SECTION N

THE ELECTRICAL SYSTEM

	Section
General description	
Battery	N.2
Dry-charged—preparation for service	N.3
New, unfilled, uncharged—preparation for service	N.4
Control box	N.7
Dynamo	N.5
Faults, location and remedy	N.9
Flasher unit	N.10
Fuse unit	N.8
Headlamps	N.16
Horn and horn-push	N.17
Lubrication	N.1
Number-plate illumination lamp	N.15
Panel and warning lamps	N.14
Pilot and flashing direction indicator lamps	N.12
Replacement bulbs	N.19
Starter	N.6
Switches	N.18
Tail and stop and direction indicator lamps	N.13
Windshield wipers	N.11
Wiring diagram (see also Section Nc)	End of Section

GENERAL DESCRIPTION

The 12-volt electrical equipment incorporates compensated voltage control for the charging circuit. The positive earth system of wiring is employed.

The battery is mounted on the dash under the bonnet and is readily accessible for examination and maintenance attention.

The dynamo is mounted on the right of the cylinder block and driven by an endless belt from the crankshaft pulley. A rotatable mounting enables the belt tension to be adjusted.

The voltage control unit adjustment is sealed and should not normally require attention. The fuses are carried in external holders mounted in an accessible position on the right-hand side of the engine compartment together with spare fuses.

The starter motor is mounted on the flywheel housing on the right-hand side of the engine unit and operates on the flywheel through the usual sliding pinion device.

The headlamps employ the double-filament dipping system. Both lamps are fitted with double-filament bulbs for Europe, and a sealed-beam unit is fitted for Home and U.S.A. markets, both types dipping according to the regulations existing in the countries concerned.

Section N.1

LUBRICATION

Dynamo

On early cars unscrew the lubricator with the felt pad and half-fill with lubricant at regular intervals. On later cars add two drops of lubricant at regular intervals in the lubricating hole in the centre of the rear end bearing plate.

Section N.2

BATTERY

The battery is a 12-volt lead-acid type, having six cells, each cell consisting of a group of positive and negative plates immersed in a solution of sulphuric acid (electrolyte).

The battery has three functions: to supply current for starting, ignition, and lighting; to provide a constant supply of current to the electrical equipment under normal operating conditions and when the consumption of the electrical equipment exceeds the output of the dynamo; and to control the voltage of the electrical supply system.

Adjustments in the vehicle

The purpose of the following operations is to maintain the performance of the battery at its maximum.

The battery and its surrounding parts should be kept dry and clean, particularly the tops of the cells, as any dampness could cause a leakage between the securing strap and the battery negative terminal and result in a partially discharged battery. Clean off any corrosion from the battery bolts, strap, and tray with diluted ammonia, afterwards painting the affected parts with anti-sulphuric paint.

Remove the manifold and check it for cracks.

The electrolyte should be maintained just level with the tops of the separator guards by adding distilled water. Never add acid.

Check the terminal posts. If they are corroded remove the cables and clean with diluted ammonia. Smear the posts with petroleum jelly before remaking the connections and ensure that the cable terminal screws are secure.

Check the condition of the battery cells using a hydrometer. If the level of the electrolyte is too low for hydrometer readings to be taken, top up with distilled water and recharge the battery for at least 30 minutes before taking hydrometer readings.

The hydrometer readings and their indications are as follows:

For climates below 27° *C.* (80° *F.*)

Cell fully charged	1·270 to 1·290
Cell about half-discharged ..	1·190 to 1·210
Cell completely discharged.. ..	1·110 to 1·130

For climates above 27° *C.* (80° *F.*)

Cell fully charged	1·210 to 1·230
Cell about half-charged	1·130 to 1·150
Cell completely discharged.. ..	1·050 to 1·070

These figures are given assuming an electrolyte temperature of 16° C. (60° F.). If the temperature of the electrolyte exceeds this ·002 must be added to hydrometer readings for each 3° C. (5° F.) rise to give the true specific gravity. Similarly, ·002 must be subtracted from hydrometer readings for every 3° C. (5° F.) below 16° C. (60° F.).

The readings of all the cells should be approximately the same. If one cell gives a reading which differs from the remainder by 40 points (·040 S.G.) or more, an internal fault in that cell is indicated. The battery should then be checked by a battery specialist. Should the battery be in a low stage of charge, it should be recharged by taking the car for a long daytime run or by charging from an external source of D.C. supply at a current rate of 4·0 amps until the cells are gassing freely.

Removing

Disconnect both cables from the battery.

Release the battery clamp and lift out the battery.

Inspection

Place the battery on a lead-covered bench or on a wooden bench treated with anti-sulphuric paint.

Check the electrolyte levels.

Inspect the container for cracks, which may be indicated by external corrosion or extreme variation in the electrolyte levels.

Recharging from an external source

The length of time for a used battery to remain on charge before it can be accepted as fully charged depends entirely on the specific gravity before charging commences and the charging rate. The charging should continue at 4·0 amps. until all cells are gassing freely and evenly and the specific gravity in each of the six cells has reached a maximum, i.e. has shown no further rise in four hours. The specific gravity at the end of charging should be within the limits given and should not vary ·005 from the values given.

Do not allow the temperature of the electrolyte to exceed the maximum permissible temperature, i.e.

For climates below 27° C. (80° F.) .. 38° C. (100° F.)
For climates above 27° C. (80° F.) .. 49° C. (120° F.)

If this temperature is reached the charge should be suspended to allow the temperature to fall at least 6° C. (10° F.) otherwise the life of the battery will tend to be shortened.

NOTE:—Whenever booster charging of the battery or electrical welding of the body is carried out, the battery earth lead (positive) must be disconnected to prevent damage to the electrical system.

Refitting

The installation of the battery is a reversal of the procedure **'Removing'.** Smear the terminal posts and cable connections with petroleum jelly and tighten the retaining screws sufficiently to prevent the cables from moving on the terminal posts when tested by hand, but do not overtighten.

Section N.3

PREPARING A DRY-CHARGED BATTERY FOR SERVICE

A dry-charged battery is supplied without electrolyte but with the plates in a charged condition. When it is required for service it is only necessary to fill each cell with sulphuric acid of the correct specific gravity. No initial charging is required.

Preparing electrolyte

The electrolyte is prepared by mixing together distilled water and concentrated sulphuric acid, taking the precautions given in Section N.4. The specific gravity of the filling electrolyte depends on the climate in which the battery is to be used.

Filling the battery

Remove the sealing tapes (when fitted) in the cell filling holes and fill each cell with electrolyte to the top of the separator guards, **in one operation.** The temperature of the filling room, battery, and electrolyte should be maintained between 16 and 38° C. (60 and 100° F.). If the battery has been stored in a cool place it should be allowed to warm up to room temperature before filling.

Putting into use

Measure the temperature and specific gravity of the electrolyte in each of the cells. Allow to stand for 20 minutes and then re-check. The battery is ready for service unless the electrolyte temperature has risen by more than 5·5° C. (10° F.), or the specific gravity has fallen by more than 10 points (·010 S.G.). In this event, re-charge the battery at the normal re-charge rate until the specific gravity remains constant for three successive hourly readings and all cells are gassing freely. During the charge the electrolyte must be kept level with the top of the separator guards by the addition of distilled water.

Section N.4

PREPARING A NEW, UNFILLED, UNCHARGED BATTERY FOR SERVICE

Preparing electrolyte

A battery should not be filled with acid until required for initial charging. Electrolyte is prepared by mixing distilled water and concentrated sulphuric acid, usually of 1·840 S.G. The mixing must be carried out either in a lead-lined tank or in suitable glass or earthenware vessels. Slowly add the acid to the water, stirring with a glass rod. **Never add the water to the acid,** as the resulting chemical reaction causes violent and dangerous spurting of the concentrated acid. The approximate proportions of acid and water are indicated in the following table:

	To obtain specific gravity (corrected to 16° C. [60° F.])	*Add 1 vol. of acid of 1·840 S.G. (corrected to 16° C. [60° F.])*
For climates	*of*	*to*
Below 27° C. (80° F.)	1·260	3·2 volumes of water
Above 27° C. (80° F.)	1·210	4·3 volumes of water

Heat is produced by mixing acid and water, and the electrolyte should be allowed to cool before taking hydrometer readings—unless a thermometer is used to measure the actual temperature and a correction applied to the readings before pouring the electrolyte into the battery.

Filling the battery

The temperature of the filling room, battery, and electrolyte should be maintained between 16 and 38° C. (60 and 100° F.).

Carefully break the seals in the filling holes and **half-fill** each cell with electrolyte of the appropriate specific gravity. Allow the battery to stand for at least six hours in order to dissipate the heat generated by the chemical action of the acid on the plates and separators, and then add sufficient electrolyte to fill each cell to the top of the separators. Allow to stand for a further two hours and then proceed with the initial charge.

Initial charge

The initial charging rate is 2·5 amperes. Charge at this rate until the voltage and specific gravity readings show no increase over five successive hourly readings. This will take from 48 to 80 hours, depending on the length of time the battery has been stored before charging.

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

For climates below 27° C. (80° F.) .. 38° C. (100° F.),
For climates above 27° C. (80° F.) .. 49° C. (120° F.),

the charge must be interrupted until the temperature has fallen at least 5·5° C. (10° F.) below that figure. Throughout the charge the electrolyte must be kept level with the top of the separators by addition of acid solution of the same specific gravity as the original filling-in acid until specific gravity and charge readings have remained constant for five successive hourly readings. If the charge is continued beyond that point, top up with distilled water.

At the end of the charge carefully check the specific gravity in each cell to ensure that, when corrected to 16° C. (60° F.) it lies between the specified limits. If any cell requires adjustment some of the electrolyte must be siphoned off and replaced either by distilled water or by acid of strength originally used for filling in, depending on whether the specific gravity is too high or too low. Continue the charge for an hour or so to ensure adequate mixing of the electrolyte and again check the specific gravity readings. If necessary, repeat the adjustment process until the desired reading is obtained in each cell. Finally, allow the battery to cool, and siphon off any electrolyte over the tops of the separators.

Section N.5

DYNAMO

Testing on vehicle when dynamo is not charging

Make sure that belt slip is not the cause of the trouble. It should be possible to deflect the belt approximately ½ in. (13 mm.) with moderate hand pressure at the centre of its longest run between two pulleys. If the belt is too slack tightening is effected by slackening the two dynamo suspension bolts and then the bolt of the slotted adjustment link. A gentle pull on the dynamo outwards will enable the correct tension to be applied to the belt and all three bolts should then be tightened firmly.

Check that the dynamo and control box are connected correctly. The dynamo terminal 'D' should be connected to the control box terminal 'D' and the dynamo terminal 'F' connected to the control box terminal 'F'.

After switching off all lights and accessories disconnect the cables from the dynamo terminals marked 'D' and 'F' respectively.

Connect the two terminals with a short length of wire.

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

Clip the negative lead of a moving coil-type voltmeter calibrated 0–20 volts to one dynamo terminal and the other lead to a good earthing point on the dynamo yoke.

Gradually increase the engine speed: the voltmeter reading should rise rapidly and without fluctuation. Do not allow the voltmeter reading to reach 20 volts. 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.

If there is no reading check the brush gear.

If the reading is low (approximately ½ to 1 volt) the field winding may be faulty.

If the reading is approximately 4 to 5 volts the armature winding may be faulty.

If the dynamo is in good order leave the temporary link in position between the terminals and restore the original connections, taking care to connect the dynamo terminal 'D' to the control box terminal 'D' and the dynamo terminal 'F' to the control box terminal 'F'. Remove the lead from the 'D' terminal on the control box and connect the voltmeter between this cable and a good earthing point on the vehicle. Run the engine as before. The reading should be the same as that measured directly on the dynamo. No reading on the voltmeter indicates a break in the cable to the dynamo. Carry out the same procedure for the 'F' terminal, connecting the voltmeter between cable and earth. Finally, remove the link from the dynamo. If the reading is correct test the control box (Section N.6).

Removing

To remove the dynamo disconnect the dynamo leads from the dynamo terminals.

Slacken all four attachment bolts and pivot the dynamo towards the cylinder block to enable the fan belt to be removed from the dynamo pulley. The dynamo can then be removed by withdrawing the two upper and one lower attachment bolts.

Dismantling

Remove the securing nut and take off the drive pulley.

Remove the Woodruff key from the commutator shaft.

Unscrew and remove the two through-bolts and take off the commutator end bracket. The driving end bracket, together with the armature and its ball bearing, can now be lifted out of the yoke. Unless the ball bearing is damaged or requires attention it need not be removed from the armature. Should it be necessary to remove the bearing, the armature must be separated from the end bracket by means of a hand press.

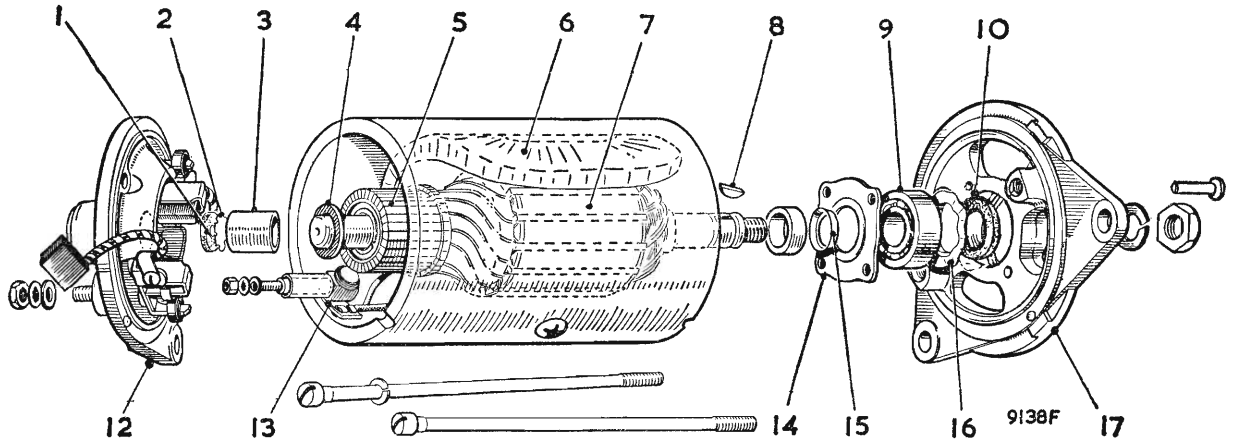


Fig. N.1

The windowless yoke dynamo (C39 type)

1. Felt pad.
2. Aluminium disc.
3. Bronze bush.
4. Fibre washer.
5. Commutator.
6. Field coils.
7. Armature.
8. Shaft key.
9. Bearing.
10. Felt washer.
12. Commutator end bracket.
13. Field terminal post.
14. Bearing retaining plate.
15. Cup washer.
16. Corrugated washer.
17. Driving end bracket.

Servicing

Brushes

Lift the brushes up in the brush boxes and secure them in that position by positioning each brush spring at the side of the brush. Fit the commutator end bracket over the commutator and release the brushes. Hold back each of the brush springs and move the brush by pulling gently on its flexible connector. If the movement is sluggish, remove the brush from its holder and ease the sides by lightly polishing it on a smooth file. Always refit the brushes in their original positions. If the brushes are badly worn, new brushes must be fitted and bedded to the commutator. The minimum permissible length of brush is $\frac{11}{32}$ in. (8·8 mm.) (C39 type), $\frac{1}{4}$ in. (6 mm.) (C40/1 type).

Test the brush spring tension, using a spring scale. The tension of the springs when new is 18 to 26 oz. (510 to 737 grs.) (C39 type), 22 to 25 oz. (624 to 709 grs.) (C40/1 type). In service it is permissible for this value to fall to 15 oz. (425 grs.) before performance may be affected. Fit new springs if the tension is low.

Commutator

A commutator in good condition will be smooth and free from pits or burned spots. Clean the commutator with a cloth moistened with fuel. If this is ineffective carefully polish with a strip of fine glass-paper while rotating the armature. To remedy a badly worn commutator mount the armature (with or without the drive end bracket) in a lathe, rotate at high speed, and take a light cut with a very sharp tool. Do not remove more metal than is necessary. Polish the commutator with very fine glass-paper. Undercut the mica insulation between the segments to a depth of $\frac{1}{32}$ in. (·8 mm.) with a hacksaw blade ground down to the thickness of the mica.

Some commutators fitted to the C40/1 dynamos are of the moulded type and may be re-skimmed to a minimum diameter of 1·45 in. (36·8 mm.).

The undercut must conform to the following dimensions:

Width	·040 in. (1·016 mm.).
Depth	·020 in. (·508 mm.).

It is important that the sides of the undercut clear the moulding material by a minimum of ·015 in. (·381 mm.).

The most common armature faults are usually confined to open- or short-circuited windings. Indications of an open-circuited armature winding is given by burnt commutator segments. A short-circuited armature winding is easily identified by discoloration of the overheated windings and badly burnt commutator segments.

Field coils

Test the field coils with an ohmmeter without removing them from the dynamo yoke. The reading on the ohmmeter should be between 6·0 and 6·3 ohms. If this is not available connect a 12-volt D.C. supply with an ammeter in series between the field terminal and the dynamo yoke. The ammeter reading should be approximately 2 amps. If no reading is indicated the field coils are open-circuited and must be renewed.

If the current reading is much more than 2 amps. or the ohmmeter reading much below 6 ohms it is an indication that the insulation of one of the fields coil has broken down.

In either case, unless a substitute dynamo is available, the field coils must be renewed. To do this carry out the procedure outlined below.

Drill out the rivet securing the field coil terminal assembly to the yoke and unsolder the field coil connections.

Remove the insulation piece which is provided to prevent the junction of the field coils from contacting the yoke.

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

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

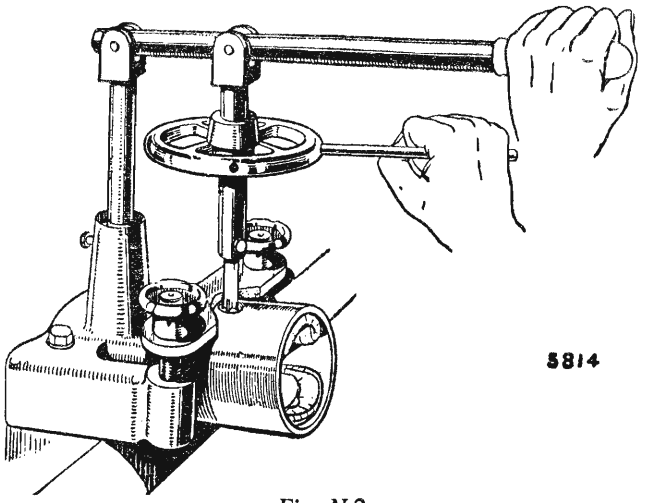


Fig. N.2

Using a wheel-operated screwdriver to remove the pole-shoe screws

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

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

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

Fully tighten the screws by means of a wheel-operated screwdriver and lock them by caulking.

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

Resolder the field coil connections to the field coil terminal tags and rerivet the terminal assembly to the yoke.

Armature

The testing of the armature winding requires the use of a voltage drop-test and growler. If these are not available the armature should be checked by substitution. No attempt should be made to machine the armature core or to true a distorted armature shaft.

Bearings

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

To renew the bearing bush in a commutator end bracket proceed as follows.

Remove the old bearing bush from the end bracket. The bearing can be withdrawn with a suitable extractor or by screwing a $\frac{5}{8}$ in. (15·87 mm.) tap into the bush for a few turns and pulling out the bush with the tap. Screw the tap squarely into the bush to avoid damaging the bracket.

Press the new bearing bush into the end bracket, using a shouldered, highly polished mandrel of the same diameter as the shaft which is to be fitted in the bearing, until the visible end of the bearing is flush with the inner face of the bracket. Porous bronze bushes should not be opened out after fitting or the porosity of the bush may be impaired.

NOTE.—Before fitting the new bearing bush it should be allowed to stand for 24 hours completely immersed in thin (S.A.E. 20) engine oil; this will allow the pores of the bush to be filled with lubricant. In cases of extreme urgency this period may be shortened by heating the oil to 100° C. (212° F.) for two hours, then allowing it to cool before removing the bearing bush.

The ball bearing is renewed as follows.

Drill out the rivets which secure the bearing retaining plate to the end bracket and remove the plate. Press the bearing out of the end bracket and remove the corrugated washer, felt washer, and oil-retaining washer.

