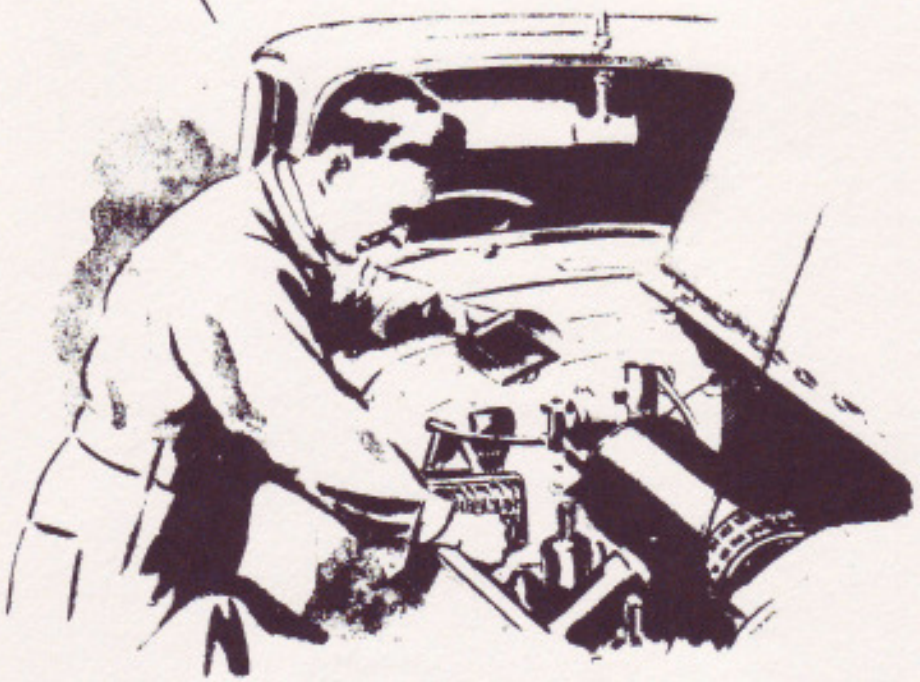
ELECTRICAL



SECTION P.

THE ELECTRICAL SYSTEM.

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SECTION P.

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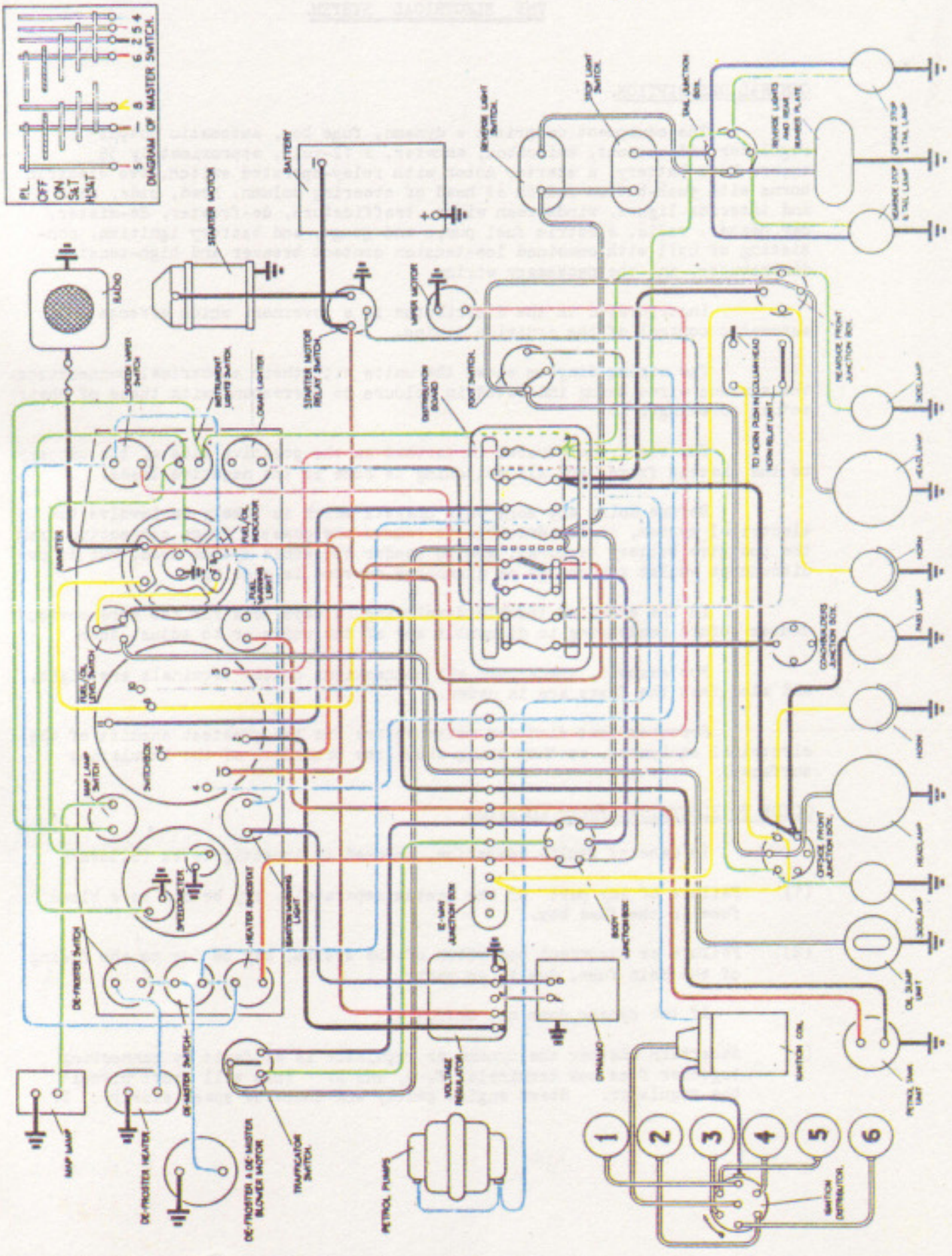

ELECTRICAL WIRING DIAGRAM

THE ELECTRICAL SYSTEM.

GENERAL DESCRIPTION.

The equipment comprises a dynamo, fuse box, automatic output regulator and cut-out, switchbox, ammeter, a 12-volt, approximately 55 ampere-hour battery, a starter motor with relay-operated switch, two electric horns with push-button switch at head of steering column, head, side, rear and interior lights, windscreen wiper, trafficators, de-froster, de-mister, car heater, radio, electric fuel pumps and gauge, and battery ignition, consisting of coil with combined low-tension contact breaker and high-tension distributor, and the necessary wiring.

