

Fig. 35 ELECTRICAL WIRING DIAGRAM

CHAPTER X

The Electrical System

General—Dynamo—Fuse Box—Fuse Data—Output Regulator and Cut-out—Switchbox—Ammeter—Battery—Ignition—Ignition Coil—Ignition Timing—Firing Order of Cylinders—Sparking Plugs—Starter Motor—Starter Motor Switch—Use of Starter Motor—Electric Fuel Pumps and Gauge—Electric Horns—De-mister and De-froster—Electrical Fault Location—Recommended Lamp Bulbs—Headlamps—Replacing a Headlamp Bulb—Aligning the Headlamps—Side Lamps—Radio.

General.

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 (Fig. 36), 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.

Dynamo.

The dynamo, shown in Fig. 37, is driven by the same belt which also drives the water pump and fan. It is of the shunt-wound type, the excitation of the field being automatically regulated, in order to adjust the charge rate to suit the dynamo speed, the state of charge of the battery and the lighting load.

There are two external terminal connections, the large terminal being the "armature" connection and the smaller terminal the "field" connection.

The armature lead from the large terminal is taken to the output regulator and connected to the terminal marked "D", and similarly the field connection is to the terminal marked "F" in the fuse box.

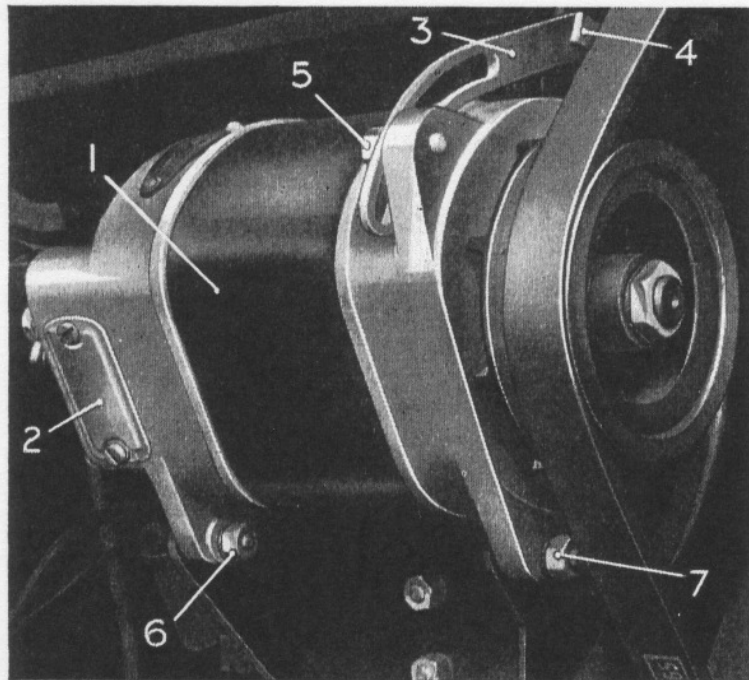


Fig. 37.—THE DYNAMO.

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| 1. Dynamo. | 3. Slotted Link. |
| 2. Cover—Brush Gear. | 4, 5, 6 and 7. Securing Nuts. |

Every 10,000 miles, as directed on page 33, take out the securing screws and remove the cover. This will expose the commutator and brushes, which should be inspected. Deposits of brush dust, moisture and oil, should be removed, and note taken of any appreciable wear of the brushes.

Cleanliness of the commutator and freedom of the dynamo brushes in their holders are the most important points in the maintenance of the dynamo.

Premature failure or excessive wear, however, indicates some definite fault in the machine, which should be returned for correction. In normal circumstances the brushes should need replacing only after considerable running; in the event, however, of a new set of brushes being required, it is recommended that this work should be done by

Messrs. Bentley Motors (1931) Ltd., or one of their "Special Retailers". Emphasis is laid on this point, as cases have arisen of faulty operation of the dynamo, due to inexperienced fitting of brushes.

When it is necessary to disconnect the wires to the dynamo, care must be taken to ensure their correct replacement.

Fuse Box.

The unit is shown in Fig. 38, with its cover removed.

There are two different types of fuses, easily distinguishable, as follows:—

- (a) The main fuse, this should be three strands of No. 32 S.W.G. tinned copper wire.
- (b) The circuit fuses are all of one strand of No. 32 S.W.G. tinned copper wire.

Spare wire of this gauge is provided on a special holder within the box.

