Instruction Manual

for the

Two-Litre

Price 10/-

THE
Instruction Manual
for the

Two-Litre
(S. Type)

Foreword.

The object of this Instruction Book is to place the owner in possession of as much detailed information as possible for the maintenance of the M.G. Two-Litre.

Details are provided regarding running-in, and separate chapters deal with the various items of the car, such as chassis, engine, carburetters, brakes, etc. Each section contains more detailed information than is needed for ordinary maintenance, which it is hoped will prove of interest to owners, and of assistance to service stations.

The time arises when a part of the car has to be dismantled, and it is then that the reference to the detailed instructions can be of considerable value, both to the owner and repair shops unacquainted with the construction of the car.

Should the owner fail to find the particular information he requires in the Instruction Book, it is hoped he will not hesitate to communicate with the Service Department at Abingdon (being sure always to quote the car's chassis and engine numbers), who will always be only too ready to afford any assistance they can at any time.

We cannot stress too highly the *danger* of fitting non-genuine parts to M.G. cars.

Unfortunately cases have come to our notice where accidents have actually been caused by this practice, and we strongly advise all M.G. owners to insist and see that for all repairs and replacements only genuine M.G. parts are fitted.

M.G. parts are specially designed and manufactured to withstand the stresses imposed by a high-speed sports car, and we would warn all owners that the fitting of non-genuine parts renders the guarantee *null* and *void*.

POSTAGE AND PACKING CHARGES. The prices quoted in the Spare Parts List are nett at the Distributors' or Dealers' premises; but in the event of parts having to be forwarded, packing and posting charges will of course be extra. Except in the case of those who have opened approved accounts, all parts that can be will be forwarded C.O.D.

The prices of M.G. Spare Parts are naturally subject to an increase in overseas markets to cover freight, insurance, duty, etc.

G.K. — G.T.

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January, 1937 (*Reprinted*).
August, 1937 (*Reprinted*).
November, 1937 (*Reprinted*).
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TELEGRAMS:
"EMGEE"
ABINGDON

THE MG CAR
COMPANY LTD
ABINGDON-ON-THAMES
BERKSHIRE

TELEPHONE:
251 (4 LINES)
ABINGDON-
ON-THAMES

MISCELLANEOUS HINTS.

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

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

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

Do remember to keep the radiator filled.

Do carefully run-in a new engine ; restraint during the first 2000 miles will be handsomely repaid.

Do remove the oil filter element and replace with a new one at the end of the first 1000 miles, and subsequently every 10,000 miles.

Do change the engine oil after the first 500 miles and every 1200–1500 miles thereafter.

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

Do specify the genuine M.G. parts when ordering spares, the use of " pirate " parts is certain to lead to serious breakdowns, and renders the guarantee null and void.

Do check the tyre pressure every week, and inflate to the pressure recommended.

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

Do study the maintenance chart at the back of the book and attend to the chassis, etc., at the periods stated.

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

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 pull out the starter button and let go immediately. Overcoming engine inertia is a big drain on the battery. Once the engine is spinning much less current is being consumed, so keep the starter switch in contact a reasonable time to give the engine time to fire and take hold.

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 between 1200–1500 r.p.m.

Do not allow the engine to labour.

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

Do not slip the clutch except when actually starting off or changing gear.

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 forget to top-up the battery with distilled water regularly.

Do not lean on open doors.

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.

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INDEX—(*Continued*).

ALPHABETICAL LIST OF ILLUSTRATIONS

GENERAL DATA

THE M.G. TWO-LITRE

Bore	69.5 m/m
Stroke	102 m/m
Capacity	2322 c.c.
Horse Power (R.A.C. Rating)	17.97
Sump capacity	$2\frac{1}{2}$ Gallons approx.
Firing order	1, 5, 3, 6, 2, 4
Sparking plugs	Champion L.10 (14 m/m)
Capacity of water system	$2\frac{7}{8}$ Gallons
,, ,, gear box	$2\frac{1}{4}$ Pints
,, ,, rear axle	2 Pints
,, ,, petrol tank	10 Gallons approx.

DIMENSIONS (SALOON) :—

Overall length	16′ 2″
,, width	5′ $6\frac{1}{2}$″
,, height	5′ 2″
Wheelbase	10′ 3″
Track	4′ $5\frac{1}{2}$″
Weight	$29\frac{3}{4}$ cwt.

Tyre pressures - 30 lb. all tyres

Gearbox Ratios.	Overall Ratios.	Speeds at 1,000 r.p.m.
TOP	4.75 to 1	18 m.p.h.
THIRD	6.55 to 1	13.05 m.p.h.
SECOND	10.11 to 1	8.45 m.p.h.
BOTTOM	17.86 to 1	4.79 m.p.h.
REAR AXLE RATIO		4.75 to 1.

(See chart of speeds on gears against engine revolutions on page 62.)

VALVE TIMING :—

Inlet opens 11° before T.D.C. Closes 59° after B.D.C.
Exhaust opens 56° before B.D.C. Closes 24° after T.D.C.
Tappet clearance .015″ when hot.
Contact breaker points .010″/.012″.
Ignition timing 7° before T.D.C.

The valve timing diagram is given on page 53, but it may be more convenient to check the valve timing on the periphery of the flywheel, these measurements being :—

Inlet opens	27.8 m/m before T.D.C.
Inlet closes	149.3 m/m after B.D.C.
Exhaust opens	141.7 m/m before B.D.C.
Exhaust closes	60.7 m/m after T.D.C.

SECTION A

MAINTENANCE DETAILS

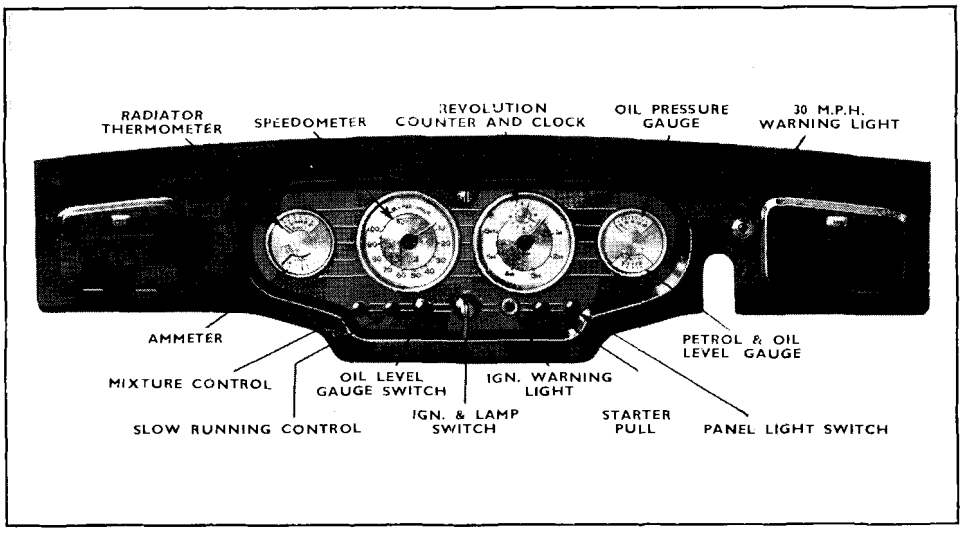


Illustration No. 1. The facia board layout.
Commencing Chassis No. SA.0903, the positions of the revolution counter and speedometer are reversed, also a wander plug is incorporated between them.

How the Controls and Switches are placed.—The accelerator on the M.G. Two-litre is on the extreme right, with the foot brake to the left of it and the clutch of course to the left of the brake pedal. The gear positions of the four-speed gearbox are plainly marked on the top of the gear lever, and the direction indicators, which are of the self-cancelling type, are operated by a switch in the centre of the steering column. The other press button on the steering head operates the twin horns.

The steering wheel is instantly adjustable for position from the driving seat, being locked in the desired position by quick release clamp immediately under the steering wheel boss.

The headlamp dipper switch is foot operated, the switch being placed on the ramp board close to the clutch pedal where it can be operated by the left foot.

The 30 m.p.h. warning light is placed just above the steering column and is switch-operated for bright or dull illumination for day and night driving (for details of switch see item 7 below). This warning operates between 20 and 30 m.p.h. This is not fitted on cars that are exported.

The complete set of instruments and controls on the facia panel are as follows : reading from the left—combined in one instrument is the water temperature gauge and ammeter, next to it the speedometer with total mileage and " trip " readings. (The " trip " release is at the back of the panel below the instrument—pull and turn to return to zero.) To the right of the speedometer is the revolution counter reading in thousands of r.p.m. Incorporated in the dial is an eight-day clock, the winder being behind the facia panel immediately below the clock.

On later cars the speedometer and revolution counter are reversed, also wander plugs are incorporated between the instruments.

On the extreme right is an instrument with a three-fold purpose as follows : the top dial reads oil pressure and the bottom dial reads the contents of the petrol tank or the oil level in the sump (see details of the change-over switch No. 3 described on this page). **Warning.**—If the gauge hand is beyond the "full" mark and into the red segment on the dial when reading petrol or oil, an open circuit is indicated between the instrument and tank or sump attachment.

Below the instruments, switches, etc., reading from the left are as follows :—

1. Mixture control or choke pulls out to richen the mixture for starting ; it has a number of notches which are engaged by turning the knob in an anti-clockwise direction so that the required degree of richness is obtained. There are eight progressively rich positions—always be sure to return control to the " right-in " position as soon as possible.
2. Throttle set (turn anti-clockwise to speed up the engine).
3. Change-over switch for petrol and oil gauge. The gauge normally shows the amount of petrol in the tank, but when the button is pressed shows amount of oil in the sump. The ignition must be "on" when readings are taken.
4. Lamp switch and key operated ignition switch.
5. Ignition warning light.
6. Starter switch. (Pull outwards.)
7. Switch and rheostat for panel and " 30 " lights. Turn clockwise for panel and "30" lights rheostat controlled, and anti-clockwise for "30" lights only, for day driving. The "30" light is not fitted on export cars.

Warming Up.—We advocate warming the engine to 70/80 deg. centigrade on the water thermometer before starting out. Apart from a warm engine being far more pleasurable to drive, the initial warming-up gives the oil a chance to become thoroughly fluid.

It is, however, just as important that the engine should not be allowed to idle, the best warming-up speed being between 1200 and 1500 r.p.m.

Running-in.—It must not be taken for granted that the engine is run in at the time of delivery ; in fact 2000 miles of steady running are advised, keeping down to the speeds printed on the running-in instruction label, and which are repeated here for convenience in case it is desired to remove the label.

FOR THE FIRST 500 MILES - - - -	2250 r.p.m.	40 m.p.h.
FROM 501 TO 1000 - - - - -	2800 r.p.m.	50 m.p.h.
FROM 1001 TO 2000 - - - - -	3400 r.p.m.	60 m.p.h.

It is difficult to recommend the exact procedure for running-in, but the points of importance are that the engine should never be allowed to labour or pull hard on a high gear. It is far preferable to let the engine rev. at a reasonable speed, and no damage will be caused provided it is " run light." Also ease the foot off the accelerator at frequent intervals—this allows the oil to come up the bores.

Although it is not essential, upper cylinder lubricant is beneficial during the running-in period. We do not, however, advise the use of anything other than an upper cylinder lubricant, added to the fuel in the proportion recommended by the makers.

Refuelling.—Refuelling will probably be the next point on which information is sought, and details are as follows :—

The petrol tank on all Two-litre models is at the rear and holds 10 gallons, the filler is placed just behind the rear wing on the near-side.

Before the car leaves the Factory the carburetters are tuned for Ethylised fuel, and this type of petrol is recommended for general use.

Although M.G. engines can satisfactorily be run on all the well-known brands of No. 1 petrol, there is a tendency to " pink," owing to the compression ratio employed, especially if the engine requires decarbonising. Because of this we recommend, without preference, alcohol blends, benzole mixtures or Ethylised fuels, particularly as such anti-knock fuels are obtainable from the pumps practically universally throughout the country.

The first named, it should be noted, really requires special carburetter setting for best results, and is inclined to affect paintwork.

The use of No. 3, or cheap commercial fuels, is deprecated.

The oil level in the sump can be determined, as stated on page 6, by the right-hand instrument on the facia board. As a precautionary measure a dip stick is also fitted, which is to be found on the near-side just below the distributor. The oil filler is placed in a convenient position on the valve cover beside the air silencer, and access to it is obtained by lifting the bonnet on the near-side.

Recommended and Approved Lubricants.—The sump holds $2\frac{1}{2}$ gallons of oil, and before the car leaves the Works has been filled with Duckham's "Aero" N.P.5 (Summer), "Aero " N.P.3 (Winter), which is the engine oil recommended by The M.G. Car Company Ltd. The following, however, is a list of those also approved :—

	Summer.	*Winter.*
Duckham's - - -	Morrisol Engine	Morrisol Engine
Essolube - - - -	50	40
Filtrate - - - -	Super	Ex. Hy.
Mobiloil - - - -	D	BB
Price's Motorine - -	" C " de luxe	M
Shell - - - -	Triple (Heavy)	Double (Medium)
Sternol - - - -	WW Med. Hy.	WW Med.
Wakefield - - - -	Patent Castrol XL	Patent Castrol XL

Included in the car's equipment is a quart tin of " Aero " N.P. for emergency topping-up.

It is very essential that the sump is drained and refilled with new oil at the intervals specified on page 9.

Don't forget to change the oil filter element after 1000 miles.

Recommended by the Company for general lubrication through the car are the following :—

Gearbox (Direct engagement type).

Chassis.

Recommended : Duckham's : Adcol Gear Oil N.

Approved : Duckham's : Morrisol (Trans.) Motorine : Amber B.
Essolube : Super Gear Oil. Shell : Gear Oil.
Filtrate : Gear Oil. Sternol : Liquid Ambroleum.
Mobiloil : Gear Oil C. Wakefield's : Castrol Swanshot.

Gearbox (Synchromesh type).

Recommended : Duckham's : Adcol " S " Synchro-Gear Oil.

Approved : Duckham's : Morrisol Synchro-Gear Oil.
Essolube : Gear Oil Medium.
Filtrate : Synchromesh Filtrate.
Mobiloil : C.W.
Price's : Motorine Amber A.
Shell : Golden.
Sternol : Liquid Ambroleum SG.
Wakefield's : Castrol Swanshot.

Rear Axle.

Recommended : Duckham's : Adcol XS-Press Oil.

Approved : Essoleum Expee 110. Shell : E.P. Spirax.
Filtrate : E.P. Gear Oil. Wakefield's : Castrol Hi-press.
Mobiloil : E.P. Gear Oil.

Hubs and Water Pump : Duckham's H.B.B.
On later models the water pump is lubricated with engine oil.

The Water System.—The water system holds $2\frac{7}{8}$ gallons. It is desirable if possible, to fill up with soft water. The water is circulated through the engine by means of an impeller, and the engine temperature is maintained at the best running heat by means of a thermostat control which is automatic in operation.

Care should be exercised in the selection of anti-freezing mixture, if its use is found necessary on account of frost, as some have an immediate effect on hose connections. Bluecol has been approved ; but in case of doubt, please write to our Technical Department.

Change the Oil after 500 Miles.—The engine lubrication is pressure throughout by gear type pump, which sucks oil from the sump float through an internal gauze and feeds it via a Tecalemit oil filter to the main and big-end bearings and the valve gear.

After the first 500 miles the engine oil should be drained and the sump refilled with new oil. The oil should again be changed after the first 1000 miles have been covered, and the Tecalemit filter element should be renewed.

Engine oil should afterwards be changed every 1200 to 1500 miles, the Tecalemit oil filter element need not, however, be renewed more often than every 10,000 miles.

Under no circumstances should paraffin be used to wash out the lubricating system of the engine. More detailed instruction on lubrication will be found on pages 37/39, dealing 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.

Chassis Lubrication.—Most of the chassis fittings are conveniently lubricated from six oil nipples, three 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 oilgun provided with the car. The plates attached to the dash state the points fed by each nipple.

It is advisable periodically to hoist the car so that the load is taken off the springs, and after first thoroughly cleaning them to lubricate the spring leaves with penetrating oil. The steering head pins, the track rod and other steering ball socket joints are lubricated separately. Use Duckham's Adcol Gear Oil N.

All flexible control cables, i.e. starter, slow-running and mixture controls, revolution counter and speedometer cables, require lubrication every 10,000 miles. They should be removed and greased with Duckham's H.B.B.

A lubricating chart is provided at the end of the book indicating the lubrication carried out from the central dashboard nipples, and the other points on the chassis that have to be individually lubricated.

Should it be necessary to refer to the serial numbers stamped on the frame and engine units, they are to be found as follows :—

Chassis Number.—Immediately behind the near-side front dumb iron on the side of the chassis frame (prior to Chassis No. SA.0640 the number was stamped on top of the off-side front dumb iron).

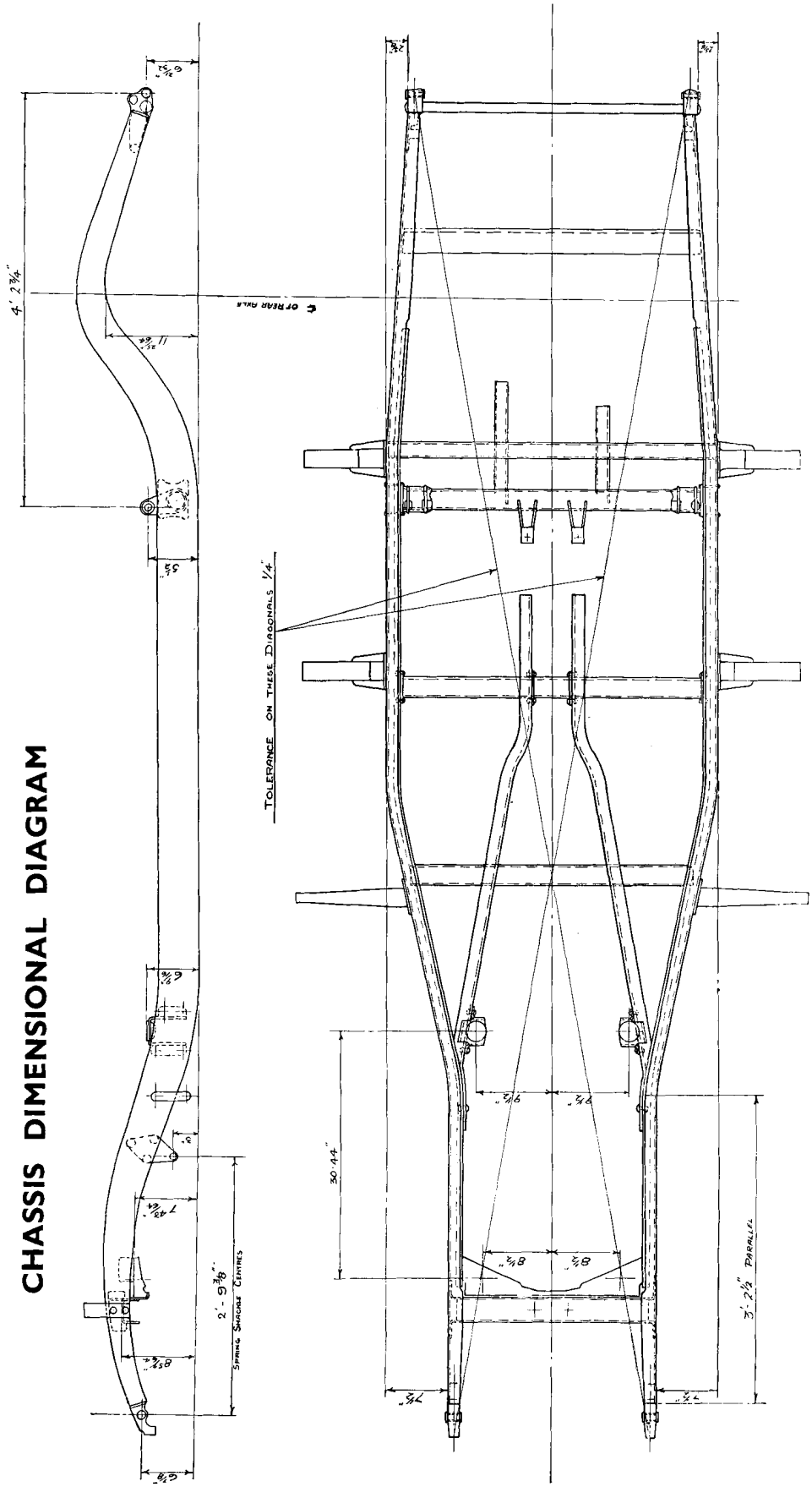
Engine Number.—On the circular disc fixed to the off-side of the cylinder block (see Illustration No. 16). On export cars the number is also stamped on the near-side of the cylinder block, between plugs 2 and 3.

N.B.—These numbers are for convenience duplicated on the guarantee plate attached to the side of the tool box.

Body Number will be found on the serial plate fitted to the inside of the luggage compartment lid.

SEE CHASSIS MAINTENANCE CHART AT THE END OF THE MANUAL AND LIST OF OILS ON PAGES 7 AND 8.

CHASSIS DIMENSIONAL DIAGRAM



With the aid of this drawing and dimensions the chassis frame can be checked for alignment. Should a frame need repair, due to accidental damage, it is advisable to return it to the factory for repair.

SECTION B

CHASSIS

Index is on Page 3

Removing Front Axle complete.—First block up the car under the chassis ; naturally the jacking system can be used until the blocks are in place, the correct height is with the tyres just touching the ground when the automatic jacks are released and the car is resting on its blocks.

Undo the spring shackles front and rear after disconnecting the Lockheed brake pipes where they connect to the brake back plates. Before disconnecting the brake pipes, reference should be made to the brake section to prevent loss of brake fluid due to incorrect dismantling.

Disconnect the drag link at the axle end. The axle complete with springs can then be drawn clear from the car.

Front Wheel Bearings.—Having removed a lock nut and wheel, take the grease from inside the hub. There is a hole in the hub where it is splined and covered with a steel plug ; remove the steel plug and this gives access to the split pin locking the castellated nut, which can be withdrawn through the hole. Remove the hub nut with a box spanner. The hub can then be withdrawn complete with bearings with the aid of a suitable puller.

The outer ball race is smaller than the inner one and can easily be withdrawn from the housing ; but before the inner one can be removed from the other end of the housing, the oil seal will have to be removed.

On reassembling, the bearings and distance piece will go together without any difficulty ; but it is well, on tightening the castellated nut, to spin the hub to make sure it rotates freely. Finally, do not forget to replace the split pin, the steel plug, the grease inside the hub, and to smear with hub grease and a little graphite the splines on the outside of the hub.

Removing King Pin.—First dismantle the hub as previously described, then take off the brake back plate complete with shoes. The king pin is held in place with a small cotter ; when this has been removed, the king pin can be withdrawn.

Renewing King Pin Bushes.—When the old bushes have been pressed out from the steering knuckles and new bushes pressed in, it is necessary to reamer them with a reamer of sufficient length to do the two at once, thus ensuring that they are in line with one another. Do not fit the king pin too tightly, it should be just possible to press it in without the use of tools.

When assembled there should be just sufficient vertical free movement to feel between the steering knuckle and the axle beam eye. If measured with a feeler, the clearance should not exceed .004" between the steel thrust washer and the flange of the brass bush.

Steering Ball Joints (Drag Link).—These will need periodic inspection and cleaning. If they are dismantled, be extremely careful to reassemble all parts in the same order. When readjusting, the slotted end plug should be screwed up tightly and then released half a turn and the split pin replaced. After reassembling, it is necessary thoroughly to re-lubricate.

In case the order of the springs and ball seats in the drag link is lost when dismantling, the following details will give the necessary information for correct reassembly : ball seat, ball, ball seat, spring, plug and split pin.

Torque Cable Adjustment (Front Axle).—The duty of the torque cables is to take the torque reaction of the axle beam when the front brakes are applied ; it is important, however, that they are correctly adjusted.

The following procedure gives the correct method for adjustment :—

Turn the steering to the " straight-ahead " position and adjust the cables so that, with pressure applied by the fingers midway between the fulcrum pins, there is $\frac{3}{4}$ in.—1 in. of free up and down movement or $\frac{3}{8}$ in.—$\frac{1}{2}$ in. either side of the centre line. The lock nuts on the cables' yoke ends are then tightened to maintain the adjustment.

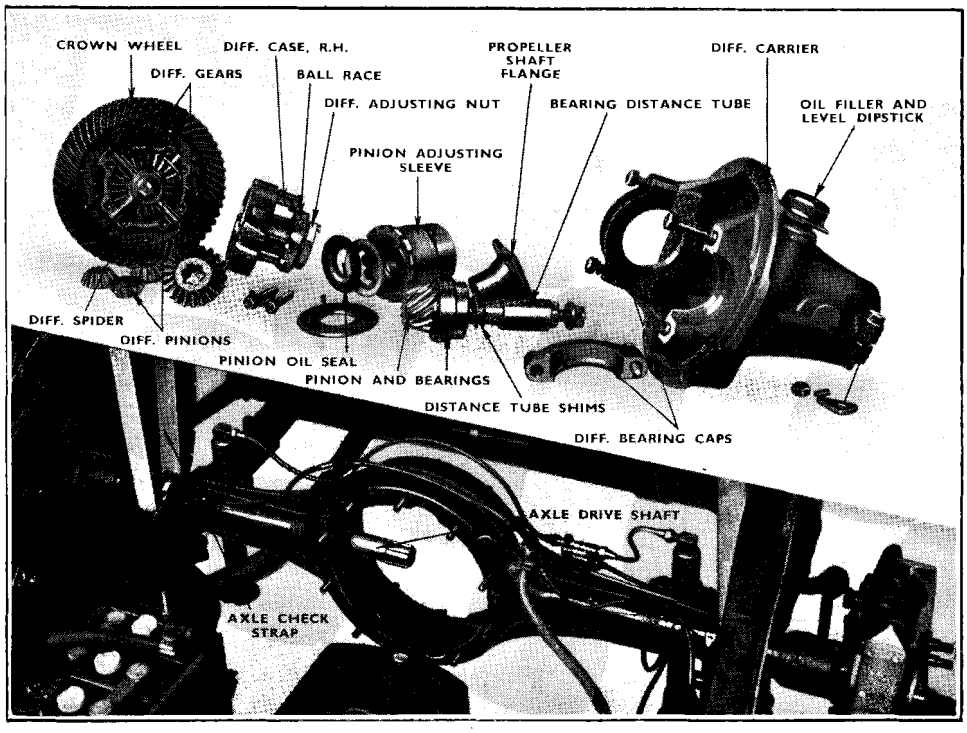


Illustration No. 2.—The rear axle—top pictures showing differential assembly dismantled, and below, the axle casing. Note the drive shaft, also the pipe lines to the brakes and jacks.

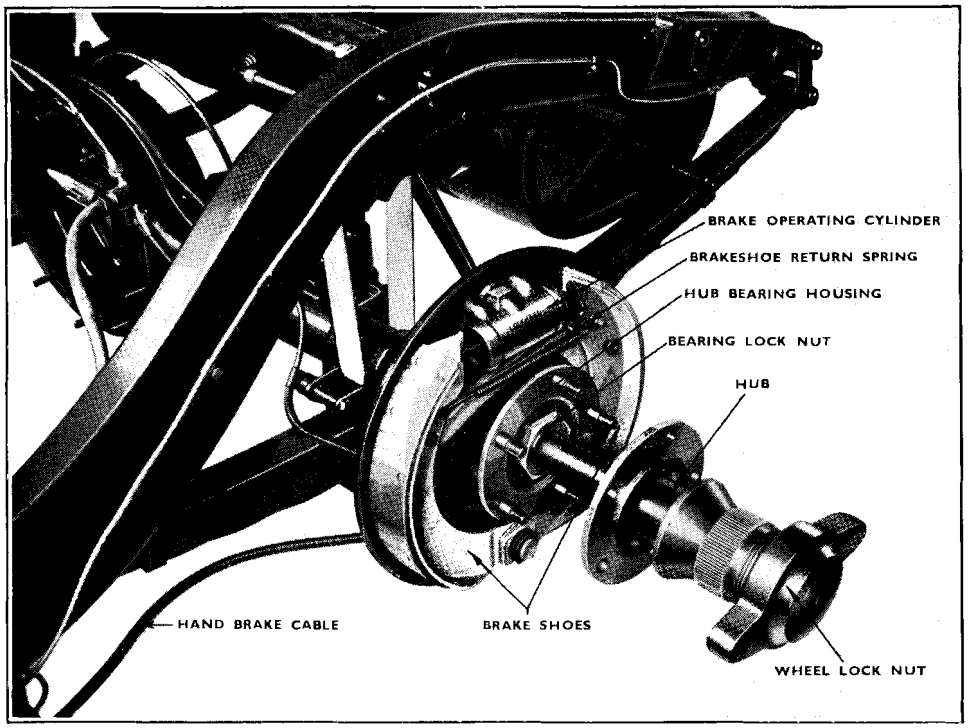


Illustration No. 3.—The near-side hub and brake after the wheel and brake drum have been removed to show the details.

Removing Rear Axle.—Take out in the following order the rear seat cushion, rear seat squab, the cloth-covered board above the rear seat pan, door sill plates, rear carpet; undo inner ends of front and rear door stops and plates, rear floor side boards, and remove rear seat pan.

Uncouple the propeller shaft rear flange (first refer to the special instructions on page 16) and the Lockheed and Jackall pipe connections. Uncouple the hand brake cables from the hand brake cross shaft and all their supports from the foot wells and chassis. Disconnect the shock absorber connecting link lower pins from their lugs on the axle. Put sufficient ballast in luggage compartment to bring the rear springs nearly flat. Put a strong beam about three feet long under each rear spring, and secure their ends firmly to the springs to prevent them re-flexing when the load is taken off. Remove the rear axle check straps and ballast.

Withdraw the front spring pins and rear lower spring shackle pins and lift the car off the axle and springs.

Note (i).—A suitable cramp (Part No. T.81) is available for compressing the springs, the use of which obviates the ballasting and securing operations, otherwise it is important that the spring be kept secured in its "nearly flat" position, as owing to its great free camber it cannot be reassembled in its free state.

Note (ii).—If it has been necessary to let a spring free, or to change a spring, and if suitable means of flattening the spring for reassembly purposes are not available, the best procedure is to strip the spring, and fit it to the car a leaf at a time, using a couple of jacks to squeeze the lower leaves upwards so that there is sufficient thread exposed for the nut to be started on the centre pinch bolt.

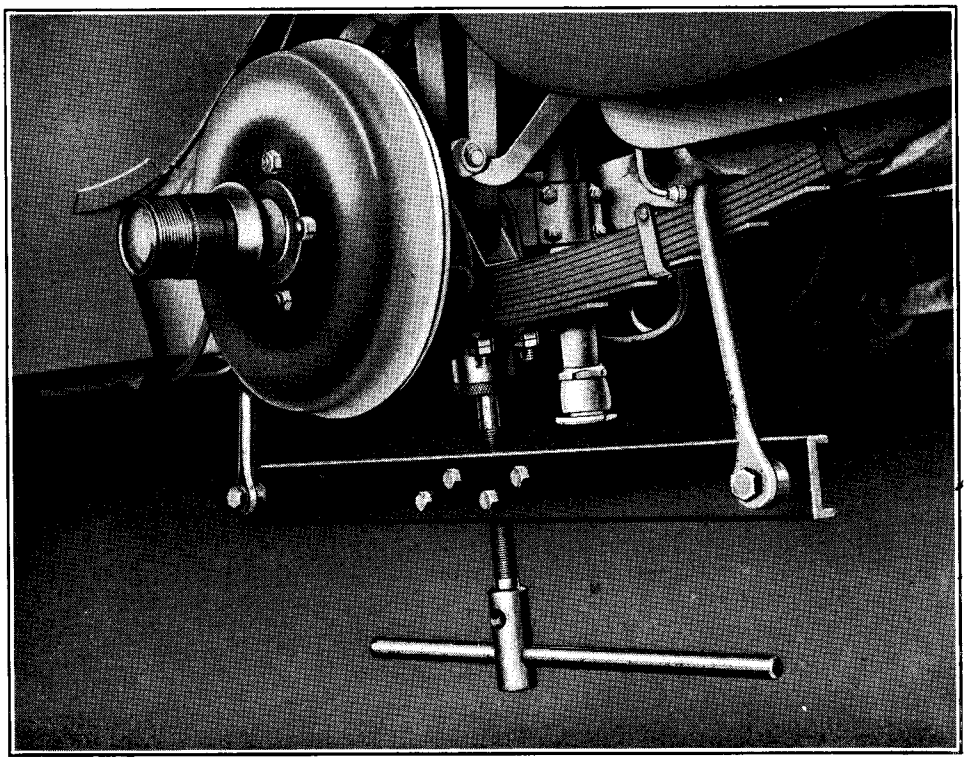
Dismantling Rear Axle.—This process is the same whether the axle is removed from the car or not. First the axle should be drained by removing the rear cover. If the axle is on the car this is best reached through the luggage compartment, when the floor has been removed.

Next, the wheels being removed, unbolt and draw off the brake drums, then replace the wheel nuts on the hubs and drive out the axle half shafts, with hubs complete, by hitting on the nut "ears" with a copper hammer.

The differential housing may be removed without disturbing the rear seat pan as follows: remove rear seat cushion, hinge up the rear seat squab and secure it to the hook provided in the roof, by means of the little strap on the end of the armrest. Lift out the cloth-covered boards from over the batteries. Disconnect and lift out the batteries. Remove the leather-covered "dome" from over the axle centre. Uncouple the propeller shaft rear flange, first marking them as described on page 16. Remove the nuts which secure the differential housing to the axle casing and lift out the differential housing.

Dismantling Differential Unit.—The bevel pinion and its three bearings may be withdrawn as a unit by removing the pinch bolt and locking tab from the axle nose piece and screwing out the adjusting sleeve, and the complete stripping of this sub-unit is achieved by removing the universal joint flange (see page 16), taking off the front cover plate, picking out the oil seal, and pressing the pinion shaft from the adjusting sleeve. The number of shims between the bearing distance sleeve and the inner race of the outer ball bearing is important. The correct number is the smallest that will enable the pinion to be free, and only just free, in the adjusting sleeve when the propeller shaft flange is fully tightened.

The crown wheel and differential are removed complete from the differential carrier by removing the bearing caps, after which they may be dismantled as desired. If the differential housing is dismantled it is desirable to use new tab-washers on reassembly, as tab-washers which have been bent and straightened again are not really safe after a second bending, and a broken-off tab-washer end, loose inside the back axle, may do serious damage.



