SINGER

INSTRUCTION BOOK *and* REPAIR MANUAL

Price 5/-

IMPORTANT

WE draw your attention to the notice regarding speed that is affixed to the inside of the driver's compartment. By observing these rules the car will give better service and smoother running. Pistons, rings, cylinder walls and bearings will by this time have a surface that can never be obtained by fast, hard driving. Even after the five hundred miles recommended, it will pay to increase the maximum speed of travelling with discretion.

When cars are sent out from our works, a small quantity of Wakefield's "Castrollo" is included with the petrol at the rate of half-an-ounce to two gallons. The object of this is to provide an oily mixture which serves to lubricate slightly the upper part of the cylinder walls and piston rings. The continuance of this is strongly recommended as it is extremely valuable when the engine is started up, especially after the car has been garaged for a few days.

PREFACE

THE Singer Cars are so designed that a sound and economical performance may be expected with the minimum of attention from the owner. Every effort has been made to render their manipulation as easy as possible and to make all necessary adjustments very accessible.

Three Models are dealt with in this Manual, the 1½-Litre, 14 h.p. and 2-Litre Cars, and although they are very similar in construction, their differences will be clearly shown in the specifications and instructions.

In compiling this book, some knowledge of the care and operation of a motor car has been pre-supposed, and the instructions contained herein will, if followed with reasonable care, enable the owner to keep the car in excellent mechanical order.

Advice is given to enable the owner to trace a fault, and reference is made to that portion of the text which will explain the correction of a fault.

The book is fully illustrated with diagrams which have been carefully prepared to give useful information in the simplest form, instead of making long technical descriptions. The arrangement of all mechanical parts is carefully shown by photographs and sectional diagrams of all units, and the information given will be found sufficient in the majority of cases.

If at any time difficulties arise or further information is required, advice will be given willingly upon application to the Technical Department of our Service Depot at Coventry, but it is essential in any communication regarding the car, that you quote the chassis number which will be found stamped on a metal plate fixed to the dashboard under the bonnet.

The interest of Singer & Company in their productions does not end with delivery of the car—it continues directly in a one thousand miles, free of charge, after-sales service, which is available to every owner through the Singer Dealer from whom the car was purchased.

This service forms an extension of the Factory Inspection organization and serves to ensure that each car during its preliminary running in, is maintained in good order.

The service comprises, among other things, general inspection and, if necessary, the tuning and adjustment of the carburetter and ignition system, adjustment of tappets and exchanging the lubricant in the engine, gear box and rear axle, the lubricant used for replenishing purposes being, of course, a chargeable item.

In addition to this, Singer & Company maintain a fleet of fully equipped Service Vans, manned by highly skilled mechanics who are experts in repairing Singer Cars.

These vans are continually touring the country, and are at the service of any owner who is experiencing difficulty. It is merely necessary to communicate with one of our Service Depots, giving a rough idea of the nature of the trouble which is being experienced; instructions will then be given to the travelling Service Representative nearest to your district, who will call upon you at the first opportunity.

The recommendations in this book should not be construed as extending or modifying in any way, the liability of this Company as determined by the Singer guarantee reproduced opposite.

GUARANTEE

WE warrant that in the manufacture of new Vehicles we have taken all precautions which are usual and reasonable to secure excellence of materials and workmanship and we undertake that if any defect is disclosed in any part of a new vehicle within six months of the date of delivery of such vehicle we will (provided such defective part is returned to our Works Carriage paid) examine the part alleged to be defective and if on such examination the fault is due to defective materials or workmanship for which we are responsible we will repair or replace the defective part free of charge.
It must be clearly understood that this Guarantee is given only on the understanding that the vehicle has been purchased by the owner as a new vehicle, for which the Company's List Price has been paid.

The foregoing Warranty is limited to new vehicles manufactured by us and is in lieu of any Warranty (or Condition) implied by Common Law Statute or otherwise as to the quality or fitness for their purpose of any goods manufactured replaced or repaired by us every such implied Warranty (or Condition) being in all cases excluded and our liability under the terms of this Warranty is strictly limited to the replacement or repair and despatch to the sender carriage forward of the part replaced or repaired. We shall not be responsible for any other liability expenses damages or loss which may occur consequent upon any defective material or workmanship of any description.

The Warranty shall not apply to any defects caused by or arising in the following circumstances and in which instances all other warranties (or Conditions) implied by Common Law Statute or otherwise are also expressly excluded :—

(a) Defects caused by wear and tear accident misuse or neglect.
(b) Defects in any Vehicle which has been altered in any manner whatsoever or upon which the identification numbers have been altered or removed.

This Warranty shall be construed as including and shall be limited in its application to :—

(a) New Vehicles or Goods manufactured by us and which are bought direct from us or from one of our duly authorised Dealers.
(b) Replacements supplied by us direct.

and all other Warranties (or Conditions) implied by Common Law Statute or otherwise are excluded.

We give no Warranty of any description in respect of any Secondhand Vehicles or goods sold by us or by our authorised Dealers or by any other person nor shall any warranty (or Condition) be implied whether arising by Common Law Statute or otherwise.

All Agreements and quotations by us to supply goods execute repairs or make replacements shall be deemed to include the above Warranty and the exclusion of all implied Warranties and/or Conditions.

We do not warrant the specialities of other manufacturers fitted to our vehicles such as tyres electrical fittings lamps and horns. We endeavour to secure the best quality in these articles and the makers whose names usually appear thereon are generally willing to replace any defective part. We shall be pleased at all times to furnish the maker's name and address.

Conditions of Warranty

If a defective part be found in any vehicle or goods it must be sent to us carriage paid and accompanied by an intimation from the sender in writing that he desires to have it repaired or replaced free of charge under this Warranty. The Sender must also furnish us at the same time with :—

(a) The number of the Car.
(b) The name of the Dealer if any from whom the car was purchased.
(c) The date of the purchase of the car or the date when the repairs were executed or replacements made as the case may be

The Sender shall accept our decision as final and conclusive on all claims for replacement of or repairs to defective material and/or workmanship and to the exchange of defective parts. If these Conditions are not strictly complied with the goods received by us will lie at the risk of the Sender and this Warranty shall not be enforceable.

We shall not be responsible for the cost of any labour involved in connection with the removal or replacement of any defective part from or to the vehicle.

Repairs and Replacements

All parts sent for repair or replacement must be forwarded carriage paid and bear the sender's name and address: the car number and year of manufacture should also be given. The foregoing Warranty is given by us in respect of all repairs to Vehicles or parts of Vehicles executed by us or replacements supplied by us direct but for three months only and subject nevertheless to the reservations limitations and conditions therein contained and all other conditions or warranties implied by Common Law Statute or otherwise are excluded. We shall not be responsible for any other liability expenses damages or loss which may occur consequent upon any defective material or workmanship of any description in connection with any replacements supplied or repairs executed by us.

We accept no responsibility whatsoever for any replacements or parts which are not fitted by us to a Vehicle even if such replacements or parts are supplied by us.
Cars which are sent for repair will only be driven by our employees at the risk and responsibility of the owners and repairs of Cars are undertaken only on the assumption that the owners give us authority to drive the cars on their behalf.

SINGER & CO. LTD
COVENTRY.

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SPECIFICATION

ENGINE. Monobloc casting, six cylinders, detachable cylinder head, carrying overhead valves, camshaft and rocker assembly.

Ample provision is made for water cooling purposes, both the block and head being proportioned to avoid distortion. Cooling is thermo-syphonic assisted by fan.

The cylinder block casting is extended well below the centre line of the engine and carries a crankshaft of unusually robust dimensions. The crankshaft is of heat treated steel, carefully balanced, provided with four main bearings, and a vibration damper is mounted at the front end. The connecting rods are of H-section high tensile steel, with die cast white metal bearings. The pistons are of a special aluminium alloy, drilled for oil economy, in conjunction with a special design of scraper ring. The gudgeon pins are fully floating and fitted with end pads.

The valves, of special steel, are operated by overhead harmonic cams and rockers. The camshaft is driven by a duplex roller chain, and provision is made for adjustment of the chain tension.

Engine lubrication is drawn through a filter in the sump, and forced under pressure to all main and big-end bearings, to the intermediate timing gear assembly and to the overhead camshaft assembly. The oil filler cap, in the cover of the camshaft assembly is airtight, and fumes are conveyed by a breather below the floor board level of the car.

The carburetters are of the Solex self-starting type, and are carefully adjusted to give the best results before the car leaves the works. Petrol is fed to the carburetters by an S.U. electric petrol pump, incorporating a filter and is drawn from a petrol tank at the rear of the car.

DATA

	1½-Litre.	14 h.p.	2-Litre.
Bore	59 m/m.	60 m/m.	65 m/m.
Stroke	91 m/m.	95 m/m.	100 m/m.
Cubic capacity	1,493 c.c.	1,611 c.c.	1,991 c.c.
R.A.C. Rating ..	12.95 h.p.	13.4 h.p.	15.72 h.p.
Tax	£13 os. od.	£14 os. od.	£16 os. od.

BRAKE HORSE POWER

	1½-Litre.	14 h.p.	2-Litre.
1,000 r.p.m. ..	12.5 b.h.p.	12.3 b.h.p.	16.6 b.h.p.
2,000 r.p.m. ..	26.0 „	24.3 „	33.0 „
3,000 r.p.m. .	38.0 „	33.5 „	46.0 „
Peak	46.0 „	37.25 „	49.0 „
Cooling capacity ..	24 pints	24 pints	32 pints
Amount of Anti-Freeze Glycerine	6 „	6 „	8 „
Petrol capacity	10 gallons	10 gallons	12 gallons

TOP GEAR ACCELERATION

(Driver and Passenger).

	1½-Litre.	14 h.p.	2-Litre.
10-30 m.p.h.	11 secs.	11 secs.	10.5 secs.
30-40 m.p.h.	8 „	11 „	11.0 „

MAXIMUM SPEEDS

	1½-Litre.	14 h.p.	2-Litre.
Top gear	73 m.p.h.	63 m.p.h.	66 m.p.h.
Third gear	65 „	50 „	52 „
Second gear	40 „	35 „	37 „

CLUTCH. Single dry plate, cushion type, having flexible centre. (1½-Litre Model fitted with heavy duty single dry plate clutch to give rapid take up of drive).

GEAR BOX. Permanent mesh type, mounted as a unit with the engine and providing four forward speeds and reverse, the second and third speeds being silent. The 14 h.p. and 2-Litre models are fitted with the pre-selective clutchless gear-change, incorporating a free-wheel and Startix automatic starting.

The gear box is secured to the engine by means of an extension case casting, housing the clutch, and carrying the clutch withdrawal mechanism. The gear ratios are as follows :—

	1½-Litre.	14 h.p.	2-Litre.
Top	5.66 : 1	5.66 : 1	5.22 : 1
Third (Silent)	7.18 : 1	8.43 : 1	7.78 : 1
Second (Silent)	11.57 : 1	11.55 : 1	10.65 : 1
First	21.05 : 1	19.18 : 1	17.70 : 1
Reverse	26.00 : 1	26.00 : 1	24.00 : 1

ENGINE UNIT MOUNTING. Of VIBRO-DAMPER design, carrying engine, clutch extension and gear box as one unit.

CARDAN SHAFT. An open type tubular shaft of large diameter to provide against "whirling" and consequent vibration. Hardy-Spicer Universal Joints are fitted.

REAR AXLE. Of the semi-floating type, with a noiseless spiral bevel final drive and bevel gear type differential, housed in an exceptionally strong steel casing.

FRONT AXLE. A high tensile steel stamping.

STEERING. New pattern type worm and nut (patented), rigidly anchored to the frame. Designed for self-centring action, and definite but easy control.

DIAMETER OF TURNING CIRCLE, IN FEET

1½-Litre .. 39 ft. 14 h.p. .. 38 ft. 2-Litre .. 42 ft.

FOUR WHEEL BRAKES. Lockheed hydraulic brakes, operating on 13in. brake drums. Foot brake operates on all four drums. Hand brake operates independently on rear drums only.

STOPPING DISTANCE FROM 30 M.P.H.

1½-Litre .. 26 ft. 14 h.p. .. 30 ft. 2-Litre .. 30 ft.

FRAME. Downswept pressed steel with specially designed cross-members, giving exceptionally low centre of gravity.

SUSPENSION. Wide, long semi-elliptic springs, assisted by Armstrong hydraulic shock absorbers, (Hartford heavy duty friction type shock absorbers to 1½-Litre Models). All springs are mounted upon silentbloc bushes.

SPRING DIMENSIONS

ALL MODELS .. .. Front—32⅜" x 1⁹⁄₁₆" Rear—46⅜" x 1¾"

ROAD WHEELS AND TYRES. Five detachable wire wheels, with "Magna" type hubs are fitted to the 14 h.p. and 2-Litre models, and the tyres are size 18 x 5.00in. and 18 x 5.25in. low pressure, respectively. To the 1½-Litre model, "knock-on" self-locking type hubs are fitted with tyres size 18 x 5.25in. low pressure to the four-seater and coupe models.

CHASSIS DIMENSIONS

	1½-Litre.	14 h.p.	2-Litre.
Wheel base	9ft. 0½in.	9ft. 0½in.	9ft. 3½in.
Track	4ft. 4in.	4ft. 4in.	4ft. 8in.
Ground clearance	8in.	8in.	8in.

Lubrication by Tecalemit high pressure grease gun to nipples in accessible positions. A large number of oiling points has been eliminated from the suspension by fitting Silentbloc bushes to all spring shackles.

CHASSIS EQUIPMENT. 12-volt 51-ampere battery located under driver's seat. The starter motor is of the automatic pinion type engaging with a geared ring machined on the flywheel. On the 14 h.p. and 2-Litre models, Startix automatic starting equipment is fitted as standard. The instrument board carries a fuel gauge, speedometer, oil pressure gauge, ammeter, and an eight-day clock, tastefully grouped and illuminated by concealed lighting. Dip and switch headlamps are fitted. Ignition control is automatic, but a hand control is fitted to the 1½-Litre model.

UNLADEN WEIGHTS

	1½-Litre.				14 h.p.				2-Litre.			
	Ton	Cwt.	Qr.	Lb.	Ton	Cwt.	Qr.	Lb.	Ton	Cwt.	Qr.	Lb.
4-seater Tourer ..	1	2	0	14		—				—		
Coupe	1	3	0	21		—				—		
Saloon		—			1	4	2	0	1	5	0	21
Continental Sal.		—			1	4	2	0	1	3	2	0

BODY EQUIPMENT. Safety glass all round, sliding roof, winding windows, window ventilators, adjustable bucket seats with Leveroll fittings, rear seat arm rests at sides and centre, pneumatic rear cushion, adjustable foot rest, furniture hide upholstery, pile carpet and under-felts, rope pulls, rear and side blinds, door pockets, ashtrays, roof lamp, gloves boxes, electric windscreen wiper, private door lock, interior driving mirror, walnut cappings, front and rear bumpers, spare wheel cover, traffic direction indicators and luggage grid.

On the Continental Saloon Model, a large trunk is situated at the rear to accommodate luggage and tools. The rear door, opening sideways, gives access to the luggage compartment, and the top door, opening upwards, discloses the tools.

1½-LITRE "LE MANS" TWO-SEATER

THIS is a special model prepared for Sports purposes, and the following brief description will show that it combines a modified 1½-Litre six-cylinder Sports engine in a short wheel base frame, specially designed to give the high power to weight ratio necessary for competition and speed work.

ENGINE. Bore and stroke, etc., as the 1½-Litre model, but the detachable combustion head has been specially treated to assist gas flow; the camshaft, valves and rocker gear are of special design.

COOLING SYSTEM by centrifugal water pump and fan, capacity 20 pints, quantity of anti-freezing glycerine 5 pints.

IGNITION. Special type of high tension coil and distributor to ensure efficient working at high speeds. Automatic and manual control.

CARBURETTERS. Two 30m/m. type Solex FH, with hot-spot manifold.

ENGINE LUBRICATION. The sump is of extra large capacity, of cast aluminium alloy with cooling fins and adaptor for oil sump thermometer.

FRAME. Double downswept pressed steel with specially designed cross members giving exceptionally low centre of gravity.

SPRING DIMENSIONS. Front, 27in. x 1½in. Rear, 41½in. x 1½in.

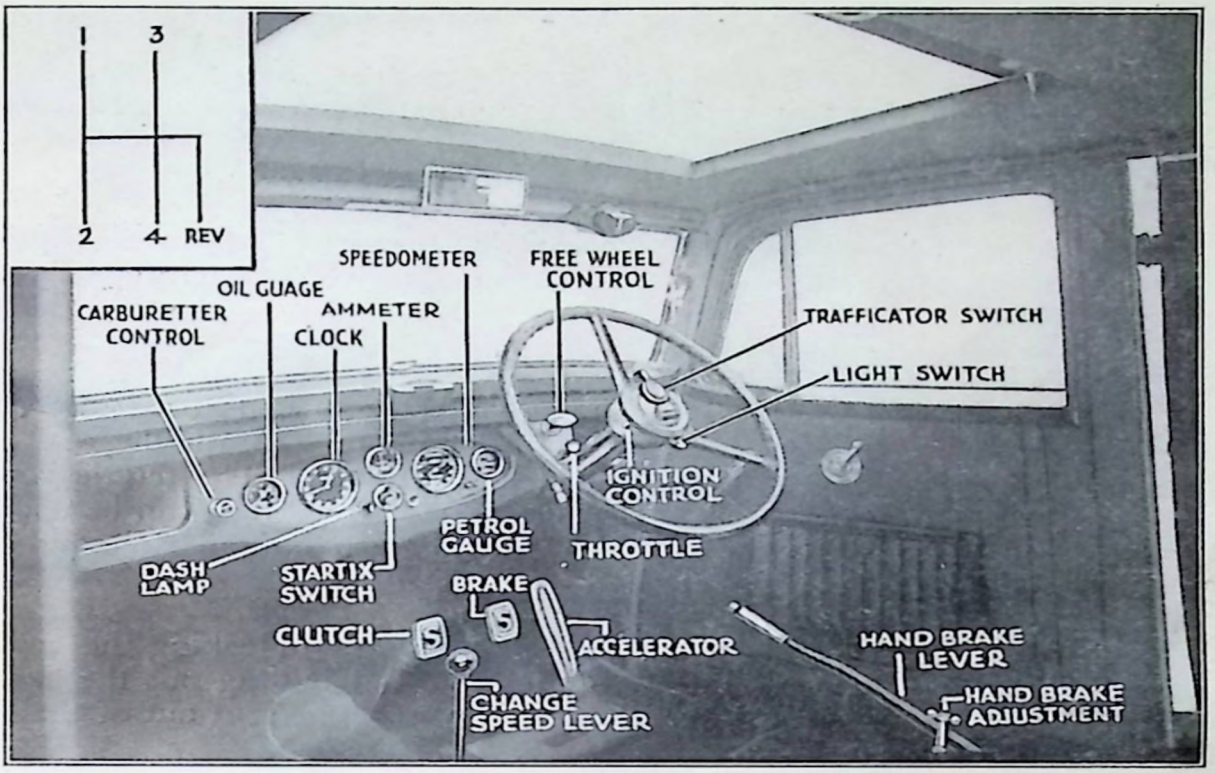
CHASSIS DIMENSIONS. Wheel base, 7ft. 8in.; track, 3ft. 9in.; ground clearance, 6½in.

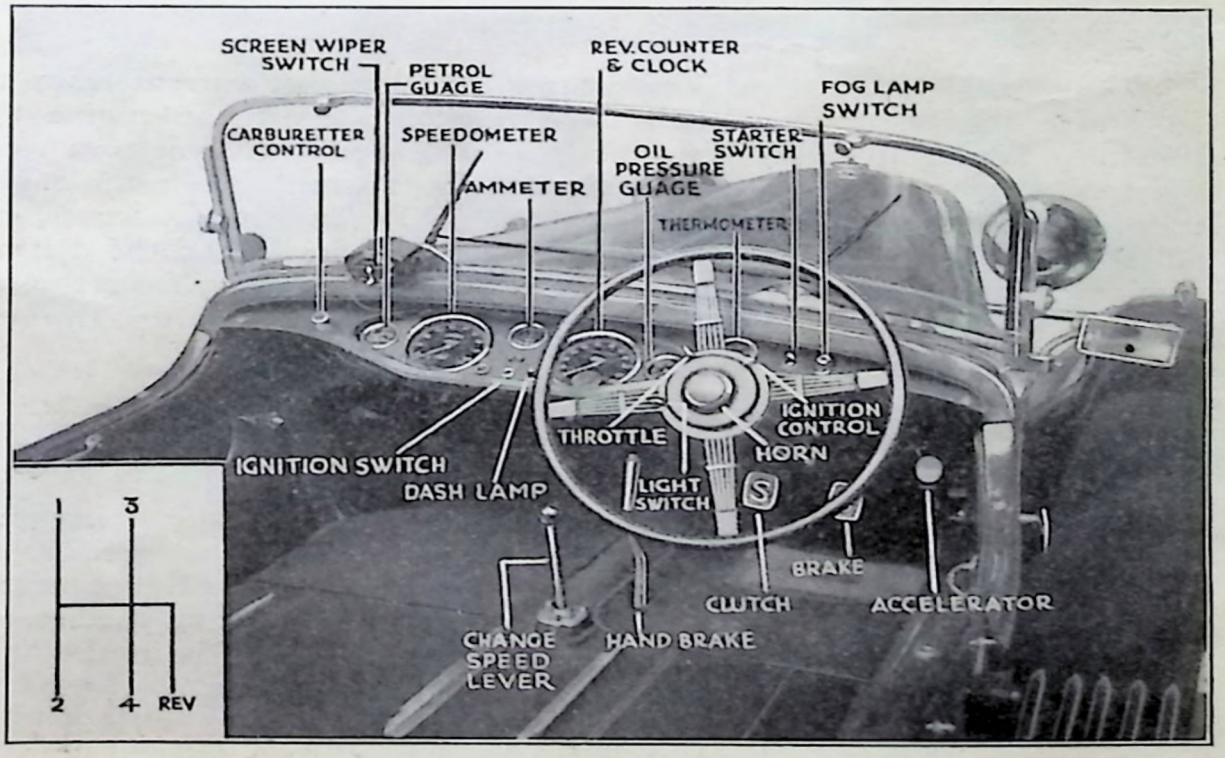
WHEELS AND TYRES. Six racing type "knock-on" wheels with self-locking hubs and special wing nuts. Six Dunlop 4.75 x 19in. tyres.

CHASSIS EQUIPMENT. Large dial speedometer, revolution counter and clock combined, dash reading radiator thermometer, oil pressure gauge, dual windscreen wiper, dash reading oil sump thermometer, tools and number plate.

DIAMETER OF TURNING CIRCLE. 38ft.

ELECTRICAL EQUIPMENT. 12-volt, 51-ampere hour battery, Solenoid switch for dashboard control of starter motor, large output dynamo, ammeter, head, side and tail lamps, two dash lamps, headlamps, high frequency tuned horn and road lamp mounted low on special badge and lamp bar.


1
3
2
4
REV
SPEEDOMETER
FREE WHEEL CONTROL
OIL GUAGE
CARBURETTER CONTROL
AMMETER
CLOCK
TRAFFICATOR SWITCH
LIGHT SWITCH
IGNITION CONTROL
PETROL GAUGE
THROTTLE
DASH LAMP
STARTIX SWITCH
BRAKE
CLUTCH
ACCELERATOR
HAND BRAKE LEVER
CHANGE SPEED LEVER
HAND BRAKE ADJUSTMENT


SCREEN WIPER SWITCH
PETROL GUAGE
REV.COUNTER & CLOCK
FOG LAMP SWITCH
CARBURETTER CONTROL
SPEEDOMETER
STARTER SWITCH
OIL PRESSURE GUAGE
AMMETER
THERMOMETER
IGNITION CONTROL
THROTTLE
HORN
IGNITION SWITCH
DASH LAMP
LIGHT SWITCH
BRAKE
CLUTCH
ACCELERATOR
CHANGE SPEED LEVER
HAND BRAKE
1
3
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REV

CONTROL OF THE CAR

ON taking delivery of a new car, be assured that everything is in order and that any special equipment has been satisfactorily fitted. The tool kit should be checked and packed away in the tool box, and the supply of oil, petrol and water checked over.

No doubt the Supplier will have attended to matters of this description, but a cursory examination of the coachwork and chassis generally is well worth while.

There are several adjustments provided for the personal comfort of the driver and passengers. The front seats can be adjusted for comfort by releasing the locking lever which will be found underneath the seat and sliding the seat backwards or forwards on its runners. The scuttle ventilators are easily operated from the inside, and the windscreen can be opened by releasing two thumb screws on the windscreen bottom rail, and the screws on the side swivels.

The windscreen wiper is brought into action by unlocking the curved handle, swinging the wiper arm into position and pulling out the switch knob. Stop the wiper by switching off and locking the arm out of the line of vision.

The controls are conveniently grouped about the driving position, and in the majority of cases their purpose is self-explanatory. Some, however, are worthy of note and reference to the illustration will no doubt be of service.

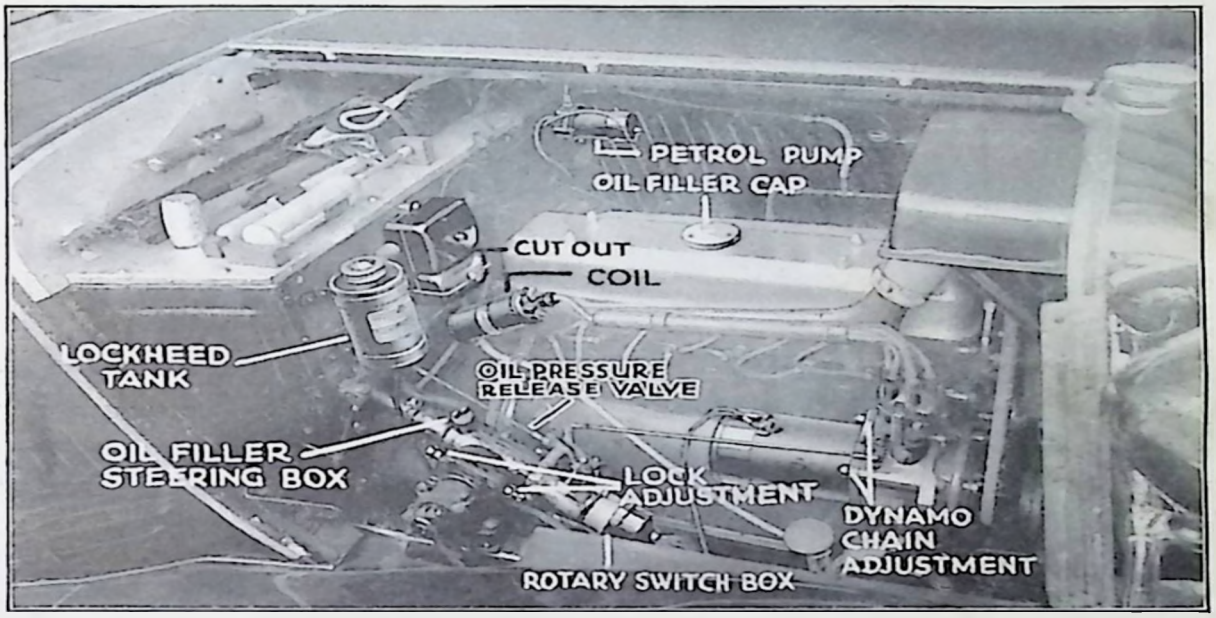
The ignition switch and key control the supply of current from the battery to the ignition coil, and must be "on" before the engine will function. A warning lamp gives a red light if the switch is left on when the engine is not running, and the light is also apparent while the engine is running but the dynamo not charging. This condition, however, can only be expected when the engine is running very slowly and the dynamo charging rate insufficient to balance the drain on the battery from the coil ignition. **Always remove the switch key when leaving the car standing.**

All controls and the change speed lever positions are fully illustrated in the photographs on the previous page.

