CHAPTER VIII

Steering, Shock Dampers, Road Springs, Wheels and Tyres

Steering Box and Column—Front Suspension—Warning, Front Suspension Springs—Steering Arms and Joints—Front Stabiliser—Rear Hydraulic Shock Dampers—Rear Road Springs—Wheels—Wheel Discs—Lubrication of Wheel Bearings—Tyres—The Jacking System—Wheel Changing—Fitting and Removing Tyres—Inflation of Tyres—Balancing Road Wheels.

Steering Box and Column.

The steering mechanism is of the cam-and-roller type, and requires no attention beyond inspection of the oil level.

The cover of the box is provided with a filling plug. Every 5,000 miles, as directed on page 30, this plug should be removed, preferably when the box is warm, and the level of the oil inspected. If necessary oil should be poured in until it is on the point of overflowing from the plug orifice.

For correct oils, see page 28.

With the steering wheel in its normal central position, a hole will be found in its boss, adjacent to the upper arm, into which the nozzle of the oil-can should be inserted to reach an oil hole provided in the control carrier. This operation should be included when lubricating the controls every 5,000 miles, as directed on page 30.

Front Suspension.

Each wheel is independently sprung, the suspension consisting of the two upper and two lower radius arms of different lengths set at a leading angle, between which a vertical yoke is carried, and on this the stub axles are pivoted.

The upper radius arms are connected to and operate the special Bentley shock damper, which effectively dampens excessive spring action.

The main helical coil spring is mounted between the forward lower radius arm and a seat formed as an integral part of the chassis frame.

The ball joints and the steering pivot bearings are lubricated from the central chassis system. (See Fig. **4**.)

The shock damper consists of two pistons operating in cylinders full of oil. The oil being displaced from one cylinder to the other through drilled passages, the degree of damping being controlled by spring-loaded valves.

Until it is obvious that the effectiveness of the shock damper has become reduced, or undue leakage is apparent, no attention whatever will be necessary for 10,000 miles, when the level of the oil in the shock damper should be inspected, as directed on page 31.

It is of vital importance that only perfectly clean oil of the correct grade should be used, and this should be strained through a fine gauze before using.

Straining is facilitated if the oil be first warmed to about 75° C.

The importance of the above cannot be over-emphasised, as a very small particle of foreign matter in the oil may lodge under one of the valves and impair the effectiveness of the shock damper.

WARNING.

Front Suspension Springs.

No attempt must be made to remove the coil springs of the front suspension.

Special appliances are required because the powerful springs are compressed even when in the rebound position.

Any necessary dismantling or adjustment of the suspension must be effected by Messrs. Bentley Motors (1931) Ltd., or one of their "Special Retailers". (See page 16.)

Steering Arms and Joints.

The steering gear should be examined occasionally to see that all bolts are tight and joints well lubricated.

If any of the nuts are found loose, and only retained by their split pins, the latter should be removed, the nuts screwed up tightly and new split pins fitted.

The ball joints of the cross and side steering tubes are lubricated from the centralised chassis system, as described in Chapter I, and illustrated in Fig. **4**.

The bearing pads of all joints are spring-loaded, being self-adjusting for wear. They should not normally require attention except when the car is undergoing a general overhaul.

Front Stabiliser.

In order to reduce the tendency of the car to "roll" on corners, a steel torsion-rod stabiliser is provided at the front end of the chassis.

The stabiliser is carried in rubber bearings, and is coupled to the wheel mountings by links with rubber pads.

No attention is necessary.

Rear Hydraulic Shock Dampers.

Hydraulic shock dampers of Bentley design and manufacture are fitted to the rear axle, one of the dampers being shown in Fig. **23.**

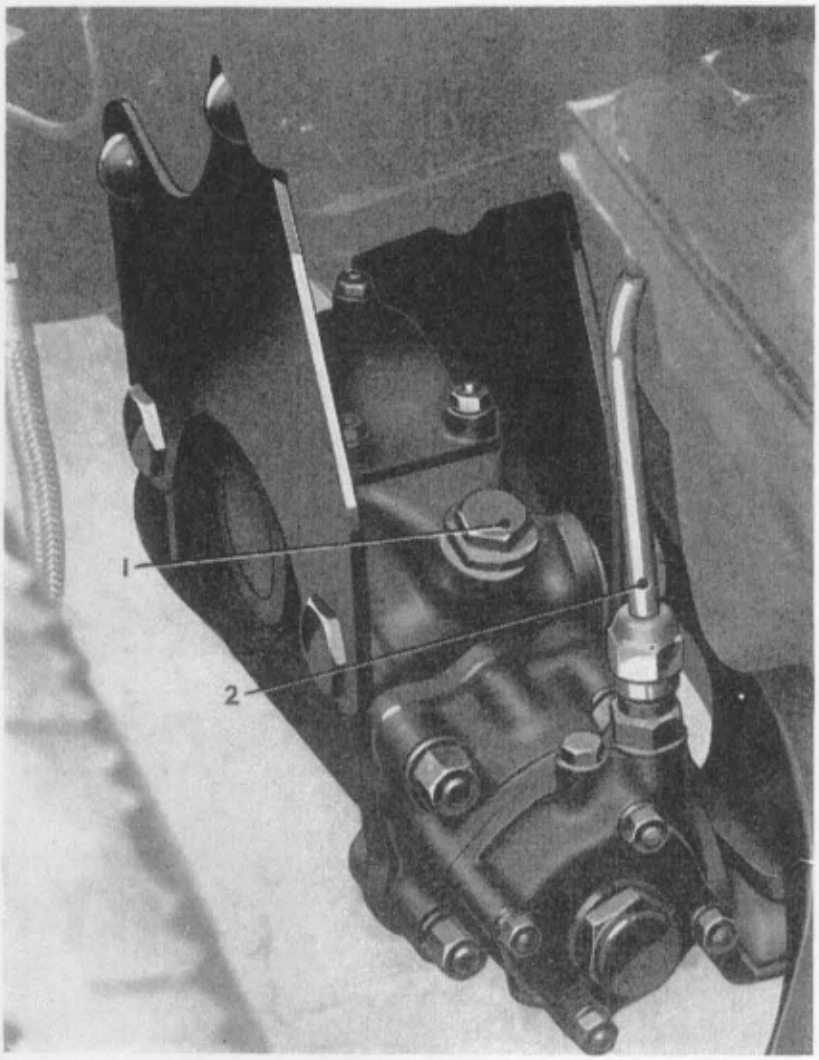

Fig. 23.—REAR HYDRAULIC SHOCK DAMPER.

1. Filler plug. 2. "Ride Control" oil pipe.

Unless it is obvious that the effectiveness of the shock damper has become reduced, or undue leakage of oil is apparent, no attention will be necessary for 10,000 miles of running.

After 10,000 miles, it is necessary to inspect the oil level in the shock dampers as directed on page 31.

For this purpose a filling plug (**1**, Fig. **23**) is provided, arranged at such a height in the casing as to control the maximum oil level.

It is of vital importance that only perfectly clean oil of the correct grade should be used. The following precautions must be observed:—

1. Before attempting to remove the plug (**1**), both the plug and the shock damper casing adjacent to it must be cleaned very carefully with a brush dipped in paraffin, in order to avoid the possibility of dirt entering the hole when the plug is removed.
2. Only a recommended oil must be used (see page 28), and before inserting this, it must be strained through a fine gauze. Straining is greatly facilitated if the oil be first warmed to about 75°C.

