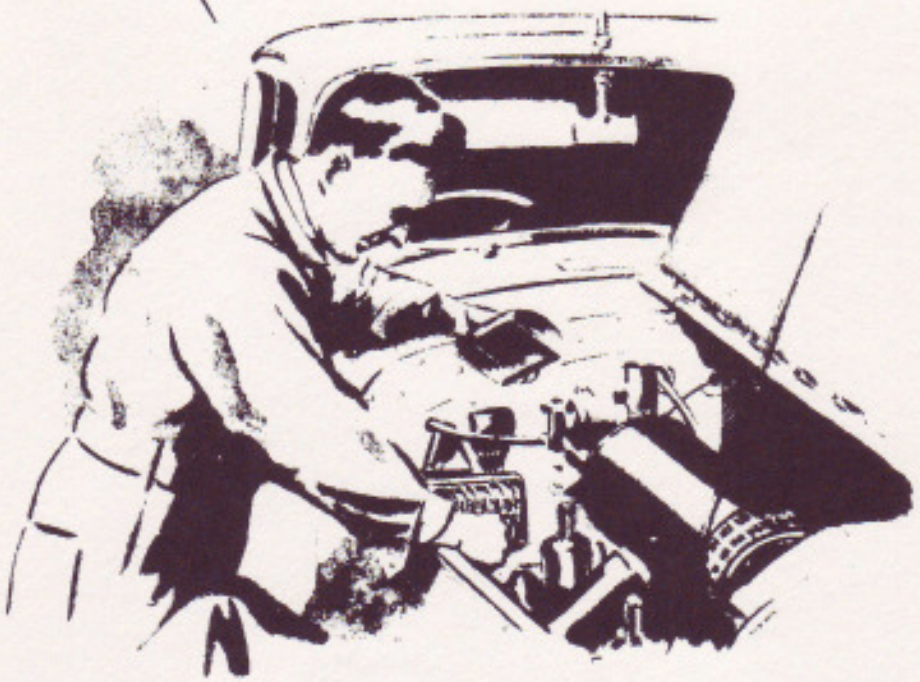
ELECTRICAL



SECTION P.

THE ELECTRICAL SYSTEM.

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SECTION P.

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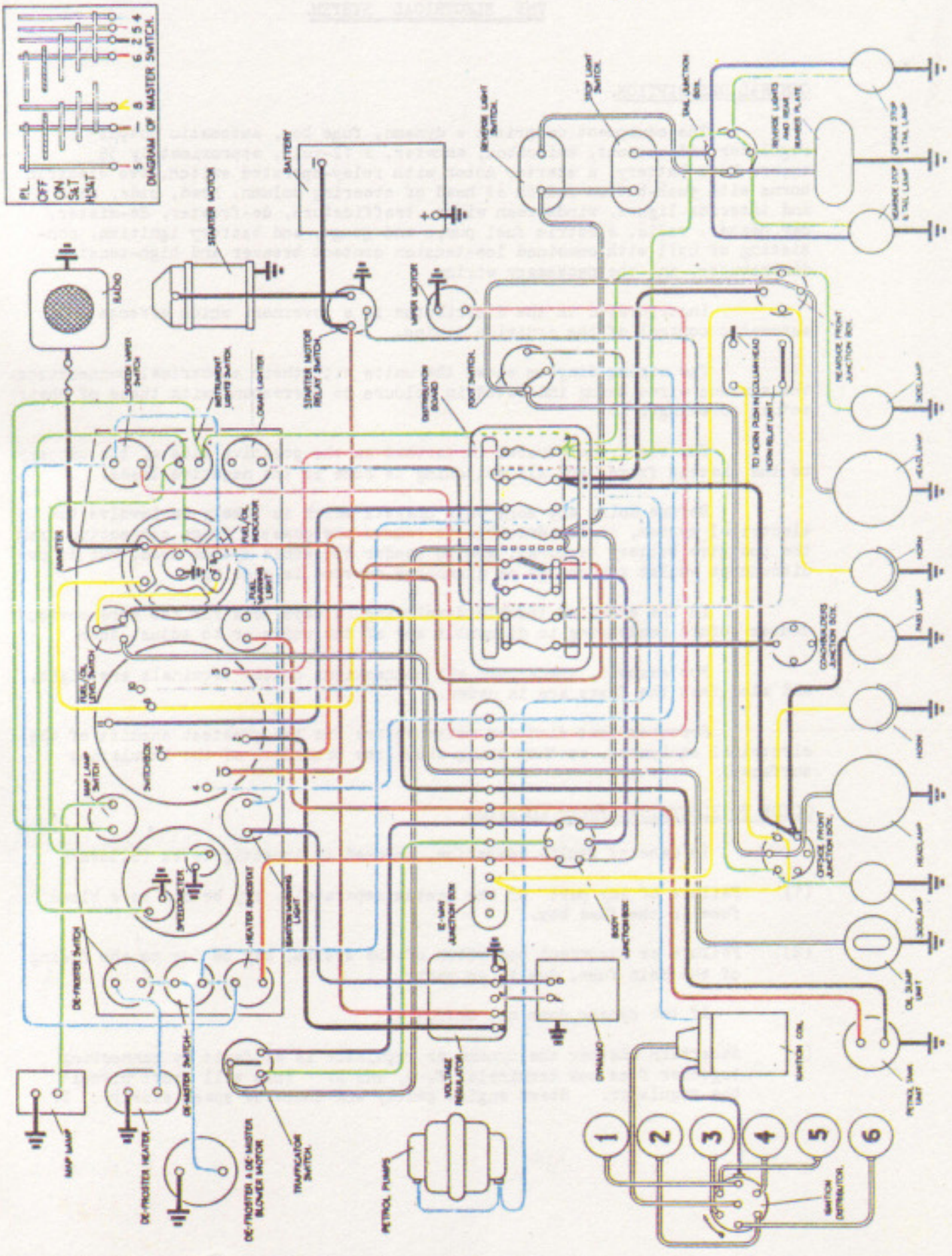


ELECTRICAL WIRING DIAGRAM

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

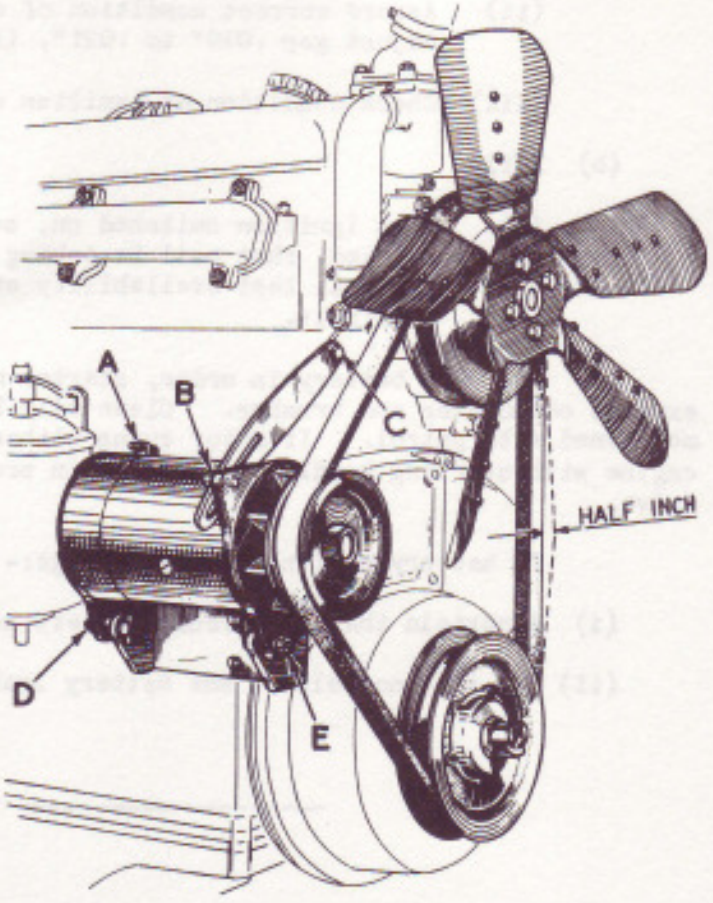


FIG. 1 DYNAMO AND "VEE" BELT DRIVE.

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.

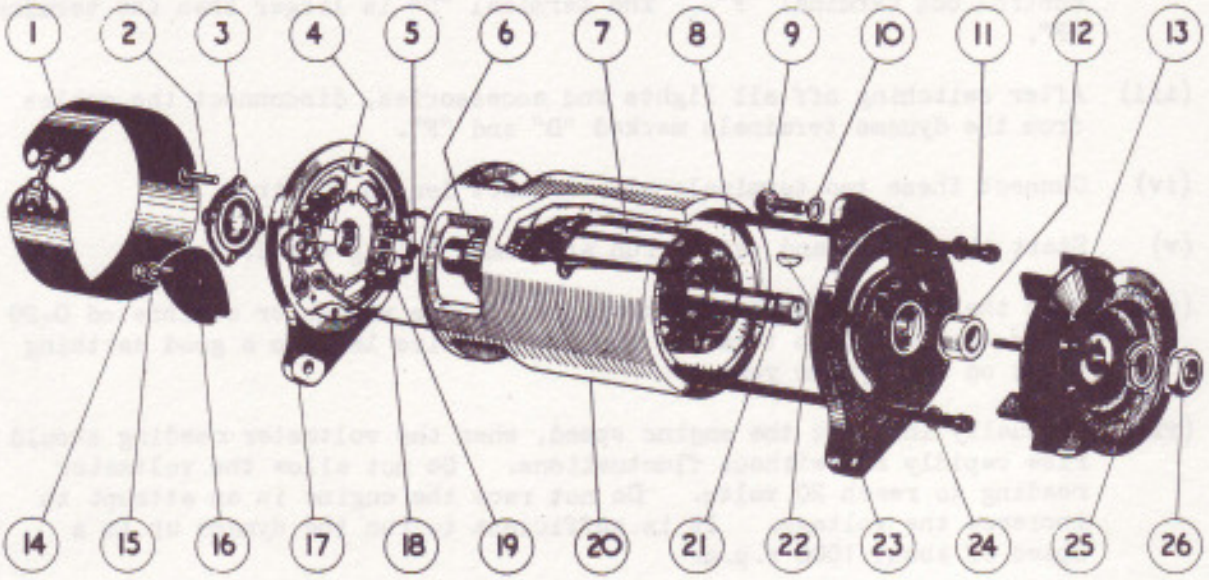


FIG. 2. EXPLODED VIEW OF DYNAMO.

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.

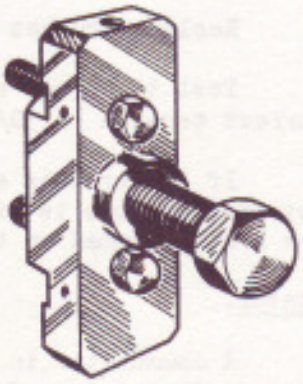


FIG. 3. UNIVERSAL EXTRACTOR. TOOL NO. STD.505.

