The Manual of the

Magna

(L Type)

ERRATUM

Illustration No. 58. Page 55.
"Steel Floating Plate 4" is shown the wrong way round. The boss on the centre portion should be towards the "Clutch Cover Plate 1."

Price 10/-

Instruction Manual

for the

Magna

(L Type Models)

TELEGRAMS
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ABINGDON
TELEPHONE
251 (3 LINES)
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Second Edition - Jan., 1934

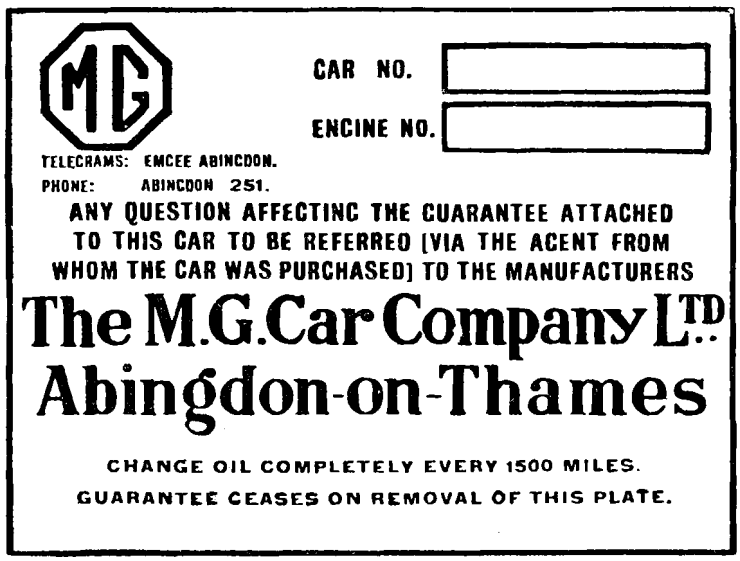

Illustration No. Ia. The identification plate is to be found on the engine side of the dashboard, and bears the official chassis and engine numbers, which should always be quoted in any correspondence relating to the car.

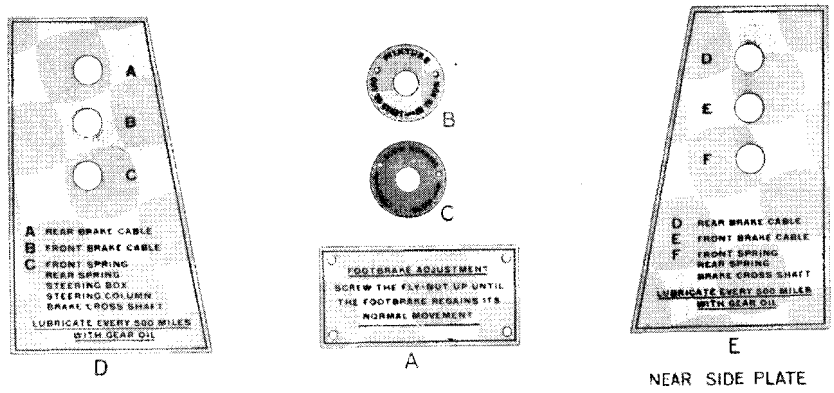

Illustration No. Ib. Various instruction plates to be found on the car. Plate A is situated on the trap door in floorboards just in front of the driver's seat, B and C on the gearbox extension, and D and E on the dash wall supports.

INDEX

	Page
LUBRICATION	
Important points concerning lubrication	10
Approved engine oils	12
Approved gearbox oils	12
Approved back axle oils	12
Engine lubrication	46
Upper cylinder lubricants	12
Dynamo lubrication	80
Distributor lubrication	85
Chassis Lubrication Chart will be found at the end of *Manual*.	
GENERAL SURVEY	
Chassis	13
Steering	19
Brakes	22
Carburetter	71
Engine	31
Electric starter	34
Water pump	45
Clutch	54
Clutch operation	55
Clutch withdrawal	57
Gearbox	59
Universal joint and propeller shaft	62
Rear axle	66
Differential	69
Suspension	70
Tyres	92
ADJUSTMENTS	
Running adjustments	26
Brake adjustment	23
Clutch adjustment	57
Tappet adjustment	27
Engine dismantling	36
Cylinder head removal	38
Timing dismantling	42
Steering gearbox	63
Axle dismantling	68
Synchronisation of carburetters	73
Removing the dynamo	80
Third brush regulator	82
The detection and remedy of ignition faults	86
Engine will not fire	86
Misfiring and bad starting	86
Replacement of lamp bulbs	87
Tyre pressures	92
Removing tyres	92

	Page
ELECTRICAL	
Ignition	29
Instruments	75
Cut-out and junction box	76
Distributor	85
Coil	86
Warning lamp	86
Wiring diagram	Facing page 75
Self-starter	82
Dynamo	78
Brushes	78
Dynamo field fuse	80
Commutator	79
Ammeter	84
Cut-out	84
Battery	83
Distributor cam	85
Automatic timing control	85
Fuses	84
Headlamps	87
Sidelamps and tail-lamp	88
Horn	88
Petrol pump	89
The list of M.G. Distributors	94
,, ,, ,, M.G. Dealers	95
,, ,, ,, M.G. Radiator Repair Service Depots	97
,, ,, ,, Lucas Agents	93
,, ,, ,, Tools and equipment	6
,, ,, ,, Miscellaneous hints	8

FOREWORD

The object of this Instruction Book is to place the owner in possession of as much detailed information as is possible concerning The M.G. Magna L Type. It is intended in the early chapters to afford a pictorial survey of the chassis generally, and the book is so arranged that all the essential information and instructions necessary to maintain the car in efficient condition are contained in the early part. The remaining chapters contain more detailed information which it is hoped will prove of interest to most owners.

The time arises when a car has to be dismantled, and it is then that the reference to the Instruction Book can be of considerable value, as it points out both to the owner and repair shops unacquainted with the construction of the car, the correct method of procedure.

There are a number of adjustments which have to be carried out from time to time such as adjusting valves and brakes, and more detailed information is given upon these points separately. The Book is provided with a comprehensive index, to which reference should be made, as it is quite possible that either illustrations or reading matter concerning the same parts may come under different headings. Should at any time the owner fail to find the particular instruction he requires in the Instruction Book, it is hoped he will not hesitate to communicate with the Service Department at Abingdon, who will always be only too ready to afford any assistance they can.

LIST OF TOOLS AND EQUIPMENT SUPPLIED WITH THE M.G. MAGNA

Two-seater Model.

1 Tool roll.
1 10 in. screwdriver in roll.
1 Adjusting spanner in roll.
1 Pair 6 in. pliers in roll.
1 Tappet spanner in roll.
1 Double-ended spanner ($\frac{3}{8}'' \times \frac{5}{16}''$) in roll.
1 Double-ended spanner ($\frac{1}{2}'' \times \frac{7}{16}''$) in roll.
1 Double-ended spanner ($\frac{1}{4}'' \times \frac{3}{16}''$) in roll.
1 Spanner ($\frac{1}{8}''$ Whit.) (single-ended).
1 Box spanner ($\frac{7}{16}''$).
1 Box spanner ($\frac{1}{4}''$).
1 Contact breaker spanner.
1 Grease gun (for gear oil and grease).
1 Tyre pump.
1 Starting handle.
1 Hub cap hammer in roll.
1 Cylinder head spanner in roll.
1 Small grease gun (Hardy Spicer).
1 Plug spanner.
1 Spare Lodge plug.
1 Carrier for above (fitted to bulkhead).
1 Licence holder (fitted to windscreen).
1 Jack with handle.
1 Tecalemit oil filter element.
1 Spare quart tin of engine oil.
1 Sump drain plug wrench.

Four-seater and Saloon Models.

1 Tool roll.
1 10 in. screwdriver in roll.
1 Adjusting spanner in roll.
1 Pair 6 in. pliers in roll.
1 Tappet spanner in roll.
1 Double-ended spanner ($\frac{3}{8}'' \times \frac{5}{16}''$) in roll.
1 Double-ended spanner ($\frac{1}{2}'' \times \frac{7}{16}''$) in roll.
1 Double-ended spanner ($\frac{1}{4}'' \times \frac{3}{16}''$) in roll.
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1 Carrier for above (fitted to bulkhead).
1 Licence holder (fitted to windscreen).
1 Jack with handle.
1 Tecalemit oil filter element.
1 Spare quart tin of engine oil.
1 Sump drain plug wrench.

The tools on the L Type Two-seater Model are neatly packed away behind the seat squab, and on the Four-seater and Saloon Models in the toolbox, which is accessible when the bonnet is lifted.

MISCELLANEOUS HINTS

Do read this *Manual* thoroughly and carefully and follow out the instructions laid down.

Do write to us or come and see us (by appointment, please) when in any difficulty.

Do always quote model, year, engine and chassis numbers when writing. **This is very important.**

Do avoid "harsh" driving, particularly when braking; the M.G. brakes are smooth and powerful and need never be "stamped on."

Do, please, drive slowly when in the vicinity of the factory when you come to visit us.

Do use the gears freely, particularly on hills and when accelerating after corners, in traffic, etc.

Do free the engine by hand when cold before using the starter.

Do remember to keep the radiator filled.

Do not allow the engine to "pink."

Do not slip the clutch except when actually starting off or changing gear; change down in traffic, to bottom gear if necessary.

Do not subject the tyres to glancing blows from the kerb when drawing up beside the pavement; this may interfere with wheel alignment and have a serious effect on steering and tyre life.

Do not lean on open doors.

Do not under any circumstances allow the oil level to fall below half full; it is best to keep it always up to three-quarters at least.

Do not mix different brands of oil in the sump.

Do not race the engine when it is cold; this will shorten considerably the life of pistons and bearings, and may even result in piston seizure. At the same time do not allow it to idle, this is equally injurious. The best warming up speed is 1000 r.p.m.

Do not allow the engine to labour.

Do not forget to turn the petrol tap back to the main position after refilling the tank.

Do not run the engine with the mixture control in the rich position longer than necessary.

Do not leave the headlamps alight when the car is stationary at night; this drains the battery unnecessarily and is very discourteous to other road users.

Do not try to improve your car's performance by altering the ignition timing or interfering in any way with standard settings and adjustments. The makers know best.

Do not forget to lubricate clutch thrust.

Do not forget to top up the battery with distilled water.

GENERAL DATA

Engine bore and stroke	57×71 mm. (6-cyl.)
Cylinder capacity	1087 c.c.
Horse-power (R.A.C. rating)	12.08 (Tax £12)
Sump capacity	1¼ gallon (approx.)

Petrol tank capacities :—

Two-seater	12 gallons
Four-seater	10 ,,
Salonette	9 ,,
Continental Coupé	12 ,,

Reserve supply included in the main tank : 2 gallons on all models except Two-seater, which has 3 gallons.

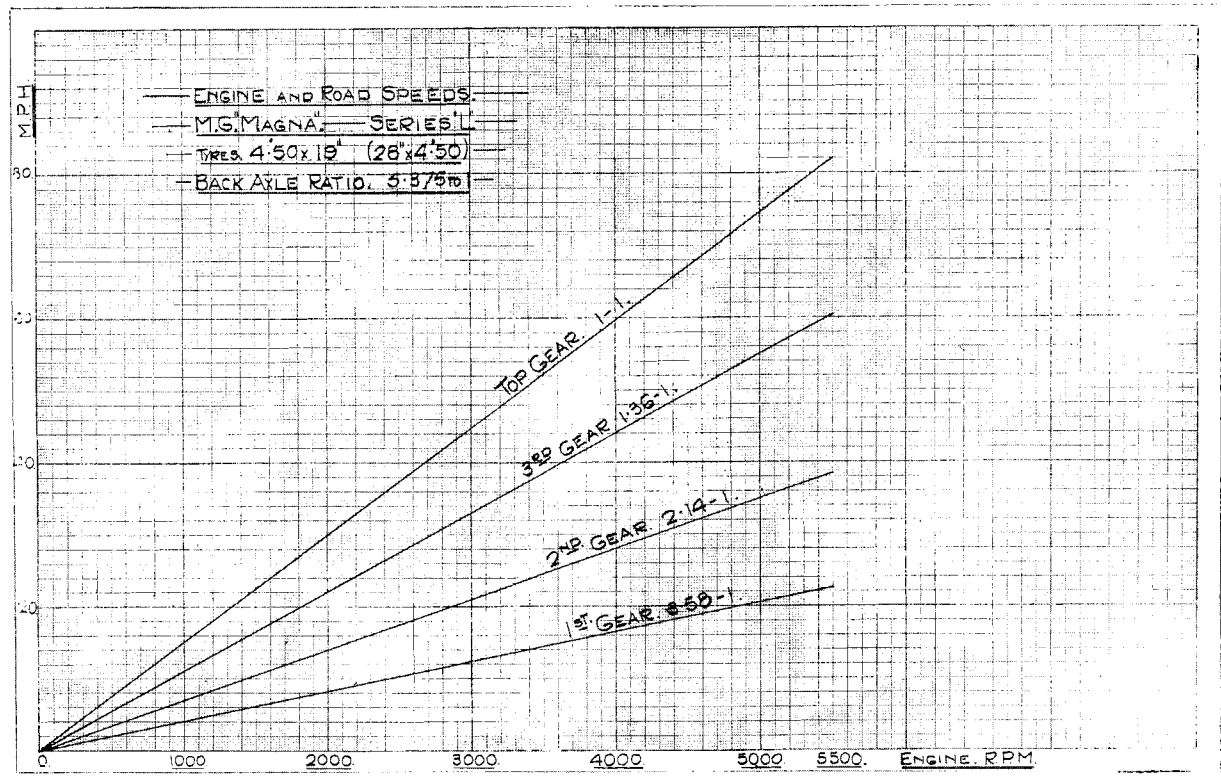
Gear ratios :—

	Gearbox	Final
Top	1 to 1.	5.375 to 1
Third	1.36 to 1.	7.31 to 1
Second	2.14 to 1.	11.49 to 1
Bottom	3.58 to 1.	19.21 to 1
Reverse	3.58 to 1.	19.21 to 1

Tyre size	4.50×19
Battery	12-volt, 53 amp.

Dimensions :—

	Two-seater.	Four-seater.	Saloon.
Overall length	11′ 4½″	12′ 0″	11′ 10″
Overall width	4′ 4″	4′ 4″	4′ 4″
Overall height	4′ 0″	4′ 0½″	4′ 8″
Turning circle	36′ 0″	36′ 0″	36′ 0″
Ground clearance	6″	6″	6″
Wheelbase	7′ 10″	7′ 10″	7′ 10″
Track	3′ 6″	3′ 6″	3′ 6″
Weights	15½ cwt.	16½ cwt.	17¼ cwt.



This graph indicates the speeds on all gears against revolutions of the engine, and reference to the running-in speeds below in conjunction with the graph show that for the first 1000 miles, 2350 r.p.m.; between 1000 and 1500, 2700 r.p.m.; and 1500 and 2000 miles, 3000 r.p.m. should not be exceeded.

The following speeds should strictly be adhered to during the running-in period :—

	Up to 1000 *miles.*	*From* 1000 *to* 1500 *miles.*	*From* 1500 *to* 2000 *miles.*
Top	35	40	55
Third	26	30	41
Second	17	19	26
Bottom	10	11	15

The Manual of the M.G. Magna

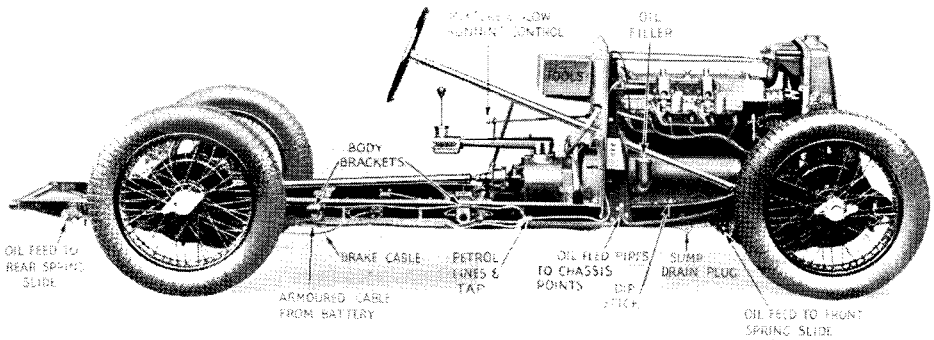


Illustration No. 2.—General off-side view of the M.G. Magna chassis with reference to the various lubrication points, etc., referred to in the text. On 1934 closed models the petrol tap control is on the dash.

Important Points concerning Lubrication.—The first thing the owner will want to know about his car will concern lubrication : the various lubricants recommended and the points of the engine and chassis requiring attention. It must not be assumed that the engine is thoroughly run in and fit for heavy work before a distance of about 2000 miles has been covered. **Until this figure is reached under no circumstances should the car be driven fast on the lower gears (see the table on the previous page).** At the end of the first 500 miles the engine oil should be drained and the base chamber refilled with new oil, at the same time the element from the Tecalemit oil filter should be removed and thrown away—a replacement is supplied with the tool kit. Subsequently the Tecalemit filter should be cleaned thoroughly in petrol or paraffin every 2000 miles. The oil filter in the sump also should be taken out and cleaned with petrol (see page 42). The engine oil filler is situated on the off-side of the engine (see Illustration No. 2), with the dipstick alongside. The oil level should be checked before starting out on a long journey or at least every 200 miles, and the sump topped up if necessary with the same brand of oil already in use. Before checking the oil level the dipstick should be wiped clean and reinserted, otherwise when a reading is taken there is a possibility of it showing a false level.

Even when run in it is inadvisable to run a cold engine fast until the oil has had an opportunity of circulating and warming up sufficiently in order to run freely through the oil passage ways throughout the engine. This avoids excessive piston and cylinder wear, and lengthens considerably the period before which a re-bore is necessary. The pump is called upon to suck from the base chamber or sump oil which has become thick with standing, particularly in cold weather. It may be noticed that the oil gauge will show that the pressure drops as the speed increases if the engine is driven fast when cold. This is an indication that the oil has not become thin enough to pass into the pump in sufficient quantity, and the speed of the car should for a while be decreased accordingly. The pump lubricates the whole of the engine, including the valve gear.

The gearbox and rear axle are provided with hexagon shape caps situated in such a manner that they automatically indicate the height level to which oil should be filled, and prevent the possibility of overfilling. It should be remembered that the car must not be moved in any way when the gearbox and back axle are being filled, otherwise additional lubricant will be carried round by the teeth of the gears, thus causing the housings to contain more oil than they need and above the proper level.

Most of the chassis fittings are conveniently lubricated from 6 oil nipples, 3 on either side of the car, which are to be found on the brackets supporting the dashboard. The bonnet has to be lifted and the nipples fed by the large oilgun provided with the car. Reference to the plates attached to the dashboard (Illustration 1b) shows that on the off-side of the car there are nipples marked A, B and C, and on the near-side of the car nipples D, E and F. The points lubricated by these various nipples are the brake cables, the spring shackles, the steering box and column and the brake cross shaft. The brake operating spindles which pass through the brake-drums are separately lubricated, as also are the steering head pins and the track rod and other steering ball socket joints. **Only use gear oil in the large oilgun.**

A lubricating chart is provided at the end of the book indicating the lubrication carried out from the central dashboard nipples and is shown in black, and the other points on the chassis that have to be individually lubricated are shown with a red circle surrounding them, and if there is any doubt in any owner's mind as to the exact location of the nipples, they can be seen in one or more of the illustrations of the parts contained in this *Manual*. **The only point which cannot be normally seen is the clutch thrust lubricator, but this will be dealt with on page 54, from which it follows that the clutch inspection cover has to be removed before the thrust can be lubricated. This requires attention every 2000 miles.**

On the next page there is a list of oils approved for use in the engine. **Under no circumstances should mineral and vegetable base oils be mixed in the engine,** and it is preferable by far if anybody wishes to run on a particular oil or is forced to do so by circumstances, that the old oil should be drained out first and a complete replenishment made.

Under no circumstances should paraffin be used to wash out the lubricating system unless the engine is being dismantled. More detailed instruction of the lubricating system of the engine will be found on pages 46 to 52 which deal with the complete travel of the oil from the sump to the pump, thence through the various pipes and passages in the engine to the main and big-end bearings and to the overhead valve gear. The oil pump is provided with a relief valve of very simple construction consisting of a spring and dashpot enclosed in a cover plug. The details of this will also be found on page 47.

The following lubricants are recommended by the Company :—

Approved Engine Oils.—Every M.G. Magna is tested on Duckham's Adcol N.P.5 Aero and the sump and spare quart tin are filled with the same brand when the car is issued new. We very strongly recommend the use of this oil both in Summer and Winter.

On the rare occasions when this oil cannot be obtained the following oils are approved for use :—

Duckham's Adcol N.P.3 (Summer and Winter).
Castrol XL (Winter), XXL (Summer).
Filtrate Sports (Summer and Winter).
Mobiloil AF (Winter), D (Summer).
Essolube 50 (Summer), 40 (Winter).
Price's Motorine " C " de Luxe (Summer and Winter).
Shell Triple or AeroShell (Summer and Winter).
Speedolene " B " (Summer and Winter).
Sternol WW Heavy (Summer and Winter).

Gearbox and Back Axle.—As in the case of engine oils, we recommend the use of Duckham's oil, the particular brand for the gearbox and back axle being Duckham's Adcol Gear Oil " N." The following list is also approved for use :—

Castrol Swanshot Gear Oil.
Filtrate Gear Oil.
Mobiloil " C " Rear Axle CW Gearbox Oil.
Pratt's Super Gear Oil.
Price's Motorine Amber " B."
Shell Gear Oil.
Speedolene " H."
Sternol Liquid Ambroleum.

Hub Grease.—Duckham's Adcol H.B.B.

Universal Joints.—Duckham's Hardy Spicer Grease.

Upper Cylinder Lubricants.—For the first 1000 miles of the car's life it is advisable to introduce a good upper cylinder lubricant into the fuel; the recommended quantities can be gauged by the measure which accompanies the containers of these oils. The following are approved for use :—

Castrollo Upper Cylinder Lubricant.
Gargoyle ,, ,, ,,
Mixtrol ,, ,, ,,
Petroyle ,, ,, ,,
Shell ,, ,, ,,

We will now leave the general lubrication summary with the advice to **use recommended oils whenever obtainable.** Five-gallon drums, with a special drum stand, can always be supplied by accredited Agents, and this is by far the cheapest way of buying oil. Keep the receptacle which is used for filling clean and covered, and also wash around back axle and gearbox filler-caps before they are unscrewed. **The gearbox and back axle should be drained and refilled for preference after the car has been running some time, so that the lubricant has had a chance to become fluid.**

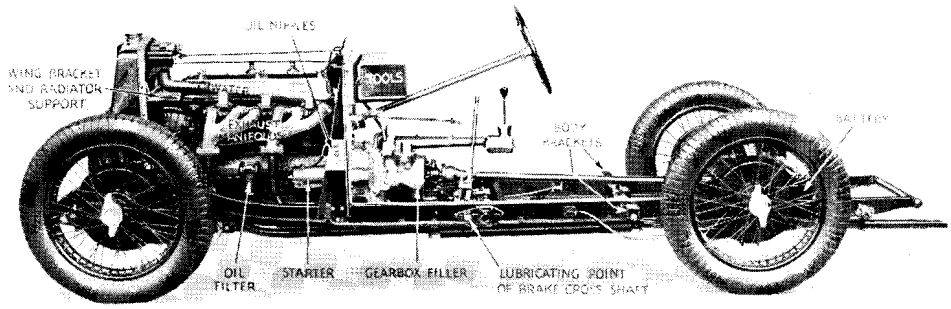


Illustration No. 3.—A near-side view of the M.G. Magna chassis. The various points which are lettered are referred to in the text.

General Survey.—As soon as the owner receives the car it is advisable to become familiar with its general mechanical details, and in order to assist in this as much as possible, it has been thought advisable to take a general pictorial survey of the chassis, in particular those parts which cannot be seen after the body has been fitted.

Illustrations Nos. 2 and 3 are general side views of the chassis showing various points of lubrication and how it has been kept as low as possible. Semi-elliptic springs are fitted fore and aft. The engine is mounted in such a way that there is actually a seal between it and the dashboard, thus preventing fumes entering the driving compartment. The bonnet in point of fact not only covers the engine, but also the space between the dashboard and the instrument board. This affords marked accessibility to points behind the facia board which otherwise would be hidden.

By bringing the change speed lever back in the small gate through the gearbox extension, a low rake steering column is possible. The body is mounted on extension brackets attached outside the frame, thus adding to the stability of the former. The floorboards are independent of the body, being fitted to the chassis.

Illustration No. 3 is the view obtained by looking at a chassis from the near-side. The body brackets can be seen in the illustration.

In order to obtain a better view of the car it has been found desirable to remove unnecessary fittings such as wings, etc.

Illustrations 4 and 5 are views of the near-side and off-side of the engine. No. 4 shows the upsweep of the frame over the front axle, the position of the radiator in relation to the side members, the water pump, the two water connections to the engine, and the Tecalemit oil filter. Cooling is by pump driven from the timing gears. It will be seen from this illustration that the dynamo, which is placed vertically and driven from the front end of the engine, has a coupling at its upper extremity which in turn operates the overhead camshaft contained in the top cover.

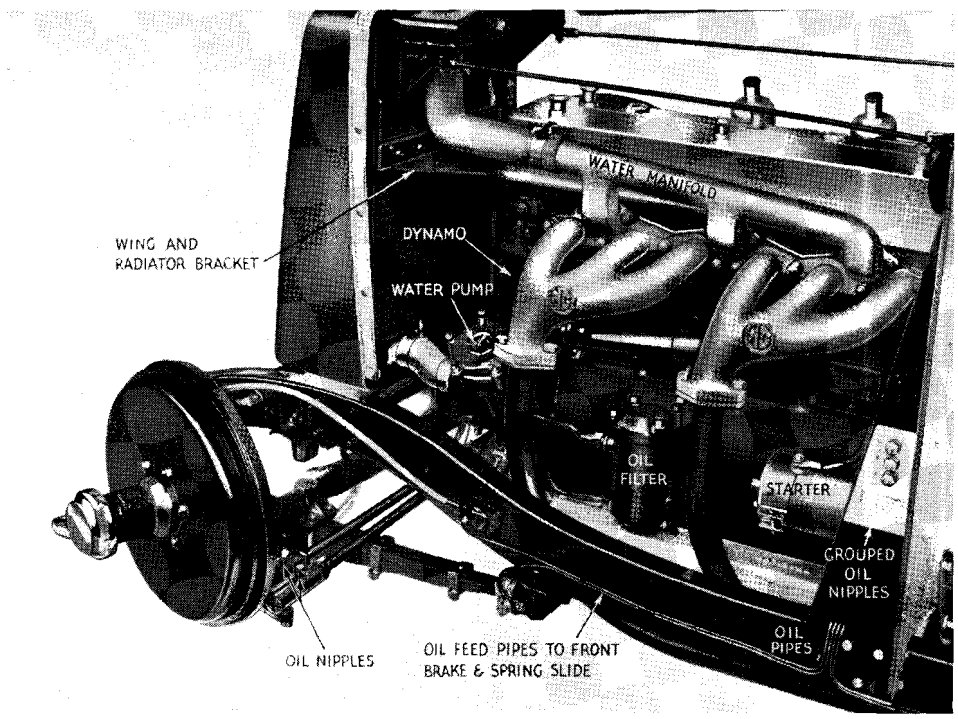


Illustration No. 4.—Near-side engine view, looking forward, with references to various engine details referred to in the accompanying text.

Illustration No. 5 shows in particular the method of mounting the front wings and the front tie bar with its anchorage on the cylinder head block and the radiator support ; it will be seen that the bottom of the wing bracket is carried in a silent block bush and there is in addition rubber packing between the headlamp bracket and the wing stay, also at the point where the tie bar passes through the radiator shell.

The position of the 14 mm. sparking plugs, the inlet manifold, and the pair of S.U. carburetters attached thereto can be seen also. These carburetters are in couple, so that the throttle control operates them simultaneously, and the " jet control " enriches the mixture for starting of both carburetters at the same time.

We will now pass to Illustration No. 6, which is a side view of the engine removed from the chassis. The engine bearer shown on the left of the picture serves also as a bracket on which the radiator on fibre washers is mounted. Note also the oil feed pipe from the sump to the pump and to the filter, thence to the main and big-end bearings and the overhead valve gear. The oil pump relief valve can also be seen in the picture.

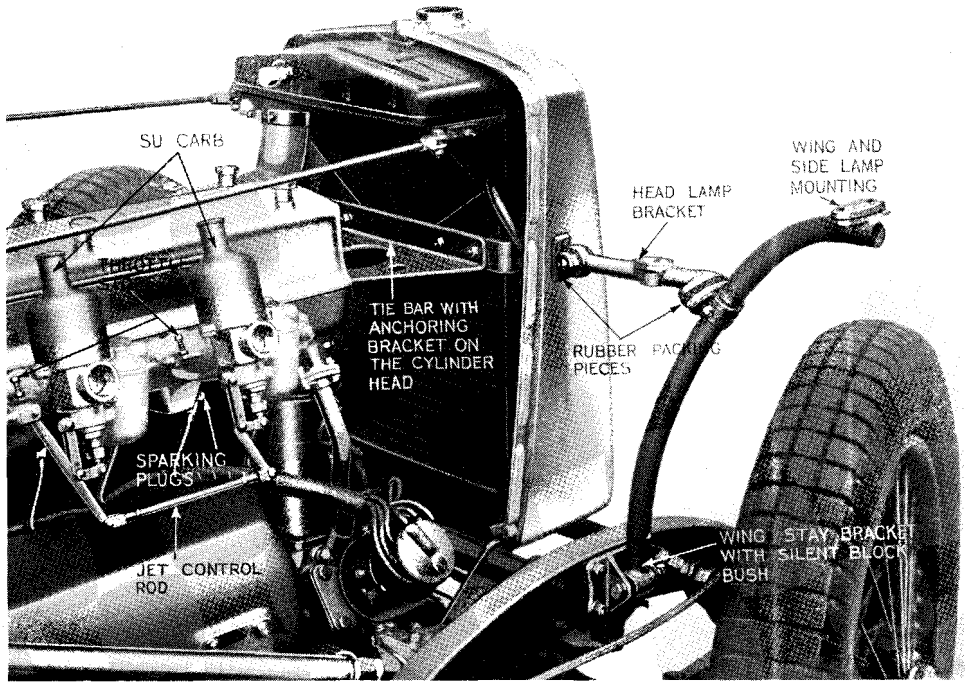


Illustration No. 5.—Off-side of engine, showing inlet manifold, carburetters, position of the sparking plugs and the method of mounting the front wings.

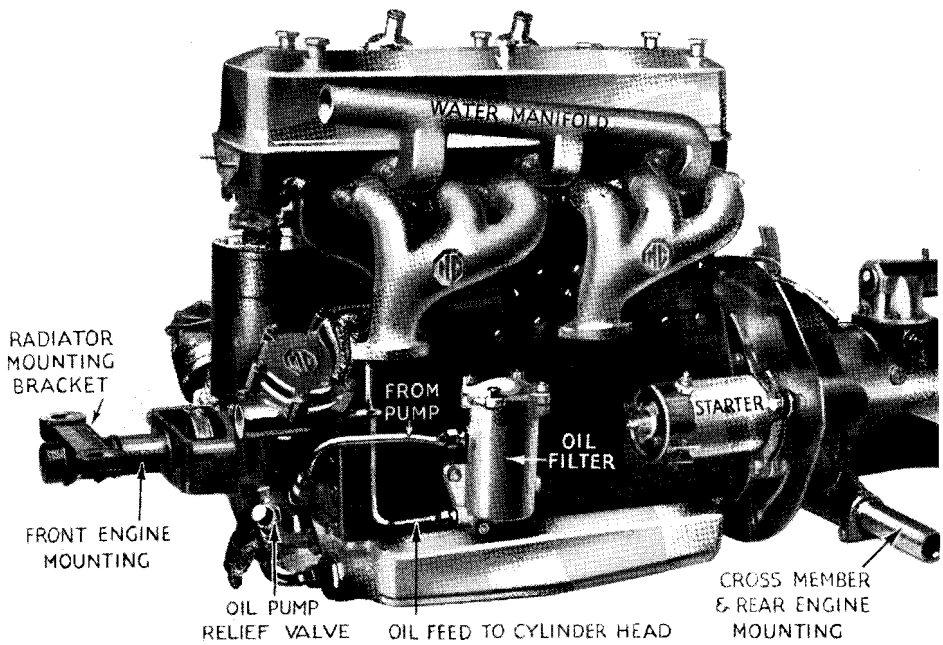


Illustration No. 6.—Near-side of the engine removed from the chassis, showing various oil ways and the radiator and engine mounting.

The next Illustration, No. 7, deals particularly with the near-side view of the dashboard, steering column, clutch, brake and accelerator pedals, gearbox, and the general controls of the car. The slow-running throttle setting and jet controls are operated by two small rods situated in front of the change speed lever. The hand brake lever operates direct on the brake cross shaft and is seen at the side of the gearbox.

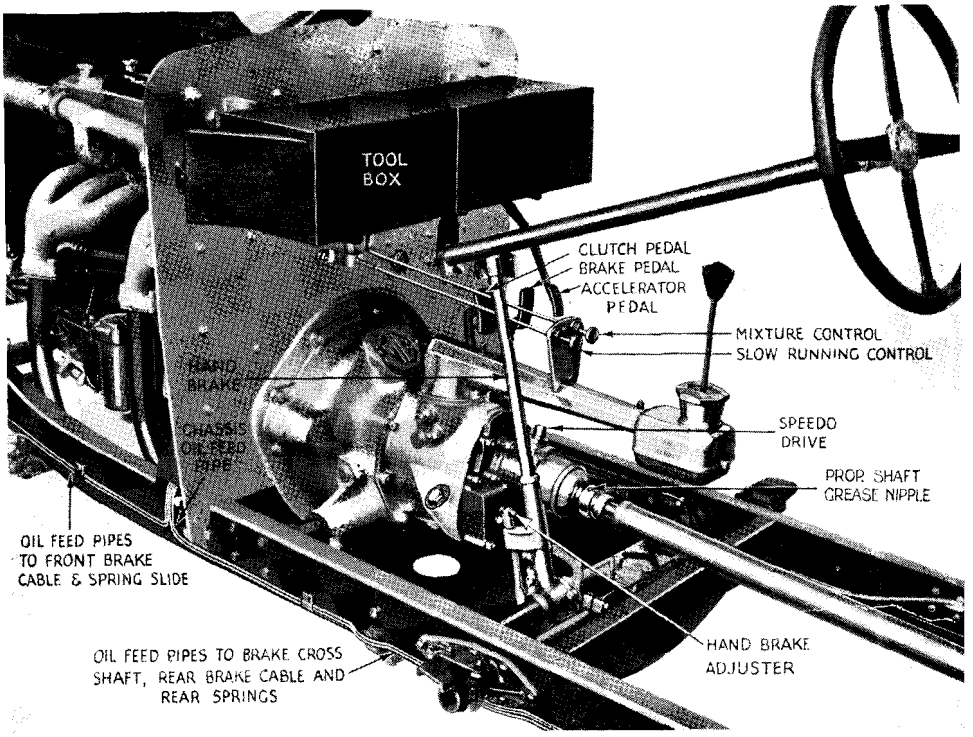


Illustration No. 7.—Near-side view of chassis, showing gearbox, propeller shaft and various controls.

The speedometer is driven from the rear of the gearbox immediately in front of the universal joint. The latter is coupled to the front end of the propeller shaft by means of a splined telescopic joint. The oil pipe lines from the centralised oiling points on the dash wall supports can be seen alongside the chassis side member, and are referred to in the illustration. The position of the toolbox will also be noted in this illustration.

Continuing the general survey of the portion of the rear end of the chassis, reference should be made to Illustration No. 8. Looking first of all at the left-hand corner, the oil nipples for the centralised lubrication of the off-side of the chassis units will be seen ; one pipe passes to the brake cross shaft, another to the brake outer cable, and another pipe can be seen leading to the top of the front spring anchorage pin. The body brackets also can clearly be seen, as well as the petrol feed lines.

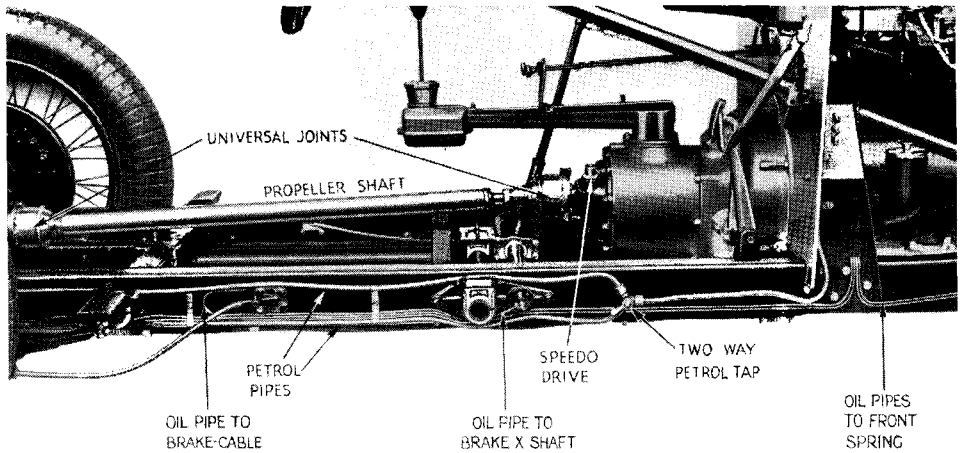


Illustration No. 8.—Shows the petrol pipes as applied to the closed models. The pipes are somewhat similarly arranged on the open models except that the petrol tap is positioned on the top of the rear tank, and therefore one line only is required alongside the chassis. On 1934 models the petrol tap is on the dash wall with remote control on the facia.

