

HANDBOOK  
FOR  
BENTLEY  
CONTINENTAL SPORTS  
SALOON  
(WITH AUTOMATIC GEARBOX)  
WITH INSTRUCTIONS FOR RUNNING  
AND MAINTENANCE

---

*Liable to Alteration without Notice*

Number XV

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**T**HE information contained in this book has been arranged to facilitate reference, by condensing all essential driving and upkeep instructions in the first two chapters. Numerous references to other parts are provided, whereby any particular instruction may be amplified if required.

Subsequent chapters include explanations of the working of the various units or components of the chassis, and include detailed directions for lubrication and maintenance.

Owners and drivers should, therefore, familiarise themselves with the first two chapters in order to operate the car successfully, referring to the remainder of the book at leisure, or if necessary.

A set of special spanners and tools is supplied with the chassis. It is most desirable that these should be used when effecting any adjustment, as otherwise vital parts may be seriously damaged.

*It is strongly recommended that this book be carefully studied, and the instructions faithfully followed, to ensure the greatest satisfaction.*

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## THE SECRET OF SUCCESSFUL RUNNING

---

Before a Bentley car is sold, it is very carefully tested and adjusted by experts. It will run best if no attempt is made to interfere unnecessarily with adjustments.

An owner would do well to instruct his driver as follows:—

Lubricate effectively, in strict accordance with the advice given in this book, and do not neglect *any* part.

Inspect all parts regularly, but take care not to alter any adjustments unless really necessary.

## SERVICE FACILITIES FOR BENTLEY CARS

Our interest in your Bentley car does not cease when you take delivery of the car. It is our ambition that every purchaser of a Bentley car shall continue to be more than satisfied.

With this end in view, the "Special Retailer", through whom the car was purchased, has established a properly equipped Service Station, staffed by men who have been specially trained in servicing Bentley cars.

In addition, on the staff of Bentley Motors (1931) Ltd., there are experts whose sole duty it is to maintain contact with the "Special Retailers", and they are available, at all times, to be called in for consultation on any matters affecting your car.

If, therefore, you require any assistance, we ask that you should immediately contact the "Special Retailer", who will be only too pleased to place his facilities at your disposal. If necessary he will call in for consultation our expert in that area. It is earnestly hoped that this arrangement will prove of mutual benefit, as we shall thus be kept in constant touch with our Customers, who may be spared the trouble of a long journey to one of our Company's Service Stations.

In the event of it being more convenient to call on us direct for assistance, our main Service Station at Hythe Road, Willesden, London N.W.10, and the one at our factory at Crewe, will be ready at all times to help. (See maps at end of Handbook.)

## LEADING PARTICULARS OF CHASSIS

### **Engine.**

Six cylinders,  $3\frac{5}{8}$ " (92 mm.) bore,  $4\frac{1}{2}$ " (114 mm.) stroke, 4,566 c.c., cubic capacity, 31.54 h.p. R.A.C. rating.

Mono-bloc casting, detachable cylinder head, overhead inlet valves, side exhaust valves.

Aluminium alloy pistons.

### **Engine Lubrication.**

Pressure feed to all crankshaft and connecting rod bearings.

Relief valve, providing positive low-pressure supply to the valve rocker shaft, from which the inlet valves, push rods and tappets are lubricated.

Two-gallon capacity sump.

### **Carburetter.**

Two special type S.U.

Air intake silencer and air cleaner.

### **Fuel System.**

Eighteen-gallon tank at rear of chassis. Supply by electric pumps. Fuel level gauge and warning light on instrument board. The warning light indicates when fuel is low.

### **Cooling System.**

By centrifugal pump circulation and fan. Thermostatically controlled. Coolant temperature thermometer on instrument board.

### **Electrical Equipment.**

Twelve-volt system with automatic regulation of dynamo output. Starter motor with reduction gear and pinion providing gentle engagement. Battery of 55 ampere-hour capacity.

**Gearbox.**

Four forward speeds and reverse. Fully automatic with over-riding hand and "kick-down" change speed control.

**Gear Ratios.**

Rear Axle Ratio.	1st Speed.	2nd Speed.	3rd Speed.	4th Speed. (Direct.)	Reverse.
3.077 : 1	11.75 : 1	8.10 : 1	4.46 : 1	3.077 : 1	13.24 : 1

**Rear Axle.**

Semi-floating type. Hypoid gears with differential. Torque and brake reactions taken by road springs.

**Rear Suspension.**

Semi-elliptic springs in combination with controllable hydraulic shock dampers.

**Front Suspension.**

Independent; open helical springs in combination with hydraulic shock dampers.

**Steering.**

Cam-and-roller type.

**Brakes.**

Hydraulic operation on front wheels, mechanical operation on rear wheels assisted by mechanically driven servo motor.

Hand brake operates on rear wheels.

**Chassis Lubrication.**

Centralised chassis lubrication system supplied by foot-operated pump and reservoir on dashboard.

**Road Wheels.**

Detachable steel wheels, fitted with 6.50" by 16" India "Speed Special" tyres.

### Dimensions.

Total length overall, including bumpers ...	...	206 $\frac{1}{2}$ "	—	17'	2 $\frac{1}{2}$ "
Width of car ...	...	71 $\frac{1}{2}$ "	—	5'	11 $\frac{1}{2}$ "
Wheelbase ...	...	120"	—	10'	0"
Track—Front ...	...	56 $\frac{1}{2}$ "	—	4'	8 $\frac{1}{2}$ "
Rear ...	...	58 $\frac{1}{2}$ "	—	4'	10 $\frac{1}{2}$ "
Turning circle, over front wings ...	...	...	...	43'	...
Weight (dry) ...	...	...	...	...	33 cwt. (approx.)

### Chassis and Engine Numbers.

The chassis number will be found on the identification plate fixed to the front of the dashboard under the bonnet, and also stamped on the left-hand side frame member just in front of the dashboard, under the bonnet.

The engine number is stamped either on the front left-hand crankcase lifting lug, or on a boss on the crankcase above the front left-hand lifting lug.

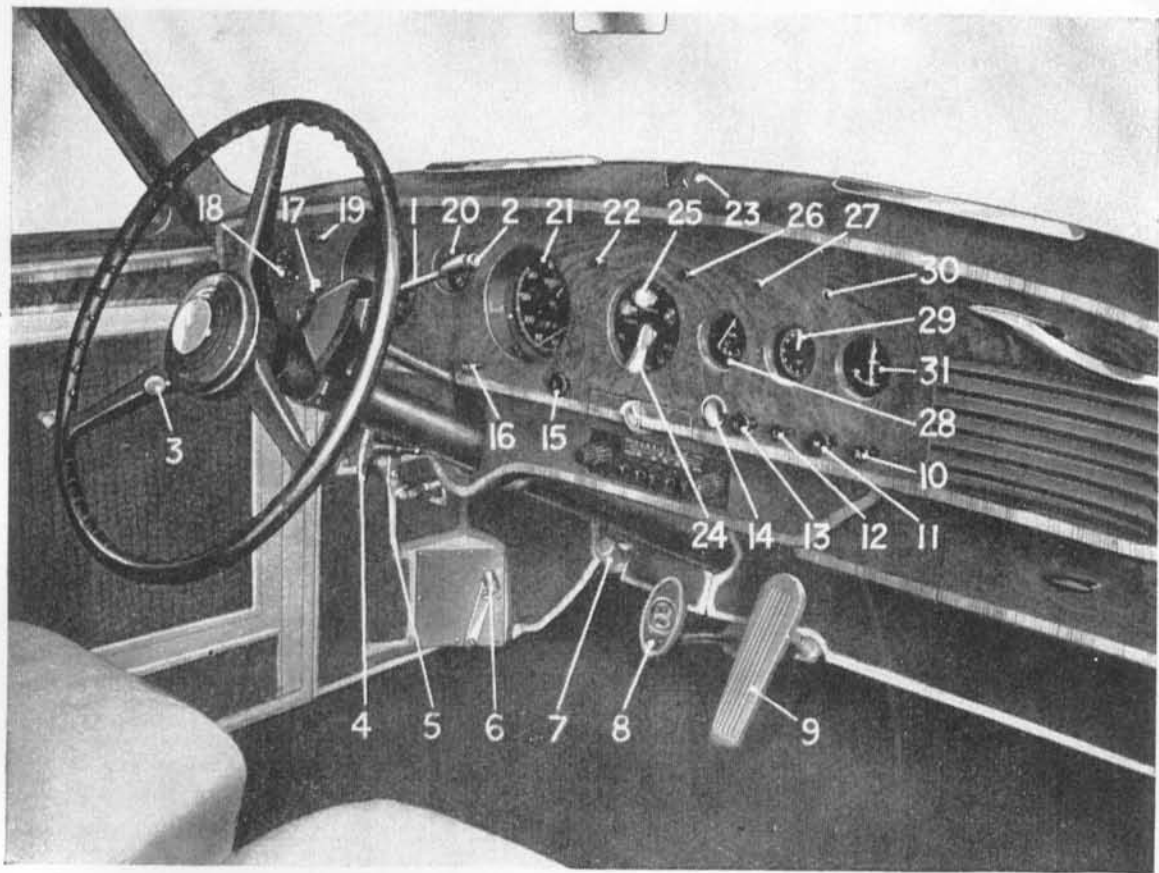


Fig. 1. DRIVER'S CONTROLS.

1. Gear range lever.
2. Lock button.
3. Ride control.
4. Hand brake.
5. Bonnet release.
6. Fresh air duct.
7. Dip-switch.
8. Brake pedal.
9. Accelerator pedal.
10. Roof light.
11. Demister motor.
12. Fog lamp.
13. Heater switch. (Anti-clockwise is off. Heat is full on at initial movement of knob and diminishes with further turning.)
14. Cigar lighter. (Push in, lighter clicks out when ready for use.)
15. Instrument lights.
16. Rear window demister.
17. Windscreen washers. (Press-release for each squirt.)
18. Oil temperature thermometer.
19. Charging plug.
20. Pressure gauges.
21. Speedometer.
22. Map lamp switch. (Push on—push off.)
23. Direction indicator switch.
24. Master switch (controls all accessories except inspection and roof lamps).
25. Ignition switch. (Can remain at ON position, use master switch.)
26. Fuel/oil level switch. (Press button, read on fuel gauge dial.)
27. Fuel warning light.
28. Fuel/oil level indicator.
29. Clock.
30. Direction indicator light.
31. Ammeter.

## CHAPTER I

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### Starting the Engine and Driving the Car

*Starting the Engine—Use of Starting Handle—Automatic Gear Changing—Tow Starting—Fuel Feed—Fuel Gauge—Chassis Lubrication—Controllable Shock Dampers—Battery Charging—Lighting Control and Switch—Accessories—Radiator Thermostat and Thermometer—Coolant Level in Radiator—Frost—Snow Tyres—Fitting of Snow Chains.*

#### **Starting the Engine.**

Switch on the ignition by turning the master and ignition switches to ON. The master switch controls all the electrical system, excepting the electric clock, inspection and roof lamps, the latter being available for convenience on entering the car in the dark.

The action of switching on the ignition also switches on the electric fuel pumps, and a few pulsations of the latter may be heard.

A small red warning light on the instrument board will be illuminated when the ignition is switched on, but will be extinguished when the engine speed is sufficient to cause the cut-out contacts to close.

Ensure that the gear lever on the steering column is in neutral, quadrant gear position "N", as it is only in this position that the starter switch is operable.

For starting the car in all temperatures above freezing point, *first depress the accelerator pedal slightly and then allow it to return to its normal position.* This permits the throttle stop on the carburetter to re-position itself correctly according to engine temperature.

For starting the car under very cold conditions in temperatures of below freezing point, it will be necessary to depress the accelerator pedal slightly, about a quarter of its full travel, and hold it depressed while the starter button is being operated. Immediately the engine fires, the accelerator pedal should be released.

*Depress the starter button firmly, an appreciable pause must be made between the operations of switching on the ignition and depressing the starter button, especially when making a start from cold.* This is necessary in order to give the pumps time to fill the float chambers of the carburetters.

*(To be inserted in Bentley Handbook No. XV, to face page 22.)*

### **COASTING.**

Owners are advised that coasting or "freewheeling" down hills *with the engine switched off* must definitely be avoided, as this is likely to cause severe damage to the Automatic Gearbox mechanism.

This damage can occur with the manual control lever in any of the five positions, including position "N".

Similarly, if, in the unfortunate event of an accident, it should be necessary to give instructions for the car to be towed, owners are requested to instruct that the following procedure should be carried out before the car is moved, to safeguard the gearbox from further damage.

- (i) The car should not be towed if there is any sign of mechanical failure or breakage in the gearbox. In this case the car must be transported.
- (ii) When satisfied that the gearbox is undamaged, remove the front interior carpet to obtain access to the inspection cover in the floor (see 3, Fig. 21), page 67. Remove the six screws and the cover.
- (iii) Release the locknut and slacken off the rear band adjusting screw (5, Fig. 21)  $4\frac{1}{2}$  complete turns. Re-tighten the locknut and replace the inspection cover, screws, and front carpet.
- (iv) Keep the control lever at "N" throughout, and maintain when possible a towing speed between 15 and 25 miles per hour. Distances must at all times be kept to a minimum.

### **IMPORTANT.**

At no time must a speed of 25 miles per hour be exceeded whilst towing.

BENTLEY MOTORS (1931) LTD.,  
LONDON.

### Use of Starting Handle.

*It is imperative when starting the engine with the starting handle, that the gear lever must be at Neutral.*

### Automatic Gear Changing.

The gearbox is fully automatic in operation throughout the range of the gear ratios, however, a manual control lever is mounted on the steering column, by means of which a selection may be made of the desired range best suited to the operating conditions, thus giving the driver greater flexibility of the control and enabling him to use his judgment and skill.

Three forward speed ranges are provided, also neutral and reverse. The quadrant is marked as follows:—

N.     4.     3.     2.     R.

The gear ratios available in each of the positions are as under:—

“4”—Top, 3rd, 2nd and 1st.

“3”—3rd, 2nd and 1st.

“2”—2nd and 1st.

For all normal driving conditions the lever is placed in the position marked “4”, when all four speeds are available under the control of the automatic “control unit”, which will select the suitable gear ratio according to the degree of throttle opening and the speed of the car.

The gear lever quadrant is provided with a gate between positions “2” and “3” and a button on the lever has to be depressed to move in or out of neutral or into reverse, thus preventing inadvertent engagement with an unwanted gear.

For greater control of the car when touring in hilly or difficult country, the gear lever should be placed in the position marked “3”. The change either up or down, between 4th and 3rd speed, can be made at any moment by the simple movement of the lever. Easing the pressure on the accelerator pedal facilitates the change, but this is not essential.

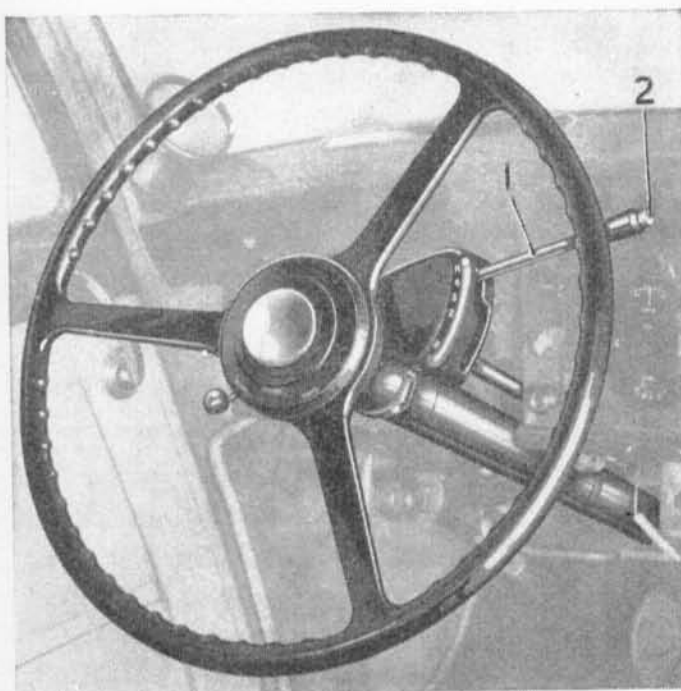


Fig. 2.—GEAR RANGE SELECTOR LEVER.

1. Lever.
2. Neutral and Reverse Lock Button.

Should the driver desire maximum acceleration, he may obtain a lower gear at full throttle by depressing the accelerator pedal beyond the normal limit of its travel, so actuating the kick-down switch.

It should be noted that although the hand control lever may be set in position "3", this gear ratio will not be held if the engine revolutions are excessive. The automatic control unit will over-ride this setting and the gearbox will automatically change up to 4th gear.

When descending very steep gradients, the gear lever should be placed in the 2nd position.

Only at prolonged halts, due to traffic jams, etc., is it necessary to engage neutral; at all ordinary traffic controls, the gearbox may be left in the gear range then in use.

Reverse can be engaged while the car is travelling forward at any speed below 10 miles an hour. This feature can be used to advantage should the car become embedded in deep snow, when by suitable timing of the engagement of reverse and second, the car can be rocked out of the rut.

When the engine is stationary, a parking lock is provided by placing the hand control lever in "R".

The illustration of the steering column control lever shows that a "gate" is provided between positions "3" and "2"; this design of quadrant allows changes between 4th and 3rd speed ranges to be made without risk of entering the 2nd speed range. Likewise, changes between 2nd speed range and reverse when "shunting" are facilitated.

It should be noted that when starting the car from cold the engine will run at a "fast idle", with the consequent build-up of an operating oil pressure in the gearbox. If when parked in a confined space it is necessary to engage reverse gear from neutral, thereby temporarily engaging the forward speed ranges, care must be taken not to release the brakes until the gear lever is in position "R".

### **Tow Starting.**

If it should be necessary to start the car by towing, the gear lever should be placed at position "2". When the car speed reaches about 20 miles per hour, the engine will start to turn over and fire. The lever should then be placed in the neutral position, and care should be taken not to have the throttle too wide open or the car may accelerate too rapidly and overtake the towing vehicle.

### **Fuel Feed.**

Fuel is supplied from the main tank to the carburetter by means of a dual electric pump mounted in the frame (see Fig. 11). The total capacity of the main tank is 18 gallons.

### **Fuel Gauge.**

The electric fuel gauge on the instrument board is graduated to register the total quantity of fuel in the main tank. The gauge is in-operative when the ignition is switched off.

Special contacts carried by the tank unit cause the green warning lamp to light when only about three gallons of fuel remain in the tank.

### **Chassis Lubrication.**

When starting the car for the first time in the day, it is a good plan to form the habit of operating the chassis oil pump pedal. The foot-operated pump should be used according to the mileage travelled, and the pedal should be given three or four strokes at first starting, and subsequently repeated every 200 miles. This will ensure adequate lubrication at remote parts of the system.

### **Controllable Shock Dampers.**

In order to provide comfortable riding at all speeds, controllable shock dampers are fitted to the rear axle.

The control is effected by the lever, mounted above the steering wheel, and marked **Ride Control**.

For ordinary town work, or touring with moderate loads, it will be found that the damper loadings as set by the pump are adequate when the hand lever is at **Normal**.

With heavy loads, improved riding comfort will be obtained by moving the lever towards **Hard**, the control being progressive.

### **Battery Charging.**

This is entirely automatic, as the provision of an automatic output regulator in conjunction with a shunt wound dynamo, adjusts the charge rate to suit the state of the battery.

When the battery is low in charge, the ammeter on the instrument board will show a higher reading towards **Charge** than it will when the battery is well charged. In making such comparison, however, other factors which affect the ammeter reading must be taken into account, chiefly engine speed and current-consuming apparatus in use at the time.

Whenever the master switch and the ignition switch are **On**, and the engine running above idling speed, the battery is being charged. This should be checked by reference to the ammeter.

Further information regarding the electrical system is given in Chapter X.

### Lighting Control and Switch.

As already mentioned, the movement of the master switch and the ignition switch to **On** not only switches on the ignition and charge, but brings into operation the electric fuel pumps and fuel gauge.

The ignition switch also switches on a red warning light on the instrument board, which is automatically extinguished when the engine is running at a speed sufficient to cause the dynamo to excite up to battery voltage.

The master switch controls the head, side and tail lamps, alternative **On** positions being provided, viz.:—

**S** and **T**.—Side and Tail lamps on.

**H, S** and **T**.—Head, Side and Tail lamps on.

**PL**.—"Parking" lights on, e.g. Side and Tail lamps on, accessories off.

In addition, a foot-operated switch is provided, by means of which the beam of the driving lights is altered to allow anti-dazzle precautions to operate, thus extending courtesy and safety to passing traffic.

### Accessories.

Windscreen wipers, de-misters, direction indicators and a car heater are normally fitted to all cars.

The windscreen wiper has two speeds controlled by a two-position switch (see Fig. 1). Operate by turning switch knob to the right; the first position gives **Slow**, further turning to the right to the second position gives **Fast**. Hard over to the left is **Off**.

The higher speed of wiping is intended for use during heavy rain. It should not be used in heavy snow or with a dry or drying windscreen, i.e. when the load on the motor is in excess of normal.

For de-misting the windscreen, warm air is taken from a special heater under the front wing, through suitable ducting to vents in the capping rail.

The normal forward motion of the car is usually sufficient to ensure adequate de-misting; under severe conditions switch on booster motor (11, Fig. 1), the operation of the switch being "Pull on", "Push off".

The rear window is of the electrically heated type formed by moulding a series of wires into the glass. A switch on the facia board marked "R.W." should be operated when required.

The car heater, normally fitted on the dashboard under the scuttle, consists of a water heated matrix with which is incorporated an electrically driven fan to circulate a current of warm air. A rheostat switch on the facia board, see Fig. 1, controls the fan.

The winking light system of direction indicators is fitted, and the control switch is mounted in the centre of the capping rail as shown in Fig. 1.

*(To be inserted in Bentley Handbook, No. XV, to face page 26.)*

### **FAULTY IGNITION CONDENSER.**

In cases where the engine misfires or fails to start, and that this condition is obviously not due to petrol starvation, it is possible that the ignition condenser is at fault.

Two condensers are mounted on the side of the ignition distributor, one being carried as a spare. (See Fig. 43, page 97.)

In the above circumstances, it is recommended that the wire is disconnected from the terminal of the suspected condenser and reconnected to the spare. The faulty condenser should be renewed at the earliest opportunity.

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Also, a press button switch on the facia board, see Fig. 1, is available for ascertaining the engine oil level which reads on the fuel gauge.

All these features are controlled by the master switch, which should be regularly switched off when leaving the car, to avoid leaving one of the accessories in operation.

### **Radiator Thermostat and Thermometer.**

A thermostat is provided in the upper radiator coolant pipe which automatically restricts the flow through the radiator, until the coolant in the system attains a temperature of about 78° C.

A thermometer is provided on the instrument board to indicate that the thermostat is operating properly and that there is no shortage of coolant.

### **Coolant Level in Radiator.**

The radiator filler cap, which is located beneath the bonnet on the left-hand side, should be removed occasionally for inspection of the coolant level, but it *must not be removed when the engine is running.*

The level of the coolant should be maintained to the bottom edge of the filling orifice. Top up if necessary with the correct anti-freeze mixture. (See page 86.)

### **Frost.**

The car is delivered with a suitable anti-freeze mixture in the cooling system. (See page 83.)

If the original coolant has been replaced with water, and the car has to stand exposed to frost with the engine not running, it is of vital importance that the system should be drained by opening the drain taps on the water pump inlet pipe, and on the cylinder block (see Fig. 38), and releasing the filler cap. The car heater must also be drained by opening the tap on the return pipe.

*Before attempting to start, or even move the engine again, hot water should first be poured over the water pump, as otherwise damage may be caused to the pump rotor by the presence of particles of ice within the casing. Warm water can be used with advantage for refilling the radiator.*

### **Snow Tyres.**

Special tyres are now available from certain tyre manufacturers, which are recommended as an alternative to "chains", as they give an easier and better ride and allow faster driving over snow-covered roads.

The tyres recommended for use on the Bentley car are:—

“India—Winter Type”.

It is suggested that two spare wheels might be fitted with Snow Tyres and held in the garage, for change-over with the rear wheels of the car when conditions warrant their use.

There is no objection to the use of these tyres on ordinary road surfaces, except that they would probably be noisy.

The tyre pressure should be maintained at the normal tyre pressures as quoted in the Handbook.

### **Fitting of Snow Chains.**

In the event of snow chains being preferred, they should be fitted to the rear wheels only.

A Parsons' chain, known as the “Special Bentley Type”, is available. It is recommended that these be obtained through Messrs. Bentley Motors (1931) Ltd., or one of their “Special Retailers”, in order to ensure the supply of the correct type.

When fitting these special chains, it is essential to commence by fastening the one hook on the inside of the wheel and to ensure that the outer joining links are fitted as low down on the tyre wall as possible. The tensioning springs which are supplied to go on the outside of the wheel must always be fitted.

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*(To be inserted in Bentley Handbook, No. XV, to face page 29.)*

## **AUTOMATIC GEARBOX.**

### **SERVICE AFTER 1,000 MILES RUNNING.**

#### **Important.**

During the early life of the Automatic Gearbox, a certain amount of initial bedding-in of the brake bands occurs. This cannot be compensated for in the original factory adjustments, and it is therefore most important that after the car has completed the first 1,000 miles running, it should be taken to the Bentley Retailer in your territory for the appropriate adjustments to be carried out.

No charge will be made for this service.

If it is inconvenient for you to send the car to the retailer from whom it was purchased, any Bentley Retailer will be pleased to carry out this adjustment.

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## CHAPTER II

### Periodic Lubrication and Attention

#### LUBRICANTS RECOMMENDED.

##### Engine.

Bentley Motors (1931) Ltd., recommend a first quality oil of viscosity S.A.E. 30 for the engine for all-the-year-round use.

Under extreme Winter conditions, the use of a lighter grade oil of S.A.E. 20 viscosity would provide easier starting and satisfactory lubrication.

The following oils are recommended:—

		"A"	"B"
		S.A.E. 20	S.A.E. 30
B.P. ...	...	Energol 20	Energol 30
Wakefield's ...	...	Castrolite	Castrol XL.
Shell ...	...	X.100—20	X.100—30
Vacuum ...	...	Mobiloil Arctic	Mobiloil "A"

Equivalent oils to the above are also marketed by:—Sternol Ltd., Alexander Duckham & Co. Ltd., Esso Petroleum Co. Ltd., Gulf Oil (Great Britain) Ltd., and Dalton & Co. Ltd.

In the instructions which follow, reference is made to oil "A" or "B" as above, i.e. viscosity 20 or 30.

##### Gearbox.

The automatic gearbox should be filled and topped up only with Automatic Transmission Fluid, Type "A", having an Armour qualification number prefixed by AQ/ATF.

Either of the following may be used:—

Vacuum Oil Co. ...	Mobiloil Fluid 200 ...	Type AQ ATF—101
Shell ...	Donax T.6 ...	Type AQ ATF—103
B.P. ...	Energol Automatic ...	Type AQ ATF—261
	Transmission Fluid	
Wakefield's ...	Castrol T.Q. ...	Type AQ ATF—156
General Motors ...	Hydra-Matic Fluid	

**Rear Axle.**

Wakefield's Special Castrol Hi-press S.C. (If this is unobtainable, use a first quality Hypoid oil of viscosity S.A.E. 90. Do *not* mix these oils; drain and refill.)

**Carburettor Air Valve Damper.**

Viscosity 10 oil; any of the following may be used:—

B.P.	...	...	...	...	U.C.L.
Wakefield's	...	...	...	...	Oilit.
Shell	...	...	...	...	Donax A.I.
Vacuum	...	...	...	...	Mobiloil Arctic Special.