The special tool part number T.81 for compressing the rear springs.

Reassembling Differential Unit.—To reassemble the differential unit, reverse the operation described under " Dismantling," watching the five following points :—

1. Renew all tab locking washers that have been removed, as it is not advisable to use them more than once owing to the possibility of fracture.
2. That the eight bolts securing the two halves of the differential housing assembly are tight (do not over-tighten), but lock the bolt heads with the tab locking washers.
3. That the differential ball bearings are against the shoulders in the differential carrier caps.
4. That the ten bolts securing the crown wheel to the differential are tight and locked by the tab locking washers.
5. After the pinion is finally adjusted it must be locked by means of the locking tab held by the pinch bolt in the front of the differential carrier.

Adjustment of Crown Wheel and Pinion.—Two adjustments are provided : (i) of the bevel pinion to or from the crown wheel, by means of the screwed sleeve of the pinion housing in the differential carrier ; (ii) of the crown wheel, across the car, by means of the two nuts on the outside of the differential ball bearings.

As it is very essential that the ball race centre tracks are against the shoulders machined in the differential housing caps, before tightening the bolts securing these caps, using the soft punch, tap the ball race outer track against the shoulder.

After tightening the cap bolts, adjust the ball race nuts so that they just pinch the ball race inner track, at the same time bringing the nut locking screw in line with one of the serrations in the locking washer, after which the off-side adjusting nut must be tightened one further serration to obtain a slight pre-load which is necessary to prevent any slackness in the races when the axle is under load.

It is of interest to note that each crown wheel is lapped with its pinion during their manufacture to ensure perfect tooth contact. The necessity for meshing the gears in exactly the same relative position will fully be understood.

The best method of obtaining this position is as follows :—

1. As a starting point, line up the inner edge of the crown wheel teeth with the small end of the pinion.
2. Adjust the differential assembly to give .007 in. to .010 in. clearance between the teeth of the crown wheel and pinion, not forgetting to adjust the differential thrust races as previously described.
3. Cover the teeth of the crown wheel with a mixture of red lead and oil, mixed into a fairly stiff paste. A short bristle brush will ensure even distribution.
4. The differential must then be revolved in both directions. A handle will be required for this, which can easily be made up from round bar ; two collars are required to fit into either side of the differential casing. One must be secured to the handle and the other end must be loose on the shaft, the whole being locked up with a nut.

When the gears have been revolved in both directions the tooth mating markings can be seen on the crown wheel. These markings must be identical on both sides of the teeth and in the centre of each tooth. It must be noted, however, that the tooth markings should only extend for half the length of the tooth, but under load will extend for the full length.

Too much backlash between the gears is indicated by a very narrow tooth marking, and insufficient backlash is indicated by the tooth rooting or bottoming.

The red lead marking must then be removed from the gears.

If further adjustment is necessary when the car is on test, this must not exceed .004 in. in either direction, which is equal to one notch. If the gears are still noisy after this adjustment, the whole differential assembly should be removed and an endeavour made to remesh them, by marking with red lead and repeating the previous instructions.

Where adjustment as described is not satisfactory, before the gears are condemned, all bearings should carefully be inspected for slackness, particularly the pinion rear roller race, which must be renewed if a feeler of .0015 in. thick could be inserted between the roller and the outer track.

Examination of Rear Wheel Bearings.—Naturally, it is necessary first to jack up the rear of the car and remove the wheel attached to the hub which is to be examined. Undo the ring of bolts securing the brake-drum to the hub, remove brake-drum (first be sure the hand brake is " off "), now replace the wheel lock nut and withdraw the half shaft by tapping the back of the lock nut ears with a copper hammer. Having removed the half shaft, tap back the tab washer locking the bearing securing nut, undo the nut, the bearing housing can then be withdrawn complete with bearing ; the assistance of a suitable drawer will in all probability be required. When reassembling, smear the ball race with grease.

Whilst the wheel bearing is removed, it is advisable to examine the oil retaining seal behind the bearing. The reverse operation to dismantling follows for reassembly, the most important point to watch is that the bearing lock nut is really tight and the tab washer turned on to it to lock it.

Lubricating Road Springs.—It is necessary to jack up the car by the chassis, thus removing the weight from the spring leaves. Now undo the spring clips and part the leaves by inserting a screwdriver or similar instrument which will allow sufficient room to apply the grease, either with a knife blade or one of the special tools which are manufactured for the purpose. A simpler method nowadays is to take the car to a service station specialising in chassis lubrication service, who will spray the springs with penetrating oil. This, however, should be done fairly frequently.

Replacement of Shackle Pins and Bushes.—Brass bushes are fitted to all spring eyes with the exception of the front end of the rear springs, which are silent bloc. There are two flanged bushes to each eye, pressed in from either side with an oil retaining distance piece in the centre. When renewing bushes, the distance pieces should be renewed also. The bushes will have to be reamered to suit the shackle pin.

Universal Joint and Propeller Shaft.—The needle bearing type of Hardy Spicer propeller shaft is fitted. This is light in construction and is designed so that no periodic lubrication is required for the universal joints ; each joint is filled with lubricant when assembled and no further attention is required unless the joints are dismantled. Should this become necessary it can be accomplished by pinching together the ends of the retainer locking rings or circlips with a pair of pliers, and having removed them from their grooves the bearings themselves can be tapped out from either side. When reassembling the universal joints, the bearings must be refilled with Duckham's Adcol " S " Synchro-Gear Oil.

Before disconnecting the propeller shaft from the gearbox and rear axle flanges, it is a matter of some importance to mark the adjacent flanges in order to ensure that on reassembling, the propeller shaft retains its original relative position.

Should it be necessary to remove either the gearbox flange or the rear axle flanges, it will also be necessary to mark these in relation to the primary shaft and pinion shaft, respectively, before removal.

In addition, when removing these flanges, great care is necessary, as careless removal can so easily distort them, which completely destroys the concentricity of the propeller shaft.

An ideal puller, therefore, is one which will grip as large an area as close to the hubs as possible.

There is one point on the Propeller Shaft which requires lubrication every 500 miles, and this is the splined shaft at the forward end. Access to it is by way of a hole in the propeller shaft tunnel, and gear oil should be applied.

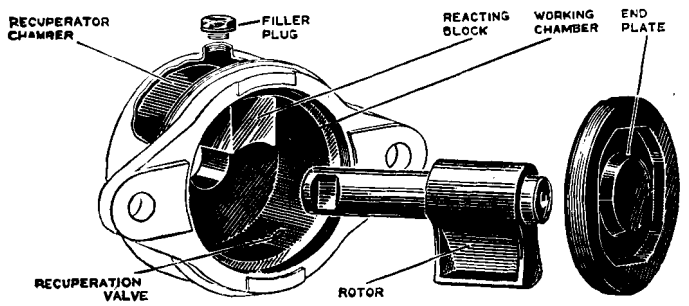


Illustration No. 7.— Showing a Luvax shock absorber dismantled.

Luvax Shock Absorbers.—The Luvax shock absorbers fitted to the M.G. 2-litre are of the hydraulic type and are designed to control the road springs both on compression and on recoil.

The shock absorbers incorporate constant pressure valves arranged to operate at a pre-determined pressure. These valves prevent the resistance of the shock absorbers rising too far, and they are situated in either the reacting block or the rotor. They are accurately set in the factory when being assembled and require no further adjustment, so that no adjusting screw is provided in this type of Shock Absorber.

In order to ensure the proper functioning of this instrument, it is essential that the working chamber should always be completely full of fluid. The whole of the mechanism is therefore enclosed in another cylindrical chamber, or reservoir, in which is maintained a reserve supply of fluid. Any shortage of fluid in the working chamber is automatically made good through valves in the lower wall of the cylinder, and similarly any air which may be present is expelled through a special air duct in the top of the reaction block.

The oil valves fall automatically on to their seats when the shock absorber is doing no work, thus preventing loss of fluid or entry of air into the working cylinder.

The Connecting Links.—Tilting bearings are used in the connecting links between the lever arm and the spring. These bearings consist of round blocks of rubber which grip the bearing portion of the connecting link and obviate the use of ball joints. With this construction they do not require attention such as lubrication, etc.

Replenishment.—Every 10,000 miles the recuperator chamber should be inspected by removing the filler plug on the top of the case, and the fluid replenished if necessary.

It is essential to use only Luvax Official Hydraulic Shock Absorber Fluid. This is a special grade of fluid whose properties have been carefully selected in order to comply with the conditions necessary for efficient working at all times.

It can be obtained from any M.G. Agent, all reputable garages, or any Lucas Service Depot, in sealed one-pint tins with a special pouring spout.

The recuperator chamber must not on any account be allowed to become empty. Under these conditions, air will find its way into the working chamber and destroy the action of the shock absorber. At the same time it should not be overfilled. When the recuperator is three-quarters full there is an ample supply of fluid.

Tyres.—The tyres, being one of the most expensive items in the upkeep of a car, should have special attention that they may give the utmost service.

The most important factor is the maintenance of the correct air pressure, and all five tyres should be checked 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, and the makers' recommended pressures are as follows :—

	Inflation Pressures (lb. per square inch).	
Tyre size.	**Front Tyres.**	**Rear Tyres.**
5.50″ × 18″ (Fort "90")	**30**	**30**

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 and a very little petrol.

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 difficulty.

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.

THE DUNLOP CENTRE LOCK WHEEL, built on the Rudge-Whitworth system, provides the most rapid method of changing road wheels. Like all mechanical devices, it must be properly treated in order to give 100 per cent. service. Observation of the following quite simple hints will ensure complete satisfaction :—

(a) **When the car is new.**—After the first long run, or after fifty miles of short runs, jack up each wheel and hammer nuts to ensure that they are tight.

(b) **When wheels are replaced,** cover both conical surfaces and the serrations in the hub, also the coned surface and threads in the lock-nut, with a light coating of grease mixed with some graphite. Hammer tight and repeat as when car is new.

(c) **When a forced change is made on the road,** remove and grease the hub as soon as convenient.

(d) **Once in twelve months** remove wheels for examination and re-greasing.

(e) **When changing wheels** wipe the serrations and cones on hub, wheel and lock-nut to remove any foreign matter that would prevent the wheel from properly seating. Rust and dirt are the enemies of all mechanical devices.

(f) **After general overhaul** of car, which may involve stripping of axle, the inscription on the lock-nuts should be checked to see that it corresponds with the side of the car on which it is applied.

It is a good practice to change wheels round, including the spare, at intervals of about 2000 miles, thus securing even distribution of tyre wear and preventing the spare being kept out of service too long.

GENERAL.—Always hammer the lock-nuts tight. Lift car on jack before using the hammer. The lock-nuts are designed for self-locking ; but should not on that account be permitted to run untightened, because there is, in such case, a possibility of damaging the splines.

In-built Jacking System.—Operated on the hydraulic principle, the " Jackall " set consists of four single jacks, mounted permanently on the axles.

These are connected by means of piping and flexible joints to the self-contained pump and distributor unit fitted beneath the front floorboards, in front of the passenger's seat on the near-side, and to which access is obtained after turning back the corner of the carpet and lifting off the cover.

To operate, simply apply operating handle (which when not in use is clipped conveniently on the bulkhead, on the engine side), close the release valve by turning clockwise, turn pointer on selector dial to " F " for front wheels, " R " for rear wheels, or " ALL " if the entire car is to be raised, and oscillate the handle to and fro until a considerably increased resistance indicates that the jacks have reached the limit of their extension. A safety valve is provided to prevent excessive pressure damaging any part of the apparatus.

When the car is to be lowered to the ground, the release valve should be opened and the jacks will automatically return into their housings.

The jacks are heavily spring loaded with internal springs, which make it impossible for a jack to fall down.

The diagram shows the distribution of the oil travel system. The oil is pumped from the distributor box to the jacks, which descend from their housings and raise the car off the ground. When the release valve is opened the internal springs in the jacks force the oil back to the fluid container and the jacks automatically return to their housings. When not in use the pointer on the distributor unit should be placed in the " ALL " position and the release valve left open.

To ensure satisfactory working and that damage is not caused to the system, it is essential that only genuine " Jackall " Fluid should be used.

This preparation is the result of extensive research on the part of the makers, and is manufactured to a special formula guaranteed to give the maximum amount of protection to the rubber components as well as thorough lubrication to all bearing surfaces.

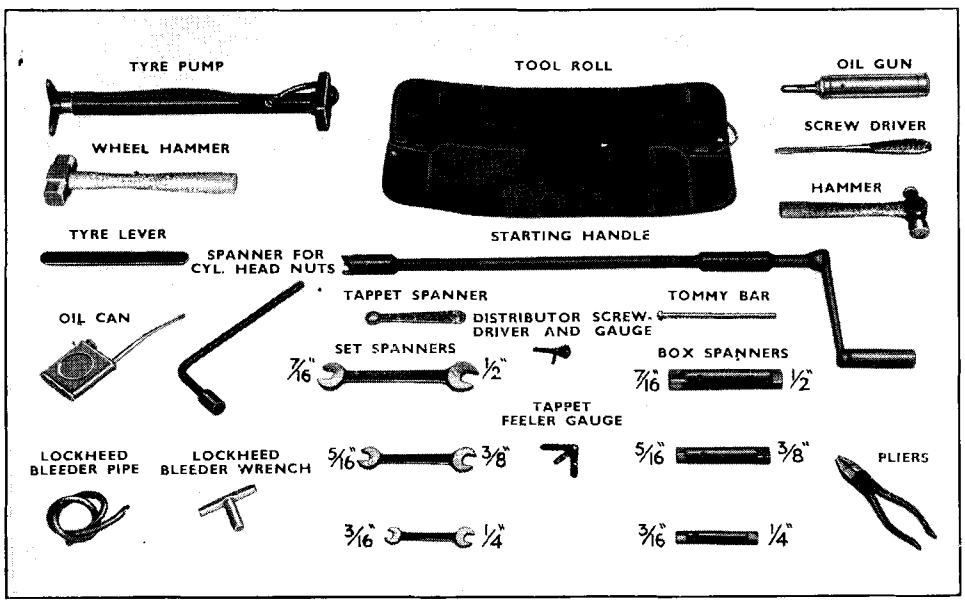
The fluid container is fitted behind the engine on the bulkhead at the near-side. It should be inspected every month and, if necessary, topped up to the level of the mark on the outside of the container.

If it is desired to lay the car aside for an extended period, it is advisable to raise the tyres from the ground. The car should be lifted by means of the jacks and blocks inserted under the axles. The jacks should then be released, allowing the axles to rest on the blocks.

In this way the chassis can be supported equally on four points for indefinite periods without stress or distortion.

Do not leave the car for a longer period than is necessary when raised on the jacks, as all the pipe lines, junctions, etc., are subject to extreme pressure.

Removing Jacks.—If for any reason it is necessary to remove one jack or two, either at the front or rear, it is necessary only to turn the pointer on the distributor unit to the opposite pair of jacks (i.e., to the " fronts " if the rear jacks have to be attended to and the reverse in the case of the fronts). If all four jacks need attention, it is best to empty the fluid from the system by removing one connection, turning the indicator to " ALL " and pumping until the fluid ceases to flow from the open pipe line. **When refilling it is essential that the car is off the jacks, otherwise the system will be overfilled.**



This illustration of the tool equipment is self-explanatory, therefore no descriptive matter is given relating to it. Some of the special tools are, however, referred to in various sections.

THE HYDRAULIC JACKING SYSTEM ON THE M.G. TWO-LITRE

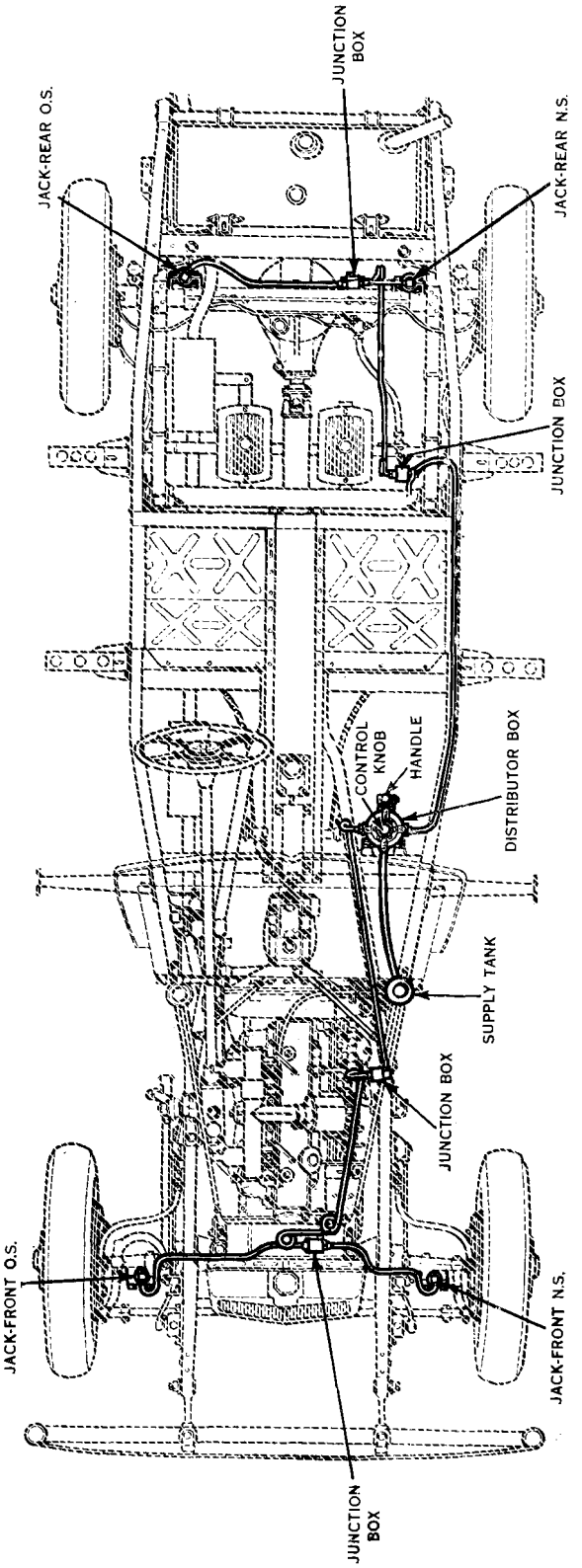


Illustration No. 5.—The jacking system layout.

SECTION C
THE LOCKHEED HYDRAULIC BRAKES

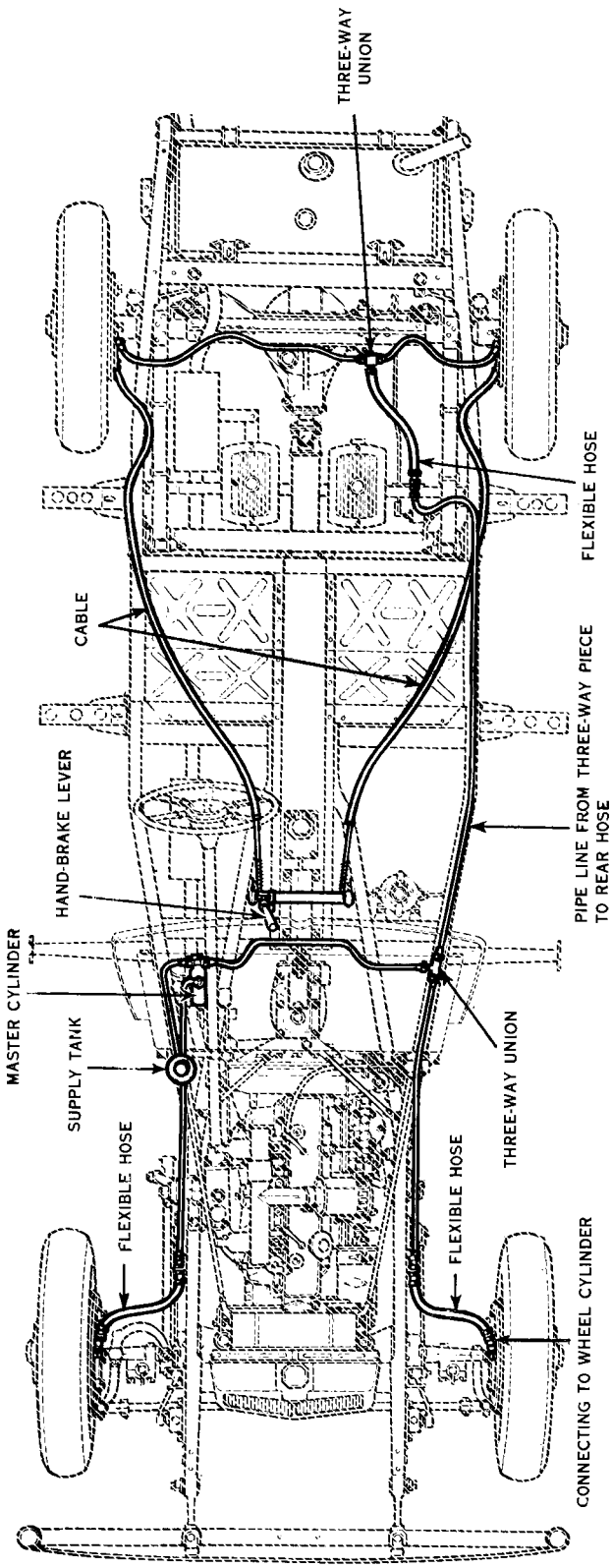


Illustration No. 6.—The Lockheed hydraulic brake layout.

Lockheed Brakes.—In the Lockheed Fluid Brake the effort from the foot pedal is conveyed to the brake shoes by means of a column of fluid, which is incompressible. This **special fluid** has been developed as a result of many years' research, and for Lockheed Fluid Brakes to function satisfactorily and remain efficient, genuine **" Lockheed Brake Fluid Orange " must be used exclusively.**

The Lockheed Fluid Brake consists of a master cylinder in which the hydraulic pressure is generated ; wheel cylinders operating the brake shoes ; a supply or reserve tank by which the system is maintained full of fluid ; and the " line " consisting of copper tubing, flexible hoses and unions interposed between the master cylinder and wheel cylinders.

The master cylinder is fitted with a piston, and the wheel cylinders are each fitted with opposed pistons, all of which are provided with cup washers which act as a seal to maintain pressures and prevent any loss of fluid. When pressure is applied to the foot pedal, the piston within the master cylinder is forced forward, and causes the fluid to flow through the copper tubing and flexible hose connections into the wheel cylinders (Illustration No. 7).

The brake fluid enters each of the wheel cylinders between the opposed pistons, causing the latter to move outwardly against the brake shoes, thus bringing the shoes into contact with the drums.

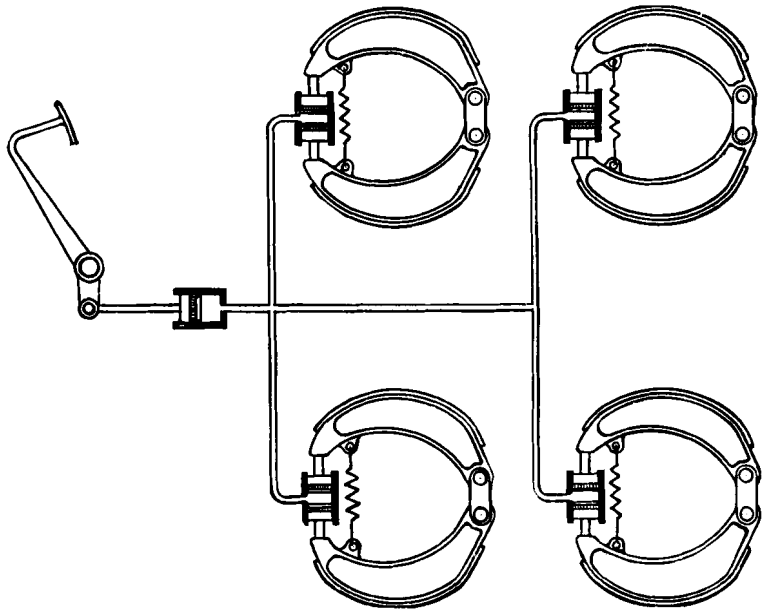


Illustration No. 7.—Diagrammatic view of brake layout.

The pressure generated in the master cylinder is transmitted to each wheel cylinder " with equal and undiminished force," and the efforts applied to all shoe tips are identical, providing perfect equalisation with the maximum of efficiency, thus obtaining infinitely longer wear of the shoe linings.

When the pressure on the foot pedal is released, the brake shoe return springs force the wheel cylinder pistons to their normal " off " position, and the fluid is forced back through the pipe line into the master cylinder.

The Supply Tank.—The supply tank containing the reserve supply of brake fluid is attached to the engine side of the bulkhead on the off-side where it is accessible, and is connected to the master cylinder by a copper pipe.

Examine fluid level at least every month, and keep topped up to within one inch of the cap with **genuine " Lockheed Brake Fluid Orange."**

Examine vent hole in filler cap periodically and keep free from obstruction.

The Master Cylinder (Single Outlet Barrel Type).—The Single outlet Barrel Type Compensating Master Cylinder provides automatic compensation for expansion or contraction of the fluid due to temperature changes.

Within the Master Cylinder (B) is a piston (G) and a cupped washer (F) normally held in the " off " position by a coiled spring (C). Immediately in front of the cup washer, with the piston in the " off " position, is a small port hole (D) connecting the cylinder interior with the hollow boss above it, which is connected by a length of copper tube to the fluid supply tank. With any rise in temperature causing the fluid to expand in the system, the fluid is allowed to pass through the port into the supply tank. With any drop in temperature causing the fluid to contract, the fluid flows back through the port. Thus a constant volume of fluid is maintained in the system.

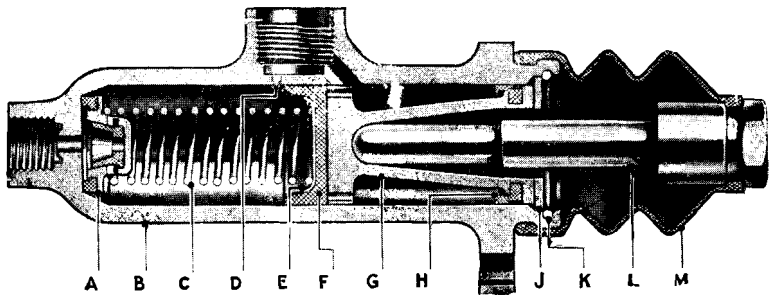


Illustration No. 8.—The master cylinder, the items indicated by letters are referred to in the text.

Pressure is applied to the piston (G) by means of a push rod (L) which is attached directly to the brake pedal.

The open end of the master cylinder is fitted with a rubber boot (M) to prevent the ingress of dirt.

In the head of the Master Cylinder is a combination inlet and outlet check valve (A), which is held in place by the return spring (C). The function of this valve is to cut off the return to the Master Cylinder of fluid pumped into the pipe line during the " bleeding " operation, thus ensuring a fresh charge of fluid being delivered at the next stroke of the pedal.

When the brakes are applied the Master Cylinder piston is pushed forward and fluid is forced through holes in the metal valve body, deflecting the walls of the rubber cup and so passing into the system. When the pedal is released the Master Cylinder return spring forces the piston back to its " off " position against its stop (J). At the same time the pistons in the wheel cylinders, as a result of the action of the brake shoe return springs, are forcing back fluid and so lifting the whole valve assembly off its seat, until the fluid pressure balances with the effort of the master cylinder return spring, and the inlet valve closes.

Leading from the interior of the hollow boss above the cylinder to the annular space formed by the reduced skirt of the piston (G) is a large diagonal port. Through this port the annular space is at all times kept full of fluid from the supply tank, leakage at the rear of the piston being prevented by the secondary cup (H).

If, for any reason, the return of fluid from the pipe line is insufficient to equal the displacement caused by the return of the master piston, a vacuum is created in the master cylinder sufficient to cause the master piston cup (F) to turn in at the lip and allow the fluid to bypass, from the annular space through the small holes in the piston head, into the master cylinder.

Any excess fluid thus introduced into the system will pass freely into the supply tank through the port (D) when the master cylinder piston returns to its " off " position.

The Proper Adjustment of the Brake Pedal.—It is important that the push rod (L) should have a slight clearance where it seats in piston (G) when in the " off " position. Should the push rod be adjusted tightly against the piston the port hole (D) will be covered by the cup washer (F), thus preventing the compensating action of the master cylinder and causing binding brakes.

It is essential that the cup washer (F) should be clear of the port hole (D). To be absolutely sure of this allow the brake pedal a slight amount of free movement before the master cylinder piston starts to move. The adjustment is made at the forked end of the push rod. Lack of free movement may be due to the pedal fouling the floorboard.

To Remove the Master Cylinder from the Chassis.—Drain the supply tank. To do this conveniently, disconnect the pipe at the cylinder head, depress the brake pedal slowly by hand, allowing the fluid expelled to flow into a clean container. Repeat the performance until the tank is drained. Detach the push rod from the foot pedal and, having removed the three bolts holding the cylinder to the chassis, withdraw the cylinder.

To Dismantle Master Cylinder.—Remove the rubber boot and the piston retaining spring clip and washer, and then draw the piston from the barrel. The cup, spring and valve are then removable.

Cleaning after dismantling.—ANY NECESSARY CLEANING MUST BE CARRIED OUT WITH LOCKHEED BRAKE FLUID. NEVER USE PETROL, PARAFFIN OR OIL.

To Reassemble the Master Cylinder.—Dip all parts in **Lockheed Brake Fluid.**

Insert valve body and cup assembly in end of spring and drop in to cylinder, which should be held vertically to ensure valve seats properly. Insert master cylinder cup, pressing it firmly on to end of spring. Replace the piston and secondary cup assembly.

The Pipe Line.—The pipe line is composed of special copper tubing, tested to withstand high pressures, and internally clean and free from any scale or dirt. Inspect periodically for loose or misplaced pipe clips to prevent vibration of the tubing and possible fracture.

The Patent Flexible Hose.—The patent flexible hose is specially manufactured and tested to withstand six times the highest pressure ever applied when braking.

The Wheel Cylinder (Internal).—The wheel cylinder (Illustrations 10/11) is mounted rigidly to the brake shoe back plate, and the opposed pistons act through push rods directly on the tips of the brake shoes. The ends of the wheel cylinder are fitted with rubber boots to protect the cylinder from dust or dirt. At the uppermost position, and between the opposed pistons, is a bleeder screw, required for expelling all air when filling the system (see illustration No. 11).

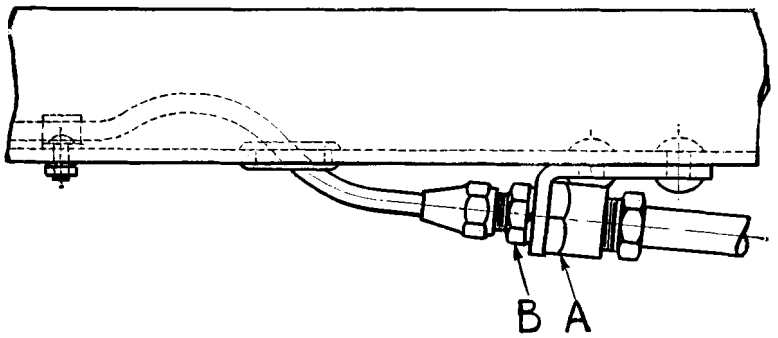
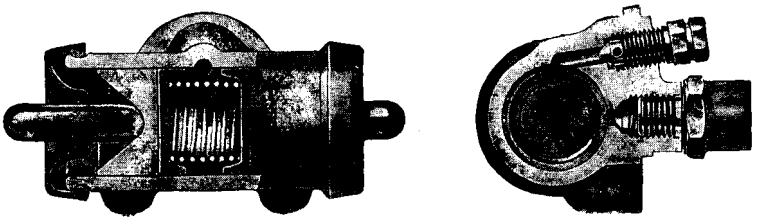


Illustration No. 9.—Showing the position at which to disconnect the copper tubing from the hose union.

DISMANTLING INSTRUCTIONS

Removal of the Front Wheel Cylinder (Internal).—It is advisable not to unscrew the flexible hose at either end. Proceed, therefore, as follows : Disconnect copper tubing from the hose union (A) (Illustration 9) at the frame, then remove the nut and lock washer (B), when the hose union may be removed from the bracket. Unhook the brake shoe return spring. Removal of the two set-screws holding the cylinder to the back plate allows the cylinder to be withdrawn with the hose in place.



Illustrations Nos. 10 and 11.—A wheel cylinder (10) as viewed from the side, and (11) the end view.

Removal of the Rear Wheel Cylinder (Internal).—Follow the above instructions, except that the copper tubing must be disconnected at the cylinder inlet.

Removal of Brake Shoes.—Unhook the brake shoe return spring, remove split pins and washers on shoe steady pins protruding through webs of shoes ; remove horse-shoe circlips retaining the shoes on the anchor pin, the shoes can then be withdrawn. In reassembling, these operations are reversed.

To Re-line Brakes.—When re-lining brake shoes, it is important that the same make and quality of lining be used on all four wheels, otherwise the braking on the wheels will be unequal.

To Adjust Brakes (Internal Cylinder).—When lining wear has reached a point where the foot pedal goes almost to the floor board, it becomes necessary to adjust the brake shoes into closer relation to the drums. Raise the car on a jack until the wheel is free. Adjustment is made by rotating the adjustment cam (A) (Illustration 12) against stop pin (B) on the shoe. Rotate the adjustment nut (C) with a wrench until brake shoe comes into contact with drum, then back off adjustment slightly until the wheel rotates freely without any appreciable drag.

Special Note.—One complete turn of the adjustment nut (C) is sufficient to take up all lining wear. When adjusting, the nut will only require a **partial turn** before shoes are brought in contact with drum.

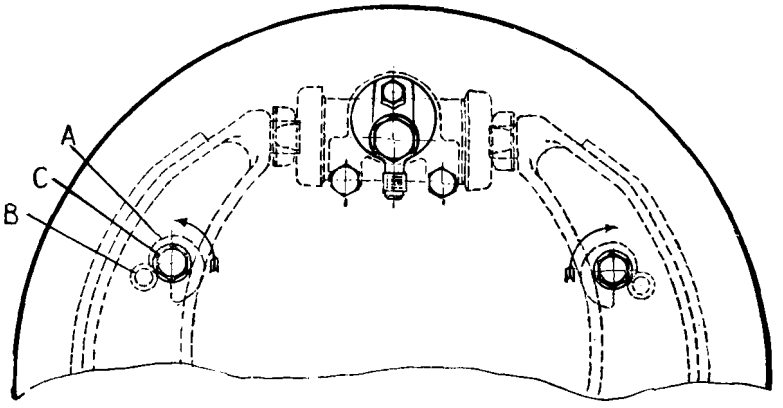


Illustration No. 12.—With reference to individual adjustment of the brake for each wheel.