Illustration No. 9 is a rear end view of the chassis and shows the back axle attached to the springs by long " U " bolts and a spacer, the mounting of the shock absorbers, the rear cover to the back axle, and the battery. The rear cross member has extensions on either side in which the rear end of the rear springs are located. The petrol tank on the Saloon model is supported in the body and in the case of the Four-seater and Two-seater on the chassis. The two petrol feed pipes (as fitted on the Saloon and Four-seater models) coupling up to the main and reserve supplies are shown in Illustration No. 8.

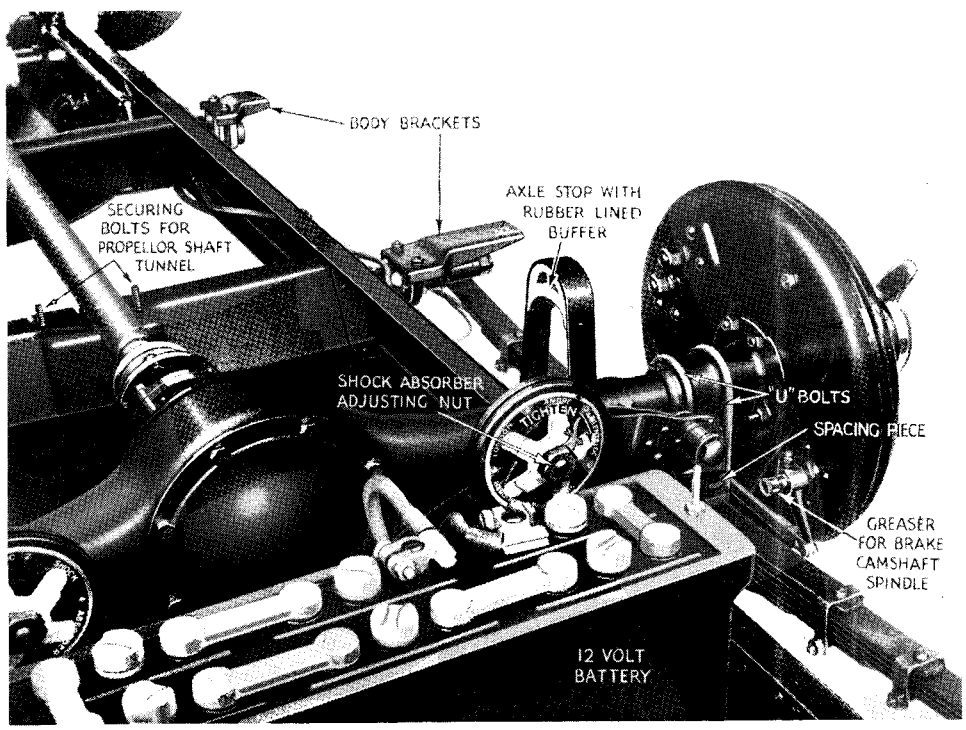


Illustration No. 9.—Rear view of chassis showing battery with the cover removed and the method of attaching the two battery leads. The shock absorber adjustment can also be seen. Alongside is shown the rear axle rebound clip.

Illustration No. 10 shows the location of the petrol tank in relation to the pipe lines on the closed models.

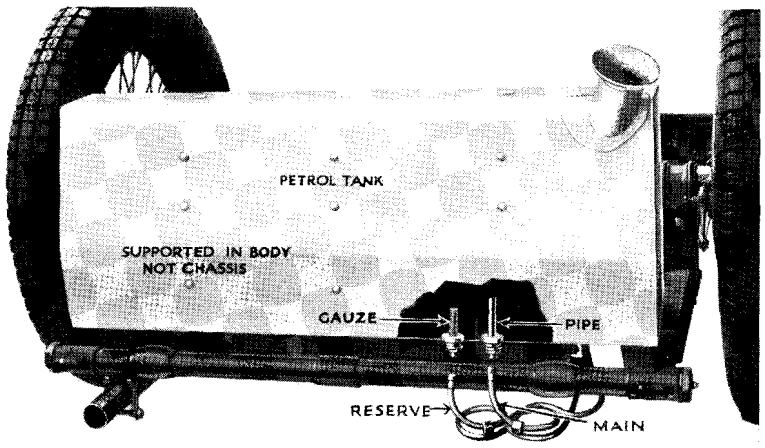


Illustration No. 10. — Sectional view of petrol tank, showing main and reserve feed pipes, leaving 2 gallons for reserve.

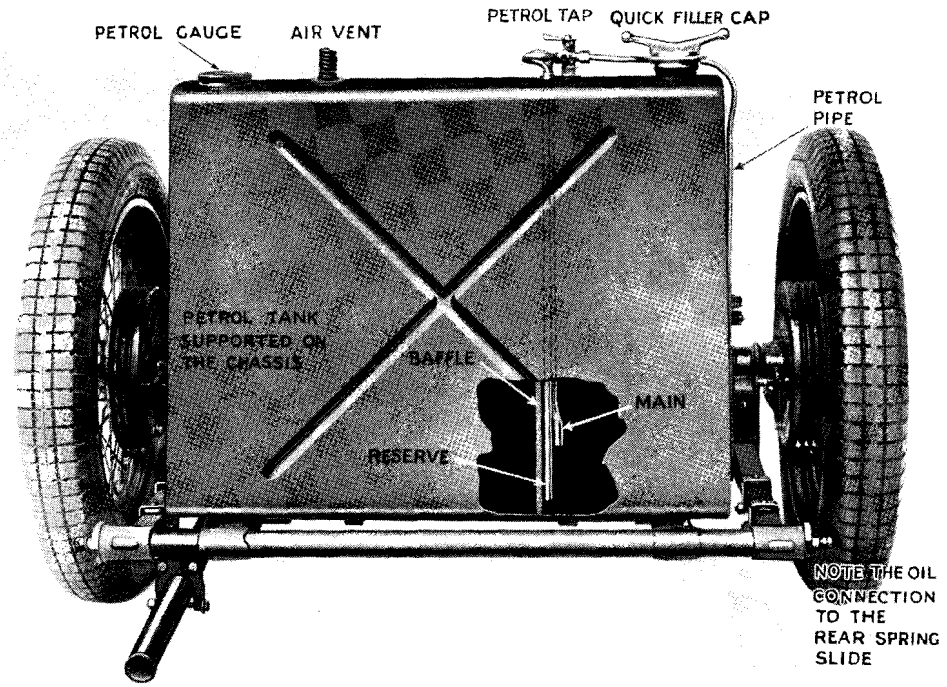


Illustration No. 11.—Sectional view of the petrol tank on the Two-seater model.

Illustration No. 11 shows the petrol tank on the Two-seater model having a capacity of 12 gallons, leaving 3 gallons for reserve. The petrol tap and petrol gauge are at the top of the tank, the former in a position which is easily accessible from the driver's seat, and is suitably marked to indicate the desired position of the lever. There is a similar arrangement of pipe lines on the Four-seater, although the tank is a somewhat different shape.

Illustration No. 12 may need a little explanation. It contains a close-up view of the rear of the chassis as well as a view taken of the axle anchorage and shock absorber bracket as seen from beneath the car. The springs are held in position by two "U" bolts. It is obvious that these will require tightening from time to time, and therefore the illustration shows exactly how they are mounted. Shock absorbers need no lubrication whatever, being mounted on "silent blocs."

Reverting to Illustration No. 9, this shows a close-up view of the shock absorber from above, showing the point of adjustment, the axle stop being situated alongside.

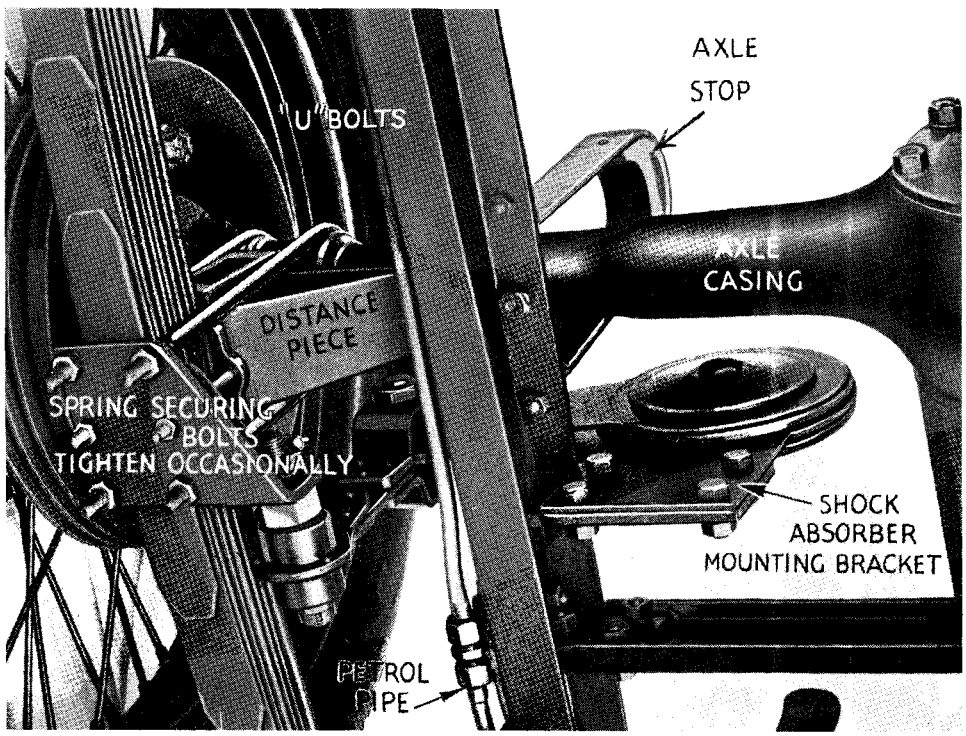


Illustration No. 12.—View of the off-side of the rear axle, as seen from below. The shock absorber mounting is visible, also the six nuts on the spring anchorage plate ; four are at the ends of the "U" bolts and the other two serve to secure the spacing piece between the spring and axle case. The lock nuts have been removed from the end of the "U" bolts in the illustration.

Steering.—The operation of the Marles-Weller gear, which is standard on M.G. Magna models, is entirely novel. A hardened steel cam, in which a spiral groove is cut, is mounted on the shaft carrying the steering wheel. Into this groove is inserted a follower, on each side of which and deeply embedded in it are two hemispheres which make contact with the sides of the cam track. This follower is free to rotate in a bearing in the rocker-shaft to which the drop arm operating the draglink is fixed.

The cam is mounted between special ball bearings expressly designed for the duty they have to perform. At the top end of the shaft carrying the cam and also the steering wheel, a third bearing is mounted, which bearing is arranged to eliminate any binding of the shaft.

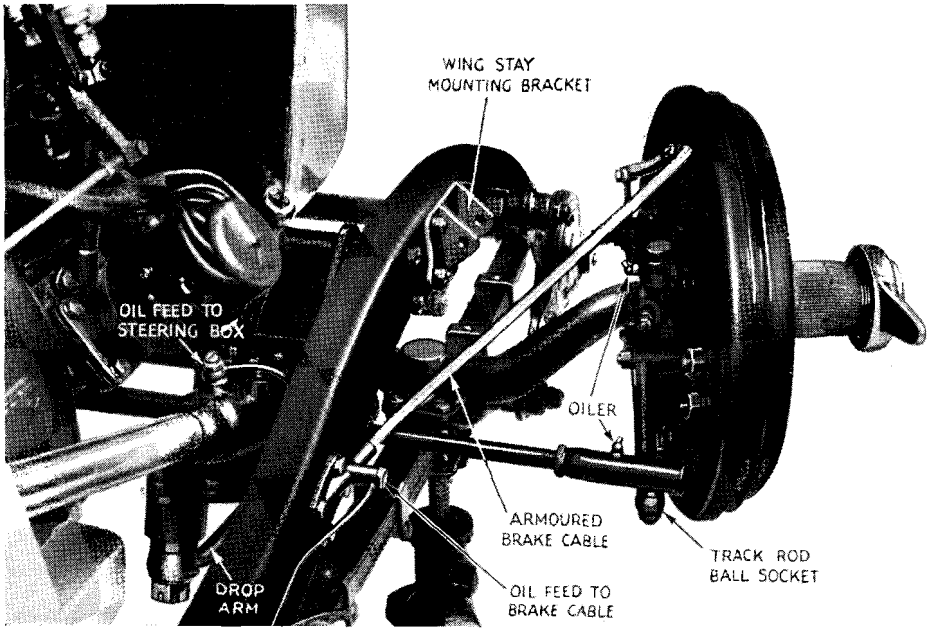


Illustration No. 13.—General view of the steering layout and front wheel track actuating mechanism.

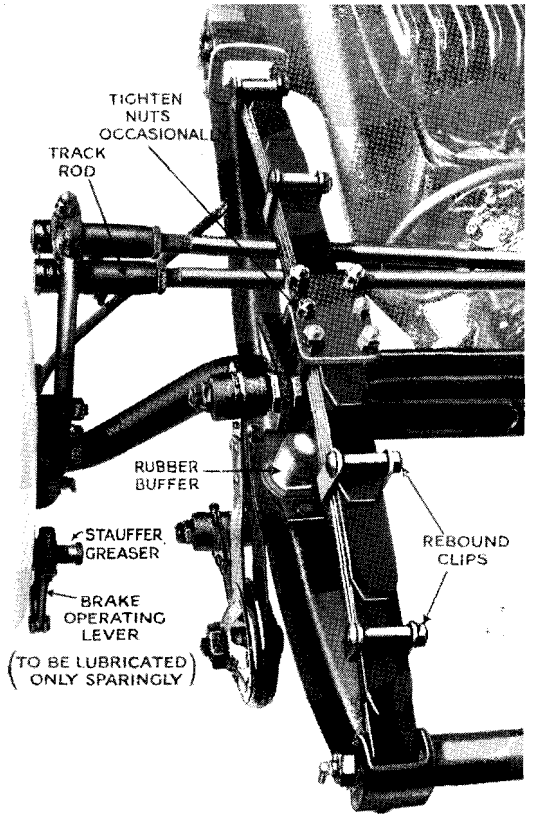


Illustration No. 14.—Underneath view of the off-side of the frame, showing the near-side steering arm, to which are attached two ball sockets of the steering rods. The picture shows clearly also the shock absorber mounting, the rubber buffer between the frame and the spring and the various lubricators. Six spring bolts require tightening occasionally.

This bearing excludes all dust and dirt, both from its own working parts and from the gear, and is designed to damp out vibration of the steering column.

The rocker-shaft is carried in massive phosphor bronze bearings providing adequately against the shocks to which this part is subjected in use.

The operation of the gear is very simple. As the steering wheel and cam are rotated, the hemispheres and follower engaging the cam are moved backwards and forwards in the groove, thus imparting the required motion to the drop arm and draglink. At the same time each hemisphere aligns itself in its seating to the side of the track engaging with it, and the follower, complete with its four hemispheres, also adjusts itself in the bearing in the rocker-shaft.

It will be seen from this that a considerable area is always evenly presented to the cam track by the hemispheres, and this area and the self-alignment of the contacting faces is the fundamental difference between the Marles-Weller and other types of steering gears.

The area and the self-alignment explained above are responsible for the sweet performance and long life of the Marles-Weller gear, the same action being available throughout the whole of its movement.

The view of the steering gearbox in Illustration No. 13, besides showing the oil feed to the steering gearbox and track rod, also shows the drop arm and the track rod ball socket. Every articulating joint of the steering is fitted with an oil nipple. The track rod is threaded at either end. In fact, all the steering rods, or, to be more exact, tubes, are threaded. This permits of accurate adjustment, and to take care of any irregularities in the tracking of the wheels.

Illustration No. 14 is an underneath view of the front end of the frame showing the near-side steering arm, to which are attached two ball sockets of the steering rods. This illustration shows clearly the shock absorber mounting, the rubber buffer between the frame and the spring and the various lubricators on the near-side front axle assembly.

Illustration No. 15 is the same view as Illustration No. 14, but taken from above, and after it has served its purpose to illustrate the lubricating points of the steering head pin, steering rod joints, and brake camshaft spindle, it is proposed to pass on to the most important part, namely the brakes.

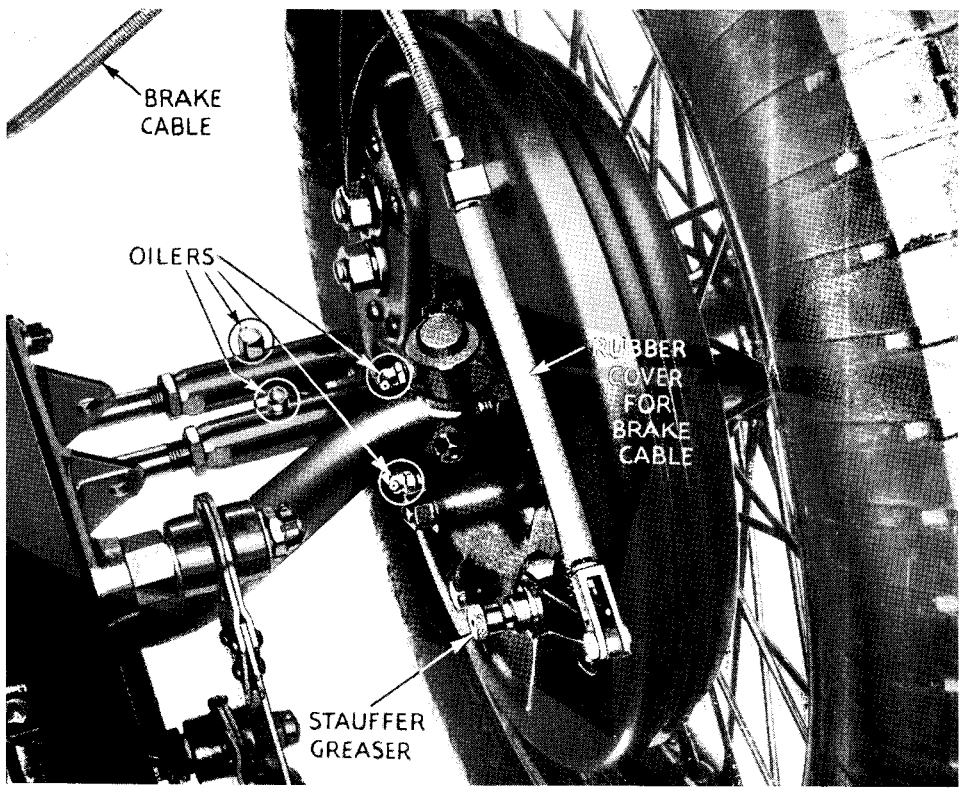


Illustration No. 15.—Lubrication points of steering head are marked with circles, and the method of actuating the brakes can also be seen.

Brakes. No useful purpose will be served by including redundant illustrations in the book, and it will already have become apparent from the examination of previous illustrations that the brakes are applied through the agency of steel cables which pass through metal sheathed rubber-covered outer cables from either side of the centre of the chassis to the brake-drums, the final application being shown in Illustration No. 16. The sketch shows diagrammatically how the brakes are applied.

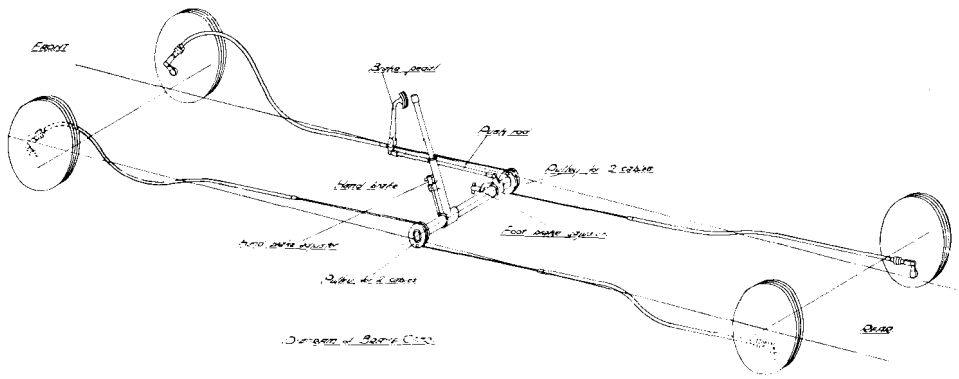


Illustration No. 16.—This sketch shows diagrammatically how the brakes are applied.

A cross shaft is placed in the middle of the chassis anchored at either end and supported in the centre by a tubular cross member of the frame. This can be seen by referring to Illustration No. 17, which more particularly illustrates the hand brake. The lever is situated on the near-side of the gearbox, and towards the base an extension will be found on which there is a thumb nut. The foot brake adjustment is on the off-side of the car. The brake cross shaft removed from the car is shown in Illustration No. 18.

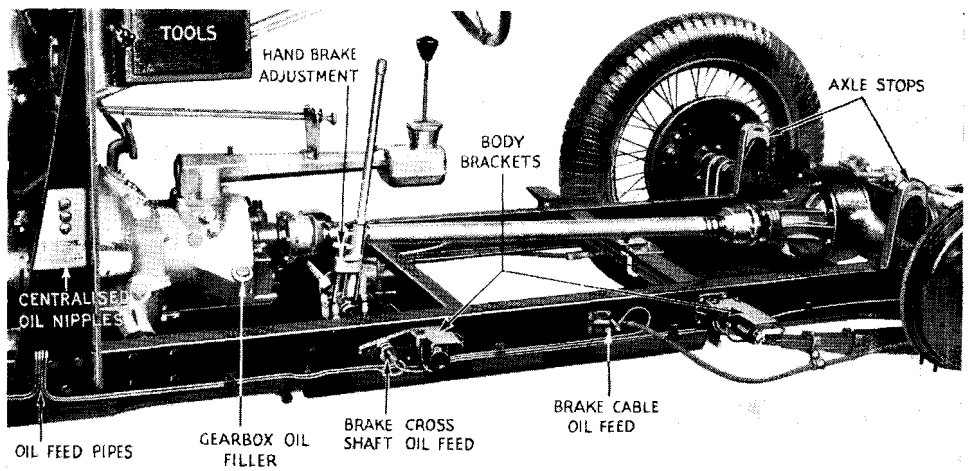


Illustration No. 17.—Near-side of centre of the chassis, showing the hand brake and various items on the chassis referred to in the text.

The foot brake pedal is coupled to the brake actuating cross shaft by a rod, and either extremity of the brake cross shaft is provided with a pulley having holes drilled through it top and bottom to receive the end adaptors of the brake cables. As either brake is applied, the brake cross shaft is rotated, pulling the rear brake cables forward, and the front brake cables backwards.

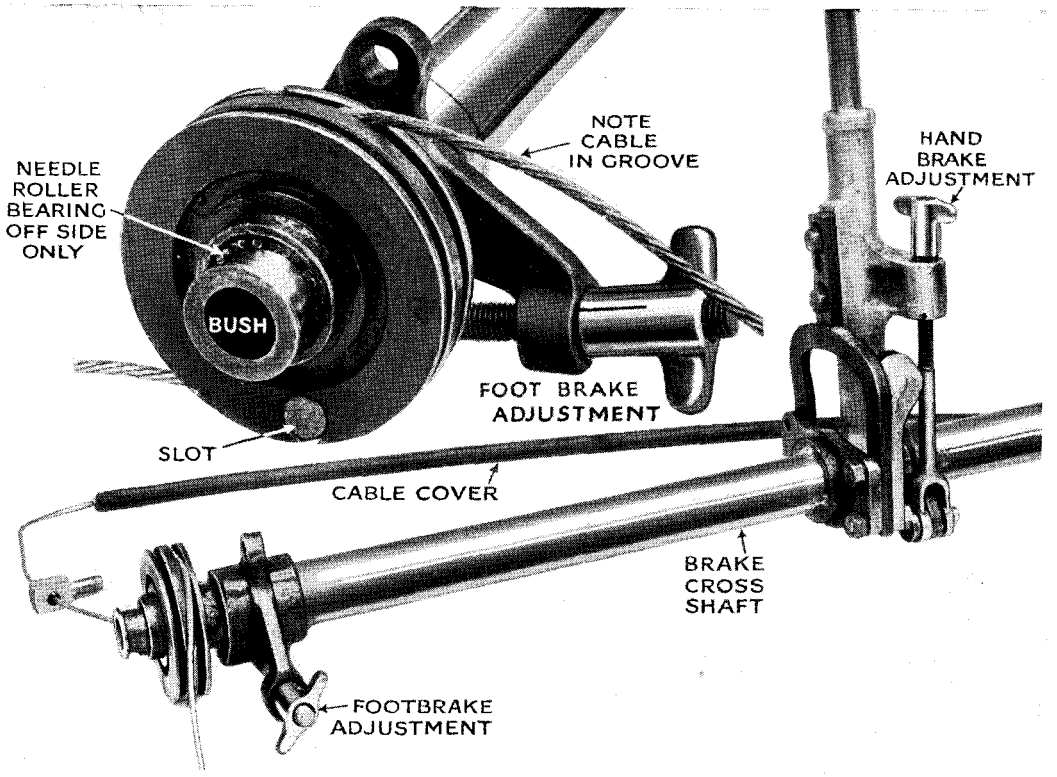


Illustration No. 18.—Views of the brake cross shaft, showing the hand and foot brake adjustments, and the manner in which the cross shaft is supported at one end on a needle bearing.

Independent Adjustment.—Should it be necessary to adjust the brakes independently this can be done by means of adjusting screws fitted to the cable stops on the axle back plates. At this point on the cables a rubber dirt excluder is fitted in the form of a rubber tube, and this tube is mounted on what is actually the lock nut for this adjustment.

By undoing this lock nut the cable stop can be adjusted on its thread by the amount required and the lock nut re-tightened.

The whole of the brake cross shaft is lubricated from the dash wall nipples, and in order to give perfect freedom for the rotation of the cross shaft it is mounted at one end on what are termed needle bearings. These are shown in Illustration No. 18. Should it ever become necessary to remove the cross shaft the needle bearings can be reinserted by covering the inner shaft with grease and embedding the bearings in it, when it will be found that they will stop in position in order that they can be inserted inside the cable operating pulley. At this point reference should again be made to Illustration No. 18.

The front and rear brake-drums of the car are identical in design. It is necessary from time to time to remove the brake-drums in order to clean out the brakes or have them re-lined. The procedure is very simple. When the wheel is removed

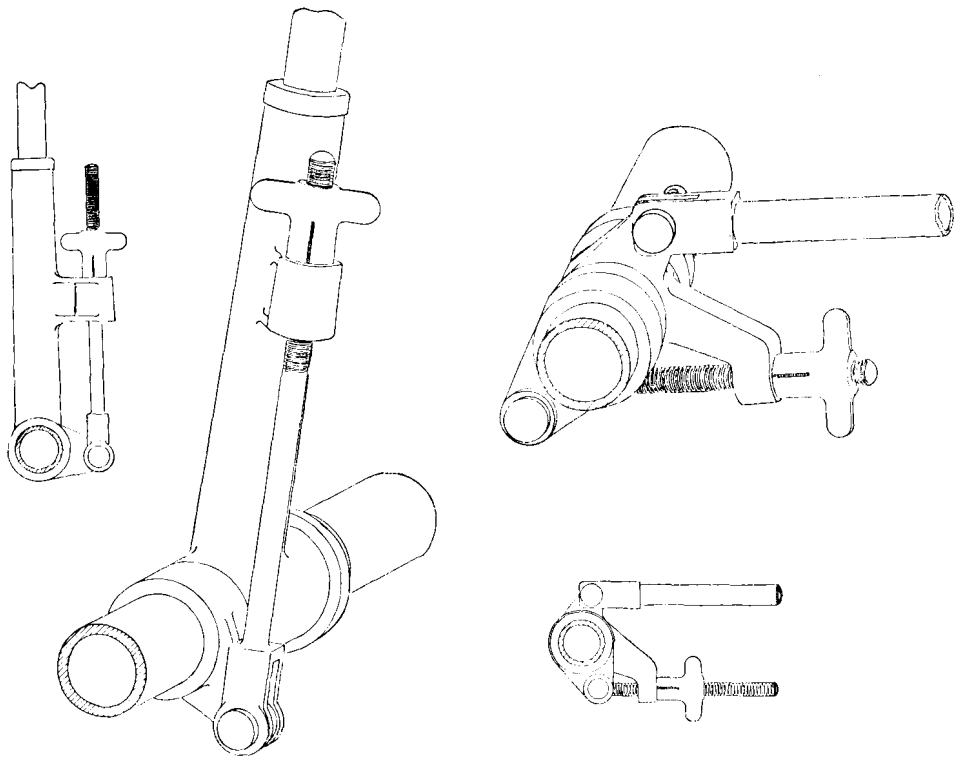


Illustration No. 19.—Details of the foot and hand brake major adjustments. To tighten the brakes the thumb nuts should be turned in a clockwise direction.

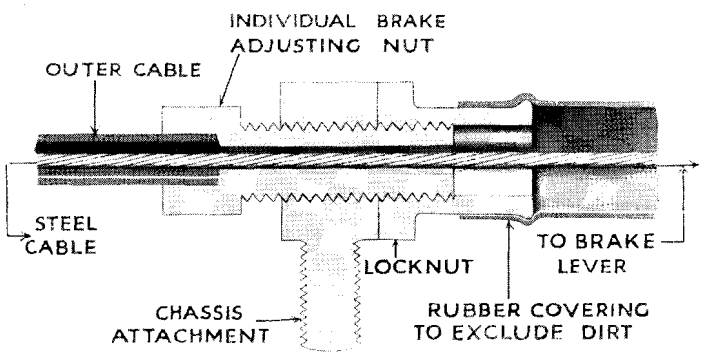


Illustration No. 20. — Independent brake adjustment for each wheel, see text on page 23.

as shown in Illustration No. 21, take off the nuts with a $\frac{5}{16}$ in. spanner, and after releasing the brake, the drum can be withdrawn by a slight tapping on the ribs with a wooden mallet or a piece of wood and a hammer. The brake-drum and its components are shown in the centre of Illustration No. 21, and in the off-side of the illustration the brake-shoes with the two pull-off springs can be seen.

The countersunk screw in the fluted portion of the hub is intended, after removal, to give access to the split pin of the hub nut, which can then be removed easily and replaced through the hole in the hub.

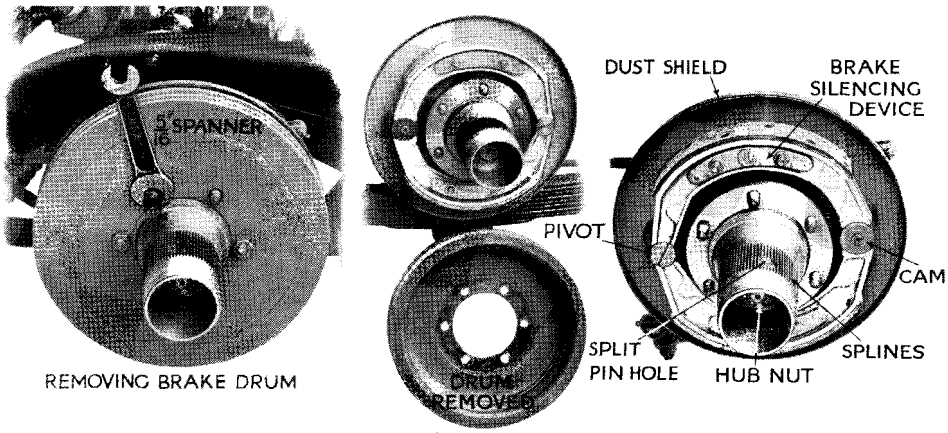


Illustration No. 21.—Three views of a brake being dismantled, first showing the drums being removed, the centre view of the hub with drum removed, and on the right the brake-shoes and brake silencing device.

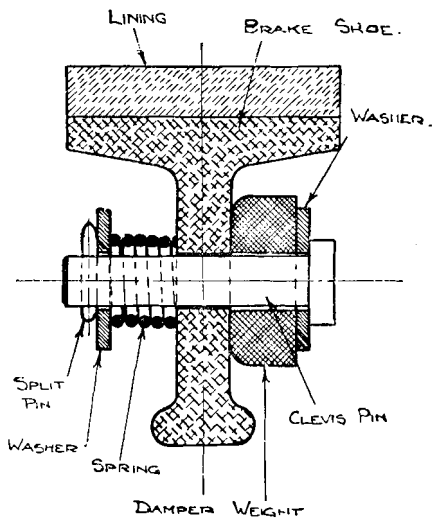


Illustration No. 22. —Sectional view through a brake-shoe, showing the lead weight attached to the brake-shoe, and the various component parts for same.

Brake Anti-squeak Device.—The brake-shoes are fitted with an anti-squeak device, which consists of lead alloy blocks fitted into the channel section of the brake-shoes and held in position by means of clevis pins and little coil springs. When vibrations take place in the brake-drum, they are communicated to the brake-shoes

and the shoes vibrate; the lead weights, however, are in effect "left behind" by the vibrating shoes and energy is wasted in friction between the weights and the shoes. The conditions under which the weights are mounted can in practice be made such that they can always waste more energy than the squeaking forces can generate and the squeak is prevented.

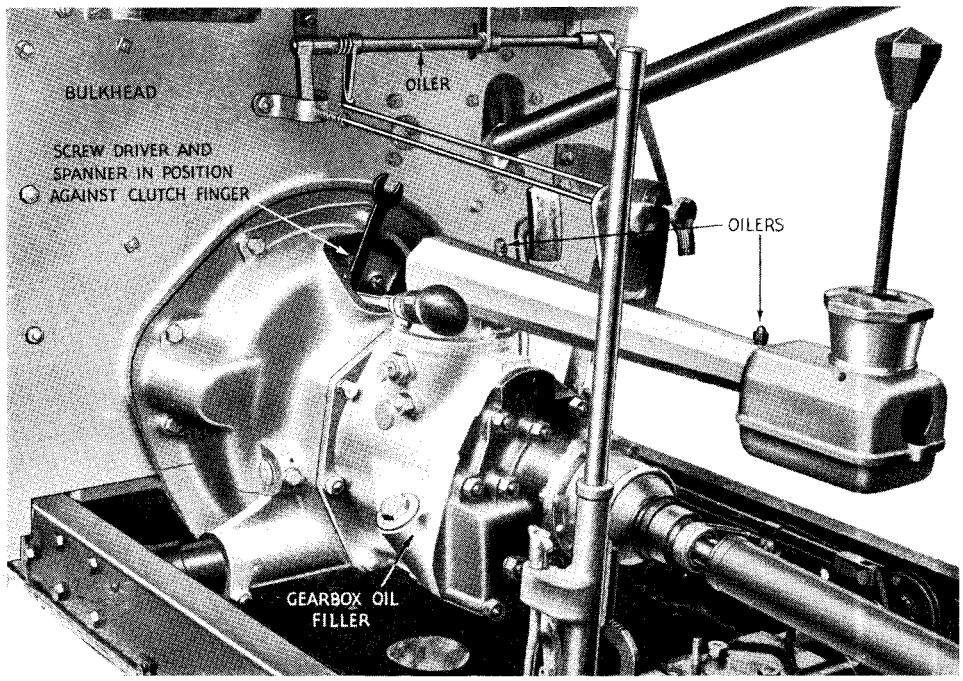


Illustration No. 23.—View of the clutch housing with cover removed, showing method of adjusting clutch.

Running Adjustments. Before dealing with the detailed description and dismantling of the various units of the chassis, the owner may require to know the particular adjustment which he can carry out with the aid of a spanner and a screwdriver, namely adjusting the clutch. Reference to Illustration No. 23 shows the rear of the dashboard and the location of the clutch inspection cover. After removing this it will be found that there are three clutch withdrawal arms towards the outer extremity of which are situated three set screws and locking nuts. When the clutch is pushed out by the pedal the three withdrawal arms are forced forward sufficient to disengage the clutch plates. The proper working of the clutch is dependent upon the adjustment of the set screws of the withdrawal arms. It will be better to refer to the section dealing with the clutch before attempting to adjust it. There should always be at least 1 in. free travel on the pedal before the clutch disengages. The free motion can be felt with the hand by pressing on the clutch pedal.