Before fitting the replacement bearing see that it is clean and pack it with high-melting-point grease.

Place the oil-retaining washer (C39 type only), felt washer, and corrugated washer in the bearing housing in the end bracket.

Press the bearing into the housing. The outer bearing journal is a light push-fit in the bearing housing.

Refit the bearing retaining plate, using rivets having the same dimensions as those originally fitted.

NOTE.—When fitting a drive end bracket to the armature shaft the inner journal of the bearing MUST be supported by a mild-steel tube—do not use the drive end bracket.

Reassembling

The reassembly of the dynamo is a reversal of the dismantling sequence.

If the end bracket has been removed from the armature in dismantling, press the bearing end bracket onto the armature shaft, taking care to avoid damaging the end plate and armature winding. When assembling the commutator end bracket the brushes must first be held clear of the commutator by partially withdrawing them from their boxes until each brush is trapped in position by the side pressure of its spring. The brushes can be released onto the commutator by a small screwdriver or

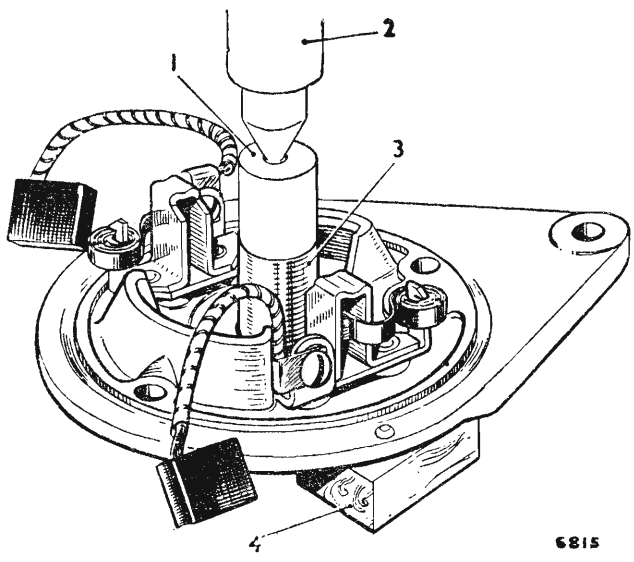


Fig. N.3

The method of pressing in the commutator end bracket bush

1. Shouldered mandrel.
2. Hand press.
3. Bearing bush.
4. Support block.

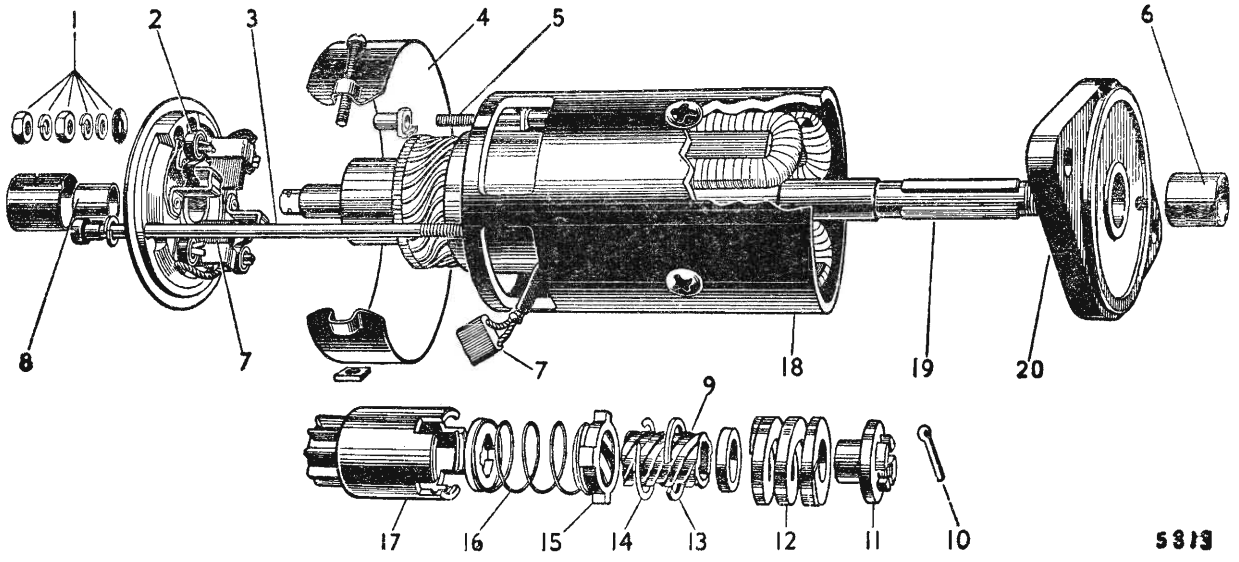


Fig. N.4

An exploded view of the starter motor and drive

1. Terminal nuts and washers.
2. Brush spring.
3. Through-bolt.
4. Band cover.
5. Terminal post.
6. Bearing bush.
7. Brushes.
8. Bearing bush.
9. Sleeve.
10. Split pin.
11. Shaft nut.
12. Main spring.
13. Retaining ring.
14. Washer.
15. Control nut.
16. Restraining spring.
17. Pinion and barrel.
18. Yoke.
19. Armature shaft.
20. Driving end bracket.

similar tool when the end bracket is assembled to within about $\frac{1}{2}$ in. (12·7 mm.) of the yoke. Before closing the gap between the end bracket and the yoke see that the springs are in correct contact with the brushes.

Refitting

Reverse the removal procedure, noting that on later models plain washers are fitted under the heads of the two upper fixing bolts.

Section N.6

STARTER

Testing on vehicle when starter is not operating

In the following test it is assumed that the battery is in a charged condition.

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

Should the lamps retain their full brilliance when the starter switch is operated, check that the switch is functioning. Next, if the switch is in order, examine the connections at the battery and starter switch, and also examine the wiring joining these units. Continued failure of the starter to operate indicates an internal fault in the starter, which must be removed for examination.

Sluggish action of the starter is usually caused by a poor connection in the wiring which causes a high resistance in the starter circuit. Check the wiring as described above.

Removing

Remove the distributor as described in Section B.

Release the starter cable from the terminal and unscrew the top starter securing bolt.

Working beneath the vehicle, release and withdraw the dirt deflector situated under the starter motor and unscrew the bottom starter securing bolt.

Manœuvre the starter forward and lift clear of the engine.

Examination of commutator and brush gear

Remove the starter cover band and examine the brushes and commutator.

Hold back each of the brush springs and move the brush by pulling gently on its flexible connector. If the movement is sluggish remove the brush from its holder and ease the sides by lightly polishing with a smooth file. Always replace brushes in their original positions. If the brushes are worn so that they no longer bear on the commutator, or if the brush flexible lead has become exposed on the running face, they must be renewed.

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

Secure the body of the starter in a vice and test by connecting it with heavy-gauge cables to a 12-volt battery. One cable must be connected to the starter terminal, the other held against the starter body or end bracket. Under these light load conditions the starter should run at a very high speed.

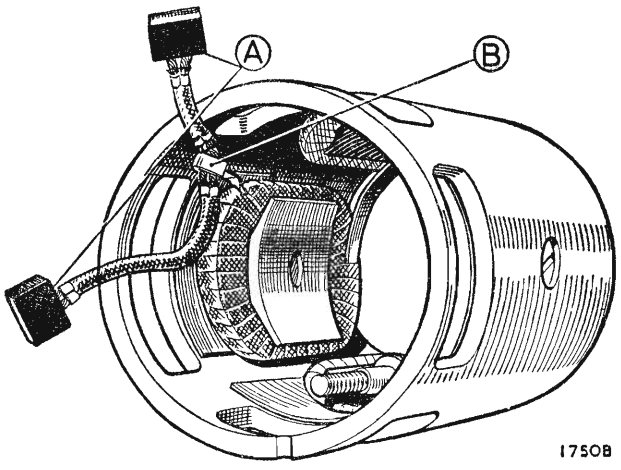


Fig. N.5

The starter brush connections

A. Brushes. B. Tapping on field coils.

If the operation of the starter is still unsatisfactory, it should be dismantled for detailed inspection and testing.

Dismantling

Hold back the brush springs and take out the brushes.

Remove the terminal nuts and washers from the terminal post on the commutator end bracket.

Unscrew and withdraw the two through-bolts and take off the commutator end bracket.

Remove the driving end bracket complete with armature and drive assembly.

Servicing

Brushes

Test the brush springs with a spring balance. The correct tension is 25 to 15 oz. (709 to 425 gm.). Fit a new spring if the tension is low.

If the brushes are worn so that they no longer bear on the commutator, or if the flexible connector has become exposed on the running face, they must be renewed. Two of the brushes are connected to terminal eyelets attached to the brush boxes on the commutator end bracket. The other two brushes are connected to tappings on the field coils.

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

Drive

If the pinion is tight on the screwed sleeve, wash away any dirt with paraffin (kerosene).

If any parts are worn or damaged they must be renewed.

On earlier cars remove the split pin, unscrew the nut (R.H. thread), and take off the main springs.

On later cars compress the spring and extract the circlip.

The complete drive can now be removed from the splined shaft by pulling it off with a rotary movement. Unscrew the screwed sleeve from the barrel assembly.

Further dismantling of the barrel assembly is carried out by removing the large retaining ring.

NOTE.—If the screwed sleeve is worn or damaged it is essential that it is renewed together with the control nut.

Reassemble by reversing the above procedure.

Commutator

A commutator in good condition will be smooth and free from pits and burnt spots. Clean the commutator with a cloth moistened with fuel. If this is ineffective, carefully polish with a strip of fine glass-paper while rotating the armature. To remedy a badly worn commutator, dismantle the starter drive as described above and remove the armature from the end bracket. Now mount the armature on a lathe, rotate it at high speed, and take a light cut with a very sharp tool. Do not remove any more metal than is absolutely necessary, and finally polish with very fine glass-paper.

The mica on the starter commutator **must not be undercut.**

Field coils

The field coils can be tested for an open circuit by connecting a 12-volt battery having a 12-volt bulb in one of the leads to the tapping-point of the field coils to which the brushes are connected and the field terminal post. If the bulb does not light there is an open circuit in the wiring of the field coils.

Lighting of the bulb does not necessarily mean that the field coils are in order, as it is possible that one of them may be earthed to a pole-shoe or to the yoke. This may be checked by removing the lead from the brush connector and holding it on a clean part of the starter yoke. Should the bulb now light, it indicates that the field coils are earthed.

Should the above tests indicate that the fault lies in the field coils, they must be renewed. When renewing the field coils carry out the procedure detailed in the dynamo section.

Armature

Examination of the armature will in many cases reveal the cause of failure, e.g. conductors lifted from the

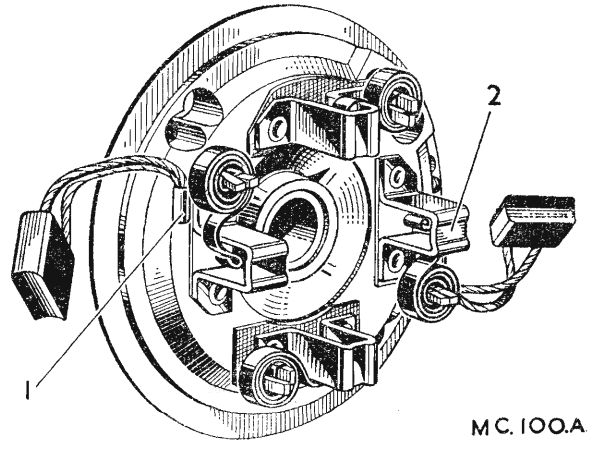


Fig. N.6

Commutator end bracket

1. Terminal eyelet. 2. Brush holder.

commutator due to the starter being engaged while the engine is running and causing the armature to be rotated at an excessive speed. A damaged armature must in all cases be renewed—no attempt should be made to machine the armature core or to true a distorted armature shaft.

Bearings

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

Press the new bearing bush into the end bracket, using a shouldered mandrel of the same diameter as the shaft which is to fit into the bearing.

NOTE.—The bearing bush is of the porous phosphor-bronze type, and before fitting, new bushes should be allowed to stand completely immersed for 24 hours in thin engine oil in order to fill the pores of the bush with lubricant.

Reassembling

The reassembly of the starter is a reversal of the operations described in this section.

Refitting

Refitting is a reversal of the removal procedure.

Section N.7

CONTROL BOX

This unit contains the cut-out and voltage regulator. The regulator controls the dynamo output in accordance with the load on the battery and its state of charge. When the battery is discharged the dynamo gives a high

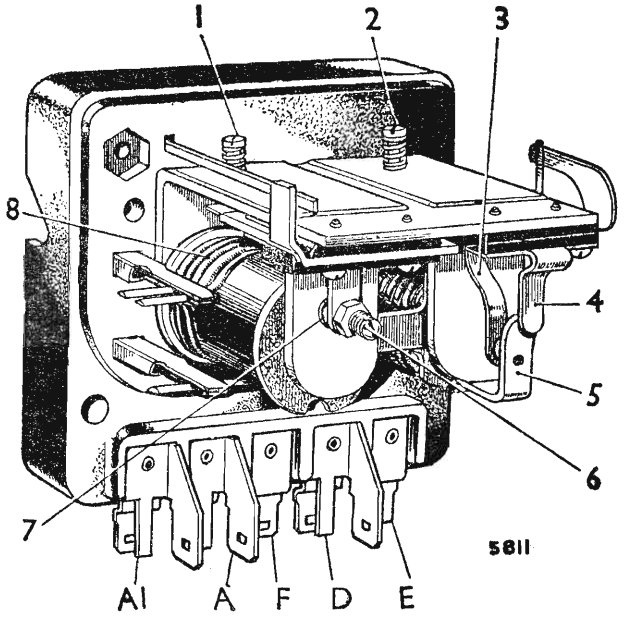


Fig. N.7

The control box

1. Regulator adjusting screw.
2. Cut-out adjusting screw.
3. Fixed contact blade.
4. Stop arm.
5. Armature tongue and moving contact.
6. Regulator fixed contact screw.
7. Regulator moving contact.
8. Regulator series windings.

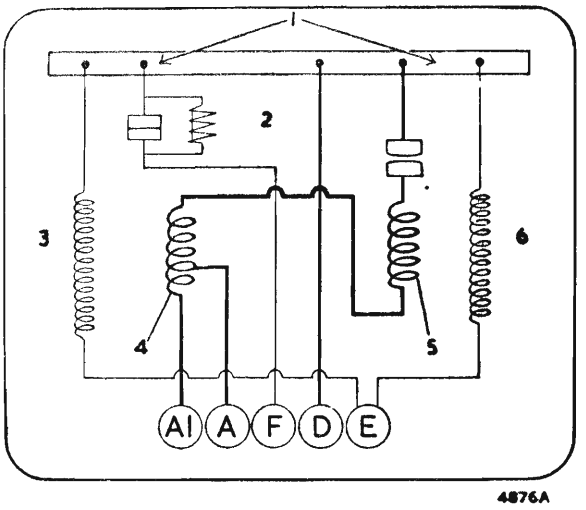


Fig. N.8

The control box (regulator and cut-out) internal connections

1. Regulator and cut-out frame.
2. Field resistance.
3. Shunt coil.
4. Tapped series coil.
5. Series coil.
6. Shunt coil.

output, so that the battery receives a quick recharge which brings it back to its normal state in the minimum time.

On the other hand, if the battery is fully charged the dynamo is controlled to give only a trickle charge, which is sufficient to keep it in good condition without any possibility of causing damage to the battery by over-charging.

The regulator also causes the dynamo to give a controlled boosting charge immediately after starting up, which quickly restores to the battery the energy taken from it when starting. After about 30 minutes' running, the output of the dynamo has fallen to a steady rate best suited to the particular state of charge of the battery.

The cut-out is an automatic switch for connecting and disconnecting the battery with the dynamo. This is necessary because the battery would otherwise discharge through the dynamo when the engine is stopped or running at a low speed.

Regulator adjustment

The regulator is carefully set to suit the normal requirements of the standard equipment before leaving the Works, and in general it should not be necessary to alter it. If, however, the battery does not keep in a charged condition, or if the dynamo output does not fall when the battery is fully charged, it may be advisable to check the setting and, if necessary, to readjust.

It is important, before altering the regulator setting when the battery is in a low state of charge, to check that its condition is not due to a battery defect or to the dynamo belt slipping.

Checking and adjusting the electrical setting

The regulator setting can be checked without removing the cover of the control box.

Withdraw the cables from the terminals marked 'A' and 'A1' at the control box and join them together.

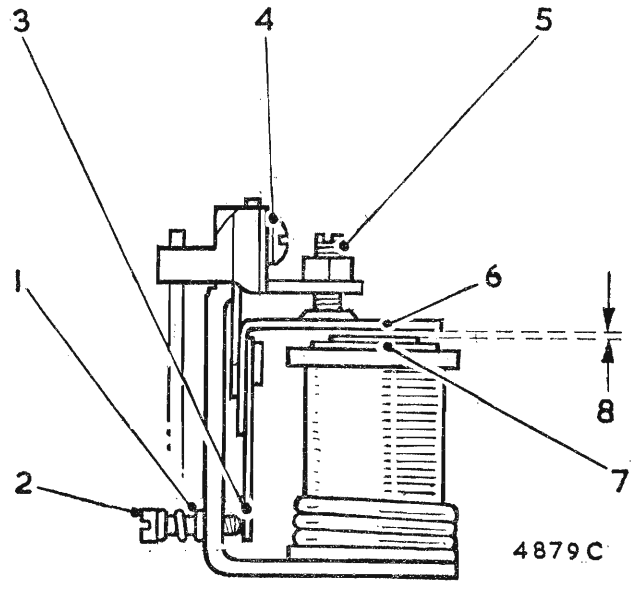


Fig. N.9

Mechanical setting of the regulator

1. Spring.
2. Voltage adjusting screw.
3. Armature tension spring.
4. Armature securing screws.
5. Fixed contact adjustment screw.
6. Armature.
7. Core face and shim.
8. ·015 in. (·38 mm.).

Connect the negative lead of a moving-coil voltmeter (0 to 20 volts full scale reading) to the 'D' terminal on the dynamo and connect the other lead from the meter to a convenient chassis earth.

Slowly increase the speed of the engine until the voltmeter needle 'flicks' and then steadies; this should occur at a voltmeter reading between the limits given for the appropriate temperature of the regulator.

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

Shut off the engine, remove the control box cover, and turn the adjusting screw (2) (Fig. N.9) in a clockwise direction to raise the setting or in an anti-clockwise direction to lower the setting. Turn the adjustment screw a fraction of a turn at a time until the setting is correct.

When adjusting, do not run the engine up to more than half-throttle because, while the dynamo is in open circuit, it will build up to a high voltage if run at a high speed and in consequence a false voltmeter reading will be obtained.

Electrical settings of the regulator must be made as quickly as possible because of the temperature rise effects.

Mechanical setting

The mechanical settings of the regulator are accurately adjusted before leaving the Factory, and provided that the armature carrying the moving contact is not removed, these settings should not be tampered with. If, however, the armature has been removed, the regulator will have to be reset. To do this proceed as follows.

Slacken the fixed contact locknut and unscrew the contact until it is well clear of the armature moving contact. Slacken the two armature assembly securing screws.

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

Insert a ·015 in. (·4 mm.) feeler gauge between the armature and core shim. Take care not to turn up or damage the end of the shim. Press the armature squarely down against the gauge and retighten the two armature assembly securing screws.

With the gauge still in position, screw the adjustable contact down until it just touches the armature contact. Tighten the locknut and remove the feeler gauge. Reset the voltage adjusting screw as described under **'Electrical setting'.**

Cleaning regulator contacts

After periods of long service it may be found necessary to clean the regulator contacts. Fine carborundum stone or fine emery-cloth may be used. Carefully wipe away all traces of dust or other foreign matter, using a clean, fluffless cloth moistened with methylated spirits.

Cut-out electrical setting

If the regulator is correctly set but the battery is still not being charged, the cut-out may be out of adjustment. To check the voltage at which the cut-out operates remove the control box cover and connect the voltmeter between the terminals 'D' and 'E'. Start the engine and slowly increase its speed until the cut-out contacts are seen to close, noting the voltage at which this occurs. This should be 12·7 to 13·3 volts.