Bleeding the Line.—Whenever any part of the system has been disconnected it is necessary to " bleed " the system in order to expel all air. Fill the Supply Tank with genuine **Lockheed Brake Fluid** before starting this operation, and keep the tank at least half full of fluid during the whole period of bleeding.

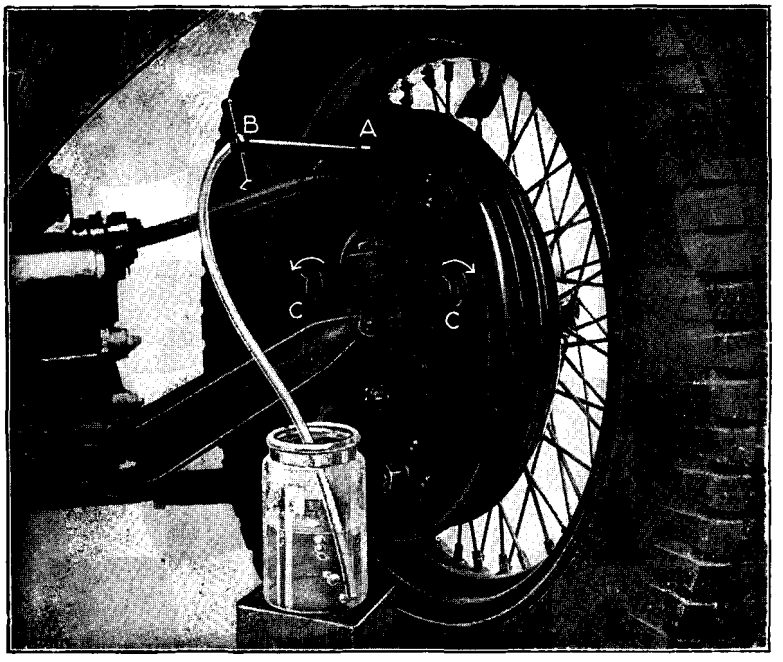


Illustration No. 13.—Bleeding part of the braking system; note the special tool provided for the job.

Remove the set screw at A (Illustration 13) from end of bleeder screw, and screw in the bleeder drain, which is a screwed brass nipple fitted with a rubber tube. Allow the rubber tube to hang into a clean glass container. Unscrew the bleeder screw one turn with the wrench B, and depress the foot pedal quickly, allowing it to return fully without assistance. This gives a pumping action which forces fluid out at the wheel cylinder, carrying with it any air that may be present. No less than ten strokes of the foot pedal will be necessary to bleed each wheel cylinder. Watch the flow of fluid from the bleeder drain, the end of which should be kept below the surface of the fluid, and when all air bubbles cease to appear, close the bleeder screw. The bleeding operation must be repeated on each wheel cylinder, and the supply tank replenished each time. Should the supply tank be drained during the bleeding operation, air will be drawn into the system at this point, necessitating re-bleeding.

Equalization of Brakes.—NO ADJUSTMENT IS REQUIRED FOR EQUALIZATION.

Adjustment is only necessary to compensate for wear of the brake lining. While the pressure delivered to the brake shoes will always be equal, yet paint, grease, oil or any foreign substance on the brake lining will so change the co-efficient of friction of the lining that the brakes will be unequal. This inequality can only be remedied by first thoroughly cleaning the linings with petrol or methylated spirit, and then scraping them. Should the linings be thoroughly saturated, it will be necessary to re-line the brake shoes affected.

IN CASES WHERE BRAKES ARE NOT FUNCTIONING PERFECTLY SATISFACTORILY, THE FOLLOWING INFORMATION IS GIVEN WHICH SHOULD ENABLE THE CAUSE OF THE TROUBLE TO BE DIAGNOSED AND REMEDIED.

SOME GENERAL BRAKE TROUBLES AND HOW TO LOCATE THEM

Excessive Pedal Travel (Requires Pumping).

(*a*) Brake Shoes require closer adjustment to the drums.
(*b*) A Leakage in the System—Tighten joints in the Line.

Pedal Feels Springy.

(*a*) The System requires bleeding, as instructed.
(*b*) There is no fluid in the Supply Tank—Replenish with **genuine Lockheed Brake Fluid.**

Inequalities in Braking.

(*a*) The Linings are not bedded in—Rectify or re-line.
(*b*) Protruding rivets or scored drums—Rectify.
(*c*) Grease on Linings—Should be re-lined.

Poor Braking.

(*a*) Brake Shoe Linings worn down or grease-soaked Linings—Re-line brake shoes with a good quality lining.

Brakes Stay " On " when the Pedal is Released.

(*a*) Brake Shoes are too closely adjusted—Readjust.
(*b*) Brake Shoes seized or tight on their Anchor Pins—Remove shoes and pins, and ease.
(*c*) Brake Shoe Return Springs weak or broken—Renew.

(*d*) No Initial Clearance on Pedal—It is essential to have free pedal play of about half an inch at the pedal pad to allow the piston in the master cylinder to go right back in the " off " position to release excess fluid pumped into the system when the brake is applied. If there is no pedal slack when in the " off " position, it prevents the release of the fluid, thereby keeping the brake shoes on. A floorboard fouling the pedal may cut out this required pedal slack, or an incorrect adjustment of the pedal link gear may also be the cause. (Refer to page 24.)

(*e*) The Master Cylinder Cup and/or Wheel Cylinder Cups sticking in the Cylinder Bores due to the use of spurious fluid—Thoroughly flush out the System with **genuine Lockheed Brake Fluid** and fit new rubber parts.

Brake Drag.

(*a*) The Shoes adjusted too closely to drums—Readjust.

(*b*) Hand Brake operating mechanism seized or is fouling some portion of the chassis, etc.—Lubricate and release hand brake gear where necessary.

(*c*) Brake Shoes are tight or seized on their Anchor Pins, or Brake Shoe Return Springs weak or broken—Remedy this as above.

(*d*) No Initial Clearance on Pedal—Remedy as above.

(*e*) Oil or spurious Fluid in System—Remedy as described above.

(*f*) Wheel bearings are loose—Adjust or fit new bearings.

Brakes Grab or the Car Pulls to One Side.

(*a*) Brake Linings not bedded in correctly—Bed linings to drum and chamfer off the ends of linings.

(*b*) Brake Linings have varying co-efficients of friction (or holding capacities) due to grease, etc.—Clean linings or re-line if necessary.

(*c*) Incorrect inflation of tyres—Rectify.

(*d*) Back-plate loose on axle or front spring loose at its anchorage—Tighten and rectify.

Do not, under any circumstances, use a substitute for genuine **" Lockheed Brake Fluid Orange."** The use of other than genuine **Lockheed Brake Fluid** will nullify **all Guarantees** given by both The M.G. Car Co. Ltd. and the Lockheed Hydraulic Brake Co. Ltd.

If any difficulties are experienced, consult Lockheed Service Station or M.G. Service Dept. for advice.

SECTION D

THE BISHOP CAM STEERING GEAR

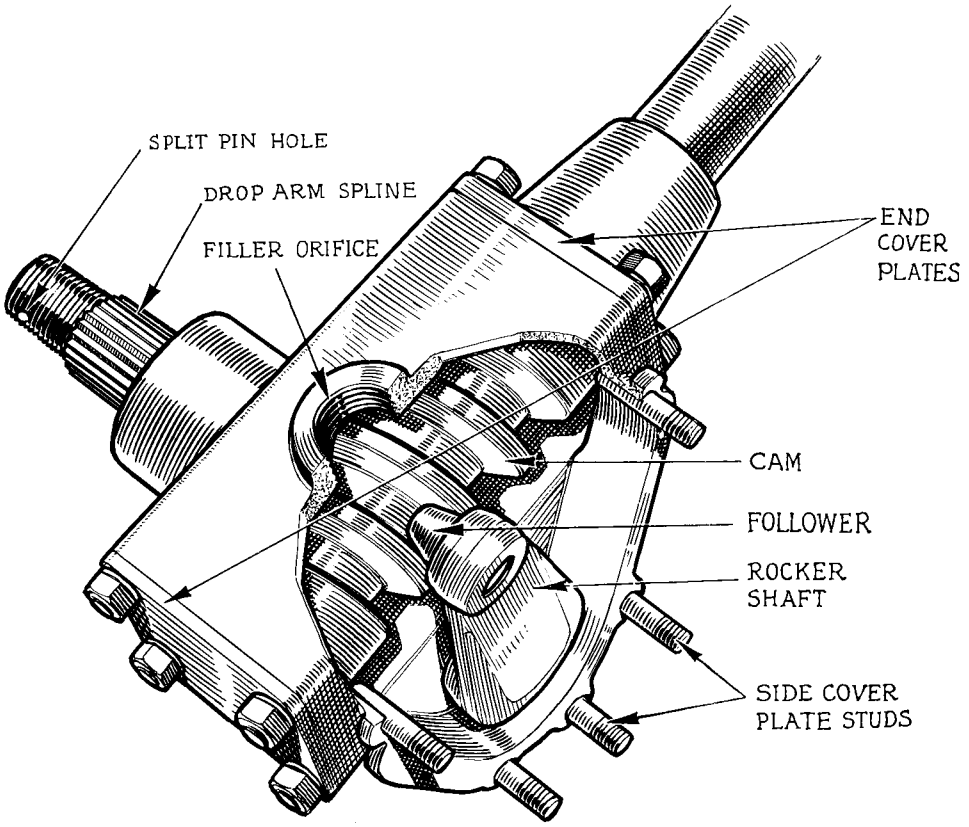


Illustration No. 14.—Internal view of steering gearbox.

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Steering.—The operation of the cam steering gear, which is standard on M.G. Two-litre models, is quite straightforward. A cam, in which a spiral groove is cut, is mounted on the shaft carrying the steering wheel. Into this groove is inserted a follower which makes contact with the cam track.

The cam is mounted between special ball bearings expressly designed for the duty they have to perform. The whole mechanism is contained in an oiltight casing and replenishment at intervals is the only attention required.

Lubrication.—Remove the filler cap on the top of box (see Illustration 14), and, if necessary, fill to the top with gear oil. Check every 2000 miles.

On no account must grease be used with the Bishop Gear.

Adjustments. The Cam.—It will be observed that the cam and mainshaft are mounted on ball bearings which take the thrust from the rocker-shaft, and shims of various thickness are introduced under each end cover so that cam is mounted centrally in the box. It should never be necessary to alter the adjustment, which is carefully set before the car leaves the Works ; but if the gear is dismantled for cleaning or inspection a careful note of the number of shims at each end should be made. On reassembly this shaft should " spin " with the fingers, but there should be absolutely no end play.

The Rocker-shaft.—The only adjustment ever likely to be needed is the removal of one or more shims from underneath the side cover-plate (see illustration on page 29) covering the lever inside the steering gearbox. The motion of the steering wheel is transmitted to the road wheels through the cam and the follower fitted into the lever, and in time a small amount of wear (as shown by " lost motion " between the steering wheel and the drop arm when the road wheels are in the straight-ahead position) may possibly become apparent ; but the whole of this can be removed and the gear restored to its original perfection by the removal of one or more of the shims mentioned. As these shims vary in thickness, a very fine adjustment can be obtained. If too many shims are removed the gear will become a little stiff in the centre of its travel, and this must not be permitted. All adjustments to the steering gear should be carried out with the draglink disconnected.

Reassembling the Gear.—The Cam track is slightly relieved from the centre towards each end, so that whereas in the central position there is practically metal-to-metal connection and the gear should be adjusted so that there is no " play " whatever when the road wheels are straight ahead, provision is made to give a little clearance at full lock in both directions. The amount of this clearance—as shown by the motion of the drop arm—should be equal on both locks, and if it is greater at one end than the other the shims must be adjusted by removing one or more from under the end cover where most motion exists, as shown by the lever **inside** the box, and placing them at the other end until the clearance is equal.

Care should be taken to see that the flat face of the Rocker Shaft takes a good bearing against the hardened side cover-plate, and that the cork gland is in good condition. A new gland can be sprung into position without removing the retaining ring if cut radially at one place on the circle.

All adjustments to the gear should be made before the unit is filled with oil.

Removal of the Drop Arm.—The drop arm is attached to the rocker-shaft on a splined shaft and secured by a slotted nut and split pin. This method of attachment makes the drop arm absolutely secure, but it may be difficult to remove the drop arm from the shaft unless a drawer is used on the lugs provided for this purpose. If difficulty is experienced in removing the drop arm the side cover-plate must be removed first, and the shaft should be driven through the drop arm so that the reaction from the blow is taken on the main casing instead of on the hardened steel cam and roller.

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 the marks on the end of the rocker-shaft and the boss of the drop arm be noted so that they can be fitted together again afterwards in the same relative position.

In case this marking has been obliterated we give below the correct method of fitting, and we would draw attention to this matter, which is of some importance. Should this operation not be properly carried out, most 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 the 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.

Removing the Steering Gear.—First disconnect the batteries as a precaution against shorting, disconnect the wiring cables at the junction box on the steering gearbox, then after removing the screws from the steering wheel hub the controls complete with stator tube can be withdrawn.

The steering wheel is now free to be removed (up to Chassis No. SA.0902 it is secured by nut and key, but subsequently, with the telescopic type, it can be removed from the splines when the circlip has been removed).

Next in order take away the baffle board which extends from the lower edge of the facia to the ramp, the column support, the foot ramp plate and the drop arm. Then, after removing the cap from the chassis securing bracket, the steering column can be withdrawn.

It is important when reassembling to be sure that all draught excluders are fitted correctly, also that if any lubricant has been lost the steering box is replenished with gear oil.

SECTION E

THE ENGINE

General Lay-out

Lubrication

Decarbonising

Removal of Sump, Pistons and Big Ends, Etc.

Removing Engine from Chassis

Removing Crankshaft and Camshaft

Timing

Index is on Page 3

General Description of the Engine.—In order that the owner may become familiar with all the details of the power unit, illustrations have been prepared showing both sides of the complete engine unit suitably lettered to indicate the various parts. More detailed information regarding each component will be given later. It is sufficient at this stage to become acquainted with the position of the various components.

Dealing with the near-side of the engine first (Illustration No. 15), front to rear.

Water Outlet.—The outlet pipe embodies a thermostat, this pipe leads hot water from the engine to the radiator. **The fan** is driven by an endless belt from the crankshaft. The fan spindle is also the spindle which drives the **water impeller** which assists water circulation throughout the engine. The greaser for the water impeller is just below the water outlet pipe (on later cars a new type of water pump is fitted which is lubricated with engine oil). **Dynamo** which supplies the current for the batteries is driven by the same endless belt which drives the fan and impeller. The revolution counter is driven through a reduction box from the rear end of the dynamo.

The front engine mounting bracket, by which the engine is secured to the frame, incorporates rubber blocks fitted between the bracket and the frame. These allow slight engine movement and prevent engine shocks from being transmitted to the frame. **Valve cover**, which is removable to give access to the valve tappet adjustment points, embodies also the oil filler. The **carburetter air cleaner**—this component serves a dual purpose ; besides filtering the air before it enters the carburetters, it serves also as an air silencer. **Sparking plug lead conduit**—this protects the plug leads and keeps them in their respective positions opposite the sparking plug which each one feeds. **Distributor**—a full description of this component is given under the electrical section heading, but note here should be taken of the micrometer adjustments. **Oil dip stick**—this is for determining the amount of oil in the sump and is marked to show the capacity at the time of reading. **The sump or oil container**—this is made from aluminium alloy and is ribbed for cooling purposes. The oil drain plug can be seen just below the body of the oil filter. **Oil filter**—the oil system is so arranged that all the oil delivered from the pump to the bearings and other points of the engine has to pass through it each time it circulates throughout the engine, therefore the lubricant is absolutely filtered before doing its work. **Oil pump** is driven by skew gearing from the camshaft. It draws oil from the sump and delivers it to the filter, already described. **Oil gallery pipe**—after the oil has been filtered, it passes along this pipe to the main bearings, big ends and camshaft bearings. **Overhead oil feed pipe**—feeding from the oil gallery pipe, this carries lubricant to the overhead valve gear. Where it enters the cylinder head, a tap can be seen from which a pipe leads off to the oil pressure gauge on the dash. **Breather pipe**—prevents pressure building up inside the crankcase. A pipe leading from the elbow, shown in the illustration, is carried down into the air stream under the car. **Rear engine mounting bracket**—the function of this is exactly similar to the one in front already described. **The starter motor** has a sliding pinion which, when the starter is put into operation, engages with teeth on the flywheel. The switch can be seen at the rear end of the starter and is operated by a " Bowden " cable connected with the starter switch control on the dash.

Turning now to the off-side of the engine, illustration No. 16, commencing at the front as in the previous illustration.

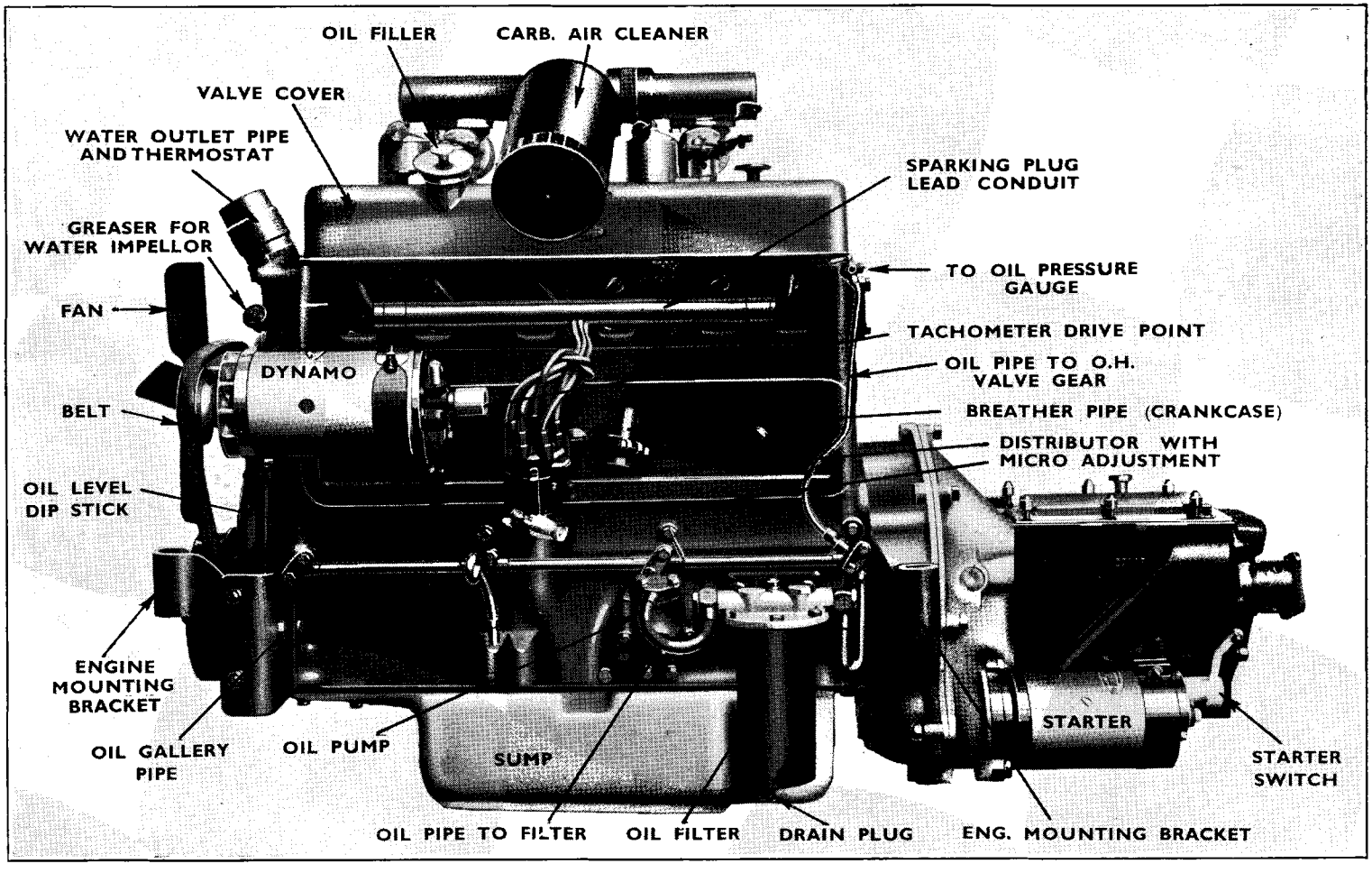


Illustration No. 15.—Near-side view, Two-Litre engine.

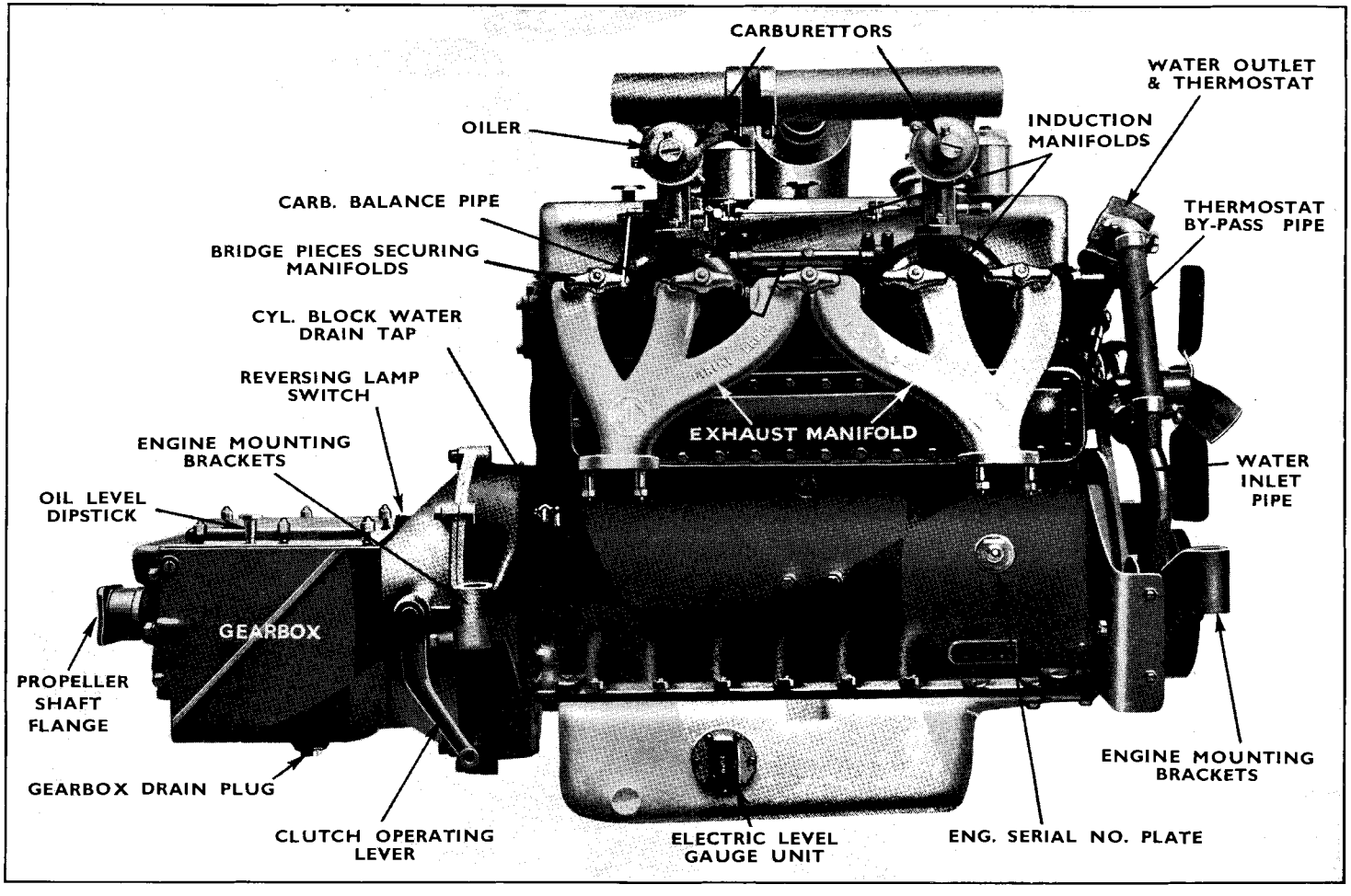


Illustration No. 16.—Off-side view, Two-Litre engine.

Water inlet pipe connects the bottom water connection in the radiator to the water impeller. **Thermostat by-pass pipe**—this pipe only functions when the engine is cold ; it works in conjunction with the thermostat and permits the water to circulate through the engine when the thermostat valve is closed. **Engine serial number plate**—this is really self-explanatory and does not interest the owner as the number is duplicated on the guarantee plate. **Exhaust manifolds**—these are simply a means of connecting the six exhaust ports to the twin pipes leading down to the silencer. **Induction manifolds**—these carry the mixture from the carburetters to the combustion spaces. **Balance pipe**—this ensures that slight differences in the adjustment of the two carburetters is balanced, especially at low speeds, and that each cylinder has an equal supply of mixture. **Carburetters**—nothing further need be said about these at this juncture as a special section is devoted entirely to their maintenance and adjustment. The pipe connecting the two carburetter inlets to the air cleaner is seen immediately above the carburetters. **Cylinder block water drain tap**—the tap below the radiator does not entirely empty the water system, hence the necessity for using the tap shown in the illustration. **Oil level gauge sump unit**—this consists of a rheostat operated by a float inside the sump. Connection to the gauge is through the electric wiring system. **Clutch operating lever**—this is connected to the clutch pedal through the medium of a rod. **Gearbox drain plug**—this is self-explanatory. **Propeller shaft flange**—the needle-bearing Hardy Spicer propeller shaft is connected at this point. Special instructions regarding this will be found under the propeller shaft heading. **Gearbox oil level dipstick**—this is for determining the quantity of oil in the gearbox and, like the engine dipstick, is graduated to show the capacity at the time of reading.

Reversing Lamp Switch—this is automatically operated when the gear lever is put in the reverse position. It controls a lamp placed at the back of the car. As this light is not required during the day time, it comes into operation when the side and tail lamps are switched on.

The Engine Lubrication.—The sump, when full, contains approximately 2½ gallons of oil. It is replenished through the filler cap on the top of the valve cover. The drain plug is towards the rear on the near side. Of this oil, one gallon must be added before any reading shows, either on the oil gauge on the dashboard or on the dipstick.

The oil feed connection to the pump consists of a swinging arm, at the end of which a suction strainer provided with a float ensures that the oil fed to the engine is sucked from the top of that in the sump, thereby giving any sludge formed in the oil, or grit inadvertently introduced or produced by internal wear, the maximum opportunity to settle to the bottom.

The oil pressure control valve is a spring-loaded ball which controls a passage formed in the oil pump bottom cover casting between the suction and delivery sides of the pump pinions. The spring is non-adjustable, and is set to allow the ball to by-pass oil at 80 lbs. per square inch. See page 38.

The oil from the pump next reaches the " Tecalemit " oil filter. There are two possible ways from the " In " to the " Out " connection of this filter. First, the proper one, through the cleaning element. Second, the emergency path round the top of the cleaning element and through the by-pass valve. The spring of the by-pass valve is such that, provided the filter is attended to periodically (renew the element after the first 1000 miles and subsequently every 10,000) the valve remains permanently closed ; should it become clogged, however, the by-pass valve will open and allow unfiltered oil to reach the engine. See page 38.

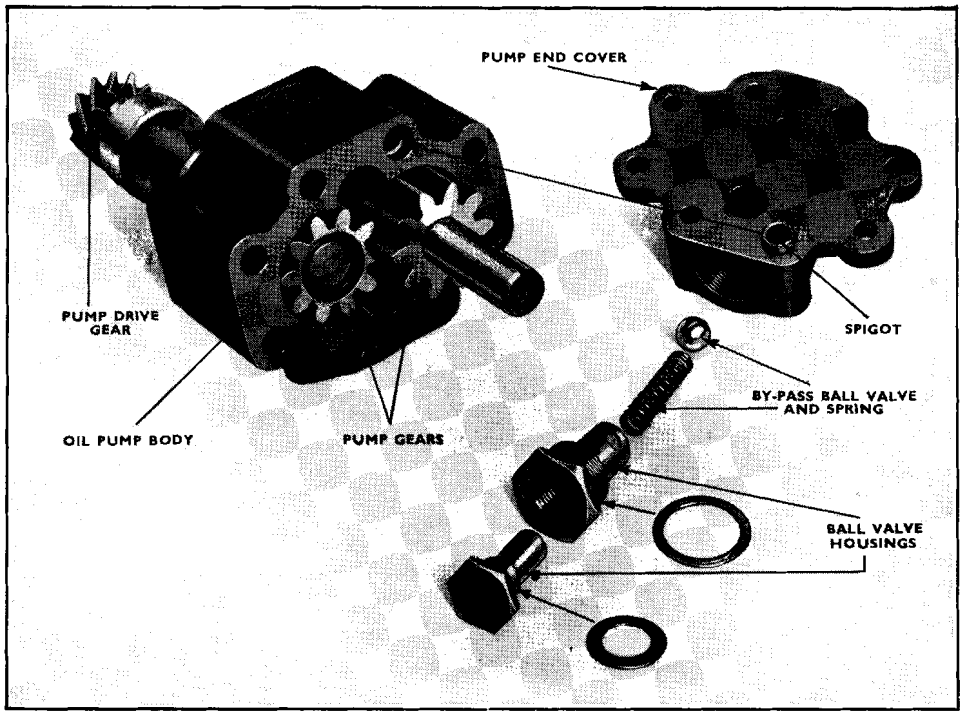


Illustration No. 17.—Oil pump.

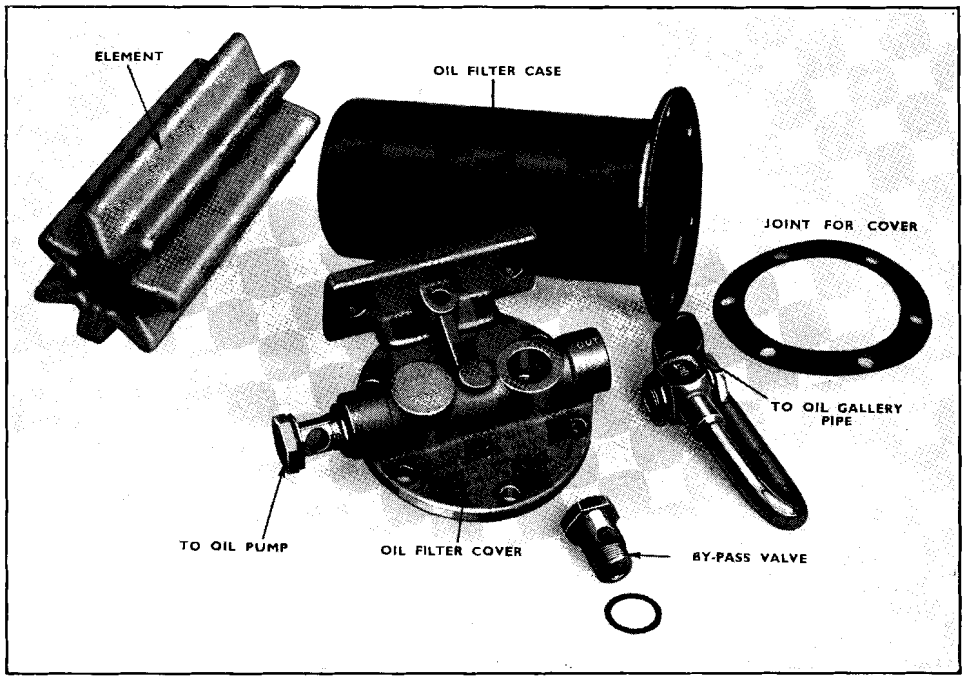


Illustration No. 18.—Tecalemit oil filter.

From the " Outlet " connection of the oil filter, the oil is led to the rearmost of the four unions by which the oil gallery pipe is secured to the side of the cylinder block. Each of these connections forms a union by which oil from the gallery pipe is transferred to the holes drilled in the cylinder block casting, of which there are two, one drilled diagonally upwards to feed a camshaft bearing, the other diagonally downwards to feed a crankshaft main bearing. Taking these unions in order, counting from the front, No. 1 feeds the front main bearing and the camshaft front bearing. The front main bearing feeds No. 1 big end through a ring cut in the white metal, the hole drilled up the crank web, and the inserted pipe, which in turn feeds No. 1 cylinder wall through the spray hole drilled in the off-side of the big end. The camshaft front bearing has a forward leak to the camshaft chain wheel thrust face, and from there are three diagonal holes through the gear wheel boss to the inside of the wheel rim, whence radial holes take oil to the chain links. Union No. 2 feeds the camshaft second bearing and the second main bearing. The second main bearing feeds Nos. 2 and 3 big ends and cylinder walls as already described. Union No. 3 feeds the third main bearing, and thence Nos. 4 and 5 big ends and cylinder walls, the oil pump driving skew gears, which are in the middle of the third camshaft bearing, and the third camshaft bearing are also fed from here. Union No. 4 feeds the rear main bearing and the rear camshaft bearing, and the vertical pipe which takes oil to the rocker shaft and the oil pressure gauge. The rear main bearing feeds No. 6 big end and cylinder walls, and the clutch by a hole drilled up the centre of the crankshaft.

The oil which has passed the clutch plates escapes through gauze windows in the clutch spring plate into the clutch housing, where it is picked up by the teeth of the starter motor ring on the flywheel and thrown into a gallery on the nearside of the flywheel housing, whence it drains back to the sump.

At the top of the vertical oil pipe at the rear of the engine is a union, fitted on the outside with a screwed tap, to which the connection to the oil pressure gauge on the dashboard is fitted. The inner side of this union is drilled to communicate with passages drilled in the cylinder head to register with a hole drilled in the rear rocker shaft support and so to the inside of the hollow rocker shaft. The rocker shaft is drilled at each rocker, and the oil which passes the rocker bushes finally finds its way down the push rod passages to the sump.

