Instruction Manual

for the

ONE-AND-A-HALF LITRE

(VA Type)

1937–1939

Price 10/-

INTRODUCTION

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.

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 required in the Instruction Book, it is hoped there will be no hesitation in communicating 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.

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 net 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.

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TELEGRAMS:
"EMGEE"
ABINGDON

THE MG CAR
COMPANY LTD
ABINGDON-ON-THAMES

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 run-in a new engine carefully ; 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 top up the back axle ; drain and refill with new extreme-pressure gear oil.

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.

INDEX

INDEX—*continued*

FOR AMENDMENTS AND ALTERATIONS SEE THE END OF EACH SECTION

ALPHABETICAL LIST OF ILLUSTRATIONS

GENERAL DATA

THE M.G. 1½-LITRE (VA Type)

ENGINE :—

Bore	69.5 mm.
Stroke	102 mm.
Cubic capacity	1548 c.c.
Horse-power (R.A.C. rating)	12
Firing order	1, 3, 4, 2
Sparking plugs	Champion L.10 (14 mm.)

VALVE TIMING (see page 69) :—

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 clearances (when hot): exhaust .015 in. max., inlet .010 in. max. (Refer to page 65 before adjusting.)
Contact breaker points .010 in.—.012 in.
Ignition timing, points just breaking T.D.C.

CAPACITY of :—

Engine sump	1⅜ gallons
Gearbox	1¾ pints
Rear axle	2 pints
Petrol tank	12 gallons
Water system	2⅜ gallons

Gearbox Ratios :	Overall Ratios :	Speeds at 1000 r.p.m.
TOP 1 to 1	5.22 to 1	16.29 m.p.h.
THIRD 1.35 to 1	7.05 to 1	12.07 m.p.h.
SECOND 1.95 to 1	10.18 to 1	8.36 m.p.h.
BOTTOM 3.38 to 1	17.64 to 1	4.82 m.p.h.

(See chart of speeds on gears against engine revolutions on page 88.)

DIMENSIONS :—	Saloon	Tourer
Wheelbase	9 ft. 0 in.	9 ft. 0 in.
Track	4 ft. 2 in.	4 ft. 2 in.
Overall length	14 ft. 1 in.	14 ft. 3 in.
„ width	5 ft. 2 in.	5 ft. 2 in.
„ height (Tourer hood up)	5 ft. 1¼ in.	5 ft. 0 in.

	Saloon	Tourer
WEIGHT (unladen)	24¼ cwt.	22 cwt.

TYRES :—	Saloon	Tourer
Dunlop	5.00×19	5.00×19

PRESSURES :—		
Front	30 lb.	28 lb.
Rear	30 lb.	28 lb.

SECTION A

MAINTENANCE DETAILS

Positions of Controls.—The accelerator on the M.G. 1½-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 on the Saloon and Foursome are of the self-cancelling type, operated by a switch in the centre of the steering column. The press button on the steering head operates the horn.

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 on the right-hand side of the facia panel and is switch-operated for bright or dull illumination for day and night driving (for details of switch see item 7 on page 9). This warning light is fitted with a green glass to distinguish between it and the ignition warning light and operates between 20 and 30 m.p.h.

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 is the revolution counter in thousands of r.p.m. Incorporated in the dial is an eight-day clock, the winder being behind the facia panel.

To the right of the revolution counter is the speedometer with total mileage and " trip " reading. (The " trip " release is at the back of the panel below the instrument—pull and return to zero.)

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, item No. 3, described on page 9).

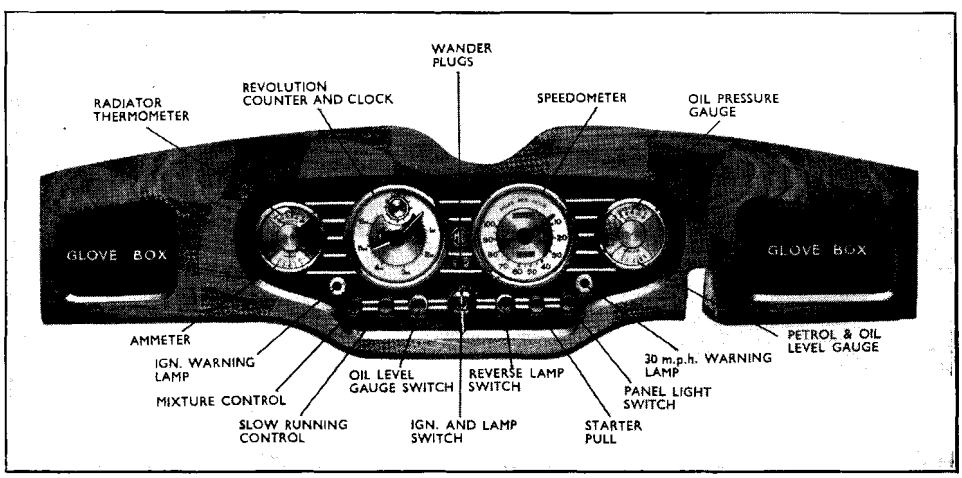


Illustration No. 1.—Facia board layout.

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

1. Mixture control or choke. The choke control has a number of notches which are disengaged by turning the knob in a clockwise direction. Pull out and re-engage notches by turning knob anti-clockwise. 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 operating lower readings on the right-hand instrument, when the button is pressed the oil sump capacity is given in place of the petrol tank capacity. Switch on the ignition to obtain these two readings.
4. Lamp switch and key-operated ignition switch.
5. Reverse lamp operating switch.
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" light only, for day driving.

The two warning lights on the dash panel are :

1. On the left ignition warning light.
2. On the right 30 m.p.h. warning light.

Starting.—To start the motor, switch on the ignition and fuel pump by means of a key on the centre of the instrument panel. The red warning light which comes into operation when the ignition is switched on is automatically switched off when the voltage of the dynamo equals that of the battery.

Richen the mixture, as described on page 8, item No. 1. The starter switch control pulls out to operate and should be released as soon as the engine fires. **See that the rich mixture control is returned to normal as soon as the engine will run without its assistance ; excessively rich mixture washes the oil from the cylinder bores.**

Another danger of excessive use of the mixture control is, if the engine does not fire a few moments after the starter is put into operation there is a possibility that the extra quantity of petrol drawn into the cylinders will "wet" the plugs, which may have to be taken out and dried before the engine will start.

When starting in cold weather it assists if the clutch is pressed out to relieve the starter motor of the gearbox load, which is considerable, due to the low temperature having partially solidified the gearbox oil.

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 THE FIRST 500 MILES	2250 r.p.m.	37 m.p.h.
FROM 501 TO 1000 MILES	2800 r.p.m.	46 m.p.h.
FROM 1001 TO 2000 MILES	3400 r.p.m.	55 m.p.h.

(Note the m.p.h. figures are top gear speeds.)

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 (excluding those having a graphite content), added to the fuel in the proportion recommended by the makers.

Re-fuelling.—Re-fuelling will probably be the next point on which information is sought.

The petrol tank on the M.G. 1½-Litre is at the rear and holds 12½ gallons, the filler is placed on top of the tank on the near-side. To open the quick lift filler cap press the catch below the cap, it will then fly open. To close simply shut down the cap, it will click when closed.

Although M.G. engines can be run satisfactorily 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 throughout the country.

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

The oil level in the sump can be determined by means of the dipstick which will be found just below the distributor on the near-side. The oil filler is placed in a convenient position on the valve cover, and access to it is obtained by lifting the bonnet on the near-side.

Lubrication.—The sump holds 1⅜ gallons of oil, and before the car leaves the Works has been filled with Duckham's N.P.3, 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.*
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 N.P.3 for emergency topping-up.

It is very essential that the sump is drained and refilled with new oil at the intervals specified on page 11.

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

Recommended and approved by the Company for general lubrication throughout the car are the following :—

Gearbox Oils

Recommended : DUCKHAM'S ADCOL "S" Synchro-Gear Oil

Approved : Essolube : Gear Oil Medium
Filtrate : Synchromesh
Mobiloil : CW
Price's : Motorine Amber A
Shell : Golden Extra Heavy
Sternol : Liquid Ambroleum SG
Wakefield's : Castrol Swanshot

Chassis Lubrication and Rear Axle Oils

Recommended : DUCKHAM'S ADCOL XS-Press Oil

Approved : Essoleum : Expee 110
Filtrate : EP Gear Oil
Mobiloil : EP Gear Oil
Shell : EP Spirax Heavy
Wakefield : Hi-Press

Do not mix the above oils. If a different brand is desired, the old oil must be removed.

The reserve tanks for the hydraulic brakes, the finger-tip controlled shock absorbers and the hydraulic jacks (if fitted) also need periodic attention, they are dealt with in Sections E, C and D respectively.

Change the Engine Oil after the first 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 57 and 59, 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.—The inaccessible chassis fittings are conveniently lubricated from six oil nipples, three on either side of the car, which are to be found on the front of the engine shield, mounted on an engraved plate indicating the points fed by each. The bonnet has to be lifted and the nipples fed by the oilgun provided with the car. Use Duckham's gear oil. Grease is too thick to pass through the pipe lines of the group system.

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.

All flexible control cables, i.e. starter, slow-running and mixture controls, revolution counter and speedometer cables, require lubrication every 10,000 miles.

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.

Cooling System.—The water system holds $2\frac{3}{8}$ gallons of water. It is desirable, if possible, to fill up with soft water. The water is circulated through the engine by means of a pump 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, as some have an immediate effect on hose connections. Bluecol has been approved, but in case of doubt, please write our Technical Department.

500 Miles Free Service.—When 500 miles have been covered, or as soon as possible afterwards, the M.G. 1½-Litre should be taken to the Dealer from whom it was purchased, and he will carry out, free of charge, the following items, which should be attended to at this mileage :

1. Drain sump, gearbox and back axle, and refill with Duckham's oils specified for the purpose.
2. Lubricate the vehicle throughout with Duckham's lubricants.
3. Clean and adjust plugs.
4. Check and, if necessary, adjust ignition timing, tappet clearances, carburetter control gear, mixture setting and slow-running, clutch, alignment of front wheels, all steering controls, tyre pressures, brakes, electrical equipment and Jackall system; look over and tighten all nuts, particularly cylinder head, wheels, spring clips and body securing bolts; top up battery, brake fluid, shock absorber and Jackall fluid containers.

All this work will be carried out free of charge, but lubricants, etc., are chargeable to the customer.

Reference Numbers.—In the event of it being desirable to communicate with the Factory, please be sure and quote chassis and engine numbers, and body number where the body is concerned, in all correspondence, as this materially assists the supply of spare parts and ensures quick service.

The serial numbers are to be found as follows :—

Chassis Number.—Immediately behind the near-side front dumb-iron on the side of the chassis frame.

Engine Number.—On the circular disc fixed to the off-side of the cylinder block (see Illustration No. 22). 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 near-side of the metal bulkhead.

Body Number will be found close to the guarantee plate.

Tool Equipment.—The tools on the Saloon and Coupé are packed away in a fitted tray in the luggage carrier lid. To open the tool tray lid give the two securing screws half a turn with a suitable coin. On the Four-seater the tools are in a box on the engine side of the bulkhead.

Tyres.—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 19″ × 5.00″ tyres are fitted, and the makers' recommended pounds pressures are as follows :—

Closed Models		Open Models	
Fronts : 30	Rears : 30	Fronts : 28	Rears : 28

It is suggested that when the car is to be driven hard, or with full load, pressures could with advantage be increased 2-3 pounds.

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.

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

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.

(*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.

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.

AMENDMENTS AND ALTERATIONS

SECTION A

MAINTENANCE DETAILS

Facia board layout.—Commencing at Chassis Number VA.1371, the reverse light switch, shown in Illustration No. 1, and referred to on page 9, is a spare, since a separate switch was incorporated in the gearbox to control the reverse light. The reverse light is now automatically switched on by moving the gear lever into reverse gear.

CHASSIS DIMENSIONAL DIAGRAM

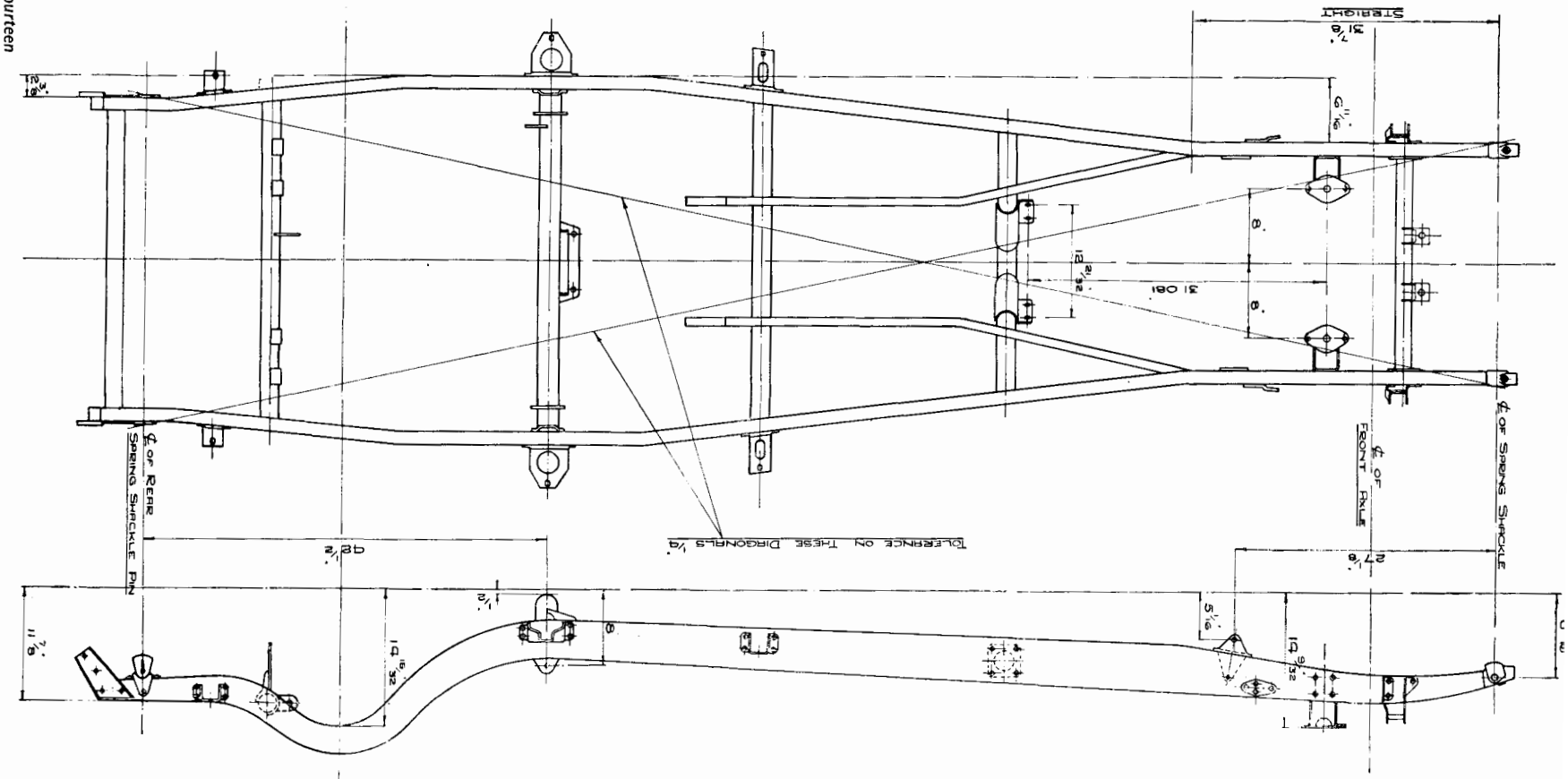


Illustration No. 2.—With the aid of this drawing the chassis frame can be checked for alignment. Should the frame need repair, due to accidental damage, it is advisable to return it to the Factory for repair.

SECTION B

CHASSIS

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

Undo the spring shackles front and rear after disconnecting the Lockheed brake pipes. Before disconnecting the brake pipes, reference should be made to the brake section (see Illustration No. 15) for correct method and to prevent loss of brake fluid due to incorrect dismantling.

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

Front Wheel Bearings.—Remove the lock nut and wheel. There is a hole in the hub, where it is splined, 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 (Part No. T.61).

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, and to smear with 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 with the aid of a suitable press (Part No. T.62).

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 (oil groove towards beam). Do not fit the king pin too tightly, it should be just possible to press it in its bushes 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 in. between the steel thrust washer and the flange of the brass bush.

Steering Ball Joints (Drag Link).—All steering joints are of major importance if the steering is to operate correctly. Loose and inadequately lubricated joints are responsible for many steering instabilities. It is advisable, therefore, to ensure that all steering joints are kept adequately lubricated and also receive 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 with gear oil (not grease).

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.

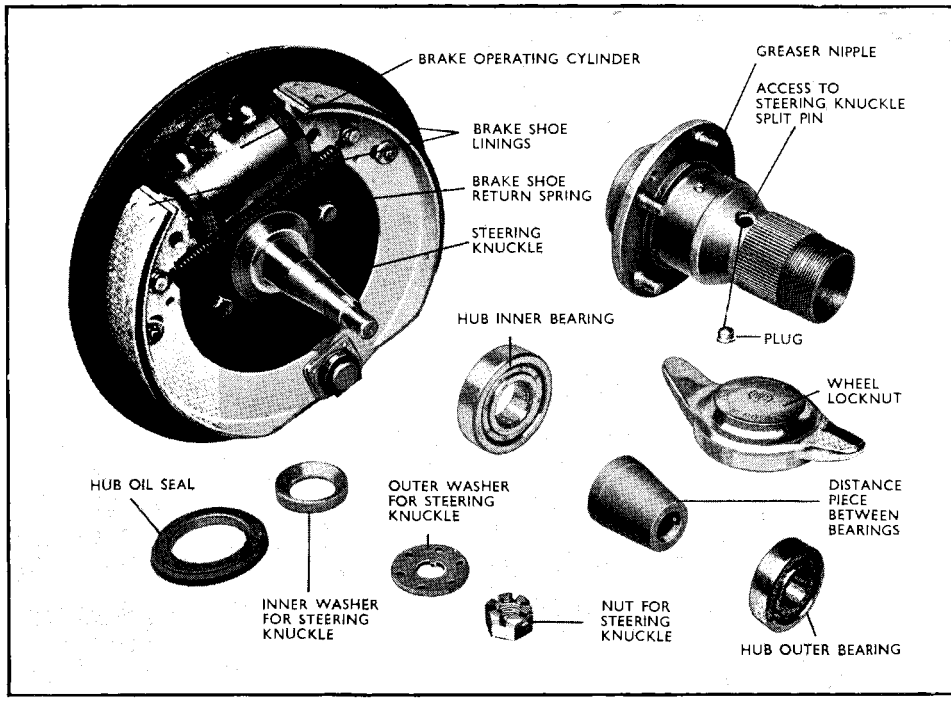


Illustration No. 3.—The front hub dismantled.

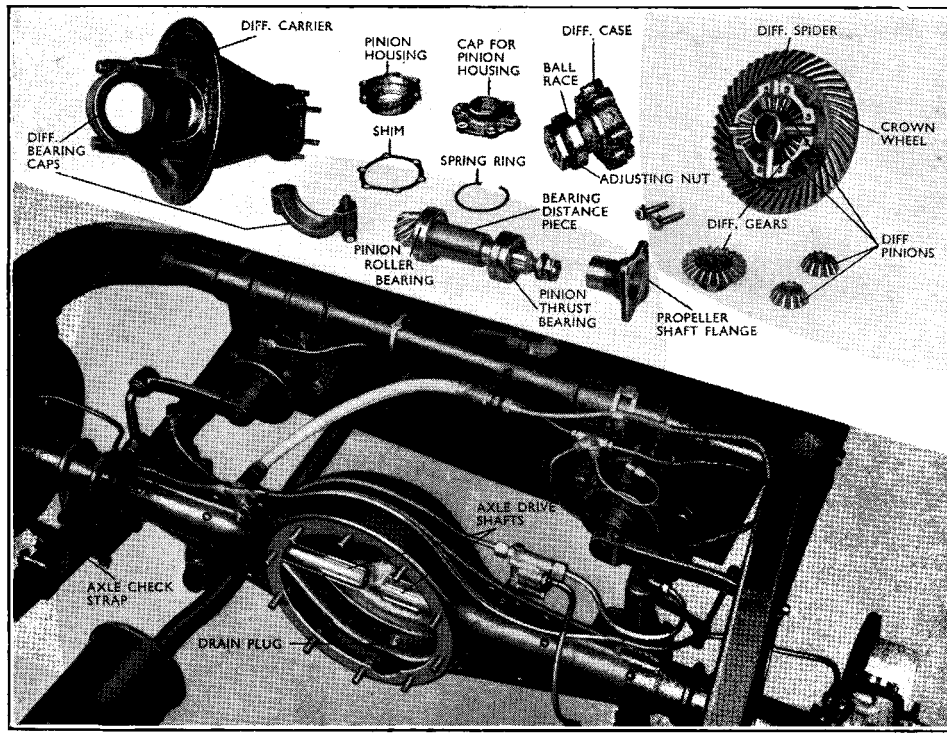


Illustration No. 4.—The differential unit dismantled.

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.

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. Tighten the lock nuts on the cables' yoke ends to maintain the adjustment.

Removing Rear Axle.—Take out in the following order the rear seat cushion, lift rear carpets, remove the rear floor side boards, and rear seat pan, the latter is secured by two bolts in either side, four bolts through the footwell from underneath and screws to the back of the body.

Uncouple the propeller shaft rear flange (first refer to the special instructions on page 21) 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. Disconnect the rear axle check straps and lift the chassis so that the springs are allowed to resume their natural curvature.

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

Refitting Rear Axle.—When refitting the rear axle to the car the instructions given for removal are reversed, but important points to remember are :—

1. Don't forget the rubber washers both sides of the rear spring front eye.
2. Don't forget to bleed both the Lockheed and Jackall systems, checking all joints to see that all unions are tight.
3. Don't forget to be careful when refitting the propeller shaft.
4. Don't forget to reconnect the axle check straps after the supports have been removed from the chassis.
5. Don't forget to refill the axle with the recommended lubricating oil.
6. Don't forget that the various felt packings fitted under the rear seat pan are very necessary and therefore should be carefully refitted.

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 drain plug (see Illustration No. 4).

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 from under the car if desired. Uncouple the propeller shaft rear flange, first marking them as described on page 21. Remove the nuts which secure the differential housing to the axle casing and lift out the differential housing.

Dismantling Differential Unit.—Remove the six nuts securing the pinion bearing housing assembly to the differential carrier, when this assembly can be withdrawn. The shims should then be taken off from the studs. After the propeller shaft flange (see instructions on page 21) and the countersunk screws securing the cap of the bearing housing are removed the ball race with its housing, distance piece and roller race can be withdrawn from the pinion. The outer track of the roller race can now be taken away from the differential carrier after the rear retaining circlip has been removed.

The crown wheel and differential unit should then be removed from its carrier; it is held in place by the two caps. It is necessary to remove only the eight bolts which secure the crown wheel to the differential housing for this unit to be dismantled completely.

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

1. That the shims for adjusting the bevel pinion are clean and undamaged.
2. 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.
3. 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.
4. That the differential ball bearings are against the shoulders in the differential carrier caps.
5. That the eight bolts securing the crown wheel to the differential are tight and locked by the tab locking washers.

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 shims between the pinion housing and 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 be understood.

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

1. As a starting point, insert .010 in. thickness of shims behind the pinion housing.
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.

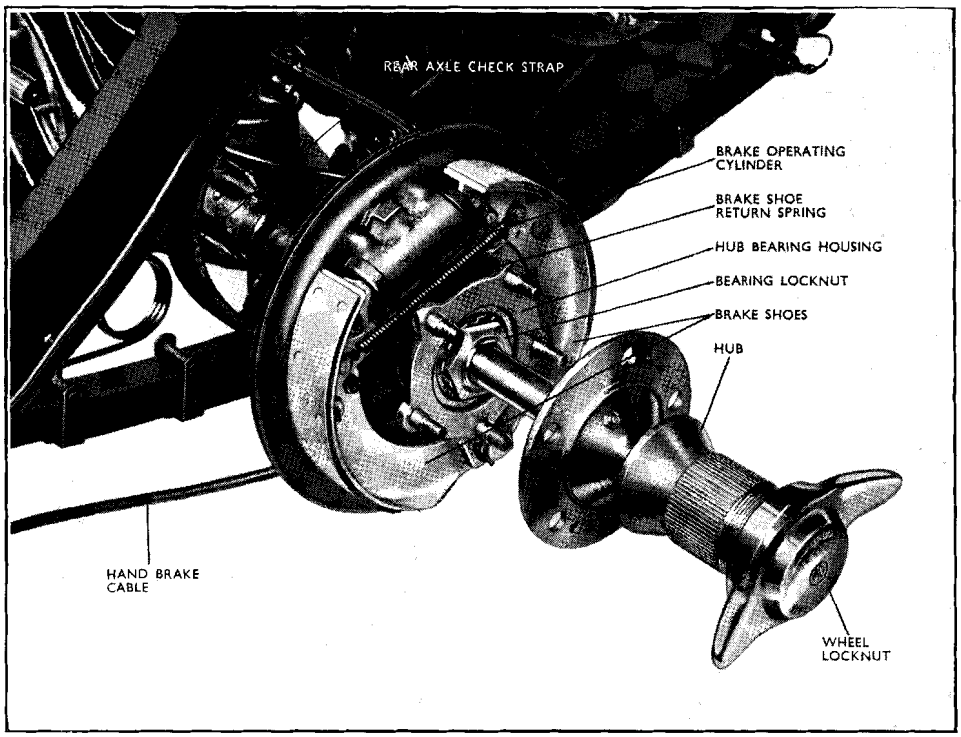


Illustration No. 5.—The rear hub partially dismantled.

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, which ensure full tooth contact under load.

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, shims can be removed from behind the pinion housing, not exceeding .004 in., or, alternatively, additional shims inserted, also not exceeding .004 in.

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. (Illustration No. 5.)

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 re-assembly, 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. The brass bushes are longer than the width of the spring eye, when replacement bushes are fitted it is essential that an equal amount protrudes either side of the eye. Brass washers fit over the protruding ends to provide a face surface for the shackle plates. The bushes will have to be reamed 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.

This point must be lubricated from underneath the car, and it may be necessary to rotate the propeller shaft until the greaser nipple points to the ground.

AMENDMENTS AND ALTERATIONS

SECTION B

CHASSIS

Suspension Springs.—Commencing at Chassis No. VA.1255 a slightly different type of suspension spring was fitted. The leaf retention clips are of entirely different construction which do not allow the leaves to be parted for greasing, the best method of lubrication, therefore, is to spray with a penetrating lubricant.

Steering Knuckle (King) Pins.—The thrust race fitted to the top of the king pin has been replaced by a bronze thrust washer between the bottom of the axle beam eye and the steering knuckle.

This alteration commenced at Chassis No. VA.1255.

Cars fitted with the thrust race can be converted if desired by removing the thrust race, replacing the metal cover and circlip, to exclude grit and water, and fitting the thrust washer. If, however, the king pin needs renewal the latest type of king pin and thrust washer should be fitted.

The difference between the washer used with the original type of king pin and the latest type is only in the diameter of the hole, being larger for the original type of king pin.

