

## THE ROVER GUARANTEE.

WE give the following guarantee with our Motor Cars instead of the guarantee implied by statute, or otherwise, as the quality or fitness of such machines for the purpose required; and this guarantee is in lieu and in exclusion of any common law or statutory condition, warranty or liability whatsoever. In the case of cars which have been used for "hiring out" purposes, no guarantee of any kind is given or is to be implied. We guarantee, subject to the conditions mentioned below, that all precautions which are usual and reasonable have been taken by us to secure excellence of materials and workmanship, but his guarantee is to extend and be in force for TWELVE MONTHS only from the date of purchase, and damages for which we make ourselves responsible under this guarantee are limited to the **supply** of any part which may have proved defective. In the case of a purchase through a Dealer, the guarantee dates from the day of delivery to the purchaser, providing the car has not been used in the meantime. We undertake, subject to the conditions mentioned below, to make good at any time within TWELVE MONTHS any defects in these respects. As Motor Cars are easily liable to derangement by neglect or misuse, this guarantee does not apply to defects caused by wear and tear, misuse, or neglect.

### CONDITIONS OF GUARANTEE.

If a defective part should be found in our Motor Cars it must be sent to us by passenger train, carriage paid, and accompanied by an intimation from the sender that he desires to have it repaired free of charge under our guarantee, and he must also furnish us at the same time with the number of the Car, the name of the Dealer from whom he purchased, and the date of the purchase. Failing compliance with the above, no notice will be taken of anything which may arrive, but such articles will lie here at the risk of the senders; and this guarantee, and any implied guarantee, shall not be enforceable.

We guarantee only those cars which are bought either direct from us or from one of our duly authorised Dealers, and under no other conditions.

We do not guarantee the specialities of other firms, such as tyres, amps, etc., supplied with our Motor Cars or otherwise.

# INSTRUCTION M A N U A L FOR THE 16 / 50 H. P. ROVER CAR

### —SPECIAL NOTICE—

When communicating with us regarding this car always quote the "Car No." stamped on the plate on the dash, under bonnet.

### THE ROVER COMPANY LTD.,

METEOR WORKS, Rover Road, COVENTRY, England.

Telegrams: "Rover, Coventry." Telephone: 3011 (7 lines)

London Showrooms:

61, NEW BOND STREET, W.1.

Telegrams: "Roverdom Phone"

Telephone: Mayfair, 0157.

London Service Depot:

SEAGRAVE ROAD, FULHAM, S.W.6.

Telegrams: "Roverrepair, Phone"

Telephone: Western 7050.

## IMPORTANT

### To the Owner of this Car.



WE wish the owner of every 16/50 h.p. Rover to have the fullest possible satisfaction from his car, and so that we may keep every owner advised of any information we may issue from time to time, we request that, on taking delivery of this car, the owner will write on the back of a post card:

(a) THE CAR No. (STAMPED ON THE PLATE ON THE DASH, UNDER BONNET).

(b) OWNER'S NAME AND ADDRESS.

No other communication should be put on card, which should be forwarded to:

THE ROVER COMPANY, LTD.,  
SERVICE DEPT., COVENTRY.

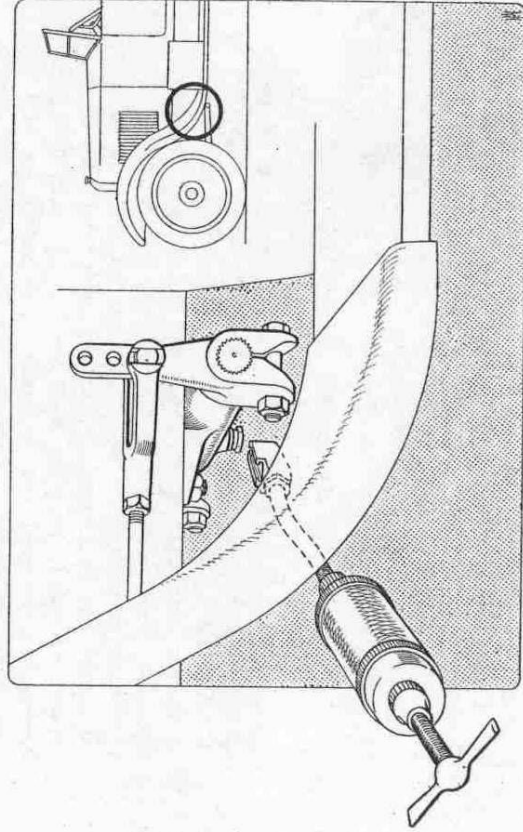
Purchasers of second-hand Cars are also invited to carry out this procedure.

(10) It is essential that the spark gap on each plug should be exactly the same, also that there should be no "whiskers" on the electrodes.

(11) It is important that each tyre should be kept at the same pressure (35 lb. per sq. in. on the back and 30 lb. per sq. in. on the front is recommended). Inequality in the pressures of the front tyres may cause the car to "wander" on the road.

The car is right, and has been thoroughly tested. If you have the slightest trouble, write to us, or our local Agent, and we will tell you what to do or send someone to see you.

THE ROVER COMPANY LIMITED.



## IMPORTANT.

WHEN greasing up the car, it is **VERY IMPORTANT** that the point indicated in the above illustration should not be overlooked. There is a greaser on each side of the car, and both should receive regular attention, otherwise trouble may be experienced with the front brakes binding "on."

## To the Owner of this Car:--

We wish you to have the utmost satisfaction from the car, and therefore desire to bring the following points prominently to your notice:—

- (1) The battery is not on charge unless the switch in on "D."
- (2) Please remember that the explosion in this engine is more rapid than usual, and when pulling slowly on hills the spark must be retarded. Bear in mind that, when fully retarded, the engine is firing at the top of the stroke; in this position the ignition lever is at the top of its quadrant.
- (3) When the fan belt is slack the engine will "thrash." If the belt should break it will "thrash" more, but if the belt be properly adjusted the "thrashing" will cease. You will probably have to adjust the belt after a week's running in the first place; the second time it might be after a month; the third time only after a very long interval. "Thrashing" of the engine is a sign that the fan belt is either too slack or broken, and this "thrashing" is intentionally arranged to call attention to the fact that immediate attention is required by the fan belt.
- (4) Brakes want re-adjusting (near foot pedal) after a week's running the first time; the second time after a month, the next time probably not for a year.
- (5) Packing gland on pump wants tightening up probably after a week, the next time probably after the first month, and then not for about a year. At the same time inspect level of oil in fan casing, and replenish if necessary.
- (6) SPARKING PLUGS.—In case of any trouble in pulling of engine, suspect the sparking plugs first.
- (7) Do not force the engine for the first 500 miles.
- (8) Renew the oil in engine sump after the first 1000 miles, then only after each 5000 miles.
- (9) Tappets ought to be readjusted after the first 1000 miles. There is no difficulty in doing this yourself, but any Rover Dealer, or the Works, will be pleased to do it for you.

## During the FIRST 500 MILES

**DO NOT EXCEED 30 M.P.H.** if you wish to have the best out of the car later on, as aluminium pistons are fitted to the engine, and it is not advisable to give them a possible chance of distortion. Although we test every car on the road over a considerable mileage, it is nevertheless desirable for the owner to co-operate by taking precautions during the early life of the car.

**KEEP LEVEL OF ENGINE OIL HIGH** by replenishing sump, if dip rod gauge shows oil to be below high level mark, after 250 miles.

A half-pint of engine oil may be put in each tank full of petrol, if convenient, with beneficial results to a new engine.

Adjust water pump packing gland at intervals, and after 500 miles drain oil from fan casing and refill with Wakefield's Castrol "D."

## AFTER THE

## FIRST 1000 MILES

**DRAIN OIL FROM SUMP**, clean filters and refill with *fresh oil*.

# ADDRESSES OF MAKERS OF COMPONENT PARTS AND THEIR SERVICE DEPOTS.

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- AUTOVAC.**  
 AUTOVAC MFG. Co., LTD.,  
 HEATON NORRIS, STOCKPORT.
- CARBURETTER.**  
 THE S.U. Co., LTD.,  
 PRINCE OF WALES ROAD,  
 KENTISH TOWN, LONDON.  
 STROMBERG MOTOR DEVICES LTD.,  
 MILMAN'S STREET AND CHEYNE WALK,  
 CHELSEA, N.W. 10.
- LIGHTING AND STARTING SET.**  
 JOSEPH LUCAS, LTD.,  
 GREAT KING STREET, BIRMINGHAM.  
 (See p. 64 for list of Lucas Service Depots.)
- MAGNETO.**  
 B.T.H. Co., LTD., (MAGNETO DEPT.),  
 LOWER FORD STREET, COVENTRY.  
 M.L. MAGNETO SYNDICATE LTD.,  
 WEST ORCHARD, COVENTRY.  
 (Service Depots as shown below).
- SPEEDOMETER AND CLOCK.**  
 S. SMITH & SONS (M.A.), LTD.,  
 CRICKLEWOOD WORKS,  
 LONDON, N.W. 2.
- SMITH'S AND M.L. SERVICE DEPOTS.**  
 MIDLAND ... .. 122, ALMA STREET, BIRMINGHAM. Telephone : Northern 680.  
 NORTHERN ... .. 233, DEANS GATE, MANCHESTER. Telephone : Central 18.  
 SCOTTISH ... .. 19, WEST REGENT STREET, GLASGOW. Telephone : Douglas 1063  
 IRISH ... .. 39, DONEGAL STREET, BELFAST. Telephone : Belfast 4894.





## SECTION IV.

### MEMORANDA FOR THE OWNER'S USE.

Car No. .... Reg. No. ....

Date first used. ....

	Summ & Gearbox cleaned out.	Back Axle lubrication checked.	Hubs Greased.	Engine decarbonised
Date				
Mileage				
Date				
Mileage				
Date				
Mileage				
Date				
Mileage				
Date				
Mileage				
Date				
Mileage				
Date				
Mileage				
Date				
Mileage				

## INTRODUCTION.



**I**N the design of the 16/50 h.p. Rover Car every effort has been made to simplify as far as ever possible the amount of attention which the owner must devote to the upkeep of the car: we realise however, that many a purchaser will desire to have the fullest possible information regarding the mechanical parts of his car, and it is for that reason that we include so much matter in the present manual, even though the average owner-driver will probably never have need of one quarter of the information it contains.

Therefore, in order to present the information in as acceptable a manner as possible, we have divided the manual into sections, so that the owner who is content to be familiar only with those parts of the car which are visible from the exterior will probably probe no deeper into this booklet than Sections I. and II., in which he will find all the instructions necessary to the running of the car.

On the other hand, since specialised information is necessary when adjustments, decarbonization, &c., are called for, we are including sections dealing with the maintenance of the car which we trust will prove helpful in the right quarters.

We are always only too pleased to be of assistance to users of our cars, and to supply them with any information that may be desirable in order that their cars may render the maximum of efficient service.

We feel we should add that, in the instructions contained in the booklet, we have assumed that the reader is acquainted with a certain amount of *general* knowledge regarding the operation of Motor Cars: if not, we advise that one of the handbooks issued by the publishers of the leading motoring papers should be studied.

THE ROVER COMPANY LIMITED.

## SECTION I.

### A GENERAL DESCRIPTION OF THE 16/50 H.P. ROVER CAR.



**ENGINE** has four cylinders, cast en bloc, bore 80 mm. (3.172 in.), stroke 120 mm. (4.724 in.) giving a total cubic capacity of 2413 cc. (147 cu. ins.) The firing of the cylinders is 1-3-4-2. Treasury rating is 15.9 h.p. British Tax £16 p.a., actual power developed 50 b.h.p. at 2,500 r.p.m.

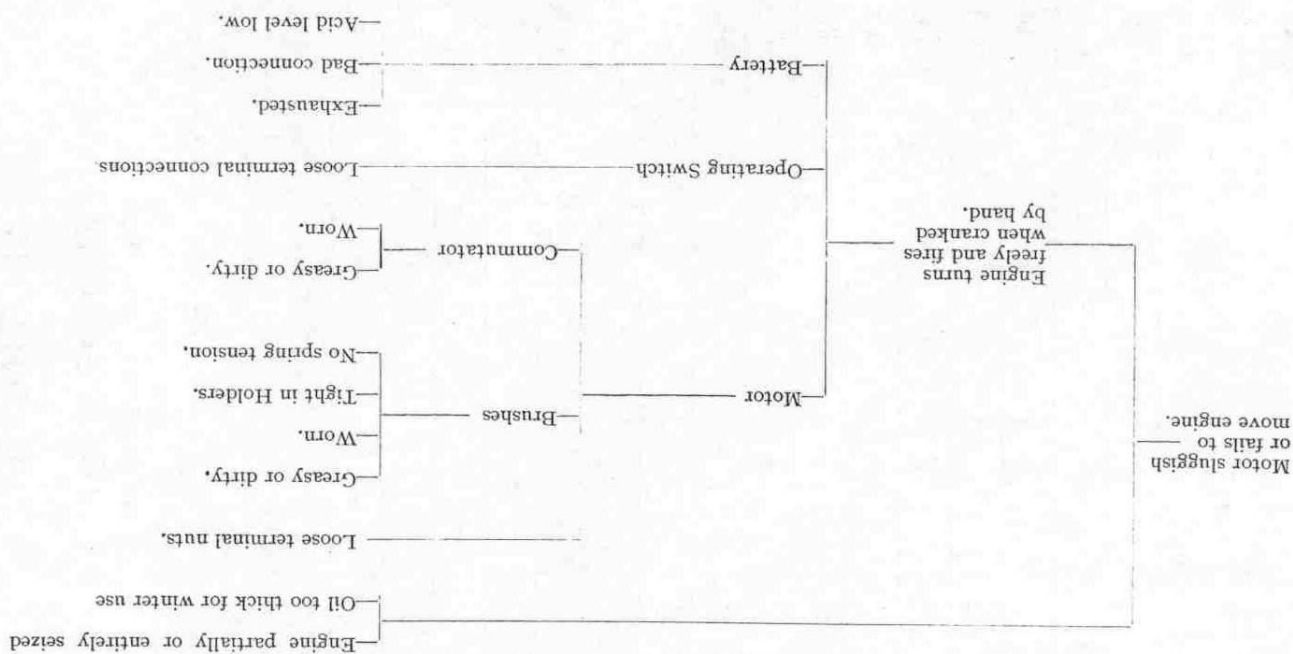
**COMBUSTION CHAMBERS** are hemispherical, machined all over, sparking plugs being located dead central and valves inclined at 45 deg. Due to this scientifically correct lay-out maximum engine efficiency is obtained.

**VALVES** are of the overhead type, and are operated by a camshaft worm-driven from the rear end of the crankshaft. The inlet valves are operated direct from the camshaft, through rockers, the exhaust valves being actuated by horizontal push rods passing across the cylinder head.

Temperature variation of engine causes no more than 1½ thousandths inch difference in valve clearance. Rise in engine temperature *increases* valve clearance.

**LUBRICATION** of engine-clutch-gearbox-steering gear unit is effected automatically from one source of supply, namely, the engine sump. The unit holds 3 gallons of oil, which is forced by means of a gear type pump to every bearing in the engine, including valve gear. A constant level of oil is maintained by the same means in the gearbox (*no grease must, therefore, on any account be put into the gearbox or the consequences would be serious*). NOTE.—The engine sump holds 2 galls. oil, and the gearbox approximately one gallon.