When preparing the car for the road there are three items which must receive attention : petrol, oil and water. As explained in the specification, petrol is carried in a tank at the rear of the car and an electrically operated gauge with the dial situated on the instrument panel indicates the amount of petrol in the tank, the whole time the engine switch is in the "on" position.

It is essential that the level of oil in the engine be maintained near the full mark on the dip stick, which will be found on the nearside of the

engine. To obtain a correct reading of the level of oil in the sump by means of the dip stick, run the engine for a short time until the oil is warm, then with the engine stopped, withdraw the dip stick, wipe it, replace to its full extent and withdraw again. The level of oil will then be accurately indicated. The oil filler will be found on the engine top cover, and is air-tight in order to prevent fumes from escaping. An oil breather is, of course, fitted to the rear of the engine block which conveys fumes below the body level.



The radiator should be filled with water to a level not higher than 1in. below the filler cap, and it is preferable to use soft water for the cooling system in order to avoid an accumulation of lime deposits which will eventually impede the water circulation.

It is advisable before starting the engine to make a practice of using the starting handle for a few revolutions in order to ease the load on the starter motor caused by the natural "gumminess" of the cold engine oil. This is especially important in winter time. After this, the engine should start quite easily when switched on, and the carburetter starter control knob pulled out to bring the self starter carburetter jet into action. Should the carburetter be set to give a very low idling speed with a warm engine, it will help starting if the accelerator pedal be very slightly depressed while the starter switch is brought into operation. Release the starter switch immediately the engine fires, and when the engine has been running for about two minutes push back the carburetter starter control knob. It SHOULD NOT BE NECESSARY TO USE THE CARBURETTER STARTER CONTROL WHEN RESTARTING A WARM ENGINE.

If the car is fitted with LUCAS STARTIX AUTOMATIC STARTER equipment, this appliance starts the engine automatically immediately the engine switch is turned on to the "auto" position. An alternative is provided by turning the switch to the "hand" position. This is for non-automatic starting and switches on the ignition only. To start the engine with the switch in this position, it is necessary to press the starter button in the usual way.

For normal running, turn the switch key to the "auto" position for automatic starting. Immediately the engine fires, the starter is automatically switched off, and when the engine is stalled in traffic, the Startix automatically waits for one second before reclosing the main switch, thus delaying re-starting until the engine has actually come to rest. In cold weather the delay action automatically frees a sticking starter pinion.

Full information concerning the Startix equipment is given in detail on page 75.

As pointed out in the preface of this book, some knowledge of the care and operation of a motor car has been pre-supposed, and, therefore, we do not propose to deal at length with the method of driving the car.

It should, however, be understood that no two cars, even from the same maker, are exactly alike in performance, and as a consequence any instructions regarding the setting of controls, instruments, etc., should be taken as general remarks that are variable within narrow limits.

Perhaps a few words concerning the gear box and the method of changing gear will be of assistance to the novice.

The Singer gear box has been specially designed for easy operation, and with a little practice no difficulty should be experienced in making a smooth change. When changing up, release the accelerator, depress the clutch pedal and move the gear lever into the position selecting the desired gear, then let the clutch pedal gradually in to pick up the drive. Do not at any time force the gear lever, but repeat the operation until the gear is easily engaged. With a little practice gear changing becomes a subconscious action and an easy change will be general.

Gear changing down is a similar procedure, excepting that pressure on the accelerator pedal is maintained while the clutch pedal is depressed and the gear lever moved to the next position. This, too, requires a little practice before the driver is able generally to effect a good change.

With the clutchless gear change, these instructions may be disregarded. It is merely necessary to depress the clutch pedal only to select the lowest gear when the car is stationary. After this the clutch pedal may be entirely disregarded. Once the car has started all that is necessary to change gear, is to release the accelerator pedal, allow the engine to idle for a second or so, and then move the gear lever into the next gear position, and changing down is quite as easily effected. There is no necessity to speed up the engine revolutions before engaging the lower gear but merely to release the accelerator pedal and move the gear to the required gear position. This can be done with any gear at any speed at which the car would normally travel on that gear.

The only point to be remembered is THAT THE ACCELERATOR PEDAL MUST BE RELEASED TO ALLOW THE ENGINE REVOLUTIONS TO FALL BELOW DRIVING SPEED.

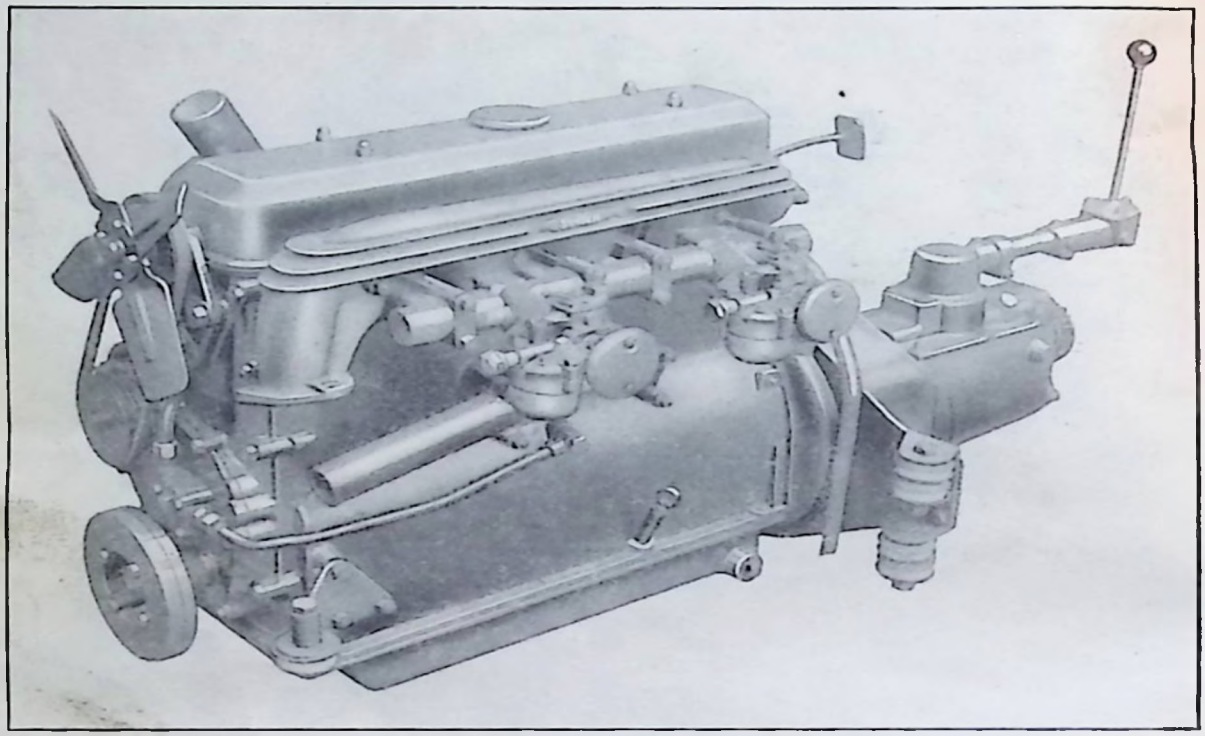
The free-wheel is used to give the advantage of the pre-selective gear. Assume that the car is approaching a corner still at some distance. The pressure is relieved on the accelerator pedal so that the car is coasting, third gear can be engaged before reaching the corner, the car continuing to coast. Immediately the corner is turned and the accelerator pedal depressed, third gear comes into operation.

It has been said against the free-wheel that it is not possible to take advantage of the retarding effect of the engine when the accelerator pedal is released, to enable a downward gradient to be taken without using the mechanical brakes. There is no danger whatsoever with the Singer device, as a simple lock is fitted with a plunger on the dashboard, which can be instantly engaged at any reasonable speed, giving an entirely solid drive.

To make use of this, the accelerator pedal should be lightly depressed so that the engine is just pulling, and the plunger on the dashboard may then be pulled out.

HAVING described briefly in the specification the general details of the car, it is proposed now, to deal in detail with the lubrication, maintenance adjustments and instructions for overhauling the various units.

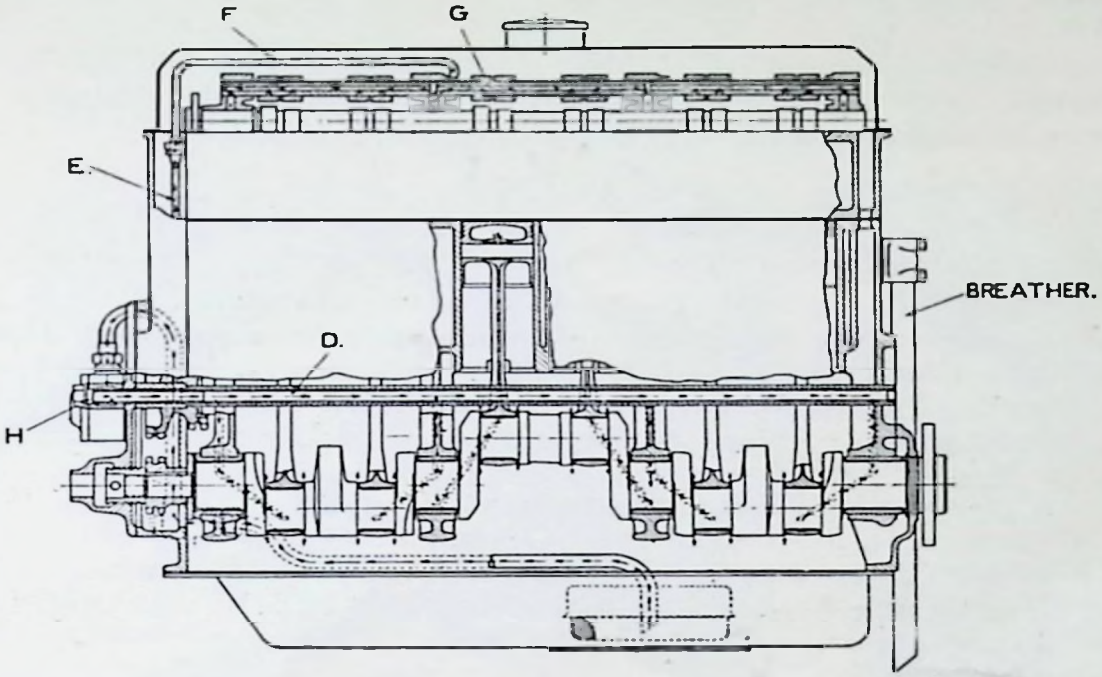
ENGINE



To the new car owner, we cannot give greater service than to impress upon him the importance of regular attention to lubrication. A lubrication chart summarising the attentions necessary is given on page 50 and this will be found of valuable assistance in obtaining trouble-free running.

A list of recommended lubricants also will be found on page 51 and we strongly advise owners to use only the oils specified. ON NO ACCOUNT MUST CHEAP OILS BE USED.

Lubrication of the engine is automatic providing the correct oil level is maintained in the engine sump, but it is always advisable to check the correct functioning of the lubricating system by the gauge mounted on the instrument panel. When the engine is running, the oil gauge should indicate a steady pressure of between 20/25 lbs. per square inch when the engine oil is warm and the car running at about 20 miles per hour in top gear. It is, of course, understood that a higher pressure reading will be obtained when the engine oil is cold.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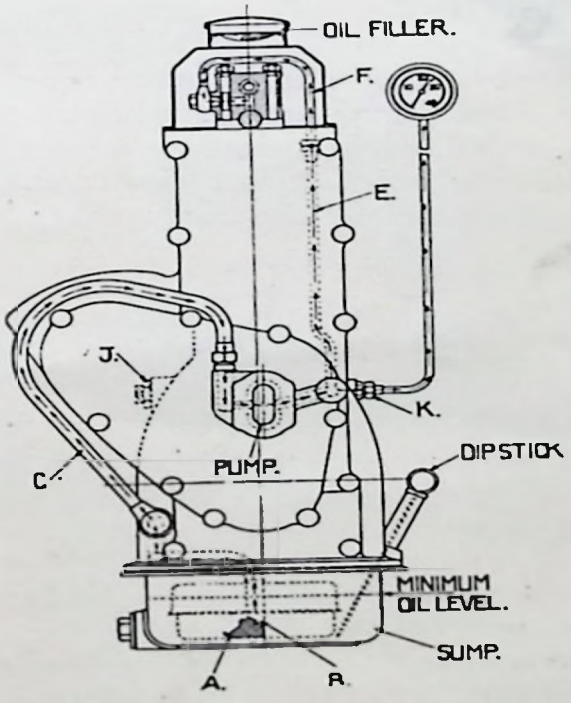
G
E.
BREATHER.
D.
H


OIL FILLER.
F.
E.
J.
K.
DIPSTICK
PUMP.
C.
MINIMUM
OIL LEVEL.
SUMP.
A.
B.

Should the gauge read very low, or the needle oscillate rapidly, this indicates that the lubricating system is not functioning correctly, and steps must be taken to trace the fault and correct it.

Sectional diagrams are shown on the opposite page which, if consulted with the following description, will be of considerable assistance to the owner in understanding the engine lubricating system.

When oil is poured through the filler cap on the engine top cover, it makes its way down passages through the cylinder head and block castings into the sump. The oil pump draws oil through the filter A and up pipes B and C to the pump. The pump discharges through a union into a main engine oil gallery D, with leads to each of the four main bearings. Leads drilled in the crankshaft convey oil from these main bearings to all connecting rod big-ends, the oil which exudes being thrown up to lubricate the cylinder walls, any excess trickling back into the sump.

An upward lead from the main gallery takes oil up pipes E and F to the centre of the rocker shaft G, and leads from this shaft feed the four camshaft bearings as well as each rocker. Here again, as oil is exuded from the bearings, it makes its way back to the sump and is filtered before going into circulation again.

A lead K is also taken from the main oil gallery to the pressure gauge on the instrument board, and an oil release valve J is incorporated in the system.

The sump holds approximately 12 pints of oil, and this quantity should be maintained by checking the oil level daily or at least every 150 miles. As previously explained, a dip stick is fitted to the nearside of the crankcase and is marked with the correct oil level. The level is read as indicated on page 13 of this book, and if the oil is below the mark on the dip stick, bring to the correct level by pouring fresh oil through the filler in the engine top cover. A few moments must be allowed when adding oil, for it to drain into the sump, before finally checking the level, but do not under any circumstances fill the sump above level as this is likely to lead to various minor troubles.

To prove that the engine lubricating system is working correctly, the following procedure should be adopted. With the engine running slowly, disconnect the oil pipe leading from the crankcase to the gauge (at the crankcase end) and if oil pressure is present at this union, then either the oil lead to the gauge is obstructed or the gauge is at fault. Make sure that the pipe is clear, and if the trouble persists have the gauge attended to by your local dealer.

If no oil pressure is present at the union, then the fault must be in the lubricating system. It is unlikely to be in the pump itself and the cause will most probably be due to: (a) a choked filter, (b) foreign matter of some description in the pressure release valve. To clean the filter it will be necessary to lower the sump, and instructions for this operation are given in the overhauling instructions, page 26.

To remove foreign matter from the pressure release valve, slack off the lock nut sufficiently to allow the centre pin to be withdrawn—the position of the lock nut will be an indication of how far to screw in the centre pin when reassembling—then withdraw the pin and remove the spring and ball for cleaning in petrol. When replacing, first insert the ball, then the spring, screw in the centre pin up to the lock nut and tighten the lock nut.

To increase the oil pressure, slack back the lock nut two or three turns, screw in the centre pin and tighten the lock nut. To decrease the oil pressure, release the lock nut, screw the centre pin back two or three turns and relock the nut.

In some cases, low oil pressure is due to the engine oil becoming very thin owing to dilution with petrol (due to misuse of the carburetter self-starter or worn pistons and rings). This can easily be checked by draining a little of the oil from the sump through the drain plug, and if the condition of the oil verifies the suspicion of dilution, the remedy is to drain the sump and refill with fresh oil of the correct grade.

Clean engine oil is essential, and after the first 750/1,000 miles the oil should be drained from the sump and fresh oil put in. After this, the oil should be changed about every 2,000 miles.

Draining the sump can best be carried out while the engine oil is warm, and should the old oil appear to be very dirty, swill out the case with a thin "flushing" oil. ON NO ACCOUNT SHOULD PETROL OR PARAFFIN BE USED. If a "flushing" oil is used, it will be necessary after draining the sump to replace the drain plug and pour about a quart of "flushing" oil into the engine through the filler, turn the engine over for a number of revolutions by hand to circulate the cleansing oil, then drain away, replace the drain plug and refill with the correct grade of oil to the level marked on the dip stick.

If lubrication is carefully attended to, very little is likely to be necessary beyond the small adjustments required to balance wear and tear, and the periodical cleaning of the engine interior which includes decarbonizing, grinding in the valves and the cleansing of the oil sump and filter.

RUNNING ADJUSTMENTS

Decarbonizing is one of the periodic attentions which many owners prefer to carry out themselves, and one which offers no difficulty if carried out methodically. It is not possible to state definitely over what mileage a car should be run before decarbonizing becomes necessary, but signs of excessive carbon deposit are noticeable owing to the sluggishness of the engine and a tendency to "pink" under load. In the case of an ordinary touring car, a new engine should be decarbonized after 5,000 miles, and thereafter every 10,000 miles will be a fair average period.

A Sports car, however, is different. In this case, a clean engine is essential and it is recommended that a Sports engine is decarbonized for the first time between 3/4,000 miles and thereafter about every 5,000 miles.

The operation of decarbonizing consists of cleaning the inside of the combustion chambers and the tops of the pistons and, of course, necessitates removing the cylinder head. The method of procedure is as follows:

REMOVE BONNET—three nuts and washers secure bonnet hinge to radiator support channel.

DRAIN WATER SYSTEM by means of the drain tap at the base of radiator on near side.

REMOVE CARBURETTER by disconnecting the self-starter control clamp and pin securing the wire to the carburetter lever, disconnect petrol feed pipe at the filter union to the carburetter. Disconnect the carburetter throttle lever controls and remove nuts securing carburetter to inlet manifold flange.

DISCONNECT EXHAUST MANIFOLD by releasing the three bolts and nuts securing the lead pipe to the manifold flange. Remove eight nuts securing induction manifold to cylinder head and eight nuts securing exhaust manifold to cylinder head.

REMOVE VALVE COVER, secured by four dome nuts, and lift cover carefully to avoid damage to joint washer.

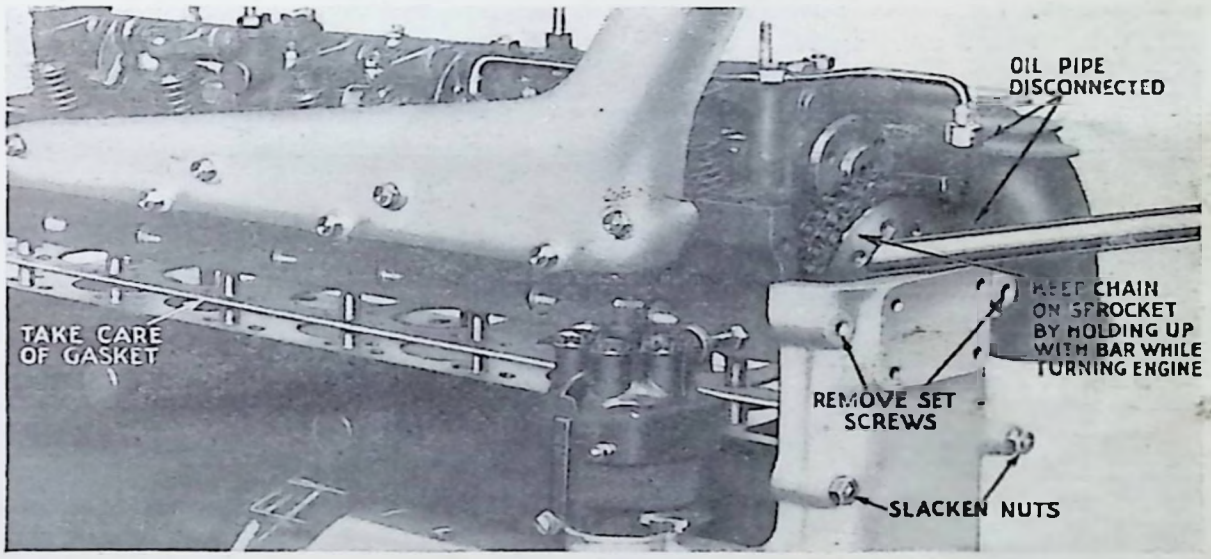
REMOVE WATER OUTLET PIPE. Release high tension cables from sparking plugs, coil and distributor. Eight nuts and one countersunk set screw secure water outlet pipe to cylinder head, and high tension wire carrier is secured to outlet pipe by two clips. Disconnect radiator hose.

DISCONNECT CAMSHAFT OIL FEED PIPE by releasing the union nut and set screw securing the feed pipe to the timing case pipe and camshaft bearing.

REMOVE FAN ASSEMBLY by releasing three nuts which secure bracket to timing case.

SET ENGINE POSITION by turning with starting handle until mark 1/6 appears on flywheel, and inlet valve of No. 6 cylinder about to open.

DISCONNECT CAMSHAFT CHAIN SPROCKET. Release timing chain tensioner by unscrewing lock nut and turning back adjustment bolt in cylinder head. Remove the set screw, tab washer and plain washer which secure the chain wheel to the camshaft flange, DO NOT UNDER ANY CIRCUMSTANCES REMOVE CHAIN FROM CHAIN WHEEL.



REMOVE CYLINDER HEAD. Take off fourteen nuts and washers securing cylinder head to engine case. Remove two top set studs securing timing case to cylinder head, and slack off the two nuts immediately below these set studs. Rock cylinder head to break joint, but do not use any lever between faces of cylinder head or cylinder block, as this will damage the gasket. Remove gasket and store for safety.

REMOVE CAMSHAFT ASSEMBLY by releasing eight nuts and washers which secure the four camshaft bearings, and withdraw upper halves of bearings complete with valve rockers and shafts. Release bearings and rockers, etc., from rocker shaft, and mark to ensure return to correct position. It is also policy at this stage to remove camshaft bearing bases from cylinder head studs and pair with upper halves.

Remove ferrules, one from each valve stem, and place valve extracting tool in position for compressing valve spring and removing split collar.

Release valve extractor and remove valve spring and collar. The valves may then be withdrawn through their guides from the combustion head. The valves are marked, and should be returned to their correct seatings.

CLEANING THE ENGINE. Having removed the cylinder head, the pistons will now be visible, numbers 1 and 6 at the top of their strokes. Fill the exposed bores and water ports with rag and remove the carbon from the top pistons, using for this purpose a blunt instrument such as a screwdriver. DO NOT USE EMERY UNLESS THE PISTONS ARE COMPLETELY REMOVED FROM THE CYLINDERS AS SOME ABRASIVE MAY FIND ITS WAY INTO THE ENGINE, CAUSING CONSIDERABLE DAMAGE.

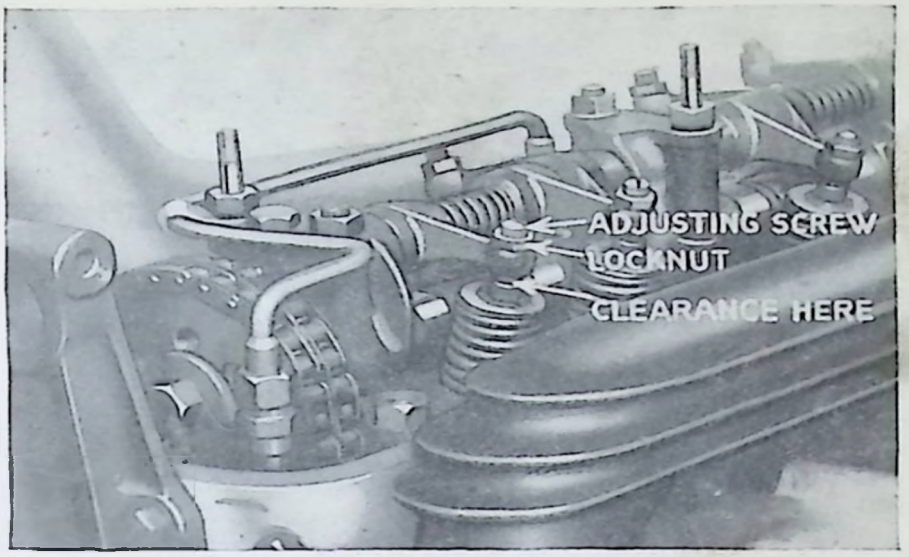
To clean the remaining pistons, hold the camshaft sprocket up and in alignment with its lower sprocket by means of a steel bar or tommy bar, while turning the engine clockwise to bring these pistons to the top of their stroke. Afterwards remove any carbon deposit from the face of the cylinder block, and cleanse the cylinder head gasket ready for refitting.

Again hold the camshaft chain wheel up and turn the engine forward until pistons numbers 1 and 6 are again at the top of their stroke and the distributor rotor arm is in the same position as it was prior to removing the cylinder head, i.e., opposite the segment for No. 1 high tension lead. Inject a small amount of oil into each cylinder bore to provide lubrication for the first few revolutions of the engine when reassembled.

GRINDING IN VALVES. Although it is not always necessary to carry out this operation every time the engine is decarbonized, it is, perhaps, policy to give the valves a thorough cleansing to ensure good compression after decarbonizing. Remove all carbon deposit from the combustion chambers and the face of the cylinder head, also from the valve heads, stems, and valve seatings. Smear a little valve grinding compound over the seating on valve and cylinder head and grind in the valve by rotating backwards and forwards upon its seat. Do not allow the valve to make a full revolution of the seating, but lift the valve from its seating at the end of each stroke. A light coil spring placed between the head of the valve and the guide will considerably facilitate this method of grinding. When a true contact ring appears on valve seating, withdraw the valve and clean away all abrasive with petrol. A good test of a true valve seating, is to chalk strokes across the seating of the valve head and cylinder head in similar positions to the figures on a clock face. The valve is then replaced on to its seating, and a slight turn in one direction should break each chalk line.

RE-ASSEMBLING THE CYLINDER HEAD is merely a reversal of the dismantling operation, but smear the valve stems with oil before refitting to their guides and be quite sure that the valves are returned to their correct seatings. Check the valve clearances by slackening the lock nut of the ball pin in the rocker arm, and turning the adjusting screw until the following clearances are given :—

Inlet valves	.004in.
Exhaust valves	.006in.



