

Fig. 10.9 View of the alternator regulator connections (Sec 21)

length protruding from the holder and renew the brushes if worn to less than the minimum specified length.

15 Check that the brushes slide smoothly in their holders. Any sticking tendency may first be rectified by wiping with a petrol moistened cloth, or if this fails, by carefully polishing with a very fine file where any binding marks may appear.

16 Refitting the brushes is the reverse sequence to removal.

22 Starter motor – general description

Two types of Lucas starter motor have been fitted to Mini models covered by this manual. Both are of the inertia type and are similar in construction, with the exception of the brush gear and commutator layout. The starter motors are interchangeable and both are energized by a separate solenoid switch mounted on the front inner wing panel.

The principle of operation of the inertia type starter motor is as follows: when the ignition switch is turned, current flows from the battery to the starter motor solenoid switch, which causes it to become energised. Its internal plunger moves inwards and closes an internal switch, so allowing full starting current to flow from the battery to the starter motor. This creates a powerful magnetic field to be induced into the field coils which causes the armature to rotate.

Mounted on helical splines is the drive pinion which, because of the sudden rotation of the armature, is thrown forwards along the armature shaft and so into engagement with the ring gear. The engine crankshaft will then be rotated until the engine starts to operate on its own and, at this point, the drive pinion is thrown out of mesh with the ring gear.

23 Starter motor – testing in position

1 If the starter motor fails to turn the engine when the switch is operated there are four possible reasons why:

- (1) The battery is faulty
- (b) The electrical connections between the switch, solenoid, battery and starter motor are somewhere failing to pass the necessary current from the battery through the starter to earth
- (c) The solenoid switch is faulty
- (d) The starter motor is either jammed or electrically defective

2 To check the battery, switch on the headlights. If they dim after a few seconds, the battery is in a discharged state. If the lights glow brightly, operate the starter switch and see what happens to the lights. If they dim, power is reaching the starter motor but failing to turn it. Therefore check it is not jammed by placing the car in gear (manual

transmission only) and rocking it to and fro. Should the motor not be jammed, it will have to be removed for proper inspection. If the starter turns slowly when switched on, proceed to the next check.

3 If, when the starter switch is operated, the lights stay bright, insufficient power is reaching the motor. Remove the battery connections, starter/solenoid power connections and the engine earth strap and thoroughly clean and refit them. Smear petroleum jelly around the battery connections to prevent corrosion. Corroded connections are the most frequent cause of electric system malfunctions.

4 When the above checks and cleaning tasks have been carried out, but without success, you will have possibly heard a clicking noise each time the starter switch is operated. This is the solenoid switch operating, but it does not necessarily follow that the main contacts are closing properly (if no clicking has been heard from the solenoid, it is certainly defective). The solenoid contact can be checked by putting a voltmeter or bulb across the main cable connection of the starter side of the solenoid and earth. When the switch is operated, there should be a reading or lighted bulb. If there is no reading or lighted bulb, the solenoid unit is faulty and should be renewed.

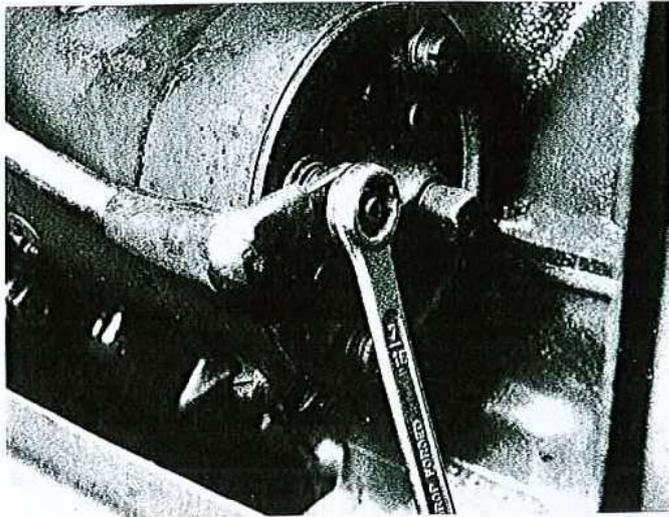
5 Finally, if it is established that the solenoid is not faulty and 12 volts are getting to the starter, then the motor is faulty and should be removed for inspection.