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.

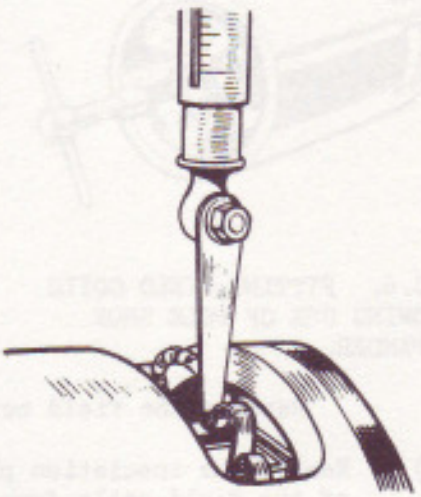


FIG.4. SHOWING CHECKING OF BRUSH SPRING TENSION.

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.

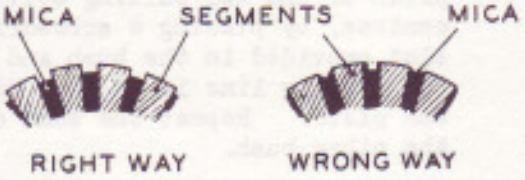


FIG. 5. SHOWING UNDERCUTTING OF THE COMMUTATOR MICA.

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.

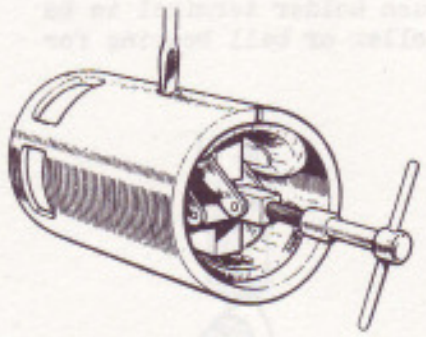


FIG. 6. FITTING FIELD COILS SHOWING USE OF POLE SHOE EXPANDER.

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.

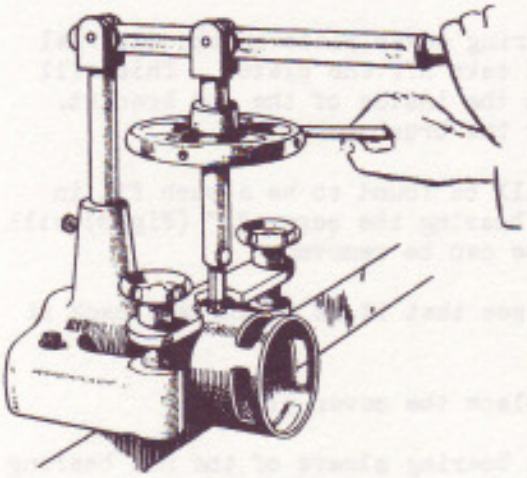


FIG. 7. SHOWING TIGHTENING POLE SHOES WITH WHEEL OPERATED SCREWDRIVER.

(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.

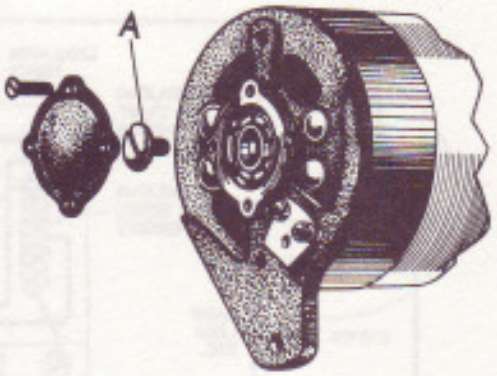


FIG. 8. COMMUTATOR END BRACKET SHOWING COVER AND THRUST SCREW "A" REMOVED.

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.

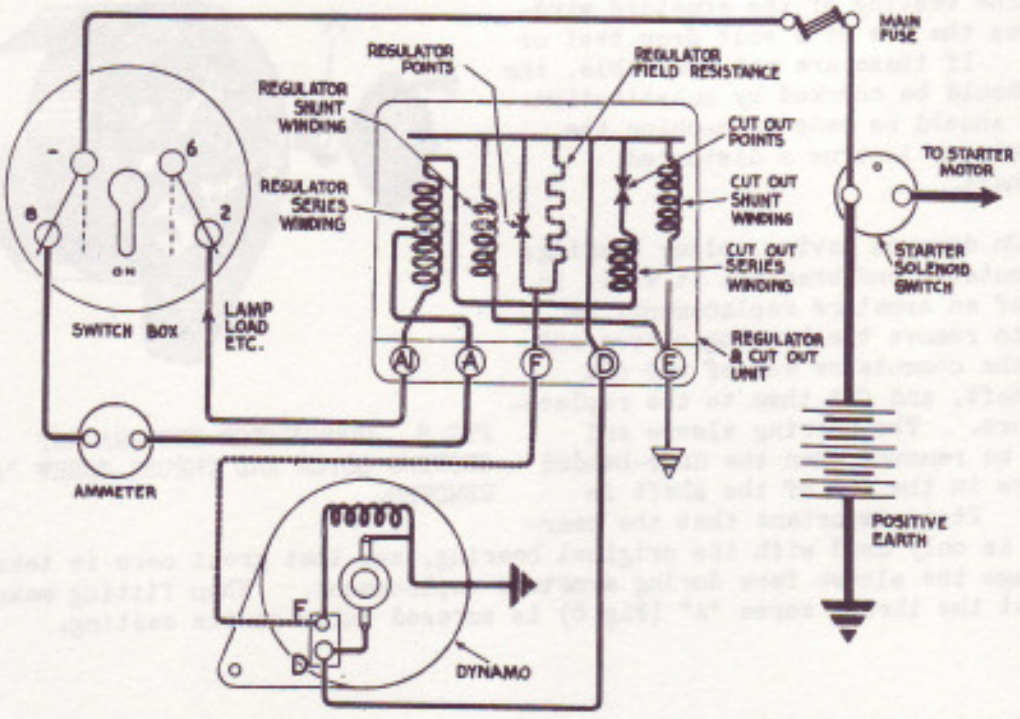


FIG. 9. CHARGING CIRCUIT.

(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.

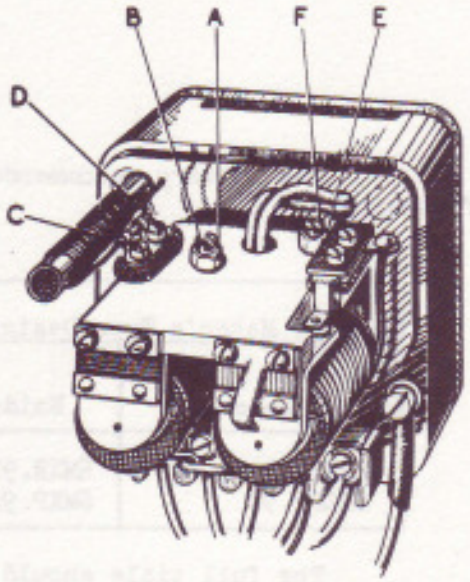


FIG. 10. SHOWING CONTROL UNIT ADJUSTMENT SCREWS.

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.

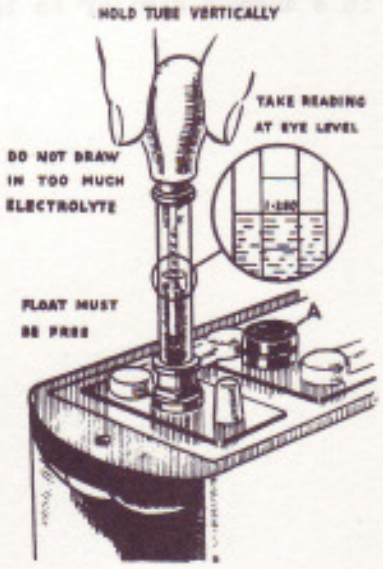


FIG.11. TESTING SPECIFIC GRAVITY.

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.

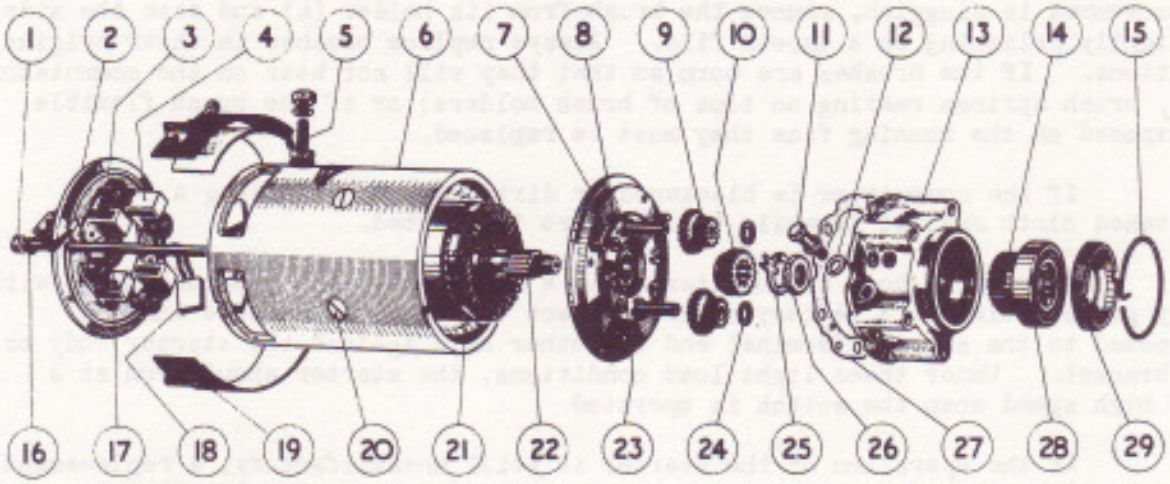


FIG.12. "EXPLODED" VIEW OF STARTER MOTOR & REDUCTION GEAR.

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).

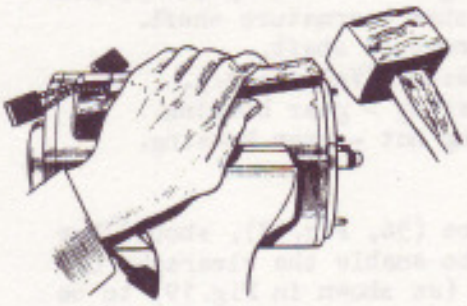


FIG.13. REMOVING COMMUTATOR END BRACKET.

(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.