The importance of such cleanliness cannot be over-emphasised. A small particle of foreign matter may lodge under a valve and impair the effectiveness of the shock damper.

The plug (**1**) can then be removed with a box-spanner, and the oil level restored, if necessary, to the bottom of the plug hole, the oil being poured in very slowly to avoid entrapping bubbles of air. It will be found most convenient to add oil by means of small syringe provided in the tool kit. When replacing the plug, care must be taken that its washer is in position.

The shock damper consists of a piston assembly operating in a cylinder which is maintained full of oil, the latter being displaced from one end of the cylinder to the other, past spring-loaded valves.

The loading of these valves, and hence the degree of damping is controllable through the **"Ride Control"** lever, by means of a small pump carried in a casing bolted to the gearbox, which maintains a pressure of oil in a system of piping. This pressure is variable, and is controlled through a relief valve, operated by the aforementioned lever.

The pump is charged with oil from the gearbox. It must be observed that oil is not actually pumped into the dampers, and there should be no wastage of oil from the pump unit or pipe line. Such wastage or leakage will impair the functioning of the control.

As it is of such importance that the shock dampers, and also the pump and pipe line, should be maintained full of oil, evidence of undue leakage should be at once reported to Messrs. Bentley Motors (1931) Ltd., or one of their "Special Retailers". (See page 16.)

Rear Road Springs.

The forward ends of the rear springs are pivoted to the frame by means of steel bushes. The shackle pins at the front and rear ends are of the threaded type, and both bushes and shackle pins are lubricated from the centralised chassis system

The advantage of threaded bearing pins is that they do not develop end-play as the result of wear.

The springs themselves are encased in leather gaiters, and by means of a special arrangement of oil holes and grooves in the leaves, the ends of the three longest leaves of each spring are lubricated by surplus oil from the eye of the master leaf.

Owing to this arrangement, in combination with absorbent material inside the gaiter, the springs are entirely self-lubricating and remain free from squeaks.

Wheels.

All wheels are of heavy gauge pressed steel, with 16″ by 5″ well-base rims, and are secured with five nuts.

The securing nuts for the "off-side" or R.H. wheels have right-hand threads, and those for the "near-side" or L.H. have left-hand threads.

The nuts must be tightened, with the wheel-brace provided, evenly and securely, and the threads must be kept clean and greased.

If any difficulty is experienced in removing the nuts with the wheel-brace, extra leverage can be applied by using the $\frac{1}{2}$″ spanner, provided in the tool kit, on the squared section of the wheel-brace spanner head.

Wheel Discs.

When fitting the wheel discs, care must be taken to get the valve centered in the hole provided.

The outer nuts, having right-hand threads for both "off-side and near-side" wheels, are necessary only to retain the disc, and should therefore not be overtightened.

The correct tension is attained by giving the nut **one complete turn** with the special spanner provided after the disc has been felt to be in light contact with the rubber stops on the wheel centre.

There should be a small gap, approximately ·100″, between the edge of the disc and the wheel. Overtightening distorts and brings the disc in contact with the wheel, thus causing creaks and rattles.

Lubrication of Wheel Bearings.

The wheel bearings are correctly packed with ball-bearing grease in the first instance, and should need no attention between general overhauls of the chassis.

Tyres.

The tyres fitted are India Super Silent Rayon, size 6.50″ by 16″.

When ordering new covers, the above should be specified. With regard to the inner tubes, it is necessary to state the size and mention "well-base".

Tubes for flat base rims should not be used.

The Jacking System.

A portable jack is provided in the tool kit and is operated as shown in Figs. **24** and **25**.

The jack is fitted on to a slide arranged on the side frame member near the centre body pillar, and is used either side of the car as required.

To operate, push the jack **right home** on the slide, spin the body of the jack to the ground, insert handle and use as shown in Fig. **25**.

It is important, before operating the jack, that the handbrake is pulled well on.

It is convenient to note that the jack may be used in other suitable positions, such as under the rear springs or front jacking pad if required.

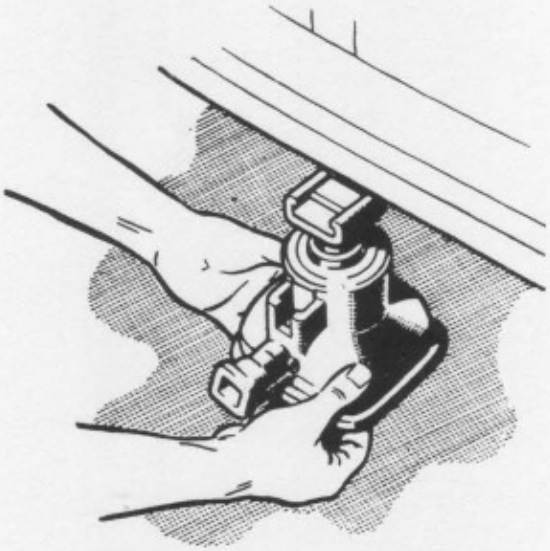

Fig. 24.—FITTING JACK TO SLIDE.

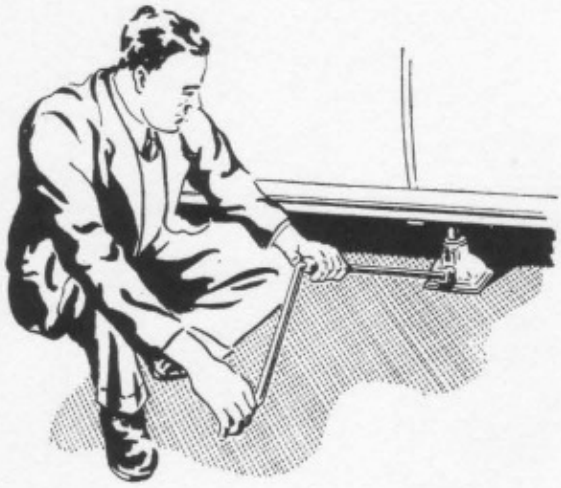

Fig. 25.—OPERATING JACK.

Wheel Changing.

No difficulty should be experienced in wheel changing, the spare wheel can be put on the rear or front hub with very little effort as follows:—

Rear.—Having jacked up the car, applied the hand brake and removed the rear wheel:—

1. Roll the spare wheel under the hub, the top of the wheel being inclined outwards, then with a foot at the bottom of the wheel, lift by the rim on to the hub extension, as shown in Fig. **26**.

2. One of the five wheel studs will be found to be nearly on the horizontal halfway line, either to the front or rear. Rotate and tilt the wheel until this stud protrudes through the nearest stud hole.

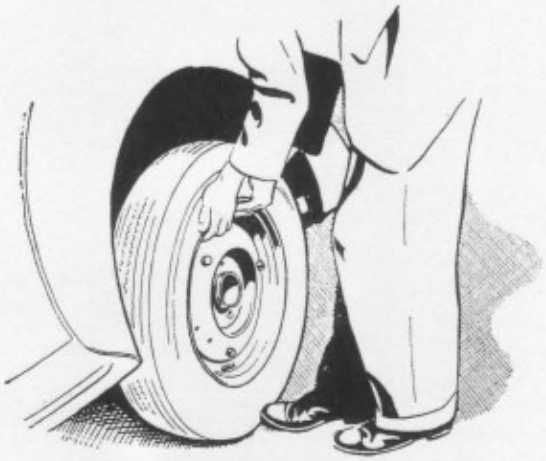

Fig. 26.—MOUNTING REAR WHEEL.