Incorporated in the distributor is a governor, which effects automatic control of the ignition timing.

The wiring diagram shows the units with their electrical connections, the various wires being indicated in colours to correspond with those of their actual coverings.

The electrical system is earthed on the positive side of the battery to the chassis frame, and all switching is done in the negative leads.

Before doing any work on a chassis which is likely to involve the electrical system, it is advisable to remove the chassis frame connection from the positive battery terminal, and so render the whole system dead, but do not disconnect whilst any charge or discharge current is passing.

In the event of trouble developing, always look for the more obvious causes before commencing to dismantle any of the units or to adjust them.

For example, check that all connections to the terminals are tight, and also that the fuses are in order.

Remember that dirt and moisture are the two greatest enemies of the electrical equipment, as they bring about the breakdown of the insulating surfaces.

GUIDE TO ELECTRICAL FAULT LOCATION.

In case of faulty operation, proceed to investigate as follows:-

(1) Failure of any part of the system separately, may be due to a blown fuse in the fuse box.

(2) Failure or incorrect operation of the system, may be due to the fusing of the main fuse, due to an earth.

If the dynamo does not charge:-

(1) Ascertain whether the dynamo or regulator is at fault by connecting together fuse box terminals, F, D, and A. This will short-circuit the regulator. Start engine gently and increase speed slowly. If

dynamo is in order, the output will be delivered and the defect will lie in the regulator or cut-out.

Alternatively, test dynamo by disconnecting both main terminals, connect the two terminals together, and connect the terminals of an inspection lamp between one of the dynamo terminals and earth, gently speed up the engine, and if the dynamo is in order, the lamp will light.

(2) Dynamo brushes may be sticking, due probably to oiliness. Clean brushes and holders with rag moistened in petrol.

(3) Cut-out contacts may be burnt out or sticking.

If dynamo output is low, this may be due to the battery being fully charged, but if low with lights on, i.e., ammeter indicates an abnormal discharge, the regulator may be sticking in such a manner as permanently to insert the field resistance. Low output may also be caused by a slack driving belt.

If dynamo gives an excessive charge when speeded up, this may be due to the regulator sticking or to a break in the regulator shunt coil circuit. Check regulator wiring conditions.

If, with the fuses intact, and the lights in order, the ignition:-

(a) Misses.

(i) First confirm right condition of sparking plugs.

(ii) Assure correct condition of contact breaker points, and adjust gap .019" to .021", if necessary.

(iii) Check condition of ignition coil casing.

(b) Fails.

(i) With ignition switched on, see by ammeter, while engine is cranked, that coil is taking current intermittently. If no current, test availability of battery voltage at coil terminals.

If, with battery in order, starter motor is sluggish or does not turn, examine commutator and brushes. Clean oily brushes and holders with a rag moistened with petrol. If motor turns without turning engine, check freedom of engine with starting handle. If found in order, the trouble lies in starter drive.

If battery will not retain charge:-

(i) Ascertain that no circuit is left switched on.

(ii) See that no cell of the battery leaks acid.

THE DYNAMO.

The dynamo is a Lucas model C45PV, Type N7. Service No.22413A. These identification marks are stamped on the yoke. The Bentley Motors (1931) Ltd. reference number is RD.3006. When ordering replacements always quote these numbers.

TESTING DYNAMO IN POSITION.

(i) The tension of the belt should be such that it can be moved transversely with the fingers through a total distance of approximately one inch, when checked at a point equidistant from the crankshaft and fan pulleys. See Fig.1.

Should adjustment be necessary, proceed as follows:-

Release the nut of bolt C a turn or two. Slacken off the nuts D and E, and then slacken the setscrew B.

The dynamo may now be moved away from or towards the cylinder block as required to give the correct belt tension, then re-tighten the set-screw B and then the nuts D, E and C.

If it should be necessary to remove the belt for any reason, it must not be strained over the pulleys. The dynamo must be pushed towards the cylinder block.

The fan must not be forcibly turned by hand, as this will cause bending of the blades.

(ii) Check that the dynamo and control box are connected correctly. The dynamo terminals are accessible after the removal of the moulded terminal cover (16) shown in Fig.2, secured to the commutator end bracket (17) by a setscrew (14). The dynamo terminal "D" should be connected to the

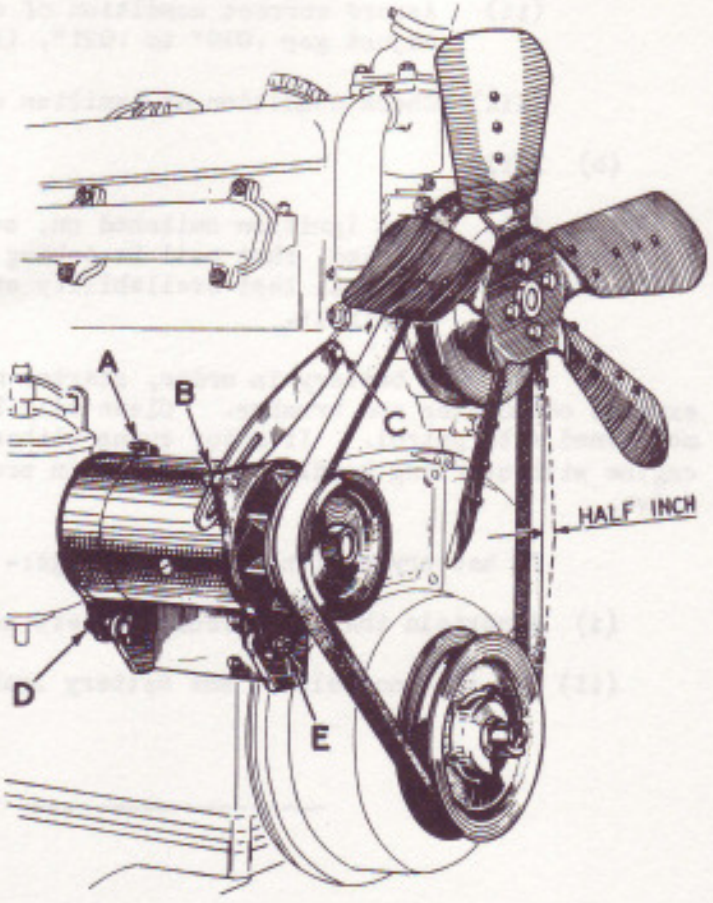

FIG. 1 DYNAMO AND "VEE" BELT DRIVE.

control box terminal "D", and the dynamo terminal "F" connected to control box terminal "F". The terminal "D" is larger than the terminal "F".