If operation of the cut-out takes place outside these limits it will be necessary to adjust. To do this, turn the cut-out adjusting screw (2) (Fig. N.7) in a clockwise direction to raise the voltage setting or in an anti-clockwise direction to reduce the setting. Turn the screw a fraction at a time. Test after each adjustment by increasing the engine speed and noting the voltmeter readings at the instant of contact closure. Electrical settings of the cut-out, like the regulator, must be made as quickly as possible because of temperature rise effects.

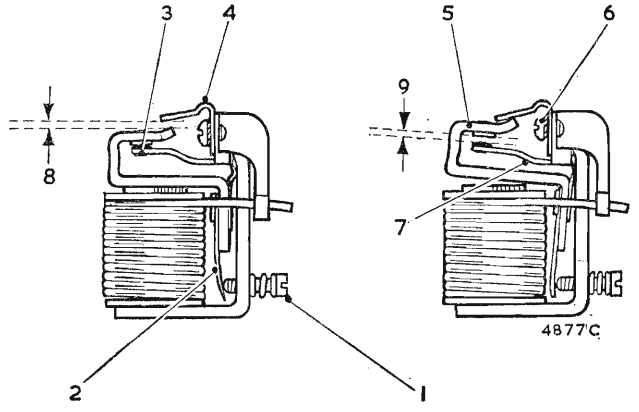


Fig. N.10

Mechanical setting of the cut-out

1. Cut-out adjusting screw.
2. Armature tension spring.
3. Follow through'—·010 to ·020 in. (·254 to ·508 mm.).
4. Stop arm.
5. Armature tongue and moving contact.
6. Armature securing screws.
7. Fixed contact blade.
8. ·025 to ·040 in. (·63 to 1·01 mm.).
9. ·010 in. to ·020 in. (·254 to ·508 mm.).

Adjustment of the drop-off voltage is effected by carefully bending the fixed contact blade. If the cut-out does not operate there may be an open circuit in the wiring of the cut-out and regulator unit, in which case the unit should be removed for examination or renewal.

Cut-out mechanical setting

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

Turn the adjusting screw until it is well clear of the armature tension spring. Slacken the two armature assembly securing screws (Fig. N.10). Press the armature firmly down against the copper-sprayed core face and retighten the two armature assembly securing screws.

Using a pair of round-nosed pliers, adjust the gap between the armature stop-arm and armature tongue by bending the stop-arm. The gap must be ·025 to ·040 in. (·6 to 1·0 mm.) when the armature is pressed squarely down on the core face.

Similarly, the insulated contact blade must be bent so that when the armature is pressed squarely down against the core face there is a 'follow through' or contact deflection of ·010 to ·020 in. (·25 to ·50 mm.). Reset the cut-out adjusting screw as described under **'Cut-out electrical setting'.**

Cleaning cut-out contacts

If the contacts appear rough or burnt place a strip of fine glass-paper between them, close them by hand, and draw the paper through. This should be done two or three times with the abrasive side towards each contact. Wipe away all dust or other foreign matter, using a clean, fluffless cloth moistened with methylated spirits.

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

Section N.8

FUSE UNIT

Description

The fuse unit, which is located on the right-hand side of the engine compartment, is an open, insulated moulding carrying two single-pole 35-amp. cartridge-type fuses which are held in spring clips between the Lucar connectors. Two spare fuses are carried in recesses in the fuse unit box and are positioned by retaining springs. The fuse which bridges the terminal blocks 'A1'—'A2' is to protect general auxiliary circuits, e.g. the horn, which is independent of the ignition switch. The other fuse, bridging terminal blocks 'A3'—'A4', is to protect the ignition and auxiliary circuits, e.g. the fuel gauge, windshield wiper motor, and flasher indicators, which only operate when the ignition is switched on.

Section N.9

LOCATION AND REMEDY OF FAULTS

Although every precaution is taken to eliminate possible causes of trouble, failure may occasionally develop through lack of attention to the equipment or damage to the wiring. The following pages set out the recommended procedure for a systematic examination to locate and remedy the causes of some of the more usual faults encountered.

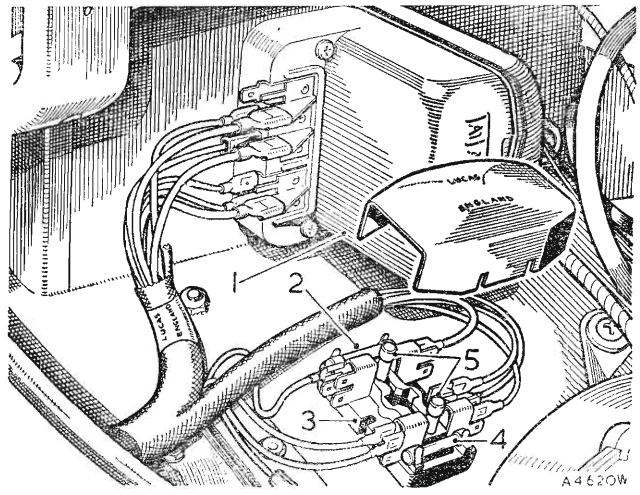


Fig. N.11

Regulator and fuse unit

1. Regulator cover.
2. AUX. IGN. fuse (35-amp.).
3. Fuse block.
4. AUX fuse (35-amp.).
5. Spare fuses.

The sources of trouble are by no means always obvious, and in some cases a considerable amount of deduction from the symptoms is needed before the cause is disclosed.

For instance, the engine might not respond to the starter switch; a hasty inference would be that the starter motor is at fault. However, as the motor is dependent on the battery it may be that the battery is exhausted.

This in turn may be due to the dynamo failing to charge the battery, and the final cause of the trouble may be, perhaps, a loose connection in some part of the charging circuit.

If, after carrying out an examination, the cause of the trouble is not found the equipment should be checked.

CHARGING CIRCUIT

1. Battery in low state of charge

(*a*) This state will be shown by lack of power when starting, poor light from the lamps, and the hydrometer readings below 1·200. It may be due to the dynamo not charging or giving low or intermittent output. The ignition warning light will not go out if the dynamo fails to charge, or will flicker on and off in the event of intermittent output.

(*b*) Examine the charging and field circuit wiring, tighten any loose connections, or renew any broken cables. Pay particular attention to the battery connections.

(*c*) Examine the dynamo driving belt; take up any undue slackness by swinging the dynamo outwards on its mounting after slackening the attachment bolts.

(*d*) Check the regulator setting, and adjust if necessary.

(*e*) If, after carrying out the above, the trouble is still not cured, have the equipment examined.

2. Battery overcharged

This will be indicated by burnt-out bulbs, very frequent need for topping up the battery, and high hydrometer readings. Check the charge reading with an ammeter when the car is running. It should be of the order of only 3 to 4 amps.

If the ammeter reading is in excess of this value it is advisable to check the regulator setting, and adjust if necessary.

STARTER MOTOR

1. Starter motor lacks power or fails to turn engine

(*a*) See if the engine can be turned over by hand. If not, the cause of the stiffness in the engine must be located and remedied.

(*b*) If the engine can be turned by hand first check that the trouble is not due to a discharged battery.

(*c*) Examine the connections to the battery, starter, and starter switch, making sure that they are tight and that the cables connecting these units are not damaged.

(*d*) It is also possible that the starter pinion may have jammed in mesh with the flywheel, although this is by no means a common occurrence. To disengage the pinion rotate the squared end of the starter shaft by means of a spanner.

2. Starter operates but does not crank the engine

This fault will occur if the pinion of the starter drive is not allowed to move along the screwed sleeve into engagement with the flywheel, due to dirt having collected on the screwed sleeve. Remove the starter and clean the sleeve carefully with paraffin (kerosene).

3. Starter pinion will not disengage from flywheel when engine is running

Stop the engine and see if the starter pinion is jammed in mesh with the flywheel, releasing it if necessary by rotation of the squared end of the starter shaft. If the pinion persists in sticking in mesh have the equipment examined. Serious damage may result to the starter if it is driven by the flywheel.

LIGHTING CIRCUITS

1. Lamps give insufficient illumination

(*a*) Test the state of charge of the battery, recharging it if necessary from an independent electrical supply.

(*b*) Check the setting of the lamps.

(*c*) If the bulbs are discoloured as the result of long service they should be renewed.

2. Lamps light when switched on but gradually fade out

As paragraph 1 (*a*).

3. Brilliance varies with speed of car

(*a*) As paragraph 1 (*a*).

(*b*) Examine the battery connections, making sure that they are tight, and renew any faulty cables.

Section N.10

FLASHER UNIT

Description

The unit is contained in a small cylindrical metal container, one end of which is rolled over onto an insulated plate carrying the mechanism and three terminals. The unit depends for its operation on the linear expansion of a length of wire which becomes heated by an electric current flowing through it. This actuating wire controls the movement of a spring-loaded armature attached to a central steel core and carrying a moving contact—the sequence of operation being as follows.

When the direction indicator switch is turned either to the left or right, current flows through the actuating wire, ballast resistor, and coil wound on the central core and hence to earth via the flasher lamp filaments. This current is limited by the ballast resistor to a value which will ensure that the flasher lamp filaments do not light at this stage. The actuating wire increases in length under the heating influence of the current and allows the armature to move inwards to its alternative position, thereby closing a pair of contacts in the supply circuit to the flasher lamps and at the same time short-circuiting the actuating wire. The increased electro-magnetic attraction of the armature to the core, due to the full lamp current now flowing through the coils, serves to hold the closed contacts firmly together. At the same time a secondary spring-loaded armature is attracted to the core and closes a pilot warning lamp circuit so that now both flasher lamps and warning lamp are illuminated.

Since, however, heating current no longer flows through the short-circuited actuating wire, the latter cools and consequently contracts in length. The main armature is therefore pulled away from the core, the contacts opened, and the light signals extinguished. The consequent reduction of electro-magnetism in the core allows the secondary armature to return to its original position and so extinguish the pilot warning light. The above sequence of operations continues to be repeated until the indicator switch is returned to the 'off' position.

Functions of warning lamp

The warning lamp not only serves to indicate that the flasher unit is functioning correctly but also gives a warning of any bulb failure occurring in the external direction indicator lamps—since a reduction in bulb current flowing through the coil reduces the electro-magnetic effect acting on the secondary armature and so prevents closure of the pilot light contacts.

Checking faulty operation

In the event of trouble occurring with a flashing light direction indicator system, the following procedure should be followed.

Check the bulbs for broken filaments.

Refer to the vehicle wiring diagram and check all flasher circuit connections.

Check the appropriate fuse.

Switch on the ignition.

Check with a voltmeter between the flasher unit terminal 'B' (or '+') and earth that battery voltage is present.

Connect together flasher unit terminals 'B' (or '+') and 'L' and operate the direction indicator switch. If the flasher lamps now light, the flasher unit is defective and must be renewed.

Maintenance

Flasher units cannot be dismantled for subsequent reassembly. A defective unit must therefore be renewed, care being taken to connect as the original.

Renewing flasher unit

When renewing a flasher unit or installing a flashing light system it is advisable to test the circuits before connections to flasher terminals are made. When testing join the cables normally connected to those terminals (green, green with brown, and light green) together and operate the direction indicator switch. In the event of a wrong connection having been made, the ignition auxiliaries fuse will blow but no damage will be done to the flasher unit.

Section N.11

WINDSHIELD WIPERS

Maintenance

Inspect the rubber wiping elements, which after long service become worn and should be renewed.

Lubricate the rubber grommet or washer around the wheelbox spindle with a few drops of glycerine.

Methylated spirits (denatured alcohol) should be used to remove oil, tar spots, and other stains from the windshield. It has been found that the use of some silicone- and wax-based polishes for this purpose can be detrimental to the rubber wiper blades.

The gearbox and cable rack are packed with grease during manufacture and need no further lubrication.

Checking switching mechanism

If the wiper fails to park or parks unsatisfactorily, the limit switch in the gearbox cover should be checked. Unless the limit switch is correctly set, it is possible for the wiper motor to overrun the open-circuit position and continue to draw current.

Resetting the limit switch

Slacken the four screws securing the gearbox cover and observe the projection near the rim of the limit switch. Position the projection in line with the groove in the gearbox cover. Turn the limit switch 25° in an anti-clockwise direction and tighten the four securing screws. If the wiping blades are required to park on the opposite side of the windshield, the limit switch should be turned back 180° in a clockwise direction.

Checking current consumption

If the wiper fails to operate, or operates unsatisfactorily, switch on the wiper and note the current being supplied to the motor. The normal running current should be 2·3 to 3·1 amps. Use a 0 to 15 amps. moving-coil ammeter connected in the wiper circuit, then proceed as follows.

Wiper takes no current

Examine the fuse protecting the wiper circuit. If the fuse has blown, examine the wiring of the motor circuit and of all other circuits protected by that fuse. Renew, if necessary, any cables which are badly worn or chafed, fitting protective sleeving over the cables to prevent a recurrence of the fault.

If the external wiring is found to be in order, replace the fuse with one of the recommended rating. Then proceed as for the wiper taking an abnormally high current.

If the fuse is intact, examine the wiring of the motor circuit for breaks, and ensure that the wiper control switch is operating correctly.

When a current-operated thermostat is fitted test it by connecting an ohmmeter across its terminals in place of the two cables. If a closed circuit is indicated the thermostat is in order and the cables must be refitted. An open circuit means that the thermostat has operated but not reset. Check the thermostat by substitution. Adjustment of the thermostat must not be attempted.

If the thermostat is in order, proceed as for the wiper taking an abnormally high current.

Wiper takes abnormally low current

Check that the battery is fully charged. The performance of the motor is dependent on the condition of the battery.

Remove the commutator end bracket and examine the brush gear, ensuring that it bears firmly on the commutator. The tension spring must be renewed if the brushes do not bear firmly on the commutator. Brush levers must move freely on the pivots. If these levers are stiff they should be freed by working them backwards and forwards by hand.

Examine the commutator and, if necessary, clean with a fuel-moistened cloth. A suspected armature should be checked by substitution.

Wiper takes abnormally high current

If an abnormally high current is shown on the ammeter, this may be due to excessive load on the driving shaft. The stall current of the motor when cold is 14 amps. and when hot is 8 amps.

If there is no obvious reason for this, such as a sticking wiper blade, a check should be made at the gearbox.

Remove the gearbox cover and examine the gear assembly, checking that a blow on the gearbox end bracket has not reduced the armature end-float. The armature end-float adjusting screw must be set to give an armature end-play of ·008 to ·012 in. (·20 to ·30 mm.).

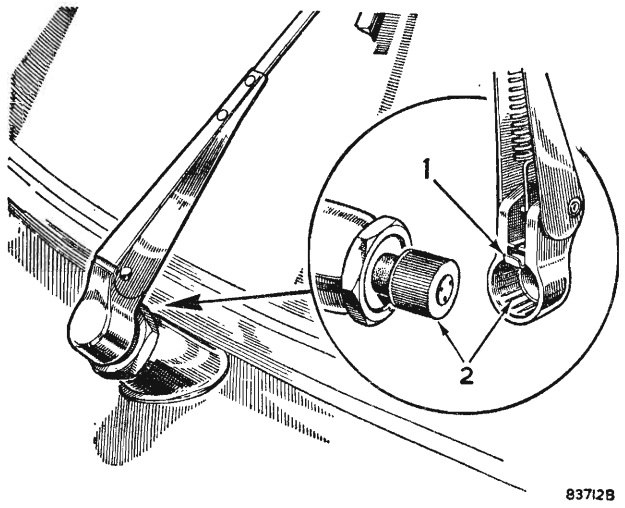


Fig. N.12

Removal and replacement of the windshield wiper arm

1. Retaining clip. 2. Splined drive.

Sluggish operation with excessive current consumption may be caused through frictional losses in badly positioned or defective connecting tubes. The connecting tubes can be checked, using a cable gauge. (Details of this gauge can be obtained from any Lucas Agent.) The gauge cable is similar in appearance to the driving rack but is ·010 in. (·25 mm.) larger in diameter and is less flexible. The gauge will not easily pass through connecting tubes having less than the minimum permissible curvature.

To check the tubing, using the gauge, it is necessary to remove the inner rack. Insert the gauge into the connecting tube as far as the first wheelbox and then withdraw it. Remove the tubing connecting the wheelboxes. Insert and withdraw the gauge. If the gauge moves freely the tubing is correctly installed. If the gauge does not move freely the tubing must be checked for sharp bends and obstructions. Check the wheelboxes for alignment and then reassemble.

Removing the motor, gearbox, and wheelboxes

The motor and gearbox is located beneath the passenger's side of the fascia panel and is mounted on a bracket secured to the bulkhead panel by three set screws and nuts.

The cable rack connected to the cross-head in the gearbox passes through outer casings which connect the gearbox to the first wheelbox and the first wheelbox to the second wheelbox.

Remove the fascia panel, Section R and Ra.

Disconnect the wiper arms, the electrical connections from the motor, and the outer cable from the gearbox housing. Remove the three nuts securing the motor to the bulkhead panel and withdraw the motor, and cable rack.

Slacken the cover screws in each wheelbox and remove the cable rack outer casings.

Remove the nut, front bush, and washer from the front of each wheelbox and remove the wheelbox together with the rear bush and spindle tube from beneath the fascia panel.

Replacement is a reversal of the removal sequence, but ensure that the wheelboxes are correctly lined up and that the cable rack engages the gear and spindle assemblies.

Dismantling the motor

Withdraw the four screws securing the gearbox cover and remove the cover.

Withdraw the connectors and through-bolts at the commutator end bracket.

Remove the commutator end bracket clear of the yoke.

The brush gear can be removed by lifting it clear of the commutator and withdrawing it as a unit. Care should be taken at this point to note the particular side occupied by each brush so that each may be replaced in its original setting on the commutator.

Access to the armature and field coils can be gained by withdrawing the yoke.

If it is necessary to remove the field coil, unscrew the two screws securing the pole-piece to the yoke. These screws should be marked so that they can be returned to their original holes.

Press out the pole-piece complete with field coil, marking the pole-piece so that it can be replaced in its correct position inside the yoke. The pole-piece can now be pressed out of the field coil.

Pieces of carbon short-circuiting adjacent segments of the commutator will also cause excessive current consumption. The resistance between adjacent commutator segments should be ·34 to ·41 ohm. Cleaning the commutator and brush gear removes this fault. When dismantling, check the internal wiring of the motor for evidence of short-circuiting due to chafed or charred insulation. Slip a new piece of sleeving over any charred connections, and arrange them so that they do not rub against sharp edges.

While the motor is dismantled check the value of the field resistance. If it is found to be lower than 12·8 to 14 ohms, a short-circuit in the windings is indicated and a new field coil must be fitted. Other evidence of a short-circuit will be given by charred leads from the field coil.

Dismantling the gearbox unit

Remove the circlip and washer from the cross-head connecting link pin and lift off the cross-head and cable rack assembly. Then remove the circlip and washer from the final gear shaft located underneath the gearbox unit. Remove any burr from the circlip groove before lifting out the final gear. The armature and worm drive can now be withdrawn from the gearbox. All gear teeth should be examined for signs of damage or wear and, if necessary, new gears fitted.

Reassembling

Reassembly is a reversal of the above procedures. When reassembling, the following components should be lubricated.

Armature bearings

These should be lubricated with S.A.E. 20 engine oil—the self-aligning bearing being immersed in this for 24 hours before assembly.

Armature shaft (commutator end)

Apply S.A.E. 20 engine oil.

Felt lubricator in gearbox

Apply S.A.E. 20 engine oil.

Worm wheel bearings, cross-head, guide channel, connecting rod, crankpin, worm, and final gear shaft
Grease liberally.

Cable rack and wheelboxes
Grease liberally.

Testing

Switch on the ignition and the wiper control. The two wiper areas should be approximately symmetrical on the windshield.

Fitting a blade to a wiper arm

Pull the wiper arm away from the windshield and insert the curved 'wrist' of the arm into the slotted spring fastening of the blade. Swivel the two components into engagement.

Fitting a wiper arm to the driving spindle

First ensure that the wiper spindles are in the correct parking position by switching on the ignition and turning the wiper control on and then off.

To fit the arms, press the headpieces onto the spindles at the correct parking angle until the retaining clip is heard to snap over the end of the spindle drum.

Operate the wiper control to ensure that the arms come to rest in the correct parking position.

Adjusting

Correct operation can be obtained by adjusting the position of the arms relative to the spindles. If necessary, the position of the arms may be adjusted by removing and re-engaging them with the splined driving spindles, the angular pitch of the splines being 5°.