**Steering Box—Chassis Oil Pump—Starter Motor Gears—Contact Breaker Cam Pad.**

Viscosity 30 oil, as under "B" above.

**Hydraulic Shock Dampers.**

Viscosity 20 oil, as under "A" above.

**Propeller Shaft—Door Hinges.**

Vacuum Mobilgrease No. 2.

**Distributor Grease Cup.**

High Melting Point Grease.

**Hydraulic Brake Fluid.**

Lockheed Hydraulic Brake Fluid, S.A.E., Spec. 70 R.2.

**CAPACITIES**

Engine	...	...	...	...	...	16 pints Imp. approx.
Gearbox	...	...	...	...	...	20 pints Imp. ..
Rear Axle	...	...	...	...	...	1 $\frac{3}{4}$ pints Imp. ..
Chassis Oil Pump	...	...	...	...	...	2 pints Imp. ..
Cooling System	...	...	...	...	...	32 pints Imp. ..
Fuel Tank	...	...	...	...	...	18 gallons Imp. ..

**GENERAL**

In addition to the points supplied with oil by the centralised system, there are others which, for various reasons, cannot be fed in this way and must, therefore, be lubricated by hand.

In the notes which follow, these points are classified as far as possible under mileages, or according to the usage of the car.

It is important that careful attention should be given to their lubrication so as to reduce wear and eliminate mysterious squeaks and rattles.

Further notes are included covering the periodic operations and adjustments which are necessary.

*(To be inserted in Bentley Continental Sports Handbook No. XI to face page 31.)*

### **SPARKING PLUGS.**

Owners are notified that the Lodge CLN Sparking Plug quoted as an alternative on pages 31 and 103, should no longer be used.

The only recommended Sparking Plug for use in the Bentley Continental Sports engine is the Champion N8.B.

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## Points for Regular Attention according to Use of Car

### FREQUENTLY, OR DAILY IF LONG JOURNEYS ARE CARRIED OUT

#### 1.—Engine Oil.

Inspect oil level on dipstick or electric gauge **when engine is not running**, and top up as necessary with correct oil. Do not run engine with oil level down to "Min." mark. (See page 41.)

(Filler cap on rocker cover.)

#### 2.—Chassis Lubrication.

Use foot-operated pump according to mileage travelled. As it is necessary to prime the system and expel air, the first stroke of the pump may not be effective, therefore give the pedal three or four strokes every 200 miles. This will ensure adequate lubrication at remote parts of the system.

Replenish reservoir as necessary, but do not overfill. Leave one inch between oil level and bottom of filler orifice.

(Reservoir on front of dashboard, under bonnet.)

### WEEKLY

#### 3.—Radiator Coolant.

Inspect coolant level and, if necessary, top up with the correct anti-freeze mixture to maintain the level to the bottom edge of the filling orifice.

(Filler cap on header tank, under bonnet.)

#### 4.—Tyres.

Check the tyre pressures.

These should be:—

Front—30 lb./sq. in. or 2.109 kg./sq. cm. } Cold.  
Rear—35 lb./sq. in. or 2.46 kg./sq. cm. }

**Note.**—It is of the utmost importance in the interests of safety that these tyre pressures are maintained.

#### 5.—Distributor Grease Cup.

Give grease cup one turn; when empty, fill with the correct grease. (See page 30.)

#### 6.—Windscreen Washer.

Inspect and refill reservoir if required; leave one inch between liquid level and top of filling orifice.

(Reservoir on front of dashboard, under bonnet.)

## MONTHLY

### 7.—Battery.

Check level of acid in each cell and top up with distilled water if necessary. Check more frequently when big mileages are covered or when the car is being run during hot weather.

(Access through trapdoor, under driver's seat.)

### 8.—Brakes.

See Chapter VI for description.

To check the adjustment, rotate the adjusters in a clockwise direction until obvious resistance is felt. This resistance should be equal for all four brakes, and should the last "click" on any one adjuster require noticeably greater force to obtain, this adjuster should be turned back to the previous "click". (See page 63.)

The above check should be undertaken every month or every 2,500 miles, whichever is the shorter.

### 9.—Gearbox.

Run the engine for three minutes and while still running inspect the fluid level in the gearbox by means of the dipstick. (See Fig. 21.) If necessary, replenish with one of the recommended Automatic Transmission Type "A" Fluids, to the level marked on the dipstick. (See page 29.)

(Access: Remove rubber bung in floor in front of front passenger's seat.)

### 10.—Carburettors.

Inspect oil level in oil reservoir of automatic air valve guide, and top up with the recommended oil. (See page 30.)

### 11.—Oil Bath Air Cleaner.

Every 1,000 miles, the oil container and the filler element should be removed by unscrewing the long bolt which passes through the top of the silencer.

The oil container should be emptied and carefully cleaned, the filter element being thoroughly washed in petrol and allowed to dry.

Replace the element and refill the oil container with oil "A" to the indicated level, and refix in position.

NOTE.—The cleaner should be serviced at more frequent intervals if the car is being operated under very dusty conditions. (See page 55.)

## Lubrication and Maintenance

### EVERY 5,000 MILES

#### 1.—Engine Oil Filter.

Remove felt element and washers, and discard. Replace with new element and washers. Refill bowl with oil, re-assemble and check that cover joint is oil tight. (See page 42.)

(Filter on right-hand side of engine crankcase.)

**2.—Engine Oil Sump.**

When engine is warm drain crankcase and refill with a recommended oil to the correct level.

**3.—Rear Axle.**

Inspect oil level in rear axle when warm by removing level plug (Fig. 24), and, if necessary, top up with correct oil to level of hole. (See page 69.)

*If the correct oil is not obtainable, do not add a different oil, but if replenishment is necessary, drain off and refill with an alternative oil as directed on page 30.*

**4.—Steering Box.**

Remove plug and fill casing with correct oil to mouth plug of orifice. (See page 71.)

**5.—Ignition Governor.**

Remove the distributor cover and lift off rotor. Apply two or three drops of oil "A" to governor spindle. (See page 97.)

**6.—Contact Breakers.**

Apply one drop of oil "A" with oil-can to the pivot pin of each rocker arm. (See page 97.)

**7.—Distributor Cam.**

Apply one or two drops of oil "B" to the cam lubricator pad. (See page 97.)

**8.—Control Mechanism.**

Apply a few drops of oil "A" with oil-can to controls on steering wheel (oil hole), accelerator pedal mechanism, clutch pedal mechanism, and all other control points and bearings.

**9.—Brake Connections, etc.**

Apply liberally oil "A" with oil-can to all joints and pins of brake rods and connections, or spray with penetrating oil.

**10.—Bonnet Fasteners and Locks.**

Carefully lubricate with oil "A" bonnet fasteners and locks.

**11.—Sparking Plugs.**

The sparking plugs are Champion Type N8B, 14 m/m. non-detachable. Plugs should be serviced on special plug cleaning and testing machine, which should be available in all service stations. Set gaps to .025" (.635 m/m.).

**EVERY 10,000 MILES****1.—Starter Motor.**

Remove plug from front cover of reduction gear casing, and fill to plug orifice with oil "B".

**2.—Dynamo.**

Inspect brushes for wear; to do this, unscrew securing screws and remove cover to expose brushes. (See page 90.)

If renewal is necessary, remove dynamo, clean out dust and fit new brushes, making sure that they are bedding correctly on the commutator. Refit dynamo. (See page 90.)

**3.—Hydraulic Shock Dampers.**

Inspect oil level and add more oil if necessary.

*Use only correct oil.* (See page 30.)

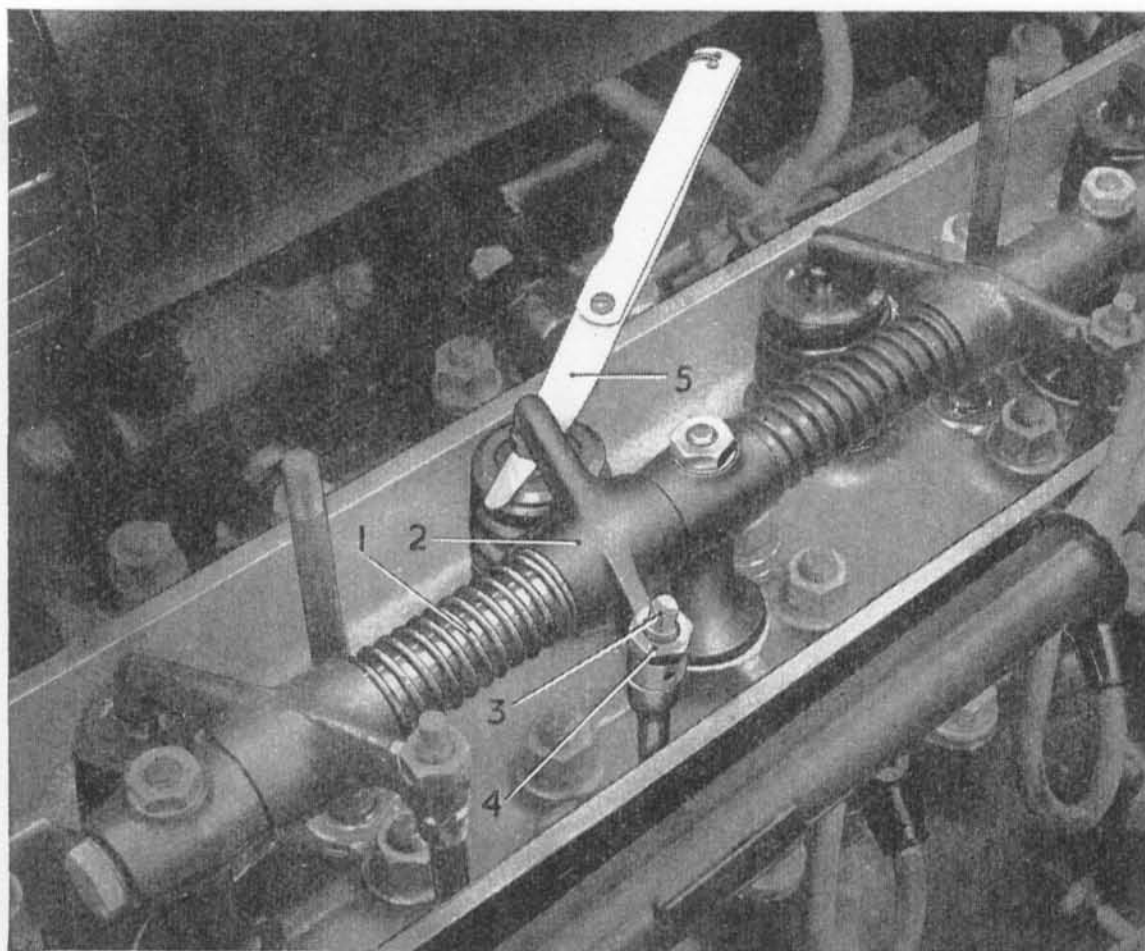


Fig. 3.—ADJUSTING THE INLET VALVE ROCKER CLEARANCES.

- |                              |                  |
|------------------------------|------------------|
| 1. Rocker shaft.             | 4. Locknut.      |
| 2. Rocker.                   | 5. Feeler gauge. |
| 3. Ball ended contact screw. |                  |

#### 4.—Universal Joints and Propeller Shaft.

Inject grease by means of grease-gun into lubricator located at centre of each universal joint, and also into the lubricator on the sliding joint. (See Fig. 23.)

#### 5.—Valve Rocker Clearances.

Check the inlet valve rocker clearances and reset if necessary.

This operation should be performed *when the engine is cold*.

The method of adjusting the valve rocker clearances is illustrated in Fig. 3.

Before commencing to adjust a tappet, it should be ascertained that the lower tappet operating the push rod is on the base circle of its operating cam. This is best done by turning the crankshaft by hand until the valve has opened and closed, and then cranking round half a revolution beyond this point.

The ball ended contact screw (3) is screwed into the rocker and locked with a nut (4). On releasing the nut the screw can be turned by means of the special spanner provided.

The correct clearance for the inlet rockers is .006" (.152 m/m.). A feeler gauge is provided in the tool kit, and is shown in position (5), for measuring the clearances

As each contact screw is adjusted, its locknut should be securely tightened up.

The correct clearance for the exhaust tappets is .012" (.305 m/m.), *with the engine cold*. These should need no attention between de-carbonising periods of the engine.

#### 6.—Air Cleaner (Standard Type).

Remove cleaner element from front end of silencer, after unscrewing the wing-nut and taking off the end cover. Carefully wash element in petrol or paraffin and afterwards oil with oil "A". Drain off excess oil before refitting.

It should be noted that if the car is being run under particularly dusty conditions, the element may need cleaning more frequently. (See page 55.)

#### 7.—Doors.

Oil lock bolts and hinges with oil "A".

#### 8.—Hydraulic Master Cylinder.

Remove the filler plug (1), Fig. 20, and check the fluid level, top up if necessary with the recommended fluid (see page 30) so as to maintain the level at one inch below the filler cap. (Access through trapdoor to battery.)

**EVERY 20,000 MILES****1.—Gearbox.**

Drain out all the fluid by removing the drain plugs from the fluid coupling casing and the gearbox sump, and refill with the correct type of fluid. (See page 29.)

Detailed instructions are given on page 67.

**2.—Fuel Filters.**

Remove and clean gauzes of rear filter, located on cross-member of frame in front of main tank. Drain and clean filter sump. (See page 49.)

Also, remove and clean gauze filter on fuel inlet to carburetter float chamber, taking care, first, to see that the ignition is switched off, and fuel pumps are therefore inoperative. (See page 49.) (Access to rear filter through cover in floor of luggage boot.)

**3.—Fuel Tank.**

*Release*—but do not remove—drain plug at bottom of main tank to allow any accumulated water to escape. (See page 49.)

**4.—Rear Axle.**

Drain axle when warm, and refill. Approximately  $1\frac{3}{4}$  pints of oil will be required.

*None but the recommended oil should be used*, and this should be warmed before inserting.

**5.—Chassis Lubrication System.**

Remove and discard felt strainer pad, located at base of chassis oil pump. (See page 39.). Replace with new pad.

## CHAPTER III

## Centralised Chassis Lubrication

*General — Foot-operated Oil Pump — Drip Plugs.*

**General.**

A foot-operated pump, with which is combined an oil reservoir, is located on the front of the dashboard, and supplies oil under pressure for chassis lubrication.

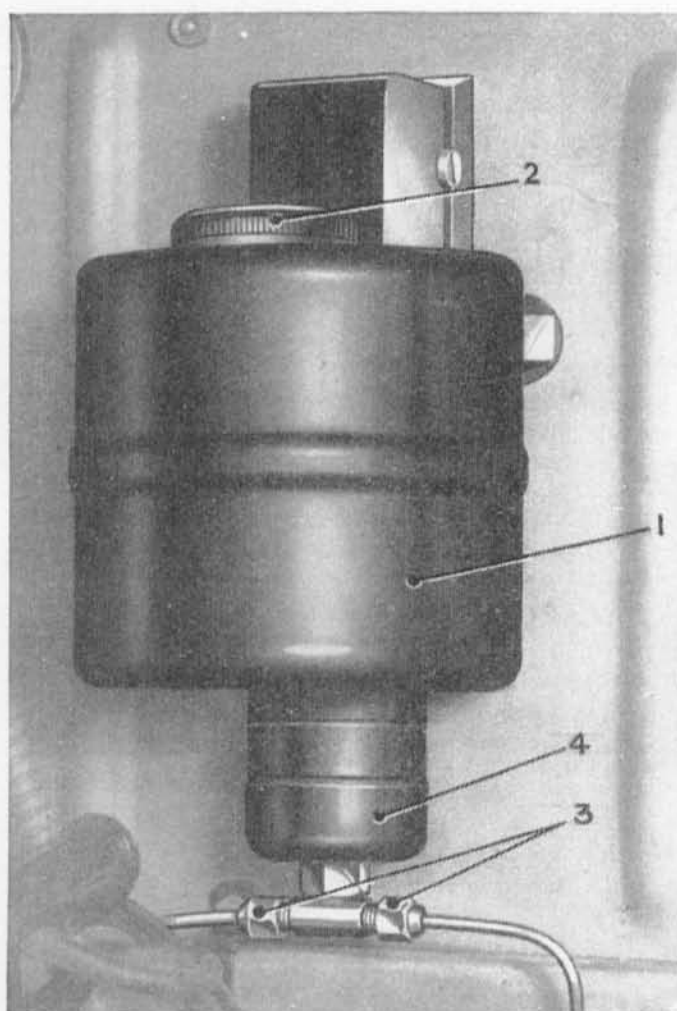


Fig. 4.—CHASSIS OIL PUMP AND RESERVOIR.

- |                |                 |
|----------------|-----------------|
| 1. Reservoir.  | 3. Pipe unions. |
| 2. Filler cap. | 4. Strainer.    |

A diagram of the complete system is given in Fig. 5, the piping being coloured red. Red discs indicate the positions of drip plugs, and the rating of each is given in parentheses against the description of the part lubricated.

**DIAGRAM**  
**CHASSIS LUBRICATION SYSTEM**

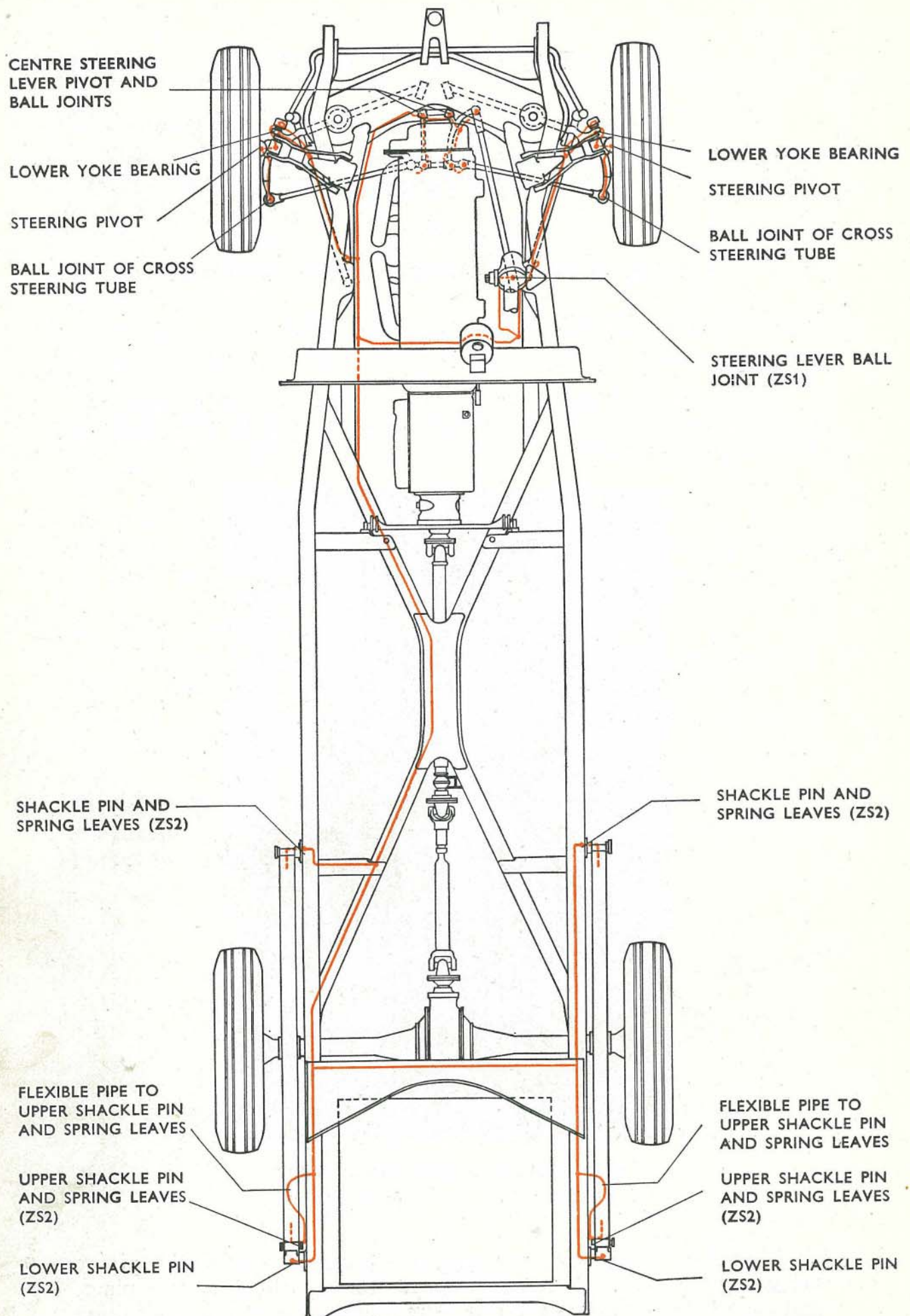


Fig. 5.—DIAGRAM OF CHASSIS LUBRICATION SYSTEM.

### Foot-operated Oil Pump.

The chassis oil pump is shown in Fig. 4. Normally no attention to the system is necessary beyond filling the reservoir with the correct oil (see page 30), after removal of the filling plug (2), as directed on page 31.

It should be filled to about one inch from the top of the filler cover.

When the reservoir is nearly empty it will be found that the pedal returns instantly after depression, due to the presence of air in the system.

On the other hand, if the pedal takes an abnormal length of time to return to its raised position, this may indicate that the felt strainer located at the bottom of the reservoir is choked. Under these circumstances a new felt strainer must be fitted.

This is arranged at the bottom of the reservoir, and is removed by disconnecting the two unions (3), and unscrewing the cap (4). An aluminium distance washer, the felt strainer pad, and a wire gauze support can then be taken out.

When replacing the parts, the wire gauze support should be refitted in the cap first, followed by a new felt pad and, finally, the aluminium distance washer *with its recessed face towards the felt pad*. Packing washers are provided on either side of the aluminium washer, and it should be observed that these are in position.

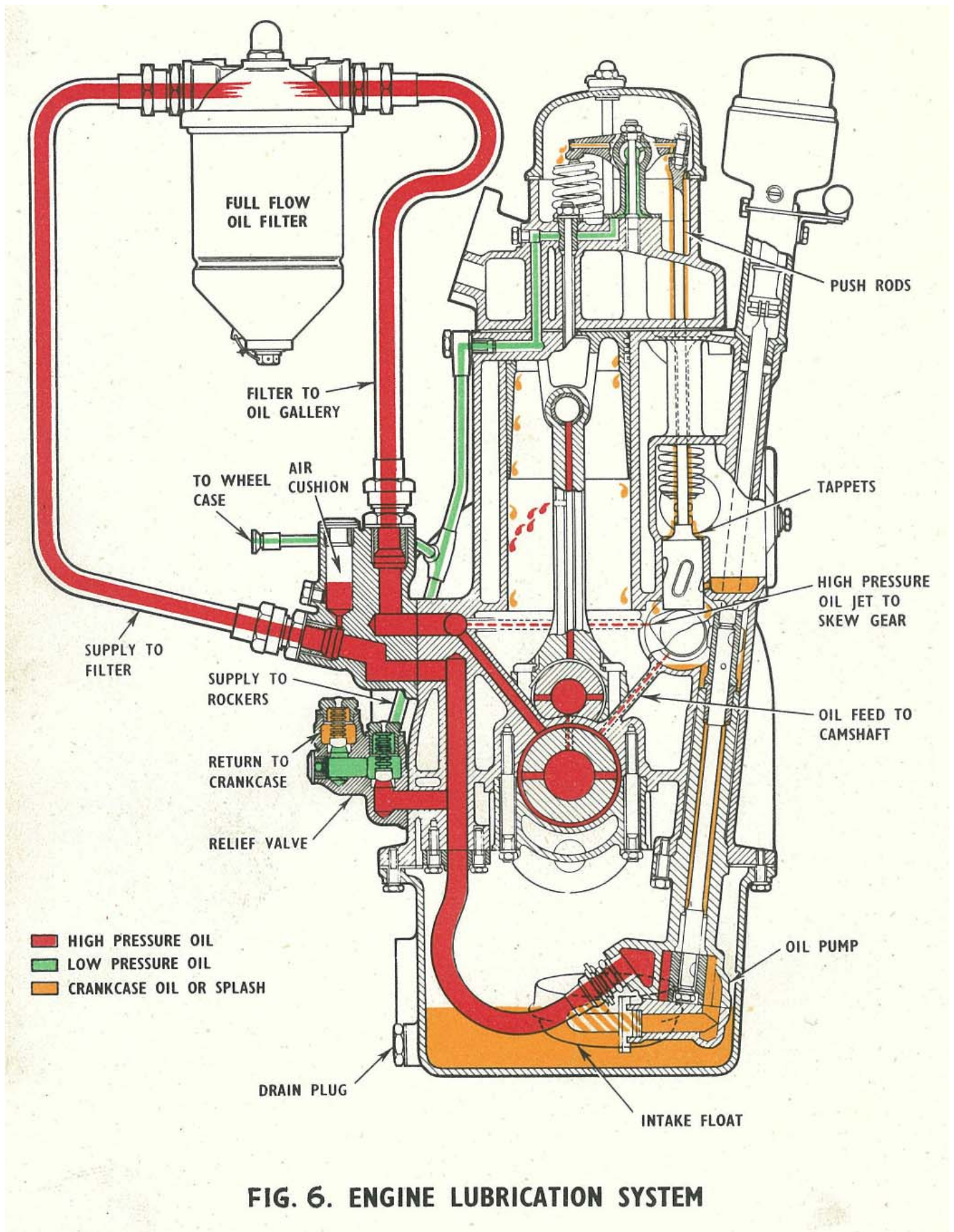
Normally, the felt strainer pad should be discarded and a new one fitted every 20,000 miles, as directed on page 36. It should never be necessary further to dismantle the pump.

### Drip Plugs.

The drip plugs are non-adjustable and non-demountable, and are lettered and numbered to indicate their shapes and relative rates of oil emission respectively, a higher number indicating a greater rate.

The drip plugs never require cleaning, and, being non-demountable, no attempt must be made to take them apart. If one is suspected of being defective, it should be replaced with a new plug of the same rating. (See Fig. 5.)

**DIAGRAM**  
**ENGINE LUBRICATION SYSTEM**



## CHAPTER IV

## Engine Lubrication System

*Filling the System—Oil Pump—Oil Filter—Crankshaft and Connecting Rods—Relief Valves—Valve Rockers, Push Rods and Tappets—Camshaft—Oil Sump—Oil Level Indicator—Oil Pressure—Oil Temperature.*

The engine lubrication system is of the forced feed, full-flow filtered type, and is diagrammatically illustrated in Fig. 6.

Recommended oils will be found on page 29.

**Filling the System.**

The system is filled, or topped up, by opening the oil filler cap (1, Fig. 7), on the inlet rocker cover, and pouring in the required amount of recommended oil.

It should be appreciated that it takes a little time for the oil to drain through to the sump, especially if the oil is cold.

The level of the oil should be frequently checked with the dipstick (2, Fig. 7), **when the engine is not running**, and the system regularly topped up as required (see page 31), so as to keep the level of the oil up to the "Max" mark.