Tighten the lock nut and turn the camshaft in a clockwise direction until the inlet valve of No. 6 cylinder is just commencing to open. Replace the cylinder head and gasket and tighten the cylinder head nuts evenly, half a turn at a time, working from the centre outwards. Reassemble the oil feed pipe to the camshaft assembly, remount the camshaft chain sprocket and lock into position, not overlooking the correct location of the tab washer with the chain sprocket stud.

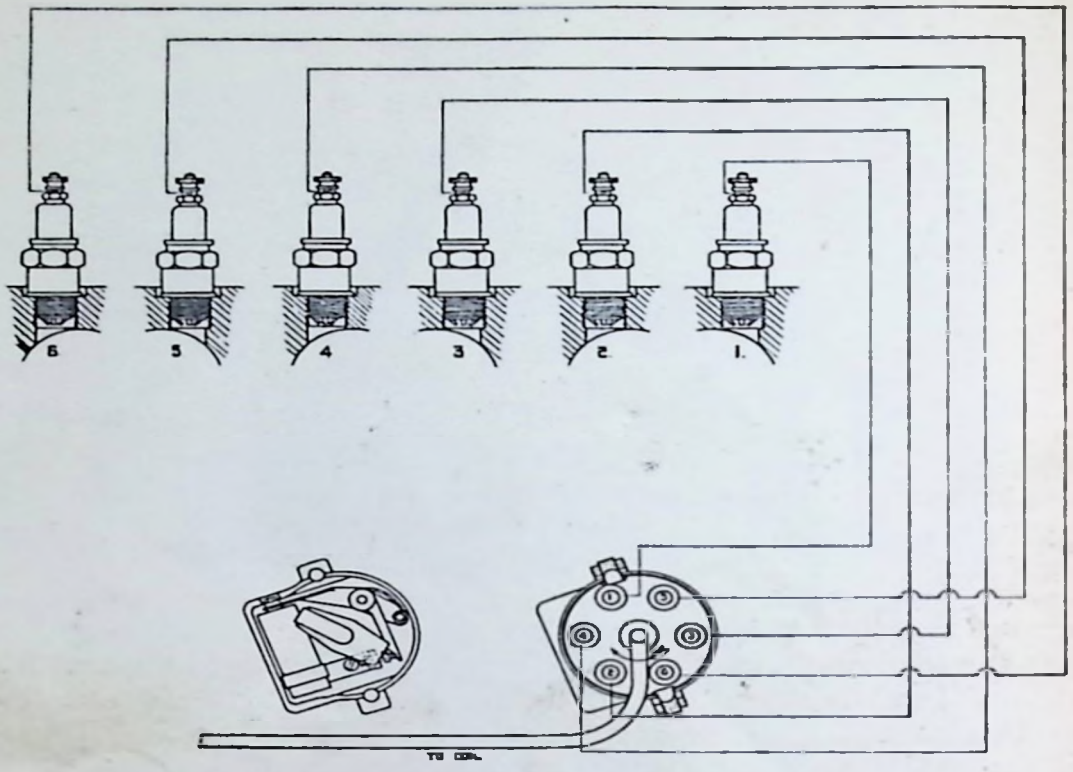
If the previous instructions have been closely followed, the engine valve timing will be correct, i.e., inlet valve about to open $^{15}/_{16}$in. before the mark 1/6 on the flywheel is at top dead centre and the distributor rotor arm opposite the segment for No. 1 cylinder high tension lead, that is, the lead to No. 1 sparking plug.

IGNITION TIMING. After any operation that has necessitated the removal of the distributor unit, it will be necessary to retime the ignition. It will be seen from the engine timing chart (p. 25) that the ignition is timed to fire when fully retarded ½in. before top dead centre, this measurement and the valve timing measurement being taken from the 1/6 mark on the flywheel. The firing order of the engine is 1, 5, 3, 6, 2, 4.

Always time on No. 1 cylinder.

Remove engine top cover and the flywheel inspection cover, and turn the engine until the inlet valve of No. 1 cylinder closes. Continue to turn the engine until the mark 1/6 on the flywheel is ½in. before its vertical position. Remove the distributor cover and the contact breaker points at this position should be about to open. Should this not be the case, release the distributor clip nut and turn the distributor body anti-clockwise until the contact breaker points just begin to open, then tighten the clip nut.

Replace the distributor cover after noting which segment makes contact with the rotating arm. The lead to No. 1 sparking plug must be plugged in opposite to this segment. Proceeding in a clockwise direction, place the lead to No. 5 sparking plug opposite the next segment, then that for No. 3, then No. 6, followed by No. 2, and finally No. 4 in the last position.



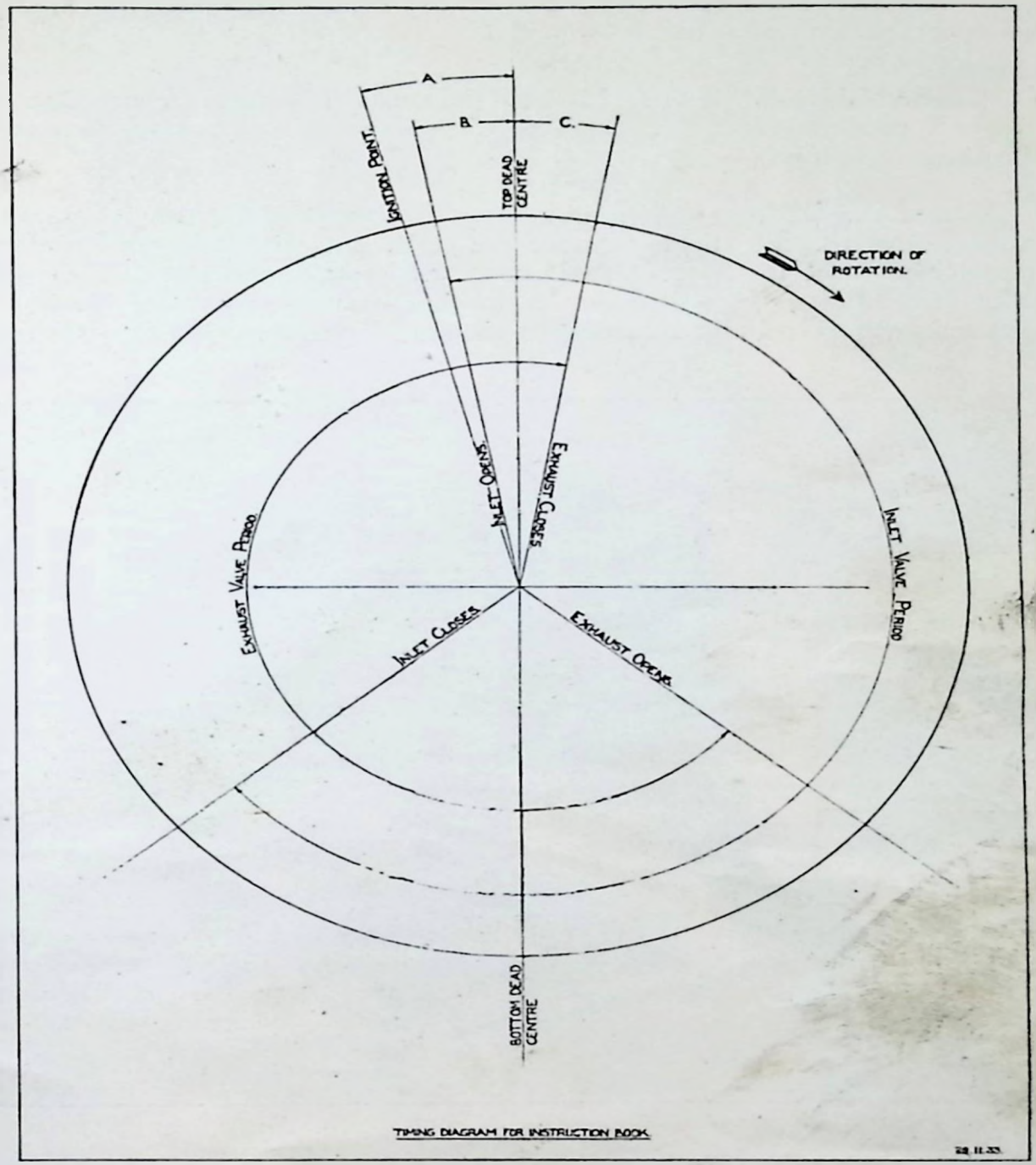
Test the engine after this setting, and any slight variation which may seem necessary can be made by slackening the distributor clip nut and slightly rotating the distributor. Turning clockwise will retard the ignition, and anti-clockwise will advance it.

If the ignition is too early, the engine will be inclined to knock when pulling at low engine speeds. Late ignition causes overheating and lack of power.

DYNAMO CHAIN ADJUSTMENT to compensate for stretch of the dynamo chain may be necessary after considerable running and will be noticeable by the chain becoming noisy. To adjust, it is first necessary to slacken off the fan belt to its fullest extent; this is done by releasing the clip bolt holding the fan spindle and rotating the spindle.

The dynamo chain can now be adjusted by slacking the three nuts which secure the dynamo to its housing, and the two nuts holding the dynamo shaft cover to the timing cover. The whole assembly can then be swung over, pivoting on the bottom dynamo stud. Do not overtighten or excessive wear will result, and carefully tighten all nuts after adjustment. Readjust the fan belt to the correct tension.

CAMSHAFT CHAIN ADJUSTMENT. On signs of undue noise from the camshaft chain, adjustment can be effected by means of the tensioner screw situated behind the distributor. Release the lock nut and turn the screw until the resistance of the chain is felt, and then slack off half a turn to allow the correct running clearance. Tighten the lock nut. Great care should be taken to ensure that the tensioner screw is not too tight, or undue strain will be thrown upon the chain.



ENGINE TIMING CHART.

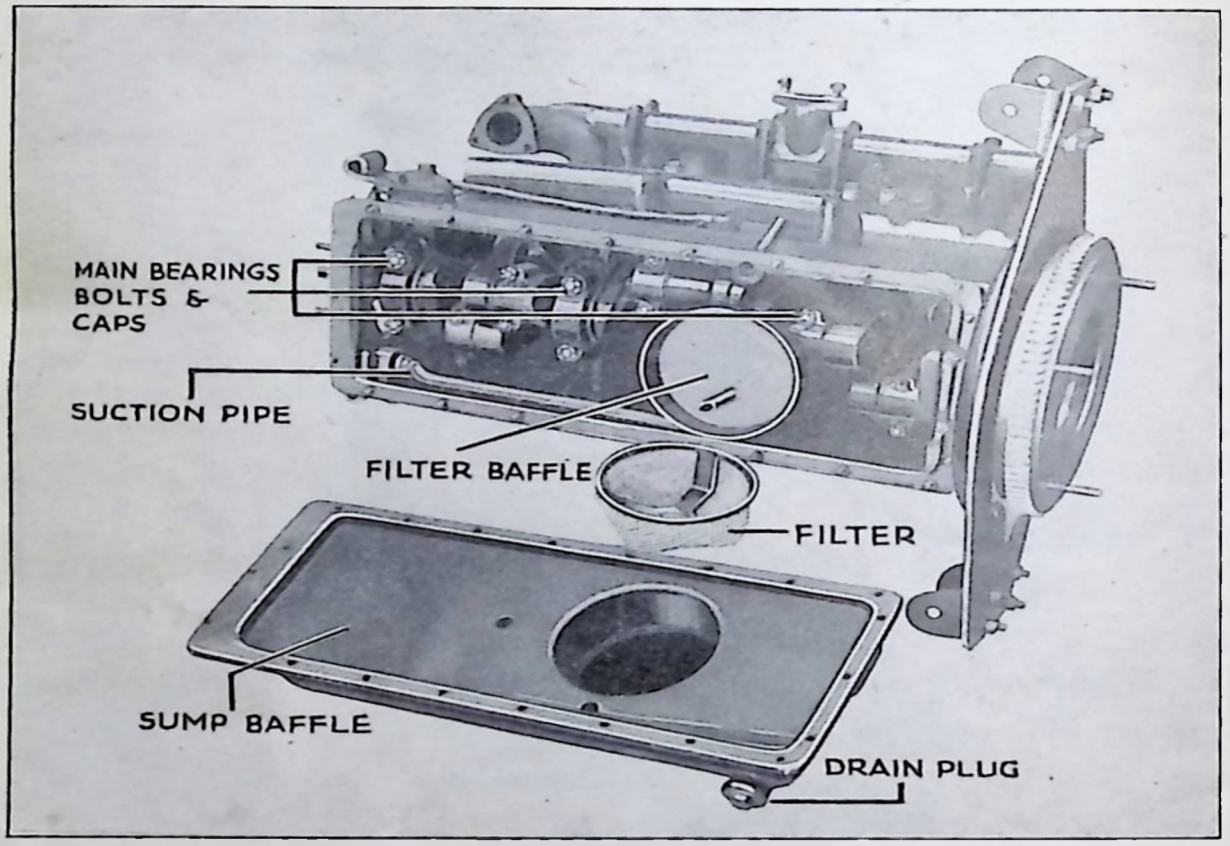
Model	Ignition Point "A"	Inlet Opens "B"	Exhaust Closes "C"
1½-Litre ..	½" B.T.D.C.	1 1/16" B.T.D.C.	1 7/32" A.T.D.C.
Le Mans ..	½" B.T.D.C.	1 5/8" B.T.D.C.	1 3/8" A.T.D.C.
14 h.p. .	½" B.T.D.C.	15/16" B.T.D.C.	15/16" A.T.D.C.
2-Litre ..	½" B.T.D.C.	1 7/8" B.T.D.C.	1 13/32" A.T.D.C.

These Measurements are taken from the 1/6 Mark on the Flywheel.

FAN BELT ADJUSTMENT has been dealt with under the heading of dynamo chain adjustment.

CLEANING THE OIL FILTER becomes necessary on any sign of low oil pressure, and in any case it is advisable every 8/10,000 miles. Proceed as follows :—

Drain the oil from the engine sump by removing the drain plug and also remove the dip stick. Remove the eight nuts and washers from the circular plate at the base of the sump, and remove the plate. This will allow the filter to be withdrawn from the sump in order that it can be cleaned with petrol and returned to its correct position. When returning



the sump plate to the sump, be quite certain that the joint is in order and that the nuts are tight. To remove the sump it is necessary to take away nineteen nuts and washers, and three studs and washers. Lower the sump with a rocking motion and do not prise between the joint faces. This will avoid breaking the washer between the engine case and the sump. All traces of carbon, etc., must be removed from the sump with petrol. When refitting the sump be quite certain that the joint washer is in good condition, and tighten the anchorage nuts evenly and in alternatively opposite positions.

SPARKING PLUGS

THE 14 h.p. and 2-Litre models are fitted with Champion J8 14 m/m. sparking plugs. The 1½-Litre and 1½-Litre "Le Mans" two-seater models are fitted with Champion J10 14 m/m. sparking plugs.

These plugs have been fitted after exhaustive tests, and it is advised that replacements be of the same type.

The plug has an important part to play in the running of the engine and has an influence on such items as smooth running, speed, slow running and petrol consumption. Therefore, it fully merits the small attentions that are advised below.

After the first few hundred miles remove the plugs, clean, and check the gaps, re-setting if necessary to .025in.

A "feeler" strip of this thickness can be obtained cheaply from most garages or tool dealers. Always re-set by bending the side electrode. Do not attempt to move the centre.

These attentions will normally be required every 2,000 miles.

ENGINE OVERHAULING INSTRUCTIONS

REMOVING ENGINE FROM CHASSIS
(14 H.P. AND 2-LITRE MODELS)

Remove bonnet and bonnet support channel as for decarbonizing.

Remove front bumpers (Saloon Models).

Disconnect battery by removing front seat cushions, releasing bucket seat slide levers and withdrawing seats from runners. Remove floor carpet from press studs, unscrew press studs from floor boards, remove accelerator pedal pivot pin and release pedal. Remove floor board cover for gear box remote control tower. Remove floor boards, and disconnect battery main positive lead.

Drain water cooling system as for decarbonizing, release set screws securing headlamp rims and remove rims and glasses. Release the three screws securing the reflector and dipping mechanism to the headlamp shell, and disconnect headlamp cables. Release the nuts and washers securing the headlamp tie bar brackets to the front wing stays, withdraw the headlamp cables through the tie bars. Disconnect the top and bottom radiator hose connections, remove the two anchorage bolts securing the base of the radiator to the front cross member, and remove radiator together with headlamps and tie bars, from the chassis frame.

Disconnect the petrol supply pipe by releasing the union of the electric petrol pump, and remove the set screw securing the filter union to the carburetter. Release the ball joint nuts securing the control rod between the control cross shaft lever on the scuttle and the bell crank on the engine case. Release the ball joint nut securing the control rod between the bell crank on the engine case and the carburetter throttle lever. Disconnect the carburetter self-starter control by releasing the clamp and clamp pin securing the wire, remove the nuts anchoring the carburetter to the flange of the inlet manifold, and take away the carburetter and air cleaner.

Release the oil gauge pipe union at the base of the engine case, remove the engine breather pipe by means of the two bolts securing the pipe bracket to the engine case. Release the three bolts and nuts securing the exhaust pipe to the exhaust manifold flange, remove the carburetter drip tray by releasing the support nut on the frame side member and the pipe clip which is secured to one of the oil sump studs.

Release the ball joint nuts securing the ignition control rod to the control lever at the base of the steering column, and the lever on the distributor. Remove the junction box lid and disconnect the electric horn wires from the terminals (it is necessary to remove four wires, two of which are red, one green and one yellow). Release the set pin securing the lighting switch box at the base of the steering column and withdraw horn cable from switch box centre. Disconnect the high tension lead from

the ignition coil to the distributor, disconnect the earth wire from the coil to the distributor, disconnect the dynamo wires and the cable from the starter motor to the Startix unit on the scuttle board.

REMOVE STEERING ASSEMBLY FROM CHASSIS FRAME. Slack off the two nuts securing the steering bracket cap on the chassis frame side member. Release the two dome nuts securing the steering column cap to the dashboard bracket, and lower the column. Release the clamp bolt and nut securing the steering drop arm to the splines on the steering rocker shaft (before removing the drop arm, mark the steering rocker shaft and drop arm so that the arm will be returned to its original setting when re-assembling the steering). Remove the steering drop arm from the rocker shaft, release the steering bracket cap and withdraw the steering box and column assembly towards the rear of the body between the clutch and brake pedals.

REMOVING GEAR BOX UNIT. Disconnect the speedometer cable by releasing the pinch bolt and nut securing the cable to the guide in the free wheel housing. Release the bolts, nuts and washers securing the Hardy Spicer joint on the propeller shaft to the flange on the gear box mainshaft. Release the bolt securing the starter cable clip to the gear box top cover. Remove the free wheel control cable from the gear box lever by releasing the clamp pin and nut securing the cable to the lever. Release the cable clip from the gear box inspection cover bolt. It now becomes necessary to select second gear, release the bolts and washers securing the gear box top cover and remove the remote control tower and change speed assembly. Remove the bolts, nuts and washers securing the clutch housing to the engine rear bearer arm, remove the bolts, nuts and washers securing the starter motor to the engine bearer arm and housing (the bottom bolt for the starter motor also releases the clutch pedal return spring). Withdraw the starter motor from the housing, remove the Lockheed brake pipe clips from the gear box cross member, withdraw the gear box towards the rear of the car until the splines of the constant mesh pinion are free from the clutch floating plate centre. Swing the clutch housing to the nearside of the chassis frame, and tilt the entire assembly towards the offside of the car. The gear box and free wheel assembly can now be removed from the chassis frame by lifting the front end first.

REMOVE ENGINE FROM CHASSIS FRAME. First place the pulley blocks and tackle in position to take the weight of the engine on releasing the Vibro-damper anchorage. Release the eight bolts, nuts and washers securing the engine rear bearer arm brackets to the vibro-dampers (one on the offside releases the foot brake pedal return spring, one on the nearside releases the frame earth connection). Release the eight bolts, nuts and washers securing the rear vibro-dampers to the frame side members and remove the dampers. Release the six bolts which secure the engine front bearer brackets to the engine case, and pull the hinged brackets away from the case (one bolt on the offside releases the junction box and bracket). The engine unit can now be removed, care being taken to ensure that the oil gauge pipe is clear of the engine rear bearer arm. Tilt the front of the engine upwards, and withdraw the unit forward from the chassis frame.

REMOVING ENGINE FROM CHASSIS
(1½-Litre Models)

Disconnect battery positive lead as on 14 h.p. and 2-Litre models.

Remove bonnet by releasing the three nuts and washers which secure the bonnet hinge to the bonnet support channel, between the scuttle board and the radiator case. Disconnect thermometer pipe from radiator tank and release clips securing pipe to bonnet support channel. Release two bolts securing bonnet support channel to brackets on scuttle board and radiator case.

Remove radiator by releasing the two dome nuts and washers which secure the horn tie bar assembly through the front apron over the dumb iron. Disconnect the horn cables and remove tie bar assembly, front apron and number plate. Release the headlamp rim lock pin at the base of the lamp, and remove rim and glass, remove reflector and dipping mechanism as detailed in electrical equipment section of this book. Disconnect cables from dipping mechanism and withdraw cables through tie bar. Release the nuts and washers securing the tie bars to the front wing stays, drain the water cooling system through the drain tap at the bottom of the radiator on the nearside, disconnect the top and bottom hose connections, remove the two anchorage bolts securing radiator to front cross member, and remove radiator together with headlamps and tie bars from the chassis frame.

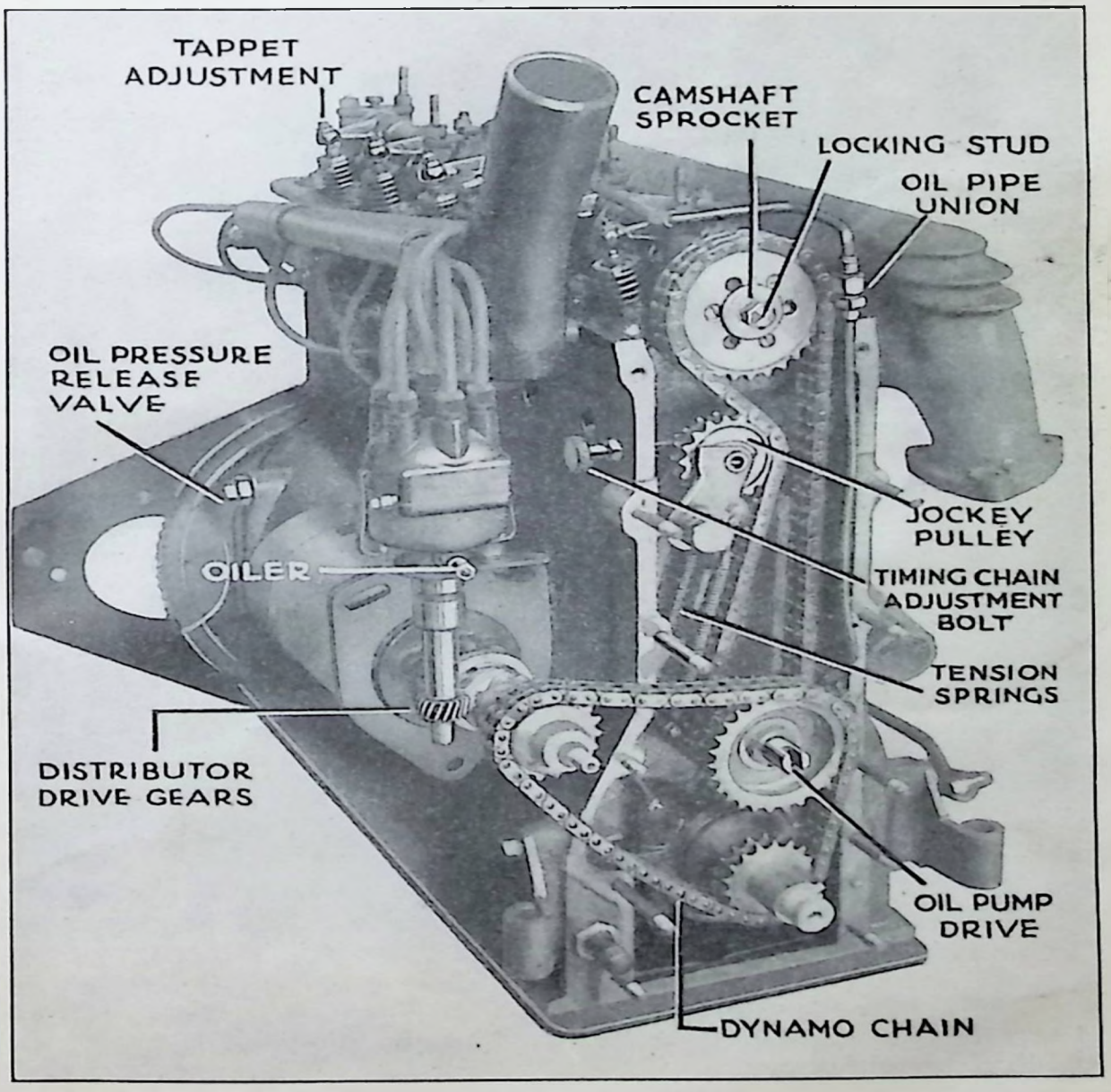
Release the nearside engine connections as follows. Remove the three bolts securing the exhaust pipe to the manifold flange, release petrol feed pipe from union connecting pipe to petrol pump and release the set screws securing the feed pipe unions to the two carburetters. Remove petrol pipe assembly. Disconnect the carburetter self-starting controls by releasing the two bolts and clamp pins which secure the wire to the carburetter levers. Release ball joint nut from rod connecting the accelerator lever on the cross shaft to the intermediate control shaft on the exhaust manifold. Release the accelerator lever, screw and spring on the cross shaft and lift lever flush with scuttle board. Secure in that position until re-assembling. Release the ball joint nuts on the two rods connecting the carburetter throttle levers to the intermediate cross shaft, remove carburetter throttle return spring, release the bolts securing the carburetters to the inlet manifold and remove carburetters.

Release the oil gauge pipe union at the base of the engine case, remove two screws and nuts securing carburetter drip tray to frame side member and remove tray. Remove the engine breather pipe by releasing the two bolts securing the breather pipe bracket to the engine case.

Release the offside engine connections as follows. Remove the two junction boxes complete by removing the bolt which secures the junction box brackets to the engine case. Disconnect the revolution counter drive by releasing the two set screws securing the drive to the dynamo and distributor housing. Release the ball joint nuts securing the ignition control rod to the control lever at the base of the steering column and the lever on the distributor, and remove rod. Disconnect high tension lead from ignition coil to distributor. Disconnect the low tension wires on the distributor. Remove bolt securing ignition coil bracket and revolution counter

cable clip to the top water pipe and remove bracket and coil. Disconnect dynamo wires, disconnect starter motor cable.