24 Starter motor – removal and refitting

- 1 Disconnect the battery earth terminal.
- 2 If an ignition shield is fitted to the front of the engine, release the three retaining lugs and lift off the shield.
- 3 Undo and remove the nut and spring washer and then detach the starter motor cable from the terminal stud (photo).
- 4 If the ignition coil is mounted on a bracket secured to the cylinder head, undo and remove the nut securing the bracket to the head and place the coil to one side.
- 5 Undo and remove the two bolts securing the starter motor to the flywheel housing, then lift the motor upwards and out of the engine compartment.
- 6 Refitting is the reverse sequence to removal.

25 Starter motor (Lucas M35G) – dismantling and reassembly

1 With the starter motor on the bench, loosen the screw on the cover band and slip the cover band off. With a piece of wire bent into the shape of a hook, lift back each of the brush springs in turn and check the movement of the brushes in their holders by pulling on the flexible connectors. If the brushes are so worn that their faces do not



24.3 Unscrew the nut securing the starter motor cable

rest against the commutator, or if the ends of the brush leads are exposed on their working face, they must be renewed.

2 If any of the brushes tend to stick in their holders then wash them with a petrol moistened cloth and, if necessary, lightly polish the sides of the brush with a very fine file, until the brushes move quite freely in their holders.

3 If the surface of the commutator is dirty or blackened, clean it with a petrol dampened rag. Secure the starter motor in a vice and check it by connecting a heavy gauge cable between the starter motor terminal and a 12 volt battery.

4 Connect the cable from the other battery terminal to earth in the starter motor body. If the motor turns at high speed it is in good order.

5 If the starter motor still fails to function or if it is wished to renew the brushes, then it is necessary to further dismantle the motor.

6 Lift the brush springs with the wire hook and lift all four brushes out of their holders one at a time.

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

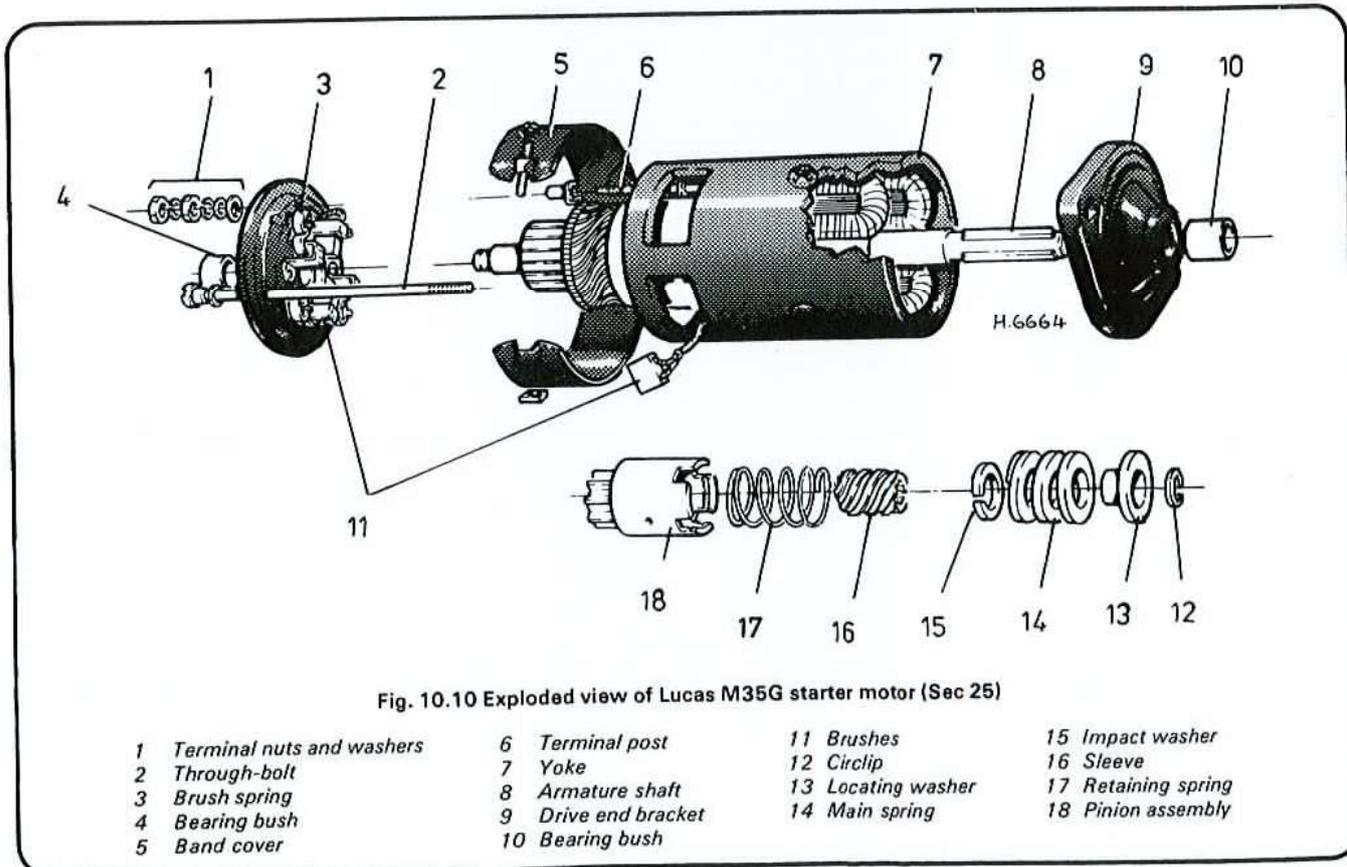
8 Unscrew the two through-bolts which hold the endplates together and pull off the commutator end bracket. Also remove the drive end bracket, which will come away complete with the armature.