Do not attempt to turn the arms whilst in position, but press back the retaining clip (Fig. N.12) in the headpieces and withdraw the arms from the driving spindles. Refit in the desired position. The above adjustment may affect the self-parking position. If so, it may be corrected by adjustment of the limit switch position as described previously.

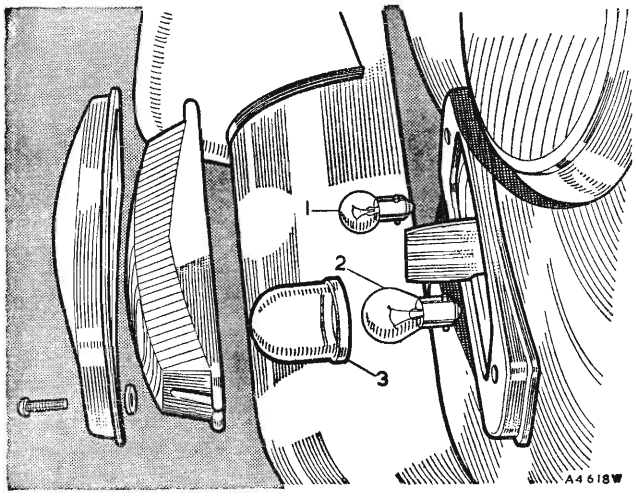


Fig. N.13

The side and direction indicator lamp

1. Sidelamp bulb.
2. Direction indicator bulb.
3. Amber direction indicator bulb cover.

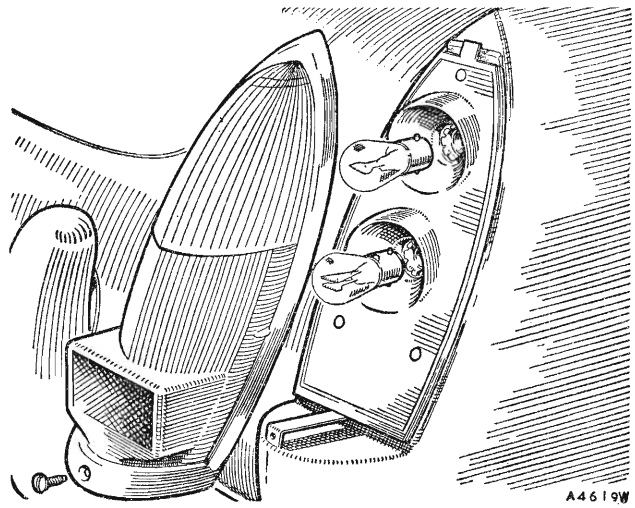


Fig. N.14

The tail, stop, and direction indicator lamps

If the arms and blades are required to come to rest on the opposite side, the limit switch should be turned through 180°. It should be noted that the switch cover is designed for turning through a sector only and not through 360°. This feature prevents unnecessary twisting of the external flexible connections.

Section N.12

PILOT AND FLASHING DIRECTION INDICATOR LAMPS

Remove the two securing screws and lift away the plated rim and glass. An amber cover is fitted over the direction indicator bulb when the vehicle is operating in countries where the lighting regulations require amber flashing indicators.

Refitting is a direct reversal of the removal procedure.

Section N.13

TAIL AND STOP AND DIRECTION INDICATOR LAMPS

The tail lamp bulbs are of the double-filament type, the second filament giving a marked increase in brilliance when the brakes are applied.

Access to the bulbs is gained by extracting the securing screws from the outer face of the lamp lens to release the lens.

The tail and stop lamp bulbs must be fitted one way only; offset retaining pegs ensure that they are replaced correctly.

The lamp body can be removed when the lens is taken off as indicated in Fig. N.14 and the three screws located in the lamp body withdrawn. When refitting the glass to the body make certain that it is seating correctly over the sealing rubber.

Section N.14

PANEL AND WARNING LAMPS

Access to the warning lamps for the ignition and headlamp beam is effected from under the fascia by withdrawing the push-in-type holders from the rear of the fascia panel.

A list of the correct types of bulbs for replacement purposes and their part numbers appears in Section N.19.

Section N.15

NUMBER-PLATE ILLUMINATION LAMP

The number-plate is illuminated by a separate lamp with twin bulbs.

The cover is removed by unscrewing the single attachment screw, which enables it to be withdrawn, giving easy access to the bulbs.

Section N.16

HEADLAMPS

The two types of headlamp fitted have sealed-beam units or, alternatively, replaceable bulb light units.

Variations within the two basic types cater for the local lighting regulations existing in the country for which the car was produced. The method of retaining and adjusting the light unit together with the type of lens and bulb used are subject to territorial variation. Fig. N.15 shows the alternative methods of retaining and adjusting the light unit and Fig. N.16 the different types of bulb fittings used.

Removing a light unit

Removable-type retaining screw (1) *Fig. N.15*

(1) Unscrew the outer rim retaining screw from the bottom of the rim, and withdraw the rim.
(2) Remove the rubber dust excluder (if fitted).
(3) Remove the three screws securing the light unit retaining plate and withdraw the light unit from the lamp body.

Combined adjusting/retaining screw (2) *Fig. N.15*

(4) Carry out the operations detailed in (1) and (2).
(5) Press the light unit inwards against the tension of the springs and turn it in an anti-clockwise direction until the heads of the screws can pass through the enlarged ends of the slots in the retaining plate, then withdraw the light unit.

Captive-type retaining screw (3) *Fig. N.15*

(6) Carry out the operations detailed in (1) and (2).
(7) Slacken the three retaining screws and turn the light unit retaining plate in an anti-clockwise direction until the heads of the screws can pass through the enlarged ends of the slots in the retaining plate, then withdraw the retaining plate and light unit.

Bulb replacement

Cap-type holder (1) *Fig. N.16*

(8) Press and turn the cap anti-clockwise, lift off the cap and withdraw the bulb.
(9) Fit the bulb into the reflector ensuring that the notch in the bulb flange locates on the ridge in the reflector.
(10) Engage the cap lugs in the reflector slots, press and turn the cap clockwise.

Spring clip type (2) *Fig. N.16*

(11) Withdraw the three-pin socket.
(12) Disengage the spring clip from the reflector lugs, swing the clip up and withdraw the bulb.
(13) Fit the bulb into the reflector ensuring that the pip on the bulb flange engages the slot in the reflector.

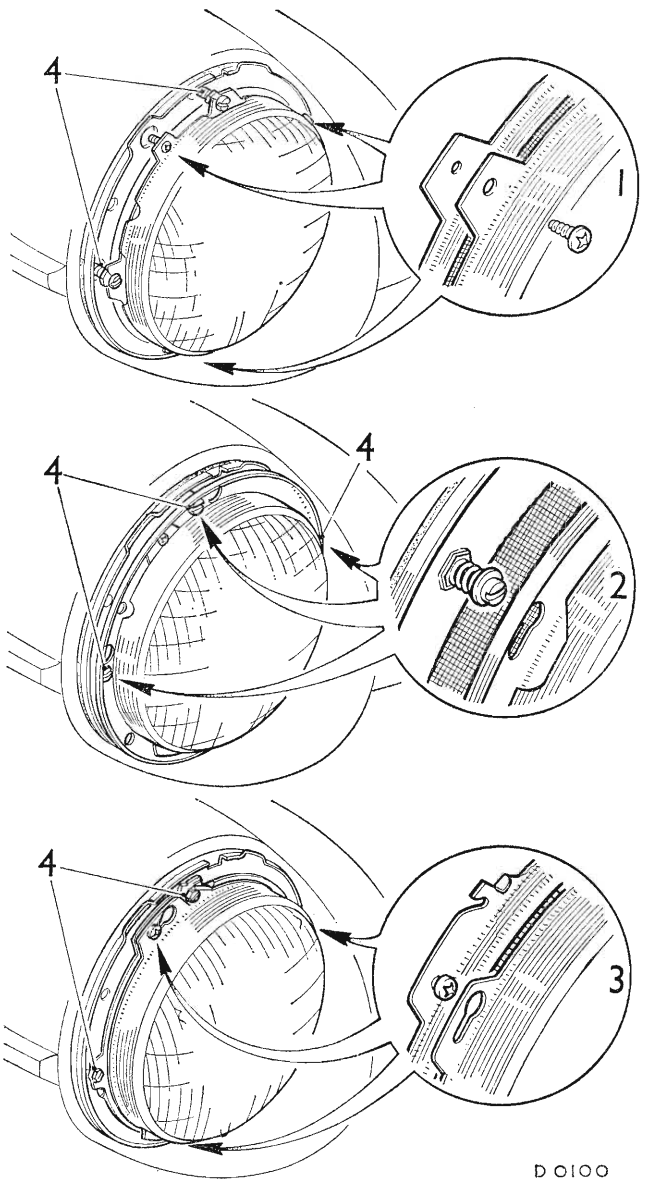


Fig. N.15

Light unit retaining screws

1. Removable screw.
2. Combined adjusting/ retaining screw.
3. Captive retaining screw.
4. Beam-setting adjusting screws.

(14) Swing the spring clip back, ensure that the coils in the clip are resting on the base of the bulb, and engage the legs of the spring clip under the reflector lugs.

Headlamp pilot lamp (3) *Fig. N.16*

(15) Withdraw the holder from the reflector.

(16) Press and turn the bulb anti-clockwise and withdraw the bulb.

(17) Locate the pins of the bulb in the grooves in the holder, press and turn the bulb clockwise.

(18) Press the holder into its hole in the reflector.

Refitting a light unit

(19) Reverse the removing procedure.

Beam setting

The headlamps must be set so that the main driving beams are parallel with the road surface or in accordance with local regulations.

Section N.17

HORN AND HORN-PUSH

Removing the horn

Remove the horn bracket to body securing nuts, spring washers, and set screws. Disconnect the horn leads and remove the horn assembly.

Maintenance

If the horn fails to operate, or operates unsatisfactorily, first carry out the following external checks.

Examine the cables of the horn circuit, renewing any that are badly worn or chafed. Ensure that all connections are clean and tight and that the connecting nipples are firmly soldered to the cables.

Check that the bolts securing the horn brackets are tight and that the horn body does not foul any other fixtures.

Check the current consumption which should be 3 to 3½ amps. when the horn is operating correctly.

After making a thorough external check remove the horn cover and examine the cable connections inside the horn. Examine the contact breaker contacts. If they are burnt or blackened clean them with a fine file, then wipe with a petrol-moistened cloth.

Refitting

Refitting is a reversal of the removal procedure.

Removing the horn-push

When removing the horn-push it is a simple operation of levering the complete assembly out of the steering-wheel with a screwdriver. Take care not to damage the bakelite surround.

Refitting

When refitting ensure that the brass contact strip is in line with the live contact in the steering-wheel assembly.

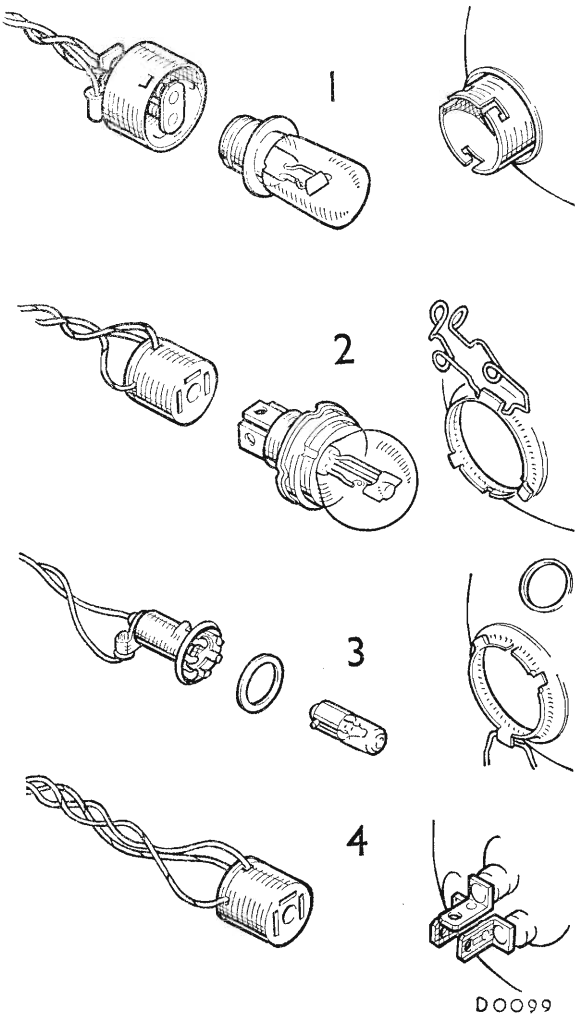


Fig. N.16

Bulb holders and fixings

1. Cap-type holder.
2. Spring clip type.
3. Headlamp pilot lamp.
4. Sealed-beam unit.

Section N.18

SWITCHES

NOTE.—In all cases when removing switches the battery terminals should be disconnected.

Lighting, direction indicator, and windshield wiper

Removing

In all of the above cases disconnect the Lucar connectors, unscrew the fixing nut, and remove the switch assembly complete with its 'D'-shaped locking washer.

Refitting

Refitting is a reversal of the removal procedure.

Ignition

Removing

Disconnect the Lucar connectors, unscrew the fixing nut, and remove the switch assembly complete with its 'D'-shaped locking washer.

Dismantling

To remove the locking barrel from the switch body insert the key and turn the switch to the 'ignition on' position to align the barrel-retaining plunger with the small hole in the switch body. Using an awl, depress the plunger and withdraw the barrel complete with key.

Reassembling and refitting

Reverse the dismantling and removing procedure.

Starter

Removing

Disconnect the battery leads from the switch terminals.

Remove the switch-operating cable by slackening the lock screw on the connecting sleeve and pulling the wire out of the sleeve. Remove the locknut from the threaded sleeve of the switch and withdraw the switch assembly from its mounting bracket.

Refitting

Refitting is a reversal of the removal procedure.

Headlight dipper

Removing

Remove the dipping switch to bracket securing screws and withdraw the switch assembly.

Disconnect the cables from the switch connectors and remove the switch assembly. Switches are serviced as complete units only.

Refitting

Reverse the removal procedure.

Panel

Removing

Remove the securing screws and withdraw the switch assembly.

Disconnect the cables from the switch connectors and remove the switch assembly.

Refitting

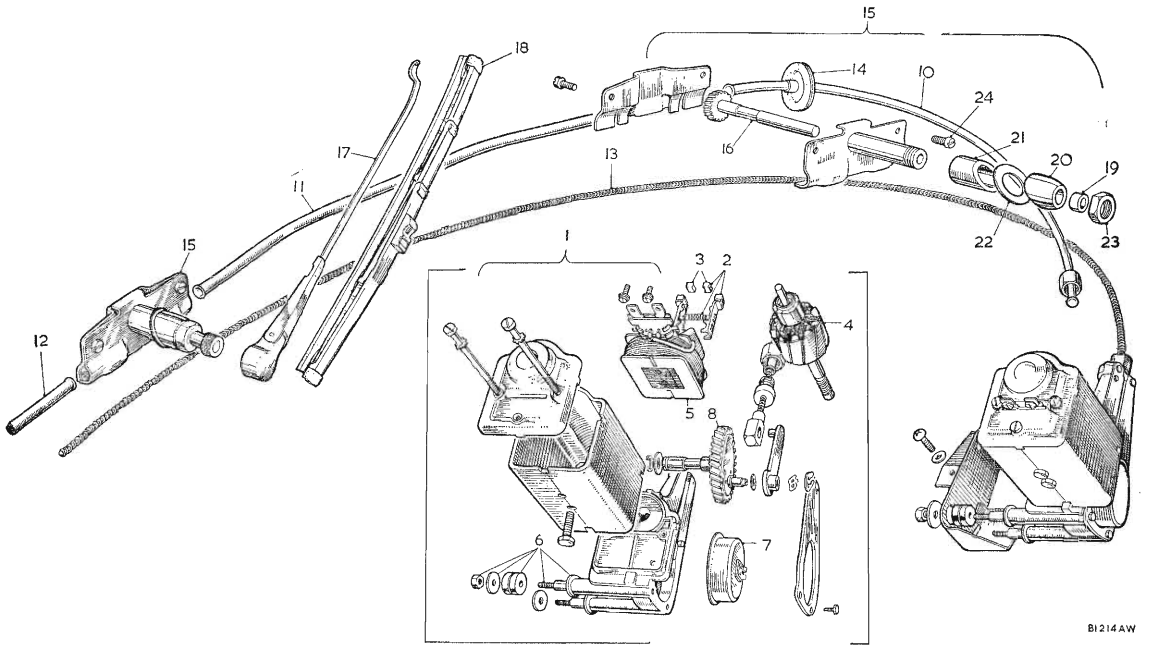
Reverse the removal procedure.

Section N.19

REPLACEMENT BULBS

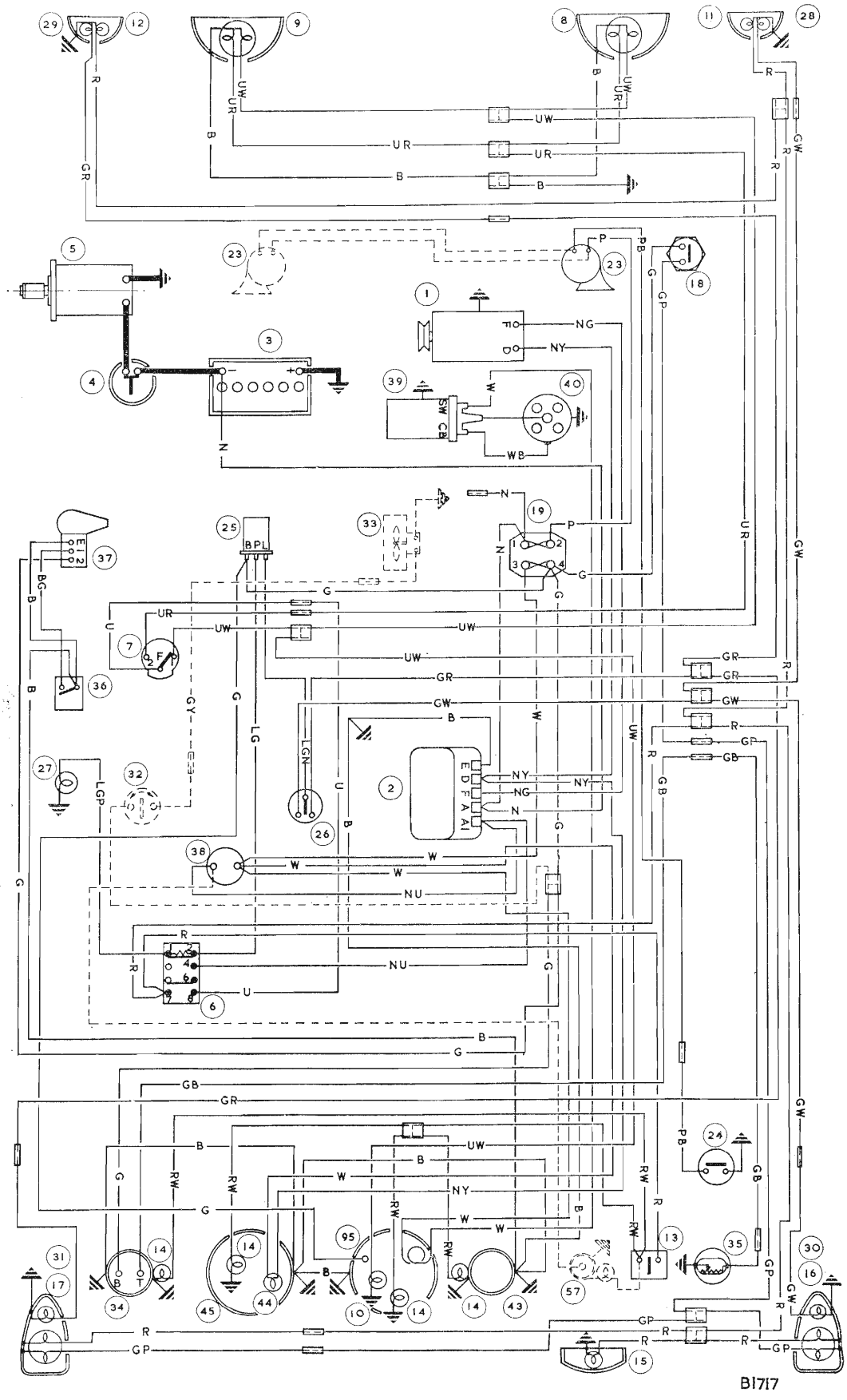
	Volts	*Watts*	*BMC Part No.*
Headlamps—L.H.D. except North America and Europe	12	50/40	BFS 415
Headlamps—Europe except France	12	45/40	BFS 410
Headlamps—France only	12	45/40	BFS 411
Sidelamps	12	6	BFS 989
Sidelamps, direction indicator lamps—North America and Italy	12	6/21	BFS 380
Direction indicator lamps (front)	12	21	BFS 382
Direction indicator lamps (rear)	12	21	BFS 382
Tail and stop lamps	12	6/21	BFS 380
Number-plate illumination lamp	12	6	BFS 989
Panel and warning lights	12	2·2	BFS 9874
Reverse lamps	12	21	27H 881

THE WINDSHIELD WIPER COMPONENTS



No.	*Description*
1.	Windshield wiper motor.
2.	Brush gear.
3.	Brush.
4.	Armature.
5.	Field coil.
6.	Fixing parts.
7.	Parking switch.
8.	Gear and shaft.
10.	Motor to wheelbox outer casing.
11.	Wheelbox to wheelbox outer casing.
12.	Wheelbox extension outer casing.
13.	Cross-head and rack assembly.
14.	Grommet.
15.	Wheelbox.
16.	Spindle and gear.
17.	Wiper arm.
18.	Wiper blade.
19.	Rubber tube spindle.
20.	Front bush.
21.	Rear bush.
22.	Rubber washer.
23.	Nut.
24.	Cover screw.

