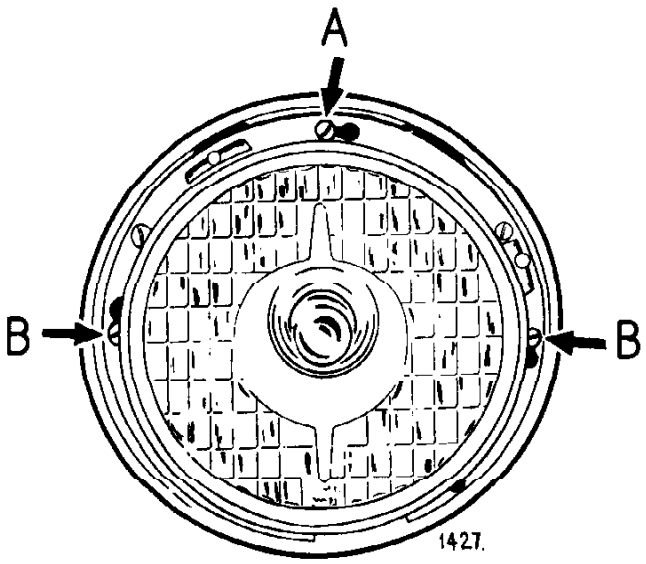


Figure O1.

A Vertical adjustment screw.
B. Horizontal screw.

SETTING THE HEADLAMP BEAMS

The headlamp beams must be set in accordance with instructions laid down by the Ministry of Transport Vehicle Lighting Regulations which may be interpreted as follows.

The car's lighting system must be arranged so that it can give a beam of light which is incapable of dazzling any person standing on the same horizontal plane as the car at a greater distance than twenty-five feet from the headlamps, whose eye level is not less than three feet six inches above that plane.

The headlamps must, therefore be set so their main beams of light are parallel with the road surface and with each other.

Spring off the headlamp ring, starting at the six o'clock position and remove the rubber dust excluder beneath. Adjust the vertical setting of the light unit by rotating the spring loaded screw at the top; clockwise to raise the beam and anti-clockwise to lower the beam. Adjust the horizontal setting of the light unit by rotating the spring load screw at the side; clockwise to move the beam toward that screw and anti-clockwise to move the beam away from that screw. Replace the rubber dust excluder and front rim.

NOTE: During the foregoing sequence, do not leave the headlamps on for too long a period or the front glass may crack due to the heat generated by the glowing bulbs.

REMOVAL AND REPLACEMENT HEADLAMP BULB Fig. O2.

Spring off the headlamp ring starting at the six o'clock position and remove the rubber dust excluder beneath. Release the light unit from the back shell by applying slight pressure and rotating it anti-clockwise a short distance so that the holes in the seating rim align with the heads of the three spring loaded beam setting screws. Withdraw the bulb from inside the reflector by

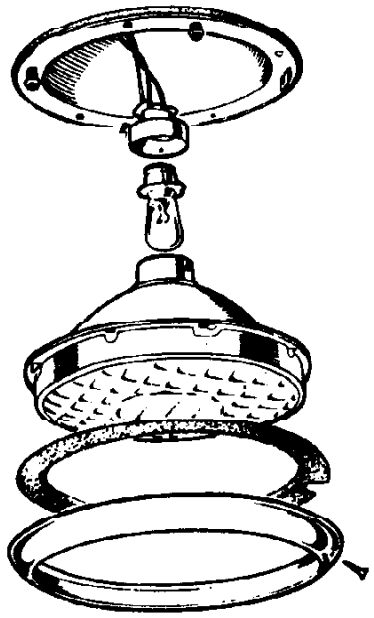


Figure O2.

Replacing headlamp bulb.

rotating the adaptor, a short distance anti-clockwise. Fit the replacement bulb so that the "nick" in the seating flange aligns with "the spline" in the reflector. Replace the adaptor carefully aligning the two arrowheads. Fit the light unit to the heads of the spring loaded screws, apply slight inward pressure and rotate it clockwise. Check the setting of the beam as detailed on page O1. Replace the rubber dust excluder and front rim.

HEADLAMP LIGHT UNITS
UNITED STATES OF AMERICA

Sealed headlamp light units are fitted to cars for export to the United States of America. While there are small differences in design, the foregoing instructions in many respects still apply; however, more explicit instructions can be obtained from their Daimler Distributor or Dealer.

REMOVAL AND REPLACEMENT
LIGHT UNIT AND BACK SHELL

1. LIGHT UNIT

Detach the earthing lead from the battery. Remove the light unit as detailed in the REMOVAL AND REPLACEMENT, HEADLAMP BULB as detailed on page O1.

2. BACK SHELL

Detach the short harness of the light unit from the main harness and remove the back shell from the body by withdrawing four screws. The harness and adaptor can be removed from the back shell by easing it through the rubber grommet.

3. REPLACEMENT

The replacement of the light unit and back shell is the reversal of the removal sequence, but particular attention must be given to the following point:

That the setting of the headlamp beams is checked as detailed on page O1.

FOOT OPERATED DIPPER SWITCH

The foot operated dipper switch is situated in the L.H. side of the drivers foot well and is operated by pressure of the drivers left foot. When the "main" headlamp beam is in use, a warning lamp incorporated in the face of the speedometer will glow.

Press the switch down to change from "main" to "dipped" headlamp beam or vice versa.

REMOVAL AND REPLACEMENT
FOOT DIPPER SWITCH

1. REMOVAL

Detach the earthing lead from the battery. Remove the foot dipper switch from the L.H. side of the driver's foot well by moving the carpet aside and withdrawing two screws. Detach the electrical harness from the terminals in the underside of the dipper switch.

2. REPLACEMENT

The replacement of the foot operated dipper switch is the reversal of the removal sequence.

HEADLAMP SWITCH

The headlamp switch is the second from the L.H. side in the centre instrument panel and also incorporates the switch for the side lamps. It is of the three position tumbler type and the positions are as follows:

(i) UPWARD	All lamps	OFF
(ii) CENTRE	Side and rear lamps	ON
(iii) DOWNWARD	Head, side and rear lamps	ON

REMOVAL AND REPLACEMENT
HEADLAMP SWITCH

1. REMOVAL

Detach the earth lead from the battery. Withdraw the headlamp switch from the centre instrument panel by removing the front nut and detaching the electrical harness from its rear face.

2. REPLACEMENT

The replacement of the headlamp switch is the reversal of the removal sequence.

REMOVAL AND REPLACEMENT
MAIN BEAM WARNING LAMP

Detach the earthing lead from the battery. Withdraw the L.H. bottom bulb holder from the underside of the speedometer situated toward the bottom of the instrument. Unscrew the spent bulb, fit the replacement and clip the bulb holder back in position.

THE SIDE LAMPS

A small fairing is built in the body above each headlamp to which the side or parking lamp abuts. The electrical harness comes up from the engine compartment into the rear of the fairing.

REMOVAL AND REPLACEMENT
SIDE LAMP BULB Fig. O3.

Remove the front rim and lamp glass from the side lamp by withdrawing the two side screws exercising care not to allow the lamp glass to fall on hard ground. Withdraw the spent bulb and fit the replacement. The front rim and lamp glass are replaced by reversing the removal sequence.

REMOVAL AND REPLACEMENT
SIDE LAMP

1. REMOVAL

Detach the earthing lead from the battery. Remove the front rim and glass from the front of the side lamp as detailed in REMOVAL AND REPLACEMENT, SIDE LAMP BULB. Remove the electrical harness from inside the engine compartment and the side lamp body from the body by withdrawing two screws.

2. REPLACEMENT

The replacement of the side lamp is the reversal of the removal sequence.

SIDE LAMP SWITCH

The side lamp switch is incorporated in the headlamp switch to which reference should be made and is detailed above

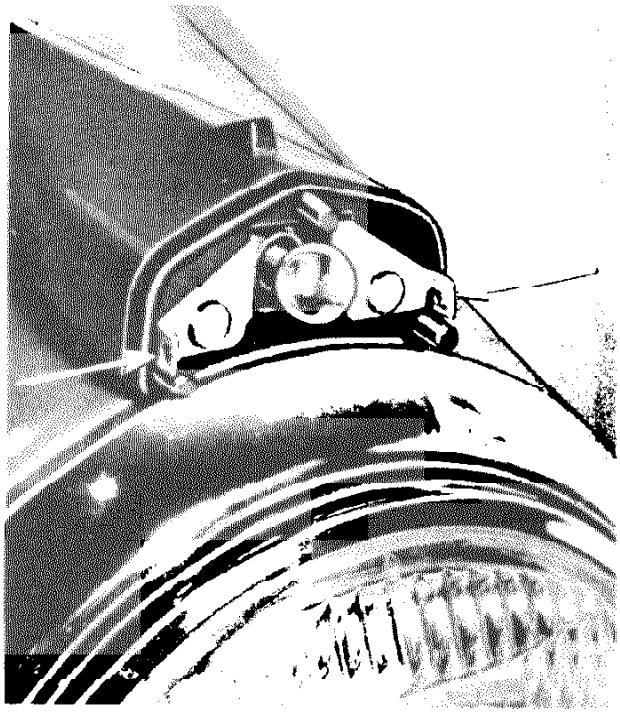


Figure O3.

Side lamp with rim and glass removed.

THE REAR AND STOP LAMPS

DESCRIPTION

The combined rear and stop lamp is the lower of the two lamps fitted on the two rear corners of the body beneath a metal mounting finisher. The rear lamp incorporates a double filament bulb, the larger filament of which serves as a stop lamp and will glow each time the brake pedal is depressed while the ignition is switched on.

A periodical check that both the stop filaments are glowing while depressing the brake foot pedal is well worth while as the use of flasher type directional indicators is becoming more universal and the glowing of a single stop light could momentarily indicate to following traffic that a turn is to be made.

REMOVAL AND REPLACEMENT REAR AND STOP LAMP BULB

Remove the rear lamp finisher from the corner of the body by slackening four screws; these screws are retained in the mounting finisher. Detach the lamp glass by applying slight inward pressure and rotating it approximately 30°, withdraw the spent bulb and fit the replacement. Note the offset pins. The lamp glass and mounting finisher are replaced by reversing the removal sequence.

REMOVAL AND REPLACEMENT REAR AND STOP LAMP

1. REMOVAL

Detach the earthing lead from the battery and remove the lamp glass as detailed in REMOVAL AND REPLACEMENT, BULB above. Withdraw the electrical harness from inside the luggage boot, the rear and stop lamp with its seating rubber from the corner of the body by withdrawing three screws.

2. REPLACEMENT

The replacement of the rear and stop lamp is the reversal of the removal sequence.

STOP LAMP SWITCH

The stop lamp switch is fitted in the L.H. outlet port of the hydraulic brake five way connector.

REMOVAL AND REPLACEMENT

1. REMOVAL

Detach the earthing lead from the battery. Remove the electrical harness from the two terminals on the stop light switch and withdraw the stop lamp switch.

2. REPLACEMENT

The replacement of the stop light switch is the reversal of the removal sequence but

particular attention must be given to the following points.

That sufficient washers are fitted on the threaded shank of the stop light switch to bring the electrical terminals vertically upward.

THE REGISTRATION NUMBER PLATE ILLUMINATION LAMP

DESCRIPTION

The registration number plate illumination lamp is attached to the rear outside face of the luggage boot. It is of the hooded type and throws the light downward on to the registration number plate.

REMOVAL AND REPLACEMENT REGISTRATION NUMBER PLATE ILLUMINATION LAMP BULB

Detach the metal hood and glass assembly from the registration number plate illumination lamp by withdrawing the centre bolt. Remove the spent bulb and fit the replacement. Fit the metal hood and glass assembly by reversing the removal sequence.

REMOVAL AND REPLACEMENT REGISTRATION NUMBER PLATE ILLUMINATION LAMP

1. REMOVAL

Remove the earthing lead from the battery and remove the metal hood and lamp glass as detailed in REMOVAL AND REPLACEMENT, BULB. Detach the electrical harness from the snap connectors inside the registration number plate illumination lamp. Remove the illumination lamp from the rear of the luggage boot by detaching two nuts situated inside the luggage boot and drawing it off the electrical harness.

2. REPLACEMENT

The replacement of the registration plate illumination lamp is the reversal of the removal sequence.

THE FLASHER DIRECTION INDICATORS

DESCRIPTION

The flasher direction indicating system consists of four lamps, two at the front and two at the rear of the car; a flasher unit, situated in the engine compartment and a switch lever incorporated in the control head mounted in the centre of the steering wheel. The switch is of the self-cancelling type providing steering wheel has traversed 30^{o} from its straight ahead position; when the movement of the steering wheel is less than this, the switch lever must be cancelled by hand.

The direction indicating system is only operative when the ignition is switched on when the warning lamps, one indicating each side are incorporated in the face of the engine speed indicator, will give an intermittent glow when both front and rear flasher indicator lamps are operating. When both warning lamps glow it indicates a fault in the system, such as a bulb failure. It is quite normal for the flasher unit, in the engine compartment, to give off a "beating" noise while the flasher lamps are operating and each "beat" indicates a "flash". This system will only operate correctly when the correct wattage bulbs are fitted to the lamps.

REMOVAL AND REPLACEMENT FRONT FLASHER LAMP BULB

Remove the metal ring from the flasher lamp by pushing back the rubber surround, similarly remove the lamp glass. Withdraw the spent bulb and fit the replacement, which must be of the specified wattage. Fit the lamp glass and metal ring by reversing the removal sequence.

REMOVAL AND REPLACEMENT
REAR FLASHER LAMP BULB

This is effected in the same manner as the REAR AND STOP LAMP BULB detailed on page O4 Ensure that the bulb is of the specified wattage.

REMOVAL AND REPLACEMENT
FLASHER DIRECTION INDICATOR
WARNING BULB

Detach the earthing lead from the battery. Withdraw the L. or R.H. bulb holder from the underside of the engine speed indicator according to which one requires attention. Unscrew the spent bulb, fit the replacement and clip the bulb holder back in position.

REMOVAL AND REPLACEMENT
FRONT FLASHER LAMP

1. REMOVAL

Detach the earthing lead from the battery and the metal ring and glass from the front flasher lamp as detailed in REMOVAL AND REPLACEMENT, BULB, as detailed on page O5 Remove the front flasher lamp from the end of the grille by detaching the electrical cable from the harness adjacent to the radiator and withdrawing three screws.

2. REPLACEMENT

The replacement of the front flasher lamp is the reversal of the removal sequence.

REMOVAL AND REPLACEMENT
REAR FLASHER LAMP

The removal and replacement of the rear flasher lamp is similar to that of the REAR AND STOP LAMP, detailed on page O4, the only difference being that having a single filament bulb and so will have an electrical harness of lesser wires.

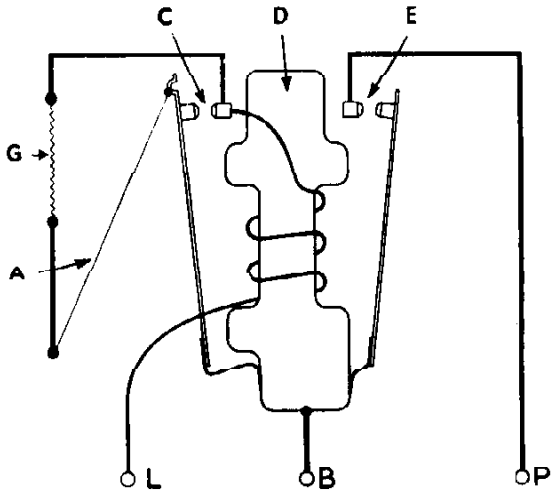


Figure O4.
Diagramatic layout of flasher unit.