SECTION C

SHOCK ABSORBERS

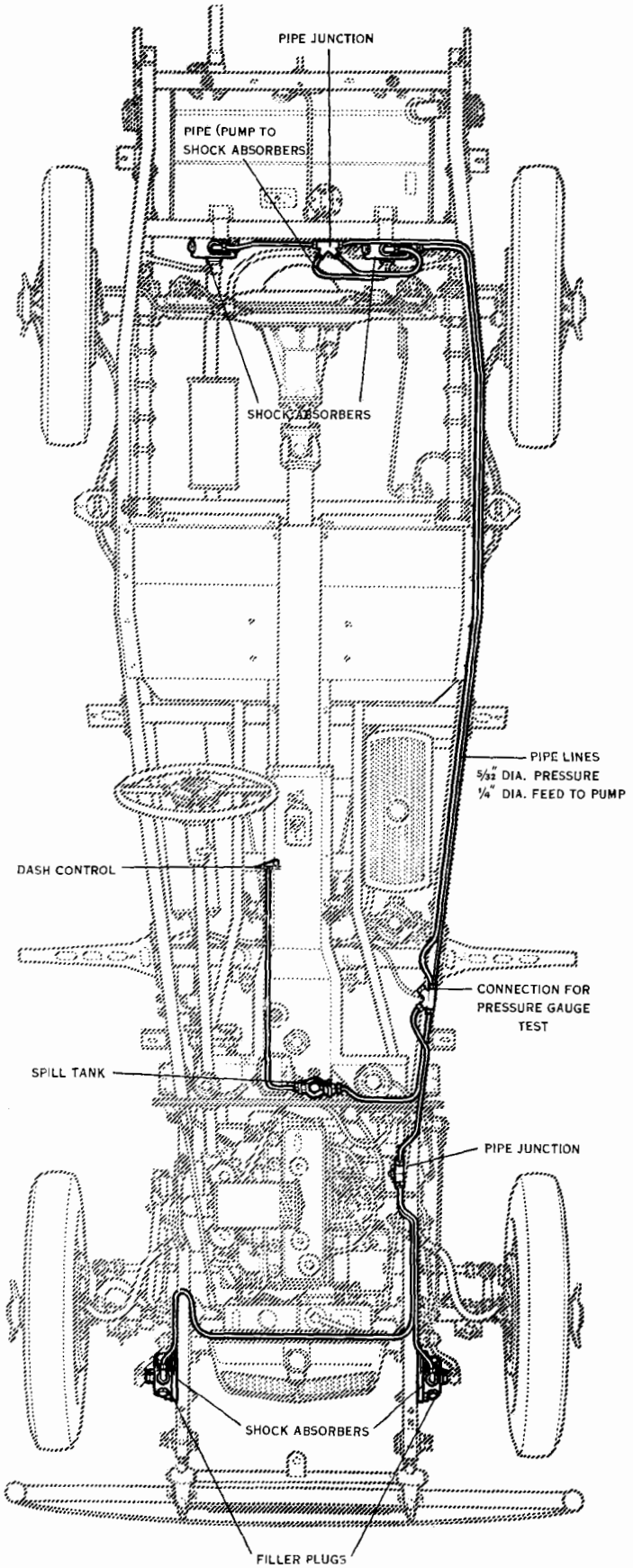


Illustration No. 6.—The shock absorber layout.

Luvax Shock Absorbers.—The shock absorbers fitted to the M.G. 1½-Litre are of the Luvax hydraulic finger-tip controlled type and are designed to control the road springs on both compression and recoil.

Operation.—This system (see Illustration No. 7) utilises the axle movement as the controlling factor for the amount of damping imposed on the spring by the shock absorber, with an over-riding control operated by the driver, so that personal tastes, change in load, and other variables, can be provided for.

The system consists of four special **Luvax Shock Absorbers** fitted with controllable valves which are operated by fluid pressure, the source of pressure being a *pump* operated by axle movement. This pump will generate pressure in proportion to axle movement, the more the axle bounces in relation to the frame the higher the pressure generated in the system, and the farther the shock absorber valve will be closed, thus increasing the damping capacity. Conversely, when the relative movement between axle and frame decreases, the pressure will be decreased, the shock absorber valve will be opened, and the damping capacity reduced. It thus provides an automatic control for the damping of the road spring.

The *over-riding control* is by a *spill valve* mounted on the rear face of the engine shield and controlled by a *lever* on the steering column, which enables the pressure generated by the pump to be discharged into a *reservoir* (which is at atmospheric pressure) at varying rates depending on the position of the spill valve. From the bottom of this reservoir the oil is sucked back into the pump. Usually the "Mid." position will be the best place for the control lever, as rough roads will automatically increase the damping and smooth roads reduce it, but if, due to increase of load or increase of speed, a fiercer damping is required, then the valve should be shut ("Max." position). If, on the other hand, the load is small and it is desired to have maximum flexibility, then the valve should be open ("Min." position). It will of course be realised that the automatic variation occurs in any position of the control valve lever. These conditions are, of course, what are required to attain the best results.

It will usually be found that control requires to be slightly more towards "Min." in the Winter than the Summer, other conditions being equal.

Maintenance of Shock Absorbers (excluding the Control System).—The replenishment of the shock absorbers with fluid is important ; the controlling system will also need replenishment with fluid—this, however, is dealt with under "Maintenance of the Finger-tip Control" and requires another special fluid. After about every 8000-10,000 miles' running, unscrew the filler plug on the top of the shock absorber casings and examine the fluid levels. If necessary, add *Luvax Official Hydraulic Shock Absorber Fluid* to the level of the filler plug. It is essential that the recuperator chamber is not allowed to become empty, otherwise air will enter the working chamber and impair the action of the shock absorber.

Fluid.—Use only Luvax Official Hydraulic Shock Absorber Fluid. This is a special grade of fluid whose properties have been carefully selected to meet the conditions essential for efficient working at all times. It can be obtained from any Lucas—C.A.V.—Rotax Service Depot or M.G. Service Station in sealed one-pint tins with a special pouring spout. It is imperative to use this Official Luvax Fluid as otherwise the working of the shock absorbers is likely to be seriously affected.

Maintenance of Finger-tip Control for Shock Absorbers.—The essential parts of the control (see Illustration No. 7) are the spill valve " A " and the pressure pump " B," which is driven from the rear axle (near-side), also the connecting pipe lines, all of which are indicated on the diagram (Illustration No. 6).

The system is protected by a filter in the bottom of the spill valve body (see Illustration No. 7), which can be cleaned by washing in petrol after withdrawing the body from the valve chamber (press fit).

The spill valve is protected by a filter placed between the pipe and the valve body (see Illustration No. 7), which can be unscrewed and also cleaned by washing in petrol.

No other attention is necessary unless the pipe line is disconnected for service work or some other reason, in which case some oil will be drained from the pipe line and replaced by air. In which case, after reassembly, it is necessary to refill the pipe line so that it is " solidly " full of oil. Use an oilgun for this purpose filled with the correct oil. First disconnect the spill valve outlet pipe " C " from the bottom of the spill valve reservoir, and attach the oilgun to the pipe line. Disconnect also the unions on top of all four shock absorbers, then force oil into the pipe line until the ends of all four pipes are flowing with **air-free oil.** Reconnect the ends of all four pipes to the shock absorbers and then, with the spill valve in the closed position, raise the pressure in the system with the oilgun until the relief valve opens and discharges oil into the spill valve reservoir. When the filler cap is removed oil may easily be seen surging past the cone valve.

Finally, with pressure maintained in the system as described above, the line " C " should be carefully examined for leaks or weeping of oil at any joint. Every joint in this line must be oiltight and should there be the slightest crack in the pipe line a new length of pipe should be fitted. This pressure test is very important, as under working conditions this pipe line is a suction line and the slightest tendency to suck air will prove fatal to the proper functioning of the system.

The car should finally be checked by running on the road to see that the desired control is obtained.

An additional check is to connect a pressure gauge to the spare plug indicated on Illustration No. 6 and see that it rises as the car passes over an increasingly rough road. It will be found that with the control lever in the " Mid " position the pressure gauge will register 25 to 45 lb. sq. in. on a rough road, or from 50 to 75 lb. on a very rough road.

A similar method may be used in the shop by connecting the pressure gauge as already described, and disconnecting the link on the pump from the shock absorber and operating the lever by hand. With the control valve in the " Shut " position, a dozen strokes should bring the gauge up to 25 lb. sq. in. If it is thought that the damping is incorrect, then all four shock absorbers can be disconnected from the links, and with one operator working the lever of the pump the increase of the damping of the other three can be measured in conjunction with the gauge reading by another observer.

It is important that the valve position is in correct relationship with that of finger lever. This may be checked as follows : With finger lever in the " Max." position, a groove which will be seen on valve spindle should line up with a similar groove on flexible drive support bracket on top of reservoir. The valve will then be shut (see Illustration No. 7).

The fluid in the control system is *not* the same as that in the shock absorbers, but a special thin oil (Duckham's Shock Absorber Ride Control Oil), and the reservoir of the spill valve should be inspected every month to see that it is full to within one inch of the top.

The shock absorbers and pump are accurately set before leaving the Works and no further adjustment is necessary, therefore no means of adjustment is provided other than the dash control.

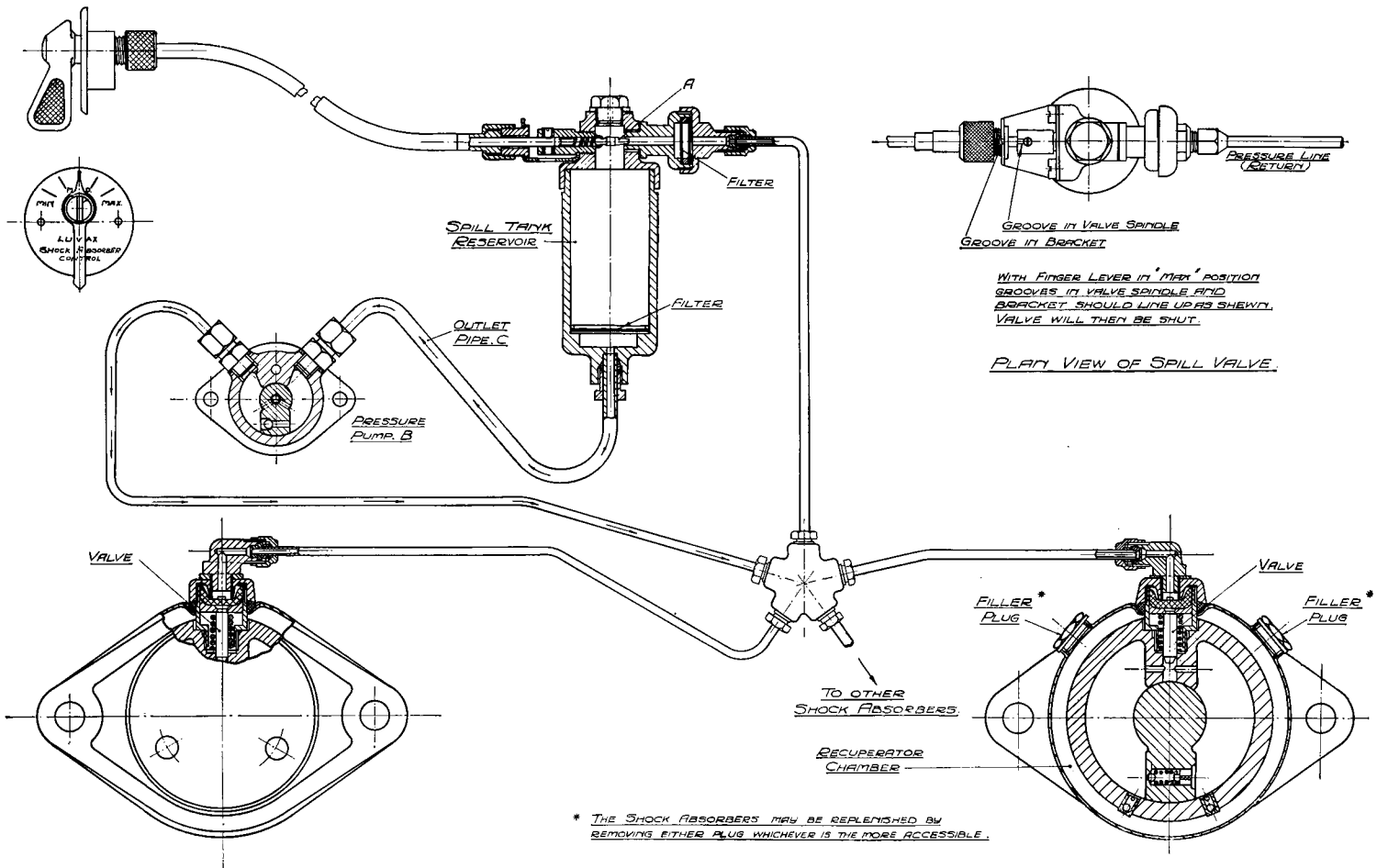


Illustration No. 7.—Shock absorber control system.

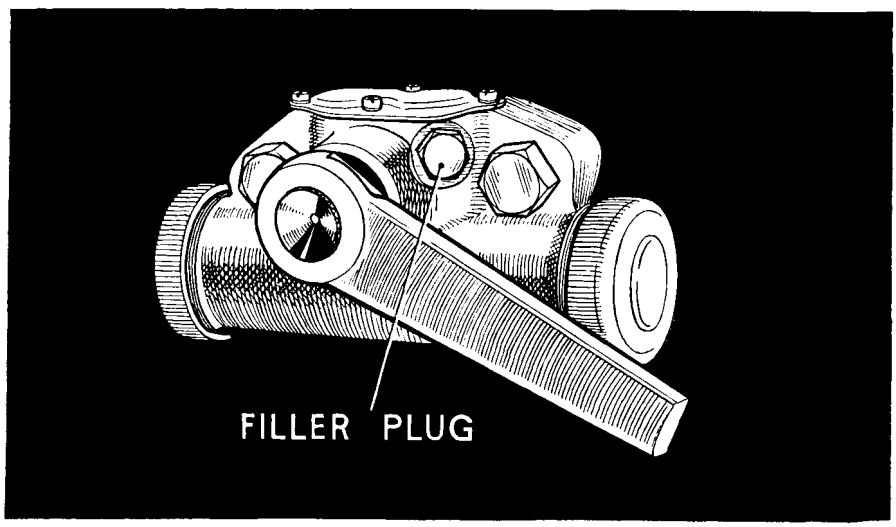
LUVAX PISTON TYPE HYDRAULIC SHOCK ABSORBERS

(Commencing Chassis No. VA.1915)

Both front and rear road springs are controlled by Luvax Piston Type Hydraulic Shock Absorbers. These have been accurately calibrated in the makers' Works and give the correct amount of damping to the springs. No further adjustment is required, or provided for.

The retaining bolts should be checked for tightness periodically.

Every 8000 to 10,000 miles (13,000 to 16,000 Km.) remove the filler plug and if necessary replenish the fluid. The filler plug is positioned on the side of the unit about $\frac{3}{4}$ in. from the top, and the correct fluid level is obtained by filling right up to the plug hole. Great care must be taken to see that no dirt or foreign matter enters through the filling orifice. Do not remove the cover plate on top of the unit. On no account neglect this simple operation of "topping-up." If the low-pressure chamber of the unit is allowed to become empty, air will enter the pressure cylinders and the action of the shock absorber will become impaired.



Use only Luvax Official Piston Type Shock Absorber Thin Fluid.—This is a special fluid, the properties of which have been carefully selected to comply with the conditions essential for the efficient working of the shock absorber. It is obtainable from reputable garages in one pint tins with special pouring spout, but if any difficulty is experienced in obtaining supplies, apply direct to The M.G. Car Company Limited or Joseph Lucas Limited. If incorrect fluid is used, damage may result, therefore for your own protection use only the correct fluid. The Luvax PISTON Type Thin Fluid is a great deal thinner than that used with the original Luvax Vane Type Shock Absorbers which were fitted to our earlier models, and it will be found to flow more easily through the filler orifice. It will not mix with the Vane Type Fluid.

SECTION D

INBUILT JACKING EQUIPMENT

(If fitted)

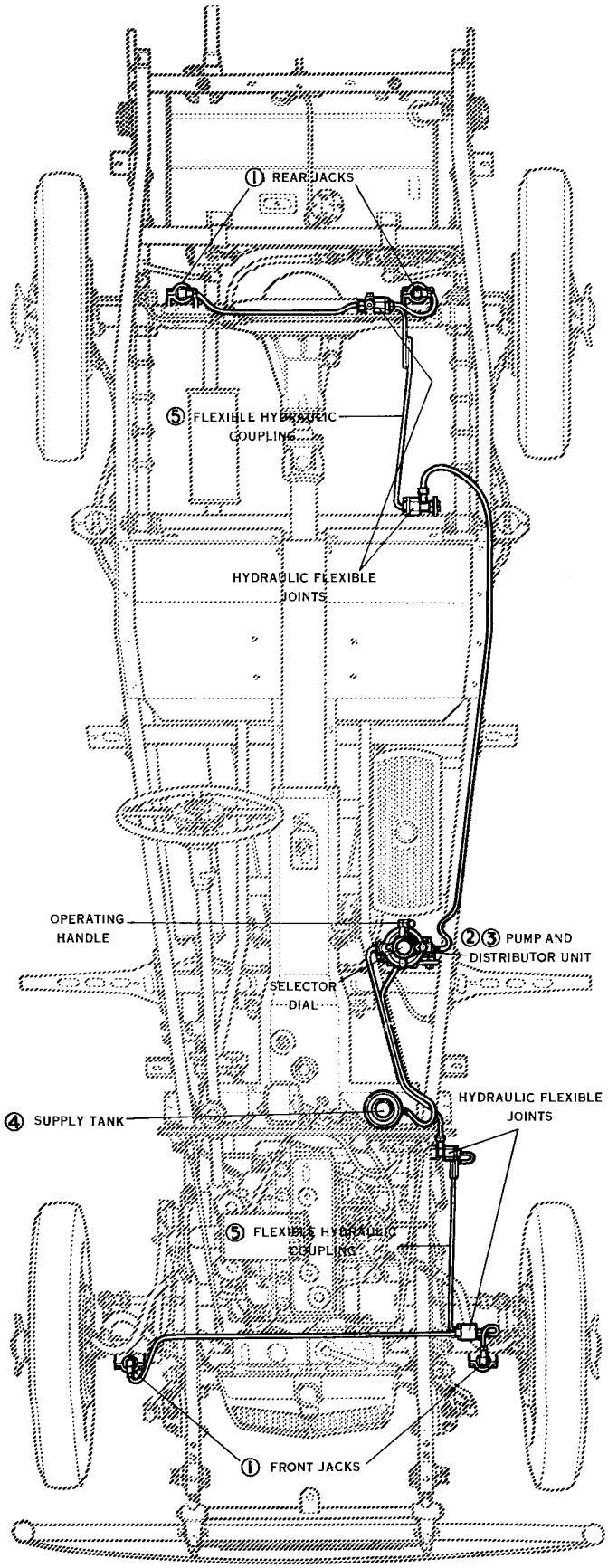


Illustration No. 8.—The hydraulic jack layout.

Inbuilt 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.

This pump and distributor is supplied with fluid by a supply tank mounted on the engine shield, which should be examined every 2–3 months to maintain the fluid to the correct level.

Important.—Do not replenish the supply tank when the jacks are in use or the system will be over-filled.

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.

Illustration No. 8 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.

A special fluid, " Smith's Jackall Fluid," which is a lubricant, and at the same time is non-injurious to any of the components of the system, has been evolved, and under no circumstances must any other fluid be used. **The use of any but the genuine Jackall Fluid cancels the Guarantee.**

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.

The Pump and Distributor Unit.—The pump and distributor unit (see Illustration No. 9) is composed of a neat, light but exceptionally sturdy die-casting in a special alloy developed for this purpose. The double-ended plunger "A" is ground to a close fit in the highly finished cylinders " A1," no packing being necessary. The ends of the cylinders are sealed with the plugs " B " and the joint between the plug and body is made with copper washer " B1." The plunger is oscillated by the rocking arm " C," actuated by means of a detachable handle fitted to the rocking arm lever " D," which is keyed to the shaft by a special chrome nickel steel cotter pin " D1." (*Note :* The ordinary cycle cotter is useless for this purpose.)

Leakage through the bearing is prevented by means of the moulded composition gland " D2." The orthodox type of spring-loaded inlet valve is dispensed with, as this is a feature of small high-pressure pumps which is prone to give trouble ; instead, the cylinders are ported " E," and the plunger itself used to seal the port on the return stroke. By this system, so long as fluid is available, the pump cannot fail to function. The delivery valves, instead of being spring loaded, are governed by the square-section gravity weights " F," which also serve the purpose of limiting the travel of the ball valve " F1 " to $\frac{1}{16}$ in., thus securing a high degree of efficiency and preventing damage to the valve seats by " pounding."

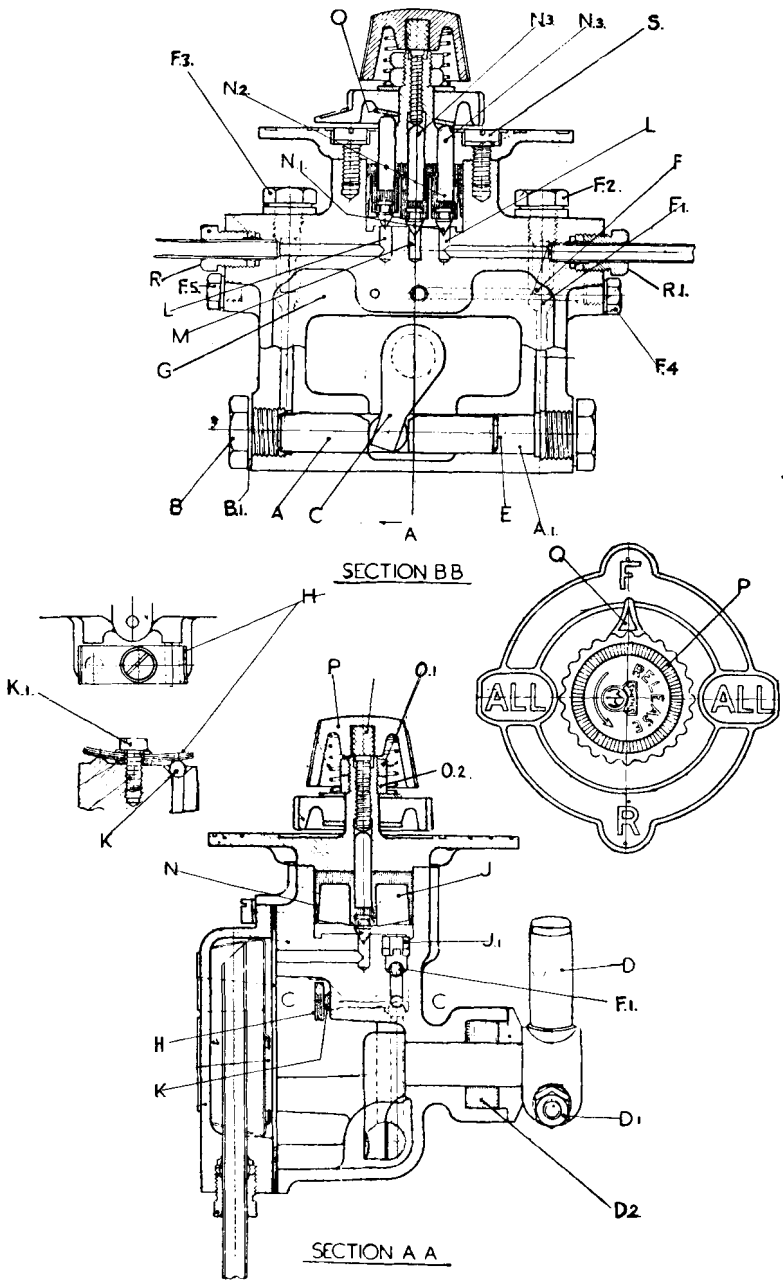


Illustration No. 9.—A diagrammatic sketch of the hydraulic jack pump and distributor unit.

After passing the delivery valves the fluid enters the transverse passage "G," in communication with which is the pressure relief or safety valve "H" by means of which any excess pressure is avoided and surplus fluid allowed to return to the reservoir. The fluid under pressure enters the annular chamber "J" through the master check valve "J1," which effectually prevents any return of the fluid back to the pump, thus relieving the ordinary delivery valves and safety valve of any duty other than their normal function. The safety or pressure relief valve "K" consists of a $\frac{7}{32}$ in. steel ball loaded with a laminated spring. No adjustment is necessary, as when the securing screw "K1" in the centre is screwed firmly home, the spring resistance obtained gives the correct pressure.

A filter is incorporated in back cover-plate, through which the fluid passes after each operation.

The Distributor.—The distributor consists of an annular chamber "J," cast integral with the pump body. In the "floor" of this chamber three ports are positioned, the outer ports "L" each supplying fluid to the jacks to which they are connected, the centre port "M" forming a passage for the return of the fluid to the reservoir after use.

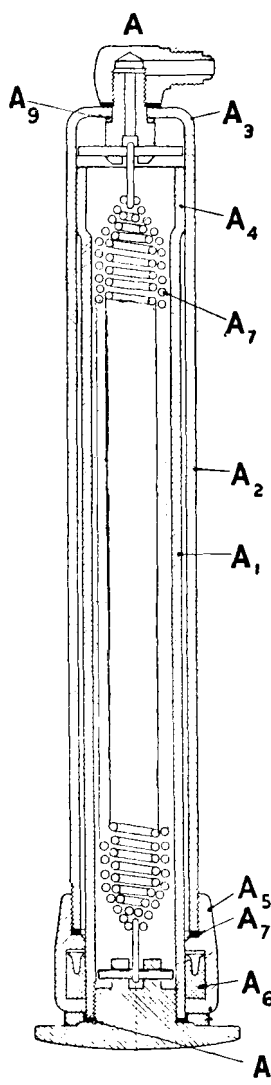


Illustration No. 10.—Diagrammatic view of a jack.

The valve "member" consists of three valves "N1" manufactured from a special alloy, securely vulcanised in a moulded composition cup or bucket "N," which has on its reverse side three sockets "N2" to receive the valve operating pins "N3." The outer pins are actuated by a distributor cam "O," by means of which front or rear jacks can be selected; or if the pointer is placed to the "ALL" position, all jacks will be operated simultaneously. Before operating, the release valve knob "P" must be screwed home, but not too forcibly. To release the jacks, the knob is turned anti-clockwise, gently at first to lower the car to the ground without shock, and then opened one full turn to ensure the return of the rams to the closed or inoperative position.

Note.—After using, the pointer "Q" should always be turned to the "ALL" position and the release valve left at least one full turn open.

The Jacks.—The jacks (see Illustration No. 10) consist of two tubular steel members, the upper end "A3" of the outer tube "A2" being domed to form a cap or end, and the upper end "A4" of the inner tube "A1" being bulged to form a long guide or bearing which ensures stability when the jack is fully extended. The bottom cap "A5" contains the special moulded composition gland "A6" which is designed to prevent the escape of the fluid either under high pressure or whilst the jacks are in the normal out-of-use position.

The return of the fluid is secured by the use of a compound spring of the highest quality "A7." It will be seen that there are two springs, wound concentrically, with sturdy end hooks. These springs give an initial pull of over 30 lb. when the jacks are in the

inoperative or closed position, and from this it can be realised that there is no danger of the ram being extended whilst the vehicle is in motion.

Flexible Hydraulic Couplings.—The flexible couplings (Illustration No. 11) are one of the features of the Jackall system. They consist of die-cast unions "1" and "2," in which the pipe end bushes "3" are flexibly mounted, a moulded composition "U" bucket "4" effectually sealing the joint against leakage, whilst permitting ample movement. The thrust is taken by a loose washer "5." The unions are coupled together with a silico-manganese steel tube "6" suitably coiled to ensure flexibility and to deal with the movements caused by the varying degrees of spring deflection.