9 At this stage if the brushes are to be renewed, their flexible connectors must be unsoldered and the connectors of new brushes soldered in their place. Check that the new brushes move freely in their holders as detailed above. If cleaning the commutator with petrol fails to remove all the burnt areas and spots, then wrap a piece of glasspaper round the commutator and rotate the armature. If the commutator is very badly worn, remove the drivegear as detailed in Section 27. Then mount the armature in a lathe, and with the lathe turning at high speed, take a very fine cut out of the commutator and finish the surface by polishing with glass paper. Do not undercut the mica insulators between the commutator segments.

10 With the starter motor dismantled, test the four field coils for an open circuit. Connect a 12 volt battery with a 12 volt bulb in one of the leads between the field terminal post and the tapping point of the field coils to which the brushes are connected. An open circuit is proven by the bulb not lighting.

11 If the bulb lights, it does not necessarily mean that the field coils are in order, as there is a possibility that one of the coils will be earthing to the starter yoke or pole shoes. To check this, remove the lead from the brush connector and place it against a clean portion of the starter yoke. If the bulb lights the field coils are earthing. Renewal of the field coils calls for the use of a wheel-operated screwdriver, a soldering iron, caulking and riveting operations and is beyond the scope of the majority of owners. The starter yoke should be taken to a reputable electrical engineering works for new field coils to be fitted. Alternatively, purchase an exchange Lucas starter motor.

12 If the armature is damaged, this will be evident after visual inspection. Look for signs of burning, discoloration, and for conductors that have lifted away from the commutator. Reassembly is a straight reversal of the dismantling procedure.