Tappet Adjustment.—Before the owner has had an opportunity of reading through the whole *Manual* he may require to adjust his valves, and in order that he should know what is taking place, a careful examination of Illustration No. 24 will make the matter clear. He will probably be aware that there is a necessity to have a definite clearance between the cam and the valve rocker, the various parts are distinctly marked in the illustration. It is of course important to see that the valve is properly seating when any adjustment is attempted, and this can easily be seen by the position of the cam in relation to the rocker. There is a single camshaft

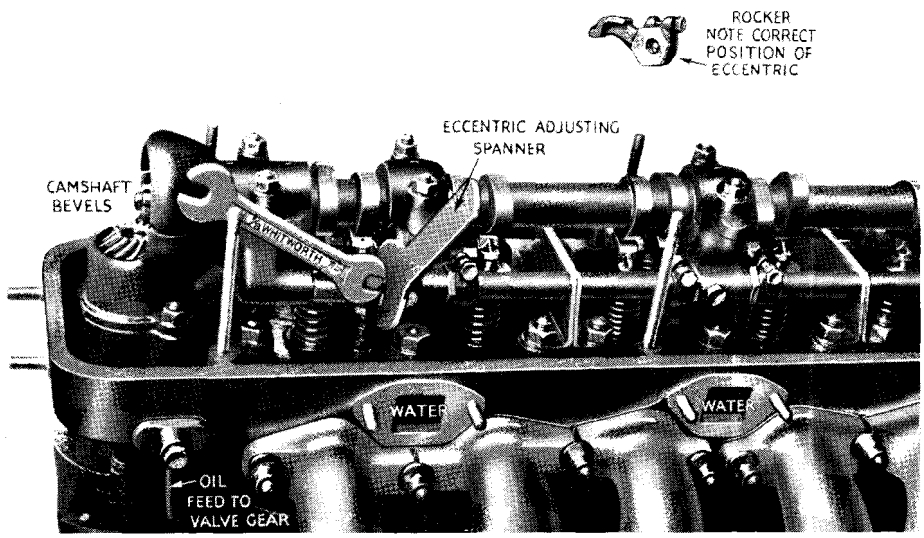


Illustration No. 24.—View of valve gear with cover removed showing method of adjusting a tappet, by rotating an eccentric bush, seen above the engine.

operating both the inlet and the exhaust valves. These are easily distinguished, from the fact that all the exhaust valves are on the *near*-side of the engine and the inlet valves on the *off*-side of the engine. The valve rockers are attached to separate shafts at their outer extremity, and are provided with eccentric bushes. The opposite extremity of the rocker is wedge shaped, so that if the nut which forms part of the eccentric bush is rotated, the wedge end of the rocker will either advance or recede from beneath the cam, and present a thicker or thinner section to the face of the cam when this rotates. The eccentric bush is provided with a pinch bolt and in Illustration No. 24 a spanner ($\frac{1}{8}$ in. Whitworth) is shown in position ready to slack off the pinch bolt. The eccentric bush with pinch bolt is shown above the engine.

It is possible for a person not acquainted with the engine to set the rockers in various wrong positions, which will cause considerable variation of timing of the corresponding valve.

The correct method which prevents mistakes is as follows :—

1. The clearance is measured between the rocker and the back of the cam and should be .006 in., tested by feeler gauge, when the engine is at its normal running temperature.

2. **The clearance must always be decreased by pressing the handle of the spanner downwards, this makes it impossible to turn the eccentric the wrong way up.**

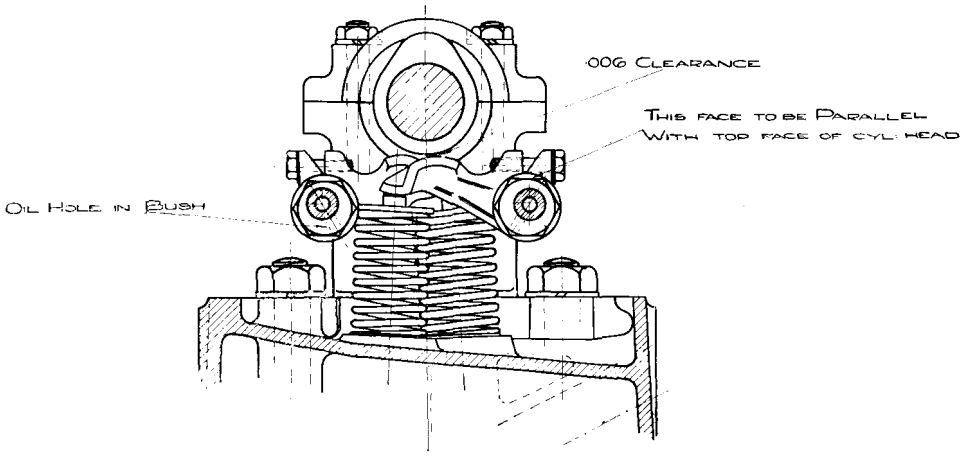
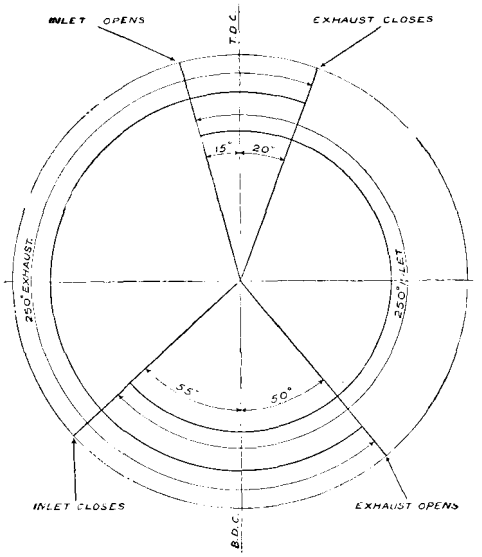


Illustration 25.—Sectioned view of the cylinder head showing the correct position of the rocker eccentric, and the point at which the rocker clearance should be checked.

When adjusting the rockers, it should be remembered that the valve gear is designed to give the correct valve timing when the cam and rocker is in the position shown in Illustration No. 25 with a clearance of .006 in. measured between the top of the rocker and the cam. It may be found after the valves have been ground in that the clearance has been taken up, and although the point can be disregarded within small limits, it is advised that in order to get best results from the engine the valve lengths should be checked up, and if necessary shortened after they have been ground in once or twice, by an authorised M.G. Agent, who has a gauge specially for this purpose.



Valve and ignition timing diagram.

Ignition.—Little instruction need be given on this subject.

The high-tension distributor with automatic advance mechanism is very accessible. It is provided with an oiler to lubricate the spindle, and only a few drops of thin machine oil should be put in every 1000 miles.

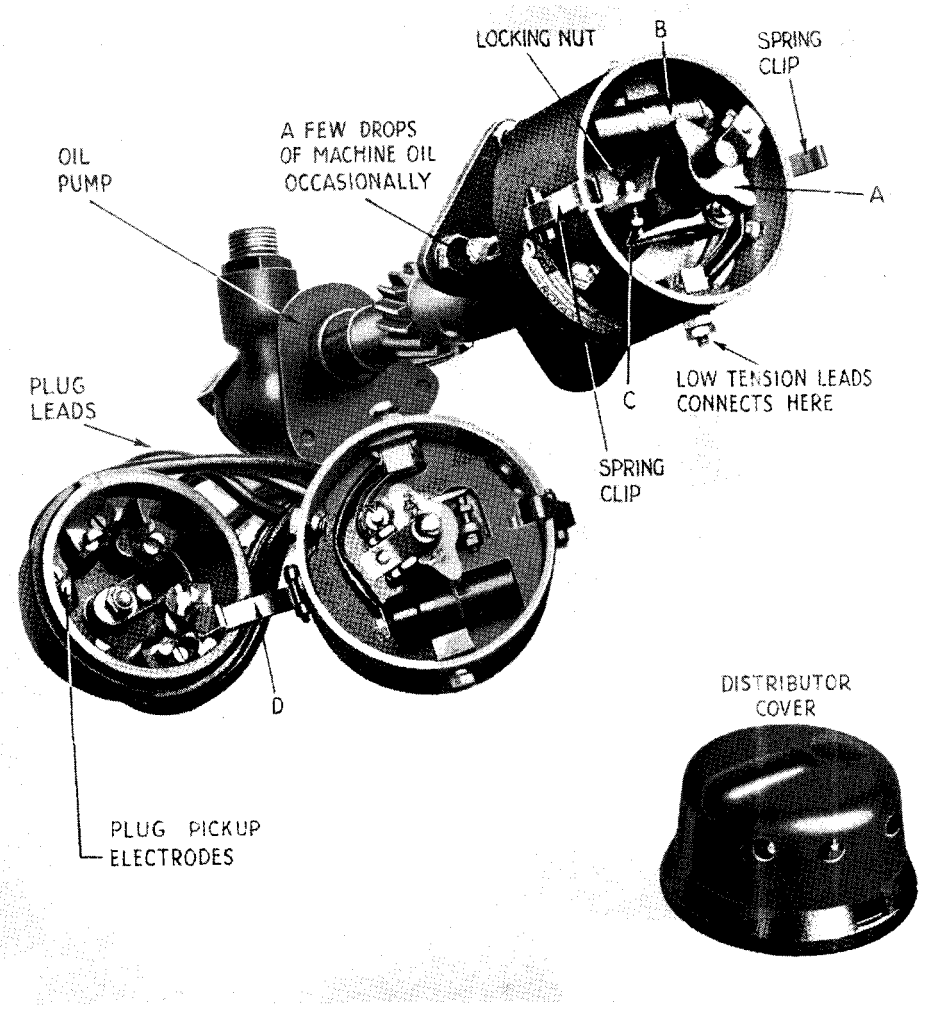


Illustration No. 27.—The distributor and oil pump.

The contacts can be inspected by unclipping the two springs, when the cover carrying the high-tension leads can be removed. Should for any reason it be necessary to check or adjust, the ignition timing should be set so that No. 1 piston is on top dead centre, measured on the flywheel when the 1 | 6 marking is in the centre of the clutch inspection aperture and the inlet valve of No. 6 is opening and the contact breaker arm pointing towards No. 1 plug segment. Then, after slackening the securing bolt shown in Illustration No. 30, rotate the body of the distributor and set the contact breaker arm so that the fibre heel on the contact breaker arm is on the apex of the cam on the rotor. The points may require adjustment from time to time, and a spanner is provided with the tool kit for this purpose. The clearance between the points should be 15—20/1000 of an inch. They are carefully set before leaving the Works. It is not advisable to alter the setting unless the gap varies considerably from the gauge supplied. If adjustment

is necessary, proceed as follows :—When the contacts are fully opened, slacken the locking nut on the stationary contact screw, and rotate it by its hexagon head until the gap is set to the thickness of the gauge. After making the adjustment, care must be taken to tighten the locking nut.

The centre spindle of the high-tension distributor carries a " Bakelite " arm called the " rotor." It can only fit on the spindle one way. If this part is removed (it simply pulls off) it affords an excellent thiefproof device, but care should be exercised to see that it does not become chipped or in any way damaged, not to mention lost after it has been removed. The ends of the high-tension cables are secured by means of pointed contact screws which pierce the rubber insulation to make good contact with the cable strands, at the same time securing the cables tightly in the terminals. The screw heads are located on the inside of the distributor moulding.

The automatic advance device, which consists of a centrifugal governor, is housed in the distributor body. It is packed with grease before leaving the Works and needs no attention beyond very occasional lubrication. Occasionally remove the distributor moulding by pushing aside its two securing springs. See that the electrodes are clean and free from deposit. If necessary, wipe out the distributor with a dry duster and clean the electrodes with a cloth moistened with petrol. Clean the outside of the moulding, particularly the spaces between the terminals. Next examine the contact breaker ; it is important that the contacts " C " are kept free from any grease or oil. If they are burned or blackened, they must be cleaned with very fine emery cloth and afterwards with a cloth moistened with petrol. Care must be taken that all particles of dirt and metal dust are wiped away. Misfiring may be caused if the contacts are not kept clean, or by any of the following :—

1. Dirty sparking plug (correct plug gap 20/1000 inch).
2. Cracked porcelain.
3. Bad connection to high-tension leads.
4. Bad connection from high-tension distributor to coil.
5. Improper adjustment of make-and-break points.
6. Dirt between make-and-break points.
7. Defective coil.

These causes exclusively deal with the electrical side. There is one other remote cause of electrical failure, namely bad earth contacts from the battery to the frame. Other causes of misfiring can be attributed to carburetter and improper valve adjustment, the latter having been already dealt with on pages 27-28.

Warning. When emptying the water system in frosty weather it is advisable to empty the water jacket as well as the radiator. The water jacket tap is shown on illustrations Nos. 28 and 37.

General description of the M.G. Magna (L Type) Engine.—In order that the owner may become familiar with all the details of the power unit, illustrations have been prepared showing the complete engine unit removed from the chassis.

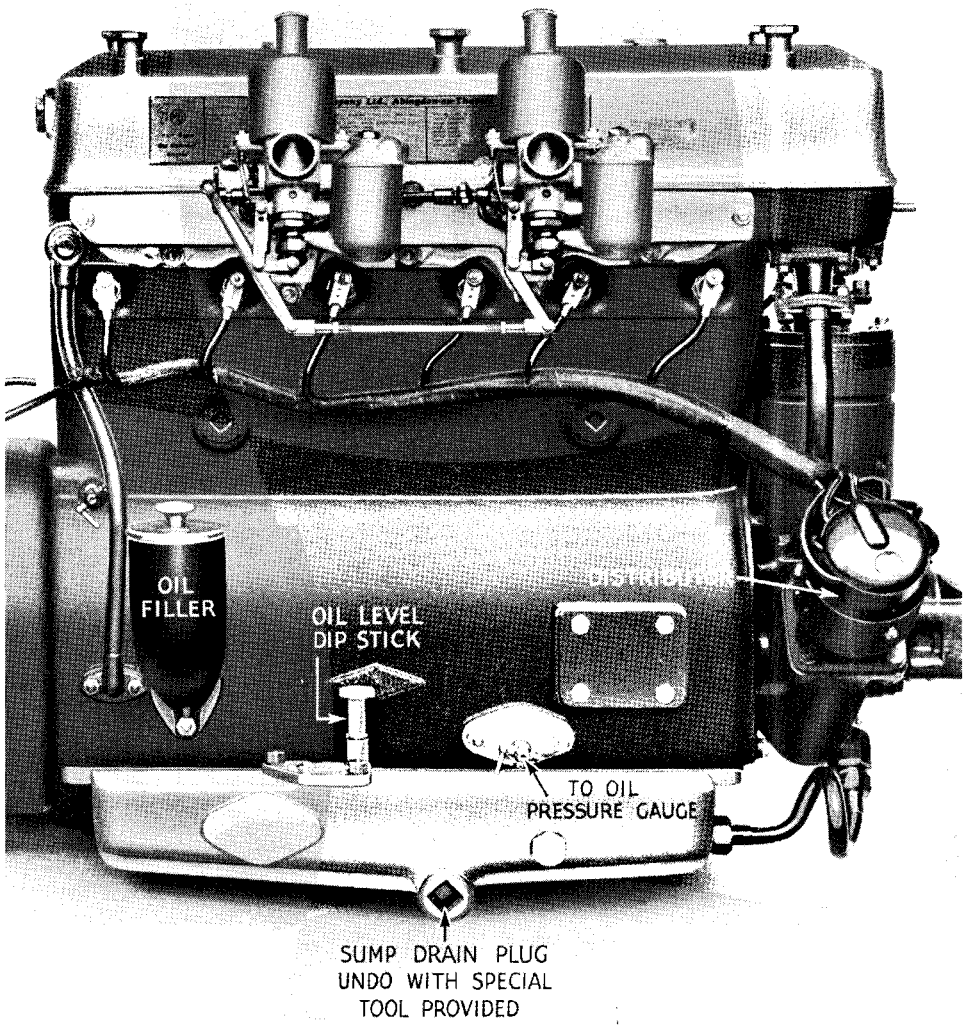


Illustration No. 28.—Off-side view of the engine removed from the frame, showing the sump drain plug as well as the position of the sparking plugs. **Note also the drain tap for the cylinder water jacket. When emptying the water system it is necessary to empty the jacket separately by means of this tap. The tap is shown to the left, above the oil filler.**

Illustration No. 28 is a view of the off-side of the engine suitably lettered to indicate the various parts. More detailed instruction will be subsequently given concerning the items of distributor and dynamo. The principal points of interest in the illustration are the location of the oil filler and the sump. The majority of the details shown in this illustration have already been covered in Illustration No. 5, but this particular illustration shows the sump or oil container of the engine and its drain plug, which consists of a brass nut having a square plug hole. A special tool is provided in the kit to remove this drain plug. It will be seen in this illustration that there is a return oil feed pipe from the front and rear end of the cylinder head.

The near-side of the engine, Illustration No. 29, shows a good deal more than can be seen when the engine is in the chassis.

There is a front extension on the extreme left of the illustration which acts for the dual purpose of starting handle bracket and radiator support as well as front engine bearer.

The water inlet pipe from the pump to the cylinder block is also visible.

It will have become obvious that the front end of the crankshaft is fitted with gearing which in turn drives the oil pump. The oil is sucked up by the pump from the sump and delivered to the oil filter, where it passes through a specially prepared inner body, to be delivered to the main bearings and the overhead valve, camshaft and rockers. A passage from the filter is fitted with a tap-controlled union to which the pipe to the oil gauge is attached. The manner in which the oil is delivered to the two centre and rear main bearings will be seen subsequently, as well as the details of the oil filters.

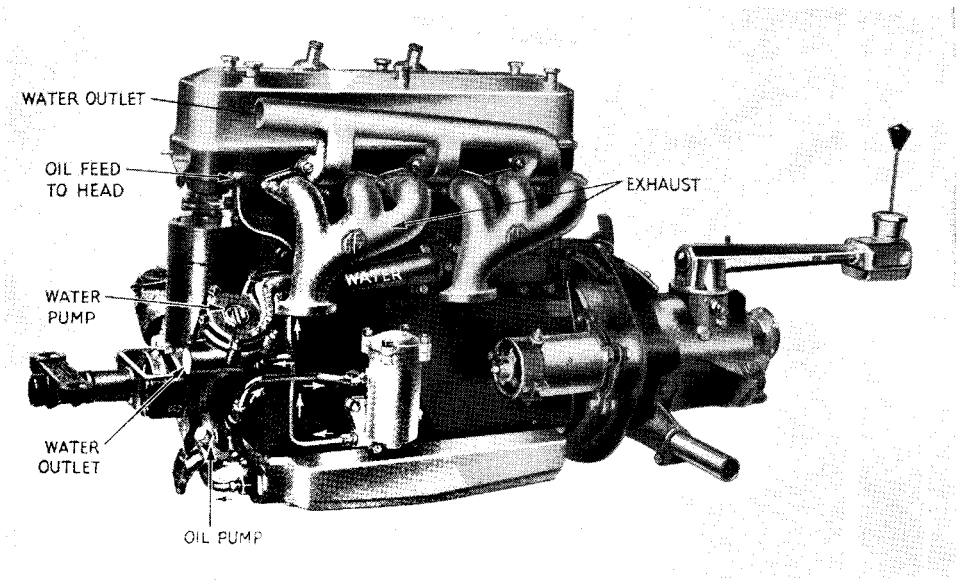


Illustration No. 29.—Near-side view of the engine removed from the frame. This first of all shows the water inlet and outlet pipes and the two exhaust branches ; it further shows the position of the oil pump and the fact that oil is drawn from the sump and delivered by the pump to the oil filter, whence it is delivered internally to three main bearings.

Illustration No. 30 is a front view of the engine, showing more detailed position of the oil and water pumps.

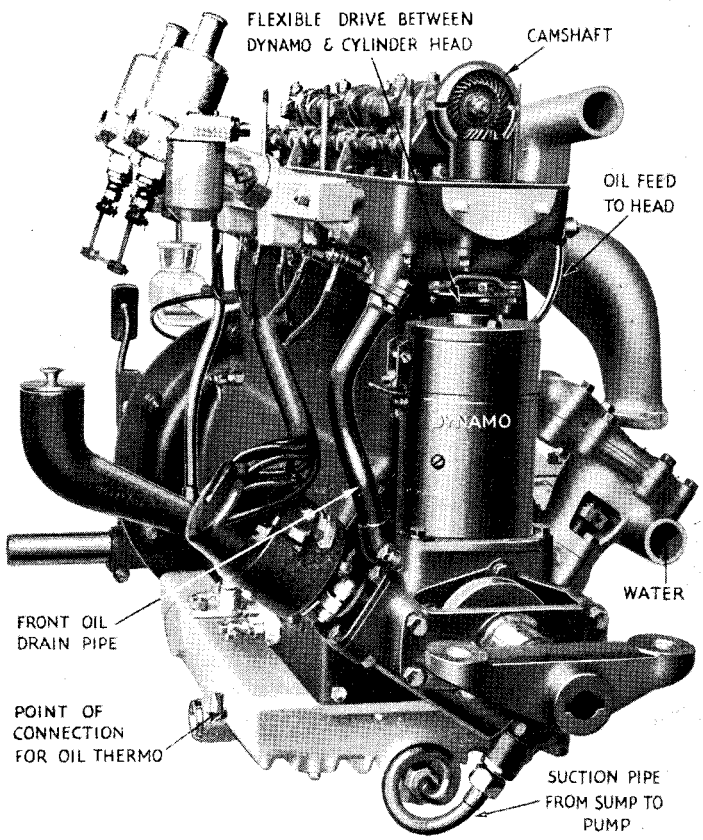


Illustration No. 30.—A view of the front of the engine showing the dynamo in position between the crankshaft gears and overhead valve mechanism ; the oil feed pipe to this will be noted, and the surplus lubricant is conveyed back to the sump through the large pipe which feeds the magneto drive. The position of the oil and water pumps can be seen.

It will be noticed that the dynamo is placed vertically in front of the engine and the armature shaft is utilised to drive the overhead valve gears. The distributor is seen on the left-hand side of the illustration and the return oil pipe feed which conveys parts of the surplus oil back to the sump. An oil feed pipe is shown on the off-side of the engine which serves to feed the overhead valve gears with oil. This is attached to the cylinder head and should always be removed whenever the head is lifted, very carefully, because behind the nut and flange there is a detachable metering or restriction pin, which controls the amount of oil that passes through the orifice.

If ever the pin is removed, as can be seen on referring to Illustration No. 39, it will be noted that it has a flat machined on it which meters the amount of oil passing to the valve gear.

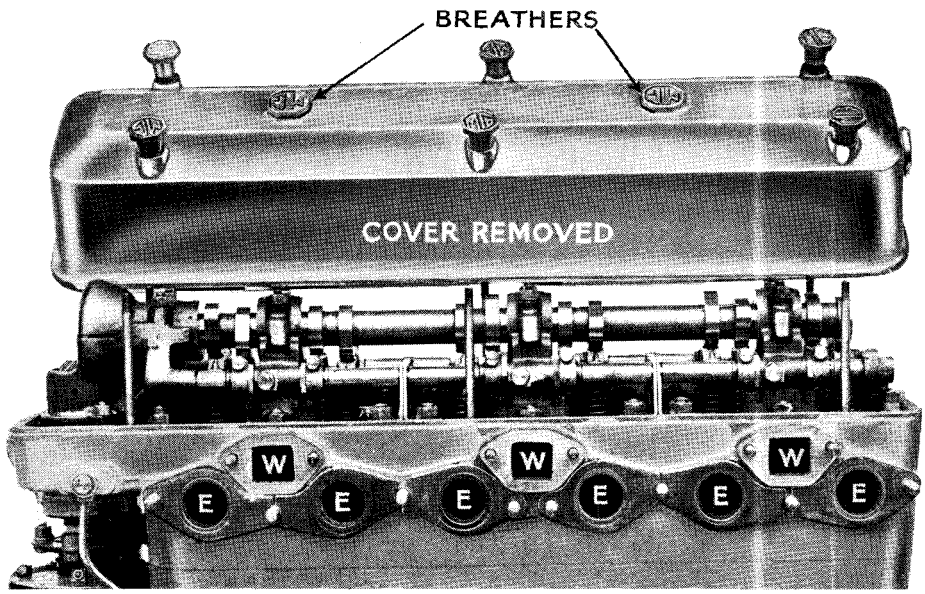


Illustration No. 31.—View of the overhead valve mechanism as seen after removal of the cover. This is held in position by six nuts, and these should be tightened equally to make the cover fit evenly on the cork washer. The slots in the valve cover can be seen acting as crankcase breathers. It is possible to see how the exhaust pipes and water outlet pipe are attached to the engine and the type of washers employed.

Illustration No. 31 shows the water and exhaust ports after the manifolds have been removed and the copper and asbestos washers which are fitted between them and the cylinder head. If ever the manifolds are removed, the washers should be inspected and cleaned, as well as threads on the studs by which the manifolds are refitted. The nuts holding the manifolds to the studs should be gradually tightened so as to get a uniform pressure and prevent any possible chance of leakage through distortion.

Illustration No. 31 also shows the valve operating parts after the cover has been removed.

The valve cover is held in position by six nuts which should be tightened up evenly so that a good joint between the cover and the cork washer fitted on top of the cylinder head is formed. It will be noticed that the two bosses on the top of the valve cover are slotted, so as to form breathers.

Action of the Electric Starter. The engagement consists of a coarse threaded shaft on which a pinion is fitted. When the starter button is pressed the starter motor rotates quickly, causing the pinion to be rotated, but owing to the form of this pinion it has a tendency to travel along the starter extension shaft, and thus engage with the teeth of the flywheel, the shock being taken up by a recoil spring.

The moment the engine starts up and the self-starter button is released the flywheel rotation causes the pinion to travel back along the starter shaft out of engagement.

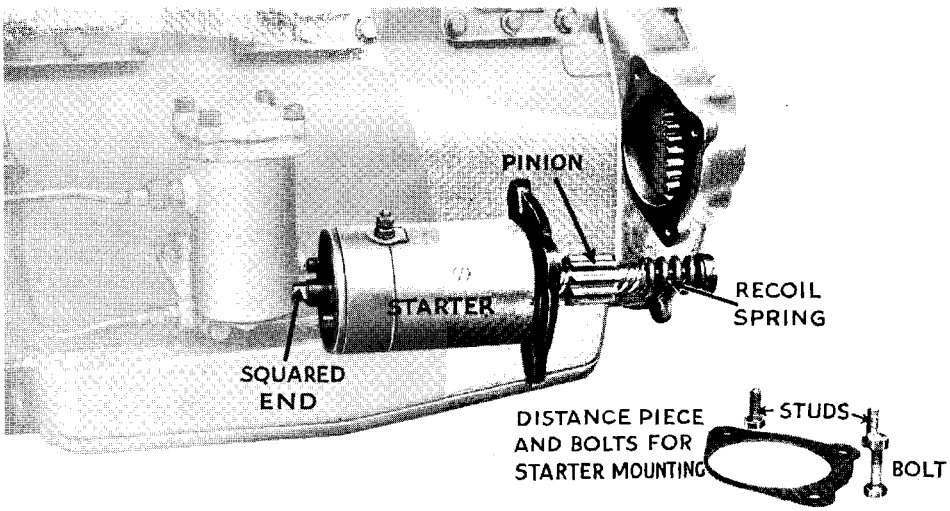


Illustration No. 32.—Self-starter removed from the engine to show the method of attachment. The forward end of the self-starter spindle has a squared end on to which a spanner can be fitted, in the case of a slight jam of a pinion in the flywheel.

The front end of the self-starter shaft is provided with a square end, and it is possible in the case of only a slight jam to rotate this spindle with a spanner and thus disengage the starter pinion from the flywheel. The above explanation will be made clearer on examining Illustration No. 32, which shows the starter removed from the engine. It is held in position by two studs and one bolt, and there is a distance plate between the starter housing and the flywheel housing. The flywheel teeth can be seen and also the spiral thread on the extension of the starter shaft, along which the engaging pinion travels to and fro ; the recoil or buffer spring is clearly visible.

Before dealing with the internal dismantling of the engine, it may be as well to clean up the exterior fittings by referring to the method in which the engine is mounted in the frame at the front end, and the removal of the self-starter.

The self-starter has already been illustrated in Illustration No. 6, and Illustration No. 32 shows the starter after removal of the engine.

Engine Mounting.—It has been seen in Illustration No. 17 that a steel tube passes through the bell housing of the flywheel and is supported in two brackets, one on either side, in order to secure the rear end of the engine unit in the frame. The front end mounting, however, is entirely different.

The frame is provided with a front tubular cross member, which is shown in Illustration No. 33 in its relationship to the engine. A central bracket is attached to the cross member, and by means of a bridge piece the front end of the engine extension bracket is attached to the cross member, bushes being interposed to afford a certain amount of resiliency to the mounting, and isolate the engine from road shocks. Reference back to Illustration No. 4 shows the front cross member in the frame, and the means whereby the radiator is attached thereto. This illustration is particularly instructive in case it is necessary at any time to remove the radiator. The radiator proper is mounted on the front engine extension by means of two studs and nuts and interposed fibre washers.

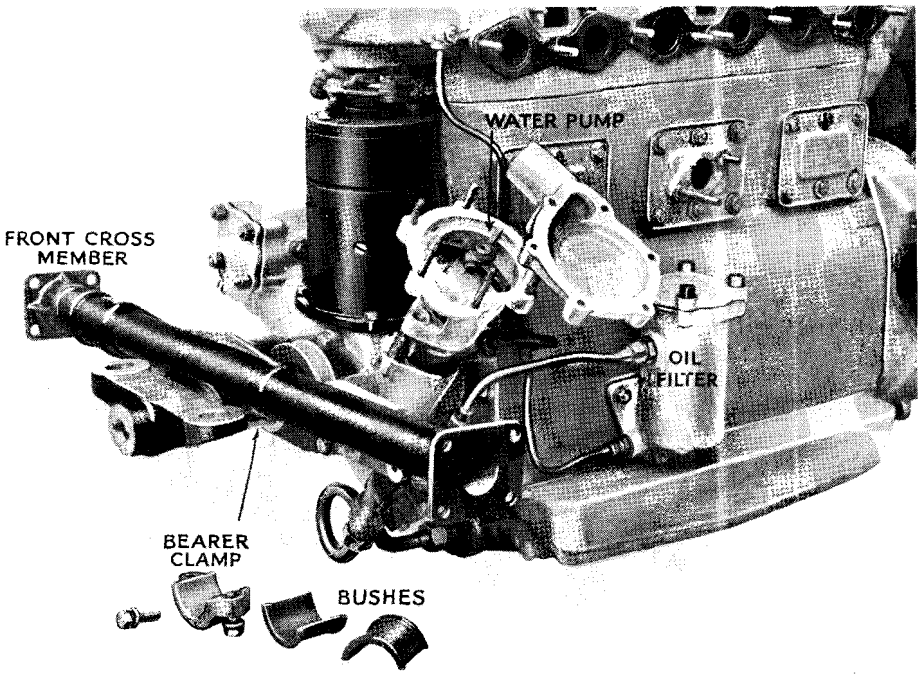


Illustration No. 33.—The frame front cross member has been photographed in its relation to the front engine bearer. It will be noted that there is a bearer clamp which holds the engine in position and attaches it to the cross member, rubber bushes being employed as shown. The top cover of the water pump has been removed to expose the pump impeller. In this particular illustration a magneto drive instead of distributor is shown.

Engine Dismantling. The principal external components of the engine having been dealt with, it is now proposed to describe (in dismantling the engine pictorially) the construction of the engine and the method of dismantling.

The first feature in dismantling is obviously the cylinder head. This comprises the timing of the valves, the dismantling of the valve gear, the grinding of the valves, the relationship of the cylinder head to the cylinder block, and the method of driving the camshaft.

The first thing that should be borne in mind is that considerable care has been exercised in the design of the engine to render the operation of valve timing as simple as possible. It must be taken for granted that the drive from the crankshaft through the dynamo is correct, and it follows, therefore, that when the dynamo is in a certain position there is a definite relationship between the arms of the coupling on the top of the dynamo and the position of the piston in the cylinder.

The firing order is 1, 4, 2, 6, 3, 5.

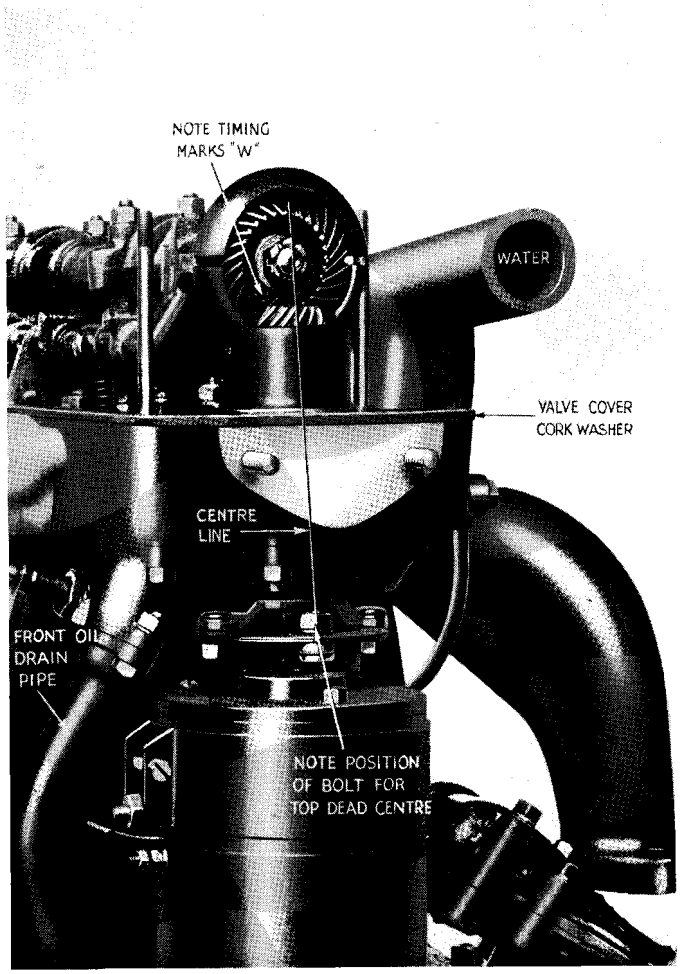


Illustration No. 34.—This should be carefully studied because it has to do with the timing of the valves and shows the relative position of the arm of the dynamo coupling when two of the pistons are on top dead centre. The valve cover cork washer can be seen and the type of fittings employed to drive the camshaft.

When the cross head of the dynamo coupling is in the position shown in Illustration No. 28, that is to say with the bolt through the coupling attached to the dynamo towards the front of the car, then No. 1 piston is on top dead centre.

The cross head coupling attached to the dynamo is connected to the coupling driving the vertical spindle by means of laminated steel discs, and when the overhead valve camshaft cover is removed it will be seen that there is a mark on the driving bevel gear wheel which meshes with the camshaft gear wheel, and if ever the camshaft is removed, provided nothing else has been disturbed, these marks only have to coincide for the timing to be correct.

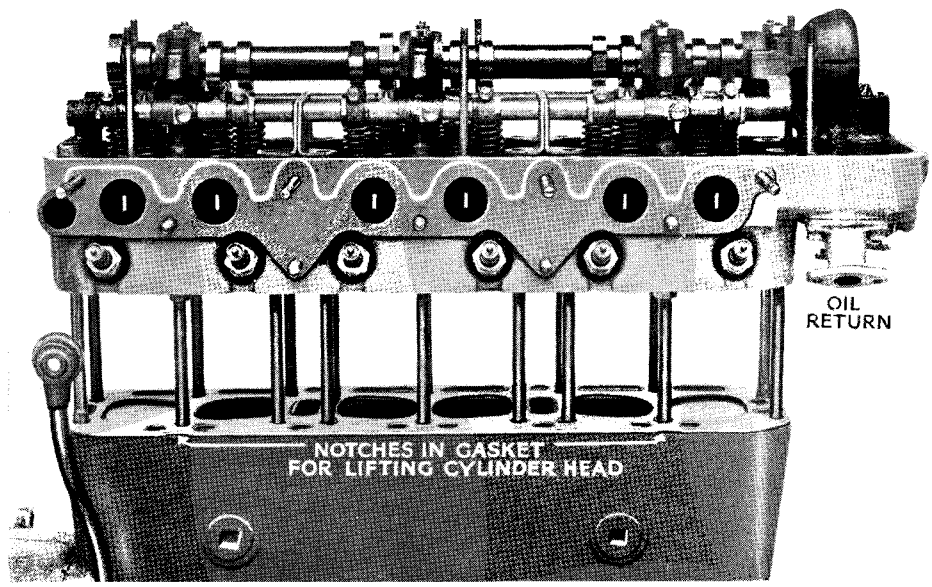


Illustration No. 35.—View of the cylinder head partially removed from the cylinders. This is a view of the inlet side of the engine ; the pipe on the left-hand side of the illustration is a return feed from the head to the base chamber. It will be noted that there are notches in the gasket, so that a tool like a spanner can be inserted to help to lift the cylinder head.

It also follows that if one wants to find top dead centre to check the ignition, or for any other purpose, it can be found by turning the dynamo coupling, as shown in the above illustration.

The form of coupling employed permits the cylinder head being removed without disturbing the timing in any way.

It is only necessary to undo two bolts to disengage the coupling between the dynamo and the cylinder head.

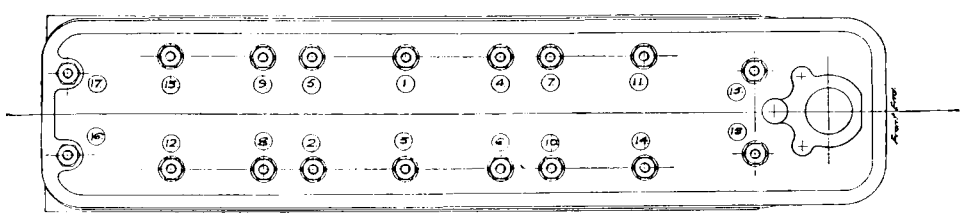


Illustration No. 35a.—Showing the rotation of slackening off and bolting down the cylinder head.