WIRING DIAGRAM



KEY TO THE WIRING DIAGRAM

No.	*Description*
1.	Dynamo.
2.	Control box.
3.	Battery—12-volt.
4.	Starter switch.
5.	Starter motor.
6.	Lighting switch.
7.	Headlamp dip switch.
8.	Headlamp—R.H.
9.	Headlamp—L.H.
10.	Main-beam warning lamp.
11.	Sidelamp—R.H.
12.	Sidelamp—L.H.
13.	Panel lamps switch.
14.	Panel lamps.
15.	Number-plate illumination lamp.
16.	Stop and tail lamp—R.H.
17.	Stop and tail lamp—L.H.
18.	Stop lamp switch.
19.	Fuse unit.
23.	Horn (twin horns when fitted).
24.	Horn-push.

No.	*Description*
25.	Flasher unit.
26.	Direction indicator switch.
27.	Direction indicator warning lamp.
28.	Front flasher lamp—R.H.
29.	Front flasher lamp—L.H.
30.	Rear flasher lamp—R.H.
31.	Rear flasher lamp—L.H.
32.	Heater or fresh-air motor switch (when fitted).
33	Heater or fresh-air motor (when fitted).
34.	Fuel gauge.
35.	Fuel gauge tank unit.
36.	Windscreen wiper switch.
37.	Windscreen wiper motor.
38.	Ignition switch.
39.	Ignition coil.
40.	Distributor.
43.	Oil pressure gauge.
44.	Ignition warning lamp.
45.	Speedometer.
57.	Cigar-lighter (when fitted).
95.	Tachometer (impulse) (later cars).

CABLE COLOUR CODE

N. Brown.	P. Purple.	W. White.
U. Blue.	G. Green.	Y. Yellow.
R. Red.	LG. Light Green.	B. Black.

When a cable has two colour code letters the first denotes the main colour and the second denotes the tracer colour.

Section Na

THE ELECTRICAL SYSTEM

The information given in this Section refers specifically to the Sprite (Mk. III and IV) and Midget (Mk. II and III) and must be used in conjunction with Section N

	Section
Battery (Type A9/AZ9—A11/AZ11)	Na.8
Cigar-lighter	**Na.2**
Control box (Model RB340)	Na.7
Direction indicator/headlight flasher low-high beam switch (Midget Mk. III from Car No. G-AN5-105501)	Na.13
Fuse unit (Type 7FJ)	Na.9
Ignition switch (Midget Mk. III from Car No. G-AN5-105501)	Na.14
Lamps—stop, tail, and direction indicator	Na.6
Replacement bulbs	Na.11
Reverse lamps	**Na.4**
Starter (Type M35J)	Na.10
Switches	**Na.1**
Switches (Midget Mk. III from Car No. G-AN5-105501)	Na.12
Tachometer—impulse type	**Na.3**
Windshield wipers (later cars)	Na.5
Wiring diagrams	Section Nc

Section Na.1

SWITCHES

Direction indicator switch

Removing

Disconnect the battery. Remove the set screws securing the two halves of the cover and disconnect the snap connections beneath the column. Remove the set screws securing the switch to the column and lift away the assembly.

Refitting

Reverse the removal procedure.

Horn switch (Early cars)

Removing

Disconnect the battery. Press the horn switch and turn anti-clockwise to remove.

Refitting

Reverse the removal procedure.

Ignition and starter switch

Removing

Disconnect the battery. Remove the bezel ring with Service tool 18G 671. Disconnect the leads and pull the switch from the rear of the instrument panel.

Refitting

Reverse the removal procedure.

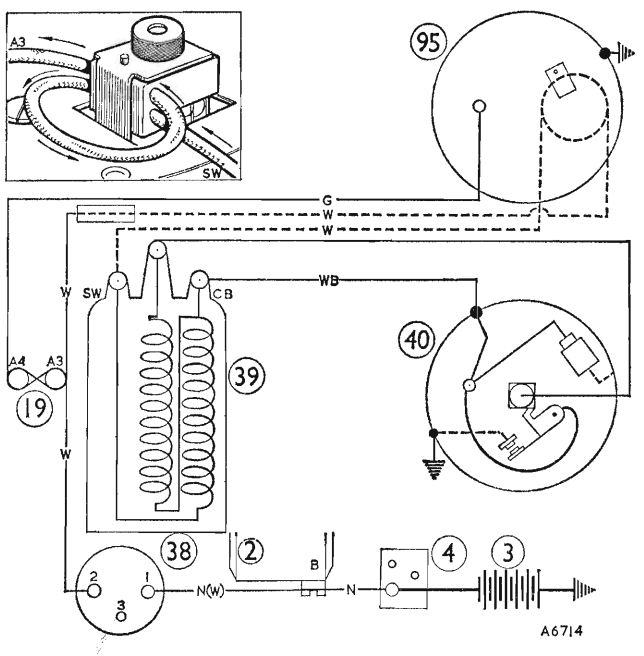


Fig. Na.1

Impulse tachometer circuit

2. Control box.
3. Batteries (12-volt).
4. Starter solenoid.
19. Fuse—A3-A4.
38. Ignition switch.
39. Ignition coil.
40. Distributor.
95. Tachometer.

Inset: symmetrical loop of pulse lead

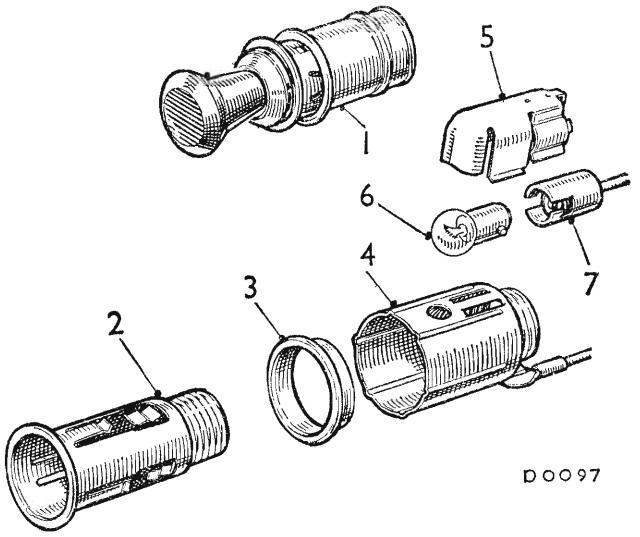


Fig. Na.2

The cigar lighter components

1. Pop-out heater unit.
2. Switch base.
3. Glow ring.
4. Shell.
5. Lamp cover.
6. Bulb.
7. Bulb holder.

Section Na.2

CIGAR-LIGHTER

Removing

(1) Disconnect the cigar-lighter feed wire from the ignition switch terminal.

(2) Disconnect the earth wire from the cigar-lighter.

(3) Press in the sides of the illumination lamp cover and withdraw the lamp unit from the lighter shell.

(4) Unscrew the lighter shell from the switch base.

(5) Withdraw the switch base and glow ring from the front of the fascia panel.

Refitting

(6) Reverse the removing procedure in (1) to (5).

Section Na.3

TACHOMETER—IMPULSE TYPE

The equipment consists of an indicator head and pulse lead. The pulse lead is connected in series between the ignition switch and the ignition coil, and transmits voltage pulses to the indicator head.

Faulty operation

Check wiring connections to the indicator head and continuity of the circuit. Poor connections may result in faulty readings.

The pulse lead should form a symmetrical loop and not tight against the plastic forms (inset Fig. Na.1).

Section Na.4

REVERSE LAMPS

Bulb replacement

(1) Remove the screws securing the reverse lamp to the rear panel.

(2) Withdraw the lens.

(3) Press the bulb down towards the lower contact and withdraw it from the lamp.

(4) Fit one end of the bulb into the hole in the lower contact, then press the top of the bulb until the point on the bulb cap engages in the hole in the upper contact.

(5) Refit the lens and securing screws.

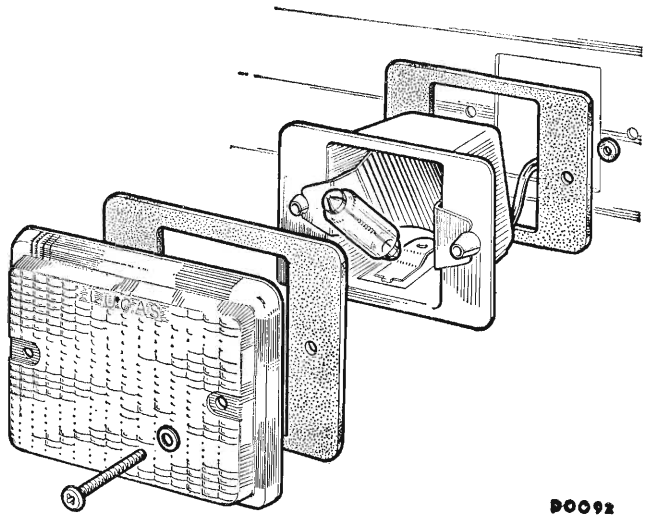


Fig. Na.3
The reverse lamp

Section Na. 5

WINDSHIELD WIPERS
(Later cars)

Removing

Wiper arms

Slacken the screw securing the wiper arm to the wheelbox spindle. Tap the screw head to release the splined locking wedge and withdraw the wiper arm.

Motor and gearbox assembly

(1) Disconnect the battery.

(2) Disconnect the wiring from the motor terminals.

(3) Remove the wiper arms.

(4) Remove the two motor securing nuts and bolts.

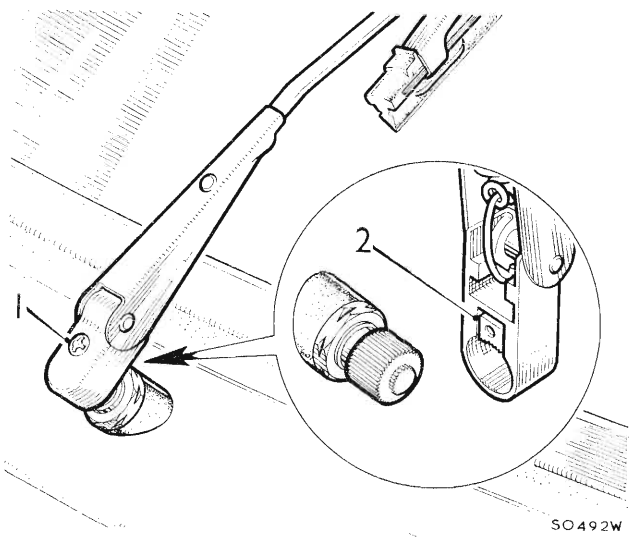


Fig. Na.4
Removal and replacement of the windshield wiper arms

1. Screw. 2. Splined locking wedge.

(5) Withdraw the motor and gearbox assembly complete with the inner drive cable. The inner cable will rotate the wiper spindles as it is withdrawn.

Dismantling

Motor and gearbox assembly

(6) Unscrew the four gearbox cover retaining screws and remove the cover.

(7) Remove the circlip and flat washer securing the connecting rod to the crankpin.

(8) Withdraw the connecting rod, taking care not to lose the flat washer fitted under it.

(9) Remove the circlip and washer securing the shaft and gear.

(10) Clean any burrs from the gear shaft and withdraw the gear, taking care not to lose the dished washer fitted under it.

(11) Mark the yoke and gearbox for reassembly.

(12) Unscrew the two fixing bolts from the motor yoke and remove the yoke assembly and armature. The yoke must be kept clear of metallic particles which will be attracted to the pole piece.

(13) Remove the screws securing the brushgear and the terminal and switch assembly, and remove both assemblies.

Inspection

Motor and gearbox assembly

(14) Examine the brushes for excessive wear; if the brushes are worn to $\frac{3}{16}$ in. (4·8 mm.) the brush gear assembly must be renewed.

(15) Check the brush spring pressure with a push-type gauge, the gauge reading should be 5 to 7 oz. (140 to 200 gm.) when the bottom of the brush is level with the bottom of the slot in the brush box. The brush gear assembly must be renewed if the springs are not satisfactory.

(16) Test the armature for insulation and open or short circuits; renew the armature if faulty.

(17) Examine the gear wheel for damage or excessive wear; renew if necessary.

Reassembling

Motor and gearbox assembly

(18) Reverse the dismantling procedure in (6) to (13) noting the following points:

(*a*) Use Ragosine Histate Grease to lubricate the gear wheel teeth and cam, armature shaft worm gear, connecting rod and connecting pin, cross-head slide, cable rack, and wheelbox gear wheels.

(*b*) Use Shell Turbo 41 oil to lubricate the bearing bushes, armature shaft bearing journals (sparingly), gear wheel shaft and crankpin, felt washer in the yoke bearing (thoroughly soak), and the wheelbox spindles.

(*c*) Tighten the yoke fixing bolts to a torque figure of 20 lb. in. (·23 kg. m.).

(*d*) If a replacement armature is being fitted, slacken the thrust screw to provide end-float for fitting the yoke.

(*e*) Fit the thrust disc inside the yoke bearing with its concave side towards the end face of the bearing.

(*f*) Fit the dished washer beneath the gear wheel with its concave side towards the gear wheel.

(*g*) When fitting the connecting rod to the crankpin ensure that the larger of the two flat washers is fitted under the connecting rod with the smaller one on top beneath the circlip.

(*h*) With the thrust screw fully tightened against the gearbox casting, an end-float of ·004 to ·008 in. (·1 to ·21 mm.) should exist on the armature. Adjustment of the armature end float can be achieved by adjustment of the thrust screw.

Refitting

Motor and gearbox assembly

Reverse the removing procedure in (1) to (5) ensuring that the inner cable engages correctly with the wheelbox gear teeth.

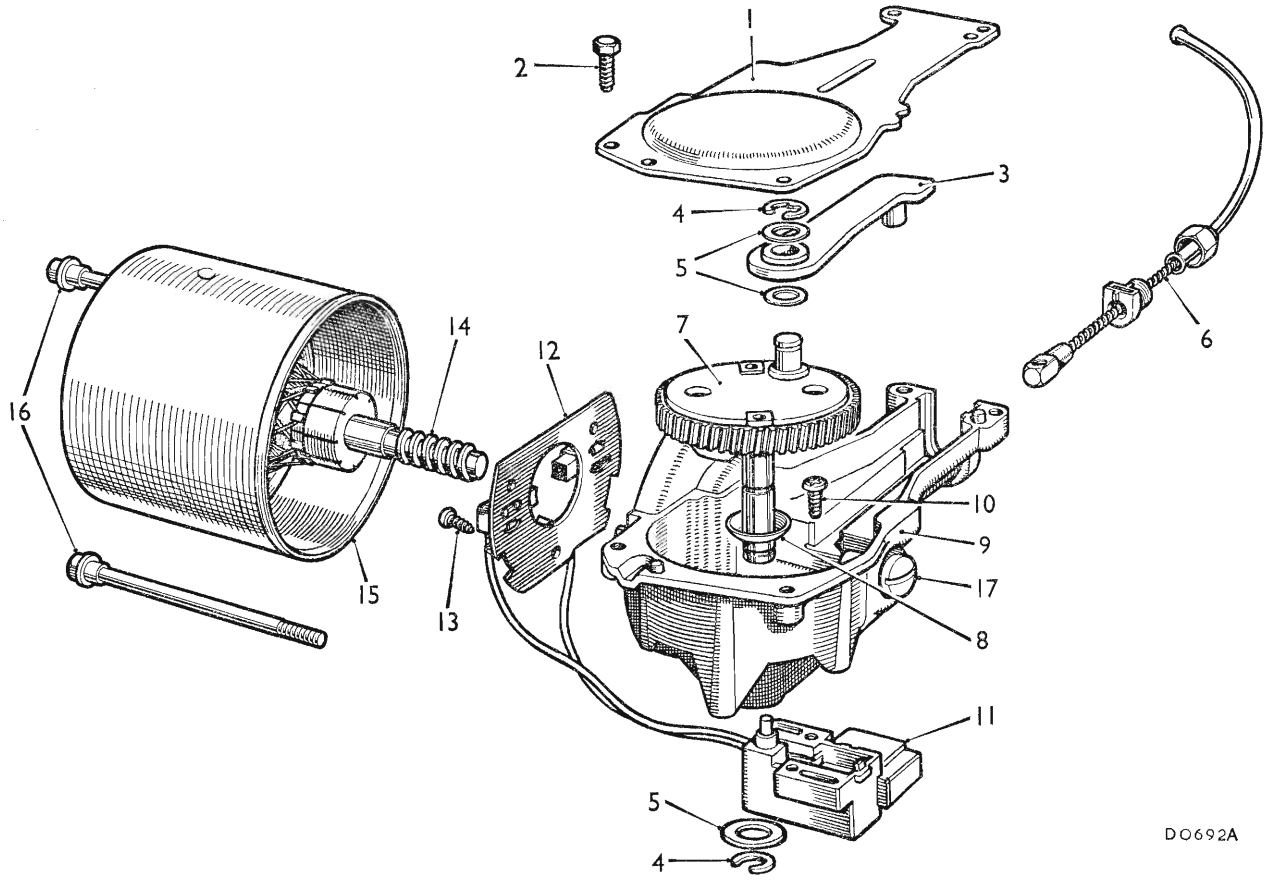


Fig. Na.5

The windshield wiper motor components

1. Gearbox cover.
2. Screw for cover.
3. Connecting rod.
4. Circlip.
5. Plain washer.
6. Cable assembly.
7. Shaft and gear.
8. Dished washer.
9. Gearbox.
10. Screw for limit switch.
11. Limit switch assembly.
12. Brush gear.
13. Screw for brush gear.
14. Armature.
15. Yoke assembly.
16. Yoke bolts.
17. Armature adjusting screw.

Section Na.6

LAMPS

Stop, tail and direction indicator

Bulb replacement

(1) Remove the two screws securing the lamp lens and remove the lens. When refitting, ensure that the lens seal is correctly positioned.

Lamp unit removing

(2) Disconnect the battery.

(3) Remove the nuts and washers retaining the lamp unit.

(4) Disconnect the electrical leads at the harness connectors.

(5) Remove the lamp.

Number-plate lamp

Bulb replacement

(6) Remove the two securing screws and lift off the lamp hood and lens. Remove the bulb.

(7) When reassembling, ensure that the lamp lens seal is correctly positioned. Tighten the screws evenly and progressively to compress the seal.

Lamp unit removing

(8) Remove the two nuts and washers retaining the lamp to the mounting bracket; alternatively, remove the lamp complete with the bracket.

(9) Disconnect the electrical leads at the harness connectors inside the boot. Remove the lamp unit.

NOTE.—The lamp mounting brackets are handed left- and right-hand.