A. Actuating wire.
B. Lead from battery.
C. Main armature and contacts.
D. Steel core and coil.
E. Secondary armature and warning lamp contacts.
L. To flasher lamps through switch.
P. To flasher warning lamps.

FLASHER UNIT
DESCRIPTION Fig. O4.

The flasher unit consists of an insulated plate with its mechanism mounted on one side and three terminals on the second or external side, all but the latter are enclosed in a cylindrical

cover having a mounting bracket on its closed end. The operation of the flasher unit depends on the linear extension of the actuating wire which becomes heated and so extends when an electrical current is passed through it. This actuating wire controls the movement of a contact mounted on one end of a spring loaded armature, attached by its second end to a centrally mounted steel core which is in circuit with the battery. When the ignition is switched on and the flasher direction indicator switch lever is moved either to the L. or R. the electrical current flows through the actuating wire, the ballast resistor and a coil wound on the central steel core through the flasher lamp filaments to earth; the current is limited by the ballast resistor at this stage to ensure that the flasher lamp filaments do not glow.

The actuating wire grows in length due to the heating influence of the electrical current passing through it and allows the contact on top of the armature to close inward and "make" with a second contact on one end of the wire coiled around the central steel core, thereby supplying electrical current to the filaments of the flasher lamps in circuit with the second end of the coiled wire and of course short circuits the actuating wire.

The central steel core and wire coil carrying the current to the flasher lamps form a solenoid and the resultant electro-magnetic effect closes a second pair of contacts similarly mounted as the first pair of contacts, but with the fixed contact in circuit with the flasher warning lamps mounted in the face of the engine speed indicator. This lamp will glow in conjunction with the flasher lamps.

However, as the current is no longer passing through the actuating wire it cools down and will contract in length resulting in the armature, to which it is attached, moving away from its fixed contact cutting off the current to the flasher lamps and so the electro-magnetic field, attracting the second armature, will also collapse allowing the second armature to move away from its fixed contact extinguishing the flasher warning lamp.

As the position of the flasher direction indicator switch lever has remained unchanged, the electrical current will continue to pass through the actuating wire, resulting in the previous cycle being repeated and will continue to repeat while the switch lever remains in that position or is moved over to the opposite side and the ignition remains switched on.

PRECAUTIONARY NOTE

Flasher Units must be handled with care. Factory-made settings though satisfactory for conditions of normal automobile duty, can be thrown off balance by rough handling.

TESTING FOR FAULTY OPERATION
FLASHER UNIT

In the event of flasher direction indicator failure, the following procedure should be adopted:

(i) Check all bulbs for broken filaments.

(ii) Check that there is no disconnections in the wiring.

(iii) Connect a 12 volt lamp between the flasher terminal "B" and earth. Switch on the ignition and the lamp should glow indicating that electrical power is available. When the lamp remains extinguished, check the wiring for a disconnection due to a broken wire.

(iv) Short the flasher terminals "B" and "L" and operate the flasher direction indicator switch. If the indicator lamps emit a steady glow, the flasher unit is defective and must be replaced; when one or more lamps remain extinguished, check the wiring for a disconnection due to a broken wire.

REMOVAL AND REPLACEMENT
FLASHER UNIT

1. REMOVAL

Remove the flasher unit from the R.H. side of the wing valance inside the engine compartment by removing the bolt and detaching the electric cable from the underside of the flasher unit.

2. REPLACEMENT

The replacement of the flasher unit is the reversal of the removal sequence but particular attention must be given to the following points:

(i) That the electric cables are attached to the three terminals in accordance with their identification colours and the wiring diagram.

(ii) That the bonding wire under the head of the attachment bolt is not omitted.

FLASHER DIRECTION INDICATOR SWITCH

DESCRIPTION

The flasher direction indicator switch is the lever protruding upward through the top edge of the control head mounted in the centre of the steering wheel. Providing the steering wheel traverses more than 30° the switch is self-cancelling, otherwise the switch lever must be returned to its mid point of travel by the driver's hand. The direction indicator system is only operative when the ignition is switched on and warning lamps, incorporated in the face of the engine speed indicator will give an intermittent glow when both front and rear flasher lamps are operating.

SETTING THE FLASHER DIRECTION INDICATOR SWITCH Figs. O5 and O6.

When the flasher direction indicator switch in the centre of the steering wheel has become misplaced, inasmuch that it will not cancel correctly, or that the control head is slack and turns with the steering wheel or that the switch does not cancel at all; the following procedure should be adopted:

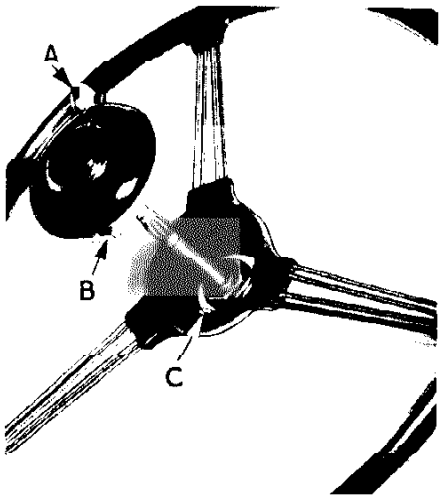


Figure O5.

The flasher direction indicator switch withdrawn from steering wheel.

A. Flasher direction indicator lever.
B. Groove in cylinderical body.
C. Trip lever.

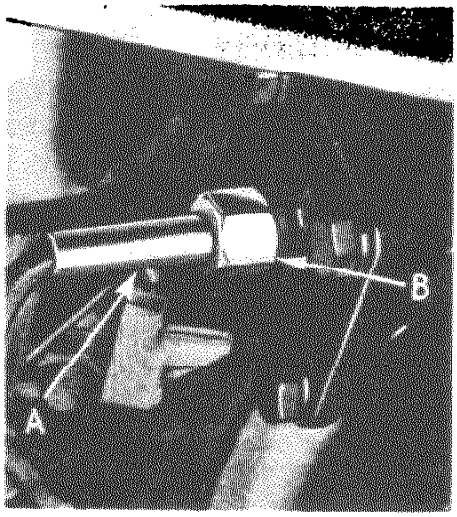


Figure O6.

The bottom end of stator tube protruding through end cover of steering unit.

A. Stator tube.
B. Union nut.

Position the car on level ground with the front roadwheels in the straight ahead attitude with the steering wheel spoke visible between the speedometer and engine speedometer; set the flasher direction indicator switch lever at the mid-point of its travel. Position a tray beneath the steering unit to trap any escaping oil; remove the union nut and olive from the bottom end of the stator tube protruding through the bottom of the steering unit beneath the car. Pull the control head out of the steering wheel hub and observe the position of the trip lever trapped between the steering wheel nut and steering wheel. This trip lever must be tight and in the six o'clock position, when the steering wheel and front roadwheels are in the straight ahead attitude and can be repositioned by slackening and retightening the steering wheel securing nut.

Replace the control head in the steering wheel hub, ensuring that the groove in the cylinderical body of the control head is in the six o'clock position and locates the trip lever. Ensure that the flasher direction indicator switch lever is at the mid-point of its travel and in the twelve o'clock position. Fit the olive and nut to the bottom end of the stator tube protruding through the bottom end of the steering unit beneath the car and fully tighten. Top up the steering unit with the recommended brand and grade of oil as detailed in THE STEERING, SECTION L.

THE BATTERY

DESCRIPTION

Model	B.T.9A
Voltage	12
Earthing	Positive
Ampere-hour capacity	
at 10 hour rate	51 amp.hr.
at 20 hour rate	58 amp.hr
Number of plates per cell	9
Initial charge current	3.5 amperes
Recharge current	5.0 amperes

The battery is stowed in the engine compartment on the engine bulkhead but on the opposite side to the steering unit.

When fitting a replacement battery ensure that it is of the specified capacity. The battery capacity is matched to the electrical equipment of the car and should a battery of a smaller capacity be fitted it may remain in a constant state of low charge.

MAINTENANCE
WEEKLY

Check the level of the electrolyte and the security of the two terminals.

TOPPING UP THE BATTERY Fig. O7.

The use of a Lucas Distilled Water Dispenser will be found useful during the topping up operation. It is so constructed to automatically ensure the correct height of the electrolyte and prevent spilling of the distilled water over the top of the battery when the filler spout is being moved from cell to cell.

Wipe away any foreign matter or moisture from the top of the battery and remove the six filler plugs in the top face. Add sufficient distilled water to raise the level of the electrolyte to the top of the separator guard.

NEVER USE A METAL CONTAINER FOR THE DISTILLED WATER.

SERVICING
BATTERY PERSISTS IN A LOW STATE OF CHARGE

First consider the conditions in which the battery is used. When the battery is subjected to long periods of discharge without suitable opportunities of a recharge, then a low state of charge can be expected.

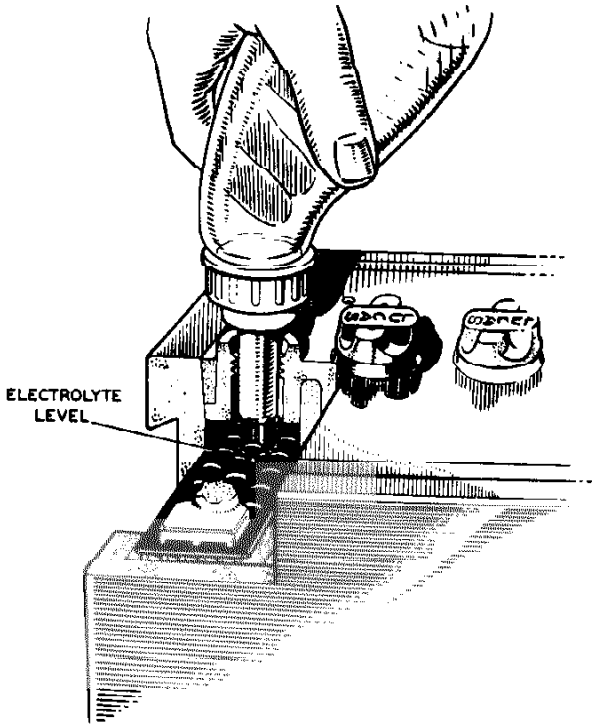


Figure O7.

Topping up the battery

VENT PLUGS

Ensure that the ventilation holes in the screwed plug, one plug to each cell, are completely unobstructed.

LEVEL OF ELECTROLYTE

When necessary top up with distilled water. Any loss of electrolyte due to spilling or spraying, as opposed to the normal loss of water by evaporation, should be made good with dilute acid of the specific gravity as that already in the cell.

CLEANLINESS

Ensure that the battery top, plugs and terminals are free from foreign matter and moisture that might provide a discharge path. Check that the battery posts and terminals are clean, tight and are smeared with petroleum jelly.

HYDROMETER TESTS Fig. O8.

Check the specific gravity of the electrolyte in each cell in turn with a hydrometer. To avoid misleading readings do not take hydrometer reading immediately after having added distilled water. The readings of each cell should be noted and then compared with one another and when the battery is in good condition the readings will almost be the same. When one or more cells are distinct from the others an internal fault is indicated. The readings obtained should be compared with those specified under the next heading.

The appearance of the electrolyte drawn into the hydrometer while taking the readings will give an indication of the condition of the plates. When the electrolyte is very dirty, or contains small particles in suspension, it is possible that the plates are in a bad condition.

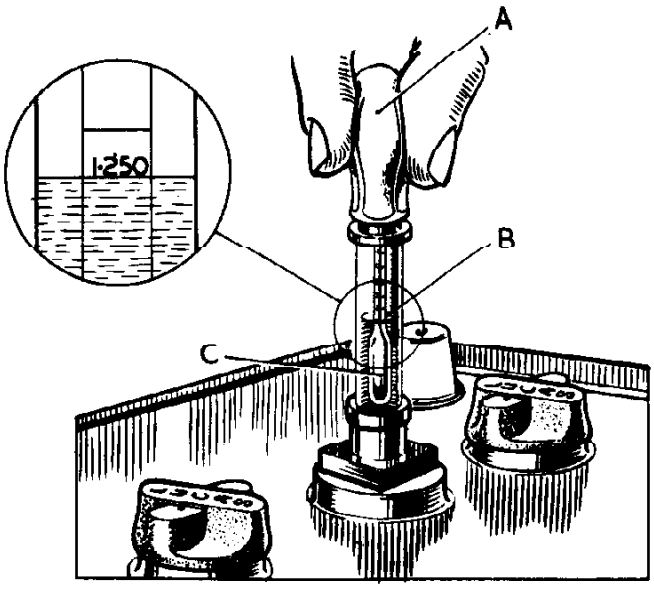


Figure O8

Checking the specific gravity of the electrolyte with a hydrometer.

A. Hold hydrometer vertical.
B. Do not draw in too much electrolyte.
C. Gauge float must be completely free.

STATE OF CHARGE

	Home and climates ordinarily below 90°F. (32°C.) Specific gravity of electrolyte corrected to 60°F. (15.5°C.)	Climates frequently above 90°F. (32°C.) Specific gravity of electrolyte corrected to 60°F. (15.5°C.)
Fully charged	1.270 - 1.290	1.210 - 1.230
Half charged	1.190 - 1.210	1.130 - 1.150
Discharged	1.110 - 1.130	1.050 - 1.070

The specific gravity of the electrolyte varies with the temperature, therefore, for convenience while comparing specific gravities, this is always corrected to 60°F. which is adopted as a reference temperature. The method of correction is as follows:-

For every 5°F.(-15°C) below 60°F. (15.5°C.) deduce .002 from the observed hydrometer reading to obtain the true specific gravity at 60°F. (15.5°C.).

For every 5°F.(-15°C) above 60°F. (15.5°C.) add .002 to the observed hydrometer reading to obtain the true specific gravity at 60°F. (15.5°C.)

The temperature must be that indicated by a thermometer actually immersed in the electrolyte and NOT the AIR TEMPERATURE.

Compare the specific gravity of the electrolyte with the values given in the table and so calculate the state of charge of the battery. When the battery is indicated as fully discharged it should be recharged from an external supply.

DISCHARGE TEST

A heavy discharge tester 150/160 amperes consists of a two or three volts full scale voltmeter, across which is connected a shunt resistance capable of carrying the current involved. Pointed prongs must be provided to contact with the inter-cell connectors.

A good cell will maintain a reading of 1.2 to 1.5 volts, depending on the state of charge, for at least 6 seconds. When the voltmeter reading rapidly falls off, the cell is probably defective. This test must not be effected immediately the car has returned from a journey, otherwise an inaccurate reading will be indicated.

RECHARGING FROM AN EXTERNAL SUPPLY

When the hydrometer and discharge tests indicate that the battery is merely discharged and is otherwise in a good condition, it should be recharged from an external source. The battery should be charged at the specified rate until the specific gravity and voltage shows no increase over five successive hourly readings. During the charge, the electrolyte must be kept level with the top of the separator guard by the addition of distilled water.