Cylinder Head Removal.—Whenever the cylinder head is removed it is obvious that the oil delivery pipe and return pipes will have to be disconnected and the two set screws securing the bracket between the engine and the radiator taken out altogether. There are 18 cylinder head holding-down bolts, which should be slackened off in the order shown in Illustration No. 35a, and Illustration No. 35 shows the cylinder head partially removed. A copper and asbestos gasket is fitted between the cylinder head and the cylinder block, and if ordinary care is employed there is no reason why this should be damaged in removal.

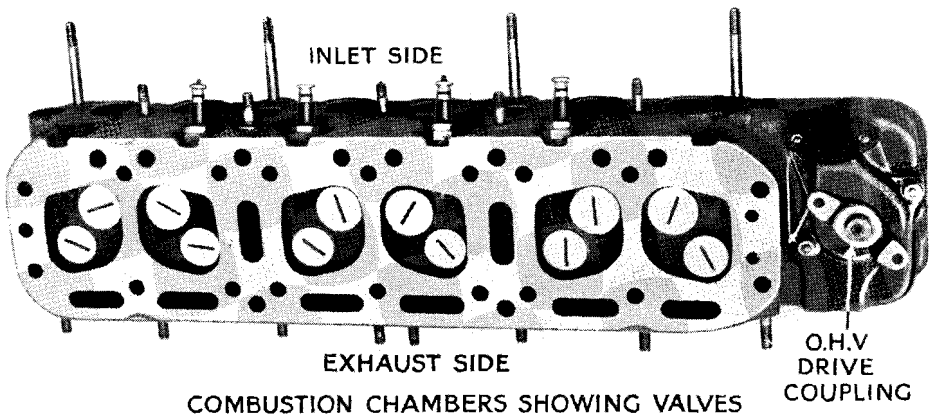


Illustration No. 36.—Interior of cylinder head, showing the position of the valves, the shape of the combustion spaces and the holes through the cylinder head through which the holding-down bolts pass, as well as the passage ways conveying water to the head. The coupling for the overhead camshaft will also be seen.

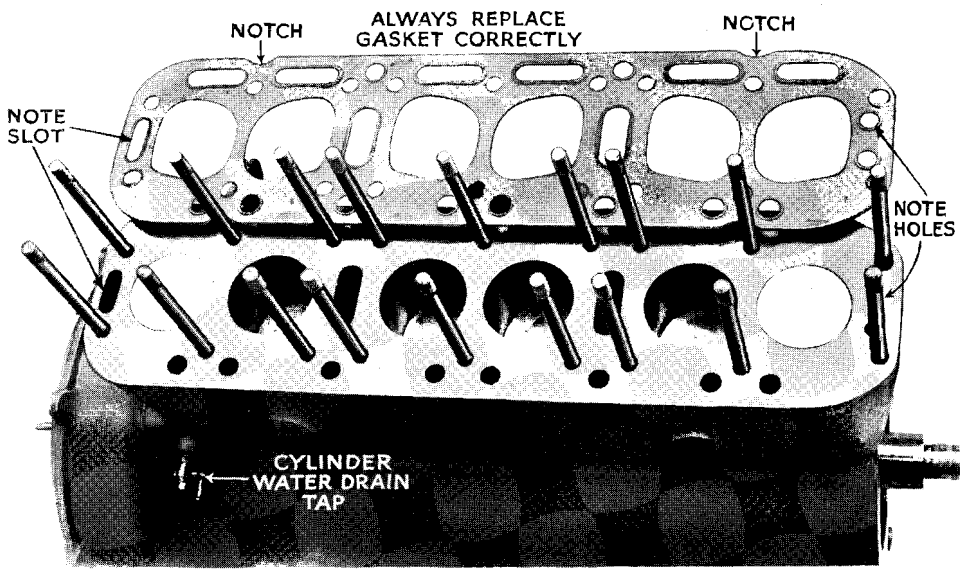


Illustration No. 37.—Plan view of the cylinder block and the gasket. Care must be taken when fitting the gasket ; be sure that the slots register with the corresponding ones in the cylinder block. An important feature of this illustration is the cylinder head water drain tap, which has to be open when the whole of the circulation is empty, for example in Winter time as a precaution against frost.

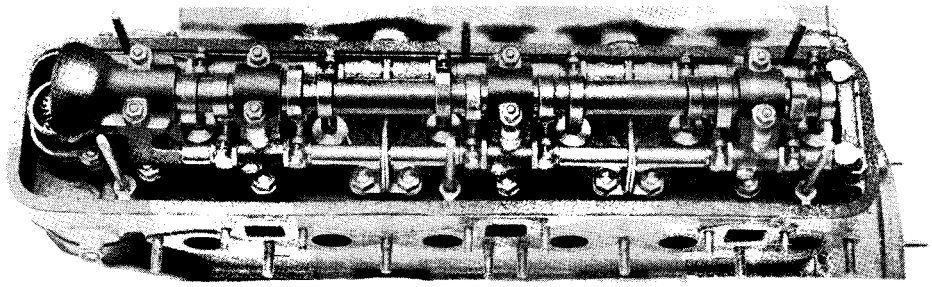


Illustration No. 38.—Plan view of the cylinder head, showing the camshaft and rockers in position.

After the cylinder head has been removed the combustion chamber side presents the view seen in Illustration No. 36. Each valve is numbered in relation to the number on the face of the cylinder head, and valve grinding can be effected either by holding the valve in a suitable clamp from above, or by means of the screw-driver from the combustion chamber side. It is as well to study this illustration from another point, namely the possible necessity of changing a valve spring. In a case of emergency a rod can be inserted through the sparking plug hole, after the sparking plug has been removed, which will prevent a valve dropping into the cylinder, but should a spring break it is preferable to remove the head in order to change the spring. As has been previously stated, there are 18 cylinder head studs, and Illustration No. 36 shows the holes through which the studs pass. The remaining holes in the head are for the free travel of water from the cylinder body through the gasket to the cylinder head. The right-hand side illustration shows the coupling attached to the pinion shaft which operates the overhead gears.

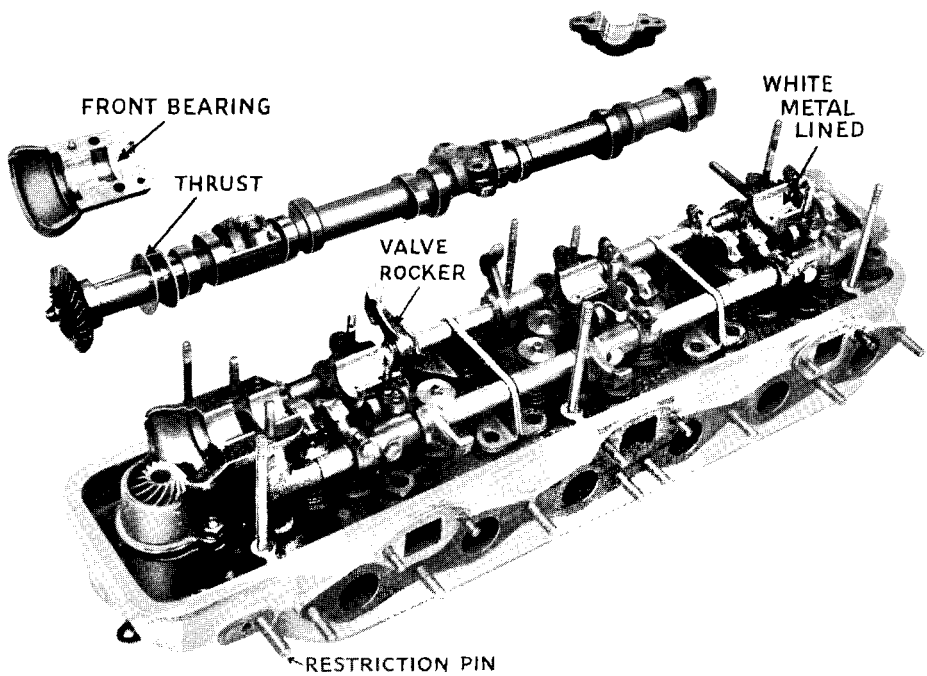


Illustration No. 39.—A very detailed view of the cylinder head, showing camshaft removed from its four bearings, which are white-metal lined. On the left lower side of the illustration the restriction or metering pin will be noticed. This pin has a flat machined upon it to control the amount of oil that passes to the overhead valve gear. Oil is delivered to the front bearing of the camshaft and then through the rocker-shafts to lubricate the rockers and remaining bearings.

A plan view of the cylinder block after the head has been removed, Illustration No. 37, is worthy of careful consideration. It shows the cylinder head studs in position and the cylinder head gasket resting alongside. Before an attempt is made to replace a gasket, it should be carefully noted that there is only one way in which the gasket must be fitted. There is in the first place a slot at one end, while there are holes at the other end for the passage of water, and the shape of the gasket must conform to the contour of the combustion chamber. This illustration affords an opportunity of noticing notches made in the gasket which afford a method of inserting a screwdriver or similar tool between the head and the cylinder block, in order to break the joint, which may have become very tight due to the presence of carbon and jointing compound.

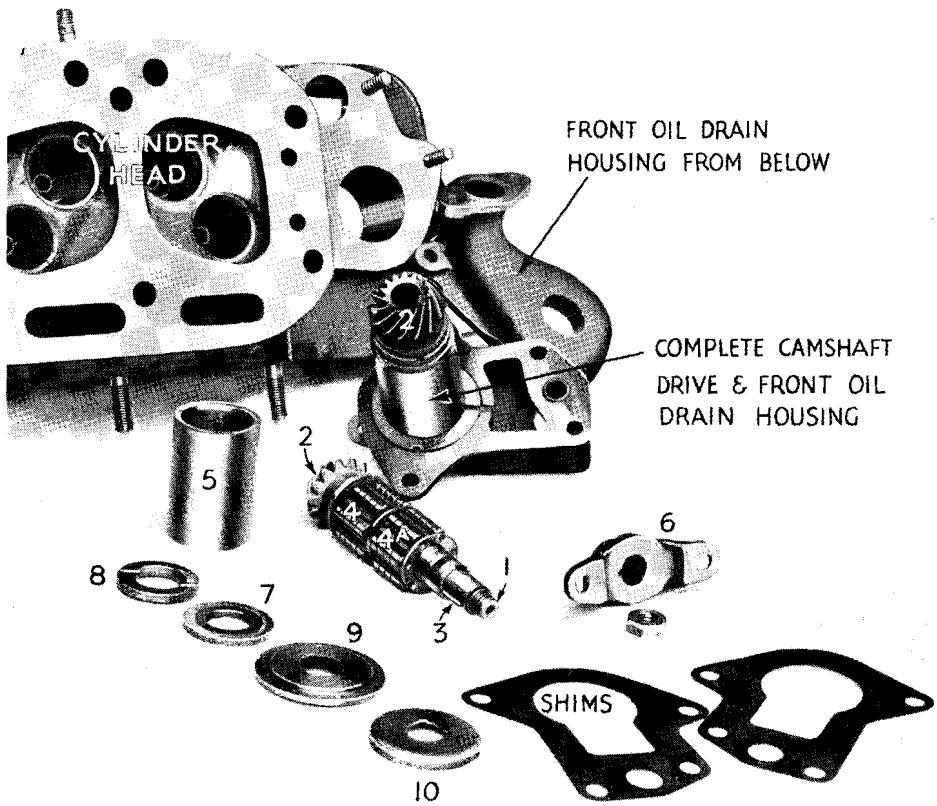


Illustration No. 40.—View of the underneath side of the cylinder head, with complete camshaft drive removed. A separate unit has been dismantled, the parts being as follows :—

A number of shims are employed in the original assembly. These should never be dismantled.

1. Camshaft driving shaft.
2. Camshaft driving bevel pinion.
3. Camshaft driving bevel pinion key.
4. Hyatt roller bearing.
4a. Hyatt roller bearing.
5. Bevel pinion bearing sleeve.
6. Universal joint fork for bevel pinion.
7. Bevel pinion washer.
8. Bevel pinion thrust washer.
9. Bearing retainer plate.
10. Bevel pinion oil thrower.

Illustrations Nos. 38 and 39 need very little explanation as they afford a detailed view of the cylinder head as seen from above, with the valves in position. In the latter illustration the camshaft is removed and the articulating rockers and the rocker-shafts can be inspected.

The camshaft is held in position in four white-metal bearings by bearing caps, and oil is introduced into the bearings along each of the rocker-shafts, as well as supplying the drilled rockers. The surplus oil, as previously explained, drains back into the sump. It will be noticed that some of the cylinder head holding-down bolts pass through brackets that support the rocker-shafts in position and a $\frac{5}{16}$ in. special ring spanner is required to slacken the holding-down bolts, one of these is included in the tool kit.

By swinging the valve rockers out of position it is possible to remove the valve cups and cotters after the camshaft has been lifted. Particular note should be made of the thrust on the front end of the camshaft, and be sure that this registers properly when the latter is reinstated.

The number of washers will be seen on the camshaft, consisting of a steel disc and a spring steel washer. These fit on the front side of the front bearing next to the bevelled gear, and take the thrust of the drive of the shaft.

Before leaving the cylinder head the details of the overhead valve gear drive can be seen by reference to Illustration No. 40. The complete camshaft drive assembly on the left-hand side of the illustration is bolted to the cylinder head by four studs and nuts, and in order to ensure correct meshing of the driving pinion with the camshaft gear wheel a number of shims are employed between the face of the cylinder head extension and the assembly housing. These are in point of fact a Factory fitting, but care should be exercised, if ever a unit is removed, to see that the shims are neither damaged nor omitted. The caption beneath the illustration suffices to describe it.

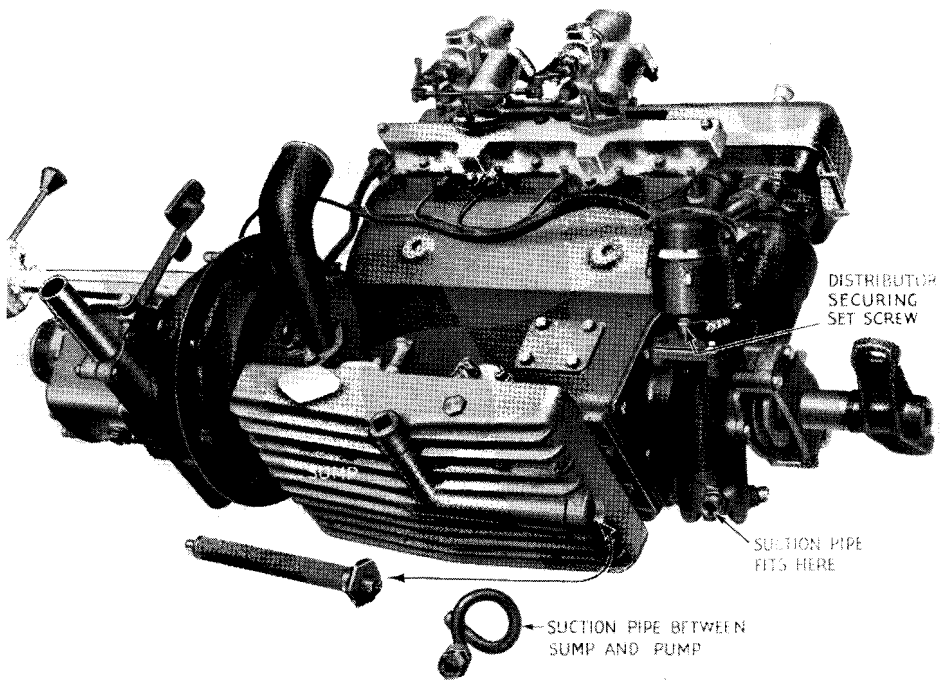


Illustration No. 41.—This illustration is primarily intended to show the position of the suction filter inside the engine, also how the distributor is fitted. It will be noted that the oil pump is driven by the timing gear off the same shaft that drives the distributor.

Timing Dismantling.—The following operations will deal with a number of parts, such as oil pump, distributor, and dismantling of timing gears, prior to dealing with the most important subject of engine knowledge, namely lubrication. All the various parts are so co-related in the case of the M.G. Magna engine that the description may appear to be somewhat disjointed, but it will be found that the illustrations will materially assist and are, in fact, more informative than any amount of text.

Take Illustration No. 41. This shows a view of the engine as seen from below. There is the sump, the oil pump, the front engine bracket, the distributor and suction filter.

A suction filter consists of a tube surrounded by a fine gauze mesh through which the oil in the sump has to pass prior to being drawn into the oil pump. The filter should be removed from time to time and thoroughly washed in petrol. When replacing it, make sure that the fibre washer between the nut and the sump is not damaged. It is also necessary to see that the short snail-shaped pipe between the suction filter and the oil pump is properly tightened up, because a very small leak at this point would be fatal to the oil circulation.

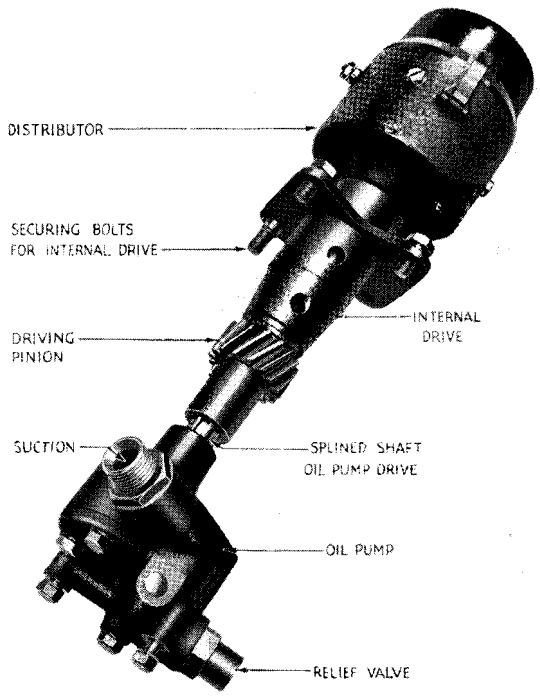


Illustration No. 42.—Distributor drive and oil pump removed from the engine. It will be seen that these are driven by the same shaft. The oil pump spindle registers inside the internal drive.

Reference to Illustration No. 42 shows the pump actually removed. The pump is attached by means of five studs. The upper end of the pump spindle is castellated and registers inside the lower extension of the distributor drive, or internal drive, which is shown in Illustration No. 42 coupled to the pump, thus forming a single unit and driven by the gear which engages with the gear on the crankshaft.

To remove the distributor it is only necessary to take out the set screw and withdraw it from the internal drive. The slots in the drive are "off centre," so the distributor will go back in one way only.

In order to remove the internal drive, it is first of all necessary to undo the four bolts which secure it to the timing cover and give the housing a half turn to disengage the gears, as it will be noticed that they are a true worm. If ever the internal drive is removed, it is necessary to remove the oil pump first, and when the oil pump is replaced care should be exercised to see that the splines register without force.

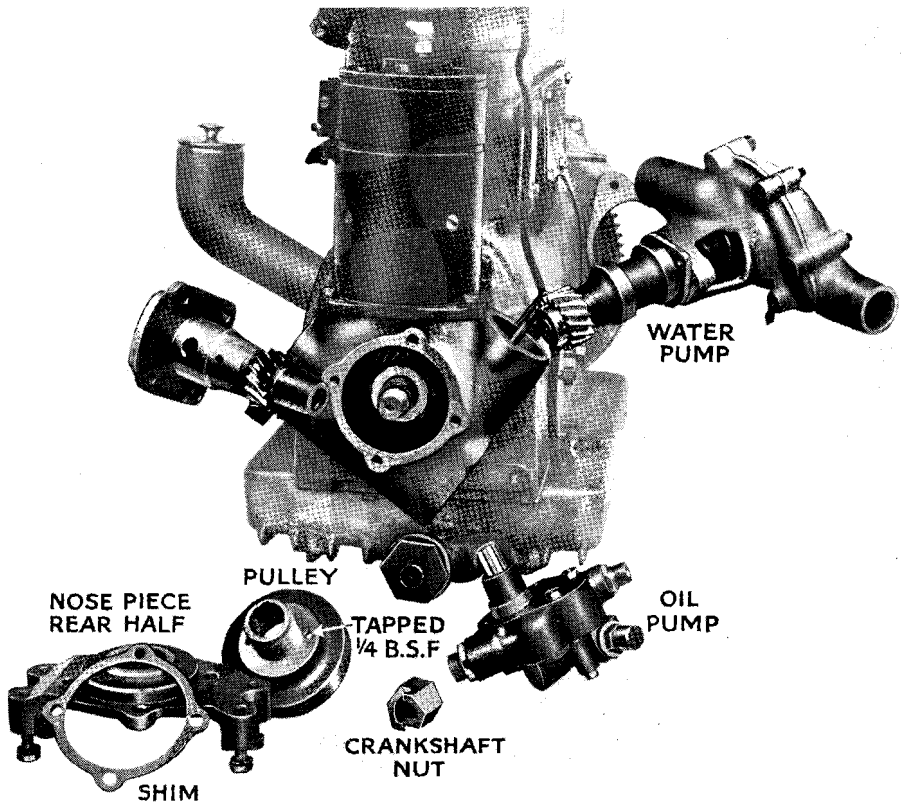


Illustration No. 43.—Oil pump, water pump and internal drive removed from the engine. To remove the fan pulley it is necessary first of all to unscrew the starting handle dog nut and, by using two quarter B.S.F. bolts, the pulley can be withdrawn from the crankshaft.

Before removing the internal drive carefully mark the position of the slots in the distributor drive in relation to the housing, since unless the same teeth on the gears are meshed when replacing, the distributor timing will be incorrect. From the previous paragraphs it will be gathered that either the pump or distributor can be removed at the same time or separately without interfering with the drive from the crankshaft providing the internal drive is left in position.

Illustration No. 43 shows how the front end engine bearer has first of all been removed from the front end engine cover. The pulley is removed by using $\frac{1}{4}$ in. B.S.F. bolts, which act as drawers, and then the front end engine housing can be withdrawn by the removal of four bolts, disclosing the front end of the crankshaft, as seen in Illustration No. 43. The front end thrust of the crankshaft is taken through a hardened steel washer butting up against the white metal of the front main bearing.

It stands to reason that before the pulley can be removed the nut on the front end of the crankshaft which acts as a starting handle dog, and shown at the bottom of Illustration No. 43, must first of all be removed.

It may be necessary at some time to remove the dynamo. This is a comparatively simple matter if reference is made to Illustration No. 44. The front end extension of the crankshaft is fitted with two gears, a helical bevel and a worm. The helical bevel drives the dynamo, and here again we find the necessity for correctly meshing gears, which is taken care of by a number of interposed thin metal shims. The dynamo gear is attached to the spindle by means of a bolt and tab washer, the gear being held in position on the shaft by means of a key. The gears are suitably marked for re-meshing, but the dynamo cannot be put back wrongly if No. 1 piston is put on top dead centre and the coupling on the top of the dynamo placed on so that it points accurately fore and aft, as indicated in Illustration No. 34. The object of the shims is to allow the gears being correctly meshed when assembled.

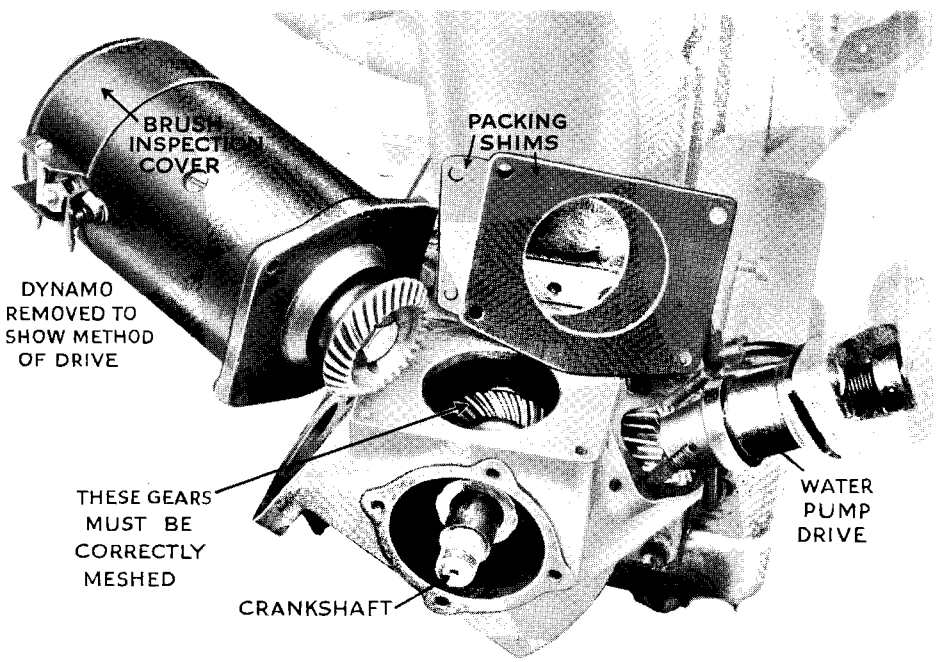


Illustration No. 44.—This shows the manner in which the dynamo is driven. In order to correctly mesh the drive gears it will be noted that packing shims are interposed between the dynamo body and the timing case. The water pump is driven by a separate gear in front of the bevel which drives the dynamo.

Water Pump.—Illustration No. 45 shows the complete water pump after removal from the engine, and below this the pump will be seen dismantled. The principal point of which the owner has to take care is the packing gland adjustment. This consists of a brass bush screwed at one end to register inside the pump body and hold the gland, consisting of special pump packing, in position that will prevent water creeping along the pump spindle and leaking. The packing gland nut can be tightened by inserting a small piece of rod in the holes drilled in the nut and using the side of the pump body as a fulcrum.

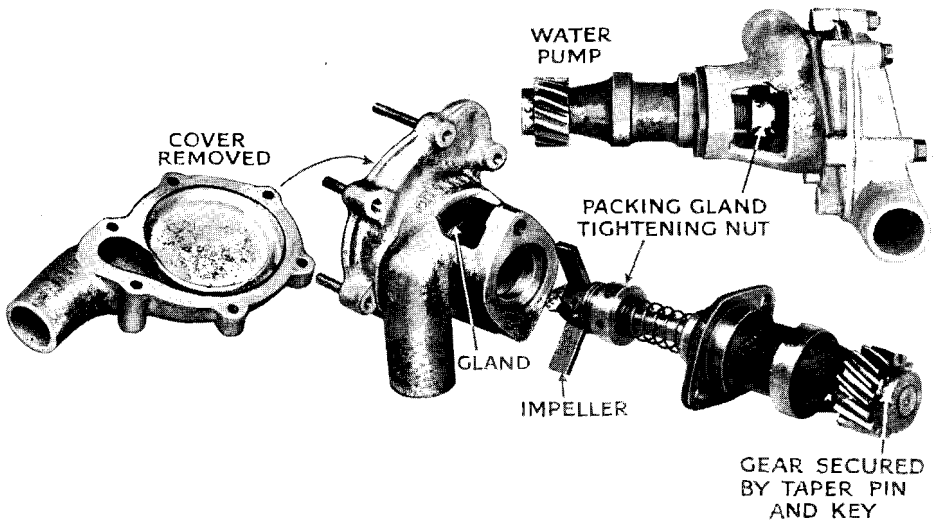


Illustration No. 45.—View of the water pump completely dismantled. The principal point of interest to the user is the packing gland tightening nut. The gland needs no lubrication and should only be tightened sufficiently to prevent leaks.

In order to remove the pump from the engine it is necessary to unscrew the two nuts that hold it in position, and after the removal of the rubber hose connections it can be withdrawn by giving it a gentle pull. Care must be exercised, however, in reinstating it to see that the gears mesh, before any pressure is put on the pump in replacing it. There are three small items which really only concern the Repair Shop. They relate to the removal of the gear wheels from the crankshaft and the front end housing of the base chamber. After the dynamo has been removed it is possible to withdraw the worm wheel from the crankshaft by tapping it with a suitably soft tool, such as a piece of brass, through the dynamo housing. It is a parallel fit on the crankshaft and is held in position by a key.

Illustration No. 46 shows the necessity of employing a puller to remove the helical bevel pinion from the crankshaft. The holes in the pinion are tapped $\frac{1}{4}$ in. B.S.F.

To remove the front end housing it is also necessary to use a means of withdrawal in the form of two $\frac{5}{16}$ in. B.S.F. bolts. These are shown in Illustration No. 46.

We then see, in Illustration No. 48, the front end of the crankshaft, also the two keys on the crankshaft on to which the two gear wheels fit.

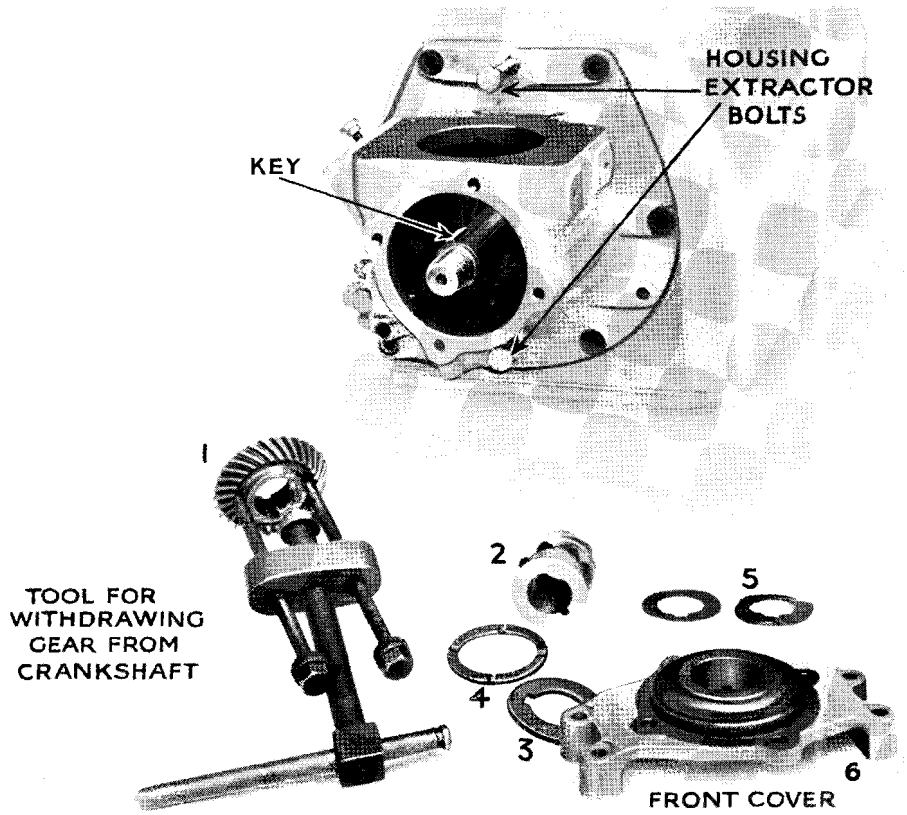


Illustration No. 46. View of the components attached to the front end of the crankshaft. The helical bevel wheel is a tight fit on the shaft, held in position by a key, and it is necessary to utilise a wheel removal tool, similar to that shown, in order to extract this. The principal parts are as follows :—

1. Helical bevel wheel.
2. Worm wheel for driving oil pump.
3. Distance column.
4. Cover with thrust face.
5. Packing shims.

Engine Lubrication.—The actual lubrication of the engine is very simple. Approximately seven quarts of oil are contained in the sump when filled to its proper level.

The oil flow can be followed by referring to Illustration No. 47. Here we see the sump, oil suction pipe, and the pump. Oil is delivered from the pump to the oil filter, which is shown attached to the near-side of the engine and having two connections 1 and 2. The oil filter is also shown removed in this illustration, with the connections 1 and 2 marked thereon. In point of fact the holes that can be seen on the removed oil filter marked "oil feed holes" couple up with holes drilled across the crankcase, so that the oil that is forced by the pump into the oil filter is cleansed and is delivered internally to the two centre and rear main bearings. A view of the oil filter in dismantled form is shown at the end of the engine lubrication section on page 54. The oil feed passes through the union No. 2 to deliver oil by means of an external pipe to the front main bearing and the overhead valve gear.

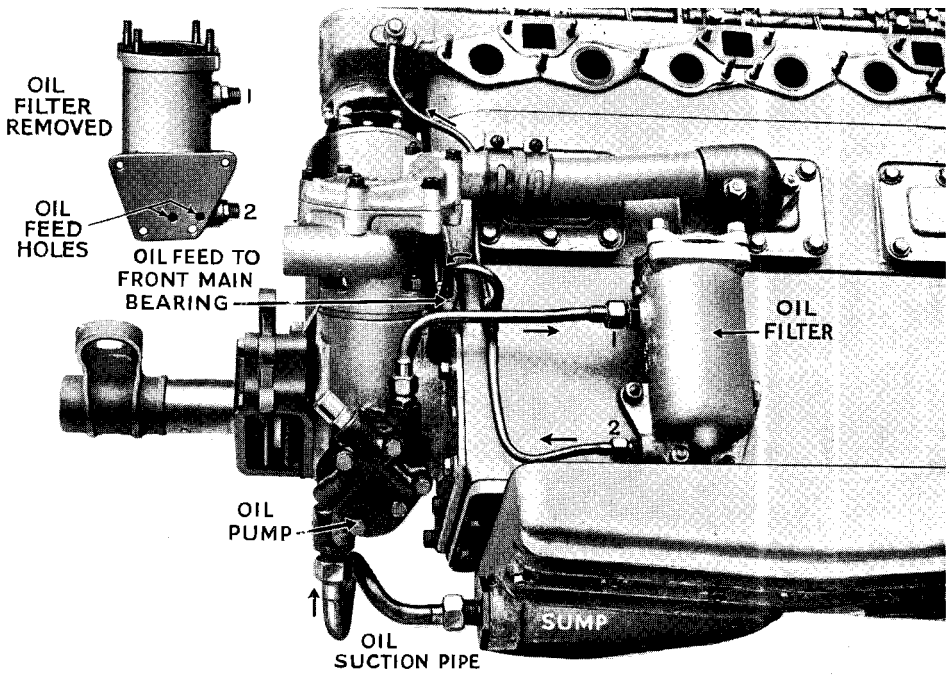


Illustration No. 47.—View of the front part of the engine showing the position of the oil pump, which is coupled to the sump by the oil suction pipe, and the external view of the oil filter which has unions marked 1 and 2, on the opposite side of the oil filter, which is at the top left-hand corner, and it will be seen that after oil has passed through the element inside the filter it is delivered through two small holes which communicate with the main bearings of the engine, as well as the feed pipe to the gauge on the dashboard.

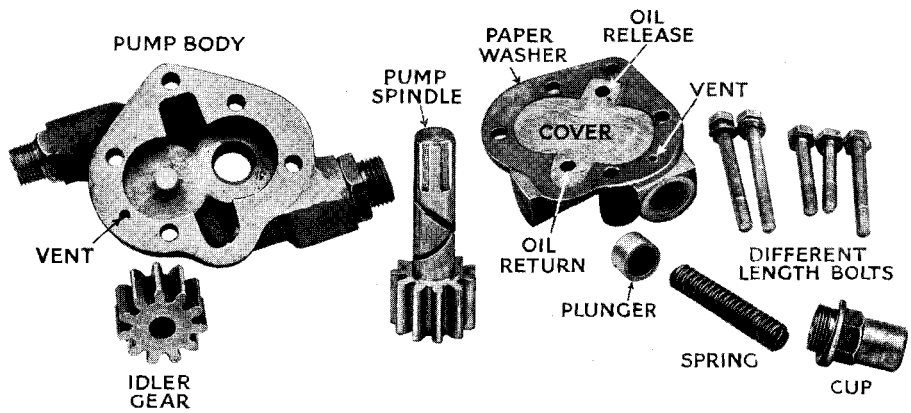


Illustration No. 48.—The components of the oil pump, which is of the gear type. The pump spindle gear engages with the idler gear.

The principal part of the pump to examine is the relief valve, which consists of a plunger, spring and hollow cap nut. When the oil pressure registers a pre-determined limit, the spring is compressed and allows the plunger to uncover a passage which will cause the pressure of the pump to drop. There is no adjustment to the amount of pressure ; this is determined at the Factory, and is governed by a spring.

The pump is of the gear type, fitted with a cover-plate and having a by-pass relief valve incorporated in the body of the pump. The relief valve, as can be seen in Illustration No. 48, consists of a cover which encloses a spring and maintains the small piston up against a seating in the pump body until such time as either the force of the oil through pressure or cold non-fluidity forces the piston off its seating. Whenever this occurs there will be either the corresponding drop in oil pressure, or the release of excess oil will maintain the oil pressure at a point pre-determined by the makers, dependent upon the resistance of the spring. It is obviously possible to increase the tension of the spring by introducing washers in the cap, or obtaining a stronger spring, but no such alterations should be effected without first obtaining the advice from the Works.