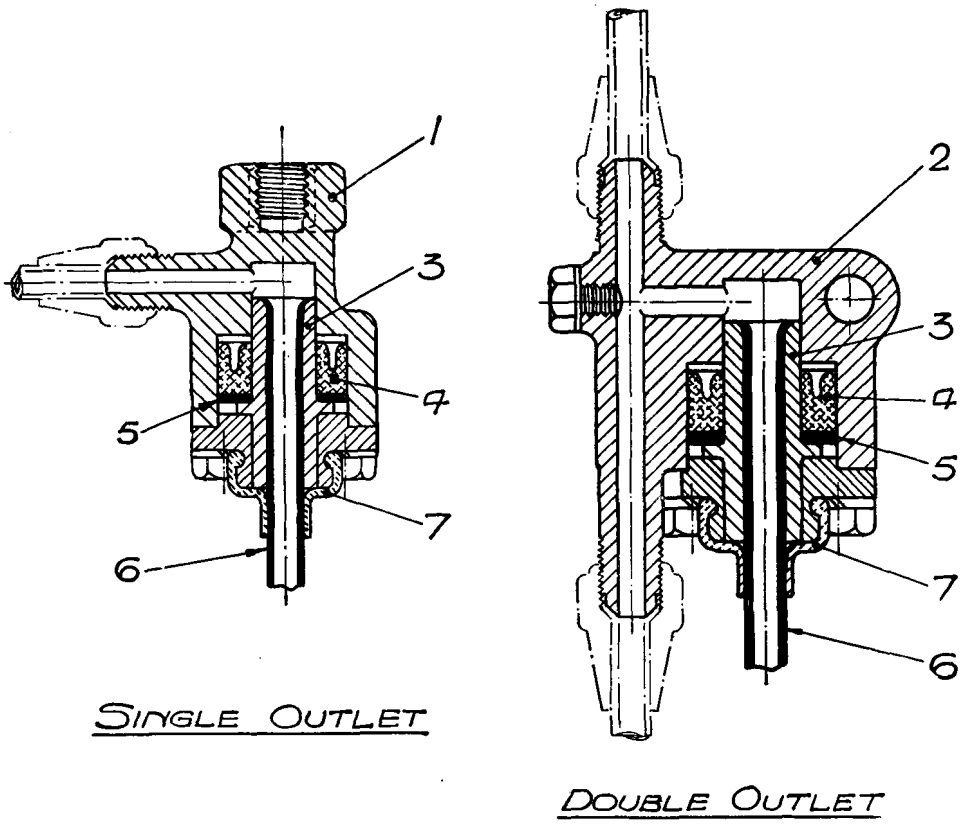


Illustration No. 11.—Flexible high-pressure joints to compensate for axle movement.

Two types of union are used, single and double outlet, the double outlet union being attached on the axle to distribute the fluid to the jacks mounted thereon, whilst the single outlet union is anchored firmly to the chassis and conveys the fluid from the pump and distributor unit to the flexible steel pipe. The outer end of each joint is sealed by a moulded rubber cap "7" which excludes grit, moisture and foreign matter.

General Instructions.—The Jackall hydraulic jacking system requires no attention other than the periodic examination of the fluid reservoir. This should be seen to every 2–3 months, a little fluid being added when necessary.

When it is necessary to drain fluid from the system for the purpose of repairs, disconnect either delivery pipe-joint at distributor and pump the fluid into a clean receptacle. The fluid should be carefully filtered when refilling the system.

Where attention to a jack or flexible hydraulic connection is necessary, the indicator pointer should be turned to the side opposite to that which it is desired to disconnect. This closes the valve on the defective side and repairs can generally be effected without loss of fluid.

The valve bucket may be changed or removed for examination without loss of fluid. If it is desired to examine the bucket, use a cork or other suitable plug $1\frac{1}{4}$ in. in diameter to seal the opening temporarily.

As a special rubber composition is used extensively throughout the system, the use of mineral oil, or the addition of even a small amount of mineral oil, would render the system in a short time wholly inoperative. Should the fluid become contaminated by mineral oil, the various units of the system should be removed from the chassis and thoroughly washed out with methylated spirits before replacing.

On the following pages are lists of possible faults, showing cause and suitable treatment.

PUMP

Faults.	*Diagnosis.*	*Treatment.*
1. Pump will not operate.	No fluid in reservoir. Loose cotter pin, blow-hole in casting, broken safety valve spring, release valve not seating, airlock, vent holes in reservoir cap choked.	To ensure there is no airlock, slacken off either valve cap "F2" above delivery valve three or four turns, operate pump for at least 60 secs. If no fluid appears, pump must be dismantled and trouble located.
2. Works on one cylinder only.	Travel of operating handle restricted on one side.	In order to allow fluid to enter cylinder it is essential that a full stroke be given to the pump in each direction. It sometimes happens that an adjustable seat, fixed too far forward, or other obstruction, fouls the handle and prevents this.
3. Will not retain pressure.	Defective casting, faulty master check valve, faulty release valve or valve seat, external leakage in system.	Dismantle distributor box, carefully examine all valve seats and valves, removing master valve, retaining ring and valve "K." If no defect is apparent and there is no external leak, casting is faulty and should be replaced.
4. Will not lower car when release is operated.	Foreign matter in release valve duct, release valve faulty.	First of all lower car by unscrewing joints "R" or "R1" three or four turns, allowing sufficient fluid to escape so as to enable the jacks to return to a fully closed position. Under no circumstances must screws "S" on indicator plate be interfered with until the jacks have returned fully home. Remove indicator plate, remove valve unit, fit new valve unit and reassemble. If trouble persists, pump should be removed, dismantled and thoroughly cleaned. Care must be taken that all passages and ducts are free. To reset indicator "O" adjust nuts "O1" and "2" until the pointer is able to move 20 deg. freely on each side of the "ALL" position and a slight resistance felt when the pointer is turned to "F" or "R." The indicator should be set so that little effort is required to move it to any desired position.
5. Jacks return very slowly when release is fully open.	Operating pins "N3" too tight in cap.	Usually caused by corrosion. Remove indicator plate, remove pins, clean and oil thoroughly with castor oil and replace.
6. Works on one side of indicator, but not on other, or "ALL" position.	Defective casting or one faulty valve.	Remove valve bucket "N," and examine valve seats and valves carefully. Replace bucket if necessary. If fault persists, casting is faulty.
7. Leaks at indicator plate.	Defective casting or faulty valve bucket.	Remove valve bucket "N," examine for puncture, replace bucket if necessary. If fault persists, casting is faulty.
8. Leaks under pressure.	Cylinder end cap "B" or other caps loose—"F2," "F3," "F4," "F5."	Without removing unit from chassis, go over all plugs with spanner to ensure tightness, wipe box thoroughly. If leak persists, a new copper washer will probably effect a cure, wipe thoroughly, then operate all four jacks, pumping 10 or 12 strokes against safety valve, then examine the various plugs.
9. Leaks slow drip.	Cover-plate screws loose, or faulty gasket.	Remove unit from chassis and tighten screws thoroughly, do not disturb cover-plate unless absolutely necessary. If cover-plate is removed, a new washer must be used, all faces thoroughly cleaned and Seccotine, Croid or similar adhesive used on both sides of washer.

FLEXIBLE HYDRAULIC COUPLING

Faults.	*Diagnosis.*	*Treatment.*
1. Leak at hydraulic joints.	Plug on double outlet loose, or faulty copper washer, fault in casting, faulty rubber bucket, faulty brazing.	Tighten plug, fit new copper washer if necessary, examine rubber bucket. If leak appears through rubber dust cap, brazing is faulty.
2. Leaky pipe.	Split, or damaged externally.	Must be replaced by pipe, complete with end bushes, cover-plate and rubber dust cap.

JACKS

Faults.	*Diagnosis.*	*Treatment.*
1. Failing to return after use.	If either pair or all jacks fail to return, fault is due to defective valve in distributor box or choked pipe. If one jack fails to return, broken spring, bent or distorted ram.	Remove jack, first turning indicator on distributor box to opposite side, grip in vice (using shaped hardwood blocks), remove elbow. Remove bottom cap. Ram can then be withdrawn, remove spring anchor pin, grip ram in vice (again using shaped blocks), remove foot to which spring is attached. Check ram for straightness or distortion, check spring. When reassembling, new copper washers should be used.
2. Leak at foot.	Faulty copper washer or foot loose.	Remove jack. Without dismantling, ram can be pulled out and gripped in shaped blocks for retightening.
3. Leaks at screwed part of bottom cap.	Faulty copper washer or cap loose.	Remove jack, grip in blocks, retighten; if leak persists, jack should be dismantled and new copper washer fitted. Great care must be taken to prevent cap being distorted by undue force when reassembling.
4. Leak at elbow.	Elbow loose or faulty copper washer.	Without removing jack from bracket, remove union nut, remove elbow and examine copper washer and replace if necessary, ease off bracket to enable elbow to be turned into line with pipe and retighten.
5. Leak past gland.	Faulty rubber bucket. Bottom cap damaged or distorted, "swarf" or other foreign matter lodged between bucket and ram.	Dismantle jack, prise out bucket with blunt tool, examine for faults, examine inside of annular groove for dents or distortion. Bucket housing or bucket to be changed if distorted or faulty in any way.

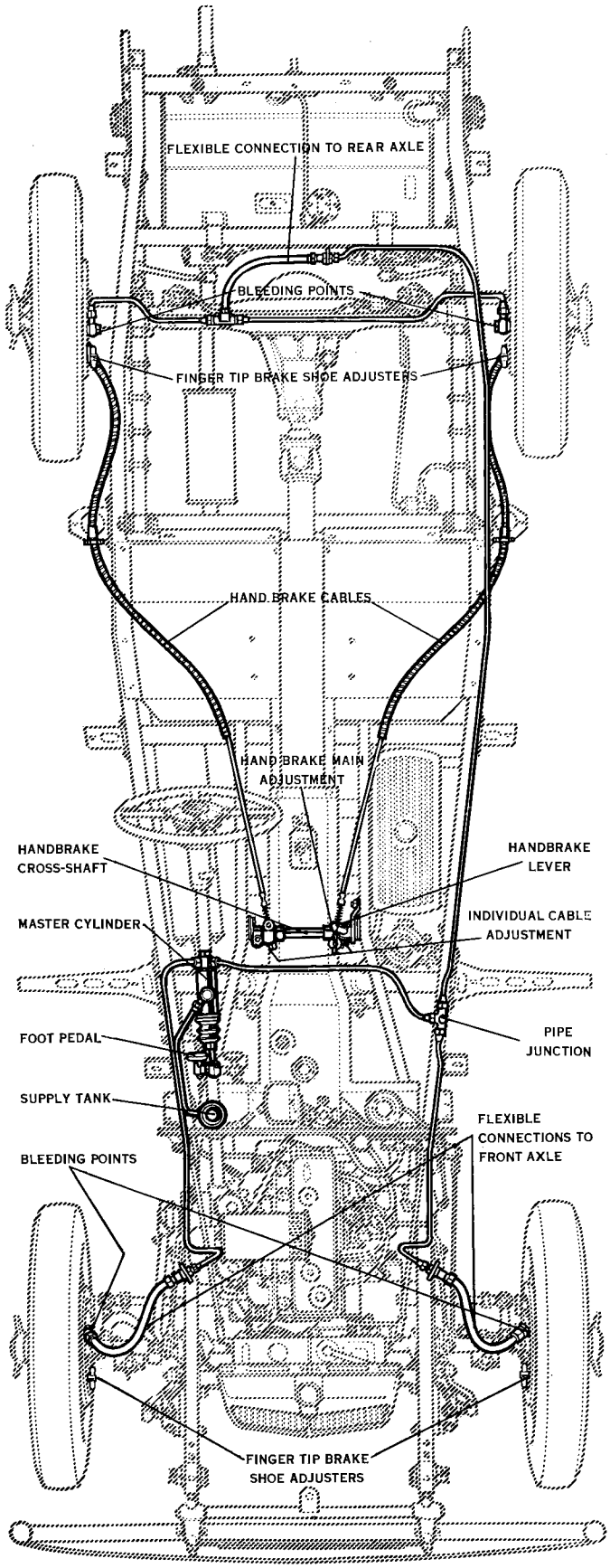


Illustration No. 12.—The hydraulic brake layout.

SECTION E

THE HYDRAULIC BRAKES

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 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. 13).

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.

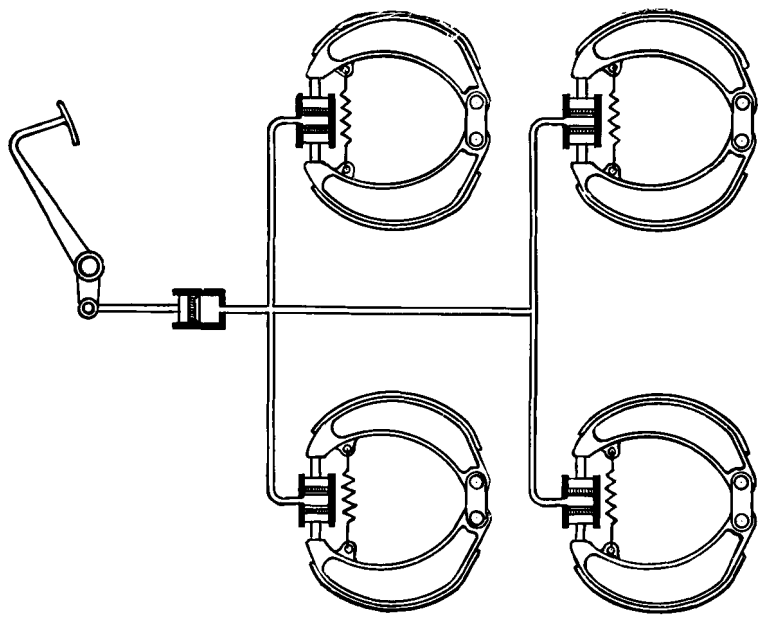


Illustration No. 13.—Diagrammatic view of brake layout.

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 rear of the engine shield 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 Orange Brake Fluid.**

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

The Master Cylinder (Single Outlet Barrel Type) (Illustration No. 14.)—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.

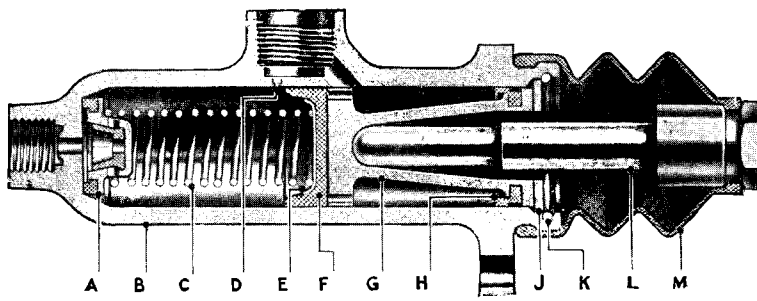


Illustration No. 14.—The master cylinder, the items indicated by letters are referred to in the text.

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 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.

The clearance usually amounts to $\frac{3}{8}$ in. at the pedal pad and is set at the Factory. Should it have been disturbed, readjustment must be made at the fork end of the push rod. A floorboard or mat fouling the pedal may give rise to the condition of mal-adjustment.

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 " K " and washer " J," and then draw the piston " G " 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 into 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, piston stop washer and circlip.

The Pipe Line.—The pipe line (see Illustration No. 12) 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.—The wheel cylinder (Illustration No. 16) is mounted rigidly to the brake-shoe back plate, and the opposed pistons " B " act directly on the tips of the brake-shoes. The ends of the wheel cylinder are fitted with rubber boots " G " to protect the cylinder from dust or dirt. At the uppermost position, and between the opposed pistons, is a bleeder screw " RQ," required for expelling all air when filling the system.

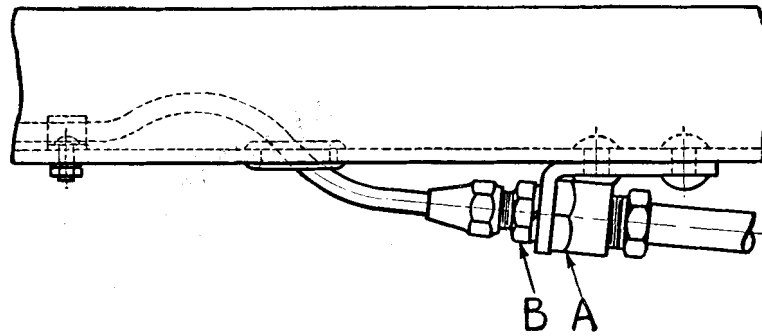


Illustration No. 15.—Showing the position at which to disconnect the copper tubing from the hose union.

DISMANTLING INSTRUCTIONS

Removal of the Front Wheel Cylinder.—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 No. 15) 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.

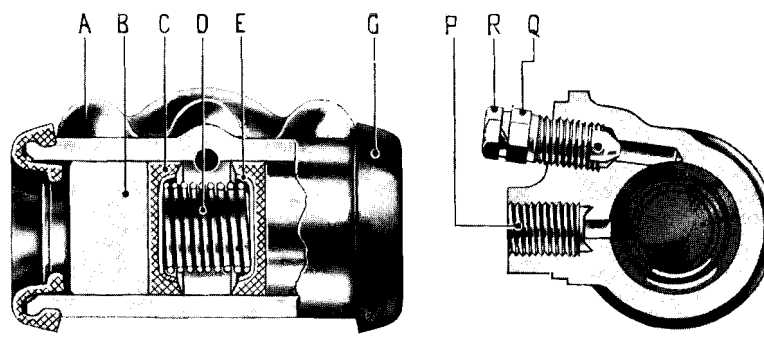


Illustration No. 16.—A wheel cylinder as viewed from the side and the end.

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

Removal of Brake-shoes.—Unhook brake-shoe return spring, remove " C " washer holding shoes on anchor pin, remove split pins and washers on shoe steady pins after which shoes may be pulled off. In the case of the rear brakes the hand brake cable will need to be unhooked from the lever behind the brake-shoe.

When reassembling, care must be taken to see that the adjuster cam is in the position shown in Illustration No. 17.

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.

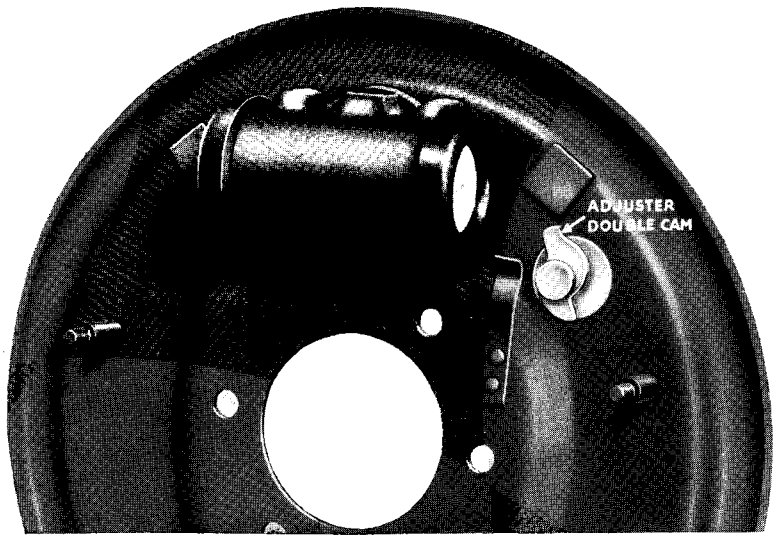


Illustration No. 17.—Showing position of double cam when reassembling.

To Adjust Foot Brake.—When lining wear has reached a point where the foot pedal goes almost to the floorboard, it becomes necessary to adjust the brake-shoes into closer relation to the drums. This is accomplished by rotating the hand wheel (Illustration No. 18) in the direction of the arrow until the brake-shoes come into contact with the drum, i.e. until it cannot be turned farther by hand. NEVER USE TOOLS FOR TURNING THE HAND WHEEL OR THE MECHANISM MAY BE STRAINED. Repeat at all wheels.

To Adjust Hand Brake.—Jack up both rear wheels clear of the ground and adjust foot brake as previously instructed. Now screw up adjusting nut on front end of each cable, taking care not to over-adjust beyond the shoe position already obtained by foot brake adjustment. With the hand brake partially applied, pull round each wheel by hand and readjust at cable nuts until an equal feel is obtained.

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.

Remove the set screw at " R " (Illustration No. 16) from end of bleeder screw " Q," 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 (see also Illustration No. 18). 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.

Equalisation of Brakes.—NO ADJUSTMENT IS REQUIRED FOR EQUALISATION.

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 coefficient 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.

Illustration No. 18.—Bleeding part of the braking system ; note the special tool provided for the job.

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—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 $\frac{3}{8}$ in. 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 can prevent the foot pedal from returning to the fully " off " position, or an incorrect adjustment of the pedal link gear may also be the cause. (Refer to page 42.)
(*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*) Hand brake operating mechanism seized or is fouling some portion of the chassis, etc.—lubricate and release hand brake gear where necessary.
(*b*) Brake-shoes are tight or seized on their anchor pins, or brake-shoe return springs weak or broken—remedy this as above.
(*c*) No initial clearance on pedal—remedy as above.
(*d*) Oil or spurious fluid in system—remedy as described above.
(*e*) 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 coefficients 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.** The use of other than genuine **Lockheed Brake Fluid** will nullify **all Guarantees** given both by The M.G. Car Co. Ltd. and the Lockheed Hydraulic Brake Co. Ltd.

SECTION F

STEERING GEAR

Steering.—The operation of the cam steering gear, which is standard on M.G. 1½-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.

Lubrication.—The whole mechanism is contained in an oiltight casing and replenishment at intervals is the only attention required. Remove the filler cap on the top of box (see Illustration No. 19), 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.

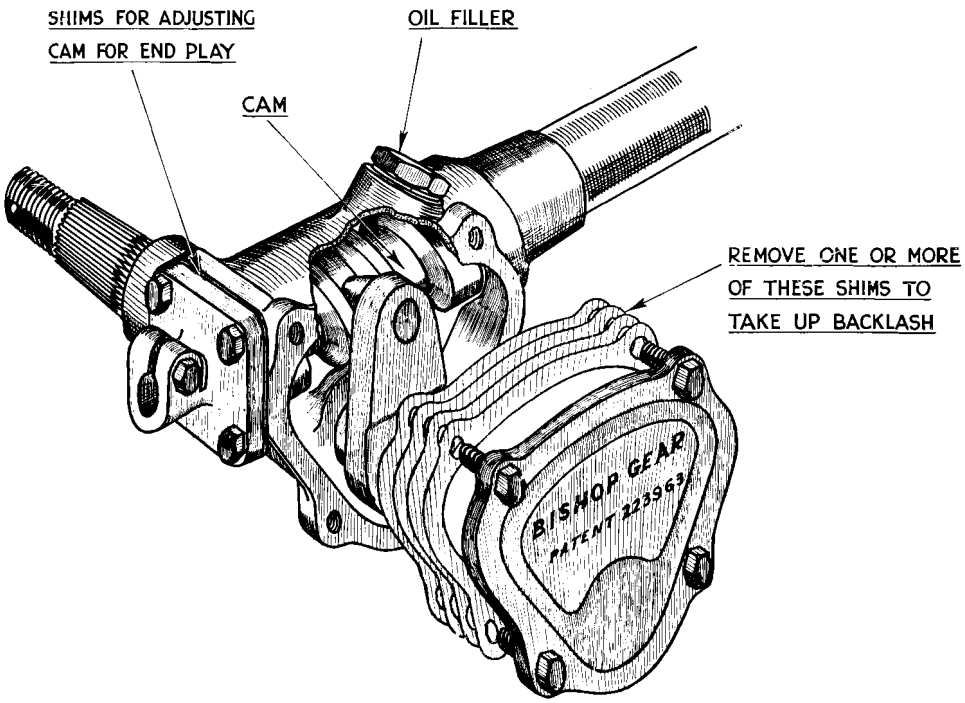


Illustration No. 19.—Diagrammatic view of steering gearbox.

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 the end cover to provide adjustment of the cam bearings. The adjustment 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 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 No. 19) 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.

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. Should it be necessary to replace the cork gland, withdraw the rocker-shaft, when the 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 by splines 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 (Part No. T.60) is used, or any other suitable drawer, 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, 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 body, 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, the stub axle should be touching the stops on the front axle beam.

If this is so 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.

Note.—If the axle stops are operating correctly, then with the wheels on full lock in either direction a certain amount of spring can be felt in the steering wheel, but if the internal stops in the steering box are operating before the axle stops the steering wheel will feel very solid.

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

Steering Wheel Adjustment.—Two adjustments are provided to enable the steering wheel to be placed in the most convenient position, which allow for the variations in human stature.

1. Height. Release the clamp holding the steering box to the frame, undo the bolt locking the steering column to the body, when the height of the steering wheel can be moved to the desired position. The column clip and steering box clamps must then be re-tightened.
2. Length. Refer to Illustration No. 20.

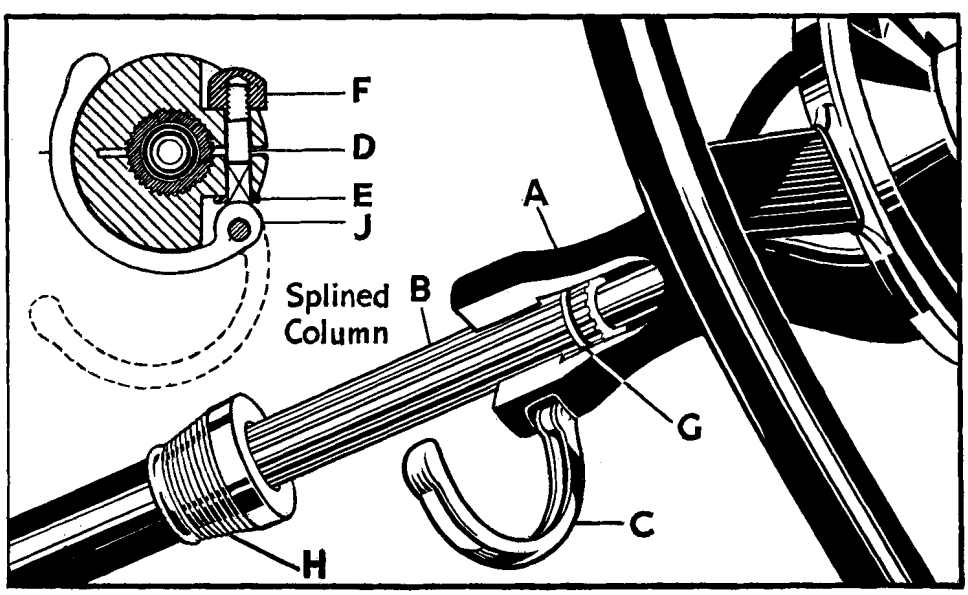


Illustration No. 20.—Diagrammatic view of adjustable steering wheel.

The principle of the wheel adjustment is extremely simple, being the movement of the entire steering wheel up or down the extended column. Both hub and column are machined with longitudinal splines or serrations (see Illustration No. 20) engaging each other, so that whilst hub "A" cannot rotate on the column "B," up and down movement is possible. The adjustment is controlled by a lever "C," which, when raised, releases the wheel so that it can be moved up or down the column. When the desired position has been selected it is locked by the cam action of the lever, which causes the split hub ("D," Illustration No. 20) to close and grip the splines on the column.

Control of the steering wheel is always positive, even if the lever be inadvertently left open, and all that can happen is an upwards or downwards movement of the wheel.

Adjustment.—An adjustment nut (marked "F" in the illustration) is provided, and this varies the amount of pressure exerted by the clamping lever. The pressure is correct if the lever can be *fully* closed with one hand, to lie closely round the wheel hub. If, after closing it, the wheel can be moved up or down by exerting heavy pressure on the rim the grip is insufficient. To increase the pressure, open the lever and screw up nut "F" a *very little* until correct.

Lubrication.—To ensure ease of operation, occasionally raise wheel to highest position, push the spiral dust cover "H" up or down and put a few drops of engine oil on the splines of the column ; also a spot of oil on washer "E" where the cam "J" bears against it. If breakage of any part of clamp occurs, which is extremely unlikely, remove and replace with suitable $\frac{1}{4}$ in. bolt and nut until a replacement clamp assembly can be obtained.

Removing Wheel.—Take out the retaining ring "G" in order to pull the wheel completely off column "B," but before the ring "G" can be reached the central controls must first of all be removed from wheel centre as follows :—

The heads of two grub screws will be seen opposite each other on the outside of the hub "A" ; these should be unscrewed about $\frac{1}{8}$ in. (it is not necessary to remove them entirely), when, after disconnecting the wiring at the bottom of the steering gearbox, the entire upper part of the central control assembly with wiring can be withdrawn from column "B." Care must be taken to see that wiring, when disconnected at bottom of steering box, is neatly arranged so that the whole cable can go through the column without resistance from loose wires, lumpiness due to insulating tape, etc., or trouble may be experienced in getting it right through the column.