A battery that shows a general falling-off in efficiency, common to all cells, will often respond to the process known as "cycling". This process consists of fully charging the battery as detailed in the previous paragraph and then discharging it through a lamp board or other load taking a current equal to the charging current. The battery should be capable of providing this current for at least seven hours before it is fully discharged, as indicated by the voltage reading of each cell falling to 1.8 volts. When the battery becomes discharged in a shorter time, repeat the cycle of charge and discharge.

MINIMUM PERMISSIBLE ELECTROLYTE TEMPERATURE DURING CHARGING

Home and climates normally below 90°F. (32°C.)	Climates frequently above 90°F. (32°C.)
100°F. (37.7°C.)	120°F. (48.8°C.)

Keep the current constant by varying the series resistor of the circuit or the generator output. THIS CHARGE SHOULD NOT BE BROKEN BY LONG REST PERIODS. When the temperature of any cell rises above the permissible maximum specified, the charge must be interrupted until such time as the temperature of the electrolyte has fallen at least 10°F. below that figure. Throughout the charge, the electrolyte must be kept level with the top of the separator guard by the addition of an acid solution of the same specific gravity as the original filling-of-acid, until the specific gravity and voltage readings have remained constant for five successive hourly readings. When the charging is to continue beyond that point, top up the cells with distilled water.

At the end of the charging, check the specific gravity of each cell to ensure that, when corrected to 60°F. (15.5°C.), it lies within the specified limits. When any cell requires adjustment, some of its electrolyte must be drawn off and replaced either by distilled water or by acid to the strength originally used for original filling-of-acid, depending on whether the specific gravity was too high or too low. Continue the charge for an hour to ensure adequate mixing of the electrolyte and again check the specific gravity of the electrolyte in each cell. Finally allow the battery to cool and draw off any electrolyte above the top of the separator guard.

NOTE: Never use a naked light when examining a battery as the mixture of oxygen and hydrogen given off by the battery while it is being charged and to a lesser degree when standing idle, can be dangerously explosive.

REMOVAL AND REPLACEMENT
BATTERY

1. REMOVAL

Detach the battery terminals from the two terminal posts by withdrawing the two centre screws and lifting the terminals off. Remove the battery from the rear engine bulkhead by detaching the two nuts and securing straps.

2. REPLACEMENT

The replacement of the battery is the reversal of the removal sequence but particular attention must be given to the following point:-

That the rubber bonded strip beneath the battery clamp has not deteriorated to a degree that it will impair its usefulness.

(i) That the battery is held firmly by the securing straps but without damaging the case.

(ii) That the battery posts and terminals are perfectly clean and well coated with petroleum jelly.

THE DYNAMO

DATA

Model	C.40-1
Cutting in speed	1,250 to 1,450 dynamo r.p.m. at 13.0 generator volts.
Maximum output	22 amps at 2,050 to 2,250 dynamo r.p.m. at 13.5 generator volts and a resistance load of 0.61 ohms.
Field coil resistance	6.0 ohms.
Brush spring tension	26 ozs. maximum.
Brush spring tension	18 ozs. minimum.

DESCRIPTION

The dynamo is a shunt wound two-pole, two brush machine arranged to work in conjunction with a regulator unit. A cooling fan, fitted with the driving pulley draws air through the dynamo, inlet and outlet holes being provided in the rear and front mounting brackets respectively.

The output of the dynamo is controlled by the regulator unit and is dependent on the state of charge of the battery and the loading of the electrical equipment in use. When the battery is in a low state of charge, the dynamo will give a high output and when the battery is fully charged, the dynamo will give only sufficient output to keep the battery in good condition without any possibility of overcharging.

An increase in output is given by the dynamo to balance the current taken by the lamps and other electrical equipment as it is brought into use. It must be realised, however, that the persistent use of too much electrical equipment all at one time may cause the dynamo to overheat, resulting in premature failure.

The dynamo is mounted on top of the engine unit and is driven by a vee belt from a pulley on the front end of the crankshaft.

MAINTENANCE

FIRST 500 MILES (805 kms.)

Check tension of vee belt drive.

EVERY 5,000 MILES (8,050 kms.)

Check tension of vee belt drive.

EVERY 10,000 MILES (16,100 kms.)

Clean dynamo commutator and brush gear.
Lubricate dynamo.

EVERY 20,000 MILES (32,000 kms.)

Fit new dynamo brushes.

LUBRICATION Fig. O9.

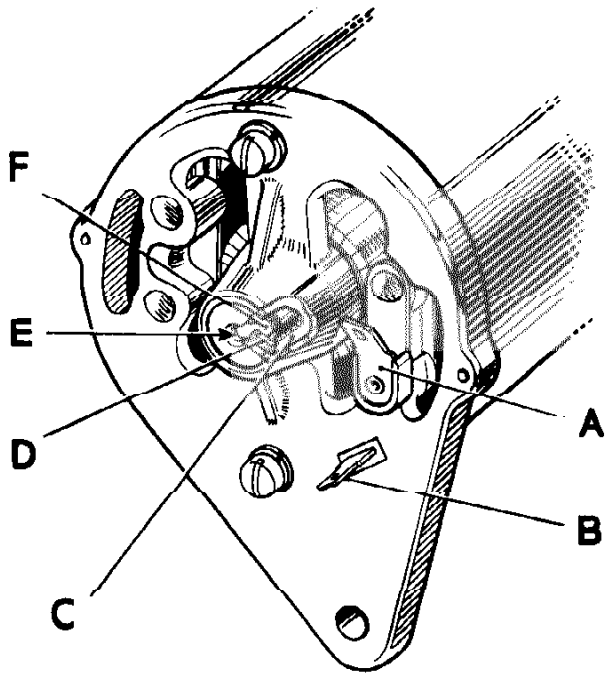


Figure O9

The dynamo commutator end bracket.

A. Output terminal "D".
B. Field terminal "F".
C. Porous bronze bush bearing.
D. Felt ring.
E. Inject oil here.
F. Felt ring retainer.

The front dynamo bearing is prepacked during initial assembly and will require no further lubrication. The rear dynamo bearing is an oil treated bronze bush and will require periodical lubrication.

Inject a few drops of oil, from an oil can, into the circular aperture in the rear bearing housing incorporated in the rear dynamo mounting bracket, where it will soak into a felt pad.

REMOVAL AND REPLACEMENT
DYNAMO

1. REMOVAL

Detach the electrical harness from the two Lucar connections on the rear dynamo mounting bracket. Remove the vee driving belt from the dynamo pulley as detailed in THE COOLING SYSTEM. SECTION C. Detach the dynamo from its mounting bracket between the two cylinder heads by withdrawing a clamp bolt and two pivot bolts and nuts.

2. REPLACEMENT

The replacement of the dynamo is the reversal of the removal sequence but particular attention must be given to the following points:

(i) That the vee drive belt is fitted and adjusted as detailed in THE COOLING SYSTEM, SECTION C.

(ii) That the electrical harness is fitted to the Lucar tabs in the rear mounting bracket according to their size.

CLEANING DYNAMO BRUSH GEAR
AND COMMUTATOR

REMOVAL AND REPLACEMENT
DYNAMO BRUSHES Fig. O10.

1. CLEANING

Remove one brush spring from the top of the brush inside the rear end of the dynamo, utilizing a thin rod fed through one of the windows in the rear dynamo mounting bracket. Partially lift the brush from its box and allow the brush spring to locate the indentation in the side face of the brush and so hold it away from the commutator. Repeat this operation with the second brush. Detach the rear dynamo mounting bracket from the dynamo by withdrawing the two through bolts and collecting the fibre thrust washer from the front end of the rear armature journal.

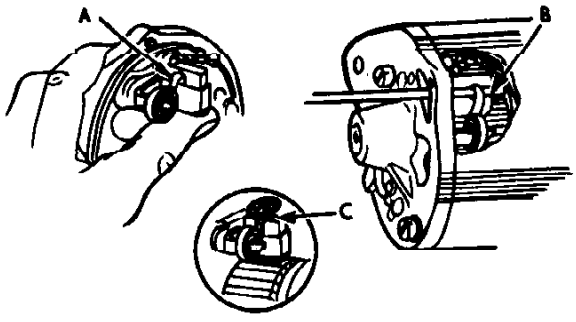


Figure O10.

Dynamo commutator end bracket showing method of holding brushes in position.

A. Brush spring locating indentation in brush.
B. Rod fed through window and lifting brush spring.
C. Brush spring finally located on top of brush.

Examine the brushes for freedom of movement by holding the brush spring clear and gently pulling on the flexible connection wires. When their movement is sluggish, remove the brush from the box, ease its fouling side by polishing it with a smooth file and wash both brush and box in petrol. Always return the brush to its original position.

Test the brush spring tension utilizing a spring balance and fit new brush springs when they record the minimum tension specified.

The commutator should be clean and have a polished appearance. When it is dirty, clean with a petrol soaked cloth while turning the armature by hand. Should this fail to clean completely, use a piece of fine glass paper and finish again with the petrol soaked cloth.

2. REMOVAL, BRUSHES

When the brushes are observed to be reduced in thickness to 0.250" (6.350 mm.) or below, remove the brushes from the rear dynamo mounting bracket by withdrawing one screw each. Fit the replacement brushes ensuring they have complete freedom of movement in their boxes.

3. REPLACEMENT

The replacement of the rear dynamo mounting bracket and brushes is the reversal of the removal sequence, but particular attention must be given to the following points:

(i) That the brushes are trapped in the top regions of their boxes by their brush springs.

(ii) That the fibre thrust washer is located on the front end of the rear armature journal by a smear of grease.

(iii) That the rear dynamo mounting bracket is offered up to the yoke so its locating dowel locates a recess in the latter.

(iv) That after the rear dynamo mounting bracket has been fitted, the brush springs are lifted by a thin rod fed through the ventilation windows in the rear and the brushes allowed to drop to the commutator and then the springs positioned on top of the brushes.

TESTING THE DYNAMO IN POSITION
TO LOCATE A FAULT IN THE CHARGING CIRCUIT

In the instance of a fault in the charging circuit, locate the cause of the trouble by the following procedure:

(i) Inspect the driving belt tension and adjust when necessary as detailed in THE COOLING SYSTEM, SECTION C.

(ii) Check the Lucar connections on the rear dynamo mounting bracket and ensure they are making good contact. The large connector carries the main dynamo output while the small connector, the field current.

(iii) Switch off all lamps and accessories, pull off the Lucar connectors from the rear dynamo mounting bracket and connect the two terminal blades with a short piece of wire. Start the engine and allow it to run at the normal idling speed. Clip the negative lead of a moving coil voltmeter, calibrated 0-20 volts, to the wire across the two terminals and the positive lead to a good earthing point on the dynamo.

Gradually increase the engine speed, when the voltmeter reading should rise rapidly and without fluctuation. Do not allow the voltmeter reading to reach 20 volts and do not race the engine in an attempt to increase the voltage. It is sufficient to run the dynamo up to a speed of 1,000 r.p.m.

When the voltmeter reading does not rise rapidly and without fluctuation as the engine speed increases, the dynamo must be removed and dismantled for an internal examination.

When the dynamo is judged to be in good order, remove the voltmeter, the link wire and fit the Lucar connections. In this instance it will be necessary to check the wiring and the control box in order to find the still persisting fault.

REMOVAL AND REPLACEMENT
FIELD COILS

1. REMOVAL

Have the dynamo stripped of its front and rear mounting brackets and armature. Drill

out the rivet securing the field coil terminal assembly to the yoke. Unsolder the field coil connection from the small Lucar terminal. It will be necessary to prise open the terminal clamp immediately the solder runs in order to avoid overheating the insulation.

Remove the insulation piece which is provided to prevent the junction of the field coils contacting the yoke. Identify the yoke and the pole shoes so that they can be returned to their original positions. Withdraw the two pole shoe retaining screws by means of a wheel operated screwdriver, remove the pole shoes and field coils from the yoke and separate the pole shoes and field coils.

2. REPLACEMENT Fig. O13.

Fit the replacement field coils over the pole shoes and position inside the yoke according to their identification markings, exercising care not to trap the taping of the field coils between the pole shoes and the yoke. Fit the pole retaining screws and tighten with a wheel operated screwdriver. Solder the field coil connections to the terminal assembly, fit the insulation piece between the field terminal tags and rivet the terminal assembly to the yoke.

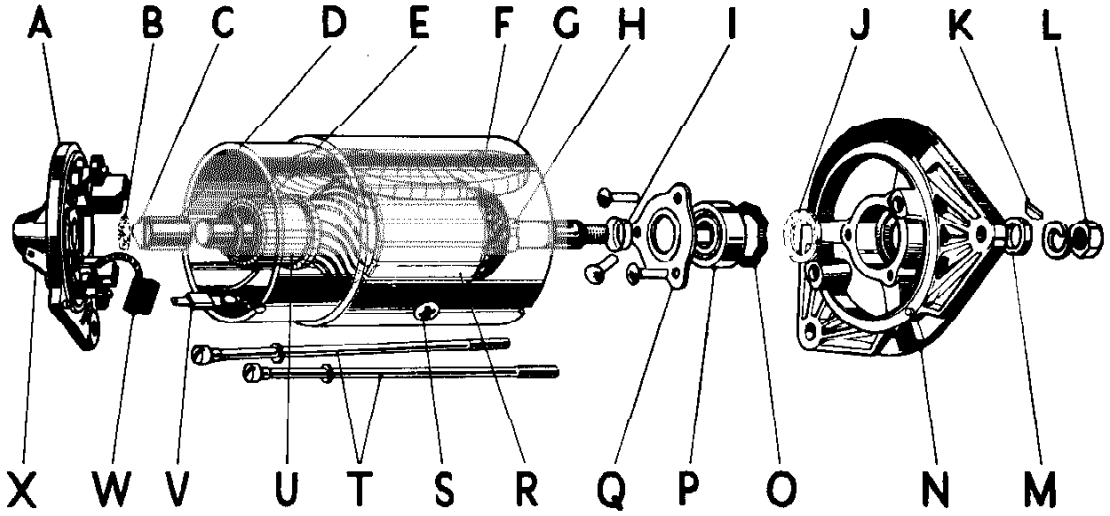


Figure O11.

Exploded details of dynamo.

A. Commutator and bracket.
B. Felt ring.
C. Felt ring retainer.
D. Porous bronze bush.
E. Fibre thrust washer.
F. Field coils.
G. Yoke.
H. Shaft washer.
I. Shaft collar retaining cup.
J. Felt ring.
K. Armature shaft key.
L. Shaft nut.
M. Bearing collar.
N. Front dynamo mounting bracket.
O. Corrugated washer.
P. Ballbearing race.
Q. Bearing retainer plate and rivets.
R. Armature.
S. Pole shoe retaining screws.
T. Through bolts.
U. Commutator face.
V. Field terminal "F".
W. Brushes.
X. Output terminal "D".

DISMANTLING AND ASSEMBLING DYNAMO Fig. O11.

1. DRIVE PULLEY

Remove the drive pulley and key from the front end of the dynamo by detaching a nut and utilising a suitable extractor.