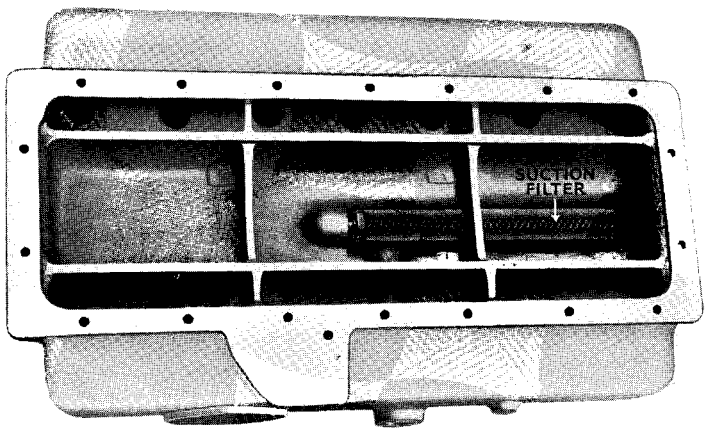


Illustration No. 49.—View of the interior of the sump, showing how it is baffled to prevent surging. The suction filter is shown in position. If ever this is removed, be careful to see that it is screwed up tightly against the fibre washer at the front. It is fatal to get an air leak.

Oil that is forced to the main bearings finds its way under pressure to the big-end bearings through holes drilled in the crankcase, whence in the usual course it is thrown out by centrifugal force, finding its way upwards to lubricate the pistons and gudgeon pins. The path of the oil can better be followed if the dismantling of the engine is now continued.

Before proceeding with the details of the oil circulation it is as well to examine the interior of the sump, from which it will be seen that there are a number of baffles to take care of oil surging, and also the manner in which the suction filter registers in a boss in the centre of the sump.

Illustration No. 50 shows a view of the crankshaft in position after the sump has been removed. The crankshaft runs in four main bearings, the front and rear bearings being white-metal lined bushes and the two centre bearings being of white metal, direct in the split steel housings. Examine for a moment the crankshaft after removal. Owing to the size of the balance webs of the crankshaft it is necessary to employ split housings to accommodate the two centre main bearings and to register these in the barrel type crankcase. These housings are held in

position by long bolts which pass through them, and a view of the crankshaft after it has been removed is shown in Illustration No. 51, which shows the crankshaft, front end housing with its bush for the front main bearing, the rear end housing of the crankcase and the split centre main bearings, and the manner in which the bolts pass through them.

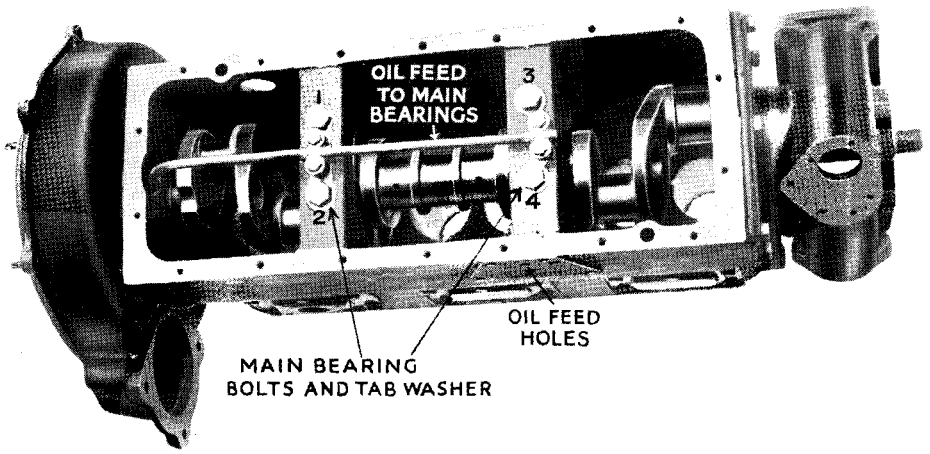


Illustration No. 50.—View of the base chamber after the sump has been removed, showing the crankshaft in position in the main bearings. The oil feed pipe to the three main bearings can be seen and also the heads of the bolts 1, 2, 3 and 4, which pass through the centre supports of the crankcase in which the main bearing housings are fitted and lock these in position.

As has been stated already, the front main bearing is fed with oil by an external pipe, and it is now possible, on examining Illustration No. 50, to see how the oil feed holes on the side of the base chamber correspond with the large front cross web coupling up the two halves of the crankcase and, of course, integral therewith. The two centre and rear main bearings receive their supply from the oil pipe that can be seen in the illustration.

The crankshaft centre main bearings are fitted into housings which will be shown later, and these housings are held in the crankcase by means of long bolts, Nos. 1, 2, 3 and 4, the bolts being prevented from turning by the use of tab washers.

There is one other point that should be noted in this illustration, namely the position of the oil feed to the main bearings. It has been shown in Illustration No. 50 that the centre and rear main bearings are fed by one pipe, which delivers oil to the main bearing housings and to a union below the rear main bearing. The oil then goes via the bearing feeds as marked 1, 2, 3 and 4 in Illustration No. 51.

The rear main bearing is, however, differently designed. An examination of the rear end of the crankshaft, as shown in Illustration No. 52, will disclose the fact that the crankshaft has a tapered rear end, and is fitted with a key. A flange is fitted on to this with an extension. The object of the flange is to act as a mounting for the flywheel. A white-metal lined bush is fitted over this extension and registers inside the rear end of the flywheel housing.

Before dealing with the rear main bearing and its construction, it may be as well to examine the crankshaft, two views of which are shown in Illustration No. 52, the main journals being indicated by the letter " M " and the big-end journals indicated by numerals, 1, 2, 3, 4, 5, 6. A close examination of the illustration will

show that the shaft is drilled so that oil can pass through the holes in the shaft from the main to the big-end bearings. The front end of the crankshaft is slotted to receive two keys, on which the timing gears are fitted. The rear end of the crankshaft, however, can be seen in two positions, 1 and 2, in Illustration No. 52, showing that on one side there is an oval slot with a hole in it, and on the other side there is a key, the purpose of which will be made clear on examining Illustration No. 53.

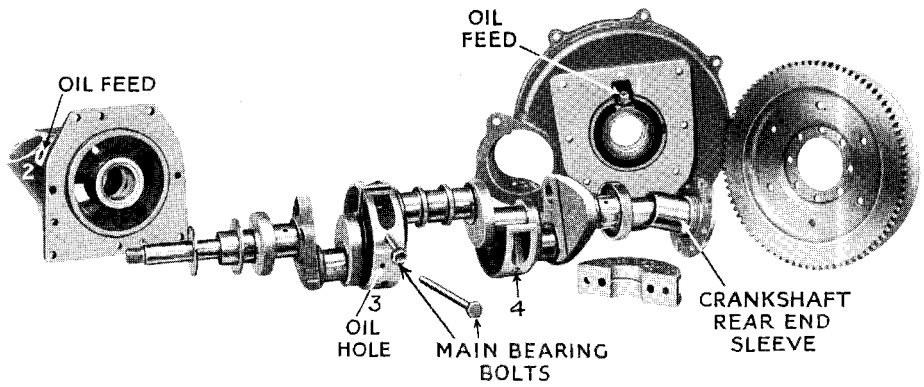


Illustration No. 51.—View of the crankshaft removed from the engine and its relation to the front end housing. It will be noted that the two centre main bearings are split in two halves. The rear end of the crankshaft is fitted with a sleeve to receive the flywheel. The front end main bearing is white-metal lined.

First of all the flywheel is attached to the crankshaft by utilising the flange No. 2 in Illustration No. 53. This flange has a hole in it on one side and a keyway cut on the inside. The external extension of the flange fits inside the rear main bearing and is secured to the tapered end of the crankshaft by means of a key, and is locked in position by a nut which can be seen on the end of the crankshaft in Illustration No. 52.

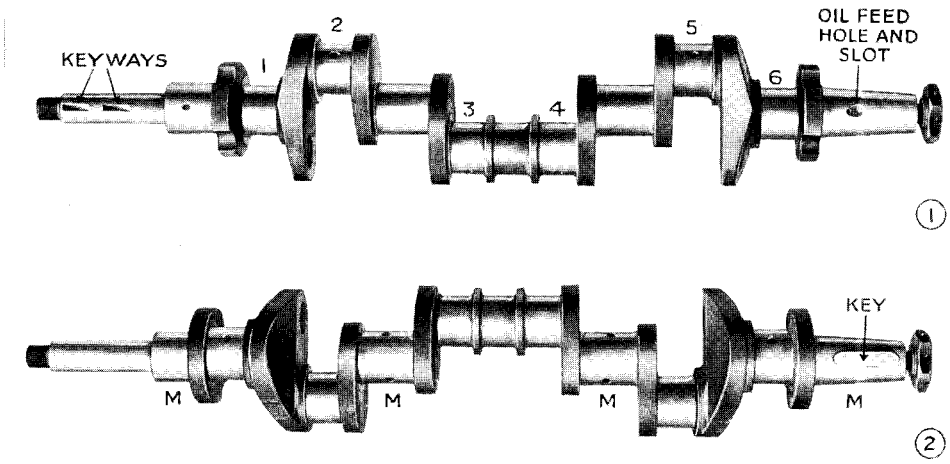


Illustration No. 52.—Two views of the crankshaft : (1) the front end of the shaft is provided with two keyways on to which the timing gears are fitted : at the rear end can be noted the oil feed hole and slot. The lower illustration (2) shows four main bearings marked " M " and also that at the rear end there is a long key.

The hole in the flange 2 registers with the oil feed hole in the slot in the crankshaft 3, so that the lubricant which is delivered to the union on the rear main bearing 1 passes through hole 2 and into the hollow crankshaft in order to lubricate the big-end bearings.

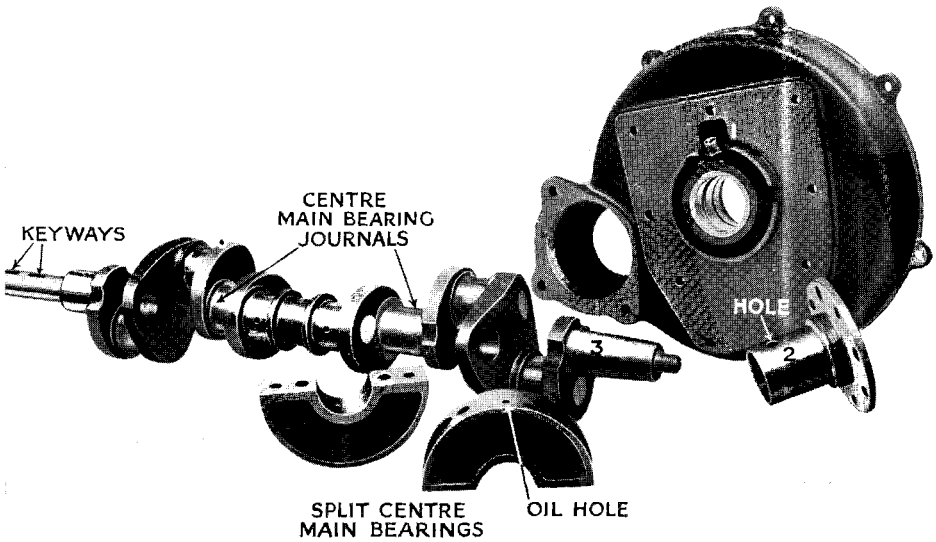


Illustration No. 53.—This is primarily intended to show the manner in which the crankshaft 3 passes through the flywheel housing and rear main bearing 1, the actual bearing of the shaft being the sleeve 2. The main bearing 1, which is really upside down, receives oil through the nipple ; this passes through the hole of the sleeve 2, which registers with the slot in the crankshaft shown in Illustration No. 52.

In order to remove the crankshaft hub it is necessary to employ a tool similar to that shown on the right-hand side of Illustration No. 54. It has already been shown that the flywheel, hub, and bearing sleeve are fitted on to the crankshaft by means of a taper and key ; this type of flywheel actually illustrated is used when a normal clutch is employed, but the method of flywheel attachment is similar in all cases.

Note :—Should the owner have the misfortune to run a bearing—in other words, through insufficient lubrication the bearings become molten—it will be found that part of the white metal will actually run into the oil channel ways and block them. Cases have been known where the bearing has been refitted, and omission to clear the crankshaft has only resulted in the bearing running immediately after reassembly. If ever a bearing runs, it is necessary to see that all the ducts through the crankshaft are cleaned out, and it may even be necessary to remove the blanking plugs and pass drills of correct size through the holes. It may be found, however, that only a small quantity of white metal has run into the oil ways, and if a syringe of thin oil is squirted through these oil ways it is possible to see if they are clear.

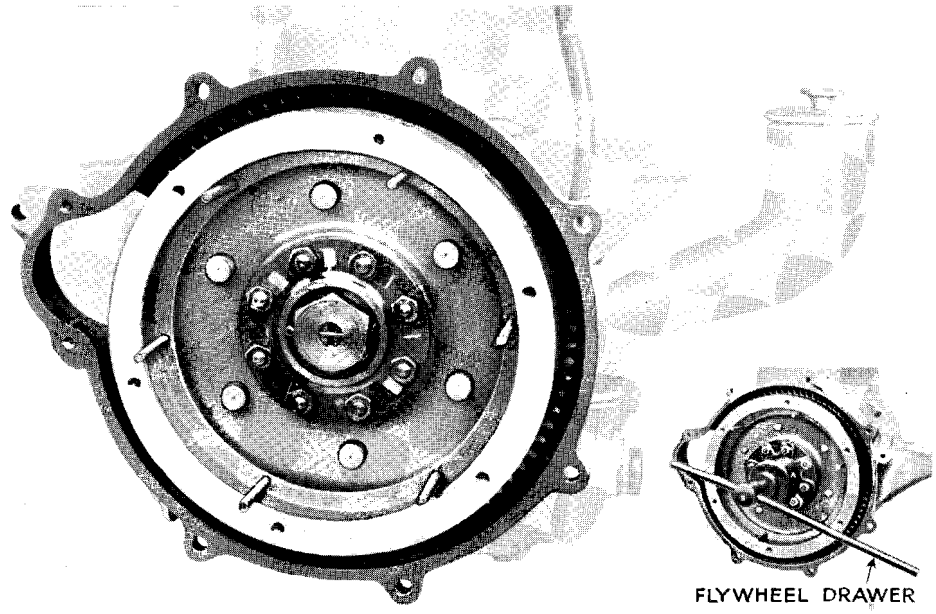


Illustration No. 54.—Rear view of the flywheel in position on the crankshaft. The flywheel is bolted to the detachable rear crankshaft flange, which latter is held in position by the large hexagon nut and split pin. It is necessary to use a withdrawal tool to remove the flange ; this is shown on the right-hand side of the illustration.

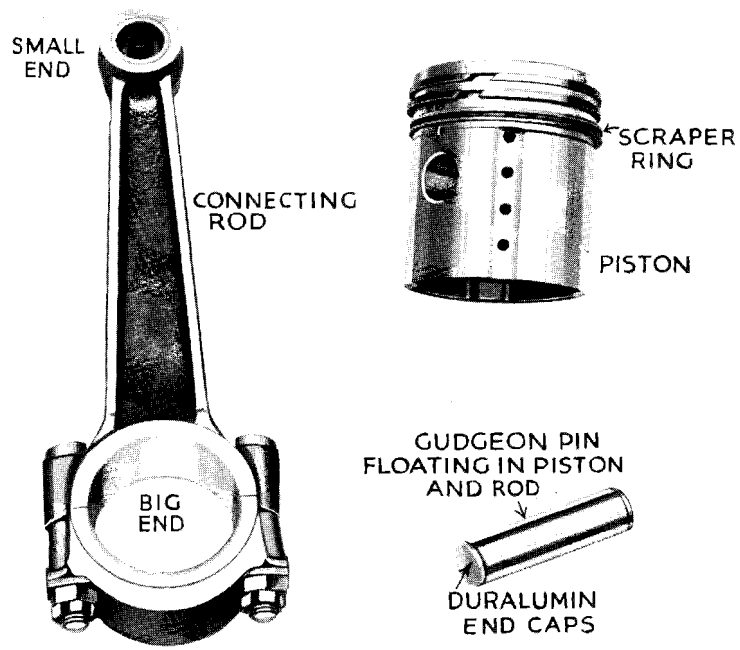


Illustration No. 55.—The gudgeon pin is hardened and ground and is free to float in piston and connecting rod. It is fitted with duralumin end caps to prevent scoring the cylinder walls.

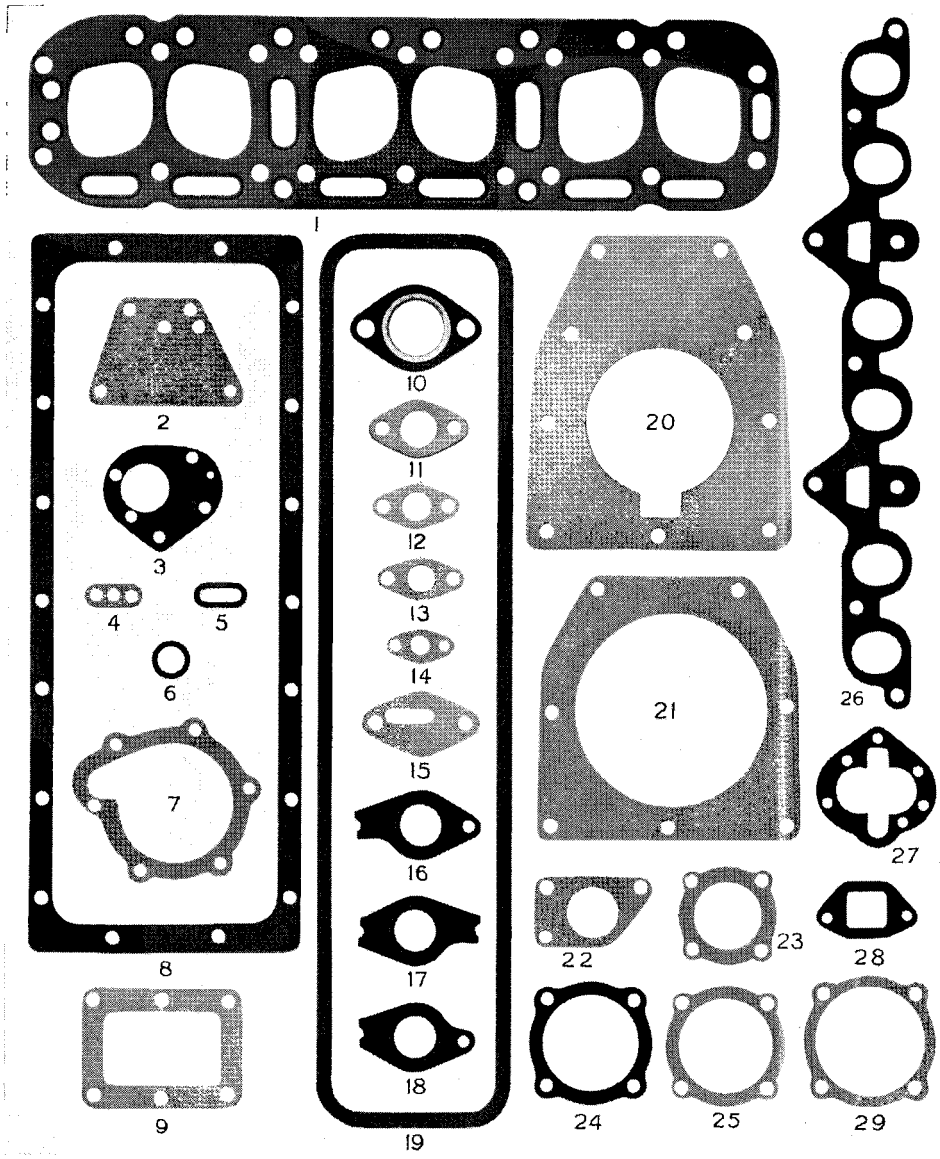
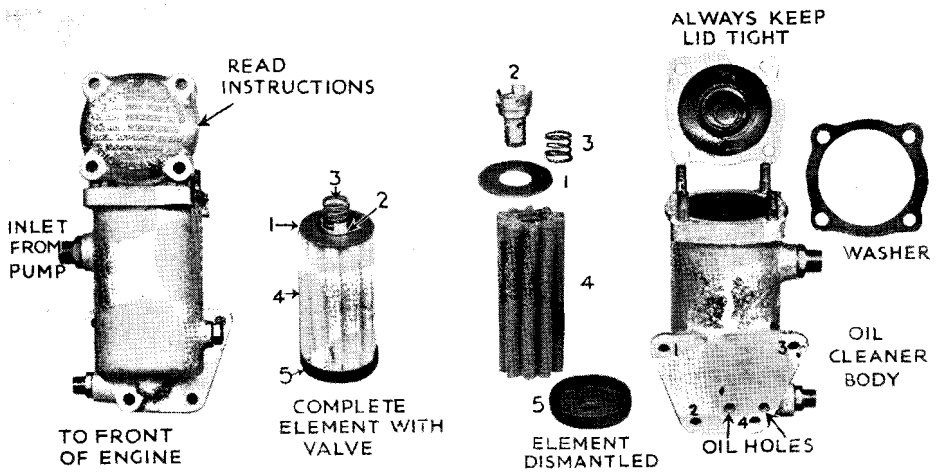


Illustration No. 56.—Various types of washers used.

1. Cylinder head gasket.
2. Oil filter body joint.
3. Joint for oil pump.
4. Main oil feed flange joint.
5. Cylinder head feed pipe joint.
6. Cylinder head drain pipe joint (top rear).
7. Water pump joint.
8. Joint for oil base.
9. Joint for cylinder jacket cover-plate.
10. Exhaust flange gaskets.
11. Carburetter flange gasket.
12. Cylinder head drain pipe joint (front bottom).
13. Ditto (front top).
14. Ditto (bottom rear).
15. Joint for oil gauge adaptor.
16. Exhaust manifold joint (front).
17. Ditto (intermediate).
18. Ditto (rear).
19. Valve cover joint.
20. Joint for bell housing.
21. Joint for front bearing housing.
22. Joint for oil filler.
23. Joint for magneto bearing cap (if fitted).
24. Joint for Tecalemit filter cap.
25. Joint for magneto drive casing (if fitted).
26. Induction manifold gasket.
27. Joint for oil pump cover.
28. Joint for water outlet pipe.
29. Joint for engine nose piece.

Illustration No. 55 shows the type of connecting rod employed. The pistons are of aluminium alloy fitted with three rings (the lower one being a scraper ring). The gudgeon pin is free to rotate in the piston boss and the small-end bearing of the connecting rod. Duralumin end caps are pressed into the gudgeon pins so that these can contact with the cylinder walls without in any way damaging them. White metal is cast direct into the connecting rod for the big-end bearings, and

it will be noticed that the bottom cap is of generous proportions and is held in position by means of two bolts. The heads of the big-end bearing bolts are so formed that they register with the connecting rod and are thus prevented from turning round.



The Tecalemit oil filter, referred to on this page, shown in complete form and also dismantled. The various figures serve to indicate the position of the various components to assist assembly when fitting a new element.

Clutch.—The operation of the clutch on the modern motorcar is comparatively speaking foolproof ; that is to say, when the clutch pedal is pushed down the power from the engine is disconnected, but when the pressure on the pedal is released the clutch engages. From a point of view of actual maintenance there are only two items in connection with the clutch that the owner need trouble about—one is periodical lubrication of the clutch withdrawal ball race or thrust ; secondly, adjustment of the set screws attached to the withdrawal arms in order to give the necessary clearance between the clutch plates when the clutch is disengaged, and equally to prevent slipping when engaged.

Access to the clutch withdrawal collar is obtained by removing the clutch cover-plate. The withdrawal only needs a little lubricant every 2000 miles ; too much is worse than none at all. Excess will be flung on to the clutch plates, which will cause slipping. **Always use non-separating grease, a small gun is provided in the tool kit for this purpose. (See Illustration No. 61.)**

Do not put more work on the withdrawal bearing than is necessary by pressing the foot on the clutch pedal when driving. To do so will overheat the withdrawal and induce clutch slip.

Before proceeding with a description of the clutch it is as well for a moment to study the details shown in Illustration No. 57, which is the clutch housing as seen when removed from the flywheel housing. In the first place there is a withdrawal shaft consisting of a " U " shaped member attached to a shaft which finds a bearing in either side of the housing. This shaft is attached to the clutch pedal, so that when the latter is pushed forward the " U " shaped bracket will force the clutch withdrawal sleeve forward ; this clutch withdrawal sleeve comes into contact with the three withdrawal arms, which has the effect of separating the clutch plates and compressing the springs which cause the centre plates to be gripped between the Ferodo faces attached to the pressure plate and clutch cover-plate. It will be noticed in Illustration No. 57 that there is a splined shaft passing through the clutch withdrawal collar, and this shaft enters into the centre plate of the clutch, the centre being also splined as shown.

Clutch Operation.—In order that the owner may understand the relationship of the various parts, he is referred to Illustration No. 58, for each part has been photographed in its correct relationship. The parts are also shown in Illustration No. 59, in this case each one on its own. Various terms are employed to describe the clutch parts by different people, but in the M.G. Works they are described as follows :—

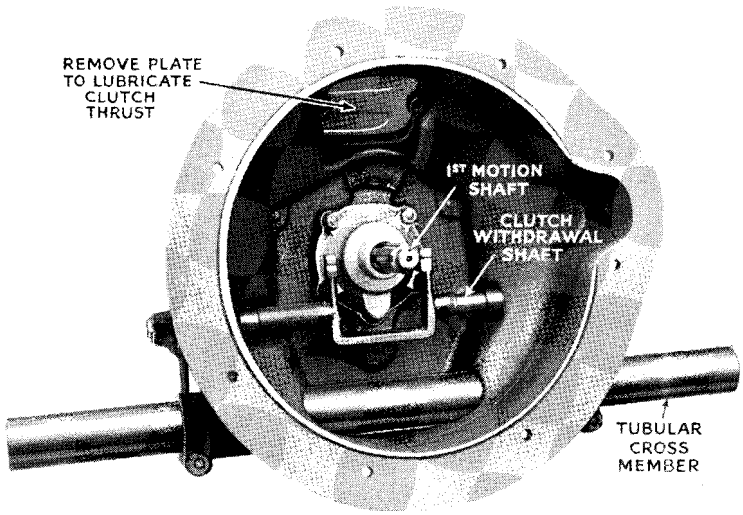


Illustration No. 57.—View inside the clutch housing showing the withdrawal mechanism.

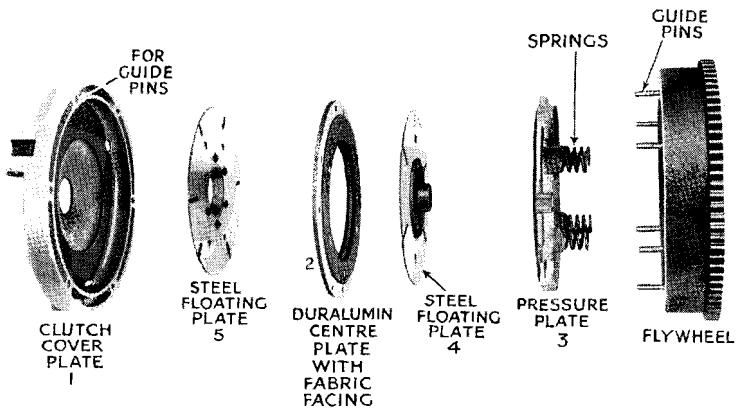


Illustration No. 58.—Various components of the clutch, showing that there are two floating steel plates and that the pressure plate is nearest the flywheel.

First there is the clutch cover-plate ; next to it the floating plate ; next to that the duralumin centre-plate with fabric facing on either side ; then another steel floating plate which contacts with the pressure plate, the rear of which is formed into a series of cups to house the clutch springs, and behind this the flywheel.

The driven plates are made of steel, and, as has been previously explained, are a sliding fit to the front end extension of the gearbox shaft. The clutch cover-plate, centre plate, and the pressure plate are each fitted with Ferodo discs, the Ferodo being attached by means of rivets suitably countersunk. There are six clutch springs which fit into recessed cups on the flywheel side of the pressure plate, and the flywheel is fitted with six guide pins that pass through slots in the pressure plate, and, when the whole clutch is bolted up, register through holes in the clutch cover-plate. These pins are shown in Illustrations Nos. 58 and 59.

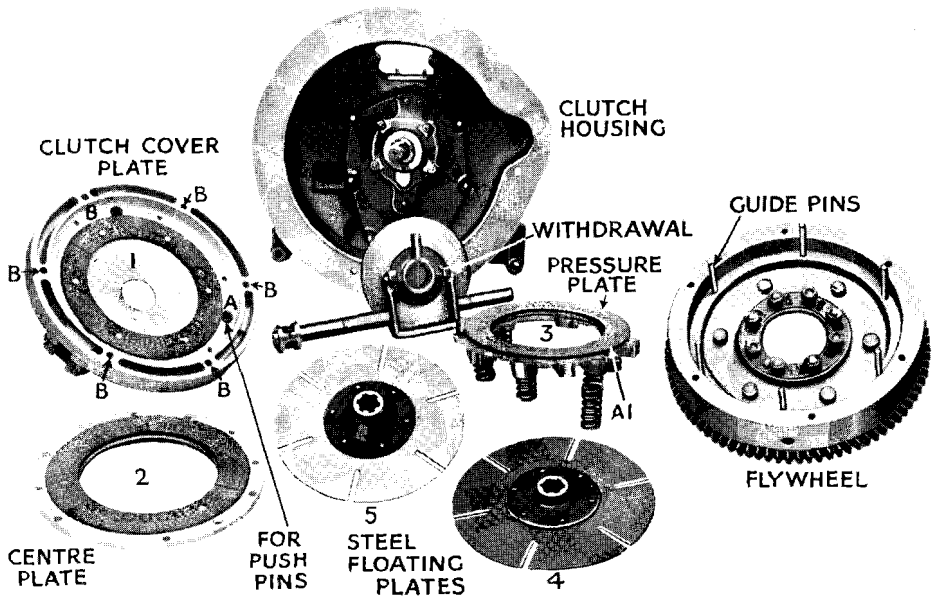


Illustration No. 59.—Inner view of the clutch and its components. The clutch cover-plate is bolted to the flywheel and the centre plate 2 registers over the guide pins in the flywheel. The pressure plate 3 is forced rearwards by the action of the springs, when it grips the floating plates 4 and 5 between the friction surfaces on the plates 1, 2 and 3. When the clutch is pushed out, three push pins pass through holes, one of which is marked " A " in the plate 1, and forces pressure plate 3 towards the flywheel, thereby compressing the clutch springs.

It stands to reason that when the clutch is bolted up solid as shown in Illustration No. 61 the pressure of the springs will force the pressure plate into contact with the driven plate, and grip the latter between the pressure plate and the clutch cover-plate. It is essential that the Ferodo rings must be free from any lubricant so that they can work effectively, and one can visualise that letting in the clutch with a jerk may rough up the Ferodo faces. Alternatively, by letting the clutch continually slip, the centre plates will become overheated, which will, in turn, have a detrimental effect on the clutch surfaces.

Clutch Withdrawal.—In order to effect the disengagement of the clutch it is necessary to force the pressure plate out of engagement with the floating plate by compressing the clutch springs. It will be seen on reference to Illustration No. 59 that on the inner side of the clutch cover-plate there are three holes, one of which is marked A, in which short plungers register, which, when the clutch is assembled, come into contact with the three hardened steel abutments marked A1 in Illustration No. 59. These plungers are controlled by the adjusting screws carried in the withdrawal arms, which can be clearly seen in Illustration No. 60. Pressure on the clutch pedal forces the withdrawal arms forward, and in turn these force the adjusting screws against the plungers, which in turn force the clutch pressure plate towards the flywheel, thus compressing the clutch springs.

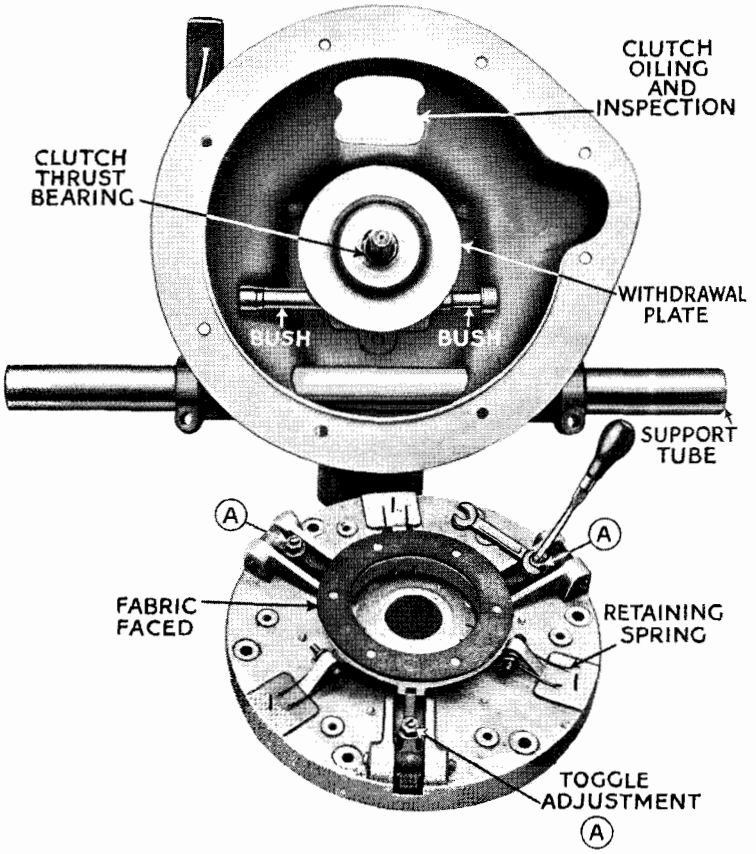


Illustration No. 60.—Clutch cover-plate as seen from the exterior of the clutch, and above this the clutch housing and withdrawal mechanism. The withdrawal plate is moved forward by the action of the clutch pedal and presses upon a fabric faced ring in the centre of the cover-plate ; this forces the small set screw "A" forward sufficiently to disengage the clutch. The set screws are fitted into what are known as "toggle arms," which can be adjusted by a spanner and screwdriver through the clutch inspection cover.

The action of the clutch thus having been described, it simply remains to show how adjustment is effected, and the reason for the three small springs marked I shown in Illustration No. 60. The springs are only intended to anchor the withdrawal plate to the withdrawal arms. It is also necessary to limit the travel of the clutch

pedal so as to avoid the clutch being pushed out too far. As the clutch gradually wears, the thickness of the Ferodo rings will decrease, which will cause the floating plates to come nearer to the clutch cover-plate. This necessitates the clutch withdrawal set screws being adjusted to give a clearance between the fabric face and withdrawal disc. The correct clearance is $\frac{3}{32}$ in. when the clutch pedal is out of engagement.

In Illustration No. 60 a spanner and screwdriver are shown on the adjusting set screws, access being obtained through the aperture in the upper housing marked for "clutch oiling and inspection." (See also page 26.)

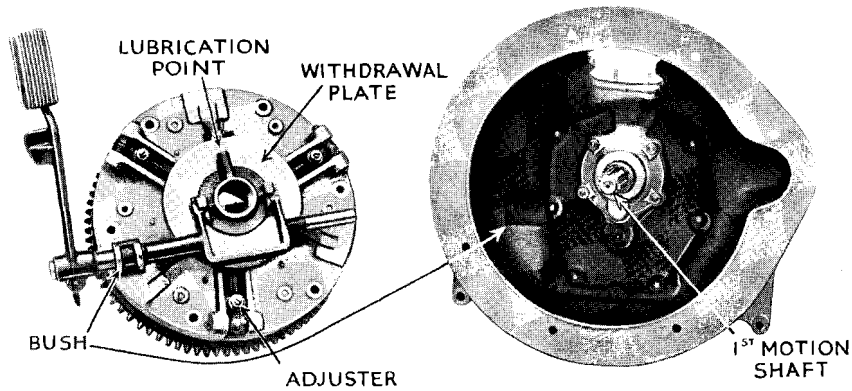


Illustration No. 61.—In order to show the clutch withdrawal and the action of the clutch pedal, inspect the left-hand illustration. The clutch pedal is coupled to a shaft having a central portion in the shape of a "U," this registers in the withdrawal plate. The right-hand end of the illustration shows the first motion shaft of the gearbox, the forward extension of which passes through the clutch and engages with the steel floating plate by means of splines. The whole clutch mechanism is lubricated from a point behind the clutch withdrawal collar and through the inspection cover. Use small grease gun with non-separating grease.

Gearbox.—It is thought desirable to deal with the gearbox at some length as it differs in many respects from the orthodox type of box. It has been seen that the change speed lever is fitted to an extension to the gearbox lid, and this is shown removed in Illustration No. 62. The gearbox affords four speeds and reverse. The gate is marked so that it is easy for anyone to see where the 1st, 2nd, 3rd and top speed gears are. In order that the reverse gears shall not be inadvertently engaged, the gate is provided with a stop clearly visible. The gears are operated by a series of forks coupled to selector rods. These are shown in Illustration No. 62.