Water Impeller.—Should it be found necessary to service the water impeller, it is advised that the unit complete is taken off and returned to the factory and replaced by a service one. Spare parts for the impeller can be supplied, but the replacement system will be found more satisfactory and economical.

Thermostat Control.—This device is situated in the water outlet pipe between the cylinder head and the top tank of the radiator. On starting from cold it automatically isolates the radiator from the engine and allows only the water in the engine to circulate until a pre-determined temperature is obtained, approximately 80° C. Above this temperature, the thermostat valve opens and allows the entire water system to function. The purpose of the thermostat is to allow the engine to warm up quickly, and as it is entirely automatic in operation, there is no provision for adjustment. It should be noted that the water temperature thermometer connects to the thermostat on the engine side. So should the thermometer show an unduly high temperature and the radiator at the same time be cool, it is an indication that the valve is sticking. The instrument, however, is very simple and unlikely to give trouble.

The Carburetter Air Cleaner and Silencer.—The air cleaner and silencer functions in the following way :—

Air enters the cleaner and passes through the central tube A. Any sound waves produced and passing from the carburetter would also ordinarily pass through this tube into the car; but in the case of the intake silencer they pass through passages B and B.1 into resonating chambers C and C.1, and thus set up counter waves which eliminate or considerably damp the original waves, so that no sound waves pass from the air intake tube A. The filtering medium D is oil-wetted woven mesh, to which dust from the incoming air adheres.

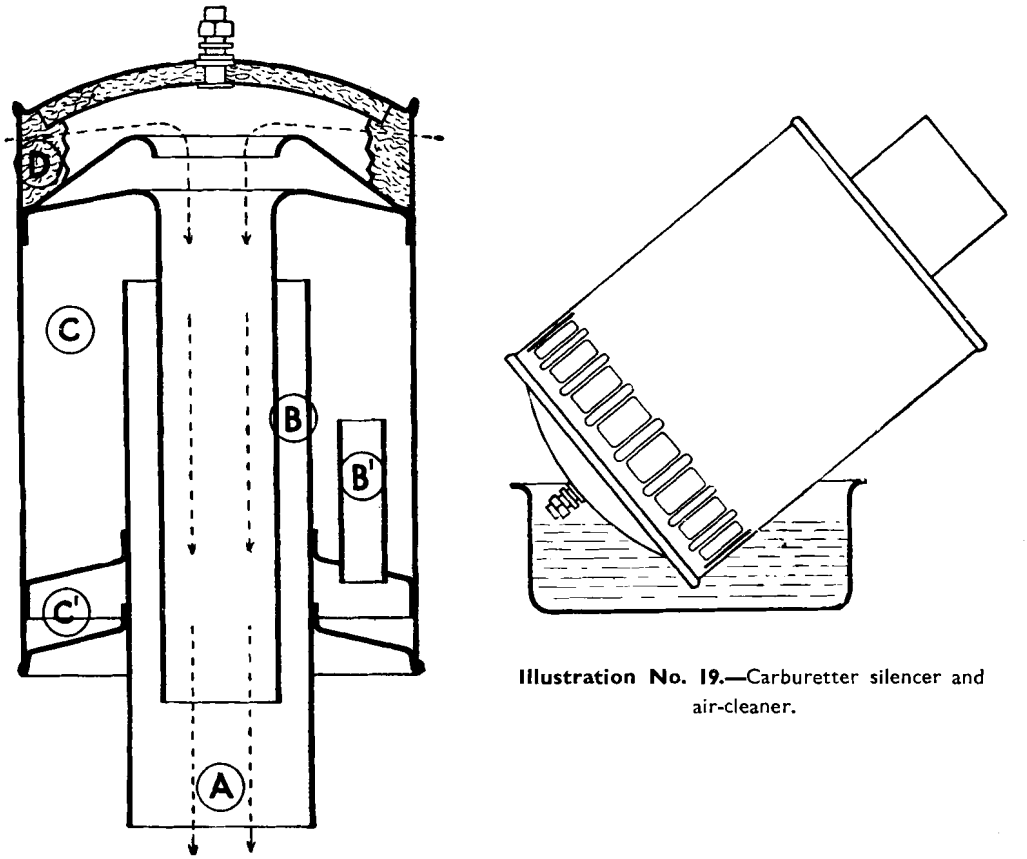


Illustration No. 19.—Carburetter silencer and air-cleaner.

Cleaning and Re-oiling.—Every 5000 miles these oil-wetted air cleaners need cleaning and re-oiling. This is best done by swilling the louvred end of the cleaner in a shallow pan of petrol, as shown in the illustration.

After drying, the filtering mesh should be re-oiled with engine oil, allowing any surplus to drain off before refitting the cleaner to engine.

Decarbonizing.—First of all drain the water system by opening the tap at the bottom of the radiator, and the small tap on the off-side of the cylinder block, see illustration No. 16.

Remove the bonnet altogether after taking out the two screws at the rear end of the bonnet hinge.

Detach the cables from the sparking plugs. As they are carried in a fibre tube clipped to the cylinder head, there is no fear of confusion when reassembling. Remove the screws securing the fibre tube and unclip the distributor head. This allows the H.T. wiring to be taken away complete.

Now take out the six sparking plugs, being careful not to break the porcelain centres.

Next remove the petrol pipes, the throttle control and the mixture control. Uncouple the exhaust pipe from the manifolds and undo the support by which they are held to the cylinder block, and let them hang. The carburetter assembly and the exhaust manifolds are then held only by the five securing bridge pieces. To lift away the carburetters and exhaust manifolds, first remove the bridge pieces and take away the carburetter assembly and all its attachments and the exhaust manifolds.

The top water joint embodying the thermostat is secured to the cylinder block by setscrews, these should be removed and the water connections left attached to the rubber hoses. There is no need to remove the assembly as the cylinder head can be lifted clear without disturbing them. When reassembling, a new gasket will be needed at this point, and it is therefore advised that one is obtained before commencing the job.

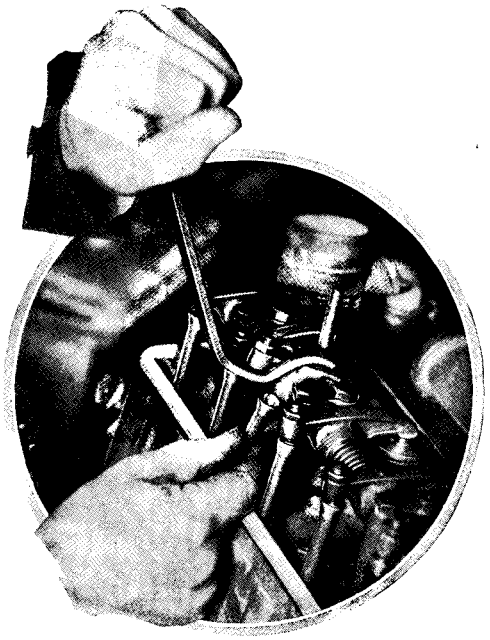


Illustration No. 20.—Showing method of removing valve push-rods.

Remove the oil feed pipe to the rocker gear at the point where it connects to the oil gauge tap or union.

The cylinder head is now clear of all attachments. Remove the valve cover. The push rods will then have to be removed before proceeding further ; illustration No. 20 shows a special tool which facilitates this operation.

After removing the eighteen cylinder head holding-down nuts with the special cranked spanner provided in the tool kit, the cylinder head can be lifted clear.

Removing the Gasket.—The copper and asbestos gasket is not difficult to remove, providing that it is lifted squarely with the cylinder head studs. If lifted at an angle, it will jam on them. As the copper either side of the asbestos is very thin and soft, it is easily damaged and the gasket rendered useless.

After the cylinder head has been removed, stuff the open ends of the cylinders with clean rag to prevent the possibility of damage to the cylinder walls. The cylinder head can then be dealt with. The valve springs are secured by means of split cotters, and to remove each valve the cylinder head should be placed on a bench, combustion chambers downwards, with a wood block or suitable packing piece which fits in the combustion space below the valves which are being dealt with. By depressing the valve spring from above, the two cotter halves can be removed and the spring and its cap will then lift away from the valve, which can be withdrawn from below.

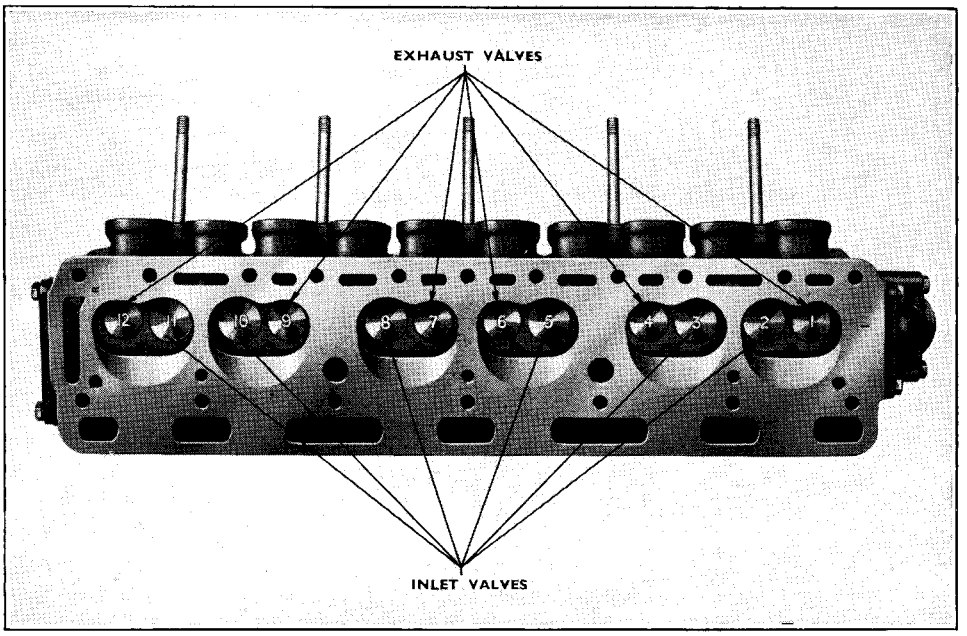


Illustration No. 21.—Showing how the valves are numbered and their positions in the cylinder head.

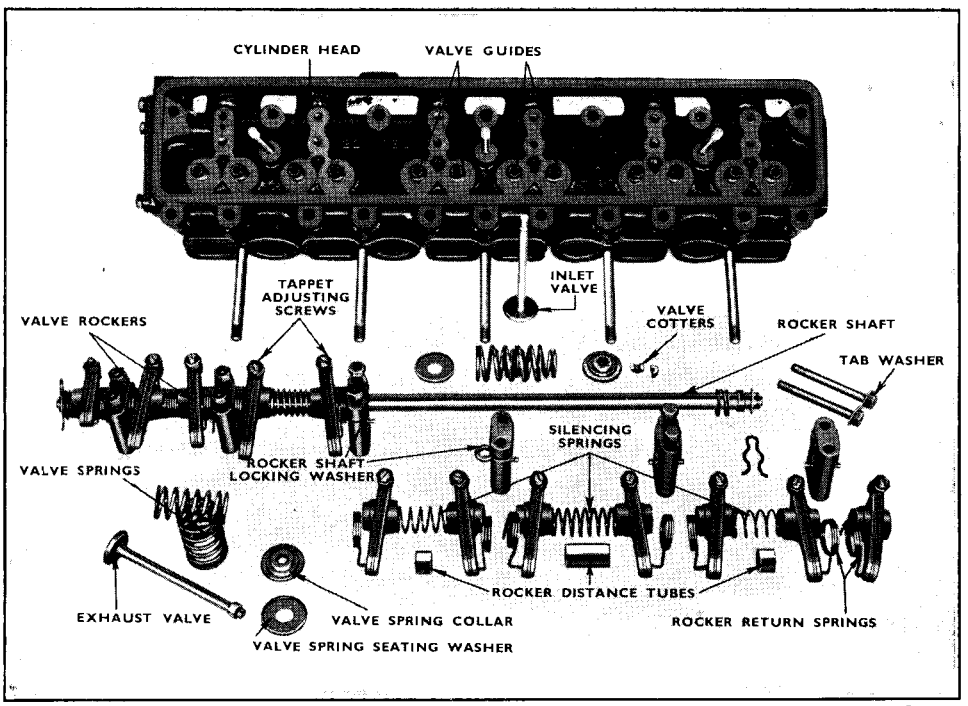


Illustration No. 22.—Showing the relative positions of all the parts contained in the rocker gear.

N.B.—Rocker return springs are not fitted on later models.

Removing Carbon from the Head.—The next operation is thoroughly to clean the head. Remove the carbon with a wide screwdriver or similar blunt tool, taking care not to damage the valve seatings. After washing the complete head thoroughly, it is advisable, if possible, to dry it off by blowing with compressed air rather than wiping over with rag which is inclined to leave particles of fluff on the casting.

Grinding-in the Valves.—Examination of the valves will show that the edges of their mushroom-like heads are bevelled off at an angle to correspond with the similar bevelled edges of the valve ports in the cylinder head and thus provide a gastight joint when they are in contact. Obviously, gastightness is not attained if these bevelled edges are dirty or "pitted," and in order that they make perfect contact over the whole of their surfaces it is necessary to grind them in. When grinding-in the valves the utmost care should be taken to see that they are inserted into the correct port. (See illustration No. 21.) No. 1 is at the front end of the head.

The grinding-in process consists in coating the bevelled face of the valve with a small quantity of valve-grinding paste—applied on the end of a match-stick—reinserting the valve in its guide and partially rotating it backwards and forwards, using a suitable tool that will grip the valve stem. Here we come to the secret of good valve-grinding. The valve should be raised from its seating every few reciprocations and given a half turn in order that the grinding compound may spread itself evenly over the whole surface. If this is not done there is the possibility that minute circular grooves will be cut into the face of both the valve and its seating, which will absolutely prevent the obtaining of a good gastight fit.

Probably the most convenient way of carrying out this periodic lifting is to obtain a light coil spring (similar to the valve spring, but much lighter) and insert it into the valve port beneath the valve head. When pressure is released from the valve it will pop up, when it can be easily rotated into a fresh position.

It is not necessary to continue grinding the valves once the faces of both valve and seating have assumed a clean, even, matt-surfaced appearance. A polished surface must not be expected and is quite unnecessary. If the engine has been run for a long period without being decarbonised, the valve may be badly "pitted"—that is to say, it will have a number of small black spots or depressions on its face. Should these depressions be at all excessive or deep, it is best to have the valve face trued up on a special machine to an angle of 45°. In extreme cases it may be necessary to treat the valve seats in a similar way. This will prevent needless grinding away of the valve seating in the cylinder head—a matter of importance, as it cannot be renewed. Any valves which are distorted should immediately be replaced by new ones. To attempt to grind them in will only produce extensive damage to the seating.

After each valve is ground-in it should be withdrawn and carefully washed in petrol, and, what is equally important, the valve seating and the surrounding valve port should also be thoroughly cleaned with a rag moistened with petrol. Do not wash out the valve ports with petrol or paraffin or some of the grinding compound will find its way into the valve guides or other working parts, and it is of the utmost importance that it should be prevented from finding its way on to any of the working surfaces of the engine, where extensive damage may be done.

Reassembling the Valves.—When you have satisfied yourself that all trace of the grinding compound has been removed, the valves may be reassembled. Care should again be taken to see that they are in their correct ports. Reassembly of the valve is not a difficult matter. After inserting the valve in its guide and resting its head on the wood packing block, the valve spring may be placed in position with the valve spring cap resting on top of it. Engage a tool on the cap and depress the spring to expose almost the whole of the groove in the upper end of the valve stem, into which insert the two conical cotters (small ends downwards) and gradually release the spring. Make sure that the cotters are properly engaging in their grooves.

The Rocker Gear.—Should it be desired to examine the rocker bushes, the rocker shaft may be detached complete with its six holding brackets by unscrewing the bolts which hold them to the cylinder head. It will be noticed that the two middle holding brackets are slotted and that washers are inserted in these slots to engage with Woodruff keyways in the rocker shaft to prevent it turning. These washers may be picked or shaken out, and when the " hairpin " retaining springs are removed, the rockers, return springs, silencing springs, distance tubes and holding brackets may be drawn off the rocker shaft one after the other.

Before reassembling the rocker gear, refer to illustration No. 22, which shows the correct position of all the components, and will be of great assistance when reassembling.

In replacing the rocker shaft, particular care must be taken of three points : (i) That the correct holding bracket is put on the rear end of the shaft. This bracket has a hole drilled up its centre to convey oil to the hollow rocker shaft. (ii) That the washers engage properly with the keyways cut in the shaft. (iii) The tab plates which lock the holding-down bolts should be carefully inspected for any sign of cracking where they have been bent up round the bolt heads and straightened out again. If one of the bent-up corners of these plates should break off it is likely to find its way by one of the oil return passages into the sump ; and, while the lubrication system is such that it is unlikely to do any damage there, loose pieces of metal inside an engine are to be avoided if possible.

Valve Guides will need renewing periodically. The oiling of plugs is an indication. This should not be undertaken by the owner as the guides need very accurate fitting, and we recommend that it be left to an authorized M.G. repairer, as both the removal of the old guides and the fitting of the new ones require a special tool and a press to prevent crushing. The correct clearance between the valve guide and valve stem is .003". After new valve guides have been fitted, it will be necessary to true-up the valve seatings to ensure that they are concentric with the new valve guides.

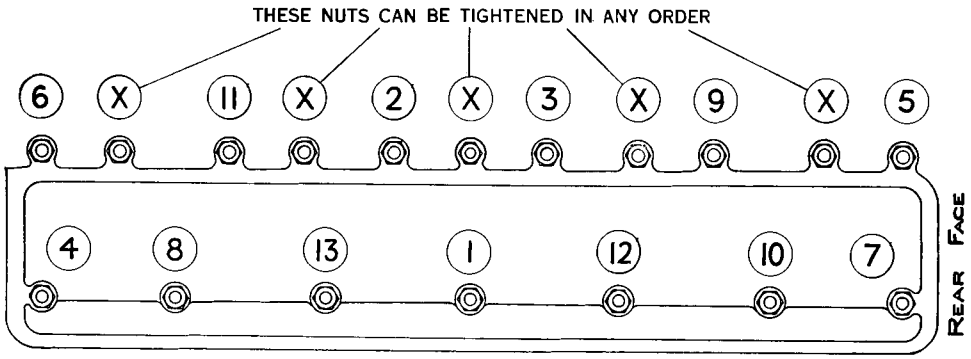
Cleaning the Piston Head.—First of all, turn the engine until the piston to be cleaned is at the top of its stroke. It is important to realize that the pistons are aluminium alloy, which is a soft metal. Very great care, therefore, must be taken not to damage them when cleaning. A very blunt instrument and no hard pressure is the best method, and under no circumstances must an abrasive such as emery cloth be used. Carefully remove all particles of carbon and make sure none gets in the water ways or cylinder bores.

Refitting the Cylinder Head.—Make sure the surfaces of both the cylinder block and cylinder head are clean; it is not necessary to use a jointing compound for the gasket, but it may with advantage be smeared with grease. Having slipped the gasket over the studs, next lower the cylinder head into position and fit the eighteen cylinder head securing nuts finger tight. Illustration No. 23 shows the correct order for tightening down the major securing nuts. The remainder may be tightened down in any order after the major ones have been dealt with.

The push rods should next be fitted, adopting the reverse method to that described for removal. Since the valves have been ground in, it is necessary to check the tappet adjustments to make sure there is a clearance; this, of course, will be readjusted after the engine has been completely assembled and run. Now fit the valve cover, not forgetting the cork gasket; the gasket is not very wide, so be sure that the cover fits squarely on it. It is advantageous to solution the cork gasket to the cylinder head, but not to the valve cover.

The next point to attack is the oil feed pipe to the rocker gear, after which the water joint should be re-made and the elbow connected. If the gasket has been damaged, both faces must be cleaned thoroughly and a new gasket fitted. To make a good joint use one of the special compounds or shellac. As the water joint elbow is a casting, it is necessary to pull down the securing bolts evenly.

Now refit the exhaust and induction manifolds complete with carburetter assembly. As far as fitting is concerned, this is a quite straightforward operation. The five securing nuts holding the manifolds and carburetters should be tightened down evenly. All the major items are now fitted, and attention should be turned to the smaller points—fit the mixture control, throttle control and exhaust pipe to the manifold, not forgetting the stay pieces. Don't forget the gaskets when connecting the exhaust pipes to the exhaust flanges, also to pull up the three nuts evenly on each flange.



CORRECT SEQUENCE FOR TIGHTENING UP MAJOR HOLDING DOWN NUTS

Illustration No. 23.

Sparking Plugs.—The correct sparking plugs are Champion L.10 (14 mm.). We do not advise that the owner dismantles the sparking plugs, and since it is necessary that the plugs are tested periodically we recommend they are taken to a service station equipped with plug servicing equipment which can be entrusted with this job. When having the job done, specify that the points be checked and, if necessary, adjusted to .018 in.

Now replace the sparking plugs into the cylinder head, fit the fibre tube, connect the H.T. leads to the plugs, and replace the top of the H.T. distributor. It is possible that the distributor points may need some attention, and full details of this will be found on page 76.

All the components have now been fitted back on the engine, and it remains to close the two taps on the water system and refill the radiator with water, preferably soft water. Switch on the ignition which automatically turns on the petrol pumps, and check the petrol connections to see that there are no leaks. The engine can now be started and allowed to run at 1500 r.p.m. until the water thermometer shows a temperature of between 70° and 80° C.

Final Adjustments after Decarbonizing.—Whilst the engine is at the temperature mentioned, remove the valve cover, retighten the cylinder head holding-down nuts and adjust the tappets.

The tappet adjustment is effected by means of the ball-ended screws which engage the tops of the push rods. The clearance should be .015" for all valves when the engine is **hot.**

For very fast touring this clearance may with advantage be increased to .019" **when the engine is hot.** This will slightly increase tappet noise when the engine is idling, but will be beneficial at speed.

As the backs of the cams are truly circular it is not necessary that the cam should be exactly at 180° to the tappet when checking clearance. The following routine will enable all the clearances to be checked, and adjusted if necessary, with the minimum turning of the engine. Turn the engine till No. 1 exhaust valve (the first counting from the front) is fully open. Then check the clearances on

	No. 2 exhaust.	The	4th	counting from the front.	
	No. 3 inlet.	,,	5th	,,	,,
	No. 3 exhaust.	,,	6th	,,	,,
	No. 5 inlet.	,,	10th	,,	,,
and	No. 6 exhaust.	,,	12th	,,	,,

Then give the engine two-thirds of a turn when No. 3 exhaust (the 6th counting from the front) is fully open, and check the clearances on

	No. 1 exhaust.	The	1st	counting from the front.	
	No. 2 inlet.	,,	3rd	,,	,,
	No. 4 exhaust.	,,	7th	,,	,,
	No. 6 inlet.	,,	11th	,,	,,

Then give the engine another two-thirds of a turn when No. 2 exhaust (the 4th counting from the front) is fully open, and check the clearances on

	No. 1 inlet.	The	2nd	counting from the front.	
	No. 4 inlet.	,,	8th	,,	,,
	No. 5 exhaust.	,,	9th	,,	,,

Having adjusted the tappets, the valve cover should be replaced.

Finally, replace the bonnet, not forgetting the two screws that secure the hinge rod support at the rear end.

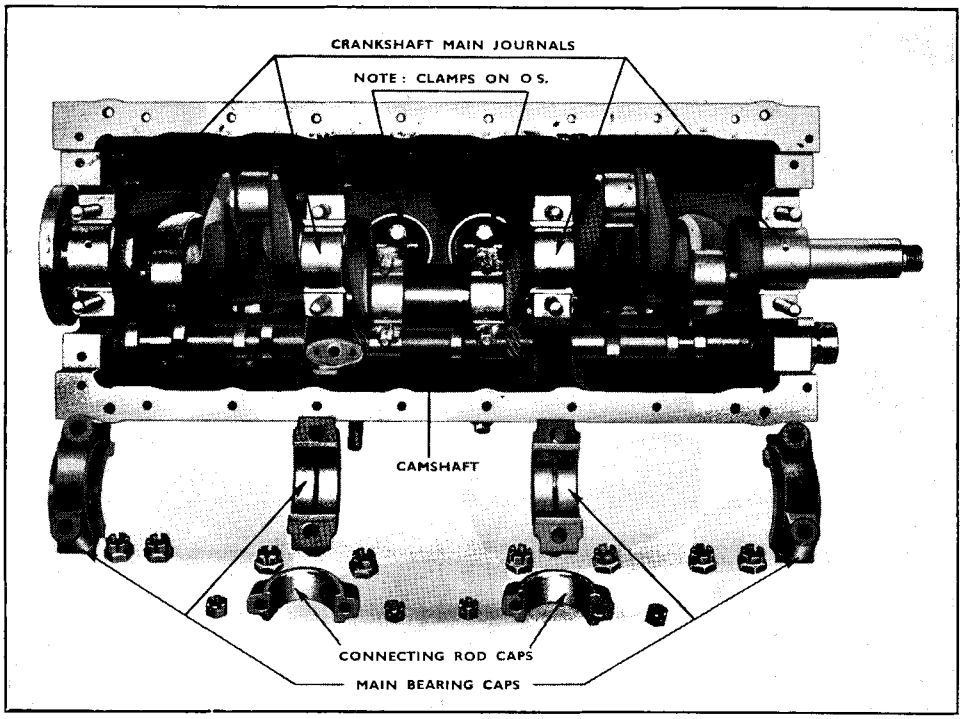


Illustration No. 24.—Interior view of engine partially dismantled.

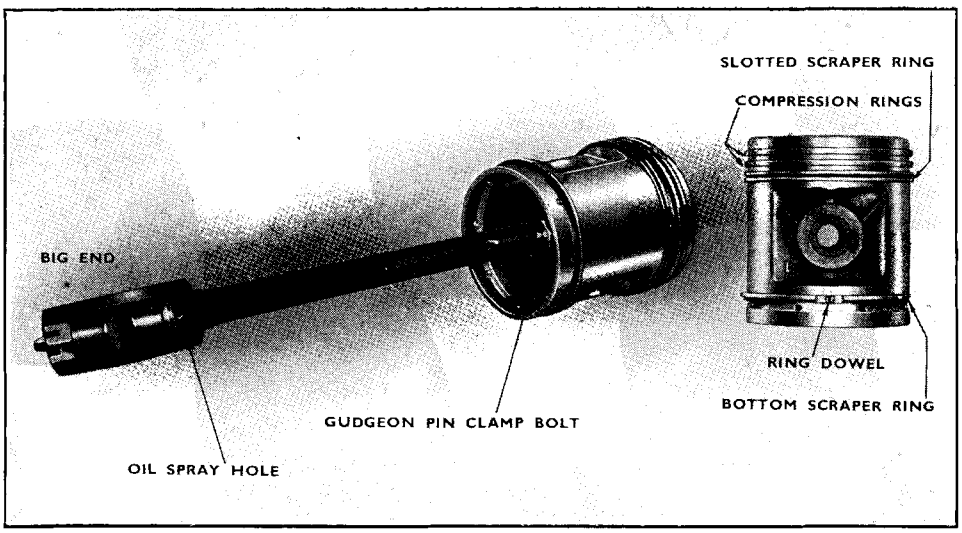


Illustration No. 25.—Piston assembled to connecting rod, also position of piston rings (first type).

Removing Connecting Rods and Pistons.—The first operation is to drain the sump. Then the car should be raised at the front on trestles, the sump can then easily be removed after disconnecting the lead connected to the oil gauge rheostat fitted in the sump. The next operation is to remove the split pins and nuts from all big end bolts, when the bottom caps can be withdrawn. Remove the connecting rod and piston complete, taking care before putting on one side to replace the cap in the same position as it was before removal. It is as well also to replace the nuts to ensure that the connecting rod and its cap do not become separated. (See illustration No. 24.)

Illustrations Nos. 25 and 26 show connecting rods complete with pistons and pistons separately. When separating a piston from its connecting rod, special care will have to be exercised when undoing the pinch bolt in the small end of the connecting rod. It will have to be removed entirely, as it fits in a groove in the gudgeon pin. It is inadvisable to hold the connecting rod in a vice while the pinch bolt is undone, as a procedure of this sort is liable to distort the connecting rod. The correct method is to employ end pads which can be inserted into the open ends of the gudgeon pin and which extend beyond the sides of the piston and can be gripped in the vice without fear of damage.

The Fitting of Pistons.—Should it be necessary to replace or refit pistons, the correct clearance between the piston and the cylinder wall below the three top piston rings, and at 90° to the gudgeon pins, is as follows :—

Up to and including Engine No. **QPHG1165**
.11 mm. or its equivalent, .0043".

When a new type of piston was fitted commencing at Engine No. **QPHG1166** :
.064 mm.—.076 mm. or its equivalent, .0025"—.003".

Piston Rings (Ceasing Engine No. QPHG1165).—Referring again to Illustration No. 25 (this is the original type of piston which ceased at Engine Number as stated), it will be noted that there are four piston rings and three different types : the two top ones are perfectly plain, being simple compression rings ; the third one is an oil scraper ring, so also is the fourth one on the skirt of the piston. The two scraper rings are entirely different and must not be changed over.

The bottom scraper ring has square ends instead of angle ends as is the case with the three top rings, the reason for this being that it is pegged in position ; care, however, must be exercised when refitting in the cylinder bore to see that this piston ring is not riding over the top of the peg.

Piston Rings (Commencing Engine No. QPHG1166).—Referring to Illustration No. 26, which is the latest type of piston, it will be seen that it differs from the earlier type since it has only three rings instead of four. The two top rings are perfectly plain, being simple compression rings ; the third ring is an oil or scraper ring.

When fitting new rings of either type the gap measured when they are compressed in the cylinder (without the piston, of course) should be .004"—.006".

N.B.—It is important when refitting piston rings to see that their gaps are equi-spaced around the diameter of the piston and that no two gaps are opposite one another, thus defeating their effectiveness in preventing oil from travelling straight up into the combustion space.

Before ordering new pistons it is advisable to communicate with the nearest M.G. Service Depot, which will be able to advise on the correct size required.

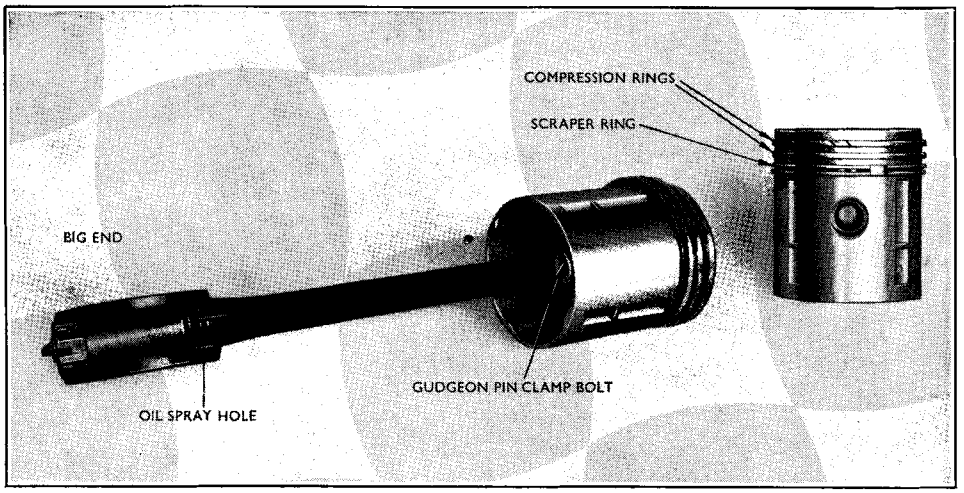


Illustration No. 26.—Piston assembled to connecting rod, also position of piston rings (second type).

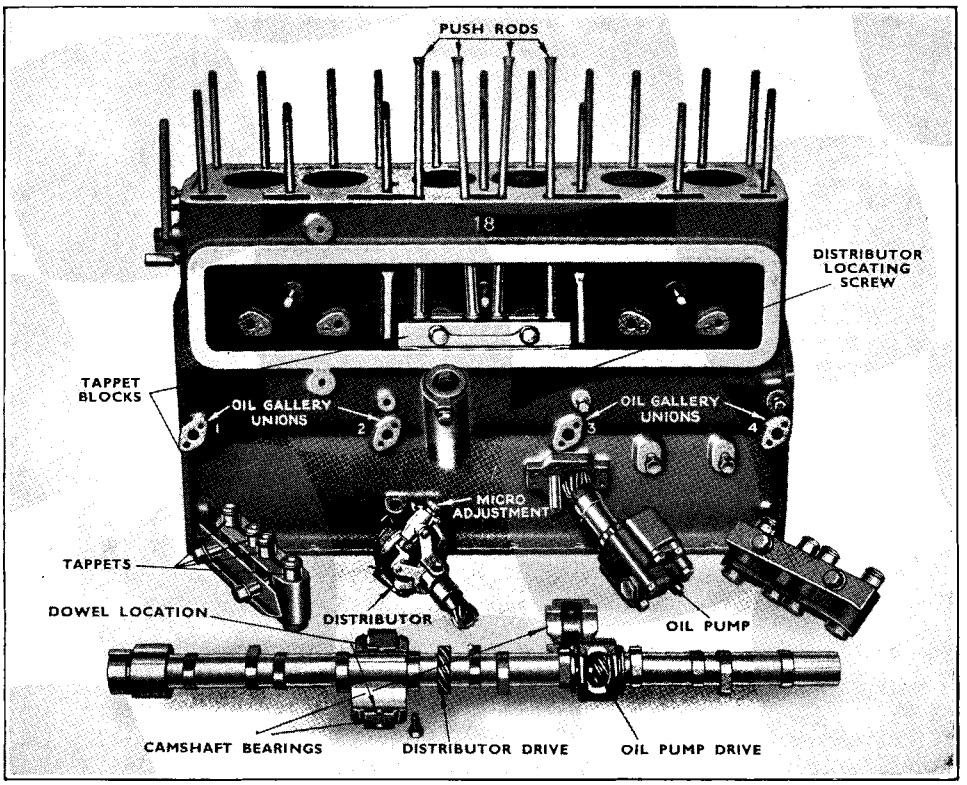


Illustration No. 27.—With details of the camshaft and operating gear for the overhead valves.