### STARTING MOTOR FAULT FINDING TABLE.



# DYNAMO FAULT FINDING TABLE.

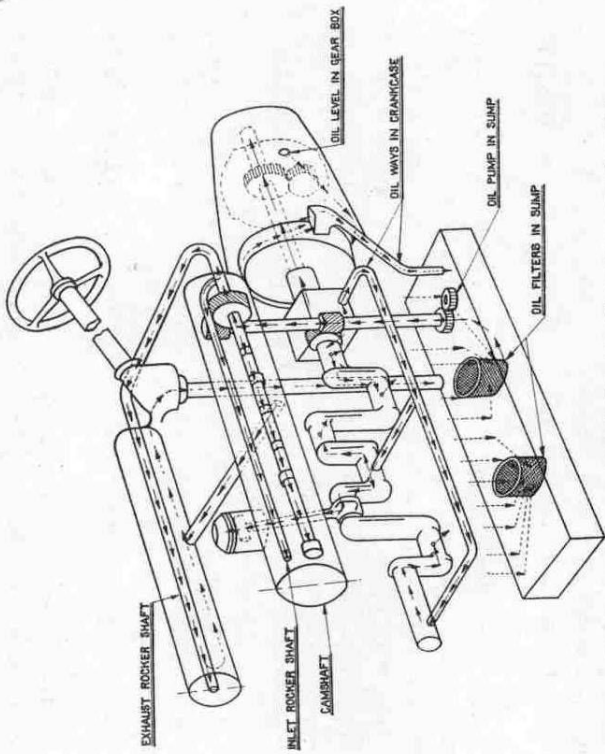
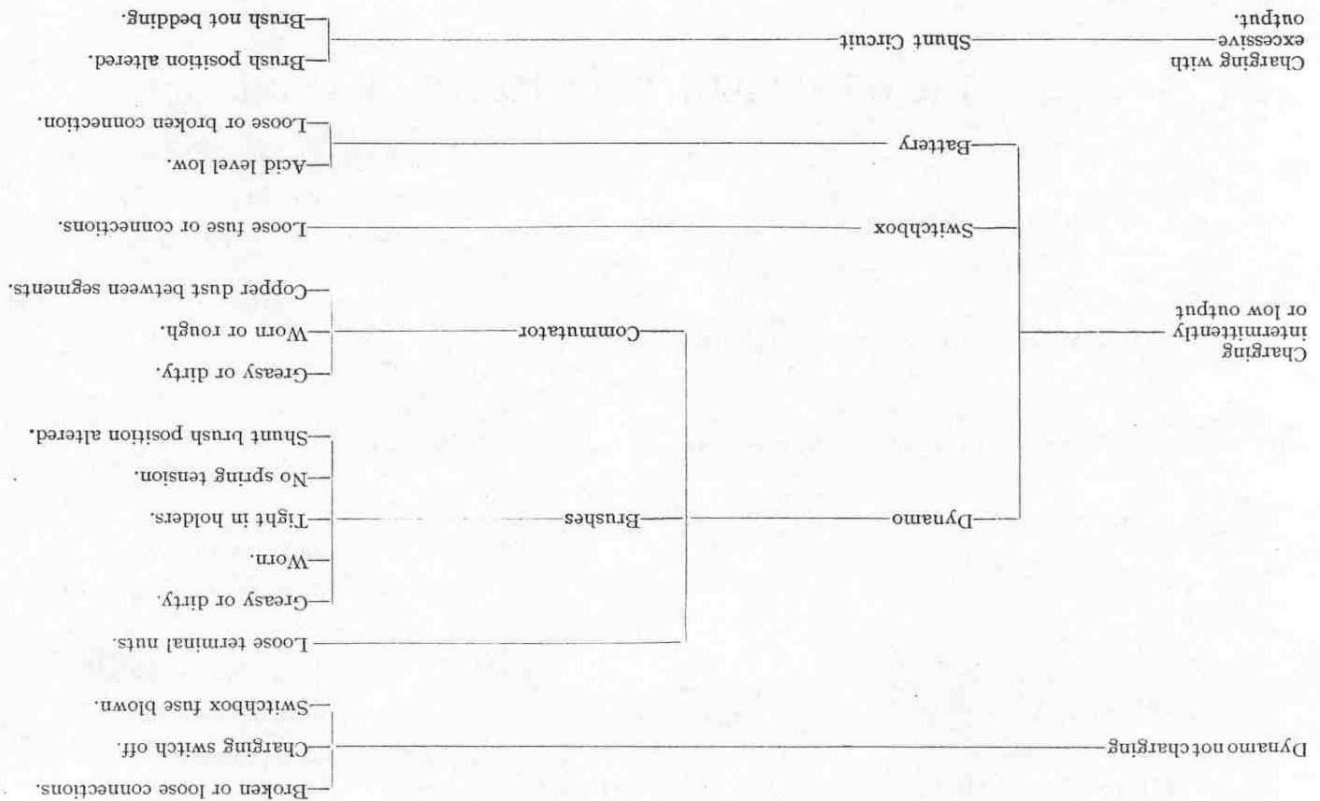


Diagram showing circulation of oil from sump through engine, clutch, gearbox and steering gear.

**SPECIAL NOTE.**—The oil capacity of the engine sump alone is 2 gallons, the additional gallon being contained in the gearbox.

**ENGINE COOLING** is by impeller driven from fan. Cool water from honeycomb radiator is impelled through cylinder head, cylinder barrels being served by thermosiphon circulation. Fan is driven by belt from front end of crankshaft: fan pulley is adjustable so that belt stretch can be taken up. Fan is mounted in such a way that none of weight of fan is thrown on pump spindle. Fan bearing is lubricated by a supply of oil put into fan casing.

**THERMOSTAT.** In order to obviate lengthy "warming-up" on cold days, a thermostat is fitted in water-circulation system. This impedes flow of water through cooling system until a pre-arranged temperature—about 70° C.—is attained, when thermostat goes out of action and water circulates in the ordinary way. Thermostat is located in outlet water pipe of engine just above cylinder head.

**IGNITION** is by high tension magneto, mounted at upper end of vertical shaft which drives camshaft. No part of weight of magneto is taken by this driving shaft. Contact



breaker of magnet is uppermost, and immediately below upper near-side of bonnet. The magneto runs in a clockwise direction.

**FUEL SYSTEM.** Ten gallons of petrol can be carried in the fuel tank. Petrol is drawn from tank by Autovac, which is mounted on near-side of the dash, below bonnet. Autovac delivers to carburetter by gravity feed.

**ELECTRICAL SYSTEM.** Self-starter and lamps are supplied from a 12-volt accumulator carried on nearside running-board. Accumulator is kept charged by dynamo, which is driven by adjustable silent chain from transmission, being mounted on near-side of the clutch-gearbox casing. Starter motor is rigidly held in flywheel casing, and operates on fly-wheel by means of Bendix gearing.

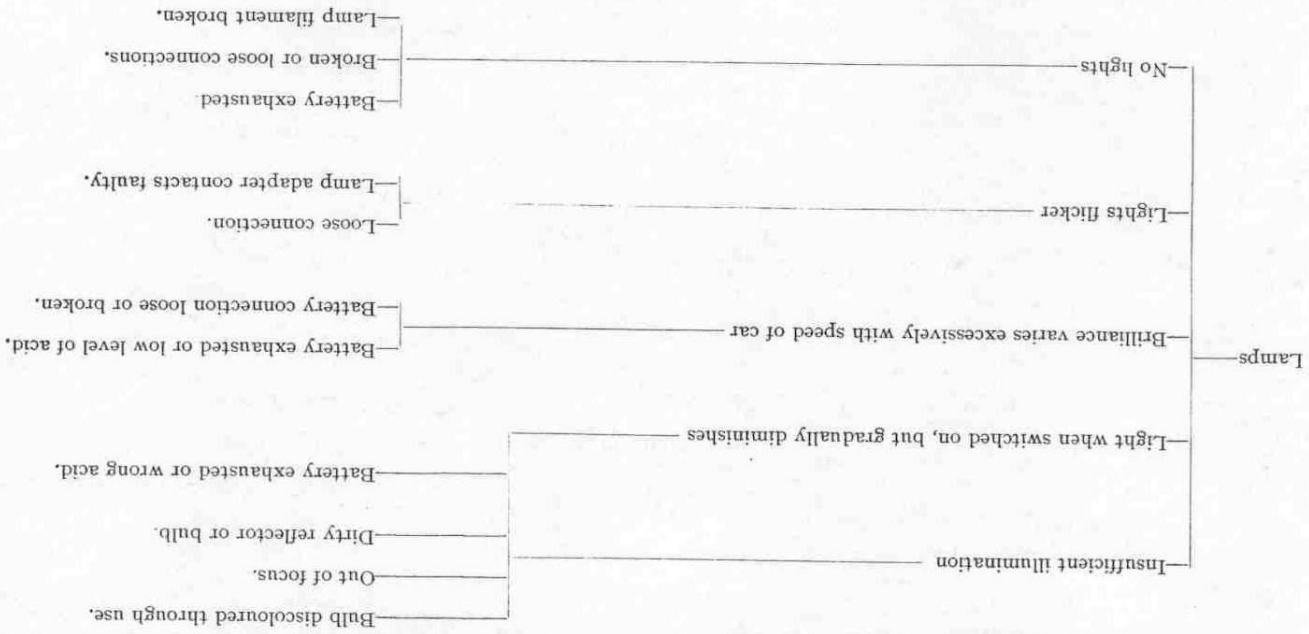
**CLUTCH** is of the single plate type, and runs in oil automatically supplied from the engine. Spiral springs furnish the necessary spring pressure, all clutch thrust being taken by a special engine bearing at rear end of crank shaft, which is under 70-lb. oil pressure. Clutch adjustment can be effected via a removable cover plate below driving seat floorboard.

**GEARBOX.** provides four forward speeds and reverse, and is of sliding pinion type. On top gear drive is direct. Gearbox end plates are of malleable iron, which is not subject to distortion. If necessary, the entire gear assembly, with exception of constant mesh pinions, can be withdrawn from gearbox without disturbing either the unit in which they are contained or the back axle.

**TRANSMISSION** from gearbox to back axle is by propeller shaft enclosed in drawn steel torque tube, the latter having a bronze bearing about midway. This prevents "whip" of the propeller shaft at speed, and renders the transmission remarkably noiseless. The centre bearing is lubricated from the back axle, which is of spiral bevel type.

**SUSPENSION** is by semi-elliptic springing front and rear. Road springs are arranged to give a very big deflection—approximately 5in. This big range of deflection

## LIGHTS FAULT FINDING TABLE.





**REPLACEMENT OF BULBS.** All our lamps are designed to take bulbs of the small bayonet cap type only. When the replacement of any bulb is necessary we strongly recommend that Lucas bulbs are used, as the filaments are arranged to be in focus, and to give the best results with Lucas reflectors.

The particulars of bulbs fitted in the lamps are as follows:—

<b>Lucas 12 volt (double contact) bulbs.</b>			
	BULB.	B.A.S. No.	APPROX. CANDLE POWER.
Head Lamp	Gas filled	3	24
Side, Tail and Dash Lamps	Vacuum	10	50
		6	6

**IMPORTANT.** Do not dismantle the apparatus needlessly. In the event of any difficulty Messrs. Lucas will only be too pleased to give every assistance possible. In communicating, or ordering spare parts, always give type and number of the machine in question, and date of the car on which it is fitted. Also do not forget that for your benefit there are Lucas Service Depots in the following towns:—

<b>BIRMINGHAM</b>	Gt. Hampton Street. Telephone : Northern 2201.
<b>BRISTOL.</b>	25, Temple Street. Telephone : Bristol 6661.
<b>COVENTRY.</b>	Priory House, Priory Street. Telephone : Coventry 3068.
<b>GLASGOW.</b>	229, St. George's Road. Telephone : Douglas 3075-6.
<b>LONDON.</b>	Scrubbs Lane, Willesden, N.W. 10. Telephone : Willesden 4881. And 155, Merton Rd., Wandsworth, S.W. 18. Telephone : Putney 235.
<b>MANCHESTER.</b>	Chester Road, Gorse Hill, Stretford. Telephone : Trafford Park 1117.
<b>NEWCASTLE.</b>	68 St. Mary's Place. Telephone : City 306.

necessitates considerable clearance between wheels and mudwings. Second leaf of each spring is carried round the eye of the top leaf, as a safeguard against breakage. Springs are encased in leather gaiters packed with grease.

**STEERING GEAR** is of the worm and sector type, and adjustment is provided to take up wear in every direction. As already mentioned, steering gear is automatically lubricated from engine, the oil returning to the sump from the overhead valve gear passing through it. The ball joints on steering connections are mud and grit proof without need for leather covers.

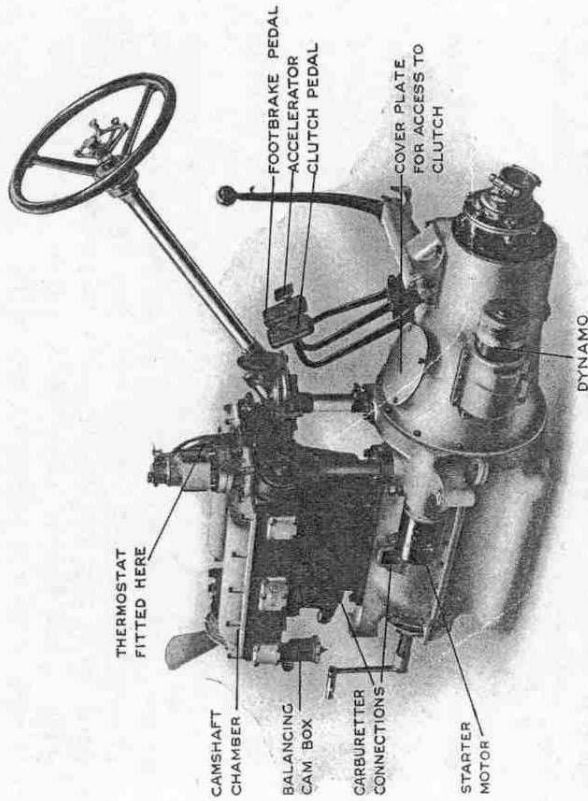
**BRAKES** on all four wheels are of the internal-expanding type, the front being Perrot type. Drums are of unusually large size (13.8 in. diameter); and brake shoes are lined with friction fabric. Both hand and foot controls apply brakes through a special compensating device.

**WHEELS** are of the pressed steel artillery type. They are easily detachable by removing six nuts and withdrawing the plated hub cap. A special brace is provided for unscrewing the wheel nuts. Front axle is furnished with suitable pads for jacking up either wheel. Spare wheel is carried at rear of the car, and space is allowed for a second spare wheel, which can be obtained as an extra.

**TOOL EQUIPMENT** is carried in a box on off-side running board. Jack and tyre inflator are included in equipment.

**SIDE CURTAINS** are carried behind back squab of rear seats on 5-seater open car, and in a special partition in the front of boot on 2-3 seater model.

## SECTION II. THE CONTROLS OF THE CAR.

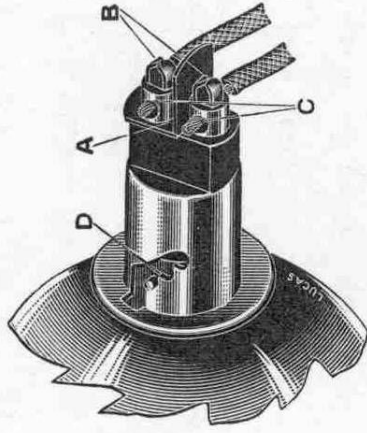


Near-side of engine—clutch—gearbox unit showing location of various points referred to in the letterpress.

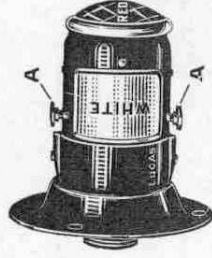
Of the three pedals, that on the left operates the clutch; the centre one the four-wheel braking system, while the outside pedal on the right is the accelerator.

On the steering wheel are two levers; the lower retards or advances the ignition (advanced down), and the upper lever is for hand setting of the throttle (opens down).

The mixture delivered by the carburetter is enriched by turning the knob on the left of the dash in a clockwise direction. For normal running the knob should be as far in the opposite direction as possible.



A—insulator piece.  
B—contact pieces.  
C—terminal holes.  
D—focussing notches.



Tail lamp. Type TF201.

**SIDE LAMP—R.445.** The construction of this lamp is similar to the head lamp. The methods of focussing, and removing the lamp front and reflector are exactly the same. The lamp is fitted with universally adjustable mounting which enables the beam to be sent to the best advantage on the road.