REMOVE GEAR BOX. Release pinch bolt and nut securing speedometer cable to gear box rear end cover and withdraw cable from guide. Release the bolts, nuts and washers securing the Hardy Spicer joint on the propeller shaft to the flange on the gear box mainshaft. Remove the bolts and washers securing the gear box top cover (the offside rear bolt releases the hand brake return spring), and remove remote control tower of change speed assembly. Remove bolts, nuts and washers securing clutch housing to engine arm. Remove bolts, nuts and washer securing starter motor to engine arm and housing (on removing the bottom bolt securing the starter motor, this also releases the clutch pedal return spring). Withdraw starter motor from housing and draw gear box towards rear of the car, until the splines of the constant mesh pinion are free from the centre of the clutch floating plate. Remove gear box from chassis.



REMOVE ENGINE FROM FRAME. Place pulley blocks and tackle in position to take the weight of the engine on releasing the Vibro-damper engine bearer. Remove the eight rear engine arm bolts securing the brackets to the vibro-dampers (on the nearside one bolt releases the frame earth connection and also the exhaust pipe extension clip). Release the six bolts which secure the front engine bearer brackets to the engine case, and pull the hinged brackets away from the engine case. The engine unit can now be removed, care being taken that the oil gauge pipe is clear of the engine rear bearer arm. Swing engine unit to the nearside of the chassis, and tip towards the offside when removing, in order that the offside rear bearer arm clears the steering box and column.

REMOVE TIMING CASE AND TIMING GEAR ASSEMBLY

Remove fan by taking away three nuts and washers securing fan bracket to timing case.

Remove fan pulley by releasing the nut and split pin which secure the fan pulley to the dynamo and distributor driving sleeve. The fan pulley is keyed on to the sleeve.

Release the union and banjo nut which secure the oil suction pipe to the oil pipe and the oil pump. Remove the camshaft main feed pipe by releasing the union in the oil sump and the set screw securing the union to the oil pump, also the set screw for the union to the timing case. Release the four set screws and tab washers securing the oil pump to the timing case, and withdraw the pump.

Remove the vibration damper by unscrewing the dog which secures the damper to the crankshaft. The dog is machined with a right-hand thread, and it will be necessary to manufacture a slotted tubular spanner to fit the pin through the dog.

Remove the timing cover by taking away the eight nuts and washers and withdrawing the cover from its dowels.

Remove the distributor by releasing the bolt which secures the advance and retard lever, and the two studs which secure the distributor to its housing. This unit may then be withdrawn.

Remove the dynamo and distributor driving chain by taking away the fan pulley key from the distributor driving sleeve, withdrawing the oil flinger and extracting the dynamo driving sprocket which is also keyed on to the sleeve. The dynamo and distributor drive housing may then be withdrawn and the driving sleeve pushed out of its bearing. The dynamo chain wheel and chain may then be removed.

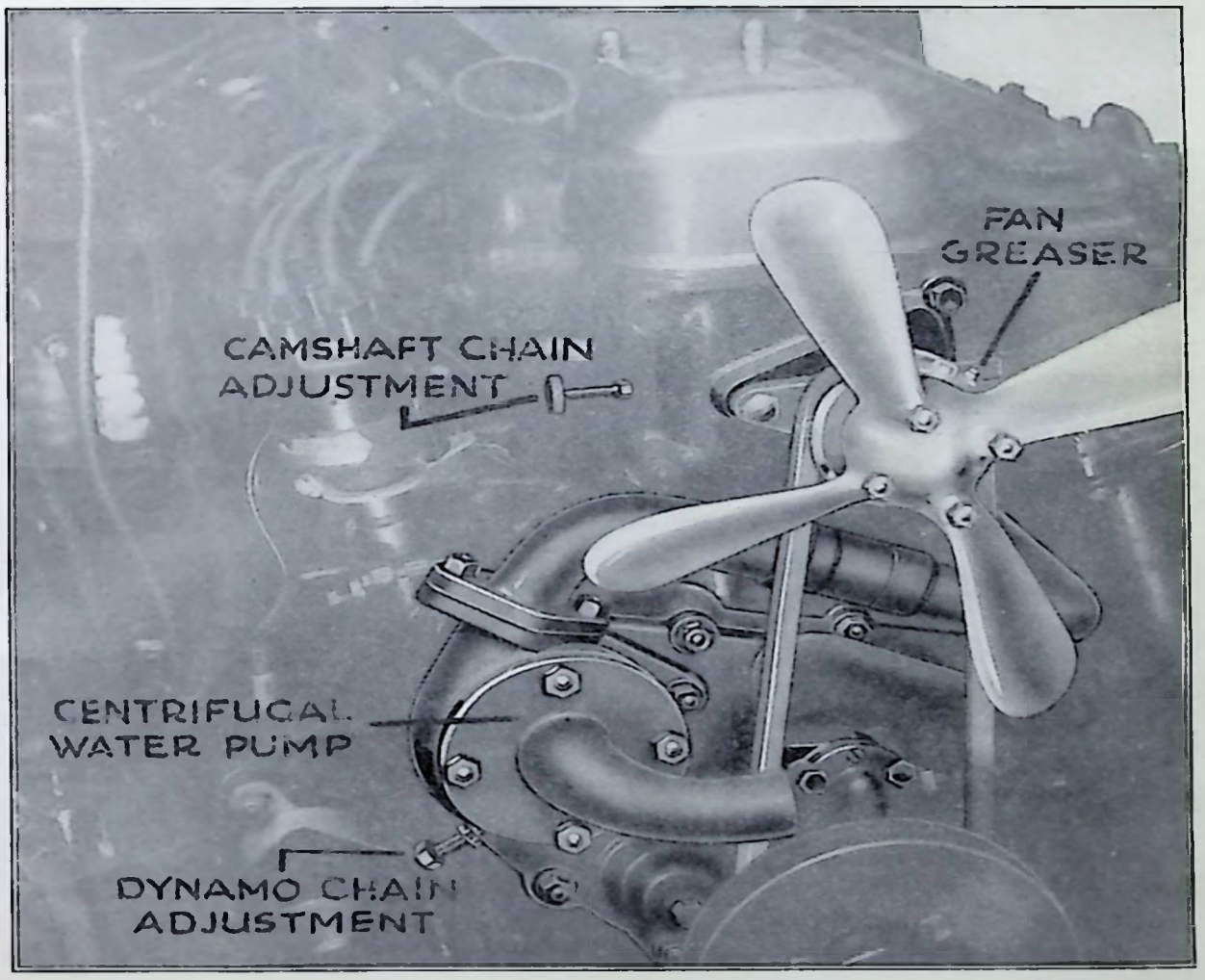
Remove two studs at the top of the timing case, seven nuts and washers and three studs from the front of the sump. The timing case may then be withdrawn.

Remove the camshaft chain wheel in the manner previously indicated under the heading of decarbonizing, and to take away the camshaft driving chain it is merely necessary to remove the intermediate timing shaft thrust washer and to take away the intermediate gear assembly complete.

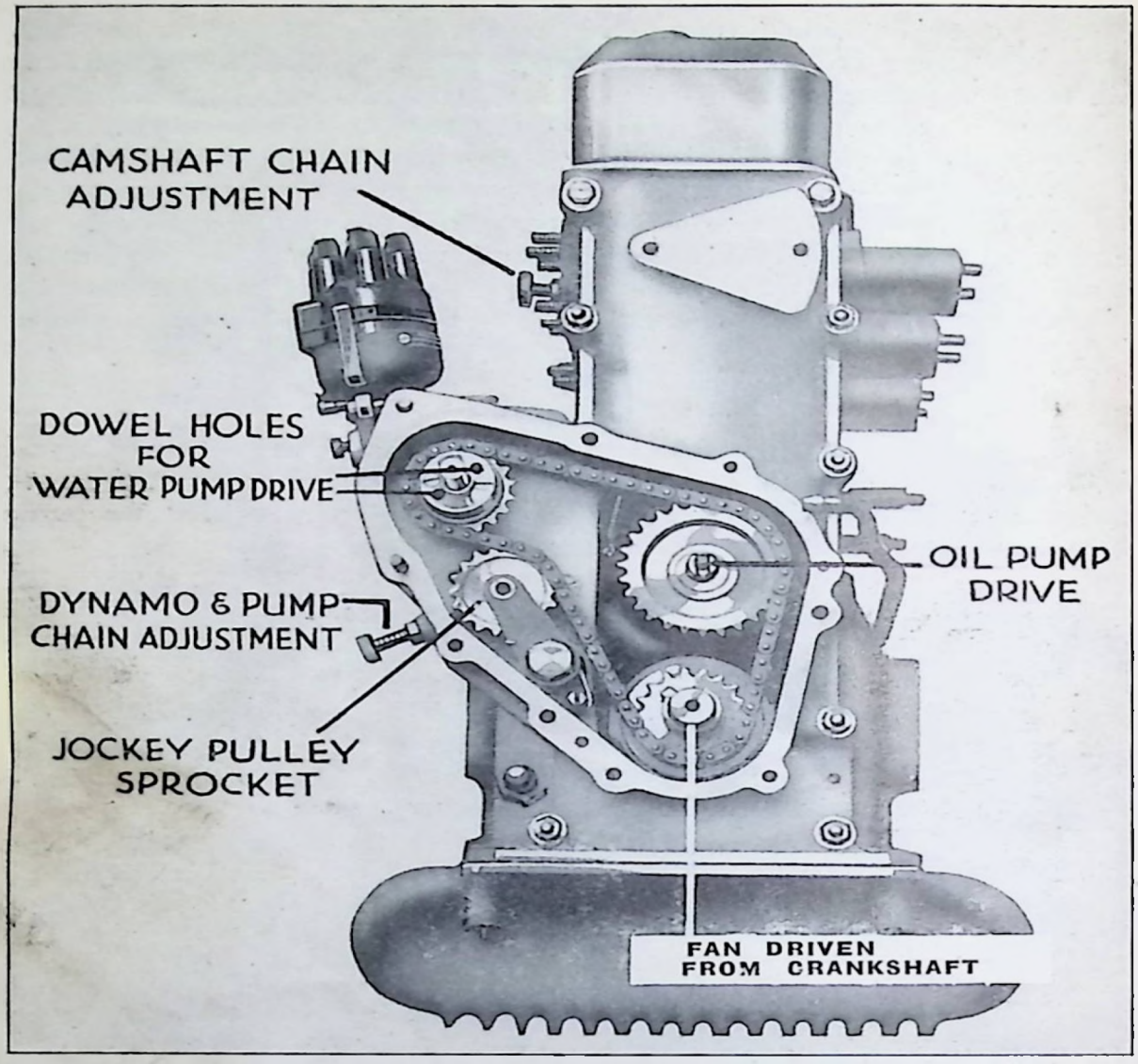
To dismantle the timing chain tensioner, remove the front tension springs from the chain tensioner sprocket arm by releasing the spring from the top pin. Remove the set screw from the spring anchor in the engine case, which also secures the rear tension spring at the bottom. Release the pivot pin, plain washer, spring and fibre washer securing the tensioner sprocket arm to the engine case, and withdraw the tensioner.

REMOVE TIMING CASE, ETC.
(1½ Litre L.M. 2-str).

The method of procedure is exactly the same as for the Standard Model previously outlined, but the fan drive is taken from a pulley at the back of the vibration damper on the crankshaft, and a centrifugal water pump is fitted at the front end of the dynamo and distributor drive shaft.



To remove the water pump, disconnect the hose clips, remove the hoses and take away three nuts and spring washers anchoring the water pump to the case. The water pump may then be taken away.



It will be noted that the water pump drive is in the form of two dowels locating in dowel holes on the boss of the distributor drive sprocket, and that the method of anchoring the sprocket to the distributor drive shaft is by means of two set screws and a locking washer in place of a nut.

There is also on this model, a separate chain tensioner fitted to the dynamo chain. The construction of the tensioner is exactly the same as that fitted to the camshaft chain, but the bolt has a 5/16in. square head instead of a knurled nut.

To adjust, screw in the bolt until the tension of the chain is felt, then screw back half a turn and tighten the lock nut.

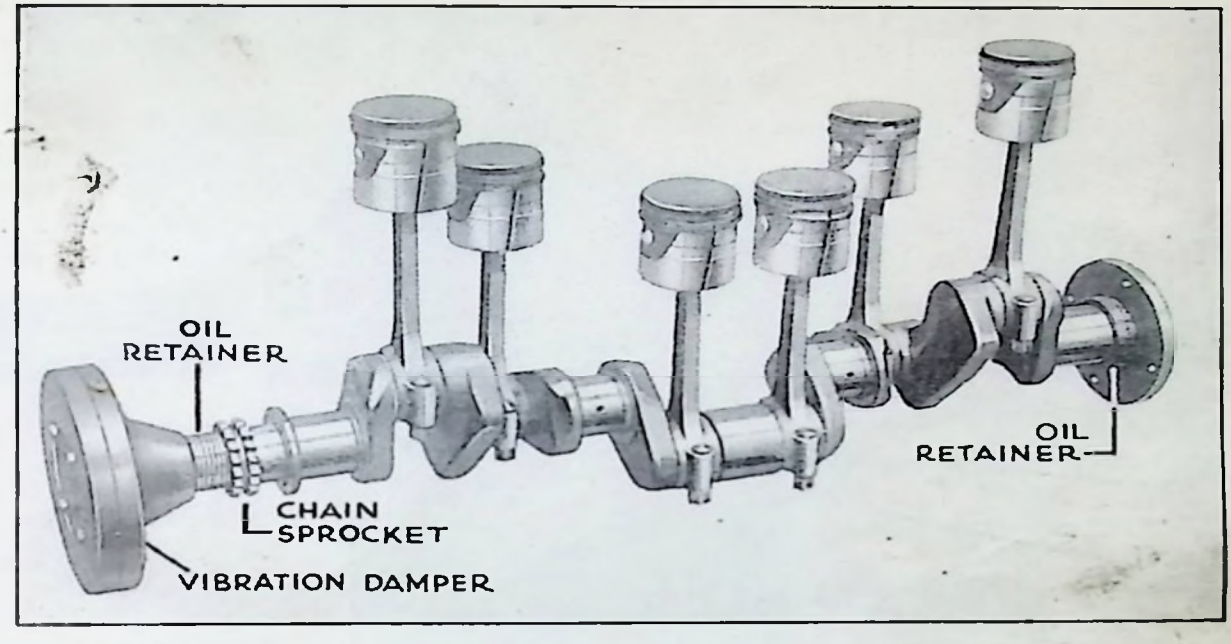
REMOVING BIG END BEARINGS, ETC.

Remove the dip stick and drain the engine oil, and remove the sump assembly as indicated on page 26.

Remove the main suction pipe (inside the engine case) by extracting the oil sump stud which acts as a set screw on the oil pump union nut, and tap out the union which is a taper fit in the engine case.

Extract split pins and release the nuts from the connecting rod bolts. Remove the connecting rod caps and push the connecting rods and pistons

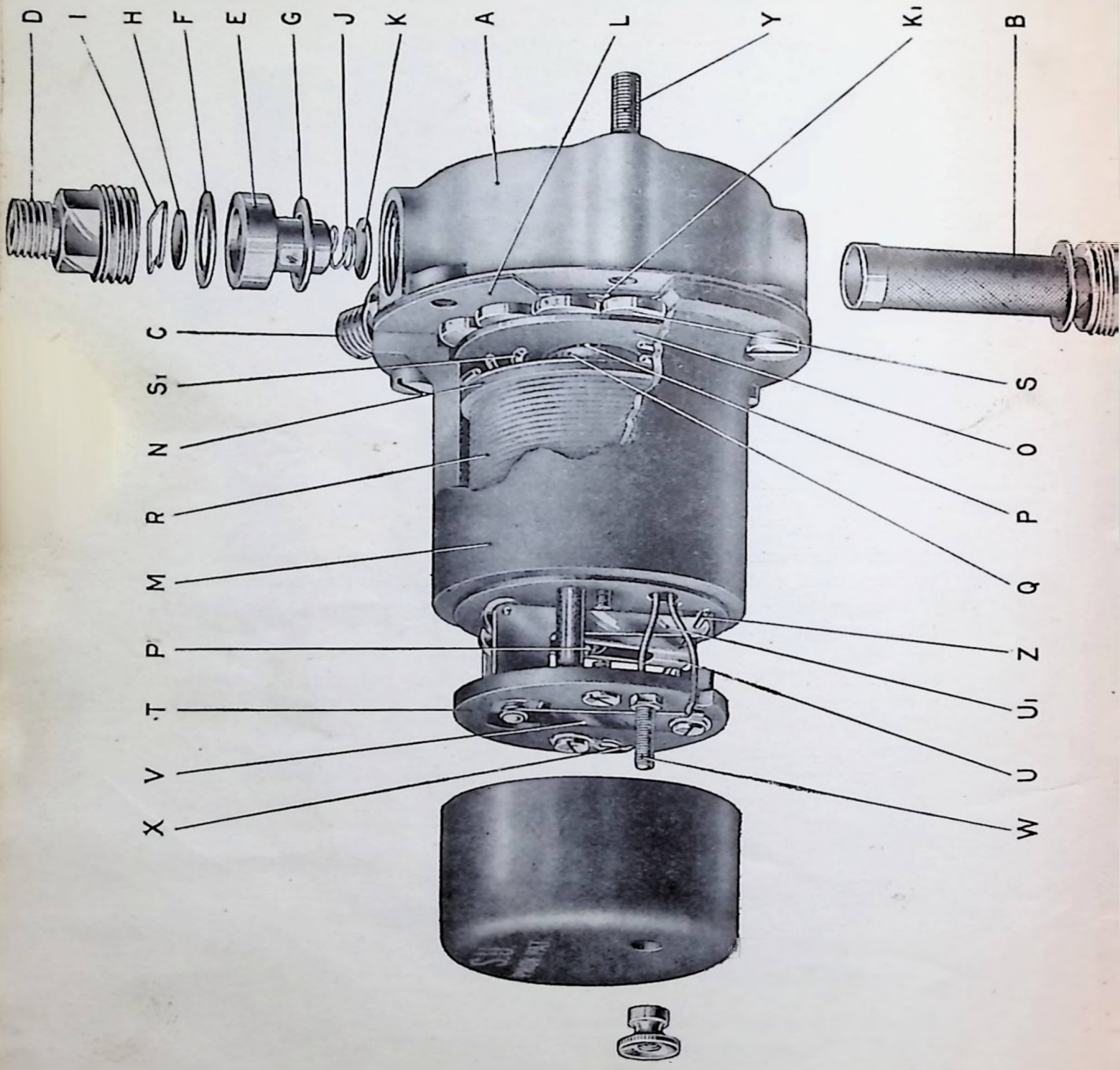
a little way up the cylinder bores, care being taken to avoid the top piston ring passing over the top face of the cylinder block. The crankshaft may then be revolved to clear each cylinder bore and to allow each connecting rod and piston to be withdrawn from beneath.



Remove the outer studs securing the clutch cover plate assembly to the flywheel and withdraw the clutch. Next release the tab washers and remove the four bolts securing the flywheel to the flange of the crankshaft, and withdraw the flywheel.

Remove eight nuts securing the engine rear bearer plate to cylinder casting and withdraw bearer plate from dowels upon which it is located.

Remove split pins and nuts from the four main bearings. Remove the four main bearing caps and remove the crankshaft from the cylinder case.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PETROL SUPPLY AND CARBURETTERS

THREE components directly concern the supply of petrol to the engine. First, the petrol tank, from which the petrol is drawn by means of the S.U. pressure pump to the Solex carburetter, secondly, the S.U. petrol pump, and lastly, the carburetter.

PETROL TANK

This is situated at the rear of the chassis, and has a capacity of ten gallons for the 1½-Litre and 14 h.p. models, and of twelve gallons for the 1½-Litre "Le Mans" two-seater and 2-Litre models.

On all models with the exception of the "Le Mans" two-seater, the tank is fitted with an electric petrol gauge having a recording dial on the facia board. This dial records the amount of petrol in the tank the whole time the ignition switch is in the "on" position.

On the "Le Mans" two-seater model, the tank is fitted with a two-way petrol tap providing a reserve supply of approximately one gallon and also with a quick-action filler cap.

S.U. PRESSURE PUMP

This instrument is capable of delivering eight gallons of petrol per hour through a suction lift of four feet continuously.

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

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

The contact breaker consists of a small bakelite moulding carrying two rockers "U' and "U1", which are both hinged to the moulding at one end and are connected together at the top end by two small springs arranged to give a "throw over" action. A trunnion is fitted into the centre of the inner rocker and the bronze rod "P" connected to the armature is screwed into this. The outer rocker "U1" is fitted with a tungsten point

which makes contact with a further tungsten point on a spring blade "V". This spring blade is connected to one end of the coil and the other end of the coil is connected to the terminal "W". A spring, "S1", is interposed between the armature and the end plate of the coil.

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

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

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

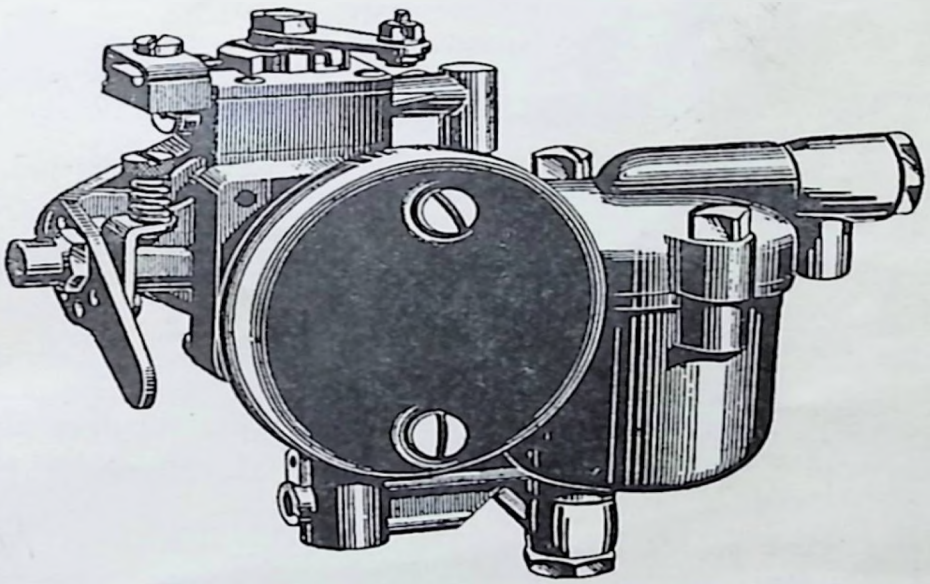
If the magnet is removed from the body for any reason care should be taken that the rollers "S" do not drop out. If the armature and centre rod have been unscrewed it will be necessary to reset these. In order to do this the magnet should be held in the left hand and the first finger used to hold the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

In the unlikely event of trouble, disconnect the lead from the terminal and strike against the body of the pump to see if it sparks and therefore if any current is available in the wire. If there is no current the trouble must be looked for elsewhere. If the current is there remove the bakelite cover and touch the terminal with the lead. If nothing happens and the points are intact and a spark cannot be struck off the terminal it is probable that there is some dirt on the points. If on the other hand the points are not in contact look to see if the tips of the inner rocker "U" are in contact with the magnet housing. If they are not it indicates that the

armature has not gone right back. To cure this loosen the six screws which hold the magnet housing to the body, make sure that the diaphragm is not sticking to the magnet housing by passing a penknife down the side of it and remove the hinge pin "Z". The six screws may then be tightened up again, when it will probably be found that the tips of the inner rocker are making contact with the magneto housing. If they are not it will be necessary to remove the whole magnet assembly, dismantle it and see if any foreign matter has caused a jam.

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

CARBURETTERS



On all models the Solex self-starting carburetter type 30FH is fitted. This carburetter is extremely simple in operation and as a rule the only attention which is necessary is occasional cleaning of the fine mesh filter and adjustment of the slow running control.

Before the car leaves the works the carburetter is set to give the most satisfactory combination of power, speed and petrol consumption, and the standard setting is as follows :—

	1½-Litre	"Le Mans" 2-str.	14 h.p.	2-Litre
Choke tube ..	24	24	24	25
Pilot jet ..	50	50	50	50
Main jet ..	120/51	120/51	120/51	125/51

In the case of a new car, it may be found desirable to reduce the size of the main jet after the engine is run in, but other items should only need alteration under special conditions.

The carburetter embodies a self-starting appliance which has been evolved after many years of study given to the problem of how to secure immediate starting and getaway, no matter what the weather conditions may be. Actually, the self-starting carburetter consists of a normal or main carburetter with which most motorists are familiar, but built into it is an auxiliary carburetter for the purpose of providing a mixture which will give immediate starting merely by pulling the knob on the dashboard.

By following the diagram (Fig. 2) it will be seen that the petrol passes from the float chamber of the main carburetter via a channel underneath the main carburetter to the well "A" via a calibrated petrol jet "G".

A dip-tube which is also calibrated to govern a fixed air supply descends from the mixing chamber into the petrol well "A".

When the throttle of the main carburetter is closed, it will be evident that as soon as the engine is turned over, depression, or "suction", occurs in the mixing chamber, so lifting a mixture of petrol and air from the well "A" via the tube into the mixing chamber, where still more air is introduced via the calibrated air jet.

It will be noted that the air jet and the petrol jet "G" are the factors governing the correct mixture ultimately in the mixing chamber, and upon the selection of the sizes of these two jets depends the success of the "Starter." How easy this is to determine will presently be seen.

This auxiliary carburetter is then, the means by which a mixture is secured of sufficient richness and volume to ensure an immediate start and continued running of the engine from cold.

As soon as the engine starts, however, the richness of the mixture automatically decreases.

To illustrate the point, imagine that the engine is turning over at normal starting speed as effected by the starter motor—say, 80 r.p.m.; the mixture is very rich for the quantity of air drawn through the air jet is very small compared with the quantity of petrol drawn through the dip tube from the well "A".

As the engine warms up and the resistance imposed by the oil is reduced, it naturally speeds up. The quantity of air drawn through the air jet obviously becomes automatically greater, but the supply of petrol from the well "A" remains constant, as governed by the side of the jet "G" through which, of course, the petrol must pass. Thus it will be seen that the mixture automatically weakens immediately the engine has started and gathers speed.

It will also be noted that starting the engine is effected with the butterflow throttle of the main carburetter closed, i.e., in normal idling position, so that once the engine starts its continued running depends entirely upon the mixture drawn from the mixing chamber of the auxiliary carburetter, i.e., a mixture which automatically adjusts itself. Thus the engine can never stall.

HOW TO OPERATE THE STARTER. The lever operating the "starter" is connected up to the dashboard by means of a cable, which is supplied with the carburetter, and the engine is started in one operation as follows :—

Pull the knob operating the control of the auxiliary carburetter, switch on, and press the starter button. The engine will start instantly.

There is no need to open the throttle of the main carburetter—in fact it must remain closed, i.e., in normal idling position, to allow full "suction" to be imposed on the auxiliary carburetter—no need to "set" your ignition, no need to "jiggle" your foot throttle, and no need to "flood" the carburetter.

Once started, and leaving the Solex "Starter" in operation, it will be possible to drive away without hesitation and without risk of the engine stalling.

Leave the "Starter" in operation for a few moments until the engine warms up. Then push the control knob in and the main carburetter will function as usual.

Once the engine is hot, it is not necessary to use the Solex "Starter" to start it up again.

ADJUSTMENT OF THE CARBURETTER
(TYPE 30 FH)

DESCRIBING THE FUNCTIONING OF THE MAIN CARBURETTER INDEPENDENTLY OF THE STARTING DEVICE.