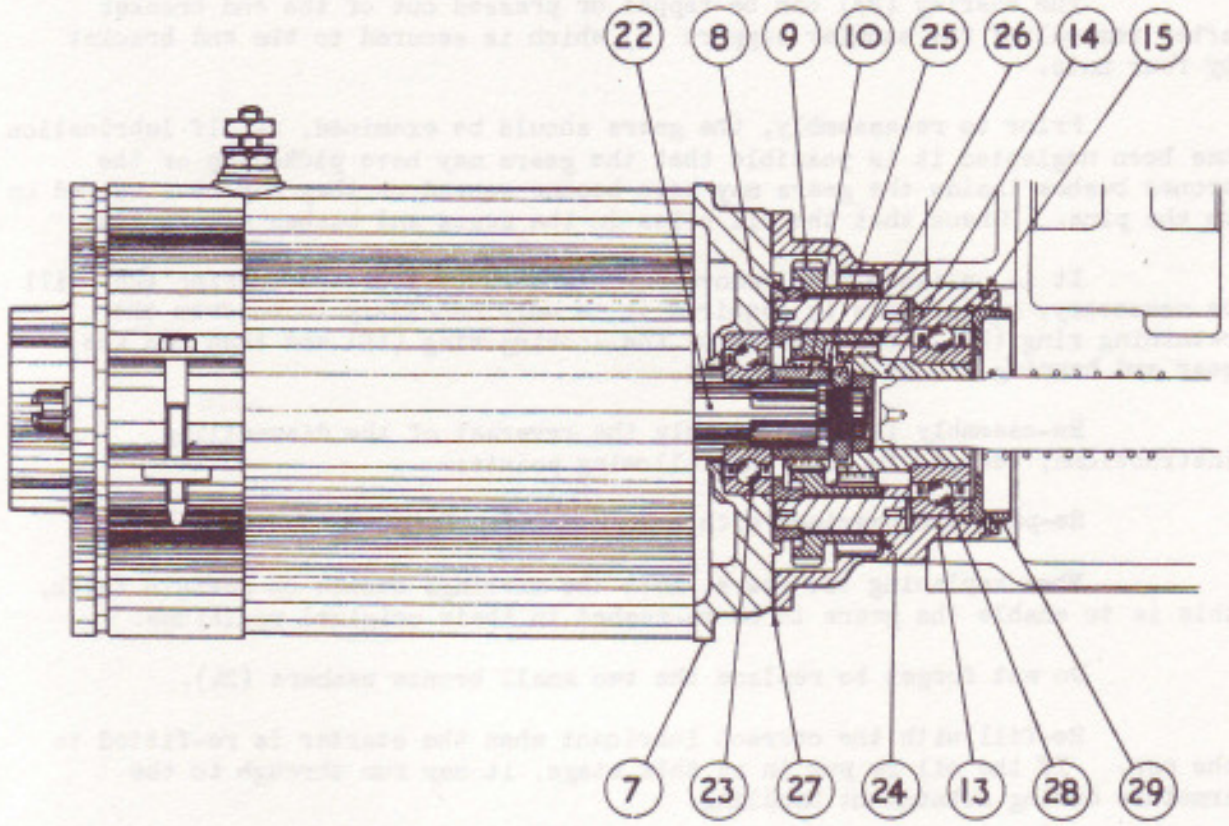


FIG. 15. SECTION THROUGH REDUCTION GEAR.
(See Notation for Fig.12.)

(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.

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 points of the field coils to which the brushes are connected. If the lamp does not light, there is an open circuit in the wiring of the field coils.

Lighting of the lamp 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 one of the leads 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, the complete starter should be returned and a replacement fitted. If, however, a pole shoe expander and wheel operated screwdriver are 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 starter yoke.

Replace the field coils as follows:-

(i) Unscrew and remove the terminal nuts and washers from the terminal (5).

(ii) Remove the two insulation pieces which are fitted beneath the field coils to prevent the intercoil connectors from contacting with the yoke.

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

(iv) Unscrew the four pole shoe retaining screws (20) by means of the wheel operated screwdriver.

(v) Draw the pole shoes and field coils out of the starter yoke and lift off the field coils.

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

(vii) Locate the pole shoes and field coils by lightly tightening the fixing screws.

(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 and lock the screws by peening into the slot.

(x) Replace the insulation pieces between the field coil connections and the yoke.

(xi) Position the terminal nut through its location in the starter yoke and fully tighten securing nuts.

ARMATURE.

Examination of the armature will in many cases reveal the cause of failure, e.g. conductors lifted from the commutator due to the starter sticking in the engaged position while the engine is running and causing the armature to be rotated at an excessive speed. A damaged armature must in all cases be replaced - no attempt should be made to machine the armature core or to true a distorted armature shaft.

MOTOR 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. Ball bearings are fitted at both commutator and driving ends, although some early starters had a roller bearing at the commutator end.

To replace the bearing at the commutator end, remove the commutator end bracket as previously described, and remove the bearing as shown in Fig.16. Fit the new bearing, taking care to replace the distance piece, steel washer and felt washer as shown.

To replace the bearing at the driving end, dismantle the gearbox as previously described, and remove the bearing from the driving end by means of an extractor or by lightly tapping on the inner race.

The bearings should be packed with a High Melting Point grease.

THE DRIVE UNIT

The purpose of the clutch which is incorporated in the starter drive unit, is to allow a limited amount of slip to take place during engagement of the pinion with the flywheel, this has the effect of reducing the shock loading on the pinion and the flywheel teeth and thus increasing their life.

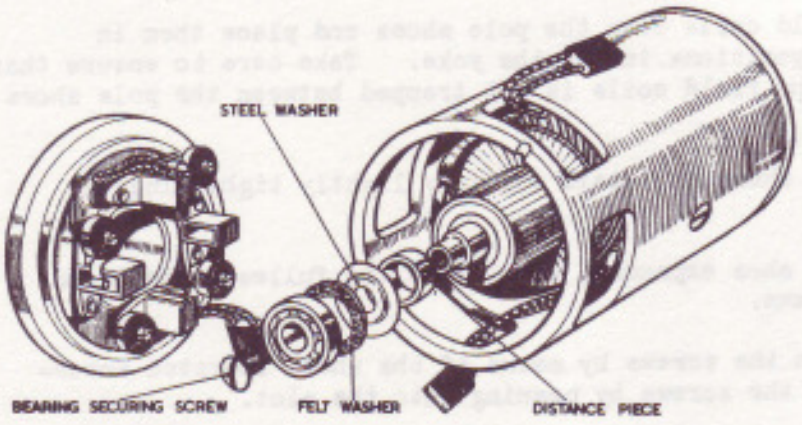


FIG.16. COMMUTATOR END BEARING REMOVED.

It is important that the clutch should slip within the fairly wide limits of torque loading prescribed, in order that it should perform its duty satisfactorily. For this reason, careful assembly of the drive is necessary and a slipping torque test (see later paragraph) strongly recommended.

On earlier type drives, five cork friction discs were used, while on later

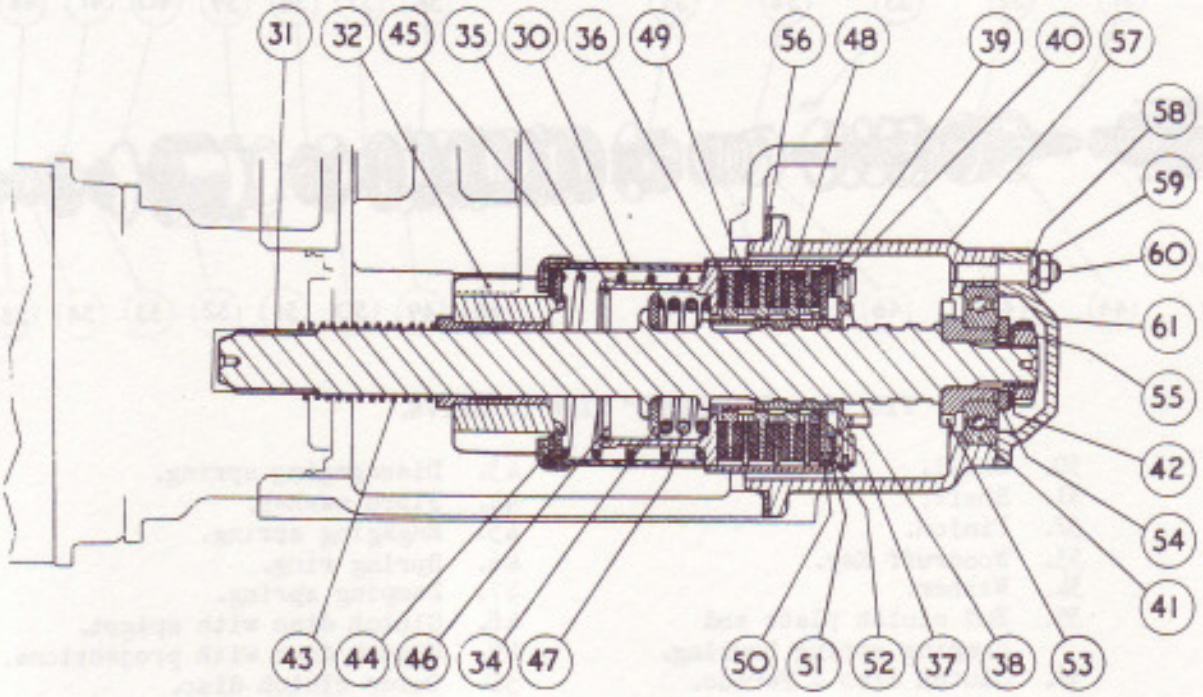


FIG.17. SECTION THROUGH DRIVE IN ENGAGED POSITION. (A Vellumoid washer is fitted each side of the packing piece 56 on late chassis.)

56.	Packing piece.	59.	Nut.	(For other numbers
57.	Aluminium drive housing.	60.	Stud.	see Notation List
58.	Spring washer.	61.	End Cover.	for Fig.18.)

drives seven Ferodo discs are used. For a time the seven discs were made of an asbestos base material - Ferodo AN11, but this was superseded later by a cotton base material - Ferodo CR.

To dismantle the Drive.

Do not dismantle the drive unnecessarily. If it is functioning satisfactorily it is advisable to leave well alone. If there is any doubt about its performance, then the slipping torque can be measured as described in the appropriate paragraph, and as long as the slipping torque figures are between the limits of 15 to 35 lbs.ft., the drive can be considered to be performing satisfactorily. However, if dismantling is necessary, proceed as follows:-

(i) Remove the small aluminium cover (61, Fig.17) secured by 3 nuts and spring washers.

(ii) Mount the drive vertically in a vice, holding it by means of fibre vice clamps on the splined end of the shaft and after bending back the tab of the lock washer (42), unscrew and remove the slotted ring nut (55) and then remove the lock washer and plain washer (54). Remove from vice.