**TAIL LAMP—TF.201.** This lamp is fixed on the rear number-plate by means of a flange. The front portion of the lamp can be removed for bulb replacement by fully depressing the two spring studs and gently pulling out the front of the lamp.

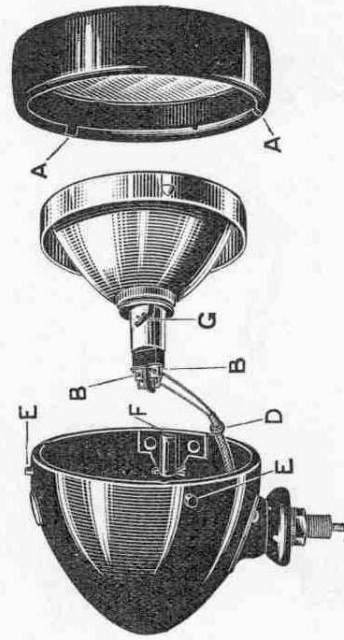
**DASH LAMP—D.21.** This lamp is fixed to the dashboard by means of a flange. The knurled head of the cover operates as a switch, and the cover has three positions giving alternative light apertures.



It is only necessary to remove the reflector for the purpose of connecting or disconnecting the cables from the terminals. Press evenly on its edge and turn to the left as far as possible, when it can be withdrawn from the case. To refit the reflector place it so that all the studs engage together in their respective slots, then turn to the right as far as possible, the word "TOP" marked on the reflector being finally at the top of the lamp. When replacing the lamp front be sure that it is turned to the right as far as possible; it is then locked in position.

**FOCUSsing HEAD LAMPS.** Never attempt to alter the focus of the head lamps except after dark on a straight level road. Try the bulb in each of the three notches to obtain the best road illumination. The headlamps are intentionally dipped down slightly in order to obviate as far as possible dazzle to oncoming traffic. With correct focussing, however, they provide ample driving light.

**WIRING HEAD LAMP.** See that the spring terminals on (straight part is the back). Depress spring "A" as far as possible, thread bared end of the cable through the hole in the lip "B" and the wire will be securely held and good contact made. Cables should not be pushed too far through as there is a danger of shorting on to the body of the lamp.



Side lamp—Type R440.

- A—slots in rim which engage with studs E.
- B—spring terminals.
- D—knot in cable to take strain from terminals
- F—cylindrical sockets holding locking springs
- G—focussing notches.

The electric horn is worked by the press button on the centre of the steering wheel.

The lighting set is controlled by the switchboard bearing the dial marked "amperes." This ammeter indicates (a) the net amount of current which is passing into the accumulator when the engine is running, or (b) the discharge rate when the lamps are burning with engine stationary.

The ignition is controlled by the left-hand lever on the lighting switchboard. The lever has three positions, marked "off," "M" and "D." When moved to "M" the magneto is switched "on," and when moved farther over to "D" both magneto and dynamo are "on."

The oil pressure gauge indicates that the lubrication system is functioning. It should normally show up to 60 lbs. when engine is running. If the pressure drops seriously, or no pressure at all is indicated, an immediate stop must be made to discover the reason: this may be shortage of oil in the sump. The car must not be driven, even a few miles, with the oiling system out of action.

The self-starter is brought into action by pressing the knob on the right-hand side of the dash.

## TO START THE CAR.

**TO START ENGINE:** 1.—If the engine is dead cold, make use of the mixture enriching control on dash (see p. 38). 2.—See that the gear lever is in neutral (*i.e.* able to move sideways). 3.—Switch on the ignition. 4.—Push the starter knob, and when the engine is being rotated depress the accelerator pedal slightly.

The engine should start up within a few seconds, however cold. If it does not, do not exhaust the accumulators needlessly by keeping the starter at work. First make sure the various control levers are set properly, and if the engine still refuses to start, trace the cause.

Once the engine has started do not keep the rich mixture control at "rich" position longer than sufficient to get the engine well under way.

*When starting up with engine warm*, rich mixture will not be necessary; it may, in fact, cause the engine to refuse to start.

Assure yourself before starting up that there is plenty of water in the radiator. It should be practically up to the neck of the filler.

When the engine has warmed up, set the throttle lever on the steering wheel to the position which allows the engine just to "tick over."

**To set the car in motion with engine running**, depress clutch pedal as far as possible, slip the gear-lever into 1st speed (towards the driver and forward), release hand brake, speed up engine slightly, and let clutch in gently.

**CHANGING GEAR "UP."** To change "up," let the engine speed up, but not race, depress clutch, let accelerator pedal up so as to slow engine, and pull gear lever into second speed position (straight back from 1st gear position), letting in the clutch when the gear is "home," and depressing the accelerator again. Follow the same procedure through third speed into top. (Third speed is through the gate and forward: top speed is then straight back.)

**CHANGING "DOWN."** It is advisable to "double de-clutch" when changing "down." The principle underlying this operation is to bring the speed of the gear wheels about to be engaged to as near the same speed as possible, so that they will slip into mesh easily and quietly. This necessitates speeding up the engine after the one gear has been disengaged, and before attempting to engage the lower gear.

To carry "double de-clutching" into practice, push out the clutch and change the gear lever from the high gear position into *neutral*, then let in the clutch again, and speed up the engine. Next depress the clutch pedal for the second time, and slip the gear lever into the next lower gear position than that from

above. Tighten this screw and cut off the surplus fuse wire, replacing it in carton.

**NOTE** :—Should it be found that the fuse is continually blowing, do not add two or three more strands to prevent this occurring, but have the equipment overhauled to find out the reason.

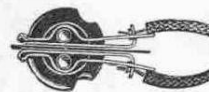
## LAMPS.

**Focussing Bulbs.**—There are three alternative positions in the bulb holder. Try the bulb in each position to obtain the best result.

**Care of Reflector.**—**Do not touch unless tarnished**, then clean carefully with a fine chamois leather and rouge wet with petrol. Do not use metal polish, or the reflector will be scratched and damaged.

**Care of Outer Body.**—If the ebony black becomes dull in service, the original finish can be restored, no matter how neglected, by a good furniture or car polish.

**HEAD LAMPS—R.55.** These lamps are secured to special brackets fitted on the sides of the radiator. The front and reflector are locked in bayonet slots by an arrangement of locking springs. To remove, hold the sides of the lamp with the fingers, press the front rim evenly with the thumbs and palms of the hands, then rotate to the left (looking at the front of the lamp) as far as possible, when the front may be withdrawn.



Spring terminals end view.



Spring terminals assembled.

The question is sometimes asked whether the operation of the cut-out in any way depends upon the state of the battery. There is no such relation between the two, the sole function of the cut-out is to switch on the dynamo with rising engine speed and to disconnect it when the engine slows down to below a certain speed.

**AMMETER.** A centre-zero instrument is provided so that the driver can see at a glance whether the dynamo is giving sufficient output to keep the battery charged in accordance with the load. In other words, this type of meter shows the actual current flowing into or from the battery; thus if the lamps are switched on and take 6 amps, and the dynamo is generating 8 amps, the meter shows 2 amps. in the charge direction, this being the current in excess of the lamp load which is available for charging purposes.

**FUSE.** A fuse is located in the switchbox in order to prevent possibility of damage to the equipment. Occasionally examine the switchbox by removing the two switch levers and detaching the cover in order to ascertain that the fuse is held tightly in position on its holder. A fuse loose in its holder will cause intermittent or no output from the generator.

If it becomes necessary to replace a fuse wire, proceed as follows: remove the fuse-holder from the switchbox, loosen the two screws "G" (see p. 58) and remove any remaining pieces of old fuse wire. Take the length of fuse wire from the carton "A" and wrap the end once round one of the screws "G," taking care that the wire does not cross underneath the washer. Tighten this screw, then stretch the wire lightly across the holder, and wind it round the second screw taking the same precaution as

which it has just been withdrawn. The amount of speeding up of the engine necessary in between the change can only be learnt by experience. Naturally, it depends largely upon the road speed of the car when the change down is made: the higher the pace the more the engine must be speeded up.

Always change "down" when the engine appears to be labouring, as not only is unfair strain thrown upon the engine bearings, etc., as well as the transmission, but a higher speed will be attainable on the next lower gear ratio.

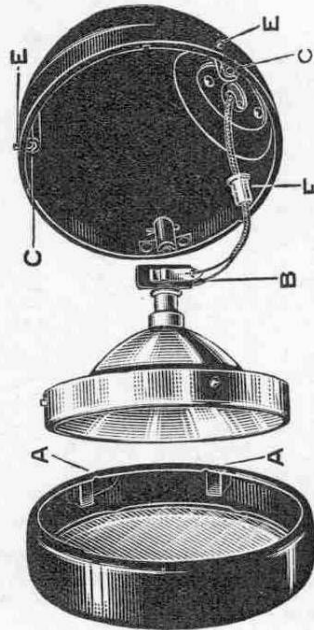
It is difficult to state exact road speeds at which a change "down" is required, since the car will run perfectly smoothly on a level road on top gear at a very low speed. It is when climbing a hill that the road speed should not be allowed to slow down too much before changing gear.

**IMPORTANT DRIVING HINT.** While it is advisable to keep the ignition as far advanced as possible for ordinary running, *i.e.*, at normal speeds on more or less level roads with average loads, it will be found beneficial to retard the ignition when running slowly *at full, or nearly full, throttle.* Judicious use of the ignition control is highly desirable if the very best results are to be obtained from the engine.

## HOW TO OBTAIN MAXIMUM DRIVING COMFORT.

The driver's seat may be moved over a total range of six inches. This should enable any driver, no matter how tall or short, to find a position for the seat which will give him fullest driving comfort. The setting of the gear lever, also, may be varied so as to bring it to the most convenient spot for the driver's right hand.

**TO ADJUST THE SEAT.** On saloon models pull up the handle which will be found in the centre of the front seat, just above the floor-board, and slide the seat to the required position.



A—slots in rim which engage with studs E.  
B—spring terminals.  
C—cylindrical sockets holding locking springs.  
F—collar to take strain of cable from terminals.





On the open model 5-seater, take up the seat cushion: underneath will be found two nuts, one each end of the seat. Loosen these a few turns, and also slack off the nuts at the sides of the seat, between it and the body sides. The seat can now be moved. Tighten all nuts after adjusting.

On 2/3 seater and Coupé Models the procedure is similar. **To set the gear lever**, loosen the pinch bolt at the bottom of the lever, just above the floor board, and, with the lever in such a position that it will not slip into any of the gear positions, move it forwards or back on its shaft until the best setting for the drivers' reach is found, when the pinch bolt should be well tightened.

## FIXING ALL-WEATHER EQUIPMENT.

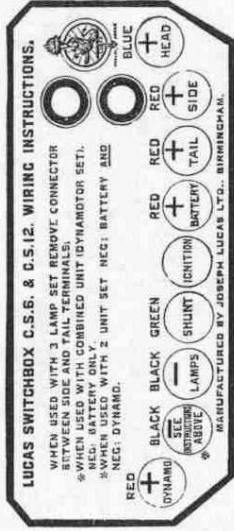
It is desirable to take a little care with hood and side curtains, as their life may be shortened by thoughtless use. The hood, for instance should not be folded down when wet, and in any case the folds should be arranged with care when putting down the hood, so that the fabric is nowhere nipped by the hood sticks. It is advisable always to make use of the hood envelope.

Similarly, the side curtains, when not in use, should be stowed away in such a manner that they will not scratch each other with the motion of the car.

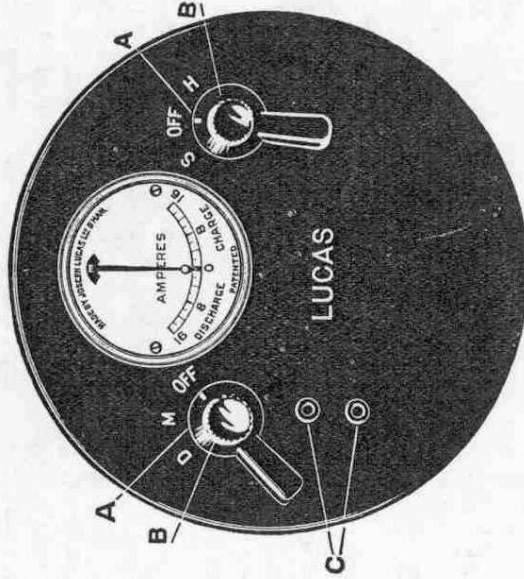
The fore part of the hood when "up" clamps to the top of the screen on each side and in the centre, a rubber flap, which should lie on the outside of the screen, being fitted to prevent water getting in in front.

The side curtains have pegs which engage in ferrules let into the top rail of the body sides. Spring windows are fitted to the side curtains for signalling, and other purposes.

Should the celluloid panes of the side curtains become scratched or discoloured, they may be improved by rubbing over with liquid metal polish, just as in cleaning plated work.



Wiring Instructions on the inside of the switchbox cover plate.



A—switch levers.  
 B—securing screws.  
 C—inspection lamp plug adapter.

**ELECTRO-MAGNETIC CUT-OUT.** The Cut-out automatically closes the charging circuit as soon as the dynamo voltage rises sufficiently above that of the battery. When the dynamo voltage falls below that of the battery the reverse action takes place, the cut-out opens and thereby prevents the battery from discharging itself through the dynamo. The cut-out is accurately set before leaving the makers' works, and should not be tampered with or adjusted. Should the cut-out fail to close the circuit on accelerating the engine the cause of the damage is likely to be found elsewhere in the system, and the fault-finding table should be referred to.

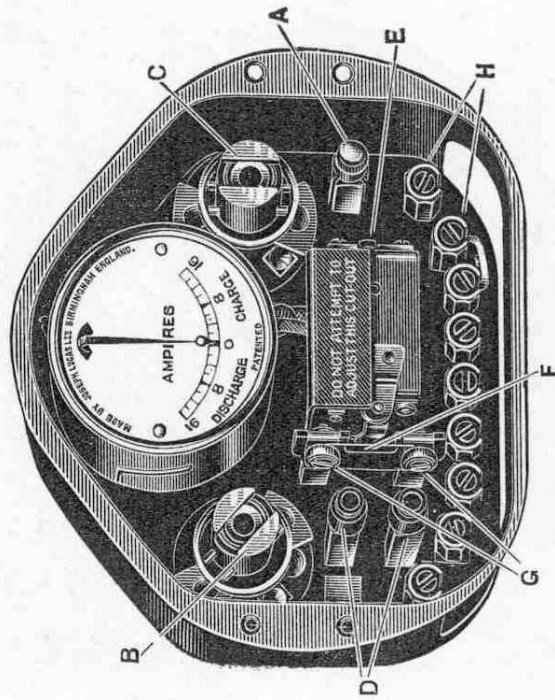
## CHARGING.

It is difficult to lay down rigid instructions on this subject as the conditions under which cars are used vary considerably, and obviously the amount of charging the battery will require is directly dependent on the number of starts made, and the extent to which the lamps are used. The following suggestions will serve as a rough guide:—

1.—Under normal conditions, providing that the lamps and starter are used a fair amount, the battery should be kept on charge all the time during the winter and about half the day-time running in the summer.

2.—Always keep the left-hand switch pointing to "D" when the head lamps are in use.

3.—If the car is used for long tours in the day-time it is quite unnecessary to keep the charging switch "on" all the time, as this will cause overcharging of the battery and consequent reduction of the acid level.