Any other screw heads on outside of hub "A" should not be touched ; they hold the auto-return "Trafficator" trip plate and do not need loosening. When the controls are removed as described, the ring "G" can be removed and the wheel pulled off the column "B."

To replace, assemble the dust cover "H" as it came off the column ; replace wheel and circlip—first oiling the splines ; carefully thread the wiring cable back through the column—it may be necessary to introduce copper wire upwards through the box of steering gear and thus pull the cabling through—and very carefully introduce the tubing attached to controls and bushing into column, turning the tubes until the telescopic joints half-way down are properly engaged. *No force* must be used. The tubes will slip into position with control head in some angular position as originally with a little "feeling" and patience. Screw up the two grub screws after making sure the plate of bushing is properly down on its seating on the hub "A." This is important. If it is not fully down, the screws cannot hold it properly.

If there is doubt whether the plate is properly down, take out one screw, edge of plate then can be seen through the tapped hole ; upper edge should be about half-way across hole, or a little lower.

Note that the lower halves of control tubes that are fixed at the bottom of steering box need not be disturbed, and that as the upper parts are quite short, no difficulty owing to roof (if a saloon car) will be experienced in withdrawing them from column. When reassembling, oil the joints of control tubes and bearings in order to obtain sweet operation and minimum wear.

AMENDMENTS AND MODIFICATIONS

SECTION F

STEERING GEAR

Oil Leaking from Steering Column.—Commencing at Chassis No. VA1257 the bottom cover of the steering box was modified. The method of retaining the steering controls stator tube was altered from the clamp secured by a bolt, see Illustration No. 19, to an olive and union nut which prevents loss of lubricant.

SECTION G

THE ENGINE

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. 21), 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 oiler for the water impeller is just below the water outlet pipe. **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. **Distributor**—a full description of this component is given under the electrical section, but note here should be taken of the micrometer adjustment. **Oil dipstick**—this is for determining the amount of oil in the sump and is marked to show the quantity at the time of reading. **Oil level gauge sump unit**—this consists of a rheostat operated by a float inside the sump. This unit controls a gauge mounted in the instrument panel. **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 completely 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. **Overhead valve gear oil feed pipe**—feeding from the oil gallery, this carries lubricant to the overhead valve gear. Where it enters the cylinder head a union can be seen from which a pipe leads to the oil pressure gauge on the panel. **Breather pipe**—prevents pressure building up inside the crankcase. The pipe shown in the illustration extends downwards 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.

Turning now to the off-side of the engine (Illustration No. 22), commencing at the front as in the previous illustration.

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 is so arranged that the water circulates through the engine only and not through the radiator when the thermostat valve is closed. **Cylinder head water feed pipe**—this leads water from the impeller to the back of the cylinder head. **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 manifold**—this is simply a means of connecting the exhaust ports to the pipe leading down to the silencer. **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

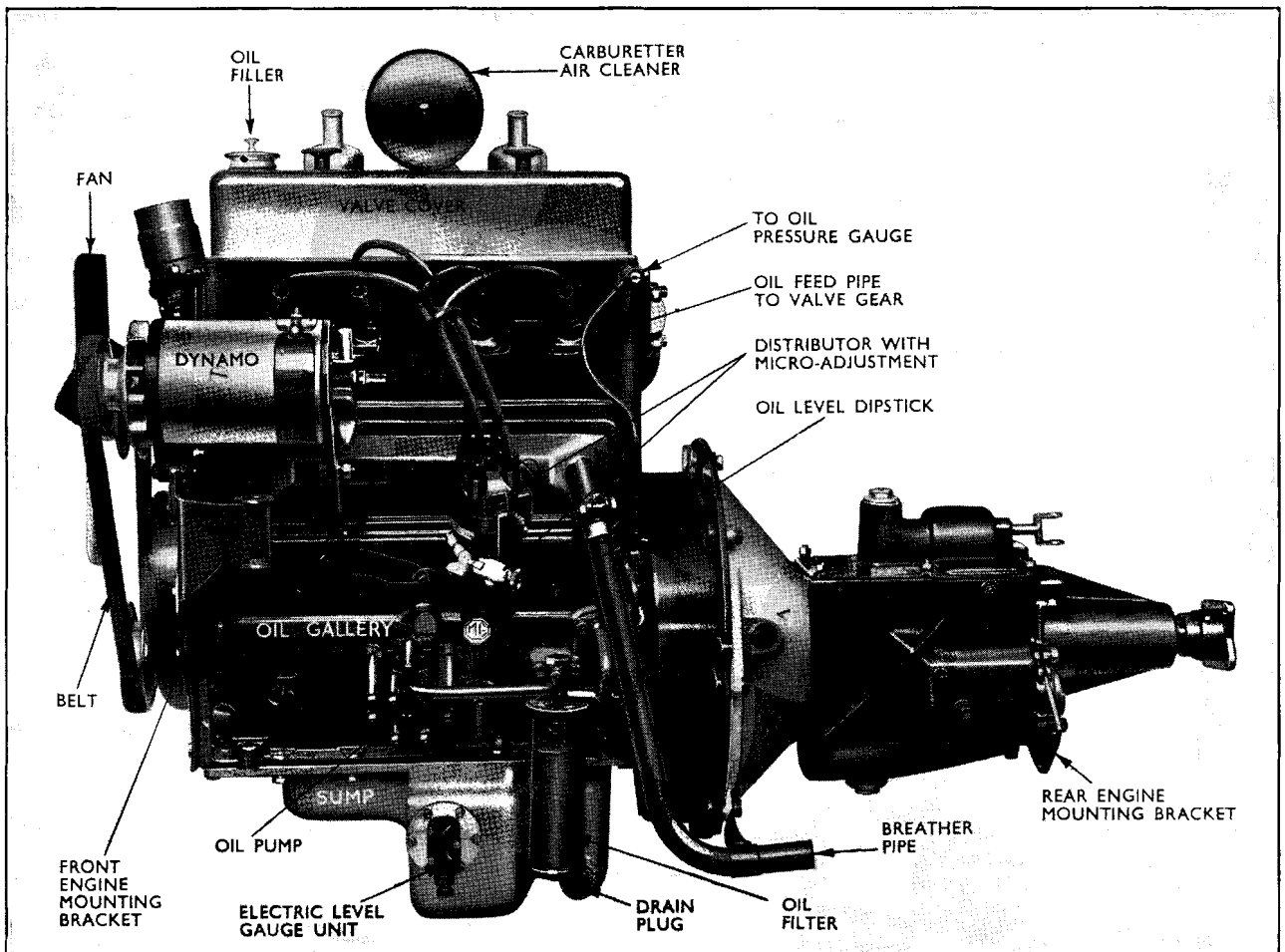


Illustration No. 21.—View of engine, near-side.

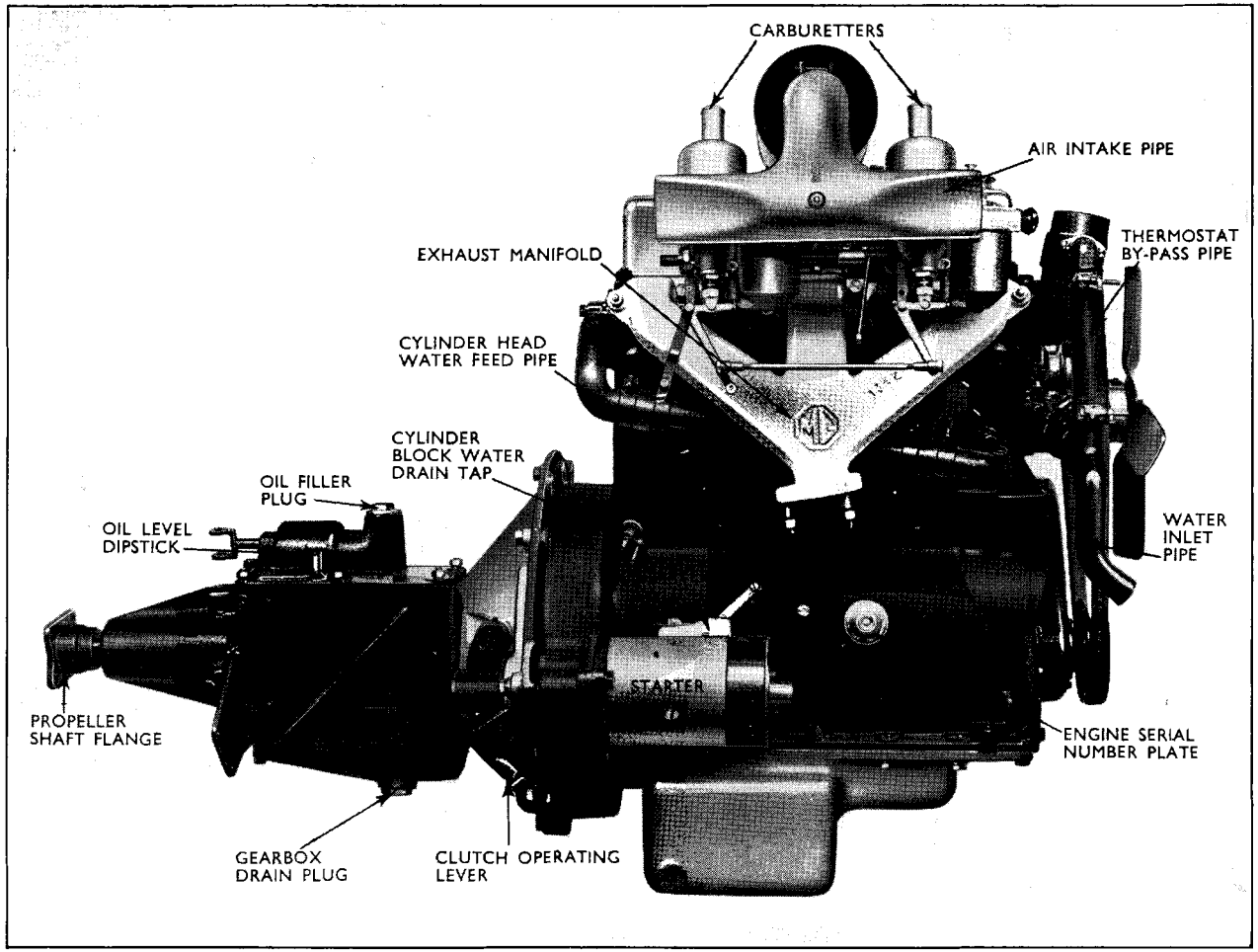


Illustration No. 22.—View of engine, off-side.

two carburetter inlets to the air cleaner is seen immediately in front of 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. **The starter motor** has a sliding pinion which, when the starter is put into operation, engages with the teeth on the flywheel. The switch can be seen on top of the starter, it is operated by a " Bowden " cable connecting the starter switch control lever to a knob on the dash. **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 quantity at the time of reading. The gearbox **filler plug** is alongside the dipstick.

The Engine Lubrication.—The sump, when full, contains approximately $1\frac{3}{8}$ 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 three pints must be added before any reading shows 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 (see Illustration No. 23). The spring is non-adjustable, and is set to allow the ball to by-pass oil at 40/60 lb. per square inch.

The oil from the pump next reaches the oil filter (see Illustration No. 24). 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 from the inside of the element lifting the spring-loaded plate on top of the element to the outlet connection marked " Out." 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.

From the " outlet " connection of the oil filter the oil is led to the internal oil gallery in the side of the cylinder block. Passages drilled into this gallery pipe lead the oil to the camshaft and crankshaft bearings. Taking these passages 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, 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. Passage No. 2 feeds the camshaft centre bearing and the centre main bearing. The centre main bearing feeds Nos. 2 and 3 big-ends and cylinder walls as already described, and the oil pump driving skew gears, which are in the middle of the centre camshaft bearing. Passage No. 3 feeds the rear main bearing and the rear camshaft bearing. The rear main bearing feeds No. 4 big-end and cylinder walls, and the clutch by a hole drilled up the centre of the crankshaft, and the vertical pipe which takes oil to the rocker-shaft, the top union of this pipe communicates with the oil pressure

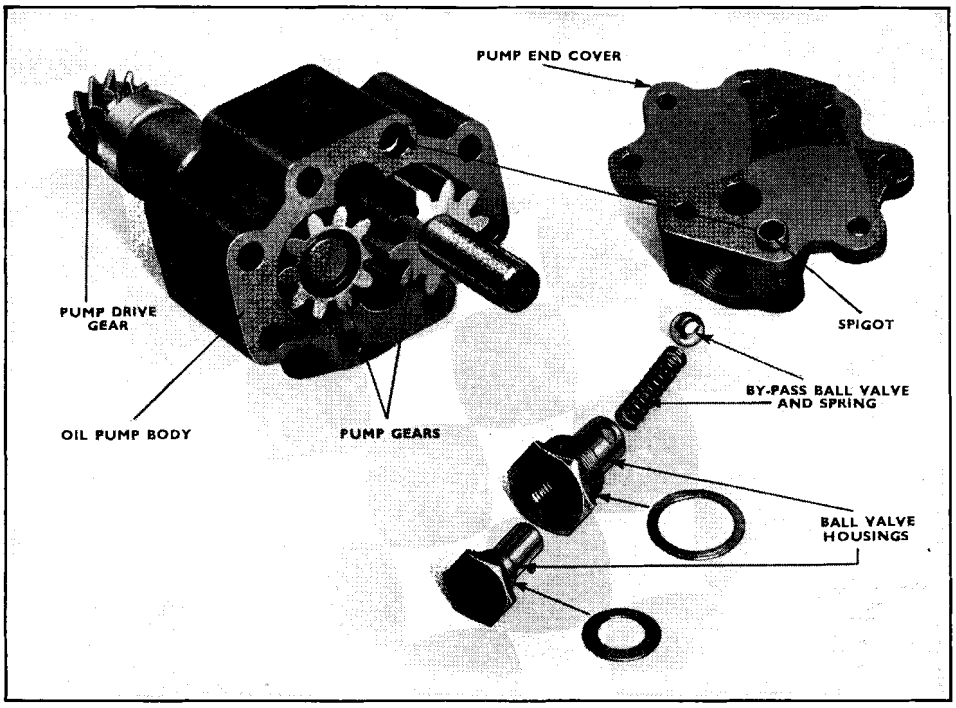


Illustration No. 23.—Oil pump dismantled.

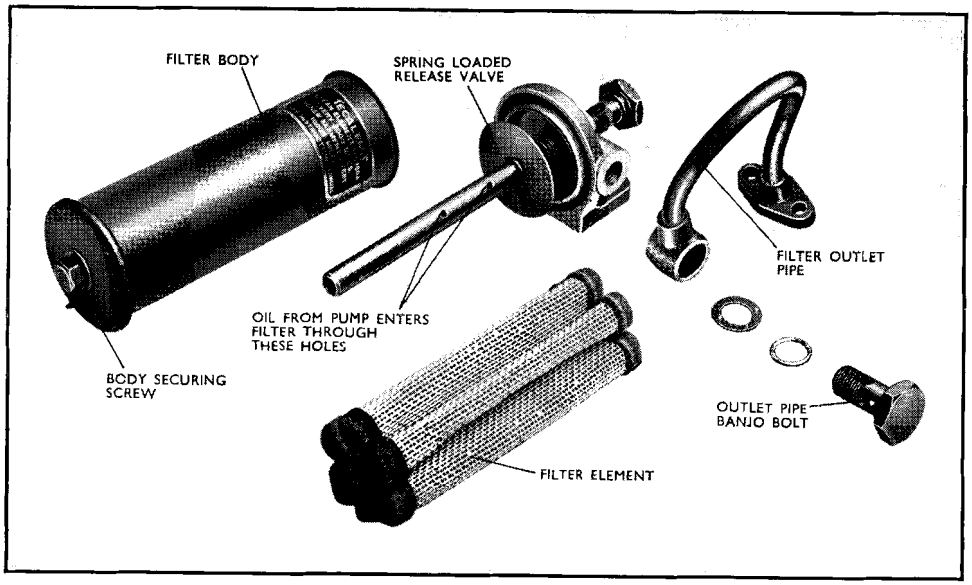


Illustration No. 24.—Tecalemit oil filter dismantled.

gauge pipe and 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.

The oil which has passed the clutch plates escapes through gauze windows in the clutch cover-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 near-side of the flywheel housing, whence it drains back to the sump.

Water Impeller and Fan Unit.—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.

Two points need lubricating on this unit : (1) the oil nipple behind the fan blades which lubricates the front ball race, and (2) the oiler on top of the impeller which lubricates the rear bearing.

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. The instrument, however, is very simple and unlikely to give trouble.

The Carburetter Air Cleaner and Silencer (refer to Illustration No. 25).—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.

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 Illustration No. 25.

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

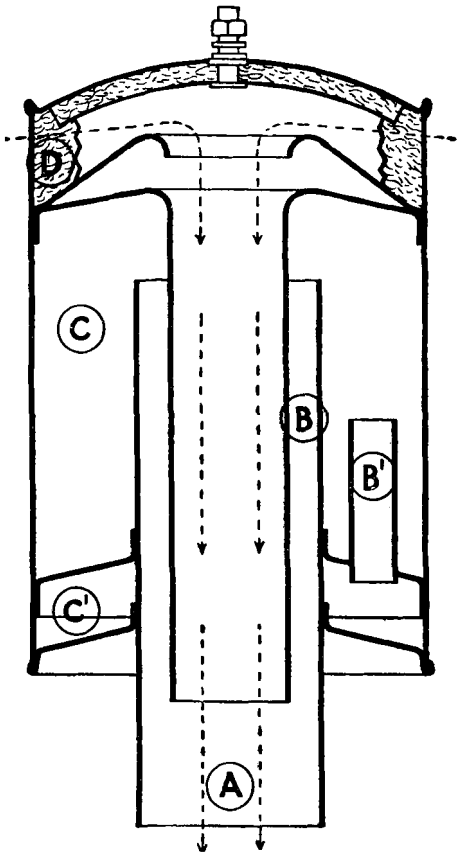
Decarbonising.—First of all drain the water system by opening the tap at the bottom of the radiator, and the small tap on the off-side of the cylinder block, see Illustration No. 22.

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

Detach the high-tension cables from the sparking plugs (noting carefully from which plug each is taken), unclip the distributor head, and unscrew the centre terminal below the coil, this permits the high-tension wiring to be taken away complete.

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

Next remove the petrol pipe, the throttle controls and mixture control, and uncouple the exhaust pipe from its manifold.



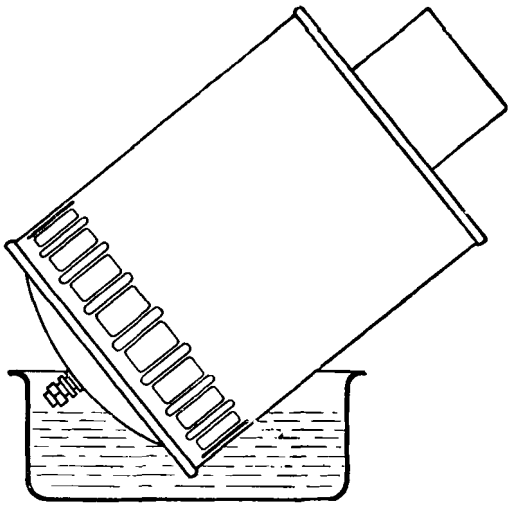


Illustration No. 25.—Diagrammatic view of carburetter air cleaner and silencer.

Remove the carburetter float-chamber overflow pipes, also the carburetter air cleaner and its manifold, unbolt the carburetters from the induction manifold, when the induction and exhaust manifolds can then be removed.

The top water elbow joint embodying the thermostat is secured to the cylinder block by set screws, 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.

Remove the oil feed pipe to the rocker gear at the point where it connects to the oil gauge 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. 26 shows a special tool which facilitates this operation.

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

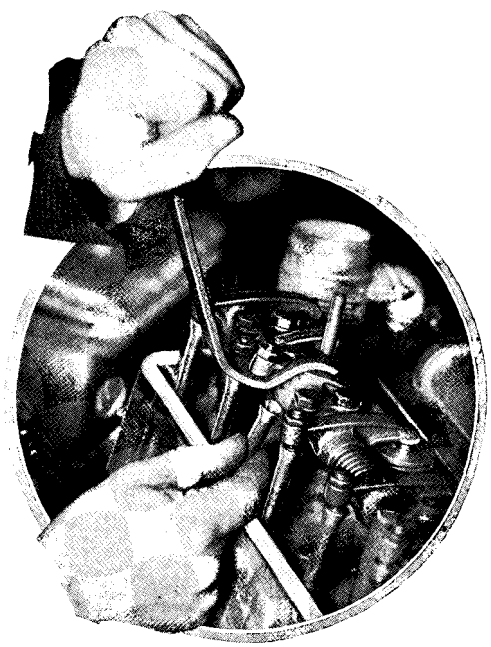


Illustration No. 26.—Special tool in use when removing the push rod with the cylinder head intact.

Removing the Gasket.—The copper and asbestos gasket is not difficult to remove, provided 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 triple 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 with a special compression tool (Part No. T.74) from above, the two cotter halves can be removed, and the springs and cap will then lift away from the valve, which can be withdrawn from below.

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. 27.) 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 special tool (Part No. T.71)—this tool has a suction disc which adheres to the valve head. 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.

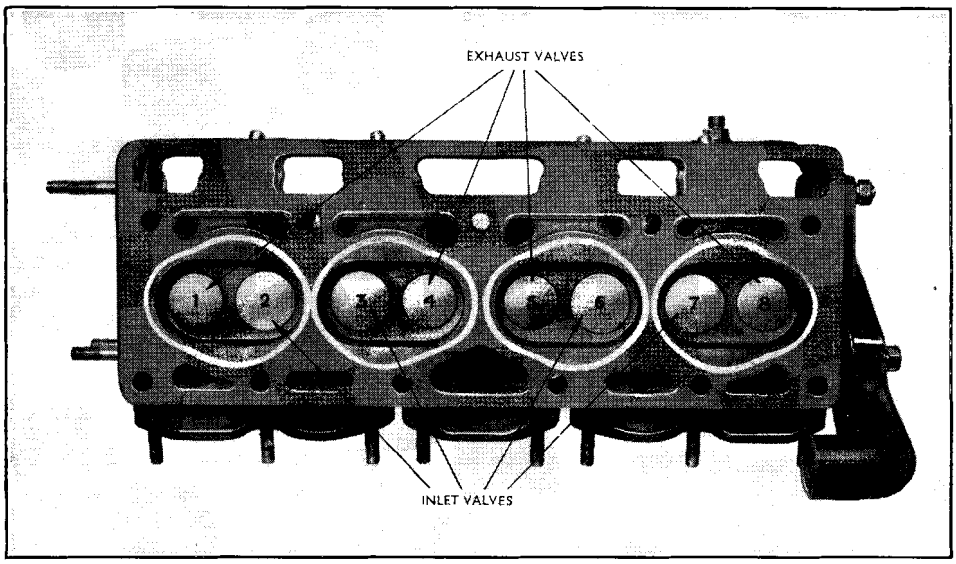


Illustration No. 27.—Showing how the valves are numbered and their positions in the cylinder head.

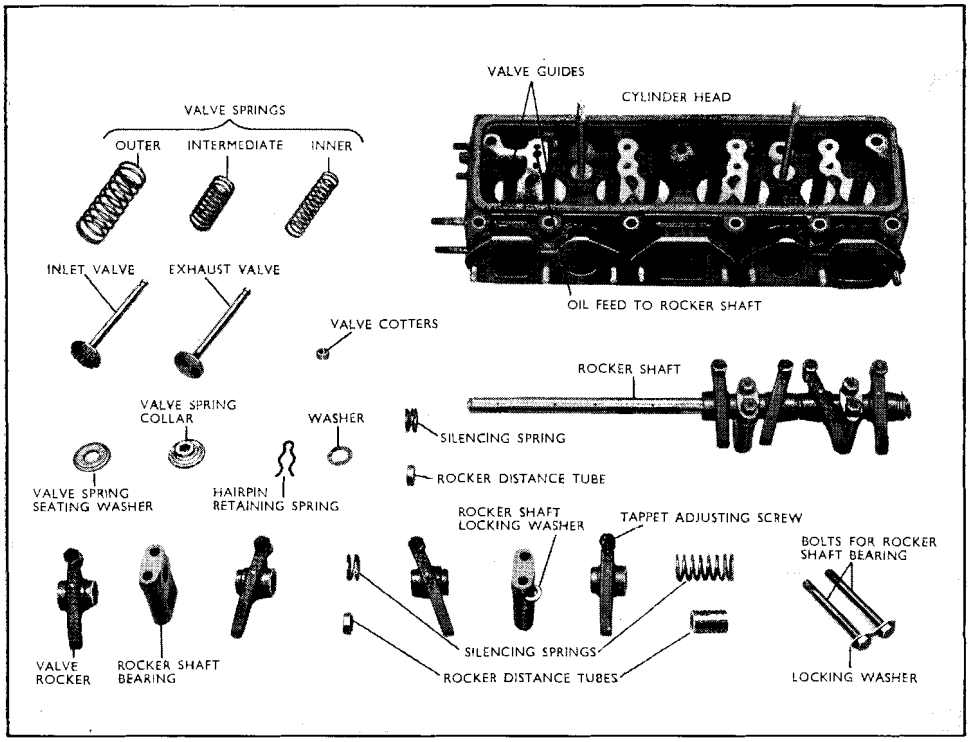


Illustration No. 28.—Showing the relative positions of all the parts contained in the rocker gear.

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 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 and its cap may then be compressed, using the special tool (Part No. T.74). The valve spring can then be placed into position and the two conical cotters inserted (small end downwards) in the groove of the valve stem, when the spring compressor may be released. 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 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, silencing springs, distance tubes and holding brackets may be drawn off the rocker-shaft one after the other.

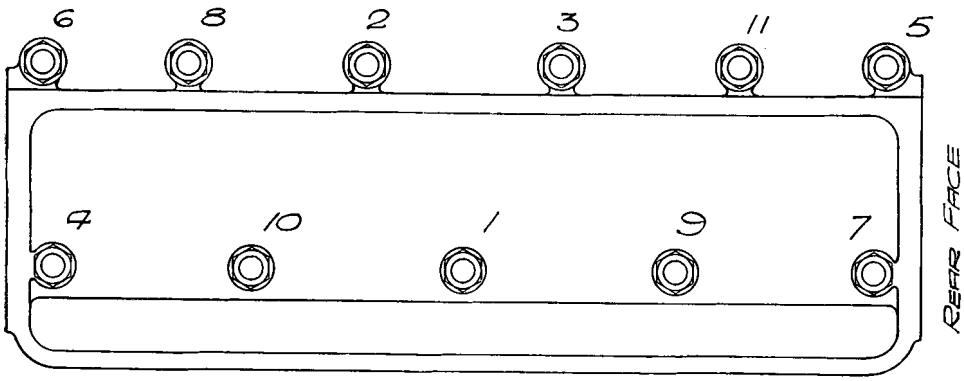
Before reassembling the rocker gear, refer to Illustration No. 28, which shows the correct position of all the components, and will be of great assistance.

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 inspected carefully 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 authorised M.G. repairer, as both the removal of the old guides and the fitting of the new ones requires a special tool (Part No. T.68, which correctly positions the valve guide in the head) and a press to prevent crushing. The correct clearance between the valve guide and valve stem is .003 in. 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 realise 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 cylinder head securing nuts finger tight. Illustration No. 29 shows the correct order for tightening down the securing nuts.



CORRECT SEQUENCE FOR TIGHTENING UP HOLDING DOWN NUTS.

Illustration No. 29.

The push rods should next be refitted, 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 deal with is the oil feed pipe to the rocker gear.

Refit the exhaust and induction manifolds complete with carburetter assembly, if removed. The 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 controls and exhaust pipe to the manifold. Don't forget the gasket when connecting the exhaust pipe to the exhaust flange, also pull up the three nuts evenly.

Sparking Plugs.—The correct sparking plugs are **Champion L10 (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 who 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, connect the high-tension leads to the plugs and coil, and replace the top of the high-tension distributor.