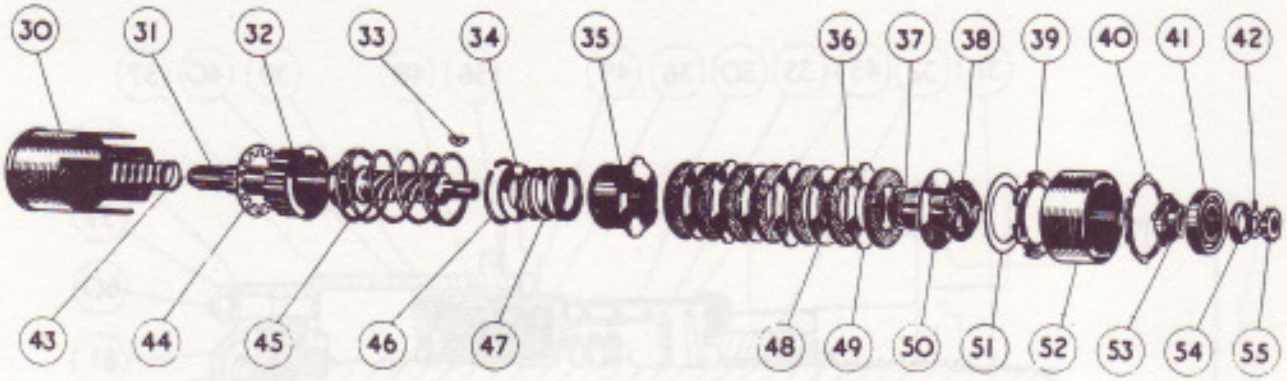


FIG. 18. "EXPLODED" VIEW OF DRIVE.

30. Shell.
31. Shaft.
32. Pinion.
33. Woodruff Key.
34. Washer.
35. End clutch plate and damping spring housing.
36. Clutch disc - Ferodo.
37. Spring ring.
38. Operating nut.
39. Clutch ring.
40. Locking ring.
41. Ball bearing.
42. Lock washer.
43. Disengaging spring.
44. Fibre washer.
45. Engaging spring.
46. Spring ring.
47. Damping spring.
48. Clutch disc with spigot.
49. Clutch disc with projections.
50. Outer clutch disc.
51. Fibre distance washer.
52. Cover.
53. Stop operating bush.
54. Plain washer.
55. Nut.

(iii) Support the housing (57) and drive out the assembly from the housing, using an aluminium drift or fibre hammer on the end of the shaft.

(iv) Remove the locking ring (40) by prising inwards with a screwdriver.

The drive will now come apart quite easily.

Inspection of dismantled Drive and preparation for re-assembling.

It is presumed that the clutch will only have been dismantled because of faulty operation, therefore visual examination of the parts will probably indicate the cause of the trouble.

In the case of the five cork disc clutch, the corks may have fractured; this will entail converting the drive to the seven disc type. For this, the following parts will be required: Three new steel discs (48, Fig.18) with a narrower spigot on the inner diameter to replace the two existing spigoted discs, also one additional inner clutch disc with projections (49) similar to the existing type and seven new Ferodo CR friction discs.

In the case of the seven disc clutch, inspection may reveal a charred surface on the Ferodo discs due to excessive slipping, this will entail replacement of the discs with new Ferodo CR type, irrespective of whether the discs

removed are of the asbestos base or cotton base type. A new lock washer (42) will also be required.

To Re-assemble the Drive.

Place the fibre washer (44) over the pinion (32) with the chamfer outermost.

Place the pinion into the shell (30) and then drop the shaft (31) into the shell and through the pinion.

Place the engaging spring (45) into the shell.

Place the assembly, which consists of the end clutch plate (35), the damping spring (47), the washer (34) and the spring ring (46), over the shaft and into the engaging spring and shell.

Now, holding the operating nut (38) vertically in the left-hand, assemble the various clutch discs to it in the following order (noting first that the outer steel clutch disc (50) is securely held in position by the spring ring (37).

1st Ferodo disc, 1st steel disc with projections, 2nd Ferodo disc, 1st spigoted steel disc, 3rd Ferodo disc, 2nd steel disc with projections, 4th Ferodo disc, 2nd spigoted steel disc, 5th Ferodo disc, 3rd steel disc with projections, 6th Ferodo disc, 3rd spigoted steel disc and finally the 7th Ferodo disc.

Having thus assembled the discs, hold them closely together with the fingers, remove the operating nut (38) and with the aid of a 1 to 2 inch micrometer, measure the overall thickness of the discs, this should be 1.108" - .010" as shown in Fig.19. The .094" dimension shown in Fig.19 is the nominal thickness of each Ferodo disc.

If above the limit, then reduce the thickness of the Ferodo discs slightly by rubbing them on a piece of medium glass paper on a flat surface.

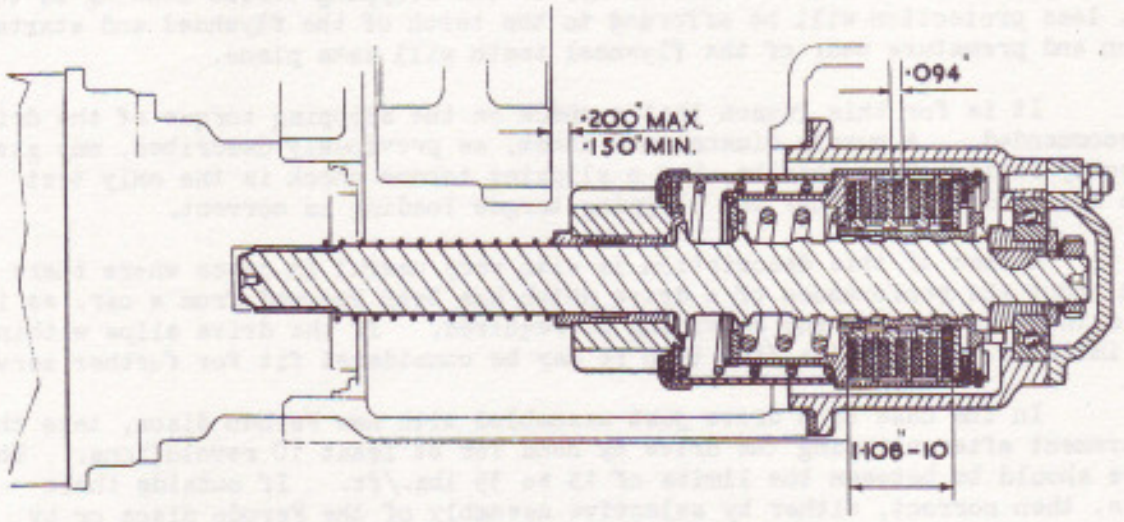


FIG. 19. SECTION THROUGH DRIVE IN DISENGAGED POSITION.

If below the limit, increase the thickness by selective assembly of the Ferodo discs.

Next, soak the Ferodo discs in engine oil for 30 minutes and then re-assemble the clutch discs on to the operating nut as already described.

The remainder of the re-assembling can be more easily carried out if the drive is mounted vertically in a vice, clamping on the pinion by means of fibre vice clamps.

Place the sub-assembly (just completed) consisting of the various discs and the operating nut, over the shaft and force it down against the spring by screwing the shaft up through the operating nut. If the shaft is held in this position, the spring will remain compressed thus allowing the assembly to be completed.

Place the fibre distance washer (51) into the clutch ring (39), entering the chamfered outer diameter first, then place this ring and distance washer assembly on to the outer clutch disc (50) and hold down by turning the shaft, then fit the cover (52) and retain by means of the locking ring (40).

With the stop operating bush (53) in position in the bearing and the key (33) in its keyway, replace the aluminium housing (57) and bearing, and secure with the plain washer (54), a new locking washer (42) and the slotted ring nut (55). Do not bend up the tab of the lock washer until the slipping torque of the clutch has been tested. When this test has been satisfactorily concluded, lock the nut with the lock washer, lubricate the bearing with an H.M.P. grease and then replace the end cover (61) and secure with the three nuts and spring washers.

Measurement of the Slipping Torque of the Drive.

It is important that the clutch of the starter drive should slip at the correct torque loading within certain limits, for if the clutch slips too easily then damage may be done to the drive due to overheating of the friction discs during the excessive slipping which may occur when starting the engine under very cold conditions. Conversely, if the slipping torque loading is too high, less protection will be afforded to the teeth of the flywheel and starter pinion and premature wear of the flywheel teeth will take place.

It is for this reason that a check on the slipping torque of the drive is recommended. A purely dimensional check, as previously described, may give perfectly satisfactory results, but a slipping torque check is the only test which will indicate whether the slipping torque loading is correct.

A test of this description is also very useful in cases where there is doubt about the performance of a drive which has been removed from a car, as it should indicate whether any servicing is required. If the drive slips within the limits of 15 to 35 lbs./ft. then it may be considered fit for further service.

In the case of a drive just assembled with new Ferodo discs, take the measurement after slipping the drive by hand for at least 10 revolutions. The figure should be between the limits of 15 to 35 lbs./ft. If outside these limits, then correct, either by selective assembly of the Ferodo discs or by reducing their thickness slightly by rubbing them on medium glass paper

supported on a flat plate.

The following paragraphs describe alternative methods which may be adopted for measuring the slipping torque.

(i) By Torque Spanner.

If a torque spanner capable of reasonably accurate measurements and with a capacity of up to 35 lbs./ft. (420 lbs./ins.) is available, then the slipping torque of the drive can be measured very easily. To do this proceed as follows:-

Remove the slotted ring nut (55) from the end of the drive and substitute for this a standard half inch B.S.F. nut. This will allow the standard adaptor on the torque spanner to be used.

Mount the drive vertically in a vice and using fibre vice clamps, tighten up on the pinion and then apply the torque spanner to the nut on the top of the drive shaft as shown in Fig.20, turning the nut until slipping occurs and then continue turning very slowly and read off the torque loading from the dial.

If no suitable torque spanner is available, adopt method (ii).

(ii) By Torque Arm and Spring Scale.

A torque arm suitable for the purpose may be made from a piece of mild steel plate. The end which fits around the pinion may be suitably shaped by drilling and filing so that two or three projections in the shape of teeth are left on it to engage with the teeth of the pinion. The length of the arm should be 1 ft. between the two hole centres. A spring scale capable of reading up to 35 lbs. will be required. The torque in lbs./ft. required to make the drive slip, can be read directly off the scale. See Fig.21. If it is desired to use a smaller size of spring scale, then the torque arm could be made 2 ft. long and the reading off the spring scale is doubled.

When carrying out this test, keep the spring scale approximately at right angles to the torque arm.

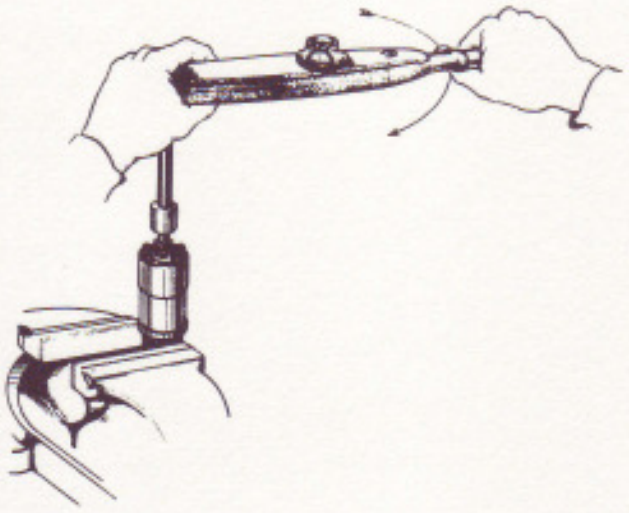


FIG. 20. MEASURING SLIPPING TORQUE OF CLUTCH WITH A TORQUE SPANNER.