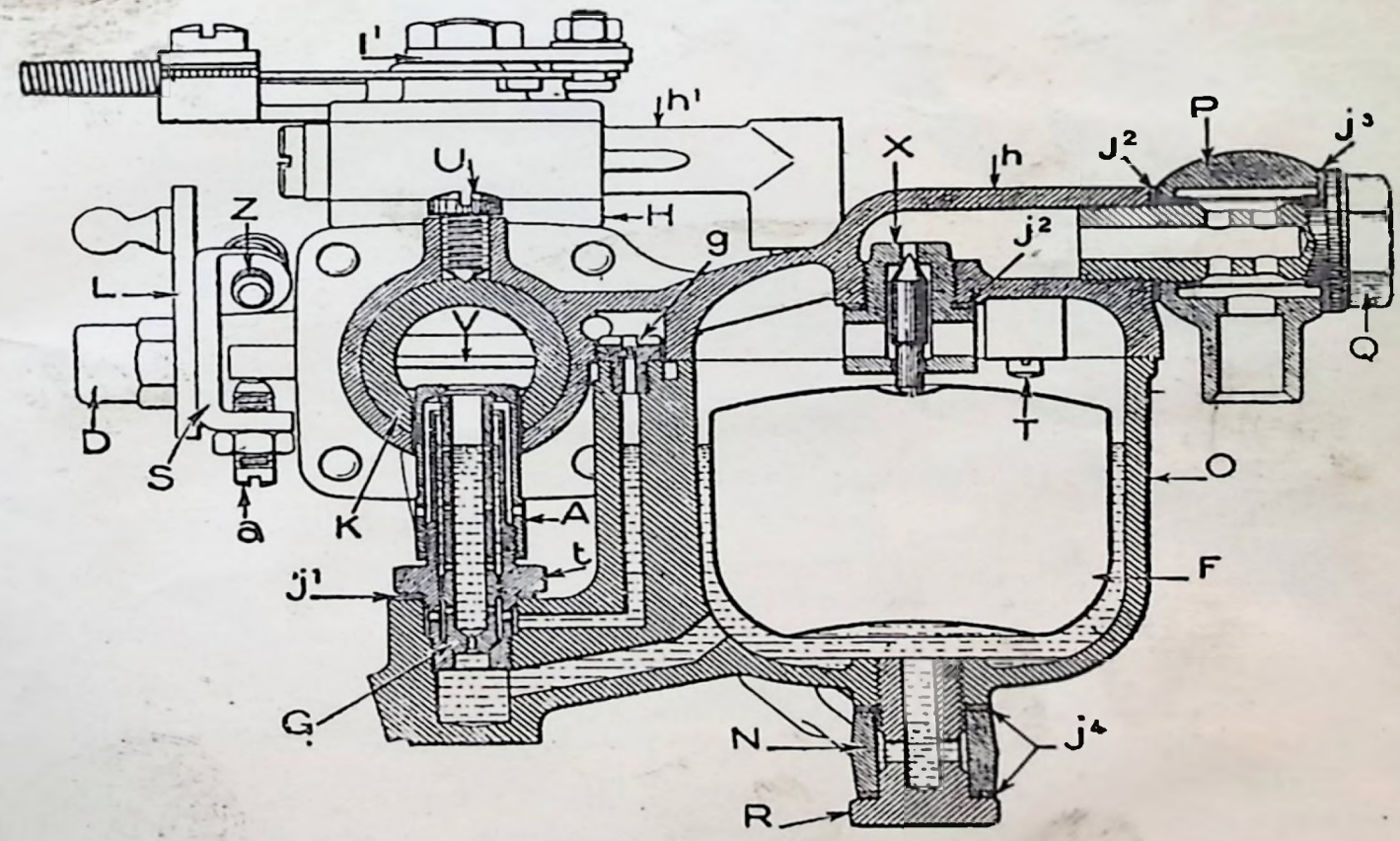
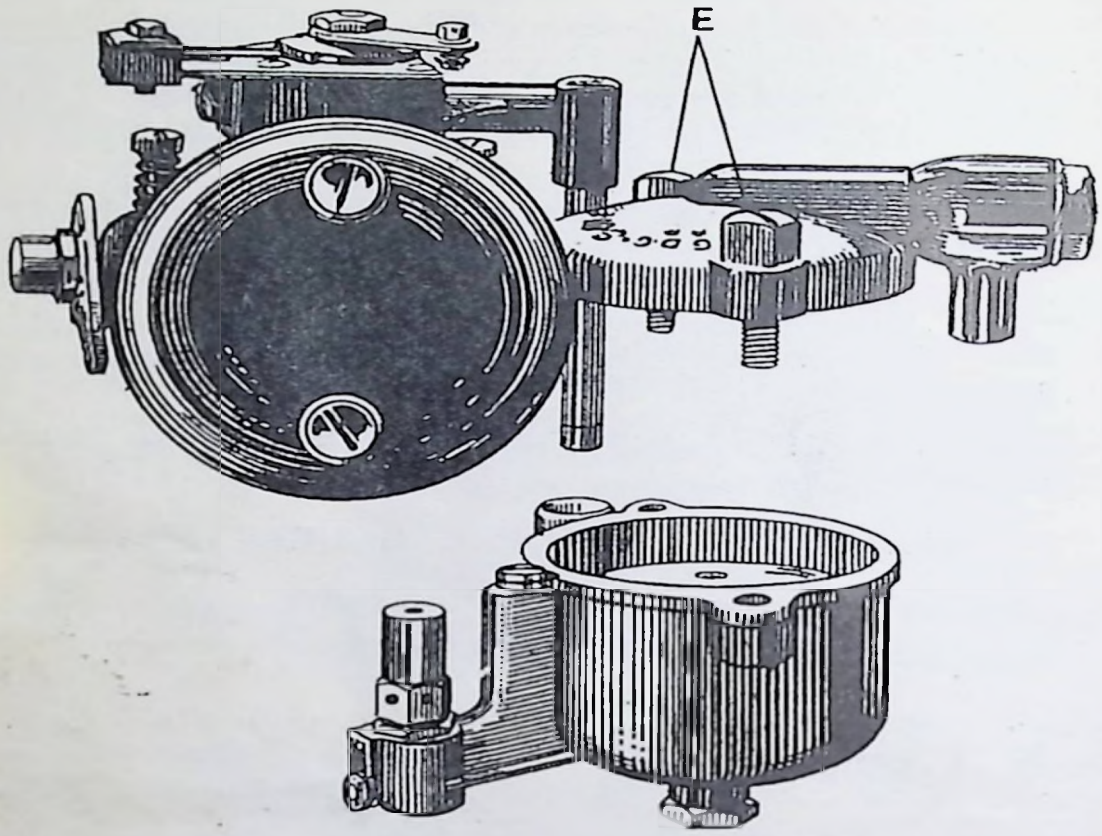


Fig. 2.

It is necessary if at any time spare parts should be required, to quote the number shown on the part required and at the same time the size and number of the carburetter, which is stamped on the outside of the float chamber. The size of jets, choke tube, should also be given on any order, but for unnumbered parts it will be sufficient to quote the carburetter number.



Dismantling the float chamber—this is accomplished with this type of carburetter in the most simple manner. It is only necessary to loosen the two screws (E) to enable the float chamber complete with float and both jets to be removed. When remounting be careful that the main and auxiliary jets register correctly in their places before tightening the fixing nuts.

The elements concerned in the adjustment of the carburetter, Fig. 2 :—

The choke tube (K) which controls the air volume.

The main jet (G) for idling mixture.

The F type Solex comprises in addition an auxiliary mixture regulating screw (W) which is intended for refinement of the idling adjustment.

To dismantle the choke tube (K) remove the bell in the case of the horizontal carburetter and loosen the choke tube fixing screw placed at the upper part of the body, when the choke tube itself can be withdrawn.

When remounting, note that the choke tube (K) numbers indicative of size and type are stamped on the atmospheric side.

To dismount the main jet (G), remove the jet cap (A).

To dismount the auxiliary jet (g), unscrew it by the aid of a screwdriver.

The adjustment of carburetters is generally determined in advance with great care following a series of bench and road tests.

Carburetters therefore are fitted to standard engines with this adjustment already in, and if the engine is in standard condition it is as a rule unnecessary to make any departure from this setting.

This setting is intended for a good all-round performance in a temperate climate at an altitude of less than 3,000 ft. and for normal fuel ordinarily obtainable from petrol pumps.

SLOW RUNNING ADJUSTMENT

The auxiliary jet (g) deals with the idling and its size has been determined with great care.

The slow running adjustment screw (Z) is mounted on the abutment plate and limits the closing of the throttle, thus regulating the rate of idling. By rotating the screw clockwise the speed will increase and vice versa.

The F. type carburetters comprise in addition an auxiliary mixture regulating screw, which is intended within certain limits to regulate the auxiliary mixture strength. When this is incorrect, the engine tends either to "hunt" or stall.

In order to carry out this adjustment, commence with the regulating screw fully home and the throttle adjusting screw set to the lowest possible idle, in which circumstances the motor should then have a tendency to "hunt". Then rotate the mixture regulating screw anti-clockwise until the engine runs regularly.

In exceptional cases the range of this screw is insufficient to obtain the results required, and a larger or smaller auxiliary jet must be used according to circumstances.

N.B.—Make the adjustments when the engine is at normal working temperature.

ADJUSTMENT FOR POWER

As a rule the choke tube provided in the carburetter is correct and should only be changed when a specific performance is required from the car, irrespective of the general all round results.

The power adjustment then is a question of the determination of the correct size of main jet (G). Generally speaking, it is advisable to make this as small as possible, and it is usually a good plan to finally decide upon the number which is one size bigger than that which gives an obviously poor mixture.

One can recognise the latter symptoms easily by the tendency to back-fire through the carburetter on opening the throttle.

Excess of petrol on the other hand can be recognised by heavy consumption and by a tendency to soot up the plugs after quite a short distance of normal running.

The colour of the porcelains when the carburetter is correct should be approximately chestnut.

When the mixture is correct for summer work it is generally a little poor during the winter weather. In this case it is usually advisable to fit a main jet one or perhaps two sizes bigger.

MAIN JET. The main jet is provided with two numbers marked on the side of the jet tube. The first number (75, for example) indicates the

diameter of the fuel metering orifice (lowest hole) expressed in hundredths of millimetres. The second number (41, for example) indicates the number and disposition of the lateral correction holes.

We would especially warn owners against attempting to reamer any of the jet holes. In making tests, jets of original calibrations larger or smaller and of the same "correction" should be used.

DIAGNOSIS OF CARBURETTER FAULTS

There are so many slight engine irregularities that may affect the perfect functioning of this "Starter" and for that matter of the main carburetter, that we will proceed to enumerate hereunder the most common.

DIFFICULT STARTING. Petrol pipe obstruction. Dirt or water in the petrol tank will find its way eventually to the petrol pipe and a definite obstruction may result. Shortage of petrol has frequently been traced to pieces of packing material or other foreign matter having become lodged in the petrol pipe. Also air locks may occur. A stopped up vent pipe in the petrol tank filler cap or a petrol pipe too close to the exhaust manifold, are often the causes. In the latter case, partial vaporization of the petrol akes place in the pipe and a vapour lock is formed.

The same thing may happen in the carburetter if fed by a petrol pump mounted too close to the exhaust system.

Fortunately these short notes deal with the conditions that seldom arise, but it is hoped that readers of this booklet may find a solution when as sometimes happens, there seems to be no obvious explanation of starting failure.

Fuel. There are now very many varying grades of fuel on the market. Whilst a "No. 1" spirit in all well-known makes may be accepted as beyond reproach, there are a number of low grades of obscure origin which are not at all suitable for general use. Always use a "No. 1" Fuel unless you are positive that any other grade covers the above requirements.

FLOODING. Loose Joints. The self-starting Solex Carburetter has only six joints—

The joint of the main jet carrier.

The joint of the needle valve.

The joints of the petrol union.

The joints in the petrol pipe exterior to the carburetter.

The joints in the base plug connecting the starter to the float chamber.

It is easy to see whether any of the exterior joints are loose. The first thing to do therefore when a carburetter floods is to verify these various joints.

Grit on the Needle Seating. This does not as a rule occur in the case of carburetters provided with a filter, and generally only within the first few miles after fitting, in which case it is usually due either to stray

particles of material or to particles of oxide or solder which are apt to loose inside the petrol pipe. Remove the needle valve and clean same by carefully blowing it out and noting by suction test that it is hermetic, after which replace it and be sure that the washer is perfect and the tightening adequate.

PUNCTURED FLOAT. If any petrol gets into the float its weight is, of course, increased, with the consequence that the level is raised and flooding occurs via the jets. In such a case, one must either change the float, or locate if possible the point of leakage, and solder it. To do this, immerse the float under boiling water when the emergence of bubbles will disclose the puncture.

EXCESSIVE CONSUMPTION. Note first that there is no leakage either at the carburetter, in the pipe-work or the petrol tank. Be sure then that the estimation of fuel consumption is correct. To confirm this, it is always advisable if possible to make a definite test over a known mileage in average country with a measured quantity of petrol, either in the main tank if it is of the type from which all petrol can be drained or by the use of an externally placed auxiliary test tank. The longer the test, of course, the more accurate will be the reading, assuming a non-stop run. Never estimate petrol consumption either from the speedometer readings or from supposedly accurate quantities delivered from petrol pumps either of which are subject to appreciable errors.

LOOSE MAIN JET CAP. If the heating is sufficient and the jets as small as possible, consistent with maximum speed and correct idling, the wastage can seldom come directly from the carburetter excepting through the main jet cap being loose or the jet for some reason not seating correctly in its carrier.

UNEVEN SLOW RUNNING. Ascertain that the adjustment is correct. If even then good slow running is not obtained, air leakage is indicated at some point of the induction system, probably via worn inlet valve stems or their guides. In this case try a slightly larger auxiliary jet, but not too large, for then the engine will "hunt" when idling. Where there is any choice between two jets which give approximately the same results, always use a larger one. Before making any jet alterations it is well to assure oneself in every case that the jet is clear of obstruction. If, in spite of trying various auxiliary jets, regular slow running is not possible, excessive induction leakage is certainly indicated—assuming the ignition to be in order and valve timing normal. The engine in this case will not idle regularly and when one attempts to reduce the idling speed it will generally stall. Air leakage in such a case is confirmed by a depression of the "tickler" at this moment, which will cause a temporary pick-up. One must realise that slow running is in such a case impossible, for the engine is actually obtaining, via various sources of leakage, a greater quantity of air than that entering via legitimate means, so that the correct slow running mixture becomes unobtainable.

POOR ACCELERATION. INCORRECT ADJUSTMENT. Assure oneself by reference to that particular engine, that the carburetter is adjusted in an average manner. If the performance is still bad in spite of this, a larger

jet than is normally necessary may in some cases be required, owing to the individual characteristics of the engine, but the choke tube as a rule should not be changed.

Complete Impossibility of Acceleration. Assuming that starting and idling are possible, this can only be caused by obstruction of the main jet, weak ignition or other engine irregularities.

LACK OF POWER OR MAXIMUM SPEED. Butterfly not Opening Fully. Note that when the accelerator is depressed fully, the butterfly opens to its greatest extent. This can be checked by observing the position of the limit screw which should be in contact with the boss cast on the outside of the throttle chamber.

Insufficient Advance. This is a prevalent cause of both heavy petrol consumption and insufficient top speed, and can be usually recognised by inability to make the engine knock when pulling up a hill with fully advanced spark. This, of course, has nothing to do with the carburetter.

Defective Petrol Supply. This can always be recognised by standard acceleration after a certain speed at which "periodic hestitations" and backfiring occur, curable always by a slight throttle reduction. In such a case, remove the float chamber and note the rate of petrol flow from the needle valve which will frequently be a sufficient indication. For confirmation, make a special test with an independent test tank placed as high as possible on the car so as to ensure a good head.

ENGINE EFFICIENCY. Carburetter and induction pipe joints must, of course, be tight. Compression should be tested, for where this can leak outwards, air can of course leak inwards and so upset the starting and idling mixture. All these items have the greatest ill effect when the engine is turning slowly, i.e., when one is endeavouring to start it, so that it is important to maintain the engine in good order to safeguard against troubles.

TROUBLES CAUSED BY AIR FILTERS. An air filter with too small a section of filtering medium will frequently raise the consumption owing to the increased vacuum thereby imposed upon the jet. If this is suspected, make a comparative test with the air filter removed. Should the cause be located here, first clean carefully the filtering medium and try again, but if the consumption is still bad it is probably the result of the filter itself being too small.

OVERHEATING. It is seldom that the carburetter is the cause of this and it is definitely impossible, strictly speaking, where water-cooling is concerned. Too much petrol or, on the other hand, an excessively weak mixture can certainly raise the temperature a little, but in no case should it nearly approach the margin of cooling that should be provided by the water cooling system under normal conditions.

Apart from a major examination, the most likely directions in which to work are reducing the mixture, but not to an unduly weak condition, and advancing the ignition as far as possible consistent with the avoidance of knocking.

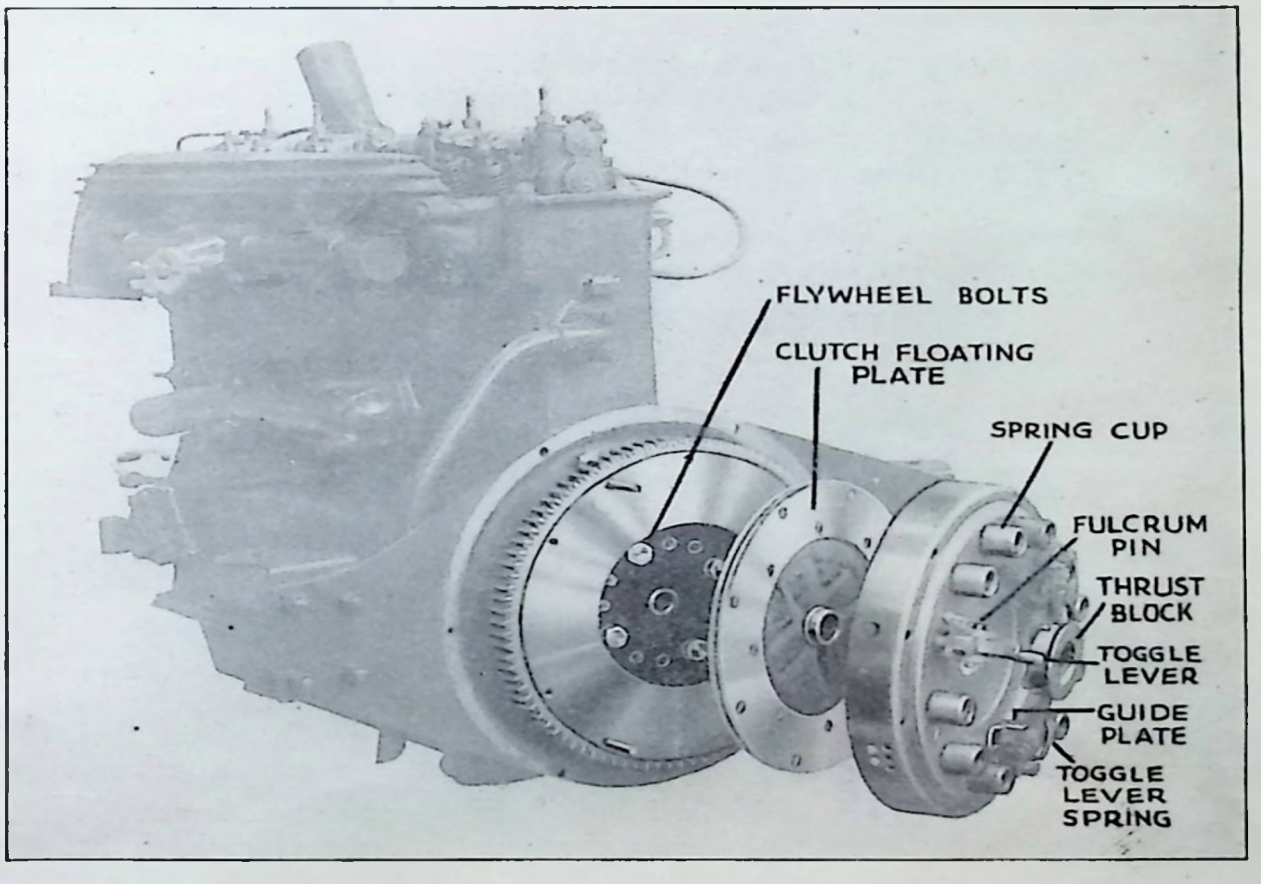
In passing, a retarded spark will always raise appreciably the engine temperature, hence these brief notes concerning the ignition timing.

CLUTCH

VERY little need be said about this unit as the operation of the clutch is entirely automatic, adjustment only being provided to alter the clearance to the foot pedal.

No provision is made for lubrication other than the oil port which is drilled in the constant pinion for the purpose of allowing a small quantity of oil from the gearbox to reach the splines of the clutch floating plate. It is, however, policy to make a practice of oiling the clutch withdrawal mechanism with a hand oil can when the routine chassis lubrication is carried out.

In course of time wear of the clutch friction plates will make adjustment necessary. This is most readily observed by a lack of free play in the foot pedal—it should be possible to depress the pedal at least one and a half inches before the pressure of the clutch springs is felt.



The adjustment is arranged on the coupling rod which connects the clutch pedal to the clutch operating lever and when adjustment is necessary slacken the lock nuts, turn the coupling rod until the desired amount of free play is obtained and re-tighten the lock nuts.

Too much free movement in the pedal is inclined to prevent the clutch from fully disengaging and will make gear changing difficult. Too little movement will definitely prevent the clutch engaging and will result in slipping and will cause damage to the friction plates.

Both the clutch and the brake pedals are adjustable at the stem for pedal reach and to effect this adjustment, merely release the lock nuts holding the stem to the pedal, set the pedal to the required position and re-tighten the lock nuts.

DISMANTLING CLUTCH ASSEMBLY

Remove clutch assembly as in paragraph four (crankshaft assembly).

The clutch floating plate was released when the clutch assembly was removed from the flywheel, and to dismantle the clutch cover plate assembly it is necessary to remove the three toggle lever adjustment bolts and guide plates. This releases the clutch pressure plate and the three toggle level adjustment springs. Remove the nine spring cups and clutch springs from the cover plate.

Remove split pins and fulcrum pins which secure the toggle levers to the eye bolts in the clutch cover plate. The toggle levers and thrust collar are then free to be taken away.

Release the three set pins and tab washers which secure the circular plate of spring steel to the thrust collar, this releases the three toggle levers.

Take away the three nuts which secure the eye bolts to the clutch cover plate.

GEAR BOX, FREE WHEEL AND CHANGE SPEED ASSEMBLY

A brief description of the gearbox was given in the specification and the method of operating the change speed mechanism was dealt with in the section of this book dealing with the control of the car.

A similar type of gear box is fitted to all models, the free-wheel unit being an addition to the gear box.

Practically the only attention the gearbox needs is the periodical replenishing of the oil level (approximately every 1,000 miles) and occasionally draining off the old oil, flushing out and refilling with new oil.

Lubrication is entirely automatic, the oil level being sufficient to cover the layshaft gears. When the car is in motion the movement of the gears throws oil on to all gears and bearings and an oil mist is thrown up into the change speed lever control tower to lubricate the selector mechanism.

The filler plug is situated behind the change speed lever bracket and the oil level plug is on the offside of the gearbox, access to both being obtained by removing the floorboard.

Always check the oil level after the car has been running and while the oil is still warm. Refill gradually and allow a few minutes for the new oil to find its level before checking. The capacity of the gearbox is three pints and it is not policy to overfill this unit.

Change the oil in the gearbox about every four thousand miles by removing the drain plug at the base of the gearbox while the oil is warm. Swill out with paraffin, replace the drain plug and fill with fresh oil to the correct level.

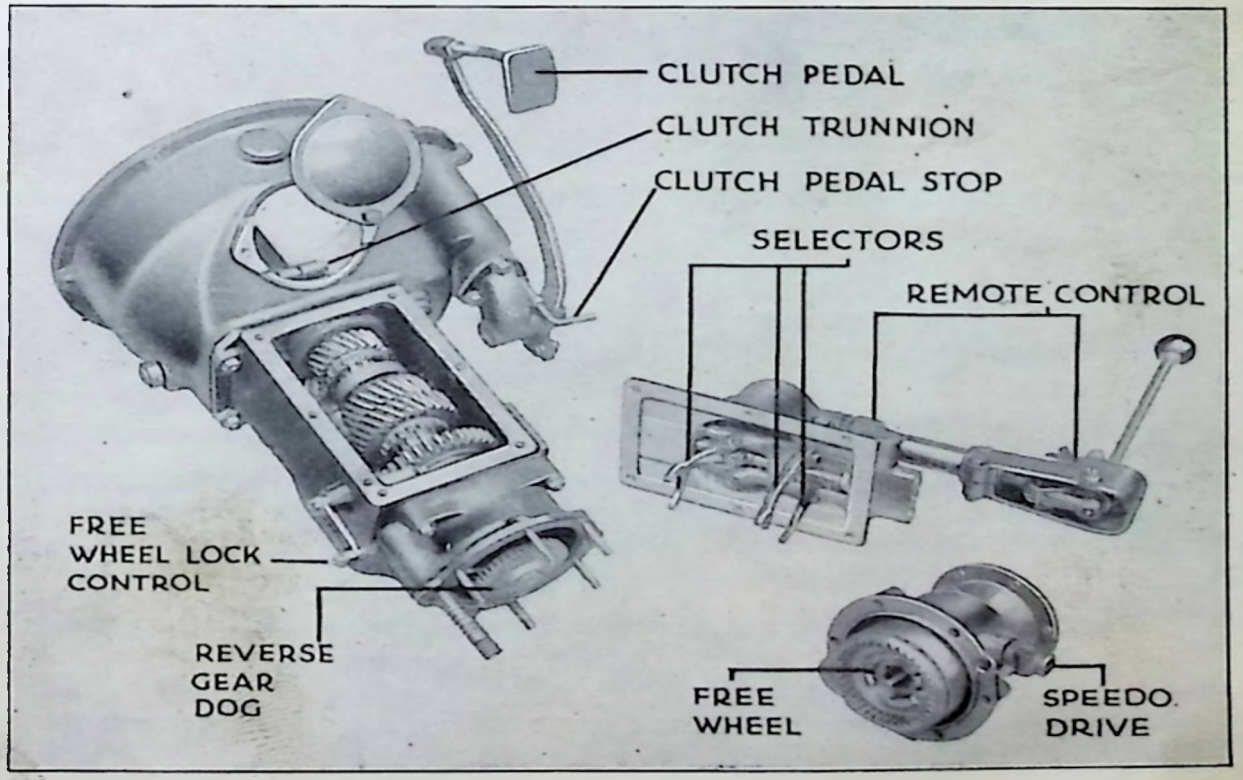
DISMANTLING GEAR BOX, FREE WHEEL AND CHANGE SPEED ASSEMBLY

Remove gear box from chassis as indicated in paragraph 6 (removing engine from frame).