If the distributor has been removed from the engine it will be necessary to check that the plug leads are in their correct positions in the distributor head.

The following information will be of assistance :—

Firing order—1, 3, 4, 2.

Rotation of distributor rotor anti-clockwise, when viewed fitted to engine.

It is possible that the distributor points may need some attention, and full details of this will be found on pages 96 and 97.

Replace the radiator and connect up the headlamp brackets, the radiator stay rods, the top water elbow with new gasket, and also tighten the water hose clips, after which tighten the two nuts securing the radiator to the cross member.

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 pump, 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 rises to a temperature between 70° and 80° C.

Final Adjustments after Decarbonising.—Whilst the engine is at the temperature mentioned, remove the valve cover, re-tighten the cylinder head holding-down nuts and adjust the tappets by means of the ball-ended screws which engage the tops of the push rods.

The correct clearances to which valves should be adjusted are: inlet valves .010 in. maximum, exhaust valves .015 in. maximum.

Clearances are measured when the tappet is immediately opposite the maximum lift point of the cam, which is obtained as follows: turn the engine until the valve is at its maximum open position, then rotate the engine one complete turn.

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

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 starter must then be loosened and swung over to give access to the sump bolts behind. The sump can then be removed. 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 rods and pistons complete, taking care before putting on one side to replace the caps in the same position previous to removal. It is as well also to replace the nuts to ensure that the connecting rod and its cap do not become separated. (See Illustrations Nos. 30 and 31.)

Illustration No. 31 shows a connecting rod complete with piston and one piston 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 (Part No. T.78), 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 pin, is as follows :—

.033 mm.—.061 mm. or its equivalent, .0013 in.—.0024 in.

Piston Rings.—Referring to Illustration No. 31, it will be seen that the piston has three rings. The two top rings are perfectly plain, being simple compression rings ; the third ring is an oil or scraper ring.

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

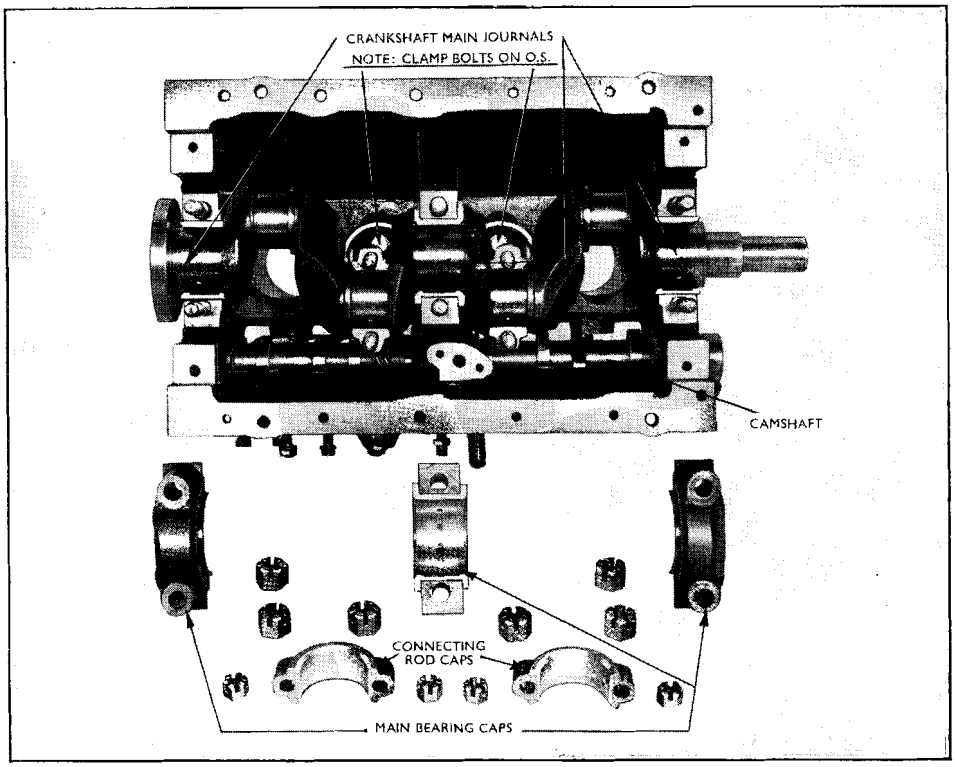


Illustration No. 30.—Interior view of engine partially dismantled.

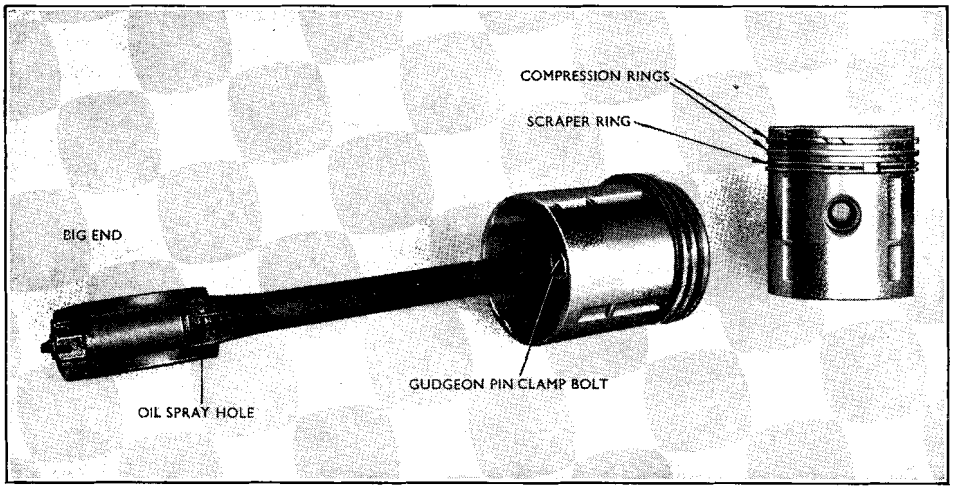


Illustration No. 31.—Piston assembled to connecting rod.

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.

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 (see Illustration No. 30), the reason for this being that the oil spray hole above the big-end bearing shown on Illustration No. 31 may be in the correct position to lubricate the cylinder walls.

When tightening the big-end bolts, care should be taken not to over-tighten 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 the Car.—Assuming radiator and bonnet have already been removed.

Remove front seats, front carpets and the rubber excluders from the bases of the clutch and brake pedals, and slide them and their securing plates up the pedals. Remove the floorboards, also the metal gearbox cover (the dipper switch must be disconnected to allow this to be withdrawn).

Disconnect battery and the high-tension lead from the coil, also the cables connected to the oil gauge sump attachment. Undo the screws which secure the off-side ramp plate to the dash and lift out the panel.

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

Uncouple the clutch withdrawal rod from the lever, and leave it hanging on the pedal.

Uncouple remote control at forward universal joint.

Disconnect the propeller shaft at rear of gearbox, *the flanges must be marked before removal*, as they must go back in the same position (see page 21).

Remove all controls and petrol pipes as already detailed in instructions for removing cylinder head, also remove front exhaust pipe.

The engine can now be uncoupled from its mountings in the frame. Firstly, uncouple the engine front tie straps, unscrew the two front bolts, and remove the four securing bolts from the mounting at the rear end of the gearbox. (The engine must of course be supported before all the securing bolts are removed.)

To allow more freedom for lifting the engine out of the chassis, the rubber seal between the flywheel housing and the engine shield must be removed. (The rubber retainer is bolted to the flywheel housing).

Refitting Power Unit Complete with Gearbox to Frame.—To replace the unit, reverse the removal operations. Important points to remember :—

1. The clutch operating rod must be correctly readjusted. See instructions under " Gearbox and Clutch," Section 1. (Prior to Chassis No. VA.1254.)
2. Reconnect engine front tie straps, as the engine is mounted on rubber, these are very necessary to obtain perfect clutch operation. (Prior to Chassis No. VA.1254.)
3. Refer to wiring diagram, also wiring system, pages 100 to 106, before reconnecting any electrical circuits.
4. Reconnect propeller shaft flanges in the same position as they were before removal.
5. All draught excluders, rubber and felt, must be replaced properly.
6. Leave the radiator loose on the frame so that its position can be adjusted to suit the bonnet.

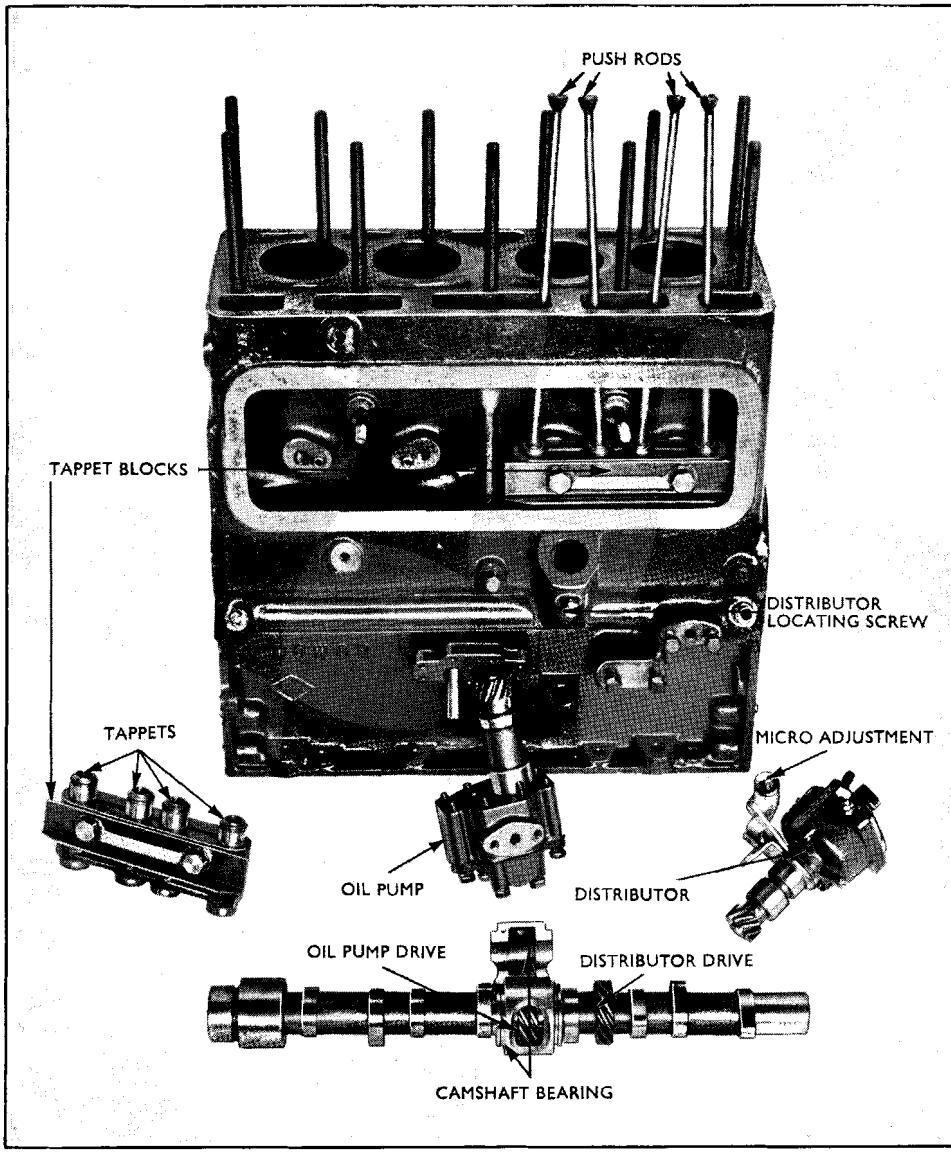


Illustration No. 32.—Showing details of the camshaft and operating gear for the overhead valves.

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 tappets 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 retained 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 middle bearing part of the way with it. To permit this the dowel screw which secures this bearing to the cylinder block must be taken out (see Illustration No. 32, seen just above the oil pump). This bearing has a groove turned round either end, by which it may conveniently be tied or wired to the camshaft to prevent it falling when free of the housing. When the camshaft has been drawn sufficiently to bring the middle bearing free of the housing it may be untied and lifted out, and the withdrawal of the camshaft 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 middle bearing. This should be put on its proper place on the shaft, and either tied or wired to it ; when this bearing has entered its housing sufficiently, the tie or wire must be removed before the shaft is finally pushed home. With the shaft in place the bearing may be moved about until its locating hole is opposite the locking screw hole, using a tool, such as a blunt-ended scriber, to feel that the locking screw will enter properly. The locking screw should now be inserted and wired. Refer to Illustration No. 32.

Removing Crankshaft.—Assuming that the engine is out of the chassis and the sump, clutch, etc., removed as described on pages 65—86, it remains only to undo the flywheel bolts and withdraw the flywheel.

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 three 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.

It will be noticed that the timing chain has two plated links, and each of the sprockets has a tooth marked "T." Between the plated 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 plated link with the shorter black portion of the chain uppermost. The twelve black and two plated links are clearly shown in Illustration No. 33, which shows one plated 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 plated link, twelve black links behind the first one.

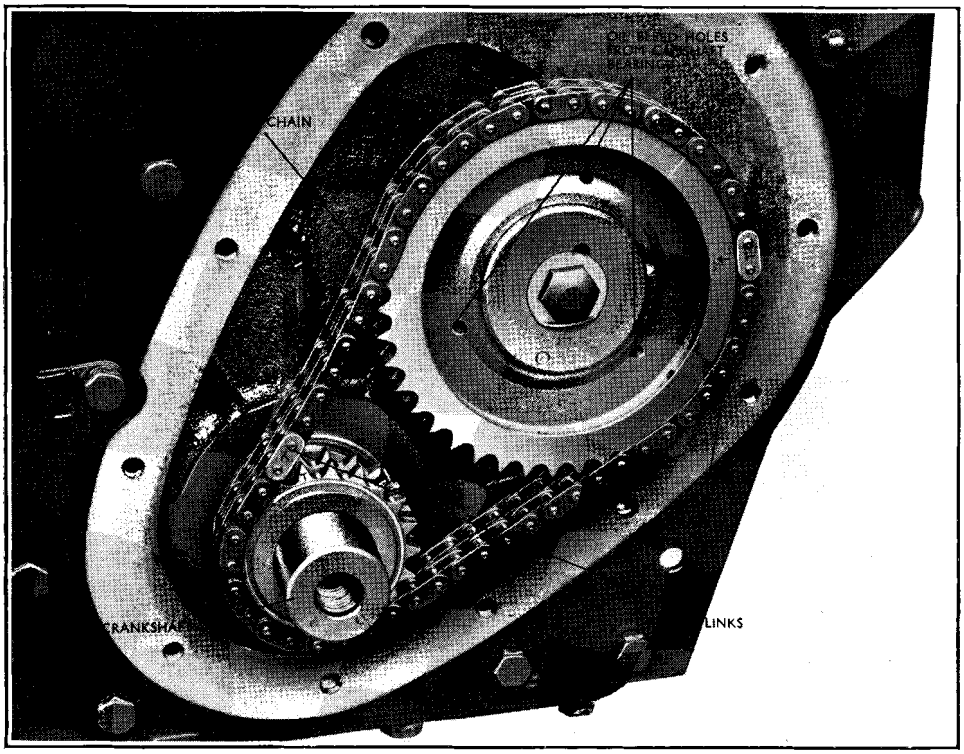


Illustration No. 33.—Timing chain (see page 69).

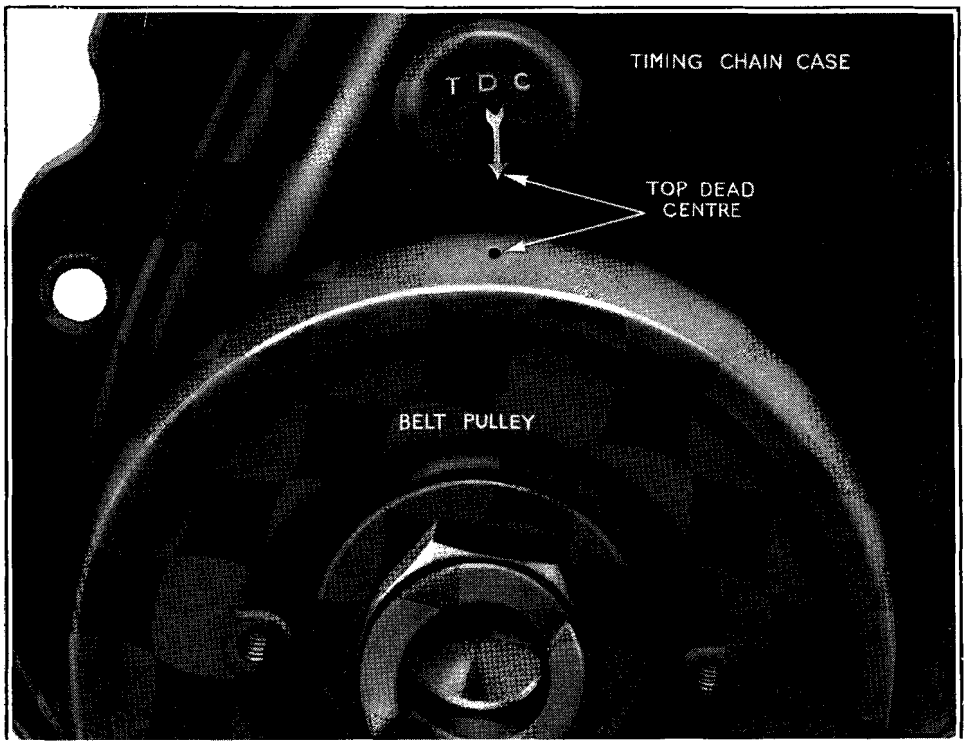


Illustration No. 34.—Showing method of obtaining T.D.C.

The engine must be turned fifty-eight times before the plated links and marked teeth come back to this position again.

Ignition Timing Adjustment.—If the distributor has been removed for any reason, it must be re-timed on replacement. First, set the engine with Nos. 1 and 4 cylinders on top dead centre. This is done by bringing the small hole in the belt pulley rim opposite the arrow stamped on the chain cover as shown in Illustration No. 34.

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 high-tension 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 in the centre position, slack off the pinch bolt, and turn the head until the points are just breaking.

The correct starting point is points just breaking T.D.C. This, of course, may be varied, but probably not more than 1° either way, to suit the grade of fuel used, or the driver's personal ideas. 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.

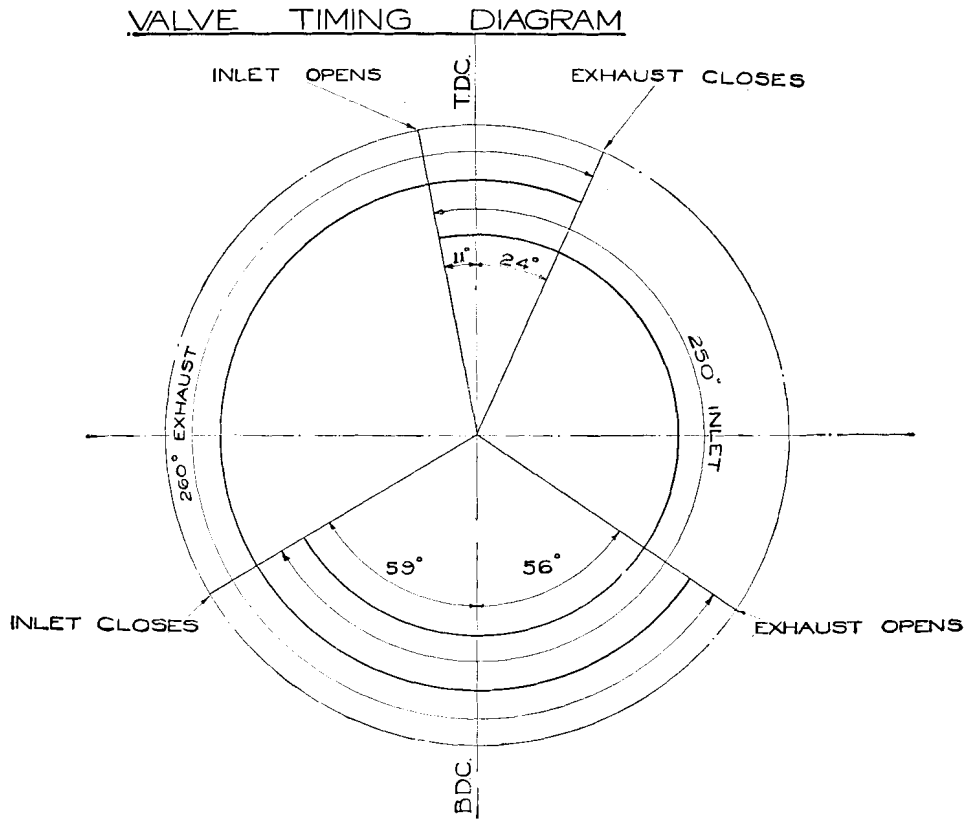


Illustration No. 35.—Valve timing diagram.

Valve Timing.—The valve timing diagram is given above but it may be more convenient to check the valve timing from measurements on the periphery of the flywheel, these measurements being: Inlet opens 27.8 mm. before T.D.C.; Inlet closes 149.3 mm. after B.D.C.; Exhaust opens 141.7 mm. before B.D.C.; Exhaust closes 60.7 mm. after T.D.C.

THE COMPLETE SET OF GASKETS FOR THE M.G. 1½-LITRE ENGINE

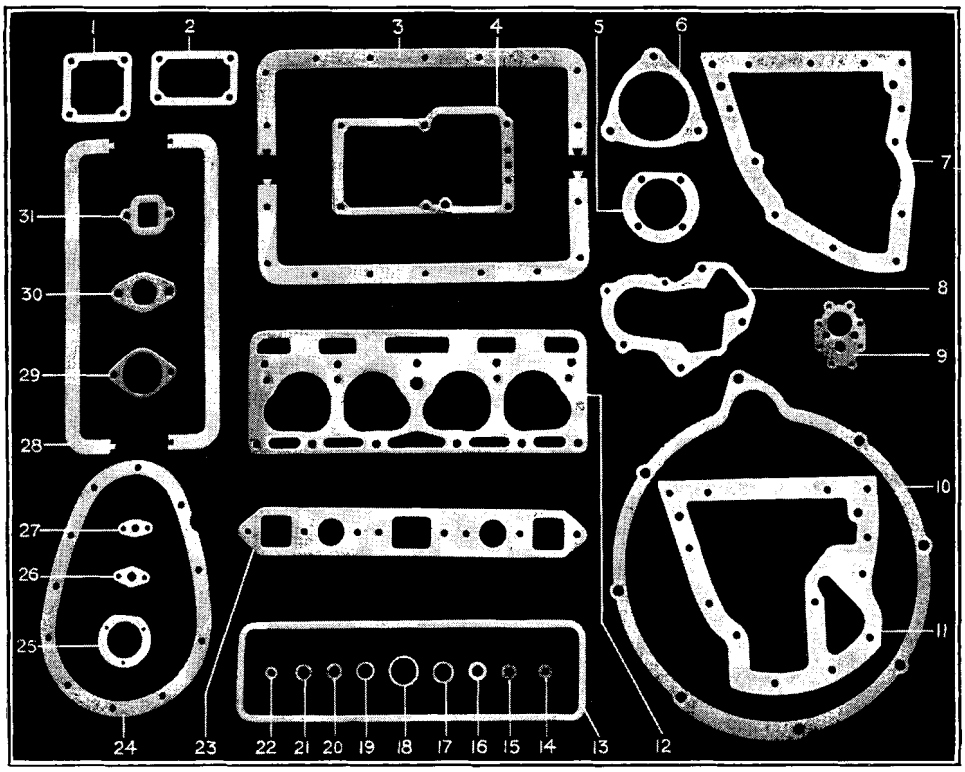


Illustration No. 36.

No.	Part No.	Description.
1	MG679/308	Water outlet pipe gasket
2	MG679/185	Water inlet elbow gasket (head)
3	MG735/138	Sump gasket
4	MG735/232	Gearbox top cover gasket
5	MG679/302	Water pump body gasket
6	MG706/213	Starter gasket
7	MG679/130	Front bearer plate gasket
8	MG735/201	Gearbox rear cover gasket
9	MG679/255	Oil pump cover gasket
10	MG735/165	Clutch housing gasket
11	MG679/479	Flywheel housing gasket
12	MG735/129	Cylinder head gasket
13	MG735/132	Cylinder head cover gasket
14	X679/27	Cylinder head cover nut washer
15	P151/281	Cylinder head oil feed pipe washer
16	MG706/245	Oil filter banjo washer
17	X679/36	Oil pump cover plug washer
18	X151/44	Sump drain and gearbox filler and drain plug washer
19	MG706/244	Oil filter banjo washer
20	X679/37	Oil pump relief valve plug washer
21	MG679/123	Tappet cover screw washer
22	P151/110	Cylinder block drain tap washer
23	MG735/135	Manifold gasket
24	MG679/136	Timing chain case gasket
25	MG706/116	Starter inspection cover gasket
26	MG679/270	Oil pipe gasket (pump to filter)
27	MG679/249	Oil suction pipe gasket
28	MG735/105	Tappet cover gasket
29	MG679/305	Thermostat gasket
30	MG706/111	Carburetter gasket
31	MG735/157	Water outlet elbow gasket (block)

SECTION G

THE ENGINE

Oil Pressure Control Valve.—Referring to Illustration No. 23, the oil pressure control valve was changed for a slightly different type which commenced at Engine No. T.P.B.G.1510.

This valve is identical in operation and is non-adjustable. The correct oil pressure is between 60—80 lb. per sq. in. at all engine speeds over 1500 r.p.m.

Oil Filter.—Referring to Illustration No. 24, the oil filter was also slightly modified, commencing Engine No. T.P.B.G.1510.

The position of the filter is approximately 3 in. higher which allows the filter body to be connected directly to the oil gallery, when provision for the oil outlet from the filter is made in the body, deleting the copper pipe. In all other respects the filter is unchanged.

Piston Clearance.—On page 65 the clearance given for the piston is incorrect, instead of .033 mm.—.061 mm. or its equivalent .0013 in.—.0024 in. read .064 mm.—.076 mm. or its equivalent .0025 in.—.003 in.

Engine Mounting. On pages 67 and 68 reference is made to the engine front tie straps. These were superseded by rubber buffers which in addition to preventing rearwards movement of the engine when declutching, control torque reaction.

These rubber reaction buffers are adjustable, and when in correct adjustment just touch their abutment brackets without any compression of the rubber.

When removing the engine from the chassis whereas the original tie straps had to be uncoupled the new arrangement needs only to be adjusted back giving clearance for removal.

Crankshaft.—A new crankshaft is fitted to the engine commencing at Engine No. T.P.B.G.1510. This crankshaft differs only in regard to the flywheel flange, due to the fitting of a dry clutch in place of the oil immersed clutch (for details of the new clutch see page I—1 at the end of Section I, Gearbox and Clutch).

The flywheel flange is modified to receive an oil thrower to prevent oil from leaking into the clutch pit, into this thrower the spigot race of the gearbox first motion shaft is fitted.

The clearance between the oil return threads of the oil thrower and the flywheel housing is extremely important, the correct clearance being .003 in.—.006 in.

The flywheel is secured over the oil thrower then both flywheel and oil thrower are secured to the flywheel flange by six bolts which are wired through the head to lock them.

To remove the flywheel oil thrower, after having removed the flywheel it is necessary to remove also the flywheel housing.

On reassembling the oil thrower and flywheel housing check the clearance between the oil thrower thread and flywheel housing, making certain that an even clearance as previously stated is maintained.

Valve and Ignition Timing.—Referring to Illustration No. 34, in addition to this method of obtaining T.D.C. the flywheel has also been marked, 1 and 4, and a scribed line which must line up with a pointer fixed to the clutch housing, seen through the clutch inspection cover, indicating the crankshaft top dead centre or T.D.C. of cylinders Nos. 1 and 4, also six marks either side of the T.D.C. mark representing degrees.

The above commenced at Engine No. T.P.B.G.1510.