In the event of a spring scale not being available, then the drive could be mounted horizontally in the vice and the load applied to the torque arm by hanging weights on the end.

PERIODIC ATTENTION AND LUBRICATION.

The reduction gear will require attention every 10,000 miles, when the filler plug should be removed and an S.A.E.30 viscosity engine oil should be added until the level reaches the mouth of the plug orifice.

Periodically, approximately every 10,000 miles the brush gear and commutator should be examined and cleaned.

The various ball bearings, of which there are four, one supporting each end of the motor armature, one in the gearbox and one at the rear end of the drive unit, are lubricated with an H.M.P. grease during initial assembly and no further attention is necessary to these bearings until the starter motor and drive is dismantled for overhaul, when the bearings should again be lubricated with an H.M.P. grease.

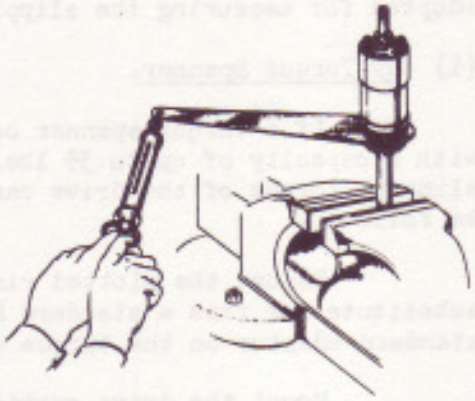


FIG.21. MEASURING SLIPPING TORQUE OF CLUTCH WITH A SPRING SCALE.

STARTER MOTOR SWITCH.

TYPE.

The starter switch is a Lucas Model ST810, Service No.076003. This identification mark is stamped on the case of the starter switch. The Bentley reference number is RD.3009. When ordering a replacement always quote these numbers.

To test the Switch in position.

Disconnect the existing cables from the switch terminals and connect a pair of test leads from a 12 volt battery to the switch. The negative lead must be connected to the small terminal fitted with a grub screw and the positive held against some clean metallic part of the switch body or fixing bracket. If the switch is in working order it will be heard to operate every time the circuit is completed.

If the switch is not heard to operate it is probably damaged internally and a replacement must be fitted. No attempt should be made to dismantle the switch.

THE IGNITION SYSTEM.

THE DISTRIBUTOR.

A diagram of the ignition circuit is shown in Fig.22. The distributor, which is accessibly mounted on the near side of the engine, is of the three lobe cam and twin contact breaker arm type. An automatic centrifugal advance mechanism is housed in the base of the distributor head. No hand control for varying the ignition timing being fitted.

To expose the contact breakers and cam, spring back the securing clips and remove the moulded distributor cover.

The only adjustments required in service are maintenance of the correct gaps, and in certain circumstances, the synchronisation of the contact breaker arms.

The firing order is 1,4,2,6,3,5, this is embossed on the distributor cover, No.1 being the front cylinder. The direction of rotation of the distributor is clockwise when viewed from the top.

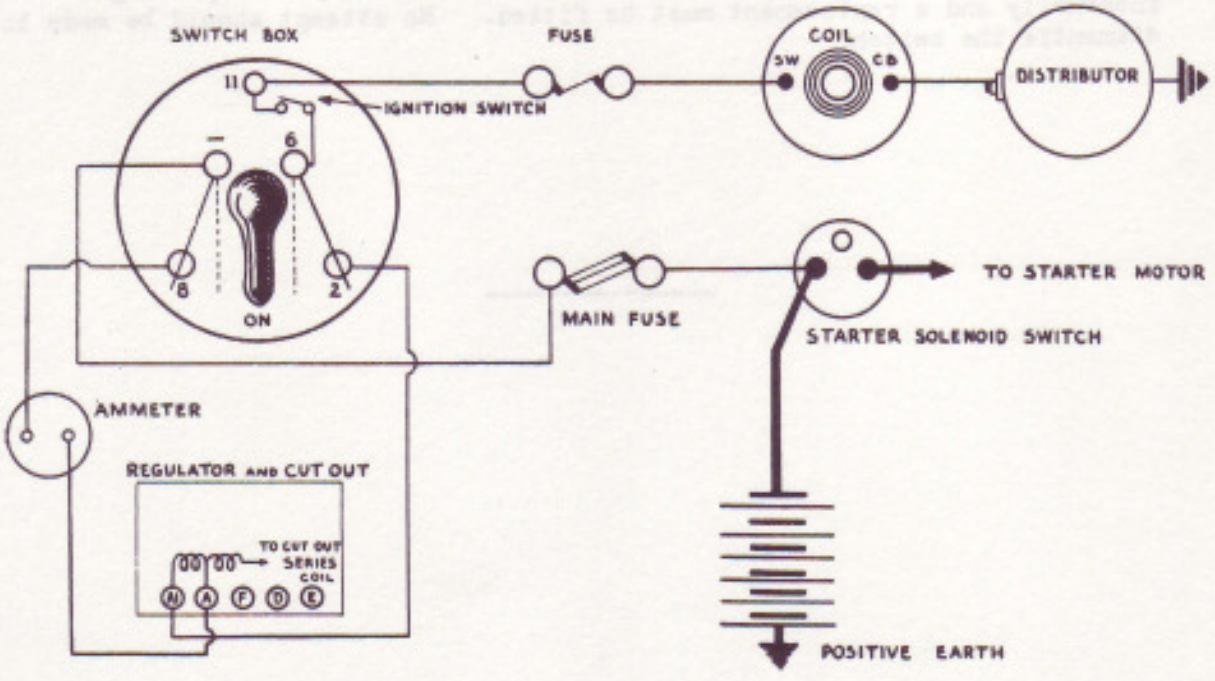


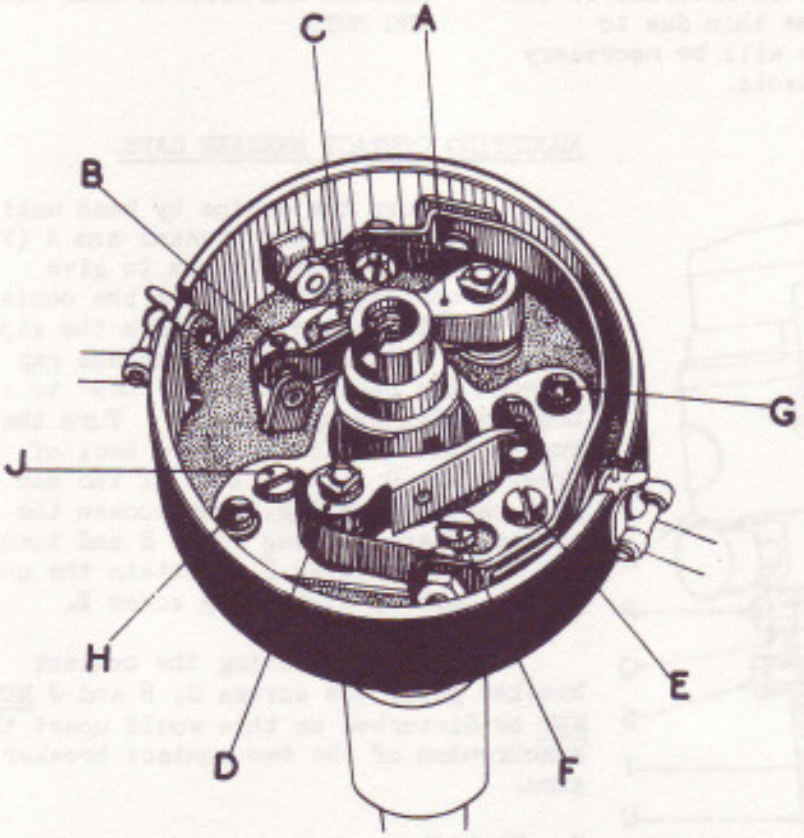
FIG. 22. IGNITION CIRCUIT.

CLEANING THE CONTACTS.

Every 5000 miles the contact surfaces should be examined. If they have a clean greyish frosted appearance and are not badly pitted, then do not try to improve them by trimming.

If, however, they appear burnt and badly pitted, they should be removed from the distributor for trimming as follows:-

Lift the Rotor Arm off the top of the spindle. Remove the small screws which attach the springs to their anchorage. Remove the two Contact Plate Locking Screws B and E (see Fig.23), then remove the contact plates complete with breaker arms. Screws G, H and J MUST NOT be disturbed.



A. Breaker Arm.

D. Breaker Arm.

B. Locking Screw (Contact Plate).

E. Locking Screw (Contact Plate).

C. Adjusting Screw (Gap Adjustment).

F. Adjusting Screw (Gap Adjustment).

J. Adjusting Screw (Synchronising).

H. Locking Screw (Synchronising Plate).

G. Locking Screw (Synchronising Plate).

FIG. 23. LOW TENSION CONTACT BREAKERS.

Trimming is best done with an India stone. It is advisable to leave the breaker arms in position on the pivots during this operation, to prevent loss of the small spring retaining clips and fibre washers, and to allow the contacts to be swung together to check for trueness of the surfaces, which should close flush with each other. All raised portions of the contact surfaces should be removed, but it is not necessary to remove the pit mark. Finish by wiping with a petrol moistened cloth to remove all traces of grease or dirt.

When replacing the contacts, they must be refitted in the correct position; i.e. the breaker arm D and its contact plate must be fitted over the synchronising plate, otherwise the springs will not line up with the anchorage nor will the fibre heels bear centrally on the cam. When attaching the springs to their anchorage, tighten the nuts as shown in Fig. 24, to avoid twisting the springs, and so cause the breaker arms to bind on their pivots.

Finally, lubricate where necessary and adjust the gaps.

When the tungsten material of the contact points has become thin due to erosion and trimming, it will be necessary to fit a new set of contacts.

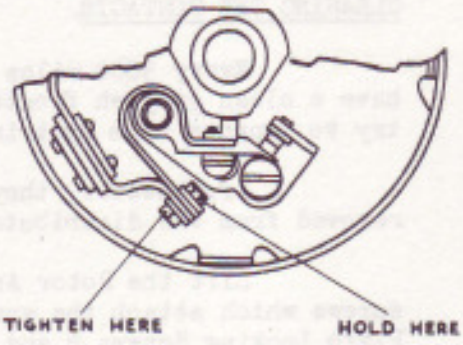


FIG. 24. TO AVOID TWISTING BREAKER ARM SPRINGS WHEN TIGHTENING NUTS.