(iii) After switching off all lights and accessories, disconnect the cables from the dynamo terminals marked "D" and "F".

(iv) Connect these two terminals with a short length of wire.

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

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

(vii) Gradually increase the engine speed, when the voltmeter reading should rise rapidly and without fluctuations. 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 about 1000 r.p.m.

If there is no reading, check brush gear, as in paragraph viii.
A low reading of approximately 1 volt, indicates that the field winding may be faulty.

A reading of approximately 5 volts, indicates that the armature winding may be faulty.

(viii) Remove the dynamo cover band (1) and examine the brushes (5) and commutator (6). 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 on a smooth file. Always replace brushes in their original positions. If the brushes are worn so that they do not bear on the commutator, or if the brush flexible is exposed on the running face, new brushes must be fitted. If the commutator is blackened or dirty, clean it by holding a petrol moistened cloth against it while the engine is turned slowly by hand cranking.

Re-test the dynamo; if there is still no reading on the voltmeter, there is an internal fault and the complete unit, if spare is obtainable, should be replaced.

(ix) If the dynamo is in good order, restore the original connections to the dynamo. 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 at the dynamo. No reading on the voltmeter indicates a break in the cable to the dynamo. If the reading is correct, test the control box.

REMOVAL AND REPLACEMENT.

Disconnect the battery at the positive terminal. Remove the moulded terminal cover (16 Fig.2) and disconnect the two cables marked "D" and "F".

Release the nut of bolt C (Fig.1) a turn or two. Remove the adjusting screw B and slacken off the nuts D and E.

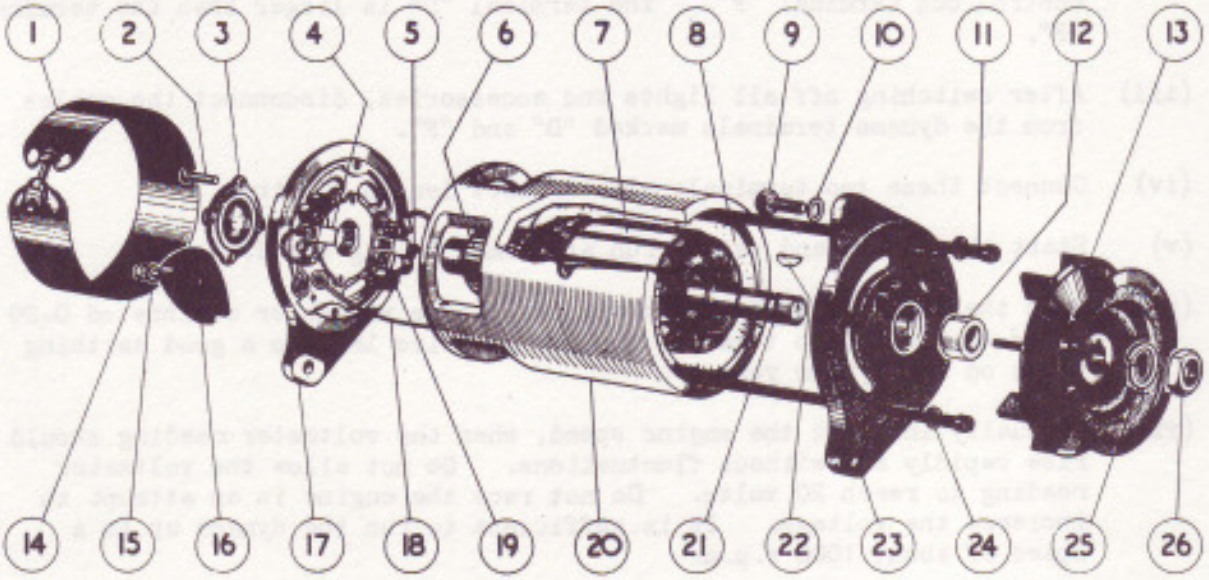

FIG. 2. EXPLODED VIEW OF DYNAMO.

1. Cover Band.
2. Screw.
3. Bearing Cap.
4. Brush Holder.
5. Brush.
6. Commutator.
7. Armature.
8. Field Coil.
9. Mounting & Adjustment Bolt.
10. Plain Washer.
11. Fixing Bolt.
12. Distance Collar.
13. Pulley & Fan.
14. Terminal Cover Setscrew.
15. Plain Washer.
16. Terminal Cover.
17. Commutator End Bracket.
18. Lead to Field Terminal.
19. Brush Spring.
20. Yoke.
21. Armature Shaft.
22. Woodruff Key.
23. Driving End Bracket.
24. Flat Spring Washer (small).
25. Flat Spring Washer (large).
26. Nut.

Push the dynamo towards the cylinder block.

The fan belt can now be removed.

Remove the nuts D and E and the two bolts from the support bracket.

When refitting, these operations are reversed. Adjust the tension of the fan belt as previously described.

SERVICE OPERATIONS.

Dismantling.

(i) Remove the drive pulley from the armature shaft as follows:-

Place a suitable box spanner on nut (26) and while the pulley is held by hand, give the spanner a sharp light tap with a hammer which will release the nut. Remove nut and flat spring washer.

The pulley should be removed with the extractor shown in Fig.3. The extractor is universal, permitting the centres of the two pulling bolts to be adjusted. Set the pitch of the two pulling bolts to 1.925" centres, by placing a screwdriver in the slot provided in the bush and turn it until the setting line is in line with the mark on the plate. Repeat the same operation for the other bush.

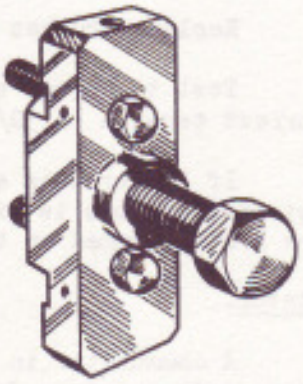

FIG. 3. UNIVERSAL EXTRACTOR. TOOL NO. STD.505.

Two holes tapped .3125" dia. 22 T.P.I. (R.H.) are provided in the pulley for extraction purposes.

(ii) Remove the woodruff key (22) and the distance collar (12).

(iii) Remove the cover band, hold back the brush springs and remove the brushes from their holders.

(iv) Unscrew and remove, from the driving end bracket (23) the two through bolts (11) securing the commutator end bracket and driving end bracket to the yoke.