Engine Gaskets.—Commencing at Engine No. T.P.B.G.1510 gaskets No. 6 and No. 10, Part Nos. M.G.706/213 and M.G.735/165 respectively are not required.

Engine Tie Straps.—Commencing at Chassis No. VA.1254 the engine front tie straps are replaced by rubber buffers which can remain in position. These are referred to at the foot of page 67 under the heading of "To Remove Engine and Gearbox Complete from Car."

Ignition Timing Adjustment (refer to page 71).—Commencing at Engine No. T.P.B.G.1510 T.D.C. is given on the flywheel. Access to this is through the clutch inspection cover.

SECTION H

CARBURETTERS
AND
PETROL PUMP

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 to lubricate the piston guide rod after removing the brass cap on the top of the dashpot (see Illustration No. 37) every thousand miles ; three drops of machine oil or bicycle oil are advised for this purpose.

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 to obtain a good tick-over. Screwing the jet adjusting nut upwards—that is, in a clockwise direction looking from underneath 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, providing the correct needle is fitted, 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.

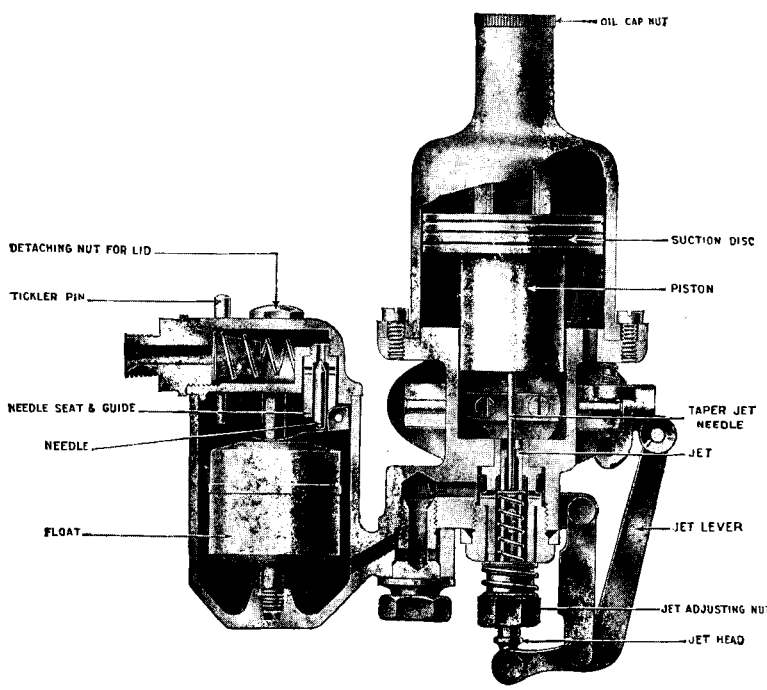


Illustration No. 37.—Showing section through carburetter.

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.

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 or yoke ends, 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, in order not to damage the taper jet needle. Mark the suction chamber before removal and replace it the same way as originally fitted. Do not change the suction chambers or pistons from one carburetter to another.

Wash air cleaner thoroughly in petrol every 5000 miles and re-oil gauze with engine oil. See page 59.

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, bent needle, or jet out of centre.
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 finger in the air intake and moving the piston. If the air cleaner has not been removed the piston can be lifted by inserting a match-stick or preferably a small metal rod through the hole in the carburetter body under the piston chamber or dashpot. The piston should move quite freely and return to its seat with a soft click as soon as it is released. The air cleaner and branch pipe will have to be removed to get access to the carburetter air intake.

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 out from the vent pipe. Flooding is generally caused by foreign matter finding its way on to the seating of the float-chamber needle. It can sometimes be removed by flooding the carburetter with the tickler pin, thus permitting the incoming petrol stream to wash away the particles of grit. Otherwise access to the needle is obtained by removing the float-chamber top. To take out the needle it is necessary first of all to take out the pin which holds the needle 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 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. The correct level is $\frac{1}{8}$ in. maximum, $\frac{5}{16}$ in. minimum, below the jet bridge.

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 pages 69 and 71. Check and, if necessary, adjust distributor points to .012 in., plug points to .018 in., and valves to clearances detailed on page 65.

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, but for checking purposes the following information will be of assistance. With the dashpot and piston removed, the petrol level should be $\frac{1}{8}$ in. maximum, $\frac{5}{16}$ in. minimum, below the jet bridge. 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 suction chambers to the carburetters, making sure that, when screwed down tightly, the pistons return to their seatings with a soft click. If for any reason it is thought advisable to fit new needles, see that they are the same type as before. The marking (CO, in the case of the M.G. $1\frac{1}{2}$-Litre models) is stamped on the shoulder. Alternative needles are—richer BK, weaker CP.

Next unscrew the jet adjusting nuts two complete turns and disconnect slow-running control. Then slacken one of the 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 unscrewed, 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, if the air cleaner and its manifold is removed, 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 lifting each of the pistons in turn with a pencil or similar object a height of about $\frac{1}{8}$ in. 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, $\frac{1}{4}$ in., 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 up both jet nuts one or two flats ; before attempting the final adjustment for mixture strength, it is essential that the engine should have attained its normal working temperature. The mixture may then 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, also showing 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 up one or two flats, 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 down. 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.

Slow-running Control.—The adjustment of the cable leading to the dash control knob is effected by means of a clamp on the end of the slow-running lever on the carburetter butterfly spindle. It is necessary when readjusting this control to make quite sure that the knob on the dash is screwed in as far as it will go and also the carburetter butterfly spindle is resting on the slow-running adjustment screws when the required idling speed is obtained. The inner cable can then be readjusted in the clamp so that all slackness of the cable is removed.

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.

The Electric Petrol Pumps.—The pump is fitted on the off-side of the dash wall and consists of three main assemblies : the body, the magnet assembly and the contact breaker. Referring to Illustration No. 38, 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 "KI" 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 "UI" 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 "UI" is fitted with a tungsten point which makes contact with a further tungsten point on the 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 "SI" 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. Two fibre bushes are fitted to one of the spindles of the " throw over " mechanism of all pumps in order to silence the operation of the contact breaker.

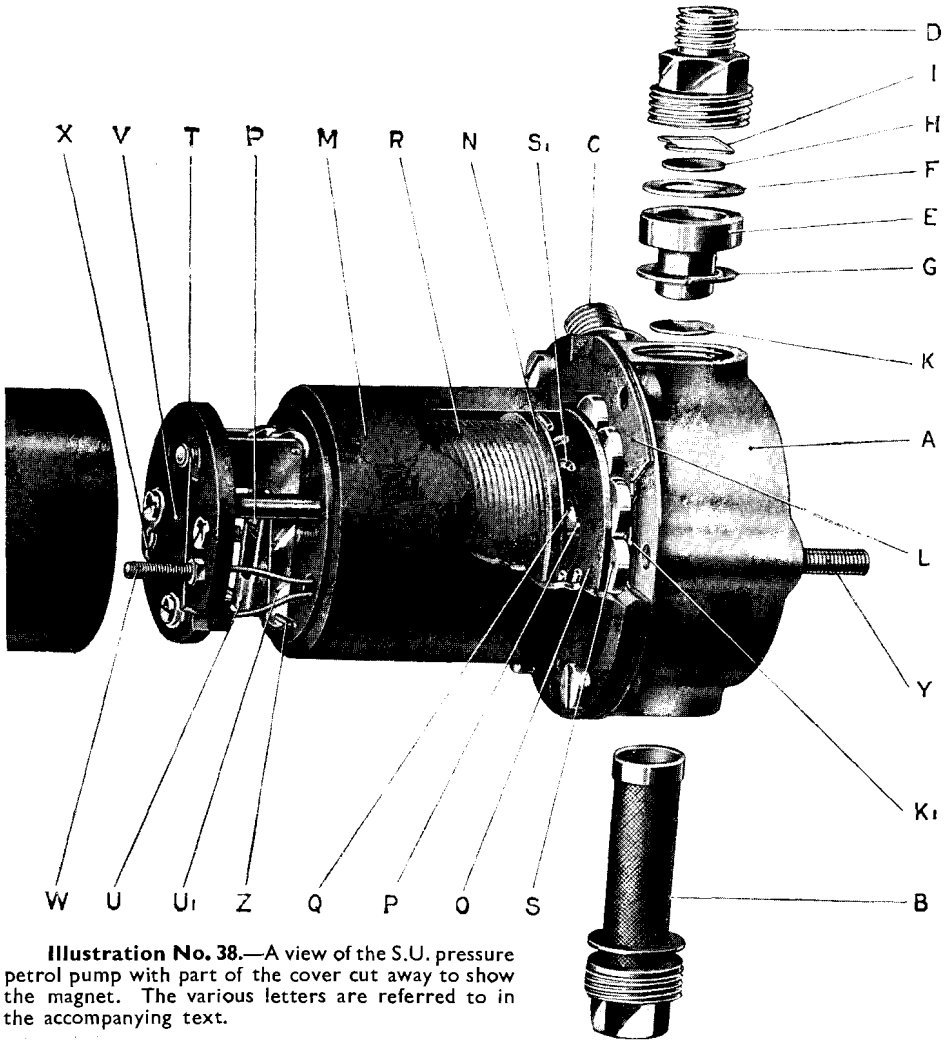


Illustration No. 38.—A view of the S.U. pressure petrol pump with part of the cover cut away to show the magnet. The various letters are referred to in the accompanying text.

The 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 " SI " 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.

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.

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 essential 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 swung to one side while the adjustment is being made. 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.

If the pump becomes noisy in operation it is possible that this is being caused by an air leak on the suction side of the pump or dirty suction valves in the pump due to the presence of some foreign matter.

An air leak can be detected by disconnecting the pipe from the carburetter and allowing the pump to deliver petrol into a can. If the end of the pipe is then submerged in the liquid and any bubbles are seen to come through, it will indicate the presence of an air leak on the suction side of the pump. All unions, olives and pipe fittings between the pump and the petrol tank should be tightened and carefully inspected for fracture.

If no air bubbles are apparent but the pump is not delivering an adequate supply, it may be due to dirty valves. These can easily be removed for inspection, and if they are clean, but there is some doubt as to their good condition, they should be replaced with new ones.

Guarantee.—S.U. products are guaranteed for the length of time covered by the normal guarantee of the car to which they are fitted. The guarantee is confined to the exchange or repair of any part or parts which are faulty by reason of defective workmanship or defective material. The Company will not be responsible for any expense or labour charge incurred in removing or replacing defective parts. Every form of liability for consequential loss or damage is expressly excluded.

AMENDMENTS AND ALTERATIONS

SECTION H

CARBURETTERS AND PETROL PUMP

Jet Lever Connecting Rod.—Reference is made to the necessity of adjusting the jet lever connecting rod after adjustment to the jets by screwing or unscrewing the **ball joints**. Commencing at Chassis No. VA.0950 the ball joints were replaced by yoke ends which, however, are adjusted in an identical manner.

SECTION I

GEARBOX AND CLUTCH

Removal of Gearbox.—First remove the metal gearbox cover and off-side ramp plate as described in the instructions for removing the power unit (page 67). Drain the gearbox, remove the rubber seal and its retainer from the flywheel housing, uncouple the gear lever remote control at the forward universal joint, also the clutch control rod at the front end and let it hang on the clutch pedal, uncouple the propeller shaft at the front end (first refer to the special instructions on page 21) and remove the clutch operating lever from its cross shaft through the clutch housing.

As the front engine bolts will have to be slackened off to allow slight engine movement, first remove the rubber washers and retainers from underneath and undo the bolts. It is then necessary to jack up the rear of the engine and remove the bolts securing the gearbox rear bearer plate to the rear mounting blocks, also the bolts securing the clutch housing to the flywheel housing. The rear of the engine must then be lifted until the gearbox rear bearer plate is clear of the frame brackets, when the gearbox can be withdrawn.

Dismantling Gearbox.—The dismantling of the gearbox is a comparatively simple operation, but, due to the fact that a second gear synchromesh unit is incorporated, the operations are somewhat unorthodox. The following dismantling instructions will be of assistance.

1. Remove the gearbox top—care must be taken that the selector ball springs are not lost. Their positions can be seen at the rear of the gearbox casing in Illustrations Nos. 39 and 40.
2. Remove the propeller shaft flange. Before doing so, however, it is necessary to mark both the flange and the shaft so that it can be replaced in exactly the same position. The rear cover can then be removed, also the rear engine support plate, the rearmost ball bearing, distance tube and speedometer driving gear.
3. The clutch housing must then be removed from the gearbox casing.
4. Remove the layshaft locking screw which is found underneath the gearbox casing and withdraw the layshaft, allowing the gear unit to fall into the bottom of the box.
5. Remove the selector operating gear, taking care not to lose the two interlocking balls found between the selector shafts at the rear end.
6. Engage second gear ; it must be fully engaged to give the necessary clearance for removing the mainshaft.
7. The first motion shaft can then be removed complete with ball race.
8. The mainshaft rear ball race must now be removed.
9. The mainshaft can then be withdrawn from the gearbox casing as shown in Illustration No. 40.

The reverse gear and its operating mechanism are now the only parts left in the casing, and it remains only to remove the locking screw securing the reverse gear shaft from the side of the box, also the bolt securing the actuating lever, for the whole of this mechanism to be removed.

The layshaft bearings and spacer tube are retained inside the layshaft gears by steel dowels which fit the internal bore, over which are pressed steel washers which make surfaces for the bronze thrust washers. As they are of different sizes, they cannot very well be confused.

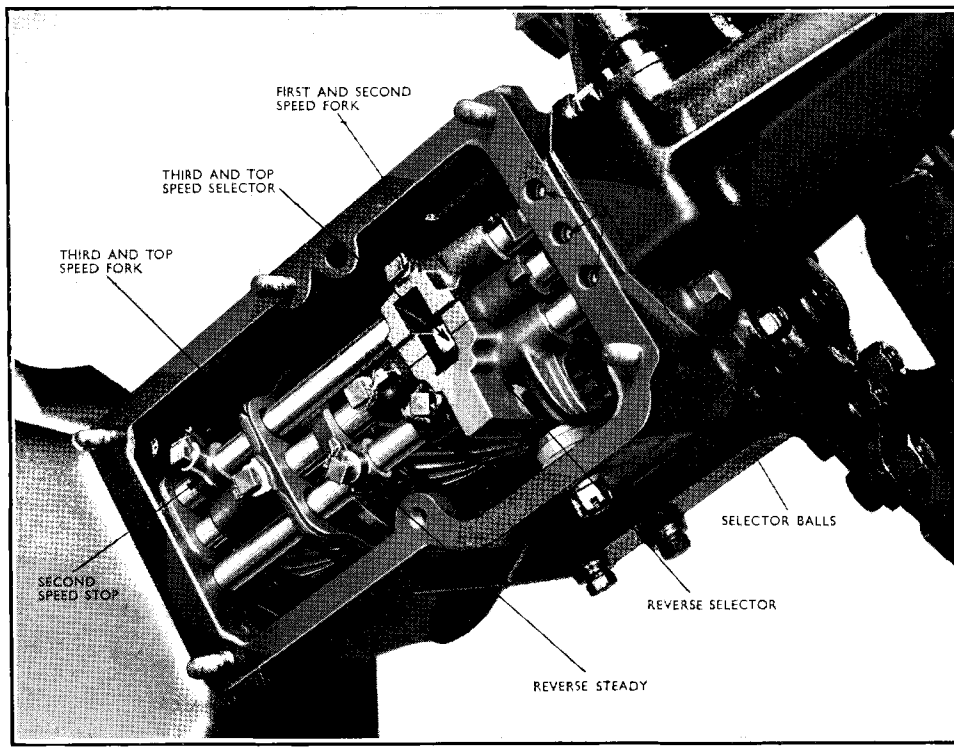


Illustration No. 39.—Gearbox with cover removed, showing selector mechanism.

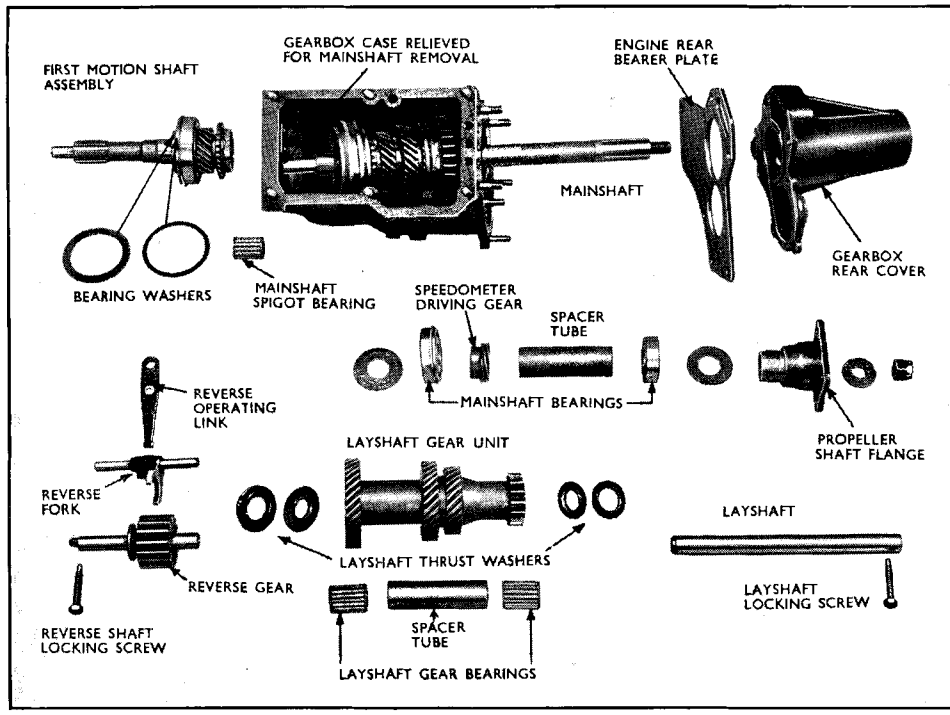


Illustration No. 40.—Gearbox dismantled.

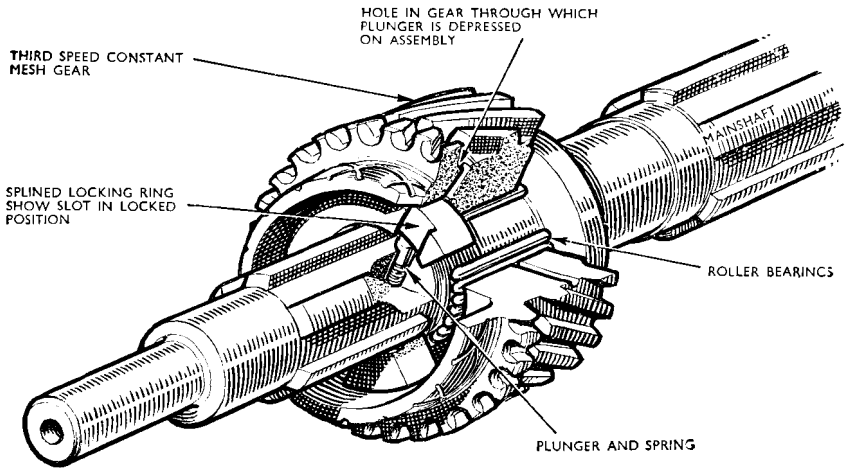


Illustration No. 41.—Showing method of securing third speed constant mesh wheel to mainshaft.

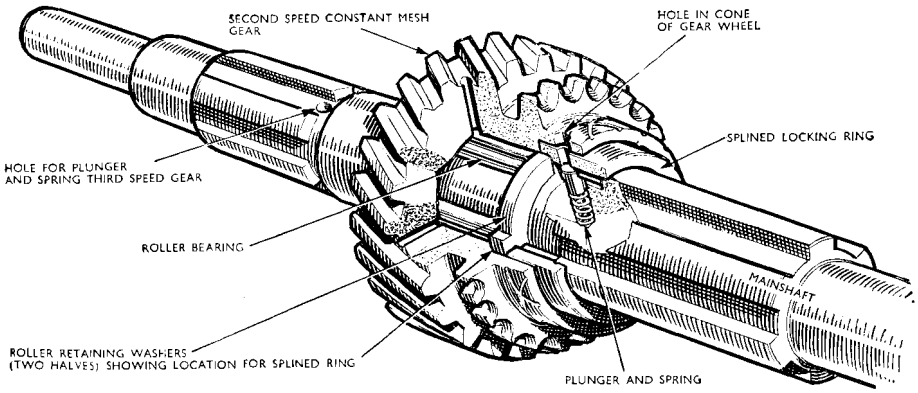


Illustration No. 42.—Showing method of securing second speed constant mesh wheel to mainshaft.

Removing Third Speed Constant Mesh Gear from the Mainshaft.—This gear is retained on the mainshaft by a splined ring locked in position by a spring and plunger (see Illustration No. 41). It will be noted that the ring has two slots cut in the outer face to enable the plunger to be depressed. The locking ring can then be rotated until its male splines match with the female splines of the mainshaft and withdrawn.

The plunger can then be removed, which will in turn allow the gear wheel and its thirty-two rollers to be removed.

Removing Second Speed Constant Mesh Gear from the Mainshaft.—The retaining arrangement for this gear is slightly different from the third speed gear (see Illustration No. 42). This gear is also retained on the mainshaft by a splined ring locked in position by a spring and plunger.

Two holes in the coned portion of the gear give access to the plunger. By inserting a split pin through the hole in the gear and the hole in the splined ring the plunger can be depressed, which will allow the ring to be rotated until its male splines match up with the female splines of the mainshaft and the ring withdrawn. The plunger can then be removed, which will allow the needle roller retaining washer (two halves), the gear wheel and twenty-two rollers to be removed.

Dismantling the Synchromesh Mechanism.—The striking dogs for top and third, and second gears are retained on sliding hubs by balls and springs which are housed in their sliding hub. Therefore each sliding hub can be pushed out from its striking dog when sufficient effort is applied to overcome the springs.

Reassembly of the Top and Third Synchro Mechanism.—The balls and springs must be fitted in the sliding hub, when the striking dog can be slid over. A special tool is required to enable the spring and balls to be fitted to the synchro mechanism, Part No. T.83.

When the sliding hub is just entered into the striking dog each piece of shim should be pushed down between the striking dog and the sliding hub, holding a ball and spring in the hub. This leaves the operator's hands free and retains the balls and springs. The sliding hub can now be pushed into the striking dog and the pieces of shim withdrawn, when the balls will spring into an indentation ground in the centre of the teeth.

Reassembly of Second Gear Synchro Mechanism.—The assembly of this unit is almost identical to the top and third synchro unit, with the exception that there is insufficient clearance to use steel shims, and a special tool, Part No. T.83, is required to compress the balls and springs to enable the striking dogs to slide over them.

Reassembly of Gearbox.—The assembling of the gearbox necessitates the reversing of those operations outlined under "Dismantling." There are several points, however, that need special mention, which are as follows :—

1. Before putting the layshaft gears into the bottom of the box, do not forget to insert both roller bearings and spacer tube, also steel washers and bronze washers. It must also be remembered that the layshaft should not be replaced until the mainshaft and first motion shaft have been fitted.
2. When assembling the third speed constant mesh gear to the mainshaft it is essential that the roller bearings are perfectly clean. There are thirty-two rollers, over which the constant mesh gear is fitted. The locking plunger

and spring must be placed in the shaft, followed by the splined locking ring. It is important to note that on the outer face of the locking ring two slots are cut. These must line up with the plunger when in the locked position. They are intended to give access to the locking plunger to enable it to be depressed so that the locking ring may be turned to release the gears (see Illustration No. 41). When sliding on this locking ring, the plunger can be depressed through a hole drilled between the constant mesh gear and the striking dog mating gear, as illustrated.

3. When reassembling the second speed constant mesh gear on the mainshaft the procedure is slightly different. There are twenty-two rollers, which can be held in position with a little grease. The locking plunger spring must first be placed in position, when the second speed constant mesh gear can be slid into place. The two steel half washers should next be inserted inside the gear next to the rollers so that their protrusions line up between two splines. The splined locking ring can then be placed in position (with the slots cut on its inner face in line with the protrusions on the two half washers), having first depressed the plunger through the hole indicated. This allows the locking ring to be turned until the plunger springs up into a spline and locks it.
4. Before entering the mainshaft into the gearbox complete with its gears, do not forget fully to engage second gear, giving sufficient clearance to allow the spigot or front end of the mainshaft to clear the gearbox casing.
5. The mainshaft rear ball race can then be fitted. The oil spinning washer, however, must be placed between the ball race and the second gear synchromesh hub with its outer edge clear of the ball race. Next to this ball race must be fitted two large steel washers, the wide one next to the ball race and the thin one following it, after which the speedometer driving gear, spacer tube and rearmost ball race can be fitted, followed by the engine rear support bracket and gearbox rear cover.
6. When replacing the first motion shaft do not forget to insert the mainshaft roller race inside it.
7. The selector mechanism can then be inserted, not forgetting the two interlocking balls between the selector shafts.
8. After refitting the layshaft do not forget to lock it with the locking screw from underneath the gearbox.
9. When refitting the clutch housing do not forget to replace the two steel washers, the wider one going next to the ball race, the thinner one following it.
10. Before replacing the gearbox top do not forget to insert the three locking balls and springs.
11. After the gearbox has been refitted to the car do not forget to refill with the recommended lubricant.

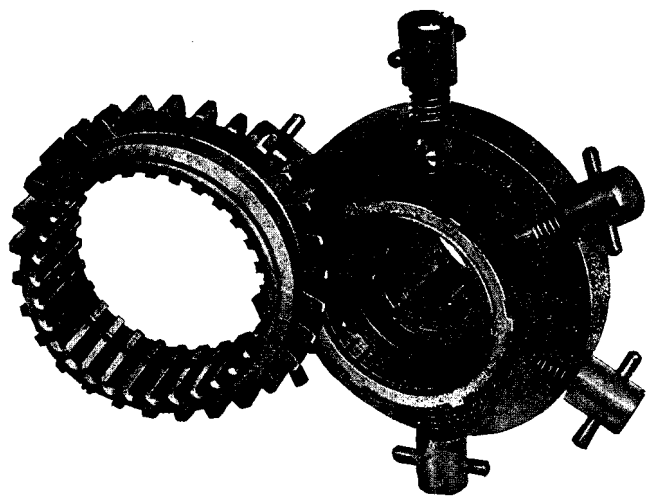
The Clutch.—Access to the clutch is obtained by removing the gearbox and clutch housing from the flywheel housing (see " Removal of Gearbox," page 82). The clutch cover, the springs and the pressure plate can now be removed as a single unit by undoing the ring of bolts on the outside of the clutch cover-plate 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. 43).

SECTION I

GEARBOX AND CLUTCH

Removing the third speed Constant Mesh Gear from the Mainshaft.— Commencing at Engine No. T.P.B.G.1510 the number of roller bearings was increased from 32 to 36.

Reassembly of Third and Second Speed Synchromesh Units.—The special tool, Part No. T.83, is illustrated below showing its operation.



Clutch.—The clutch unit was changed from an oil immersed clutch to a dry clutch commencing at Engine No. T.P.B.G.1510.