Special care must be taken that all fuses are gripped firmly in their holders, and that the contacts are clean and tight.

Output Regulator and Cut-Out.

The output regulator and cut-out are mounted on the front of the dashboard, and are shown (3, Fig. 38).

The output regulator operates to control the dynamo output by varying the field excitation in accordance with the load on the battery and its state of charge.

The operation of the regulator depends upon the fact that the voltage of a battery varies between certain fixed limits according to the state of charge of the battery, the voltage being, of course, a maximum when the battery is fully charged, and a minimum when the battery is fully discharged.

The regulator is combined structurally with the cut-out. The regulator and cut-out are, however, electrically separate, employing separate armatures, though they possess field systems which are common over a portion of the magnetic path.

The cut-out is operated when the dynamo speed rises high enough for the dynamo to charge the battery by means of its shunt coil connected across the main terminals of the dynamo. This closes the cut-out contacts and so connects the dynamo with the battery, via the regulator and ammeter, as shown in the wiring diagram (Fig. 36).

The series coil is so connected that, when carrying the charging current, it assists the shunt coil in holding the contacts firmly together.

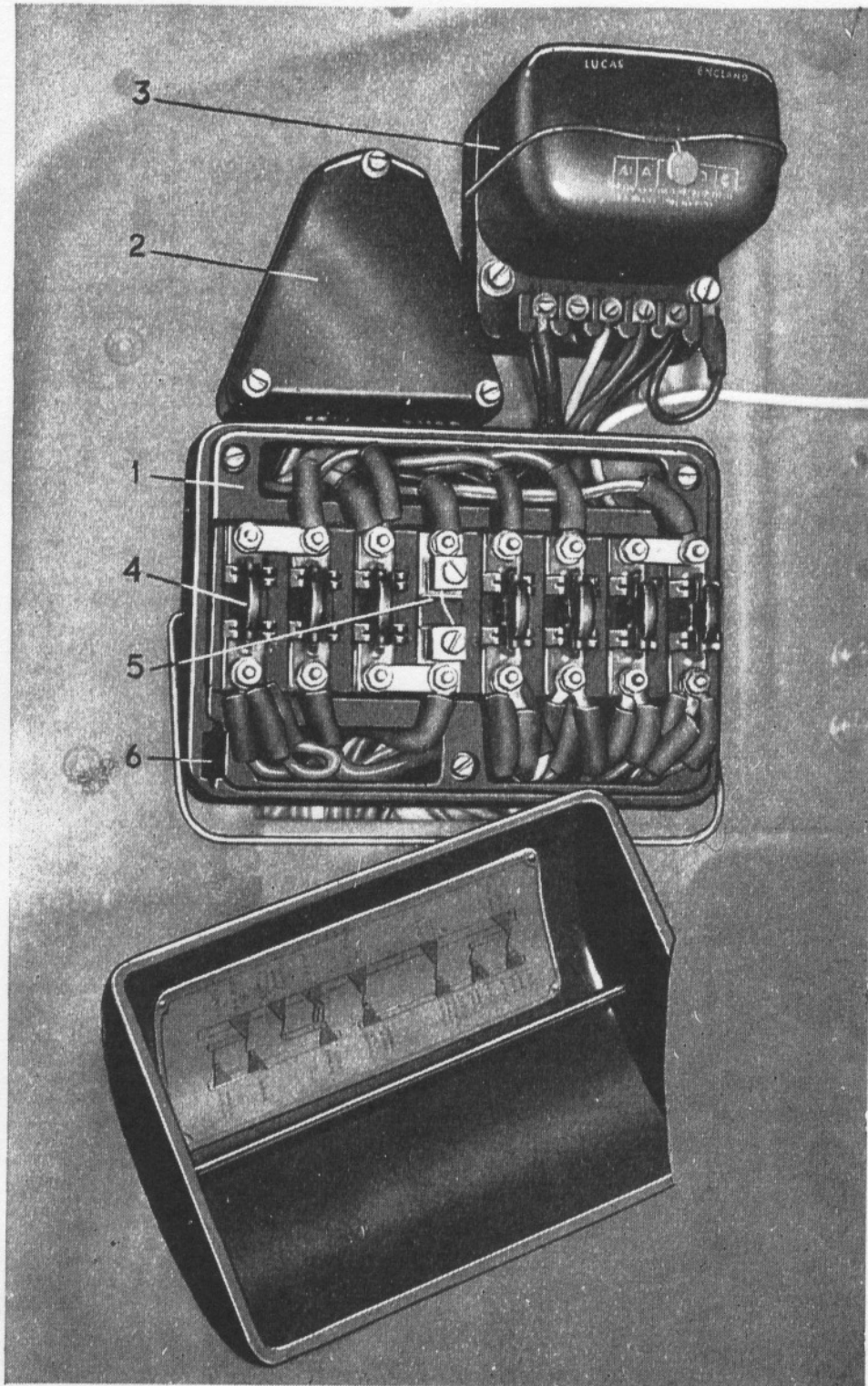


Fig. 38.—FUSE BOX, CONNECTING BOX, OUTPUT REGULATOR AND CUT-OUT

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| 1. Fuse box. | 3. Output regulator and cut-out. | 5. Main fuse. |
| 2. Connecting box. | 4. Circuit fuse. | 6. Spare fuse wire. |

FUSE DATA.

Circuit fuse No. 1—Coachbuilders' accessories.
 Circuit fuse No. 2—Horn and cigar lighters.
 Circuit fuse No. 3—Roof light.
 Circuit fuse No. 4—Trafficators, reversing light,
 Stoplight and companion lights.

Circuit fuse No. 5—De-mister and de-froster,
 screen wiper, petrol pumps, ignition,
 warning lamps and car heater.
 Circuit fuse No. 6—Centre lamp
 Circuit fuse No. 7—Instrument lamps, side
 lamps, map lamp, tail lamp and rear
 number plate.

When the dynamo slows down, and its voltage falls below that of the battery, the current reverses through the series coil, and the effect of the shunt winding becomes neutralised, which results in the contacts falling apart.

The output regulator and cut-out requires no attention; it is a sealed unit, and no adjustment of any kind must be attempted. If any defects in operation should develop, as described under "Electrical Fault Location" (page 97), which are traceable to the regulator, it must be detached bodily and returned, *with the seal unbroken*, to Messrs. Bentley Motors (1931) Ltd., or one of their "Special Retailers", for correction.