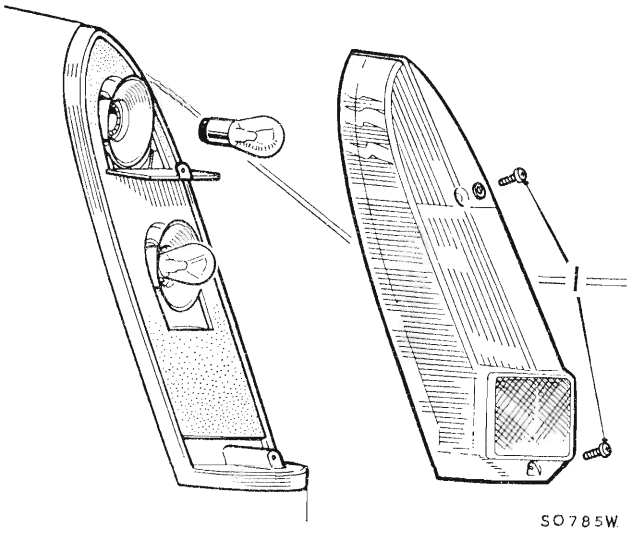


Fig. Na.6

The stop tail and direction indicator lamp

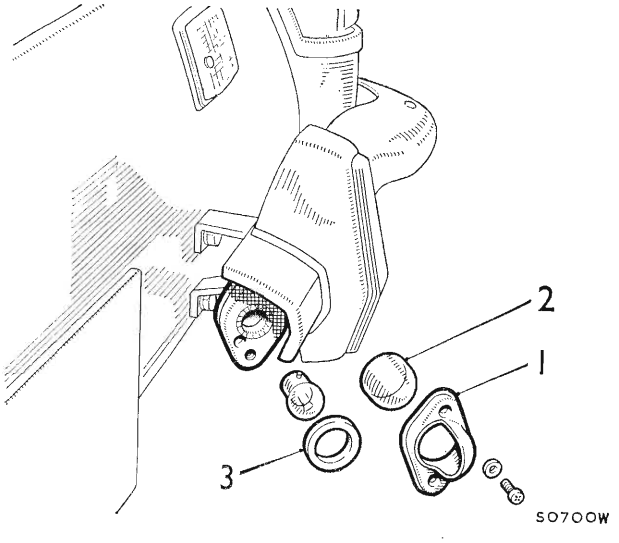


Fig. Na.7

The number-plate lamp

Interior courtesy lamp

Bulb replacement

(10) Remove the two screws securing the lamp lens and withdraw the festoon-type bulb from the retaining clips.

Lamp unit removing

(11) Remove the two screws, nuts and washers retaining the lamp to the mounting bracket.

(12) Disconnect the electric leads behind the mounting bracket. Remove the lamp unit.

Section Na. 7

CONTROL BOX (Model RB340)

General description

The RB340 control box operates on the current–voltage system of dynamo output regulation. Three units are housed in the control-box: two separate, vibrating armature-type, single-contact regulators, and a cut-out relay. One regulator is responsive to changes in current and the other to changes in voltage.

The voltage regulator and cut-out relay are temperature- and voltage-compensated. The effect of temperature fluctuation is further minimized by a swamp resistor connected in series with the shunt coils of the voltage regulator and cut-out relay.

Voltage and current adjustments are made by turning toothed cams with a suitable tool; a special tool is available from Joseph Lucas Ltd.

Testing and adjusting

Equipment: Hydrometer; 0–20 volt moving-coil voltmeter; 0–40 amp. moving-coil ammeter.

IMPORTANT.—Check and adjust as rapidly as possible to avoid errors due to heating of the operating coil. Aim for nominal setting when making electrical and mechanical adjustments. Before attempting to adjust the control box settings, the following preliminary checks must be made.

(1) Check the state of the battery with a hydrometer.
(2) Check the dynamo output (Section N.5).
(3) Check the charging circuit wiring between the dynamo, control box, and ignition switch for insulation and continuity.
(4) Check the earth connections, particularly the control box.

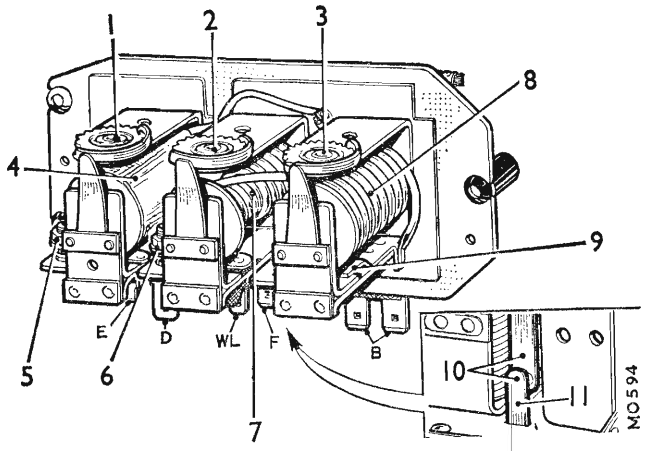


Fig. Na.8

Control box (RB340)

1. Adjustment cam—voltage.
2. Adjustment cam—current.
3. Adjustment cam—cut-out.
4. Voltage regulator.
5. Voltage contacts.
6. Current contacts.
7. Current regulator.
8. Cut-out relay.
9. Armature back stop.
10. Cut-out contacts.
11. Fixed contact bracket.

Voltage regulator

(5) Withdraw the cables from the control box terminals 'B' and bridge the disconnected cables.
(6) Withdraw the cable from the control box terminal 'WL' and connect the voltmeter between the terminal blade and a good earth point on the car.
(7) Start the engine and run the dynamo at 3,000 r.p.m.
(8) A steady voltmeter reading should be registered within the limits given according to the ambient temperature.

Ambient temperature	*Voltage regulator checking limits*	*Voltage regulator setting limits*
10° C. (50° F.)	14·5 to 15·8 volts	14·9 to 15·5 volts
20° C. (68° F.)	14·4 to 15·6 volts	14·7 15·3 volts
30° C. (86° F.)	14·3 to 15·3 volts	14·5 to 15·1 volts
40° C. (104° F.)	14·9 to 15·1 volts	14·3 to 14·9 volts

(9) If the reading obtained is within the limits but fluctuates more than ±3 volts, check for dirty contacts or foreign matter in the air gaps.
(10) If the reading is steady but falls outside the appropriate limits, carry out the adjustment in (11) to (15).
(11) Stop the engine and remove the control box cover.
(12) Start the engine and run the dynamo at 3,000 r.p.m.
(13) Turn the voltage adjustment cam clockwise to raise the voltage setting or anti-clockwise to lower it, until the correct setting within the appropriate setting limits given is obtained.
(14) Check the setting by stopping the engine, re-starting it, and running the dynamo at 3,000 r.p.m.
(15) Stop the engine, refit the cover and restore the original connections.

Current regulator

(16) Remove the control box cover.
(17) Short out (clip together) the voltage regulator contacts to enable the dynamo to develop its maximum rated output.
(18) Withdraw the cables from the control box terminals 'B' and bridge the disconnected cables.
(19) Connect the ammeter between the bridged cables and the 'B' terminal blades.
(20) Check that no other loads are taken from the control box side of the ammeter.
(21) Start the engine, switch on the headlamps and run the dynamo at 4,500 r.p.m.
(22) Note the ammeter, which should register a steady reading equal to the maximum rated output of the dynamo.
(23) If this is correct but fluctuates more than ±1 amp., check for dirty contacts or foreign matter in the air gap.

(24) If the reading is steady but falls outside the limits, carry out the adjustment in (25) to (26).
(25) Turn the current adjustment cam, clockwise to raise the current setting or anti-clockwise to lower it, until the correct setting is obtained.
(26) Stop the engine, refit the cover and restore the original connections.

Cut-out relay—contacts closing
Cut-in voltage
(27) Withdraw the cable from the control box terminal 'WL' and connect the voltmeter between the terminal blade and a good earth on the car.
(28) Switch on the headlamps.
(29) Start the engine and slowly increase its speed and observe the voltmeter.
(30) The voltmeter reading should rise steadily as the engine speed is increased and then drop back slightly when the cut-out contacts close. The cut-in voltage is that which is indicated immediately before the voltmeter reading drops back and should be within the limits given.
(31) If the reading falls outside the limits, carry out the adjustments in (32) to (35).
(32) Remove the control box cover.
(33) Reduce the engine speed so that the cut-out contacts re-open.
(34) Turn the cut-out relay adjustment cam, clockwise to raise the setting or anti-clockwise to lower it, until the correct setting is obtained.
(35) Stop the engine, refit the cover, and restore the original connections.

Cut-out relay—contacts opening
NOTE.—The contact opening setting may be checked by using a voltmeter to check the '*Drop-off voltage*', or using an ammeter to check the '*Reverse current*'; both are given.

Drop-off voltage
(36) Withdraw the cables from the control box terminals 'B' and bridge the disconnected cables.
(37) Connect the voltmeter between the terminal blades 'B' and a good earth on the car.
(38) Start the engine and run the dynamo at 3,000 r.p.m.
(39) Slowly decelerate, noting the voltmeter reading. Opening of the contacts is indicated by the voltmeter reading dropping to zero, which should occur between the limits given.
(40) If the reading falls outside the limits, carry out the adjustments in (41) to (44).
(41) Stop the engine and remove the control box cover.
(42) Adjust the cut-out contact gap by carefully bending the fixed contact bracket; reducing the gap will raise the drop-off voltage setting and increasing the gap will lower the setting.
(43) Repeat the test in (38) and (39) and, if necessary, re-adjust until the correct setting is obtained.
(44) Stop the engine, refit the cover and restore the original connections.

Reverse current
(45) Withdraw the cables from the control box terminals 'B' and bridge the disconnected cables.
(46) Connect the ammeter between the control box terminals 'B' and the bridged cables.
(47) Start the engine and increase the speed until the ammeter registers a charge.
(48) Slowly decelerate, noting the ammeter reading, which should fall momentarily to show a reverse current flow within the limits given.
(49) If the reverse current reading falls outside the limits given, carry out the adjustments in (50) to (53).
(50) Stop the engine and remove the control box cover.
(51) Adjust the cut-out contact gap by carefully bending the fixed contact bracket; reducing the gap will reduce the reverse current and increasing the gap will raise it.
(52) Repeat the test in (47) and (48) and, if necessary, re-adjust until the correct setting is obtained.
(53) Stop the engine, refit the cover and restore the original connections.

Air-gap settings
The electrical settings of the regulators must be checked after the air-gaps have been adjusted.

Voltage and current regulators
(54) Withdraw the cables from the control box terminals 'B' and remove the cover.
(55) Turn the adjustment cam clockwise to the point giving minimum lift to the armature spring.
(56) Slacken the locknut and unscrew the contact.
(57) Insert a ·054 in. (1·37 mm.) feeler gauge between the armature and the copper separation on the core face, as far back as the rivet heads on the armature.
(58) Screw the contact in until the feeler gauge is just trapped (i.e. light resistance to removal).
(59) Tighten the back nut.
(60) Check that the narrowest part of the back gap between the back face of the armature is between ·030 to ·040 in. (·76 to 1·02 mm.) with a maximum taper of ·010 in. (·25 mm.) on the current regulator.
(61) Repeat the adjustment in (55) to (59) for the other regulators.
(62) Check the electrical setting of the voltage regulator. The current regulator setting must be checked after the cut-out has been checked and adjusted electrically and mechanically.

Cut-out relay
(63) Carry out (54) and (55).
(64) Press the armature squarely down against the copper separation on the core face.
(65) Check that a gap of ·030 to ·040 in. (·76 to 1·02 mm.) exists between the back face of the armature and the frame on both sides of the armature.
(66) Insert a ·015 in. (·38 mm.) feeler gauge between the head of the core and the armature using the nearest rivet as a datum.

(67) Press the armature down and bend the fixed contact bracket until the contacts just touch.

(68) With the feeler gauge still in position, adjust the armature back stop until it just touches the armature.

(69) Using the nearest rivet as a datum, check that the top gap is from ·035 to ·045 in. (·9 to 1·14 mm.).

(70) Check the electrical settings of the cut-out.

(71) Check the electrical setting of the current regulator.

Cleaning the contacts

Regulators

(72) Use a fine carborundum stone or silicon carbide paper.

Cut-out

(73) Use fine glass-paper only, never carborundum or emery cloth.

(74) Use a cloth moistened with methylated spirit (denatured alcohol) to wipe away foreign matter.

Section Na.8

BATTERY

(Types A9, AZ9, A11, AZ11)

The electrolyte levels are visible through the translucent battery case or may be checked by fully raising the vent cover and tilting it to one side. The electrolyte level in each cell must be maintained so that the separator plates are just covered. To avoid flooding, the battery must not be topped up within half an hour of it having been charged from any source other than the generating system fitted to the car.

To top up the levels, raise the vent cover and pour distilled water into the trough until all the rectangular filling slots are full and the bottom of the trough is just covered. Wipe the cover seating grooves dry and press the cover firmly into position; the correct quantity of distilled water will automatically be distributed to each cell. In extremely cold conditions, run the engine immediately after topping-up to mix the electrolyte.

The manifold must be in position at all times except during the filling or topping-up operation.

Charging the battery with the manifold raised will cause flooding of the electrolyte. Normal charging procedure should be followed, however, when fast charging, the manifold must still remain closed and this precludes the use of a thermostat. Fast charging may be carried out at a current in amps. not greater than the capacity in ampere-hours (20-hour rate) of the battery. The limit time for fast charging is 1 to 1½ hours.

The 'A'-type battery does not have accessible inter-cell connectors and the battery case must not in any circumstances be drilled. Twin cadmium testing probes should be used. A cell comparison test can be made with a hydrometer in the usual way.

Section Na.9

FUSE UNIT

(Type 7FJ)

The fuses are housed in a fuseblock (1) mounted in the engine compartment body adjacent to the battery.

Fuses 2 and 3 protect the side and tail lamps.

Fuse 4 protects the circuits which operate only when the ignition switch is on, viz., heater blower, stop lamps, reverse lamps.

Fuse 5 protects the equipment which operates independently of the ignition switch, viz., horns, interior lamp, cigar-lighter.

Two spare fuses (6) are provided and it is important to use the correct replacement fuse. The fusing value, current rated 17 amp. (35 amp. blow rated), is marked on a coloured slip of paper inside the glass tube of the fuse.

Removing

(1) Disconnect the battery.

(2) Disconnect the electrical connections at the fuse unit.

(3) Remove the two self-tapping screws retaining the fuse unit.

When refitting, refer to the Wiring Diagram to ensure that the correct connections are made to the fuse unit.

Line fuse

A line fuse (7) situated above the main fuse block protects the heater blower motor and the windscreen wiper.

NOTE.—The heater blower motor was originally fused through Fuse 4 of the fuse unit.

Section Na.10

STARTER
(Type M35J)
(Inertia drive)

Dismantling

(1) Remove the screws securing the drive-end bracket.

(2) Withdraw the drive-end bracket complete with the armature and drive.

(3) Remove the thrust washer from the commutator end of the armature.

(4) Remove the screws securing the commutator end bracket.

(5) Detach the bracket from the yoke, disengage the field brushes from the brush gear and remove the bracket.

(6) If necessary, the drive assembly can be removed by compressing the spring, removing the jump ring and withdrawing the drive from the shaft.

Inspection

Brush gear

(7) Check the brush spring tension; fit a new brush into each holder in turn, press on top of the brush with a push-type spring gauge until the brush protrudes approximately $\frac{1}{16}$ in. (1·5 mm.) from the holder. At this point check the gauge reading against the figure given. If the spring pressures vary considerably from the figure given the commutator-end bracket assembly must be renewed.

(8) Check the brushes for wear; renew any brush worn to, or approaching, the minimum length.

(9) To renew the end bracket brushes, cut the brush leads from the terminal post, slot the head of the post sufficiently deep to accommodate the new brush leads and solder the new leads to the posts.

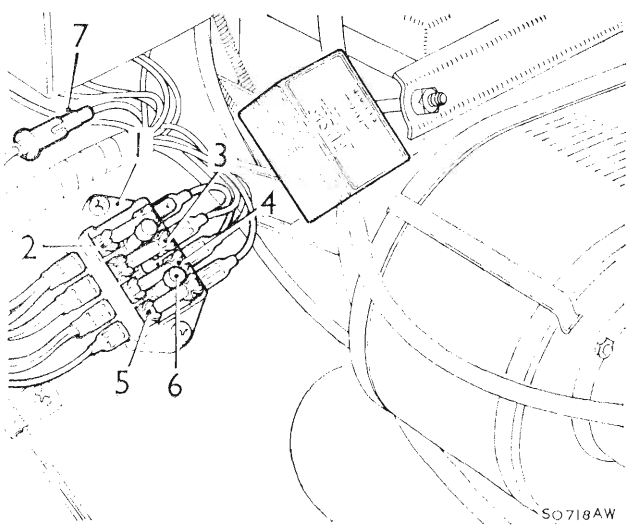


Fig. Na.9

The fuse unit type 7FJ

(10) To renew the field winding brushes, cut the brush leads approximately $\frac{1}{4}$ in. (6·4 mm.) from the field winding junction, solder the new brush leads to the stumps of the old ones ensuring that the insulation sleeves provide adequate coverage.

Commutator

(11) Clean the commutator with a cloth moistened with fuel and examine it for burns, pitting, and excessive wear; **provided that the amount of metal removed does not reduce the thickness of the commutator beyond the minimum thickness,** the commutator may be reconditioned as follows:

(*a*) Turn the commutator at high speed and using a very sharp tool remove the minimum amount of metal necessary to restore the surface.

(*b*) Polish the commutator with very fine sandpaper.

(*c*) Using an air blast, clean any copper residue from the armature.

IMPORTANT.—The commutator segment insulators must not be undercut.

Armature

(12) Test the insulation of the armature windings with a 110-volt A.C., 15-watt test lamp connected between the armature shaft and the commutator; if the lamp lights the armature must be renewed.

(13) Check the windings at their connections with the commutator for signs of melted solder or lifted conductors.

(14) Check the shaft for distortion; if the shaft is bent or distorted the armature must be renewed. Do not attempt to straighten the shaft or machine the armature core laminations.

Field windings

(15) Connect a 12-volt battery-operated test lamp between each of the field brushes and a clean part of the yoke; the lamp will light if continuity is satisfactory between the brushes, windings, and yoke connection.

(16) Disconnect the field windings from their riveted connection with the yoke. Using a 110-volt A.C., 15-watt test lamp connected between each of the brushes in turn and the yoke, check the insulation of the field windings. If the lamp lights the windings must be renewed.

(17) The field windings may be renewed as follows:

(*a*) Disconnect the windings from the connection with the yoke.

(*b*) Slacken the pole-shoe retaining screw using a wheel-operated screwdriver.

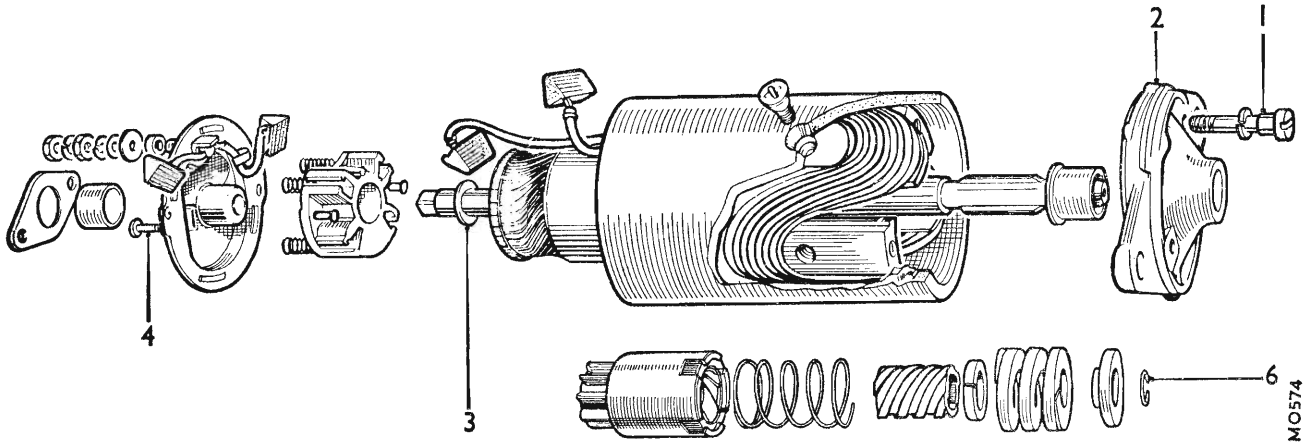


*Fig. Na.*10
The starter motor type M35J

(*c*) Remove the retaining screws from one pair of diametrically opposite pole-shoes and remove the pole-shoes from the yoke.
(*d*) Slide the windings from beneath the remaining pole-shoes and withdraw them from the yoke.
(*e*) Clean the inside of the yoke, the pole-shoes and insulation piece.
(*f*) Loosely fit the new windings and the pole-shoes and position the insulation piece between the yoke and the brush connections to the windings.
(*g*) Tighten the pole-shoe screws evenly using a wheel-operated screwdriver.
(*h*) Re-connect the winding junction connector to the yoke.