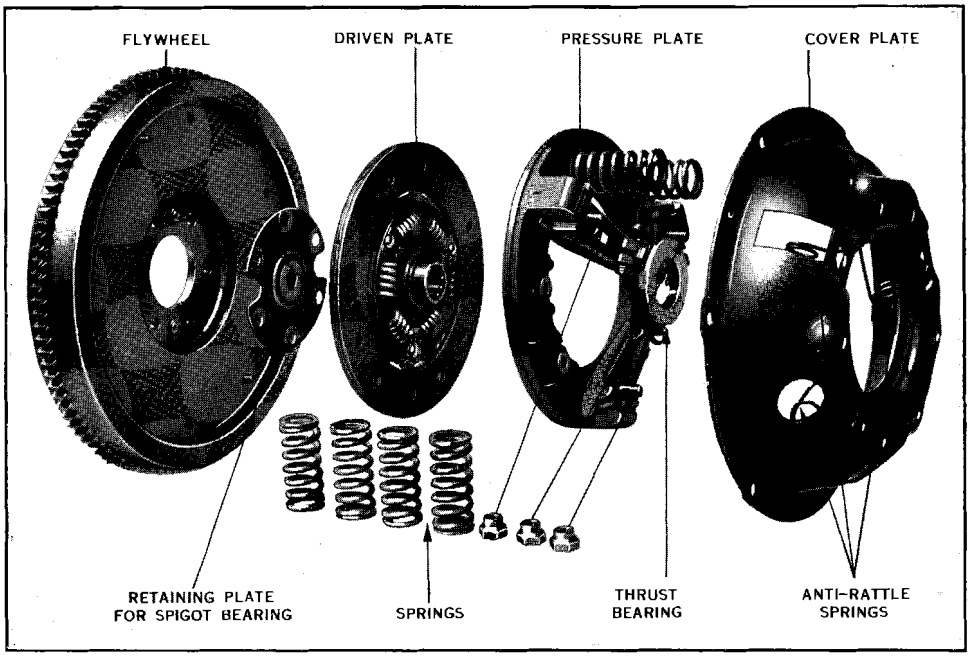
An inspection cover is incorporated in the clutch housing which gives access to the T.D.C. marks on the flywheel.

Access for dismantling purposes is identical to the original clutch by removing the gearbox and clutch housing which is secured to the flywheel housing by a ring of bolts.

The clutch is removed from the flywheel as a complete unit by undoing the ring of bolts securing the clutch cover to the flywheel.

To dismantle the clutch unit it is necessary only to remove the three nuts securing the clutch pressure plate by the fulcrum bolts to the clutch cover.

It is important to note that these three nuts which are split pinned are not adjustable, each should be replaced on its respective bolt, screwed up to the position where the split pin, which must fit the hole snugly, can be refitted.



Adjustment of Clutch Pedal.—It is of the utmost importance that the pedal has 1 in. minimum free travel before operating the clutch withdrawal mechanism. The stop limiting the travel of the pedal is then adjusted to give 3 in. pedal movement after the 1 in. free travel.

To dismantle the clutch plate, springs and pressure plate, remove the ring nut from the hub of the pressure plate, when the clutch withdrawal ball race and washer can be removed and the pressure plate withdrawn from the cover-plate (see Illustration No. 43).

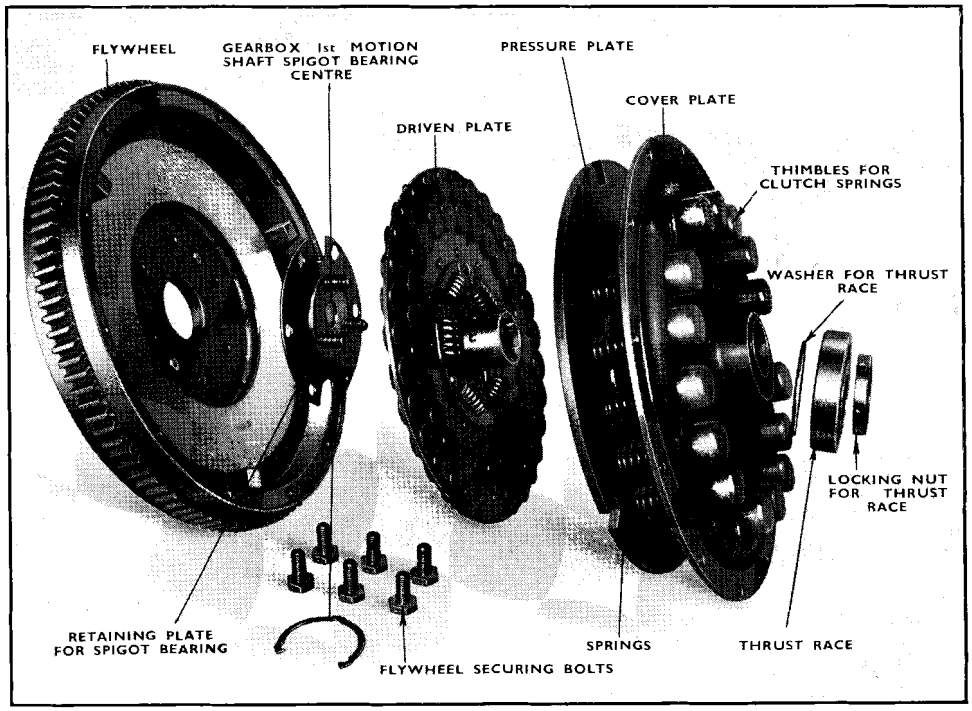


Illustration No. 43.—Clutch dismantled, showing various components.

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.

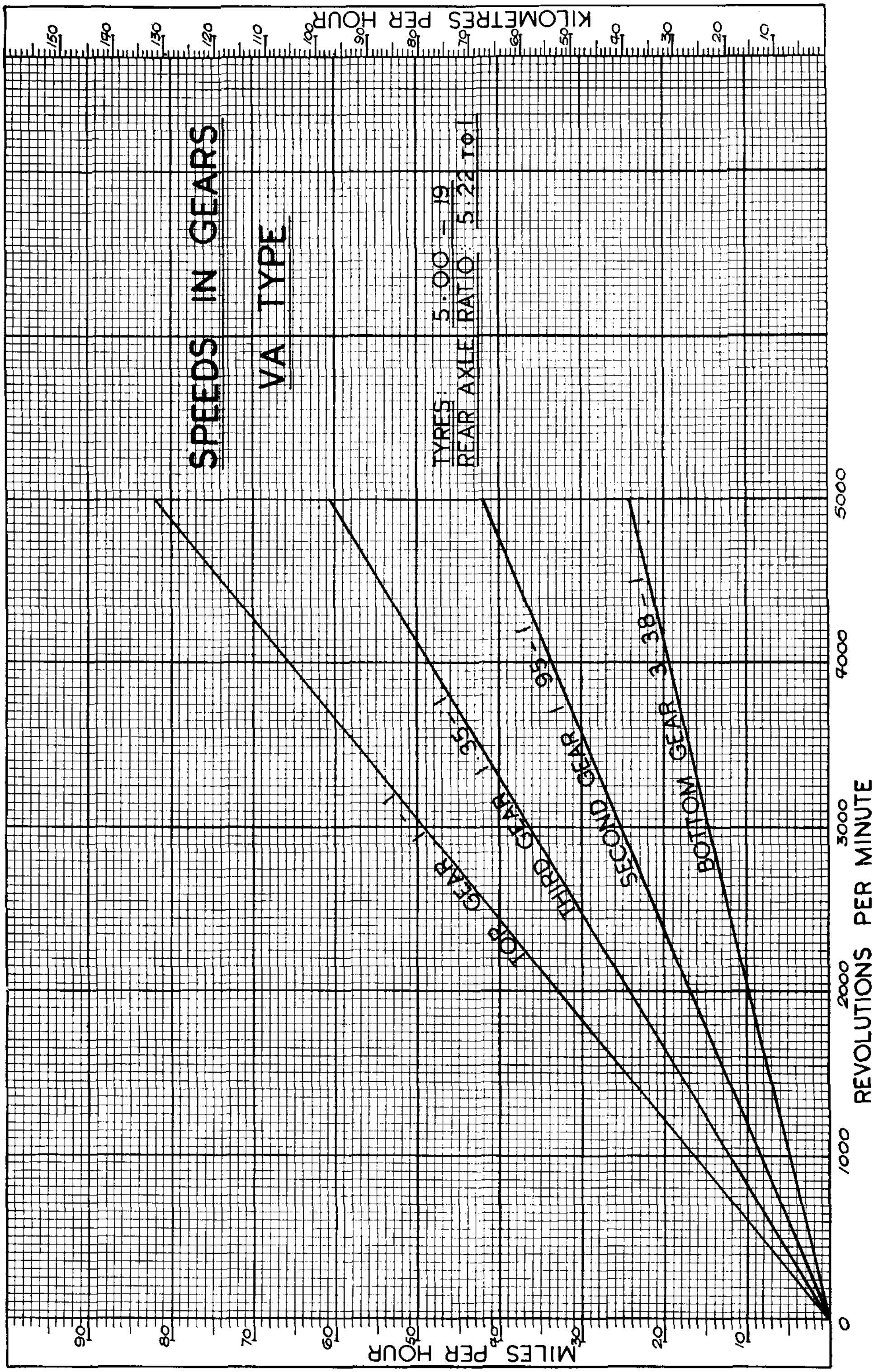


Illustration No. 44.—Showing the speeds on each gear and the corresponding engine revolutions.

SECTION J

THE ELECTRICAL AND IGNITION SYSTEMS

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 level $\frac{1}{4}$ in. above 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 damaged beyond repair.

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 a lubrication wick at the commutator end of the machine. Once every year, unscrew the cap of the lubricator, and if the wick is dry, refill the cap with vaseline. (See Illustration No. 45.)

Inspection of Commutator and Brush Gear.—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 dished 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 springs. Hold back the springs 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.

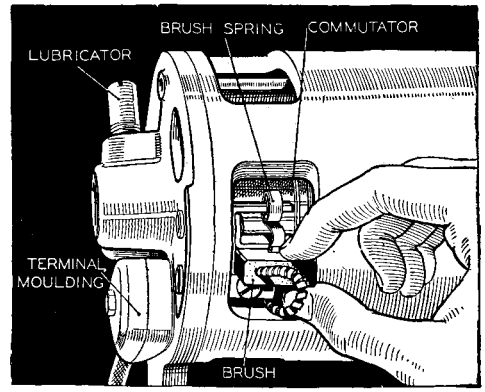


Illustration No. 45.—Dynamo brush gear.

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 bear properly on the commutator, they should be replaced. Always fit genuine Lucas brushes, as these are made specifically for work on these 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 the 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 gives only 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, twenty miles per hour, after which it will remain fairly high for perhaps ten 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.

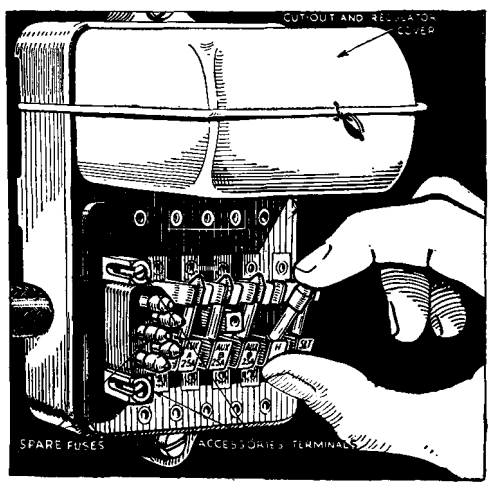


Illustration No. 46.—Cut-out, regulator and fuse unit.

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 shield.

Cut-out, Regulator and Fuse Unit.—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 five fuses. Two protect the auxiliary accessories which are operative only when the ignition is switched on, one protects those accessories which can be operated irrespective of whether the ignition is on or off, while the remaining two protect the head, side and tail-lamps.

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

1. Operate the starter switch control firmly, and of course release it as soon as the engine is running.
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 starter commutator and brush gear 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. (Speedometer and revolution counter have separate bulbs mounted in the instruments.)

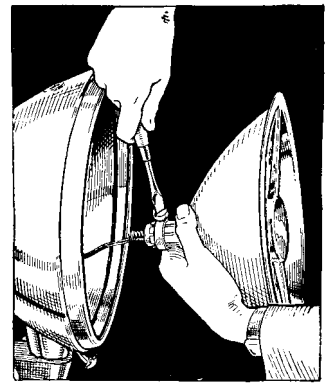


Illustration No. 47.—
Focussing headlamps.

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 dispatched 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. (Illustration No. 47.)

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.

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 and Reversing Lamps.—The fronts of these lamps can be opened when the fixing clip is sprung back.

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. Chromium-plated lamps will not tarnish and only need wiping over with a damp cloth to remove dust or dirt.

Lucas Genuine Spare Bulbs.—Lucas genuine spare bulbs are sold by any reputable garage and are specially tested to check that the filament is in the correct position to give the best results with Lucas lamps. To assist in identification, Lucas bulbs are marked on the metal cap with a number. When fitting a replacement, see that it is the same number as the original bulb.

We advise you to replace bulbs after long service before they actually burn out, as very often the filaments sag, making it impossible for them to be focussed correctly.

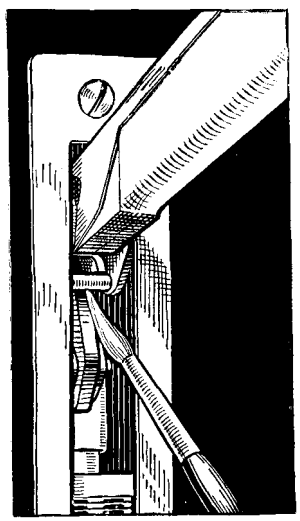
Bulbs Fitted.—

Headlamps	Lucas No. 54	12 v.	36 watt
Sidelamps	Lucas No. 207	12 v.	6 watt
"Stop" and Tail-lamps	Lucas No. 207	12 v.	6 watt
Reversing Lamp	Lucas No. 1	12 v.	24 watt
Panel Lights	Lucas No. 1224M	12 v.	2.4 watt
30 M.P.H. Warning Lamp	Lucas No. C252A	2.5 v.	.5 watt
Ignition Warning Light	Lucas No. C252A	2.5 v.	.5 watt
"Trafficators" (Saloon and Foursome only) (festoon)	Lucas No. 256	12 v.	3 watt

Electric Horn.—The horn is adjusted to give its best performance ; no subsequent adjustment is required.

Should the horn become uncertain in its action, giving only a choking sound, or cease to vibrate, it does not follow that the horn has broken down. First ascertain that the trouble is not due to some outside source, e.g. a discharged battery, a loose connection or short circuit in the wiring of the horn, or a blown fuse. It is also possible that the performance of a horn may be upset by the horn becoming loose on its mounting.

If the cause of the trouble cannot be found, do not attempt to dismantle the horn, but return it to a Lucas Service Depot for examination.



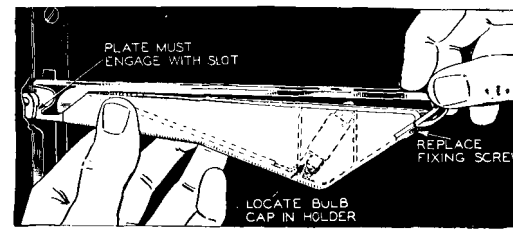


Illustration No. 49 (above).—Replacing "Trafficator" bulb.

Illustration No. 48 (on the left).—"Trafficator" lubrication.

"Trafficators."—Every 2–3 months or if the arms become stiff at any time, raise each arm, and by means of a brush, match-stick 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, replacing it if necessary by a Lucas No. 256 (3 watt festoon type) bulb. (See Illustration No. 49.)

To remove the bulb, withdraw the screw on the underside of the arm and slide off the metal plate ; the bulb 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.

Windscreen Wiper (Closed).—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.

Windscreen Wiper (Tourer).—The windscreen wiper is carefully adjusted and packed with grease during assembly, and needs no attention.

To start the wiper, pull out the metal handle and turn to disengage it from the switch. Then move the switch to the " on " position. To stop the wiper, move the switch to the " off " position, pull out the handle to disengage wiper blade from the gears, and turn end of handle into top of switch control.

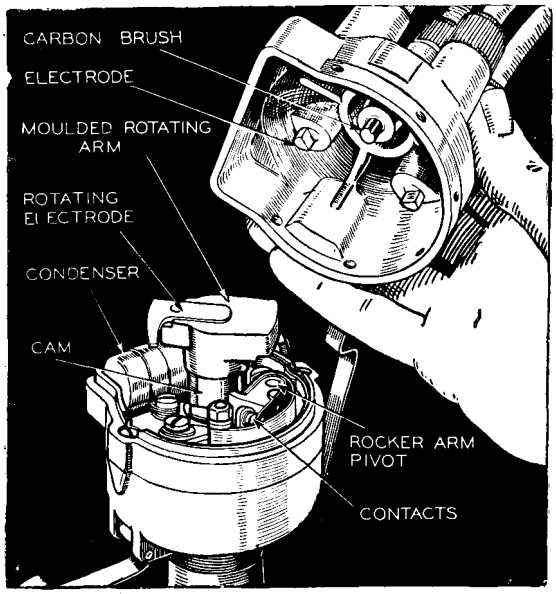


Illustration No. 50.—The distributor with the cover removed.

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 made to the engine. As most of the bedding down of the contacts occurs during this period, the contact breaker gap should be checked at the same time and, if necessary, reset to .012 in. maximum opening.

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.*—Give the cam a smear of light grease 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 Timing Control.*—Once every 2500 miles, the moving parts of the automatic timing control must be lubricated with the recommended grade of engine oil. To render the control accessible, remove the distributor moulding and lift off the rotating distributor arm ; then remove the contact breaker base 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 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.

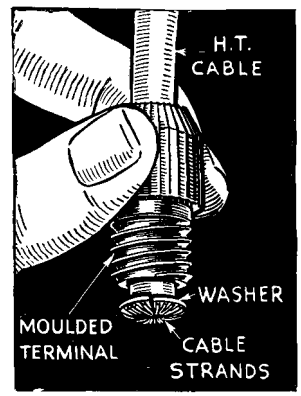


Illustration No. 51.—Showing method of securing lead to high-tension terminal (distributor).

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. (See Illustration No. 51.)

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 grease, 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 altering 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.

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 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 Lucas No. C252A.

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.

With a clean engine, and using first grade fuel, the micrometer scale should be at 0, before timing.

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 one distributor degree at a time (one division on the scale is equivalent to two distributor degrees or four crankshaft degrees).

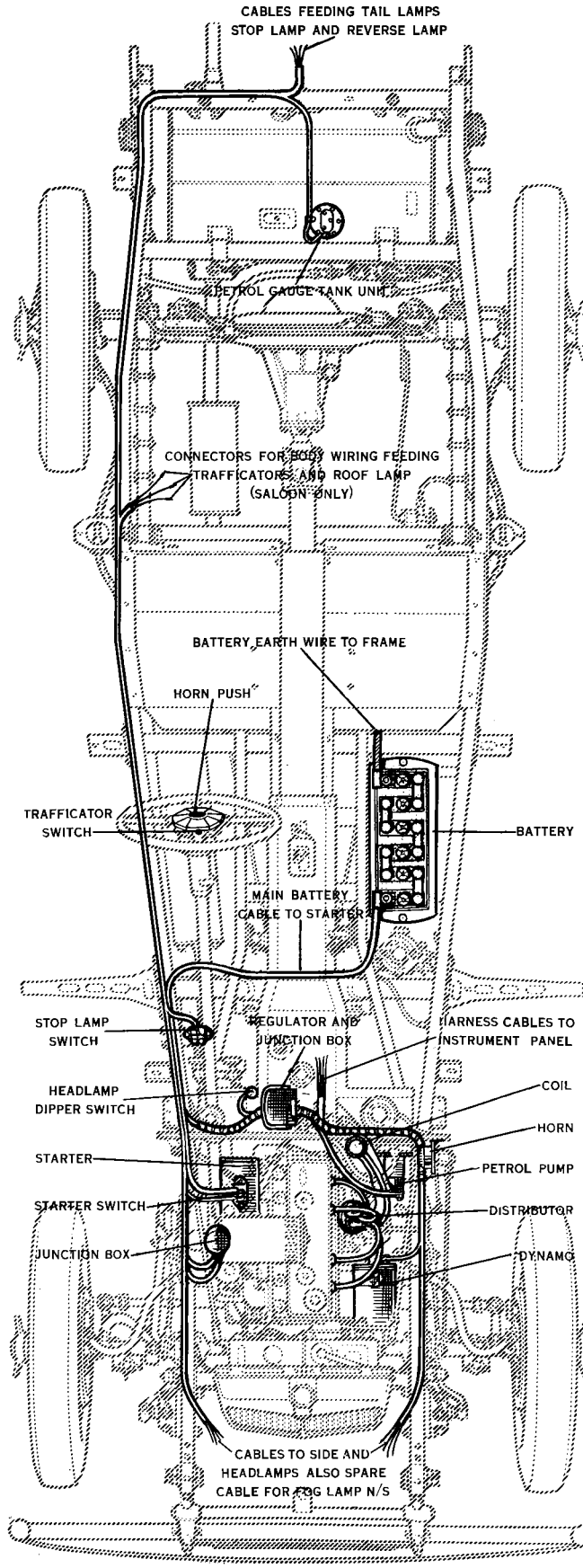


Illustration No. 52.—The wiring installation.

THEORETICAL WIRING DIAGRAM

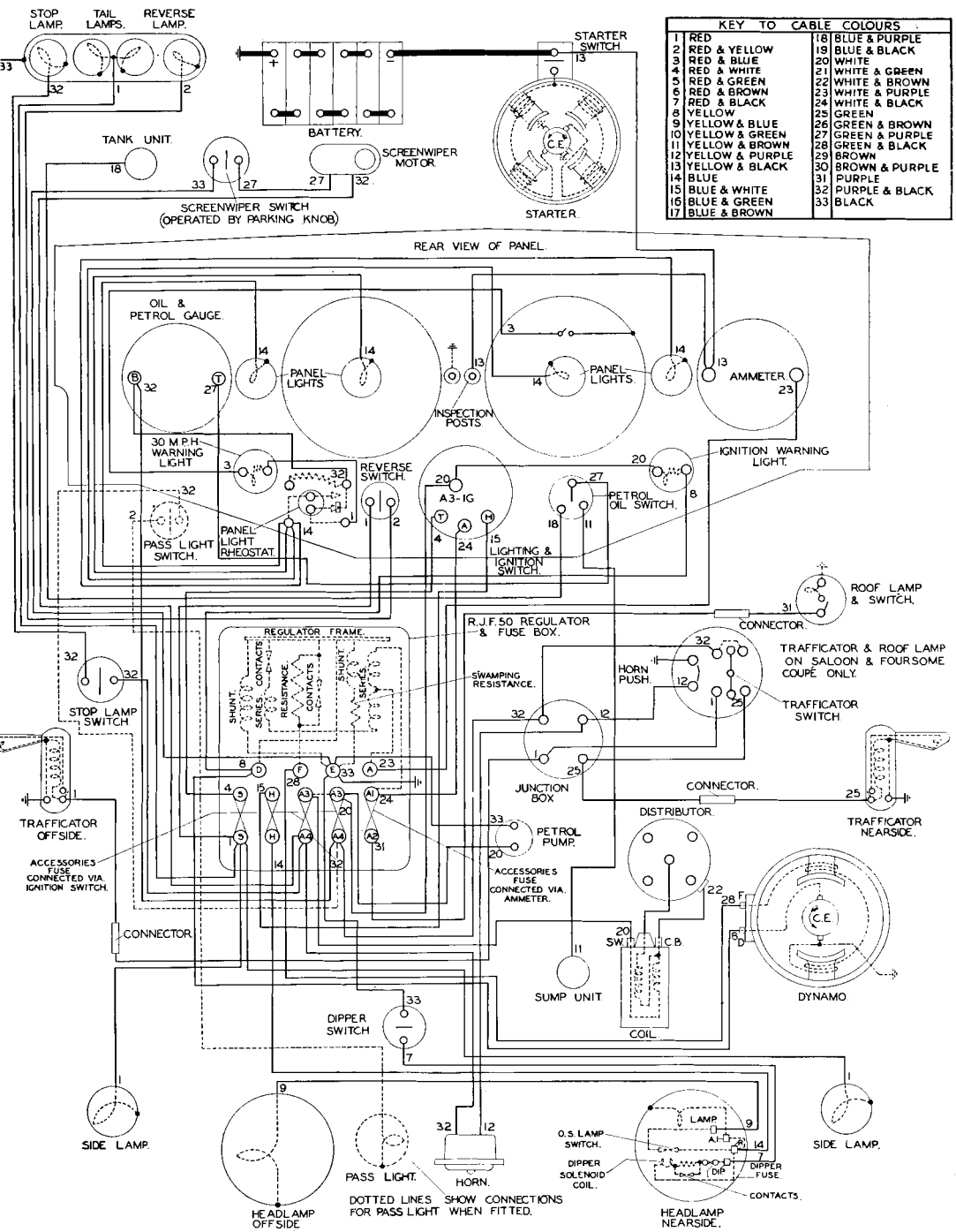


Illustration No. 53.

Wiring System.—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 two tail-lamps.
   The interior lamp (Saloon and Foursome Coupé only).
2. Those which are switched on by the ignition switch and have no fuse protection. They are :—
   The ignition.
   The ignition warning light.
   The petrol pump.
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 horn.
   The two " Trafficators " (Saloon and Foursome Coupé only).
   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. 53 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 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 revolution 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 "A1" 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 " A1," both on the back of the regulator box.

It will be seen therefore that the terminal " A1 " 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 " A1 " passes from " A " along the main current connection described above to charge the battery.

The current at " A1 " (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 " A2 " 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 (Saloon and Foursome Coupé only). 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 passengers' foot well) 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).

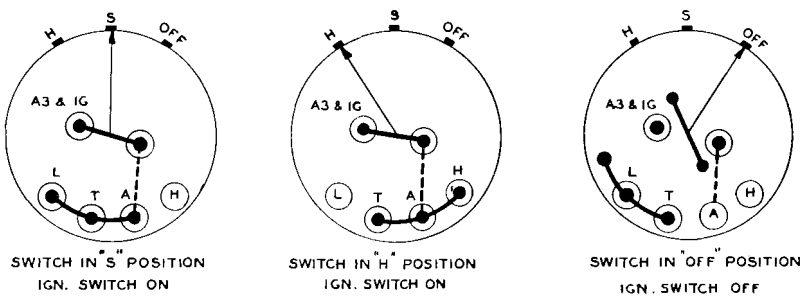


Illustration No. 54.—Internal connections of lamp switch.

The current which arrives at terminal " A " on the back of the switch body (see Illustration No. 54) 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 " (eventually this terminal will be marked " A3–IG "). (See Illustration No. 54.)

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 sidelamp.
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 the wing supports 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.

When the reverse light switch is closed (providing, 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.

When the light switch is turned to "H," 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 one of the terminals "H" on the regulator box, thence through the fuse marked "H" to the other terminal "H" on the regulator box, thence by a blue wire to terminal "A1" inside the near-side lamp body, where it is split into two courses :—

1. Through the near-side headlamp filament to the lamp body and so to the frame (earth).
2. Along the choice of three paths, according to whether the headlamps are (*a*) full on, (*b*) in the act of dipping, (*c*) dipped.
   (*a*) When the dipper switch is open, the current passes through the off-side lamp switch, which is inside the near-side headlamp, to the terminal marked "lamp," where it is picked up by a yellow and blue wire which takes it to the off-side headlamp, where the circuit is completed through the filament to the lamp body, and so to the frame (earth).
   (*b*) When the dipper switch is closed, current (as well as going to the off-side headlamp) also passes through the dipper solenoid, the dipper solenoid contacts, and the dipper fuse to the terminal marked "Dip" (all of which are inside the near-side headlamp body). From this terminal "Dip" the current is taken by a red and black wire to the centre terminal of the dipper switch. Connected to one of the other terminals (it does not matter which) is a black wire, the other end of this wire is connected to the terminal "E" on the back of the regulator box, and so to earth. The flow of current along this path magnetises the solenoid and so dips the near-side headlamp reflector.
   (*c*) As soon as the near-side headlamp reflector is dipped, it breaks the off-side lamp switch (so that no current now goes to the off-side headlamp) and also the dipper solenoid contacts, so that the current which passes through the dipper solenoid now has to pass through the dipper solenoid resistance (also inside the near-side headlamp body) before reaching the dipper fuse, and the terminal "Dip," and so, eventually, to earth by the route described above.

The dipper solenoid resistance is so proportioned that the current which now flows through the dipper solenoid, instead of being enough to pull the lamp reflector down, is now only enough to hold it in its dipped position.

When the dipper switch is again opened the connection between the red and black and the black wires is broken, so that no current can flow through the dipper solenoid, which consequently loses its magnetism, with the result that the reflector springs back to its undipped position and in doing so switches on the off-side headlamp.

On the terminal " IG " (eventually this terminal will be marked " A3–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 " (or " A3—A3 " on diagram) 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 commences 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 " (or " A3—A3 " on diagram) 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 pump.