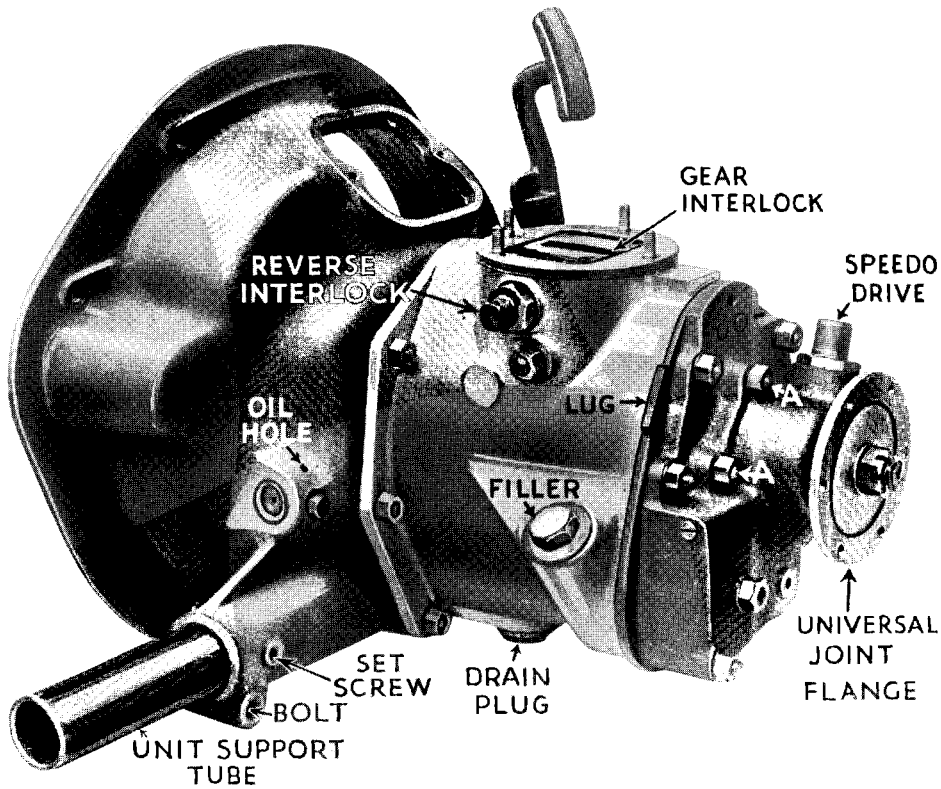


Illustration No. 62.—The external view of the gearbox, showing the position of the oil filler. The gearbox is bolted to the flywheel housing, through which the unit support tube passes. The position of the drain plug can be seen and also the small holes of the flywheel housing connecting with the bushes, carrying the clutch withdrawal shaft.

Illustrations Nos. 62 and 63 also give the owner an idea of the manner in which the selector rods are locked in position when the gear lever is placed in any of the forward or backward positions. The exterior view of the gearbox should be studied, as it shows the filler on the side of the box which acts as an automatic high level, and the drain plug beneath the box which can be removed through the trap door in the undershield by means of a box spanner.

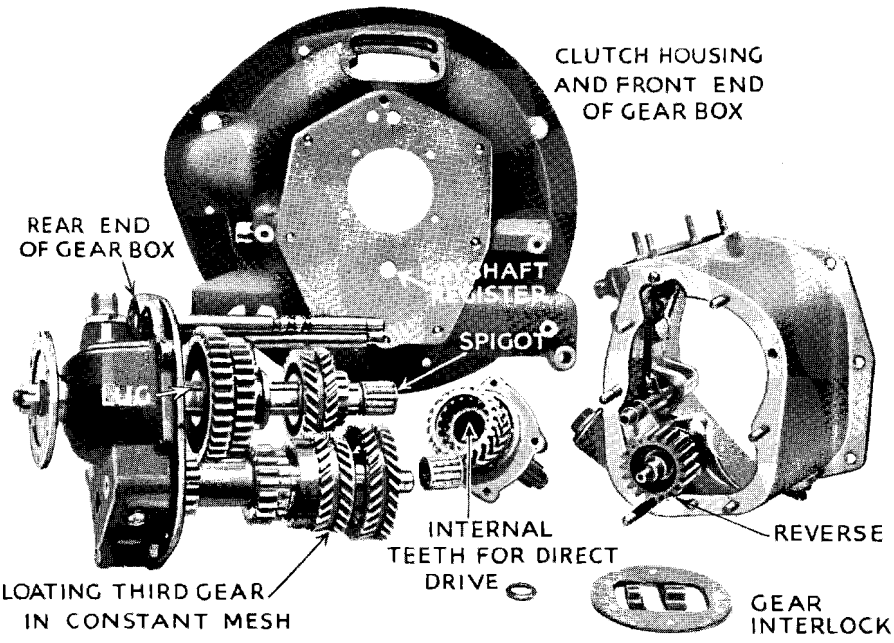


Illustration No. 63.—View of the gearbox partially dismantled, showing the flywheel housing. The centre housing carries the reverse gear and the main and layshafts built up on to the rear end cover. It will be noted that the spigot on the end of the mainshaft has a roller bearing and the layshaft is also mounted on roller bearings.

The third speed gear on the layshaft is always in constant mesh with the third speed on the mainshaft.

The rear end of the engine and forward end of the gearbox are supported in the frame by the tubular member which is located in the bell housing by means of a bolt and set screw on either side. Examination of the illustration will show that the clutch withdrawal shaft is supported in the bell housing. Bushes are located therein by means of set screws, and there is an oil hole in either side of the housing for lubrication of the withdrawal shaft ends.

In dismantling the gearbox there is no necessity to remove the nuts marked A, and it will be noticed that the rear end housing of the gearbox is provided with lugs, so that the rear end cover cap is removed by tapping on the lugs instead of introducing a tool and damaging the facing.

Steel balls register in slots in the selector rods, and as the gear lever is moved to and fro the balls ride out of one slot and re-engage in another, according to the position of the lever. Looking at Illustration No. 63, the user can obtain an excellent idea of the gearbox layout, apart from the gears themselves. It consists of three principal parts ; the front end of the gearbox is formed by the bell housing, the centre of the gearbox acts as casing and a support for the reverse shafting, and the rear end of the gearbox supports the shafts and their gears.

It will be seen that the first and second speed gears, which are on the left of the picture, are of the straight tooth variety, whereas the constant mesh gears and the third speed gears have the teeth cut at an angle, or what is usually called "double helical."

The principal point to note in this illustration is the gear on the lower or layshaft, which is indicated in the illustration as "floating third gear," which is always in constant mesh with the third speed pinion on the mainshaft.

Top gear is obtained in the ordinary way by sliding the third gear on the mainshaft forward, so that the splines on the hub of the gear mesh internally with the constant mesh pinion on the first motion shaft, and it will be noted that the spigot bearing is of the roller type. When, through the movement of the change speed lever, the third speed gear on the mainshaft is caused to slide rearwards, the nature of the tooth engagement will automatically cause the third speed gear on the layshaft to move backwards in unison ; it is then that the gear on the layshaft, which has internal cut teeth, engages with a set of teeth on the front of the second speed pinion. When any other gear is engaged except third gear this third gear on the layshaft simply rotates on its sleeve.

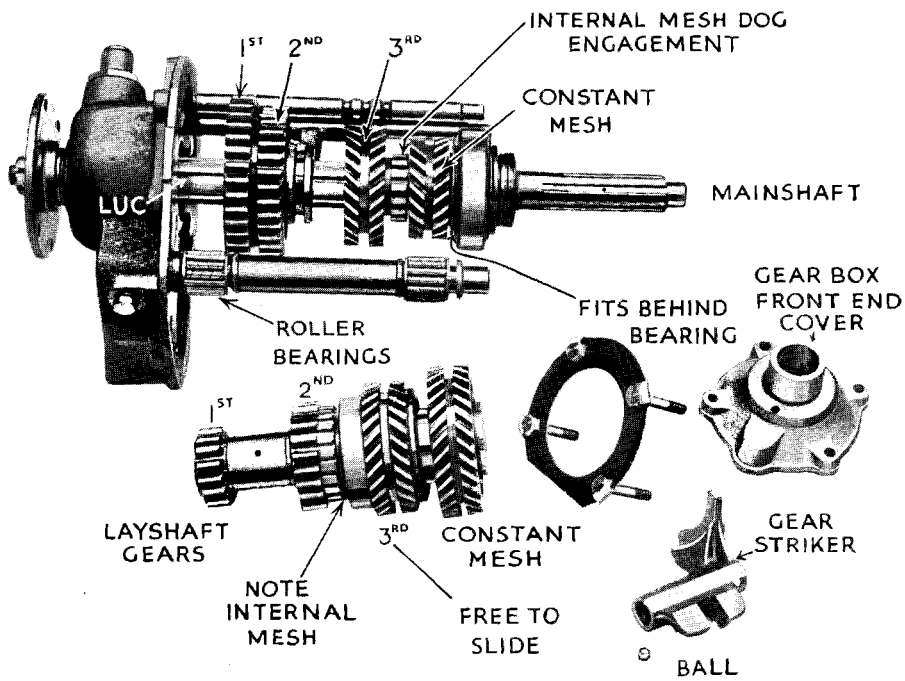


Illustration No. 64.—Another view of the gearbox components. The complete layshaft gears have been removed from the layshaft. Note the internal mesh engagement of the top gear on the mainshaft and the third gear on the layshaft.

In order to make the matter clearer, the user should now refer to Illustration No. 64, which shows the layshaft train of gears locked up on a tube removed from the layshaft itself. The layshaft is fitted with roller bearings at either end and over these roller bearings the complete layshaft is fitted.

The internal mesh dog engagements of the direct drive on the mainshaft, and the third speed free sliding gear on the layshaft should be examined.

If momentary reference is made to Illustration No. 61 it will be noticed that the mainshaft protrudes through the gearbox, passing through the gearbox front end cover.

This cover will be seen in Illustration No. 64, and alongside this will be found a steel ring with four bolts passing through it. It will be noted that this steel ring is placed behind the front ball bearing on the mainshaft to act as an oil retaining washer, and it will be also noticed that the ring has a number of lips formed upon it to act as registers for the bolts by which the front end gearbox cover is secured. A small hole is drilled on the lower portion of the front gearbox cover, permitting a certain amount of lubricant to pass through to lubricate the clutch thrust, which fits over the extension of the cover.

A gear striker to operate the gears is shown at the lower right-hand corner of Illustration No. 64. It will be noticed that there are two rods above the mainshaft which have grooves in them. These grooves are intended to register the striker in its proper position by the aid of steel balls which fit into a recess in the gear striker.

Universal Joint and Propeller Shaft.—The tubular propeller shaft is fitted at either end with Hardy Spicer universal joints. The front end of the propeller shaft is splined and fits inside the end of the universal joint. The object of this is to allow for the end movement of the propeller shaft due to the flexion of the rear springs and the rise and fall of the axle.

It is necessary to keep this sliding coupling joint lubricated, and in Illustration No. 65 the nipple for this purpose is provided, access to it being obtained through a hole in the shaft tunnel. The universal joint proper consists of a plate carrying two jaws, a cross head with hardened steel roller bushes, and the opposite set of jaws attached to the propeller shaft. This can be seen by referring to Illustration No. 65. The entire universal joint is enclosed by a pressed steel cover and a spring-loaded dust excluder cover. The hardened steel rollers are grooved to receive semi-circular wire rings which prevent them floating outwards. It is essential that this joint should be packed with Hardy Spicer grease, using the small gun provided in the tool kit. The grease nipple can be seen in Illustration No. 7 when the shaft is in position in the chassis. When applying grease it is necessary first of all to move the car, thus turning the propeller shaft, until the nipples are in the centre of their holes in the shaft tunnel.

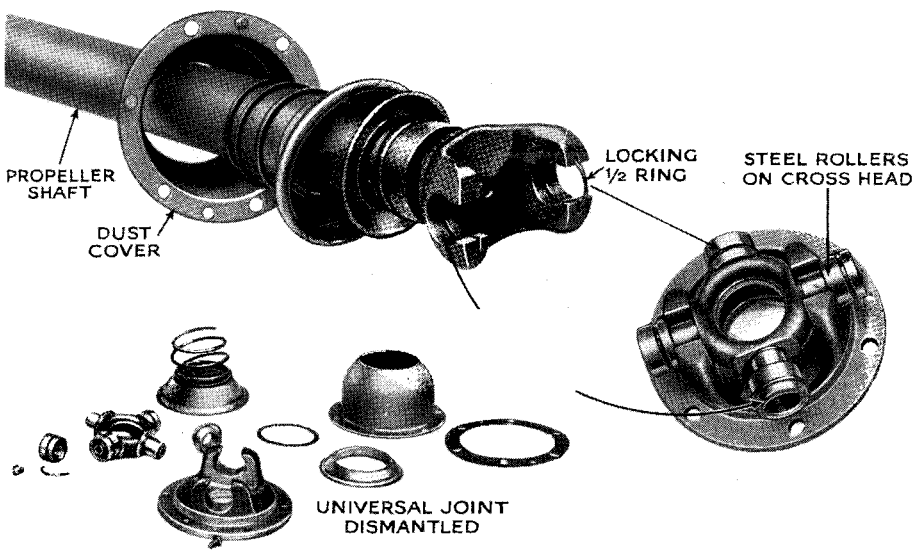
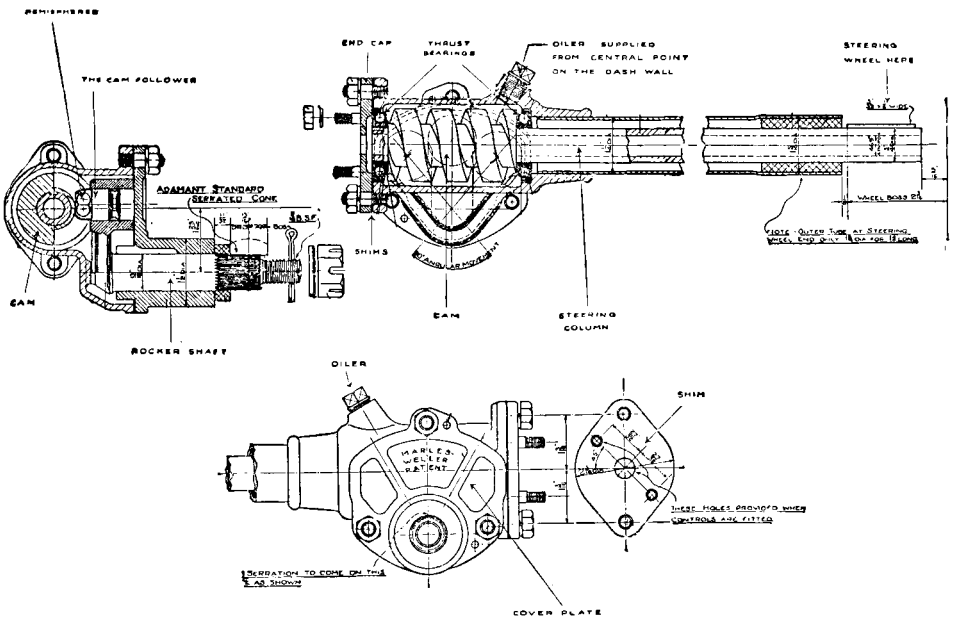


Illustration No. 65.—Various components of the Hardy Spicer universal joint. On the right-hand side is the flange having two jaws and carrying the cross head of the universal joint on steel rollers, the other two pins of the cross head being supported in the jaws of that portion of the joint which is attached to the propeller shaft. To prevent the steel rollers from being flung outwards the jaws are supplied with half rings which fit into the grooves on the rollers. The whole of the universal joint is entirely enclosed by covers held in position by a spring.

Adjustment to Steering Gearbox.—The adjustments are two in number, which control all that can be required. They are as follows :—

1. Adjustment for end play of cam.

2. Adjustment of fit between follower and cam.



Various sectional views of the Marles-Weller steering gear, parts of which are referred to in the text.

Adjustment 1.—Referring to the illustration it will be noted that a series of shims are located between the end cap and the face of the steering box. Remove one or more of these shims as required until the end play disappears, care being taken to see that when the end cap is securely rebolted, the thrust bearings are still quite free to rotate. Care should also be taken to see that the joint between the end cap and the box is properly re-made if oil leakage is to be avoided. The gear should be filled up with oil to replace any loss during adjustment.

Adjustment 2.—Adjustment for play between the follower and track, although very seldom required, and not at all until the car has been in use a considerable time, is effected by renewal of the hemispheres, those on one or both sides of the follower being changed according to the degree of adjustment required. Remove cover-plate and drain off sufficient oil to expose the cam and its track.

Withdraw the follower from its bearing on the rocker-shaft.

Replace one pair of hemispheres from one side of the follower by a new set, and then insert the follower unit into the cam track in its mid position, i.e. approximately midway between the two ends of the cam. This, for the moment, should be done independently of the rocker-shaft, which should be moved over to one side to leave the centre portion of the cam track exposed.

Should further adjustment be required, the remaining set of hemispheres should be replaced in like manner.

Correctly adjusted, the follower unit should be a free sliding fit in the centre portion of the track to ensure a free passage of oil between the surfaces, but only a minimum of sideplay should be permitted. Too close a fit will result in a stiff steering. This point determined, it now only remains to replace the follower unit through the rocker-shaft and into the track. This is most easily done with the rocker-shaft over in the extreme lock position, as the track is purposely made slightly wider at these points. A little care should be exercised here, and the hemispheres may with advantage be slightly tilted in their seatings to give a lead-in effect when entering the track. A slight to and fro movement of the steering wheel in conjunction with a light pressure on the back of the follower facilitates this assembly.

When inserting a new set of hemispheres see that they are quite clean and free from grit before inserting them into the follower. A smear of thick grease in the seatings will check any tendency for them to fall out.

The cover-plate and its shims should next be replaced, taking care to re-make the oil joint properly, and the gear filled up with fresh oil.

General Notes.—The shims between the cover-plate and the box should not be removed. They are intended for initial assembly only. A certain amount of end play is called for, and is desirable in the rocker-shaft, and no attempt should be made to take up this by removing the shims.

Should the thrust bearings be, for any reason, taken off the shaft, care should be taken to replace them the right way round. The right way round is when the word " thrust " stamped in one side of the inner race of the bearing is up against the end of the cam.

Fitting Drop Arm to Rocker-shaft.—Should it be necessary to remove the drop arm from the rocker-shaft at any time, we recommend that before doing this both these items should be marked so that they can be fitted together again afterwards in the same relative position.

In case this marking has been omitted, or in case the marking has become obliterated, we give below the correct method of fixing this, and we would draw attention to this matter, which is of some importance. Should this operation not be properly carried out, almost certainly the available lock will be limited in one direction or the other, and damage may result to the internal mechanism of the gear.

The steering column, complete with steering box, but without the drop arm attached, should (if it has been removed) first be fitted in place in the car, taking care to tighten up all fixings holding the unit to the car, including that on the dashboard, the steering wheel being placed in its final position.

Next, the lower end of the drop arm carrying the ball pin should be fixed correctly to the draglink, but the top end should not yet be connected to the rocker-shaft of the steering box.

Now jack up the front wheels and place them in the straight ahead position.

If the steering wheel is rotated gently, you will find that its movement is limited by internal stops in the steering box at each end of the travel of the internal mechanism of the gear. The number of turns of the steering wheel required to bring the gear from one end of its travel to the other should be counted. Then, commencing from one of these stops, take the wheel back half the complete number of turns available, which will bring the steering mechanism into its central position. Then fit the serrated cone in the top of the drop arm to the rocker-shaft.

Before tightening up, however, the following check should always be carried out.

The front wheels still being jacked up, with the steering wheel pull the steering right over to lock, either right or left. With the steering wheel and front wheels in this position, drop the draglink off the drop arm, and see whether you can move the steering wheel any farther in this same direction. If you can, everything is in order, and the same procedure should then be followed on the other lock.

Should further movement of the steering wheel be unobtainable, it means the front axle stops are not operating, and some adjustment must be made as follows :—

If there is movement of the steering wheel available on one lock, but not on the other, the drop arm should be put on the next serration on the rocker-shaft, which may put matters right.

If no serration will give free movement of the steering wheel at both locks, then the front axle stops must be looked to and altered so that there is.

The amount of free movement available after dropping the draglink off the drop arm should be the same at both locks, and this is the condition at which to aim.

The instructions given in this section may appear complicated, but in reality the operation is one of the simplest character.

It will be appreciated that the movement of the rocker-shaft and drop arm is restricted by the internal stops fitted in the steering box, and it is therefore necessary to fix the drop arm and connect the same up to the front wheels on the one hand, and to the steering box mechanism on the other hand, so that the necessary movement of the front wheels from lock to lock is obtained at the same time as the follower is travelling from end to end of the cam track, but not far enough in either direction to hit the internal stops in the steering box.

The whole of the instructions in this section are designed to attain this end.

Rear Axle.—The external appearance of the rear axle can be seen from Illustration No. 66. The casing consists of a steel stamping forming what is known as the "banjo." The complete differential assembly including the driving bevel and crown wheel are mounted on the front cover-plate. The rear cover-plate carries the oil filler extension. A drain plug is provided beneath the axle for draining this from time to time.

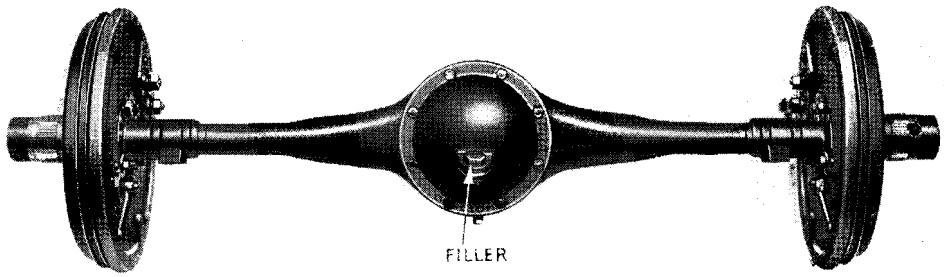


Illustration No. 66.—General view of the rear axle removed from the chassis.

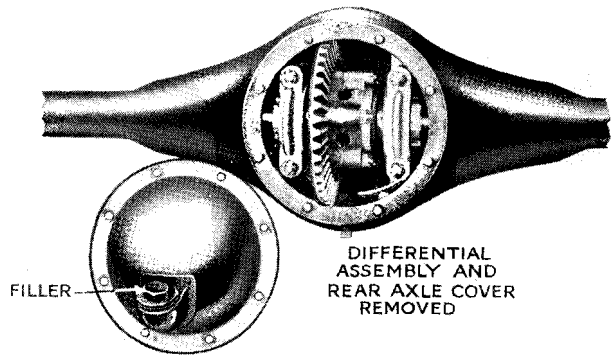


Illustration No. 67.—The rear axle, showing the differential assembly and crown wheel bolted in position.

Illustration No. 67 shows the interior of the axle with the gears in position after the rear cover has been removed. It will be seen that the complete differential assembly is clamped in position by two bridge pieces, having nuts of the "ring" type on either side ; the object of these nuts is to permit of lateral movement of the unit in order to obtain correct meshing of the bevel gears. Once these have been set at the Works there is practically no necessity ever to remove them, but in the case of an accident it may be found necessary to readjust the mesh for the bevel gears. Of course there must be two adjustments for the meshing of the bevel gears, namely the lateral adjustment of the crown wheel and the end adjustment of the driving bevel, permitting it to mesh correctly with the crown wheel.

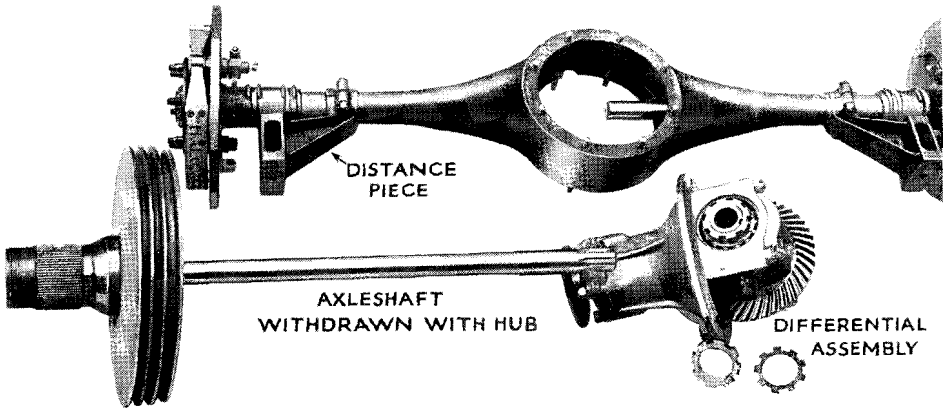


Illustration No. 68.—Entire view of the back axle removed from the frame, showing the complete differential assembly removed and the axle shaft withdrawn, complete with hub. The castellated nut beneath the differential assembly is intended to show how the lateral adjustment of the differential is effected and located in position by means of a tab washer.

Illustration No. 68 is a picture of the rear axle casing with the complete differential assembly removed, and one axle shaft and hub removed as well. Before the differential can be withdrawn, it is necessary to withdraw the axle shafts.

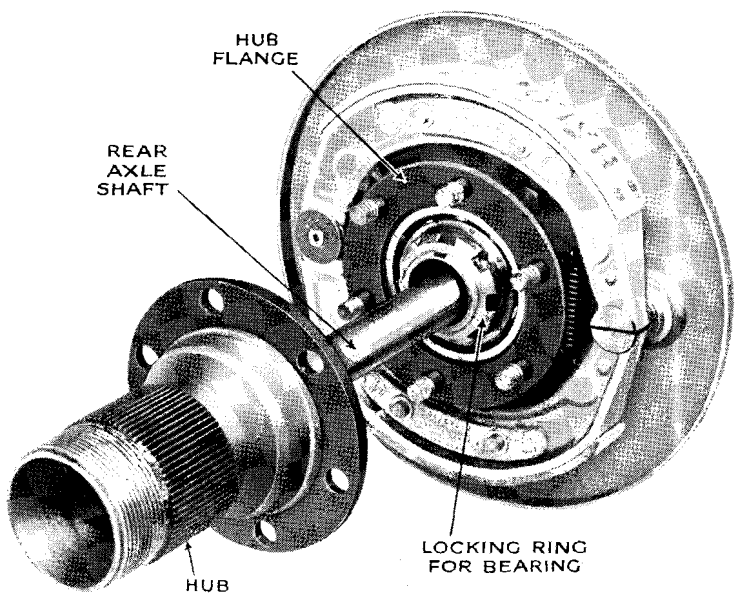


Illustration No. 69.—General view of the rear hub partially withdrawn from the axle. The hub runs on a ball bearing and is locked in position in the hub flange by means of a castellated nut and tab washer. The brake pull-off springs will be noticed.

Axle Dismantling.—First remove the wheels and brake-drums. The hub and half-shaft can be withdrawn by refitting a wheel and pulling outwards, and the view obtained in Illustration No. 69 will be visible. This shows that the axle shaft passes through the hollow axle casing, and the inner hub flange runs on a large ball bearing. This bearing has to be periodically lubricated, which is effected by forcing a little grease through a nipple on the inside of the hub recess. Under no circumstances should gear oil be used for this bearing, but on the other hand a grease of the nature of vaseline is essential, as for example Shell R.B. This grease will remain in the bearing and not be flung out and find its way on to the brakes. The ball bearing is locked on the axle tube by means of a ring nut and tab washer. If ever the ring nuts have to be slackened they can be driven off by a brass drift and hammer. Steel punches should never be used, except in absolute emergency.

A means has to be found to prevent the grease in the back axle creeping along the axle shafts, and it is as well to know that the outer ball bearings are provided with felt washers or glands. An additional gland is provided and is situated near the differential.

Differential.—After the axle shafts have been withdrawn it is possible to remove the complete differential. The helical cut crown wheel is shown on the right-hand side of the illustration, after being removed from the aluminium housing and the bridge pieces which hold it in position. The driving bevel assembly has also been dismantled ; this runs on one roller and one ball bearing, the bearings being spaced apart by a distance collar. A number of shims are provided to take care of the correct meshing of the driving bevel with the crown wheel. The rear end plate enclosing the whole assembly is provided with tapped holes $\frac{1}{4}$ in. B.S.F. to act as means of withdrawal. A circular steel ring will be noticed having a gap in it which registers in the front of the driving bevel housing, thus preventing any forward motion of the roller bearing should subsequent wear take place. If ever the differential assembly needs attention the whole unit should be returned to the Factory, where it can be properly looked over and correct adjustment of the gears be effected.

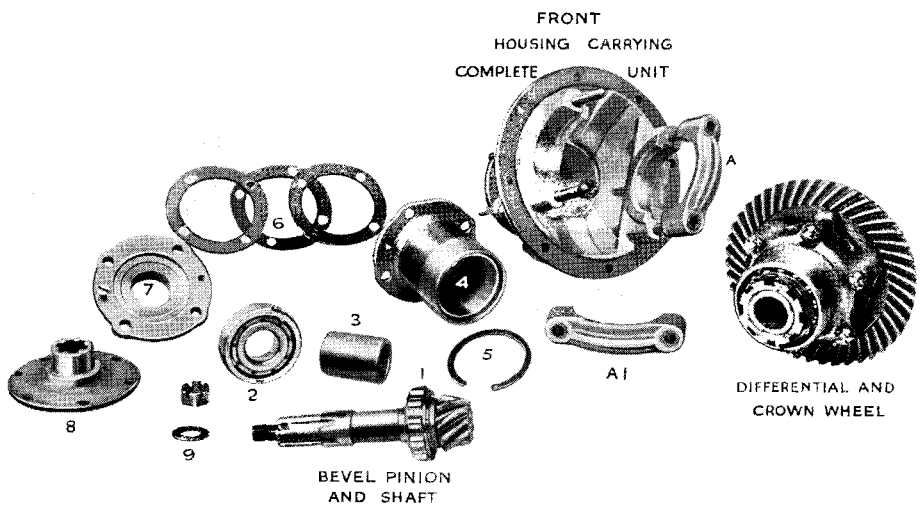


Illustration No. 70.—The components of the differential, showing the latter removed from the housing and the driving bevel pinion and shaft dismantled from its housing. The numbered parts are :

1. Bevel pinion roller bearing and shaft.
2. Bevel pinion bearing.
3. Distance piece for bevel pinion bearing.
4. Bevel pinion housing.
5. Spring ring.
6. Bevel pinion housing shims.
7. Cap for bevel pinion housing.
8. Propeller shaft flange.
9. Propeller shaft flange slotted nut and washer.

A. Differential bearing cap.
A1. Differential bearing cap.

Suspension.—The rear end of the front and rear springs slide in phosphor-bronze blocks in the spring anchorages. The front end of both front and rear springs are pivoted upon fixed points. As a spring compresses or expands, due to load or riding over inequalities, the rear end of the springs slides to and fro. The top leaf of the spring is accommodated in split phosphor-bronze blocks capable of rotating in their housings. The manner in which this is effected is shown in Illustration No. 71, which shows a rear tubular frame cross member with the phosphor-bronze slotted bushes in position. These are held in place by a distance piece and the whole assembly locked up by a large nut. A greaser nipple is provided which screws into the distance piece, and finally the whole assembly is enclosed by means of a moulded rubber cover as seen in the illustration. The bronze bushes are capable of rotating inside the tube and the spring is also capable of end movement in the slots of the bushes.

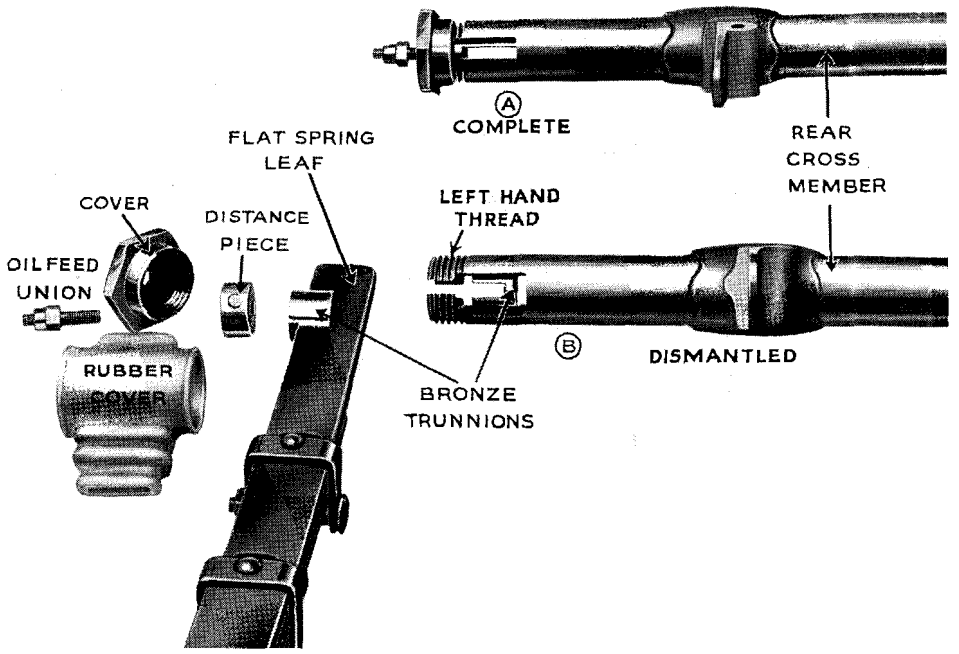


Illustration No. 71.—The component parts of the rear spring assembly. The trunnions, it will be seen, are in two parts to allow the spring to be withdrawn from the housing in the chassis frame. Note also the distance piece and cover-plate. The entire assembly is enclosed in a rubber cover and lubricated centrally from the dash wall nipples.

Shock Absorbers.—These are correctly set for average loads before the car leaves the Works, but a little looseness may become apparent after the first few hundred miles, rendering adjustment necessary. This is effected by means of the large hexagon nut with pointer attached, which is turned *clockwise* (ordinary right-hand thread) to tighten the shock absorber. The dial is graduated 0, 2, 4, 8, and the pointer should not be moved more than one degree at a time, testing repeatedly (preferably at speed on a rough road) until the best setting is found. It is important that the two Hartfords on the same axle be equally adjusted, and they must on no account be lubricated at any point.

Carburetter.—Separate instruction concerning the S.U. is provided with the car, but the following particulars specifically apply in the case of the M.G. Magna.

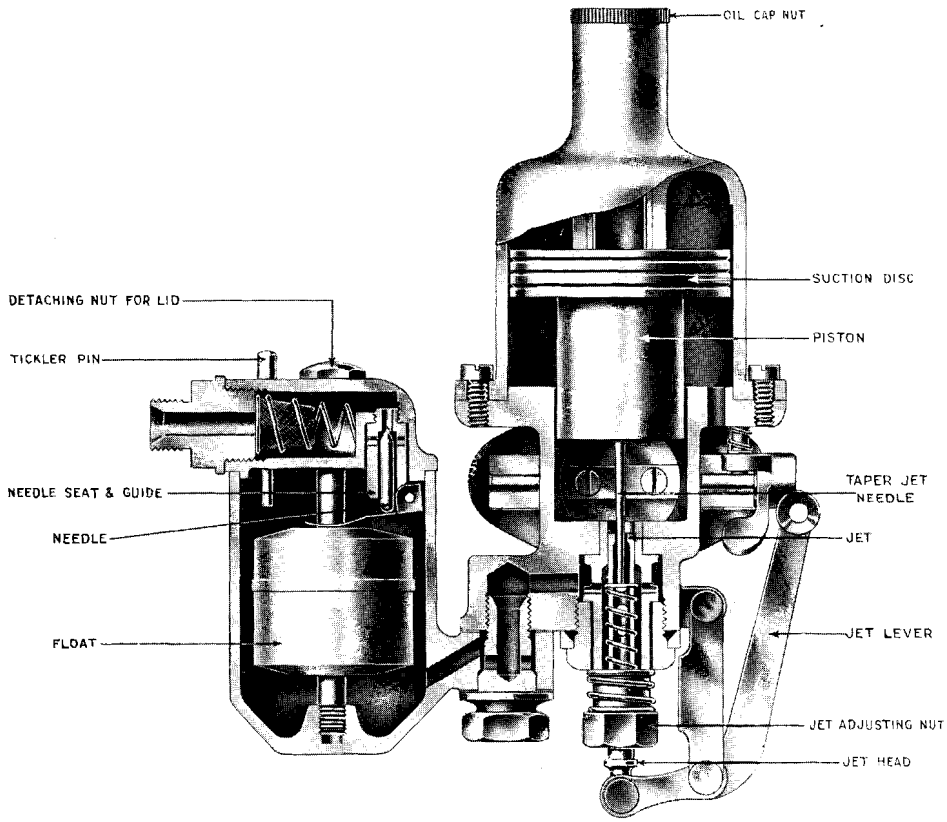


Illustration No. 72.—Sectional view through an S.U. carburetter, showing how the taper needle is locked into a piston which is caused to rise by the suction of the engine and so increase the orifice of the jet, thereby governing the petrol flow. It will be realised by this illustration that the effect of screwing the jet adjusting nut up or down has actually no effect on the jet itself ; it is simply an abutment for the jet head which is controlled by the jet lever. The two screws holding the suction disc outer chamber in position should be removed from time to time, and the suction disc and piston carefully cleaned with a dry rag ; under no circumstances should oil be used on the suction disc. The oil cap on the top of the suction disc chamber simply lubricates the spindle which guides the suction disc during its up and down travel.

The steel adjusting screw on the outside of the carburetter is only intended for slow-running adjustment and does not alter the mixture.

To afford a richer mixture for slow-running, the jet control nut should be unscrewed.

By screwing the jet adjusting nut upwards, the petrol consumption can be cut down if the owner is satisfied with a lesser degree of acceleration and speed, and sometimes in hot weather general all-round better carburation can be obtained by thus cutting down the petrol supply. Screwing up too much may cause popping through too weak a mixture.