Fig. 27.—POSITIONING REAR WHEEL.

3. Using the one entered stud as a fulcrum, raise the wheel until the other studs enter their respective holes. (See Fig. **27**.)

Replace wheel nuts, wheel disc and retaining nut as previously described.

Front.—Position the wheel on the hub extension as described for the rear wheel (1). (See Fig. **26**.)

1. Rotate the wheel, which also rotates the hub, until a stud enters at the halfway line. (See Fig. **28**.)

Fig. 28.—ROTATING FRONT WHEEL.

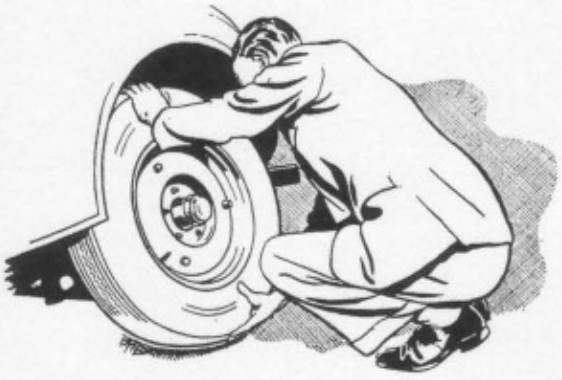

Fig. 29.—ENTERED STUD AT TOP.

2. Rotate the wheel until the entered stud is at the top, when it will be found that the other four will go home. (See Fig. **29**.)

Replace wheel nuts, wheel disc and retaining nut as previously described.

FITTING AND REMOVING TYRES.

Inextensible steel wires are incorporated in the edges of the tyres. Therefore, do not attempt to stretch the wire edges of the tyre cover over the rim edge.

Force is entirely unnecessary, and may be dangerous, as it merely tends to damage the cover edges and serves no helpful purpose.

Fitting or removing will be quite easy if the wire edges are carefully adjusted into the rim base; if it is not found to be easy, the operation is not being performed correctly.

To Remove the Tyre.

Remove all valve parts, and push both cover edges into the base of the rim at the part diametrically opposite to the valve, then lever the cover edges near the valve over the rim edge.

To Fit Tyre.

Push one edge of the cover over the edge of the rim. It will go quite easily if the part first put on is pushed right down into the wheel base.

A coloured spot on the outer wall indicates its lightest part, and the cover should be fitted so that the coloured spot is at the valve position.

1. Dust evenly with french chalk both the inside of the cover and the outside of the inner tube.
2. Inflate the tube until it begins to round out, then insert into cover.
3. Mount tyre.
4. Before inflating, make sure that the tyre beads are clear of the well of the rim all the way round.
5. Inflate slowly until the beads are fully seated.
6. Remove valve and deflate the tube completely.
7. Refit valve and inflate the tyre to the correct working pressure.

N.B.—This procedure must be followed whenever the tube is refitted.

Inflation of Tyres.

The pressures recommended for the 6.50″ by 16″ India tyres are:—

Front	25 lbs.	Cold.
Rear	30 lbs.	

Tyre pressures will increase slightly after continued running at high speeds or in hot weather. It is not considered advisable to reduce pressures under such conditions, as this would tend to cause further heating, due to excessive flexing when the tyre cools.

The pressures being comparatively low, it is important that they should be carefully maintained if maximum tyre life is to be secured. It is, therefore, recommended that the pressure be tested weekly by means of a gauge applied to the valve stem orifice.

Balancing the Road Wheels.

It is most important, in view of the high speeds attainable, that the front road wheels should be properly balanced. Therefore, it is necessary to have all the wheels balanced, and to re-balance a wheel after changing its tyre.

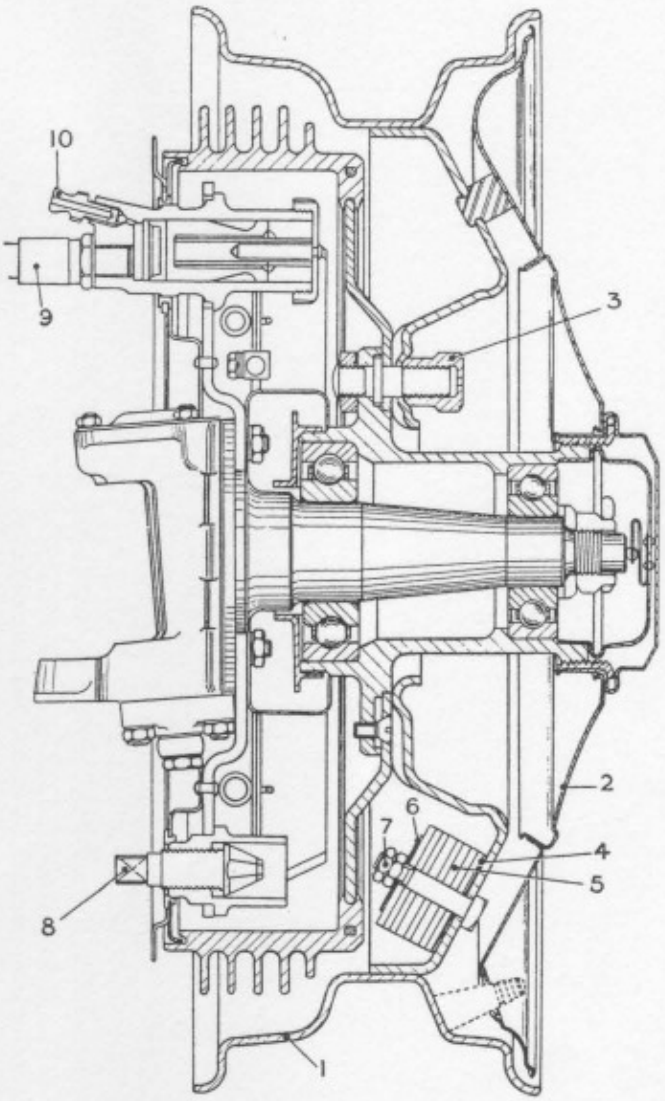

Fig. 30.—SECTION OF FRONT HUB AND WHEEL

1. Well base rim.
2. Wheel disc.
3. Wheel securing nut.
4. Fibre washer.
5. Lead washer.
6. Steel washer
7. Locknuts.
8. Brake adjuster screw.
9. Hydraulic fluid pipe.
10. Bleeder nipple.

An out-of-balance effect is usually present in the complete wheel and tyre due to:—

(a) The valve and its patch on the inner tube: and

(b) unavoidable irregularities in the outer cover, due to movement of the material during vulcanizing.

A coloured spot on the outer wall indicates its lightest part, and the cover should be fitted so that this spot is at the valve position.

To correct such out-of-balance, three bolts are provided, spaced at equal intervals around the wheel centre, as shown in Figs. **30** and **31**, and each carries a number of lead washers.