(v) Unsolder the connection to the "F" terminal on the commutator end bracket and draw the lead out of the terminal. Lift the brushes out of the holders. Remove the commutator end bracket from the yoke. If it is a tight fit it should be carefully levered off with a screwdriver. When free, slide the end bracket sufficiently clear to enable the screw securing the second field coil lead to the brush holder terminal to be removed. The end bracket is fitted with a roller or ball bearing for the armature shaft. Remove the distance collar (12) from the driving end.

(vi) The driving end bracket together with the armature (7) can now be lifted out of the yoke (20).

(vii) The driving end bracket, which on removal from the yoke, has withdrawn with it the armature and armature shaft ball bearing, need not be separated from the shaft unless the bearing is suspected and requires examination or the armature is to be replaced, in which event the armature should be removed from the end bracket by means of a hand press.

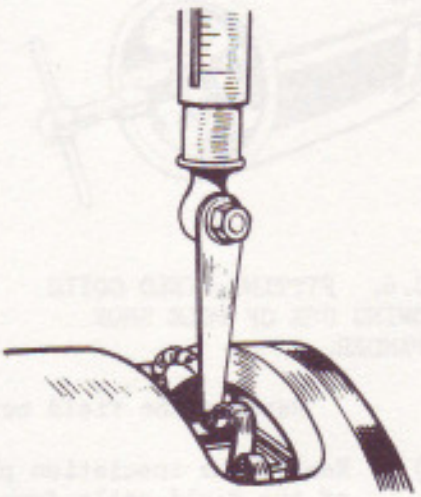

FIG.4. SHOWING CHECKING OF BRUSH SPRING TENSION.

Brushes.

Test if the brushes are sticking. Clean with petrol and, if necessary, ease the sides by lightly polishing with a smooth file.

Replace brushes in original positions.

Test the brush springs with a spring scale if available (see Fig.4). The correct tension is 30/40 ozs. Fit a new spring if the tension is low.

If the brushes are worn so that they will not bed on the commutator, or that the flexible is exposed on the running face, new brushes must be fitted. Brushes are preformed so that bedding to the commutator is unnecessary.

Commutator.

A commutator in good condition will be smooth and free from pits or burned spots. Clean the commutator with a petrol moistened cloth. If this is ineffective, carefully polish with a strip of fine glass paper (not emery) while rotating the armature. After long service, however, it may be necessary to skim the commutator. Mount the armature, with or without the drive end bracket, in a lathe, rotate it at high speed and take a light out off the commutator 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 1/32" with a hack saw blade ground down to the thickness of the mica. If the commutator is very badly worn, a replacement armature must be fitted.

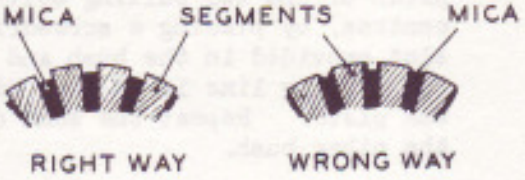

FIG. 5. SHOWING UNDERCUTTING OF THE COMMUTATOR MICA.

Field Coils.

Test the field coils, without removing from the dynamo yoke, by connecting them in series with a 12 volt battery and a 12 volt 36 watt bulb. If the field coils are satisfactory, the bulb will light up, but its brilliance will be somewhat less than when it is connected directly to the battery. Failure of the bulb to light indicates an open circuit in the field coil windings, while if the bulb lights with full brilliance, the field coils are probably either shorted or earthed to the pole shoes or dynamo yoke. In either case, unless a pole shoe expander (Fig.6) and wheel operated screwdriver (Fig.7) are available, the complete dynamo assembly must be returned to the Depot and a replacement fitted. If, however, such equipment is available, it is possible to replace the field coils. A pole shoe expander is necessary to ensure that there will not be any airgap between the pole shoes and the inner face of the yoke.

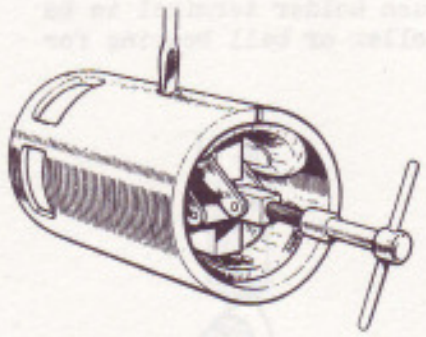

FIG. 6. FITTING FIELD COILS SHOWING USE OF POLE SHOE EXPANDER.

Replace the field coils as follows:-

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

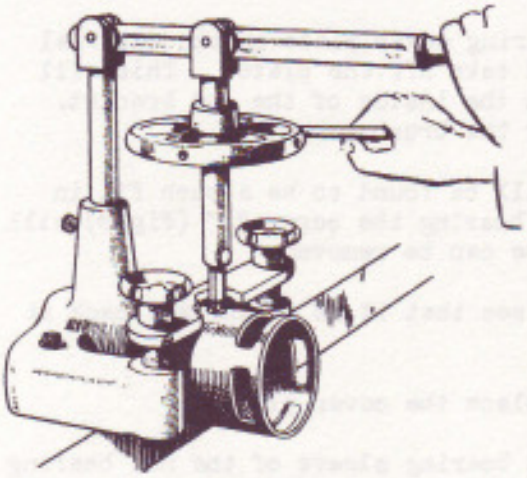

FIG. 7. SHOWING TIGHTENING POLE SHOES WITH WHEEL OPERATED SCREWDRIVER.

(ii) Mark the yoke and pole shoes in order that they can be fitted in their original positions.

(iii) Unscrew the two pole shoe retaining screws by means of the wheel operated screwdriver.

(iv) Draw the pole shoes and coils out of the dynamo yoke and lift off the coils.

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

(vi) Locate the pole shoes and field coils by lightly tightening the fixing screw.

(vii) Replace the insulation piece between the field coil connections and the yoke.

(viii) Insert the pole shoe expander, open it to the fullest extent and tighten the screws.

(ix) Finally tighten the screws by means of the wheel operated screwdriver.

Armature.

The testing of the armature winding requires the use of a volt drop test or a 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.

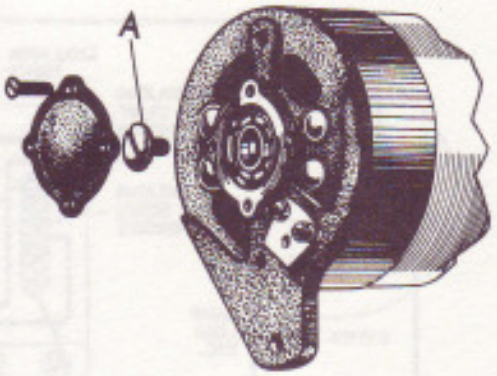

FIG. 8. COMMUTATOR END BRACKET SHOWING COVER AND THRUST SCREW "A" REMOVED.