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 " 12v " of the petrol pump.

The current goes through the pump to the terminal on the iron body, and is then taken by a black wire to the terminal " E " of the regulator box.

The 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.

Before describing the connection made to the " AUX B " fuses, it must be noted that the five wires connected to these fuses leading to the following points :—

Stop lamp,
Windscreen wiper,
Petrol gauge,
" Trafficators " and
Horn

are of the same colour—namely, purple and black—and of these the only one that can be distinguished is the horn wire, which is very much larger. So that while, for convenience of reading the wiring diagram, these wires will be described as being connected to one or the other of the " A4 " terminals, it is necessary only to distribute these wires between the two " A4 " terminals. Incidentally, these five wires are the only purple and black wires connected to the regulator box.

The " AUX B " fuse which is nearest the headlamp fuse protects the horn, stop lamp and windscreen wiper. Current which passes it arrives at the terminal " A4 " nearest the terminal " H " on the back of the regulator box, where it is picked up by three purple and black wires, one of which runs to the horn. From the horn a yellow and purple wire runs to one of the posts in the junction box.

From this post a 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 second 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 and black wire to the stop lamp. This circuit is completed through the lamp bulb to the number-plate casing (earth).

The third purple and black wire on the " A4 " terminal leads direct to the windscreen wiper motor. Current which goes through this motor returns by a green and purple 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 a 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 pump.

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

The petrol and oil gauge.
The 30 m.p.h. warning light.
The four panel lights.
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 two purple and black wires which carry current to the petrol-oil gauge and the junction box.

The purple and black wire which carries current to the petrol-oil gauge is connected to the terminal marked " B " on the 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 light.

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 the 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 lights 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 second purple and black wire (Saloon and Foursome Coupé only) 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 connector 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 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 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 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.

AMENDMENTS AND ALTERATIONS
SECTION J
THE ELECTRICAL AND IGNITION SYSTEMS

The Reverse Lamp Switch.—The reverse lamp switch shown in Illustration No. 1 and also in the theoretical wiring diagram, Illustration No. 53, is now a spare since a separate switch is incorporated in the gearbox, commencing Chassis No. VA1371.

Referring to Illustration No. 53. The cables shown as being connected to the switch in the instrument panel are connected to the switch in the gearbox, and the cable shown dotted, connecting a pass lamp, if required, to an extra switch could therefore utilise this switch, obviating the necessity for an additional switch.

SECTION K

COACHWORK

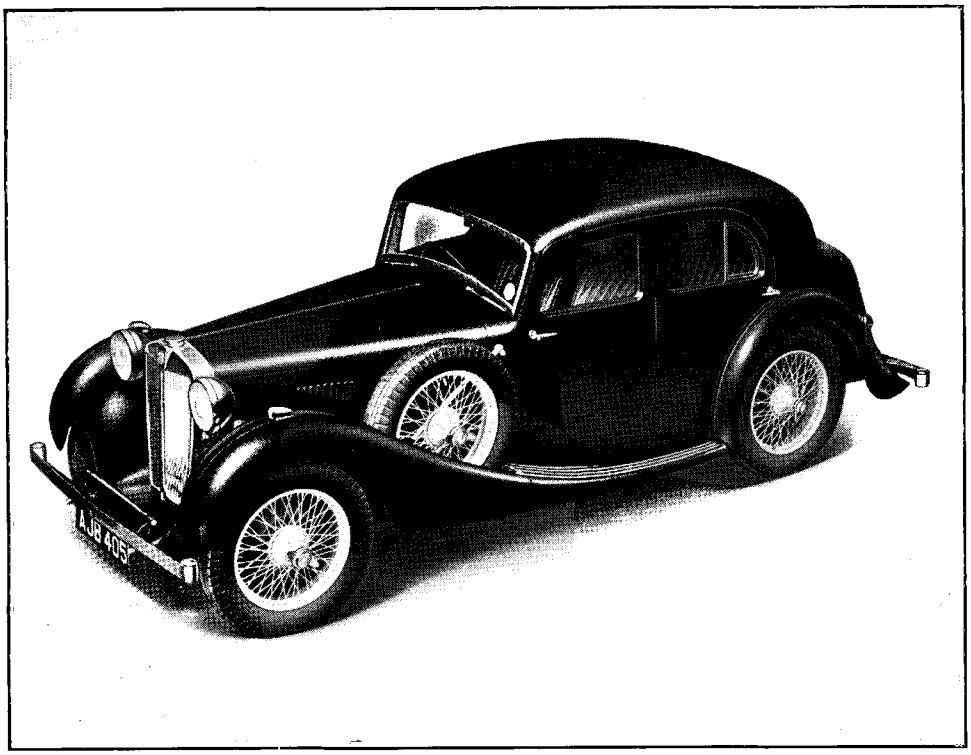


Illustration No. 55.—The M.G. 1½-Litre Four-door Saloon.

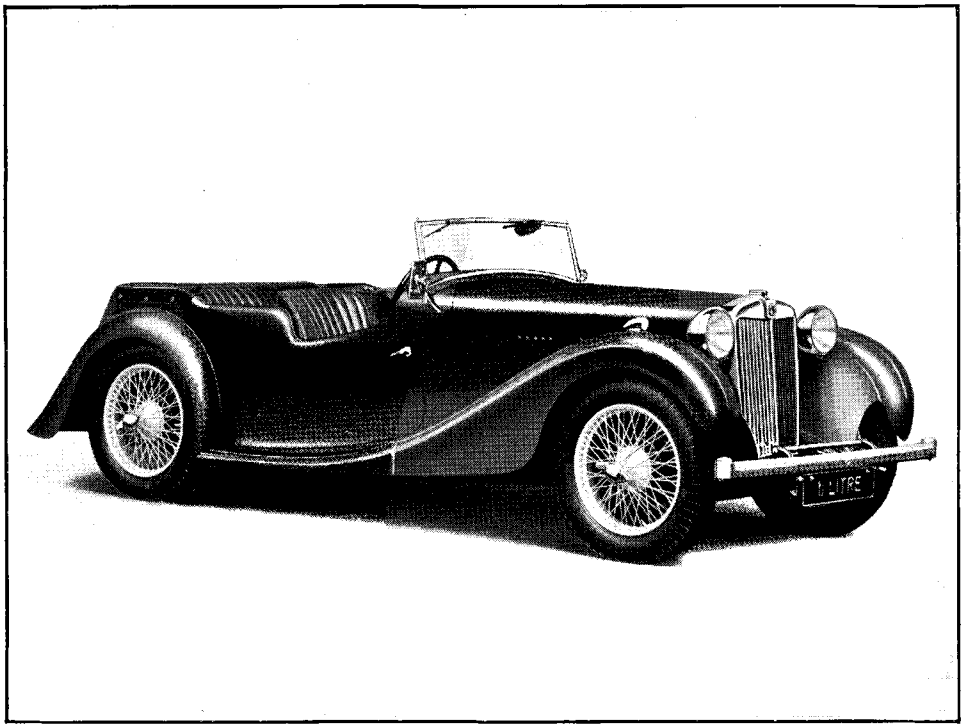


Illustration No. 56.—The M.G. 1½-Litre Open Tourer.

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, and they supply a different brand for use on polychromatic finishes.

It is wise to test the brakes after washing, 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, used very sparingly.

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. A special chromium polish is obtainable if desired.

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 (Saloon).—This is opened by turning the handle in the centre of the screen rail in a clockwise direction. The winder is self locking in any position.

Windscreen (Tourer).—This is designed so that it can be folded flat forward on the scuttle after releasing the wing nuts at either side. See that the wire to the screen wiper is in such a position that it is not strained when the screen is folded.

Seat Adjustment.—The front seats are on slides and can be moved fore and aft. Depress the adjuster and put the seat in the desired position. See that the lever re-engages with the nearest slot in the slide, which locks the seat in place.

The Hood (Tourer).—The $1\frac{1}{2}$-Litre Tourer hood is exceptionally neat, both when raised and stowed away in the back of the body, but it is very important that it is lowered and folded in the correct manner if damage is to be avoided and its neat appearance maintained. Illustrations Nos. 57 to 60 show four stages of hood folding.

Referring to Illustration No. 57, before unfastening the hood from the screen, the snap fastener either side of the hood, shown just in front of the forward hood-stick, must be released. So also must all the " Lift-a-Dot " fasteners around the back of the body to prevent tearing the hood material where it is shaped. The fasteners securing the hood to the screen can then be released and the hood folded back.

Referring to Illustration No. 58, the hood must be pulled away from the hood-sticks, also the rear portion of the hood in which the rear lights are fitted.

Illustration No. 59 shows the folding operation. Note that the corners of the top portion of the hood are folded over (" A "). The bottom is folded in between the top and rear portions of the hood (" B "), and the top of the hood is rolled forward (" C ").

Illustration No. 60 shows the top portion of the hood stowed away, leaving the rear portion to be folded as illustrated.

The hood envelope should finally be fitted on the " Lift-a-Dot " fasteners, also two snap fasteners behind the rear seat cushion.

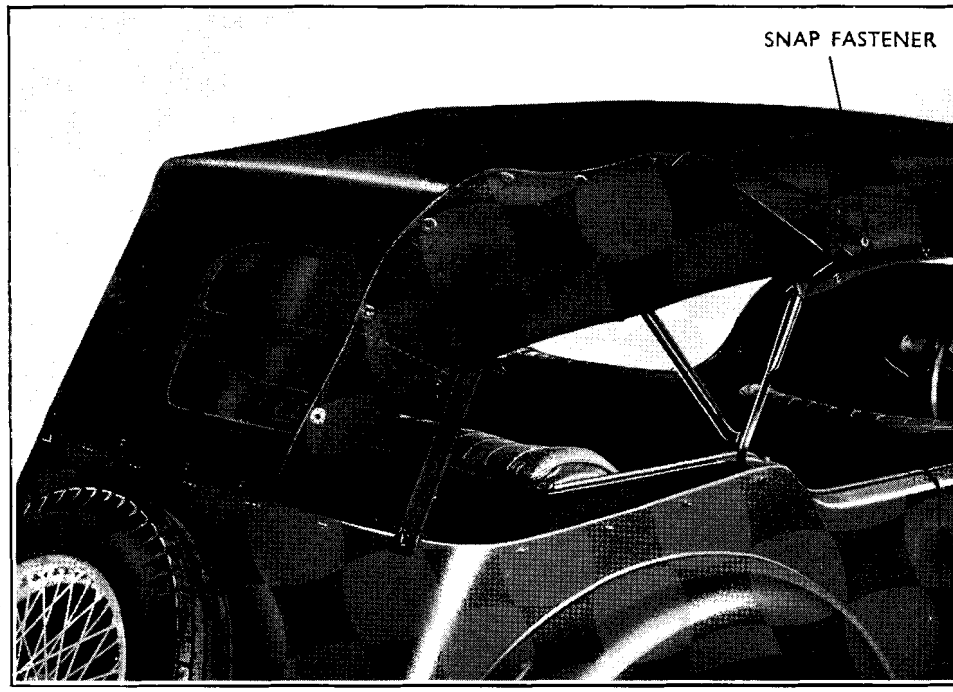


Illustration No. 57.—Before releasing the hood from the screen, release all snap and "Lift-a-Dot" fasteners.

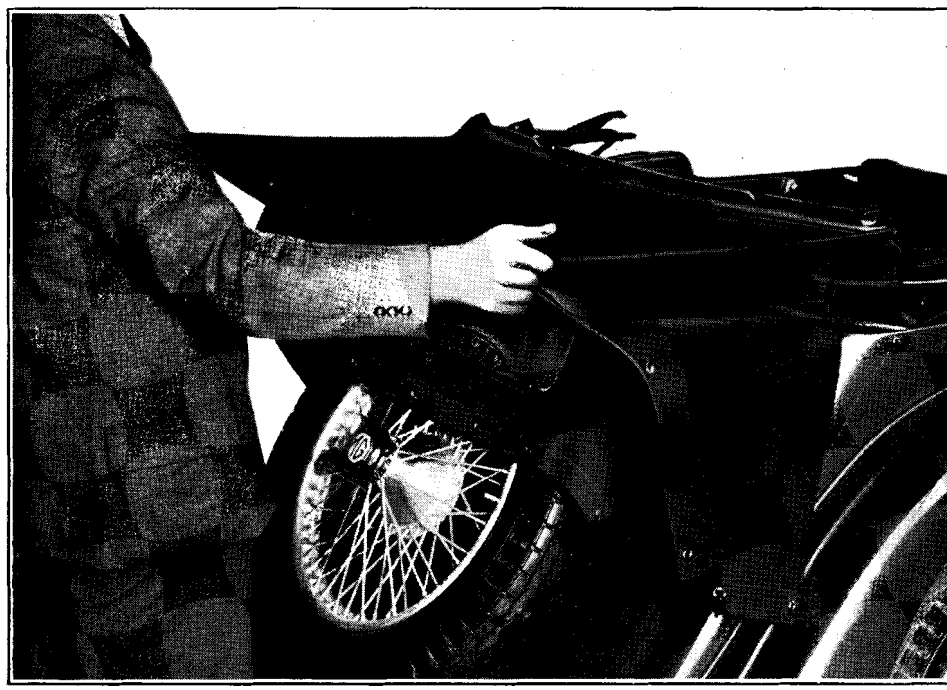


Illustration No. 58.—Pulling the hood clear of the hood-sticks.

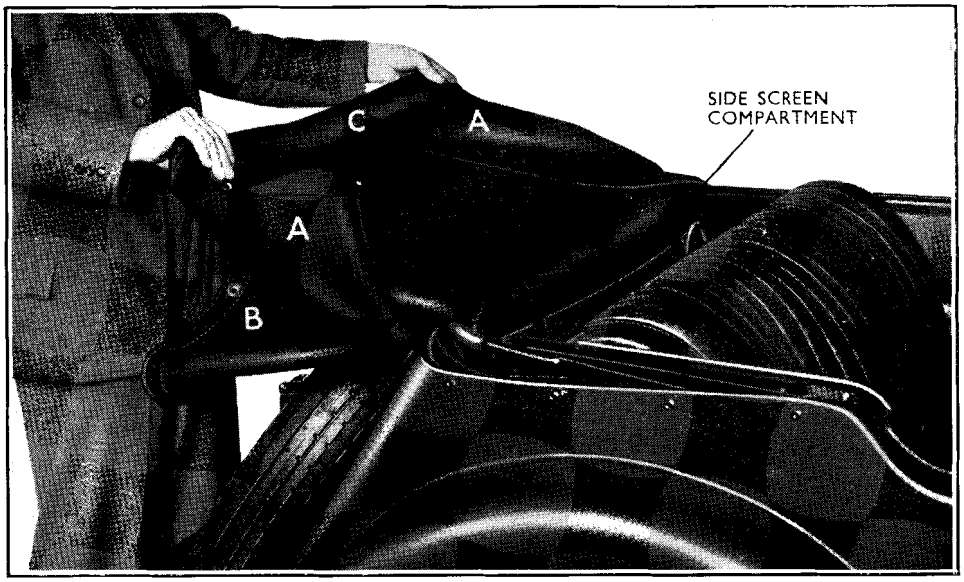


Illustration No. 59.—Folding the top portion of the hood.

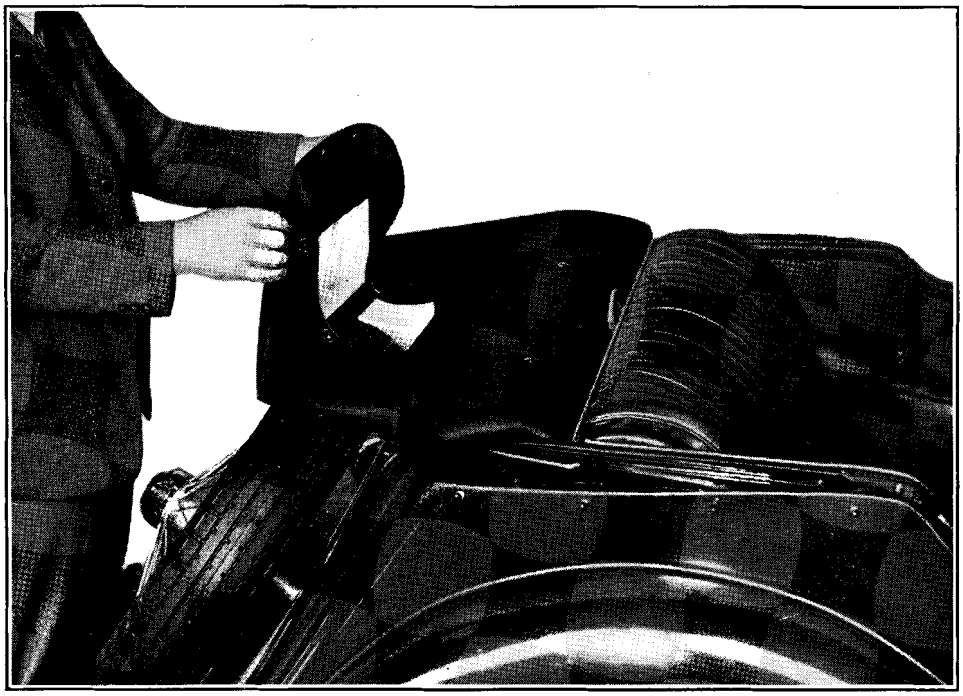


Illustration No. 60.—The top portion folded away neatly, and the rear portion partially folded.

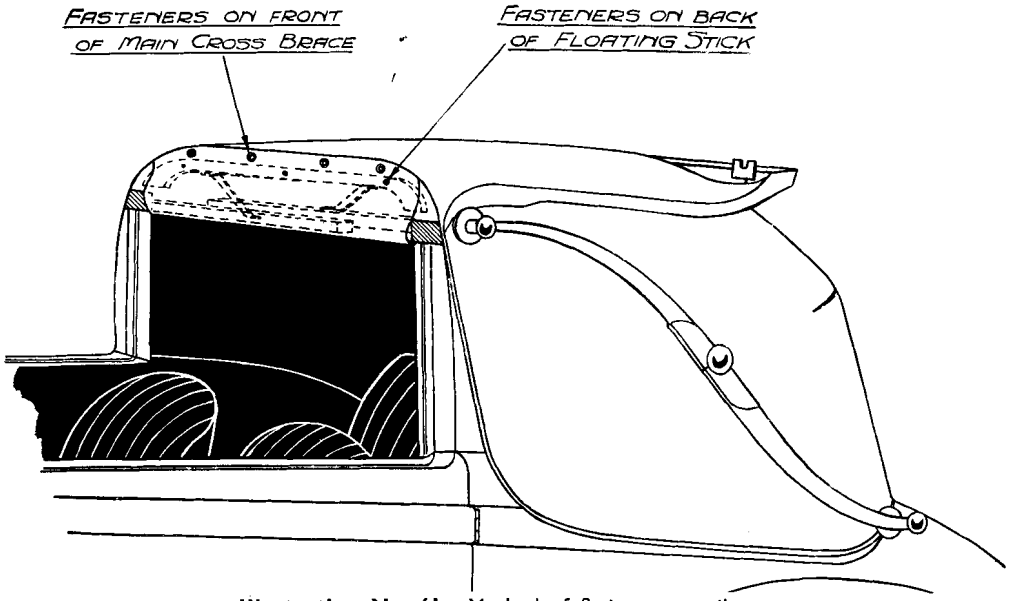


Illustration No. 61.—Method of fitting cant rail cover.

Operating the Tickford Folding Head.—

1. Unlock the cant rails and fold them back. The near-side arc should be pushed back in advance of the off-side.
2. Undo the wing nuts securing the hood to the windscreen supports and lay the " de-ville " extension flat over the back of the hood as illustrated.
3. Fit the cant rail cover, securing it first on the back of the floating stick. Wrap the cover around the cant rails and secure on the fasteners provided on the main cross brace.
4. Roll the " de-ville " portion of the hood (lining inside) and secure to the main cross brace with the two straps provided. The roll should be placed directly in front of the main cross brace.
5. Break the outside joints and push down the hood. It is important that the hood material clears the front ends of the outside joints when lowering.
6. Secure the folded hood with the two straps.

To re-erect the hood, reverse folding operations.

Sidescreens (Tourer).—These are stored away neatly in a compartment in the rear panel of the body behind the rear seat (see Illustration No. 59), but it is necessary to see that the feet of the front curtains do not scratch the celluloid of the other curtains when being either replaced or removed from the compartment.

Sliding Roof (Saloon).—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 Visor (Saloon).—The visor is fitted above the windscreen on the off-side, and can be put in any desired position to prevent direct glare from the sun. Its operation is quite obvious, and it should not require any maintenance except an occasional clean with petrol or benzine.

Rear Blind (Saloon).—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 emphasised, as a number of cases have come to our notice where they have only been loosely secured.

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.

Lubrication.—A number of points need periodic lubrication. They are—the door hinges, which are fitted with oiling nipples to suit the oilgun supplied with the car, the door stop joints, the luggage door hinges, the seat slides and operating mechanism, all door locks, bonnet fasteners, bonnet hinge, and windscreen winder chain, which need a few drops of machine oil.

The sliding roof runners require a slight smear of grease.

The windscreen wiper flexible cable needs dismantling and regreasing occasionally.

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., fix 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 in the scuttle support brackets. It is important that a strip of felt is between the metal scuttle and its brackets on the frame.
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 securing the scuttle 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.

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LUBRICATION RECORD

Delivery date of car .....

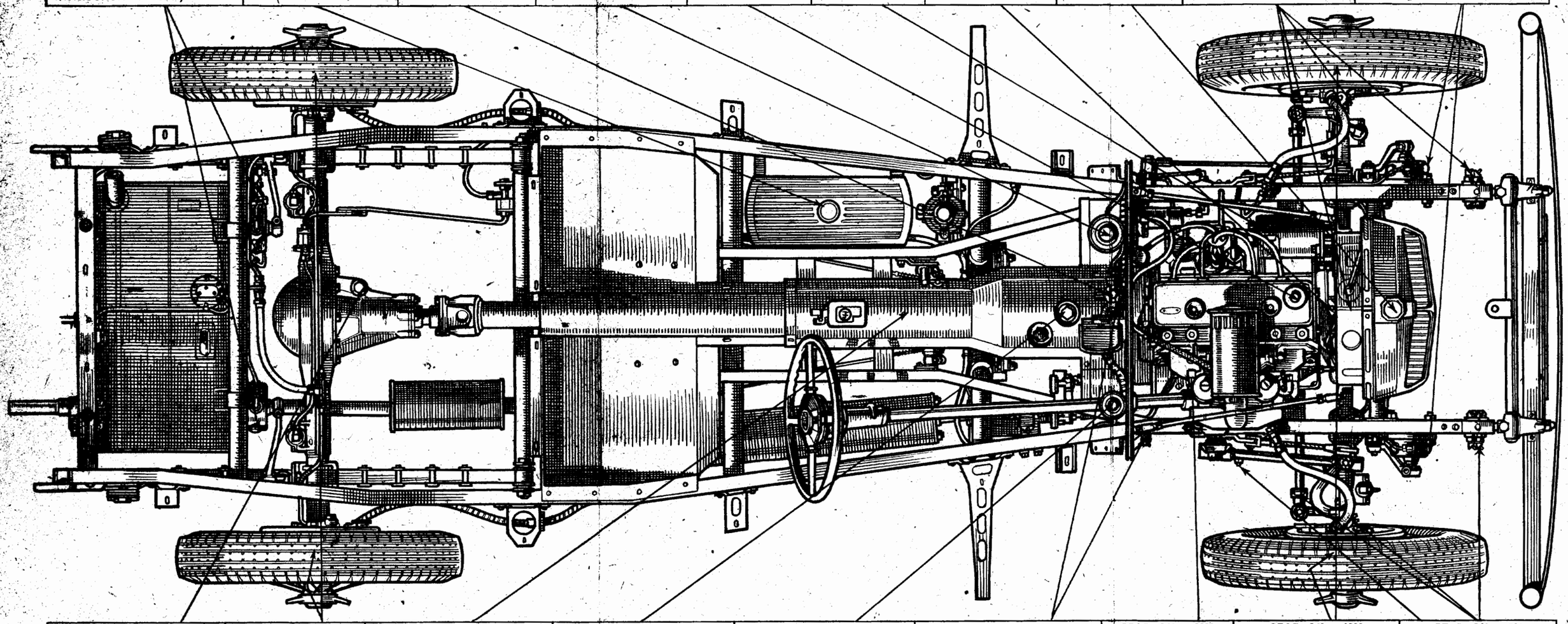
ENGINE (Oil Changed)	MILEAGE	DATE	GEARBOX	MILEAGE	DATE	REAR AXLE	MILEAGE	DATE

LUBRICATION RECORD *(contd.)*

CHASSIS	MILEAGE	DATE	CHASSIS	MILEAGE	DATE	CHASSIS	MILEAGE	DATE

M.G. 1½-LITRE CHASSIS MAINTENANCE CHART

LUVAX SHOCK ABSORBER FLUID. 8000	DISTILLED WATER (EVERY MONTH)	SPECIAL OIL	JACKALL FLUID	ENGINE OIL	VASELINE	ENGINE OIL. 500	SOFT WATER	GEAR OIL. 500	LUVAX SHOCK ABSORBER FLUID. 8000
CHECK EVERY MONTH AND TOP UP TO ¾ FULL. DO NOT FILL ABOVE THIS LEVEL. (SEE MAINTENANCE OF SHOCK ABSORBERS IN INSTRUCTION MANUAL.)	REMOVE VENT PLUGS AND TOP UP CELLS TO A LEVEL ½" ABOVE PLATES.	CHECK EVERY MONTH AND TOP UP TO WITHIN ONE INCH OF THE TOP.	CHECK EVERY MONTH AND TOP UP TO LEVEL MARK ON CONTAINER. THIS MUST BE DONE WITH RELEASE VALVE OPEN.	CHECK DAILY AND KEEP ABOVE ¾ MARK. RENEW EVERY 1500 MILES.	REMOVE CAP OF LUBRICATOR ON DYNAMO AND REFILL YEARLY.	FILL THE SPRING CAP OILER ON WATER PUMP.	CHECK DAILY AND TOP UP. PREFERABLY WITH SOFT WATER.	FRONT SHACKLES 2 TRACK ROD 1 KING PIN 2 FAN BEARING 1	CHECK EVERY MONTH AND TOP UP TO ¾ FULL. DO NOT FILL ABOVE THIS LEVEL. (SEE MAINTENANCE OF SHOCK ABSORBERS IN INSTRUCTION MANUAL.)



EXTREME PRESSURE OIL. 4000	GEAR OIL. 1000	GEAR OIL. 500	SYNCHRO-OIL. 2000	LOCKHEED FLUID	GEAR OIL. 500	GEAR OIL. 2000	GEAR OIL. 1000	GEAR OIL. 500
DRAIN AND REFILL EVERY 4000 MILES TO LEVEL OF FILLER PLUG.	REMOVE WHEELS AND APPLY OILGUN; GIVE TWO OR THREE STROKES ONLY.	TO LUBRICATE PROPELLER SHAFT SPLINES AT FRONT END ROTATE SHAFT UNTIL NIPPLE IS POINTING TO THE GROUND AND APPLY GUN FROM UNDERNEATH.	DRAIN AND REFILL WITH SYNCHRO-OIL TO "FULL" MARK ON DIPSTICK.	CHECK EVERY MONTH AND TOP UP TO LEVEL MARK ON CONTAINER. USE LOCKHEED ORANGE FLUID.	GROUPED NIPPLES, FEEDING BRAKE CABLES, REAR SPRING SHACKLES AND FRONT SPRING PIN.	REMOVE PLUG FROM STEERING BOX AND FILL TO LEVEL OF PLUG.	REMOVE WHEELS AND APPLY OILGUN, GIVE TWO OR THREE STROKES ONLY.	FRONT SHACKLES 2 TRACK ROD 1 KING PIN 2 DRAGLINK 1

NOTE.—In the place of gear oil specified for chassis lubrication on the chart, we now recommend high pressure lubricants, a list of which is given on page eleven.