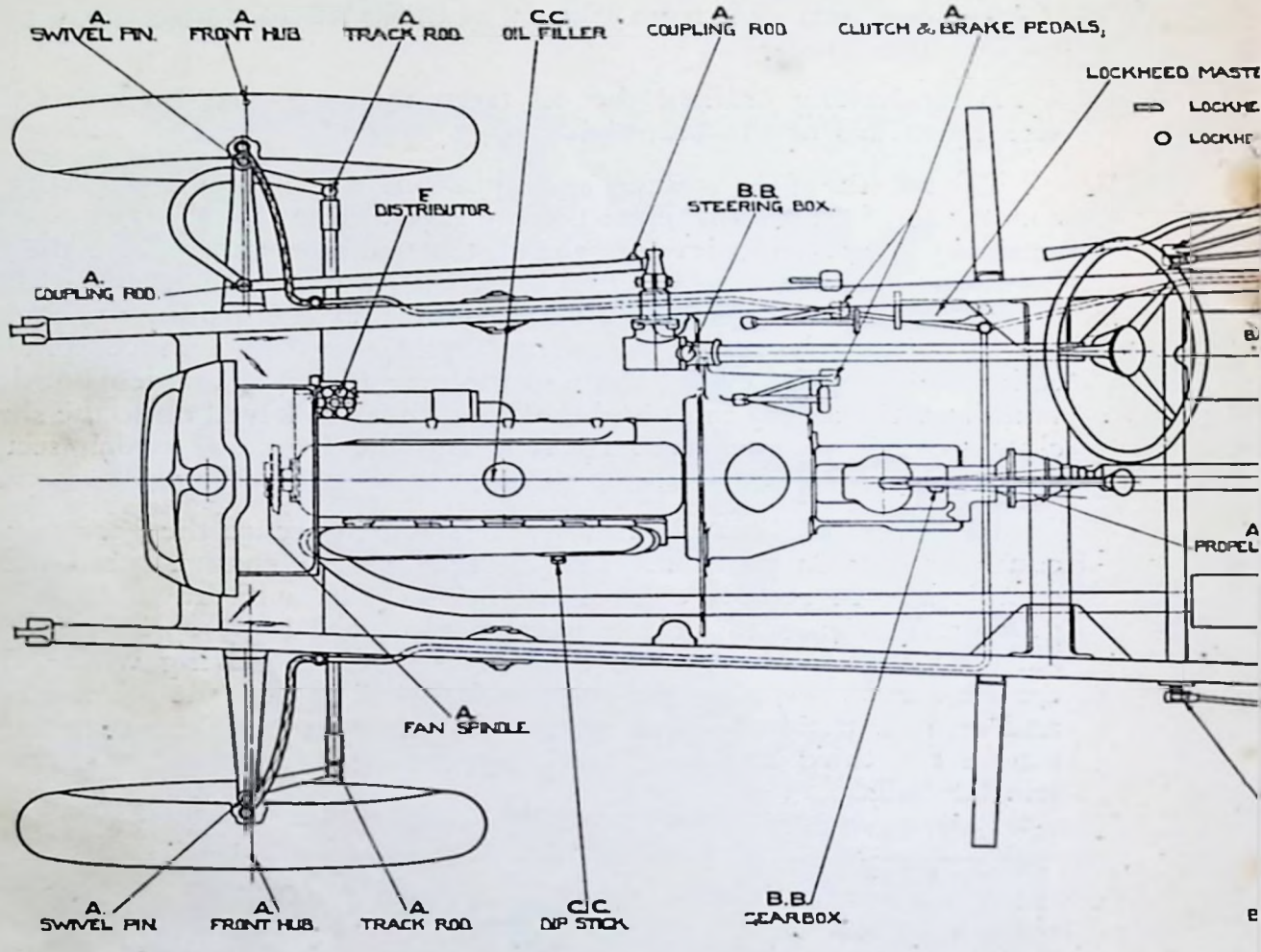
After having drained the oil from the gear box, hold this unit in a vice by means of the drain plug.

Release the pin, washer and split pin which secure the clutch pedal connecting fork to the clutch shaft lever. Remove the two spring clips retaining the shifting lever to the clutch trunnion and remove the trunnion (in the clutch trunnion is fitted a carbon ring which is removed by releasing the pinch bolt, nut and washer through the trunnion). Release the clutch shifting lever, set screw and spring washer, remove split pin and collar securing the clutch shaft to the nearside of the clutch housing, then withdraw the clutch shaft and the lever which is keyed on to the shaft. The clutch housing is removed by releasing the five nuts which secure it to the front of the gearbox.

Remove the six studs and washers which secure the gear box lid and control tower in position. This will allow the change speed mechanism complete with remote control extension to be withdrawn. Select neutral gear, and release the three selector plunger plugs, springs and selector balls situated in the gear box lid. Extract the locking wire and release the set screws securing the selector forks. Unscrew the selector rod plugs and remove the forks and rods, and care must be taken that the locking pin in the third and fourth selector rod is not mislaid. Extract the two selector balls.



THE SINGER 1½-litre, 14 h.p. & 2-litre CARS-



LUBRICATION

Reference to the Lubrication Chart above will give a summary of the essential attentions to the 9 h.p. Model.

All points marked (A) are to be greased weekly or every 250 miles, and this also applies to points (C).

Points (AA) are to be greased every 2,000 miles with non-separator grease.

Points (BB) are to be checked monthly or every 1,000 miles.

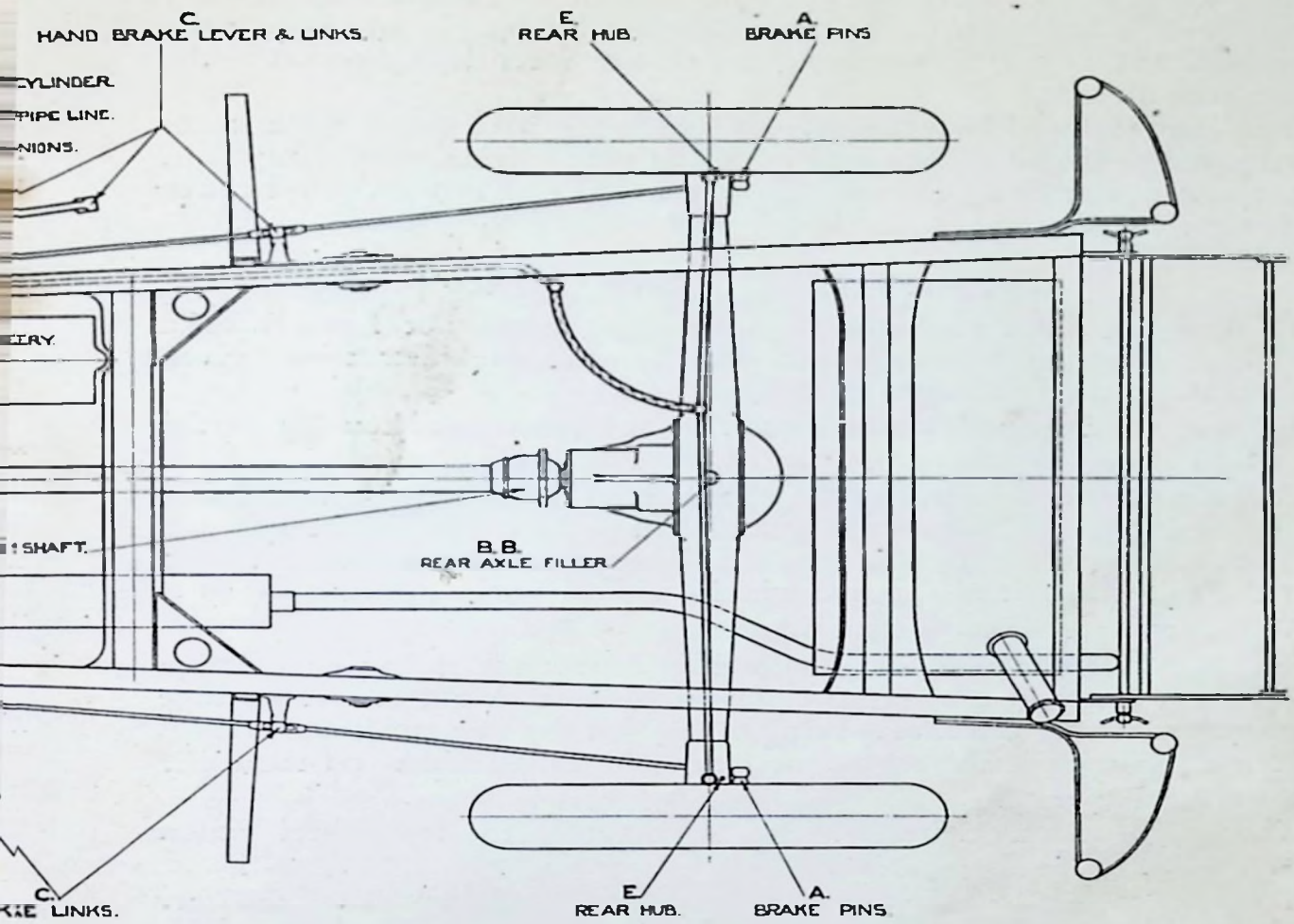
In addition to this there are daily attentions such as the engine oil level, radiator water level, and, if the petrol level is replenished, that a small quantity of "Castrollo" upper-cylinder lubricant is added at the rate of half-an-ounce to two gallons of petrol.

The tyre pressures should be tested weekly, and the battery monthly.

FRONT HUBS

A grease nipple is fitted to each front hub in the angle between the hub barrel and flange. It is necessary to remove the dust cover and road wheel to obtain access to the greaser, and each hub should be greased approximately every 250 miles.

SUMMARY OF ESSENTIAL ATTENTIONS



GREASING POINTS

Steering swivel pins	Greasers.	Two.	Propeller shaft	Greasers.	Two.
Steering track rod	,,	Two.	Rear axle . .	,,	Four.
Steering coupling tube	,,	Two.	Foot brake pedals	,,	One each.
Remote control . .	,,	One.	Distributor . .	Oiler.	One.
Fan assembly . .	,,	One.	Hand brake . .	,,	One.
Front hubs . .	,,	One each.			

RECOMMENDED LUBRICANTS

ENGINE AND GEAR BOX.

Wakefield Castrol X.L. (summer) or Price's Motorine 'C'.
Wakefield Castrol A.A. (winter) or Price's Motorine 'M'.

REAR AXLE AND STEERING BOX.

Wakefield Gear Oil 'D' or Price's Motorine Amber 'B'.

GREASERS.

Wakefield Castrolease Medium, or Price's Belmoline 'C'.

UNIVERSAL JOINTS.

Wakefield Castrol Unijoynt Grease or Hardy Spicer Universal Joint Grease.

Remove the change speed gate by releasing the four screws securing the gate to the control tower, release the clamp pin and the spring washer securing the striking lever to the actuating tube of the remote control. The striking lever is keyed on to the tube. Remove the set pin and release the clamp bolt, washer and nut securing the change speed lever bracket to the remote control tube.

The change speed lever bracket and actuating tube can now be withdrawn through the remote control extension tube. Release the clamp bolt, washer and nut securing the remote control tube clip to the control tower and remove the clip.

DISMANTLING GEAR BOX

In applying these instructions to the gear boxes not fitted with a free wheel device, it is merely necessary to omit the instructions given in dismantling the free wheel assembly.

Remove six nuts and washers securing the free wheel housing to the free wheel extension case at the rear of the gear box.

Remove the screw securing the speedometer spindle guide to the free wheel housing and withdraw the spindle and pinion. Release the split pin and nut securing the universal joint coupling, and withdraw the coupling from the splined shaft of the free wheel.

Withdraw free wheel body complete.

To dismantle the free wheel assembly, extract the spring ring which secures the roller cage and remove the free wheel centre, i.e., roller cage and pentagon centre piece, care being taken that the two small coil springs between the bosses of the centre piece and the raised plates on the roller cage are not lost.

The speedometer driving wheel is keyed on to the free wheel pinion shaft.

To proceed with dismantling the gear box, withdraw from the free wheel extension case the reverse gear dog from the splines of the mainshaft. Extract the reverse gear dog striker fork, shaft and release spring. Release six nuts and washers securing free wheel extension case to gear box.

Release the lock nut and tab washer at the rear end of the gear box mainshaft, and remove the constant mesh pinion by rotating the pinion until the milled section of the gear will clear the layshaft gear.

Drive out the constant mesh pinion, ball race, etc., and remove spigot bush.

Drive out the mainshaft and rear ball race from the gear box casing, and remove the mainshaft assembly through the top of the gear box. Dismantle the mainshaft assembly by sliding off third and top dog, remove nut and tab washer from front end, remove splined dog sleeve, third speed thrust washer and slide off the third gear. Then remove second gear and bush from mainshaft, and withdraw second gear thrust washer.

Remove the layshaft split pin, nut and washer and drive out the layshaft and front ball race, afterwards removing the layshaft gears from the gearbox, extract the layshaft rear ball race.

Release the reverse gear bush retainer pin and extract reverse gear and shaft.

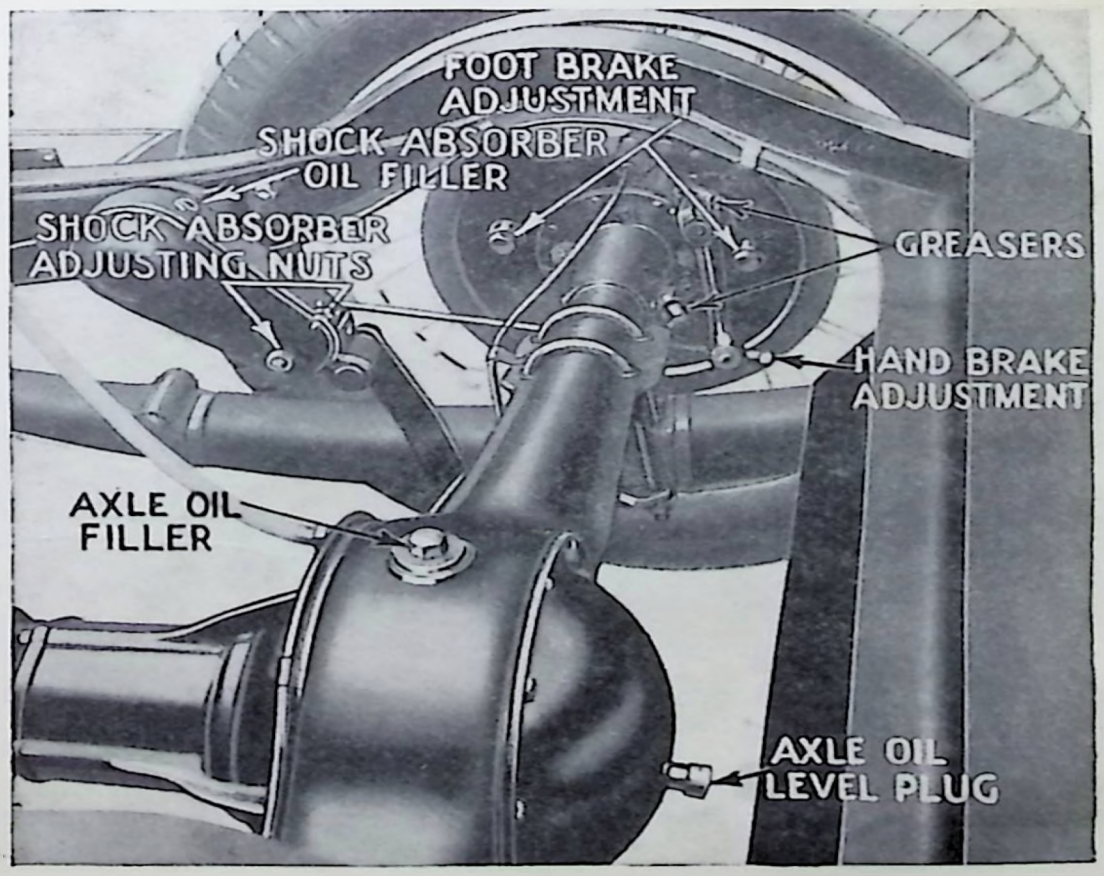
REAR AXLE

A BRIEF description of the rear axle has already been given, and as this unit is hardly likely to need any attention other than that required to ensure sufficient lubrication, it is merely necessary to add that the rear axle should be treated generally in the same way as the gear box.

The oil level should be replenished about every 1,000 miles, and the axle case should be drained, flushed out and refilled with fresh oil about every 4,000 miles. The capacity of the rear axle is approximately 5 pints, and care must be taken not to overfill the axle case to prevent any possibility of oil finding its way in to the rear brakes.

In this unit, as in the gear box, lubrication is provided by the movement of the gears throwing oil to all essential parts of the axle and bearings.

The filler plug is located on the top and in the centre of the axle case, the drain plug at the bottom and in the centre of the axle case, and the level plug on the axle case rear cover, and the work of refilling or replenishing the axle with oil is most easily carried out by removing the rear seat board and working from inside the car.



DISMANTLING REAR AXLE, HUBS AND BRAKES

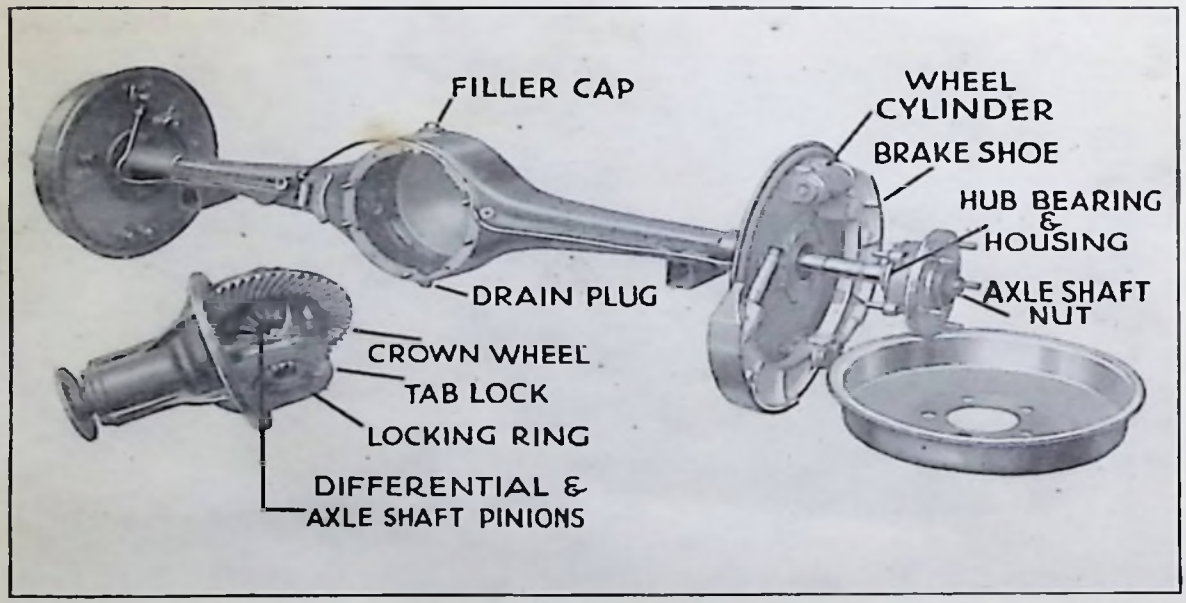
To remove the propeller shaft, release the six bolts, nuts and spring washers securing the Hardy Spicer joint on the propeller shaft to the universal joint coupling fitted to the bevel pinion. The front end of the propeller shaft has been dealt with under the heading of "GEAR BOX". The propeller shaft may then be removed entirely.

Lifting jacks should be placed under the chassis frame approximately at a position level with the front end of the rear road springs. The chassis should then be jacked up until the rear road wheels are clear of the ground. Blocks should be placed in position to support the chassis weight when the jacks are removed.

Remove the road wheels, release and remove the lifting jacks.

Remove the road spring U bolts by releasing the sixteen nuts and washers (four to each U bolt) and withdraw the bolts. Disconnect the brake rod at the brake cam lever.

Drain the Lockheed brake system, and release the unions connecting he nearside and offside cylinder feed pipes to the hose bracket. Remove he rear axle rubber buffers by releasing the bolts and nuts securing the buffers and retainers to the chassis frame. The axle may now be removed by withdrawing to the offside, through the springs.



Remove the rear axle drain plug, and drain out the oil.

Remove the countersunk screws securing the brake drums to the rear hubs, and remove the drums.

Remove the split pins and washers from the brake shoe fulcrum pins. Release the pull-off springs, and remove the brake shoes. Do not interfere with the wheel cylinders.

Release the four nuts and split pins securing the rear hub to the axle casing, and withdraw the rear hub, bearing housing and bearing together with the axle shaft. Release the split pin and nut securing the axle shaft to the hub, and withdraw the hub (which is keyed on to the shaft) and bearing housing. Release the tab washer and lock nut securing the bearing housing and bearing to the rear hub, and extract bearing housing and bearing together. Remove bearing, washers and oil retaining washer from the bearing housing.

Remove six nuts, spring washers and four studs securing differential assembly to axle case (the two offside studs secure the Lockheed brake feed pipe bracket), release the nut and bolt securing this bracket to the pipe and lift the differential assembly from the axle case. It is not necessary to remove the axle case rear cover when withdrawing the differential assembly.

Hold the differential assembly in a vice and remove the split pin and nuts securing the universal joint flange to the shaft of the bevel pinion, withdraw flange.

Remove the locking wire from the four studs and spring washers of the bevel pinion housing (mark the housing and the axle case to ensure the housing being returned to the correct position). Withdraw the bevel pinion housing, and carefully remove the shims which are fitted between the housing and the case. Remove the two distance collars from the bevel pinion.

Remove split pins securing the locking tabs to the axle bearing case caps and remove the four nuts and locking strips which secure the axle bearing case caps into position.

Remove the caps and the serrated adjusting lock rings, care being taken to keep the outer rings of the roller bearings in position, as these are not interchangeable, and they are likely to fall away when removing the crown wheel and differential assembly.

Tap out the bevel pinion and bearing towards the rear of the case.

Dismantle the bevel pinion housing by removing the spring ring and unscrewing the lock ring. Then remove the distance washer and press out the double row thrust race. Remove cap from bevel pinion housing, and withdraw felt washer and circular coil spring.

Remove locking wire and eight set studs securing the crown wheel to the flange of the differential case, and remove the crown wheel. Extract the roller bearings, remove set pin locking the centre pin for the differential pinions, tap out the pin and remove differential pinions and axle shaft pinions.

BRAKES

GENERAL DESCRIPTION

THE brakes fitted to the 1½-Litre, 14 h.p. and 2-Litre models are of the Lockheed hydraulic type operating on 13in. drums.

The foot brake operates on all four drums, the hand brake on the rear drums only.

It would perhaps be advisable first of all, to deal with the method of operation of the LOCKHEED FLUID BRAKE.

The effort from the foot pedal is conveyed to the brake shoes by means of a column of fluid which is incompressible, and this fluid is a speciality of the Company manufacturing the brakes and has been developed as a result of extensive research work. For the brakes to function satisfactorily and remain efficient, genuine LOCKHEED BRAKE FLUID MUST BE USED EXCLUSIVELY.

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

The master cylinder is fitted with a piston, and the wheel cylinders are each fitted with opposed pistons, all of which are provided with cup washers which act as a seal to maintain pressures and prevent any loss of fluid.

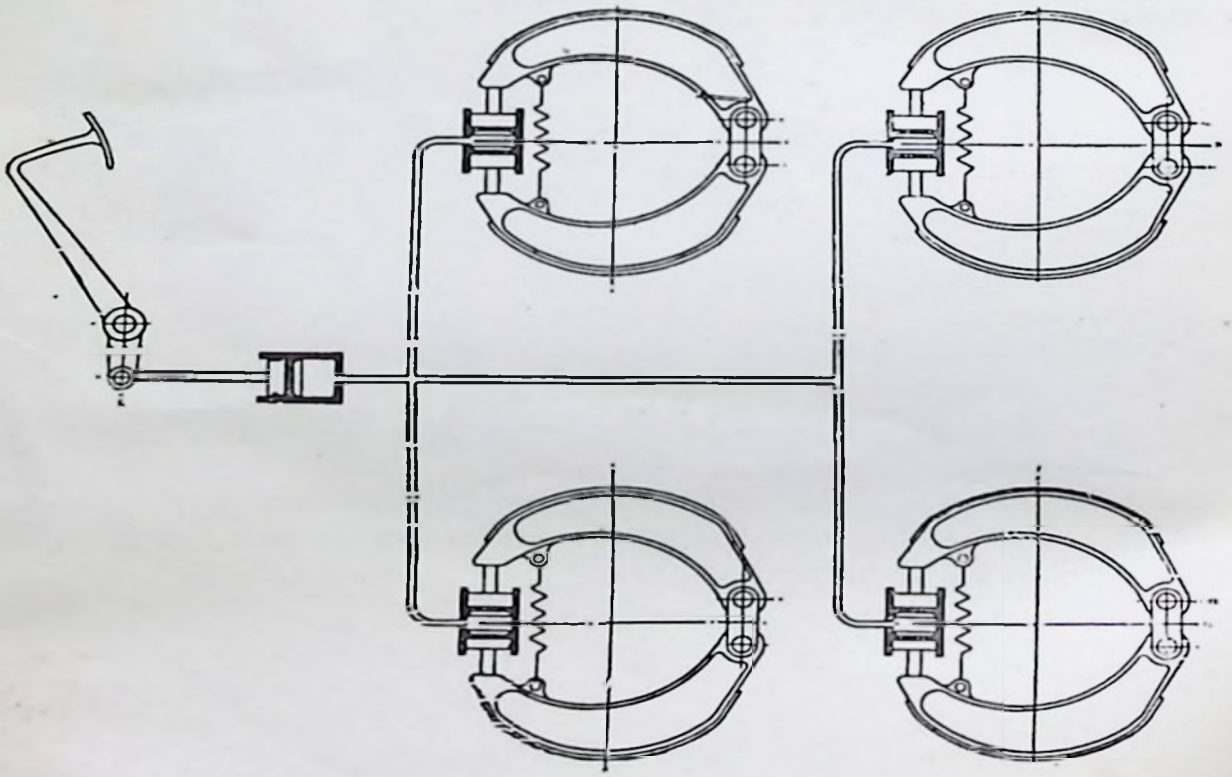


Fig. 1.

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

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

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

THE MASTER CYLINDER. This is designed to automatically maintain in the system, when at rest, a constant volume of fluid at a uniform pressure of 8 lbs. per square inch, this pressure acting as a liquid expander on all rubber cups, ensuring a complete and efficient sealing of the system (Fig. 2).