2. REAR DYNAMO MOUNTING BRACKET AND BRUSHES

Remove one brush spring from the top of the brush inside the rear end of the dynamo,

utilizing a thin rod fed through one of the windows in the rear dynamo mounting bracket. Partially lift the brush out of its box and allow the brush spring to locate the indentation in the side face of the brush and so hold it away from the commutator. Repeat this operation with the second brush. Detach the rear dynamo mounting bracket from the dynamo by withdrawing the two through bolts and collecting the fibre thrust washer from the front end of the rear armature journal. Identify the brushes to their respective boxes and remove from the inside face of the rear dynamo mounting bracket by withdrawing two screws and releasing the brush springs.

3. FRONT DYNAMO MOUNTING BRACKET

Lift the front dynamo mounting bracket and armature from the yoke.

Press the armature from the inner bearing race in the front dynamo mounting bracket.

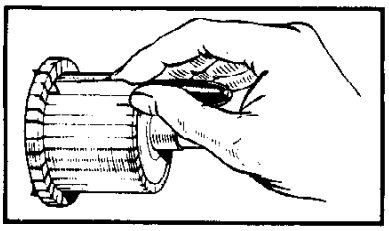
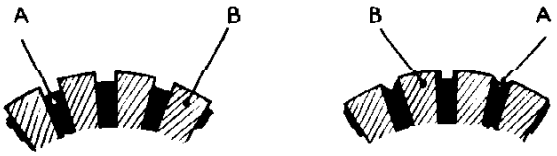


Figure O12.

Method of undercutting commutator.



A. Insulators.
B. Segments.

4. COMMUTATOR

The commutator incorporated in the rear end of the armature should be clean, smooth, free from pits and burnt spots. It can be cleaned with a petrol soaked cloth and when this is ineffective careful polishing with a piece of fine sand paper will probably suffice. When necessary, undercut the insulators between the armature segments to a depth of .0312" (0.793 mm.) utilizing a hack-saw blade ground to the width of the insulating material. When the commutator is well worn it can be mounted in a lathe, rotated at high speed and a light cut made with a diamond tipped tool and then the insulators under-cut.

5. ARMATURE

An open circuited armature winding will be indicated by burnt commutator segments and when armature testing facilities are not available, the armature can be checked by substitution.

6. FIELD COIL

Measure the resistance of the field coil without withdrawing them from the yoke by means of an ohm meter connected between the field coil and the yoke. When an ohm meter is not available connect a 12-volt battery between the field coil and the yoke with an ammeter in series. The ohm meter reading "infinity" or the ammeter reading "zero" indicates an open circuit in the field winding. When the readings of the ohm meter and ammeter are 6 ohms and 2 amperes respectively, the field coils are satisfactory. If the ohm meter reading is much less than 6 ohms and the ammeter reading more than two amperes, it indicates that the insulation of the field coils have broken down. In each instance, unless a replacement dynamo

is available replacement field coils must be fitted as detailed on page O15.

7. BEARINGS

Armature shaft bearings which have worn to such an extent that they allow sideways movement of the armature, must be replaced. The bush bearing in the rear dynamo mounting bracket can be withdrawn by screwing in a 5/8" diameter tap a number of turns and pulling the bush bearing out with the tap. Collect felt ring and retainer from the bottom of the bush bearing housing.

Remove the front ball bearing race by drilling out the three rivets in the rear face of the front dynamo mounting bracket and detaching the bearing retainer plate, press out the ball bearing race, corrugated washer and felt washer.

8. ASSEMBLING

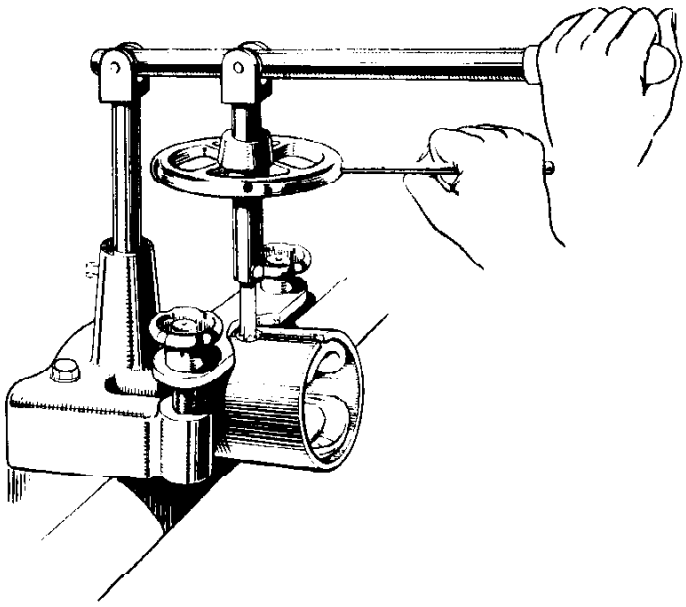


Figure O13.
Tightening pole shoe securing screws with wheel type screwdriver.

The assembling sequence of the dynamo is the reversal of the removal sequence, but particular attention must be given to the following points:

(a) That the front ball bearing race is packed with high melting point grease before it is pressed into the rear face of the front dynamo mounting bracket by its outer ring.

(b) That the rear bush bearing is soaked in oil for twenty-four hours before it is pressed in position with its visible face flush with the inside face of the rear dynamo mounting bracket.

(c) That the field coils are checked and fitted if necessary as detailed on page

(d) That the front dynamo mounting bracket is fitted to the front of the armature by applying pressure to the inner race and is located on the yoke by its dowel.

(e) That the fibre thrust washer is located on the rear journal of the armature with a smear of grease and the rear dynamo mounting bracket is also located on the yoke by its dowel.

THE CURRENT VOLTAGE CONTROL BOX

DATA

MODEL RB.310

VOLTAGE REGULATOR

OPEN CIRCUIT SETTINGS

Ambient temperatures	Voltage settings
50°F. (10°C.)	15.1 - 15.7
68°F. (20°C.)	14.9 - 15.5
86°F. (30°C.)	14.7 - 15.3

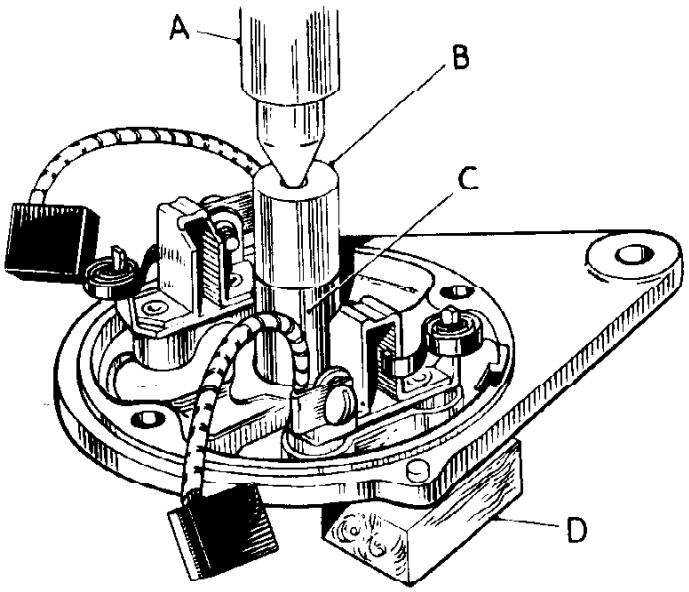


Figure O14.

Pressing in commutator end bracket bush bearings.

A. Hand press.
B. Shouldered mandrel.
C. Bush bearing.
D. Supporting block.

104°F. (40°C.)	14.5 - 15.1
Current setting	
Max. rated output of dynamo	22 amperes.

CUT-OUT RELAY

ELECTRICAL SETTINGS

Cut-in voltage	12.7 - 13.3
Drop off voltage	9.5 - 11.0

DESCRIPTION

The control box consists of three units all mounted on a common base plate and all but the Lucar connection tabs are covered. these are clearly identified by letters stamped on the top face of the cover "B", "F" and "D". The unit is attached to the R.H. side of the engine bulkhead by three screws so that the connections are upwards. The three units are as follows:-

(i) THE "CUT-OUT RELAY" is an automatic switch between the dynamo and battery. The cut-out relay will close the charging circuit when the dynamo output reaches the cut-in voltage and opens the charging circuit when the dynamo output falls below the cut-out voltage and so prevents the battery discharging back through the dynamo.

(ii) THE "CURRENT REGULATOR" limits the maximum current output of the dynamo in amperes. When the dynamo output reaches a pre-determined maximum the regulator points open, cuts a resistance into the dynamo field circuit, thus reducing the output. The points close, cutting out the resistance and the output rises. This cycle occurs so rapidly that the contact points vibrate at a high frequency, thus holding the dynamo output constant at a pre-determined maximum.

(iii) THE "VOLTAGE REGULATOR" is used for holding the voltage in the electrical system constant within close limits. When the voltage rises to a pre-determined value, the regulator points vibrate, thus cutting a resistance in and out of the dynamo field circuit.

The three units are accurately set during manufacture and will require no attention apart from occasional cleaning of the contact breaker points. BEFORE disturbing any settings of the control box make a thorough check through the charging system to ensure the fault does not lie outside the control box.

PRELIMINARY CHECK OF
THE CHARGING CIRCUIT Fig. O12.

(i) Check that the battery is fully charged by testing with a hydrometer and a heavy discharge tester.

(ii) Check the tension of the vee belt drive to ensure that it is not slipping and limiting the dynamos output.

(iii) Check the output of the dynamo by removing the electrical harness from the two terminals on the rear dynamo mounting bracket, connecting the two terminals together and applying the negative lead of a 0-20 volt moving coil volt meter to the connection and the positive lead to earth. Start the engine and run the dynamo up to 1,000 r.p.m. when a rising voltage should be shown. When no voltage is observed the fault lies in the dynamo which must be investigated.

(iv) Examine the wiring of the charging circuit for breaks, disconnections and carry out continuity tests between the dynamo, control box and ammeter.

(v) Check the earth connections, particularly that of the control box itself.

(vi) In the event of reported undercharging, ascertain that it is not due to low mileage and the excessive use of electrical equipment.

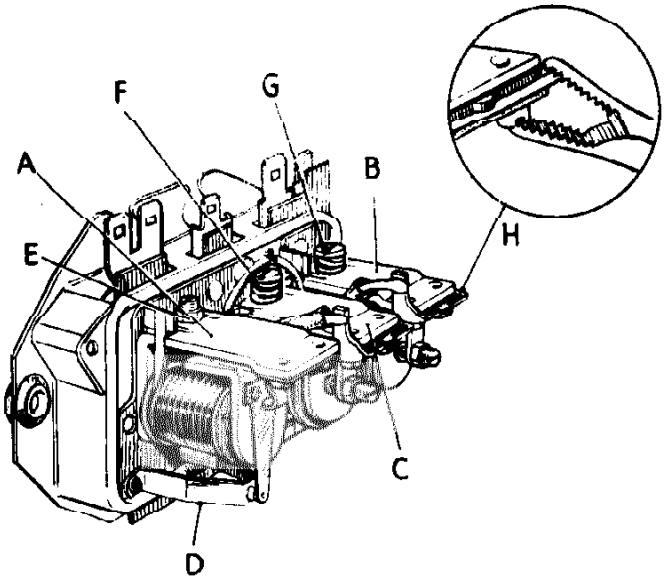


Figure O15.

The current voltage control box.

A. Cut out relay.
B. Voltage regulator.
C. Current regulator.
D. Cut out relay fixed contact post.
E. Cut in adjustment screw.
F. Current adjustment screw.
G. Voltage adjustment screw.
H. Fit crocodile clip here when setting "Current regulator".

CURRENT REGULATOR
METHOD OF ADJUSTMENT

Checking and adjusting should be completed as rapidly as possible to avoid false readings due to heating of the voltage coils.

Disconnect the control box cable "B" and connect a 0-20 moving coil voltmeter between the control box terminal "D" and a good earthing point. Start the engine and run the dynamo at 3,000 r.p.m., engine speed will be approximately 2,100 r.p.m. Observe the voltmeter reading, which should lie between the appropriate limits given under "OPEN CIRCUIT SETTINGS", page O18 according to the temperature. Switch off the engine as early as possible.

An unsteady voltmeter reading may be due to dirty or loose contacts. When the voltmeter

reading occurs outside the specified limits, an adjustment must be made, which can be effected as follows:-

(i) Detach the cover from the control box by withdrawing two screws.

(ii) Restart the engine and run the dynamo at 3,000 r.p.m. as previously detailed.

(iii) Turn the voltage adjustment screw, adjacent to Lucar connection "D"; clockwise to increase the setting or anti-clockwise to lower it, until the correct setting is obtained.

(iv) Stop the engine, then restart and again raise the dynamo speed to 3,000 r.p.m. as previously detailed and check the voltage setting, making any adjustment that may be necessary and then stop the engine.

(v) Restore the original connections and replace the control box cover and tighten its two securing screws.

CURRENT REGULATOR
ON-LOAD SETTING

The current regulator on-load setting is equal to the maximum rated output of the dynamo as specified on page O12.

METHOD OF ADJUSTMENT

The dynamo must be made to develop its maximum rated output whatever the charge state of the battery might be at the time of the setting. The voltage regulator must, therefore, be rendered inoperative and for this purpose a crocodile clip is used to short its contacts.

Detach the control box cover from the control box by withdrawing two screws. Fit the crocodile clip between the insulated fixed contact bracket of the voltage regulator and voltage regulator frame. Disconnect the cable from the control box terminal "B" and connect a 0 to 40 moving coil ammeter between the end of the cable and the terminal "B". Switch on all lamps and electrical accessories. Start the engine and run the dynamo up to 4,000 r.p.m., engine speed will be approximately 2,800 r.p.m. Observe the ammeter reading which should be indicating the maximum rated output of the dynamo as specified on page O12.

An unsteady ammeter reading may be due to dirty or loose contacts. When the ammeter reading is outside the specified limits, an adjustment must be made, which can be effected as follows:

(i) Turn the current adjustment screwadjacent to the Lucar connection "B"; clockwise to increase the setting or anti-clockwise to lower it, until the correct setting is obtained. Stop the engine.

(ii) Restore the original connections and replace the control box cover and tighten its two securing screws.

CUT-OUT RELAY

1. METHOD OF CUT-IN ADJUSTMENT

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

Connect a 0-20 moving coil voltmeter between the control box terminal "D" and a good earthing point. Switch on an electrical load such as the headlamps. Start the engine and slowly increase its speed while observing the voltmeter reading. Closure of the cut-out relay contacts, indicated by a slight drop in the voltmeter reading should occur between those voltages specified under "ELELECTRICAL SETTINGS, CUT-IN VOLTAGE" on page O19. When the "cut-in" occurs outside the specified limits, an adjustment must be made, which can be effected as follows:-

(i) Detach the cover from the control box by withdrawing two screws.

(ii) Slacken the locknut on the cut-out relay adjusting screw, adjacent to the Lucar connection "B". Turn the screw, clockwise to increase the setting or anti-clockwise to decrease it, until the specified setting is obtained. Hold the screw steady while tightening its locknut and stop the engine.

(iii) Restore the original connections and replace the control box cover and tighten its two securing screws.