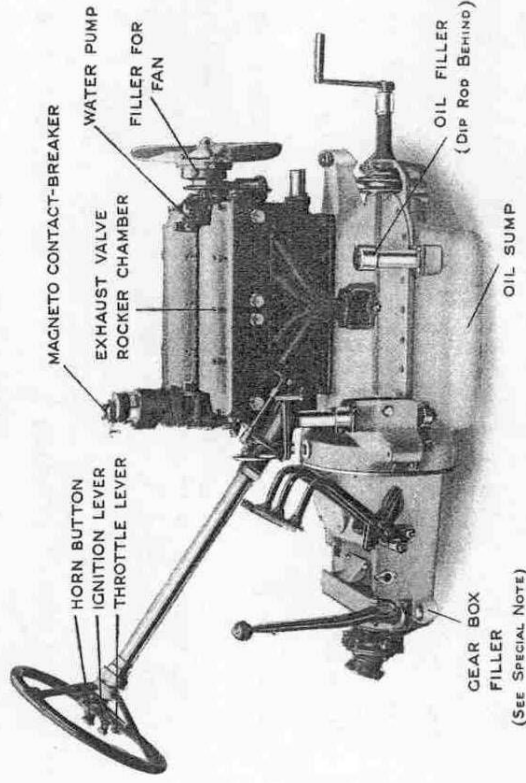
- A—spare fuse carton.
- B—dynamo switch.
- C—switch for lamps.
- D—inspection lamp plug adapter
- E—electro magnetic cut out
- F—fuse holder
- G—fuse wire terminal screws.
- H—terminals.

## THE REAR SCREEN.

On the open model 5-seater, a rear screen is provided which, when not in use, folds away into a recess formed in the back of the front seats. To erect the screen, sit in the rear seats, grasp the two sides of the screen, and draw it backwards and upwards until it reaches the limit of its travel, when a further movement *backwards* (towards the operator) of the top of the screen will bring it into position and lock it there.

To fold the screen away, first wrap the apron neatly over the top of the screen, the side wings of which should have been closed on to the centre panel, grasp the sides of the screen near the top, and reverse the previous operation.

## LUBRICATION.



The engine—clutch—gearbox unit showing location of various points referred to in the letterpress.

**ENGINE UNIT LUBRICATION.** As already mentioned, the lubrication of the engine—clutch—gear-box—steering unit is effected from the engine sump, total capacity being 3 gallons of oil. The filler cap for this sump will be found on the off-side of the engine, immediately forward of the exhaust pipe.

Just behind the filling neck is a dip-rod, which may be withdrawn by pulling out. This dip-rod has a clearly defined mark on it. It is recommended that the level of oil should be checked after the car has been standing for some considerable time to avoid risk of over-filling.

To fill the sump, pour oil into the filler until the dip rod shows the level to have reached the mark. Let the car stand on level ground while this is being done. NOTE:—The engine sump holds 2 galls. oil, the gearbox holding the extra gallon. The sump needs replenishment when the level is found to be about half way up the mark on the dip-rod.

*NOTE.—When refilling the sump after draining for cleaning purposes, do not put in more than 2 gallons (see p. 20.)*

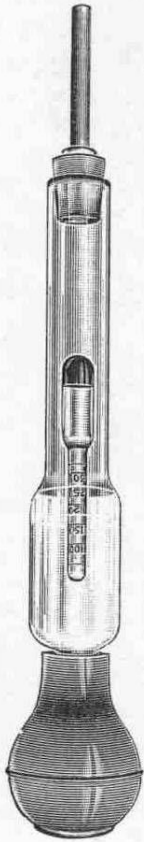
**We use and recommend WAKEFIELD'S CASTROL "A.A." for engine unit lubrication.**

**FAN LUBRICATION.** The fan is lubricated by removing one of the plugs in the casing and pouring in a little Castrol "D" oil. To avoid leakage, only put in enough oil to just drip out of filling hole when this is slightly below half way line (*i.e.*, when fan blades vertical). It is best to put in a little oil frequently.

**GEARBOX LUBRICATION.** It will be noted that a filling spout is fitted on the side of the gearbox, although the lubrication of this is effected automatically from the engine under normal running conditions. It is only necessary to put oil direct into the gearbox on occasions when the car is being used for the first time or after oil has been drained from the gearbox, such as after cleaning out or overhauling. *Engine oil* should then be poured in to the level of the filling spout.

**On no account must grease or heavy oil be put into the gearbox.**

**BACK AXLE LUBRICATION.** The lubricant recommended for back axle lubrication is WAKEFIELD'S CASTROL "D." Before replenishing the axle the oil should preferably be warmed to facilitate pouring.



Syphon Hydrometer.

It is important when examining the cells that naked lights should not be held near the vents on account of the possible danger of igniting the gas evolved during charging. It is as well to complete the inspection of the cells by checking the specific gravity of the acid solution, as the density of the solution gives a very good indication of the condition of the battery. An instrument known as a "Hydrometer" is employed for this purpose. Voltmeter readings of each cell do not provide a reliable indication of the conditions of the battery, unless special precautions are taken, and on this account we do not recommend this test for the average owner.

If the car is laid by for several months, the battery must be given a small charge from a sparate source of electrical energy at least once a fortnight, in order to obviate any permanent sulphation of the plates. Under no circumstances must the electrolyte be removed from the battery or the plates allowed to dry, as certain changes take place which result in loss of capacity.

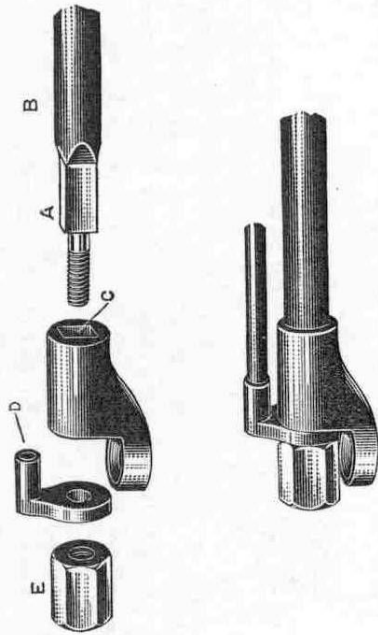
The battery lugs and cable terminals, which are made of a non-corrosive lead alloy, should be periodically examined to ensure that the nuts, holding the cable in position, are quite tight.

We may summarise the chief precautions that should be taken to maintain the battery in good condition as follows:—

- (1) Keep the acid well above the top of the plates.
- (2) Add distilled water only, *never tap water*.
- (3) Take frequent readings of the specific gravity by means of the hydrometer.
- (4) Do not allow the battery to remain discharged; if run down, through whatever cause, recharge at once.
- (5) Have battery overhauled after 18 months—2 years of service.



It should be remembered, when using the starter, that the power required is derived entirely from the stored energy in the battery, and that the condition of the battery depends to a great extent on ample and regular charging. It is therefore important that the battery is kept in good condition (see instructions re battery). For any difficulty with starter refer to Fault Finding Table.



Battery terminal.

**BATTERY.** We would impress upon the owner the importance of the Battery in the electrical equipment, and the necessity for careful treatment and regular attention if it is to be kept in good condition.

The chemical nature of the secondary battery must always be kept in mind when considering how much attention is necessary in order that it will function properly under all conditions of use. The sulphuric acid solution used in filling up the cells must be quite pure and of the correct density (1.225 at 60°F.), and it is very important that the level of the electrolyte should be kept well above the top of the plates, but just short of the bottom of the vent plugs. Neglect of this simple precaution will seriously impair the efficiency of the battery. Under ordinary conditions it will be found necessary to adjust the level of the acid solution in the cells by adding *distilled* water at least once a month. If however, acid solution is spilled it should be replaced by topping up the cells with a diluted sulphuric acid solution of 1.225 specific gravity at 60°F.

The filling spout will be found on the differential casing in the centre of the back axle: this spout is so positioned as to ensure the oil level in the axle being correct when it reaches to the filling mouth.

It is best to replenish the axle when it is warm, after a run. **Never over-fill the axle.**

The supply of oil in the axle lubricates not only the differential, axle shafts, etc., but the centre bearing of the propeller shaft, midway between axle and gearbox, as well.

During the first 500 miles that the car is run, or during the same mileage following an overhaul of the axle, it is very advisable to inspect the state of the lubrication of the axle on two or three occasions, replenishing if necessary.

Normally, the back axle will require checking and possible replenishment about every 1,500 miles.

**POINTS TO BE GREASED.** The grease gun connections on the chassis are located as

follows:

- 1 on each stub axle.
- 2 on each front brake.
- 1 on each front brake cross-over shaft tunnel.
- 3 on each front spring.
- 1 on each steering ball joint.
- 1 on each front brake pull rod.
- \*4 on brake compensating gear.
- \*1 on front end of propeller shaft.
- 4 on each rear spring.
- 2 on each rear brake drum.
- †1 on each rear brake drum at point where operating rod enters drum.
- 1 on each spring pad on back axle.

\*These 5 connections are grouped close together just beneath trap door in floorboard by driver's seat.

†These must on no account be overlooked: they are located on front side of brake drums, and can be reached through wheel spokes.



With the grease gun system of lubrication supplied it is not a lengthy job to attend to these grease connections regularly, and it is strongly advised that a few minutes be devoted to greasing at regular intervals.

**HUB BEARING LUBRICATION.** Remove all wheel nuts and plated hub cap. On the centre of the hub will be found a grease connection. Give each hub about  $\frac{1}{4}$  gun of grease every 5,000 miles.

**OILING.** An occasional spot of oil on moving joints on brake connections, accelerator and ignition control, etc., is desirable.

## MINOR UPKEEP HINTS.

**TO ADJUST FAN BELT.** The pulley on the fan is adjustable, the inner flange being on a screw thread, so that it may be brought closer to the outer flange and the belt thereby forced to ride higher up the pulley, thus tightening it. (See fig. 7a, facing p. 23).

The belt need not be removed in order to adjust pulley. Free the movable flange by removing the long pin passing through the boss formed on flange: this pin retains a circular collar which engages with one of three slots cut in the threaded core of the pulley. When this collar is taken out the pulley can be adjusted by holding the loose flange stationary and turning the fan itself until the belt has become correctly tensioned. The collar must then be engaged with the nearest slot in the pulley core, and the long pin replaced and tightened up.

As the fan belt drives also the water impeller, it is essential that it be kept at correct tension: do not set it too tight, however, but so that there is about 1 in. of "in-and-out" movement possible.

**TO ADJUST WATER PUMP GLAND.** Should occasional drops of water leakage manifest themselves from the water pump bearing, the packing gland should be gently tightened up by screwing the nut at the front of the pump (see fig. 7b, facing p. 23).

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

**TERMINALS.** For connecting up the main and field circuits of the dynamo, spring terminals are provided. The main terminals are located on the brush holders and the field terminal is mounted on the end bracket. To connect up the cable to these terminals no special sockets or attachments are required, nor is the use of solder necessary; the cables merely have to be bared; the spring on the terminal compressed until the hole in the stud is seen, into which the bared cable should then be threaded. On releasing the spring the cable will be securely held and good electrical contact made.

For any difficulty with the dynamo refer to Fault Finding Table. To remove dynamo from car, see pp. 35-37.

**STARTER.** The starter is fitted on the near side of the car, and secured by means of a barrel fixing. This machine is a series-wound motor operated by means of the starter switch on the dash. Immediately the switch button is pressed the starter armature revolves, and the pinion runs into engagement with the geared ring on the flywheel. As soon as the engine begins to fire the pinion is automatically thrown out of mesh. To remove starter from car, see p. 31.

If for any reason the pinion does not engage with the flywheel teeth, examine the screwed sleeve on the armature spindle to see that it is free from dirt; if necessary wash it with paraffin and then lubricate. A little thin grease on the sleeve occasionally is an advantage, as this prevents any possibility of the pinion vibrating into mesh when the engine is running. As in the case of the dynamo, the surface of the commutator must be kept clean and free from oil, brush dust, etc.

**WARNING.** The starter is designed for starting the engine under normal conditions, but any unnecessary or additional loading will considerably diminish the life of the machine and battery.

The two main brushes lie across a horizontal diameter, while the control brush is placed approximately midway between the two. The dynamo does not require a great deal of attention, but there are a few components which should be inspected occasionally to ensure satisfactory running.

**BRUSHES.** It is very important to make sure that the brushes "A.B.C." (Fig. 16) work freely in their holders. This can easily be ascertained by gently pulling each flexible lead, when the brush should move without the slightest suggestion of sluggishness. It should also return to its original position directly the lead is let go. When testing the brush in this way release it gently otherwise it may get chipped. The brushes should "bed" over the whole surface; that is, the face in contact with the commutator should appear uniformly polished.

If any of the brushes become so badly worn that it is necessary to replace them, this can easily be done as follows:— Having first removed the cover from the commutator end bracket (by unscrewing the hexagon nut) release the eyelet on the brush lead by withdrawing the split pin at the end of the spring terminal, then, holding the brush tension arm back out of the way, withdraw the brush from its holder. The third brush is set in its correct position before the machine leaves the makers' works, and on no account should this adjustment be altered.

**COMMUTATOR.** The surface of the commutator should be kept clean and free from oil and brush dust, etc. Neglect of this precaution will result in the commutator becoming blackened; sparking will not only occur at the brushes, but the life of the machine will be shortened. The best way to clean the commutator is to insert a fine duster, held by means of a suitably shaped piece of wood against the commutator surface causing the armature to be rotated at the same time. If the commutator has been neglected for long periods it may need cleaning with fine glass paper, but this is more difficult to do and should not be necessary if it has received regular attention.

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

**CARE OF CARBURETTER.** This is adjusted to the best setting before leaving our works, and adjustment should not be interfered with. It is only necessary to remove and clean the filter beneath the float chamber at intervals. (See pp. 38-40).

**THE AUTOVAC.** This requires no attention as regards its working, but it is advisable occasionally to turn on the drain tap below the Autovac, and to allow any water or dirt that may have accumulated to run off.

Should the Autovac ever be run dry; to re-fill it rotate the engine by means of the starter for a few moments *keeping the throttle closed.* (See p. 43).

**SPARKING PLUGS.** We strongly advise that no plugs other than the ones fitted as standard to the engine should be used, as any other plug may cause a serious falling off in engine efficiency and sweetness of running.

The plug points should have a gap of 16 thousandths of an inch.

**MAGNETO.** The only care ever likely to be required by the magneto is the occasional cleaning and adjustment of the contact breaker points. A special spanner, in which is incorporated a gap gauge, is included in the tool kit.

**ACCUMULATOR.** The accumulator is carried on the near-side running board. It should be inspected occasionally, the wiring connections being kept tight and clean and *well vaselined*, and the level of acid in all six of the cells being verified. The electrolyte should come well over the tops of the plates: if not, *distilled* water should be added to make up any deficiency. It is also advisable to test the specific gravity of the acid in the cells at intervals by means of a hydrometer, renewing the acid if considered advisable. (See p. 56).

All accumulators deteriorate with use, and after 18 months' of use it is strongly recommended that they should be sent to one of Messrs. Lucas's Service Depots for overhaul.

# THE LUCAS LIGHTING AND STARTING SET.

## GENERAL INSTRUCTIONS.

**DYNAMO (TYPE E.418.L.)** This machine gives a maximum output of 9-10 amperes when cold, falling slightly when the machine gets thoroughly warmed up. It is driven by a silent chain and is fitted to the car by a circular strap, which is secured to an extension of the gearbox casting, on the near side.

The armature is mounted on ball bearings, which are packed with grease before leaving the works. After the car has run, say, 10,000 miles, the machine should preferably be taken to the nearest Lucas repair depot for cleaning, adjustment, and repacking with fresh grease.

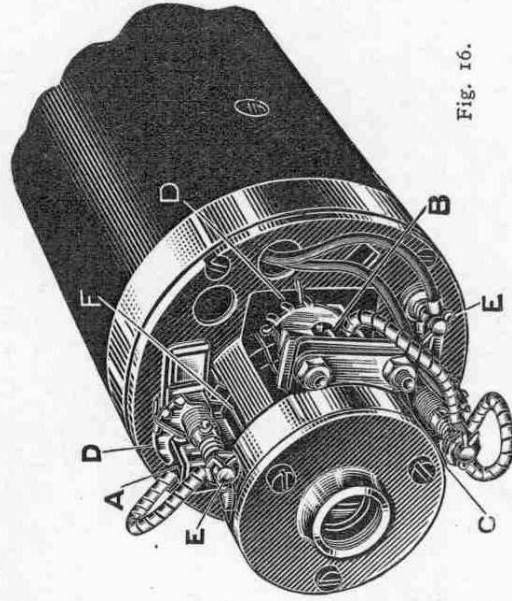


Fig. 16.