A little machine oil should be injected into the dashpot or suction chamber brass cover screw every thousand miles, to lubricate the piston guide rod ; three drops of machine oil is advised for this purpose.

Under no circumstances should the body of the piston be lubricated.

By inserting the finger through the air inlet to the carburetter, the piston can be lifted inside the body of the carburetter, and should rise and fall freely.

The use of the strangler, or, as it is correctly called, the jet control, is intended only for starting when the engine is cold, and should be employed as little as possible. The effect of using the jet control is to enrich the mixture when starting. If it is left in operation longer than is necessary the cylinder walls will be bathed with surplus petrol, which will soon have a damaging effect on the pistons and other parts of the engine as well.

Reference to Illustration No. 28 shows the jet control lever in position. The jet adjustment nut is in point of fact only a stop against which the jet head rests when the jet control lever is pulled backwards, so that it stands to reason that if any adjustment of the jet has to be effected, this has to be carried out on each separate carburetter. It follows that as all the three jet control levers are coupled up, and if only one jet nut is unscrewed, unless the jet controls are slackened off first, all the other carburetters will have been adjusted similarly to any individual one.

The two screws that hold the piston body in which the piston and suction disc operate should be removed, so that the piston and its guide rod can be cleaned. Extreme care should be exercised in removing the pistons, so as not to damage the taper jet needle in any way. Mark the suction chamber before removal and replace it the same way as originally fitted. Do not change the suction chambers from one carburetter to another.

Sources of Trouble.—There are only four troubles which may affect the functioning of the S.U. carburetters.

1. The piston may be sticking and not functioning properly.

2. There may be dirt or water in the carburetter.

3. The float mechanism may have become deranged, and the carburetter is in consequence flooding.

4. The carburetters may require synchronising.

Piston Sticking.—The suction piston consists of the piston proper forming the choke ; the suction disc, into which is inserted the hardened and ground piston rod working in a bearing in the suction chamber ; and a tapered needle regulating the jet opening. If the piston is sticking this can easily be ascertained by inserting a finger in the air intake and raising the piston. The piston should come up quite freely and return to its seat with a click as soon as it is released.

A large percentage of the carburetters returned to the Works for correction have had the jet removed and replaced without being correctly centred. On no account should the jet be tampered with.

It is quite an easy matter to bend the needle if the piston is at any time removed, in which case it will bind on the jet and cause the piston to stick. To ascertain if the needle is bent—providing the jet is not out of centre—remove it from the piston, refit the suction chamber on to the body of the carburetter and see if the piston falls freely. If the needle is bent the only satisfactory remedy is to replace it by a new one.

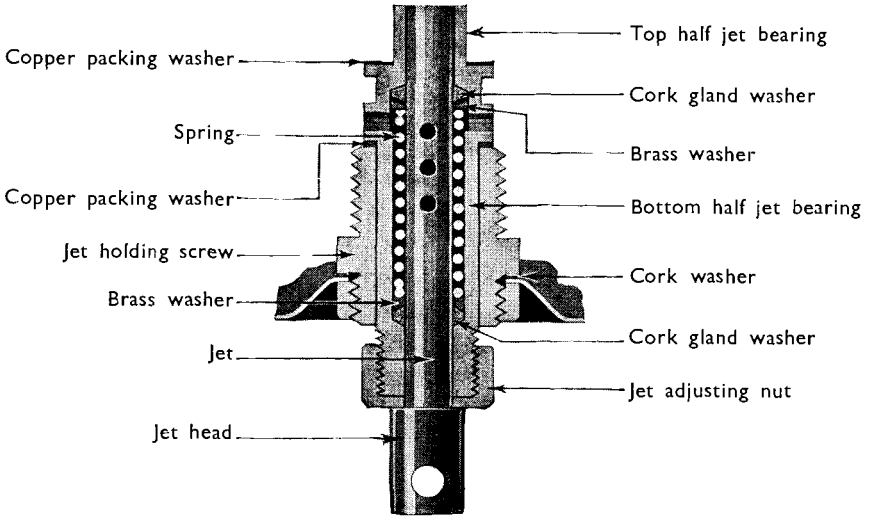


Illustration No. 73.—An enlarged section of the jet assembly. It will be noticed that the junction between the jet and the jet bearing is rendered perfectly petrol-tight by means of two cork washers which are forced against the sides of the jet by a coil spring and conical washers. If the jet is dismantled great care must be taken not to lose these washers.

Float-chamber Flooding. This is usually obvious from the quantity of petrol flowing over the float-chamber and dripping from the air inlet. Flooding is generally caused by foreign matter finding its way on to the seating of the float-chamber needle. It can sometimes be removed by flooding the carburetter with the tickler pin, thus permitting the incoming petrol stream to wash away the particles of grit, otherwise access to the needle is obtained by removing the float-chamber top. To take out the needle it is necessary first of all to take out the pin which holds the needle guide in position. After taking away the guide the needle will drop straight out ; the seating should on no account be ground in.

Synchronisation of Carburetters.—Before attempting to adjust the carburetters, it is advisable to check over the following items.

Ignition timing. Set the 1 and 6 mark on the flywheel in the centre of the clutch inspection opening. No. 1 piston is then at T.D.C. Distributor and plug points should be checked for cleanliness and gap, i.e. .015 in./.020 in. on distributor and .018 in. on plugs, also valve clearance should be .006 in. between base of cam and rocker.

Having checked these items, remove the dashpot covers and the dashpots from the carburetters, disconnect the jet coupling rod and screw the jet adjusting nuts right up. On pushing the jets up to the full weak position the correct petrol level should be 1 mm. below the top of the jet. If this is not so, and assuming the floats are in good condition and not punctured, the level can be adjusted by bending slightly the guide controlling the float needle, up to raise or down to lower, whichever is required. Next proceed to set the needle in the dashpots.

In the case of the " L " needle, the shoulder should be flush with the dashpot or piston. Refit the dashpot and cover to the carburetters, making sure that, when screwed down tight, the dashpots will fall on to their seatings with a click. Screw down the jet adjusting nuts two complete turns and screw off slow-running rod and butterfly adjusting screws so that they are not in use. Then slacken one butterfly flexible coupling bolt, press both butterflies hard closed and re-tighten bolt, making sure neither butterfly moves during this operation.

Screw down the butterfly adjusting screws to allow engine to run at three hundred to four hundred r.p.m. with ignition fully retarded. It has been observed that the suction type screen wiper valve screw is usually left open by car owners, the wiper action being only controlled by the start and stop lever. The screen wiper valve screw should therefore be left open when adjusting the carburetters, as there is occasionally a slight leak at this point.

Allow engine to warm up to normal running temperature before attempting to do the final adjustments. When that is attained the mixture may be judged by the exhaust note. If the engine is hunting, which is due to rich mixture, screw one of the jet adjusting nuts up, making sure that the jet is pushed up also.

If this makes no improvement, return it to its original position and try the same process with the other. On the other hand, if the exhaust note is irregular the mixture is too weak and the jet adjusting nuts should be screwed down, first one and then the other.

Having obtained somewhere near the correct mixture a check can be made by opening the throttle suddenly, when both carburetters should spit back a light spray of petrol. (For maximum performance it is advisable to set the adjusting nuts one flat on the rich side of the setting.)

A fairly good check can be obtained for the synchronisation of the butterflies by opening the throttle by hand and noting the height of the pistons one with the other through the mouths of the carburetters while the engine is running.

General.—It will be realised from the foregoing that the S.U. carburetter is a very simple instrument and easily managed when understood. On the other hand, considerable damage can be done if it is not treated correctly.

We would emphasise that the four troubles previously outlined are the only ones that can be caused by defects in the carburetter, and if these points are in order the carburetter should on no account be dismantled or altered, since the trouble must lie elsewhere.

Electrical Equipment.—The electrical equipment of the modern motorcar is often and quite erroneously regarded as something very complex and difficult. Yet in the present-day motorcar simple application of thoroughly tried out ideas has made possible easy adjustment and maintenance of practically all the electrically operated " bits." In this section an endeavour has been made to explain the various instruments and the best way to set about adjustments.

The wiring diagram may at first appear to be a little complicated, but it shows clearly exactly where each individual cable goes and the manner in which they are carried from point to point.

Wiring is arranged on the earth return system, and particular care has been taken to ensure that good continuity obtains at all points of the circuit, by the inclusion, where necessary, of independent earthing cables. It will also be noticed that cables at all essential points are encased in flexible metallic armouring. This not only protects the cables from possible abrasion, but excludes road dirt and water, prevents premature wear and makes for long and trouble-free service.

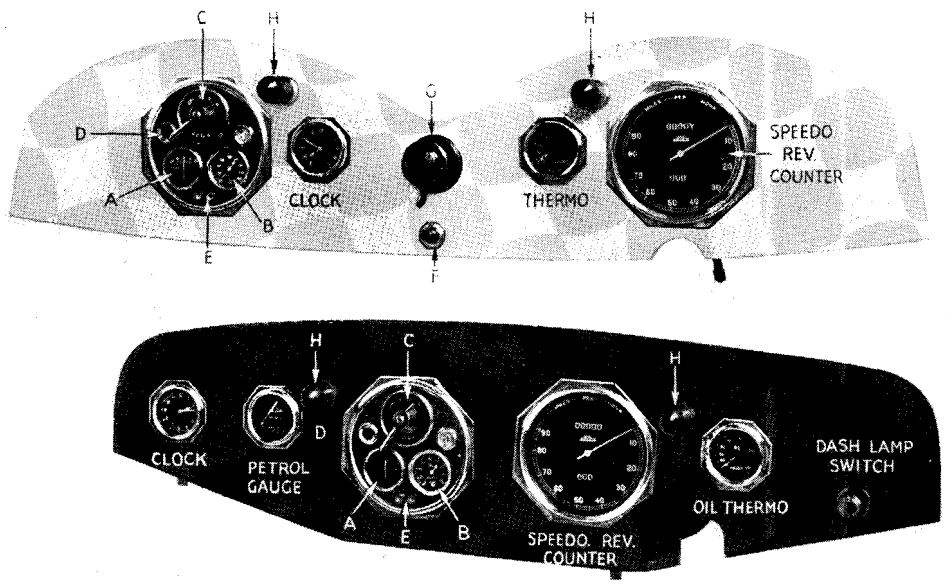


Illustration No. 75.—The front view of the facia board fitted in the " L " model M.G. Magna. At the top is the style on the Two-seater and Four-seater, and at the bottom the style on the Saloon and Continental Coupé. The letters indicate the items as follows :—

A—Ammeter.
B—Oil pressure gauge.
C—Lighting and ignition switch.
D—Ignition tell-tale lamp.
E—Plug sockets.
F—Dashlamp switch.
G—Horn and dipper switch.
H—Dashlamps.

On 1934 closed models the petrol tap control is on the dash.

Instrument Panel. The panel—see Illustration No. 75, which shows the types in use on the Two-seater and Four-seater and the Saloon and Continental Coupé models—contains the control switch for the dynamo, ignition and lights (shown at " C," a centre zero ammeter " A," two-pin plug sockets " E," oil pressure gauge " B," and the ignition warning light " D." A word of explanation on the dual function of the ignition warning light may prove of assistance. Its obvious object

is to warn the owner that the ignition switch is "on" and the battery is being discharged, but, being in effect "shunted" across the cut-out points, it will allow only a very small current of electricity to flow through the armature and field coils of the dynamo, thus giving the dynamo an initial excitation. A resistance is always included in the warning lamp circuit to prevent the voltage rise of the dynamo burning out the bulb, and in the light under consideration the resistance is of sufficient value to permit the use of a small $2\frac{1}{2}$-volt bulb of considerably longer life than the earlier heavy consumption type.

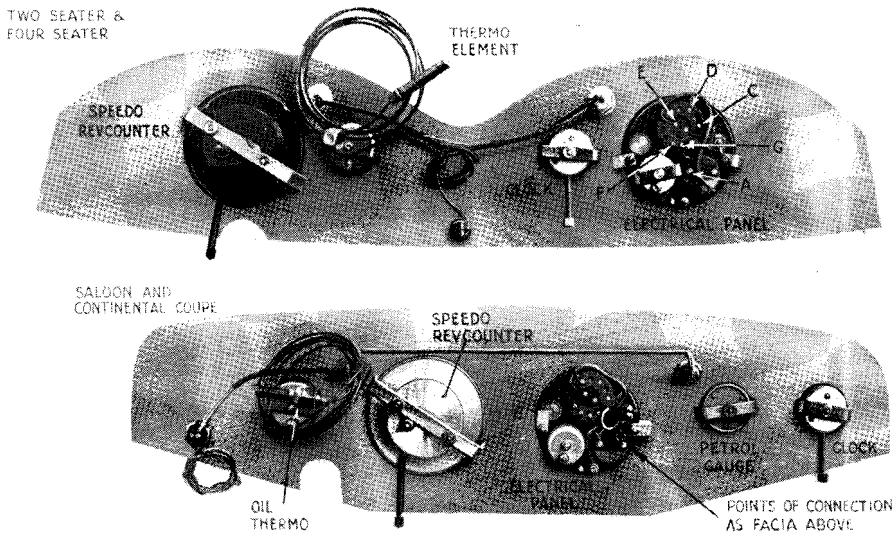


Illustration No. 76.—The facia boards viewed from the back with reference to various of the electrical points. The lettering on the electrical panel corresponds with the lettering on the wiring diagram.

Views of the back of the instrument panels can be seen in Illustration No. 76, which is intended primarily for reference to the electrical equipment, but shows at the same time the general layout of the instruments seen from behind. The electrical panel is suitably lettered, and reference to the wiring diagram shows clearly the points of connection in relation to the other electrical components, such as the cut-out, junction box, ammeter, etc.

Cut-out and Junction Box.—A good view of this component can be had by referring to Illustration No. 77. It will be seen that all cables are taken to terminal posts in a recessed space at the back of the box, and it is here that the two main harnessed cables—the panel harness associated with the control panel and the junction box harness which constitutes the cables going to the various points on the chassis—are coupled up. On the front of the junction box, and immediately opposite the junction terminal posts, are the fuses. Reading from left to right, these

are "Side and Tail," "S" or Field, "Auxiliary," and "Head." These are so arranged that should a short-circuit develop in any lamp or other component, the fuse associated with that component only will blow and the remainder of the installation will remain normal. The operation of tracing the fault is simplified enormously, as it is at once apparent which circuit is at fault. It should be noted that the "Field" or "S" fuse is only of 4-5 amperes, and this must never be replaced by one of higher value or serious damage to the dynamo and cut-out is inevitable.

In the centre of the fuse block the spare fuse carrier is provided with one complete replacement set. At the bottom of the fuse block a pair of terminal posts are available for coupling up any other instruments fitted subsequently. This pair is fused in the auxiliary circuit and is intended for additional horns, foglamps, etc. It will perhaps be helpful to note here that there are many accessories on the market, some of which take a very high operating current, and the owner should avoid fitting any of these unless approved by a competent electrical engineer. In any case a heavy current accessory must be connected directly to the battery and not through the junction box or ammeter.

A small circular four-terminal junction box is placed close to the cut-out which forms a convenient connection point for wires, details of which will be seen on referring to the wiring diagram. There is in addition a further junction box on the Continental Coupé model, and details of its connections to the direction indicators are shown in Illustration No. 77A.

DO NOT FORGET TO TOP UP THE BATTERY EVERY 1000—1500 MILES

Dynamo. The dynamo is mounted on a platform at the front end of the engine and forms part of the overhead camshaft drive. Reference to Illustrations Nos. 4 and 30 shows its actual application and Illustration No. 44 shows how it is driven and removed. Two views of the dynamo can be seen in Illustration No. 78. On the left-hand side it will be seen that the pinion is held on to a shaft by a bolt having a very wide head and also a tab washer which registers in one of the two holes in the pinion. These two holes are drilled and tapped $\frac{1}{4}$ in. B.S.F. in order to facilitate removal at any time with the aid of two bolts, one of which is shown in the illustration. The dynamo is what is known as a simple shunt machine and has been designed to stand up to the very high revolutions per minute and acceleration movement. Beyond an occasional inspection of the brush gear it requires but little attention. The brush gear can be examined by slackening off the screw holding the cover in position. The cover is shown in Illustration No. 78 above the dynamo.

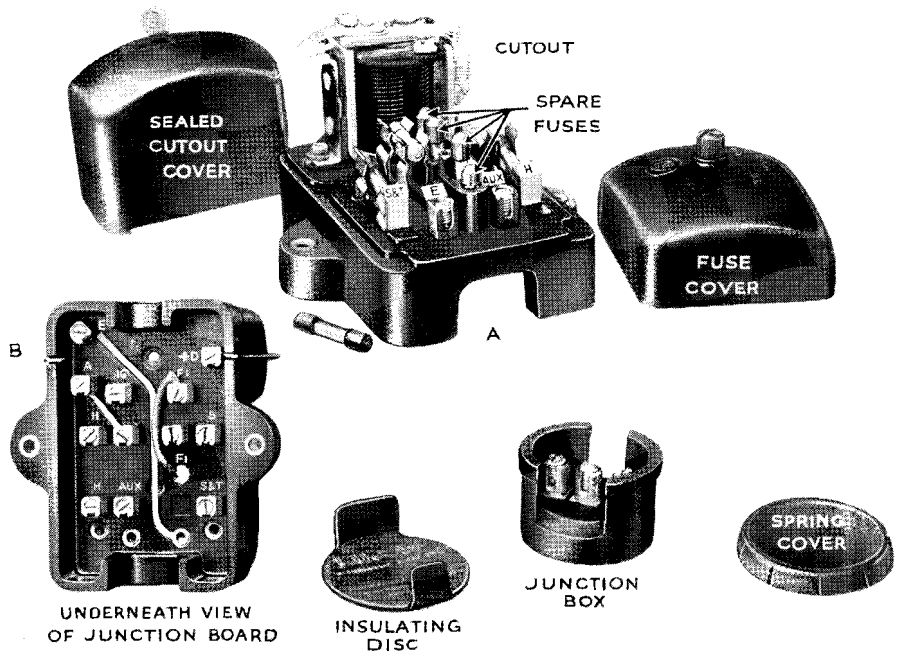


Illustration No. 77.—Details of the electrical fitting A and the junction board seen from above, the underneath of which is shown at B. Reference to the wiring diagram shows, it will be noticed, that the earth terminal is covered up by a strip for convenience. Spare glass fuses are carried in the special holder, the value of the fuses being indicated on the wiring diagram. These are of 25 amperes with the exception of the field fuse, which is 5 amperes.

Brushes. It is very important to make sure that the three brushes work freely in their holders. This can easily be ascertained by holding back the spring and gently pulling each flexible lead, when the brush should move without the slightest suggestion of sluggishness. The brushes should be clean and should " bed " over the whole of their working surface ; that is to say, the face in contact with the commutator should appear uniformly polished. Dirty brushes may be cleaned with a cloth moistened with petrol.

If any of the brushes become so badly worn that it is necessary to replace them, this is accomplished by releasing the brush lead eyelet by removal of the screw, then,

while holding the spring lever back out of the way, withdrawing the brush from its holder. The new brush can then be fitted by reversing the operation.

When ordering new brush replacements state whether they are main or control brushes, and for what type of machine they are required.

The brush springs should be inspected occasionally to see that they have sufficient tension to keep the brushes firmly pressed against the commutator when the machine is running. It is particularly necessary to keep this in mind when the brushes have been in use for a long time and are very much worn down.

Owners are cautioned that it is unwise to insert brushes of a grade other than that supplied with the machine, or to change the tension springs. The arrangement provided has been made only after many years' experience, and will be found to give the best results.

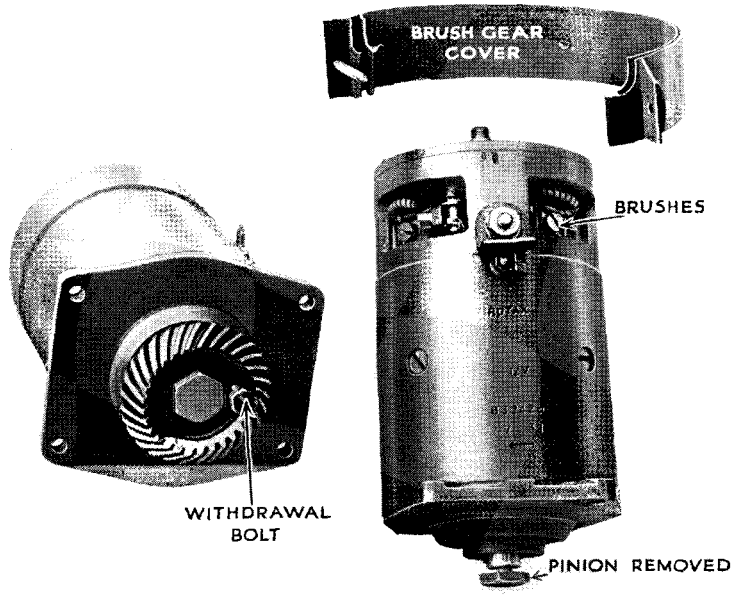


Illustration No. 78.—Two views of the dynamo showing the brush cover removed, and the method of withdrawing the gear from the shaft by two $\frac{1}{4}$ in. B.S.F. bolts.

Commutator. The surface of the commutator should be kept clean and free from oil and brush dust, etc. ; neglect of this precaution will result in the commutator becoming blackened, causing sparking to occur at the brushes, and consequent shortening of the life of the machine. The best way to clean the commutator is to insert a fine duster, held by means of a suitably shaped piece of wood, against the commutator surface, slowly rotating the armature by the starting handle at the same time.

If the commutator has been neglected for long periods, it may need cleaning with fine glass paper, but this is more difficult to do, and should not be necessary if it has received regular attention. The grooves between the commutator segments should be examined occasionally and any deposit of copper or carbon dust may be cleaned out by means of a thin saw blade or similar article. The owner is strongly advised to entrust this operation to a fully qualified electrician, as serious damage can unconsciously be done by anyone not familiar with this class of work.

Lubrication.—As the bearings are packed with grease before leaving the Works, very little attention is needed. A few drops of oil, however, may be added through the lubricators provided, say, every 1000 miles. The reader is cautioned that far more trouble has been caused by excessive oiling than by too little. (After the car has run about 10,000 miles the dynamo should be removed, cleaned and adjusted and the bearings re-packed with grease. This should be entrusted to the nearest Lucas/Rotax Service Depot.)

Dynamo Field Fuse.—A fuse is provided in the dynamo field circuit to protect the machine in the event of anything being wrong in the charging circuit, e.g. a loose or broken battery connection. If the dynamo fails to charge the battery at any time (indicated by the ammeter giving a discharge reading during daytime running), inspect the fuse and, if it has blown, replace it. If the new fuse blows after starting up, the cause of the trouble must be found, and we advise that the equipment is examined by a Lucas/Rotax Service Station. Replacement fuses must be of the same size as those originally fitted.

As explained elsewhere in this section, the fuse is one of the four cartridge-type fitted in the junction box on the engine side of the dash. The size of the fuse is marked on a coloured paper slip which can be seen inside the fuse.

Removing the Dynamo.—In order to obtain easy access to the dynamo for removal it is desirable, although not absolutely necessary, to take off the radiator. Remove the lock nuts and nuts from the radiator bolts carried through the engine nose piece extension, and the bolts retaining the yokes of the bonnet tie rods. Also, after emptying the water system, remove the water return pipe from cylinder head and loosen clips holding bottom water hose. It is unnecessary to interfere with any of the oiling system to remove dynamo.

Between the projecting portion of the cylinder head and the top of the dynamo will be found a circular flexible coupling. Remove the nuts on each of the four coupling bolts in turn, leaving the bolts in position, so that the coupling can be rotated by use of the starting handle to bring each bolt into a position where the nut may easily be reached.

Having removed all four nuts, take off the valve gear cover and turn the engine by the starting handle until the timing marks on the spiral bevel gears coincide. These will bring the driving yoke on the cylinder head across the engine, and the driving yoke on the dynamo parallel to the engine centre line. The bolts themselves may now be withdrawn, care being taken not to lose the distance washers, which must be replaced in the same position. Removal of the bolts enables the flexible coupling to be withdrawn.

Detach the two cables on the distributor side of the dynamo, noting from which terminal they are removed.

Now unscrew the four set screws which attach the dynamo to its platform at the front of the engine, thus releasing the dynamo. Lift the dynamo approximately a quarter of an inch and tilt it towards the near-side of the car until the driving yoke

on the dynamo is just clear of that on the cylinder head. The dynamo can then be tilted forwards and easily withdrawn.

Replacement of the dynamo is effected in the reverse way, but it is necessary to make sure that the engine timing has not been disturbed while the dynamo was removed. Removal of the rectangular cover-plate in the clutch housing should reveal the timing mark on the flywheel for Nos. 1 and 6 cylinders, exactly in the centre of the opening. Place the brass packing pieces which fit under the dynamo base in position on the dynamo platform, making sure that you replace the same number that you took off. If for any reason the dynamo is replaced by another, it may be necessary to readjust the mesh of the driving gears to obtain silent running by suitable selection of the packing shims used. Turn the dynamo spindle until the timing mark on the dynamo drive gear coincides with the centre line of the dynamo and is at the rear—that is, ready for engagement with the correspondingly marked teeth of the drive gear on the crankshaft. The holes in the dynamo coupling yoke will then be parallel with the engine centre line. Tilting the dynamo towards the near-side of the car and holding the dynamo coupling yoke in this position, insert the drive gear into the opening of the dynamo platform and swing the dynamo backwards and downwards into position. The gears can be felt to be meshing properly if the coupling is slightly oscillated as the dynamo is replaced, but do not overdo the oscillations or you may engage the wrong teeth.

See that the bolts in the dynamo base are coinciding with the holes in the dynamo platform, and then observe if the dynamo coupling yoke is exactly parallel to the engine centre line. If it is not, withdraw the dynamo, reset the coupling yoke and re-insert the dynamo. No difficulty should be experienced in getting the dynamo in position with the correct teeth in mesh, as the distance between one tooth and the next is sufficient to make an appreciable difference to the position of the dynamo coupling yoke, a difference which is immediately discernible.

Having satisfied yourself that the correct gear teeth are in mesh, replace the screws in the dynamo base, taking particular care to tighten them up evenly a partial turn at a time until all are quite tight. Now make a final test. The flywheel mark 1—6 should show exactly in the centre of the inspection cover opening with the distributor rotating arm pointing towards No. 1 cylinder. (This can easily be found by tracing the high-tension lead from No. 1 sparking plug to its junction on the distributor. Removal of the distributor cover should show the distributor arm directly beneath it.) The dynamo coupling bolt holes should be exactly fore and aft and at right angles to the coupling yoke on the cylinder head, and the timing marks on the camshaft driving gears should be coinciding.

If all the foregoing are correct, replace the flexible coupling and coupling bolts, taking care to replace the distance washers in exactly the same position as they were originally. Tighten up the nuts firmly and rotate the engine slowly by hand. If the distance washers are in the correct position, the flexible coupling should run absolutely true. If it does not do so, note where the error is and adjust the distance washers accordingly. Then replace the valve cover and attach the dynamo cables on to their correct terminals.

Third Brush Regulator.—The output of the dynamo—that is to say, its rate of charge—is controlled by a third brush which is shown quite clearly in Illustration No. 79. All machines are adjusted to an output of 9 amperes before leaving the Factory, and any marked variation from this standard usually indicates some other factor at fault which must be cleared before normal conditions are possible for the dynamo. Should, however, the indicated charging rate increase to a value above 10 amperes **with all lights out,** it is necessary to reduce this at once, as a continuation of high output will rapidly destroy the machine. It is inadvisable for anybody who is not an electrician to tamper with this. To reduce the output the third brush or control brush must be moved in a direction opposite to that of rotation. To move the brush it is necessary to slacken the stud marked "Locking Nut" in Illustration No. 79, and when the adjustment has been satisfactorily effected it is important to make sure that the stud is tightened.

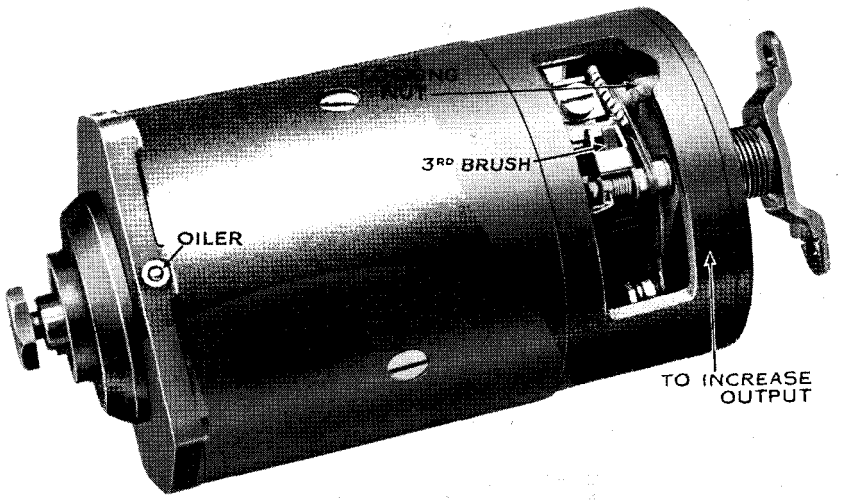


Illustration No. 79.—A view of the dynamo showing the position of one of the lubricating holes, the third regulating brush and its locking nut, and the upper coupling for driving the overhead valve gear. The instructions should be read carefully concerning the care of the commutator and brushes and the regulation of the dynamo.

The third brush is to be found on the near-side of the car and on the same side as the small ball covered lubricator. Never omit to tighten up the lock screw after any adjustment has been effected.

Self Starter.—This has already been described in some detail on page 34, which has more particular reference to the dismantling of this unit, but the following instructions may be of some assistance in case the starter is not functioning properly.

Starter Motor.—The armature spindles of these machines are fitted with a pinion which, on rotation, runs into engagement with the geared ring on the flywheel. Immediately the engine begins to fire, the pinion is automatically thrown out of mesh.

If, for any reason, the pinion wheel on the motor does not engage with the flywheel teeth, examine the screwed sleeve on the armature spindle to see that it is free from dust ; if necessary wash over with paraffin. Occasionally, give it a few drops of thin machine oil.

As in the case of the dynamo, the surface of the commutator must be kept clean and free from oil, brush dust, etc.

The starter is designed for starting the engine under normal conditions, but any unnecessary or additional loading will considerably diminish the life of the machine and battery. In order to facilitate starting in cold weather, it is advisable to flood the carburetter, and, before using the electric starter, crank the engine over slowly by the starting handle for two or three revolutions ; this will break the oil film and considerably diminish the load for starting.

In the event of the engine refusing to fire after being turned by the starter, make sure that the ignition switch is " on."

Battery.—It is of the utmost importance that the battery should receive regular attention, as upon its good condition depends the satisfactory functioning of the ignition, starting motor, and the lamps.

At least once a fortnight the vent plugs in the top of the battery should be removed, and the level of the acid solution examined. If necessary, distilled water (which can be obtained at all chemists and most garages) should be added to bring the level well above the plates. If, however, acid solution has been spilled, it should be replaced by a diluted sulphuric acid solution of specific gravity 1.320. It is important, when examining the cells, that naked lights should not be held near the vents, on account of the possible danger of igniting the gas which is generated by the plates. It is advisable to complete the inspection by measuring the specific gravity of the acid, as this gives a very good indication of the state of charge of the battery. An instrument known as a hydrometer is employed for this purpose ; these can be bought from your Dealer or from any of the Lucas/Rotax Service Stations.

For the 12-volt 53 ampere battery fitted to the M.G. Magna the specific gravity readings will be 1.285—1.300 for a fully charged battery, about 1.210 when half discharged and about 1.150 when fully discharged.

If one cell gives a reading very different from the rest, it may be that electrolyte has been spilled or has leaked from this cell, or there may be a " short " between the plates. In the latter case, the battery should be examined as soon as possible by a Lucas/Rotax Service Station.

Finally, see that the tops of the cells are clean and dry, and that the terminals are tight and smeared with vaseline.

If the equipment is laid by for several months, the battery must be given a small charge from a separate source of electrical energy about once a fortnight, in order to obviate any permanent injury to the plates.

Under no circumstances must the acid be removed from the battery and the plates allowed to dry, as certain changes take place which result in loss of efficiency.

The battery must never be left in a fully discharged condition, and, unless some long runs are to be taken, it is advisable to have the battery removed from the car periodically and charged up from an independent electrical supply.

Ammeter.—The centre-zero ammeter which is incorporated in the instrument panel indicates the actual current flowing into or out of the battery. For instance, suppose two amperes are consumed when the side and tail-lamps are switched on, and the ignition coil takes one ampere, then if the dynamo is generating at seven amperes the meter will show four amps. on the charge side of the scale. This is the current in excess of the lamp and ignition load which is available for battery charging purposes.

Fuses.—The separate fusing of the various circuits ensures that a short in any one does not affect the rest of the electrical equipment. This is particularly important when coil ignition is fitted. It will be noticed that the fusing of the lamps is such that there is no risk of the driver being plunged into total darkness. If both the headlamps, or the side and tail-lamps, or all the units connected to the auxiliary accessory terminal fail to function, examine the particular fuse protecting them.

Remove the fuse from its holder and see whether there is a break in the fuse wire. Before replacing the fuse, inspect the units that have failed, for evidence of short circuits or other faults that may have caused the fuse to blow.

If a fuse blows repeatedly, and the cause cannot be traced, we advise that the equipment is examined by a Lucas/Rotax Service Station.

The Cut-out.—The function of the cut-out is to close the charging circuit, as the increased engine speed when the car is starting causes the dynamo voltage to rise above that of the battery. When the engine slows down, the dynamo voltage falls below that of the battery, and the reverse action takes place, i.e. the cut-out opens and thereby prevents the battery from discharging itself through the dynamo.

The question is sometimes asked whether the operation of the cut-out in any way depends upon the state of charge of the battery. There is no such relation between the two ; the sole function of the cut-out is to switch on the dynamo with rising engine speed and to disconnect it when the engine slows down to below a certain speed. The cut-out, which is housed under a separate cover at the top of the junction box, see Illustration No. 77, is entirely self-operating and is accurately adjusted by the makers before fitting. It should operate for a considerable period without attention, and because considerable damage to the entire installation could be done by anyone attempting to vary the setting it is sealed by the manufacturers.

Very little attention is needed to keep the distributor in first class condition. We advise that it is inspected occasionally, and the following instructions on lubrication, cleaning and adjustment should be carried out.

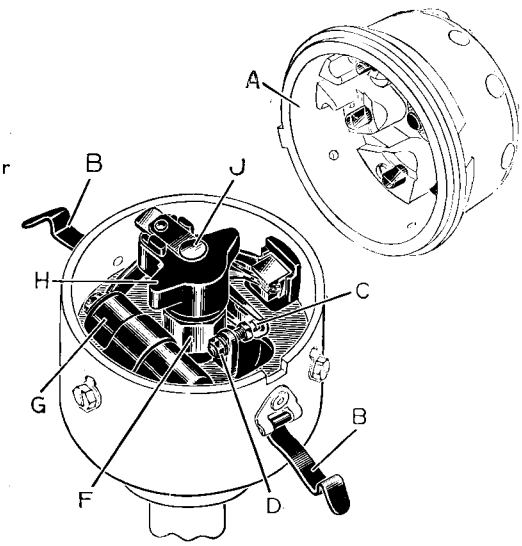


Illustration No. 81.—Distributor and Contact Breaker.

A—Distributor moulding.
B—Securing springs for moulding.
C—Contacts.
D—Lock nut.
F—Rotating cam.
G—Condenser.
H—Rotating distributor arm.
J—Spring contact.

Distributor.—Occasionally remove the distributor moulding by pushing aside its two securing springs. See that the electrodes are clean and free from deposit. If necessary, wipe out the distributor with a dry duster and clean the electrodes with a cloth moistened with petrol. See that the carbon brush is clean. Clean the outside of the moulding, particularly the spaces between the terminals. Next examine the contact breaker ; it is important that the contacts " C " are kept free from any grease or oil. If they are burned or blackened, they may be cleaned with very fine emery cloth and afterwards with a cloth moistened with petrol. Care must be taken that all particles of dirt and metal dust are wiped away. Misfiring may be caused if the contacts are not kept clean.

The contact breaker gap is carefully set before leaving the Works, and a gauge is provided on the spanner dispatched with each distributor. Provided that the cam is kept clean and that the instructions on cam lubrication are carried out, the contact breaker gap will only need adjustment at very long intervals. It is not advisable to alter the setting unless the gap varies considerably from the gauge. If adjustment is necessary, proceed as follows :—When the contacts are fully opened, slacken the locking nut " D " on the stationary contact screw, and rotate it by its hexagon head until the gap is set to the thickness of the gauge. After making the adjustment, care must be taken to tighten the locking nut.

Lubrication—(1) Distributor Shaft. Add one or two drops of thin machine oil through the oiler provided about every 1000 miles.

(2) **Cam.** About every 3000 miles, give the cam the slightest smear of vaseline.

(3) **Automatic Timing Control.** About every 3000 miles withdraw the rotating arm " H " (Illustration No. 81) from the top of the spindle by lifting it off, and add a few drops of thin machine oil. Do not remove the screw exposed to view, as there is a clearance between the screw and the inner face of the spindle through which the oil passes to lubricate the automatic timing control.