2. METHOD OF DROP-OFF ADJUSTMENT

Disconnect the cable from the control box terminal "B" and connect a 0-20 volt moving coil voltmeter between the "B" terminal and a good earth. Start the engine and run up to speed, slowly decelerate while observing the voltmeter reading. Opening of the contacts will be indicated by the voltmeter reading dropping to zero and should occur between the limits specified under "ELECTRICAL SETTINGS, Drop-off voltage" on page O19. When the drop off occurs outside the specified limits an adjustment must be made which can be effected as follows:-

(i) Stop the engine and detach the control box cover by withdrawing two screws.

(ii) Set the height of the fixed contact post by carefully bowing its legs to reduce the drop off setting or straightening the legs to increase the drop off setting.

(iii) Start the engine and repeat the previous sequence and stop the engine to make any adjustments until the specified drop off setting is obtained.

(iv) Restore the original connections and replace the control box cover and tighten its two securing screws.

CLEANING THE CONTACTS

1. REGULATOR CONTACTS

Clean the voltage or current regulator contacts utilizing a fine carborundum stone or silicon carbide paper and then wash with methylated spirit (denatured alcohol).

2. CUT-OUT RELAY CONTACTS

Clean the cut-out relay contacts utilizing a strip of fine grade glass paper - NEVER carborundum stone or emery cloth.

THE FUSE BOX

DESCRIPTION

A fuse box having two fuses in circuit and two spares is situated on the R.H. wing valance inside the engine compartment adjacent to the control box. The front fuse is in circuit with the flasher direction indicator lamps, the petrol gauge, the engine temperature gauge and the wind-screen wiper. Failure of all these components will indicate a spent front fuse. The rear fuse is in circuit with the horns and the failure of the horns to operate will indicate a spent rear fuse.

REMOVAL AND REPLACEMENT
FUSES

1. REMOVAL

The spent fuse can be recognised by failure of the electrical components with which it is in circuit and by its burnt appearance. Lift the spent fuse from its spring clips and keep by, so that a replacement of the same value can be purchased.

2. REPLACEMENT

Before fitting the replacement fuse, which must be of the same value as the original, inspect the wiring of the units with which it is in circuit in an attempt to locate the cause of the failure. In many cases the failure is due to fuse fatigue.

Remove one of the spares from its stowage and press into the spring clips. A smear of petroleum jelly not only prevents corrosion but facilitates the fitting and removal operation. Procure a replacement fuse at the earliest opportunity.

THE WINDSCREEN WIPER

DATA

Model	D.R.2.
Voltage	12
Type of motor	Shunt wound.
Resistance of armature Winding at 60°F. (15.5°C)	0.29 - 0.35 ohm. measured between adjacent commutator segments.
Resistance of field winding at 60°F. (15.5°C.)	8.0 - 9.5 ohm.
Pressure of brushes against commutator	125 - 140 grammes.
Armature end play.	0.008" - 0.012" 0.203 - 0.304 mm.
Light running current consumption (less cable rack) measured after 60 seconds.	2.7 - 3.4 amperes.
Light running speed measured after 60 seconds.	44-48 r.p.m. of the final gear or cycles per minute of the wiper blades.
Maximum permissible force required to move cable rack in protective tubing with motor arms and blades disconnected.	6.0 lbs. (2.722 kilograms)

DESCRIPTION Fig. O16.

The windscreen wiper motor and gearbox is mounted on a plate in the engine compartment between the battery and the outside skin of the body on the opposite side to the steering unit.

The rotary motion of the windscreen wiper motor armature is converted to the reciprocating motion of the cable rack by means of a single stage worm and nylon gear reduction drive. A connecting rod and cross head in the gearbox casing actuates the cable rack which passes through protective tube to the two wheel box beneath the top face of the car body. The rack consists of a flexible core of steel wire wound with a wire helix which engages with a gear in each wheel box and thus transmits the reciprocating movement to the wiper arm spindles.

The arms and blades return automatically to the parked position irrespective of their whereabouts on the windscreen at the instant of switching off. This self-switching feature is arranged by means of a normally closed limit switch located under the domed cover of the gearbox. For the greater part of each wiping cycle this switch provides an earth return path for the motor current in parallel with that provided by the wiper control switch. The moving contact consists of a phosphor bronze blade carried by an electrical contact with the earthed crank pin. This contact bears against a brass plate rivetted to, but insulated from, a domed cover. The brass plate consists of a disc from which a sector has been cut and is connected to the motor windings by way of a cable and terminal tag positioned on top of the domed cover.

On switching off at the windscreen wiper control switch, the motor continues to run until the moving contact passes on to the insulated sector portion and so interrupts the earth return circuit and stops the motor. The domed cover is angularly adjustable for obtaining the correct park position of the wiper blades, the position of the domed cover determining the instant in the wiping circle when the moving contact will reach the insulated portion of its travel.

No direct maintenance is necessary as the gearbox, cable rack and wheel boxes are greased during the initial assembly of the car and will require not periodical lubrication. Efficient wiping is dependent solely upon having a clean windscreen glass and the wiper blades being in good

condition. Worn or perished wiper blades are easily removed for replacement.

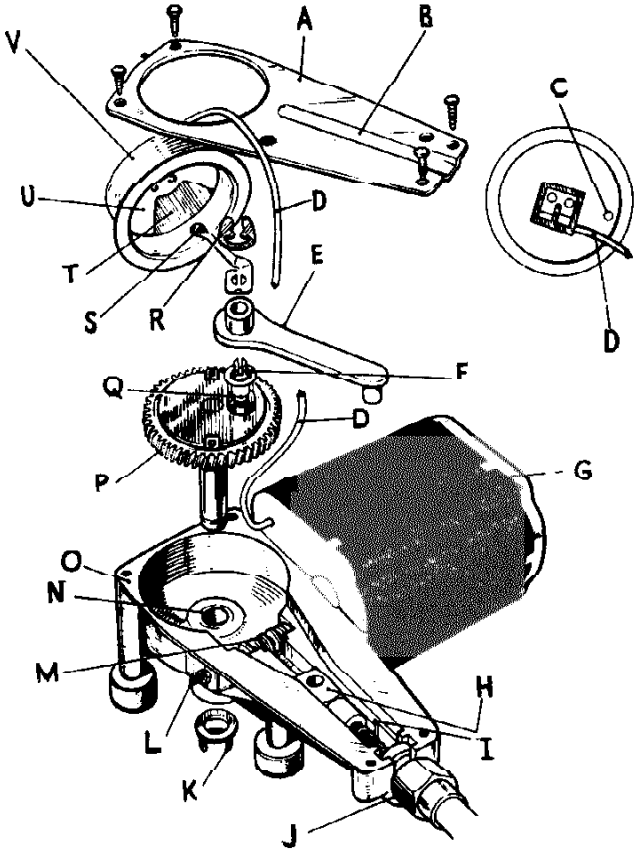


Figure O16.

Exploded details of windscreen wiper motor.

A. Gearbox cover.
B. Centre groove.
C. Domed cover setting pip.
D. Cable from domed cover to motor.
E. Connecting rod.
F. Pen steel washer.
G. Motor assembly.
H. Cable rack crosshead.
I. Guide channel.
J. Tubing securing nut.
K. Circlip and washer.
L. Armature end float adjusting screw.
M. Worm gear.
N. Porous bronze bush.
O. Gearbox casing.
P. Final gear.
Q. Crank pin.
R. Circlip.
S. Limit switch moving contact.
T. Insulated sector.
U. Limit switch fixed contact.
V. Domed cover.

FAULT DIAGNOSIS

Imperfect operation of the windscreen wipers can either be electrical or mechanical, and not necessarily due to a faulty windscree wiper motor. The following are some of the faults and causes and other tests are detailed later.

(i) Low voltage at the windscreen wiper motor, due to a low charged battery or dirty connections.

(ii) Cable rack binding in its tubing due to kinks, mis-alignment or lack of lubrication.

(iii) Excessive loading on the wiper blades due to tight joints.

(iv) Wiper arm spindles binding in the wheel boxes due to loose fitting of the latter and lack of lubrication.

TESTING

Unless the origin of the fault is obvious, the following checks must be effected to determine the cause of the failure.

1. CHECKING THE SUPPLY VOLTAGE

Connect a 0-20 volt moving coil voltmeter between the motor supply terminal No. "2" and a good earthing point. Switch on the windscreen wiper and the ignition while observing the

voltmeter, note the reading, switch off the ignition and the windscreen wiper switch.

The voltmeter should read 11.5 volts and when a lower reading is observed, check the charge state of the battery and the condition of the switch, cable and connections

2. CHECKING LIGHT RUNNING
SPEED AND CURRENT CONSUMPTION

When it has been determined that the current supply is correct, remove the windscreen wiper blades and arms as detailed on page O26 and proceed to remove the cable rack from the windscreen wiper motor as detailed below, but only detach the gearbox cover at this juncture.

Check the speed of rack operation by counting the cycles per minute of the cross-head moving in its channel in the nose of the gearbox by switching on the ignition and windscreen wiper and effecting the count after it has been running a minute. Switch off both switches and when the speed differs from that specified on page O23 the current consumption must be checked by examining the cable rack.

Complete the cable rack removal from the wiper motor gearbox and connect a 0-20 moving coil ammeter across the supply terminal No. 2 and a good earthing point. Switch on the ignition and the windscreen wiper while observing the ammeter, note the reading after it has been running for longer than a minute. Switch off both switches.

When the determined amperage differs from that specified on page O23 a replacement windscreen wiper motor must be fitted or the faulty one dismantled and examined internally.

3. CHECKING CABLE RACK AND TUBING

Remove the connecting rod from the gearbox of the windscreen wiper motor as detailed in the REMOVAL AND REPLACE MENT, CABLE RACK, below, and move the windscreen wiper blades and arms away from the windscreen.

Press the crosshead of the cable rack toward the apex of the gearbox and suitably attach the hook of a small spring balance in the crosshead hole and withdraw the cable out of the tubing by pulling on the spring balance. Observe the pointer of the latter and note the "weight" required.

When the determined weight differs from that specified, the cable rack and tubing must be detached from the body of the car and the cause diagnosed. Binding of the cable rack can be due to kinking or flattening of the tube or faulty installation.

REMOVAL AND REPLACEMENT
CABLE RACK AND TUBE FROM
WINDSCREEN WIPER MOTOR

1. REMOVAL

Remove the battery from the rear engine bulkhead as detailed on page O12. Identify the position of the domed cover and the four screws to their respective positions in the gearbox top cover. Remove the gearbox top cover from the top of the windscreen wiper gearbox by withdrawing the four screws. Identify the position of the circlip on the top of the crank pin. Detach the connecting rod from the crosshead at the end of the cable rack and the crank pin of the final gear by removing a circlip and the limit switch moving contact, exercising care not to mislay the pen steel washer beneath the connecting rod. Remove the cable rack and tube from the apex of the gearbox by slackening a nut on the outside face and withdrawing a screwed adaptor from inside the gearbox. Detach the windscreen wiper arms and draw out the cable rack.

2. REPLACEMENT

The replacement of the cable rack and tube to the windscreen wiper motor is the reversal but particular attention must be given to the following points:-

a. That the circlip is fitted to the final gear crank pin on top of the limit switch moving contact in the same attitude as it was before it was removed.

b. That the domed cover fitted to the top of the gearbox cover is returned to its particular position for this controls the parking of the windscreen wiper blades.

c. That the four self-tapping screws securing the gearbox top cover are returned to their original positions.

REMOVAL AND REPLACEMENT
WINDSCREEN WIPER MOTOR

1. REMOVAL

Remove the battery from the rear engine bulkhead as detailed on page O12 and detach tne electrical harness from the windscreen wiper motor. Remove the cable rack and tube from the gearbox as detailed on page O25. Remove the windscreen wiper motor mounting plate with motor attached from the inside skin of the body at the rear corner of the engine compartment by withdrawing four screws. Detach the windscreen wiper motor from its mounting plate by removing three nuts.

2. REPLACEMENT

The replacement of the windscreen wiper motor is the reversal of the removal sequence, but particular attention is given to the following point:

That the motor limit switch is set as detailed on page O27

REMOVAL AND REPLACEMENT
WIPER ARM WHEELBOX

1. REMOVAL

Remove the windscreen wiper blade arms from the spindle of the wheel box by lifting the retaining clip on the inside of the wiper arm and pulling the head piece off the wheelbox shaft. Detach the escutcheon plate from the outside of the wheelbox by removing the external nut. Withdraw the wheelbox from inside the car under the instrument facia by detaching it from the tubes after removing two screws. When the wheelbox furthest from the windscreen wiper motor is detached it is possible to withdraw the two tubes housing the cable rack.

2. REPLACEMENT

The replacement of the wiper arm wheelbox is the reversal of the removal sequence.

REMOVAL AND REPLACEMENT
WINDSCREEN WIPER BLADES AND ARMS Figs. O17 and O18.

1. WINDSCREEN WIPER BLADES

Hinge the windscreen wiper arm away from the windscreen and remove the blade assembly from its curved end by a circular movement.

2. WINDSCREEN WIPER ARMS

Detach the windscreen wiper arms from the splined driving drums on the wheelbox spindle by lifting the retaining clip and pulling the head of the arm outward.

3. REPLACEMENT

The replacement of the windscreen wiper blade is the reversal of the removal sequence, but particular attention must be given to the following points:-

(i) That the windscreen wiper motor is switched on and then switched off to enable the wheelbox spindle to attain their correct parked position.

(ii) That the head of the windscreen wiper arm is pressed on the splined driving drum on the wheelbox spindle until the retaining clip locates behind the splined drum.

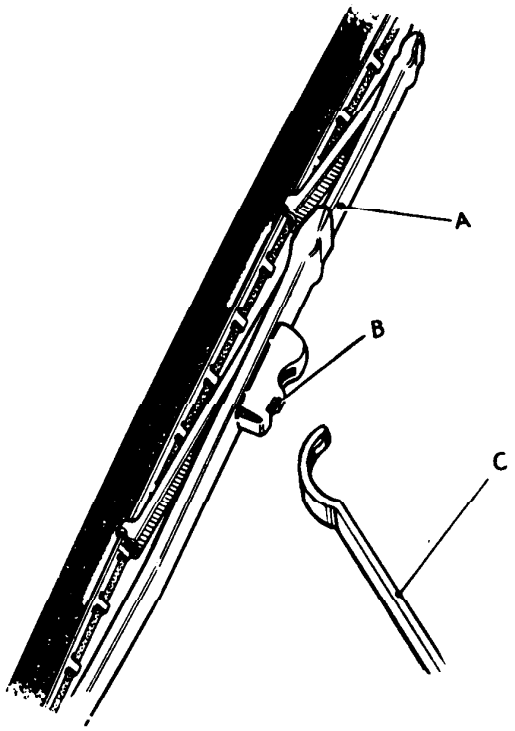


Figure O17.

The windscreen wiper blade and arm assembly.

A. Windscreen wiper blade.
B. Entry slot.
C. Windscreen wiper arm.

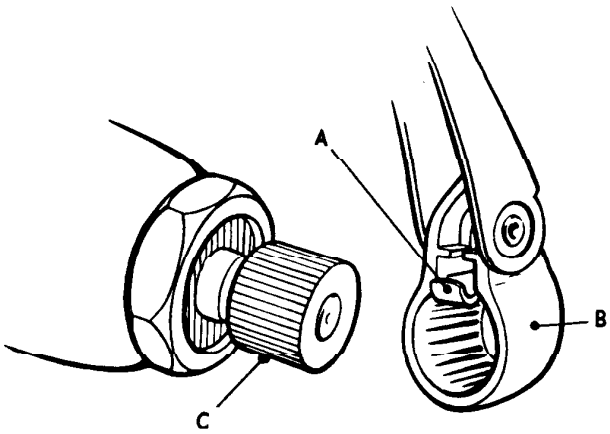


Figure O18.