A, B & C.—brushes.  
D.—springs holding brushes in position.  
E.—spring terminals.  
F.—commutator surface.

The dynamo begins to charge at a low road speed, rapidly increasing to its maximum output. The regulation of the dynamo is effected by means of the well-known three-brush method.

**TO EMPTY RADIATOR.** In frosty weather, if the car is kept in an unheated garage, it is advisable to empty the radiator by means of the drain-plug at the bottom of the radiator. (See p. 23).

It is advisable always to fill the radiator with soft water (e.g., rain water).

**TO REMOVE WHEELS.** Jack up the particular wheel to be removed (in the case of front wheels a special pad for jacking is formed on the axle on the up-sweep near the wheel), and remove all six of the nuts by which the plated hub cap is held, (a special brace is provided in the tool kit for this purpose). Detach the hub cap and pull the wheel straight off the hub, taking care not to cause damage to the threaded studs.

Be careful to see that all six of the nuts are screwed hard home when the wheel is replaced, and occasionally verify the tightness of these nuts on all wheels.

**TO CLEAN OUT SUMP.** Remove nuts from front two plates on underside of sump, when the filters may be taken out, previously having withdrawn the oil by removing one or both of the plugs in the middle of the plates. (See p. 26).

Clean filters with petrol, replace and fill sump with fresh oil. Do not put in more than 2 gallons. If the gearbox has been separately drained, 3 gallons will be required, the extra gallon being put direct into the gearbox.

Do not put paraffin into crankcase of engine.

**TO DRAIN GEARBOX.** Remove drain plug on underside of gearbox, preferably when warm, after a run. Fill gearbox with fresh *engine oil* through filling spout on side of gearbox.



If not, adjust by means of forked joints "C." When correctly set, each brake should offer equal resistance, and the brakes should both be hard on with hand lever three notches along its quadrant from the "off" position.

When considerable wear has taken place in the rear brake linings, and all available adjustment has been taken up on rods, the levers on splined brake shafts can be set back one, or two, splines. To do this, loosen pinch bolts "F" and knock levers off brake shafts (towards differential casing on axle), replacing levers in their new position and locking tightly on the shafts.

To adjust the four-wheel braking system, first set the rear brakes correctly as already instructed. Jack up all four wheels, and slack off front brake control rods completely by undoing nuts "D" several turns. Then loosen locknut "E," insert screwdriver into slot in pin, and turn this pin in a clockwise direction until brake shoes are rubbing on drums. Now slack back the pins until the shoes are just clear of drums, and re-tighten locknut "E" in this position. Having done this, screw up adjusting nuts "D" until the front brakes just rub, and then take the adjusting nuts back one turn. Now test by pressing foot pedal, and take up adjustment "A" if necessary.

**RE-LINING BRAKES.** When re-lining brake shoes it is very important that the linings be ground dead true when in position on the shoes before refitting.

**LINING SIZES.** Rear brakes:  $16\frac{3}{4}'' \times 2'' \times \frac{1}{4}''$ . Front brakes:  $16'' \times 2'' \times \frac{1}{4}''$ .  
Two linings per drum each brake.

## SUMMARY

OF POINTS TO BE ATTENDED TO REGULARLY.

- 1.—**CHECK LEVEL OF OIL IN SUMP** every 1,000 miles, and replenish with sufficient Wakefield's Castrol "A.A." oil to bring level to mark on dip rod. (See p. 15).
- 2.—**DRAIN OIL FROM SUMP AND GEARBOX** every 5,000 miles and replenish with fresh oil. (See p. 20).
- 3.—**CHECK LEVEL OF OIL IN BACK AXLE** every 1,500 miles and replenish with Castrol "D" oil (warmed) up to level of filler spout only. (See p. 47).
- 4.—**LUBRICATE FAN** by pouring a small quantity of Castrol "D" oil into the fan casing every 500 miles.
- 5.—**USE GREASE GUN** on each connection about once per fortnight, and do not overlook the points where brake operating shafts enter back wheel drums. Grease hubs every 5,000 miles. (See pp. 17 and 18).
- 6.—**CLEAR AUTOVAC** of water about once per fortnight by turning on drain tap on underside until clean petrol flows out. Clean carburetter filter once per month. (See p. 40).
- 7.—**ADJUST FAN BELT** when necessary. (See p. 18.)
- 8.—**CHECK DYNAMO CHAIN** tension about every 10,000 miles, and tighten if necessary. (See p. 37).
- 9.—**CHECK BRAKE ADJUSTMENT** when necessary. (See p. 50).
- 10.—**CHECK BATTERY ACID** about once per fortnight, adding distilled water if required. Check specific gravity of acid occasionally. (See p. 56).

# SECTION III.

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Water pump gland, to re-pack ...	25
Wheels, front, to set ...	49

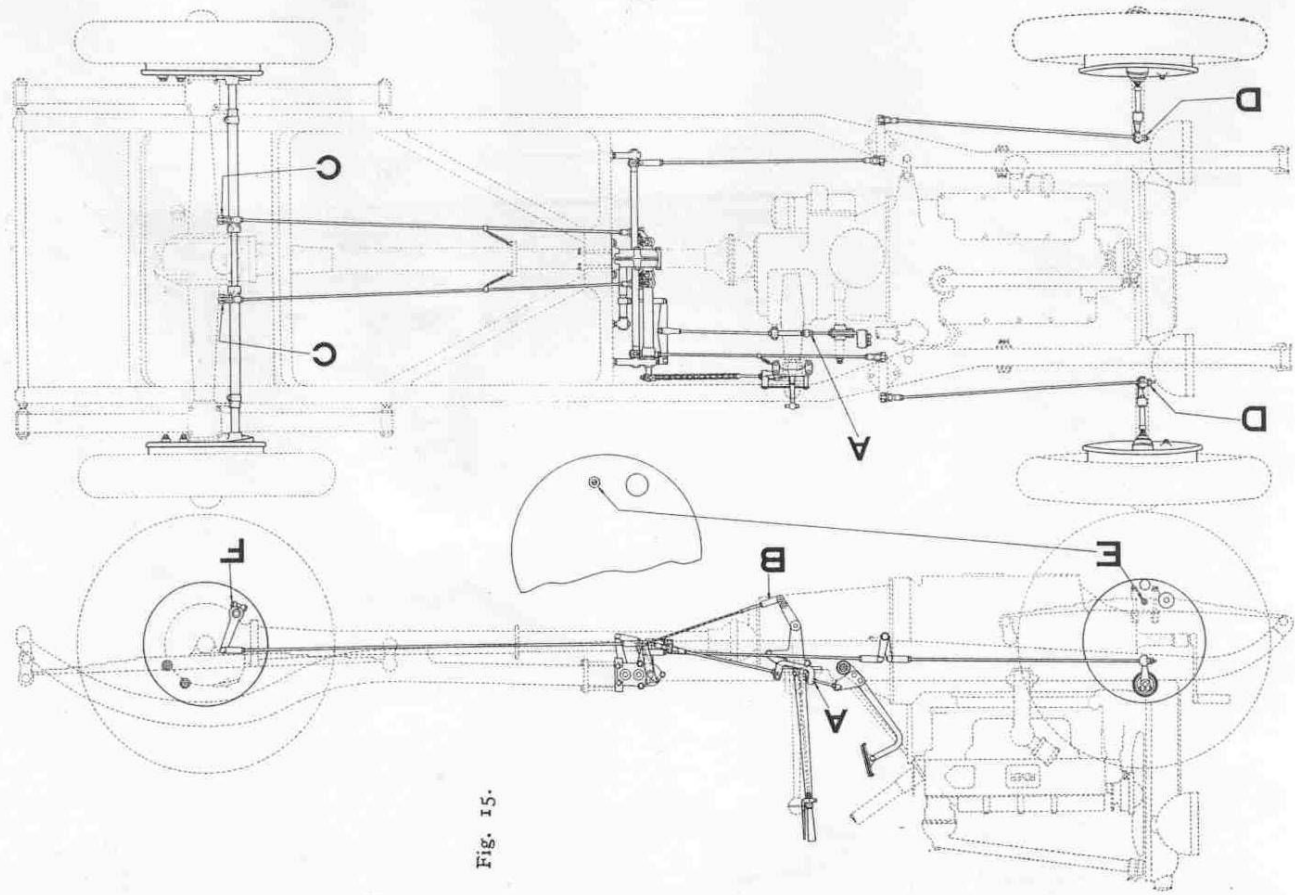


Fig. 15.



If it should be necessary to remove the front brake mechanism, the spring-loaded pins C must be compressed before the assembly can be withdrawn.

The steering ball joints E are mud and grit proof without need for leather covers. After 20,000 miles running the car should be jacked up and the joints inspected for movement. If this is excessive they can be adjusted as follows:—Remove bolt F and cottered nut G, the ball E can then be removed from the steering levers. Unscrew body complete from tube, remove locking pin H and screw-plug J further into body until solid, then unscrew back until the slot in plug J is in line with the first hole in the body. Replace lock pin H and re-assemble.

The front wheel hub bearings are not adjustable.

## THE BRAKING SYSTEM.

(The diagram referred to is Fig. 15).

The foot pedal applies brakes on all four wheels; the hand brake acts on the rear wheels only. The compensating gear attached to the cross member of the chassis distributes the braking pull from a central point; this compensating gear requires no attention save lubrication of the various bearings, and it is not adjustable.

**TO ADJUST BRAKES.** When the foot pedal travels too far before applying the brakes, the four-wheel braking system can be adjusted as a whole by taking up the floorboard in driving compartment and shortening the rod "A" by taking up nuts on U-connecting link forward of the gear-change bracket.

The hand brake is adjusted by taking off the fork joint "B" at bottom of lever and screwing up the joint on the threaded rod.

To adjust the rear brakes independently, jack up both rear wheels, and pull hand brake "on" slightly. Turn the rear wheels by hand, and see if each offers equal resistance.

## THE ENGINE.

(THE NOS. FOLLOWING THE REFERENCE LETTERS REFER TO THE FIGURE NUMBERS GIVEN ON THE DIAGRAMS).

**TO DRAIN OUT WATER.** To drain radiator and water jacket remove plug at the bottom of the radiator by means of the 5/16th box spanner in tool kit.

After the first rush of water the radiator is empty, but the cylinder jackets take some time to drain on account of the special water circulation system of the engine. Do not, therefore, replace the plug in the radiator until it is desired to refill same. As the cylinder jackets have to drain through the small hole "A" (1) it is essential that whenever the radiator is removed, this hole should be cleaned out to prevent "furring" up.

**TO REMOVE RADIATOR.** To remove radiator undo the two bolts which secure it to the front cross member of the chassis, detaching the number plate to obtain access to these bolts. Instead of breaking the rubber water joint connections, remove flange joint on water pipe where it connects to the cylinder by undoing the nuts "B" (1). Remove thermostat and water pipe complete by removing nuts "C" (1) of thermostat, then remove nut on dash behind fascia board (inside car) on end of radiator stay rod. Remove front of head lamps and disconnect wiring behind reflectors and the clips that hold wires on radiator, also disconnect all ignition wires from magneto and plugs. The radiator can then be removed complete with all water pipes and thermostat

**TO DETACH CYLINDER HEAD.** To lift cylinder head, take off valve covers and remove all head bolts "D" (1), also bolts "E" (2) on induction side of engine as well as steering bolts "F" (2) on exhaust side, and nuts "G" (3) on vertical shaft on induction side. Remove switch wire from magneto and disconnect exhaust pipe at flange on manifold, also pipe to oil gauge, and fan belt. Take off magneto (see P. 31).

After removing head bolts it is desirable to remove water pump body "Q" (1) by undoing nut "R" (1) and sliding gland

"S" (1) forward on pump spindle. The pump body can then be removed.

To lift cylinder head, it is easier to use overhead tackle connected to eye bolts screwed in sparking plug holes of Cylinders Nos. 1 and 4 (see Fig. 9), and extreme care must be taken to hoist vertically and gently to avoid damaging splined connection "H" (3). Therefore, take the strain on tackle and assist by levering cylinder head at vertical shaft end by means of suitable bar and block supported from crankcase. The first movement may be difficult on account of the press fit of vertical shaft cover. When the first movement has taken place, the head can be hoisted clear by means of the tackle, but this operation must be performed with the greatest of care.

The cylinder head gasket can be removed and used again. No jointing material need be used on this gasket. There is a separate washer to make oil tight joint to the steering box.

**TO REMOVE VALVES FROM HEAD.** To remove valves from cylinder head it is necessary first to remove the long spindles on which valve rockers work by taking out split pins on nuts "J" (4), slackening these nuts, and then tapping them down with a wooden mallet. Next remove plugs "K" (4) and insert the special screwed tommy bar (which will be found in kit) into ends of rocker shafts. These can then be withdrawn, but it will be necessary to depress spring of that valve which happens to be lifted in order to relieve load on rocker shaft. The rockers themselves can now be pulled out from the head. Remove split pins from valve nuts, and a smart tap on the valve cups will unlock the nuts on valve stem and they can be unscrewed. The valves can now be removed from the head. Great care must be taken to observe and mark the approximate positions of the tapered nuts on valve stems, otherwise when refitting the springs will be out of balance and valve gear will in consequence be difficult to quieten.

**TO STRIP HEAD.** For the operations already mentioned it is quite unnecessary to remove the camshaft or horizontal push rods, but, if their removal is essential for any other purpose, first remove magneto, with bracket, by undoing nuts "O" (3) and lifting vertically. This exposes the camshaft gearing, and the vertical shaft must now be removed by screwing in a left hand direction. Next remove the cover from lower end of balancing cambox body and withdraw spring. Remove nut "L" (4) and take off balancing cambox

## FRONT AXLE AND HUB ASSEMBLY.

See note on p. 36 re bearing replacements.

The front axle is made of particularly tough steel, and in the event of it becoming bent it must be straightened as follows: Heat axle up to 800 deg. C. and re-set, after which the axle should be again heated to 800 deg. C. and quenched in tepid water. Then re-heat to 600 deg. C. and cool in air. Should it be possible to set the axle when heated to less than 600 deg. C. it will only be necessary to cool off in air.

It is highly important that the bolts D of the spring pads be kept dead tight.

The oil cap A on the swivel pin must be given frequent attention, as stiff steering may result if this is not done. Should this point have been neglected, oil should be dripped in for about a quarter of an hour, in order to fill the cavity K and to ensure that the oil finds its way down the swivel pin to the lower bush. In the event of there appearing to be a stoppage, remove the oil cap and force oil down with a gun through a length of pipe bent to fit round the bend below the oil-cap.

The correct setting of the front wheels is as follows: with jacks under the front axle just to take the weight of the car off the tyres, the wheels should "toe in"  $\frac{1}{4}$  inch at a point 9 inches from the ground, measuring between the inside walls of the tyres. With the axle on the bench, a "toe in" of  $\frac{1}{2}$  inch should be allowed, as this will be reduced to  $\frac{1}{4}$  inch when the weight of the car is on the axle.

Should brakes require re-lining, it is desirable after fitting the new linings that they should be ground dead true.

The hubs are lubricated by means of the nipple B in the centre of the hub. Too much grease should not be given here, as an excess may find its way on to the brake shoes.