Coil.—The coil unit is not adjustable in any way, and requires no attention beyond seeing that the terminal connections are kept tight, and the moulded coil top is kept clean.

Warning Lamp.—A warning lamp is provided in the instrument panel, which gives a red light when the ignition is "ON" and the car is stationary. The warning lamp will also light when the engine is running very slowly, due to the fact that the dynamo is not running at sufficient speed to generate a high enough voltage to actuate the cut-out.

The Detection and Remedy of Ignition Faults.—If a failure of ignition or misfiring occurs, unless the cause is at once apparent the owner is strongly recommended to proceed in accordance with the following routine, which should quickly enable him to locate the trouble.

Before proceeding with the examination, make sure that the trouble is not due to defects in the engine, carburetter, petrol supply, sparking plugs, etc.

Engine will not Fire.—Switch on the ignition, turn the engine and observe the ammeter reading. The engine should be turned by hand if it is known that the battery is in a low state of charge.

If an ammeter reading is given which rises and falls with the closing and opening of the contacts, then the low-tension wiring is in order. If the reading does not fluctuate in this way, a short in the low-tension wiring is indicated, or the contacts are remaining closed. When no reading is given, a broken or loose connection in the low-tension wiring is indicated, or the battery may be exhausted.

Examine the high-tension cables, i.e. cables from the coil to the distributor, and from the distributor to the plugs. If the rubber shows signs of deterioration or cracking, the cable should be renewed. Remove the distributor moulding and examine the contacts ; if necessary, clean them as described on page 85. Turn the engine over by hand, and see that the contacts come together.

If a fault is indicated in the low-tension wiring, examine the cables from the switch or junction box to coil, and from coil to distributor. See that the battery terminals are tight and that the cables from the switchbox to the battery are secure. The battery may be dismissed as the cause of the trouble if the lamps will light.

Test the coil independently of the distributor as follows :—Remove the cable from the centre distributor terminal, and hold it about $\frac{1}{4}$ in. from some metal part of the chassis and turn the engine. The sparking should be strong and regular if the coil is functioning correctly.

Misfiring and Bad Starting.—Examine the high-tension cables and the plugs. If necessary, adjust the gaps to the correct setting (about 20 thousandths of an inch). Sooty or oiled plugs may be dismantled and washed out with petrol.

The plugs and high-tension cables may be tested by removing the plugs in turn and allowing them to rest on the cylinder head and observing whether a spark occurs at the points when the engine is turned by hand. It should, however, be noted that this is only a rough test, since it is possible that a spark may not take place when the plug is under compression.

Remove the distributor moulding and see that the electrodes and contacts are clean. If necessary, clean them as described on page 85. See that the contact gap setting is correct.

If after carrying out the examination suggested, the trouble cannot be found, we advise that the equipment should be examined by the nearest Lucas/Rotax Service Depot, the addresses of which are given later.

Headlamps.—The headlamps are provided with a patented universally adjustable mounting which allows the beam of light to be set to the best advantage. This adjustment is obtained by slacking the hexagon locking nut " A " (illustration below), turning the lamp to the desired position and then locking it by tightening up the nut.

The near-side headlamp is set to throw its beam to the near-side of the road and the off-side (set straight) can be turned off or on independently.

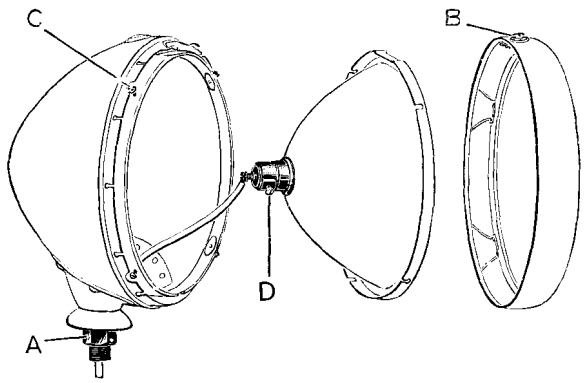


Illustration No. 82.—Headlamp dismantled.

A—Locking nut for adjustable mounting.
B—Screw head.
C—Reflector fixing screw.
D—Clamping screw.

Removing the Front and Reflector.—The headlamps are constructed with detachable fronts, parabolic reflectors and focussing devices. To remove a lamp front for fitting a new lamp bulb, give the screw head at the top of the lamp about a quarter of a turn—a coin will serve as a screwdriver. This movement presses a cam against the body and pushes the front away from the body, enabling it to be removed. To replace, turn back the screw head and locate the cam between the two lugs on the body, then push the front into place. The reflector is secured by means of four fixing screws " C." Lamps are correctly focussed when sent out from the Works, but if a bulb is replaced it may be necessary to adjust the focus of the lamp. Accurate focussing is imperative if the maximum results are to be attained. The method of focussing is as follows :—

Remove the front as above, remove the screws holding reflector and then carefully draw forward the reflector until the lamp holder is exposed. This holder is fixed by the screw " D " and may be moved backwards or forwards when the screw is loosened. Each lamp must be focussed separately, care being taken that lamps are properly set in line, not pointing up or down. Correct focussing adjustment is obtained by reflecting lamps on to a wall or, preferably, a white object at a distance of about 100 yards, sliding the holder backwards or forwards until the light reaches its highest point of brilliancy with total absence of shadows. Then tighten screw and replace the reflector and front.

Wiring Headlamps.—Remove the front and reflector as described in a previous paragraph. Then depress the insulating washer on the bulb holder terminal against the spring until the cable hole is exposed. Thread the cable end through the hole, release the pressure on washer, when the cable will be securely held in position and good contact made. Cables should not be pushed too far through the terminal, as there is a danger of shorting on to the reflector or body of the lamp.

Sidelamps.—The fronts of the wing lamps are secured by small grub screws ; when these are removed the fronts can be withdrawn by first pulling the top forward.

Stop and Tail-lamp.—By virtue of its extreme simplicity there is practically nothing which can go wrong with this instrument. In the event of a bulb burning out it can be replaced by removing the front of the lamp. This is done by removing the screw carried through the front of the lamp and gently prising the front away from the body at the screw side. With the front removed either of the bulbs are easily accessible.

The stop light is operated by a switch spring coupled to the brake cross shaft on the off-side of the car. This switch is wired into the ignition circuit so that with the ignition switched " off " it is not possible to leave the light on. It is perhaps as well to note here that this is the only light point on the car which is not fused.

Replacement of Bulbs.—When the replacement of any bulb is necessary we strongly advise that Lucas/Rotax bulbs are used. The filaments are arranged to be in focus and give the best results with the lamps fitted. The following are the correct bulbs to use :—Headlamps, B.A.S. No. 35 ; Side and tail-lamps, B.A.S. No. 10S.

Cleaning Lamps.—The reflectors are protected by a transparent and colourless covering, which enables any accidental finger marks to be removed with chamois leather or a soft cloth without affecting the surface of the reflector. Do not use metal polishes on Lucas reflectors. Ebony black lamps can be cleaned with a good car polish. Chromium plated lamps will not tarnish and only need wiping over with a damp cloth to remove dust or dirt.

Lucas Altette Horn (Type HF318).—All electric horns, before being passed out of the Works, are adjusted to give the best performance, and they will give long periods of service without any attention ; no subsequent adjustment is required.

If the horn becomes uncertain in its action, giving only a choking sound, or does not vibrate, it does not follow that the horn has broken down. First ascertain that the trouble is not due to some outside source, e.g. a discharged battery, a loose connection or short circuit in the wiring of the horn, or a blown fuse. It is also possible that the performance of a horn may be upset by the horn becoming loose on its mounting. If the cause of the trouble cannot be located, do not attempt to dismantle the horn, but return it to a Lucas/Rotax Service Depot for examination.

The Electric Petrol Pump.—The pump is fitted on the off-side of the dash wall and consists of three main assemblies, the body, the magnet assembly and the contact breaker. The body is composed of a hollow brass stamping " A " into the bottom of which the filter " B " is screwed. The inlet union " C " is screwed in at an angle on one side. The outlet union " D," which is screwed into the top, tightens down on to the delivery valve cage " E," which is clamped between two fibre washers " F " and " G." In the top of the cage is the delivery valve, a thin brass disc " H " held in position by a spring clip " I." Inserted in the bottom of the cage is a light spring " J," which rests on the suction valve " K," the latter being a similar disc resting on a seating machined in the body. Holes connect the space between the valves to the pumping chamber, which is a shallow depression on the forward face of the body. This space is closed by a diaphragm assembly " L," which is clamped at the outside between the magnet housing " M " and the body, and in the centre between a brass plate " K1 " and the steel armature " O." A bronze rod " P " is screwed through the centre of this and passes through the magnet core to the contact breaker which is located at the front end.

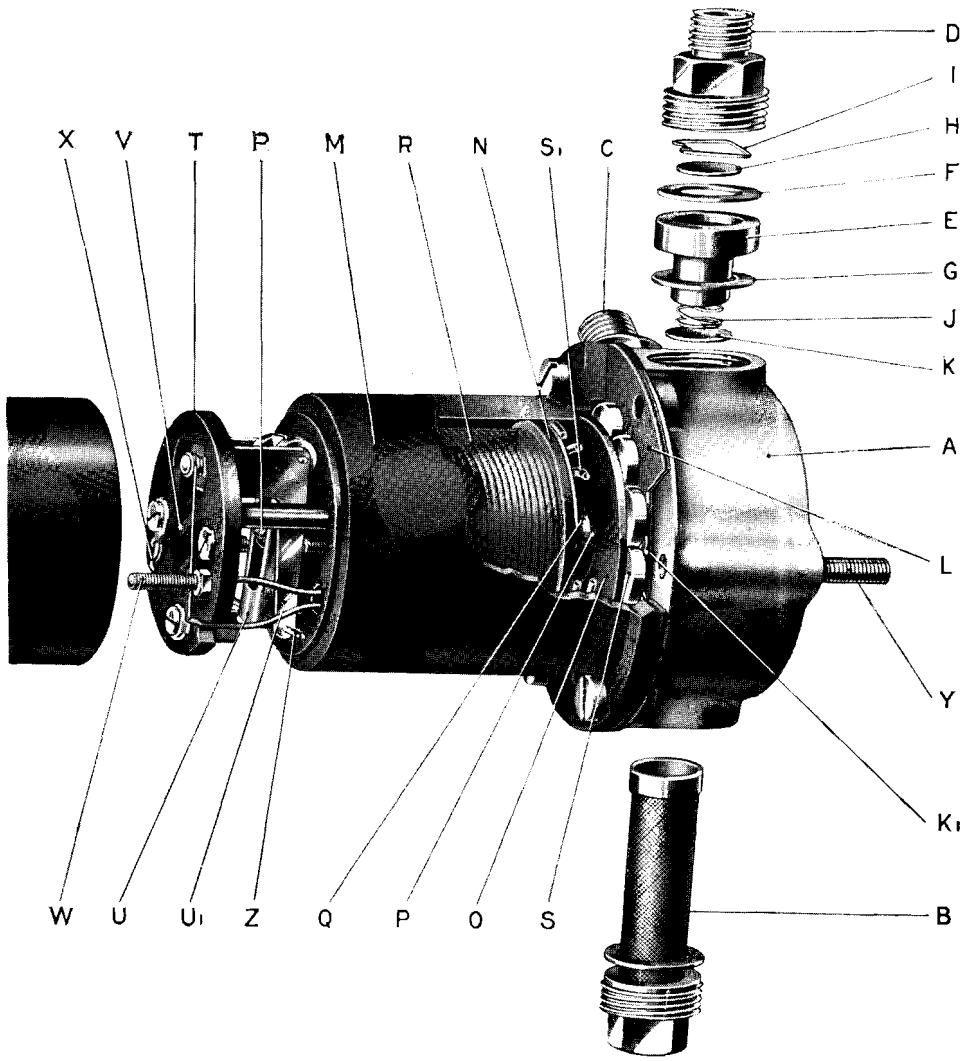


Illustration No. 83.—A view of the S.U. pressure petrol pump with part of the cover cut away to show the magnet. The various letters are referred to in the accompanying text.

The magnet consists of a cast iron pot having an iron core " Q," on which is wound a coil of copper wire which energises the magnet. Between the magnet housing and the armature are fitted eleven spherical edged brass rollers "S." These locate the armature centrally within the magnet at all times and allow absolute freedom of movement in a longitudinal direction.

The contact breaker consists of a small bakelite moulding carrying two rockers " U " and " U1," which are both hinged to the moulding at one end and are connected together at the top end by two small springs arranged to give a " throw over " action. A trunnion is fitted into the centre of the inner rocker, and the bronze rod " P " connected to the armature is screwed into this. The outer rocker " U1 " is fitted with a tungsten point which makes contact with a further tungsten point on a spring blade " V." This spring blade is connected to one end of the coil and the other end of the coil is connected to the terminal " W." A spring, " S1," is interposed between the armature and the end plate of the coil.

A short length of flexible wire is connected to the outer rocker and to one of the screws which hold the bakelite moulding on to the magnet housing, in order to ensure a good earth. In the case of double pole pumps this wire is taken to a further terminal and the rocker mechanism is insulated by fibre bushes. Two fibre bushes are in any case fitted to one of the spindles of the " throw over " mechanism of all pumps in order to silence the operation of the contact breaker.

The action of the pump is as follows. When the pump is at rest the outer rocker lies in the outer position and the tungsten points are in contact. The current passes from the terminal, through the coil, back to the blade, through the points and to earth, thus energising the magnet and attracting the armature. This comes forward, bringing the diaphragm with it and sucking petrol through the suction valve into the pumping chamber. When the armature has advanced nearly to the end of its stroke the " throw over " mechanism operates, and the outer rocker flies back, separating the points and breaking the circuit. The spring " S1 " then pushes the armature and diaphragm back, forcing petrol through the delivery valve at a rate determined by the requirements of the engine. As soon as the armature gets near the end of this stroke the " throw over " mechanism again operates, the points again make contact, and the cycle of operations is repeated.

The spring blade rests against a small projection on the bakelite moulding, and it should be so set that when the points are in contact it is deflected back from the moulding. The width of the gap at the points is of no importance.

If the magnet is removed from the body for any reason care should be taken that the rollers " S " do not drop out. If the armature and centre rod have been unscrewed it will be necessary to reset these. In order to do this the magnet should be held in the left hand and the first finger used to hold the spring blade out of contact with the rocker. The armature should be screwed in as far as possible and should then be screwed back gradually and pressed in and out until it is found that when it is pushed in the " throw over " mechanism operates. It should then be turned back a further four holes. The setting is now correct. The six screws which hold the magnet to the body may then be screwed into place, but before tightening these down the hinge pin " Z " on which both rockers pivot should be pulled out, thus allowing the inner rocker and the armature and diaphragm assembly to move further back. The screws may now be tightened and the hinge pin replaced.

In the unlikely event of trouble, disconnect the lead from the terminal and strike against the body of the pump to see if it sparks and therefore if any current is available in the wire. If there is no current the trouble must be looked for elsewhere. If the current is there remove the bakelite cover and touch the terminal with the lead. If nothing happens and the points are in contact and a spark cannot be struck off the terminal it is probable that there is some dirt on the points. If on the other hand the points are not in contact look to see if the tips of the inner rocker " U " are in contact with the magnet housing. If they are not it indicates that the armature has not gone right back. To cure this loosen the six screws which hold the magnet housing to the body, make sure that the diaphragm is not sticking to the magnet housing by passing a penknife down the side of it and remove the hinge pin " Z." The six screws may then be tightened up again, when it will probably be found that the tips of the inner rocker are making contact with the magnet housing. If they are not it will be necessary to remove the whole magnet assembly, dismantle it and see if any foreign matter has caused a jam.

If the pump becomes noisy, look for an air leak on the suction side. To do this, first of all make sure that the filter and inlet union are tight, and also see that there is sufficient petrol in the tank. If this does not cure it, it is probable that the leak is somewhere in the pipe line, and the simplest way to test for this is to replace the suction pipe with a short length of piping and let the pump suck petrol out of a can. If the pump functions satisfactorily under these conditions the fault must be elsewhere. If the pump goes on beating without delivering any petrol it is probable that a piece of dirt has lodged under one of the valves. This may be removed by unscrewing the top union from the body and lifting the valve cage out. If the pump struggles to pump and gets very hot, it is probable that there is an obstruction somewhere in the pipe line or the filter may require cleaning.

Tyres.—The tyres being one of the most expensive items in the upkeep of a car, should receive special attention in order that you may receive the utmost service from them.

The most important factor is the maintenance of the correct air pressure, and this should be checked regularly in all five tyres with a reliable pressure gauge once every week, whether the car is used or not. Remember that it is the air that carries the load.

Dunlop tyres are fitted to the M.G. Magna, and the makers' recommended pressures are as follows :—

		Inflation Pressures (lb. per square inch).	
Model.	*Tyre size.*	*Front Tyres.*	*Rear Tyres.*
M.G. Magna " L " Type (all models)	4.50—19	32	32

These pressures, if desired, may be reduced by 4 lb. per square inch if the car is to be driven at low average speeds, also in the case of Saloon and Four-seaters when the front seats only are occupied.

Oil and Grease.—Tyres should never be allowed to stand in a pool of oil, grease or petrol, as these substances are detrimental in their effects on rubber. Any oil or grease should be removed from the tyre as soon as it is noticed by the use of a rag.

To remove Tyre.—First deflate by removing all the valve parts and push both cover edges into the well of the rim at the part diametrically opposite the valve, then lever the cover edges near the valve over the rim edge. No force is required to do this, but the edges of the cover opposite the valve must be in the well of the rim.

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 well of the rim.

Very slightly inflate the inner tube, do not distend it, place it in the cover with the valve through the hole in the rim. Fit the second edge of the cover, starting at a point diametrically opposite the valve and pushing the edge down into the well of the rim. If this is done the last few inches can be fitted without using levers.

If levers are used do not use force, as this may damage the beads of the tyre.

When inflating see that the edges of the cover are seated evenly round the rim. This can be checked by the line provided on the cover.

LUCAS—C.A.V.—ROTAX SERVICE DEPOTS

In the event of any difficulty with any part of the equipment, no matter how trivial, we shall be only too pleased to give every assistance possible. The best course to adopt is to call at the nearest Lucas Service Depot, the addresses of which are given below, when the equipment can be examined as a whole. The depots are not only at your disposal for repairs, overhauls and adjustments, but to give free advice. When it is necessary, however, to communicate, or to order spare parts, always give the type and number of the unit in question, the make, and if possible the date of the car on which it is fitted.

BELFAST ... ... **3-5 Calvin Street, Mount Pottinger**
Telephone : Belfast 7017 *Telegrams* : " Servdep, Belfast "

BIRMINGHAM, 18 ... ... **Great Hampton Street**
Telephone : Central 8401 (10 lines) *Telegrams* : " Lucas, Birmingham "

BRIGHTON ... ... **Old Shoreham Road, Hove**
Telephone : Preston 3001 (4 lines) *Telegrams* : " Luserv, Brighton "

BRISTOL ... ... **345 Bath Road**
Telephone : Bristol 76001 (4 lines) *Telegrams* : " Kingly, Bristol "

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MANCHESTER ... ... **Talbot Road, Stretford**
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Telephone : Newcastle 25571 (3 lines) *Telegrams* : " Motolite, Newcastle-on-Tyne "

In addition there are official Battery Service Agents in important centres throughout the country.

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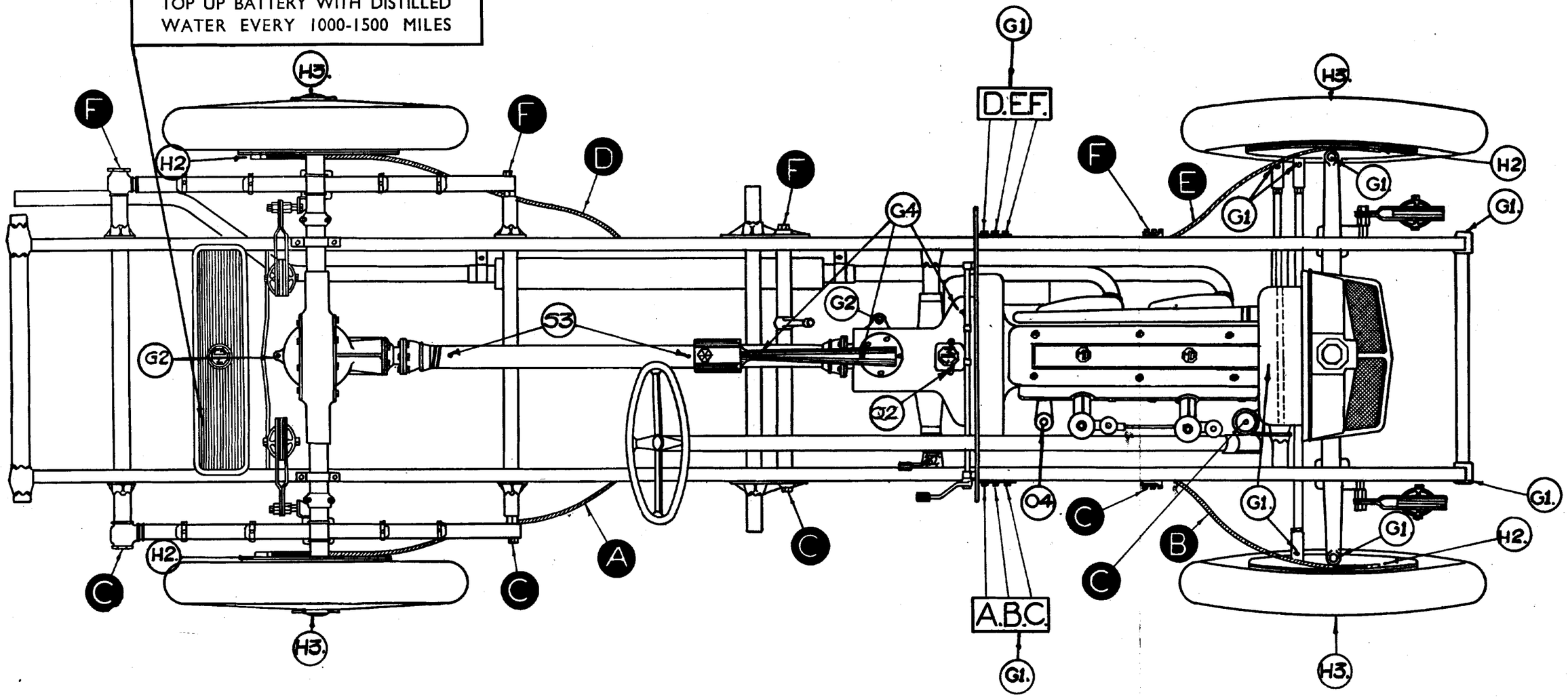
TOP UP BATTERY WITH DISTILLED WATER EVERY 1000-1500 MILES



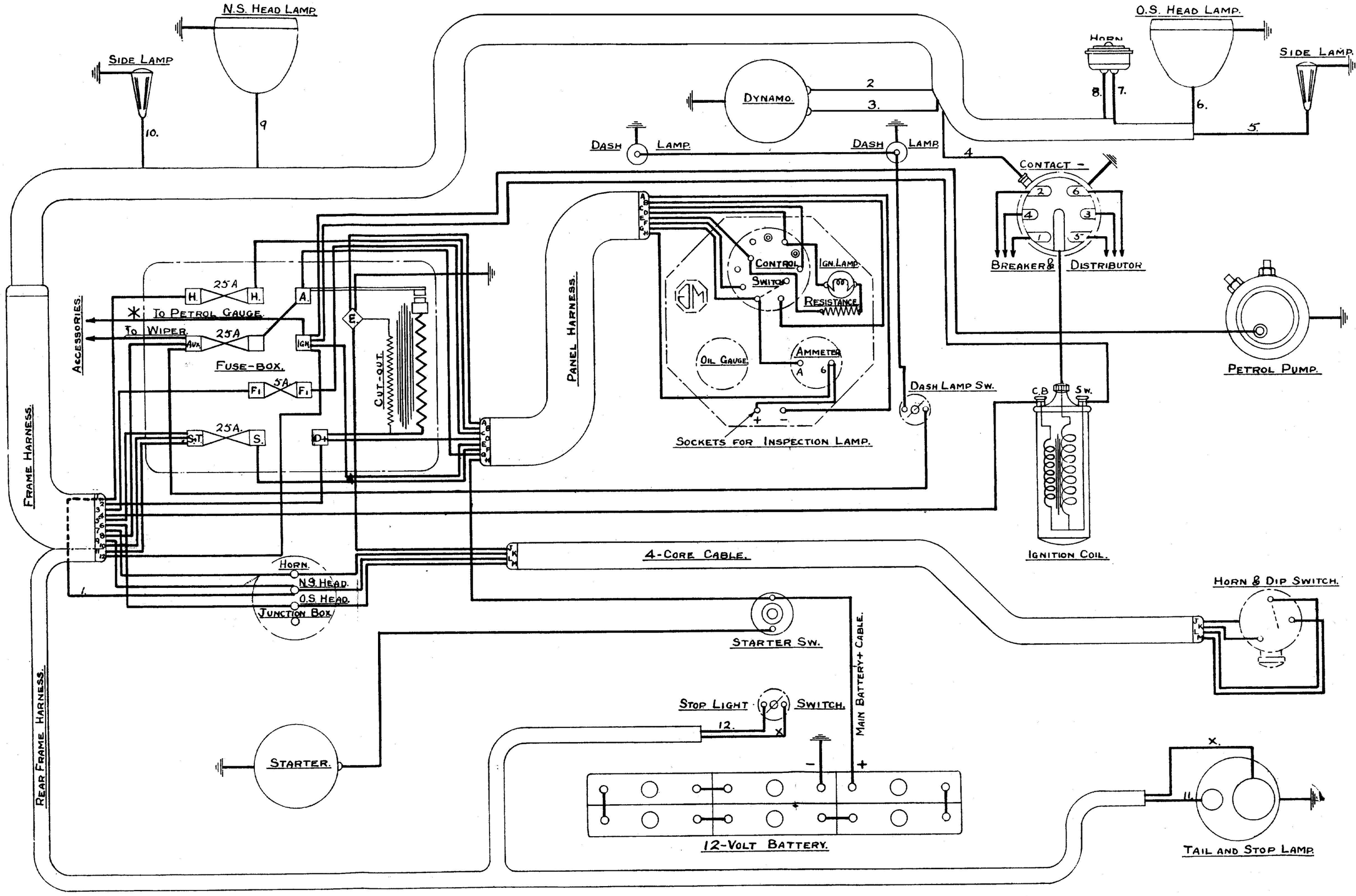
M.G. MAGNA

OILING CHART.

1.	EVERY 500 MILES.	O. — OIL.
2.	" 2000 " .	G. — GEAR OIL.
3.	" 10000 " .	S. — HARDY SPICER GREASE.
4.	AS REQUIRED.	H. — HUB GREASE.

THE WIRING LAYOUT FOR THE MG MAGNA

("L" TYPE MODELS)



* FOR SALOON ONLY.

THE WAKEFIELD LUBRICATION WALL CHART

FOR THE

M.G. MAGNA and MAGNETTE

M.G. Magna "L" type and M.G. Magnette "K" and "N" types

NOTE.—Figures in the symbols indicate periods at which attention is required in 100's of miles—i.e. 5 denotes 500 miles, 20=2,000 etc.

NOTE.—Diagram shows the Magnette "N" type. Dotted lines show position of lubrication points on "L" type Magna and "K" type Magnette where these are differently placed.

Front Brake Camshaft. (Except Magnette "K" types).—Every 2,000 miles fill Stauffer greaser with CASTROLEASE Heavy and give the cap a turn occasionally.

Front Wheel Hub.—Every 10,000 miles remove hub cap, replenish with CASTROLEASE Heavy and replace.

Front Spring Anchorage, Steering King Pin, Steering Track Rod and Drag Link.—Every 500 miles apply CASTROL Swanshot Gear Oil with the oilgun at each nipple indicated.

Front Brake Cable, Rear Brake Cable, Front Spring Shackles, Rear Spring Shackles, and Brake Cross Shaft.—These points are lubricated by applying CASTROL Swanshot Gear Oil with the oilgun to the grouped nipples indicated. Oil reaches the points referred to by means of pipe lines. Give them attention every 500 miles.

Clutch Release Bearing. On Magna "L."—Every 2,000 miles remove cover plate and apply CASTROL Unijoynt Grease. *Also see below.*

Gear Box.—Every 2,000 miles check oil level and replenish to level of filler plug with Wakefield CASTROL Swanshot Gear Oil. After first 500 miles, and subsequently every 5,000 miles, drain gear box and refill with fresh oil to level of filler plug. It is important at all times that oil be maintained to this level. *Use CASTROL "F" in Magnette pre-selector gearboxes. Oil capacity of gear box = 1½ pints. On Magnette "K" with preselector = 3 pints.*

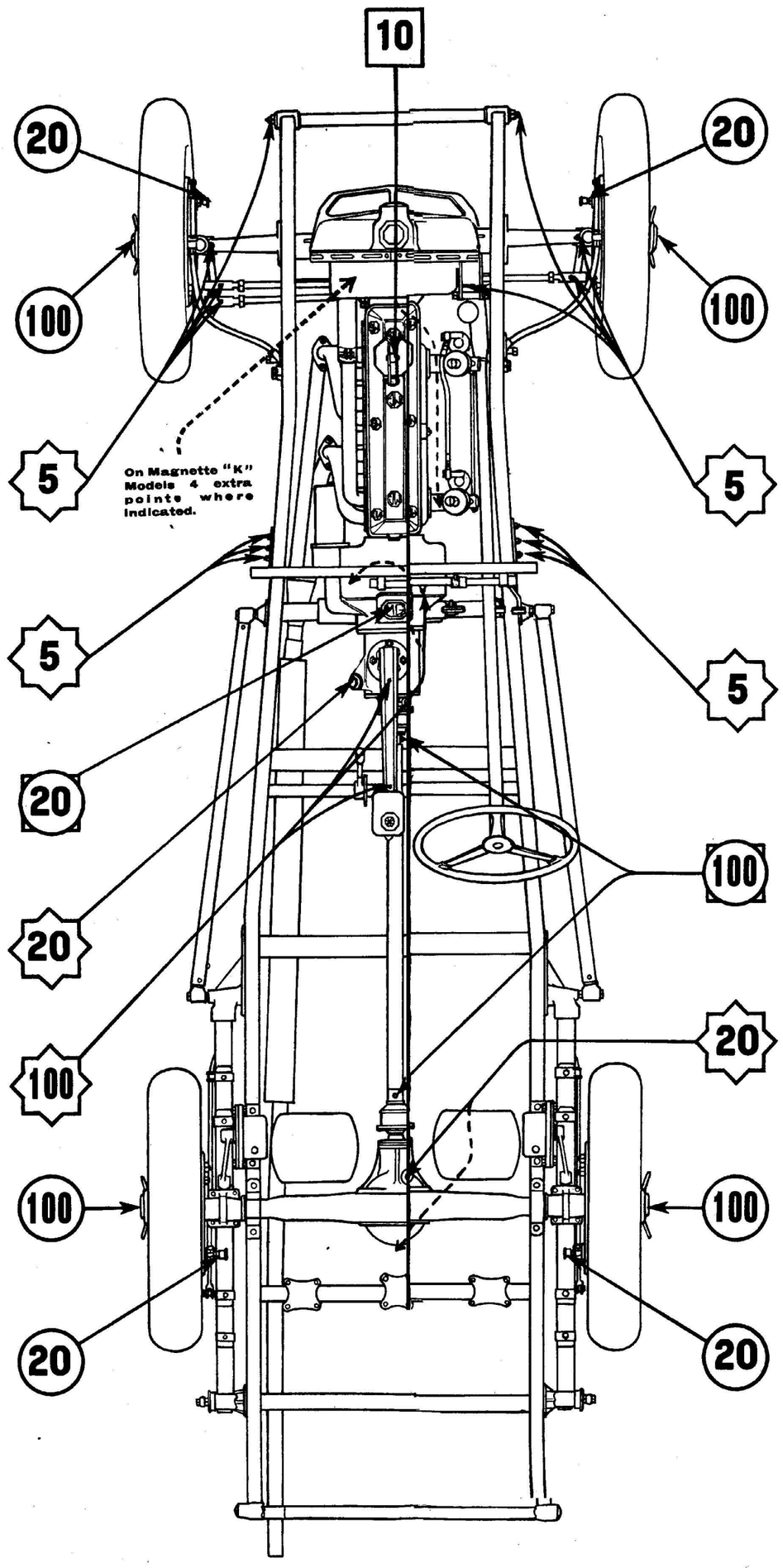
Gear Change Remote Control and Accelerator Shaft.—Every 10,000 miles or as required apply the oilgun at the nipples indicated.

Rear Wheel Hub.—Every 10,000 miles remove hub cap, replenish with Wakefield CASTROLEASE Heavy and replace.

Rear Brake Camshaft. (Except Magnette "K" types).—Every 2,000 miles fill Stauffer greaser with CASTROLEASE Heavy and give the cap a turn occasionally.

Clutch Release.—On Magnette "N" apply a few drops of engine oil. Magnette "K" preselector model needs no attention. With manual gear box treat as Magna "L" above.

Engine.—Every 100 miles or as required check oil level in the sump by removing oil indicator rod and if necessary, replenish until oil reaches "Full" mark on rod with Wakefield CASTROL XXL (in summer) or CASTROL XL (in winter). After first 500 miles, and then after every 1,000 miles, drain off old oil while warm by withdrawing drain plug from sump and refill with approximately 1 gallon of the correct grade according to season.



Front Brake Camshaft. (Except Magnette "K" types).—Every 2,000 miles fill Stauffer greaser with CASTROLEASE Heavy and give the cap a turn occasionally.

Front Wheel Hub.—Every 10,000 miles remove hub cap, replenish with CASTROLEASE Heavy and replace.

Front Spring Anchorage Steering King Pin, Steering Track Rod, and Drop Arm.—Every 500 miles apply CASTROL Swanshot Gear Oil with the oil gun at each nipple indicated.

Front Brake Cable, Rear Brake Cable, Front Spring Shackles, Steering Box, Steering Column, Rear Spring Shackles, and Brake Cross Shaft.—These points are lubricated by applying CASTROL Swanshot Gear Oil with the oilgun to the grouped nipples indicated. Oil reaches the points referred to by means of pipe lines. Give them attention every 500 miles.

Universal Joints.—Every 10,000 miles apply CASTROL Unijoynt Grease with the special oilgun provided at the grease nipple on each joint housing.

Rear Axle.—Every 2,000 miles check oil level and replenish with CASTROL Swanshot Gear Oil to level as indicated on the dipstick except on Magna "L" type which should be filled to level of the filler plug. After the first 500 miles and every subsequent 5,000 miles drain off old oil and refill with CASTROL Swanshot Gear Oil. It is important that lubricant be maintained at correct level. *Oil capacity of rear axle Magnette "K" type = 2 pints. Magna "L" type = 1½ pints. Magnette "N" type = 1½ pints.*

Rear Wheel Hub.—Every 10,000 miles remove hub cap, replenish with Wakefield CASTROLEASE Heavy and replace.

Rear Brake Camshaft. (Except Magnette "K" types).—Every 2,000 miles fill Stauffer greaser with CASTROLEASE Heavy and give the cap a turn occasionally.

WARNING.—Do not ask for "XXL" or "XL" when you require CASTROL. Ask for CASTROL "XXL" or CASTROL "XL" and see it drawn from a CASTROL container.

Also Requiring Attention.

Every 1,000 miles go round your M.G. car applying a few drops of Wakefield OILIT to carburettor and ignition control rod joints. Door hinges, bonnet fasteners and other minor points which are subject to friction.

Distributor.—Every 1,000 miles give the oiler on the distributor shaft a few drops of OILIT. Every 3,000 miles give the cam the lightest smear of vaseline. Every 5,000 miles place a single drop of OILIT on the contact breaker pivot.

Upper Cylinder Lubrication.—In order to lubricate more effectively the pistons, piston rings, valve stems and guides, especially while the engine is being "run in" or when starting from cold, Wakefield CASTROLLO should be used.
Use the cap of the CASTROLLO tin as a measure and add one cap full to every four gallons of fuel you put in your tank. CASTROLLO can be obtained loose in small quantities at most filling stations; i.e. sufficient to treat the amount of fuel purchased.

EXPLANATION OF SYMBOLS.

Wakefield CASTROL "XXL."—A Medium-heavy bodied oil of the highest quality approved by Messrs. The M.G. Car Co., Ltd., for the M.G. engine in summer,

Wakefield CASTROL "XL."—An oil of medium body for lubrication of the M.G. engine in winter.

Wakefield CASTROL Swanshot Gear Oil.—A clear coloured viscous gear oil, specially suitable for the M.G. Gear Box, Rear Axle and Chassis lubrication with the gun.

CASTROL Unijoynt Grease.—A specially prepared non-separating grease for universal joint lubrication.

CASTROLEASE Heavy—A heavy grade CASTROL grease specially suitable for M.G. wheel bearing lubrication, etc.

C. C. WAKEFIELD & CO., LTD. - *All-British Firm* - WAKEFIELD HOUSE, CHEAPSIDE, LONDON, E.C.2.

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