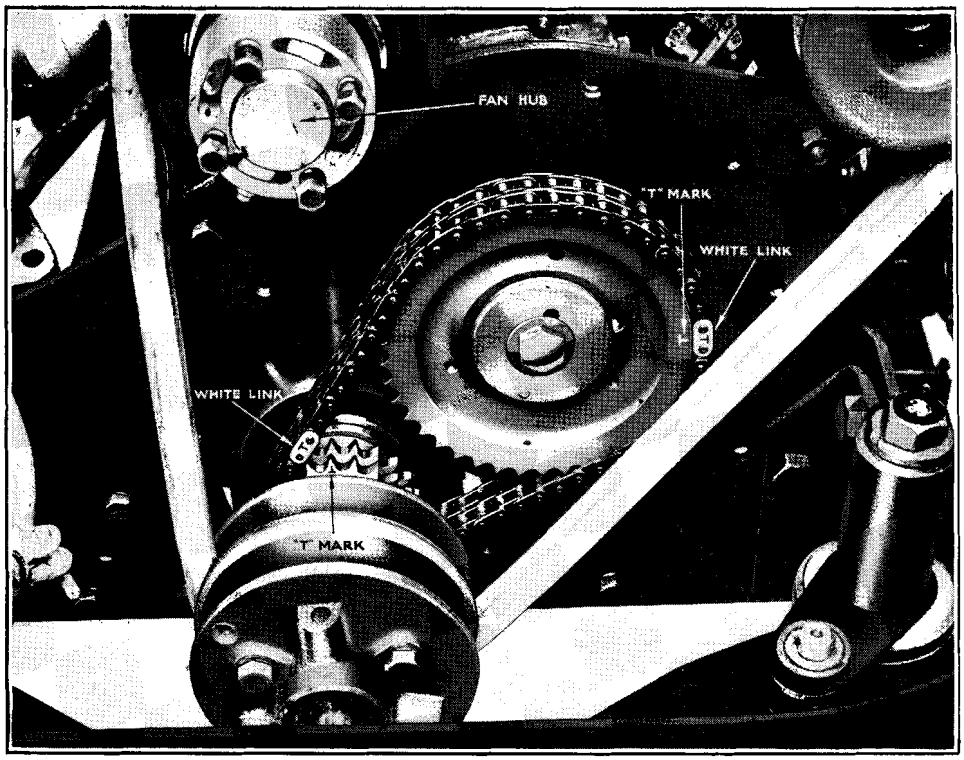


Illustration No. 28.—Timing chain (see page 52).

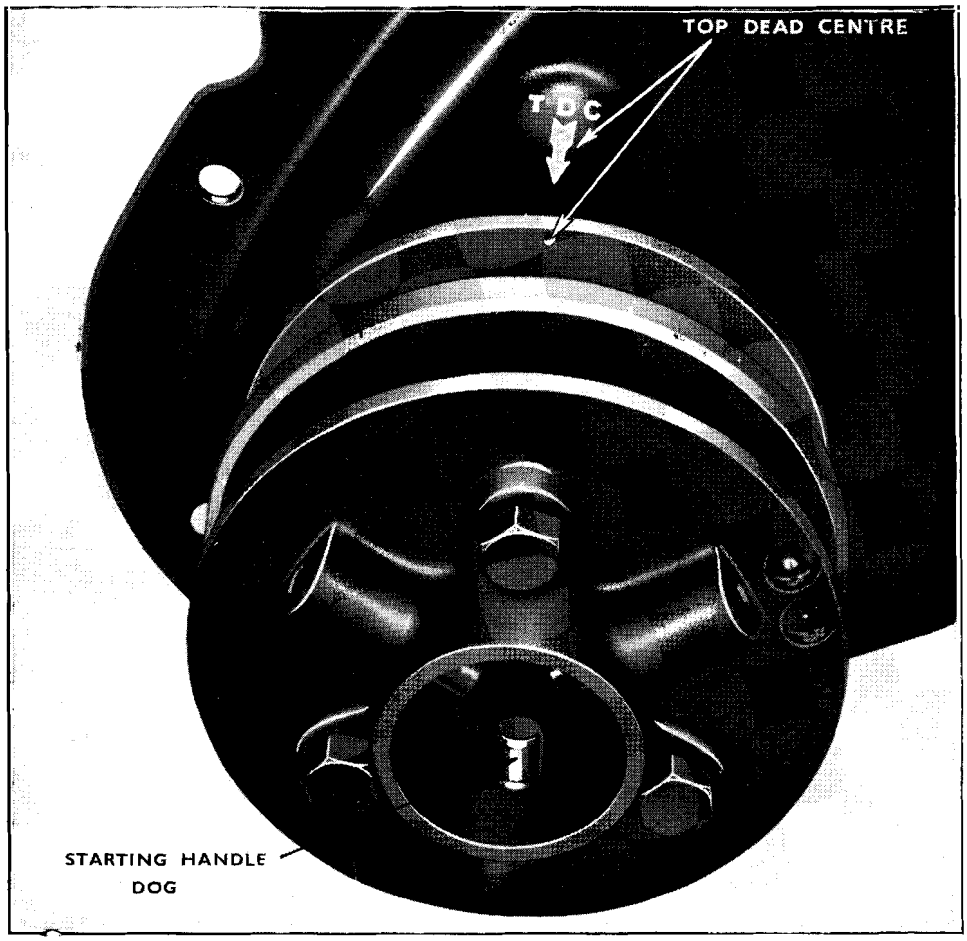


Illustration No. 29.—Showing method of obtaining T.D.C.

Refitting Connecting Rods and Pistons.—Take care when replacing a piston and connecting rod to see that the gudgeon pin pinch bolt is towards the off-side of the engine, the reason for this being that the oil spray hole above the big end bearing shown on Illustrations Nos. 25 and 26 may be in a position properly to lubricate the cylinder walls.

When tightening the big end bolts, care should be taken not to overtighten them and stretch the bolts ; even so, they should be sufficiently tight. Do not forget to replace the split pins.

Fitting Big End Bearings.—If it is necessary to renew a big end bearing, the connecting rod must be replaced complete. The factory will supply a service replacement part which can be installed straight away and without special fitting. Having attended to the big ends, etc., the refitting of the sump is a perfectly straightforward operation and no instructions are required.

Removing the Radiator.—First take off the bonnet, disconnect the top and bottom water hoses, undo the two fixing nuts under the front cross member, the two lamp brackets where they fix on to the radiator, and the two radiator tie rods. The radiator complete can then be lifted clear.

To Remove Engine and Gearbox Complete from Car.—Assuming radiator and bonnet have already been removed.

Remove front seats. Remove front carpets. Undo the rubber muffs at the bases of the clutch and brake pedals, and slide them and their securing plates up the pedals. Remove the rubber gearbox cover, also the floor boards.

Undo the rubber muff where the steering column goes through the dash, and slide it and its securing plate up the column.

Disconnect battery. Remove the wires from the reverse light switch on top of the clutch housing, the dipper switch, and pull the cables through to the front side of the dashboard.

Unbolt the Lockheed and Jackall fluid containers, and leave them on the ends of their pipes. The accelerator pedal stop on the inside of the dashboard will come away at the same time as it is secured by two of the bolts which hold the Lockheed fluid container. It will need to be readjusted on reassembly. Undo the screws which secure the ramp plate to the dash and lift the panel out.

Remove the two leads from the starter motor terminal. Remove the Bowden wire from the starter motor switch.

Slacken the nuts which secure the front ends of the gearbox steady blocks, and remove the gearbox steady crosspiece. Uncouple the clutch withdrawal rod from the lever, and leave it hanging on the pedal.

One-piece Remote Control.—Remove gearbox top cover with remote control complete.

Two-piece Remote Control.—Uncouple remote control at forward universal joint.

Uncouple propeller shaft at rear of gearbox, *the flanges must be marked before removal*, as they must go back in the same position (see page 16).

Remove all controls, petrol pipes and manifolds as already detailed in instructions for removing cylinder head.

Remove exhaust pipe support bracket from side of crankcase and let exhaust pipes hang.

Remove four main engine holding-down nuts and lift out engine, leaving the rubber mountings attached to the chassis. The engine must be lifted about 5″ to clear the mounting bolts.

Replacing Unit with Gearbox.—To replace the unit, reverse removal operations ; refer to the wiring diagram when re-connecting wiring, and leave the bottom securing nuts in the radiator loose so that the position can be adjusted to suit the bonnet.

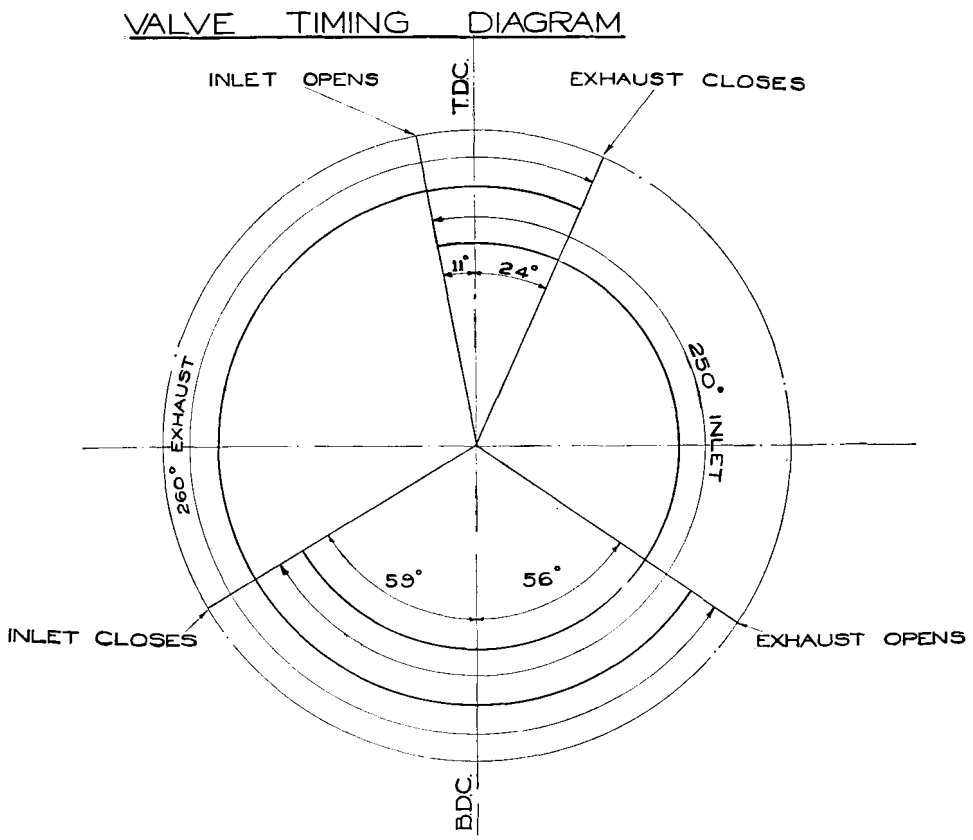
Removing Camshaft.—If the engine is upside down the tappets can be left in place; but if it is desired to remove the camshaft with the engine in the frame, or for some other reason it is not desired to turn it upside down, the tappet blocks, complete with tappets, should be removed so that the tappet bases do not catch on the cams as they are drawn underneath. To do this, remove the dynamo and its support bracket, take out the screw which locks the distributor, and remove the distributor. The tappet cover may now be removed and the tappet blocks unbolted and prised off their dowels. They will bring the tappets with them, which are restrained by circlips round their upper ends from falling out of their blocks. Before the camshaft can be removed the oil pump must be taken off (as must the distributor if this has not already been done) so that their skew gears are out of the way. When this has been done, and the timing chain and sprockets taken off, the camshaft can be drawn out forwards. It will pass through its front bearing and pull out of its rear bearing, but it must take its two middle bearings part of the way with it. To permit this the dowel screws which secure these bearings to the engine body must be taken out. They are just under the 2nd and 3rd oil gallery pipe unions. These bearings have grooves turned round their ends, by which they may be conveniently tied or wired to the camshaft to prevent their falling when they are free of their housings. When the camshaft has been drawn sufficiently to bring the two middle bearings free of their housings they may be untied and lifted out, when the withdrawal of the camshaft may be completed.

To Replace the Camshaft.—The front and rear camshaft bushes being in place and the tappets being clear (either by the engine being upside down or by the tappet blocks removed), the camshaft may be slid in from the front, until it is time to insert the second and third bearings. These should be put on their proper places on the shaft, and either tied or wired to it; when these bearings have entered their housings sufficiently, the tie or wire must be removed, when the shaft is finally pushed home. With the shaft in place the bearings may be moved about until their locating holes are opposite the locking screw holes, using a tool, such as a blunt-ended scriber, to feel that the locking screws will enter properly. The locking screws should now be inserted and wired. Refer to illustration No. 27.

Removing Crankshaft.—Assuming that the engine is out of the chassis and the sump, clutch, etc., removed as described elsewhere, it remains only to undo the flywheel bolts and pull the flywheel complete with the three studded separator plates and spigot bearing off the crankshaft.

The flywheel housing can be taken off after removing the bolts which secure the flywheel housing to the crankcase, two of which have their heads inside the crank chamber. The connecting rod caps may now be removed and the pistons drawn one at a time, turning the crankshaft as necessary to allow each one to pass. The bridge pieces over the front and rear main bearing caps may now be taken out, after which the four bearing caps may be removed and the crankshaft lifted out.

Camshaft Timing.—The two timing sprockets are secured to the crankshaft and camshaft respectively by single keys; there is, therefore, only one position in which each can be fitted to its shaft.



Valve-timing diagram.

It will be noticed that the timing chain has two white links, and each of the sprockets has a tooth marked "T." Between the white links are twelve black ones on one side of the chain and fifteen black links on the other. The camshaft is correctly timed when each of the "T"-marked teeth is in a white link with the shorter black portion of the chain uppermost. The twelve black and two white links are clearly shown in illustration No. 28, which shows one white link of the chain engaged with the "T"-marked tooth of the camshaft sprocket, while the "T"-marked tooth of the crankshaft sprocket has just left the other white link, twelve black links behind the first one.

Owing to the fact that the total number of links in the timing chain is a prime number, the engine must be turned fifty-eight times before the links and marked teeth come back to this position again.

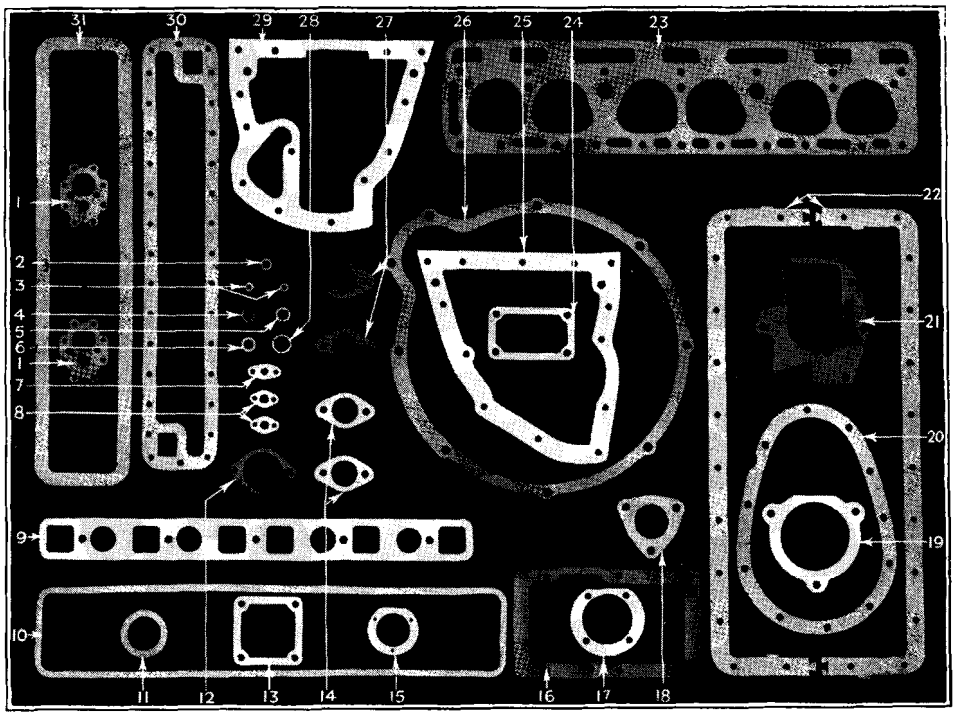
Ignition Timing Adjustment.—When the distributor has been removed for any reason, it must be retimed on replacement. First, set the engine with Nos. 1 and 6 cylinders on top dead centre. This is done by bringing the little hole in the belt pulley rim opposite the arrow stamped on the chain cover as shown in illustration No. 29.

Then examine the valves to see which of the previously mentioned cylinders is starting its firing stroke, turn the distributor until the rotor is facing the appropriate segment (i.e., the segment connected to the H.T. cable leading to the same cylinder), and insert the distributor in its housing, "feeling" it in so that the nearest tooth is engaged. Turn the body about until the locking screw will enter, and lock it.

Next (having verified that the point gap is properly set) set the micrometer adjustment to full retard, slack off the pinch bolt, and turn the head until the points are just breaking. The ignition is now set to break on top dead centre, and may be advanced as much as desired by means of the micrometer screw.

The correct starting point is 7° early. One division on the micrometer scale equals 4° (crankshaft), and each division is again divided into a definite number of "clicks," which are easily felt. This, of course, may be varied, but probably not more than 1° either way, to suit the grade of fuel used or a driver's personal idiosyncrasies.

Note.—Before setting the timing, make sure that the automatic advance and retard mechanism is working properly and is in its fully retarded position while the timing is being set.



	Part No.	
1.	M.G.679/255	Joint for oil pump cover.
2.	P.151/110	Washer for water drain tap.
3.	M.G.679/113	Washer for water jacket cover plate bolt.
4.	X.679/27	Washer for cylinder head cover screw.
5.	P.151/281	Washer for cylinder head oil feed pipe.
6.	X.679/37	Washer for oil pump relief valve plug.
7.	M.G.679/249	Joint for oil suction pipe.
8.	M.G.679/280	Joint for main bearing oil feed pipe.
9.	M.G.679/337	Joint for induction and exhaust manifolds.
10.	M.G.679/213	Joint for cylinder head cover.
11.	X.679/12	Washer for crankshaft (through timing case).
12.	M.G.679/305	Joint for Thermostat.
13.	M.G.679/308	Joint for water outlet pipe.
14.	M.G.679/325	Joint for air intake pipe.
15.	M.G.679/128	Joint for starter inspection cover.
16.	M.G.679/331	Joint for gearbox top.
17.	M.G.679/302	Joint for fan and water pump bearing bracket.
18.	S.15/5	Joint for front exhaust pipe.
19.	M.G.679/231	Joint for starter motor.
20.	M.G.679/136	Joint for timing chain case.
21.	M.G.679/377	Joint for speedo gear casing.
22.	M.G.679/243	Joint for oil base.
23.	M.G.679/208	Cylinder head gasket.
24.	M.G.679/185	Joint for cylinder head rear cover plate.
25.	M.G.679/130	Joint for front bearer plate.
26.	M.G.679/345	Joint for clutch housing.
27.	M.G.679/401	Joint for carburetters.
28.	X.679/36	Washer for oil pump cover plug.
29.	M.G.679/126	Joint for bell housing.
30.	M.G.679/111	Joint for water jacket cover plate.
31.	M.G.679/124	Joint for tappet inspection cover.

SECTION F

THE S.U. CARBURETTERS AND THE PETROL PUMPS

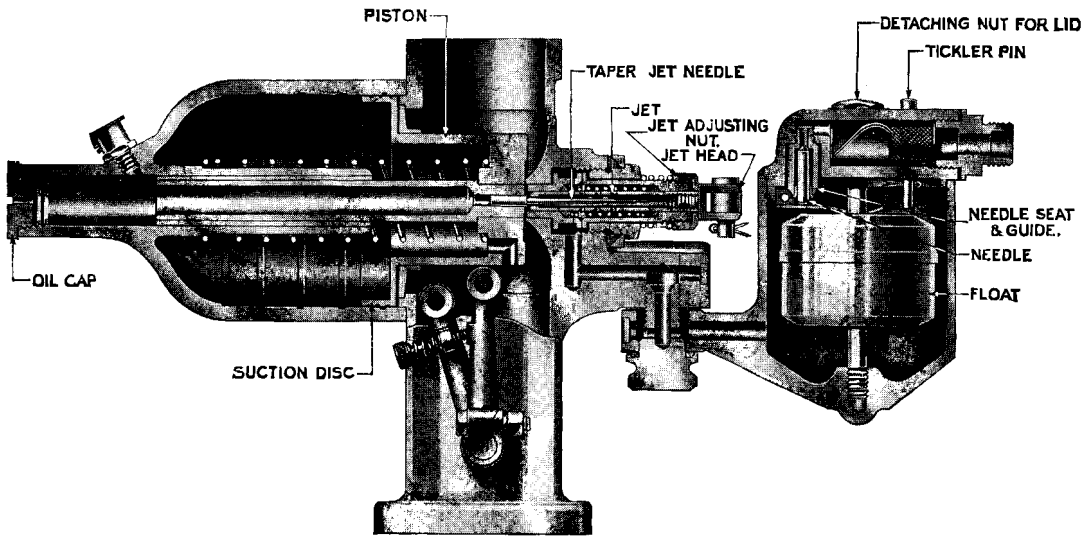


Illustration No. 30.—Sectional view of downdraught carburetter.

Index is on Page 3

Carburetters.—Since the two carburetters are identical, it is necessary, except in the case of synchronising, to describe the construction and maintenance of one instrument only.

A little machine oil should be injected into the dashpot or suction chamber every thousand miles, to lubricate the piston guide rod ; three drops of machine oil or bicycle oil are advised for this purpose. There is a small lubricator on the side of the piston rod guides.

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

The jet control nuts are provided solely for the purpose of setting the mixture strength for the purpose of obtaining a good tick-over. Screwing the jet adjusting nut inwards—that is, in a clockwise direction looking at it from the off-side of the car—and subsequently pushing in the jet until the jet head abuts against the nut, weakens the mixture. Both jets should be adjusted in this way, so that when the engine is thoroughly warm, the weakest setting is provided which is consistent with a uniform tick-over. When the jets are adjusted in this way, the performance of the carburetters in other respects should be correct. If it is thought that a richer or weaker setting is required for general performance and consumption, the proper course to be adopted is to change the needles ; it cannot be too strongly emphasised that adjustment of the jet positions will not achieve this result, except at the expense of upsetting the idling.

The use of the choke 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. 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 cylinder walls and other parts of the engine.

Reference to the illustration No. 30 of the carburetter 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 in the normal running position (pushed in); so that it stands to reason that if any adjustment of the jet has to be effected, this has to be carried out separately on each carburetter. The rod coupling the two jet control levers should be removed before any jet adjustment is made, and before replacing this it should be rendered of suitable length by screwing up or unscrewing one of the ball joints, so that after finally replacing, both jet heads abut simultaneously against their stop nuts.

Periodically clean the suction disc, suction chamber and guide. To remove the suction chamber the two screws that hold it in position should be removed. Extreme care should be exercised in removing the piston, 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.

Wash air cleaner thoroughly in petrol every 5,000 miles and re-oil gauze with engine oil. See page 40.

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

1. The piston may be sticking, due to dirt on the suction disc or piston, or due to a bent needle.
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 ; the suction disc formed on the

upper part of the piston, and a tapered needle inserted in the piston regulating the jet opening. If the piston is sticking this can easily be ascertained by inserting a matchstick or preferably a small metal rod through the hole behind the piston chamber or dash pot and moving the piston. The piston should move 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.

The needle is easily bent if the piston is removed carelessly, 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 test for freedom as described above. If the needle is bent the only satisfactory remedy is to replace it by a new one.

Float-chamber Flooding.—This is usually obvious from the quantity of petrol flowing over the float-chamber and out from the vent pipe. Flooding is generally caused by foreign matter finding its way on to the seating of the float-chamber needle. 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 actuating fork in position. After taking away the fork the needle will drop straight out; the seating should on no account be ground in, but if damaged, both the needle and seating should be replaced.

Do not readjust the petrol level by bending the fork; if there is reason to suspect the petrol level, it is strongly advised to return the car to an M.G. Dealer.

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

Set the ignition timing as described on page 52. Check and, if necessary, adjust distributor points to .012″, plug points to .018″, and inlet and exhaust valves to .015″ when hot.

Having checked these items, remove air cleaner and branch pipe, also the suction chambers from the carburetters; disconnect the jet coupling rod and screw the jet adjusting nuts right up. The petrol level is set before the car leaves the Works and therefore needs no attention. Next proceed to set the needle in the piston.

The shoulder of the needle should be flush with the face of the piston. Refit the pistons complete with their return springs and suction chambers to the carburetters, making sure that, when screwed down tightly, the pistons return to their seatings with a click. If for any reason it is thought advisable to fit new needles, see that they are the same type as before. The number (CH, in the case of the M.G. Two-litre) is stamped on the shoulder. Alternative needles are—richer CL, weaker CK.

Next unscrew the jet adjusting nuts two complete turns and disconnect slow-running control. Then slacken one of the flexible coupling bolts on the coupling connecting the throttle spindles. The engine can then be started, screwing down the jet adjusting nuts farther if necessary in order to enable it to run until normal running temperature is attained. The slow-running screws on the throttle spindles should now be screwed up, and eventually adjusted so that the engine is idling fairly slowly. It is now easily possible, by placing the ear to the mouths of the two carburetters, to determine whether there is an equal flow of air through them. Adjustment of the slow-running screws should be made until this occurs (that is, until there is an equal " hiss " at the mouth of each carburetter), when the coupling bolt may be retightened.

A fairly good check on the mixture strength can be obtained by idling the engine fairly fast, and moving each of the pistons in turn with a pencil or similar object a height of about $\frac{1}{8}''$. This should have the effect of causing a very slight increase in engine speed, the evenness of firing not being upset. If on the other hand this operation has the effect of causing the engine to stop, it is an indication that the carburetter is set too weak. If an appreciable increase occurs and continues to occur when the piston is moved to the extent of, say $\frac{1}{4}''$, the indication is that the mixture on this carburetter is too strong, and the jet adjusting nut should therefore be screwed up.

Now replace air cleaner and branch pipe, and possibly weaken each carburetter slightly by screwing both jet nuts one or two flats towards the carburetters; before attempting the final adjustment for mixture strength, it is essential that the engine should have maintained its normal working temperature. When this is done the mixture may be judged by the exhaust note. If the engine is running with a regular rhythm but suggestive of there being more work done by one cylinder than the others, this phenomenon being accompanied by signs of black smoke from the exhaust, it may be concluded that the mixture is too strong. One of the jet adjusting nuts should now be screwed towards the carburetter, pushing up the jet head to meet it at the same time. If this effects no improvement, return it to its original position and try the same procedure with the other. If, on the other hand, the exhaust note is irregular without any perceptible rhythm, it is probable that the mixture is too weak. In this case, first one and then the other of the jet adjusting nuts should be screwed out. The slow-running adjusting screws should now be turned equally in an anti-clockwise direction until the slowest possible tick-over is obtained consistent with even firing.

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.

DON'T RUN THE ENGINE WITH THE MIXTURE CONTROL IN THE RICH POSITION LONGER THAN NECESSARY.

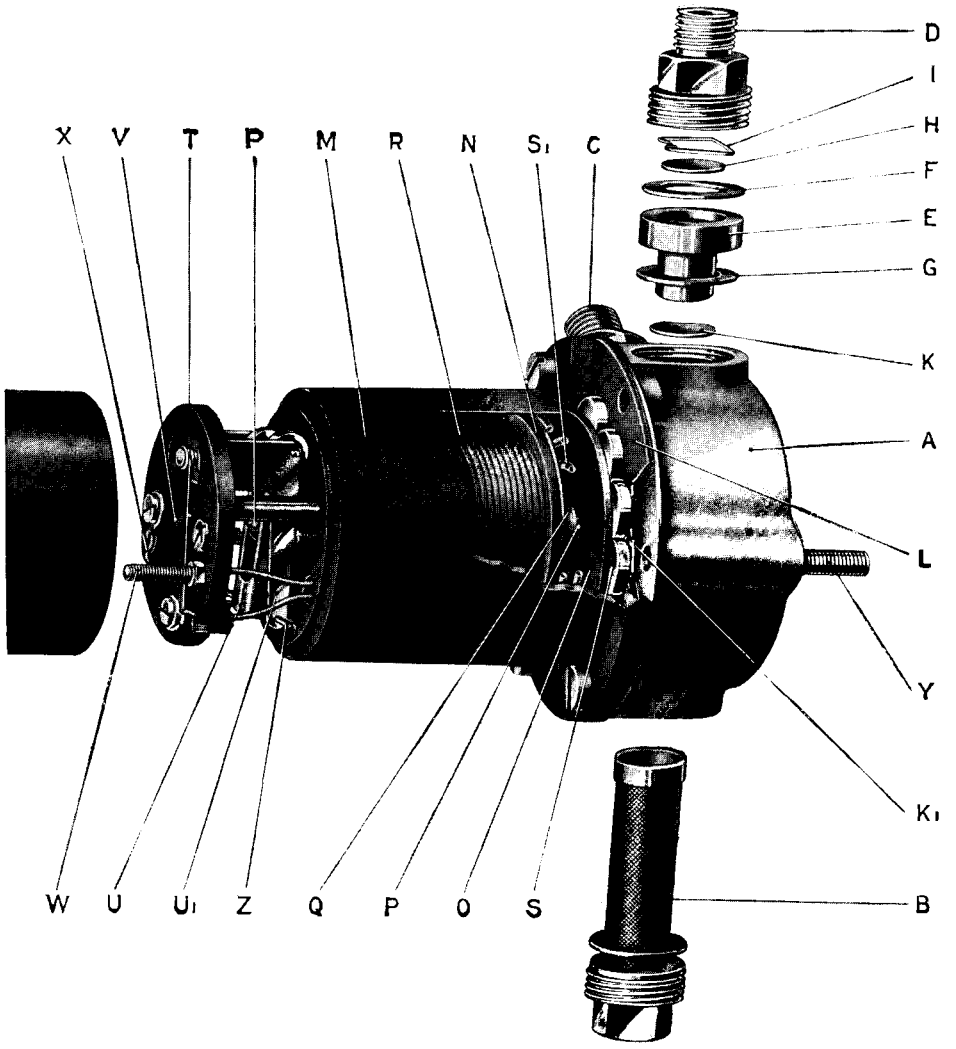


Illustration No. 31.—A view of the S.U. pressure petrol pump with part of the cover cut away to show the magnet. The various letters are referred to in the accompanying text.

The Electric Petrol Pumps.—The pumps are fitted on the near-side of the dash wall and each consists of three main assemblies : the body, the magnet assembly and the contact breaker. Referring to illustration No. 31, which shows one of the two pumps, it should be noted that 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." Below the delivery valve cage " E " is 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 " K I " 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 far end.

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 on 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 its 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. About 30 thousandths of an inch is the correct clearance, the pump will, however, work over quite a wide range of gaps.

Servicing the S.U. Petrol Pumps.—Should pump trouble be suspected, first disconnect the pump union of the pipe from the pump to the carburetter and switch on the engine. If the pump functions the shortage is due either to blockage of the petrol pipe to the carburetter, or possibly to the carburetter float needle sticking up. If the pump will not function after this has been done, first remove the filter, which is held in position by the brass hexagon nut at the base of the pump, and see if this is clear. Then disconnect the petrol pipe leading to the tank and blow down this with a tyre pump to ensure the pipe being absolutely clear, and reconnect the petrol pipe.

If the pump still does not function or only works slowly, the stoppage may be due to a bad earth return. To test for this, make definite metallic contact between the brass body of the pump and the car chassis with a short length of wire, preferably copper. To ensure a good earth it may be necessary to scrape off a small portion of the black enamel with which the chassis is coated. If the pump then functions normally, the earth wire may be permanently connected.

A bad connection in the pump itself may sometimes be traced to the nut on the terminal inside the cover not being screwed down firmly.

Should these points be found in order but the pump still does not work, the trouble is in the pump itself, and the cause will be too much tension on the diaphragm or blackened contact points, the cause of which is the tensioning of the diaphragm. The remedy is to remove the cover from the contact points and pass a piece of thin card between the points when pressed together, so as to effect the necessary cleaning.

To release the tension of the diaphragm, remove the body from the base of the pump by undoing the small screws which hold these two parts together. The diaphragm itself will then be found to be adhered to the body of the pump, from which it will have to be separated. A knife will help in this operation, care being taken to prevent the rollers which support the diaphragm, and act as a bearing, from falling out. The body should then be replaced on to the base and the screws put in loosely ; but before finally tightening up it is advisable to stretch the diaphragm to its highest possible position. This is effected by switching on the pump and holding the contact points together while tightening the screws well up. This will effect a permanent cure.

When releasing the tension of the diaphragm care should be taken not to alter the adjustment of the pump by unscrewing the armature, which is the steel plate fixed at the back of the diaphragm. Should the position of this be inadvertently altered it will have to be reset, which is done by screwing the diaphragm and armature into such a position that the contact breaker just throws over without the assistance of the contact blade, which should be held away when being set. When this position has been found, the armature will have to be unscrewed to the extent of two-thirds of a turn, when the cast iron pot may again be fixed to the base as per instructions.

Should a pump work intermittently or not start clicking when switched on in the morning, it is an indication that this trouble is occurring, and it should be given immediate attention to obviate final stoppage on the road.

Guarantee.—The terms of the guarantee with this pump are precisely the same as that of the car to which it is fitted.