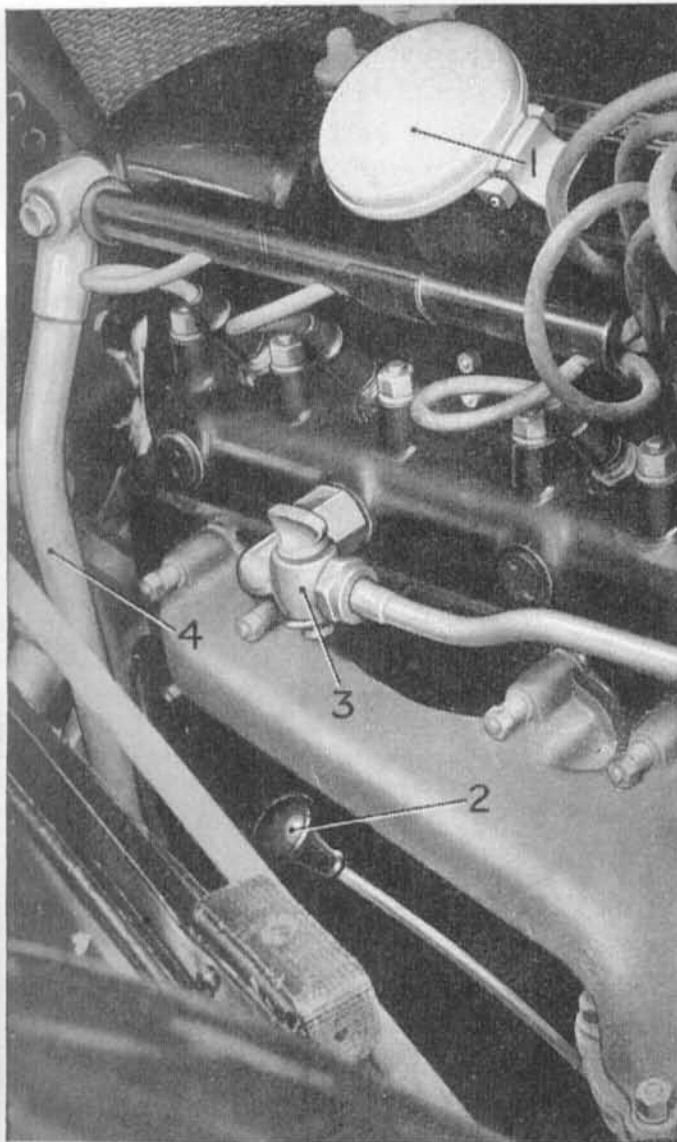


Fig. 7.—FILLER CAP AND DIPSTICK.

- |                           |                          |
|---------------------------|--------------------------|
| 1. Engine oil filler cap. | 3. Heater—Isolating tap. |
| 2. Dipstick.              | 4. Breather pipe.        |

### Oil Pump.

A gear type pump mounted in the lower half of the crankcase is driven by means of a vertically-mounted shaft and skew gears from the centre of the camshaft. A coupled extension of this shaft also drives the ignition distributor.

The oil intake from the sump is of the floating gauze filter type, ensuring the collection of clean oil, free from sludge.

Oil is drawn by the pump through the floating intake and delivered direct to the full-flow filter.

### Oil Filter.

The full-flow filter is fitted on the right-hand side of the crankcase as shown in Fig. 8, and, as previously stated, oil is fed direct from the pump to the filter, and, after passing through the filter, is returned via the relief valves to the main oil gallery, as shown in the diagrammatic illustration, Fig. 6.

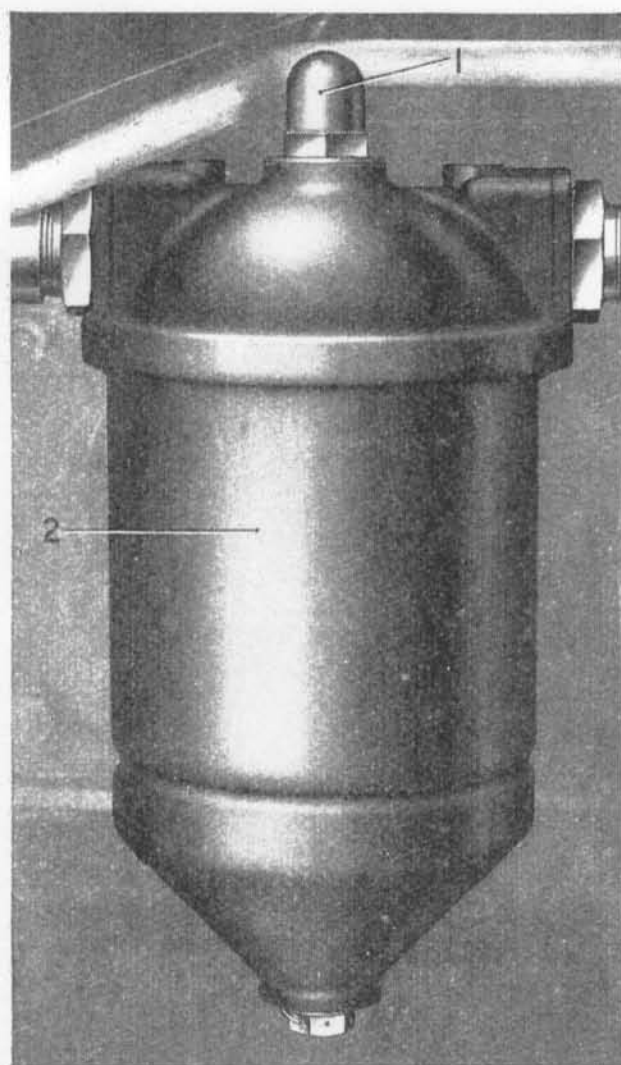


Fig. 8.—OIL FILTER.

1. Retaining bolt. 2. Filter bowl.

Every 5,000 miles, as directed on page 32, the filter element should be discarded and replaced with a new one. It is not practicable to clean the felt element, and no attempt must be made to do so.

The most convenient method of performing this operation is to remove the carburetters complete, and it is therefore suggested that this periodic maintenance should be undertaken by a qualified Service Station.

To remove the element, remove the lock plate securing the domed nut (1, Fig. 8), unscrew the central fixing bolt and remove the bowl complete with the canister. Dismantle the canister by unscrewing the knurled nut from the bottom cover and extract the felt element and the two felt washers. Discard, and replace with new ones.

Re-assemble the canister and replace in bowl. Fill bowl with oil and replace in position.

*(To be inserted in Bentley Handbook No. XI, to face page 43.)*

## **OIL TEMPERATURE**

An oil temperature gauge is fitted on the facia board. The temperature reading may be from 80°C to 110°C depending on atmosphere temperature and conditions of driving.

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LONDON.

When refitting the bowl, ensure that the rubber washer is in good condition and correctly fitted. On next running the engine, it should be inspected for oil leaks around the filter joint.

### Crankshaft and Connecting Rods.

The filtered oil is conveyed to the relief valves, from where the main oil supply, controlled at approximately 25 lbs. per square inch, is delivered to the main oil gallery incorporated in the crankcase casting. From there it is fed through oilways drilled in the crankcase webs to each of the seven crankshaft main bearings, which are of the copper-lead-indium lined steel shell type.

The crankshaft journals and crankpins are bored for lightness and to act as oil conduits, the ends of the holes being plugged with steel caps.

All the main bearings have circumferential oil grooves, and radial holes are drilled in the crank journals to register with these grooves.

Oil from the main bearings passes to the bore of each journal through the radial transfer holes in the crankshaft and then to the crankpins through diagonal ducts drilled in the crankshaft webs, and so through radial holes to each crankpin big-end bearing, these bearings being of a similar type and material to that of the main bearings.

Each connecting rod is drilled to convey oil to the gudgeon pin bearing, the drilling passing through the big-end bearing shell. Small holes are cross-drilled into this oilway to allow a fine squirt of oil to lubricate the cylinder walls.

Two radial holes in the crankpin ensure communication, twice per revolution, with the oilway up the connecting rod. Thus, all the crankshaft and connecting rod bearings are supplied with oil under pressure.

### Relief Valves.

The double relief valve unit is mounted on the right-hand side of the crankcase. (See Fig. 9.)

The two valves are in series, and their combined effect is to

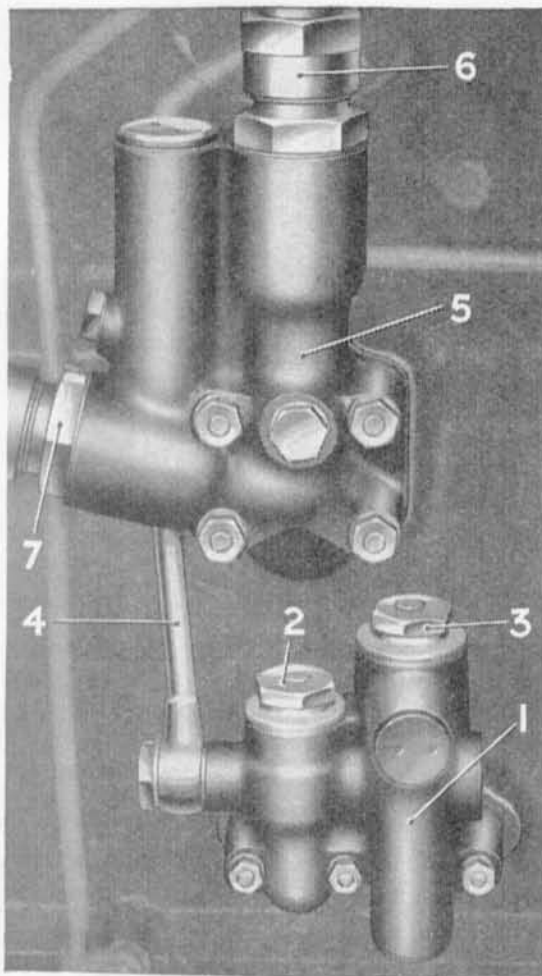


Fig. 9.—RELIEF VALVES.

1. Relief valve unit.
2. H.P. valve.
3. L.P. valve.
4. Feed to rockers.
5. High pressure oil connection.
6. Return from filter.
7. To filter.

regulate the pressure of the main high-pressure supply to the crankshaft and connecting rod bearings to approximately 25 lbs. per sq. inch.

Oil passing the high-pressure valve (2, Fig. 9) enters the low-pressure chamber and from there via a pipe (4) to the inlet rocker shaft.

In order to ensure a supply of oil to the low-pressure system under all conditions of running, small slots are cut in the seating of the high-pressure valve (2).

If it is suspected that the relief valves are not working properly, they can be inspected by removing the plugs (3 and 2) above the low and high-pressure valves respectively.

In each case the valve spring will be found retained on the plug, and when removed, the valves may be lifted out for inspection and cleaning of valves and seats.

No attempt must be made to alter the spring setting by interfering with the springs themselves, or by varying the number of washers under the plugs.

Care must be taken to replace all parts in a perfectly clean state.

### Valve Rockers, Push Rods and Tappets.

The low-pressure oil supply from the relief valves is conveyed via a pipe and oilway through the cylinder block and head to the centre pedestal of the inlet valve rocker shaft, which is drilled longitudinally, and also radially, in the plane of each rocker, to lubricate the rocker arm bearings. The rocker arms are also drilled, the holes running through the bearing bushes, to lubricate the push-rod ball ends and the ends of the valve stems.

Each valve stem is provided with a packing gland, held in position by the inner valve spring, which prevents excess oil from percolating down the valve guides. Oil is returned from the rocker casing to the crankcase through the push rod tunnels.

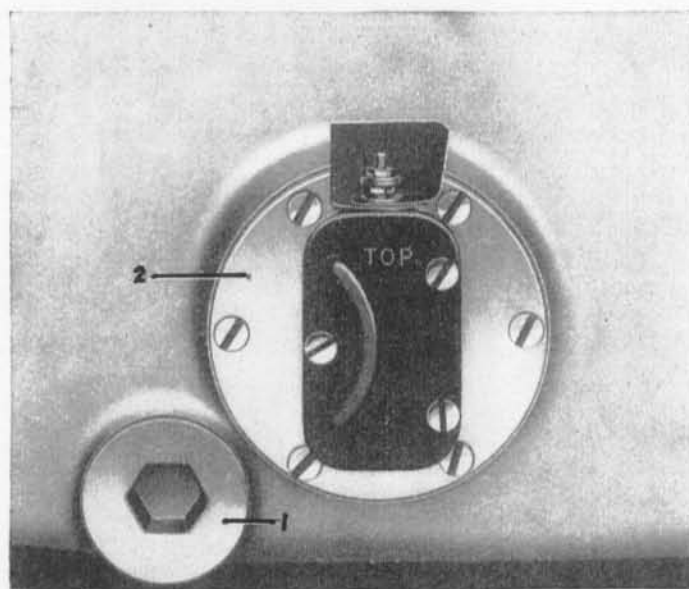


Fig. 10.—CRANKCASE DRAIN PLUG.

1. Drain plug. 2. Oil level indicator float unit.

### Camshaft.

The camshaft, driven by single helical gears, is carried in four plain bearings, these being lubricated with high-pressure oil through drillings in the crankcase webs.

The camshaft driving gears are lubricated by the jet in the wheelcase, from the low-pressure system.

### Oil Sump.

Under normal circumstances, and with proper attention, the oil filter will maintain the oil in a clean condition.

Owing to the risk of dilution of the oil, however, it is advisable to drain the sump and renew the oil every 5,000 miles, as directed on page 33.

To drain the oil, a plug (1, Fig. 10) is provided in the crankcase sump, which should be unscrewed and the oil allowed to drain out when the engine is warm.

On replacing the plug, ensure that the joint washer is sound and in position.

### Oil Level Indicator.

In order that a quick check may be obtained, the petrol gauge on the instrument panel has been so arranged that by depressing the switch (see Fig. 1), it will register the approximate quantity of oil in the engine sump.

The gauge is electrically connected to a float unit fitted into the right-hand side of the crankcase sump (2, Fig. 10).

The reading should be taken when the car is standing as nearly level as possible.

The amount of oil should be maintained at "**Full**", this corresponding with the "**Max**" mark on the dipstick, and showing that there is approximately 16 pints of oil present. A red line on the gauge indicates "minimum", and the engine should never be run with the oil level below this mark.

### Oil Pressure.

Under normal conditions of engine temperature and speed, the instrument board pressure gauge should read approximately 25 lbs.

On starting the engine from cold, however, a higher oil pressure will be indicated, but this need not cause alarm, as the pressure will fall when the engine becomes warmed up.

When the engine is idling and hot, the pressure may fall to 4 lbs., but provided that it increases as the engine speed increases, this is in order.

The car must on no account be run if the gauge reads as low as this *continuously*.

Such a persistently low pressure, which may be accompanied by fluctuations of the gauge needle, may be due to one or more causes.

In the first place, it should be ascertained that there is sufficient oil in the sump by referring to the oil level indicator.

If this is found to be in order, the trouble may be due to a particle of foreign matter having lodged on one of the relief valve seatings and preventing the valve from closing. If the latter is suspected, the relief valve should be inspected and cleaned as directed on page 43.

**Oil Temperature.**

An oil temperature gauge is fitted on the facia board. The temperature reading may be from  $80^{\circ}\text{C.}$  to  $110^{\circ}\text{C.}$ , depending on atmospheric temperature and conditions of driving.

## CHAPTER V

## The Fuel System

*The Fuel System—Fuel Pumps—Faulty Operation of Pumps—Fuel Tank—Fuel Filters—Fuel Gauge—The Carburetters (Action)—Carburetter Adjustment—Air Cleaners.*

**The Fuel System.**

The fuel supply from the 18-gallon tank at the rear of the chassis is by means of a double electric pump (1 and 2, Fig. 11), mounted inside the right-hand side chassis frame member below the rear floor.

A pipe is arranged along the right-hand side frame member conveying fuel from the tank to the pumps. The pipe is seen at (4). A filter is provided on this pipe line, being located on the frame cross-member immediately in front of the tank, as shown in Fig. 12.

Location of a filter on the suction side of the pumps ensures that the latter, as well as the carburetter, are protected from the deleterious effects of dirt or sediment in the fuel.

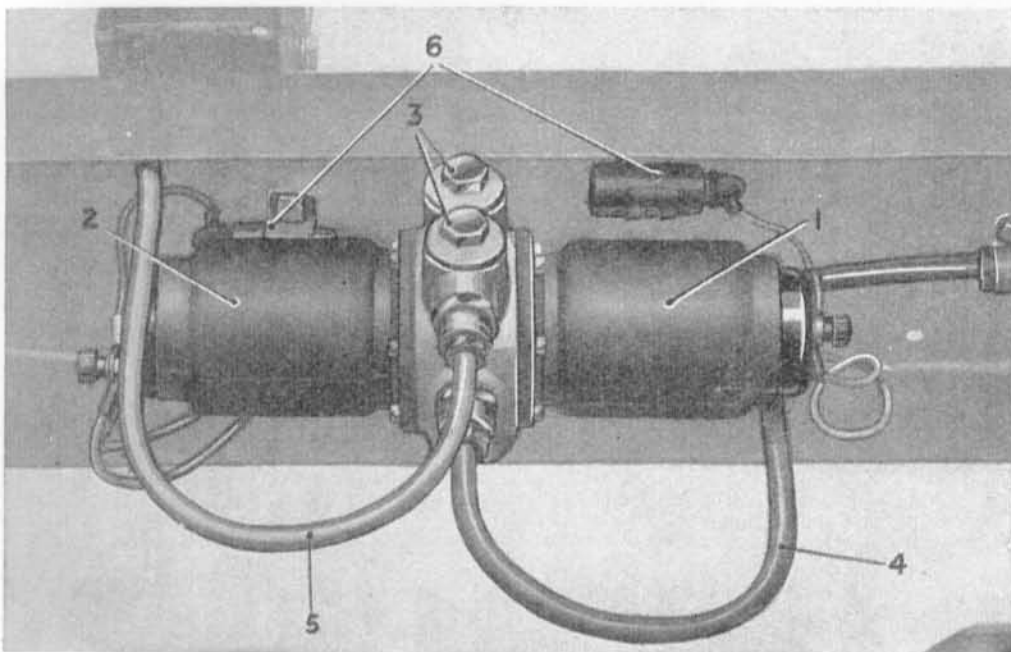


Fig. 11.—FUEL PUMPS.

- |                |                           |
|----------------|---------------------------|
| 1. Fuel pump.  | 4. Inlet pipe.            |
| 2. Fuel pump.  | 5. Outlet pipe.           |
| 3. Valve caps. | 6. Suppressor condensers. |

From the filter the fuel passes to the suction side of the pumps, and is delivered to the carburetter float chamber by way of a pipe (5), and another strainer located at the float chamber.

### Fuel Pumps.

The fuel pumps (1 and 2, Fig. 11) are of the electric, solenoid-operated, diaphragm type, and comprise two independent pumps complete with diaphragms, solenoids, contact trip mechanisms, and suction and delivery valves.

Both pumps deliver into a common chamber and are simultaneously rendered operative when the ignition and master switches are "On".

Duplicate pumps are provided primarily to ensure reliability. They also ensure that there shall be no starvation of fuel at maximum engine demands.

If it should ever be necessary to disconnect the fuel pipes at the pumps, it is important first to release the cover of the rear filter. (See page 49.) This will prevent loss of fuel by syphoning, due to the location of the pumps below the level of the main tank.

The current supply for the pumps is taken through the ignition fuse.

### Faulty Operation of Pumps.

This would cause failure, or shortage, of fuel supply to the carburetter, and may be due to one or more of the following causes:—

1. *Shortage of fuel in the tank.*—This should have caused the green warning lamp to light, but if the tank has been allowed to run dry, the pumps will tick continuously and noisily. On severe gradients and side slopes, these symptoms may occur before the tank is completely empty, due to surging of fuel in the tank, which may uncover the suction pipe.
2. *Air leak on the suction side.*—Either at the filter or on the pipe line. A slight air leak will cause the pumps to work rather faster than normal, but if sufficiently bad to cause a complete air lock, the pumps will tick continuously and noisily as if short of petrol.
3. *Pump valves not seating.*—The delivery valves do not give any easily detectable signs of their functioning. If a suction valve is not seating, the pump will tick continuously when the engine is switched on but not running. It is probable that foreign matter is lodged under one of the valves.

If the above is suspected, remove the caps (3, Fig. 11); the valves and valve cap assemblies may then be lifted out and cleaned.

4. *Sluggish operation of the pumps.*—Check that the electrical connection and contact points are clean and in proper order. Verify, by alternately disconnecting the pipes at the unions, that it is the pump, and not due to a blockage in the pipe line. If with the pipes disconnected the pumps still work sluggishly, the unit should be removed and returned to Messrs. Bentley Motors (1931) Ltd., or one of their "Special Retailers" for overhaul.

**Note**—The pumps will not work with both petrol pipes disconnected; in such circumstances the pumps must be earthed to the chassis frame.

### Fuel Tank.

The fuel tank is of 18 gallons capacity.

Every 20,000 miles, as directed on page 36, the drain plug at the bottom of the tank should be released. It is not necessary to remove the plug. It need only be unscrewed a turn or two, and must afterwards be securely retightened. This will flush out any accumulation of sediment or water.

### Fuel Filters.

The rear filter, shown in Fig. 12, is provided with two circular gauzes located above a large settling sump. Fuel passes upwards through these gauzes, and dirt settles on their lower faces and in the sump.

The filter should be cleaned every 20,000 miles, as directed on page 36.

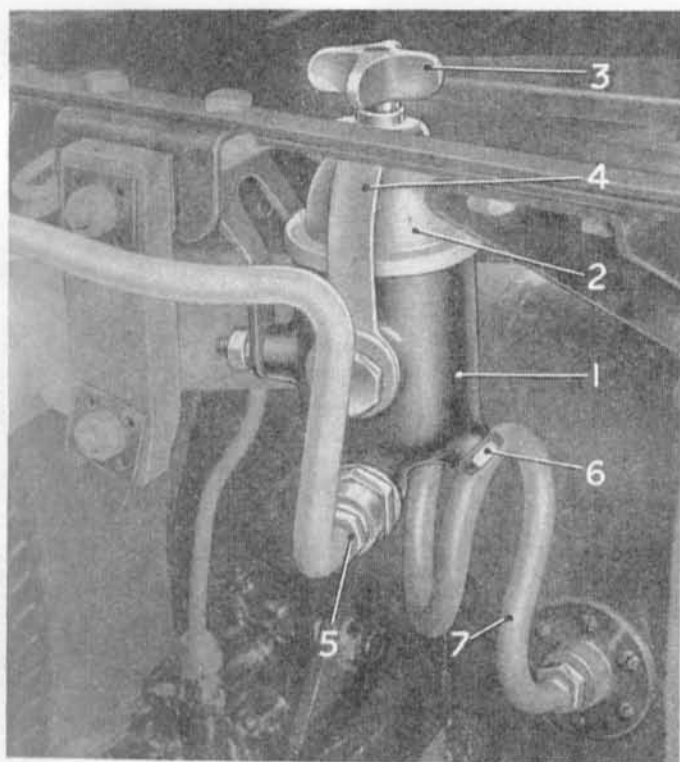


Fig. 12.—REAR FILTER.

- |               |                 |
|---------------|-----------------|
| 1. Body.      | 5. Outlet pipe. |
| 2. Cover.     | 6. Drain plug.  |
| 3. Cover nut. | 7. Inlet pipe.  |
| 4. Yoke.      |                 |

When refitting the cover, care must be taken that the cork washer is sound, and properly in position, and the nut (3, Fig. 12) tightly screwed up. Any leaks on this—the suction side of the pumps—although they may not be apparent by leakage of fuel, will impair the proper functioning of the pumps by admitting air.

In addition, a small gauze filter is fitted in the petrol union on each carburetter. These should be removed and cleaned every 20,000 miles, as directed on page 36.

Removal is effected by unscrewing the two union nuts (1, Fig. 13). The filter gauzes can then

be removed and cleaned in petrol.

When refitting the parts, care must be taken to replace each gauze with its open end outwards and that the aluminium joint washers are in position on the unions.

### Fuel Gauge.

The fuel gauge registers when the master and ignition switches are "On".

As mentioned on page 45, this gauge also registers the amount of oil in the engine sump, when the appropriate switch is depressed.

### The Carburetters (Action).

Two carburetters of the conventional S.U. type are fitted as shown in Figs. 13 and 14, one being shown in section to illustrate the principal parts.

This type of carburetter automatically adjusts both its choke and jet area in accordance with the demand of the engine as determined by the degree of throttle opening, the engine speed, and the load against which the engine is operating.

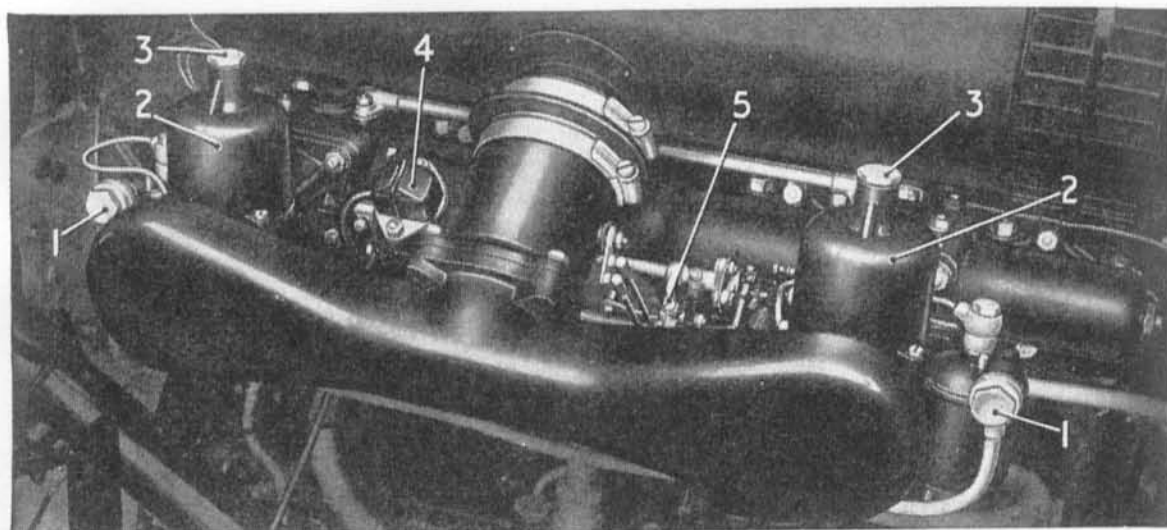


Fig. 13.—CARBURETTERS IN POSITION ON ENGINE.

1. Fuel inlet and filter.
2. Air valve chamber.
3. Hydraulic piston.
4. Solenoid.
5. Idle Adjustment Screw.

This is effected by using the manifold depression to levitate a piston or air valve carrying a tapered needle which regulates the fuel passage. The upper side of the piston is connected by passage ways to the base of the piston facing the throttle valves, and is thus subject to the depression in the throttle body.

As the air flow through the carburetter increases, so the depression between the piston and the throttle valve increases, thereby causing the piston to rise and admit more air, and consequently the needle to be withdrawn from the jet, thus allowing more fuel to flow. Similarly, as the air flow falls, due to reduced engine requirements, so the piston falls, maintaining a state of balance whereby the piston

keeps at a certain height, dependent on engine speed and throttle opening. An approximately constant air velocity, and hence an approximately constant degree of depression, is maintained in the region of the fuel jet, even under idling conditions and so obviates the necessity for a separate idling jet. A single jet only is employed in the carburetter.

### Automatic Air Valve.

The top portion of the guide spindle carrying the air valve piston is hollow, forming a well surrounding a small stationary damper piston, suspended from the suction chamber cap by means of a rod. The hollow interior of the spindle contains a quantity of thin engine oil, and the slight retarding effect upon the movement of the air valve assembly, occasioned by the resistance of this small piston, provides the momentary enrichment desirable when the throttle is abruptly opened. The damper piston is of a composite construction and offers little resistance to the passage of the oil during the downward movement of the main piston.

Every month, as directed on page 32, the oil reservoir cap nut (3) (Fig. 13), should be unscrewed and the plunger withdrawn, *great care being taken to avoid damage to the plunger rod by bending*; the reservoir should be topped up, if required, with the recommended oil, so as to maintain the level of the oil to the top of the guide rod only. The plunger should then be replaced, taking care that no dirt or grit is present. A slight steady pressure may be required to displace the oil sufficiently to allow the engagement of the thread of the oil reservoir cap nut.