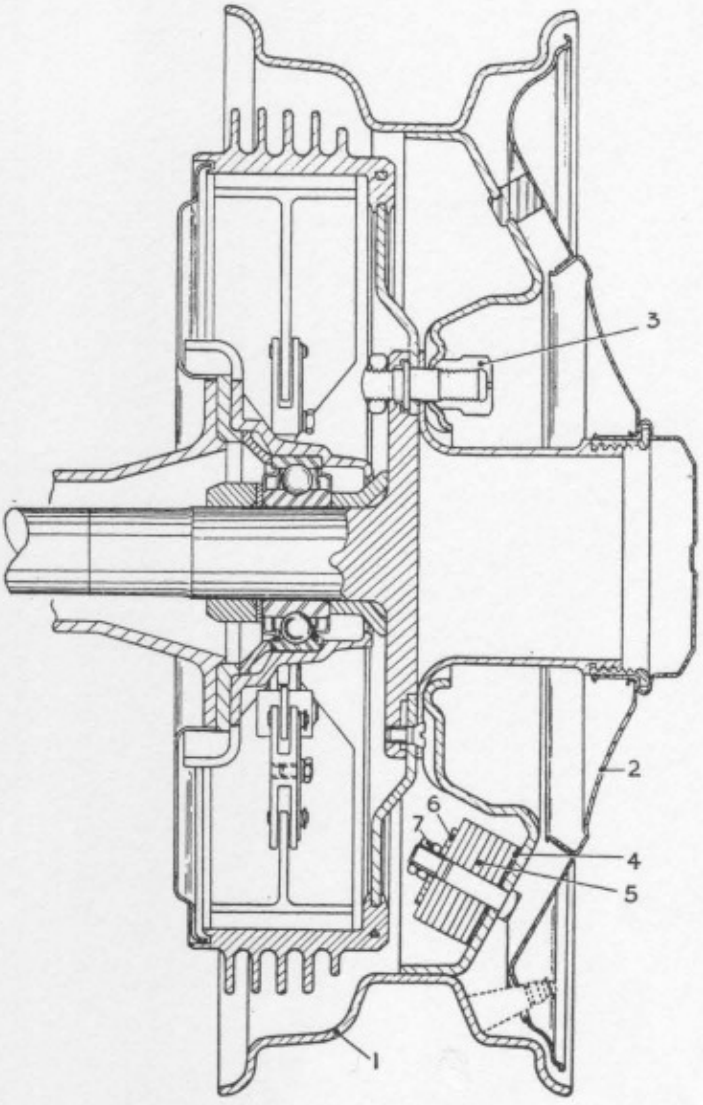

Fig. 31.—SECTION OF REAR HUB AND WHEEL.

1. Well base rim.
2. Wheel disc.
3. Wheel securing nut.
4. Fibre washer.
5. Lead washer.
6. Steel washer.
7. Locknuts.

The parts are assembled on the bolt in the following order:—

1. Fibre washer (**4**).
2. Lead washers (**5**), up to eight in number on any one bolt.
3. Steel washer (**6**).
4. Locknuts (**7**), for retaining lead balancing washers.

To balance a wheel, proceed as follows:—

1.—Remove the wheel.

2.—Remove all the washers from each bolt.

3.—Reverse the bolts in the wheel, this will allow the operation of balancing to be performed more easily, as the balance washers may then be fitted externally, and re-fit the wheel.

4.—Re-fit the fibre washers, steel washers and lock nuts.

5.—The wheel should then be turned gently and allowed to come to rest. The lowest point of the tyre should then be marked.

6.—The operation should then be repeated, and if the original mark returns to the bottom position, one or more lead washers should be added to the bolt on the opposite side of the wheel.

7.—If the mark on the tyre is adjacent to the bolt, then one lead washer should be fitted on each of the other two bolts. On the other hand, if no bolt should lie on the vertical centre line through the marked point of the tyre, the washers of the two bolts furthest from the mark must be altered; for instance, if the distance of one bolt from the centre line is approximately twice that of the other, two lead washers should be fitted on the bolt nearest to the centre line, and one lead washer on the other bolt.

This process should be continued until the wheel will remain in any position in which it may be brought to rest, the number of lead washers being kept down to a minimum consistent with good balance of the wheel.

When all the lead washers are not required, fibre packing washers should be substituted, the lead washers being fitted last, so as to keep the greatest mass as near to the centre line of the tyre as possible.

8.—Remove the wheel and reverse the studs so as to return the balance weights to their correct position, on the inside of the wheel.

9.—Re-fit the wheel and check that the balance is still correct, if any out of balance effect is still present, it will be necessary to correct this by the addition of washers as required.

CHAPTER IX

Engine Cooling System

Coolant—Coolant Pump and Fan—Fan Belt Adjustment—Overheating —Radiator Thermostat—Radiator Mounting—Coolant Level—Frost and Anti-freeze Mixtures—Car Heater—Mascots.

Coolant.

The cooling system is filled with a 25 per cent. mixture of inhibited ethylene glycol and water before the car leaves the factory, and it is strongly recommended that this, or a similar anti-freeze mixture, is used all the year round, both summer and winter.

The purpose of this is not only to provide protection against frost during the cold weather, but also to prevent any corrosion of the coolant passages and subsequent deterioration in the standard of cooling.

If there is any abnormal loss of coolant, the cause should be ascertained and rectified, and the system topped up with the correct anti-freeze mixture to maintain the level at approximately one inch below the bottom of the filling orifice.

If either of the recommended compounds (see page 80) are not available, plain, preferably soft, water may be used when there is no danger of frost.

It is very important that a glycerine base compound should not be mixed with a glycol base compound.

Coolant Pump and Fan.

The centrifugal coolant circulating pump is mounted in tandem with the fan, on the front part of the cylinder block, and is driven by a "V" belt, which also drives the dynamo, from the front end of the crankshaft.

It is improbable that any leakage or any other trouble will be experienced over long periods of running, and no attention should be necessary between general overhauls of the chassis.

If, for any cause, the engine has to be run with the fan removed, it is essential that the fan retaining set screws, with suitable distance-pieces to allow for the thickness of the fan, are refitted in position.

Fan Belt Adjustment.

Normally the belt should not require adjustment. An adjustment is provided, however, and is effected by releasing the three nuts (**3**, **4** and **5**, Fig. **32**), and moving the dynamo outwards on the special slotted link.

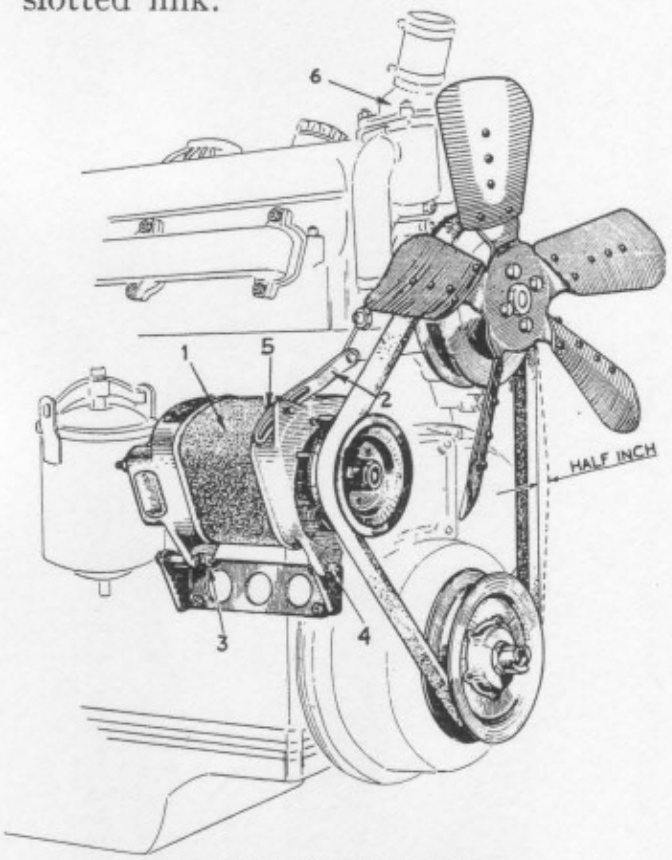

Fig. 32.—THE FAN BELT ADJUSTMENT.