Switchbox.

Mounted on the instrument panel, this unit includes:—

- (a) Master switch and lamp switch combined.
- (b) Ignition switch.
- (c) Push-button switch for the starter motor.
- (d) A lock which can be locked and the key withdrawn either:—
 1. When the master switch is in the "Off" position; or,
 2. When the master switch is in the "P.L." (parking lights) position.

No attempt must be made to lock the switch in other positions.

With the master switch in the "Off" position, all accessories and lighting circuits, with the exception of the roof lamp, are rendered inoperative. Movement of this master switch to the "On" position renders these accessories available.

The various combinations controlled are clearly indicated, as follows:—

Off.—All circuits off except for roof lamp.

On.—Accessories available.

S. and T.—Side and tail lamps on and accessories available.

H., S. and T.—Head, side and tail lamps on and accessories available.

P.L.—"Parking Lights", side, tail and roof lamps on. (No reading is shown on the ammeter and all other accessories are "off".)

A separate switch is provided for the ignition, marked "On" and "Off". Normally, this switch can be left in the "On" position, and the switching to start the engine can be carried out on the master switch.

No independent charge position is provided owing to the presence of the output regulator. Whenever the master switch is on, connections are made which cause the dynamo to charge the battery through the regulator, as previously described.

Operation of the push-button switch for the starter motor completes a relay circuit, which in turn causes the main starter switch to close.

Ammeter.

The ammeter is an instrument with a central zero and 20-ampere range, a needle deflection indicating Charge or Discharge.

As already explained under "Output Regulator", the charge rate varies in accordance with the state of the battery. Consequently, no alarm need be felt if the charge indicated on the ammeter is quite small, especially after a considerable period of running with no extra consuming apparatus, such as lamps, in use.

This will probably indicate that the battery is well charged. Under these circumstances, switching on the head lamps may cause a discharge reading to be shown, but this will only occur for a short time, as the dynamo will quickly respond to the slightest drop in battery voltage, due to the discharge, and re-adjust the output accordingly.

An unnoticed reversal of the ammeter connections causes the charge and discharge indications to be reversed.

Battery.

The battery recommended and specified for this car, is as follows:—

Battery Maker's Type Designation.		Voltage.	Normal Charging Current.
P. & R. Dagenite.	Exide.		
6 HZD9-S or 6 HZDP9-S	6 MXR9-L or 6 MXP9-L	12	5 amperes.