On dynamos having roller bearings in the commutator end bracket, it will, in the event of an armature replacement, be necessary to remove the bearing sleeve and collar at the commutator end of the old armature shaft, and fit them to the replacement armature. The bearing sleeve and collar can be removed when the dome-headed thrust screw in the end of the shaft is taken out. It is important that the bearing sleeve is only used with its original bearing, and that great care is taken not to damage the sleeve face during armature replacement. When fitting make certain that the thrust screw "A" (Fig. 8) is screwed fully on its seating.

Bearings.

Bearings which are worn to such an extent that they will allow approximately .005" total side movement of the armature shaft, must be replaced.

To replace the roller or ball bearing at the commutator end, proceed as follows:-

(i) Remove the four screws securing the bearing cover plate on the external side of the commutator end bracket, and take off the plate. This will also release the bearing cover plate on the inside of the end bracket. This plate is, however, held captive by the brushgear.

(ii) The bearing can now be removed. It will be found to be a push fit in the housing. In the case of a roller bearing the screw "A" (Fig.8) will have to be removed before the inner race can be removed.

(iii) Before fitting the replacement bearing see that it is clean, and pack it with a high melting point grease.

(iv) Fit the bearing in its housing, and replace the cover plates.

(v) In the case of roller bearings, fit the bearing sleeve of the new bearing assembly to the armature shaft, replace the screw "A" and securely tighten, then replace the cover plates.

The ball bearing at the driving end is replaced as follows:-

(vi) Knock out the three rivets which secure the bearing retaining plate to the end bracket and remove the plate.

(vii) Press the bearing out of the end bracket and remove the corrugated washer, felt washer and felt retaining washer.

(viii) Before fitting the replacement bearing, see that it is clean and pack it with a high melting point grease.

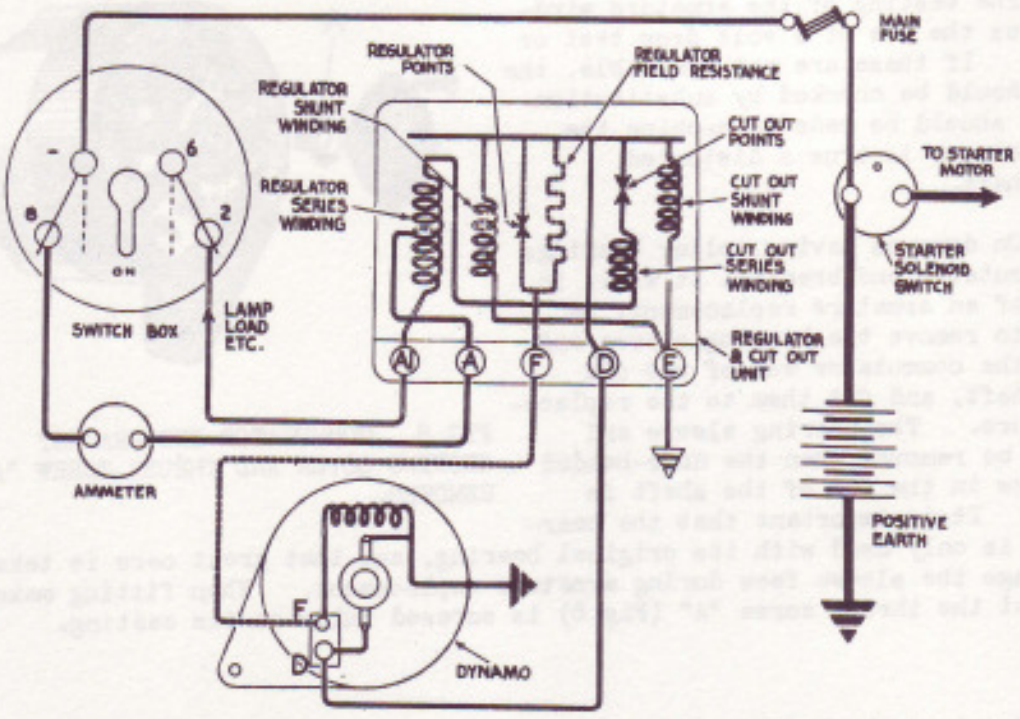

FIG. 9. CHARGING CIRCUIT.

(ix) Place the felt retaining washer, felt washer and corrugated washer in the bearing housing in the end bracket.

(x) Locate the bearing in the housing and press it home by means of a hand press, using a tool locating on the outer journal.

(xi) Fit the bearing retaining plate. Insert three new rivets from the outside of the end bracket and open the rivets by means of a punch to secure the plate rigidly in position.

Re-assembling.

In the main, the re-assembly of the dynamo is a reversal of the operations described in paragraph "Dismantling", bearing in mind the following points:-

(i) The field coil lead provided with the eyelet must be connected to the terminal on the brush holder which is in metallic contact with the end bracket.

(ii) The second field coil lead must be connected to the "F" terminal on the end bracket. The short length of cable from the terminal on the insulated brush holder must be connected to the "D" terminal on the commutator end bracket.

THE CONTROL BOX.

The control box (cut-out and regulator), which is mounted on the R.H. front face of the dash just above the distribution and fuse box, is a Lucas model RF96S, Type L4, Service No. 37052B, Bentley Motors (1931) Ltd., reference number RD. 3082.

This unit, illustrated in Fig.10, contains the dynamo voltage regulator and the cut-out. It also incorporates a choke-condenser filter circuit to prevent the regulator causing radio interference.

Both the regulator and cut-out are accurately set before leaving the works and must not be interfered with unnecessarily. The cover protecting them is, therefore, sealed.

To Check and Adjust the Regulator.

Withdraw the cables from the terminals marked "A" and "A1" in the control box and join them together.

Connect the negative lead of a voltmeter (moving coil type, 0-20 volts) to the "D" terminal on the regulator, and connect the other lead from the meter to the dynamo end bracket or some other 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 below for the particular air temperature near the regulator at the time.

Air temp. near regulator.		Regulator Setting.
10°Centigrade	50° Fahrenheit.	16.9 - 17.3 volts.
20°Centigrade	68° Fahrenheit.	16.6 - 17.0 volts.
30°Centigrade	86° Fahrenheit.	16.4 - 16.8 volts.
40°Centigrade	104° Fahrenheit.	16.1 - 16.5 volts.

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

Shut off the engine, release the locknut "A" (Fig.10) holding the regulator adjusting screw "B", and turn the screw 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 and then tighten the locknut, and re-test.