1. Dynamo. 2. Slotted link.
3, 4, 5. Securing nuts. 6. Thermostat.

The tension should be such that the fan belt can be moved transversely, with the fingers, at a point equidistant from the crankshaft pulley and the fan pulley through a total distance of one inch.

If it should be necessary to remove the belt for any reason, it must not be strained over the pulley. The three nuts (**3**, **4** and **5**), should be released and the dynamo moved upwards to the full extent of the slot, when it will be found that the belt can be easily replaced without straining.

The fan must not be forcibly turned by hand as this will cause bending of the blades and may result in a damaged radiator.

Overheating.

Overheating may be due to one or more of the following causes:—

(a) The thermostat may have failed. (See page 79.)

(b) The fan belt may need adjustment. (See above.)

(c) The continued ascent of a long steep gradient, under adverse circumstances at full throttle and too high a gear. There will be less tendency to overheating if the gear be changed to the next lower and the throttle opening reduced.

(d) There may be a shortage of coolant in the system.

Radiator Thermostat.

The thermostat which controls the flow through the radiator to suit the engine cooling requirements, is contained within a casing (**6**, Fig. **32**).

It is arranged to maintain a minimum coolant temperature of approximately 78°C.

Reference to the instrument-board thermometer will indicate that the thermostat is operating correctly and that there is no shortage of coolant.

An unusually and consistently low temperature, after the engine has been well warmed up, indicates failure of the thermostat.

A by-pass pipe acts to short circuit the radiator when the thermostat valve is closed or only partly open. This arrangement ensures a quick supply of heat to the induction pipes after starting from cold as well as a rapid warming up of the engine coolant jacket.

Radiator Mounting.

The radiator comprises two main units, namely, the outer shell and the matrix itself, the complete assembly being mounted on a single central rubber support. The shell is diagonally braced and is bolted to the wings and valance plates. The radiator matrix is secured in the shell at three points, which are arranged to provide freedom for expansion under heat.

The object of this special construction is to avoid sideways movement of the radiator assembly due to road shocks, and to isolate the matrix from such shocks.

No lubrication or attention is necessary in connection with the mounting.

Coolant Level.

The radiator filler is located under the left-hand side of the bonnet. A warning notice is embossed on the cap to the effect that it must not be removed when the engine is running. Hot coolant is likely to be forced out in such circumstances.

The correct level is approximately one inch below the bottom of the filling orifice, at which point it will stabilise itself. Filling above this level merely wastes coolant.

It is safe to run as long as the coolant is visible in the top tank when cold.

A drain tap is situated on the pipe connecting the pump with the bottom of the radiator. It is in the "off" position when the handle is pointing downwards.

On no account must any strong alkaline compound be used to clean out the coolant system. Several such compounds are available, but their use must be carefully avoided, owing to the fact that they have a detrimental chemical action on aluminium.

Frost and Anti-Freeze Mixtures.

As long as the original coolant is maintained in the system, no precautions need be taken against frost.

If, for any reason, the original coolant has been replaced with water, then the system must be drained if the car is to be left exposed to temperatures below 32° F.

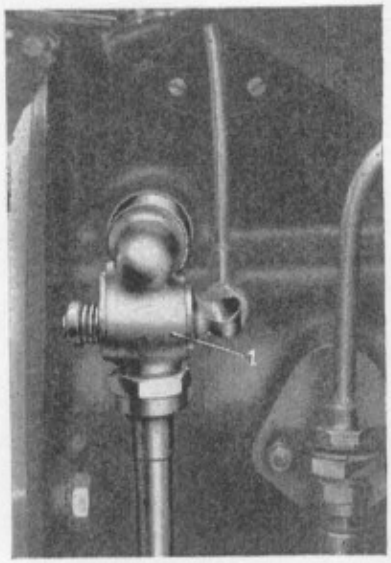

Fig. 33.—CYLINDER JACKET DRAIN TAP.

1. Drain tap.

Draining is accomplished by opening three drain taps, one situated on the pump inlet pipe, one on the right-hand side of the cylinder block, (**1**, Fig. **33**), and one on the car heater return pipe. The filler cap must also be released a few turns.

Also, before attempting to turn the crankshaft for starting after exposure to frost, *hot water should be poured over the coolant pump* to thaw any particles of ice which may be present in the casing, and which would probably damage the impeller.

A suitable anti-freeze mixture is made by mixing soft water with either Inhibited Ethylene Glycol or "Bluecol", in proportions dependent on the degree of frost likely to be encountered.

The following table gives an approximate indication of the amount of frost protection ensured by different strengths of mixture.

Freezing point	22° F.	12° F.	2° F.	−3° F.
Degrees of frost	10° F.	20° F.	30° F.	35° F.
1. Inhibited Ethylene Glycol ...	4½ pts.	6¾ pts.	10 pts.	11 pts.
2. "Bluecol"	4½ pts.	6¾ pts.	10 pts.	11 pts.

When changing from water to anti-freeze, the radiator system must be drained. New anti-freeze of the required amount should be mixed with an equal quantity of soft water before being poured into the radiator, the radiator being finally topped up with soft water.

The engine should then be run until normal operating temperature is reached, to ensure uniform distribution of the anti-freeze throughout the system.

The rubber connections must be carefully examined and replaced if unsound, as any leakage will necessitate replenishment with anti-freeze mixture.

When using an anti-freeze mixture as described, a similar mixture should be used for topping-up purposes.

Car Heater.

A hot water heater is fitted under the front passenger's seat, warm air being circulated by an electric fan which is integral with the heater.

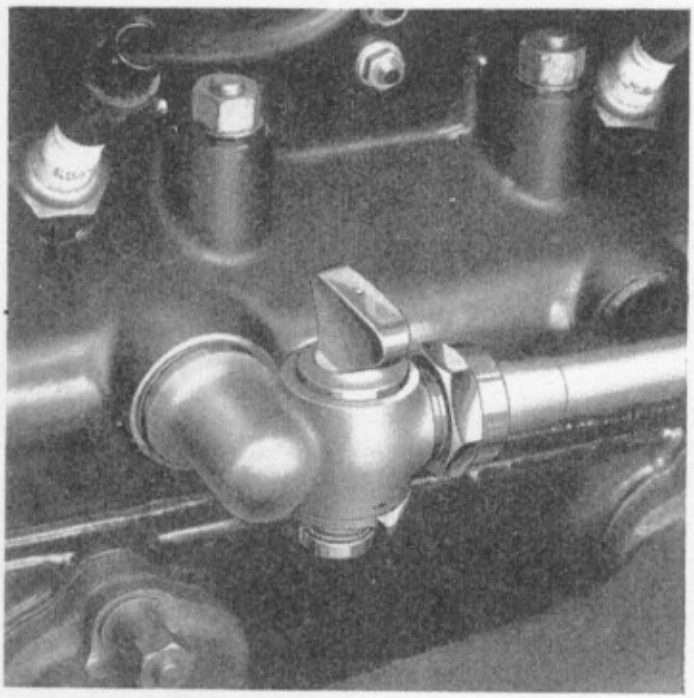

Fig. 34.—CAR HEATER CONNECTION AND ISOLATING TAP.