The windscreen wiper arm and splined drum of wheelbox.

A. Windscreen wiper arm retaining clip.
B. Windscreen wiper arm head.
C. Splined drum of wheelbox.

(iii) That the angular distance from spline to spline of the splined driving drum is 5^{o}.

SETTING WINDSCREEN WIPER MOTOR LIMIT SWITCH

Slacken the four gearbox cover securing screws sufficiently to free the domed cover. Align the "pip" on the top face of the domed cover with the centre groove of the gearbox cover. Dampen the windscreen to lubricate the wiper blades. switch on the ignition and the windscreen wiper; allow the blades to oscillate several times. Switch off the windscreen wiper, then the ignition and observe the position of the windscreen wiper blade parking. When it is desired to park the windscreen wiper blades on the opposite side of the windscreen, rotate the domed cover 180^{o} so its pipe is on the opposite side to the gearbox cover groove. Dampen the windscreen to lubricate the

wiper blades, switch on the ignition and the windscreen wiper; allow the blades to oscillate several times. Switch off the windscreen wiper, then the ignition and observe the position of the windscreen wiper blade parking. Set the position of the domed cover "pip" so the blades will park just before the conclusion of their downward stroke. This will reduce the load on the windscreen wiper motor on starting. Test the parking as previously detailed until perfection is attained. Switch off the ignition and windscreen wiper switches.

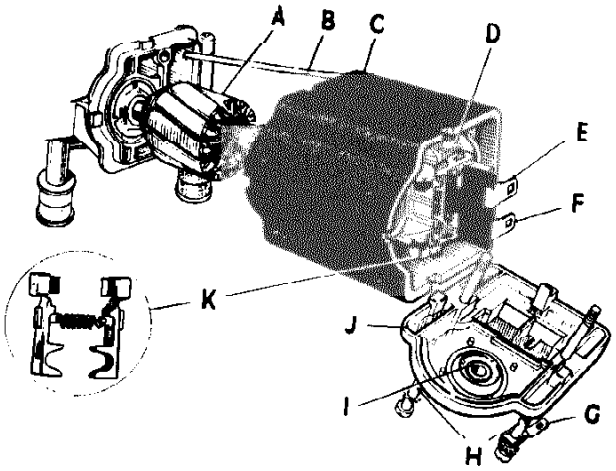


Figure O19.

Exploded details of windscreen wiper motor.

A. Armature
B. Cable from domed cover to motor.
C. Yoke.
D. Field coil assembly.
E. Supply terminal "2"
F. Supply terminal "1"
G. Earthing terminal "E"
H. Through bolts.
I. Porous bronze bush.
J. Commutator end cover.
K. Brush gear assembly.

DISMANTLING AND ASSEMBLING
WINDSCREEN WIPER MOTOR Fig. O19.

1. DISMANTLING

Detach the flexible cable from the tab on top of the domed cover by unsoldering. Remove the cover from the gearbox casing by withdrawing four self-tapping screws after identifying them to their respective positions. Detach the circlip from the outer end of the final drive gear spindle situated on the external face between the mounting studs and remove any burrs around the circlip groove so the bore will not be scored as the final gear is withdrawn from the gearbox, withdraw the final gear. Detach the connecting rod, limit switch moving contact and pen steel washer from the crankpin in the top face of the final gear by removing the circlip after identifying its position. Remove the commutator end cover from the end of the yoke by withdrawing the through bolts. Identify the position of the two brush arms and spring "off" the brush gear from its locating pegs. Withdraw the armature and gearbox casing from the yoke and withdraw the armature and worm gear from the gearbox casing. Remove the field core assembly from inside the yoke by removing two self-tapping screws after identifying them to their respective positions.

2. ASSEMBLING

The assembling of the windscreen wiper motor is the reversal of the removal sequence, but particular attention must be given to the following points:-

(i) That all the bearing surfaces are greased as they are assembled , every precaution must be taken to ensure that the commutator and brush gear does not become contaminated with lubricant.

(ii) That the Oiline B.B.B. Oil is applied sparingly to the worm gear shaft and two armature bearings also to the felt backing washers, but these must not be overloaded, this oil is also applied to the shaft of the final gear shaft.

(iii) That Rocol Molypad molybdenised oil is applied to the crankpin and Ragasine Listate grease to the connecting rod pin, the crosshead and guide channel also,

before the gearbox cover is fitted, approximately 30 c.c.'s of this grease is applied to the faces of the worm and final gears.

(iv) That the self-tapping screws are fitted to their respective holes identified during the dismantling sequence.

(v) That the pen steel washer, connecting rod, limit switch moving contact and retaining circlip are fitted to the final gear crankpin by giving particular attention to their identification markings.

(vi) That the armature endfloat is set by the adjusting screw and locknut provided in the gearbox casing side for this purpose.

(vii) That the used brush gear is replaced to its correct position by giving particular attention to their identification markings, ensuring that they move freely about their pivots and do not foul the commutator tags or connections. The pressure exerted by the brushes on the commutator should be 125 to 140 grammes.

WINDSCREEN WIPER SWITCH

The windscreen wiper switch is situated on the R.H. side of the centre instrument panel and is of the two position type:-

(i) UPWARD	Windscreen wiper	OFF
(ii) DOWNWARD	Windscreen wiper	ON

REMOVAL AND REPLACEMENT
WINDSCREEN WIPER SWITCH

1. REMOVAL

Detach the earthing lead from the battery and the harness from the windscreen wiper switch on the rear face of the centre instrument panel. Remove the windscreen wiper switch from the centre instrument panel by removing a nut from its front face.

2. REPLACEMENT

The replacement of the windscreen wiper switch is the reversal of the removal sequence.

THE STARTER MOTOR

DATA

Model	M.418.G (Inboard drive)
Lock torque	17 lb.ft. at 440-460 amps at 7.0 - 8.4 volts.
Torque at 1,000 r.p.m.	8 lb.ft. at 250 - 270 amps at 9.0 - 9.4 volts.
Light running current	45 amps at 7,400 - 8,500 r.p.m.
Brush spring tension	30 - 40 ozs.
Minimum thickness of brushes before renewal	0.3125" (7.9375 mm.)

DESCRIPTION Fig. O20.

The electric starter motor is a series wound four pole, four brush machine of similar design and construction to the dynamo but heavier copper wire is used in the winding of the armature and field coils. The field coils are parallel-connected between the field terminal and the insulated pair of brushes. The armature has an extended shaft at its rear end and this carries the starter motor drive assembly which includes the pinion gear for flywheel starter ring engagement. There

is also a short squared extension of the armature shaft at its front end, to facilitate the withdrawal of the spring loaded pinion gear should it ever become jammed in mesh with the flywheel ring gear.

MAINTENANCE

EVERY 10,000 MILES (16,100 kms.)

Clean electric starter motor commutator and brush gear.

EVERY 20,000 MILES (32,200 kms.)

Fit replacement brush gear.

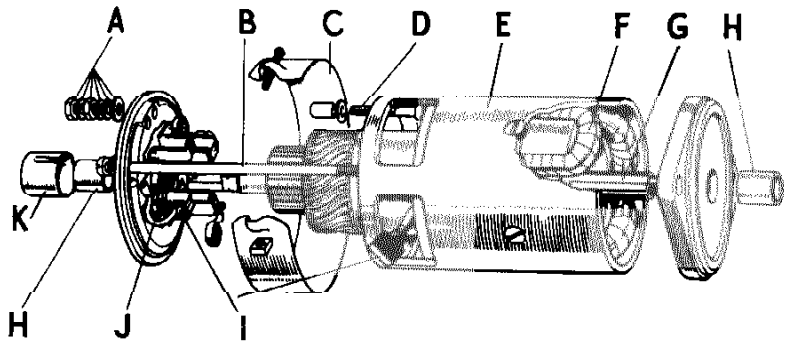


Figure O20.
Exploded details of starter motor.

A. Terminal nuts and washers.
B. Through bolt.
C. Band cover.
D. Terminal post.
E. Yoke.
F. Field coil.
G. Splined end of armature shaft.
H. Porous bush bearing.
I. Brushes.
J. Brush spring.
K. Protective cap.

TESTING THE STARTER MOTOR

1. FITTED TO THE CAR

Ensure neutral gear is selected and the handbrake is hard on. Switch on the headlights and start the engine by turning the ignition key while observing the ignition warning lamp or the glow of the headlamps. When the ignition warning lamp or headlamps go out or dim appreciably without turning the starter motor at sufficient speed to start the engine; switch off the ignition and lights. Exchange the battery for one that it known to be fully charged.

Repeat the test with the exchange battery and when the ignition warning lamp goes out or the headlamps dim and the starter motor fails to operate satisfactorily, remove the starter motor for examination.

When there is no change in the glow of the lamps but the starter motor still fails to operate, check the battery supply at the starter motor terminal with a voltmeter or test lamp across the terminal and a good earth point.

Should the result of the test prove negative, check the electrical circuit between the battery, the starter motor and the solenoid starter switch. A full voltmeter reading or full brilliance of the test lamp will indicate that the circuit is in order but the starter motor faulty which must be removed for examination.

In instances of the starter motor operating but its pinion gear failing to engage the flywheel starter ring, it indicates a weak battery or a sluggish starter motor drive assembly. Exchange the battery for one that is known to be fully charged.

Repeat the test with the exchange battery and when satisfactory operation of the starter motor is still not experienced, it must be removed and the starter motor drive assembly examined.

The starter motor requires a great deal of battery current to rotate it and in isolated instances it may appear to be cranking the engine quite satisfactorily but it refuses to fire.

This is due to the battery being drained by the starter motor leaving no current for the ignition system. Continued use of the starter will soon exhaust the battery as it is in a low state of charge.

2. ON THE BENCH

Remove the cover band from the yoke of the starter motor by slackening the pinch bolt drawing it off. Mount the starter motor in a vice and connect to a fully charged 12 volt battery; the cables must be of 37/20 P.V.C. I.S.C. wire and with a 0-50 moving coil amperes ammeter in circuit. Under light loading conditions the starter motor should run at a very high speed without excessive noise or sparking at the commutator and the starter motor drive pinion gear should move up the extended front shaft immediately the motor starts. The ammeter reading should indicate the current consumption specified on page O29.

When the operation of the starter motor is unsatisfactory, examine the brush gear and commutator. Hold back one of the brush springs and move the brush in its box by moving it with the flexible connector. When the movement is sluggish, it must be removed from its box and its high spot eased off with a smooth file and then replaced to its original position. The operation is repeated with all four brushes.

Should the brushes have worn to below the specified minimum length they must be replaced as detailed on page O33.

Check the tension of the brush springs with a spring scale and fit replacements when the tension indicated is below that specified.

When the commutator is blackened or dirty it must be cleaned as detailed on page O35

Retest the starter motor as previously detailed and if its performance is still unsatisfactory it must be dismantled for inspection as detailed on page O32.

STARTER MOTOR DRIVE

DESCRIPTION

The starter pinion gear is mounted on a threaded sleeve carried on the splined front end of the starter motor armature shaft. The sleeve is so arranged that it will move along the armature shaft in order to reduce the shock loading at the moment pinion engagement with the flywheel ring gear takes place.

When the starter motor switch is operated, the armature and screwed sleeve rotate and because of the inertia of the starter pinion gear, the screwed sleeve turns inside the pinion gear causing the latter to move along the length of the screwed sleeve, engage the flywheel ring gear and so turn the engine flywheel.

If the ignition is switched on the engine will start and commence to run under its own power and the flywheel will begin to run faster than when driven by the starter motor. This will result in the starter pinion gear moving back along the screwed sleeve and out of mesh with the flywheel ring gear teeth. In this manner the starter motor is safeguarded against damage due to it being driven at high speeds by the engine.

A pinion restraint spring fitted on a freely mounted sleeve on the armature shaft prevents the pinion gear being vibrated into contact with the flywheel ring gear while the engine is running.

DISMANTLING AND ASSEMBLING
STARTER MOTOR DRIVE Fig. O21.

1. DISMANTLING

Mount the starter motor in a vice and remove the cap from the commutator end cover and hold the squared end of the armature shaft stationary with a spanner. Remove the split pin from the second end of the armature shaft and detach the castellated nut. Withdraw the main spring, washer, screwed sleeve and pinion, collar, pinion restraining sleeve and spring.

2. ASSEMBLING

The assembling of the starter motor drive is the reversal of the dismantling sequence, but

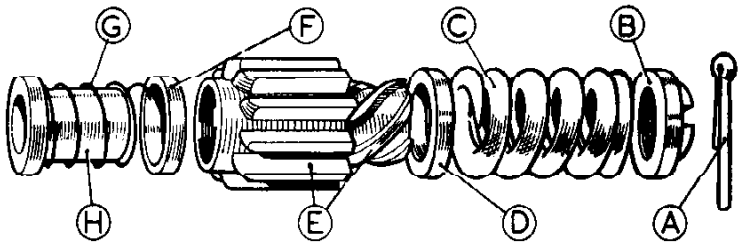


Figure O21.
The starter motor drive.

A. Split pin.
B. Shaft nut.
C. Main spring.
D. Washer.
E. Screwed sleeve and pinion gear.
F. Collar.
G. Restraining spring.
H. Restraining spring sleeve.

particular attention must be given to the following points:-

(i) That when the pinion gear has worn sufficiently to require a replacement both pinion gear and screwed sleeve must be replaced as they are a match pair.

(ii) That all the components are a sliding fit on the end of the armature shaft without any tight spots.

(iii) That the components are replaced and lubricated sparingly with light oil and sothat the chamfered end of the pinion teeth are toward the main body of the starter motor.

ENGAGEMENT OF STARTER MOTOR DRIVE

When difficulty is experienced with the pinion gear of the starter motor drive even though a fully charged battery is fitted, it indicates that the starter motor drive is dirty as the pinion gear is failing to move along the threaded sleeve on which it is mounted. The cleaning of the pinion gear and sleeve must be effected and necessitates the removal of the starter motor from the engine unit.

CLEANING

Position the starter motor on a bench top so that the drive end is above the commutator end and hold the squared end of the armature shaft at the second end of the starter motor under a small cap stationary with a spanner. Rotate the pinion gear until the thread of the sleeve becomes visible and run methylated spirit between the gear and the sleeve while rotating the pinion gear to get the best cleaning effect. The spanner can be removed and the methylated spirit run in from another circumferential position, continue until the mating surfaces are clean. Lubricate sparingly with thin machine oil and fit to engine unit.

DISMANTLING AND ASSEMBLING
STARTER MOTOR

1. STARTER MOTOR DRIVE ASSEMBLY

Dismantle the starter motor drive assembly from the splined end of the armature shaft as detailed on page O31.

2. COMMUTATOR END

Remove the band cover from the commutator end of the starter motor by slackening the pinch bolt and drawing it off the yoke. Withdraw the four brushes from their boxes by holding back each brush spring in turn and pulling gently on the flexible connections. Remove the nuts and washers from the terminal post protruding through the commutator end cover. Detach the commutator end cover from the yoke by withdrawing two through bolts.