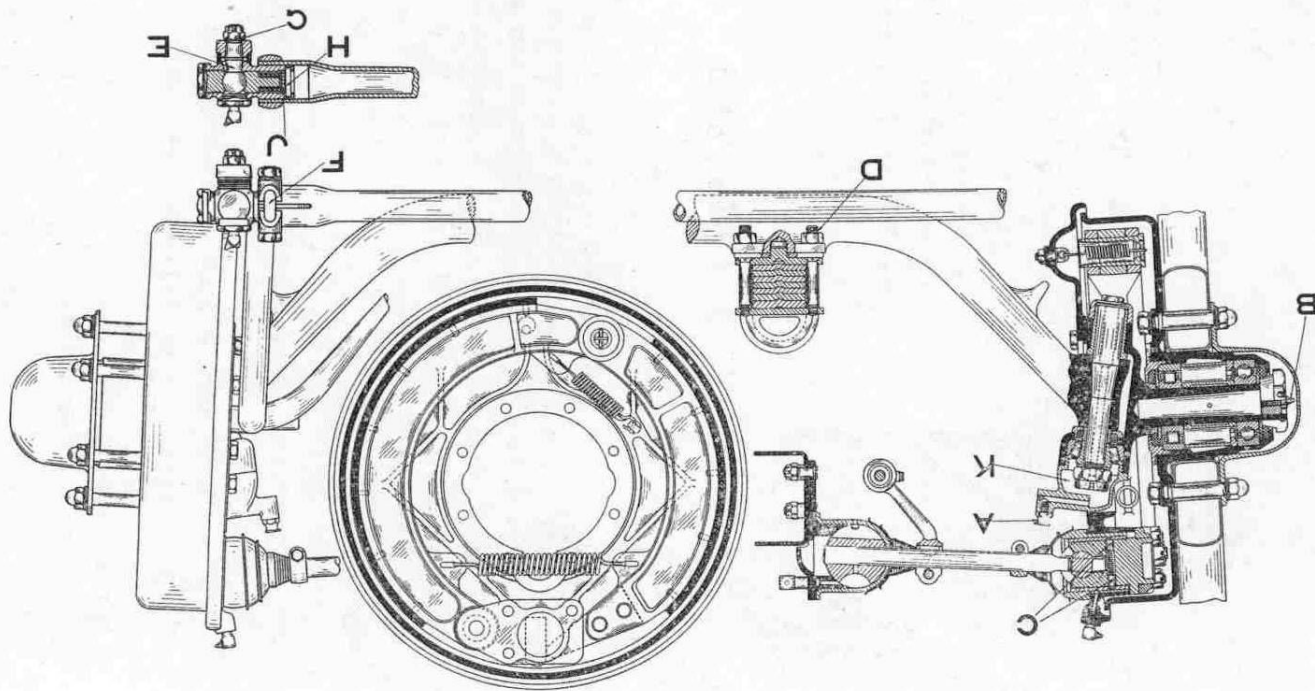


Fig. 14.—The diagram referred to on pp. 26, 49, and 50.

body complete. This will expose rod "M" (4) and plate "N" (4) complete with springs may then be withdrawn through other end of head. All horizontal push rods "P" (4) must be pulled back clear of cams, and camshaft may now be withdrawn towards rear end of head.

To remove push rods, the camshaft having been removed, take off cover from both sides of head, when push rods can be withdrawn through apertures on camshaft side. Should it be necessary to remove tappet rod guides, a splined spanner is supplied in the kit to fit the splined plugs on top of head. Under these plugs are steel plungers which must also be removed, when tappet guides can be withdrawn.

**TO REPACK WATER PUMP GLAND.** To repack water pump gland remove nut "R" (1) and slide outer gland "S" (1) forward on spindle. The inner gland "T" (1) can then be slid forward along spindle by means of holes provided. Packing can now be "lagged" round the shaft and gland repacked and tightened by means of nut "R" (1).

**TO REMOVE FAN COMPLETE.** Should it ever be necessary to remove the fan for overhaul, undo nuts "U," (1) and pull fan off after the belt has been disconnected.

**TO REMOVE FAN DRIVING PULLEY.** Remove sump and starting handle. Take off starting jaw on crankshaft. Two tapped holes will be found in boss of fan pulley to take an extractor, the draw bolt of extractor pressing on end of crankshaft. Pulley can now be withdrawn.

**TO LIFT CYLINDER BLOCK.** To remove cylinder block without first detaching head, drain radiator and remove it, with connections, also remove switch wire, carburettor controls, magneto control rod and contact breaker body. Undo nuts "G" (1) on vertical shaft casing, bolts "F" (2) under steering box and nuts "V" (1) at base of cylinder block. Insert lifting tackle (see Fig. 9) in cylinders Nos. 1 and 4, and, before lifting, in order to facilitate re-engaging timing gear, turn engine until pistons Nos. 2 and 3 are at top dead centre. Now proceed with lifting as in removing head only.



To remove cylinder block if head has been previously detached, it is only necessary to undo nuts "V" (1) and to lift cylinder block away, after disconnecting carburettor controls, etc.

**TO TAKE OFF PISTONS.** To remove pistons when cylinder block has been detached, take out split pin "W" (1). The gudgeon pins can then be pressed out of piston ears. Only one split pin is fitted, and need be replaced.

**TO REMOVE SUMP.** To remove sump, undo all flange bolts "X" (1 and 2) round crankcase, also bolts holding starting handle bracket, and the six lower bolts "P" (10). Loosen also the other nuts round clutch bell housing, but do not remove. To lower sump it is necessary to swing steering tie bar out of the way. See page 50 and fig. 14 for instructions to remove steering ball joint. It is not essential to empty oil from sump before removing, but this can be done by detaching drain plugs "Y" (1).

**TO CLEAN OIL FILTERS.** To clean oil filters, drain sump then detach cotted nuts round circular flanges in base of sump. Filters can now be withdrawn.

**INSPECTING BIG ENDS.** Big-ends and main bearings can be inspected when the sump is removed. It is possible, should big-end bearings require attention, to remove connecting rod and piston complete through base by placing crankshaft in suitable position to clear piston.

**TO STRIP STEERING.** To disassemble steering gear, remove throttle cam "A" (5), and magneto control quadrant "B" (5). Remove bolt "C" (5) which holds quadrant at top of steering wheel. Remove horn press button and disconnect wires therefrom. The magneto and throttle controls can now be pulled clear of steering column, complete with tubes. The innermost tube can then be removed by undoing nuts "D" (5), and pulling in a downward direction. Next take off steering wheel by removing nut "E" (5), which is locked by wire ring. Then take off nut "F" (5), which holds the wheel to column, and remove bolts "Z" (1). Rotate steering column to disengage worm, and remove sloping steering column.

They can be locked up by means of the three retaining nuts, and these nuts must be re-cotted before re-erecting axle.

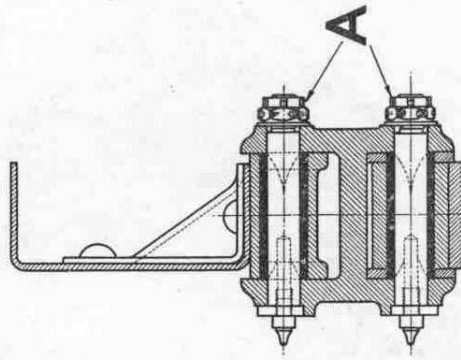
The general re-assembly of the back axle is a complete reversal of the procedure given for dismantling.

**SPECIAL NOTE RE LUBRICATING BACK AXLE.** The axle casing should not be over-filled with

oil at any time. Always replenish when the axle is warm, after a run. Pour in the oil through the aperture in top of differential casing, but, before doing so, remove the plug "Y" on the spout. When oil issues from this spout, the axle is full. The oil should always be warmed in order to thin it before pouring. **Never over-fill the axle,** or the brakes may be affected.

## THE SPRING SHACKLES.

Should side play in the spring shackles develop through wear, it can be taken up by uncottering the nuts A and re-tightening them. Re-cotter the nuts when the operation has been performed.



off universal ball joint at front end of propeller shaft (See "N," Fig. 10, page 36), and remove oil pipes "D" (Fig. 10). The axle can then be taken from car by withdrawing to the rear.

**TO STRIP AXLE.** First remove road wheels (axle having been removed from car). Take off axle nut "B" after removing locking ring. Withdraw hub "C" and brake drum complete. If hubs are tight, an extractor to suit threads on hub will be needed, but grease nipple "D" must be removed before extractor is applied. Next remove the six bolts "E" holding bearing cap, and take this off. It is now possible to withdraw the axle shafts "F" from the casing. Now remove axle casing "G" by taking off nuts "H," and then the torque tube "J" by taking off nuts "K." This will expose the propeller shaft "L," and to remove this from the pinion shaft "M" take out split pin "N." The axle case can then be taken apart by removing the eight bolts "O," and the pinion shaft "M," complete with housing, can now be removed. After this has been done, the crown wheel complete with differential box can be removed from axle casing.

**VERY IMPORTANT.** Before removing crown wheel and differential box from axle casing, it is essential to note the positions of shims "V" on either side of ball races. They must be replaced in the same positions as found when re-assembling axle, as they are of varying thicknesses, and are responsible for the correct meshing of the crown wheel and driving pinion.

It will be advisable to remove the plugs "T" at the ends of the brake tube supports when the axle is down and to clean out the oil holes before re-assembling axle.

Note specially that the oil-retaining washers "U" are a tight fit in their housings, otherwise they will revolve with the shaft and allow oil to leak past and get on to the brake drums.

To remove vertical steering column, the cylinder head must be detached. Remove bolt "J" (3) from steering arm and detach arm. Slack bolt "H" (1); the steering column can then be withdrawn vertically upwards after slacking control bracket bolts "K" (3). To examine segment the two halves of steering box may now be taken apart.

**TO REFIT HEAD.** Assuming that the head has been stripped completely, first replace valves and springs, as far as possible ensuring that each spring has equal tension (this is very important). On the inlet side all valves have a separate spring inside main valve spring holding leather packing gland in position to prevent excess oil getting into cylinders through valve stems. Make sure that these washers are in position. Next replace tappet guides, tappets and push rods "P" (4), making sure that the splined nuts are dead tight and free from dirt or grit. Replace camshaft from rear end of head; re-assemble thrust plate "N" (4), then fit balance cam box on front of head and lock nut "L" (4), taking care to refit joint washers to these. Re-assemble spring, etc., in balancing cam box.

To replace rocker shafts, feed rockers in one at a time and make sure that the thrust washers and springs are in their proper positions (see Fig. 4). Do not drive rocker shafts right in, but sufficient only to allow nuts "K" (4) to enter the threads of cylinder head; then screw the plugs "K" (4) home, as these position the rocker shafts. Tighten nuts "J" (4) and re-cotter. Replace top vertical shaft by screwing in a right hand direction, arranging it so that the "V" spline ultimately faces to front of engine with Nos. 2 or 3 inlet valve just on the point of opening. After this the magneto bracket (without magneto) can be replaced to retain short vertical shaft in position. Lock up nuts "O" (3), taking great care that drain hole in magneto bracket is in line with drain hole in cylinder head.

**REPLACING PISTONS.** Care must be taken that each piston is replaced in exactly the same position as that from which it was withdrawn. Each piston is numbered (from the front), and its position in the cylinder must be such that the dowel peg positioning the scraper ring faces to the front of the engine.

**TO REPLACE CYLINDER BLOCK.** Set pistons 2 and 3 at top dead centre. Lower the cylinder block over the pistons, taking extreme care to keep





**TO INSPECT CROWN WHEEL AND DIFFERENTIAL PINIONS.**

Without dismantling axle, or removing axle from car, it is possible to inspect differential and crown wheel. First jack up car by placing two jacks close on either side of centre of axle. Take off set screws "H" on top half of differential casing only, and also the set screws "K" holding torque tube to top half of case. Then remove the eight bolts "O" holding the two halves of the differential casing together: the top half may now be removed, exposing crown wheel and differential pinions.

**TO DRAW AXLE SHAFTS.** Remove road wheel and take off axle nut "B." Remove hub "C," then take off bolts "E" holding bearing housing. The axle shafts can now be withdrawn.

**TO REMOVE DIFFERENTIAL.** The differential and crown wheel assembly can be withdrawn without removing axle from car in the following manner: draw both axle shafts and take off top half of differential casing as already described. The crown wheel and differential assembly can now be lifted right out of casing.

**VERY IMPORTANT.** Before removing crown wheel and differential box from axle casing, it is essential to note the positions of shims "V" on either side of ball races. They must be replaced in the same positions as found when re-assembling axle, as they are of varying thicknesses, and are responsible for the correct meshing of the crown wheel and driving pinion.

**TO REMOVE COMPLETE AXLE ASSEMBLY FROM CAR.** After lifting back of car by means of rear cross bar of frame, remove axle by taking off spring pads "A"; disconnect all brake rods; take

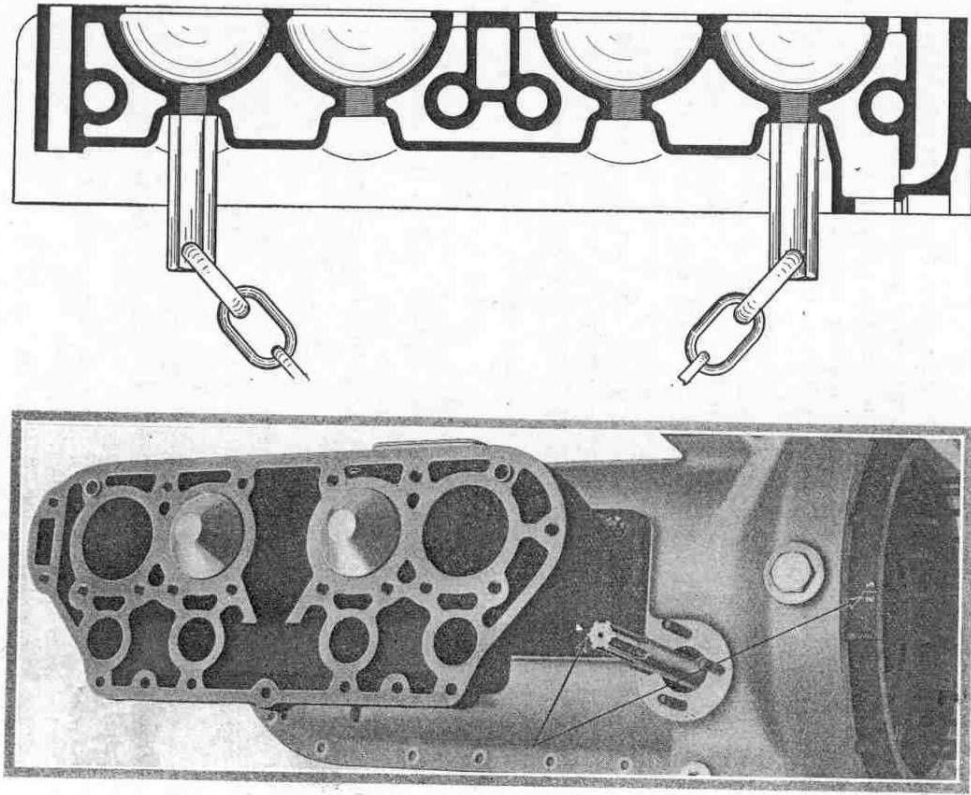


Fig. 9. Sketch of lifting tackle referred to on page 24.

Fig. 8.—Showing Nos. 2 and 3 pistons on top dead centre, and V spline facing forward.

it absolutely level, otherwise difficulty will be encountered with scraper rings entering barrel. When home, lock up nuts "V" (1) and re-cotter.

**TO REPLACE CYLINDER HEAD.** Still with pistons Nos. 2 and 3 at top dead centre, in which position the "V" spline on vertical shaft will be facing to the front of the engine, replace gasket and washer to steering box joint. Observe that the timing of valves in head remains as described in a foregoing paragraph (i.e., with "V" spline facing to the front of the engine), and carefully lower head into position making sure that the tubular dowels in two bolt holes in cylinder are in situ. Keep the head dead level while lowering, and avoid using any strain whatever.

Engage vertical shaft members by moving engine slightly in either direction, and, when almost home, make sure that tubular cover on vertical shaft enters head casting before attempting to tighten any bolts. The small set screws "E" (2) on induction side should be replaced loosely, and water pump body can now be re-fitted, also head bolts "D" (1) tightened down diagonally. After this is done, bolts "F" (2) holding steering box to cylinder head can be replaced and pulled up tight.

Before replacing magneto, the splined adjusting "pencil" "A" (3) must be tightened right down to raise worm wheel to correct centre. Tighten down as far as possible, and then release half a turn, otherwise engine will be excessively stiff. After this has been done the worm wheels can be set in correct mesh by adjusting screw "B" (3), after releasing nuts "O" (3). (Further information *re* setting worm gearing in correct mesh will be found on p. 32 under heading "To Quieten Valve Gear.")