Hot coolant is circulated through the heater from the engine cooling system, the coolant being taken from the cylinder block through a tap (see Fig. **34**), the latter being used to isolate the heater when not required.

The switch for the heater fan incorporates a rheostat, and is mounted on the instrument board, as shown in Fig. **1**, thus giving a variable control of the interior temperature.

Mascots.

A heavy or cumbersome mascot should not be carried on the radiator cap, as it is liable to cause damage to the top of the radiator shell.

The mascot provided is of a distinctive type, and designed exclusively for use on Bentley cars.

DIAGRAM

ELECTRICAL WIRING

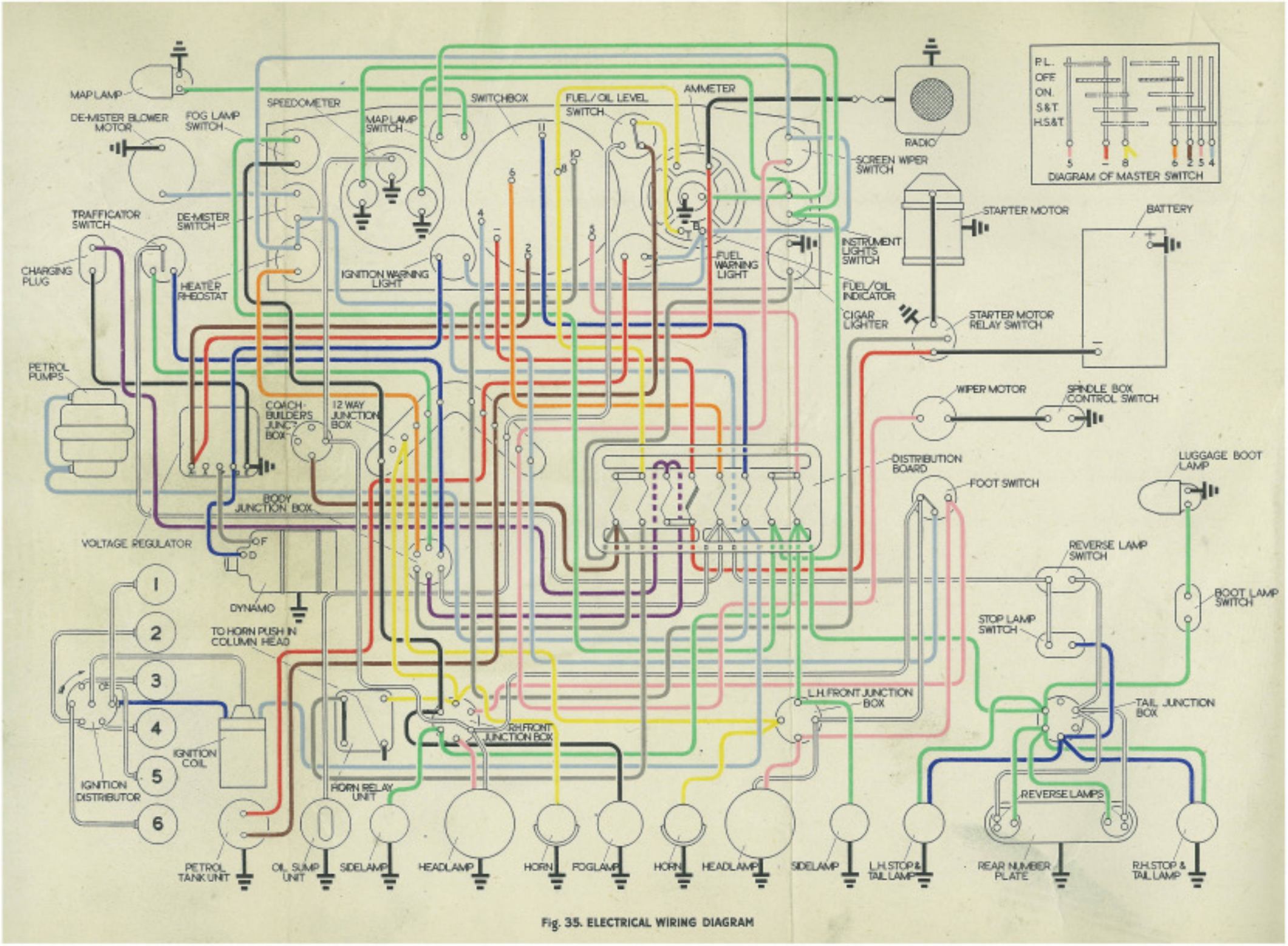

Fig. 35. ELECTRICAL WIRING DIAGRAM

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. **35**), 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. **32**, 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 connections, the actual leads being coloured and the dynamo marked as follows:—

Lead.	*Colour.*	*Corresponding mark on dynamo.*
Armature	Blue	D.
Field	Grey	F.

The internal connections of the field coils are made one to the earthed brush, and the other to the terminal marked "F". The armature lead from terminal "D" is taken to the correspondingly marked terminal of the output regulator, and the field connection to the terminal marked "F" in the fuse box.

Every 10,000 miles, as directed on page 31, 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 inexpert fitting of brushes.

When it is necessary to disconnect the wires to the dynamo, care must be taken to ensure their correct replacement, which is facilitated by the colouring and lettering adopted.

Fuse Box.

The unit is shown in Fig. **36**, 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.