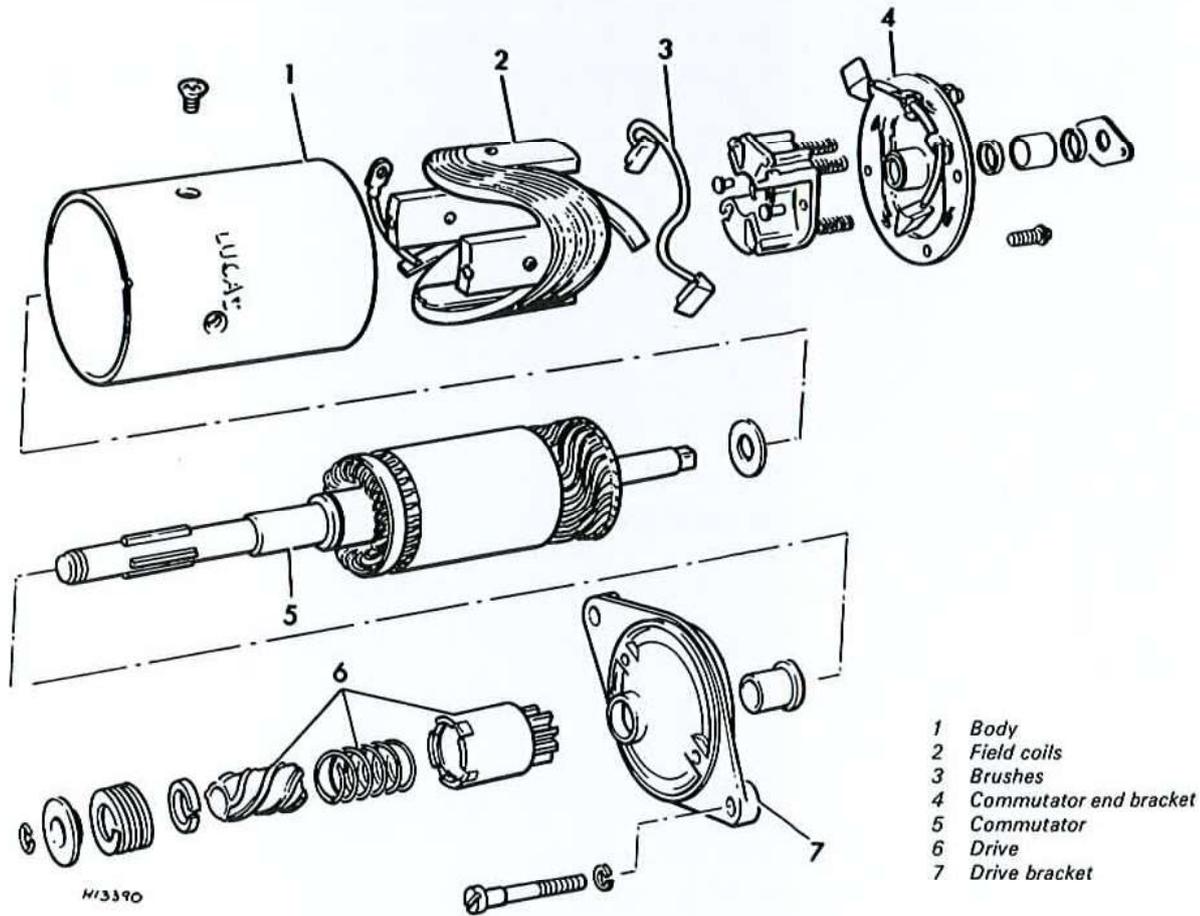


Fig. 10.11 Exploded view of Lucas M35J starter motor (Sec 26)

26 Starter motor (Lucas M35J) – dismantling and reassembly

1 With the starter motor on the bench, first mark the relative positions of the starter motor body to the two end brackets.

2 Undo and remove the two screws and spring washers securing the drive end bracket to the body. The drive end bracket, complete with armature and drive, may now be drawn forwards from the starter motor body.

3 Lift away the thrust washer from the commutator end of the armature shaft.

4 Undo and remove the two screws securing the commutator end bracket to the starter motor body. The commutator end bracket may now be drawn back slightly, allowing sufficient access so as to disengage the field brushes from the bracket. Once these are free, the end bracket can be completely removed.

5 Inspect the brushes for wear and fit new brushes if the old brushes are nearing the minimum specified length. To renew the end bracket brushes, cut the brush cables from the terminal posts and, with a small file or hacksaw, slot the head of the terminal posts to a sufficient depth to accommodate the new leads. Solder the new brush leads to the posts.