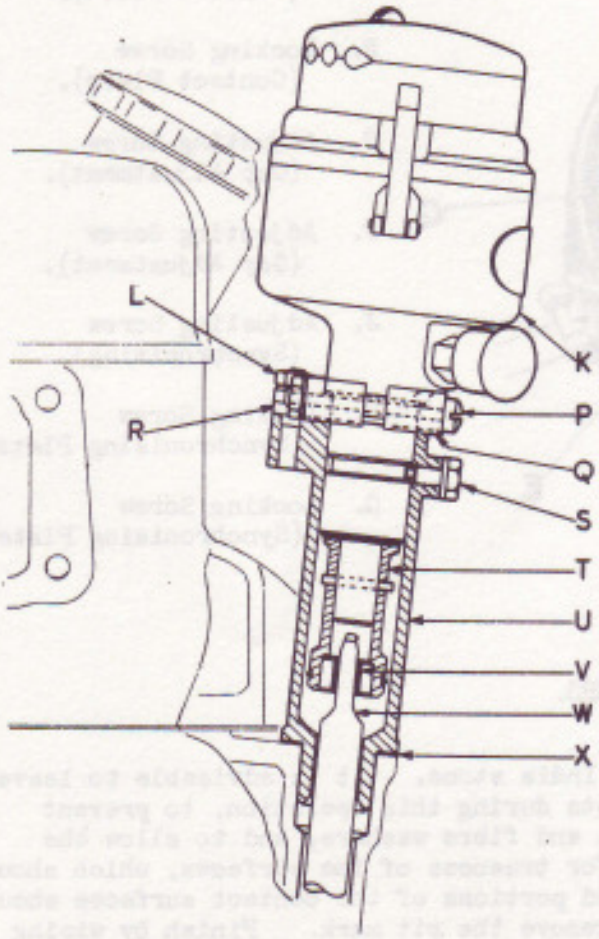


FIG. 25. DISTRIBUTOR AND HOUSING IN POSITION.

ADJUSTING CONTACT BREAKER GAPS.

Turn the engine by hand until the fibre heel of the breaker arm A (Fig. 23) is on a lobe of the cam to give maximum opening, then loosen the contact plate locking screw B and turn the adjusting screw C to obtain the correct gap between the contacts, i.e., .019" to .021". Lock by tightening screw B. Turn the engine again until the fibre heel of breaker arm D is on a lobe of the cam to give maximum opening, then loosen the contact plate locking screw E and turn the adjusting screw F to obtain the correct gap. Lock by tightening screw E.

When adjusting the contact breaker gaps, the screws G, H and J MUST NOT be disturbed as this would upset the synchronism of the two contact breaker arms.

K. Distributor.
L. Nut - Clamping Plate to Housing.
P. Screw - Clamping Plate.
Q. Clamping Plate.
R. Packing Washer.
S. Setscrew.
T. Driven Sleeve.
U. Distributor Housing.
V. Driven Plates.
W. Driving Shaft.
X. Vellumoid Joint.

WHEN TO CHECK SYNCHRONISM OF BREAKER ARMS.

The contact breaker arms are accurately synchronised by the makers, and normally no further adjustment will be required; it will be necessary, however, to check them for synchronism and re-adjust in the following circumstances:-

(a) If the screws G, H and J (Fig.23) have been accidentally disturbed.

(b) If for any reason (such as a broken C.B. spring or fibre heel) only one new pair of contacts is fitted to the distributor and the other pair have been in use for some time.

(c) If two new pairs of contacts are fitted to replace one new and one old pair as in (b) above.

Synchronising is carried out after removing the distributor from the cylinder block.

REMOVING THE DISTRIBUTOR.

Remove the distributor complete with the housing U (Fig.25) as follows:-

Remove the distributor cover. Turn the engine until the distributor rotor arm is in line with No.1 cylinder firing position as indicated on the moulded cover.

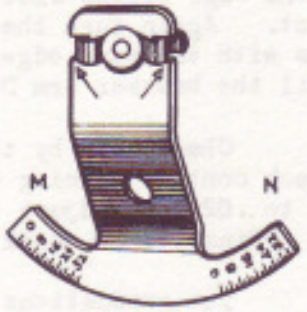


FIG. 26. SYNCHRONISING TOOL.

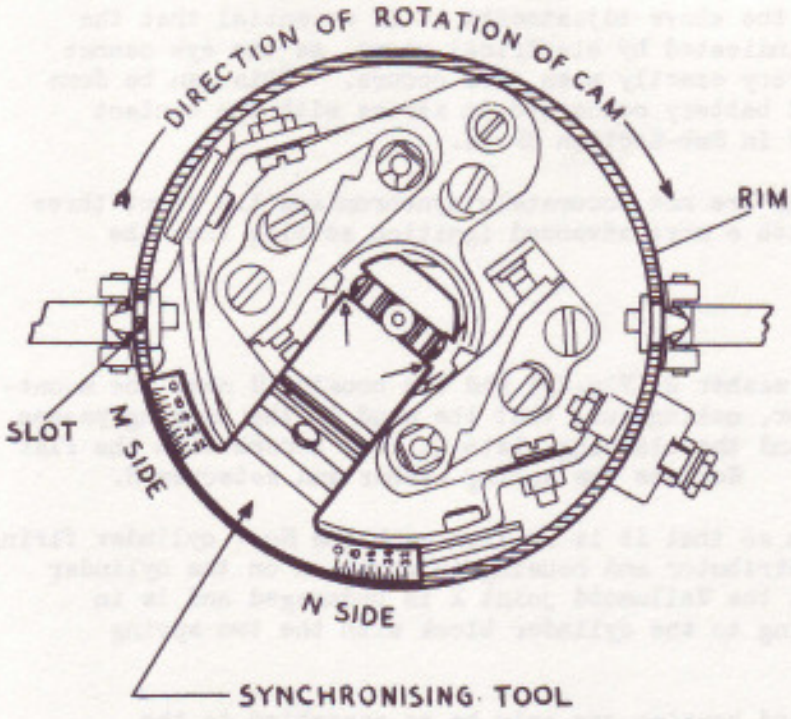


FIG. 27. SYNCHRONISING TOOL IN POSITION.

Remove the two nuts and flat spring washers which secure the distributor housing to the cylinder block and then remove the housing and distributor assembly from the block. Take care not to damage the Vellumoid joint X as fitted to the lower end of the housing.

NOTE: DO NOT slacken the clamping plate screw P, as the clamping plate should be left in position; i.e. clamped to the distributor so as not to disturb the timing.

Remove the nut L and flat spring washer which secures the clamping plate to the housing U. Remove the setscrew S which retains the distributor to the housing.

Withdrew the distributor from the housing thereby exposing the driven sleeve T.

SYNCHRONISING CONTACT BREAKER ARMS.

Using the special tool illustrated in Fig.26, proceed as follows:-

Adjust the gaps of both pairs of contacts as previously described.

Place the synchronising tool on the cam with the M side of the spring in the slot in the cam, then turn the cam in a clockwise direction until the graduations on the M side of the tool are near the slot in the rim of the distributor base (see Fig.27). Continue to turn the cam slowly until the breaker arm A just breaks contact. Note the graduation on the tool that aligns with the edge of the slot, in the exact position in which the points broke contact. Again turn the cam until the corresponding graduation on the N side aligns with the same edge. Loosen screws G and H and turn the adjusting screw J until the breaker arm D just breaks contact.

Check this by turning the cam again. Tighten screws G and H. Re-check contact opening of arm D and if it is not still within the limits of .019" to .021" re-adjust to obtain this figure, and re-synchronise the breaker arms, Finally, re-check the contact opening of arm D.

The graduations on the tool represent engine degrees and the markings on the M side are just 60 distributor degrees or 120 engine degrees from corresponding markings on the N side. The breaker arms must not be out of synchronism more than 2 engine degrees.

When carrying out the above adjustments it is essential that the opening of the contacts is indicated by electrical means, as the eye cannot detect with sufficient accuracy exactly when this occurs. This can be done by means of a small bulb and battery connected in series with the contact breaker points, as described in Sub-Section BP.6A.

If the breaker arms are not accurately synchronised the front three cylinders will be running with a more advanced ignition setting than the other three, or vice versa.

REFITTING DISTRIBUTOR.

Slide the packing washer R (Fig.25) and the housing U over the mounting spigot of the distributor, making sure that the stud in the housing passes through the packing washer and the clamping plate Q, then secure with the flat spring washer and the nut L. Replace the spring washer and setscrew S.

Turn the rotor arm so that it is in line with the No.1 cylinder firing position, then place the distributor and housing in position on the cylinder block after making sure that the Vellumoid joint X is undamaged and is in position. Secure the housing to the cylinder block with the two spring washers and nuts.

NOTE: The distributor and housing can only be re-assembled to the block as described above if the tongue on the driving shaft W is in line with the driving plates V of the distributor assembly, therefore the engine should not have been turned since the distributor

was removed. However, if the engine has been turned, it will be necessary to re-set the engine position so that No.1 piston is at the top of its firing stroke. This can be done by removing the small inspection plate from the clutch housing just above the starter motor, and turning the engine until the IGN/TDC mark on the flywheel lines up with the pointer with both valves of No.1 cylinder closed.

DISTRIBUTOR COVER.

The moulded distributor cover which is of the side outlet type, requires no attention other than cleaning. This should be done by wiping the inside and outside with a clean dry cloth.

If cleaning of the distributor cover is neglected it is possible that "tracking" may occur, in which case a new cover must be fitted.

LUBRICATION.

The distributor grease cup should be given a turn or two about every 1000 miles, to lubricate the spindle bearing.

In replenishing the grease in the cup, Shell Mex V.W. or a similar type, should be used.

Every 5000 miles the rotor arm should be removed and a few drops of engine oil applied to the felt pad in the top of the spindle, this lubricates the automatic advance mechanism. At the same time, one drop of engine oil should be applied to each contact breaker arm pivot and the cam should be lightly greased with Mobilgrease No.2 to reduce wear of the breaker arm fibre heel.

CHECKING AND ADJUSTING THE IGNITION TIMING.

In the fully retarded position the spark for No.1 cylinder should occur when the IGN/TDC marking on the flywheel is in line with the timing pointer and both valves of that cylinder are closed, i.e. No.1 piston at the top of its firing stroke.

The timing pointer and flywheel markings can be seen by removing the small inspection hole cover from the near-side front face of the clutch casing just above the starter motor.

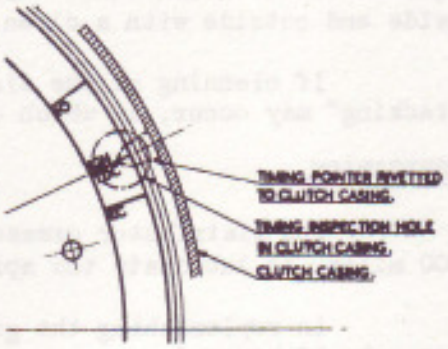


FIG. 28. TIMING MARKS ON FLYWHEEL.

Owing to the fact that a friction damped spring drive is used for driving the valve gear and distributor and as the starting handle operates to turn the crankshaft through the medium of the spring drive, the starting handle must not be used to turn the engine for timing purposes, nor must the starting handle have been used since the engine was last running. It is equally important that when the engine is turned from the rear as described later, it should be turned in the normal direction of rotation only.

If the engine has been turned in the opposite direction of rotation or if the starting handle has been used, the timing should be checked and re-adjusted if necessary after the engine has been running again.