If it is suspected that the automatic air valve is not working correctly, the air intake should be removed, and a check made by lifting the piston with the fingers, when it should be noted that the piston falls quite freely on to its seat when released.

If any sticking or sluggishness is apparent, it will be necessary to dismantle the air valve assembly: first remove the hydraulic piston damper, next remove the three screws, and lift off the air valve chamber. The piston valve can be then lifted out, *the utmost care being taken not to bend or damage its depending needle valve, or to bruise the valve in any way*. The valve, chamber and guide should be carefully wiped with a piece of clean cloth dipped in petrol, and the piston rod ONLY lubricated with a few drops of thin oil.

*No polishing paste or abrasives should be used to clean the valve or valve chamber.*

The suction disc (5, Fig. 14) does not touch the walls of the valve chamber, there being a small clearance, and it is centralised solely by the piston rod working in the guide. Therefore, any sluggishness in movement is probably due to dirt in the guide, or on the valve chamber walls.

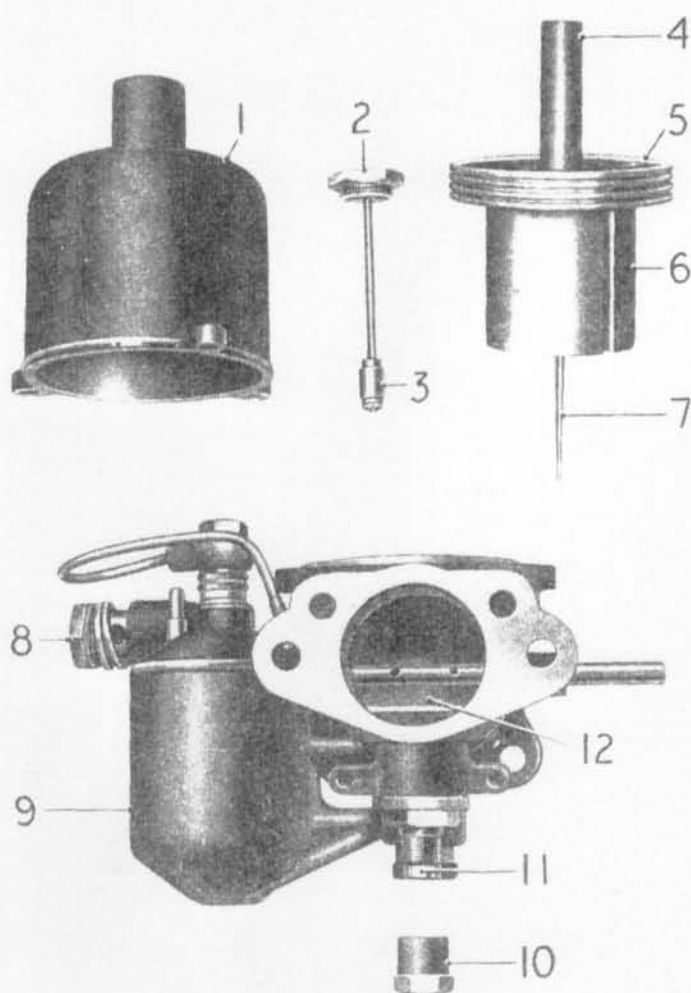


Fig. 14. - CARBURETTER - EXPLODED VIEW.

1. Air valve cylinder.
2. Oil cap nut.
3. Hydraulic damper piston.
4. Piston guide rod.
5. Suction disc.
6. Piston, air valve.
7. Needle valve.
8. Fuel inlet and filter.
9. Float chamber.
10. Cap nut.
11. Mixture adjustment screw.

When replacing the valve, it will be noticed that there is a slot which must engage a tongue provided on the carburettor body. The air valve chamber can only be replaced in one position, the three screw holes being unevenly spaced to ensure this.

If the above treatment does not effect a cure, the fault may be due to a bent jet needle or alternatively to the needle fouling the jet. If this is suspected it is recommended that communication is made with Messrs. Bentley Motors (1931) Ltd., or one of their "Special Retailers".

The needle valve is secured in position by

means of a grub screw and if it should be necessary to remove this, as, for instance, when replacing an accidentally damaged needle, it must be particularly noticed that the location of the valve is determined by a shoulder. The valve should be pushed into the piston until this shoulder is just flush with the lower face and the grub screw tightened.

If a needle should be accidentally damaged, a new one must be obtained from either Messrs. Bentley Motors (1931) Ltd., or one of their "Special Retailers". Code letters are stamped on the end of the needle, denoting the needle characteristics, and it is essential that only one of the same coding is fitted.

### Throttle Control.

The quantity of mixture for slow running is determined by means of an adjustable screw stop on the front carburetter (5, Fig. 13) which limits the closing movement of both throttles. This is so adjusted that the engine will idle slowly but reliably when the accelerator pedal is released, no hand control being provided.

### Automatic Choke Control.

The automatic system consists of:—

- (i) An out-of-balance butterfly valve in the common air intake pipe, indirectly coupled to a diaphragm which is subject to induction pipe depression.
- (ii) A small electro-magnet wired in parallel in the starter relay circuit, which holds the butterfly closed when starting.
- (iii) A cam for "fast idle", loose-coupled to a pick-up lever connected to the butterfly valve spindle.
- (iv) A thermostatic spring unit housed in a suitable recess in the water jacketing of the induction manifold.

As the engine cools, the thermostatic spring also cools, and gradually gains tension. The thermostatic spring is, however, unable to close the choke valve until the throttle stop screw has been lifted from the fast idle cam.

*It is therefore necessary to depress the accelerator pedal slightly and then allow it to return to its normal position before attempting to make a start.*

On releasing the accelerator pedal, the throttle opening is greater than that for normal idling, by virtue of the extra stop resting on the "fast idle" cam.

When the starter button is operated, the electro-magnet, wired in parallel, is energised and the armature on the butterfly spindle holds the butterfly valve in the fully closed position. Immediately the engine fires and runs and the starter button is released, the circuit to the electro-magnet is broken, and therefore the power to hold closed the butterfly valve is disconnected.

As soon as the engine is running, the depression created in the induction pipe is exerted on the diaphragm which transmits its energy to the loose lever on the butterfly spindle. This in turn catches up on a peg and turns the spindle to open the butterfly valve a pre-determined amount, against the loading of the thermostatic spring.

Assuming that the accelerator pedal has not been moved, the engine will continue to run at a speed determined by the starting position of the "fast idle" cam. The engine coolant jacketed pocket

holding the thermostatic coil units will gradually warm up and transmit heat to the coil. This in turn will wind up and gradually release the load on the butterfly, which will gradually open.

With the depression of the accelerator pedal for the drive away, the "fast idle" stop on the throttle shaft will move away from the cam and the cam will fall on to the pick-up lever coupled to the butterfly spindle. The loading of the thermostatic spring and the off-set of the butterfly have been so arranged that any air flow greater than that required for a "fast idle" automatically opens the butterfly sufficient for engine requirements.

### **Float Feed Mechanisms.**

These are of the usual "top feed" pattern, whereby, as the level of the petrol rises in the float chamber, a lever bearing on the top of the float moves the conical seat "needle" upwards on to its seating, so shutting off the supply.

If it is required to dismantle the float chambers, it will be more convenient to remove them bodily—after disconnecting the fuel pipes, and the small air bleed pipe to the cover—by unscrewing the hexagon plugs which secure each to their respective carburetter bodies.

When the covers are removed, care must be taken that the fulcrum pins of the levers do not fall out. They are normally retained by means of the walls of the float chambers.

The chambers should be wiped out with a piece of clean wash-leather before being refitted. When replacing them, care must be taken to see that the packing washers are in position, one above and one below the boss which couples each to the carburetter body.

### **Further Dismantling of Carburetter.**

It should never be necessary to remove any other parts of the carburetter than those referred to in the foregoing pages.

The jet assembly securing nut should not be disturbed, as the refitting of this requires special tools to ensure that the jet is accurately centralised relative to the taper needle valve.

### **Adjustment of Controls.**

There should be no necessity for any variation of the adjustments as fixed by the makers. Great care is taken during the testing of the car to secure the best settings, and these should not under normal circumstances be altered.

There are certain external adjustments, however, which are dealt with in the following paragraph.

**Setting of Idling Adjustments.**

1. The quantity of mixture for slow running is determined by means of an adjustable screw on the front carburetter (5, Fig. 13) which limits the closing movement of the synchronised throttles.
2. The strength or quality of the mixture for slow running is set by means of an adjustable screw in the base of each carburetter (11, Fig. 14). The screw operates to raise or lower the jet. Raising the jet causes the taper needle to sink farther into the orifice, so weakening the mixture. Conversely, lowering the jet enriches the mixture.
3. Remove the cap (19, Fig. 14) from the base of each carburetter to expose adjusting screw. With the engine warm and running, manipulate the screws; a coin provides an easy means of turning, so that the engine runs regularly. Any sign of "hunting" is due to too rich a mixture and one or both of the screws should be screwed farther in.

On the other hand, irregular firing, indicated by irregular pulsations from the exhaust pipe, shows the mixture to be weak, and one or both of the adjusting screws should be screwed out a little.

The correct positions having been found, replace the screw caps and sealing washers.

**Air Cleaner and Silencer (Standard Type).**

A cleaner is provided within the front end of the air silencer to prevent the passage of dust and grit to the engine.

The cleaner comprises a composite steel-wool element through which the air passes on its way to the carburetter. It is removed by unscrewing the wing nut in the centre of the end cover and removing the cover; the element may then be withdrawn.

Every 10,000 miles, unless the car is being operated under particularly dusty conditions, when the cleaning must be carried out at 5,000 miles' intervals or even less, depending upon the dust concentration, the cleaner element should be removed and carefully washed in petrol or paraffin, and afterwards oiled with engine oil. It should be thoroughly drained before refitting.

**Air Cleaner and Silencer (Oil Bath Type).**

The air cleaner is of the "oil bath type", which operates very efficiently to remove the dust from the air drawn into the carburetter. As this type of cleaner accumulates considerable dust and dirt, it requires regular cleaning every 1,000 miles, or more often according to the prevailing conditions, the frequency being more readily determined by experience in the territory in which the car is operated.

As directed on page 32, the filter element should be removed by unscrewing the long bolt (1, Fig. 15) which passes through the top of the silencer.



Fig. 15.—OIL BATH AIR CLEANER.

1. Filter-bowl retaining bolt.

2. Filter bowl.

The oil container should be emptied and carefully cleaned, the filter element being thoroughly washed in petrol and allowed to dry.

Replace the element and refill the oil container with engine oil to the indicated level, and refix in position.

### **Warning.**

On no account should the engine be kept running for any appreciable period with the car in a closed garage. There is a grave danger of people in the garage being asphyxiated, owing to the presence of poisonous gases in the exhaust.

Consequently, particular care should be taken always to open the garage doors wide before starting the engine.

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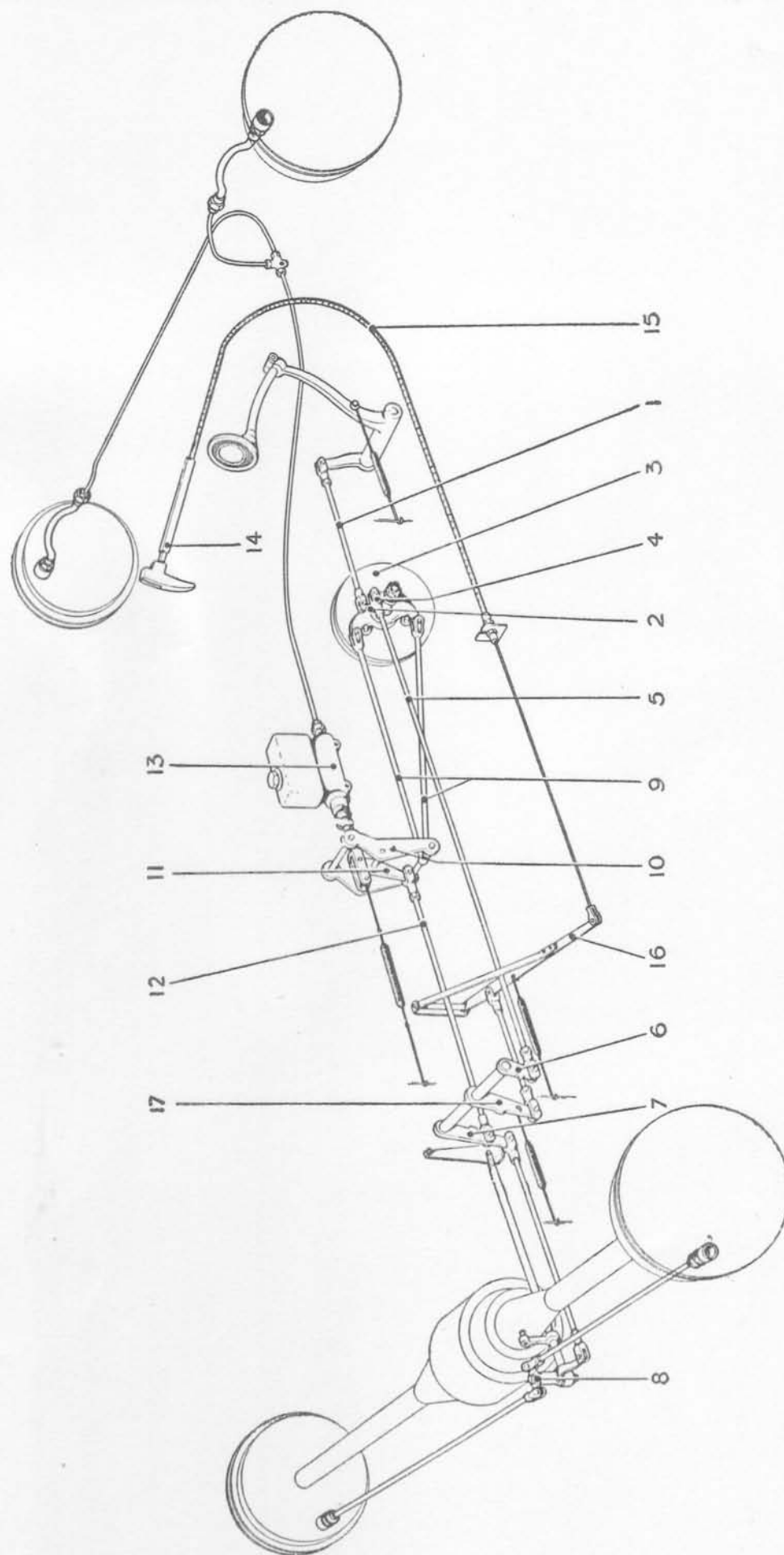


Fig. 16.—DIAGRAM OF BENTLEY BRAKING SYSTEM.—RIGHT-HAND MODEL.

## CHAPTER VI

### The Braking System

*General Description—Right-hand Model—Left-hand Model—Possible Variations—Adjustments—Adjustment of Hand Brake—Adjustment of Servo—Lubrication—Bleeding the Hydraulic System—Hydraulic Master Cylinder.*

#### **General Description.**

The Bentley four-wheel braking system is of the servo-assisted type, and comprises a mechanically driven servo motor of the dry disc-brake type, which is equally effective for either forward or backward movement of the car. Further, even should the servo be out of action, the rod operated rear brakes are still directly coupled to the pedal.

Pressure on the pedal applies the rear brakes direct in the usual manner and also engages the servo, but the front brakes, which are of the hydraulically operated type, are actuated entirely by the servo acting through the medium of a balance lever and hydraulic master cylinder.

The servo effect is distributed between the front and rear brakes, being added therefore to the direct pedal effect in the case of the rear brakes. With the leverages provided, this results in about 55 per cent. of the total braking being imposed on the front wheels, which allows for the fact that greater weight is thrown upon the front wheels during braking.

The proportioning of the servo pull to the front and rear brakes respectively is effected by a balancing lever. A separate equaliser is provided for the two rear brakes, which, with the hydraulic operation of the front brakes, ensures even braking on either side of the car.

The hand brake lever operates the rear brakes only and uses the same linkage as the foot pedal.

Diagrammatic representations of the braking systems for both the right-hand and left-hand models are shown in Figs. 16 and 17.

#### **Right-hand Model.**

A pull rod (1, Fig. 16), operated by the pedal, is coupled to a lever (2), on the servo motor shaft, the motor itself (3) being mounted on the off-side of the gearbox, and driven at approximately one-tenth of the propeller shaft speed.

The lever (2) has inclined cams formed on the face of its boss, these cams engaging, through the medium of steel balls, similar cams formed on the boss of another lever (4). From the latter a rod (5) directly actuates the rear brakes through the medium of the levers (6) and (7), which are pivoted on a bracket bolted to the "X" member of the frame, and finally, through the rear equaliser (8) mounted on a bracket suspended from the axle.

The output from the servo is taken by one of the two rods (9), according to whether the car is moving forwards or backwards, to the lever (10). This lever carries, in turn, a balance lever (11), the lower end of which is connected by the rod (12) to the rear brake lever (7), thus augmenting the direct pedal effort, while its upper end is coupled to the master cylinder (13), which actuates the front brakes.

The dashboard hand brake (14) is mounted under the facia board, convenient to the driver's right hand. The ratchet release is so arranged that should it be inadvertently knocked or pressed, the brakes will not be released. In order to release the brakes, the trigger must be fully depressed and held in this position. The hand brake is then pulled, as if applying the brakes, and this action frees the ratchet permitting the brakes to be released, provided that the trigger is still held. This device is particularly useful in preventing accidental release of the brakes when the car is parked.

To obtain this action, the trigger is not directly connected to the ratchet pawl, but compresses a spring. This spring, in turn, operates the pawl, but is only strong enough to move it out of engagement when the load has been removed by pulling on the hand brake.

The hand brake is connected by an enclosed cable (15), to a horizontal lever (16), mounted on the "X" section of the frame which provides the required leverage, and is in turn coupled to the rear brakes, through the levers (7) and (17) and the rear equaliser. The same rear brake-shoes are used, therefore, as for the pedal operation, and the application and release of the hand brake can be lightened accordingly by simultaneous application of the foot brake.

### **Left-hand Model.**

A pull rod (1, Fig. 17), operated by the pedal, is coupled via the cross rod (2), and the rod (3), to a lever (4) on the servo motor shaft, the motor itself (5) being mounted on the right-hand side of the gearbox, and driven at approximately one-tenth of the propeller shaft speed.

The lever (4) has inclined cams formed on the face of its boss, these cams engaging through the medium of steel balls similar cams formed on the boss of another lever (6). Through the latter a rod (7) directly actuates the rear brakes through the medium of levers (8) and (9), which are pivoted on a bracket bolted to the "X" member of the frame, and, finally, through the rear equaliser (10) mounted on a bracket suspended from the axle.

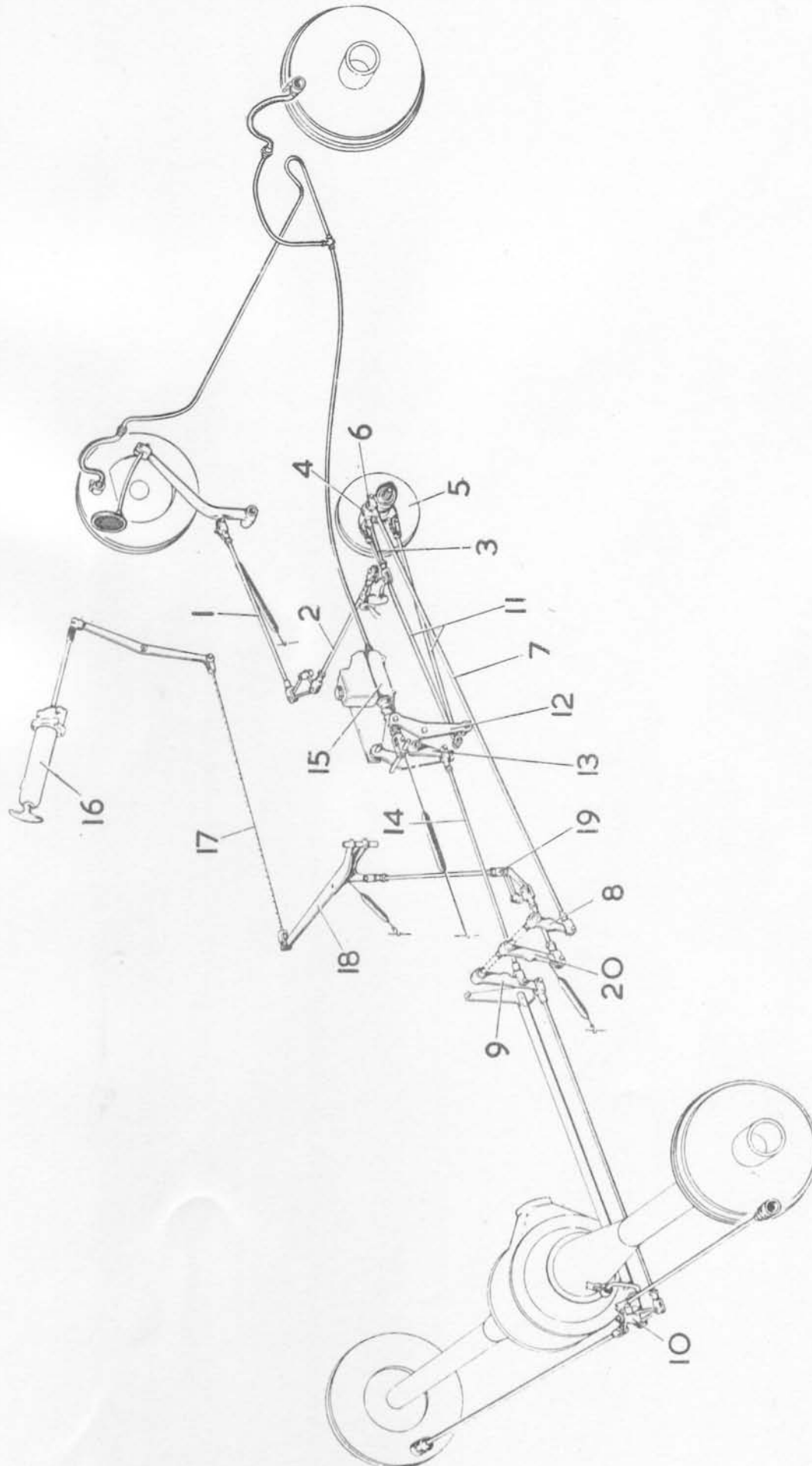


Fig. 17.—DIAGRAM OF BENTLEY BRAKING SYSTEM—LEFT-HAND MODEL.

The output from the servo is taken by one of the two rods (11), according to whether the car is moving forwards or backwards, to the lever (12). This lever carries, in turn, a balance lever (13), the lower end of which is connected by the rod (14) to the rear brake lever (9), thus augmenting the direct pedal effort, while its upper end is coupled to the master cylinder (15) which actuates the front brakes.

The dashboard hand brake (16) is mounted under the facia board convenient to the driver's left hand, and is connected by a cable (17) to a horizontal lever (18) mounted on the "X" section of the frame, which provides the required leverage, which in turn is coupled to the rear brakes through the rod and bell crank (19) to the levers (20) and (9), and so to the rear equaliser. The same rear brake shoes are used, therefore, as for the pedal operation.

The hand brake is applied by a direct pull, and released by twisting the handle in a clockwise direction, the application and release can therefore be lightened accordingly by simultaneous application of the foot brake.

### **Possible Variations.**

As already mentioned, the leverages are so proportioned that the total braking effort is distributed in a predetermined ratio between the front and rear brakes.

This distribution will be upset if the servo brakes are allowed to become badly out of adjustment, or if the servo, for any reason, fails to give its correct output. A less likely cause would be oil or grease on the brake linings.

The need for adjustment of the rear brakes will be indicated by excessive travel of the hand brake lever, whereas the front brakes, which are operated by the servo motor only, will not affect the hand brake or pedal travel.

It is unlikely, however, that the front brakes will wear more rapidly than the rear brakes, so, provided that they are adjusted whenever adjustment of the rear brakes is required, no trouble in this respect need be expected.

Low or inconsistent output from the servo would be indicated by heavy or non-progressive brake pedal action, together with insufficient front braking, in which case the servo would have to be dismantled to ascertain the cause of the trouble. As this is a delicate operation, it is recommended that Messrs. Bentley Motors (1931) Ltd., or one of their "Special Retailers" be entrusted with this work.

A light pedal action, accompanied by defective front braking, resulting in the rear wheels locking, would indicate a fault in the front braking system. An excess of front braking would indicate a fault in the rear brakes.

In the unlikely event of oil reaching either of the rear brakes, the self-seal bearing on the rear axle half shaft will be at fault. Grease catchers are provided for the front hubs, and provided that the recommended grease be used and the quantity limited to  $1\frac{1}{2}$  ozs. in each hub, this should not be able to reach the brake linings.

### Adjustments.

A separate adjustment is provided on each brake carrier plate to compensate for wear of the brake shoe linings, and is the only adjustment provided on the whole system.

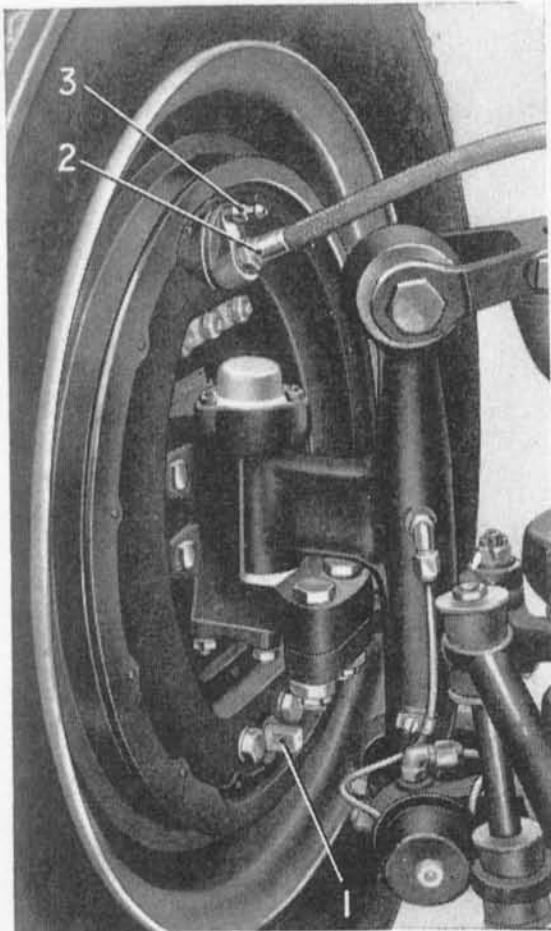


Fig. 18.—FRONT BRAKE ADJUSTMENT.

1. Adjuster screw.
2. Hydraulic pipe.
3. Bleeder connection.

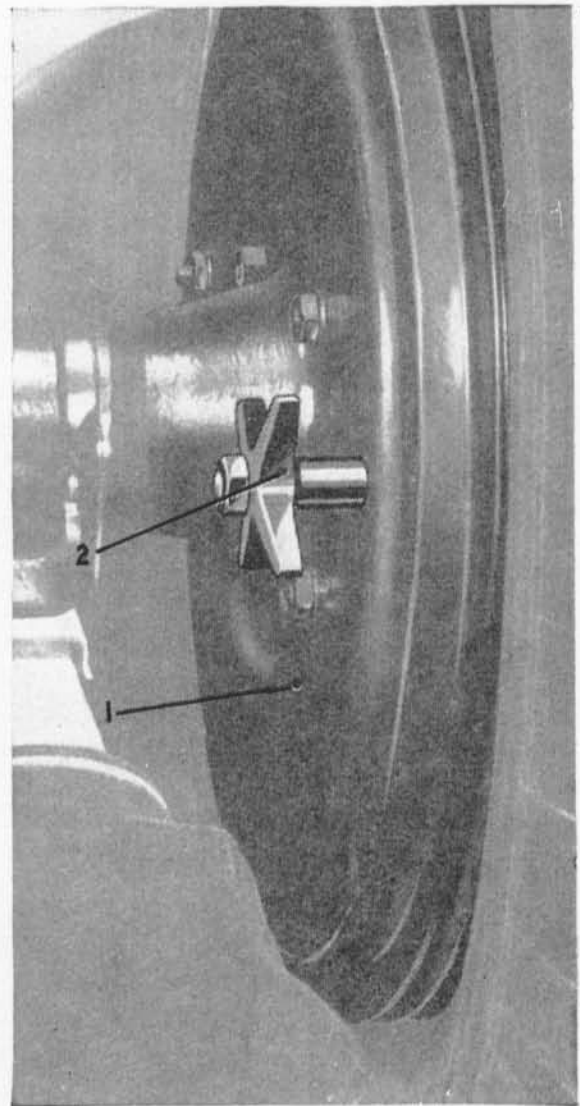


Fig. 19.—REAR BRAKE ADJUSTMENT.