6 To renew the field winding brushes, cut the brush leads approximately 0.25 in (6 mm) from the field winding junction and carefully solder the new brush leads to the remaining stumps, making sure that the insulation sleeves provide adequate cover.

7 If the commutator surface is dirty or blackened, clean it with a petrol dampened rag. Carefully examine the commutator for signs of excessive wear, burning or pitting. If evident it may be reconditioned by having it skimmed at the local engineering works or BL dealer. The thickness of the commutator must not be less than specified. For

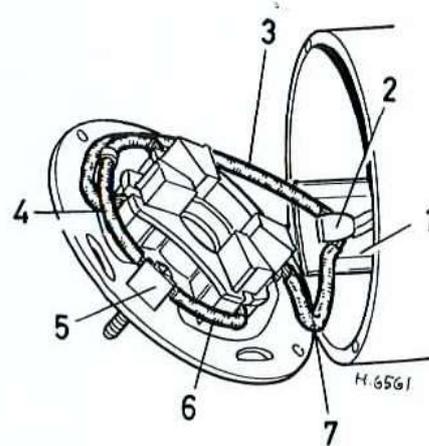


Fig. 10.12 Commutator end bracket assembly – Lucas M35J (Sec 26)

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|---|--|
| 1 Yoke insulation piece | 5 Terminal post |
| 2 Field winding junction | 6 Short brush flexible, commutator end bracket |
| 3 Long brush flexible, field winding | 7 Short brush flexible, field winding |
| 4 Long brush flexible, commutator end bracket | |

minor reconditioning, the commutator may be polished with glass paper. Do not undercut the mica insulators between the commutator segments.

8 With the starter motor dismantled, test the field coils for open circuit. Connect a 12 volt battery with a 12 volt bulb in one of the leads between each of the field brushes and a clean part of the body. The lamp will light if continuity is satisfactory between the brushes, windings and body connection.

9 Renewal of the field coils calls for the use of a wheel-operated screwdriver, a soldering iron, caulking and riveting operations and is beyond the scope of the majority of owners. The starter motor body should be taken to an automobile electrical engineering works for new field coils to be fitted. Alternatively purchase an exchange Lucas starter motor.

10 Reassembly of the starter motor is the reverse sequence to removal.

27 Starter motor drive pinion – removal and refitting

1 Using a starter motor pinion compressor or similar tool, compress the mainspring until sufficient clearance exists to enable the circlip on the end of the shaft to be removed. Remove the pinion compressor and then slide off the locating washer and mainspring.

2 Slide the remaining parts off the armature shaft with a rotary action.

3 Examine the teeth of the drive pinion that engage with the flywheel ring gear. If they are badly worn on their leading edge, renew the pinion assembly. Bear in mind that if the drive pinion teeth are worn, the teeth on the ring gear are likely to be in a similar condition.

4 Inspect the remainder of the drive pinion components and renew the assembly if any are worn.

5 Reassembly of the drive pinion is the reverse sequence to removal. **Note:** It is most important that the drive pinion components are completely free from oil, grease and dirt before reassembly. Under no circumstances should any of the parts be lubricated, as this will attract asbestos dust from the clutch which could cause the drive pinion to stick.

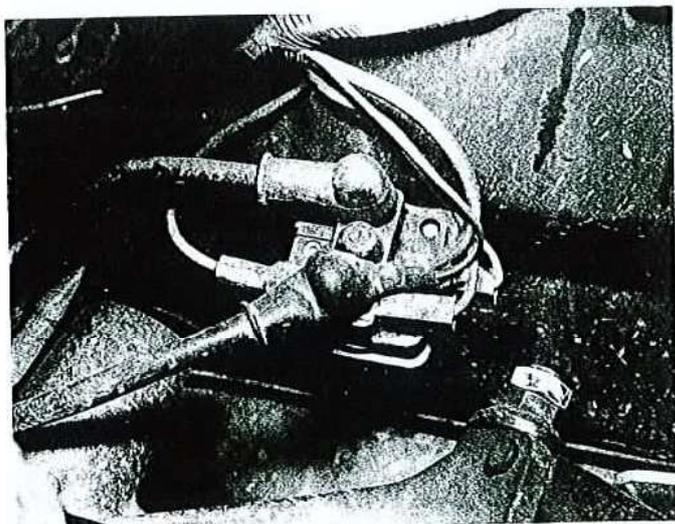
28 Starter solenoid – removal and refitting