To turn the engine for timing purposes, remove the sparking plugs, jack up one rear wheel, engage top gear, release the handbrake and turn the wheel in the normal direction of rotation.

To check the timing, turn the engine by the above method until the distributor rotor arm approaches the No.1 cylinder firing position, then continue to turn very slowly until the points just break contact. The moment the points "break" contact, prevent any further movement of the flywheel and observe the position of the flywheel marking through the inspection hole. The IGN/TDC marking should be in line with the timing pointer. If this is not so, turn the engine until the marking does line up with the pointer (not forgetting that the engine must be turned in its correct direction of rotation only) and then slacken the distributor head clamping screw (P, Fig.25) and rotate the distributor body in an anti-clockwise direction until the points of breaker arm (A, Fig.23) just break contact. Tighten the clamping screw (P) and check the timing again. If necessary re-adjust and then re-check.

On early chassis a hexagon nut was fitted to the clamping screw (P). On later chassis this has been changed to a knurled nut in order to eliminate the possibility of spannering the nut with consequent overtightening of the clamping plate (Q) causing the bearing of the distributor to be nipped. The clamping screw (P) should be tightened as follows:-

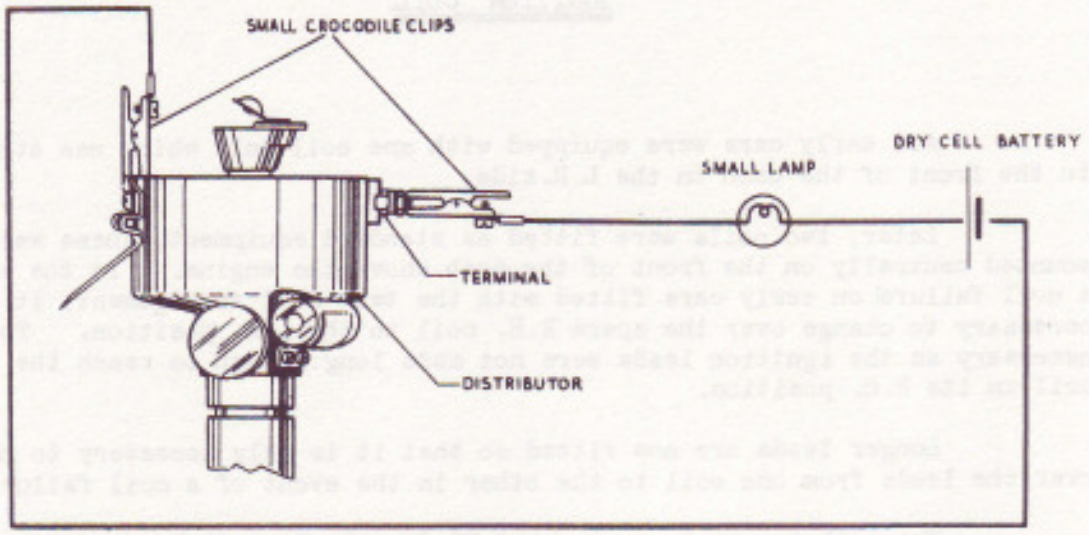


FIG. 29. BULB AND BATTERY CONNECTED IN SERIES WITH BREAKER POINTS.

(a) If the screw (P) is fitted with a hexagon nut, the nut should be held by a spanner and the screw tightened by means of a screwdriver.

(b) If the screw (P) is fitted with a knurled nut, the knurled nut should be held by hand and the screw also tightened by means of a screwdriver.

To advance the ignition timing, turn the distributor body in an anti-clockwise direction.

NOTE: When checking or adjusting the ignition timing, the distributor rotor arm must be kept fully retarded; i.e. in its fully anti-clockwise position.

TO DETERMINE WHEN THE POINTS BREAK CONTACT.

Either of the following methods of determining precisely when the contact points separate, may be used:

(a) With the ignition switched off, and a small bulb and battery connected in series with the contact breaker points, as shown in Fig.29. In this case the bulb will go out as the contact points "break" and will light as the points "make".

(b) With the ignition switched on, and by observation of the ammeter. When the points are in contact a discharge of approximately 2 amperes will be shown on the ammeter, and when the contact points "break" the ammeter needle will return to zero.

IGNITION COIL.

All early cars were equipped with one coil only which was attached to the front of the dash on the L.H.side.

Later, two coils were fitted as standard equipment, these were mounted centrally on the front of the dash above the engine. In the event of a coil failure on early cars fitted with the twin coil arrangement, it is necessary to change over the spare R.H. coil to the L.H. position. This is necessary as the ignition leads were not made long enough to reach the spare coil in its R.H. position.

Longer leads are now fitted so that it is only necessary to change over the leads from one coil to the other in the event of a coil failure.

The coil terminals are marked CB for the Contact Breaker lead and SW for the Switch lead.

The lead from the radio interference suppressor should be attached to the SW terminal of the coil in use. Make sure that the suppressor is well earthed to the dash by its mounting bracket.

SPARKING PLUGS.

The sparking plugs should be either Champion Type N8, or Lodge Type CLN, 14 m/m non-detachable.

The two important things to remember are that they should be kept clean and that the gap between the electrodes should be properly adjusted.

The gap should be checked with a feeler gauge and set at .025" (.635 m/m).

NOTE. Always remove sparking plugs with a well fitting box spanner.

Spark plugs have much to do with the performance and economy of the engine, and it is therefore recommended that they are cleaned in an abrasive, air blast type cleaning machine every 5000 miles.

The oxide deposit is a fine white powdery substance which collects on the insulator, usually well up in the shell as well as on the insulator tip. This coating being dry, is easily removed when it first forms, but under higher temperatures, the white oxide becomes fused and forms a smooth glassy coating over the insulator.

A plug in this condition will often perform satisfactorily when cool, but will miss badly as soon as it becomes warmed up.

Fused oxide coating is very deceiving, and after apparent thorough cleaning, there is apt to remain on the insulator a practically invisible layer of oxide. The safest way to handle such plugs is to give them a double cleaning to ensure satisfactory performance.

If the spark plugs are allowed to run without cleaning, the oxide will form into blisters, and the only remedy for this condition is replacement.

LAMPS.

HEAD AND PASS LAMPS.

HEADLAMPS.

The headlamps are Lucas Model RF.770, Service No.50311E, Bentley Motors (1931) reference No.RD.3936. Each headlamp incorporates a Lucas Light Unit which consists essentially of a combined reflector and front glass assembly provided with a mounting flange by means of which it is secured in the body housing. The bulb, which is of a Lucas pre-focus type, is located accurately in the reflector and is secured by a bayonet fixed backshell which also provides the contact to the bulb. The design of the bulb and its holder is such that the bulb is correctly positioned in relation to the reflector and no focussing is required when a replacement bulb is fitted.

Anti-Dazzle Scheme.

The headlamps are fitted with fixed reflectors. Operation of the foot switch extinguishes the headlamps, and at the same time switches on the pass-lamp.

To Replace a Bulb.

Slacken the screw at the bottom of the lamp and lift off the rim, removing it from the bottom first. Slacken the four screws (early lamps had two screws) which secure the flange of the Light Unit and turn it in an anti-clockwise direction to detach the flange from the securing screws when the Light Unit can be lifted out of the lamp body.

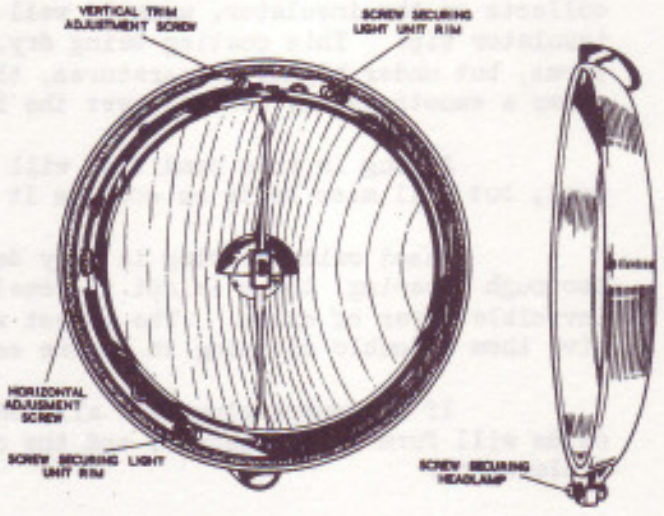


FIG. 30. HEADLAMP WITH RIM REMOVED.

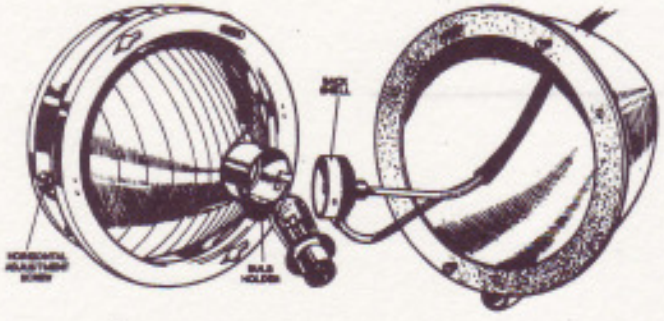


FIG. 31. HEADLAMP WITH LIGHT UNIT REMOVED.

Twist the back shell in an anti-clockwise direction and pull it off. The bulb can then be removed.

Fit the replacement bulb in the holder, taking care to locate it correctly. Engage the projections on the inside of the back shell with the slots in the holder, press on and secure by twisting it to the right.

Position the Light Unit in the lamp body so that the vertical trim adjusting screw locates in the slot in the body rim and the heads of the fixing screws protrude through the holes in the flange of the Light Unit. Twist the Light Unit in a clockwise direction and secure by tightening the screws.

Engage the tongue on the inside of the front rim in the slot at the top of the flange of the Light Unit, press it on fully at the bottom and secure by means of the screw.

Setting.

When setting the lamps, the measurements between ground level and lamp centres are to be made with the car loaded with five persons. The view inset (Fig.32) shows the pass-lamp correctly tilted to compensate for road camber.

The headlamps must be set so that the beams of light are directed straight ahead and are parallel with the ground and with each other. If adjustment is necessary proceed as follows:-

Remove the front rim by slackening the securing screw. If vertical adjustment is required, set the Light Unit to the correct position by means of the vertical trim adjustment screw at the top of the reflector unit. Turn the screw in a clockwise direction to raise the beam and in an anti-clockwise direction to lower it. (See Fig.30).

If horizontal adjustment is required, slacken off the two horizontal adjustment screws (one on each side of the Light Unit). After slackening off these two screws the reflector may be swung one way or the other as required, re-tighten the screws to lock.