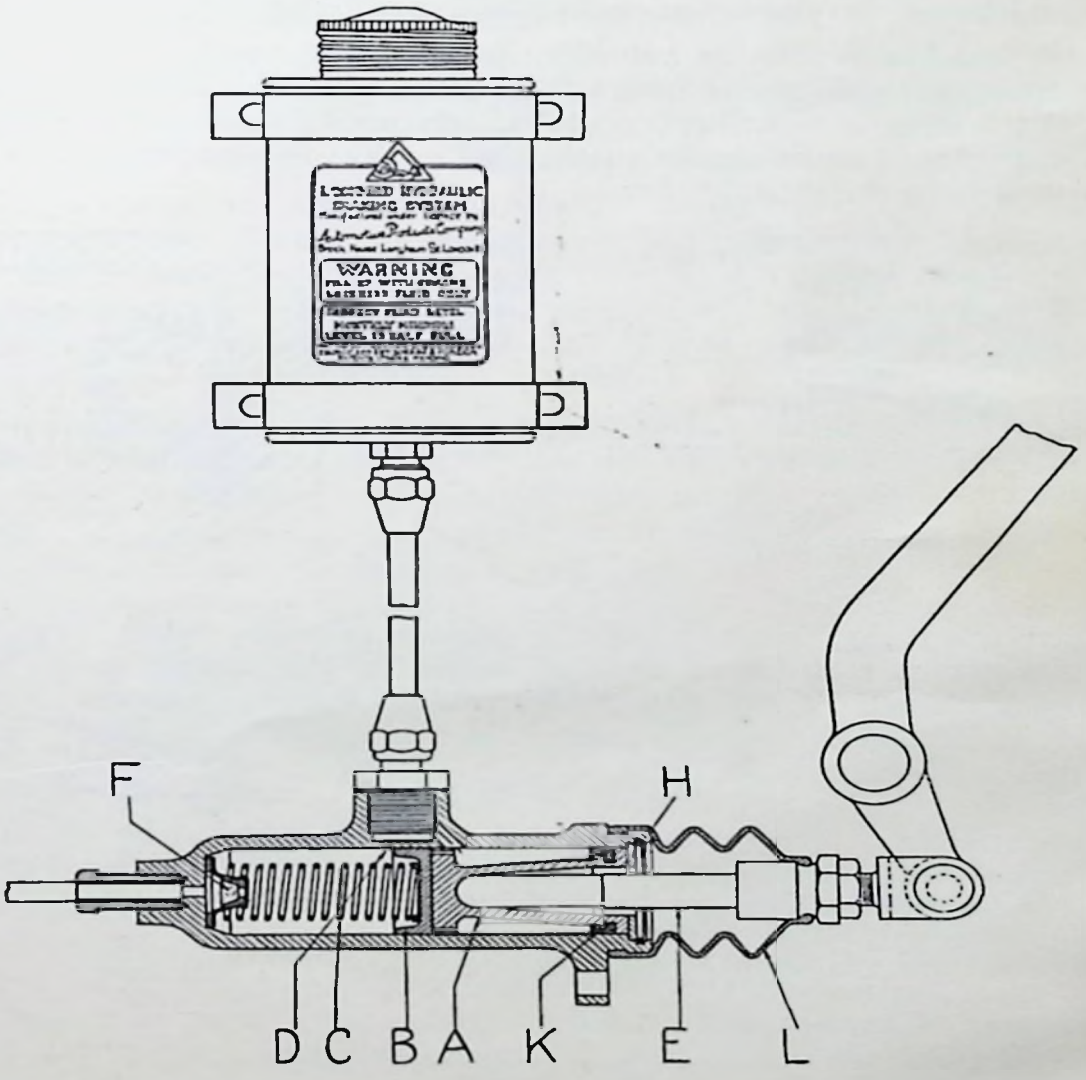


Fig. 2.

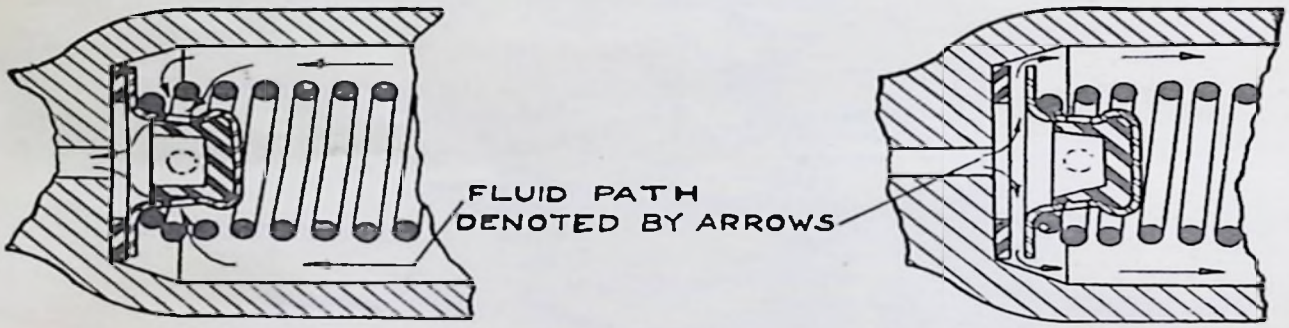
When pressure is applied to the foot pedal the piston within the master cylinder is forced forward and causes the fluid to flow through the copper tubing and flexible hose connections into the wheel cylinders (Fig. 1).

Automatic compensation for expansion or contraction of the fluid due to temperature changes is provided by inlet and outlet valves. The special Lockheed brake fluid used in the system is immune from freezing and unaffected by high temperatures.

Within the master cylinder (Fig. 2) is a piston (a) and a cupped washer (b) normally held in the "off" position by a coil spring (c). Immediately in front of the cup washer, with the piston in the "off" position, is a small port hole (d) connecting the cylinder interior with the hollow boss above it, which is connected by a copper tube to the fluid supply tank. With any rise of temperature causing the fluid to expand in the system, the fluid is allowed to pass through the port into the supply tank. With any drop in temperature causing the fluid to contract, the fluid flows back through the port; thus a constant volume of fluid is maintained in the system.

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

In the head of the master cylinder, held in place by the return spring (c) is a combination inlet and outlet check valve (f). This, shown enlarged in Figs. 3 and 4, is a hollow conical sheet metal pressing containing a rubber cup shaped to fit closely to the inside, the whole seating on a flat rubber washer in the cylinder head.



Figs. 3 and 4.

When the brakes are applied, the master cylinder piston is pushed forward and fluid is forced through holes in the metal valve body, deflecting the walls of the rubber cup and so passing into the system. (See Fig. 3). When the pedal is released, the master cylinder return spring forces the piston back to its "off" position against its stop (h) (Fig. 2), at the same time the pistons in the wheel cylinders are forcing the fluid back and so lifting the whole valve assembly off its seat (Fig. 4) by the action of the brake shoe return springs, until the fluid pressure balances with the effort of the master cylinder return spring, and the inlet valve closes.

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

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

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

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

THE SUPPLY TANK. Is attached to the dash board where it is accessible and is connected to the master cylinder by a copper pipe. The tank should be kept three-quarters full of GENUINE LOCKHEED BRAKE FLUID.

BRAKE PEDAL ADJUSTER. It is important that the push rod (E) should have a slight clearance where it seats in piston (A) when in the "off" position. Should the push rod be adjusted tightly against the piston the port hole (D) will be covered by the cup washer (B), thus preventing the compensating action of the master cylinder.

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

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

DISMANTLING MASTER CYLINDER. Remove the rubber boot and the piston retaining spring clip and washer, and then draw the piston from the barrel. The cup, spring and valve are then removable.

Any necessary cleaning must be carried out with Lockheed brake fluid. Never use petrol, paraffin or oil.

RE-ASSEMBLING MASTER CYLINDER. Dip all parts in Lockheed brake fluid. Hold cylinder vertically and drop in the rubber washer, making sure that it seats concentrically in the cylinder head. Insert valve body and cup assembly in end of spring and drop in to cylinder. Insert master cylinder cup, pressing it firmly on to end of spring. Replace the piston and secondary cup assembly, preferably using a special tool obtainable for the purpose.

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

THE PATENT FLEXIBLE HOSE. The patent flexible hose is specially manufactured by us and tested to withstand six times the highest pressure ever applied when braking.

THE WHEEL CYLINDER (Internal). The wheel cylinder (Fig. 5) is mounted rigidly to the brake shoe back plate, and the opposed pistons act through push rods directly on the tips of the brake shoes. The ends of the wheel cylinder are fitted with rubber boots to protect the cylinder from dust or dirt. At the uppermost position, and between the opposed pistons, is a bleeder screw, required for expelling all air when filling the system.

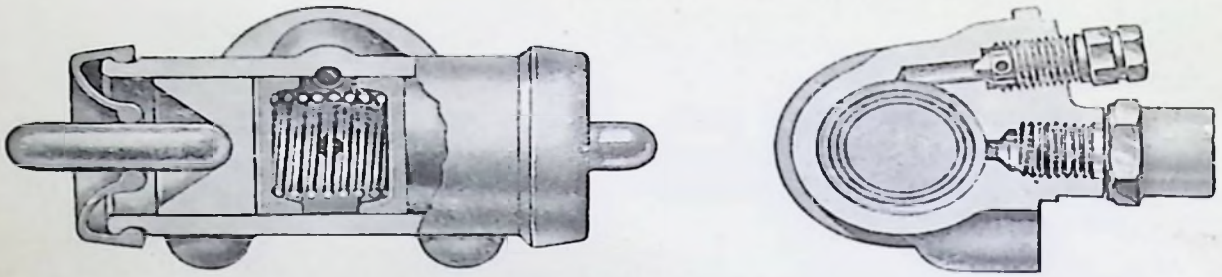


Fig. 5.

REMOVING FRONT WHEEL CYLINDER (Internal). It is advisable not to unscrew the flexible hose at either end. Proceed, therefore, as follows: Disconnect copper tubing from the hose union (A, Fig. 6) at the frame, then remove the nut and lock washer (B), when the hose union may be removed from the bracket. Unhook the brake shoe return spring. Removal of the two set-screws holding the cylinder to the back plate allows the cylinder to be withdrawn with the hose in place.

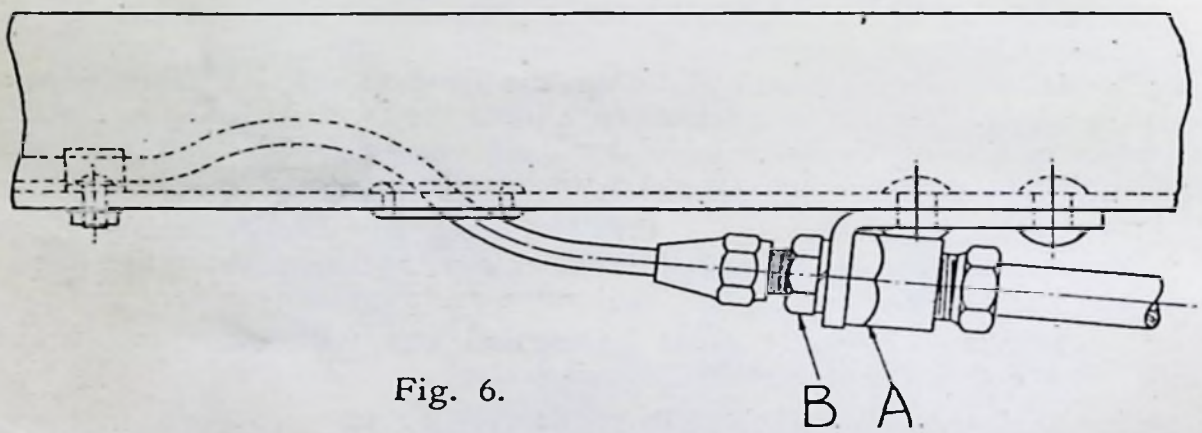


Fig. 6.

REMOVING REAR WHEEL CYLINDER (Internal). Follow the above instructions except that the copper tubing must be disconnected at the cylinder inlet.

REMOVING BRAKE SHOES. Unhook the brake shoe return spring and release the brake shoe anchor pins, after which the shoes may be pulled off. In assembling, these operations are reversed.

RE-LINING BRAKES. When re-lining brake shoes, it is important that the same make and quality of lining be used on all four wheels, otherwise the braking on the wheels will be unequal.

ADJUSTING BRAKES (Internal Cylinder). When lining wear has reached a point where the foot pedal goes almost to the floor-board, it becomes necessary to adjust the brake shoes into closer relation to the drums. Raise the car on a jack until the wheel is free. Adjustment is

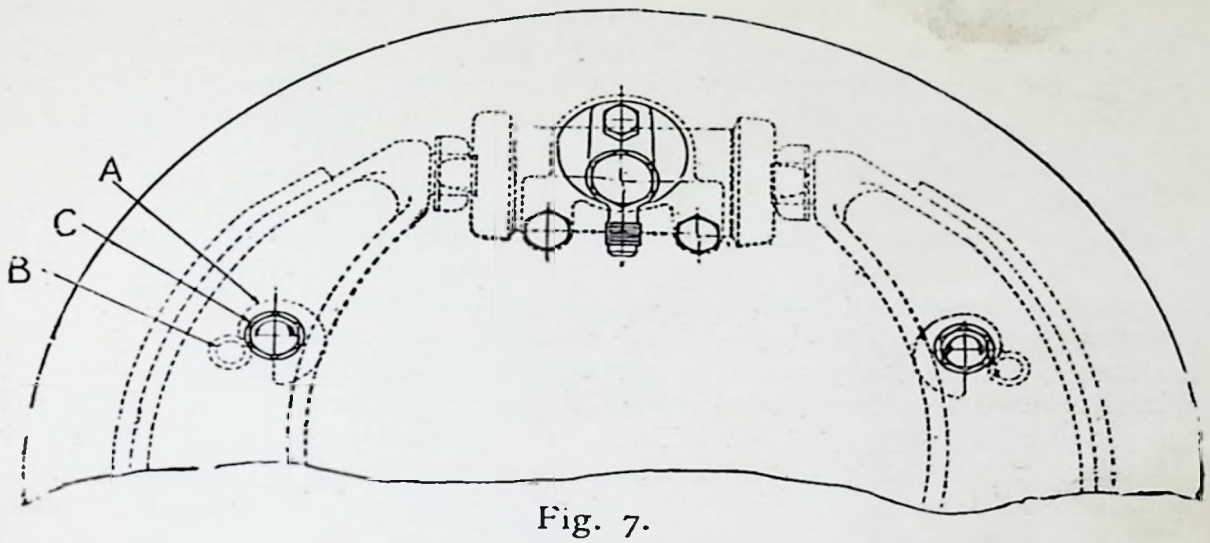


Fig. 7.

made by rotating the adjustment cam (A, Fig. 7) against stop pin (B) on the shoe. Rotate the adjustment nut (C) with a wrench until brake shoe comes into contact with drum, then back off adjustment slightly until the wheel rotates freely without any appreciable drag.

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

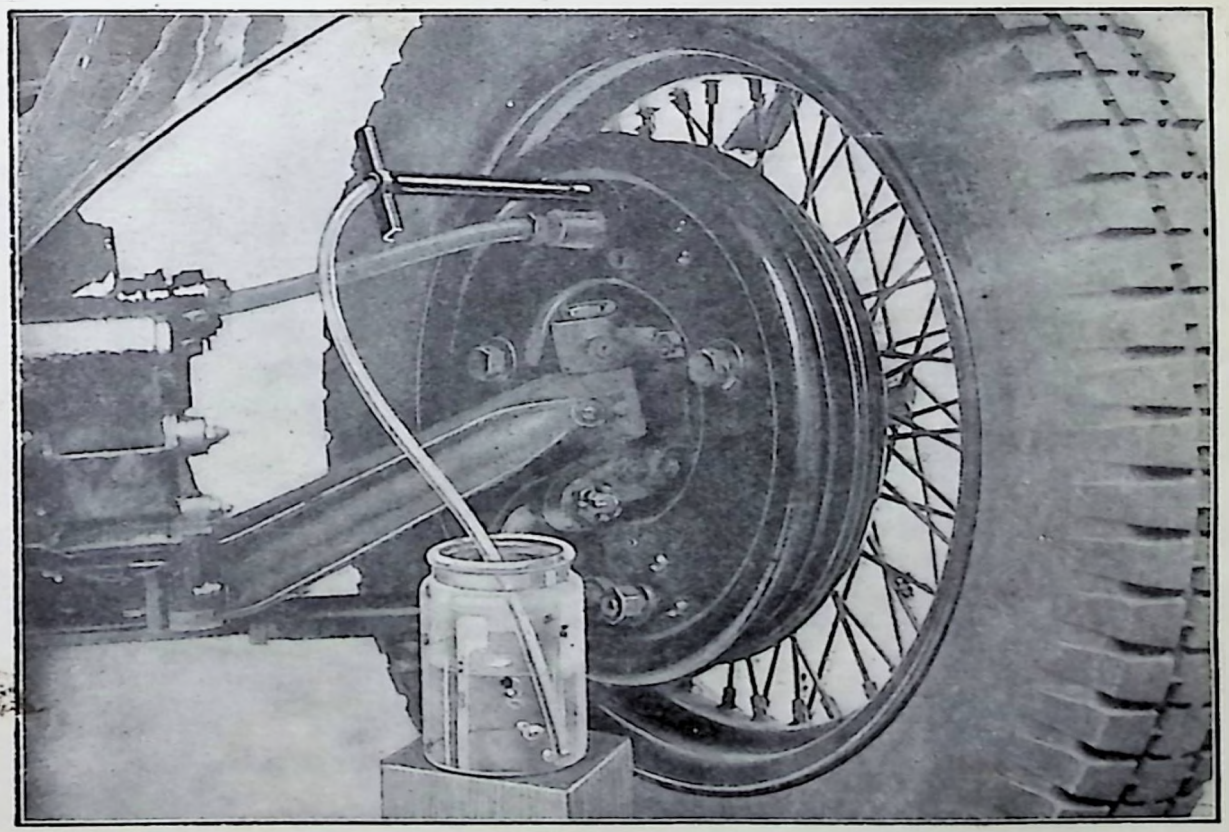


Fig. 8.

BLEEDING THE LINE. Whenever any part of the system has been disconnected, it is necessary to "Bleed" the system in order to expel all air. Fill the Supply Tank with genuine LOCKHEED BRAKE FLUID before starting this operation, and keep the tank at least half full of fluid during the whole period of bleeding.

Remove the set screw at A (Fig. 8) from end of bleeder screw, and screw in the bleeder drain, which is a screwed brass nipple fitted with a rubber tube. Allow the rubber tube to hang into a clean glass container. Unscrew the bleeder screw one turn with the wrench B (Fig. 8) and depress the foot pedal quickly, allowing it to return fully without assistance. This gives a pumping action which forces fluid out at the wheel cylinder, carrying with it any air that may be present. No less than ten strokes of the foot pedal will be necessary to bleed each wheel cylinder. Watch the flow of fluid from the bleeder drain, the end of which should be kept below the surface of the fluid, and when all air bubbles cease to appear, close the bleeder screw. The bleeding operation must be repeated on each wheel cylinder, and the supply tank replenished each time. Should the supply tank be drained during the bleeding operation, air will be drawn into the system at this point, necessitating re-bleeding.

EQUALIZING BRAKES. No adjustment is required for equalisation, but only to compensate for the wear of the brake lining. While the pressure delivered to the brake shoes will always be equal, yet paint, grease, oil or any foreign substance on the brake lining will so change the co-efficient of friction of the lining that the brakes will be unequal. This inequality can only be remedied by first thoroughly cleaning the linings with petrol or methylated spirit, and then scraping them. Should the linings be thoroughly saturated, it will be necessary to re-line the brake shoes affected.

LOCATING BRAKE TROUBLE. In cases where brakes are not functioning perfectly satisfactorily, the following information is given, which should enable the cause of the trouble to be diagnosed and remedied :—

EXCESSIVE PEDAL TRAVEL. (Requires pumping).

(a) Brake shoes require closer adjustment to the drums.
(b) A leakage in the system—tighten joints in the line.

PEDAL FEELS SPRINGY.

(a) The system requires bleeding, see instruction for bleeding the line.
(b) There is no fluid in the supply tank.

INEQUALITIES IN BRAKING.

(a) The linings are not bedded in.
(b) The lining rivets are protruding, or the brake drums are scored.
(c) Grease or foreign substance on the brake linings.

POOR BRAKING POWER.

(a) Brake shoe linings worn or soaked with grease.

BRAKES STAY ON WHEN PEDAL IS RELEASED.

(a) Brake shoes too closely adjusted.
(b) Brake shoes seized or tight on their anchorage pins.
(c) Brake shoe return springs weak or broken.
(d) No initial clearance on brake pedal—it is essential to have free pedal play of half an inch to one inch to allow the piston in the master cylinder to go right back in the "off" position to release excess fluid pumped into the system when the brake is applied.

If there is no pedal slack when in the "off" position, it prevents the release of the fluid, thereby keeping the brake shoe on. A floorboard fouling the pedal may be the cause of this or incorrect adjustment of the pedal link gear may also be the cause.

(e) The master cylinder cup and/or the wheel cylinder cups sticking in the cylinder bores.

BRAKE DRAG.

(a) The shoes adjusted too closely to the drums.
(b) Handbrake operating mechanism seized or fouling some portion of the chassis.
(c) Brake shoes tight or seizing on their anchor pins or brake shoe return springs weak or broken.
(d) No initial clearance on brake pedal
(e) Oil or spurious fluid in the system.
(f) Wheel bearings loose.

BRAKES GRAB OR THE CAR PULLS TO ONE SIDE.

(a) Brake linings incorrectly bedded or chamfered at the end.
(b) Brake linings have varying co-efficients of friction due to grease, etc.
(c) Incorrect tyre inflation.
(d) Axle back plate loose, or spring anchorages loose.

HAND BRAKES

These are normally adjusted by a wing nut mounted on the hand brake lever, along side the driver's seat, and this should be so adjusted that the lever is pulled "on" about four notches to give a full brake adjustment.

On the 1½-Litre models, this adjustment is not fitted owing to the disposition of the hand brake lever, but a further adjustment is provided to allow the braking effort on each wheel to be balanced, and this is arranged by nuts at the junction of the brake rod and the cam levers on the rear axle. To adjust, jack up the rear wheels until both are clear of the ground, pull the hand brake lever "on" about two notches and then adjust at the nut until the brakes are just rubbing when the road wheels are turned by hand. Release the brake lever, and spin both wheels to ensure that they are perfectly free.

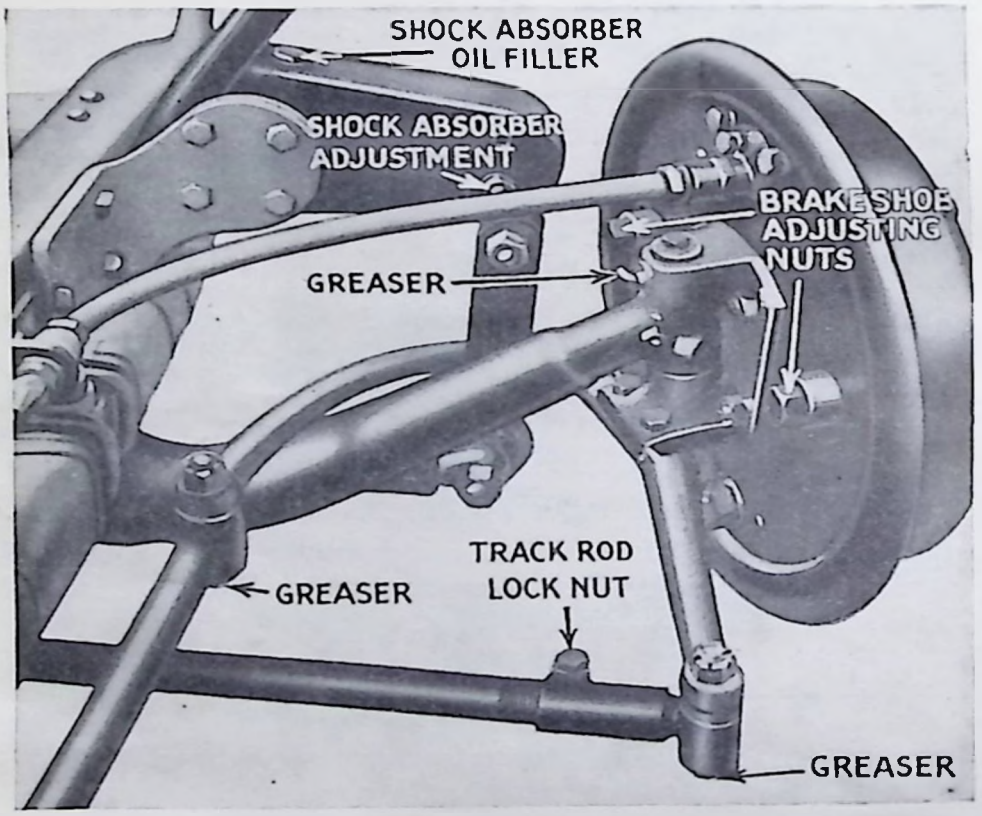
It is important that the brakes are perfectly free when the lever is in the "off" position, as rubbing brakes cause excessive petrol consumption, lack of power, besides causing undue wear of the brake shoes and linings. ALWAYS BE QUITE CERTAIN WHEN DRIVING THE CAR THAT THE HAND BRAKE LEVER IS IN THE "OFF" POSITION.

STEERING AND FRONT AXLE ASSEMBLY

THE only attention the steering box requires is periodic lubrication. Adjustment is provided in the steering box itself, but slackness or backlash in the steering column can be corrected by adjustment at the top of the column.

This adjustment should only be carried out by a skilled mechanic, but in order that the owner shall be fully conversant with the adjustment, the following is a brief description of the bearing assembly at the top of the column :—

The top bearing consists of a cup and cone ball race and the adjustment takes the form of a threaded cone and lock nut. These are exposed by removing the steering wheel pinch bolt and raising the wheel sufficient to allow a thin spanner to be applied to the lock nut.



Having released the lock nut the lower hexagon headed cone can be tightened until the backlash is eliminated, but great care must be taken in carrying out this adjustment, as excessive tightening of the cone will result in stiff steering and damage to the ball race. Tighten the lock nut and re-position the hand wheel, after the adjustment has been made.

Adjustment is provided on the steering box itself, to take up the slackness between the worm and nut which may develop after a considerable mileage. A small key spanner is provided which may be inserted

through a small plug hole in the top side of the box, into a special locking bolt in the steering nut. It is necessary to set the steering wheel straight ahead in a position which will bring the head of the bolt in the nut into line with the plug hole in the steering box.

Excessive tightening of the bolt will tend to make the steering stiff; therefore, this adjustment should be handled with discretion.

TRACK ROD AND COUPLING TUBE

This assembly should require very little attention other than applying the grease gun to the grease nipples fitted to the ball joints every 250 miles, or weekly.

The ball sockets on the track rod and coupling tube are spring loaded and are unlikely to require adjustment until a very considerable mileage has been covered (providing, of course, they are adequately lubricated). If necessary, the spring pressure of the ball joints can be increased by removing the grease nipple and the tab washer in the top of the socket and tightening the adjusting screw. Turn the screw half-a-turn or more in increments of half-a-turn at a time, two complete turns being about the maximum that should be required.

If front tyre wear appears excessive or the steering feels unsteady, it is advisable to check the alignment of the front wheels. When correctly adjusted, these should "toe in" 1/8in. at the front—this measurement being taken from the inside of one rim to the inside of the other rim at a height of approximately one foot from the ground. If this toe-in is not correct, proceed as follows :—

Release the clamp nuts on each end of the steering track rod then with a spanner on the hexagon section in the centre of the tube, turn the tube until the toe-in is correct. Turning the spanner downwards and towards the back will lengthen the track rod and increase the toe-in; upwards and towards the back shortens the track rod and decreases the toe-in. After making this adjustment, lock the clamp nuts.