Radiator, headlamps, etc., can now be replaced.

**TO RE-ASSEMBLE STEERING GEAR.** It is desirable to refit the two halves of the steering box on the bench. Make sure the thrust washer "C" (3) is replaced in position, and that it fits into the dowel peg in top half of steering box. It is advisable before refitting vertical shaft and steering box into crankcase to remove the packing gland "D" (3), which can be done by taking off locknut "E" (3), in order to prevent damage to gland. Before remaking the gland and fitting steering lever and clip bolt "J" (3), it is essential that steering box should be bolted to steering head as previously described.

## THE BACK AXLE.

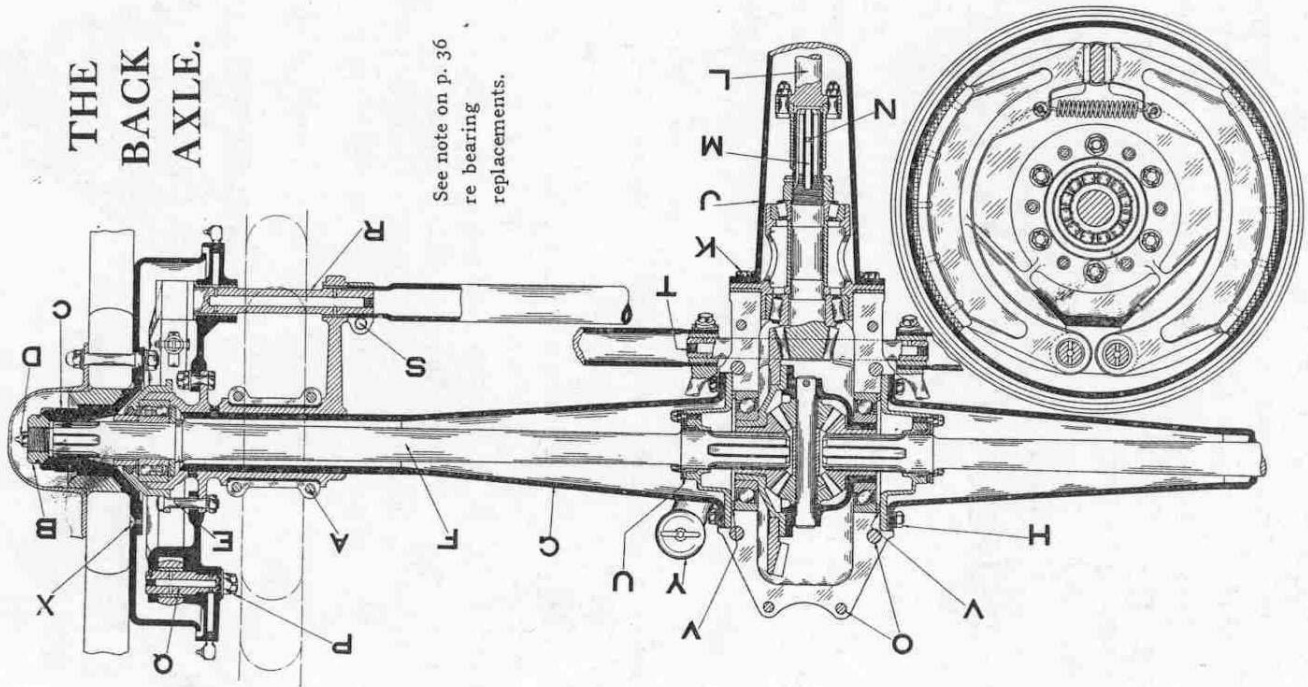


Fig. 13.—The back axle diagram referred to on pp. 43-47.

After replacing gland, when foregoing operation has been carried out, it is necessary to see that there is space between the gland cover and steering lever, otherwise steering will be stiff. Take particular care that bolt "J" (3) is pulled up absolutely dead tight, and kept tight.

To replace sloping steering column, the outer column with worm, ball races, steering wheel boss and steering wheel can be assembled on the bench. The sloping steering column can now be fitted to the steering box. To ensure steering lock being correct, the steering lever at bottom of vertical steering shaft must be set at right-angles to chassis frame, and the worm can be engaged with segment by being screwed into mesh in a right-hand direction. After this has been done replace bolts "Z" (1), and lock up tight.

The quadrant tube (innermost tube) must be inserted from bottom of column before the foregoing operation is performed. Tighten up steering column by fitting nut "E" (5), being sure to replace the wire lock-ring. Thread taper collar "G" (5) over top of quadrant tube, and insert magneto and carburetter control tubes with quadrant interposed. Before tightening up bolt "C" (5), tap quadrant firmly on to taper collar "G" (5), otherwise quadrant will rattle. To adjust sloping steering column for end-play, slack bolt "H" (5) and screw column up by means of hexagon nut on ball bearing housing "K" (5), re-tightening "H" (5) after this has been done. To take up end-play in the vertical steering column adjust screw "S" (3) and lock when correct position has been found.

Backlash in the steering gear can be taken up by slightly slackening the 5 bolts "L" (5) which hold the two halves of the steering box together, and tapping top portion of box towards the engine. Lock bolts "L" (5) tightly after correct adjustment has been found.

Now re-assemble magneto quadrant "B" (5) and throttle control cam "A" (5), and refit horn wire and press button.

#### WHEN REPLACING SUMP.

When replacing sump it is advisable to slack the bolts "M" (3) holding oil pump body to base, and to make sure that vertical pump shaft engages in pump body, also that splines are in engagement with pump wheel. After sump has been bolted to top half of crankcase the engine should be rotated a few turns before finally tightening up the bolts "M" (3).

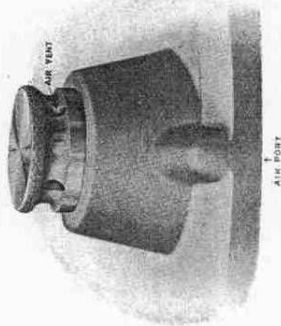


Fig. 11. Vents to be kept clean.

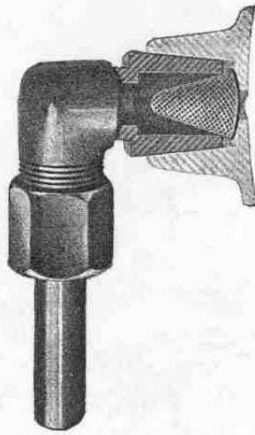


Fig. 12. Petrol Strainer.

Should petrol tank and Autovac ever be run absolutely dry, the Autovac can usually be refilled by rotating engine by means of the starter, keeping throttle completely shut. If this does not have the required effect (as when car has been standing unused for long periods, and Autovac valve may have become dry) detach petrol inlet (Fig. 12), and pour about a pint of petrol direct into Autovac.

Draw off water and other foreign matter fairly frequently by opening drain cock at bottom of outer chamber.

The drop valve (see p. 42) may possibly acquire a black carbon pitting at rare intervals which would tend to hold it from being sucked tight on its seating. In this case the inner chamber must be removed and the valve scraped clean with a knife.

## THE BACK AXLE ASSEMBLY.

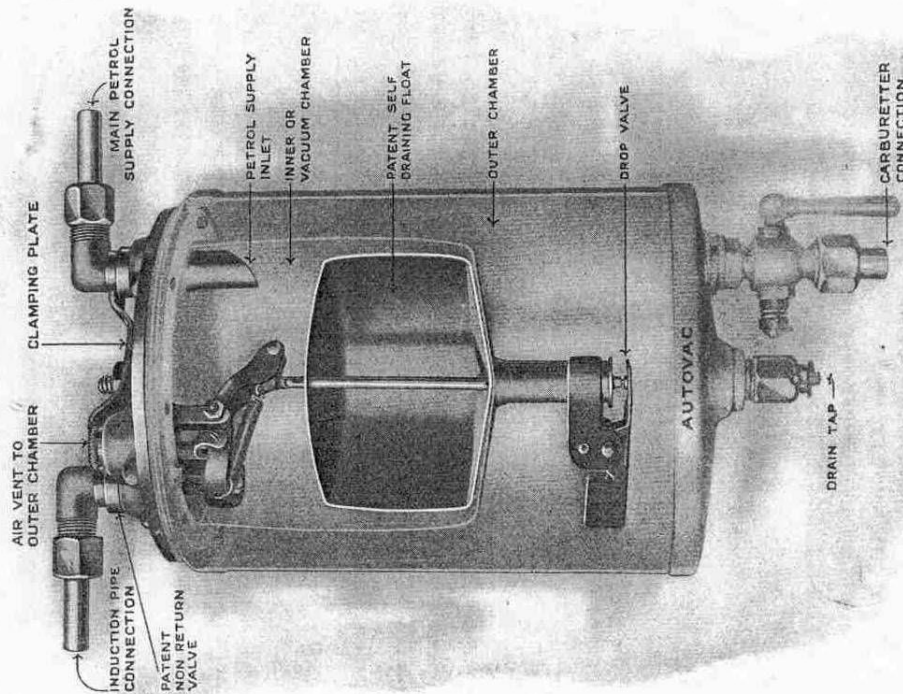
(The letters refer to Fig. 13, p. 44.)

**TO INSPECT BRAKES.** Jack up and remove road wheel.

Brake drums can then be removed by taking out the six countersunk screws "X," which allows drums to be withdrawn without disturbing hub. Brake shoes can now be removed by taking off cottered nuts "P" and drawing out brake pins "Q." Should it be necessary to remove brake operating cam "R," slack bolt "S" and withdraw "R" from its bearings.



## THE AUTOVAC.



Described on adjacent pages.

**TO REMOVE STARTER MOTOR.** To detach starter motor, remove entirely lock-pin "N" (3) and pull starter motor out of engine casing.

**TO REMOVE MAIN VERTICAL SHAFT.** The vertical shaft to camshaft "P" (3) can be removed after sump has been detached by taking off the rear main-bearing cap "Q" (3), slots being provided in this for insertion of prising tool, and pulling it off in a downward direction. Before removing the vertical shaft, place pistons Nos. 2 and 3 on top dead centre to facilitate re-assembly. (Note:—It is necessary to have the car over a pit for this operation, owing to length of vertical shaft).

The coupling "H" (3) comes away with the vertical shaft, and this coupling is threaded at its top end in order to allow of it being inserted into a suitable extractor for withdrawal from shaft "P" (3), on which it is a press fit.

**TO REPLACE MAIN VERTICAL SHAFT.** Still keeping pistons Nos. 2 and 3 at top dead centre, replace vertical shaft with "V" spline facing to front of engine. A ground mark on bottom face of vertical shaft worm wheel indicates the position of the "V" spline. This spline will engage with the corresponding spline on the top vertical shaft, which will also be facing to front of engine if the pistons were set as described before removal of shaft.

To check that timing has not been disturbed, the ground mark on worm wheel should be facing front of engine with Nos. 2 and 3 pistons at top dead centre, and gears in full engagement. It is not possible to have incorrect timing if the operation is carried out as described.

**TO REMOVE MAGNETO.** The magneto can be removed and replaced without ignition having to be reset by undoing bolts "R" (3). This allows magneto to be withdrawn complete with coupling from top vertical shaft. The position of the distributor brush should be carefully noted (by removing the distributor cover) before the magneto is removed, and, if the "V" splines on the shaft couplings are re-engaged with distributor brush in same position, the ignition timing will be exactly as before.





### TO VARY MAGNETO TIMING.

To advance or retard ignition timing, remove magneto and unbolt the split Vernier coupling plates. To **advance** timing, move the outer coupling plate slightly in an **anti-clockwise** direction until any two holes come opposite, bolting the plates together again in that position. To retard the ignition, move the outer plates in a clockwise direction.

To obtain very fine timing adjustment, it is desirable to remove the inner Vernier coupling plate from the magneto, and to re-select holes in **both** plates.

### TO QUIETEN VALVE GEAR.

Noisy valve gear may be due to the following causes:

- (1) Excessive clearance between rocker and valve.
- (2) Backlash in worm gearing driving camshaft.
- (3) More pressure required on spring in balancing cambox.
- (4) Valve springs at unequal tension.

The following is the procedure in each case:—

(1) To obtain correct adjustment of the valves, turn engine until exhaust valve of No. 1 cylinder (nearest radiator) is off its seat (*i.e.*, open); No. 4 exhaust valve and No. 3 inlet valve are then in correct position for adjusting. The rockers should be set to  $1\frac{1}{2}/1000$  in. clearance in each case, *i.e.*, the rockers should be just clear of the valves and no more.

Next turn engine until No. 3 exhaust valve is open. Nos. 2 exhaust and 4 inlet are then ready for adjustment.

No. 4 exhaust valve should next be opened, and Nos. 1 exhaust and 2 inlet can now be adjusted. Finally, open No. 2 exhaust valve and adjust Nos. 3 exhaust and 1 inlet.

The foregoing procedure is necessary on account of the cams being specially shaped to give an easy opening to the valves.

(2) A pronounced knock in engine when idling may be caused by backlash in the worm gearing which drives the camshaft. This backlash can be taken up as follows: Undo nut L. (See Figs. 4 and 6, facing p. 23) one turn only, and slip a suitable wedge at the back of N (Fig. 4) between back of nut and dash-board (this will prevent possibility of the camshaft moving back).

Bring the balancing cam box away from the vertical position to an angle of roughly 40 deg. (see fig. 6, and note that in some cases a grub screw X has to be removed). The balancing cam will now be out of action and the amount of backlash in the worm gearing can be judged by running the engine at a little more than idling speed and listening for a continuous knock or rattle. Next slacken the four Nuts O (Fig. 3) just sufficiently to allow of the bracket carrying the magneto being moved (before doing this see that the adjustment screw B (Fig. 3) is tight up against the magneto bracket), and turn the screw B in a clockwise direction very gently, when the valve noise should gradually disappear.

Very great care must be taken during this operation to avoid damage to the worm gears by setting them too hard in mesh. There should not be any signs of "grinding" or serious consequences will ensue. After screwing up B slightly, the balancing

## THE AUTOVAC.

The Autovac petrol feed system employs a small tank, into which petrol is drawn from the main tank by suction, and then delivered by gravity to the carburetter. The Autovac consists of two chambers, one inside the other, the inner one being the filling chamber from the main tank of the car, and the outer one the emptying chamber to the carburetter. The inner chamber is connected by a pipe to the induction port of the engine: thus a vacuum is created in it, and this vacuum both closes the valve between the two chambers, and draws up petrol from the main tank.

As the petrol flows into the inner chamber, it raises a valve float, and when this float has reached a certain point it operates a valve which shuts off the suction and at the same time opens an air valve. This admission of air relieves the vacuum in the inner chamber and thus causes the valve leading to the outer chamber to open, so allowing the petrol to flow through. From the outer chamber the petrol flows to the carburetter as required.

It is unlikely that it will ever be necessary to open up the Autovac. If essential to do so, however, the top can be removed, after all connections have been detached, by taking out the screws and running a knife blade carefully round the top in order to separate washers without damaging. The inner chamber, with valve, can then be lifted out. In replacing, make sure that the air port corresponds with the port on the body of the Autovac.

The air vent at top of Autovac must be kept clean (see Fig. 11), and **the strainer at the petrol inlet to Autovac should be cleaned out occasionally** (see Fig. 12). If the Autovac should ever fail to operate, examine this strainer first.

When the engine becomes warmed up, the mixture knob should be brought back towards the "weak" (or "normal") position. Experience will soon show the best position for ordinary running. About a quarter of a turn "rich" is generally the most suitable setting.

When the car is left standing, the knob should be in the "weak" (or "normal") position, otherwise the carburettor may flood.

Do not let the engine idle more than is absolutely necessary, as this is a cause of the engine sooting up.