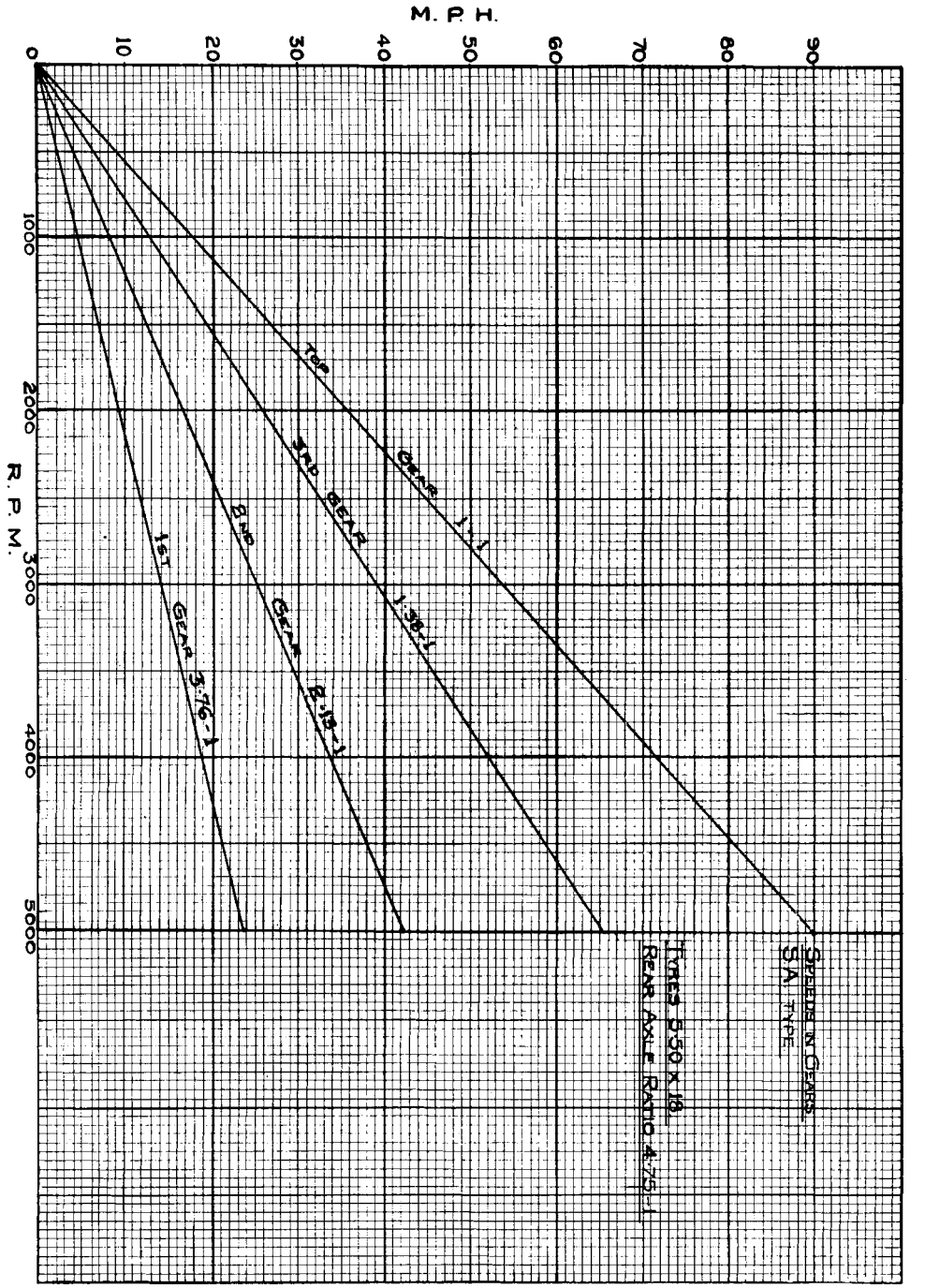


Illustration No. 32.—Chart showing the speeds on each gear and the corresponding engine revolutions.

SECTION G

THE FOUR SPEED GEAR-BOX AND CLUTCH

Gearbox Dismantling.

Gear Lever Remote Control.

The Clutch.

Diagram of Speeds on Gears.

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Removal of Gearbox.—Having removed the ramp plate, as described in the instructions for removing the power unit, proceed thus : drain the gearbox, remove the gearbox lid (after uncoupling the isolated remote control in cars so fitted), remove the forward section of the propeller shaft tunnel (complete with isolated remote control on cars so fitted), remove the starter motor, uncouple the clutch control rod at its forward end and let it hang on the clutch pedal, uncouple the propeller shaft at the front end (first refer to special instructions on page 16, Section B) and slacken the forward nuts of the gearbox steady blocks and remove the gearbox steady cross piece downwards, unbolt the clutch housing from the flywheel housing (it is necessary to draw the two studs fitted in the horizontal position ; this applies to the early cars only, as they were subsequently changed to bolts), then turn the gearbox round clockwise, looking from the rear, until the clutch control lever is free to swing forward horizontally under the sump as the box is withdrawn ; then pull the box straight back until the first motion shaft is free of the clutch, when it may be lifted out.

Dismantling Gearbox.—Remove propeller shaft flange ; before doing so mark the flange in relation to the gearbox primary shaft ; this is best done by marking both flange and primary shaft with a centre punch (see page 16). Also remove the gearbox rear cover and speedometer driven gear and lift out the rear ball race packing washer, when the various gearbox components can be drawn out backwards in their proper order (refer to illustrations Nos. 33, 34) as follows : Remove the grub screws which secure the striking forks to their rods, and draw the selector rods out one at a time, taking care at the last stage of withdrawal to catch the detent and interlocking balls as they are freed. Lift out the selector forks, press down the spring loaded plunger and turn the splined retaining plate (at rear face of third speed double helical gear), see illustration No. 38, until the gear is free to move on the mainshaft. Then draw out the mainshaft complete with its rear ball race and chip excluding washers, lifting each gear out in turn as it is freed. Remove the countershaft locking grub screw and withdraw the layshaft, allowing the layshaft gear cluster, complete with its roller races and their spacing sleeve, to drop to the bottom of the box. Remove the reverse shaft locking screw and withdraw the reverse shaft, lifting out the reverse gear cluster as soon as it is freed. Remove the clutch housing complete with the front oil seal and lift out the first motion shaft ball bearing packing washer. Remove the first motion shaft retaining circlip in front of the ball bearing, and press out the first motion shaft. The layshaft gear cluster can then be lifted out from the bottom of the box.

Reassembly of Gearbox.—The reverse operations to that given for dismantling apply, in fact after the dismantling of the gearbox has been carried out the operator will hardly need to refer to the manual.

N.B.—Points to remember when reassembling : roller bearings and distance tube to be fitted into layshaft cluster ; secure reverse gear shaft by its grub screw, also layshaft, fit plunger and spring into mainshaft, lock the third-speed double helical gear by rotating the loose locking plate in its groove in the mainshaft until the plunger engages ; fit three balls and springs underneath the three selector shafts, also one ball between each shaft ; replace propeller shaft flange on mainshaft in original position ; refill with lubricant. (See chart at end of book.)

Synchromesh Type Gearbox (illustrations Nos. 35 and 36).—As the construction of the Synchromesh Type Gearbox is identical to the Crash Type Gearbox, the instructions for removal, dismantling and reassembling are as already described. There is a further instruction needed regarding the Synchromesh "Third and Top" mechanism.

Dismantling the Top and Third Synchromesh Mechanism.—The Synchronizing cones, one for each gear, are retained in the sliding hub by circlips. The striking dog for top and third gears is retained on the sliding hub by three balls and

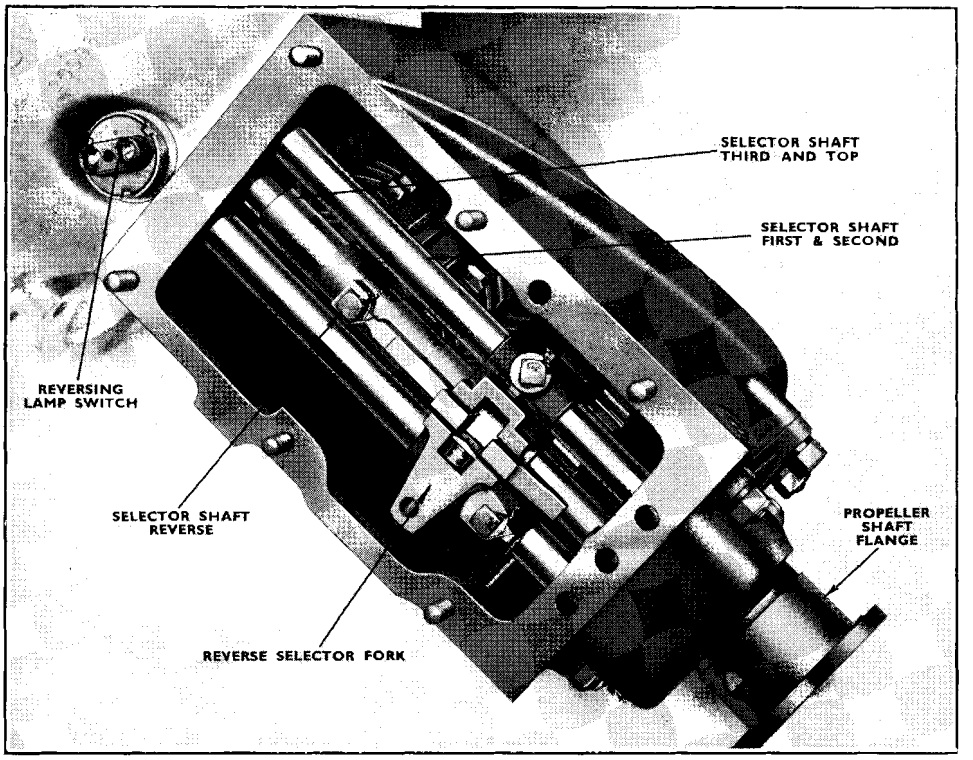


Illustration No. 33.—View of selector gear used when "one-piece" remote control is fitted.

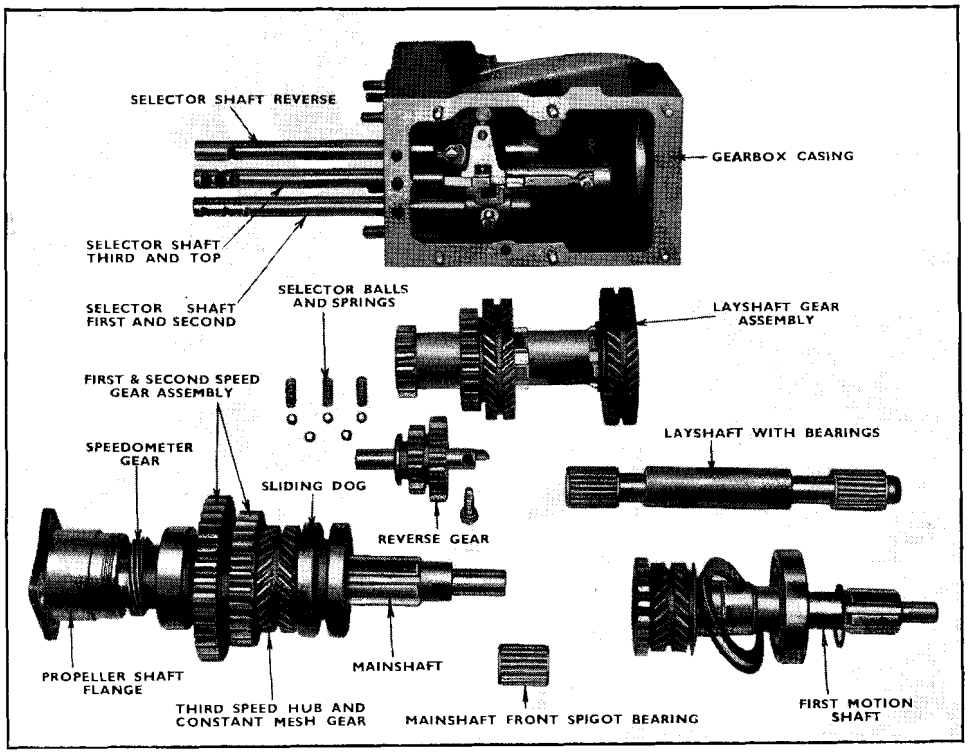


Illustration No. 34.—Components of the Crash type gearbox referred to in the text.

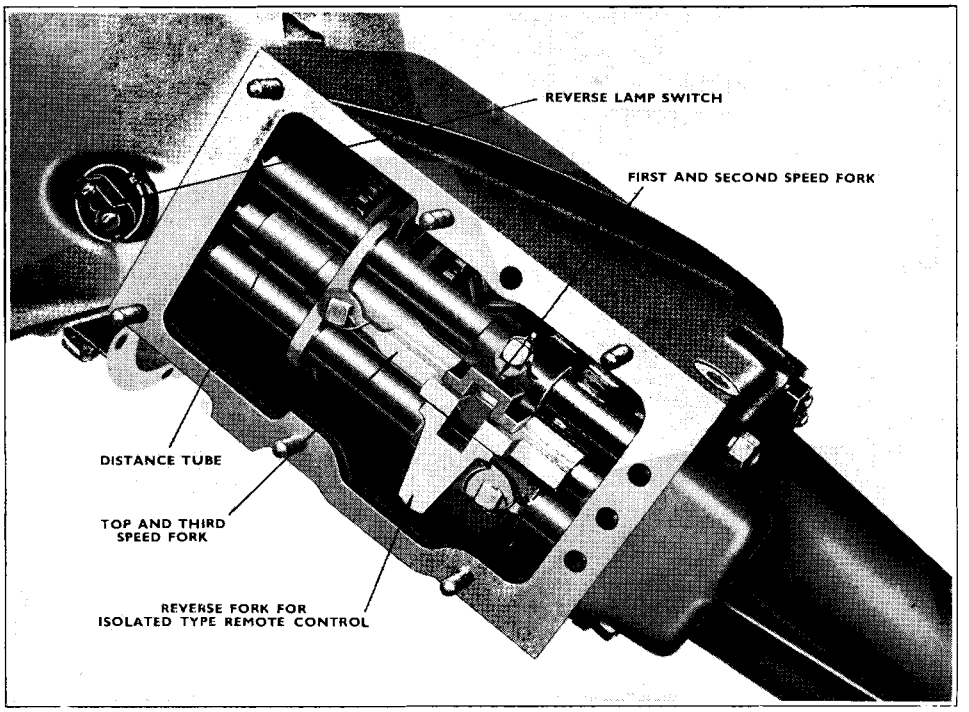


Illustration No. 35.—Gearbox lid removed to show type of selector when " two-piece " remote control is fitted.

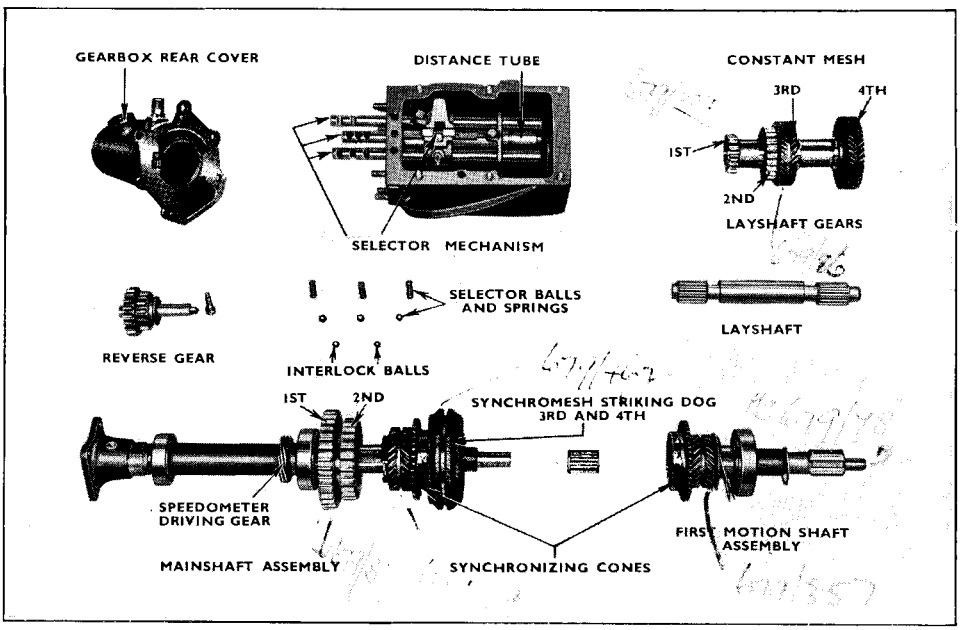


Illustration No. 36.—Synchromesh gearbox dismantled to show interior mechanism.

springs, which are spaced 120° apart and housed in the sliding hub; therefore, the sliding hub can be pushed out from the striking dog when sufficient effort is applied to overcome the springs.

Reassembly of the Top and Third Synchromesh Mechanism.—The three balls and springs must be set in the sliding hub at 120° apart, when the striking dog can be slid over. Of course the cut-outs in both the sliding hub and striking dog must be opposite one another. The cones are then fitted to the striking dog and retained by the circlips. When fitting this assembly to the mainshaft, make quite sure that the six small holes in the face of the sliding hub are toward the first motion shaft.

No special tool is required to enable the springs and balls to be fitted to the synchromesh mechanism, all that is required is six pieces of steel shim $\frac{3}{8}$" wide by .015" thick.

The sliding hub is just entered in the striking dog when one spring is fitted into place, and with the aid of one of the pieces of shim the ball is retained in the sliding hub. The shim is then pushed down between the hub and striking dog. After the balls and springs are held in place in this manner, the sliding hub can be pushed right home, when the balls will click into the indentation ground in the centre of the teeth.

N.B.—Points to remember when reassembling : roller bearings and distance tube to be fitted into layshaft cluster, secure reverse gear shaft by its grub screw, also layshaft, fit plunger and spring into mainshaft, lock the third speed double helical gear by rotating the loose locking plate in its groove in the mainshaft until the plunger engages ; fit three balls and springs underneath the three selector shafts, also one ball between each shaft ; replace propeller shaft flange on mainshaft in original position, refill with lubricant (see Maintenance Chart at end of book).

Gear Lever, Remote Control.—When the one-piece remote control is fitted, the reverse gear selector is fitted with a plunger, ball and spring, its duty being to prevent the gear selector from entering reverse inadvertently (see Illustration No. 33); but when the isolated gear remote control is fitted, these parts are not required (see Illustration No. 35), as the gear lever turret is fitted with a catch which prevents the gear lever from entering the reverse gear gate. As both the Crash type and Synchromesh type gearbox are fitted with both types of gear remote controls, it is important that the aforementioned details are checked before fitting a replacement gearbox.

The Clutch.—Access to the clutch is obtained by removing the gearbox and clutch housing from the flywheel housing (see under the heading, "Removal of Gearbox"). The clutch spring plate, the springs and the pressure plate may now be removed as a single unit by undoing the ring of bolts round the outside of the spring plate which secure it to the flywheel. Next remove the " indented C-shaped " circlip from the three studs which project through the cork-faced driven plate, and lift the driven plate out. (See Illustration No. 38.)

To dismantle the clutch spring plate, the springs and pressure plate, remove the ring nut from the hub of the pressure plate, when the ball race and washer can be removed. The pressure plate can then be withdrawn from the clutch spring plate. (See Illustration No. 38.)

Adjustment of Clutch Pedal.—It is important that the clutch pedal has 1" minimum free movement before operating the clutch withdrawal mechanism. This is to prevent the clutch thrust race from fouling the operating fork when the cork-lined driven plate wears; adjustment is at the bottom of the clutch pedal. The maximum pedal travel is controlled by an adjustable stop, and should be so adjusted that the stop comes into contact with the pedal at the same moment the clutch stops spinning.

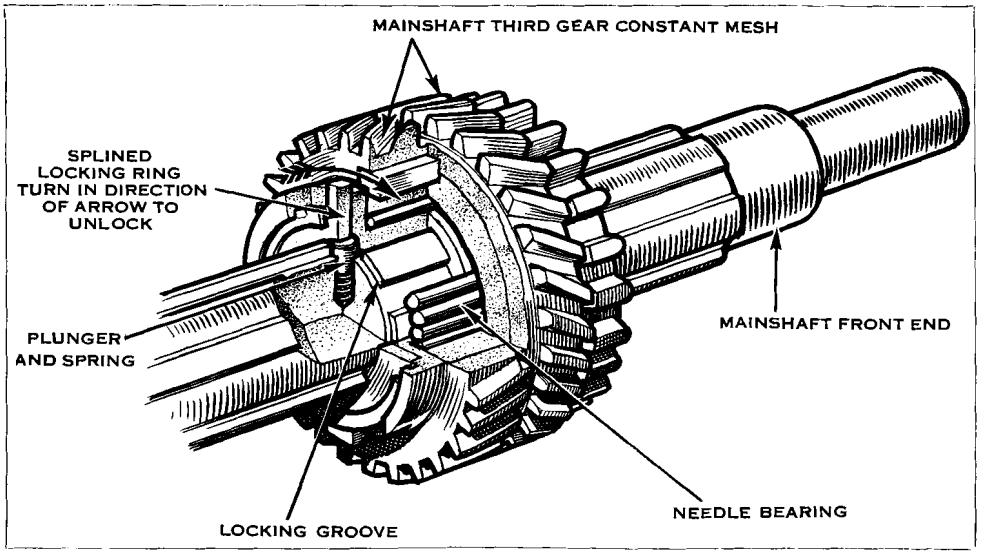


Illustration No. 37.—Third speed constant mesh gear locking device.

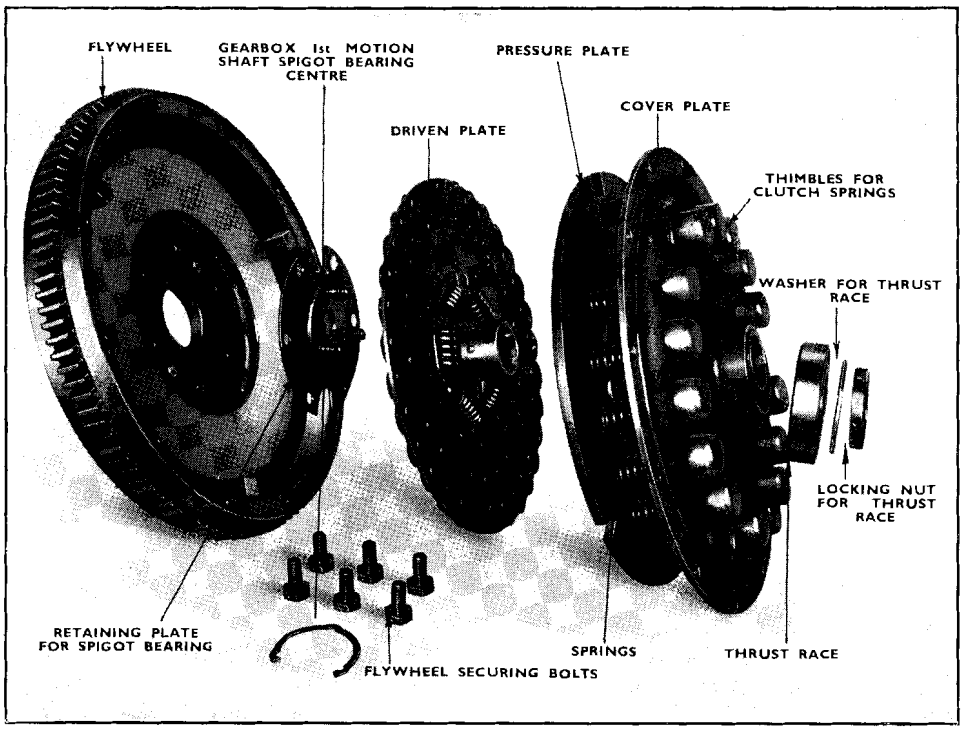
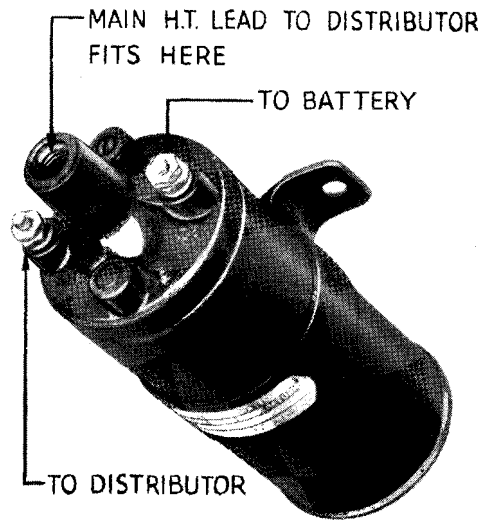


Illustration No. 38.—Clutch dismantled, showing various components.

SECTION H

THE ELECTRICAL AND IGNITION SYSTEMS



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The Battery.—About once a month unscrew the filler caps and pour a small quantity of distilled water into each of the cells to bring the acid just level with the tops of the separators. This is done to replace water which has been lost by evaporation. If any of the acid solution is spilled it must be replaced by a dilute sulphuric acid solution of the same specific gravity as the electrolyte in the cell to which it is to be added. The battery must not be allowed to remain with the plates uncovered, as they will suffer a chemical change and be irretrievably damaged.

Keep the Terminals and Battery Fixing Bolts Clean and Tight and Smeared with Vaseline.—A smearing of vaseline protects the terminals and fixing bolts from the corrosive action of the acid, which if allowed to continue will eventually result in trouble. When inspecting the battery, put a spanner on the bolt securing the cable end to the chassis in order to make sure that it is quite tight.

Keep the Outside of the Battery Clean and Dry, particularly the Tops of the Cells.—Water and dirt form a conductor of electricity, and if such a path is allowed to form between the positive and negative terminals of the battery or between the negative battery terminal and the chassis, there will be a leakage of current which will eventually cause the battery to run down. Give the cell tops a wipe over regularly and you will avoid this.

Occasionally make a Point of Examining the Health of your Battery by taking Hydrometer Readings.—The hydrometer allows you to take a sample of the acid solution. It contains a graduated float which indicates the specific gravity of the acid solution in the cell from which the sample was taken. The readings and their indications are as follows :—

1.250—1.300	...	Battery fully charged.
1.150—1.250	...	Battery about half discharged.
Below 1.150	...	Battery fully discharged.

The readings for each of the cells should be approximately the same. If one cell gives a very different reading from the rest it may be that acid has been spilled or has leaked from this particular cell, or there may be a short circuit between the plates. In this case we advise the owner to have his battery examined by a Lucas Service Depot—neglect may mean costly repairs later on.

It must be remembered that you cannot get more energy out of a battery than is put in. If the car is left parked at night with the lights on, or if the starter motor is used excessively with very little daytime running, then the battery may get into a low state of charge—particularly in winter. This may be remedied either by running the car for longer periods during daytime or by economising in the use of the headlamps and other accessories.

Never Leave the Battery in a Discharged Condition for any Length of Time.—If the car is to be out of use for any length of time, see that the battery is fully charged, and about every fortnight give it a short refreshing charge to prevent any tendency to permanent sulphation of the plates.

The Dynamo.—All dynamos are sent out from the Works with the bearings packed with grease. This lasts until the car is taken down for a general overhaul, when it is advisable to have the machine dismantled, preferably by a Lucas Service Depot, for cleaning and adjustment and repacking the bearings with grease.

The dynamo is provided with oilers to enable you to give it a little additional lubrication. The oilers should be given several drops of good quality engine oil every 1000 miles. It is of the utmost importance that the oiler on top of the lubricator shown in illustration No. 39 receives special attention or this bearing will run dry.

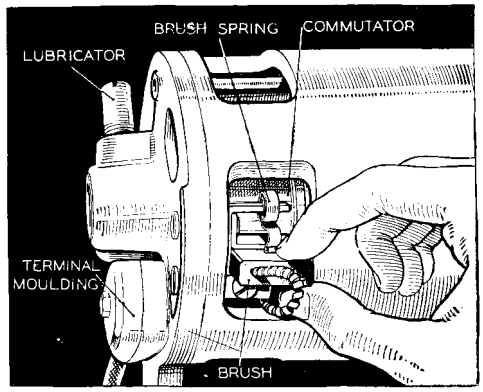


Illustration No. 39.—Dynamo brushgear.

Inspection of Commutator and Brushgear.—About once a season remove the metal cover from the dynamo for inspection of the commutator and the carbon contacts, or brushes as they are called. Take care not to lose the nut when removing the cover fixing screw, as the cover is liable to spring open when the screw is released.

It is essential that the brushes make good firm contact with the commutator. The brushes are held in boxes by means of springs. Hold back the spring, and at the same time move the brush to see that it is free to slide in its holder. If there are any signs of sticking, remove it from its box and clean it with a cloth moistened with petrol.

After removing brushes for cleaning or any other purpose, care must be taken to replace them in their original positions, otherwise they will not " bed " properly on the commutator.

If, after long service, the brushes have become worn to such an extent that they will not " bed " properly on the commutator, they should be replaced. Always fit genuine Lucas brushes, as these are made specifically for work on our machines and will give far the best results and the longest life. We advise you to have the brushes fitted at a Lucas Service Depot, so that they can be properly " bedded " to the commutator.

Next examine the commutator. It should be clean and free from any trace of oil or dirt, and should have a highly polished appearance. The best way to clean a dirty or blackened commutator is by pressing against it a fine dry duster and getting someone to turn the engine over slowly by hand. If the commutator is very dirty, the duster may be moistened with petrol.

Dynamo Output.—The dynamo automatically keeps the battery in good condition.

The dynamo is of the compensated voltage controlled type. These machines work in conjunction with a regulator unit which is housed along with the cut-out.

What the Regulator Does—a Completely Automatic Control.—The regulator causes the dynamo to give an output which varies according to the lamp load and state of charge of the battery. When a battery is discharged the dynamo gives a high output, so that the battery receives a quick recharge which brings it back to its normal state in the minimum possible time. On the other hand, if the battery is fully charged, the dynamo is arranged to give only a trickle charge which is sufficient to keep it in good condition without any possibility of causing damage to the battery by overcharging.

In addition to controlling the output of the dynamo according to the condition of the battery, the regulator provides for an increase of output to balance the current taken by the lamps or other accessories whenever they are switched on.

The regulator unit is accurately set to suit the requirements of the equipment fitted on the car, and in normal service the battery will be kept in good condition. If, however, you should find that the battery is not kept in a charged condition, or is being excessively overcharged, we advise you to consult your nearest Lucas Service Depot, where any necessary adjustments can be made. Owners should not attempt the adjustment themselves.

Ammeter Readings.—It must be remembered, when noting ammeter readings, that, normally, during daytime running, when the battery is in good condition, the dynamo only gives a trickle charge, so that the charge reading will seldom be more than a few amperes.

When starting from cold, the driver will notice the rise of charging current until it reaches a steady maximum at a speed of, say, 20 miles per hour; after which it will remain fairly high for perhaps 10 minutes or so, then fall to a steady charge which is most suitable for the particular condition of the battery.

A discharge reading may be shown sometimes immediately after switching on the lamps. This usually happens after a long run when the voltage of the battery is high. After a short time, the voltage of the battery will fall and the regulator will respond, causing the dynamo output to balance the load.

The Cut-out—an Automatic Dynamo Switch.—It will be noticed from the ammeter readings that the dynamo does not charge at very low engine speeds. This is because it is not rotating fast enough to generate sufficient energy to charge the battery.

Connected between the dynamo and the battery is the cut-out—an automatic switch which acts as a " valve," allowing the flow of current from the dynamo to the battery only. It closes when the dynamo is running fast enough to charge the battery, and opens when the speed is low or the engine is stationary, thus preventing current from flowing through the dynamo windings from the battery.

The cut-out is located together with the fuses on the engine side of the dash.

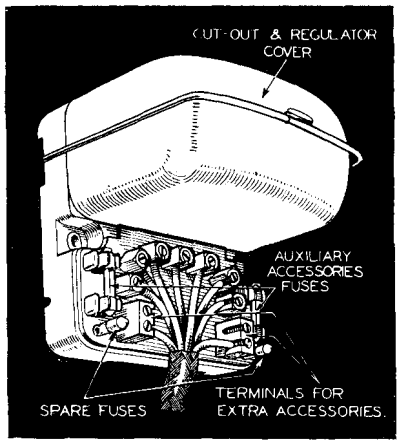
The Starter.—Observe the following points when starting :—

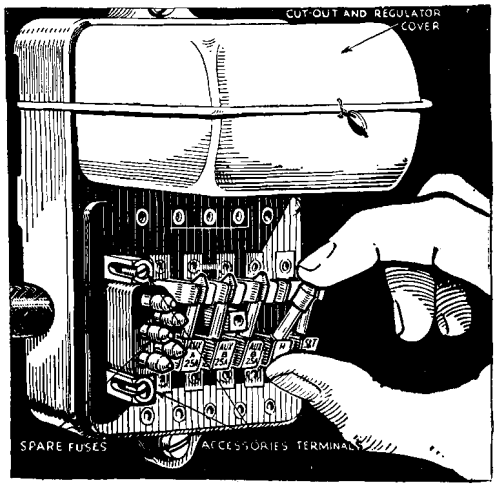
1. Operate the starter switch firmly, and of course release it as soon as the engine fires.
2. Never operate the starter when the engine is running. If the engine will not fire at once, allow it to come to rest before operating the switch again.
3. Do not run the battery down by keeping the starter on when the engine will not start.
4. In cold weather, starting will be facilitated by giving the engine a few turns by the starting handle before using the starter.

Attention Needed by the Starter.—Give the commutator and brushgear similar attention to that described for the dynamo.

Occasionally, if dirty, wash over the screwed sleeve on the armature spindle with paraffin and afterwards give it the merest trace of thin machine oil.

Instrument Panel.—The instrument panel houses the combined lighting and ignition switch, ammeter, starter switch control, etc., together with the speedometer, clock, etc. The instruments are illuminated by means of bulbs mounted on the back of the panel.





Illustrations Nos. 40 and 40a.—Cut-out, regulator, fuse and junction boxes. 40 shows the type fitted prior to Chassis No. SA.0903, and 40a the type fitted subsequently.

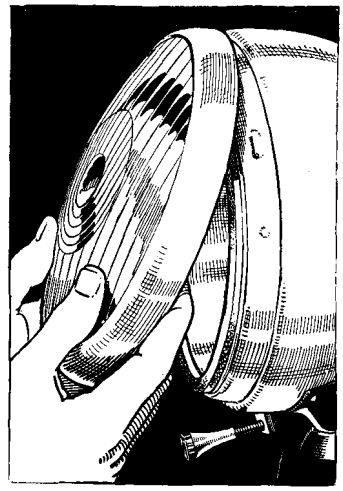
Cut-out, Regulator and Fuse Unit (Ceasing at Chassis No. SA.0902).—This unit houses the cut-out, regulator and fuses, and forms a junction box for distributing the cables to the various accessories.

The cut-out and regulator are accurately set before leaving the Works, and need no further adjustment. The cover protecting them is, therefore, sealed.

This unit also incorporates two fuses. One fuse protects the auxiliary accessories which are operative only when the ignition is switched on, while the other protects those accessories which can be operated irrespective of whether the ignition is on or off.