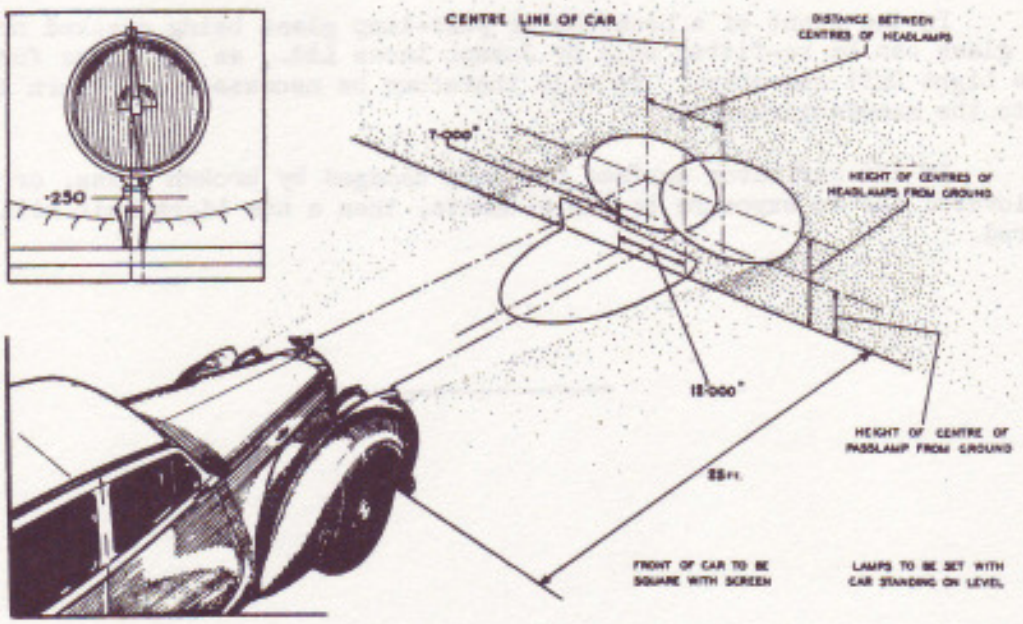


FIG. 32. THE RECOMMENDED SETTING FOR THE LAMPS.

PASS-LAMP.

The pass-lamp is a Lucas Model RSFT700, Service No.55031A, Bentley Motors (1931) reference No.RD.3196. This lamp is also fitted with a Lucas Light Unit and pre-focus bulb similar to that fitted to the headlamps.

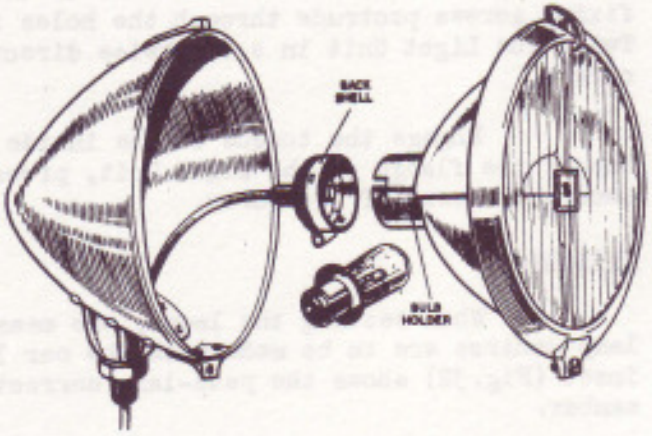


FIG. 33. PASS-LAMP WITH LIGHT UNIT REMOVED.

To Replace a Bulb.

Slacken the screw at the bottom of the lamp and pull off the rim complete with Light Unit assembly. Twist the back shell in an anti-clockwise direction and pull it off. The bulb can then be removed. Fit the replacement bulb in the holder, taking care to locate it correctly. Engage the projections on the inside of the back shell with the slots in the holder, press on and secure by twisting it to the right.

Setting.

The lamp should be set as shown in Fig.32. This will prevent dazzle to oncoming traffic even when travelling over normal road irregularities with the car fully loaded. If adjustment is necessary, slacken the single fixing nut and move the lamp on its adjustable mounting to the required position. Finally, tighten the locking nut.

REPLACEMENT OF BROKEN HEADLAMP OR PASS-LAMP GLASS.

In the event of a headlamp or pass-lamp glass being cracked or broken, a new glass can be re-fitted only by Joseph Lucas Ltd., as the glass forms part of the Light Unit assembly. It will therefore be necessary to return the Light Unit to the manufacturers.

If the reflector surface has been damaged by broken glass, or deteriorated due to exposure to the elements, then a new Light Unit will be required.

SIDE, REAR AND STOP LAMPS.

SIDELAMPS.

The sidelamps are Lucas Model R451, Service No.052348, Bentley Motors (1931) reference number is RD.3218.

Removal of Lamp Front.

Remove the small securing screw and pull out the lamp front and reflector, moving the top of the lamp in a downwards direction. When replacing, locate the metal tag at the bottom of the lamp first, refit and replace the securing screw.

To remove the lamp front from the reflector, twist it in either direction. This disengages a fixing clip, mounted on the reflector from slots in the lamp front which can then be pulled off. To replace the front, push it on to the reflector body and turn until the fixing clip re-engages the slots on the lamp front.

STOP TAIL LAMP.

The stop tail lamp is a Lucas Model RST461, Service No.052349, Bentley reference number is RD.3570.

The lamp front can be removed as described above for Sidelamps.

NUMBER PLATE BOX.

The Number Plate Box is a Lucas Model 288/3, Service No.052357, Bentley reference number is RD.3257.

To remove the lamp front, unscrew the single front securing screw then the lamp front can be swung open.

CLEANING LAMPS.

Metal polishes must not be used for cleaning the chromium plated lamp bodies. They must be washed with plenty of water and when the dirt is completely removed, the lamp bodies should be polished with a chamois leather or a soft dry cloth.

TRAFFICATORS.

The Trafficators are Lucas Model RSF34L, Service No. 54003A. The Bentley Motors (1931) reference number is RD. 3211.

SERVICING.

If the movement of the arm is stiff, raise arm and apply by means of a brush, or other suitable article, a drop of thin oil, such as sewing machine oil, to the catch pin between the arm and operating mechanism (See Fig. 34). Use only the merest trace of oil as any excess may affect the working of the operating mechanism.

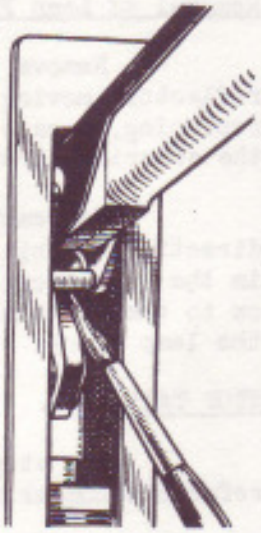


FIG. 34. LUBRICATING TRAFFICATOR CATCH PIN WITH THE AID OF A BRUSH.

Also lubricate with one or two drops of thin machine oil, the felt pad fitted in the top of the arm, which lubricates the spindle bearing (See Fig. 35). To reach this, withdraw the screw on the underside of the arm, slide off the metal cover plate and move the wire to the bulb so that it does not cover the felt pad. Replace the cover plate by sliding it on in an upwards direction so that the plates engage with the slots on the underside of the spindle bearing (See Fig. 36). Finally, secure the plate by means of the fixing screw.

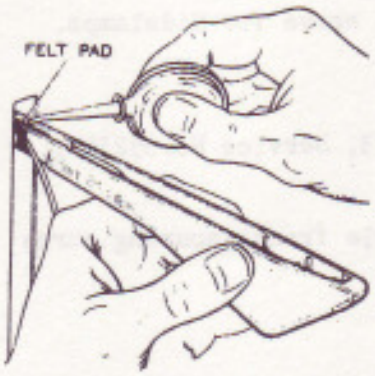


FIG. 35. LUBRICATING FELT PAD.

Failure of the arm to light up, usually indicates a bulb failure and it should be replaced by a bulb of the same type as that originally fitted. The bulb is accessible when the cover plate is removed as described above. Bulbs fitted are Lucas No. 256 12 volt 3 watt festoon type.

If any difficulty is experienced in raising the arms by hand, switch the Trafficator on and then, supporting the arm in the raised position, switch to the off position.

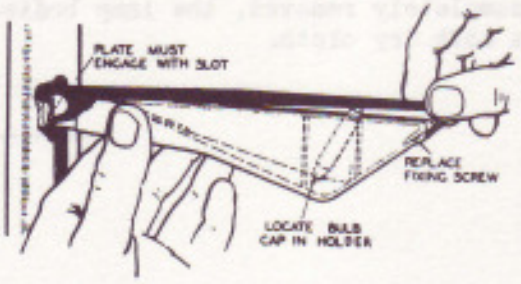


FIG. 36. REPLACING COVER PLATE.

THE ELECTRIC HORNS.

The horns are Lucas Model WT29, Service Nos. 69004A and 69005A. The Bentley Motors (1931) reference number is RD. 3206. The horns work in conjunction with a solenoid-operated relay, Model 585K, Service No. 33068A, Bentley Motors (1931) reference number RD. 3084. The horns are adjusted to give their best performance and will give a long period of service without any attention.

Testing.

If one horn fails or becomes uncertain in its action, it does not follow that the horn has broken down. First ascertain that the trouble is not due to some outside source, e.g., a loose or broken connection in the wiring of the horn. If both horns fail or become uncertain in action, the trouble is probably due to a discharged battery, inoperative relay, or blown fuse. If the fuse has blown, examine the wiring for a fault which might have been the cause, correct, and renew the fuse. It is also possible that the performance of a horn may be upset by the fixing bolt working loose or by some component near to the horn being loose.

Relay.

To test the relay, remove the moulded cover by unscrewing its two fixing screws.

Next operate the horn push and note if the relay armature moves and the contacts close. If not, there is a fault either in the relay itself, or in the horn push wiring to the unit. To determine which, remove the horn push leads from the relay unit terminals and connect a 12 volt supply across the terminals, when, if the relay is in order, the contacts will close. The relay is actually set to operate at 7-8 volts.

If the contacts appear dirty or burnt, place a strip of fine glass paper between them, then close the contacts and draw the paper through. This should be done two or three times with the rough side towards each contact.

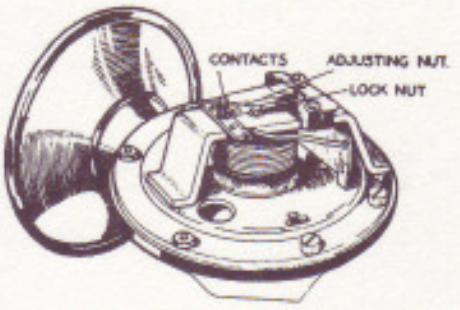


FIG. 37. HORN WITH COVER REMOVED.

Adjustment.

If, after carrying out the above examination, the trouble is not rectified, the horn may need adjustment, but this should not be necessary until the horns have been in service for a long period. Adjustment does not alter the pitch of the note, it merely takes up wear of moving parts. When adjusting the horns, short circuit the fuse, otherwise it is liable to blow. Again, if the horns do not sound on adjustment, release the push instantly.

When making adjustment to a horn, always disconnect the supply lead of the other horn, taking care to ensure that it does not come into contact with any part of the chassis and so cause a short circuit.