Commutator end bracket

(18) Check the insulation of the brush springs and terminal post by connecting a 110-volt A.C., 15-watt test lamp between each spring and the terminal and a clean part of the end bracket; the lamp will light if the insulation is not satisfactory.

Bearings

(19) If a bearing is worn sufficiently to allow excessive side-play of the armature shaft, the bearing bush must be renewed as follows.

Commutator-end bracket

(*a*) Drill out the rivets securing the brush box moulding, remove the moulding, bearing seal retaining plate and felt washer seal.
(*b*) Screw a ½ in. tap a few turns into the bush and withdraw the bush with the tap.

Drive-end bracket

(*c*) Support the bracket and press out the bush.

NOTE.—New bushes must be immersed in S.A.E. 30/40 engine oil for 24 hours or in oil heated to 100° C. (212° F.) for two hours prior to fitting. The bushes must not be reamed after fitting.

(*d*) Using a polished, shouldered mandrel, the same diameter as the shaft bearing journal, press the new bushes into the brackets.

Drive

(20) Wash the drive with paraffin (kerosene) and dry using an air blast.
(21) Check the components for damage and excessive wear; renew worn or damaged parts.

Reassembling

(22) Reverse (1) to (6).

Bench testing

Light running current

(23) Clamp the starter firmly in a vice.
(24) Connect a starter switch, a 0–600 amp. ammeter and a 12-volt battery, in series, to the starter, using the lug as the earth connection.
(25) Connect a voltmeter between the starter terminal and the yoke.
(26) Operate the switch and check the speed of the motor with a tachometer while noting the voltmeter and ammeter readings.
(27) Check the readings obtained in 26 against the figures given in **'GENERAL DATA'** for light running speed, current, and voltage.

Lock torque and current

(28) With the starter connected and clamped as for the light running check, secure an arm to the driving pinion.
(29) Connect a spring balance to the free end of the arm.
(30) Operate the switch and note the ammeter, voltmeter, and spring balance readings. Calculate the lock torque by multiplying the reading of the spring balance in pounds by the length of the arm in feet.
(31) Check the readings obtained in 30 against the figures given in **'GENERAL DATA'** for lock torque, and voltage.

NOTE.—If a constant-voltage supply is used for this test, a higher voltage may be registered on the voltmeter than the figure given. If this should occur, a variable resistance must be added to the circuit and adjusted to give the required reading and the test repeated.

Section Na.11

REPLACEMENT BULBS

	Volts	*Watts*	*Part No.*
Headlamp—Home and R.H.D. Export (English sealed beam)	12	60/45	GLU 101
Headlamp—North America (American sealed beam)	12	50/40	
Headlamp—Europe (except France) (European sealed beam)	12	60/50	
Headlamp—France (bulb type 411 yellow)	12	45/40	BFS 411
Sidelamp—all markets except North America and Italy	12	6	GLB 989
Sidelamp (with flasher)—North America and Italy	12	5/21	GLB 380
Stop, tail—all markets	12	5/21	GLB 380
Reverse—all markets except France	12	18	BFS 273
Reverse—France	12	15	BFS 267
Number-plate lamp	12	6	GLB 989
Direction indicator	12	21	GLB 382
Side-marker lamp—front and rear	14	4	BFS 222
Ignition warning—all markets except North America, Sweden and West Germany	12	2·2	GLB 987
Ignition warning—North America, Sweden and West Germany	12	2	GLB 281
Main beam—all markets except North America, Sweden and West Germany	12	2·2	GLB 987
Main beam—North America, Sweden and West Germany	12	2	GLB 281
Direction indicator warning lamp	12	2·2	GLB 987
Brake warning lamp—North America, Sweden and West Germany	12	1·5	GLB 280
Panel illumination lamp	12	2·2	GLB 987
Cigar-lighter illumination	12	2·2	BFS 643
Luggage compartment lamp	12	6	GLB 254
Interior courtesy lamp	12	6	GLB 254
Hazard warning lamp—North America	12	2·2	GLB 987
Seat belt warning lamp—North America	12	2	GLB 281

Section Na.12

SWITCHES
(Midget Mk. III from Car No. G–AN5–105501)

Removing

CAUTION: Disconnect the battery before attempting to remove any of the switches.

Panel and wiper switches

(1) Disconnect the wiring from the switches.
(2) Remove the switches, using 18G 1201.

Light switch

(3) Depress the pin in the heater knob and remove the knob.
(4) Unscrew the heater switch bezel and remove the heater switch.
(5) Disconnect the wiring from the light switch.
(6) Remove the switch, using 18G 1201.

Refitting

Panel and wiper switches

(7) Reverse the removing procedure in (1) and (2).
(8) Re-connect the battery.

Light switch

(9) Reverse the removing procedure in (3) to (6).
(10) Re-connect the battery.

Section Na.13

DIRECTION INDICATOR/HEADLIGHT FLASHER/ LOW-HIGH BEAM SWITCH
(Midget Mk. III from Car No. G–AN5–105501)

Removing

(1) Disconnect the battery.
(2) Unscrew the four switch cowl retaining screws and remove the cowl.
(3) Disconnect the switch wiring from the multi-snap connector and from the clip around the steering-column.
(4) Remove the two screws retaining the direction indicator/headlight flasher/low-high beam switch, and remove the switch and retaining clip.

Refitting

(5) Reverse the procedure in (1) to (4), ensuring that the small tongue on the switch engages in the cut-away of the outer steering-column.

Section Na.14

IGNITION SWITCH
(Midget Mk. III from Car No. G–AN5–105501)

Removing

(1) Disconnect the battery.
(2) Turn the key to position 'O'.
(3) Disconnect the wiring from the switch.
(4) Remove the two screws retaining the switch to the steering lock.
(5) Withdraw the switch.

Refitting

(6) Reverse the removing procedure in (1) to (5).

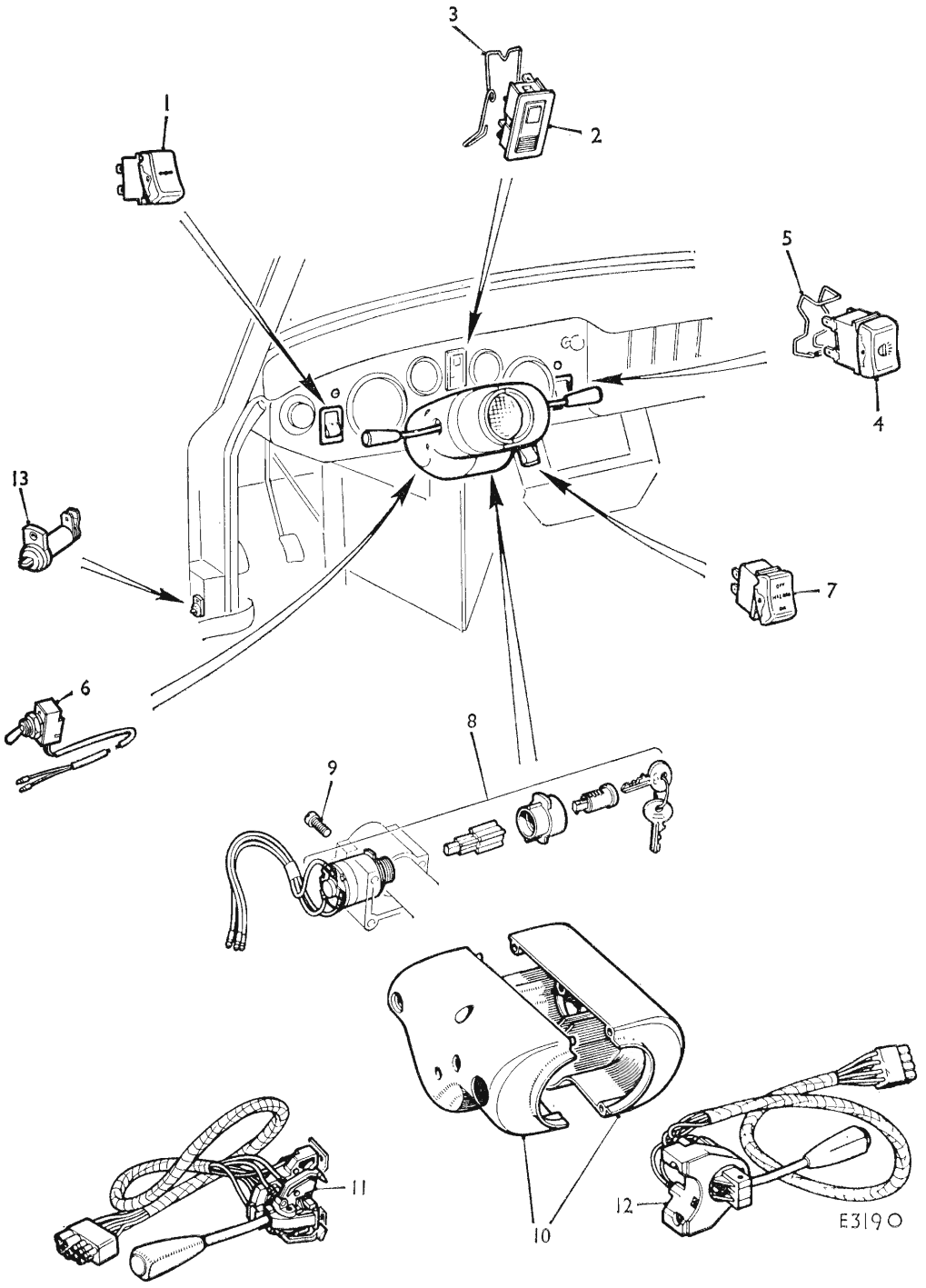
Section Nb

THE ELECTRICAL SYSTEM

The information given in this Section refers specifically to service operations on, or affected by, equipment fitted to the Sprite Mk. IV and Midget Mk. III in conformity with local and territorial requirements, and must be used in conjunction with Section N and Section Na.

	Section
Alternator (Midget Mk. III from Car No. G-AN5-105501)	Nb.6
Instruments and switches	Nb.1
Lamps—front and rear side-marker	Nb.5
Windshield washer motor	Nb.2
Windshield wipers	Nb.3
Windshield wipers (later cars)	Nb.4

THE SWITCHES



No.	*Description*
1.	Heater blower switch.
2.	Brake pressure—warning light/test push.
3.	Retaining clip.
4.	Lighting switch.
5.	Retaining clip.
6.	Panel light switch.
7.	Hazard warning switch.

No.	*Description*
8.	Ignition switch.
9.	Screw for switch.
10.	Steering-column switch cowl.
11.	Direction indicator/headlight flasher/low-high beam/horn switch.
12.	Windshield washer/wiper switch.
13.	Audible warning door switch.

Section Nb.1

INSTRUMENTS AND SWITCHES

Removing

IMPORTANT.—Disconnect the battery before attempting to remove any of the switches or instruments.

Tachometer

(1) Unscrew the two knurled retaining nuts, disconnect the earth cable and remove the retaining brackets.
(2) Withdraw the instrument from the fascia, and disconnect the wiring.

Speedometer

(3) Remove the console (Section Rb.1).
(4) Unscrew the trip recorder reset retaining nut and disengage the reset from its bracket.
(5) Disconnect the speedometer drive cable from the instrument.
(6) Unscrew the two knurled retaining nuts, disconnect the earth cable and remove the retaining brackets.
(7) Withdraw the instrument from the fascia and detach the illumination lamp.

Fuel gauge

(8) Remove the speedometer as in (3) to (7).
(9) Remove the knurled retaining nut and disconnect the earth cable.
(10) Remove the retaining bracket, withdraw the instrument from the fascia and disconnect the wiring.

Brake failure warning lamp assembly

(11) Remove the speedometer as in (3) to (7).
(12) Remove the fuel gauge as in (8) to (10).
(13) Disconnect the wiring from the back of the switch.
(14) Disengage the spring retaining clip and withdraw the switch.

Lighting switch

(15) Remove the console (Section Rb.1).
(16) Disconnect the wiring from the back of the switch.
(17) Using a short, wide-bladed screwdriver or similar tool carefully press in the two lugs on the interior of the switch and withdraw the interior from the switch case.
(18) Disengage the spring retaining clip from the switch case and withdraw the case.

Heater blower switch

(19) Remove the tachometer as in (1) and (2).
(20) Disconnect the wiring from the back of the switch.
(21) Carry out operations (17) and (18) as for the lighting switch.

Air control

(22) Press in the knob retaining button located behind the lettering 'ON'.
(23) Unscrew the control retaining nut and disengage the control from the fascia.
(24) Disconnect the control inner cable from the heater air valve.
(25) Detach the outer cable from its clip on the heater unit.
(26) Attach a piece of cord to the inner cable to assist refitting and draw the cable through the bulkhead from the inside of the car.

Hazard warning switch

(27) Remove the console (Section Rb.1).
(28) Disconnect the wiring from the switch.
(29) Press in the four retaining lugs on the switch outer case and withdraw the switch.

Direction indicator/horn switch

(30) Remove the steering column pinch bolt.
(31) Remove the three toe-plate to column securing bolts.
(32) Note the location, quantity and thickness of the packing washers fitted between the column upper fixing flanges and the body brackets, remove the three securing bolts and nuts and collect the packing washers. **If the packing washers are mislaid or their fitting positions are not recorded the steering column must be aligned as described in Section Ja.3 when refitted.**
(33) Pull the steering column back sufficiently for the switch cowl to clear the fascia.
(34) Unscrew the four switch cowl retaining screws and remove the cowl.
(35) Remove the two screws securing the direction indicator/horn switch to the steering column.
(36) Disconnect the switch wiring at the multi-snap connector below the fascia and remove the switch complete with its wiring.

Windshield wiper/washer switch

(37) Carry out operations (30) to (34).
(38) Remove the two screws securing the windshield wiper/washer switch to the steering column.
(39) Disconnect the switch wiring at the multi-snap connector below the fascia and remove the switch complete with its wiring.

Ignition switch

(40) Carry out operations (30) to (34).
(41) Unscrew the four screws securing the switch retaining saddle and remove the saddle.
(42) Disconnect the switch wiring at the snap connectors below the fascia and remove the switch complete with its wiring.

Panel light switch

(43) Carry out operations (30) to (34).
(44) Remove the switch retaining nut.
(45) Disconnect the switch wiring at the snap connectors below the fascia and remove the switch complete with its wiring.

Refitting

Tachometer

(46) Reverse the removing procedure in (1) and (2).

Speedometer

(47) Reverse the removing procedure in (3) to (7).

Fuel gauge

(48) Reverse the removing procedure in (3) to (10).

Brake failure warning lamp assembly

(49) Reverse the removing procedure in (3) to (14).

Lighting switch

(50) Reverse the removing procedure in (15) to (18).

Heater blower switch

(51) Attach the end of the control cable to the end of the cord pulled through the bulkhead when removing and carefully pull the cable through to the heater unit.

(52) Reverse the removing procedure in (22) to (25).

Hazard warning switch

(53) Reverse the removing procedure in (27) to (29).

Direction indicator/horn switch

(54) Reverse the removing procedure in (34) to (36).

(55) Enter the steering gear pinion into the steering column sleeve as far as it will go.

(56) Fit the packing washers in their original positions between the column fixing flanges and the body brackets; fit the three securing bolts and nuts tightening them by hand until the packing washers are just pinched.

(57) Screw in and tighten the three toe-plate to column securing bolts.

(58) Tighten the three column upper fixing bolts to the torque figure given in **'GENERAL DATA'.**

(59) Fit and tighten the pinion pinch bolt to the torque figure given in **'GENERAL DATA'.**

Windshield wiper/washer switch

(60) Reverse the removing procedure in (34), (38), and (39).

(61) Carry out the operations in (55) to (59).

Ignition switch

(62) Reverse the removing procedure in (34), (41), and (42).

(63) Carry out the operations in (55) to (59).

Panel light switch

(64) Reverse the removing procedure in (34), (44), and (45).

(65) Carry out the operations in (55) to (59).

Section Nb.2

WINDSHIELD WASHER MOTOR

Removing

(1) Disconnect the battery.

(2) Disconnect the wiring from the pump.

(3) Disconnect the water tubes from the pump.

(4) Unscrew the two pump mounting screws and remove the pump.

Refitting

(5) Reverse the removing procedure in (1) to (4).

Section Nb.3

WINDSHIELD WIPERS

Removing

Motor and gearbox assembly

(1) Disconnect the battery.

(2) Disconnect the wiring from the motor terminals.

(3) Remove the wiper arms.

(4) Remove the two motor securing nuts and bolts.

(5) Withdraw the motor and gearbox assembly complete with the inner drive cable. The inner cable will rotate the wiper spindles as it is withdrawn.

Right-hand wheelbox

(6) Remove the fascia (Section Rb.2).

(7) Remove the right-hand demister duct.

(8) Remove the wheelbox cover plate and slide the outer cable from the inner.

(9) Remove the spindle housing securing nut.

(10) Slide the wheelbox from the inner cable.

Left-hand wheelbox

(11) Remove the motor and gearbox as in (1) to (5).

(12) Remove the fascia (Section Rb.2).

(13) Remove the left-hand demister duct.

(14) Remove the wheelbox cover plate and detach the outer cable.

(15) Remove the spindle housing retaining nut.

(16) Withdraw the wheelbox.

Dismantling

Motor and gearbox assembly

(17) Unscrew the four gearbox cover retaining screws and remove the cover.

(18) Remove the circlip and flat washer securing the connecting rod to the crankpin.

(19) Withdraw the connecting rod, taking care not to lose the flat washer fitted under it.

(20) Remove the circlip and washer securing the shaft and gear.

(21) Clean any burrs from the gear shaft and withdraw the gear, taking care not to lose the dished washer fitted under it.

(22) Mark the yoke and gearbox for reassembly.

(23) Unscrew the two fixing bolts from the motor yoke and remove the yoke assembly and armature. The yoke must be kept clear of metallic particles which will be attracted to the pole piece.

(24) Remove the screws securing the brushgear and the terminal and switch assembly, and remove both assemblies.

Inspection

Motor and gearbox assembly

(25) Examine the brushes for excessive wear, if the main brushes (diametrically opposite) are worn to $\frac{3}{16}$ in. (4·8 mm.) or if the narrow section of the third brush is worn to the full width of the brush the brush gear assembly must be renewed.