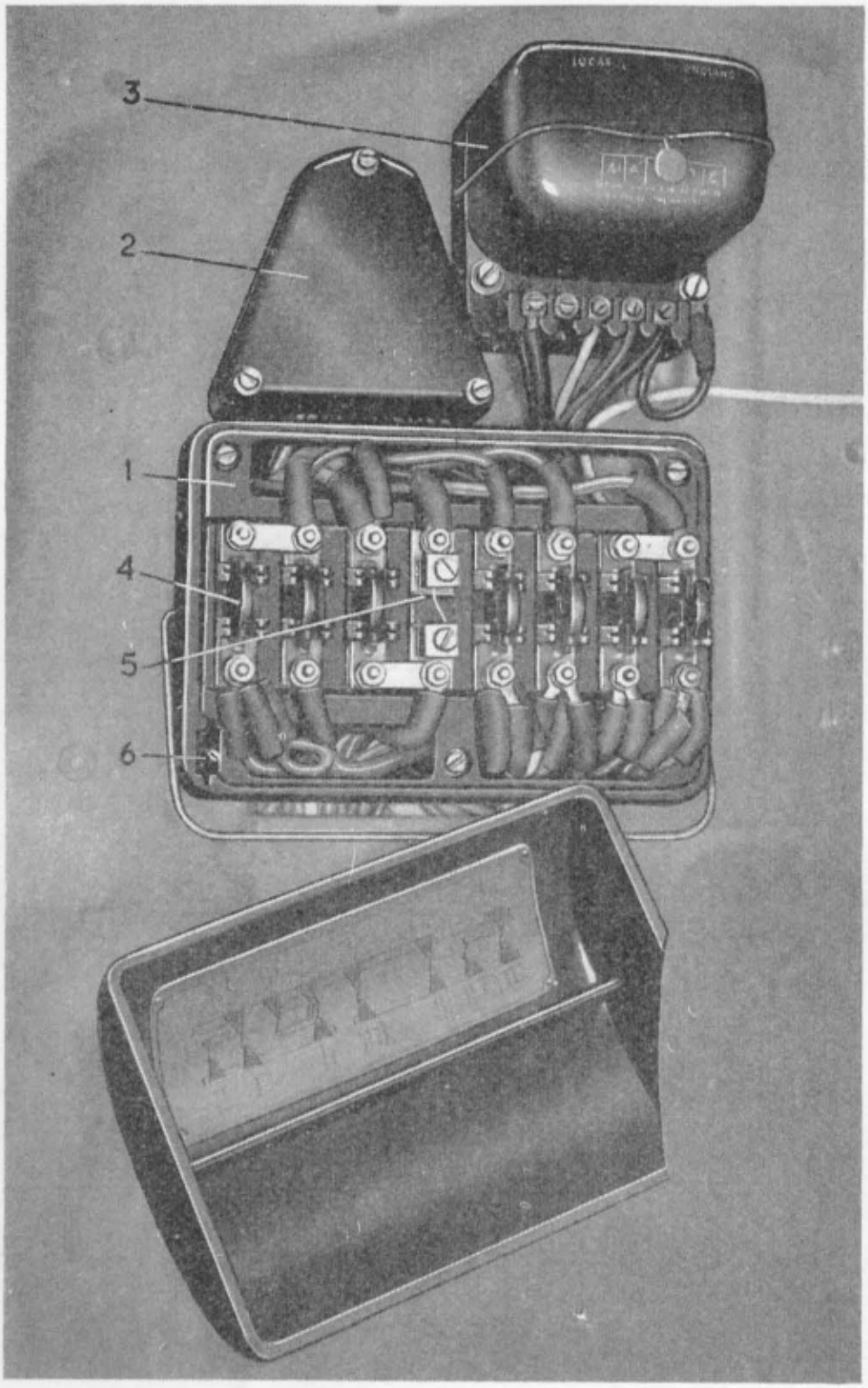

Fig. 36.—FUSE BOX, CONNECTING BOX, OUTPUT REGULATOR AND CUT-OUT.

1. Fuse box.
2. Connecting box.
3. Output regulator and cut-out.
4. Circuit fuse.
5. Main 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, stop light 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.

Output Regulator and Cut-Out.

The output regulator and cut-out are mounted on the front of the dashboard, and are shown (**3**, Fig. **36**).

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. **35**.)

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

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 96), 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 as given above.

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. **36**).
2. Connect the POSITIVE lead, by means of a clip, to any convenient clean part of the chassis, such as the windscreen wiper motor bracket, which is bolted to the dashboard.

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.

Fig. 37.—CONTACT BREAKER AND DISTRIBUTOR.
1. Contact breaker.
2. Distributor.
3. Lubricator.
4. Condenser.

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. **37**, an internal view of the contact breaker being given in Fig. **38**.

A condenser (**4**, Fig. **37**) 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. **38**) 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.

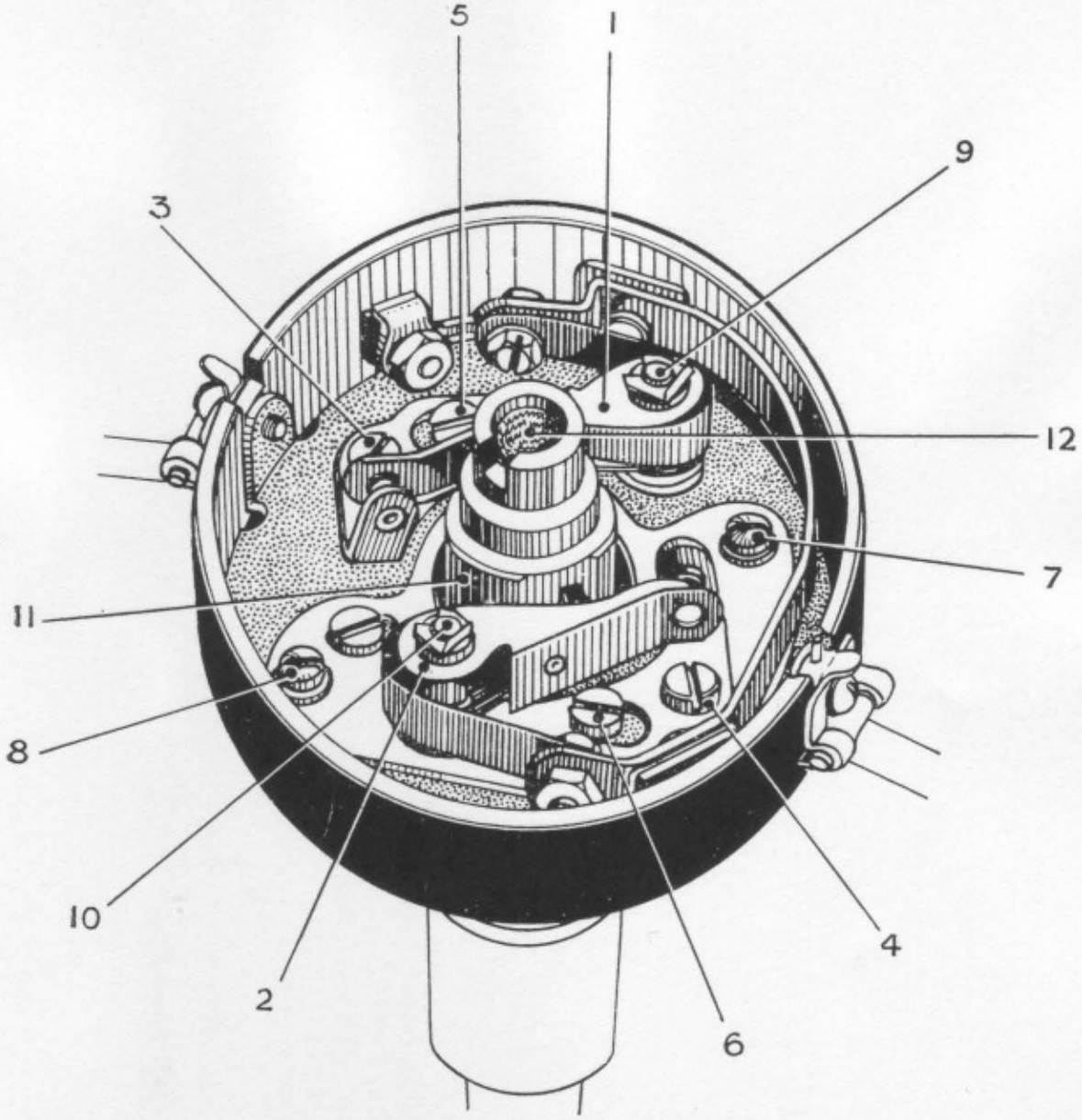

Fig. 38.—INTERIOR OF CONTACT BREAKER.