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

First Charge.

If the battery is received in a dry condition, it will be necessary to fill the cells with acid solution of the correct specific gravity and charge the battery, before it is put into use.

In such cases, it is strongly recommended that the necessary charging should be undertaken by a properly equipped service station, as unless the initial charge is correct the battery will never give satisfactory service.

Topping-Up.

In the majority of cases, however, the battery will have already been charged and the cells filled with acid solution. Under normal operating conditions the level of the solution will gradually fall in each cell, mainly owing to evaporation losses. A regular inspection should be made, as directed on page 29, to see that the level of the acid solution has not fallen to such an extent that the tops of the separators and plates are exposed.

In this case, the battery should be "topped-up", by removing the vent plug in the centre of each cell lid and adding distilled water to each cell, until the level of the solution is approximately $\frac{3}{8}$ " above the tops of the separators.

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.

Normally it should never be necessary to add sulphuric acid to the cells, unless it is definitely known that some of the acid has been lost owing to slopping or spilling. The addition of acid to the battery should only be done by an experienced battery man, who at the same time will carry out any adjustments to the acid gravity.

Specific Gravity of Electrolyte.

Various acid specific gravity figures are given for reference in the following table, and they apply to both makes of batteries.

Acid gravity figures are taken by means of an hydrometer.

Climate.	Specific Gravity of Sulphuric Acid Solution. (Corrected to 70° F.).		
	Filling in for First Charge.		Fully Charged.
	6 HZD9-S 6 MXR9-L	6 HZDP9-S 6 MXP9-L	
Temperate	1.340	1.260	1.280 (1.270-1.285)
Tropical (i.e. where the temperature is frequently 90° F. or over).	1.260	1.190	1.210 (1.200-1.215)

Charging.

The output of the dynamo on the car is controlled so as to vary with the state of charge of the battery. Overcharging the battery is thus automatically avoided. The dynamo will, under ordinary running conditions, provide enough current to ensure re-charging of the battery, but in special cases, e.g., when the car is frequently standing with the lights on and daylight running is of short duration, it may be necessary to take the battery off the car from time to time for a bench re-charge. This re-charge can be done by any well-equipped service station.

Charging Battery from an outside source.

It is possible to charge the battery in position on the car, making use of a flexible lead and the special two-pin plug supplied, which fits the charging plug socket on the facia board arranged just above the steering column.

Be certain that the direction of current is correct, the socket holes are marked + and — respectively, and, in addition, are made of different sizes in order to clearly distinguish them.

In the case of early models where this plug is not fitted, the charger should be connected as follows:—

1. Connect the NEGATIVE lead, by means of a clip, to the main fuse terminal in the fuse box (Fig. 38).
2. Connect the POSITIVE lead, by means of a clip, to any convenient clean part of the chassis.

Maintenance.

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

The cable terminals should be well coated with lanolin or pure vaseline (not grease), before putting the battery into service.

The top of the battery should always be kept clean, and as far as possible, dry; attention should be given immediately to the least sign of corrosion occurring on the terminals.

Keep the terminals and connectors well covered with lanolin or pure vaseline, all contact surfaces clean and firmly screwed up, but do not use abrasives for cleaning. To remove corrosion, use a solution of ammonium carbonate, applying with a rag.

Do not inspect the battery with the aid of a naked light, and on no account disconnect any of the battery terminals or connections when a charge or discharge current is passing, for such a course incurs risk of explosion and involves personal risk.

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 once every two months. It should be given a thorough charge before being put back into service.

Care should be taken to avoid an inadvertent discharge of the battery. Such a discharge may occur if there is an earth in the wiring system, instruments or fittings, or if the ignition switch be left on in error, and the engine happens to come to rest with the low-tension contacts in engagement. Provision is made for the latter contingency by the red warning lamp, which will remain illuminated until the ignition switch is turned off.

It should be made a practice, when leaving the car, always to observe that the warning lamp is not illuminated, and no switches are left on, and that no discharge is shown on the ammeter.

Ignition.

The battery ignition contact breaker and distributor are shown in Fig. 39, an internal view of the contact breaker being given in Fig. 40.



Fig. 39.—CONTACT BREAKER AND DISTRIBUTOR.