1 Disconnect the battery earth terminal.

2 Carefully ease back the rubber covers to gain access to the terminals (photo).

3 Make a note of the Lucar terminal connectors and detach these terminals.

4 Undo and remove the heavy duty cable terminal connection nuts and spring washers. Detach the two terminal connectors.



28.2 Electrical connections at the starter solenoid

5 Undo and remove the two securing screws and lift away the solenoid.

6 Refitting is the reverse sequence to removal.

29 Direction indicator flasher unit and circuit – fault tracing and rectification

Note: The actual flasher unit is enclosed in a small metal container located in the engine compartment or behind the instrument panel. The unit is actuated by the direction indicator switch. If the flasher unit fails to operate, or works very slowly or very rapidly, check the flasher indicator circuit as described below before assuming there is a fault in the unit itself.

1 Examine the direction indicator bulbs front and rear for broken filaments or dirty contacts.

2 If the external flashers are working but the internal flasher warning light has ceased to function, check the filament of the warning bulb and renew as necessary.

3 With the aid of the wiring diagram, check all the flasher circuit connections if a flasher bulb is sound but does not work.

4 In the event of total direction indicator failure, check the appropriate fuse.

5 With the ignition turned on, check that current is reaching the flasher unit by connecting a voltmeter between the 'B' terminal and earth. If this test is positive, connect the 'B' terminal and the 'L' terminal and operate the flasher switch. If the flasher bulb lights up, the flasher unit itself is defective and must be renewed, as it is not possible to dismantle and repair it.

6 Should a fault develop in the hazard warning light circuit, the fault tracing procedure is the same as described above. A separate flasher unit is used for the hazard circuit and is located on the left-hand side of the engine compartment bulkhead.

30 Horn – fault tracing and rectification

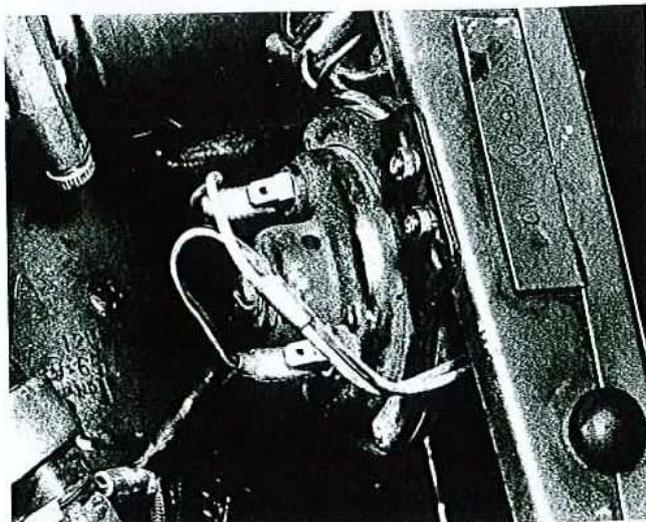
1 The horn is located in the engine compartment and is attached to a bracket, which is in turn secured to the front body panel by two small nuts and bolts (photo).

2 The horn is not repairable and should not be dismantled. On early type horns an adjustment is provided to compensate for wear of the moving parts.

3 Adjustment is by means of a screw on the broad rim of the horn nearly opposite the two terminals. Do not confuse this with the large screw in the centre.

4 Turn the adjustment screw anti-clockwise until the horn just fails to sound. Then turn the screw a quarter of a turn clockwise, which is the optimum setting.

5 If the horn fails to work it may be tested with a voltmeter or 12



30.1 Horn location showing electrical leads and mounting nuts