1. Contact breaker arm.
2. Contact breaker arm.
3. Locking screw.
4. Locking screw.
5. Adjusting screw.
6. Adjusting screw.
7. Locking screw.
8. Locking screw.
9. Pivot pins.
10. Pivot pins.
11. Cam.
12. Felt wick.

Every 5,000 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 a smear of Mobiloil Grease No. 2 should be applied to the cam (**11**). 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. **37**) 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 dash-board as shown in Fig. **39**. 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.

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

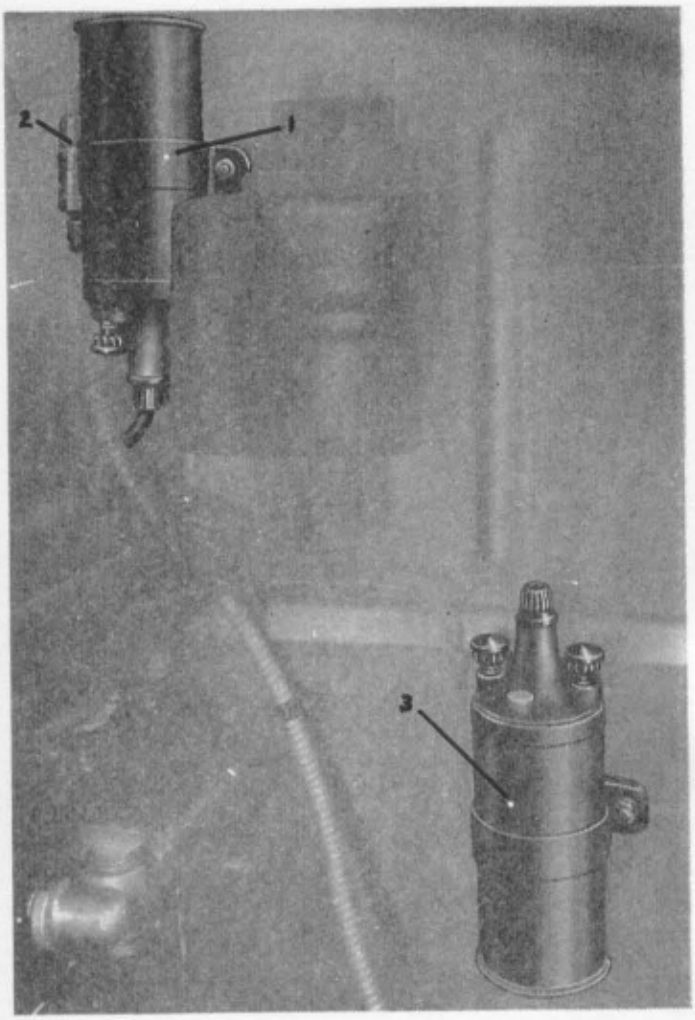

Fig. 39.—IGNITION COILS.

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

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.

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 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. **40**. 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.

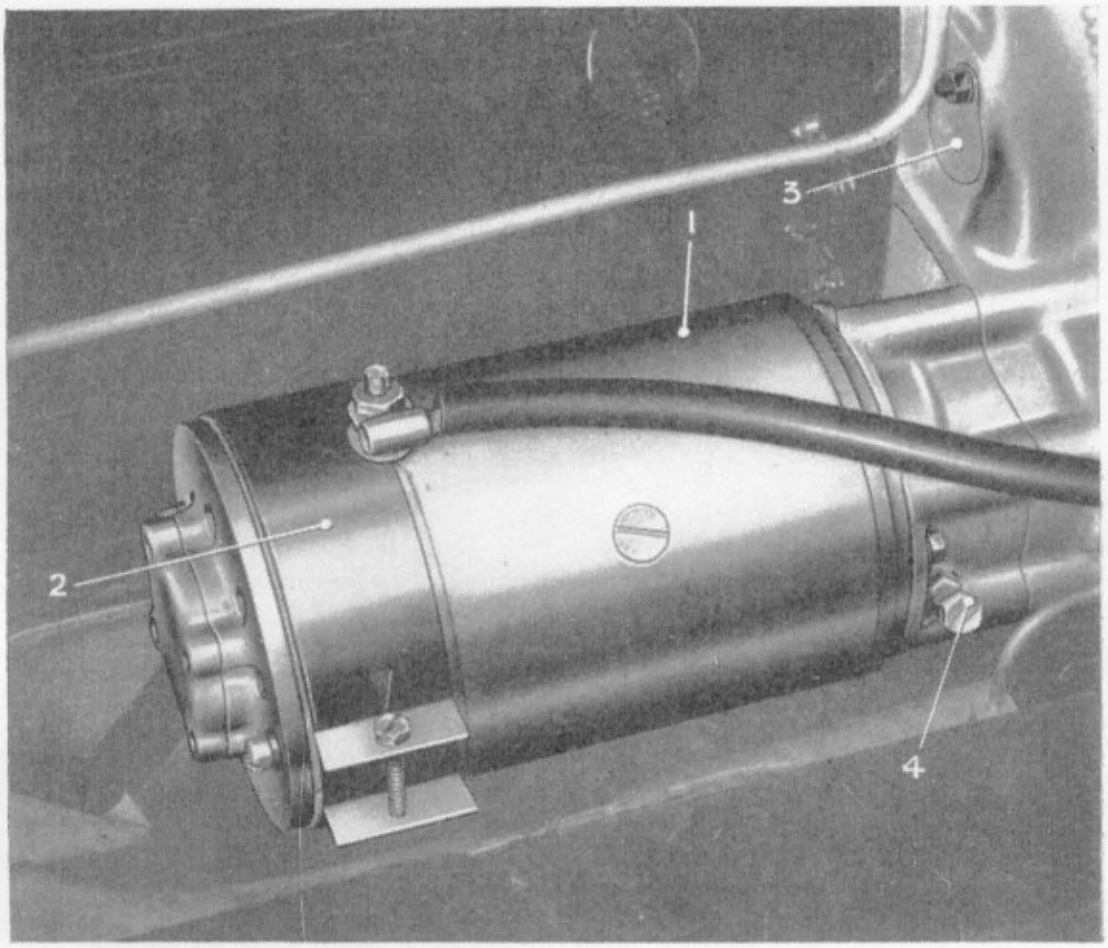

Fig. 40.—THE STARTER MOTOR.

1. Starter motor.
2. Brush gear cover.
3. Timing cover.
4. Oil level plug.

When replacing the starter motor in the chassis, it is important to be sure that a clean and sound electrical connection of cable to motor is re-obtained, owing to the heavy current which this has to carry.

Starter Motor Switch.

The main starter switch is mounted on the front of the dashboard, and is relay-operated. Closing of the push-button switch on the instrument panel energises an electric magnet, which closes the main contacts.

No attention should be necessary to the switch between general overhauls of the chassis.

Use of Starter Motor.

Careless use of the starter will reduce the life of the battery, whereas careful use will make very little difference to that life. That is to say, the heavy motor current is not detrimental to a healthy, charged battery—it only becomes detrimental to a cell which for any reason is low in charge, density or voltage. Several dozen starts may be made on a fully-charged battery without detriment. On the contrary, it is very important, if the engine does not start reasonably quickly,