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| 1. Contact breaker. | 3. Lubricator. |
| 2. Distributor. | 4. Condenser. |

A condenser (4, Fig. 39) is connected across the contact points. In setting the points, the gap opening should be .019" (.483 m/m.) to .021" (.533 m/m.), adjustment being effected by loosening the locking screws (3 and 4, Fig. 40) and turning the adjusting screws (5 and 6) to obtain the correct gaps, measured with a feeler gauge. Make sure that the locking screws are correctly tightened after adjustment.

The screws (7 and 8) *must not be disturbed*, as this would upset the synchronism of the two contact breaker arms.

Every 5000 miles, as directed on page 30, the rocker arm pivot pins (9 and 10) should be lubricated with one or two drops of oil "A"; at the same time apply

one or two drops of Oil "B" to the cam lubricator pad. Also remove the rotor and apply a few drops of Oil "A" to the felt wick (12), to lubricate the automatic timing control.

The lubricator (3, Fig. 39) should be given a turn every 1,000 miles, and when empty, refilled with the correct grease, as specified on page 27.

The high-tension distributor requires no attention beyond an occasional wiping of the interior and exterior with a clean, dry rag.

Ignition Coil.

Two H.T. coils are mounted on the dashboard as shown in Fig. 41. Only one is connected up, the other being carried as a spare. Connected to the terminal marked S.W. (switch wire) is a 1 mfd. condenser to reduce electrical interference to the radio from the

ignition system. Care must be taken that in the event of a change over to the spare coil, that the condenser is also changed over and correctly connected to the terminal marked S.W. and **not** to the output (C.B.) terminal of the coil.

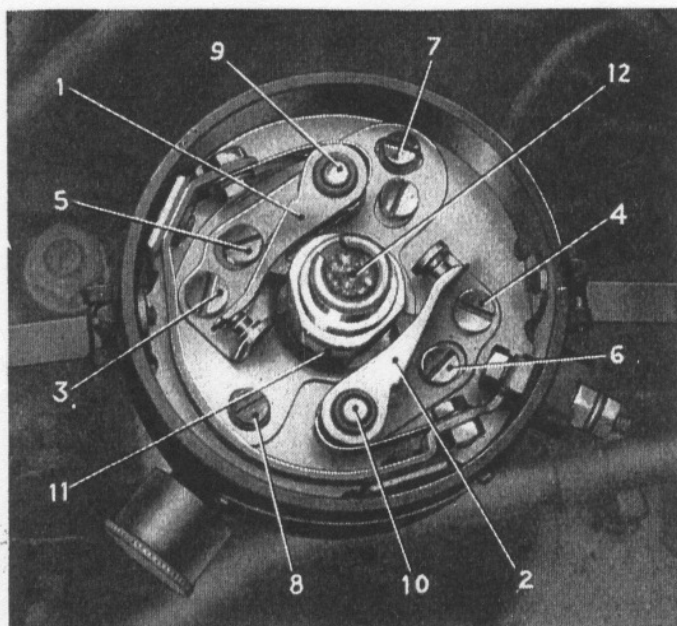


Fig. 40.—INTERIOR OF CONTACT BREAKER.

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| 1 and 2. | Rocker Arms. |
| 3 and 4. | Locking Screws. |
| 5 and 6. | Adjusting Screws. |
| 7 and 8. | Synchronising Adjustment. |
| 9 and 10. | Pivot Pins. |
| 11. | Cam. |
| 12. | Felt Wick. |

To carry out this operation, the crankshaft should be rotated until the mark "**IGN.TDC.**" on the flywheel registers with the small pointer attached to the clutch casing, when No. 1 piston is at the top of its firing stroke.

Owing to the fact that a friction-damped spring drive is used for driving the valve gear and distributor, and that the starting handle operates to turn the crankshaft through the medium of the spring drive, it is important that the crankshaft be rotated for timing purposes from the *flywheel end*, also, the starting handle should not have been used at all since the engine was last running.

The contact breaker should now be adjusted by rotating in an anti-clockwise direction, so that the cam is just on the point of causing the contact break when revolving in the normal direction, while at the same time the high-tension rotor is opposite No. 1 distributor contact, the rotor being in the fully retarded position.

A convenient method of determining precisely when the break takes place is by reference to the ammeter. With the ignition switched on, and someone watching the ammeter, the engine should be rotated until the required cam just breaks the contacts, as indicated by the reading of the ammeter.