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

Cleaning Regulator Contacts.

After long periods of service it may be found necessary to clean the vibrating contacts of the regulator. These are accessible if the top screw "C" securing the fixed contact is temporarily withdrawn and the bottom screw "D" slackened to permit the fixed contact to be swung outwards. The contacts can then be polished with fine emery cloth. After polishing take care to tighten fully the two screws. Do not take out both the screws securing the fixed contact.

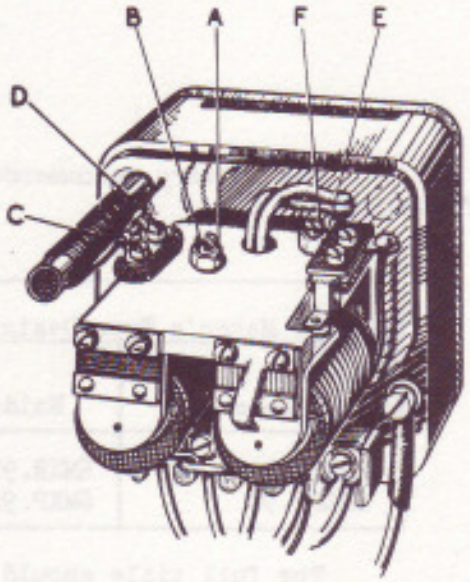

FIG. 10. SHOWING CONTROL UNIT ADJUSTMENT SCREWS.

To Clean and Set the Cut-out Contacts.

If, after setting the open circuit voltage of the regulator and reconnecting the cables to the terminals marked "A" and "A1", no charge is registered on the ammeter, check the cut-out contacts. Ascertain that they are clean and making good contact when closed.

To clean them, place a strip of fine glass paper between the contacts and then, with the contacts closed by hand, draw the paper through. This should be done two or three times with the rough side towards each contact.

Check the voltage at which the cut-out contacts close by connecting a voltmeter between the terminals marked "D" and "E" and slowly raising the engine speed. When the voltage reaches about 12.7 - 13.3, the contacts should close. Adjust the cutting-in voltage by means of the cut-out adjustment screw "F" in a manner similar to that described for the regulator.

THE BATTERY.

The battery recommended and specified for this car is either of the following:-

Battery Maker's Type Designation		Voltage	Normal Charging Current.
P & R. Dagenite	Exide		
6HZD.9S 6HZDP.9S	6MXR.9L 6MXP.9L	12	5 amperes.

The full title should be given when ordering a replacement battery.

FIRST CHARGE.

If the battery is received in a dry condition it will be necessary to fill the cells with pure sulphuric acid of the correct specific gravity in accordance with the battery maker's instructions as tabled below. Allow to stand 12 hours, then charge the battery before it is put into use.

DAGENITE EXIDE.	6HZD.9S 6MXR.9L	6HZDP.9S 6MXP.9L
Temperate climate.	1.340	1.260
Tropical climate.	1.260	1.190

SPECIFIC GRAVITY.

The liquid in which the plates are immersed is called electrolyte. When the battery is being charged the acid is forced out of the plates and causes the specific gravity of the electrolyte to rise. When the battery discharges the acid returns into the plates and the specific gravity falls, until in the case of a completely discharged battery, the electrolyte is practically distilled water.

At the top of each cell is a vent hole accessible by unscrewing the vent plug A, Fig.11, into which the hydrometer should be inserted as illustrated.

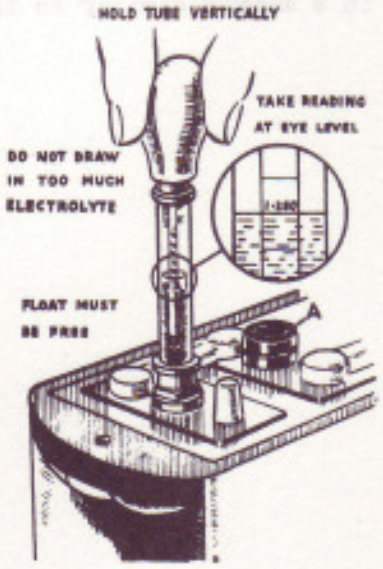

FIG.11. TESTING SPECIFIC GRAVITY.

The following table gives the approximate values for different states of charge as read by the hydrometer:-

CLIMATE	CONDITION OF BATTERY.	SPECIFIC GRAVITY OF ACID (CORRECTED TO 70°F.)
TEMPERATE	FULLY CHARGED HALF DISCHARGED FULLY DISCHARGED	1.280 (1.270 - 1.285) 1.200 1.110
TROPICAL (i.e., where the temperature is frequently 90°F or over.)	FULLY CHARGED HALF DISCHARGED FULLY DISCHARGED	1.210 (1.200 - 1.215) 1.160 1.100

TOPPING UP.

It is difficult to lay down a hard and fast rule as to how frequently "topping up" will be required, because this varies so much according to the use to which the car is put, and also the temperature in which it operates. It must be remembered that "topping up" will be necessary more frequently in hot weather than in cold.

The battery should be "topped up", by removing the vent plugs and adding distilled water to each cell as required, until the level of the electrolyte is approximately $\frac{3}{8}$" above the tops of the separators.

Filling one cell does not fill all, so examine each one and fill as required.

MAINTENANCE.

The battery should be well secured in its box so that it cannot move.

The cable terminals and connectors should be well covered with lanolin or pure vaseline, all contact surfaces clean and firmly screwed up.

If the terminals or connectors have become corroded, a solution of ammonium carbonate should be applied to them with a brush until all traces of corrosion have been removed. Afterwards the surface should be well washed with warm water, thoroughly dried, then lanolin or pure vaseline again applied. Do not use abrasives for cleaning.

The battery must never be allowed to remain in a discharged condition. A battery not in service should be kept in condition by fully charging it, and then giving it a freshening charge at least every four weeks. It should be given a thorough charge before being put into service.

THE STARTER MOTOR AND DRIVE.

GENERAL.

The starter motor and drive consists of a Lucas motor, a Bentley reduction gear and a Bentley drive unit. The Motor is Lucas model No.M45G, Type N7, Service No.26023A. These identification marks are stamped on the yoke. The Bentley reference number is RD.3127. When ordering replacements always quote these numbers.

The combined effect of the reduction gear and the reduction obtained between the pinion and the flywheel is to provide a total gear ratio between the motor and the crankshaft of 16:1.

TESTING STARTER MOTOR IN POSITION.