3. STARTER MOTOR MOUNTING BRACKET

Withdraw the armature and starter motor mounting bracket from the front end of the yoke and the armature from the mounting bracket.

4. BRUSH GEAR

Detach one pair of brushes from the commutator end cover and the second pair of brushes from the field coils in the yoke by unsoldering the end tags.

5. ARMATURE

The armature will have already been withdrawn from the mounting bracket and no further dismantling is possible. However, it can be examined for loose and lifted conductors and then mounted in a lathe to see if it runs true. There is no salvage for an armature with excessive run-out.

6. FIELD COILS

Test the field coils for continuity and insulation as detailed below.

Remove the insulation piece from between the intercoil connectors and yoke, identify the yoke and pole shoes so these interconnections can be replaced to their original positions. Withdraw the two pole shoes and field coils from inside the yoke by removing two side screws utilizing a wheel operated screwdriver. Lift the field coils from the pole shoes.

7. BEARINGS Fig. O22.

Eject the armature bush bearings from the two end covers utilizing a shouldered mandrel and a small press.

8. ASSEMBLING

The assembly of the starter motor is the reversal of the removal sequence, but particular attention must be given to the following points:

(i) That, before fitting new armature shaft bearings to the end covers, they must be soaked in clean thin engine oil for at least 24 hours. Only in the instances of extreme urgency can this period be shortened and then by keeping the oil at a temperature of 212°F. (100°C.) and soaking the bush bearings for two hours and then allowing the oil to cool before removing the bush bearings. The latter is MOST important.

(ii) That when fitting replacement field coils, offer them up to the pole shoes and position both inside the yoke according to their identification markings exercising care not to trap any of the tapings between the pole shoes and the yoke. Locate the pole shoes and the field coils by lightly tightening the securing screws and fully tighten the securing screws with a wheel operated screwdriver replacing the insulation piece between the inter-coil connectors and the yoke.

(iii) That the armature conductors are quite firmly positioned in the commutator and the latter has a clean polished appearance; reference should be made to "CLEANING STARTER MOTOR BRUSH GEAR" on page O34.

TESTING THE FIELD COILS

Test the field coils for continuity by connecting a 12-volt lamp and battery to the starter motor terminal and each field brush in turn. The glowing of the lamp will not necessarily indicate that the field coils are in order, as it is possible for one to be short circuiting through a pole shoe or yoke.

The insulation can be checked with an 110 volt test lamp; the test leads of which are connected between the starter motor terminal and a cleaned portion of the yoke. When the lamp glows, defective insulation of the field coils or of the terminal post is indicated, ensure that the insulated band is in position and examine the field coils and terminal connections for any obvious point of contact with the yoke. Should the field coils be defective in any way, they must be replaced or a substitute starter motor fitted.

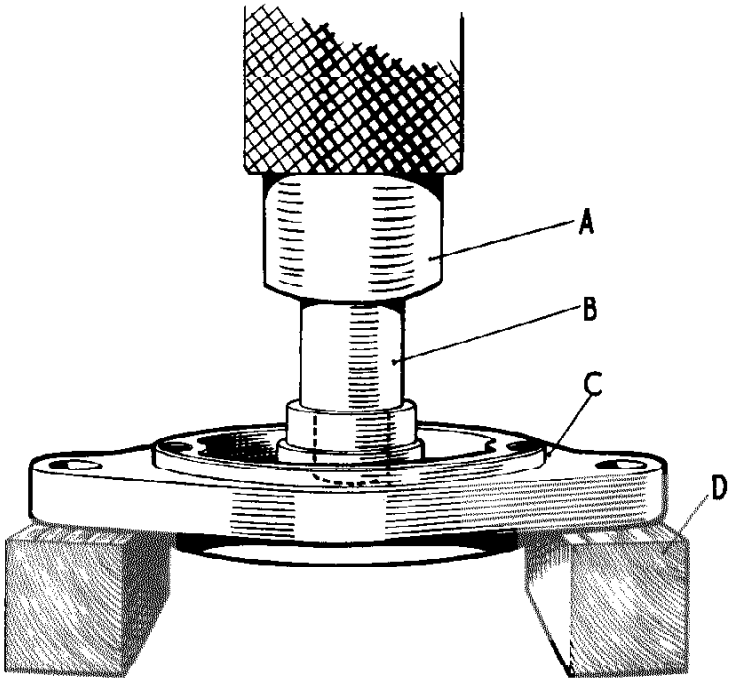


Figure O22.
Pressing bush bearings.

A. Shouldered mandrel.
B. Porous bush bearings.
C. Starter motor mounting bracket.
D. Supporting blocks.

CLEANING STARTER MOTOR BRUSH GEAR AND COMMUTATOR

REMOVAL AND REPLACEMENT
STARTER MOTOR BRUSH GEAR

1. CLEANING BRUSH GEAR

Remove the starter motor from the engine as detailed on page O36 and slide the band cover clear of the yoke windows by slackening the pinch bolt.

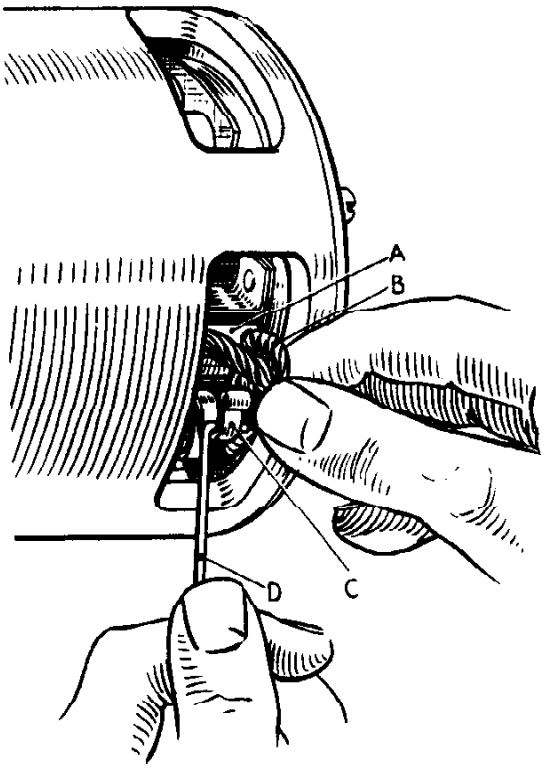


Figure O23.
Removing starter motor brush gear.

A. Brush
B. Flexible connection
C. Brush spring
D. Hooked tool.

Examine each brush in turn for freedom of movement in their respective boxes by holding the brush spring clear and gently pulling on the flexible connection wire; when the brushes are less than the specified minimum thickness they must be replaced as detailed in a later paragraph. A tight brush can be corrected by rubbing the high spot down with a smooth file. Clean both the brush and box with a lintless cloth moistened with petrol.

Test the tension of each brush spring utilizing a spring balance the hook of which is modified and positioned under the rounded nose of the spring.

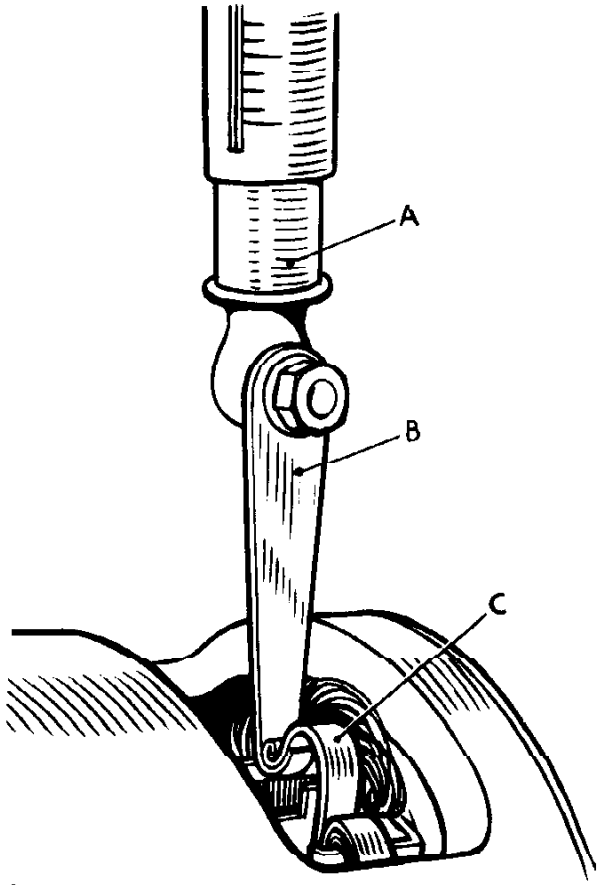


Figure O24.
Checking tension of brush spring.

A. Spring balance
B. Brush springs.
C. Brush

2. CLEANING COMMUTATOR

Ensure that all conductors are tight and clean the brush contact surface with a lintless cloth moistened in petrol, when this fails to clean completely a piece of fine glass paper can be used while turning the armature by hand. A well worn commutator can be reconditioned by removing the armature as detailed in the next paragraph and mounted in a lathe. with the starter motor drive and end cover in position, rotated a high speed and a light cut taken to clean up the armature surface. THE ARMATURE MUST NOT BE UNDER-CUT.

3. REMOVAL BRUSH GEAR Fig. O25.

Detach the terminal nuts and washers from the terminal post protruding through the commutator end cover from the yoke by withdrawing the two "U" volts. Remove the two brushes from the commutator end cover and the two brushes from the field coils situated in the yoke by unsoldering. When replacement brushes are to be fitted they should be fitted as the old are being removed and so avoid heating the terminal tags a second time. The armature, starter motor drive and end cover can be mounted in a lathe for the recutting of the armature face at this stage if nccessary.

4. REPLACEMENT, BRUSH GEAR

Solder the replacement brush gear to the terminal tags on the field coils and commutator end cover when necessary. They will require no bedding in as they are pre-shaped.

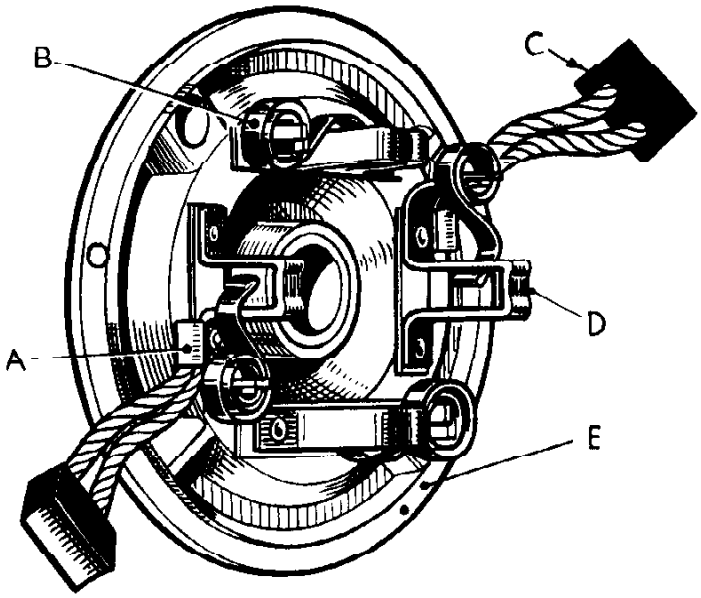


Figure O25.
Starter motor commutator end cover showing brush gear and boxes.

A. Terminal tags.
B. Brush springs.
C. Brush.
D. Brush boxes.
E. Commutator end cover

5. REPLACEMENT OF COMPONENTS

The replacement of the components is the reversal of the removal sequence but particular attention must be given to the following points:

That the starter mounting bracket and commutator end cover are located on the ends of the yoke by the two small pegs.

REMOVAL AND REPLACEMENT
STARTER MOTOR

1. REMOVAL

Detach the earthing lead from the battery and the heavy electrical cable from the terminal on the commutator end cover. Remove the front exhaust pipe from the L.H. side of the engine unit as detailed in THE EXHAUST SYSTEM, SECTION F.

Withdraw the starter motor from the front face of the engine/gearbox mounting plate at the L.H. side of the engine unit by withdrawing two nuts and bolts.

2. REPLACEMENT

The replacement of the starter motor is the reversal of the removal sequence.

RELEASING A JAMMED STARTER MOTOR Fig. O26.

In the instance of the starter motor drive becoming jammed in mesh with the flywheel starter ring it can be released by adopting one of the two following procedures:

(i) By removing the protective cap from the centre of the commutator end cover situated at the front end of the starter motor and rotating the protruding squared end of the armature shaft with a spanner in an anti-clockwise direction when looking toward the rear of the car.

(ii) By switching off the ignition, engaging top gear and rocking the car to and fro.

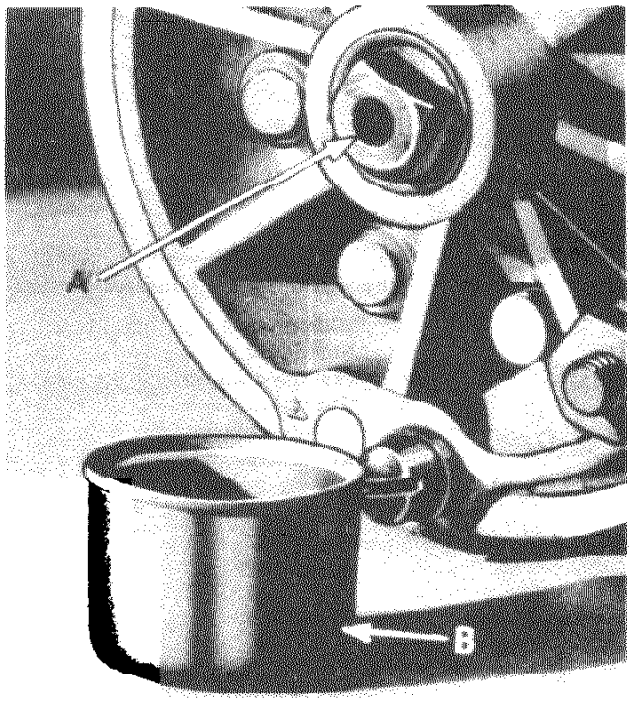


Figure O26.
The squared end of starter motor armature shaft.

A. Squared end of armature shaft.
B. Protective cap.

THE STARTER MOTOR SOLENOID SWITCH

DESCRIPTION Fig. O27.

The starter motor solenoid switch is mounted on the L.H. wing valance in the engine compartment and is earthed to the positive side of the battery and engine unit through the main earthing strip.

In normal circumstances it is controlled by turning the ignition key in the combined ignition/starter switch to the extreme R H. side against a spring incorporated in the lock mechanism. As the key is turned, battery current passes through the smaller of the three cables to the coil winding of the solenoid and on to earth through the body of the switch. The resultant magnetic field overcomes the tension of the armature return spring and moves the free contact, mounted on the bottom end of the solenoid armature, downward and bridges the gap between the two fixed contacts of the two heavy duty electrical cables. The bridging of this gap allows current from the battery to the starter motor and the latter cranks the engine.

Immediately the ignition key is released the battery supply to the solenoid coil is cut off, resulting in the collapse of the magnetic field and the armature returns to its rest position because of its return spring. The making and breaking speed and size of the moving and fixed contacts are such that sparking across the internal gap is reduced to a minimum.