Fuse Unit (Commencing at Chassis No. SA.0903) is somewhat similar to the previous type except that it contains five fuses, two protecting the auxiliary accessories which operate through the ignition switch, one the accessories working independently of the ignition circuit and two protect the head, side and tail lamps.

Illustration No. 41.—



Showing method of removing headlamp front.

Lamps. Headlamps.—Removing Lamp Front and Reflector.—To remove the lamp front, slacken the single securing screw and move it downwards from the slot in which it fits. When replacing the front locate the top of the rim first, then press on the bottom and tighten the fixing screw.

To remove the reflector, turn back the ends of the cork washer at the top of the rim and remove the screw opposite the medallion in the top of the lamp. Turn reflector until markings " O " stamped on reflector rim and lamp body coincide. The reflector can then be withdrawn. When replacing reflector engage it with the lamp body, then turn it until the screw hole in its rim is opposite to the screw hole on top of lamp body. Secure reflector by means of screw.

Checking the Alignment.—The simplest way of checking the adjustment of the lamps is to take the car on a straight level stretch of road at night and examine the direction of the beams. They should be parallel with the road and with each other. If one appears to be out of alignment, adjust it as follows :— Slacken the single fixing nut at the base of the lamp and move the lamp on its universal mounting to the required position, finally locking the adjustment by tightening the fixing nut.

Focussing.—For the lamps to give a parallel beam, the filament of the bulb must coincide as nearly as possible with the focal point of the reflector. If the filament of the bulb is behind the focal point of the reflector, the beam will be divergent; while on the other hand, if the filament is in front of the focal point, the beam will be convergent, with a dark area in the centre of the beam. In either case, the lamps will have a poor range and will cause unnecessary dazzle to approaching traffic.

Before lamps are despatched from the Works, the bulbs are carefully focussed to give the best results. Provided that official Lucas bulbs are fitted as replacements, it should not be necessary to disturb the setting. If for any reason these are not obtainable, and ordinary bulbs have to be fitted, it may be necessary to re-focus by moving the bulb backwards or forwards along the axis of the reflector until the best lighting is obtained.

Cover up one lamp while testing the other. If the lamp does not give a uniform long-range beam without any dark centre, the bulb needs adjusting. To do this, remove the front and reflector, and slacken the clamping clip at the back of the reflector.

After each adjustment, note the effect with the reflector and front refitted.

When the best position for the bulb holder has been found, see that the clamping screw is tightened.

" Pass-lights " (Ceasing Chassis No. SA.0902). Removing Lamp Front and Reflector.—Slacken the fixing screw at the bottom of the lamp and press down out of locating slot. The front and reflector can then be withdrawn. When replacing, locate top of rim first, then press front home and secure by tightening fixing screw.

The bulb holder may be withdrawn for bulb replacement when the two securing springs at the rear of the reflector are moved aside.

" Pass-light " (Commencing Chassis No. SA.0903).—To remove the front and reflector pull out the spring clip at the bottom of the lamp and swing it out from its location. The reflector front can then be withdrawn. When replacing, locate top of rim first, then press home the front and secure by the clip.

Focussing is carried out in the same manner as described in the previous paragraphs.

Sidelamps.—The front of the lamp is removed for a bulb replacement when the screw at the top of the lamp is withdrawn. When refitting the front, locate the bottom and secure with the screw.

" Stop " Tail Lamp and Reversing Lamp.—The lamp front can be removed when the securing screw is withdrawn.

Cleaning.—All Lucas reflectors are protected by a fine transparent and colourless covering, which enables any accidental finger marks to be removed with a soft cloth without affecting the surface of the reflector. Never use metal polishes on Lucas reflectors. A light polish with a soft cloth is all that is necessary. 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.

Replacement of Bulbs.—When the replacement of a bulb is necessary, it is important not only that the same size bulb is fitted, but that it has a high efficiency and will focus in the reflector. Cheap and inferior replacement bulbs often have the filament of such a shape that it is impossible to focus correctly; for example, the filament may be to one side of the axis of the bulb, resulting in loss of range and light efficiency.

It always pays you to use Lucas Genuine Spare Bulbs as then these problems will not arise.

Bulbs Fitted.—

Headlamps	Lucas No. 54	12 v. 36 watt
Sidelamps	Lucas No. 207	12 v. 6 watt
" Pass-lamps " (ceasing SA.0902) ...	Lucas 57	12 v. 36 watt
" Pass-lamp " (commencing SA.0903) ...	Lucas 87	12 v. 60 watt
" Stop " Tail Lamp	Lucas No. 207	12 v. 6 watt
Reversing Lamp	Lucas No. 1	12 v. 24 watt
Panel Lights	No. 1224 M.E.S.	12 v. 2.4 watt
30 M.P.H.—Warning Lamp	No. 1224 M.E.S.	12 v. 2.4 watt
Ignition Warning Lamp	No. 252 M.E.S.	2.5 v. —
Trafficators (Festoon)	Lucas No. 256	12 v. 3 watt
Interior Light	Lucas No. 207	12 v. 6 watt

New Alto Horns.—The horns require no adjustment. Should one or both of the horns fail or become uncertain in action, first ascertain that the trouble is not due to faulty wiring, a blown fuse or loose mounting. If the cause of the trouble cannot be found, do not attempt to dismantle the horn, but return it to a Lucas Service Depot for examination.

Windscreen Wiper (Ceasing Chassis No. SA.0902).—The windscreen wiper is carefully adjusted and packed with grease during assembly, and needs no attention.

To start the wiper, pull out the handle and turn to disengage it from the switch. Then move switch to " ON " position. To stop the wiper, move switch to " OFF " position, pull out handle to disengage wiper blades from the gears, and turn end of handle into top of switch control.

Windscreen Wiper (Commencing Chassis No. SA.0903).—To start the wiper, pull out the knob on the driver's side and turn it until the drive is engaged. In this position the wiper is automatically switched on. To bring the arm on the passenger's side into operation, pull out its knob and turn it to bring the arm on to the screen.

To stop the wiper, pull out the knob on the driver's side to its full extent, turn it as far as the concealed stop and then release it. The arm on the passenger's side must be parked by pulling out the knob and turning it in an anti-clockwise direction.

Trafficators.—Every two to three months or if the arms become stiff at any time, raise each arm, and by means of a brush, matchstick or similar article apply a drop of thin machine oil, such as sewing machine oil, to the catch pin between the

arm and the operating mechanism. Use only the merest drop of oil—any excess may affect the working of the operating mechanism. The "Trafficators" are kept in the closed position by means of a spring. The arms can be pulled out by hand. If any difficulty is experienced, switch the "Trafficator" on and then, supporting the arm in a horizontal position, move the switch to the "off" position.

If at any time the arm fails to light up when in operation, raise the arm in the manner previously described and examine the bulb. If necessary, replace the bulb by a Lucas No. 256 (3 watt festoon type) bulb.

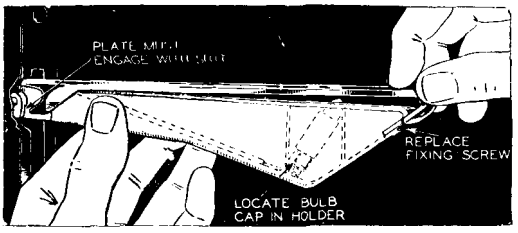


Illustration No. 42.— Replacing Trafficator bulb.

To remove the bulb, withdraw the screw on the underside of the arm and slide off the metal plate ; the metal plate can then be replaced. To replace the metal plate, slide it on in an upwards direction so that the side plates engage with the slots on the underside of the spindle bearing. Finally, secure the plate by means of its fixing screw.

Do not remove bulb while the "Trafficator" is switched on, as this may cause a short circuit.

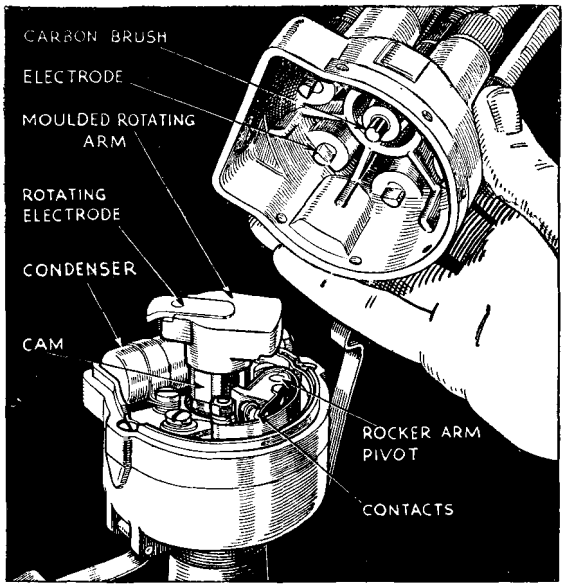


Illustration No. 43.—The distributor with cover removed.

Coil Ignition Equipment.—Considering the exacting duties coil ignition has to perform, the attention needed to ensure absolutely reliable service is very small.

After the first 500 miles running it is usual for the car to be taken to a service station to have various minor adjustments to the engine. As most of the bedding-down of the contacts occurs during this period, at the same time the contact breaker gap should be checked and, if necessary, reset to .012 in. maximum opening, and the cam must be given a smear of engine oil.

Lubrication.—The following parts of the distributor require lubrication :—

1. *Distributor Shaft.*—Add a few drops of thin machine oil through oiler provided about every 1000 miles.

2. *Cam.*—After lubricating at the end of the first 500 miles, give the cam a smear of engine oil every 3000 miles.

3. *Cam Bearing.*—About every 3000 miles, withdraw the moulded rotating arm from the top of the spindle by pulling 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 cam bearing. Take care to refit the arm correctly and to push it on to the shaft as far as possible, otherwise there is a risk of tracking and burning of the moulding.

4. *Contact Breaker Pivot.*—Every 5000 miles, place a spot of oil on the pivot on which the contact breaker rocker arm works.

5. *Automatic Advance Mechanism.*—About once every year the moving parts of the automatic timing control must be lubricated with a good grade engine oil. To render the control accessible, remove the distributor moulding and lift off the rotating distributor arm, then remove the contact breaker moulding by withdrawing its two securing screws.

Cleaning.—Keep the outside of the distributor clean, particularly the spaces between the high tension terminals. Very occasionally, remove the moulding by springing aside its two securing spring clips. Wipe the inside clean with a dry cloth, and see that the carbon brush is quite free in its holder. Clean the metal electrodes inside the moulding and also the rotating electrode on the distributor arm ; if necessary, use a cloth moistened with a drop of petrol for this.

Next examine the contact breaker ; you must keep the contacts free from any grease or oil. If they are burned or blackened, clean them with fine carborundum stone ; or if this is not available, you can use very fine emery cloth. Finish off with a cloth moistened with petrol, and remove all traces of dirt and metal dust. Misfiring is sometimes caused by dirty contacts.

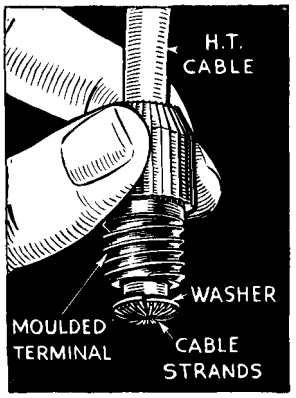
Checking and Adjusting the Contacts.—After the contacts are reset at the end of 500 miles running, they require only occasional adjustment. The chief cause of variation in the gap is wear of the heel of the contact rocker arm which bears upon the actuating cam. Provided you keep the cam smeared with engine oil, however (see Lubrication Instructions), the wear on the heel will be negligible, and the contact gap setting should only require adjustment at infrequent intervals.

To check the setting, turn the engine by hand until the contacts are fully opened. Now insert the gauge provided on the ignition screwdriver between the contacts. The gauge has a thickness of about 12 thousandths of an inch and it should be a sliding fit between the contacts when the gap is correct. We do not advise you to alter the setting unless there is quite an appreciable variation from the gauge. To make the adjustment keep the engine in the position to give maximum opening of the contacts and slacken the two screws securing the contact plate. Then move the plate until the gap is set to the thickness of the gauge. After making the adjustment, care must be taken to tighten the locking screws.

Renewing the High Tension Cable.—The high tension cables are those connecting the coil to the distributor and the distributor to the sparking plugs. When these cables show signs of perishing or cracking, they must be replaced by 7 mm. rubber-covered ignition cable.

The method of connecting the cable is to thread the knurled moulded nut over the lead, bare the end of the cable for about $\frac{1}{4}$ in., thread the wire through the brass washer provided, and bend back the strands. Finally, screw the nut into its respective terminal.

Illustration No. 44.—



Showing method of fixing lead to H.T. terminal distributor.

The Coil.—The coil requires no attention whatever beyond keeping its exterior clean, particularly between the terminals, and occasionally checking that the terminal connections are quite tight.

Ignition Switch and Warning Light.—The ignition switch, besides forming a means of stopping the engine, is provided for the purpose of preventing the battery being discharged by the current flowing through the coil windings when the engine is stopped. A warning lamp is usually provided in the instrument panel which gives a red light when the ignition is switched on and the car is running very slowly or is stationary, thus reminding you to switch off.

Should the warning lamp bulb burn out, this will not in any way affect the ignition system ; but you should replace it as soon as possible in order to safeguard your battery.

The bulb used is a No. 252 M.E.S.

Micrometer Timing Adjustment.—In order to obtain very fine timing of the ignition to the engine and to allow for altered engine conditions—e.g., state of carbonisation of engine, change of fuel, etc.—a micrometer adjustment is provided which allows fine adjustment to be made simply by the movement of a knurled knob.

The final setting can be made by use of the micrometer adjustment after running the engine. If the firing is found to be slightly too early or too late, adjust the knurled knob until the best engine performance is obtained. The adjustment should not be altered by more than 1 distributor degree at a time (1 division on the scale is equivalent to 2 distributor degrees).

Lucas " Mellotone Horns " (when fitted).—The horns are adjusted to give their best performance before being sent out of the Works, and will give long periods of service without any attention.

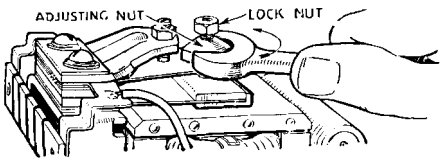


Illustration No. 45.—Mellotone horn adjustment.

If one of the horns fails or becomes uncertain in its action, first ascertain that the trouble is not due to some outside source, e.g., a loose connection or short circuit in the wiring of the horn. If both horns fail or become uncertain in their action, the trouble is probably due to a discharged battery or blown fuse. If the fuse has blown, examine the wiring for the fault and replace with spare fuse provided, a 35 ampere size.

It is also possible that the performance of a horn may become uncertain, due to its fixing bolt working loose. If after carrying out the above examination the trouble is not rectified, the horn may need adjustment; but this should not be necessary until the horns have been in service for a long period.

Adjustment does not alter the pitch of the note, it merely takes up wear of moving parts. When adjusting the horns, short-circuit the fuse, otherwise it is liable to blow. Again, if the horns do not blow on adjustment, release the push instantly.

Adjustment of Horns.—Remove the horn cover after withdrawing the fixing screw and detach the cover securing bracket by springing it from its fixing.

Adjustment must be made by the Centre Nut only.—Slacken the lock nut and turn the adjustment nut underneath, a few degrees at a time, in an anti-clockwise direction. It must be remembered that the adjustment is a very sensitive one. Tighten the locknut before testing the horns on each occasion.

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

Finally, if the note is still unsatisfactory, do not dismantle the horn, but return it to a Lucas Service Depot for examination.

Wiring System (Ceasing at Chassis No. SA.0902, see illustration No. 46).—Apart from the starter motor, which is a heavy gauge circuit complete in itself, there are twenty-six places where current, either from the battery or from the dynamo, is used. These may be divided into five groups :—

1. Those which can be used independently of the ignition switch and which have no fuse protection. They are :—
   The two headlamps.
   The two Passlights.
   The two sidelamps.
   The tail-lamp.
   The reversing light.
2. Those which can be used independently of the ignition switch and are protected by a fuse. The only one in this group which is standard equipment is the interior light ; but optional extras, such as spot lights, etc., come in this category when fitted.
3. Those which are automatically switched on with the ignition and have no fuse protection. They are :—
   The ignition.
   The ignition warning light.
   The two petrol pumps.
4. The petrol gauge is automatically switched on with the ignition, but is protected by a fuse.
5. Those which have separate controls, but which can only be used when the ignition is switched on. They are all protected by a fuse, and are :—
   The two horns.
   The two Trafficators.
   The stop light.
   The windscreen wiper.
   The oil gauge.
   The four panel lights.
   The 30 m.p.h. warning light.

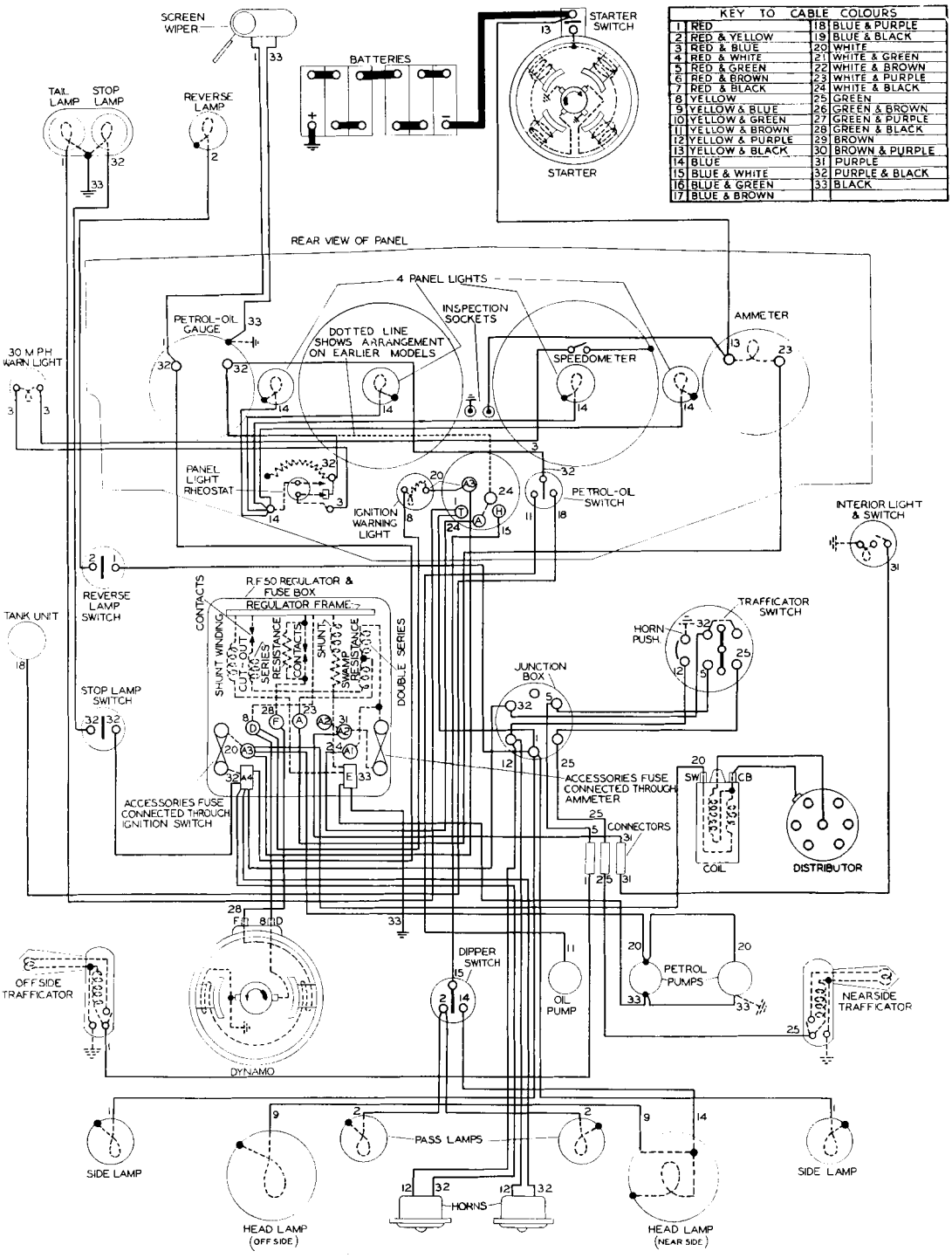


Illustration No. 46.—Diagram of the electrical wiring system ceasing at Chassis No. SA.0902.

Erratum.—The lead from the panel light rheostat to the petrol-oil level gauge should be connected to the left-hand terminal on the gauge (with the windscreen wiper cable) instead of to the right-hand terminal as incorrectly shown.

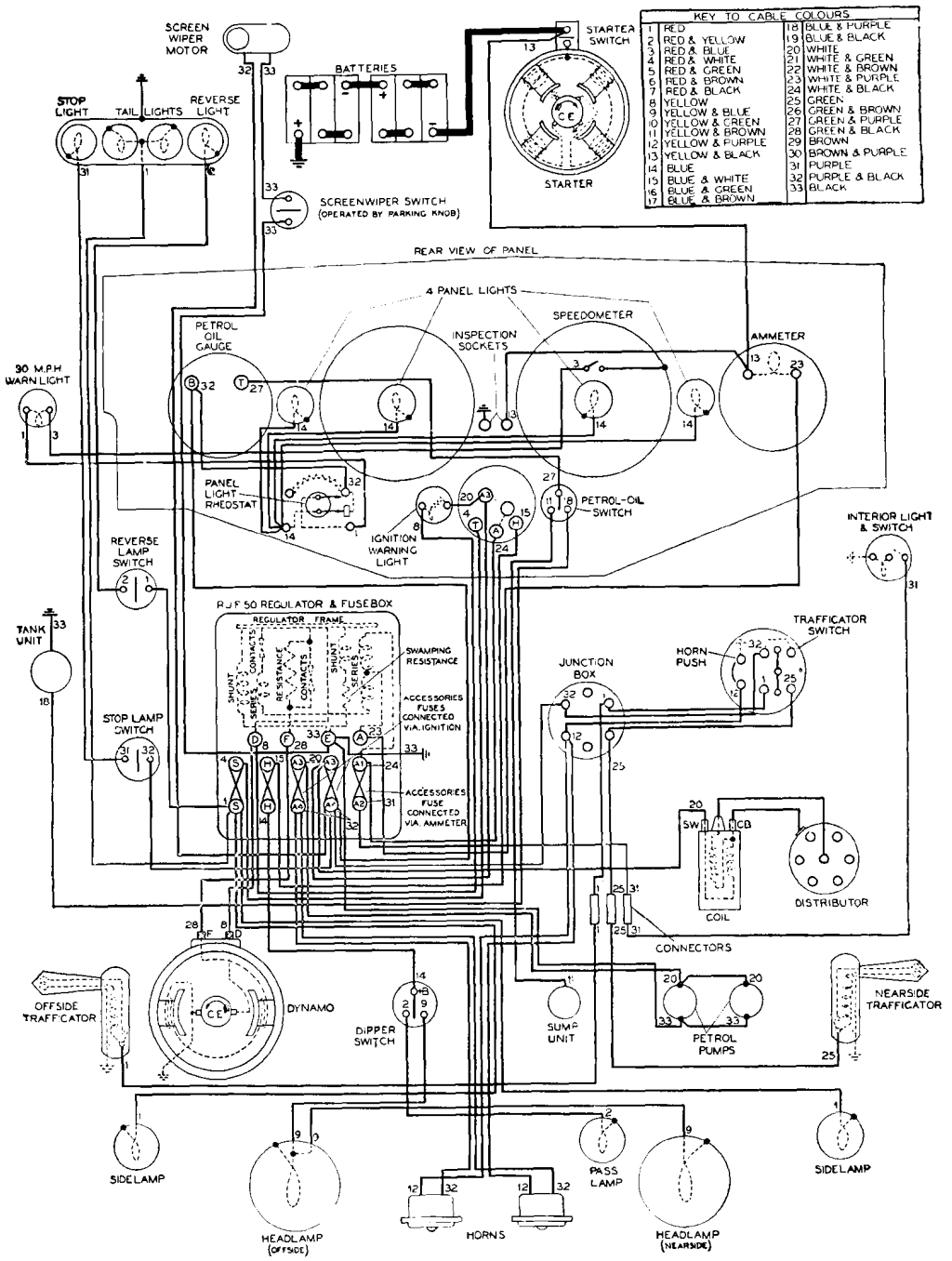


Illustration No. 46a.—Diagram of the electrical wiring system commencing at Chassis No. SA.0903.

The current leaves the battery negative terminal by the starter wire and returns to the positive terminal by the frame (earth) and earth connection.

These two wires are the only battery connections, and the negative wire to the starter carries all current so far. From there it is picked up by the yellow and black wire which goes to the ammeter, and from there on it is taken by the white and purple wire to the terminal marked " A " in the cut-out box.

These three wires and the ammeter are the main current connection, along which the current flows one way when the battery is supplying it, and the other way when the dynamo is charging the battery.

When the battery is supplying current it passes through part of the voltage control mechanism and comes out again in two places: (1) to the Terminal A.1, and (2) through the fuse alongside to the Terminals A.2.

When the dynamo is supplying current it comes from the terminal " D," (on the dynamo) by the yellow wire, to the terminal " D " on the cut-out box; from there it passes through the cut-out and the voltage control and comes out in three places : (1) to the terminal " A ", (2) to the terminal " A.1 ", and (3) through the fuse alongside to the terminal " A.2."

It will be seen, therefore, that the terminal " A.1 " is constantly supplied with current (and so is " A.2 " as long as the fuse is unbroken), whether that current is coming from the battery to " A " or from the dynamo to " D." When the dynamo is working, of course, all the current not drawn off from " A.1 " and " A.2 " passes from " A " along the main current connection described above, through the ammeter, to charge the battery.

From the terminal " A.1 " a white and black wire takes all the current required for the services listed in groups 1, 3, 4 and 5 ; and from the terminal " A.2 " a purple wire takes the current required for the interior light, and it is to this terminal that other wires may be attached for any of the optional extras that may be fitted, and that come in group 2.

The interior light circuit is completed through one of the three connectors which link up the chassis wiring with the body wiring, which connects the purple wire to a glazed black wire which runs up the inside of the upholstery to the switch, then to the light bulb, and thence by one of the three branches of a black wire (which is the common return of all the electric auxiliaries mounted on the body) to the frame (earth).

The white and black wire from terminal " A.1 " on the cut-out box carries the current to terminal " A " on the switch body on the back of the instrument panel, and from there through the switch body to the near-side one of the two centre terminals, where it is picked up by another white and black wire which carries it to the panel light rheostat.

From there it passes through the shorter of the two copper fingers to the terminal on the near-side of the rheostat body, to a red wire and so to the 30 m.p.h. warning light, thence by a red and blue wire to the speedometer and when the car is doing between 20 and 30 m.p.h. through a switch inside the speedometer body to the instrument panel (earth).

When the control knob of the rheostat is turned the current which arrived there by the white and black wire flows through the longer copper finger and the short black wire to the off-side terminal on the rheostat body and thence through the four blue wires to the four panel lights, and so to the instrument panel (earth).

When the ignition switch is turned on the current which arrived at " A " also goes to the other of the two centre terminals (marked " IG ") on the back of the switch body.

There are two white wires attached to this terminal: a short one to the ignition warning light, and another to terminal " A.3 " on the cut-out box.

If the dynamo is not charging, the current can flow through the ignition warning light, thence through a yellow wire to the terminal " D " on the cut-out box, thence through the yellow wire (by which the dynamo would feed the cut-out if it were charging) to the dynamo brushes and so to earth.

As soon as the dynamo begins to work it begins to oppose this direction of current flow, and by the time it has reached its charging speed there is an equal voltage on each side of the warning light and so no current passes.

The second white wire, which connects the terminal " IG " to the terminal " A.3 " on the cut-out box, carries all the current (with the exception of the ignition warning light) required for groups 3, 4 and 5.

Group 3, except the ignition warning light, is served by two other white wires attached to Terminal " A.3 "—one of which takes the current to the terminal " SW " of the coil, from which it passes through the primary winding of the coil out through terminal " CB," thence by a white and brown wire to the contact breaker and so through the points, when they are closed, to earth.

The other white wire takes current to the terminal marked " 12V " on the nearest petrol pump, where it is picked up by another short length of white wire which carries it to the similar terminal on the other pump. The current goes through the pumps to the terminals on the iron bodies (which are connected by a short length of black wire), and is then taken by a black wire to the terminal " E " on the cut-out box. This terminal " E " is connected by a black wire to the base of the steering gearbox, and so serves as a combined earth to all the circuits which it is most convenient to finish this way. This terminal will probably be found most convenient for optional extras.

The terminal " A.3 " is connected (through the fuse alongside) to the double terminal " A.4," and this is the start of all the circuits in groups 4 and 5.

The five wires attached to this double terminal are all purple and black.

First the petrol gauge and windscreen wiper are served together as far as the terminal " B " on the back of the petrol gauge.

Part of the current which arrives at this terminal is picked up by the red part of the twin wire in black casing which enters the body of the windscreen wiper, and (when the wiper is working) returns by the black part of the twin wire to one of the petrol gauge clamping screws which forms its earth via the instrument panel.

Inside the petrol-oil gauge the current used for level indication is split into two paths. One part goes to the gauge casing and so to the instrument panel (earth) by way of a solenoid which tends to pull the indicating hand towards " full." The other part goes to the terminal " T " on the gauge by way of another winding which tends to pull the indicating hand back towards " empty." And the tank and sump units are so arranged that the lower the level of petrol or oil the more current is allowed to pass from the terminal " T."

The current leaves this terminal " T " by a green and purple wire which takes it to the middle terminal of the petrol-oil switch and (normally) leaves this switch by a blue and purple wire (attached to the terminal nearest the instrument panel) which takes it to tank unit where it passes through more or less of the windings of the rheostat contained in this unit (according to the amount of petrol in the tank) to earth, via the metal of the tank and its supports.

When the petrol-oil switch button is pressed the connection to the blue and purple wire is broken, and the current is taken to the terminal farthest from the instrument panel, where it is taken by a yellow and brown wire to the sump unit, and so through the corresponding rheostat to the metal of the sump (earth).

Two other purple and black wires from the terminal " A.4 " lead to the horns from which two yellow and purple wires run to one of the pins in the junction box.

A single yellow and purple wire takes the current from the same pin up the steering column to the horn push. When the horn push is pressed, the end of this wire is put into connection with the top of the steering column (earth).

Another purple and black wire runs from terminal " A.4 " on the cut-out box to a terminal in the junction box, to which is attached a further purple and black wire which runs up the steering column to the trafficator control switch.

When this switch is turned to the right the current comes down the steering column by a red and green wire, and when the switch is turned to the left the current comes down the steering column by a green wire. Each of these wires goes to a terminal of its own in the junction box, which links it up to another wire of its own colour which runs to the connectors which join the chassis wiring to the body wiring. From its connector the red and green wire is continued by a red wire to the off-side trafficator, and from its connector the green wire is continued by another green wire to the near-side trafficator.

The two trafficator circuits are completed by branches of the same black body earth wire as serves the interior light already mentioned.

The last purple and black wire on the Terminal " A.4 " (cut-out box) carries the stop light current as far as one of the terminals (it does not matter which) of the stop light switch. When the switch is closed, by the application of the brake pedal the current is carried by another black and purple wire to the stop light through the bulb filament to the lamp casing, then through the rear number plate to the casing of the reversing light, and thence by a black wire (which serves as the earth to all three lamps on the rear number plate) to the chassis frame.

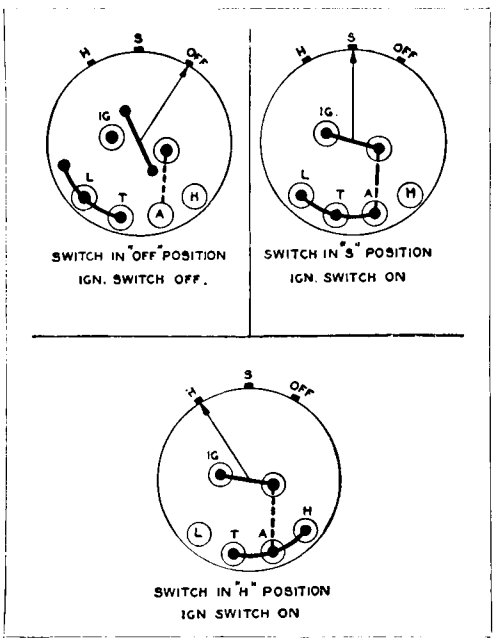


Illustration No. 47.—Internal connections of lamp switch.

It now only remains to describe the supply of current to those members of group 1 not already dealt with. That is to say, the lights controlled by the head and side-lamp switch on the instrument panel.

It has already been shown how the current supplied either by the dynamo or the battery arrives at the terminal " A " on the back of the switch body (through a white and black wire from the terminal " A.1 " on the cut-out box).

When the side-lamps are switched on this terminal " A " is brought into connection with terminal " T," to which two red wires are attached.

One of these wires takes current direct to the tail lamp, where it passes through the filament to the lamp body, and the circuit is completed through the number plate and its black earthing wire as already described.

The second red wire on the terminal " T " is carried to a terminal in the junction box, which serves to connect it to three other red wires—two of which run direct to the two side-lamps, while the third runs to the reversing light switch on the gearbox.

The current which goes to the side-lamps is earthed to the body of the lamps, which are in direct metallic contact with the wings, and so with the frame.

When reverse is engaged the current which arrives at the reverse light switch is carried back to the reverse lamp by a red and yellow wire, and the circuit is completed by the black wire already mentioned as the earth of all the lamps on the rear number plate.

When the headlamps are switched on, the terminal " A " on the switch body is put into connection with the terminal " H " as well as the terminal " T." Current is taken from this terminal " H " by a blue and white wire to the terminal " B+ " on the dipper switch, from one of whose other terminals a blue wire takes it to the off-side headlamp, and from the terminal inside this headlamp a yellow and blue wire takes current to the near-side headlamp. Both these lamp circuits are completed to the body of the lamp (earth).

When the dipper switch is turned the connection to the blue wire is broken, and instead a connection is made between the blue and white wire which feeds the switch and the other terminal. To this are attached two red and yellow wires which carry current direct to the two passlights.

These two circuits are completed through the bodies of the lamps to the bumper bar, and thence, through two flat steel strips which bridge the silentblocs on which the bumper bar is carried, to the frame (earth).

The Voltage Control.—In order that the dynamo may work, the field coils must be magnetised by passing a current through them, and the amount of this field current governs the amount of charge which the dynamo will produce.