Switch on lamps and operate starter control. If the lights dim, but the starter is not heard to operate, an indication is given that current is flowing through the starter windings, but that the starter pinion is meshed permanently with the geared ring on the flywheel, or alternatively that a breakdown of the insulation of a brush holder has occurred. In either case the starter 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 switch is in order. examine the connections at the battery and starter switch and also check the wiring between these units. Corroded battery terminals should be removed, scraped clean, refitted and coated with mineral jelly. Continued failure of the starter to operate indicates an internal fault in the starter and the starter must be removed from the engine for examination.

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

Slipping of the starter drive clutch is indicated if the starter is heard to operate but does not crank the engine.

TO REMOVE AND REPLACE THE STARTER MOTOR.

Disconnect the positive earthing lead from the battery. Disconnect the cable from the starter motor.

Remove the four long setscrews and Thackeray washers which retain the starter motor and drive to the clutch casing.

Withdraw the drive from the rear of the clutch casing and the motor from the front.

To refit the starter motor, reverse the above instructions.

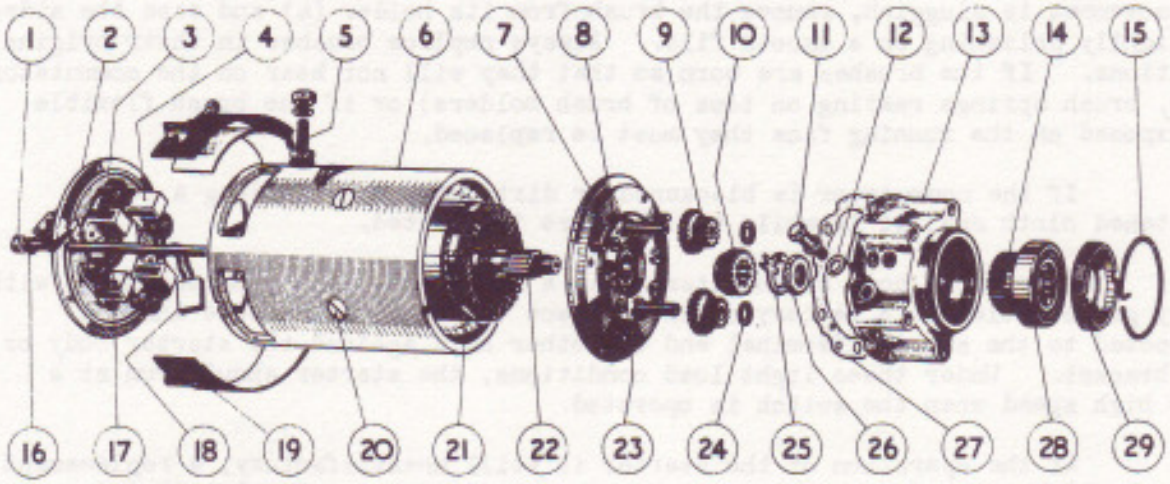

FIG.12. "EXPLODED" VIEW OF STARTER MOTOR & REDUCTION GEAR.

1. Through bolt.
2. Commutator end bracket.
3. Brush spring.
4. Brush holder.
5. Terminal.
6. Yoke.
7. Driving end bracket.
8. Annular support - Gears.
9. Compound pinion.
10. Driving gear.
11. Plug, lubricator.
12. Joint washer.
13. Gear housing.
14. Driven gear.
15. Locking ring.
16. Flat spring washer.
17. Ball or roller bearing.
18. Brush.
19. Cover band & cork joint.
20. Retaining screw - field coil.
21. Field coil.
22. Armature shaft.
23. Ball bearing.
24. Adjusting washer - compound pinion.
25. Lock washer - armature shaft.
26. Nut - armature shaft.
27. Joint washer (Vellumoid.).
28. Ball bearing - gear housing.
29. Retaining nut - gear housing.

Do not forget to replace the packing piece (56, Fig.17), should one be fitted. The purpose of this packing piece is to enable the clearance of .150" to .200" between the flywheel and the pinion (as shown in Fig.19) to be obtained upon initial assembly. It is not necessary to check this clearance each time a starter motor drive is removed and replaced, but only when a complete new drive is fitted or when new parts other than clutch discs are fitted to the drive. This clearance can be determined by measuring the distance from the front face of the pinion to the joint face of the housing (57) with a depth gauge, and then, after allowing for the thickness of the packing piece (56), subtracting this figure from the distance of the flywheel from the clutch case joint face. All later chassis are fitted with a Vellumoid washer each side of the packing piece in addition to the one between the motor and the clutch casing

Make sure that there is a clean and sound electrical connection between the cable and the terminal on the motor.

EXAMINATION OF COMMUTATOR AND BRUSH GEAR.

Remove the starter cover band (19, Fig.12) together with cork joint and examine the brushes (18) and commutator. Hold back each of the brush

springs (3) and move the brush by pulling gently on its flexible connector. If the movement is sluggish, remove the brush from its holder (4) and ease the sides by lightly polishing on a smooth file. Always replace brushes in their original positions. If the brushes are worn so that they will not bear on the commutator (i.e. brush springs resting on tops of brush holders) or if the brush flexible is exposed on the running face they must be replaced.

If the commutator is blackened or dirty, clean by holding a petrol 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 battery of the correct voltage. One cable must be connected to the starter terminal and the other held against the starter body or end bracket. Under these light load conditions, the starter should run at a very high speed when the switch is operated.

If the operation of the starter is still unsatisfactory, a replacement unit should be fitted, and the defective starter dismantled for detailed inspection and testing.

DISMANTLING THE STARTER MOTOR.

(i) Take off the cover band (19) hold back the brush springs (3) and remove the brushes (18) from their holders (4).

(ii) Unscrew the two through bolts (1) and remove them from the commutator end bracket (2). Be careful to retain the flat spring washers (16) on the through bolts.

(iii) The commutator end bracket can now be loosened from the starter yoke by gently tapping on the commutator end bracket, access being obtained through the windows in the starter yoke. A small piece of wood or similar blunt tool should be used (Fig.13).

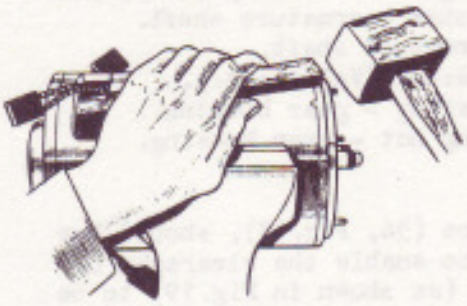

FIG.13. REMOVING COMMUTATOR END BRACKET.

(iv) When the commutator end bracket is sufficiently loosened it can be removed by levering from the yoke as shown (Fig.14), taking care to apply an even pressure on each lever.