1. Brake drum.
2. Adjuster screw.

It is important to note that in no circumstances should adjustments be attempted at any other point, for instance, by altering the lengths of the brake rods. These are all carefully determined during erection

of the chassis, with a view to synchronisation of the front and rear safety stops, which ensure that in the event of failure of any part of the system, at least one pair of brakes will remain available.

The method of adjustment is the same for both front and rear brakes, with the exception that a hand wheel is provided on the rear brake adjusters, while a  $\frac{1}{4}$ " B.S.F. open-ended spanner must be used on the squared end of the front brake adjusters. The rear adjusters (2, Fig. 19) are located forward of the axle tubes, and the front adjusters (1, Fig. 18) directly below the steering pivot pins.

For each complete turn of the adjusters, four "clicks" will be felt, and between each "click" the brake shoes are expanded towards the drum, approximately .014", and then moved back .010", giving an incremental adjustment of .004", and a running clearance of .010".

To adjust the brakes, rotate the adjusters in a clockwise direction until solid resistance is felt, the resistance being equal for all four brakes, then turn back the adjuster two "clicks". This will give the correct brake adjustment.

It is not necessary to jack up the car to adjust the brakes, as the adjusters are so designed to give the correct shoe clearances automatically.

If, after long service, the brake linings require renewal, this will be apparent by the adjusters coming to the end of their travel, and will have a solid feel quite distinct from the resistance felt when the brake shoes are correctly adjusted.

### **Adjustment of Hand Brake.**

Adjustment of the rear brakes takes up both the pedal and hand brake clearance in the same operation. No other adjustment is required.

### **Adjustment of the Servo.**

The servo is of the dry disc-brake type, and is shown in Figs. 16 and 17. An adjustment is provided for the initial setting and wear of the friction surfaces, but once correctly set, should require no further attention for a considerable period, as very little wear occurs. As the operation is of a delicate nature it is advised that this adjustment should be effected by Messrs. Bentley Motors (1931) Ltd., or one of their "Special Retailers".

### **Lubrication.**

The need for hand lubrication of various parts of the mechanism has been reduced to a minimum, by the use of self-lubricating bearing bushes at the fulcrum of practically all levers.

The only points that require attention are the jaws and pins of the pull rods and intermediate levers (6, 7 and 17, Fig. 16, or 8, 9 and 20, Fig. 17). Oil should be applied to these points every 5,000 miles, as directed on page 33. The ball bearing cams which actuate the servo (as described earlier in this chapter) are filled with lubricant upon initial build, and require no attention between overhauls of the chassis.

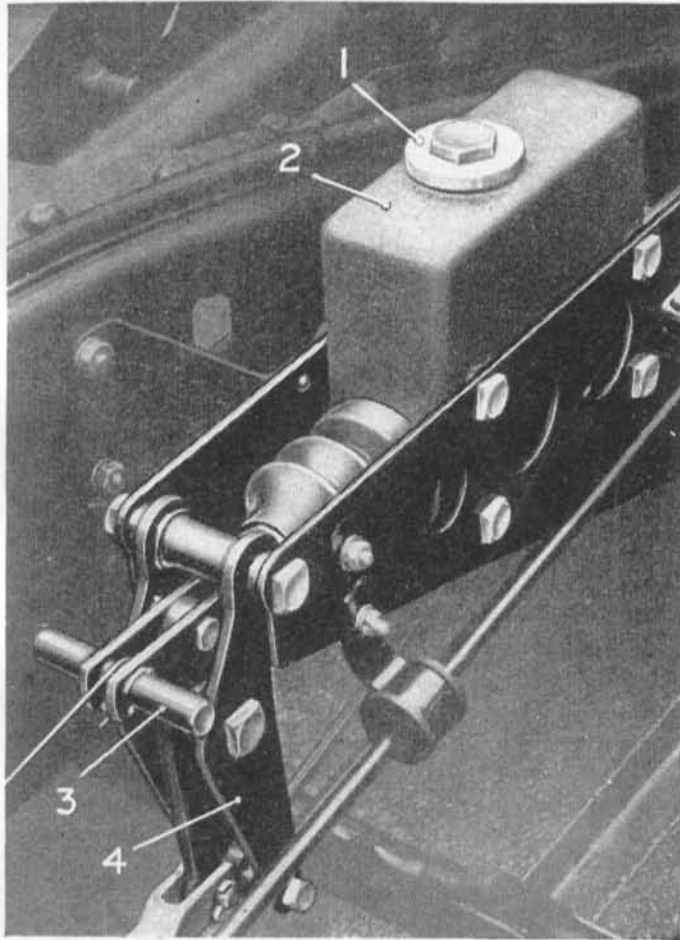


Fig. 20.—THE HYDRAULIC MASTER CYLINDER AND RESERVOIR.

- |                                   |                     |
|-----------------------------------|---------------------|
| 1. Filler plug.                   | 3. Pin.             |
| 2. Master cylinder and reservoir. | 4. Support bracket. |

### Bleeding the Hydraulic System.

Bleeding, that is to say expelling air from the system, should only be necessary when completely recharging the system with fluid following the removal of a component or the disconnection of a pipe joint. Under normal conditions air does not enter the system as a result of brake application.

To bleed the system, proceed as follows:—

1. Attach a clean rubber drain tube to one front brake bleeder screw (3, Fig. 18), and immerse the other end in a clean glass jar in which there is sufficient hydraulic brake fluid to submerge the end of the tube.
2. Release the bleeder screw (3) half to one turn.
3. Remove the filler plug (1, Fig. 20) and fill the reservoir integral with the master cylinder, with the recommended fluid. (See page 30.)
4. Push the joint forward until the extended pin (3) abuts against the master cylinder support brackets (4).
5. Release, pause slightly, and repeat until the reservoir is nearly empty, but taking care not to empty it completely.
6. Tighten the bleeder screw and transfer drain tube to the other front brake.
7. Refill the reservoir and bleed this brake in a similar manner.
8. Finally, refill the reservoir and replace the filler plug.

**Hydraulic Master Cylinder.**

The fluid level in the master cylinder should be examined every 10,000 miles, as directed on page 35, and topped up if necessary so as to maintain the level at one inch below the filler cap.

A rapid fall in the fluid level indicates a leak at some point in the system, and must be traced and rectified.

## CHAPTER VII

## Gearbox, Propeller Shaft and Rear Axle

*The Gearbox—Universal Joints—Rear Axle.*

**The Gearbox.**

With the automatic gearbox, no clutch or clutch pedal is necessary. Speed change ranges are effected automatically, the timing being controlled by the automatic control unit and is a function of the vehicle speed and the throttle opening.

Fluid is inserted into the gearbox by removing the dipstick shown at 2, Fig. 21. Recommended fluids are given on page 29.

The oil level should be inspected every month, as directed on page 32.

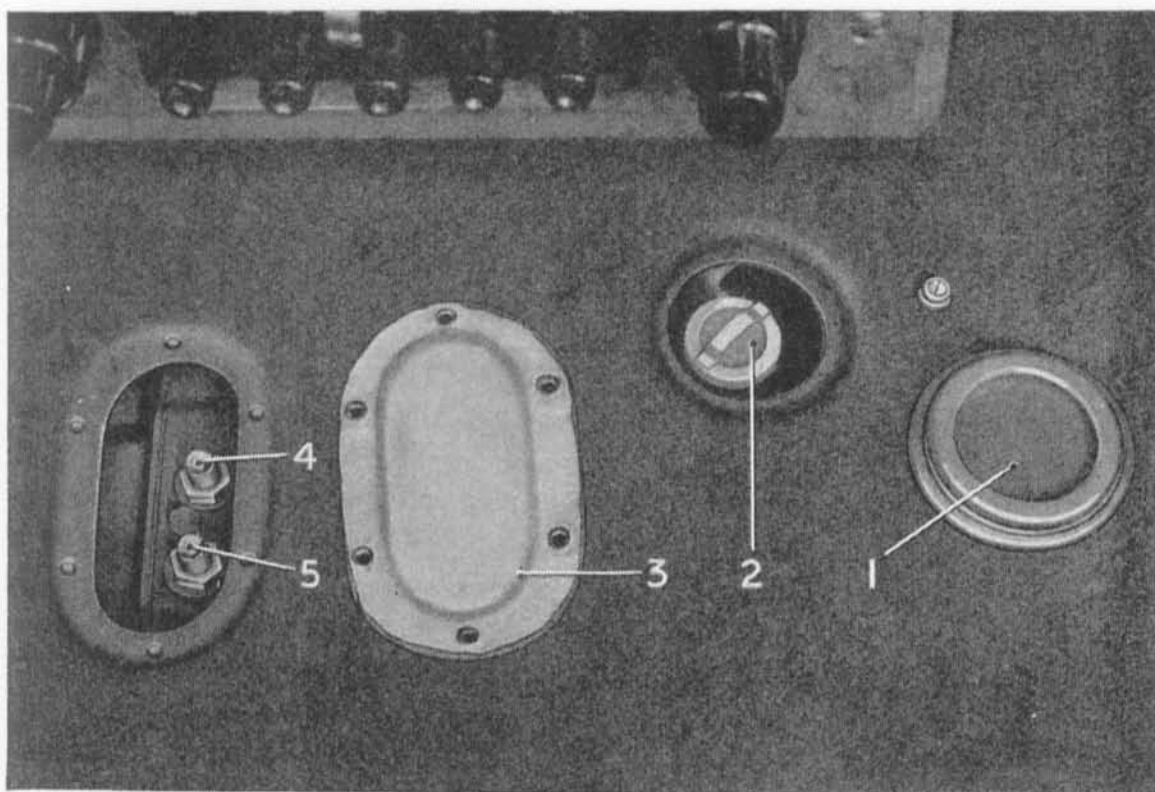


Fig. 21.—GEARBOX ACCESS POINTS.

- |                                 |                         |
|---------------------------------|-------------------------|
| 1. Cover, Dipstick.             | 4. Front Band Adjuster. |
| 2. Dipstick.                    | 5. Rear Band Adjuster.  |
| 3. Cover, Brake Band Adjusters. |                         |

For topping up, the following procedure should be adopted:— With the control lever in neutral, the engine should be allowed to run for about three minutes before the fluid level is checked. This should be done while the engine is still running. Fluid should then be added until the level reaches the mark on the dipstick, taking care that the box is not overfull.

Every 20,000 miles, the oil should be drained from the gearbox and fluid coupling. The drain plug on the fluid coupling can be reached by removing the lower cover of the bell housing (3, Fig. 22), and turning the engine by means of the starter motor until the plug is at the bottom position. The gearbox can be drained by the plug in the sump shown in 2, Fig. 22.

After draining, both plugs should be replaced.

To refill, first add 14 pints of the recommended fluid. With the hand brake on, start the engine and let it run for several minutes. Then add 5 or 6 more pints of fluid. Allow the engine to run for a short while and then check the level by means of the dipstick.

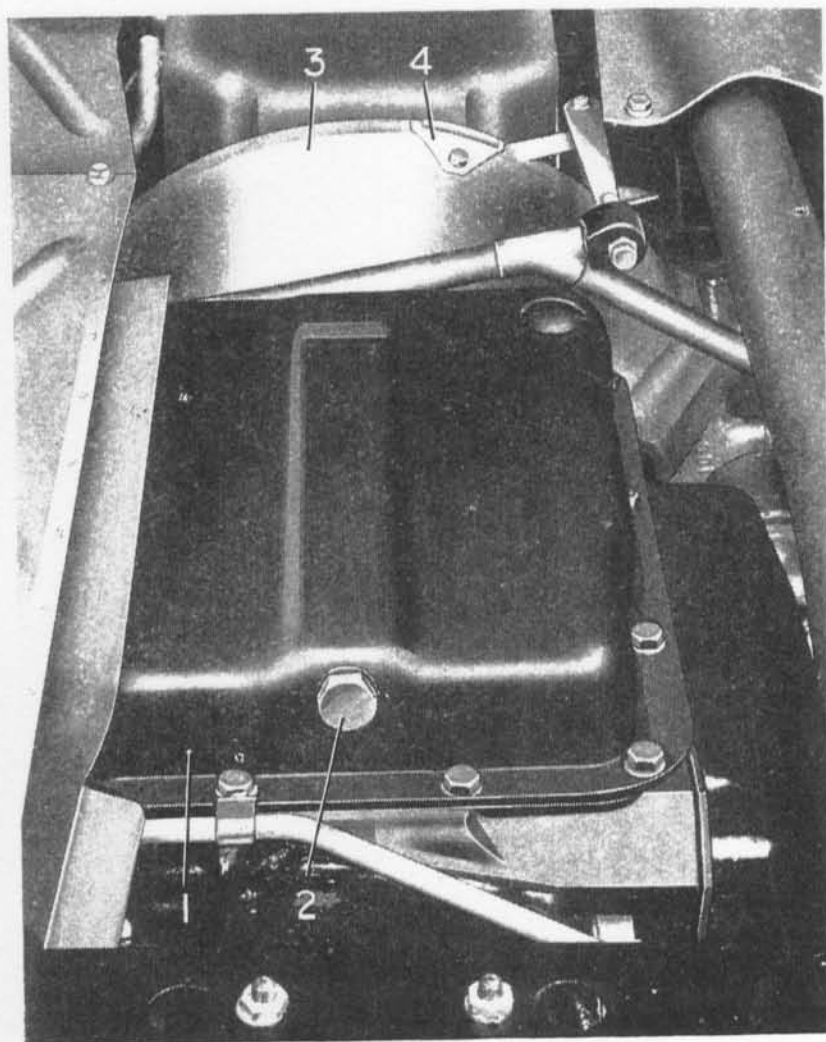


Fig. 22.— GEARBOX, UNDERNEATH VIEW.

- |                  |                                  |
|------------------|----------------------------------|
| 1. Gearbox sump. | 3. Lower bell-housing cover.     |
| 2. Drain plug.   | 4. Timing inspection hole cover. |

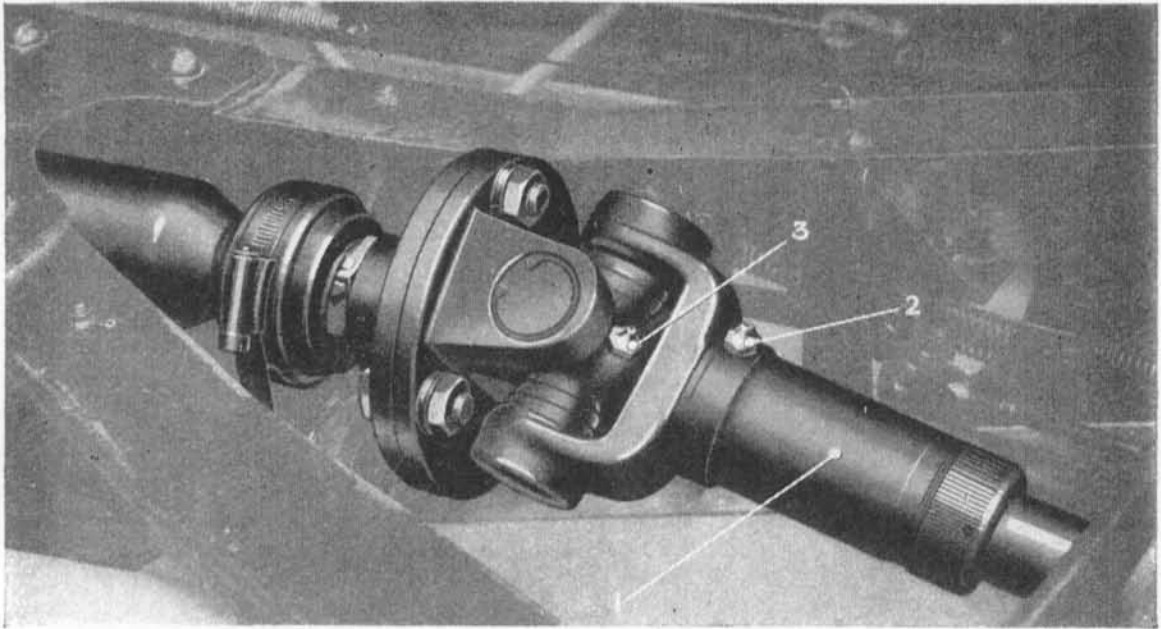


Fig. 23.—PROPELLER SHAFT.

1. Sliding joint.      2. Grease nipple sliding joint.      3. Grease nipple universal joint.

### Universal Joints.

The propeller shaft universal joints are fitted with needle roller bearings, and each joint is provided with a grease-gun lubricator (3, Fig. 23), located at the centre of the cross-piece.

The driven portion of the centre joint is provided with serrations which engage similar serrations within the propeller shaft to permit the necessary degree of telescoping movement.

This sliding joint is also lubricated by means of a grease-gun lubricator, shown at (2, Fig. 23). Every 10,000 miles, as directed on page 35, the correct grease should be injected by means of the grease-gun into all the four lubricators.

### Rear Axle.

The rear axle is of the semi-floating type.

The final drive is by offset hypoid bevel gears, which possess the advantages of being silent in running, and, owing to the offset disposition of the pinion, of enabling a lower body position to be obtained without decreasing the ground clearance.

*It is important that no other oil than that recommended should be used in the rear axle. (See page 30.)*

Every 5,000 miles, as directed on page 33, the level of the oil should be inspected, and topped-up if necessary.

Every 20,000 miles, as directed on page 36, the casing must be drained, and refilled with fresh oil to the correct level.

The drain plug (2, Fig. 24) should be removed, with the special spanner provided, preferably when the casing is warm; and all the oil allowed to drain out.

Plug (1) may then be removed for filling purposes. One-and-three-quarter ( $1\frac{3}{4}$ ) pints of fresh oil should be inserted, using a syringe. This quantity should just cause oil to overflow from the filling orifice.

Care must be taken to see that the washer is in position when replacing the plug.

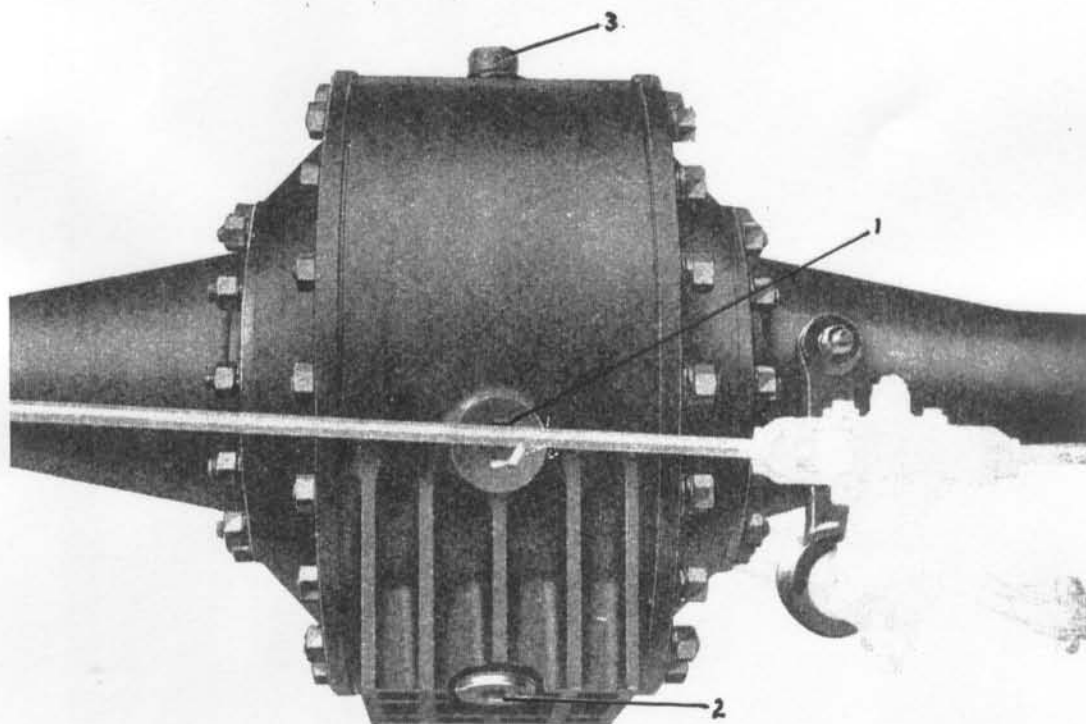


Fig. 24. — REAR AXLE CASING.

- |                           |              |
|---------------------------|--------------|
| 1. Filler and level plug. | 3. Breather. |
| 2. Drain plug.            |              |

## CHAPTER VIII

# Steering, Shock Dampers, Road Springs, Wheels and Tyres

*Steering Box and Column—Steering—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 (2, Fig. 25). Every 5,000 miles, as directed on page 33, 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 30.

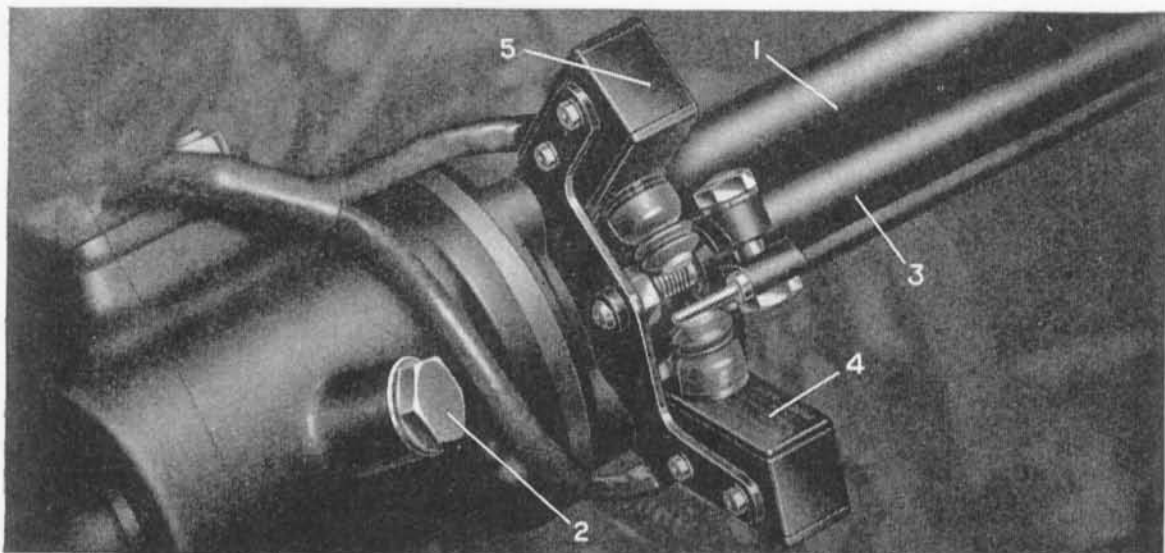


Fig. 25.—STEERING COLUMN.

- |                         |                          |
|-------------------------|--------------------------|
| 1. Steering column.     | 4. Micro-switch.         |
| 2. Oil filler plug.     | 5. Reverse light switch. |
| 3. Gear change control. |                          |

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 33.

### Steering.

Experience has shown that too much importance cannot be attached to proper balance of the front wheels and tyres.

As it is only possible to balance the wheels and tyres statically, this does not eliminate the effect of slight out-of-balance forces which can only be detected dynamically. Such a condition may be caused by the normal wear of the tyres on the front wheels; as is inevitable with independent front suspension, tyre wear will be slightly less regular than on the rear wheels.

Therefore, it is recommended that the front wheels should be periodically changed to the rear wheels and vice versa to even out the wear on the tyres.

### 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.

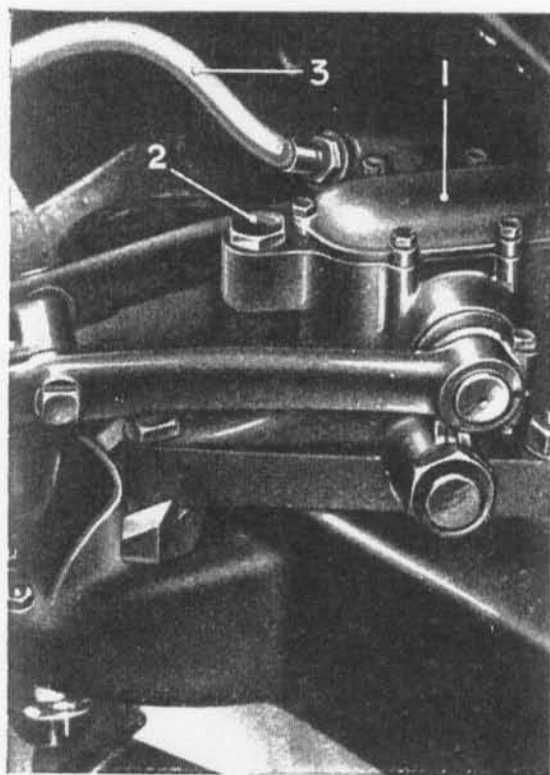


Fig. 26.—FRONT SHOCK DAMPER.

1. Shock damper.
2. Filler plug.
3. Hydraulic brake pipe.

The upper radius arms are connected to and operate the special Bentley shock dampers, which effectively dampen 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. 5.)

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 34.

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 illustrated in Fig. 5.

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 check any 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. 27.

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 34.

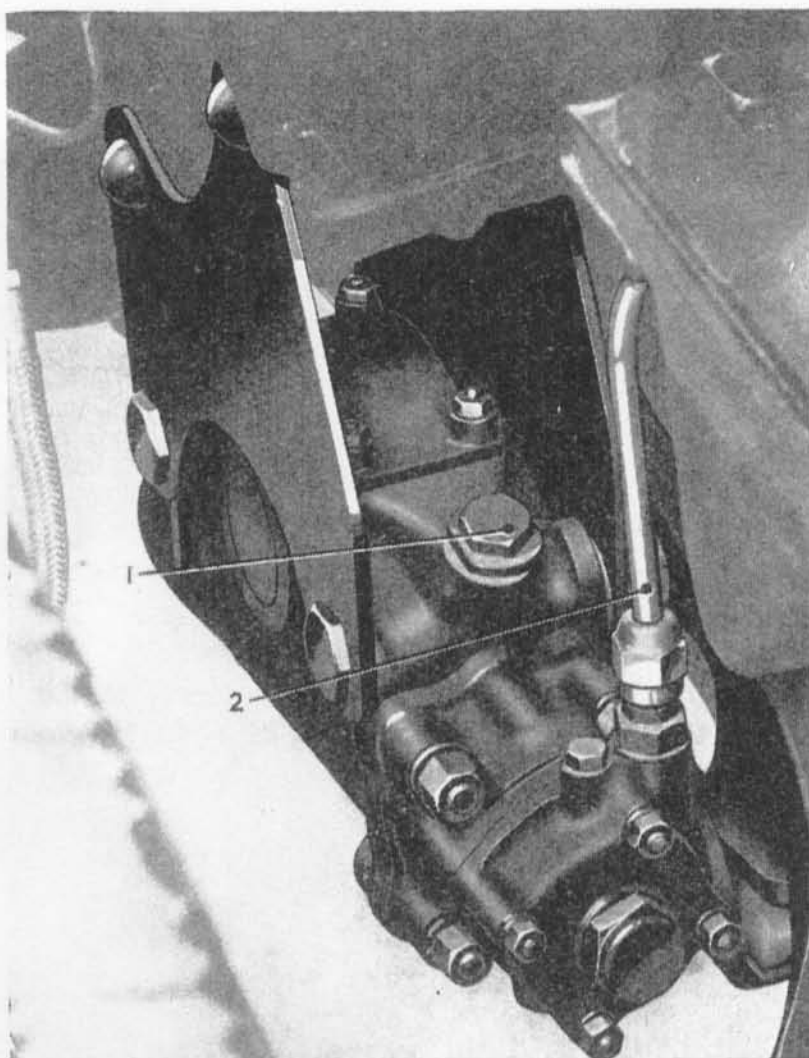


Fig. 27.—REAR HYDRAULIC SHOCK DAMPER.