Before the dynamo starts charging, the current which passes through the ignition warning lamp helps to energise the field coils, and so to get the dynamo started, but as soon as the dynamo gets going, part of the current which it produces is led back through a green and black wire from terminal " F " on the cut-out box to terminal " F " on the dynamo.

The amount of this field current is controlled by the voltage regulator, which proportions the dynamo output to the demands made on it by means of a pair of contact points. When these points are closed the full dynamo voltage is supplied to the field circuit, but when these points are open the current passes through a resistance which reduces the amount of current which can pass it, and so reduces the dynamo output.

Wiring System (Commencing Chassis No. SA.0903).—Apart from the starter motor, which is a heavy gauge circuit, complete in itself, there are twenty-seven places where current, either from the battery or from the dynamo, is used. These may be divided into six groups :—

1. Those which can be used independently of the ignition switch and are protected by fuses. They are :
   The two headlamps.
   The two sidelamps.
   The reverse lamp.
   The pass lamp.
   The two tail lamps.
   The interior lamp.

2. Those which are switched on by the ignition switch and have no fuse protection. They are :
   The ignition.
   The ignition warning light.
   The two petrol pumps.

3. The petrol gauge, which is brought into action by the ignition switch, but is fuse protected.

4. Those which are brought into action by the ignition switch and are fuse protected, but have an automatic operating device. They are :
   The stop lamp.
   The 30 m.p.h. warning lamp.

5. Those which have separate manual controls, but which can only be used when the ignition is switched on. They are all protected by fuses, and are :
   The two horns.
   The two trafficators.
   The oil gauge.
   The windscreen wiper.
   The four dash lamps.

6. The inspection sockets are a distinct circuit of their own, as they (apart from the starter motor) constitute the only circuit through which current from the battery can flow without passing through the ammeter.

Reference to the Illustration No. 46a reveals that the current leaves the battery negative terminal by the starter wire and returns to the positive terminal by the frame (earth) and earth connection.

These two wires (excluding, of course, the loop wire between the batteries) are the only battery connections, and the negative wire to the starter carries all current so far.

From there it is picked up by the yellow and black wire which goes to the input terminal of the ammeter.

Here there is a diversion. From this terminal a second yellow and black wire carries current to the " live " inspection socket (the shorter of the two terminals) and when an inspection lamp is plugged into these sockets this circuit is completed through the other terminal to the instrument panel (earthed to the frame by the speedometer and rev. counter drive cables, etc.).

It may be mentioned in passing that the battery may be charged in position on the car by simply plugging into these inspection sockets without disturbing any other connections.

Current from the battery which goes through the ammeter is taken by a white and purple wire to the terminal " A " on the back of the regulator box.

The three wires so far mentioned (excluding the diversion to the inspection sockets), together with the ammeter, are the main current connections along which current flows one way when the battery is supplying it, and the other way when the dynamo is charging the battery.

When the battery is supplying current it passes from the terminal " A " through part of the regulator winding to the terminal " A.I " on the back of the regulator box.

When the dynamo is supplying current it comes (negative) from the terminal " D " on the dynamo, by the yellow wire to the terminal " D " on the back of the regulator box, whence it passes through the cut-out to the voltage regulator from which it has two paths : (1) to terminal " A " and (2) to terminal " A.I," both on the back of the regulator box.

It will be seen therefore that the terminal " A.I " is constantly supplied with current whether that current is coming from the battery to " A " or from the dynamo to " D "—and it is from this point that current is drawn for any of the twenty-six points (since the inspection sockets are a circuit apart) where it may be wanted. When the dynamo is working, of course, all the current not drawn off from " A.I " passes from " A " along the main current connection described above to charge the battery.

The current at " A.I " (whether from battery or from dynamo) is parted here into two channels, a small part may pass through the fuse marked " Aux. A " to the terminal " A.2 " to serve the interior light. The rest is taken by a white and black wire to the terminal " A " on the back of the switch body to supply any, or all, of the other twenty-five points where current may be wanted.

Dealing first with the interior light. The current for this is carried by a purple wire to one of the three connectors (they are to be found just under the forward right-hand corner of the rear passenger's footwell) which link up the chassis wiring to the body wiring, and the circuit is completed through a glazed black wire which runs up the inside of the upholstery to the switch, then to the light bulb, and thence by one of the three branches of the black wire (which is the common return of all the electric auxiliaries mounted on the body) to the frame (earth).

The current which arrives at terminal " A " on the back of the switch body is split up here, according as the switches are manipulated.

1. When the light switch is turned to " S," terminal " A " is put into communication with terminal " T."

2. When the light switch is turned to " H," terminal " A " is in communication with both terminals " T " and " H."

3. When the ignition switch is turned on, terminal " A " is put into communication with terminal " IG."

Current which arrives at terminal " T " on the back of the switch body is taken by a red and white wire to the lower of the two terminals marked " S " on the back of the regulator box. Thence through the fuse marked " S and T" to the upper of the two terminals " S." To this terminal four red wires are attached :

One to each side lamp.
One to the two tail lamps.
One to the reverse lamp switch.

The sidelamp circuits are completed through the bulbs to the lamp bodies, thence by brass strips which bridge the rubber water excluders to the underside of the wings, and so to the frame (earth).

The tail lamp wire goes to a thimble terminal under the off-side tail lamp bulb socket which is connected by a black wire inside the number-plate casing, and two more thimble terminals to the near-side bulb. The circuit is completed through the bulbs to the number-plate casing, which is earthed by a black wire to the frame.

The reverse light switch is automatically closed by the engagement of reverse gear, and when this is done (provided of course that the sidelamps are " on ") current is carried from the other terminal of the reverse light switch by a red and yellow wire to a thimble terminal under the reverse light bulb socket. The circuit is completed through the bulb to the number-plate casing and the black wire to the frame, described above.

Current which arrives at terminal " H " on the back of the switch body is picked up by a blue and white wire and taken to the lower of the two terminals marked " H " on the back of the regulator box. Thence it passes through the fuse marked " H " to the upper terminal marked "H" on the back of the regulator box, where it is picked up by a blue wire and taken to the terminal marked "+B" on the dipping switch.

To one of the other two terminals (it does not matter which) of this switch is attached a red and yellow wire which leads to the pass lamp, while to the third terminal of the dipping switch is attached a yellow and blue wire which leads to the off-side headlamp.

The pass lamp circuit is completed (when the dipping switch is turned that way) through the lamp bulb to the lamp body, so to the badge bar and the frame (earth).

When the dipping switch is turned the other way, part of the current which reaches the off-side headlamp passes through the bulb to the lamp body, and so by the lamp bracket and radiator shell to the frame (earth).

The rest is picked up by another yellow and blue wire (in the same terminal as the main wire which brought the current from the dipping switch) and taken across to the near-side headlamp, whose circuit is completed in the same way as the off-side headlamp.

On the terminal " IG " on the back of the switch body are two white wires, one of which leads to the ignition warning light and the other to one of the two terminals (it does not matter which, as they are connected) marked " IG SW A3 " on the back of the regulator box.

The ignition warning light current flows through the lamp filament to a yellow wire which leads to terminal " D " on the back of the regulator box, thence by the yellow wire (by which the dynamo supplies current when it is charging) to the terminal " D " on the dynamo, thence through the dynamo windings to the dynamo frame (earth).

As soon as the dynamo begins to work it begins to oppose this direction of current flow, and by the time it has reached a sufficient output to close the cut-out points the terminals " D " and " A1 " (one on each side of the ignition warning lamp) are connected at the same voltage, so no current can pass through the lamp filament.

The current which arrives at the terminals " IG SW A3 " on the back of the regulator box is parted there into four channels :

1 and 2 along two white wires attached to one (no matter which) of these terminals, which lead respectively to the coil and the petrol pumps.

3 and 4 through the two fuses marked " AUX. B " to the two terminals " A4 " on the back of the regulator box.

The ignition wire (white) takes current to the terminal of the coil marked "SW," from which it passes through the primary winding of the coil, out through the terminal " CB " to a white and brown wire to the contact breaker, and so through the points, when they are closed, to earth.

The other white wire takes current to the terminal marked " 12 v. " of the nearest petrol pump, where it is picked up by another short length of white wire which carries it to the similar terminal of the other petrol pump.

The current goes through the pumps to the terminals on the iron bodies (which are connected by a short length of black wire) and is then taken by a black wire to the terminal " E " of the regulator box.

This terminal " E " is connected by a black wire to the base of the steering gear-box, and so serves as a combined earth to all the circuits which it is most convenient to finish this way.

That " AUX. B " fuse which is nearest the headlamp fuse protects the two horns. Current which passes it arrives at that terminal " A4 " nearest the terminal " H " on the back of the regulator box, where it is picked up by two purple and black wires, one of which runs to each horn. From each of which a yellow and purple wire runs to one (the same one) of the posts in the junction box.

From this post a single yellow and purple wire takes current up the steering column to the horn push, and when this is pressed the end of this wire is put into connection with the top of the steering column (earth).

The other " AUX. B " fuse (the one next the " AUX. A " fuse) protects :

The petrol and oil gauge.
The windscreen wiper.
The 30 m.p.h. warning light.
The four panel lights.
The stop lamp.
The two trafficators.

Current which passes it reaches the other " A4 " terminal (the one nearest the " A2 " terminal) on the back of the regulator box, where it is picked up by four purple and black wires which carry current to the petrol-oil gauge, the junction box, the stop lamp switch and the windscreen wiper respectively.

The purple and black wire which carries current to the petrol-oil gauge is connected to the terminal marked " B " on that gauge. This terminal acts as a junction post, for to it is connected a second purple and black wire which carries current for the dash lamps and the 30 m.p.h. warning lamp.

Inside the petrol-oil gauge the current used for level indication is split into two paths. One part goes to the gauge casing and so to the instrument panel (earth) by way of a solenoid which tends to pull the indicating hand towards " full." The other part goes to the terminal " T " on the gauge by way of another winding which tends to pull the indicating hand back towards " empty." And the tank and sump units are so arranged that the lower the level of petrol or oil the more current is allowed to pass from the terminal " T."

The current leaves this terminal " T " by a green and purple wire which takes it to the middle terminal of the petrol-oil switch and (normally) leaves this switch by a blue and purple wire (attached to the terminal nearest the instrument panel) which takes it to tank unit, where it passes through more or less of the windings of the rheostat contained in this unit (according to the amount of petrol in the tank) to earth, via the metal of the tank and its supports.

When the petrol-oil switch button is pressed, the connection to the blue and purple wire is broken, and the current is taken by the terminal farthest from the instrument panel, through a yellow and brown wire to the sump unit, and so, through the corresponding rheostat, to the metal of the sump (earth).

The purple and black wire which takes the current from the terminal " B " of the petrol-oil gauge leads it to the rheostat which controls the 30 m.p.h. warning lamp and the four panel lamps.

This rheostat has two copper fingers, of which the lower is always in contact with the resistance coils. This finger carries the current for the 30 m.p.h. warning lamp. The other finger is at once the switch and the control of the panel lamps. From this it follows that the 30 m.p.h. warning lamp is at its brightest when the panel lamps are switched " off "—is dimmed slightly when the panel lamps are switched " on "—and is progressively dimmed more and more as the panel lamps are dimmed.

The current for the 30 m.p.h. warning lamp is taken to a terminal on the near-side of the rheostat body, where it is picked up by a red wire which takes it to the lamp. Thence by a red and blue wire to the speedometer and, when the car is doing between 20 and 30 m.p.h., through a switch inside the speedometer to the instrument panel (earth).

When the upper copper finger of the rheostat is brought into contact with the resistance coils it carries current by a short flexible piece of black wire to the off-side terminal of the rheostat body, where it is picked up by the four blue wires which lead to the four panel lamps. These four circuits are completed through the lamp filaments to the instrument panel (earth).

The next of the four purple and black wires on the " A4 " terminal nearest the " A2 " terminal on the back of the regulator box leads direct to the windscreen wiper motor. Current which goes through this motor returns by a black wire to the windscreen wiper switch (which is part of, and operated by, the driver's operating knob), thence, when the switch is closed, by another black wire to the terminal " E " on the back of the junction box, and so is earthed by the same circuit as earths the petrol pumps.

The third purple and black wire on this " A4 " terminal leads to one of the posts in the junction box. From the same post another purple and black wire takes current up the steering column to the trafficator control switch. When this switch is turned to the left the current comes down the column again by a green wire, and when the switch is turned to the right the current comes down the column by a red wire.

Each of these wires goes to a terminal of its own in the junction box, which links it up by another wire of its own colour to the connectors joining the chassis wiring to the body wiring. At the connectors these wires are again continued by two wires of the same colour (green to green and red to red) to the trafficators, the green wire to the near-side and the red wire to the off-side trafficator.

The two trafficator circuits are completed by branches of the same body earth wire as serves the interior light already described.

The last purple and black wire on this " A4 " terminal goes to one of the terminals (it does not matter which) of the stop lamp switch. When the switch is closed, by the application of the brake pedal, the current is carried by a purple wire to the stop lamp. This circuit is completed through the lamp bulb to the number-plate casing (earth).

In order that the dynamo may work, the field coils must be magnetised by passing a current through them, and the amount of this field current governs the amount of charge which the dynamo will produce.

Before the dynamo starts charging, the current which passes through the ignition warning lamp helps to energise the field coils, and so to get the dynamo started, but as soon as the dynamo gets going, part of the current which it produces is led back through a green and black wire from terminal " F " on the back of the regulator box to terminal " F " on the dynamo.

The amount of this field current is controlled by the voltage regulator, which proportions the dynamo output to the demands made on it by means of a pair of contact points. When these points are closed the full dynamo voltage is supplied to the field circuit, but when these points are open the current passes through a resistance which reduces the amount of current which can pass it, and so reduces the dynamo output.

SECTION I

COACHWORK

Cleaning and Polishing.

Treatment of Upholstery, Carpets, Chromium Finish.

Removal of Tar Spots.

Method of Windscreen Opening.

Pneumatic Seats.

Sliding Roof.

Sun Visors.

Rear Arm Rest.

Fume and Draught Excluders.

Index is on Page 3

Cleaning and Polishing.—It is best to use a hose for washing the cellulose, but if this is not available use a sponge and plenty of water; a special wheel brush will be found best for the wire wheels. After washing, the car should be dried thoroughly with a chamois leather. Periodically polish the cellulose with a good quality wax polish. " Nobel " wax polish is to be recommended.

Before commencing washing it is a wise precaution to apply the brakes, this prevents to some extent water penetrating between the friction surfaces ; even so, it is wise to test the brakes afterwards, as it may be necessary to dry them out before travelling fast : this is done by running slowly with the brakes partly applied for a while.

We are able to supply $\frac{1}{2}$-pint tins of cellulose to match all M.G. finishes.

Upholstery.—Very occasionally remove the surface dirt with a damp (not wet) cloth. A good quality furniture cream sparingly applied is beneficial ; but it must be thoroughly rubbed into the leather, otherwise it will collect the dust.

Carpets.—The loose carpets should be removed from time to time and brushed thoroughly (don't beat them). Grease spots, etc., may be removed with petrol or benzine.

Tar.—Remove if possible before it is dry with a good tar remover, obtainable at most garages. Do not attempt to use petrol or chemicals likely to have injurious effects on the cellulose.

Chromium Finish.—The introduction of chromium finish has the effect of greatly reducing the labour previously entailed in cleaning the bright portions of the car. The chromium finished parts should on no account be cleaned by the use of metal polishes (all of which contain a certain amount of abrasive matter), but by the simple expedient of washing the parts with plenty of water and, when the dirt has been removed, polishing the surface with a clean dry cloth, or with chamois leather, until bright. In short, chromium finish should be treated in precisely the same way as coachwork and no special polish of any description is necessary.

All that is necessary to maintain the original brilliance of the chromium finished bright parts is that they should be wiped over once a week with a damp chamois leather. It is recommended that this is regularly carried out.

If the chromium finish has been neglected it may be restored to its original brilliance with soap and water applied with a soft rag.

Windscreen.—The single-panel windscreen fitted to M.G. Two-litre cars is provided on either side with guides, which can be locked in any desired position by wing nuts and thumb levers with cam action. See Illustration No. 48.

The thumb lever is so shaped that when the lever is pushed downwards, with the screen in the fully-closed position, it engages with a projecting pin and the windscreen is firmly locked in the closed position. *It is therefore impossible to open the windscreen, even though the wing nuts have been slackened off, until these thumb levers have been pulled upwards by hand.* To lock the windscreen in the open position, *push both thumb levers well downwards* and tighten up both wing nuts.

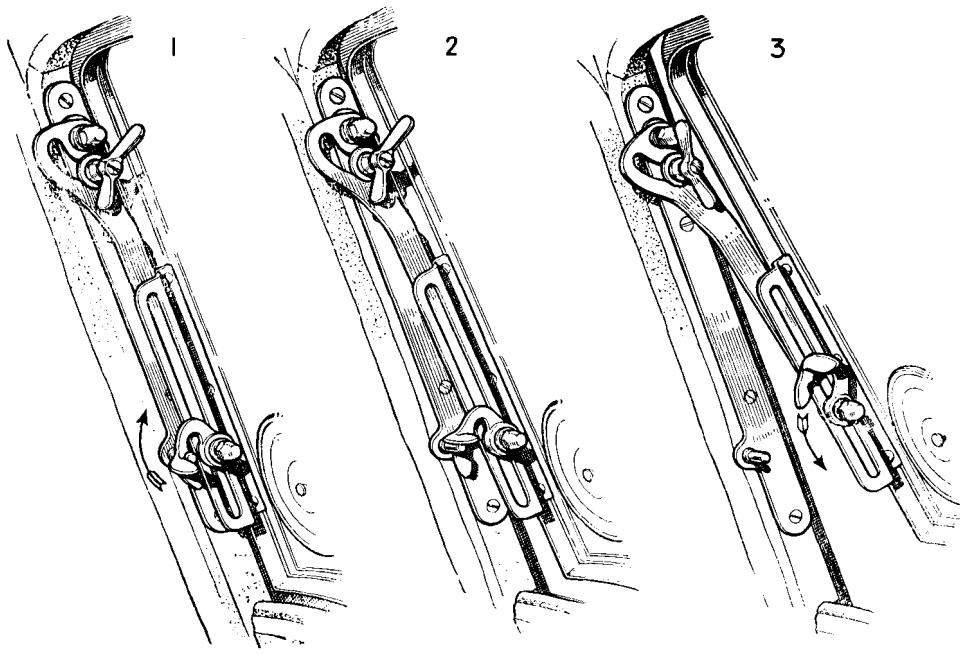


Illustration No. 48.—Position 1 shows screen closed and locked.
Position 2 shows screen just open—note position of screen lock.
Position 3 shows screen well open.

The Adjustable Pneumatic Seat Backs.—To obtain the maximum comfort from the pneumatic seat backs fitted to the front seats it is essential that they be inflated to the correct pressure.

The air pressure can be adjusted to suit individual requirements by pumping up the cushion through the valve provided with a cycle pump, or releasing the air by unscrewing the valve, as necessary.

A high pressure is not required, and the most comfortable degree of inflation can soon be arrived at by experiment.

Sliding Roof.—The sliding roof is operated by means of a handle on the front end in the centre. Turn it in an anti-clockwise direction to release, lift the forward end of the roof and slide it back to the desired position, when the roof can be locked in place by a reverse turn of the operating handle. It is well periodically to give the runners a smear of grease, but this should be done very sparingly.

Sun Visors.—The two visors are fitted above the windscreen, and they can be put in any desired position to prevent direct glare from the sun. Their operation is quite obvious, and they should not require any maintenance except an occasional clean with petrol or benzine.

Rear Arm Rest.—This folds back into the rear seat squab. It is pulled down into position by the leather thong fitted for the purpose. The hinged mechanism is quite sturdy, but sitting on it or applying undue weight should be avoided.

Rear Blind.—This is operated through cords by means of a sliding mechanism attached to the roof to the right and above the driver's head. To operate the blind, the operating lever should be pulled forward to its full extent, when it will automatically remain in position until pulled in the reverse direction, when the spring loading on the blind runner will return it to the normal position.

Fume and Draught Excluders.—Throughout the car, especially on the bulkhead and round the gearbox, are fitted various fume and draught excluders, some are rubber and others leather, laced in position. It is important to watch carefully that these are correctly replaced should any part of the car be dismantled involving their removal. In cases where the excluders are of leather laces, care should be taken that the laces are pulled up really tight. This point is emphasized, as a number of cases have come to our notice where they have only been loosely secured.

Remounting Body.—If it has been necessary completely to remove the body, the following procedure will enable the remounting operation to be carried out so that the bonnet, wings, etc., fit correctly.

1. Some insulating material must be placed between all body support brackets secured to the chassis frame and the body, usually this consists of cork or felt pads.
2. Register the body in a central position on the chassis frame.
3. Replace any packings in the same positions as they were before the body was removed. If this is not known, then the instructions given under "Adjustments to Doors," items 8 and 9, will enable their correct positions to be found.
4. Locate and fit securing bolts, but do not tighten any until all bolts are fitted.
5. Tighten all bolts either side of the body.
6. Secure rear end of body.
7. Tighten all bolts around the scuttle.
8. *Adjustment of door (door high).*—If the door is high, sufficient packing must be fitted under the front end of the body in front of the door to bring the door into correct position. Naturally, before packing is inserted under the front end of the body forward of the door, it is necessary to slacken all the bolts around the scuttle and also those securing the dash to the chassis frame.
9. *Adjustment to door (door low).*—This operation will necessitate packing under the hinge pillar, which is actually the reverse operation to that required when the door is high.

If the forward door should be fouling the body at the top front corner, it will be necessary to insert packing under the rear of the body, not only to throw the body forward but to raise it. In addition, packing will be necessary under the front of the body. The amount of packing required will be governed entirely by the amount of clearance or foul, some clearance is necessary to allow for body movement when the car is in motion. At the same time this gap must not be unsightly.

General—Freedom from body noises will result from an occasional check of the body securing bolts to ensure that they are tight. It is as well at the same time also to " go over " the hinge fixing screws, the door locks and their stops. A few drops of oil on the hinges or on the metal parts where movement takes place will often eliminate an elusive squeak. Do not forget sometimes to lubricate the bonnet hinge and fasteners.

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LUBRICATION RECORD

Delivery date of car..

ENGINE (Oil Changed)	MILEAGE	DATE	GEARBOX	MILEAGE	DATE	REAR AXLE	MILEAGE	DATE

LUBRICATION RECORD *(contd.)*

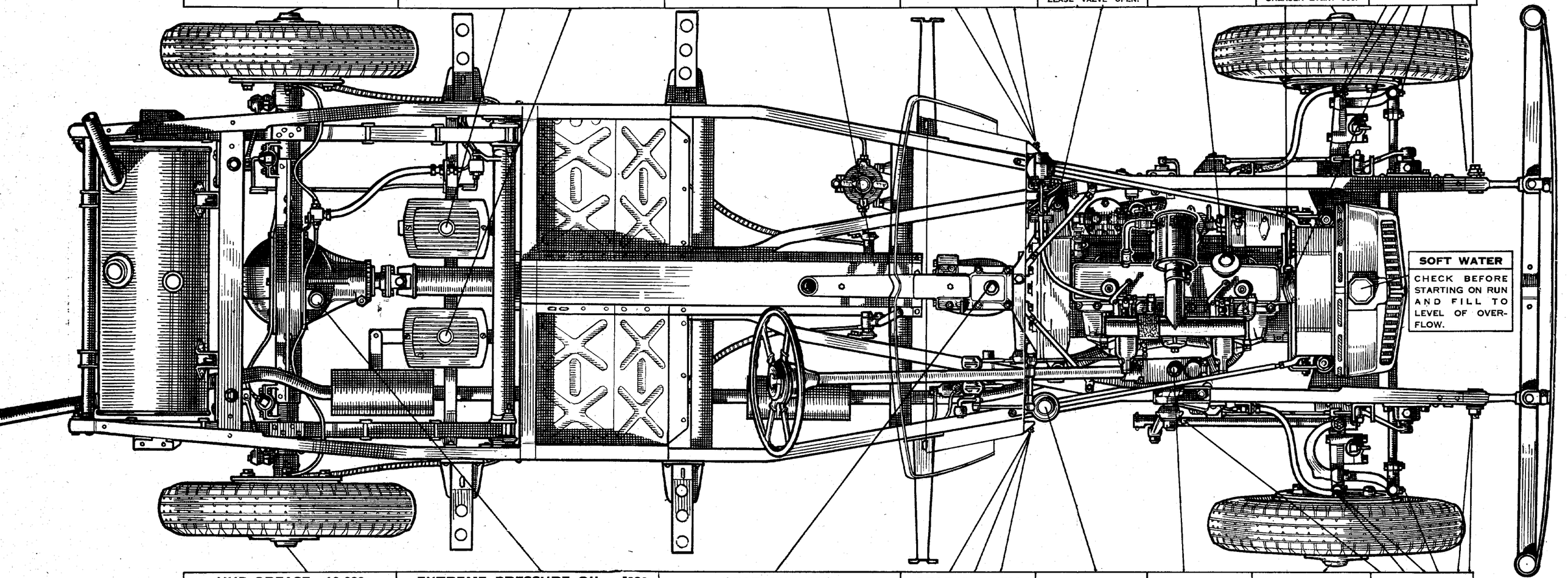
CHASSIS	MILEAGE	DATE	CHASSIS	MILEAGE	DATE	CHASSIS	MILEAGE	DATE

LUBRICATION RECORD

Delivery date of car..

ENGINE (Oil Changed)	MILEAGE	DATE	GEARBOX	MILEAGE	DATE	REAR AXLE	MILEAGE	DATE

HUB GREASE. 10,000	DISTILLED WATER—EVERY MONTH	GEAR OIL. 500	GEAR OIL. 500	JACKALL FLUID	ENGINE OIL	HUB GREASE	GEAR OIL. 500
REMOVE HUB CAP AND APPLY GREASE AT NIPPLE INSIDE HUB.	REMOVE BATTERY TOPS AND TOP UP SIX CELLS (THREE FOR EACH BATTERY) TO ¼ IN. ABOVE PLATES AT LEAST ONCE A MONTH.	TO LUBRICATE PROPELLER SHAFT SPLINE AT FRONT END ROTATE SHAFT UNTIL NIPPLE IS OPPOSITE HOLE IN TUNNEL.	GROUP NIPPLES FEEDING—REAR BRAKE CABLE, REAR SPRING SHACKLE, FRONT SPRING PIN.	CHECK EVERY MONTH AND TOP UP TO LEVEL OF MARK ON CONTAINER. MUST BE DONE WITH RELEASE VALVE OPEN.	CHECK DAILY AND KEEP ABOVE ¾ MARK.	REMOVE HUB CAP AND FILL HUB WITH GREASE EVERY 10,000. WATER PUMP 2 TURNS OF STAUFFER GREASER EVERY 500.	FRONT SHACKLES 2 TRACK ROD - - 1 KING PIN - - - 2 FAN BEARING - 1



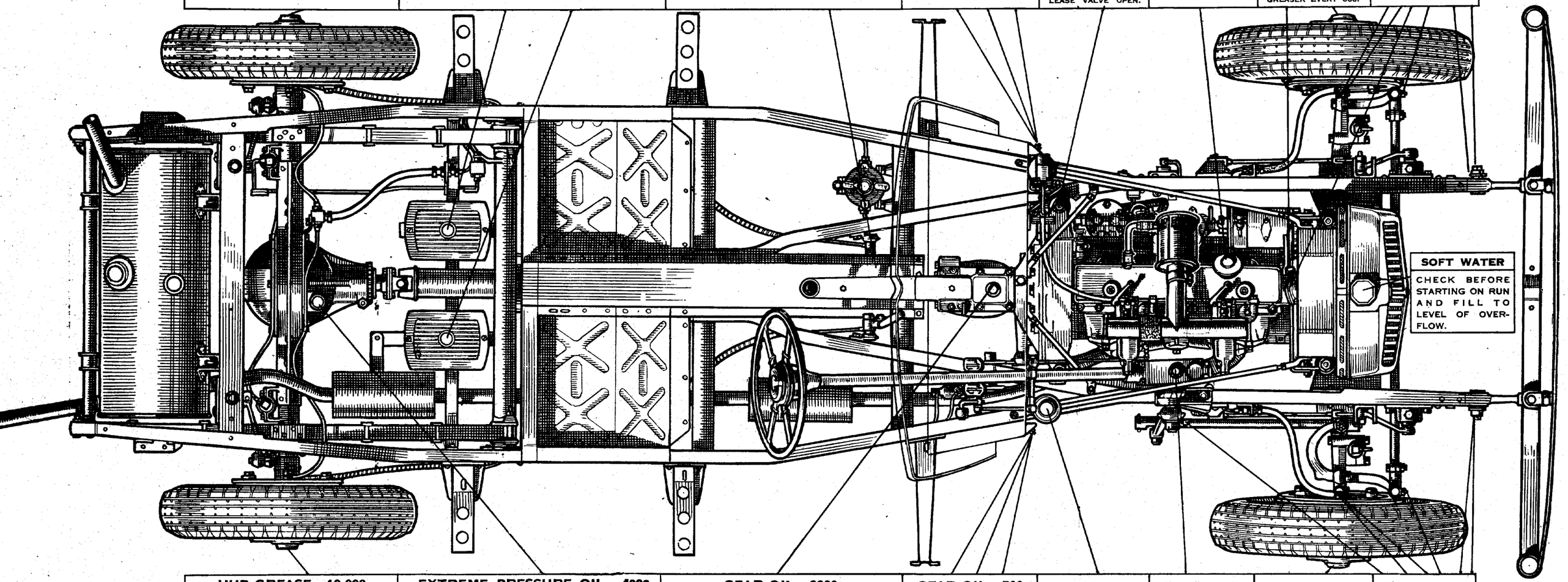
SOFT WATER

CHECK BEFORE STARTING ON RUN AND FILL TO LEVEL OF OVER-FLOW.

HUB GREASE. 10,000	EXTREME PRESSURE OIL. 4000	GEAR OIL. 2000	GEAR OIL. 500	LOCKHEED FLUID	GEAR OIL. 2000	HUB GREASE. 10,000	GEAR OIL. 500
REMOVE HUB CAP AND APPLY GREASE AT NIPPLE INSIDE HUB.	FILL TO "FULL" MARK ON DIP STICK. IT IS IMPORTANT NOT TO OVER-FILL.	FILL TO "FULL" MARK ON DIP STICK. DUCKHAM'S GEAR OIL "N"—CRASH TYPE. DUCKHAM'S SYNCHRO OIL "S"—SYNCHRO-MESH TYPE.	GROUP NIPPLES FEEDING—REAR BRAKE CABLE, REAR SPRING SHACKLE, FRONT SPRING PIN.	CHECK EVERY MONTH AND TOP UP TO LEVEL OF MARK ON CONTAINER WITH LOCKHEED NO. 5 DIACETONE FLUID.	REMOVE NUT AND TOP UP TO LEVEL OF FILLER.	REMOVE HUB CAP AND PACK HUB WITH GREASE.	FRONT SHACKLES 2 TRACK ROD - - 1 DRAGLINK - - 1 KING PIN - - 2

CHANGING OIL.—DRAIN ENGINE AND REFILL WITH NEW OIL EVERY 1500 MILES
DRAIN GEARBOX AND REFILL WITH NEW OIL EVERY 2000 MILES
DRAIN REAR AXLE AND REFILL WITH NEW OIL EVERY 4000 MILES

HUB GREASE. 10,000	DISTILLED WATER—EVERY MONTH	GEAR OIL. 500	GEAR OIL. 500	JACKALL FLUID	ENGINE OIL	HUB GREASE	GEAR OIL. 500
REMOVE HUB CAP AND APPLY GREASE AT NIPPLE INSIDE HUB.	REMOVE BATTERY TOPS AND TOP UP SIX CELLS (THREE FOR EACH BATTERY) TO ¼ IN. ABOVE PLATES AT LEAST ONCE A MONTH.	TO LUBRICATE PROPELLER SHAFT SPLINE AT FRONT END ROTATE SHAFT UNTIL NIPPLE IS OPPOSITE HOLE IN TUNNEL.	GROUP NIPPLES FEEDING—REAR BRAKE CABLE, REAR SPRING SHACKLE, FRONT SPRING PIN.	CHECK EVERY MONTH AND TOP UP TO LEVEL OF MARK ON CONTAINER. MUST BE DONE WITH RELEASE VALVE OPEN.	CHECK DAILY AND KEEP ABOVE ¾ MARK.	REMOVE HUB CAP AND FILL HUB WITH GREASE EVERY 10,000. WATER PUMP 2 TURNS OF STAUFFER GREASER EVERY 500.	FRONT SHACKLES 2 TRACK ROD - - 1 KING PIN - - 2 FAN BEARING - 1



SOFT WATER

CHECK BEFORE STARTING ON RUN AND FILL TO LEVEL OF OVER-FLOW.

HUB GREASE. 10,000	EXTREME PRESSURE OIL. 4000	GEAR OIL. 2000	GEAR OIL. 500	LOCKHEED FLUID	GEAR OIL. 2000	HUB GREASE. 10,000	GEAR OIL. 500
REMOVE HUB CAP AND APPLY GREASE AT NIPPLE INSIDE HUB.	FILL TO "FULL" MARK ON DIP STICK. IT IS IMPORTANT NOT TO OVER-FILL.	FILL TO "FULL" MARK ON DIP STICK. DUCKHAM'S GEAR OIL "N"—CRASH TYPE. DUCKHAM'S SYNCHRO OIL "S"—SYNCHRO-MESH TYPE.	GROUP NIPPLES FEEDING—REAR BRAKE CABLE, REAR SPRING SHACKLE, FRONT SPRING PIN.	CHECK EVERY MONTH AND TOP UP TO LEVEL OF MARK ON CONTAINER WITH LOCKHEED NO. 5 DIACETONE FLUID.	REMOVE NUT AND TOP UP TO LEVEL OF FILLER.	REMOVE HUB CAP AND PACK HUB WITH GREASE.	FRONT SHACKLES 2 TRACK ROD - - 1 DRAGLINK - - 1 KING PIN - - 2

CHANGING OIL.—DRAIN ENGINE AND REFILL WITH NEW OIL EVERY 1500 MILES
DRAIN GEARBOX AND REFILL WITH NEW OIL EVERY 2000 MILES
DRAIN REAR AXLE AND REFILL WITH NEW OIL EVERY 4000 MILES