The shaft of the solenoid armature is extended upward through the body and is protected by a rubber cover. This gives a secondary means of operation, by manually depressing the rubber cover and provides the means of cranking the engine without switching on the ignition. In this instance it is imperative that the CAR IS NOT IN GEAR. In the rare event of solenoid switch failure, the engine can be started by this means, providing the ignition is switched on.

REMOVAL AND REPLACEMENT
STARTER MOTOR SOLENOID SWITCH

1. REMOVAL

Detach the earthing lead from the battery and the one thin and two thick cables from the starter motor solenoid switch and detach the latter from the L.H. wing valance in the engine

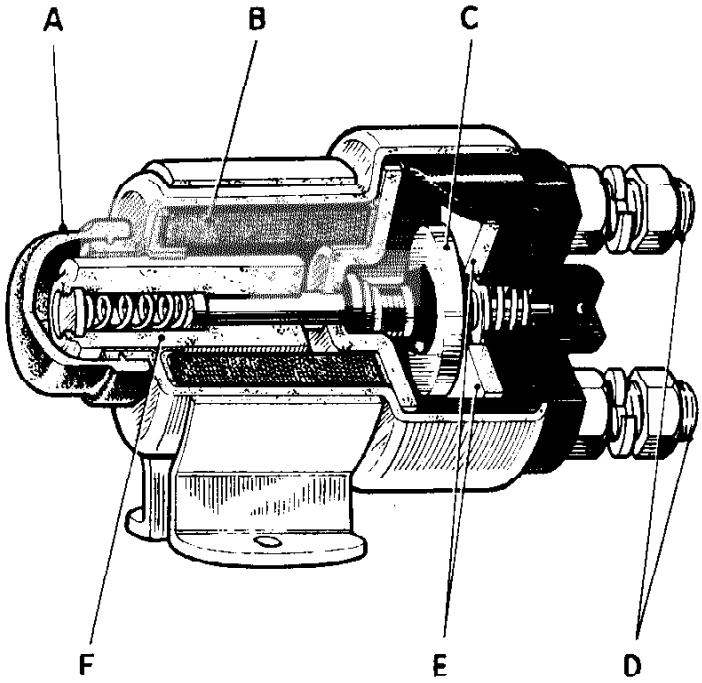


Figure O27.

The starter motor solenoid switch.

A. Rubber end cap.
B. Solendoid.
C. Moving contact.
D. Terminals.
E. Fixed contacts.
F. Armature.

compartment by withdrawing two bolts.

2. REPLACEMENT

The replacement of the starter motor solenoid switch is the reversal of the removal sequence. but particular attention must be given to the following point:

That the battery to engine unit earthing strip is positioned between the starter motor solenoid switch body and the wing valance.

TESTING THE STARTER
MOTOR SWITCH CIRCUIT AND
STARTER MOTOR SOLENOID SWITCH

When the starter motor and battery are known to be in good condition but operation of the starter motor is unsatisfactory, the wiring circuit and starter motor solenoid can be checked in the following manner:

(i) ENSURE THAT NEUTRAL GEAR IS ENGAGED.

Connect a 0-20 moving coil voltmeter to the supply terminal No. 1 of the ignition/ starter switch and a good earthing point. When a zero voltmeter reading is recorded a faulty cable or loose connection between the battery and ignition/starter switch is indicated.

(ii) Connect the voltmeter between starter terminal No. 3 or the ignition/starter switch and a good earthing point, turn the ignition key to the extreme R H. side, the "starter" position. When a zero voltmeter reading is recorded, a defective switch is indicated and the switch must be replaced.

(iii) Connect the voltmeter between the small terminal of the starter motor solenoid switch and a good earthing point, turn the ignition key to the "starter" position. When a zero voltmeter reading is recorded, a faulty cable or loose connection between the battery and solenoid switch is indicated.

(iv) Connect the voltmeter between the large supply terminal of the starter motor solenoid switch and a good earthing point. When a zero voltmeter reading is recorded, a faulty cable or loose connection between the battery and solenoid switch is indicated.

(v) Connect the voltmeter between the second large terminal of the starter motor solenoid switch and a good earthing point, turn the ignition key to the "starter" position. When a zero voltmeter reading is recorded, a defective solenoid switch is indicated and must be replaced.

(vi) Repeat the previous test a second time but by pressing the rubber covered button on the top of the starter motor solenoid switch body. When a zero voltmeter reading is recorded, it indicates a defective solenoid switch but in the instance of a full volt reading, it indicates that the solenoid of the switch is unserviceable but the engine could be started by depressing the rubber covered button until a replacement solenoid switch is available.

(vii) Connect the voltmeter between the terminal on the starter motor and a good earthing point, turn the ignition key to the "starter" position. When a zero voltmeter reading is recorded, a faulty cable or loose connection between the starter motor solenoid switch and starter motor terminal is indicated.

THE IGNITION/STARTER SWITCH

DESCRIPTION

The ignition/starter switch is a combined control switch incorporating a lock, an ignition "ON" position and a spring loaded starter position. The ignition key when first fitted to the lock, adopts a vertical position and when turned clockwise to the ignition "on" position it adopts a two o' clock position and connects the battery to the ignition circuit of the engine and all other components included in that circuit, such as windscreen wiper, fuel contents gauge and engine temperature gauge. The ignition key can be turned further clockwise to the "starter" position and connects the battery also to the starter motor solenoid switch, this in turn switches on the battery to the starter motor and starts the engine. When the ignition key is released, it returns automatically to the ignition position due to the influence of its return spring and to turn the ignition off the key must be turned manually antilclockwise. It can then be withdrawn from the lock.

The ignition lock is of the "Yale" type and its barrel is extended forward and engages the moving contact plate which effects the connection between the battery and other contacts in the ignition and solenoid starter switch circuits. The lock barrel is retained in position by a plunger and the key number is stamped on its outside face for identification purposes.

CLEANING AND LUBRICATING IGNITION/STARTER SWITCH LOCK BARREL

This is effected in a similar manner to the door lock but as it is situated inside the car it will not require such frequent attention.

REMOVAL AND REPLACEMENT IGNITION/STARTER SWITCH

1. REMOVAL

Detach the earthing lead from the battery and the ignition/starter switch from the front face of the centre instrument panel by removing the front ring. Withdraw the electrical harness from the Lucar connections on its rear face.

2. REPLACEMENT

The replacement of the ignition/starter switch is the reversal of the removal sequence.

REMOVAL AND REPLACEMENT IGNITION WARNING LAMP BULB

While the failure of this warning lamp bulb in no way effects the efficiency of the ignition system it is wise to replace it as soon after the bulb failure as possible, because its true function is to indicate whether the battery is being charged or not.

Detach the earthing lead from the battery. Withdraw the R.H. bulb holder from the rear face of the speedometer. Unscrew the spent bulb, fit the replacement and clip the bulb holder

back in position.

THE ELECTRIC HORNS

DESCRIPTION

Two horns are fitted to each car, one of a high note and one of a low note. They are each mounted on a bracket attached to the extreme front ends of the two chassis sidemembers situated between the front grille and the front face of the radiator block.

Each horn is adjusted and tested during manufacture and tested again on initial assembly of the car. They will give long service with no attention. A letter "H" or "L" cast inside the trumpet indicates whether it is High or Low note.

When either or both horns fail or become uncertain in operation, ascertain first that the trouble is not due to a loose mounting bolt, bracket or a loose connection in the wiring circuit before detaching the horn for an internal inspection.

The operation of the horns is not included in the ignition circuit and are in circuit with the front fuse of the fuse unit.

REMOVAL OR REPLACEMENT
ELECTRIC HORN

1. REMOVAL

Detach the earthing lead from the battery and the cables from the harness situated adjacent to the radiator block. Remove the horn from its mounting bracket or the horn and mounting bracket from the front end of the chassis frame sidemembers by removing two nuts and bolts, access to these is best gained from beneath the car.

2. REPLACEMENT

The replacement of the electric horns is the reversal of the removal sequence.

CLEANING THE ELECTRIC HORN CONTACTS Fig. O28.

Remove the horn from the front end of the chassis as detailed above, and detach the domed cover from the top side of the horn by withdrawing one centre screw. Agitate a piece of fine grade glass paper between the two contacts and blow any dust away. Replace the domed cover and secure with the centre screw.

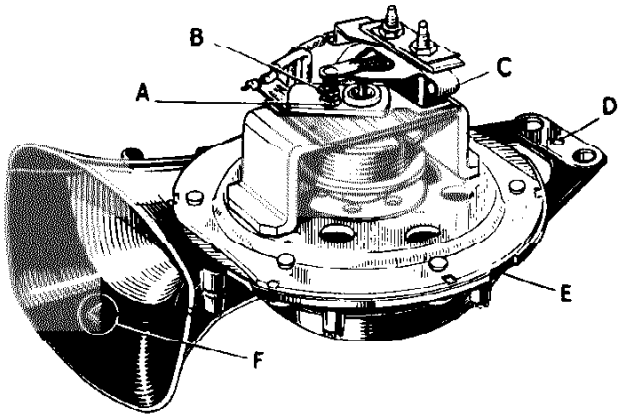


Figure O28.

The electric horn with domed cover removed.

A. Locknut.
B. Adjusting nut.
C. Terminal.
D. Mounting bracket.
E. Cover support bracket anchorage slot.
F. High or low note identification letter.

ADJUSTING ELECTRIC HORN CONTACTS Fig. O28.

Adjustment of the horn contacts does not alter its note in any way, but takes up the wear in the working parts.

Clean the horn contacts as detailed on page O40 and grip firmly in the jaws of a vice. Connect with a push button switch and a 0-20 moving coil ammeter in circuit with a 12 volt battery. Remove the domed cover support bracket.

Slacken off the locknut of the fixed contact and close the contact gap progressively until the horn just fails to sound and switch off the current. Rotate the fixed contact half a turn clockwise, sound the horn while observing the ammeter. The current consumption should be 7½ to 8 amperes, but when the consumption is observed to be above or below this figure rotate the fixed contact clockwise to decrease the current consumed or anti-clockwise to increase the current consumed.

Replace the components by reversal of their removal sequence.

ELECTRIC HORN OPERATING BUTTON

The horn button is positioned in the centre of the control head mounted in the centre of the steering wheel; it is pressed to sound the horns.

REMOVAL AND REPLACEMENT
HORN BUTTON CONTACTS

1. REMOVAL

Remove the horn button from the control head in the centre of the steering wheel by prising out the chromium surround ring. Collect the conical spring and insulated spigotted button from beneath. Remove the control head with stator tube attached from the centre of the steering wheel as detailed below. Detach the stator tube mounting plate from the underside of the control head by first slackening off the three screws progressively and then removing them. Ease the control head away from the stator tube mounting plate by pulling the electrical harness through the stator tube; it is unnecessary to withdraw the harness completely, but only sufficient to allow room for working. Remove the cylinderical body and crimped washer from the underside of the control head and hang on the harness. Remove the horn button contacts from the recess in the top side of the control head by removing the two through nuts and bolts, one on each side.

2. REPLACEMENT

The replacement of the horn button contacts is the reversal of the removal sequence, but particular attention must be given to the following points:

(i) That the horn earthing ring is attached to the underside of the control head by the R.H. nut and bolt; the brown coloured wire of the electrical harness is attached by the L.H. nut and bolt.

(ii) That the insulated spigotted button is positioned in the centre of the horn button contacts, the large end of the conical spring is fed into the underside of the horn button, while the small end is located on the insulated spigotted washer.

THE CONTROL HEAD

DESCRIPTION

The control head is situated in the centre of the steering wheel and after being correctly positioned it is secured in position by a union nut and olive to the underside face of the steering unit end cover. The olive is positioned on the outside of the stator tube before the union nut, to effect an oil seal for the oil in the steering unit.

The control head contains the horn push button and the flasher direction indicator switch and cancelling mechanism.

REMOVAL AND REPLACEMENT
CONTROL HEAD

1. REMOVAL

Detach the earthing lead from the battery and the electrical harness of the control head

from the main car harness. Position a drip tray beneath the steering unit and remove the union nut and olive from the protruding end of the stator tube and the electrical harness. Lower the cockpit hood as detailed in THE BODY, SECTION Q, and withdraw the control head and stator tube from the centre of the steering wheel. A small cork fitted to the end cover of the steering box will arrest the escaping oil.

2. REPLACEMENT

The replacement of the control head is the reversal of the removal sequence, but particular attention must be given to the following points:

(i) That the control head is set as detailed in SETTING FLASHER DIRECTION INDICATOR SWITCH on page O8.

(ii) That the control head electrical harness is connected to main car harness as detailed on the wiring diagram.

REMOVAL AND REPLACEMENT
CONTROL HEAD HARNESS

1. REMOVAL

Proceed as for replacing horn button contacts, but in this instance the electrical harness can be withdrawn completely from the stator tube. Separate the two mouldings by withdrawing the nut and bolt from the horn button recess, exercising care to control the run of the various spring loaded components. Lift out the flasher direction indicator switch, remove the spring loaded "U" shaped contact, the spring loaded roller plunger assembly at its second end, and the semi-circular rod with two springs and washers. Withdraw the two pawls noting the position of the square and shaped ends. Remove the electrical harness from the underside face of the bottom insulated moulding by detaching three nuts, one nut and bolt has already been removed.

2. REPLACEMENT

The replacement of the control head harness is the reversal of the removal sequence, but particular attention must be given to the following points:-

(i) That the electrical contacts and all moving parts are smeared with petroleum jelly to avoid corrosion, provide lubrication and assist in locating the small components to the larger.

(ii) That the plunger, roller and spring are offered up to the bottom end of the flasher direction switch and the "U" shaped contact and spring to its underside.

(iii) That two washers are fed onto the semi-circular rod followed by the two springs and located in the groove on the underside of the flasher direction switch.

(iv) That the flasher direction indicator switch is offered up to the bottom insulated moulding, roller located in a vee groove and eased into position; locate the ends of the semi-circular rod in the grooves, but do not move the switch.

(v) That the two pawls are fitted, so their rivets locate the grooves provided and their squared ends are inward and the outside rounded corners face one another.

(vi) That the two insulated mouldings are secured together with a nut and bolt diametrically opposite the flasher direction indicator switch.

(vii) That the horn button contacts are fitted as detailed on page O41.

THE "LUCAR" AND SNAP CONNECTORS.

DESCRIPTION

The "Lucar" and snap connectors are used at the instrument and mid-cable joints respectively

Bend back and splay out the wire strands protruding through the second side of the Lucar connector until they lay flat. Apply only sufficient solder to adhere the wire strands to the "Lucar" connector and not allow any to run through the "D" shaped aperture and foul the second side.

The recommended solder is of 60/40 tin-lead composition with a non-corrosive flux core, (e.g. Ersin Multicore 16 S.W.G.) "Killed" spirits,phosphoric acid or similar fluxes must not be used. Avoid overheating as this can destroy the tensile properties of the Lucar connector and the insulation under the cleats.

SOLDERING ON SNAP CONNECTOR

Strip the cable of its insulation until 0.125" (3.175 mm.) of bare cable protrudes, feed into the body of the snap connector and splay over the ends of the wire as they protrude.

Apply only sufficient solder to adhere the wires to the body of the connector, avoid overheating and use a similar solder to that used for the Lucar connector.