1. Filler plug.

2. "Ride Control" oil pipe.

For this purpose a filling plug (1, Fig. 27) 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 30), 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 centred 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 "Speed Special", size 6.50" by 16", and it is important that, owing to the high speeds attainable with this model, these tyres **only** are fitted.

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".

### **The Jacking System.**

A portable jack is provided in the tool kit and is operated as shown in Figs. 28 and 29.

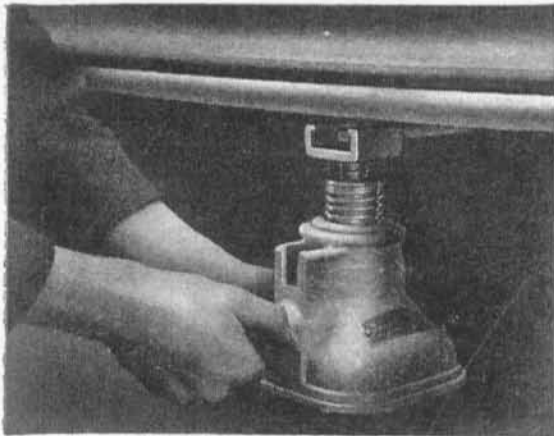


Fig. 28.—FITTING JACK TO SLIDE.



Fig. 29.—OPERATING JACK.

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. 29.

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.

### 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:—

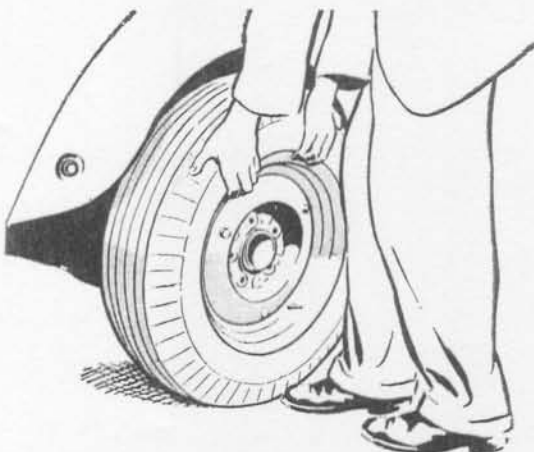


Fig. 30.—MOUNTING REAR WHEEL.



Fig. 31.—POSITIONING REAR WHEEL.

**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. 30.
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.
3. Using the one entered stud as a fulcrum, raise the wheel until the other studs enter their respective holes. (See Fig. 31.)

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. 30.)

1. Rotate the wheel, which also rotates the hub, until a stud enters at the halfway line. (See Fig. 32.)
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. 33.)



Fig. 32.—ROTATING FRONT WHEEL.



Fig. 33.—ENTERED STUD AT TOP.

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 "Speed Special" tyres are:—

Front—30 lb./sq. in. or 2.109 kg./sq. cm.	} Cold.
Rear—35 lb./sq. in. or 2.46 kg./sq. cm.	

**Note.**—It is of the utmost importance in the interests of safety that these tyre pressures are maintained.

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.

**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.

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, four steel weights are spaced at intervals around the wheel as necessary.

The method of balancing the wheel is as follows:—

- (i) Remove the wheel.

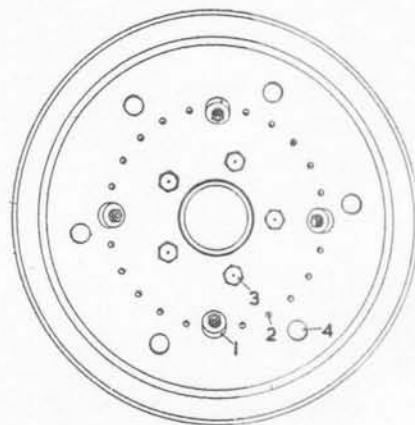


Fig. 34.—WHEEL BALANCE WEIGHTS.

1. Balance weights.
2. Balance weight adjustment holes.
3. Wheel securing nuts.
4. Wheel disc rubber.

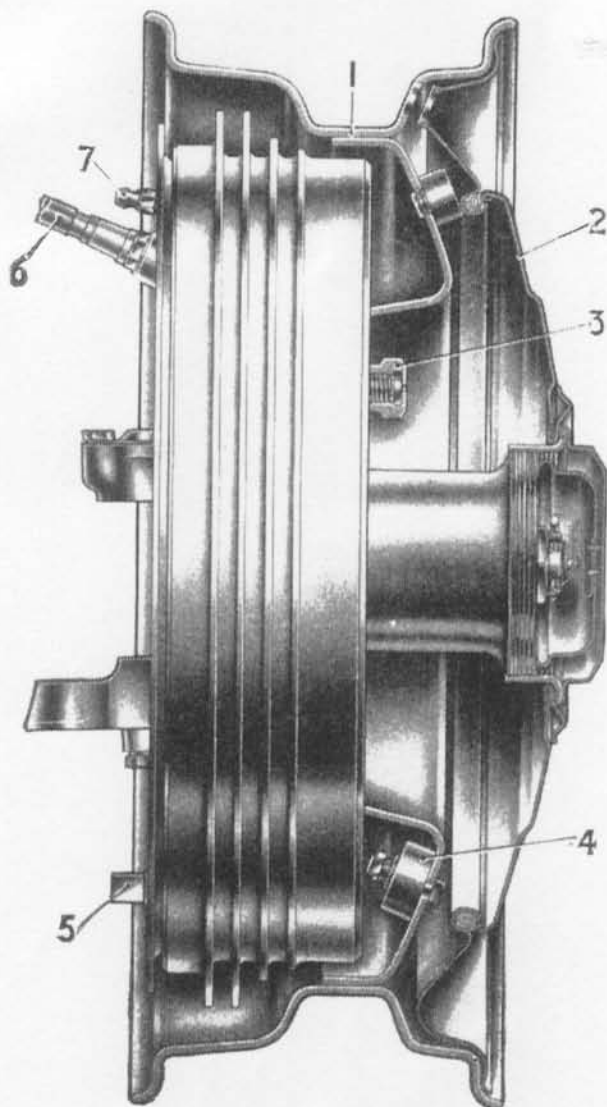


Fig. 35.—SECTION OF FRONT WHEEL.

1. Well base rim.
2. Wheel disc.
3. Wheel securing nut.
4. Balance weight.
5. Brake adjuster.
6. Hydraulic pipe.
7. Bleeder connection.

- (ii) If a hub on a bench is not available, make sure that the front hub on the car is quite free to rotate and not restricted by too close adjustment of the brakes.
- (iii) Remove all balance weights, bolts and nuts.
- (iv) Reverse the bolts in the wheel, this will allow the operation of balancing to be performed more easily, as the balance weights may then be fitted externally.

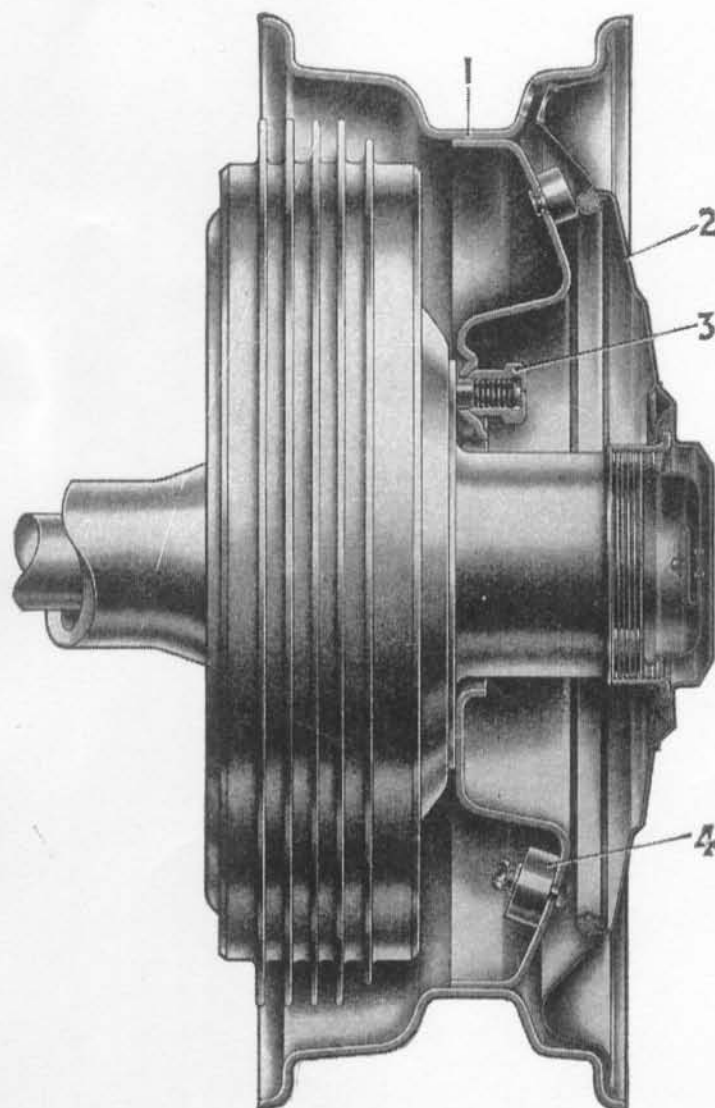


Fig. 36.—SECTION OF REAR WHEEL.

- |                   |                        |
|-------------------|------------------------|
| 1. Well base rim. | 3. Wheel securing nut. |
| 2. Wheel disc.    | 4. Balance weight.     |

- (v) Refit the wheel to the hub. Allow to swing and note the light point. Put one weight here. Allow the wheel to swing again. If the wheel is in balance, space the other 3 weights evenly round the wheel.
- (vi) If the light point is unchanged in position, add a second weight, using one of the adjacent holes. If this corrects the balance, add the other 2 weights opposite each other.

- (vii) If 2 weights together are too much, try moving them away from each other. Go one hole at a time and move each weight alternatively. When balance has been achieved, add the 2 weights opposite each other.
- (viii) If 2 weights together are insufficient, add a third, using an adjacent hole. If this balances the wheel, remove the centre weight and refit it 4 holes to one side. Fit the 4th weight 4 holes to the other side.
- (ix) If 3 weights are insufficient, add the 4th, and if this is too much, start separating the outer 2 weights as in (vi) above.
- (x) Remove the wheel and reverse the bolts so as to return the balance weights to their correct position, on the inside of the wheel.
- (xi) Refit the wheel and the wheel disc assembly. The correct tension on the disc is attained by giving the nut one complete turn by the special spanner provided after the disc has been felt to be in contact with the rubber stops on the wheel centre.

## 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.*

#### **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 86) 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. 37), and moving the dynamo outwards on the special slotted link.

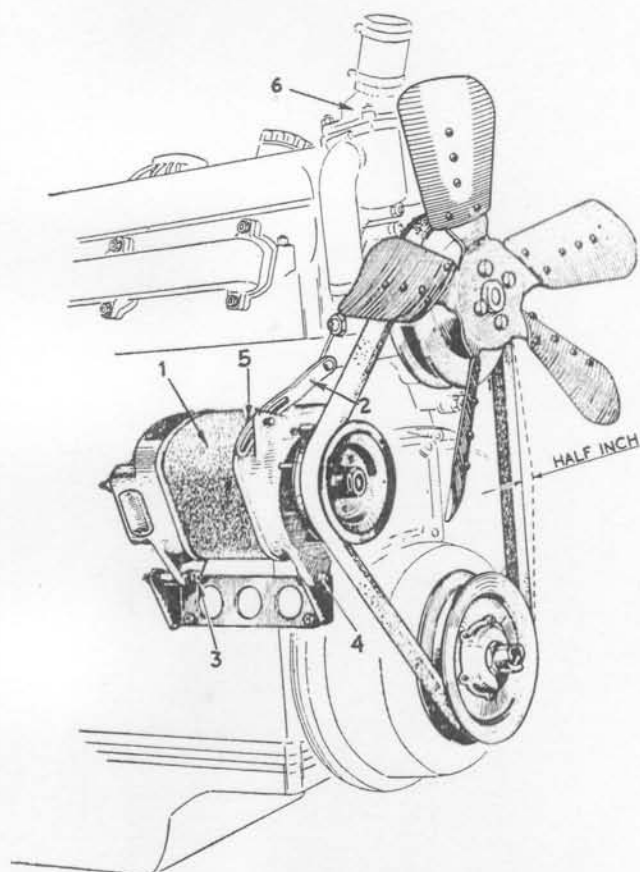


Fig. 37.—THE FAN BELT ADJUSTMENT.

- |                         |                  |
|-------------------------|------------------|
| 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.
- (b) The fan belt may need adjustment.
- (c) There may be a shortage of coolant in the system.
- (d) Detonation and a poor grade of fuel.
- (e) Radiator matrix blocked with flies or dirt, etc.

### Radiator Thermostat.

The thermostat which controls the flow through the radiator to suit the engine cooling requirements, is contained within a casing (6, Fig. 37).

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 to the bottom edge of the filling orifice.

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.

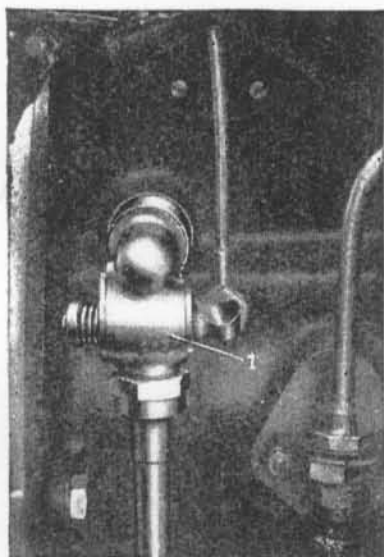


Fig. 38.—CYLINDER JACKET DRAIN TAP.

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. 38), 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 on the centre of the dash behind the facia panel, warm air being circulated by an electric fan which is integral with the heater.

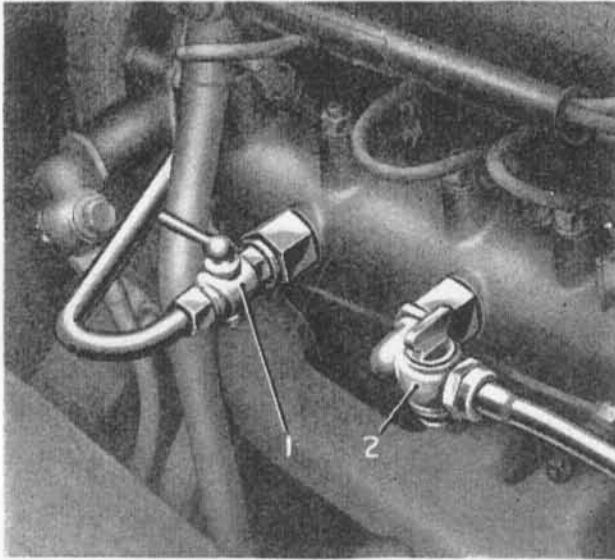


Fig. 39. ISOLATING TAPS.

1. De-mister heater.
2. Car heater.

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. 39), 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.

**DIAGRAM**  
**ELECTRICAL WIRING**

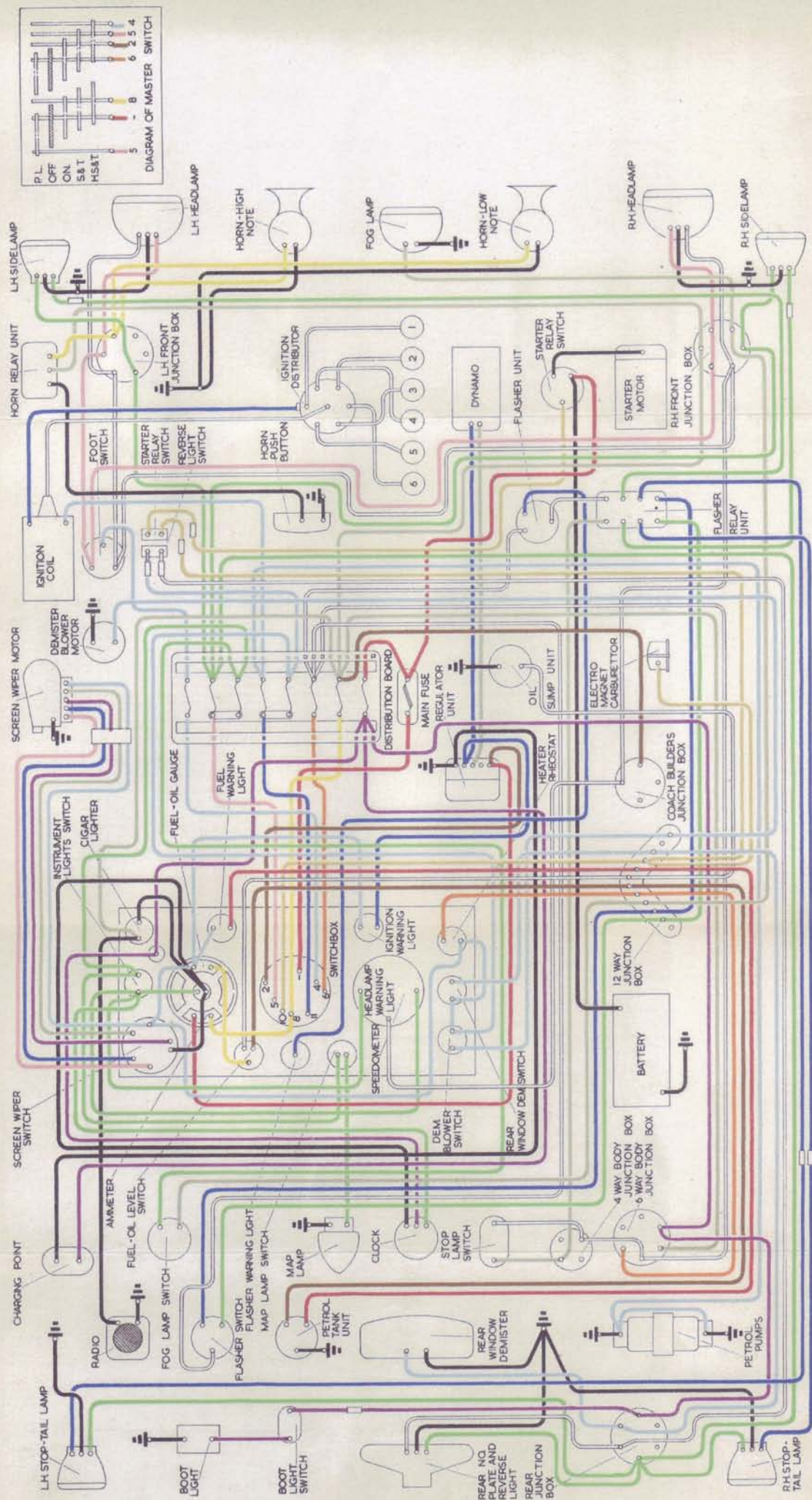


Fig-40. ELECTRICAL WIRING DIAGRAM

## 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—Micro-switch—Use of Starter Motor—Electric Fuel Pumps and Gauge—Electric Horns—De-misting and Air Conditioning—Direction Indicators—Headlamps—Replacing a Headlamp Bulb—Aligning the Headlamps—Side Lamps—Electrical Fault Location.*

#### **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, direction indicators, de-froster, de-mister, car heater, 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. 40) 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. 41, 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 three external terminal connections, two large and one small, one large terminal being the "armature" connection, the other one being earthed to the chassis frame. The smaller terminal is 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.

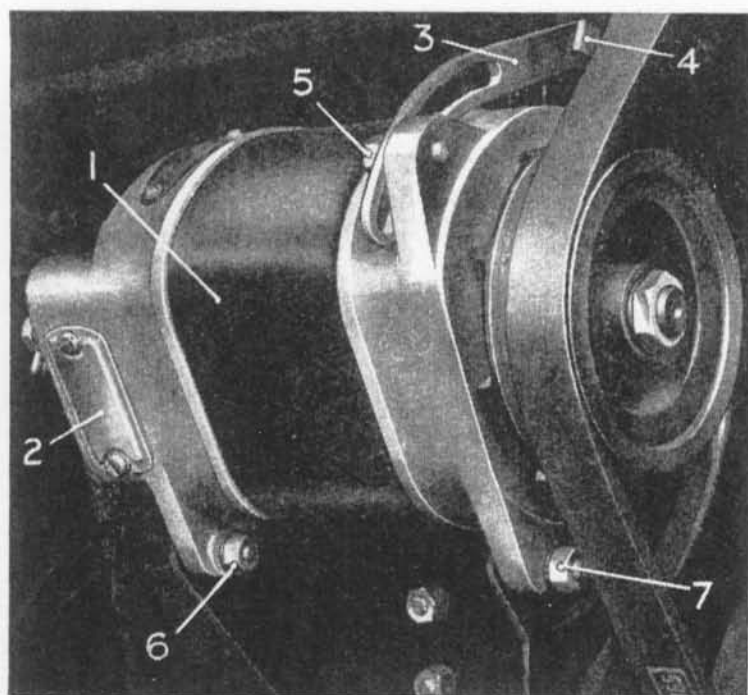


Fig. 41.—THE DYNAMO.

- |                      |                                |
|----------------------|--------------------------------|
| 1. Dynamo.           | 3. Slotted link.               |
| 2. Cover—Brush gear. | 4, 5, 6, and 7. Securing nuts. |

Every 10,000 miles, as directed on page 34, 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 large fuse box (2, Fig. 42) carries the circuit fuses. Each circuit fuse is one strand of No. 32 S.W.G. tinned copper wire.

The small fuse box (1) carries the main fuse. This is three strands of No. 32 S.W.G. tinned copper wire.

Spare wire of this gauge is provided on a special holder within the circuit fuse 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 (5, Fig. 42).

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. 40).

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

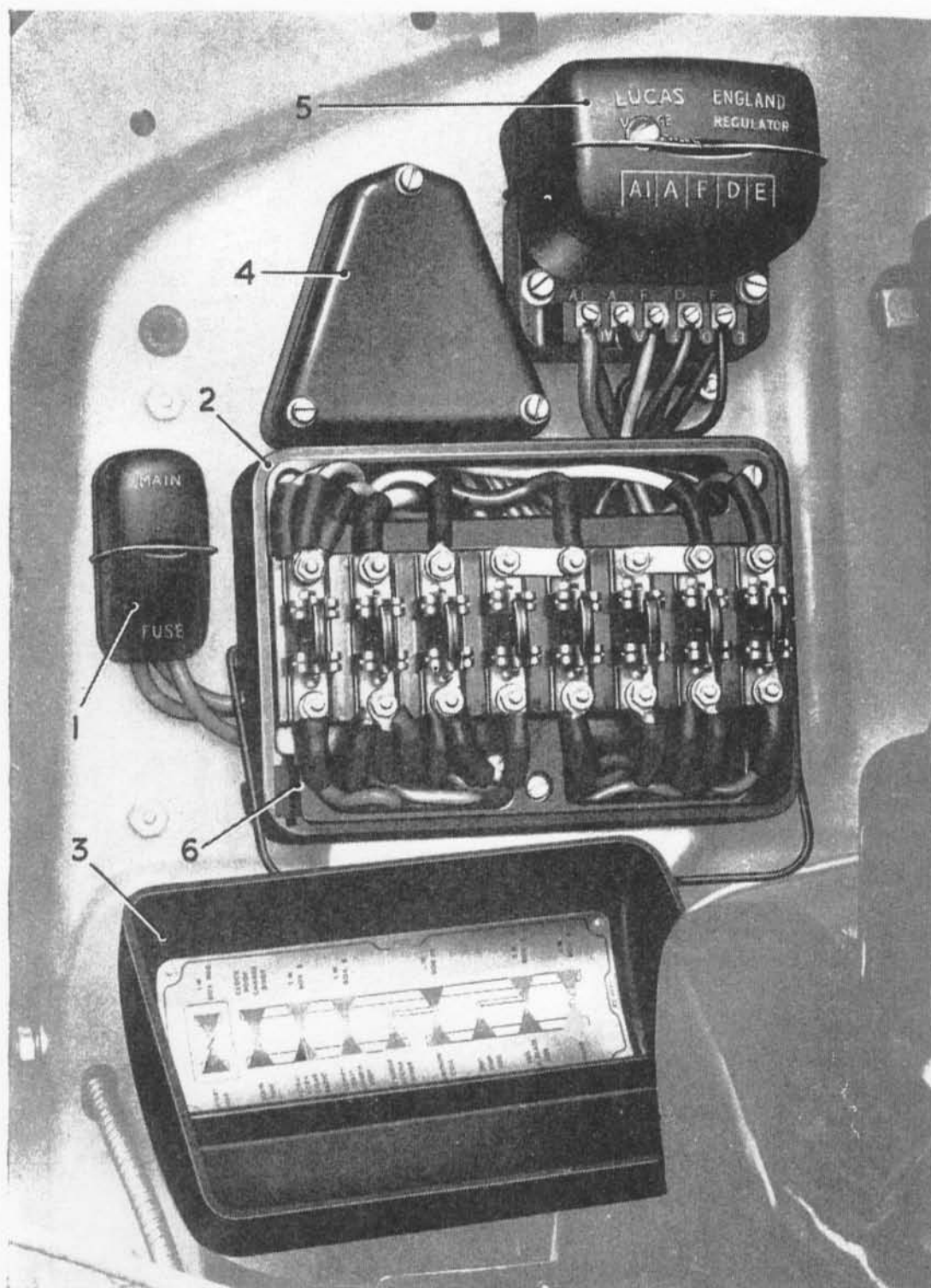


Fig. 42.—FUSE BOX, OUTPUT REGULATOR AND CUT-OUT.

- |                      |                     |                                   |
|----------------------|---------------------|-----------------------------------|
| 1. Main fuse box.    | 3. Cover, fuse box. | 5. Output, regulator and cut-out. |
| 2. Circuit fuse box. | 4. Joint box.       | 6. Spare fuse wire holder.        |

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 104); 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 clock, inspection and roof lamps.

**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 30-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 headlamps 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 HZP9-S	6 MXP9-R	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 32, 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 HZP9-S 6 MXP9-R	
Temperate ... ..	1.260	1.280 (1.270-1.285)
Tropical (i.e. where the temperature is frequently 90° F. or over).	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 from a trickle charger, whilst 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 fascia 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.

**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. 43, an internal view of the contact breaker being given in Fig. 44.