(v) The driving end bracket (7) complete with armature, drive and reduction gear can be removed from the starter yoke by gently tapping with a mallet on the commutator end of the armature shaft.

FIG.14. REMOVING COMMUTATOR END BRACKET.

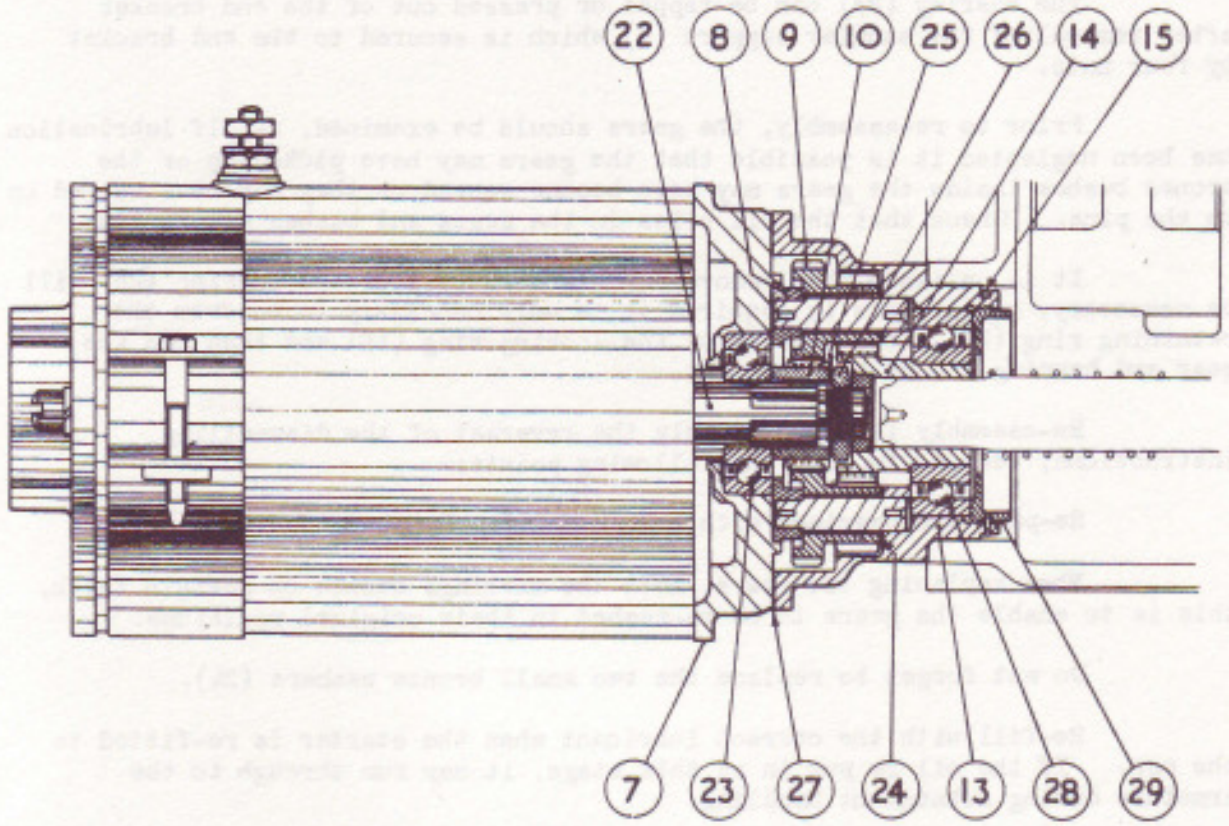

FIG. 15. SECTION THROUGH REDUCTION GEAR.
(See Notation for Fig.12.)

(vi) The bearing, felt washer, steel washer and distance piece can be pulled off the armature at the commutator end when the securing screw is removed (Fig.16).

(vii) When the gearbox is dismantled the armature can be removed from the driving end bracket by means of a hand press.

DISMANTLING AND RE-ASSEMBLING THE GEARBOX.

Remove the 4 nuts and spring washers which retain the aluminium casing (13, Fig.15) to the drive end bracket (7). Remove the aluminium casing but take care not to damage the paper washer (27) and not to lose the two bronze washers (24).

Remove the two compound pinions (9).

It will not be necessary to remove the drive end bracket from the armature unless the bearing (23) requires replacing or the armature requires attention. Should this be necessary, hold the armature carefully in a vice (it is assumed that the motor has already been dismantled as previously described), and then after bending back the tab of the lock washer, remove the nut, the lock washer and the gear (10), then with the aid of a hand press, press out the armature.

The bearing (23) can be tapped or pressed out of the end bracket after removal of the annular support (8) which is secured to the end bracket by four nuts.

Prior to re-assembly, the gears should be examined, as, if lubrication has been neglected it is possible that the gears may have picked-up or the bronze bushes inside the gears may have become scored or they may have seized on to the pins. Check that the oil holes in the gears and bushes are in line.

It is unlikely that removal of the gear (14) or the bearing (28) will be necessary, but if this is required it is only necessary to unscrew the retaining ring (29) after removal of the locking ring (15) and then tap the gear and bearing out of the housing.

Re-assembly is approximately the reversal of the dismantling instructions, bearing in mind the following points:-

Re-pack the bearings with a High Melting Point Grease.

When replacing the gears, note the markings etched on certain teeth, this is to enable the gears to be re-meshed in their original positions.

Do not forget to replace the two small bronze washers (24).

Re-fill with the correct lubricant when the starter is re-fitted to the car. If the oil is put in at this stage, it may run through to the armature during subsequent handling.

BRUSHES.

(i) Test the brush springs with a spring scale. The correct tension is 30 - 40 ozs. Fit a new spring if the tension is low.

(ii) If the brushes are worn so that they do not bear on the commutator or if the flexible connector is exposed on the running face, they must be replaced.

The flexible connectors must be removed by unsoldering and the connectors of the new brushes secured in their place by soldering. The brushes are pre-formed so that hand bedding to the commutator is unnecessary, but it is recommended that the motor should be run for about 15 minutes on 6 volts and not under load so as to finally bed the brushes to the commutator.

COMMUTATOR.

A commutator in good condition will be smooth and free from pits and burned spots. Clean the commutator with a petrol moistened cloth. 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 gear-box as previously described, and remove the armature from the end bracket. Now mount the armature in a lathe, rotate at a high speed and take a light cut with a very sharp tool. Do not remove any more metal than is necessary and finally polish with very fine glass paper. N.B. DO NOT undercut the mica.