The carburettor is set out in correct adjustment, and should not be interfered with unnecessarily. If essential to re-adjust at any time, the following procedure should be carried out: before attempting to tune up, run the engine until it is at normal running temperature. See that the jet orifice is at "weak" (or "normal") position. Fit the needle with shoulder flush with face of piston (needle retaining screw is in side of piston). If idling mixture is now too strong, withdraw needle from piston very slightly (1/64 in. may be sufficient): or if too weak, insert needle further into piston. It will be found that jet control is of great help in determining whether mixture is too weak or too strong.

The piston and needle must work perfectly freely up and down when in position. Should there be any sticking, the piston rod may be sticky or dry, and should be cleaned and a trace of oil applied to the rod only. A bent needle is also an occasional cause of sticking.

There is a gauze filter in the petrol inlet to float chamber, accessible for cleaning by removing hexagon nut beneath float chamber.

cam box should be brought back to the vertical position, and all valve noise should now be eliminated.

In rare cases it may be necessary to position the worm gears in a vertical direction as well as in the horizontal direction as described above. To do this, remove the magneto by taking off the nuts R (Fig. 3), and lifting magneto vertically away.

This will expose the splined head of the "pencil" (Fig. 7). Gently tighten this "pencil" by screwing in a clockwise direction (pliers may be used but must not be forcibly applied). When fairly tightly home, slack back to the nearest spline and refit magneto.

**NOTE.**—It is most important that the "pencil" is not screwed up too tightly, otherwise the engine will be made stiff, and the worm gears may jam. Take up the "pencil" only just sufficiently to stop the rattle in valve gear, and in any case only adjust it if the horizontal positioning of the worm gear is not sufficient in itself to eliminate the noise.

(3) Should there be any noise not due to the two foregoing causes, tighten slightly the spring in the balancing cam box by slacking off the nut A (Fig. 6), and screwing the square-headed pin Z (Fig. 6) in a clockwise direction as viewed from above (*i.e.*, apparently unscrewing it).

(4) To test the valve springs for unequal tension, which will also cause a noise in the valve gear, try if by pulling or pushing certain of the valve rockers, with the engine idling, it can be eliminated. If so, the tension of the valve springs affected requires adjustment. Withdraw the split pin from nut on valve stem: if the rocker required pushing to stop the noise, the nut should be unscrewed a turn or two to reduce spring tension. If the rocker required **pulling**, the nut should be screwed up somewhat.

**OIL PRESSURE GAUGE.** The needle of the oil pressure gauge should remain steady at between 50 and 60 lbs. when the car is running at anything over about 15 m.p.h. Below that speed it may drop slightly, but should never go below 20 lbs. even when engine is idling.

If the needle keeps on rising and falling while the car is running the cause will probably be: (a) shortage of oil in sump, or (b) dirty oil filters (see page 26).

If the needle of the oil gauge "dithers" instead of remaining steady, the cause lies in the pressure release valve in crankcase. This is accessible by removing hexagon plug at front of left-hand side of crankcase (viewed from driver's seat) (just above lower fan pulley on carburettor side of crankcase). When this plug is unscrewed the release valve spring and valve plunger can be taken out. The plunger should be smoothed with fine emery cloth as it will probably be sticking slightly.

Should this not be the cause it is possible that there is an air-lock in the pipe between oil-gauge and connection to cylinder head. The normal oil pressure can be increased if necessary by lengthening the release valve spring so that greater tension is put on the valve plunger, but this should only be done if the maximum normal oil pressure keeps below about 50 lbs.

## DECARBONIZING ENGINE BY OXYGEN PROCESS.

The engine can be decarbonized without removing head by making use of the oxygen process. A cylinder of compressed oxygen is necessary, also a strong flexible tube with a metallic nozzle of suitable length and shape to allow it to be inserted through the sparking plug holes, and to be turned round inside the head so that the stream of oxygen can be directed on to every part of the combustion chamber and piston top. A piece of  $\frac{1}{4}$  in. external diameter copper pipe, curved about 3 inches from its end, is suitable.

First turn off the tap on Autovac controlling supply of petrol to carburetter, and run engine until carburetter is quite dry. Remove bonnet completely by lifting away from radiator and from clip on dash. Protect wings and dash with suitable coverings, as the carbon leaves the cylinders in the form of burning granules.

Next rotate the engine until the exhaust valve of No. 4 cylinder (farthest from radiator) is just closing. (The position of exhaust valve can be seen through sparking plug hole.) The piston of No. 1 cylinder will now be approaching top dead centre, and, when exactly at top of stroke, No. 1 cylinder will be ready for decarbonizing.

Now turn on oxygen until a fairly powerful stream emerges from nozzle of pipe, and direct this stream at sparking plug hole for 30 secs. Then touch edge of sparking plug hole with a lighted taper, and the carbon will immediately catch fire. Gradually work the nozzle all round the interior of the combustion chamber, and on to piston head taking great care not to allow it to remain in any one position for more than a moment, until no more carbon emerges. During this process, the operator should stand well out of the path of the burning carbon.

When no more carbon emerges, the oxygen should be turned off, and a stream of compressed air should be directed into the combustion chamber just cleaned to remove any fragments. (A few strokes from a powerful tyre pump will accomplish this if no compressed air is available).

To prepare No. 2 cylinder for decarbonizing, turn engine until exhaust valve of No. 3 cylinder is just closing, and set piston of No. 2 cylinder on top dead centre, proceeding as before. To prepare No. 3 cylinder, set piston on t.d.c. with exhaust valve of No. 2 cylinder just closing. To prepare No. 4 cylinder,

## S.U. CONTROLLABLE JET.

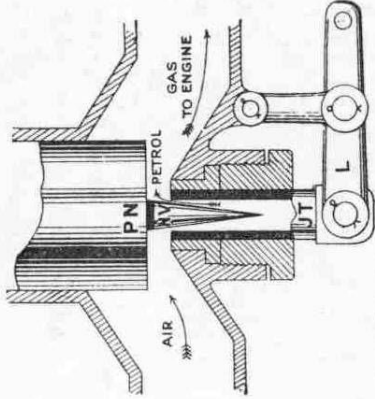


DIAGRAM A. Jet up. Weak Mixture.

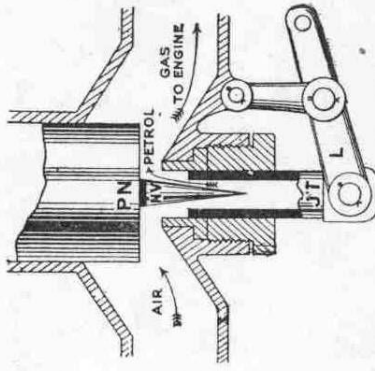
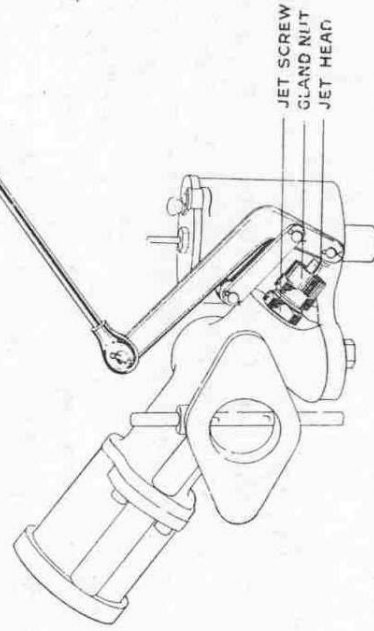


DIAGRAM B. Jet down. Strong Mixture.

Note:—These illustrations are purely diagrammatic.

DIAGRAM C.  
DASHBOARD  
CONTROL.

One complete turn of the knob to the right (clockwise) gives the strongest mixture, but any intermediate position can be used to suit the engine's requirements.



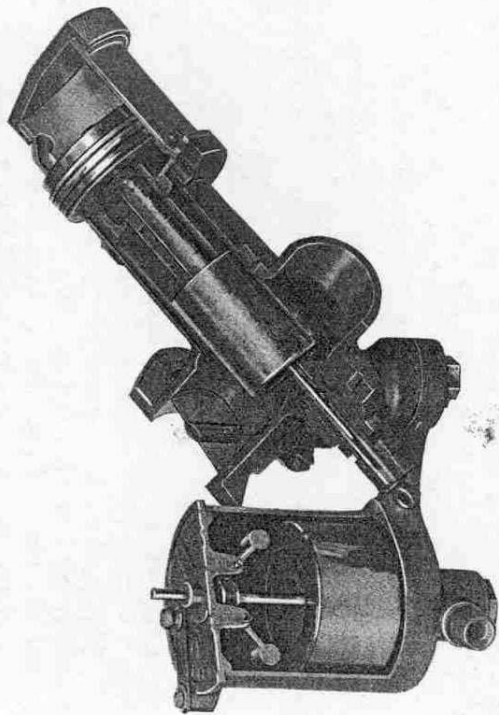
### OBJECTS:

1. To place in the hands of the driver an easy means of controlling the strength of the mixture, either on the road or when the car is stationary.
2. To give immediate starting even on the coldest morning.
3. To give maximum power when required.
4. To give greatest economy of fuel.
5. To give good running, even when engine is cold.



NOTE.—For cars equipped with Stromberg Carburetter, see separate instruction leaflet provided.

## THE S.U. CARBURETTER.



Sectional illustration of S.U. Carburetter.

The S.U. controllable jet carburetter is of the constant vacuum type, and consists of an infinitely variable choke and jet, automatically controlled by the suction of the engine. The illustration shows a section of the carburetter, and the diagrams the general arrangement of needle and jet. As the piston carrying the tapered needle is caused to rise by the action of the suction in the chamber seen on the extreme right of the sectional view, the needle is drawn upwards out of the jet orifice, and more petrol is passed, more air being at the same time admitted through the port shown covered by the piston.

The mixture may be strengthened at will by the driver, by means of the knob on the fascia board inside the car. As this knob is turned in a clockwise direction, so the jet orifice is lowered away from the needle, and more petrol is passed without a corresponding increase in the amount of air admitted. This enables easy starting without need for "ticking" the float chamber.

set piston on t.d.c. with exhaust valve of No. 1 cylinder just closing.

The entire operation can be carried out inside of 30 mins., and a 10 ft. cylinder of oxygen should be sufficient for one engine.

## CLUTCH AND GEARBOX.

(The letters refer to fig. 10, p. 36).

It is essential that the three set pins A be given exactly the same clearance. The clearance may be about 10/1000 inch.

Should clutch slip set in, uncotter the nuts on each of the clutch springs, tighten up each nut one turn, and test the clutch.

The pressure of the clutch pedal is transmitted to the clutch through the ball race B, pressing against retaining ring C.

To remove gearbox, take off all clutch springs. Detach oil pipes D. Undo pinch bolt F. Take off universal ball joint housing N, and screw ball O back along shaft until clear of threads. Uncotter and take off nuts of gimbal ring E: split gimbal ring and push rear half of universal joint back along shaft, being careful before doing this to place a block of wood under torque tube to prevent threads being damaged in event of torque tube falling to ground. Remove change speed bracket G, and disconnect brake pedal and accelerator connections and throttle ball joints.

Next take off dynamo wiring and undo all nuts P of bell housing except the two top ones. Place a trolley under the gearbox and pack with wood until the weight of gearbox is taken. Then undo the remaining two top nuts of bell housing, and draw trolley, with gearbox, *straight* back so as not to damage clutch spigot Q.

When gearbox has been detached, to take off clutch remove cover of dynamo housing, undo strap and pull off dynamo. Letting chain fall. Withdraw clutch actuating shafts by undoing big pinchbolt nuts H on horseshoe J. After having taken off brass cap on outside of clutch pit, remove horseshoe complete and withdraw clutch assembly from clutch shaft.

Then, to remove retaining ring C move ball race B forward along sleeve, when it will be found possible to remove the split retaining ring C. If this ring should be carelessly replaced it is liable, on clutch application, to break and allow clutch pedal to fall to floorboard.



## CLUTCH AND GEARBOX.

Note:—All bearings are made to special limits, and replacements must be obtained from the Rover Company.

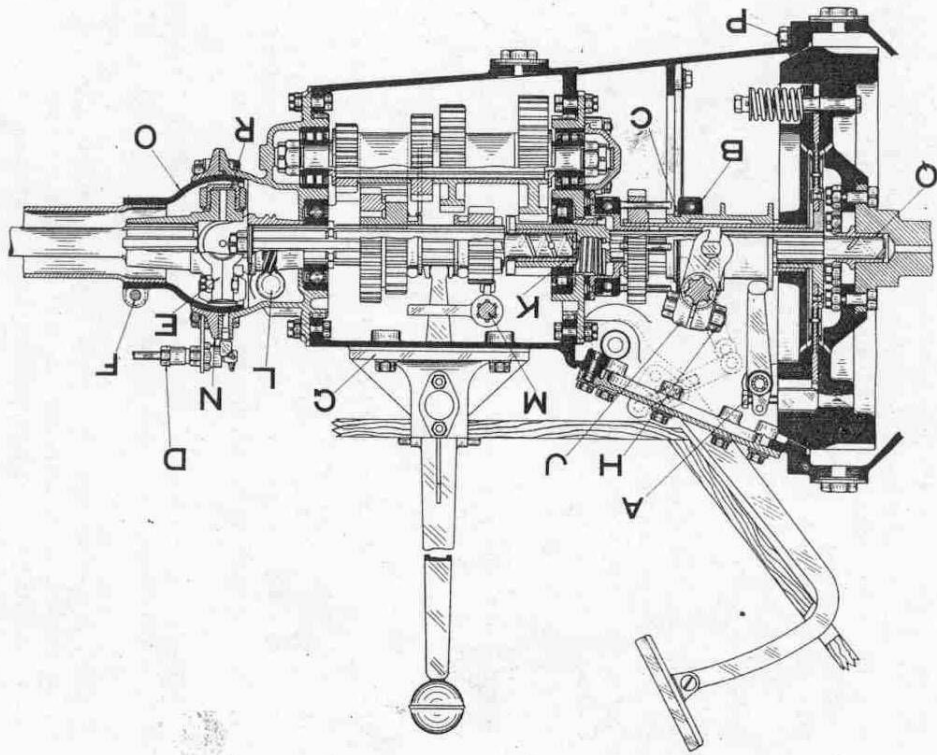


Fig. 10.—Referred to on pp. 26, 35, 37 and 46.

Examination of gears in gearbox can be done through the aperture uncovered when gear-change bracket G is detached. If necessary to remove any gears this can be done without detaching gearbox complete: remove ball joint as before and all split-cottered nuts round back end of gearbox. Remove interlocking shaft and fork M, and reverse selector shaft and fork. Pull end-cover, with primary shaft and gears right out. The secondary shaft may not come away with primary shaft, but can now be pulled out without difficulty.

When replacing gears and shafts after previous operation, it is essential that the steel thrust washer K is not overlooked. Should it have come away with gear shaft it must be carefully replaced in the position shown before the gears are put back. On no account omit to verify its presence.

To rebuild universal joint E, take off speedometer drive L, find mark on outside of gimbal ring and offer up the other half with its mark dead opposite. Push over bolts on forward half, holding this in place with a tommy bar inserted through speedometer drive hole. Unless this procedure is followed, difficulty will be found in reassembling the two halves.

It is important to note that the loose blind-end bushes R are not nipped on their corners. Bolt up and cotter all nuts on universal joint. Now screw up ball joint into place until back axle spring shackles stand vertical. Replace torque ball cover and pull up pinch bolt F on ball itself. For adjusting ball joint use a tommy bar in bolt hole.

When replacing gear change bracket G, it is essential that the gear gate be replaced right way round, and that striking lever goes *into* interlocking fork and not on either side of it.

The last operation should be the replacing of the dynamo. Insert the dynamo into its seating, and set chain over the sprocket, letting chain lie loose, and, by sighting the chain through the inspection cover in clutch pit fit chain so that chain is in correct alignment when clutch is "in." The tension can be set by rotating the dynamo, but half-an-inch of slack must be allowed in the chain to prevent humming arising from it. Care must be taken to replace wiring correctly.

When the gearbox has been dismantled, it must be filled with a supply of engine oil by means of the filler on the side of the gearbox.