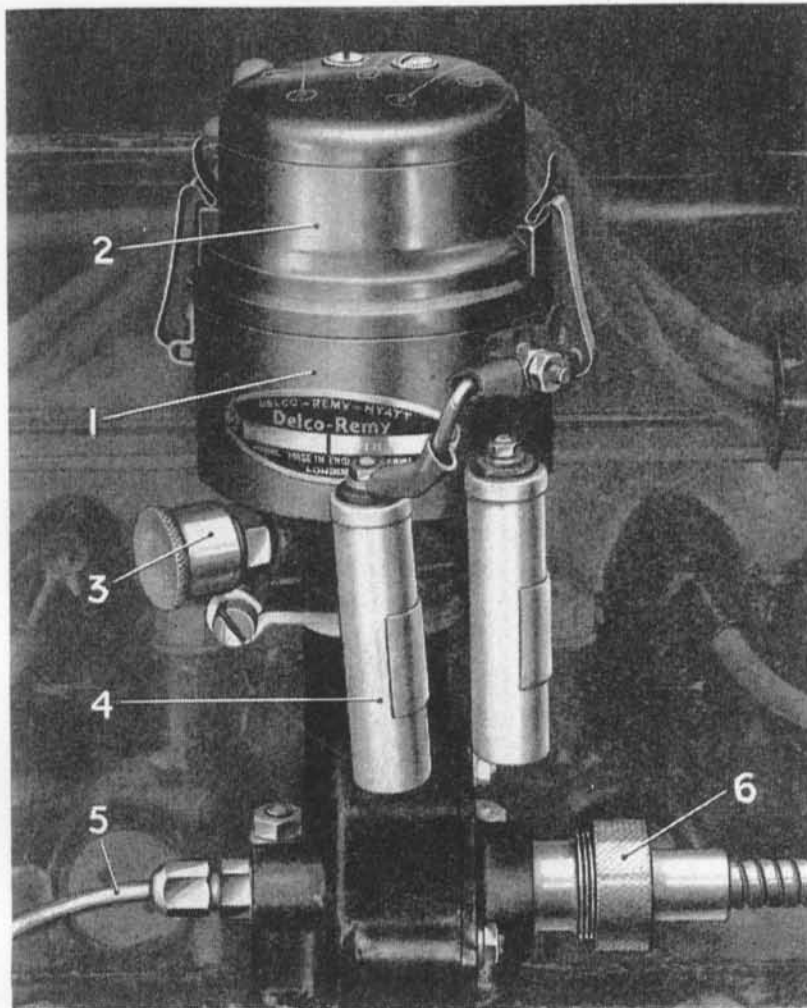


Fig. 43.—CONTACT BREAKER AND DISTRIBUTOR.

- |                     |                             |
|---------------------|-----------------------------|
| 1. Contact breaker. | 4. Condenser.               |
| 2. Distributor.     | 5. Lubrication pipe.        |
| 3. Lubricator.      | 6. Rev. counter connection. |

A condenser (4, Fig. 43) 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. 44) 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 5,000 miles, as directed on page 33, 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. 43) should be given a turn every 1,000 miles, and when empty, refilled with the correct grease, as specified on page 30.

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

### Ignition Coil.

The high-tension ignition coil is mounted on the front of the engine as illustrated in Fig. 45. 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 replacement coil being fitted, that the condenser is correctly connected to the terminal marked S.W. and **not** to the output (C.B.) terminal of the coil.

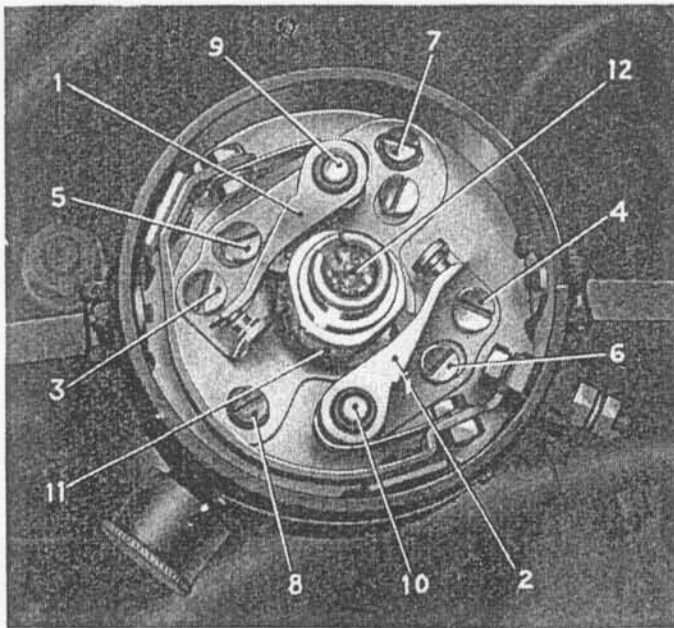


Fig. 44.—INTERIOR OF CONTACT BREAKER.

- |           |                           |
|-----------|---------------------------|
| 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.                |

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 ignition timing has been de-ranged, it can be reset by reference to the markings on the engine flywheel.

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 lower bell-housing cover, when No. 1 piston is at the top of its firing stroke.

The car should be run up on a ramp or over a pit. Examination of the lower bell-housing cover (3, Fig. 22) will show the small inspection hole on the side.

The preferable method is to note the position of the pointer and then to remove the cover. Operate the starter motor to approximately line up the flywheel marking; replace the cover for a temporary check. Remove the cover and prise the flywheel round into correct position, then permanently replace the cover.

Another method is to use the starting handle to turn the engine, which obviates the need for removing the bell-housing cover. It must be remembered that the starting handle operates through the friction damped spring drive unit, and therefore allowance must be made for the wind-up of the spring drive unit. If it is decided to use this method, the timing should be set .300" early of the **IGN. TDC.** mark on the periphery of the flywheel.

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.

The sparking plugs are Champion Type N8B 14 m/m. non-detachable. Every 5,000 miles, as directed on page 33, 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. 46. 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 in the front cover of the gear casing should be removed every 10,000 miles, as directed on page 34, 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.

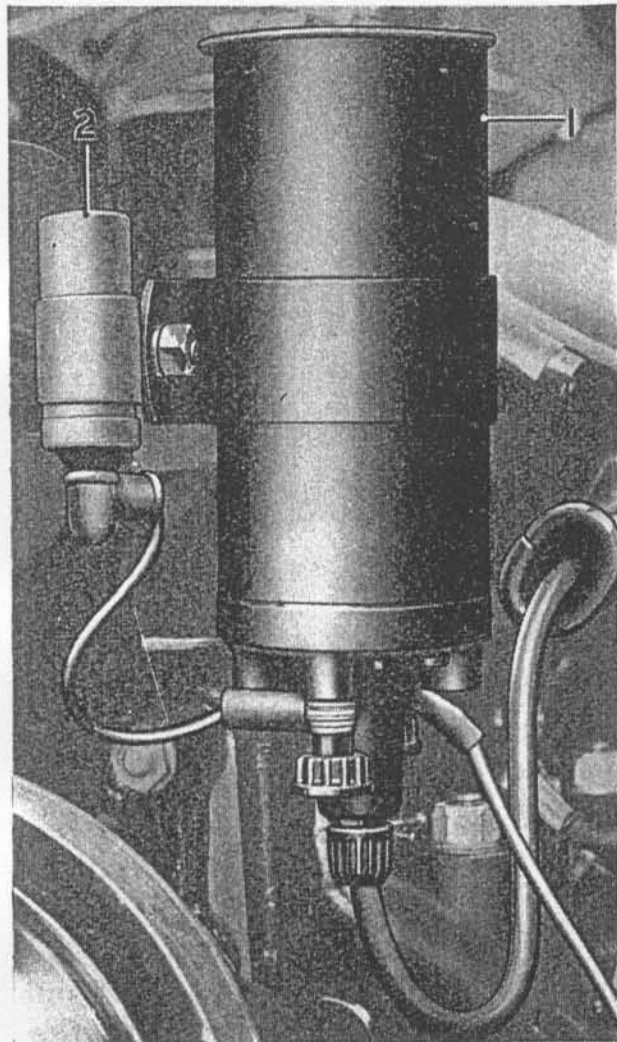


Fig. 45.—IGNITION COIL.

1. Coil.      2. Suppressor condenser.

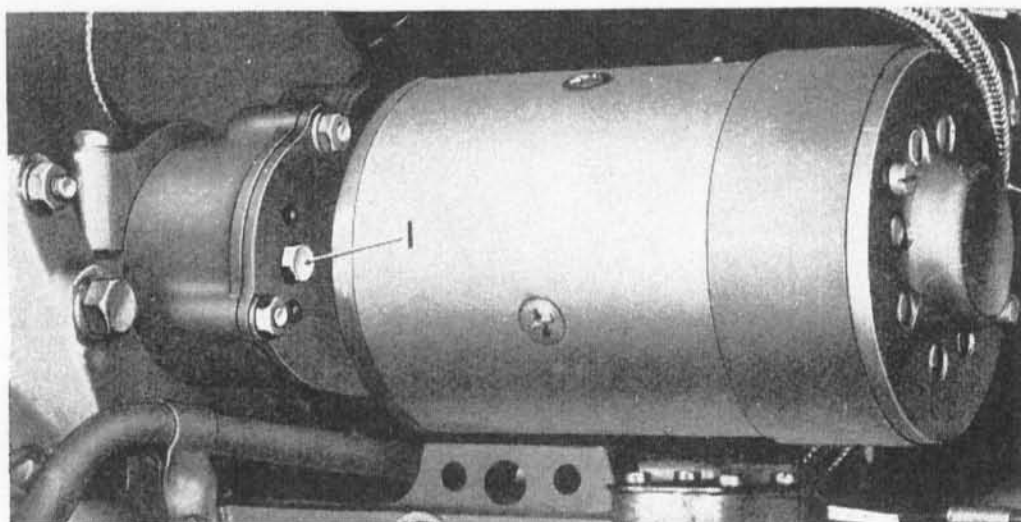


Fig. 46. STARTER MOTOR—UNDERNEATH VIEW.  
1. Oiling Plug.

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 inexperienced fitting of brushes.

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.

### **Micro-switch.**

Situated at the base of the steering column, the unit incorporates two switches actuated by the gear change column control lever (see Fig. 25).

One switch is connected in the starter motor circuit (4, Fig. 25), and is closed only when the hand control lever is neutral. This ensures that the engine can only be started up in neutral.

The second switch (5) is the reversing light switch, and is closed when the hand control lever is in reverse.

### 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, to look for the cause rather than to continue to use up the battery output, with the risk of damage to one or more cells, remembering that the battery may not always be fully charged at the time.

If the starter appears to be sluggish in its action, and such sluggishness is traceable to the battery, no further attempt should be made to use the starter until the battery has been duly inspected and fully charged from an external source.

### Electric Fuel Pumps and Gauge.

The electric fuel pumps should not need any attention over long periods of running, except, perhaps, the cleaning of the suction or delivery valves (see page 48); if an electrical fault is suspected, it is recommended that the necessary inspection and any work in connection with repairs should be carried out by Messrs. Bentley Motors (1931) Ltd., or one of their "Special Retailers".

Reference to the wiring diagram (Fig. 40), will show that they are supplied with current through the ignition switch, and, consequently, are only operative when the ignition switch is closed.

The fuel gauge is divided into two parts:—

- (a) An indicating instrument, mounted on the instrument panel, and marked "0,  $\frac{1}{4}$ ,  $\frac{1}{2}$ ,  $\frac{3}{4}$ , and F".
- (b) A petrol tank unit, with a float for measuring the amount of petrol in the tank.

The indicating instrument has two actuating coils:—

1. A control coil, which is connected across the battery and so provides a constant torque on the pointer, tending to swing it over to the "Full" side of the scale.
2. A deflecting coil, which is connected in series with the battery and the tank unit rheostat, and so arranged to act in opposition to the control coil.

The tank unit consists of a variable rheostat, the sliding arms of which are operated by the up-and-down movement of the float, thus varying the circuit resistance from a minimum in the empty position to a maximum in the full position. With the float in the "empty" position the current in the deflecting coil is at a maximum, and its turning effort is of sufficient strength to move the pointer, against the opposing force of the control coil, back to the "O" position on the

indicating instrument. Thus, as the resistance is varied by the position of the float, the pointer indicates the petrol level in the tank.

A warning light is provided on the instrument panel, which is automatically illuminated when there is approximately three gallons or less of petrol in the tank.

### **Electric Horns.**

Two tuned, wind-tone horns are provided, operated through a sealed relay mounted on the front of the dashboard.

No adjustments should be attempted. In the event of derangement, or deterioration of the tone, Messrs. Bentley Motors (1931) Ltd., or one of their "Special Retailers", should be consulted.

### **De-misting and Air Conditioning.**

A large flexible duct from a grille in the front wing, to a manually operated trap in the driver's compartment, allows for fresh air ventilation as required.

For the windscreen, a separate air tube tapped into this ducting is taken through a special heater, fed from the engine cooling system and fitted under the front wing, to a booster motor mounted in front of the dashboard. Then, through suitable ducting to vents in the capping rail.

The normal forward motion of the car is usually sufficient to ensure adequate de-misting, and it is only under severe conditions or if de-frosting is required, that the booster motor need be used.

The vents are fitted with metal covers; these should normally remain open, but they may be closed if it is found that warmed air is being drawn into the car at unseasonable times.

To operate for normal de-misting, ensure the vent covers are open by gently pulling same rearwards. For severe conditions or de-frosting, switch on booster motor (11, Fig. 1), the operation of the switch being "Pull-on", "Push-off".

The rear window is of the electrically heated type, and contains a series of wires moulded into the glass. A switch on the facia board marked "R.W." controls this feature as required.

### **Direction Indicator Signals.**

The direction indicator control switch is mounted on the centre of the capping rail (see Fig. 1), the flasher unit being mounted on the valance plate.

When a right turn is to be signalled, the control switch lever is moved to the right, and the signal bulbs in the right-hand wing lamp and the rear stop lamp begin flashing, also a pilot lamp on the facia board. When a left-hand turn is to be made, the control switch lever is moved to the left.

When the signal system is operating properly, the lights flash about 90 times per minute. If either front or rear signal bulb is burned out, the reduced current in the circuit will increase the flasher speed and the pilot bulb will not light.

In addition to the pilot light, a clicking noise in the flasher unit makes an audible signal when the circuit is on. This is purposely created as an additional warning that the signal unit is operating. The signal flasher is a sealed unit and is non-adjustable, and if service is necessary, it must be by replacement.

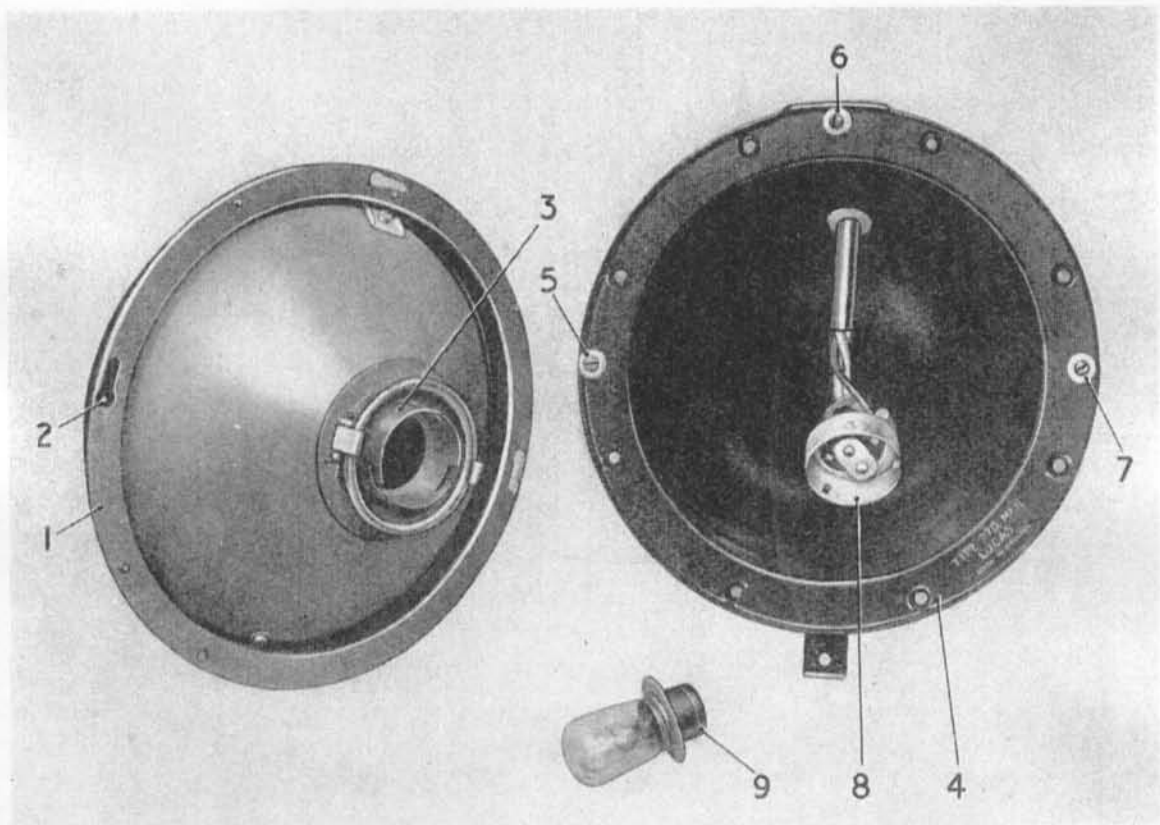


Fig. 47.—HEADLAMP—EXPLODED VIEW.

- |                                 |                                |
|---------------------------------|--------------------------------|
| 1. Light unit.                  | 6. Vertical adjustment screw.  |
| 2. Retaining screw slots.       | 7. Horizontal adjustment screw |
| 3. Bulb holder.                 | 8. Back shell.                 |
| 4. Lamp body.                   | 9. Bulb.                       |
| 5. Horizontal adjustment screw. |                                |

### Headlamps.

The headlamps are controlled by two switches, the master switch on the switchbox and a foot-switch for "beam" selection.

A small red warning light, mounted in the speedometer, is illuminated whenever the headlamps are on the "Driving Beam" (full on).

The operation of the foot-switch, changing the "driving beam" to the "passing beam", extinguishes the warning light. Thus, when

driving on a lighted road, this warning light serves as a ready indication of the selected headlamp "beam".

When the car is used on the continent of Europe, the headlamp incorporates a Light Unit, which consists essentially of a reflector and front glass assembly provided with a mounting flange, by means of which it is secured in the body housing.

Normally, provision is made for the fitting of the flanged type pre-focused bulb, as illustrated in Fig. 47. For France, an adaptor and three-pinned type bulb is fitted. The bulbs are correctly positioned in relation to the focal point of the reflector and no focusing is required when a replacement bulb is fitted.

Certain lamps may be fitted with a fuse unit attached to the lamp shell; the fuses are rated at 15 amps.

For the North American continent, the regulation "Sealed Beam" unit is fitted.

### **Replacing a Headlamp Bulb—"Light Unit" Type.**

Remove the rim securing screw, lift off the rim and the dust-excluding rubber.

Press the Light Unit in against the tension of the adjusting screw springs and turn it in an anti-clockwise direction until the heads of the screws can be disconnected through the slotted hole in the flange.

The Light Unit can now be lifted out of the lamp body. Twist the back-shell in an anti-clockwise direction and pull it off. The bulb can now be removed.

Place the replacement bulb in the holder, engage the projections in 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 heads of the vertical and horizontal adjusting screws protrude through the holes in the flange, press in and twist in a clockwise direction.

Replace the rubber dust excluder so that its thicker edge lays round the Light Unit rim. Refit the front rim and secure.

### **Aligning the Headlamps.**

The headlamps should be aligned so that they direct their beams straight ahead, i.e. parallel with the road and with each other.

The simplest way of checking the adjustment of the lamps is to take the car on a straight level stretch of road at night and examine the direction of the beams. If one appears to be out of adjustment, adjust as follows:—

Remove the rim securing screw at the bottom of the lamp and lift off the rim.

Vertical adjustment is made by operating the screw (6, Fig. 47); screwing in raises the beam and screwing out lowers the beam.

Horizontal adjustment is made by operating the screws (5 and 7, Fig. 47).

### The Side Lamps.

To change the bulb, remove the rim locking screw and the rim, and draw the lamp unit bodily forward.

To obtain access to the bulb, detach the front portion by holding firmly, and rotating the rear portion a quarter of a turn to release the spring catch.

The bulb is of the standard bayonet fitting type.

To replace, reverse the above instructions.

### 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 (Fig. 42).
2. Failure or incorrect operation of the system, may be due to the fusing of the main fuse (Fig. 42), due to an earth.

If the dynamo does not charge:—

1. Check correctness of ammeter by switching on headlamps, this should show a "discharge" reading.  
NOTE.—See that the main switch is in the "OFF" position, before making any change to the wiring connections.
2. Ascertain whether the dynamo or regulator unit is at fault by connecting together the regulator terminals F and D, this will short circuit the regulator. Start engine gently and increase speed slowly, engine speed should not exceed a fast idle. Observe ammeter; if dynamo is in order the ammeter will show a "charge" reading and the defect will be in the regulator unit.
3. To test dynamo, disconnect the wiring from both main terminals and connect these terminals together. Connect a lamp between one terminal and earth, and gently speed up engine as before. If the dynamo is in order the lamp will light.
4. Dynamo brushes may be sticking, due probably to oiliness. Clean brushes and holders with rag moistened in petrol.
5. 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.

*In the case of defective operation which is traceable to the regulator, the unit must be removed and returned for rectification to Messrs. Bentley Motors (1931) Ltd., or one of their "Special Retailers".*

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

(a) Misses.

1. First confirm right condition of sparking plugs.
2. Assure correct condition of contact breaker points, and adjust gap .019" to .021", if necessary.
3. Check condition of ignition coil casing. (See page 97.)

(b) Fails.

1. 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, and Messrs. Bentley Motors (1931) Ltd., or one of their "Special Retailers" should be consulted.

If battery will not retain charge:—

1. Ascertain that no circuit is left switched on.
2. See that no cell of the battery leaks acid.

## CHAPTER XI

### Accessories

#### *Windscreen Washing Equipment.*

#### **Windscreen Washing Equipment.**

As an added improvement to driving comfort and safety, a vacuum-operated device enables the driver to wash the windscreen whilst driving the car.

The equipment consists of two jets mounted on the scuttle just forward of the windscreen wiper blades. A press button is situated within easy reach on the facia, and on depressing this button the induction depression is communicated to the diaphragm of a pump on the reservoir, which is a glass container underneath the bonnet.

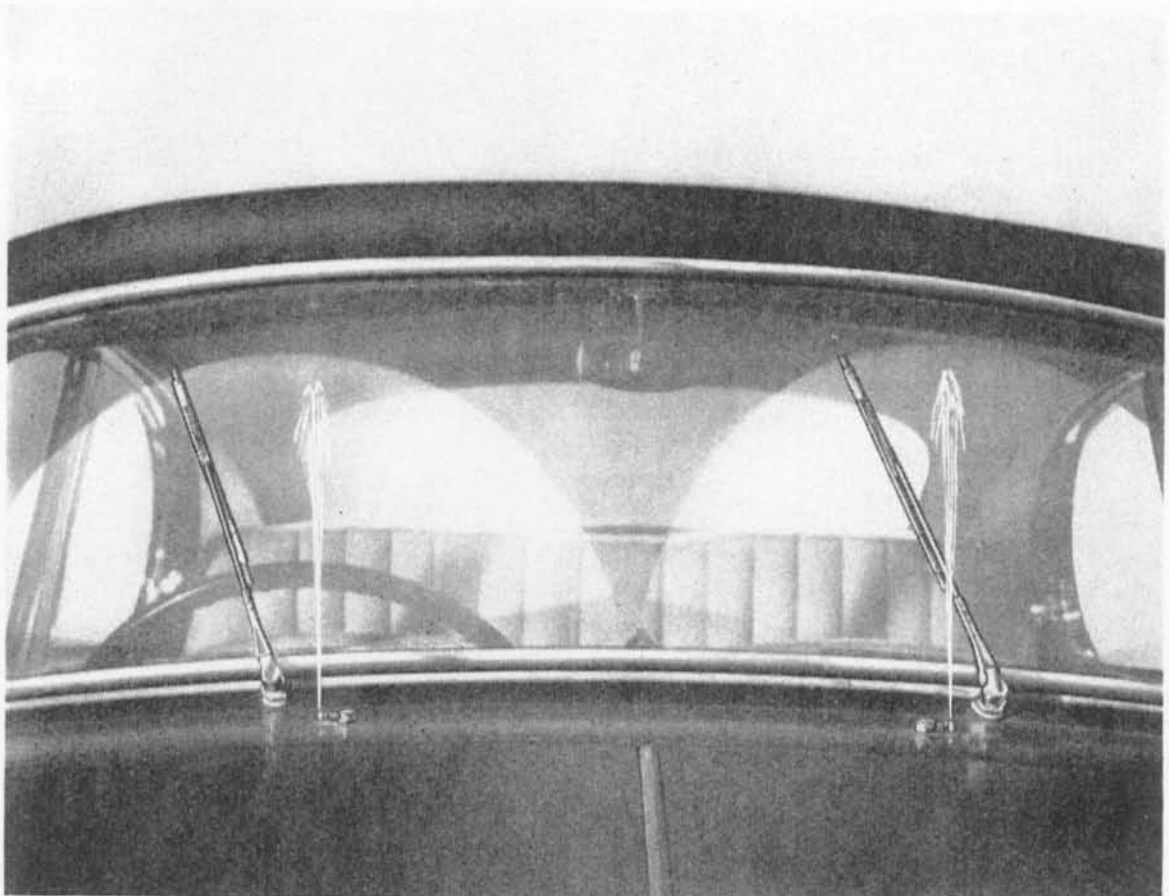


Fig. 48.—OPERATING WINDSCREEN WASHERS.

When the button is released, the diaphragm is returned under spring pressure and causes two jets of fluid to be directed on to the windscreen. The screen wipers should then be switched on, when the screen will immediately be cleaned.

The liquid in the reservoir has low surface tension and anti-freeze properties.

As the pump is actuated by the induction pipe depression, it is necessary to ease the foot off the accelerator pedal whilst the button is being depressed, otherwise there may be insufficient depression to actuate the pump.

The jets may readily be cleared if they ever become obstructed with foreign matter, by slackening off the knurled screw and operating the pump in the normal way. The jet consists of a small slot which becomes exposed when the screw is slackened off, and any obstruction is therefore easily washed away.

Adjustment of the angle of the jet is effected by turning the hexagon portion of the jet with a suitable spanner. The jet should impinge on the windscreen towards the top of the arc traversed by the screen wiper blades.

Do not attempt to dismantle the part of the jet attached to the scuttle, as reassembly may be difficult.

Tins of special liquid, which is mixed with water for refilling the reservoir, are obtainable from the Main Service Station, Hythe Road, Willesden, N.W.10, and should be used in the proportions as directed.



Fig. 49.—RESERVOIR AND PUMP.

1. Reservoir.
2. Filler cap.
3. Diaphragm pump.

## CHAPTER XII

### Storage and Recommissioning of Cars

The storage place should be dry, well ventilated and preferably heated.

The general instructions are intended to cover short periods of storage; if the storage period is likely to exceed three months, the engine, gearbox and rear axle should be drained and refilled to the correct levels with a pure mineral oil, e.g., Vacuum "BB" or Wakefield's Aero "C". Also, one of these oils should be used for injecting into the cylinders.

1.—Jack up rear wheels to take all weight off tyres, and place suitable wooden supports under the axle.

Run engine gently for a few minutes with a gear engaged. When cold, inject about two tablespoonfuls of engine oil through the spark plug holes in each cylinder. Turn the crankshaft with the starting handle a few times to distribute the oil over the cylinder walls.

Jack up front of car, a jacking pad is provided on the centre of the front suspension; support on suitable wooden blocks.

Do not deflate tyres, but cover up to exclude light.