The outside of the coil casing should be kept clean; misfiring is occasionally caused by an accumulation of dirt around the terminals.

Ignition Timing.

If the timing of the battery ignition should have become deranged, it can be reset by reference to the flywheel markings, which can be seen on removal of the small cover on the near-side of the clutch casing, adjacent to the starter motor.

The distributor head securing screw should then be securely tightened.

Ignition timing variation during running is entirely controlled by the centrifugal governor incorporated in the distributor, no hand control being provided.

Firing Order of Cylinders.

The firing order of the engine is, 1, 4, 2, 6, 3, 5, No. 1 being the front cylinder.

Sparking Plugs.

Alternative plugs are Champion Type N8, or Lodge Type CLN, 14 m/m. non-detachable. Every 5,000 miles, as directed on page 31, they should be removed and cleaned. The width of the gaps should be checked, and, if necessary, reset to .025" (.635 m/m.)

Starter Motor.

The starter motor is shown in Fig. 42. A small planetary reduction gear is arranged in a casing behind the motor, the effect of which is to provide a total reduction gear ratio between motor and crankshaft of 16.0 : 1.

A plug (4), in the side of the gear casing, should be removed every 10,000 miles, as directed on page 31, and oil "B" injected until it reaches the mouth of the plug orifice. This oil also lubricates the driving end bearing of the armature shaft.

Ordinarily, the brushes will last a long time. In the event of replacements being necessary, application should be made to Messrs. Bentley Motors (1931) Ltd., or one of their "Special Retailers".

The fitting of new brushes requires expert knowledge and care, and emphasis is laid on this point, as cases have arisen of faulty operation of the motor, due to the inexpert fitting of brushes.

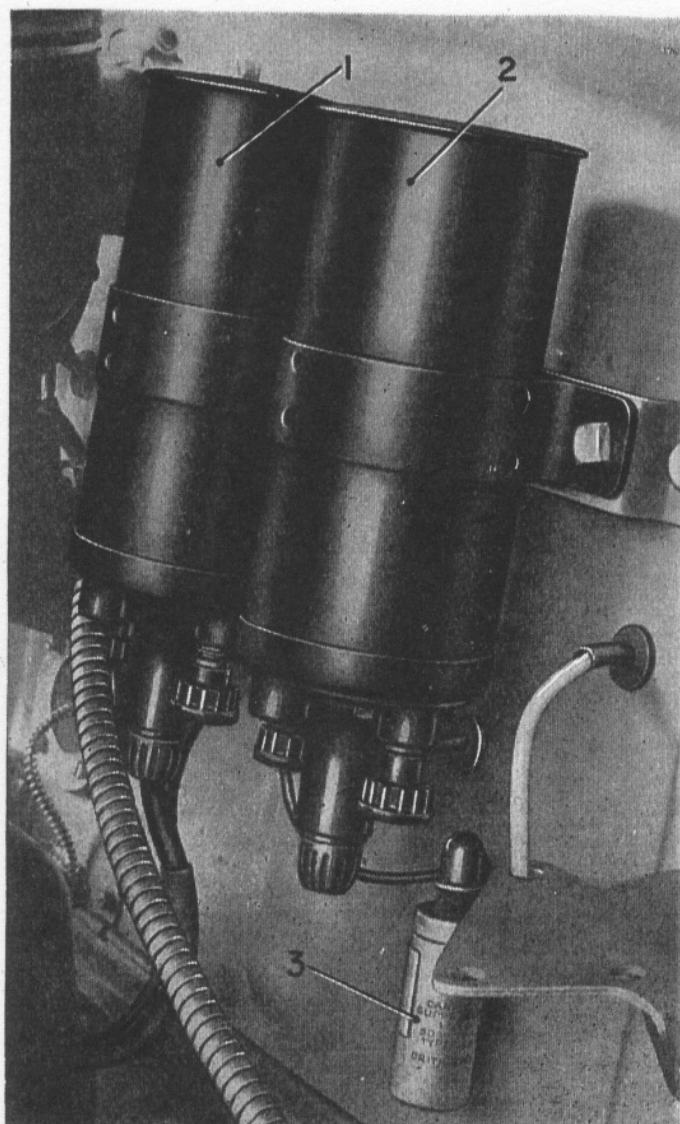


Fig. 41.—IGNITION COILS.

1. Ignition coil.
2. Spare coil.
3. Condenser (suppressor).