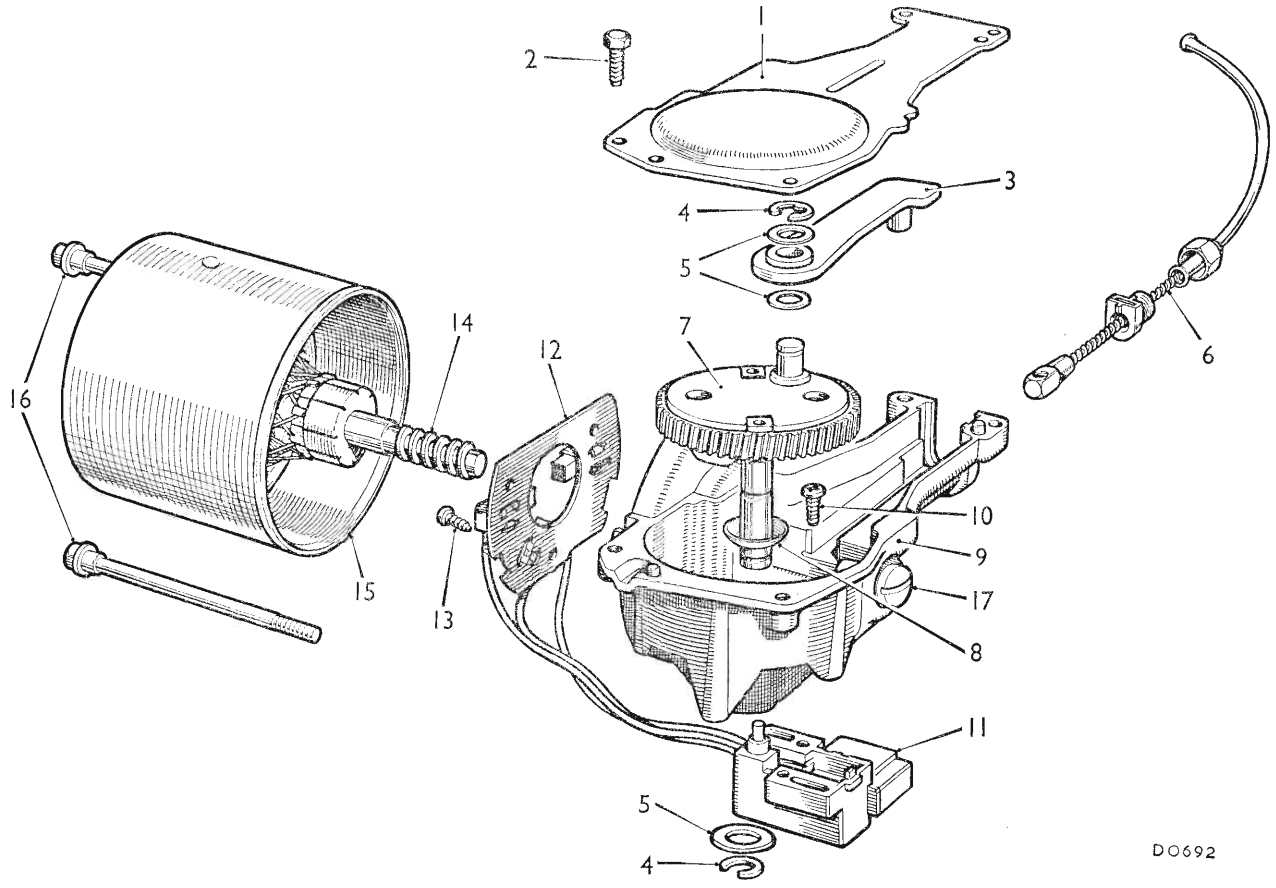


Fig. Nb.1

The two-speed windshield wiper motor components

1. Gearbox cover.
2. Screw for cover.
3. Connecting rod.
4. Circlip.
5. Plain washer.
6. Cable assembly.
7. Shaft and gear.
8. Dished washer.
9. Gearbox.
10. Screw for limit switch.
11. Limit switch assembly.
12. Brush gear.
13. Screw for brush gear.
14. Armature.
15. Yoke assembly.
16. Yoke bolts.
17. Armature adjusting screw.

(26) Check the brush spring pressure with a push-type gauge, the gauge reading should be 5 to 7 oz. (140 to 200 gm.) when the bottom of the brush is level with the bottom of the slot in the brush box. The brush gear assembly must be renewed if the springs are not satisfactory.

(27) Test the armature for insulation and open or short circuits, renew the armature if faulty.

(28) Examine the gear wheel for damage or excessive wear; renew if necessary.

Reassembling

Motor and gearbox assembly

(29) Reverse the dismantling procedure in (17) to (24) noting the following points:

(*a*) Use Ragosine Histate Grease to lubricate the gear wheel teeth and cam, armature shaft worm gear, connecting rod and connecting pin, cross-head slide, cable rack, and wheelbox gearwheels.

(*b*) Use Shell Turbo 41 oil to lubricate the bearing bushes, armature shaft bearing journals (sparingly), gear wheel shaft and crankpin, felt washer in the yoke bearing (thoroughly soak), and the wheelbox spindles.

(*c*) Tighten the yoke fixing bolts to a torque figure of 20 lb. in. (·23 kg. m.).

(*d*) If a replacement armature is being fitted, slacken the thrust screw to provide end-float for fitting the yoke.

(*e*) Fit the thrust disc inside the yoke bearing with its concave side towards the end face of the bearing.

(*f*) Fit the dished washer beneath the gear wheel with its concave side towards the gear wheel.

(*g*) When fitting the connecting rod to the crank-

pin ensure that the larger of the two flat washers is fitted under the connecting rod with the smaller one on top beneath the circlip.

(*h*) With the thrust screw fully tightened against the gearbox casting, an end-float of ·004 to ·008 in. (·1 to ·21 mm.) should exist on the armature. Adjustment of the armature end float can be achieved by adjustment of the thrust screw.

Refitting

Right-hand wheelbox

(30) Reverse the removing procedure in (6) to (10).

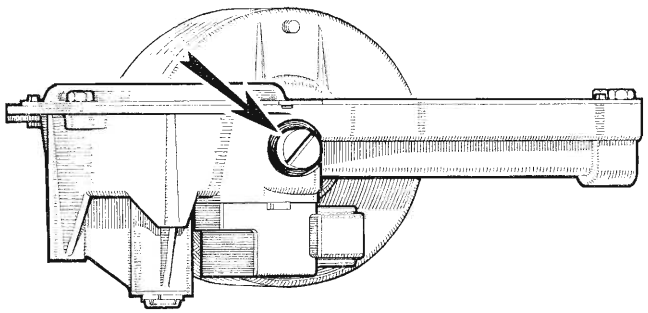


Fig. Nb.2 DO66B

The armature end-float adjusting screw

Left-hand wheelbox

(31) Reverse the removing procedure in (11) to (16) ensuring that the inner cable engages correctly with the wheelbox gear teeth.

Motor and gearbox assembly

(32) Reverse the removing procedure in (1) to (5) ensuring that the inner cable engages correctly with the wheelbox gear teeth.

Section Nb.4

WINDSHIELD WIPERS
(Later cars)

Later cars have a three-blade wiper system; the additional wheelbox is fitted in the centre position.

Removing

Centre-position wheelbox

(33) Remove the fascia (Section Rb.2).

(34) Remove the wheelbox cover-plate and slide the outer cable from the inner.

(35) Remove the spindle housing securing nut.

(36) Withdraw the wheelbox.

Refitting

(37) Reverse the removal procedure.

Section Nb.5

LAMPS

Front and rear side-marker lamps

Removing

(1) Disconnect the battery.

(2) Remove the two nuts, and four washers securing the lamp.

(3) Partially remove the lamp and disconnect the electrical leads at the harness connectors.

Bulb replacement

Front (amber). To renew a bulb, remove the securing screw (1) and lift off the lamp lens, noting that one end is secured by a locating tab (2). When refitting, ensure that the sealing rubber is positioned correctly and that the lens tab (2) is located beneath the lamp body rim before refitting the securing screw.

Rear (red). To gain access to the bulb (3), the rubber lips retaining the chrome bezel and lamp lens should be eased open with a screwdriver and the bezel (1), and lens (2), removed. When refitting ensure that the thick end of the wedge-shaped lens faces rearwards.

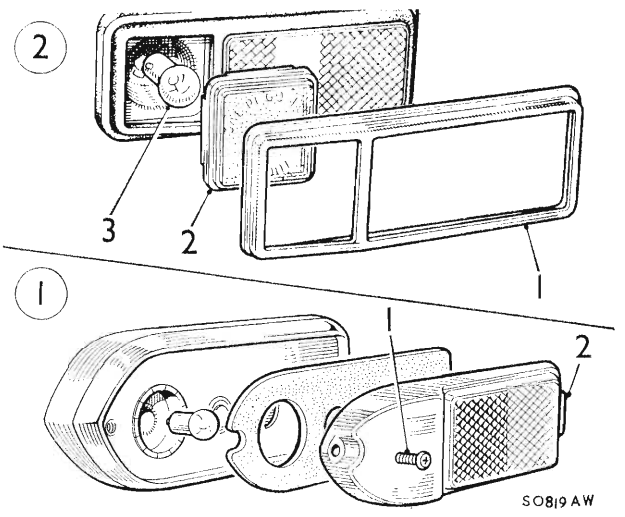


Fig. Nb.3

The front (1) *and rear* (2) *side-marker lamps*

Section Nb.6

ALTERNATOR—Lucas Type 16ACR (Midget Mk. III from Car No. G–AN5–105501)

Service precautions (Alternator in position)

Polarity

Ensure that the correct battery polarity is maintained at all times: reversed battery or charger connections will damage the alternator rectifiers.

Battery connections

The battery must never be disconnected while the engine is running.

Testing semi-conductor devices

Never use an ohmmeter of the type incorporating a hand-driven generator for checking the rectifiers or the transistors.

Testing the charging circuit

Test	Procedure	Remarks
1. Check the driving belt tension	Depress the belt at a mid-way point on the longest belt run between the pulleys.	Correctly tensioned when amount of deflection is 0·5 in. (13 mm.).
2. To check that battery voltage is reaching the alternator	Remove the cable connector from the alternator. Connect a voltmeter, negative, to earth. Switch on the auxiliary circuits. Connect a voltmeter, positive, to each of the alternator cable connections in turn.	(*a*) If battery voltage is not available at: (i) The 'IND' cable connector, check the warning light bulb and the warning light circuit for continuity. (ii) The main charging cable which connects to the alternator terminal marked '+', check the ammeter (if fitted) and the circuit between the battery and alternator for continuity. (*b*) If battery voltage is available at each cable mentioned in (*a*) (i) and (ii), proceed with Test 3.
3. Output test	Remove the alternator end cover. Bridge the 'F' terminal (green) to earth using a jumper lead. Reconnect the connector to the 'IND' terminal on the alternator using a jumper lead. If no ammeter is fitted in the charging circuit, connect an ammeter between either '+' main terminal on the alternator and its cable in the connector. Run the engine at 6,000 alternator r.p.m.	Ammeter should read 34 amps. (*a*) If a zero reading is obtained, remove and overhaul the alternator. (*b*) If a low reading is obtained, first carry out test 4 and if this is satisfactory remove and overhaul the alternator. (*c*) If the correct reading is obtained, proceed with test 5.
4. Circuit resistance test	Connect the alternator as for normal service. Switch on the headlamps. Run the engine at 6,000 alternator r.p.m.	

Testing the charging circuit (*continued*)

Test	Procedure	Remarks
4. Circuit resistance test (*continued*)		
Part One	Connect a voltmeter between positive (+) terminal and the alternator and the positive terminal on the battery.	The voltmeter should read more than ·5 volt. Proceed with Part Two of this test.
Part Two	Transfer the voltmeter connections to the casing of the alternator and the negative terminal of the battery.	The voltmeter reading should not exceed ·25 volt. If correct readings are not obtained, there is a high resistance in the circuit. Trace and rectify.
5. Regulator test	Remove the jumper lead from the 'F' terminal and earth. Leave the remaining connections as in Test 3. Connect a voltmeter across the battery terminals.	
Part One	Run the engine at 6,000 alternator r.p.m.	If the ammeter reading is zero, renew the regulator. When an ammeter reading is obtained (with or without regulator renewal) proceed with Part Two of this test.
Part Two	Run the engine at 6,000 alternator r.p.m. until the ammeter reading falls to below 10 amps.	The voltmeter reading should now be 14·0 to 14·4 volts. If the reading is outside these limits, renew the regulator.

Removing

(1) Withdraw the terminal block from the alternator.
(2) Slacken the adjuster link bolt on the alternator.
(3) Remove the nut securing the adjuster link to the engine.
(4) Slacken the alternator mounting bolts, lower the alternator and slip the fan belt from the alternator pulley.
(5) Unscrew the alternator mounting bolts and remove the alternator, noting that the rear mounting bolt is the longer of the two.

Dismantling

(6) Remove the screws retaining the end cover and detach the end cover.
(7) Detach the cable from its terminal on the rectifier.
(8) Remove the three screws retaining the brush holder and regulator assembly and detach the assembly.
(9) Check the brushes for wear by measuring the length of the brush protruding beyond the brush-box moulding. If the length protruding is ·2 in. (5 mm.) or less, the brush must be renewed.
(10) Check that the brushes move freely in their holders. If a brush shows a tendency to stick, clean it with a petrol (gasoline) moistened cloth or, if necessary polish the sides of the brush with a fine file.
(11) Check the brush spring pressure using a push-type spring gauge. The gauge should register 9 to 13 oz. (255 to 369 gm.) when the brush is pushed back until its face is flush with the housing. If the gauge reading is outside the limits given, renew the brush assembly.
(12) Remove the screws retaining the regulator cables to the brush holder.
(13) Remove the screw retaining the regulator to the brush holder and detach the regulator.
(14) Check the slip-ring surfaces for signs of burning. Clean the surfaces if necessary using a petrol-moistened cloth or very fine glass-paper.
(15) Detach the earth cable from the rectifier terminal.

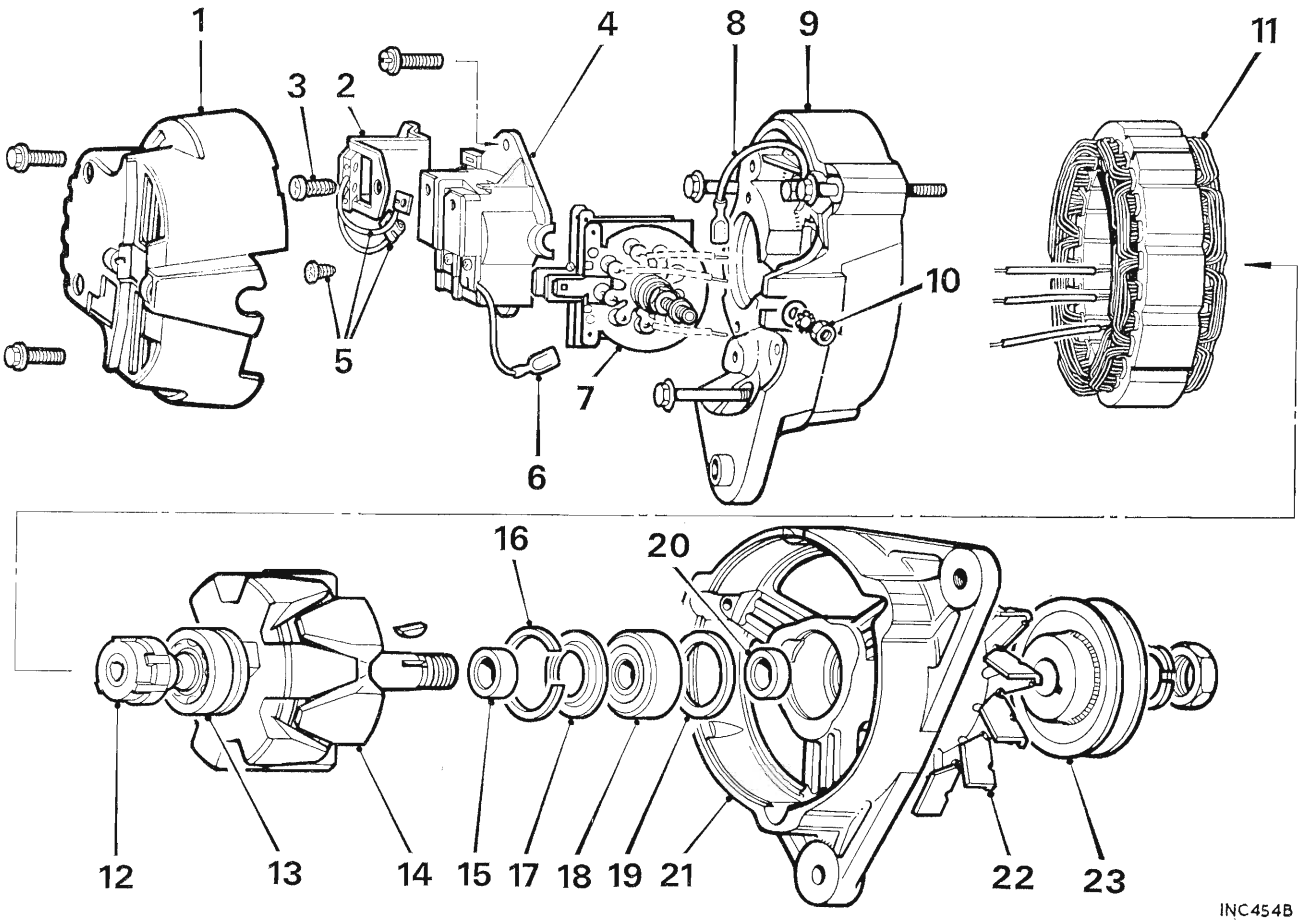


Fig. Nb.4

The 16ACR alternator components

1. End cover.
2. Regulator.
3. Retaining screw for regulator.
4. Brush box.
5. Retaining screw for regulator cables.
6. Brush box to rectifier cable.
7. Rectifier pack.
8. Earth cable.
9. Slip-ring end bracket.
10. Nut for rectifier assembly bolt.
11. Stator.
12. Slip-ring.
13. Slip-ring end bearing.
14. Rotor.
15. Distance piece.
16. Circlip.
17. Plate.
18. Drive end bearing.
19. Seal.
20. Distance piece.
21. Drive end bracket.
22. Fan.
23. Pulley.

(16) Slacken the nut on the rectifier assembly bolt.

(17) Unsolder the three stator cables from the rectifier pack, noting the cable positions. Use a pair of pliers as a thermal shunt to avoid overheating the diodes.

(18) Withdraw the rectifier assembly.

(19) Test each diode in turn by connecting a 12-volt battery and a 1·5-watt test lamp between the diode pin and the particular heatsink into which the diode is soldered, then reversing the connections. Current should flow in one direction only. If a diode is faulty, renew the rectifier assembly.

(20) Test the field (rotor) windings.

(*a*) Connect an ohmmeter or a 12-volt battery and an ammeter to the slip-rings. An ohmmeter reading 4·3 ohms or an ammeter reading of 3 amps. should be recorded.

(*b*) Test the insulation by connecting a 110-volt A.C. supply and a 15-watt test lamp between one of the slip-rings and one of the rotor poles. If the test lamp lights, the rotor must be renewed.

(21) Test the stator windings.

(*a*) Test for continuity by connecting a 12-volt battery and a 36-watt test lamp in series to any two of the stator cables, then repeat using the third cable in place of one of the first two. If the test lamp fails to light in either of the tests, the stator must be renewed.

(*b*) Test the insulation by connecting a 110-volt A.C. supply and a 15-watt test lamp between one of the three cables and the stator laminations. If the test lamp lights, the stator must be renewed.

(22) Mark the drive-end bracket, stator lamination pack, and slip-ring end bracket for correct re-assembly.
(23) Remove the two through-bolts.
(24) Remove the slip-ring end bracket by passing a tube over the slip-ring and driving the bearing out of the slip-ring end bracket.
(25) Unsolder the field connections from the slip-ring assembly.
(26) Withdraw the slip-ring assembly from the rotor shaft.
(27) Withdraw the bearing from the rotor shaft.
(28) Remove the nut retaining the drive pulley.
(29) Remove the drive pulley, fan and key.
(30) Press the rotor from the drive-end bracket.
(31) Remove the circlip from the bearing housing and remove the bearing cover-plate.
(32) Extract the bearing, 'O' ring, retainer and seal from the bearing housing.
(33) Examine the bearings for wear or roughness and renew as necessary.

Reassembling

(34) Reverse the dismantling procedure in (6) to (8), (12), (13), (15) to (18) and (22) to (33), noting:
(*a*) Use Shell Alvania 'RA' to lubricate the bearing where necessary.
(*b*) Fit the slip-ring end bearing with its shielded side towards the slip-ring assembly.
(*c*) Use Fry's H.T.3 solder to re-make the field to slip-ring connections.
(*d*) Support the inner track of the bearing when refitting the rotor to the drive-end bracket.
(*e*) Tighten the through-bolts evenly.
(*f*) Use 'M' grade 45–55 tin–lead solder to re-make the stator to rectifier pack connections. Use a pair of pliers as a thermal shunt to avoid overheating the diodes.
(*g*) Check that the brushes are entered in their housings before fitting the brush moulding.
(*h*) Tighten the pulley retaining nut to 20 to 30 lbf. ft. (2·77 to 4·15 kgf. m.).

Refitting

(35) Reverse the removing procedure in (1) to (5), noting:
(*a*) Check the fan belt tension. When correctly tensioned a total deflection of ·5 in. (13 mm.) under moderate hand pressure should be possible at a mid-way point on the longer belt run between the pulleys.
(*b*) Avoid overtightening the fan belt.
(*c*) Apply any leverage necessary to the alternator drive-end bracket only, using a wood or soft metal lever.