2.—If the cooling system contains anti-freeze, do not drain. If the original coolant has been replaced by plain water, and there is any danger of freezing, drain the system. Otherwise leave water in.

3.—Drain all fuel from the main tank, rear filter and carburetter.

The fact that motor spirits undergo deterioration with time and thus cause them to adversely affect the inlet valves and the moving parts of the carburetter, it is undesirable to keep fuel tanks half filled in a warm atmosphere.

4.—Remove battery and properly charge from an external source; give a subsequent freshening charge every four to five weeks.

5.—Wash down and polish coachwork and clean all bright parts. Lightly smear with vaseline any bright parts not having an untarnishable finish.

6.—Cover the car with a light dust sheet.

Before putting the car into service again after storage, the following operations should be performed:—

- 1.—Drain engine crankcase and refill to correct level with fresh engine oil.
- 2.—Prime cylinders with engine oil.
- 3.—If previously drained, refill cooling system to the correct level.
- 4.—If gearbox and rear axle have been filled with a pure mineral oil, as directed for long period storage, drain and refill with the correct oils.
- 5.—Run engine gently for a time after starting up.
- 6.—Remove and clean spark plugs.

## CHAPTER XIII

### School of Instruction

To enable the maximum satisfaction to be obtained from the ownership of a Bentley car, Instructional Courses of two weeks' duration are held on the maintenance of the Bentley chassis. During the Course, the mechanical features of the chassis are fully explained, particular emphasis being stressed on the points requiring lubrication or adjustment; at the same time instruction is given in the handling of the car on the road, where a high standard of driving is demanded. Suitable cars are maintained by the School for instructional purposes.

The Course is intended for chauffeurs who are undertaking the care of Bentley products for the first time, and also for drivers who have had previous Bentley experience on other models. In this latter case shorter periods can be arranged, although in most cases the full Course is desirable.

In the past, owner-drivers and/or members of their families have frequently attended the Courses with beneficial results, and suitable arrangements may be made by application.

The School is located in part of the Service Department building at Willesden. Further particulars may be obtained from the Principal, School of Instruction, Bentley Motors (1931) Ltd., Hythe Road, Willesden Junction, London N.W.10.  
(Telephone No.: LADbroke 2444.)

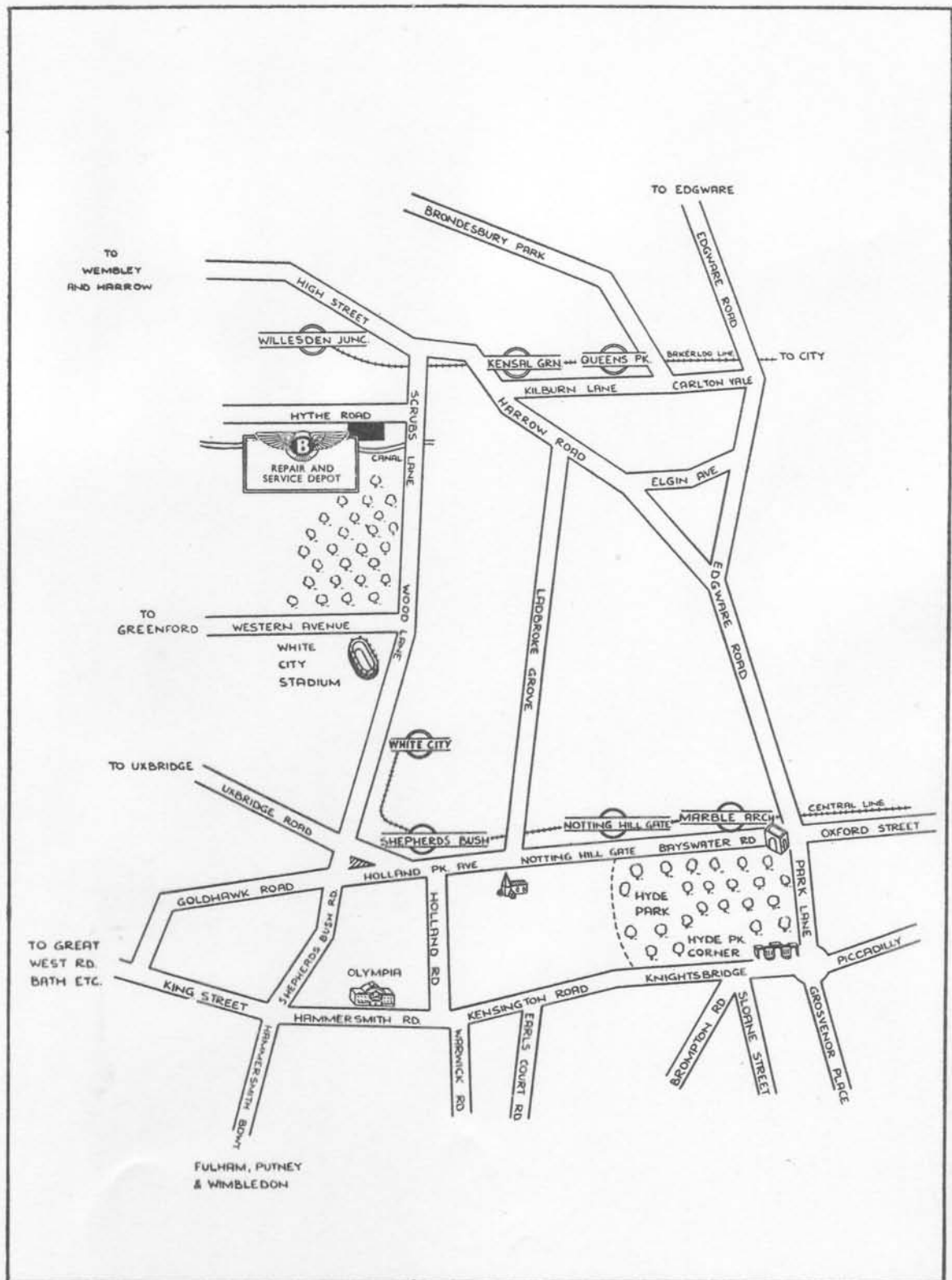


Fig. 50.—GUIDE TO LOCATION OF MAIN SERVICE STATION.

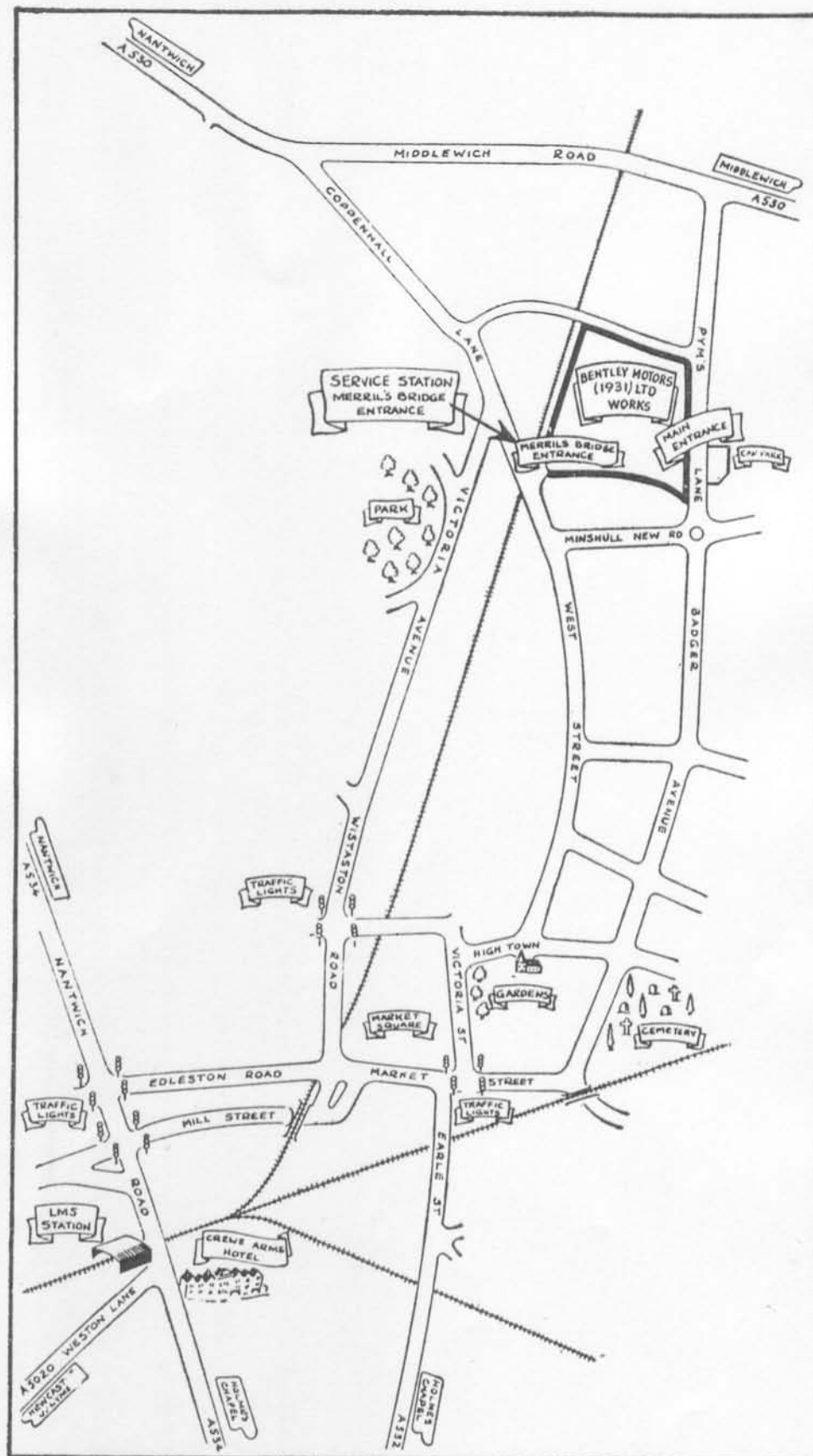


Fig. 51.—GUIDE TO LOCATION OF CREWE SERVICE STATION.

CONVERSION TABLES AND FACTORS

KILOMETRES—MILES  
OR  
MILES—KILOMETRES

# KILOMETRES—MILES

Km.				Miles		
1·60934	...	...	1	...	...	0·62137
3·219	...	...	2	...	...	1·243
4·828	...	...	3	...	...	1·864
6·437	...	...	4	...	...	2·485
8·047	...	...	5	...	...	3·107
9·656	...	...	6	...	...	3·728
11·265	...	...	7	...	...	4·350
12·875	...	...	8	...	...	4·971
14·484	...	...	9	...	...	5·592
16·093	...	...	10	...	...	6·214
17·703	...	...	11	...	...	6·835
19·312	...	...	12	...	...	7·456
20·921	...	...	13	...	...	8·078
22·531	...	...	14	...	...	8·699
24·140	...	...	15	...	...	9·321
25·749	...	...	16	...	...	9·942
27·359	...	...	17	...	...	10·563
28·968	...	...	18	...	...	11·185
30·577	...	...	19	...	...	11·806
32·187	...	...	20	...	...	12·427
33·796	...	...	21	...	...	13·049
35·406	...	...	22	...	...	13·670
37·015	...	...	23	...	...	14·291
38·624	...	...	24	...	...	14·913
40·234	...	...	25	...	...	15·534
41·843	...	...	26	...	...	16·156
43·452	...	...	27	...	...	16·777
45·062	...	...	28	...	...	17·398
46·671	...	...	29	...	...	18·020
48·280	...	...	30	...	...	18·641
49·890	...	...	31	...	...	19·262
51·499	...	...	32	...	...	19·884
53·108	...	...	33	...	...	20·505
54·718	...	...	34	...	...	21·127
56·327	...	...	35	...	...	21·748
57·936	...	...	36	...	...	22·369
59·546	...	...	37	...	...	22·991
61·155	...	...	38	...	...	23·612
62·764	...	...	39	...	...	24·233
64·374	...	...	40	...	...	24·855
65·983	...	...	41	...	...	25·476
67·592	...	...	42	...	...	26·098
69·202	...	...	43	...	...	26·719
70·811	...	...	44	...	...	27·340
72·420	...	...	45	...	...	27·962
74·030	...	...	46	...	...	28·583
75·639	...	...	47	...	...	29·204
77·249	...	...	48	...	...	29·826
78·858	...	...	49	...	...	30·447
80·467	...	...	50	...	...	31·069

# KILOMETRES—MILES

Km.			Miles		
82.077	...	...	51	...	31.690
83.686	...	...	52	...	32.311
85.295	...	...	53	...	32.933
86.905	...	...	54	...	33.554
88.514	...	...	55	...	34.175
90.123	...	...	56	...	34.797
91.733	...	...	57	...	35.418
93.342	...	...	58	...	36.039
94.951	...	...	59	...	36.661
96.561	...	...	60	...	37.282
98.170	...	...	61	...	37.904
99.779	...	...	62	...	38.525
101.389	...	...	63	...	39.146
102.998	...	...	64	...	39.768
104.607	...	...	65	...	40.389
106.217	...	...	66	...	41.011
107.826	...	...	67	...	41.632
109.435	...	...	68	...	42.253
111.045	...	...	69	...	42.875
112.654	...	...	70	...	43.496
114.263	...	...	71	...	44.117
115.873	...	...	72	...	44.739
117.482	...	...	73	...	45.360
119.091	...	...	74	...	45.981
120.701	...	...	75	...	46.603
122.310	...	...	76	...	47.224
123.919	...	...	77	...	47.846
125.529	...	...	78	...	48.467
127.138	...	...	79	...	49.088
128.748	...	...	80	...	49.710
130.357	...	...	81	...	50.331
131.966	...	...	82	...	50.952
133.576	...	...	83	...	51.574
135.185	...	...	84	...	52.195
136.794	...	...	85	...	52.817
138.404	...	...	86	...	53.438
140.013	...	...	87	...	54.059
141.622	...	...	88	...	54.681
143.232	...	...	89	...	55.302
144.841	...	...	90	...	55.923
146.450	...	...	91	...	56.545
148.060	...	...	92	...	57.166
149.669	...	...	93	...	57.788
151.278	...	...	94	...	58.409
152.888	...	...	95	...	59.030
154.497	...	...	96	...	59.652
156.106	...	...	97	...	60.273
157.716	...	...	98	...	60.894
159.325	...	...	99	...	61.516
160.934	...	...	100	...	62.137

CONVERSION TABLES AND FACTORS

LITRES—PINTS  
OR  
PINTS—LITRES

Litres to U.S. Gallons x 0.26417

# LITRES—PINTS

(8 Pints = 1 Imperial Gallon)

Litres				Pints		
0.5682454	...	...	1	...	...	1.7598
1.1365	...	...	2	...	...	3.5196
1.7047	...	...	3	...	...	5.2794
2.2730	...	...	4	...	...	7.0392
2.8412	...	...	5	...	...	8.7990
3.4095	...	...	6	...	...	10.5588
3.9777	...	...	7	...	...	12.3186
4.5460	...	...	8	...	...	14.0784
5.1142	...	...	9	...	...	15.8382
5.6852	...	...	10	...	...	17.5980
6.2507	...	...	11	...	...	19.3578
6.8189	...	...	12	...	...	21.1176
7.3872	...	...	13	...	...	22.8774
7.9554	...	...	14	...	...	24.6372
8.5237	...	...	15	...	...	26.3970
9.0919	...	...	16	...	...	28.1568
9.6602	...	...	17	...	...	29.9166
10.2284	...	...	18	...	...	31.6764
10.7967	...	...	19	...	...	33.4362
11.3649	...	...	20	...	...	35.1960
11.9332	...	...	21	...	...	36.9558
12.5014	...	...	22	...	...	38.7156
13.0696	...	...	23	...	...	40.4754
13.6379	...	...	24	...	...	42.2352
14.2061	...	...	25	...	...	43.9950
14.7744	...	...	26	...	...	45.7548
15.3426	...	...	27	...	...	47.5146
15.9109	...	...	28	...	...	49.2744
16.4791	...	...	29	...	...	51.0342
17.0474	...	...	30	...	...	52.7940
17.6156	...	...	31	...	...	54.5538
18.1839	...	...	32	...	...	56.3136
18.7521	...	...	33	...	...	58.0734
19.3203	...	...	34	...	...	59.8332
19.8886	...	...	35	...	...	61.5930
20.4568	...	...	36	...	...	63.3528
21.0251	...	...	37	...	...	65.1126
21.5933	...	...	38	...	...	66.8724
22.1616	...	...	39	...	...	68.6322
22.7298	...	...	40	...	...	70.3920
23.2981	...	...	41	...	...	72.1518
23.8663	...	...	42	...	...	73.9116
24.4346	...	...	43	...	...	75.6714
25.0028	...	...	44	...	...	77.4312
25.5710	...	...	45	...	...	79.1910
26.1393	...	...	46	...	...	80.9508
26.7075	...	...	47	...	...	82.7106
27.2758	...	...	48	...	...	84.4704
27.8440	...	...	49	...	...	86.2302
28.4123	...	...	50	...	...	87.9900

# LITRES—PINTS

(8 Pints = 1 Imperial Gallon)

Litres				Pints		
28·9805	...	...	51	...	...	89·7498
29·5488	...	...	52	...	...	91·5096
30·1170	...	...	53	...	...	93·2694
30·6853	...	...	54	...	...	95·0292
31·2535	...	...	55	...	...	96·7890
31·8217	...	...	56	...	...	98·5488
32·3900	...	...	57	...	...	100·3086
32·9582	...	...	58	...	...	102·0684
33·5265	...	...	59	...	...	103·8282
34·0947	...	...	60	...	...	105·5880
34·6630	...	...	61	...	...	107·3478
35·2312	...	...	62	...	...	109·1076
35·7995	...	...	63	...	...	110·8674
36·3677	...	...	64	...	...	112·6272
36·9360	...	...	65	...	...	114·3870
37·5042	...	...	66	...	...	116·1468
38·0724	...	...	67	...	...	117·9066
38·6407	...	...	68	...	...	119·6664
39·2089	...	...	69	...	...	121·4262
39·7772	...	...	70	...	...	123·1860
40·3454	...	...	71	...	...	124·9458
40·9137	...	...	72	...	...	126·7056
41·4819	...	...	73	...	...	128·4654
42·0502	...	...	74	...	...	130·2252
42·6184	...	...	75	...	...	131·9850
43·1867	...	...	76	...	...	133·7448
43·7549	...	...	77	...	...	135·5046
44·3231	...	...	78	...	...	137·2644
44·8914	...	...	79	...	...	139·0242
45·4596	...	...	80	...	...	140·7840
46·0279	...	...	81	...	...	142·5438
46·5961	...	...	82	...	...	144·3036
47·1644	...	...	83	...	...	146·0634
47·7326	...	...	84	...	...	147·8232
48·3009	...	...	85	...	...	149·5830
48·8691	...	...	86	...	...	151·3428
49·4373	...	...	87	...	...	153·1026
50·0056	...	...	88	...	...	154·8624
50·5738	...	...	89	...	...	156·6222
51·1421	...	...	90	...	...	158·3820
51·7103	...	...	91	...	...	160·1418
52·2786	...	...	92	...	...	161·9016
52·8468	...	...	93	...	...	163·6614
53·4151	...	...	94	...	...	165·4212
53·9833	...	...	95	...	...	167·1810
54·5516	...	...	96	...	...	168·9408
55·1198	...	...	97	...	...	170·7006
55·6880	...	...	98	...	...	172·4604
56·2563	...	...	99	...	...	174·2202
56·82454	...	...	100	...	...	175·9800

CONVERSION TABLES AND FACTORS

KILOGRAMMES PER SQ. CENTIMETRE—  
POUNDS PER SQ. INCH

OR

POUNDS PER SQ. INCH—  
KILOGRAMMES PER SQ. CENTIMETRE

Kilogrammes to Tons (English)  $\div$  1016.05

# KG./SQ. CM.—LB./SQ. IN.

Kg./sq. cm.				Lb./sq. in.		
0.0703	...	...	1	...	...	14.2233
0.1406	...	...	2	...	...	28.45
0.2109	...	...	3	...	...	42.67
0.2812	...	...	4	...	...	56.89
0.3515	...	...	5	...	...	71.12
0.4218	...	...	6	...	...	85.34
0.4921	...	...	7	...	...	99.56
0.5625	...	...	8	...	...	113.79
0.6328	...	...	9	...	...	128.01
0.7031	...	...	10	...	...	142.23
0.7734	...	...	11	...	...	156.46
0.8437	...	...	12	...	...	170.68
0.9140	...	...	13	...	...	184.90
0.9843	...	...	14	...	...	199.13
1.0546	...	...	15	...	...	213.35
1.1249	...	...	16	...	...	227.57
1.1952	...	...	17	...	...	241.80
1.2655	...	...	18	...	...	256.02
1.3358	...	...	19	...	...	270.24
1.4061	...	...	20	...	...	284.47
1.4764	...	...	21	...	...	298.69
1.5467	...	...	22	...	...	312.91
1.6171	...	...	23	...	...	327.14
1.6874	...	...	24	...	...	341.36
1.7577	...	...	25	...	...	355.58
1.8280	...	...	26	...	...	369.81
1.8983	...	...	27	...	...	384.03
1.9686	...	...	28	...	...	398.25
2.0389	...	...	29	...	...	412.48
2.1092	...	...	30	...	...	426.70
2.1795	...	...	31	...	...	440.92
2.2498	...	...	32	...	...	455.15
2.3201	...	...	33	...	...	469.37
2.3904	...	...	34	...	...	483.59
2.4607	...	...	35	...	...	497.82
2.5310	...	...	36	...	...	512.04
2.6014	...	...	37	...	...	526.26
2.6717	...	...	38	...	...	540.49
2.7420	...	...	39	...	...	554.71
2.8123	...	...	40	...	...	568.93
2.8826	...	...	41	...	...	583.16
2.9529	...	...	42	...	...	597.38
3.0232	...	...	43	...	...	611.60
3.0935	...	...	44	...	...	625.83
3.1638	...	...	45	...	...	640.05
3.2341	...	...	46	...	...	654.27
3.3044	...	...	47	...	...	668.50
3.3747	...	...	48	...	...	682.72
3.4450	...	...	49	...	...	696.94
3.5153	...	...	50	...	...	711.17

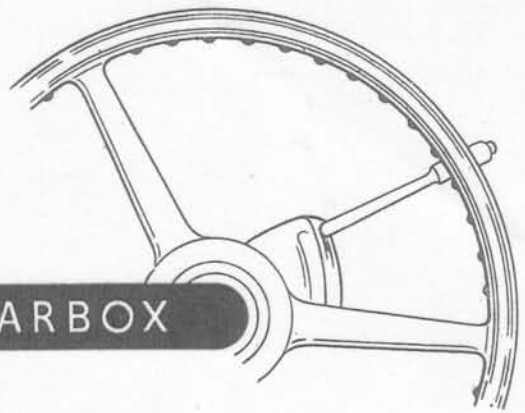


*The*

# **AUTOMATIC GEARBOX . . .**



*Driving  
Instructions*



## THE AUTOMATIC GEARBOX

The Rolls-Royce Automatic Gearbox is more than just a mechanism which automatically adjusts the gear ratios according to conditions of speed and load. An overriding control is provided which enables the driver to exercise his own judgment and desires in regard to the gear ratios to be selected, and an understanding of what is possible greatly enhances the pleasure to be derived from driving the car.

No automatic mechanism, however good, has the power of anticipation, but the driver can see ahead and he has the means for overriding the automatic mechanism when desired.

If the driver so desires, he can leave everything to the automatic gearbox, and gear changes will occur at the theoretically correct moment in terms of speed and load. Obviously, however, road or traffic conditions may be such that the theoretically correct moment of gear change may be undesirable or may be unexpected or perhaps delayed, and it is for this reason that the overriding control is provided to enable the driver to enforce a gear change as and when desired.

The driver should, therefore, first familiarise himself with the approximate speeds at which the automatic changes occur. These changes are as follows:

	UP CHANGES (m.p.h.)		
	1—2	2—3	3—4
Light throttle ..	6	11	20
Full throttle ..	18	31	65

It will be noted that greater throttle opening causes the changes to be delayed progressively, therefore an up-change can be induced by the driver at any speed within these limits by easing the foot off the throttle pedal at the moment an up-change is desired. With a little practice a driver can, by judicious use of the throttle pedal, permit the automatic mechanism to make completely smooth and unobtrusive changes.

The owner-driver who wishes occasionally to indulge in a very fast get-away will obtain maximum acceleration by allowing the automatic gearbox to make full throttle changes throughout the speed range.

The automatic down-changes at light throttle will normally occur at the following speeds:

4—3	3—2	2—1
14 m.p.h.	8 m.p.h.	4 m.p.h.

The driver should recognise that the down-changes will always occur at approximately these speeds when slowing down, but it will be found that the changes occur quite smoothly, although it is well to remember that as the speed falls to 9 m.p.h. the 3—2 change will occur which involves an appreciable reduction in gear ratio, and the smoothest change will result if the throttle opening is kept to the minimum.

In traffic which enforces for any length of time speeds between 6 and 25 m.p.h., the driver can avoid the continual changes which might occur between ranges 3 and 4 by placing the hand lever in position 3. Similarly, in traffic which enforces an even slower rate of progress, the hand lever should be placed in position 2, which will avoid unnecessary changes to and from the higher ratios.

For normal cruising on the open road the hand lever should be left in position 4, but the driver will discover that the most perfect and smooth gear changes between top and third can be made with extreme ease and rapidity by moving the hand lever between ranges 3 and 4. Completely imperceptible changes can be made if the throttle is at the same time adjusted to suit. The best

changes occur at light throttle openings. The driver is encouraged to make the fullest use of this gear change in exactly the same way that he would with a normal gearbox. Overtaking other traffic can be accomplished at the desired throttle opening with the minimum amount of fuss and with the greatest ease.

For full throttle acceleration in an emergency, the driver can immediately obtain a lower gear by pressing the accelerator pedal hard down onto its stop. Full throttle down-changes are not usually required except in an emergency, and the driver will, in most cases, prefer to make full use of the hand lever.

## **SECOND SPEED START**

It may sometimes be extremely desirable to hold the car indefinitely in 2nd gear as, for instance, when negotiating very slippery surfaces or when mountain climbing. A device has been incorporated which holds the shift valves in 2nd gear whenever the hand lever is placed in range 2. In this position, the car will start from rest in 2nd gear, and will stay in 2nd gear until the hand lever is moved to a higher range. The device is useful also when descending very steep hills and it is desired to use the engine as a brake.

When climbing or negotiating a hairpin in fixed 2nd gear, it is useful to remember that 1st gear is immediately available if suddenly required by operating the kick down valve which is obtained by pressing the throttle pedal as far as it will go. Remember also that it is possible to overrev. the engine in fixed 2nd as in this range there is no safety up-change.

## **PARKING LOCK**

A most efficient lock is provided in the design of the gearbox. This operates when the hand lever is placed in position 'R' and the engine switched off with the car stationary. The car will not move even on the steepest gradients, but naturally it will be essential to apply the brakes firmly when it is desired to start the engine as the engine will not start up until the hand lever is moved to 'N', and no parking lock will then be available.

## **MANŒUVRING**

The fluid coupling and low gear ratios of 1st and Reverse may sometimes make it a little difficult to judge precisely the correct engine revolutions required to move the car a few inches backwards or forwards, and it will be found that manœuvring in confined spaces is more easily accomplished if a little extra load is applied to the fluid coupling by light pressure on the brakes.

## **COLD STARTING**

When starting from cold it should always be remembered that the automatic carburetter system will cause the engine to start up initially at a fairly fast idle speed, and therefore it is essential always to apply the brakes firmly before starting up, and especially when engaging Reverse from cold as the driver then has to pass through the forward gear ratios to obtain Reverse, and the car may move forward if the brake is not applied.