REMOVE STEERING ASSEMBLY FROM CHASSIS FRAME

This is fully dealt with in the engine overhauling instructions, page 29

DISMANTLING FRONT AXLE ASSEMBLY

The road wheels and hubs on the 1½-Litre models are removed by releasing the knock-on type wing nuts securing the road wheels to the splined hub barrel. A lead hammer is provided in the tool kit for this purpose, and it should be noted that the wing nuts are marked right-hand and left-hand; therefore attention should be paid to the direction in which they are to be released. Withdraw road wheels from hub splines, release

the two screws, four nuts and spring washers securing the brake drums to the hubs, and remove the brake drums, afterwards withdrawing the hub assembly. Dismantle the hubs by releasing the two screws securing the bearing housing to the hubs, extracting the two bearings, distance piece and oil retaining washer.

The road wheels and hubs on the 14 h.p. and 2-Litre models are removed by releasing the cover plate screw, removing the cover plate, and the four wheel nuts, afterwards taking away the road wheel. Release the two screws securing the brake drum to the hubs and remove the brake drums. Extract the hub grease cap, remove the split pin and nut, and withdraw the hub assembly from the stub axle. Dismantle the hub by releasing the two screws securing the bearing housing to the hub, and extract the two bearings, distance piece and oil retaining washer.

Remove stub axles, track rod and coupling tube by first releasing the four bolts, nuts and spring washers securing the brake back plate to the axle swivel, and remove the plate and brake shoes complete. It is not necessary to detach the Lockheed feed pipe from the wheel cylinder except when the brakes require attention. Release the nuts securing the track rod and coupling tube ball joints to the swivel levers, and remove both rods. Remove the nut and washer from the cotter pin which secures the swivel pin through the axle beam, knock out the cotter pin and withdraw the swivel pin, thereby releasing the stub axle.

SHOCK ABSORBERS

ON all 14 h.p. and 2-Litre models Armstrong hydraulic shock absorbers are fitted. These shock absorbers are lubricated internally by the operating fluid and should not require any attention, except examination after about 10,000 miles and, if necessary, a little oil added.

Armstrong special shock absorber oil only must be used for refilling.

The shock absorbers should not be filled absolutely as a slight space is essential for air which acts as an expansion medium. The correct level for the fluid is ½in. below the filler cap.

Every shock absorber is set and tested on a special machine to the adjustment arrived at by the Experimental Department, and no further adjustments should be necessary, but if, due to local or special conditions, adjustment is desired, proceed as follows :—

To increase resistance, slack off the lock nut on the boss side of the shock absorber, taking care the screw does not turn with the lock nut.

Next, turn the screw a quarter to half-a-turn clockwise, tighten up the lock nut, still taking care the screw does not move.

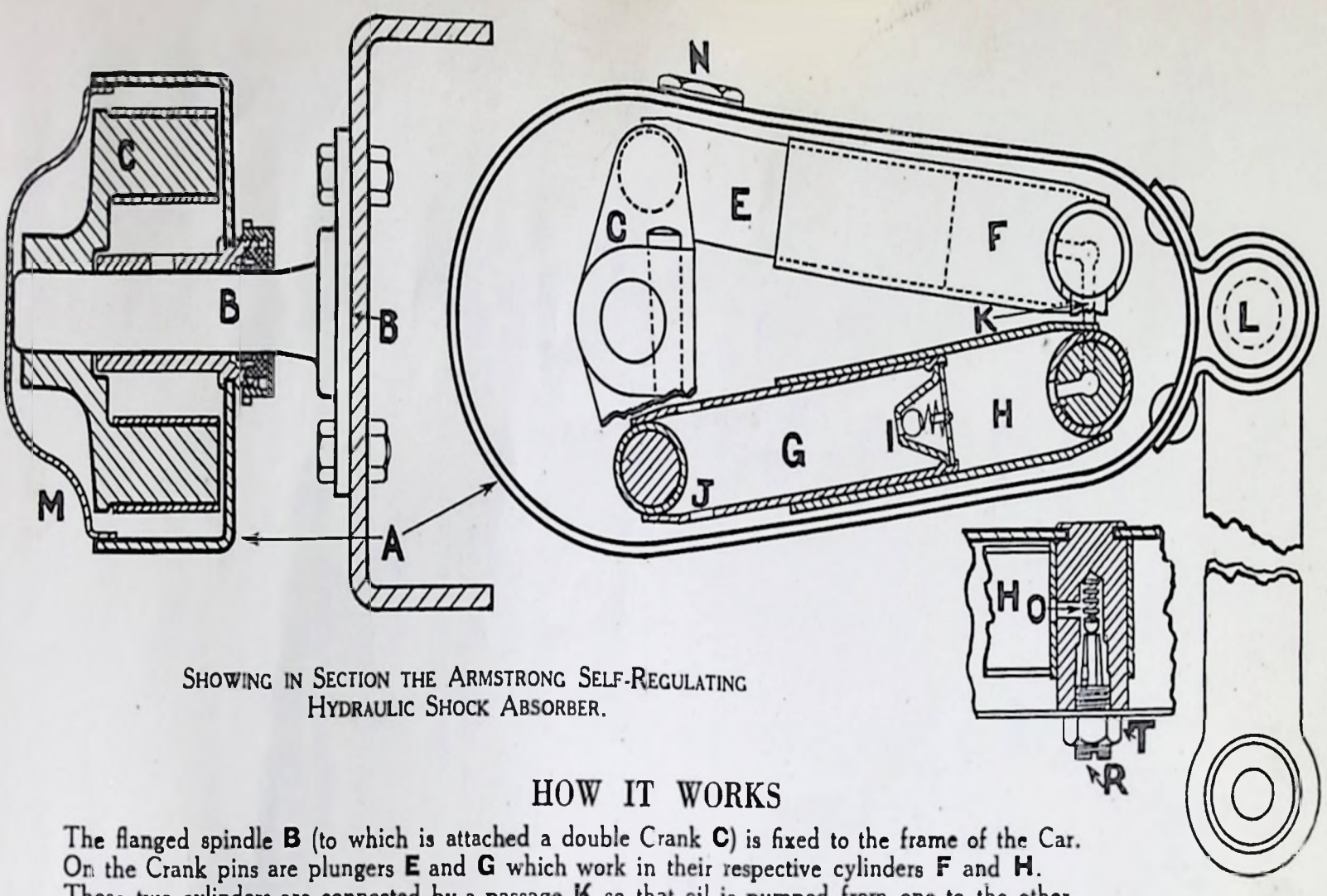
To lessen resistance, carry out the above instructions but turn the screw anti-clockwise. This adjustment controls both compression and rebound.

The adjustments should never be more than half-a-turn at a time, without taking the car out on the road for test.

The front pair of shock absorbers must be treated together, and the rear pair together, but not necessarily the front and rear together.

If there is any doubt as to whether the shock absorbers are too tight or too slack, always slacken off the adjustment first.

Armstrong shock absorbers are manufactured by Armstrong Patents Co., Beverley, who give a four hours' service delivery, and shock absorbers for servicing should therefore be sent to Messrs. Armstrong.



SHOWING IN SECTION THE ARMSTRONG SELF-REGULATING HYDRAULIC SHOCK ABSORBER.

HOW IT WORKS

The flanged spindle **B** (to which is attached a double Crank **C**) is fixed to the frame of the Car.

On the Crank pins are plungers **E** and **G** which work in their respective cylinders **F** and **H**.

These two cylinders are connected by a passage **K** so that oil is pumped from one to the other.

The cylinders, plungers and cranks are all inside the main casing **A**, which is filled with oil and sealed by an oil-tight cover **M**. The casing or arm, since it acts as both, is connected at **L** to the axle of the car by a suitable link.

As the axle moves to and from the car frame, so the plungers move in and out of their respective cylinders pumping oil from one to the other. The flow of oil, however, is governed by the valve gear placed in the passage **K** as follows :—

As the axle moves towards the frame the oil is pumped from the cylinder **F** to cylinder **H**, but as it has to pass the spring loaded ball valve **O**, a resistance governed by the tension on spring, is offered to the movement of the axle.

On the return or rebound stroke the oil is pumped from cylinder **H** to cylinder **F**, and as the ball valve only opens in one direction the oil must now find its way to cylinder **F** past the taper screw **R** which is adjustable to offer any desired resistance to the rebound of the car spring.

Any oil leakage past the plungers is immediately replaced from the recuperating chamber through a hole in plunger **G** and into the cylinder **H** through non-return valve **I**.

HARTFORD SHOCK ABSORBERS

ON the 1½-Litre models Andre Hartford type shock absorbers are fitted, type 306, and each shock absorber is set to a certain initial tension, i.e., 23 lbs. when it is fitted to the car, and no change in this adjustment should be made until the car has been driven about a hundred miles over all conditions of road surfaces.

Carefully note the riding qualities of the car. If the spring action seems too free, increase the frictional resistance of each shock absorber by turning the centre adjusting nut to the right or clockwise, but not more than one graduation at a time.

If the spring action seems too retarded and feels stiff, reduce the frictional resistance again by turning the adjusting nut to the left or anti-clockwise. Careful adjustment in this manner will produce an ideal condition. The springs will still have the required amount of flexibility for easy riding, but spring vibration will be reduced to a minimum and violent rebound effectively eliminated.

Re-adjustment may only become necessary after several thousand miles of car travel, and should be made only when the spring movement seems too free and then the indicator should be moved not more than one half of a graduation at a time.

It should be noted that the full benefit of the shock absorbers will not be felt when the car is travelling at low speeds, as under these conditions the spring movement is very limited, but as the speed increases their effect becomes more pronounced, especially over bad roads when the spring action is most severe.

Testing should therefore be carried out at comparatively high average touring speeds, and adjustment made to suit these conditions.

The frictional resistance required to effectively control the action of the springs is comparatively small, and care should be taken not to increase the pressure when adjusting more than is absolutely necessary to obtain the desired results. The initial setting of the shock absorbers is approximately correct under normal conditions, but fast sporting cars and for road and track racing, a considerable increase in pressure may be required.

THE COIL IGNITION EQUIPMENT

THE coil ignition equipment comprises a coil and a combined distributor and contact breaker, which is driven from the engine.

Very little attention is needed to keep the ignition equipment in proper condition. Occasional inspection of the system is advised, however, when any parts needing adjustment or cleaning can be attended to.

COMBINED DISTRIBUTOR AND CONTACT BREAKER

Occasionally remove the distributor moulding by pushing aside its two securing springs. Wipe out the distributor with a dry duster, and clean the electrodes with a cloth moistened with petrol. See that the carbon brush inside the moulding is clean and moves freely in its housing. Next examine the contact breaker. The contacts must be kept free from any grease or oil. If burned or blackened they should be rubbed down with carborundum stone, or if this is not available, very fine emery cloth should be used. Afterwards polish with a cloth moistened with petrol. Care must be taken that all particles of dirt and metal dust are wiped away. Misfiring may be caused if the contacts are not kept clean.

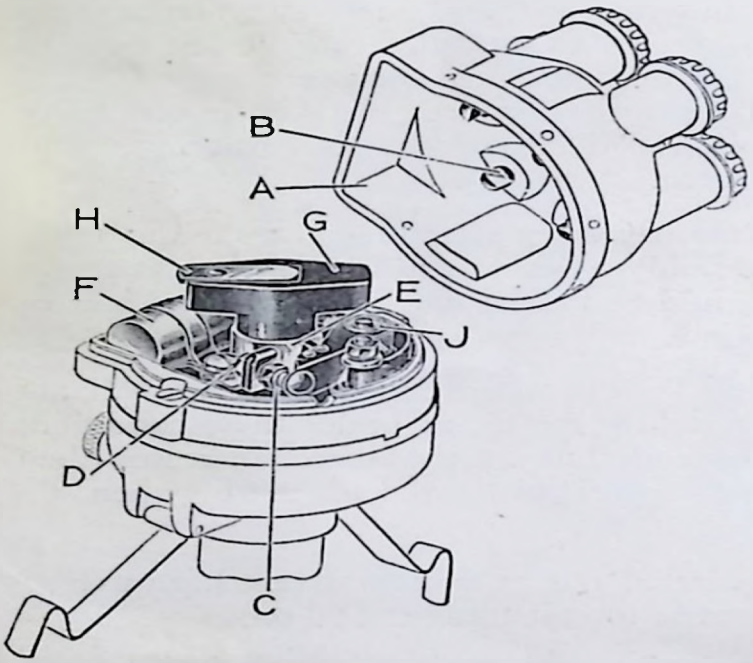


Fig. 1.

A—Distributor moulding.
B—Electrode.
C—Contacts.
D—Lock nut.
E—Rotating cam.
F—Condenser.
G—Rotating distributor arm.
H—Metal electrode.
J—Contact breaker pivot.

To test the contact breaker gap, slowly turn the engine by hand until the contacts are seen to be fully opened. Now insert the gauge on the ignition spanner in the gap between the contact points; if it is correct, the gauge should be a sliding fit. It is not advisable to alter the setting unless the gap varies considerably from the gauge. If adjustment is necessary proceed as follows.

Turn the engine round slowly by hand until the points are seen to be fully opened. Then, using the ignition spanner, slacken the lock nut on the stationary contact screw and rotate it by its hexagon head until the gap is set to the thickness of the gauge. After making the adjustment, care must be taken to tighten the locking nut.

LUBRICATION

The distributor main bearing is lubricated from an oiler through which one or two drops of thin machine oil should be added approximately every 250 miles.

The cam should be given the slightest smear of vaseline about every 3,000 miles or whenever it appears to be dry. AFTER EVERY 5,000 MILES, PLACE A SINGLE DROP OF OIL ON THE PIVOT ON WHICH THE CONTACT BREAKER ROCKER ARM WORKS.

About every 3,000 miles withdraw the moulded rotating arm from the top of the spindle by lifting it off, and add a few drops of thin machine oil. Do not remove the screw exposed to view, as there is a clearance between the screw and the inner face of the spindle through which oil passes to lubricate the automatic timing control.

COIL

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

RENEWING HIGH-TENSION CABLES

When the high-tension cables show signs of perishing or cracking, they should be replaced. Use only 7 m/m. rubber-covered ignition cable for all high-tension leads.

IGNITION SWITCH AND WARNING LAMP

In addition to merely stopping the engine, the ignition switch serves the purpose of preventing the battery being discharged by current flowing through the coil windings when the engine is stopped. A warning lamp is provided on the instrument panel, which gives a red light when the ignition is "on" and the car is stationary or running very slowly, thus reminding the driver to switch off.

After long service the warning lamp bulb may burn out. However, this will not affect the ignition, but it should be replaced as soon as possible so as to act as a safeguard for the battery. To replace the bulb unscrew the front. The bulb can then be withdrawn by means of the small tab provided. The bulb is a 3.5 volt .15 amp. screw cap type No. 3515 N.E.S.

THE DETECTION AND REMEDY OF IGNITION FAULTS

If failure of the ignition or misfiring occurs and the cause is not obvious, the owner is strongly recommended to proceed in accordance with the routine tabulated below, which should enable him to locate the trouble without difficulty.

If, after carrying out the examinations suggested, the cause of the trouble cannot be found, the equipment should be examined by the nearest Lucas Service Depot.

HOW TO LOCATE AND REMEDY IGNITION TROUBLE

CONDITION.	METHOD OF DETECTION OF POSSIBLE CAUSES.	REMEDY.
Engine will not fire.	Starter will not turn engine and lamps do not give good light. Battery discharged.	Start engine by hand. Battery should be recharged by running car for a long period during day time with charging switch in full charge position. Alternatively recharge from an independent electrical supply.
	Controls not set correctly for starting.	See that ignition is switched on, petrol turned on and everything is in order for starting.
	Remove lead from centre distributor terminal and hold it about ¼in. away from some metal part of the chassis, while engine is turned over. If sparks jump gap regularly, the coil and distributor are functioning correctly. If the coil does not spark, the trouble may be due to any of the following causes :—	Examine the sparking plugs, and if these are clean and the gaps correct, the trouble is due to carburetter, petrol supply, etc.
	Fault in low tension wiring. Indicated by (1) No ammeter reading when engine is slowly turned and ignition switch is on, or (2) No spark occurs between the contact points when quickly separated by the fingers when the ignition switch is on.	Examine all cables in ignition circuit and see that all connections are tight. See that battery terminals are secure
	Dirty or pitted contact points.	Clean with fine emery cloth and afterwards with a cloth moistened with petrol.
	Contact breaker points out of adjustment. Turn engine until contacts are fully opened and test gap with gauge on spanner.	Adjust gap to gauge.
Engine misfires.	Dirty or pitted contact points.	Clean with fine emery cloth and afterwards with a cloth moistened with petrol.
	Contact breaker points out of adjustment. Turn engine until contacts are fully opened and test gap with gauge on spanner.	Adjust gap to gauge.
	Remove each sparking plug in turn, rest it on the cylinder head, and observe whether a spark occurs at the points when the engine is turned. Irregular sparking may be due to dirty plugs or defective high tension cables. If sparking is regular at all plugs the trouble is probably due to engine defects.	Clean plugs and adjust the gaps to about 20 thousandths of an inch. Replace any lead if the insulation shows signs of deterioration or cracking. Examine carburetter petrol supply, etc.

LIGHTING AND STARTING EQUIPMENT

DYNAMO

THE only parts of the dynamo requiring very occasional inspection are the brushes and commutator, which are readily accessible when the cover is removed.

BRUSHGEAR AND COMMUTATOR. Inspect the brushes and see that they move freely in their holders. They should bed evenly on the commutator; that is, the face in contact with the commutator should present a uniformly polished appearance. Dirty brushes may be cleaned with a cloth moistened with petrol.

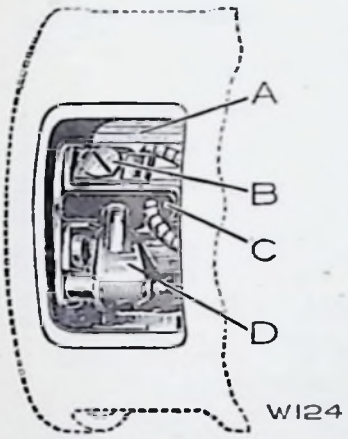


Fig. 2.
Dynamo with cover removed.
A—Commutator.
B—Brush fixing screw.
C Brush.
D--Brush tension spring.

After long service, when the brushes have become worn so that they will not bear properly on the commutator, they should be replaced. It is recommended that none but genuine Lucas brushes are fitted, as these are specially made and will give the best results and the longest life. We advise owners to have the brushes fitted at a Lucas Service Depot, so that they can be properly "bedded" to the commutator.

The surface of the commutator must be kept clean and free from oil and brush dust, etc. The best way to clean the commutator is to insert a fine duster, held by means of a suitably shaped piece of wood, against the commutator surface, slowly rotating the armature at the same time.

LUBRICATION. As the bearings are packed with grease before leaving the works, very little attention is needed. A few drops of oil may be added through the lubricator at the drive end of the dynamo about every 1,000 miles. Periodically, say, when the engine is being decarbonized, move aside the flap marked "grease" at the commutator end of the machine, and add a very small quantity of high-melting-point grease.

When the car is taken down for a general overhaul, the dynamo should be dismantled for cleaning, adjustment and repacking the bearings with grease. This should be done preferably by the nearest Lucas Service Depot.

DYNAMO FIELD FUSE. A fuse is provided in the dynamo field circuit to protect the machine in the event of anything being wrong in the charging circuit, e.g., a loose or broken battery connection. The fuse is of the cartridge type and is housed in the cut-out and fuse box on the engine

side of the dash. If the dynamo fails to charge the battery at any time (indicated by no charge reading being given on the ammeter during daytime running) check the wiring and then inspect the fuse. If it has blown, replace it with one of the spare fuses provided. If the new fuse blows after starting up, the cause of the trouble must be found and we advise that the equipment is examined by one of our Service Depots or the nearest Lucas Depot. Never fit any fuse other than the Lucas standard fuse as originally fitted. The size of the fuse is marked on a coloured paper slip, which can be seen inside the fuse.

STARTER MOTOR

In order to facilitate starting in cold weather, it is advisable to make use of the carburetter starter control, and before using the electric starter crank the engine over slowly by the starting handle for two or three revolutions, as this will considerably diminish the load for starting.

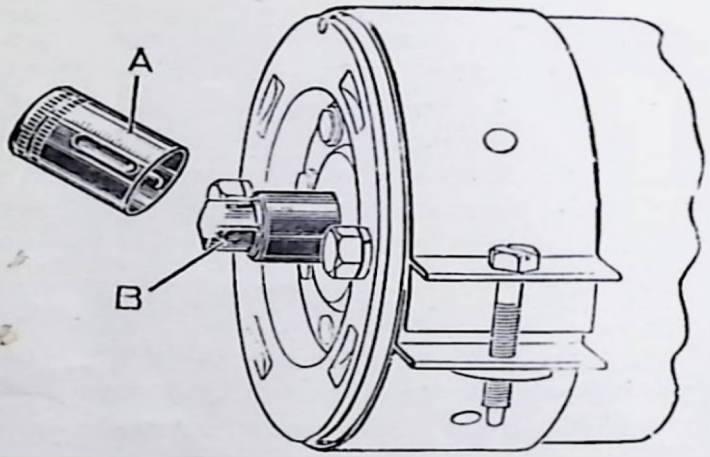


Fig. 3.

Squared end of starter shaft with cover removed.
A—Metal cover. B—Squared end of shaft

The starter is provided with an extended shaft, having a squared end, which can be rotated by means of a spanner in the remote possibility of the pinion becoming jammed in mesh with the flywheel. Access is obtained to the squared end of the shaft by withdrawing a small metal cap.

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

STARTER SWITCH (1½-Litre Model)

This is a foot operated switch which must be operated firmly and without hesitation. Should the engine not fire at once, allow it to come to rest before again pressing the switch.

LUCAS STARTIX AUTOMATIC STARTER
(14 H.P. AND 2-LITRE MODELS)

Lucas Startix equipment starts the engine automatically immediately the engine switch is turned on. It restarts the engine whenever it stalls; in traffic; on a hill; free-wheeling; when manoeuvring; in fact, whenever and as long as the starter switch remains on. Immediately the engine fires, the starter is automatically switched off. When the engine is stalled, it automatically waits for one second before reclosing the main switch, and so delays restarting until the engine has actually come to rest. In cold weather, the delay action automatically frees a sticking starter pinion.

A hand control is provided as an alternative to the automatic control for special and emergency use.

INSTRUCTIONS FOR OPERATION. Make sure the gear lever is in neutral, and adjust the throttle, carburetter, and ignition controls to the normal starting position.

AUTO POSITION: Turn the switch key to the "auto" position for automatic starting and use this position for normal running.

HAND POSITION: For non-automatic starting, turn the key to the hand position. This switches on the ignition only, then press the button firmly; this controls the starter motor and should be released as soon as the engine fires.

Use this position in the following circumstances.

1. To read electrically operated petrol gauge when you do not want to start the engine.
2. When the engine is left running unattended, e.g., when the engine is warming up first thing in the morning, otherwise variations in carburetter conditions which would be corrected by the driver when present, may result in the engine ceasing to fire, the starter cranking continuously and, in the end, a discharged battery.
3. If the battery is so nearly run down that it is necessary to start by hand cranking, under these conditions the car cannot be started automatically.
4. If the dynamo will not charge. Lucas Startix is designed so that the dynamo keeps the starter out of action. If the dynamo fails to charge for any reason, the starter tries intermittently to re-engage with the flywheel, and so immediately advises the driver that the dynamo needs attention. No damage will be done to the flywheel under these conditions. In abnormal circumstances, of which the above is one example, turn the switch into the "hand" position.

It should be remembered that whenever the engine stops, Lucas Startix automatically cranks the engine. It is important, therefore, when the engine stalls in gear, to declutch so as to obtain normal starting conditions.

If when the switch is in the "auto" position, the starter operates repeatedly, this may be due to incorrect throttle opening. In this case, the throttle opening should be reset. Should this not be effective, the reason should be investigated.

THE LUCAS STARTIX AUTOMATIC SWITCH is adjusted to the correct setting at the works, and, as it requires no further attention, it is sealed. In the unlikely event of trouble occurring in the unit, the seal should not be broken, but the complete unit should be returned to the nearest Service Depot for examination.

CUT-OUT AND FUSE BOX

This unit houses the cut-out and six fuses protecting the equipment against the possibility of damage from short circuits. The function of the cut-out is to close the charging circuit, as the increasing engine speed when the car is starting causes the dynamo voltage to rise above that of the battery. When the engine slows down, the dynamo voltage falls below that of the battery and the reverse action takes place, i.e., the cut-out opens and thereby prevents the battery discharging itself through the dynamo.

The cut-out is accurately set before leaving the Works, and does not need any adjustment; the cover protecting it, therefore, is sealed.

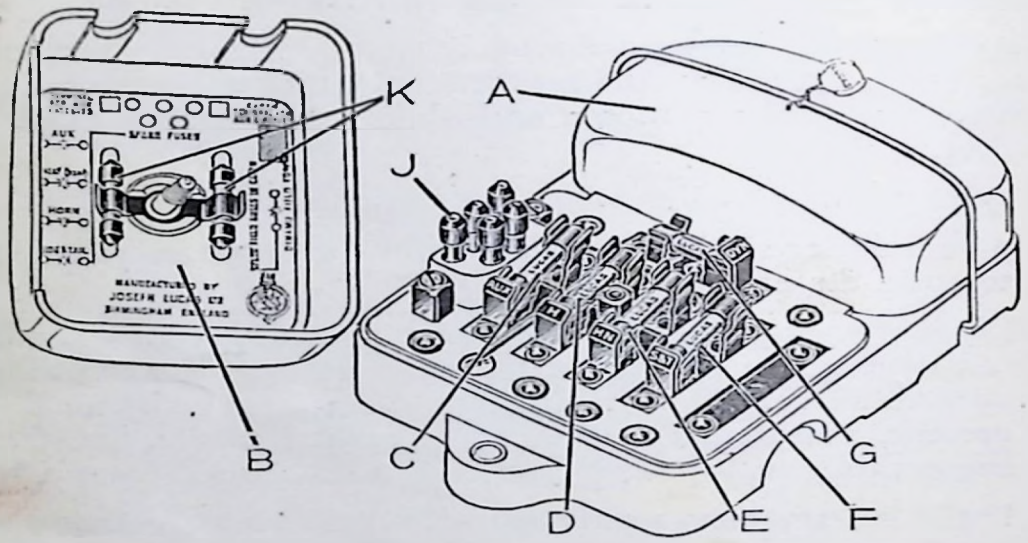


Fig. 4. Cut-out and Fuse Box, Type CJR.

A—Cut-out cover.
B—Fuse cover.
C—Auxiliary accessories fuse.
D—Nearside head lamp fuse.
E—Offside head lamp fuse.
F—Side and tail lamp fuse.
G—Petrol gauge fuse.
H—Dynamo field fuse.
J Spare fuses for C, D, E, F and G.
K—Spare dynamo field fuses.

The circuits protected by each of the six fuses can readily be seen by reference to the wiring diagram.

If it is suspected that one of the fuses has blown, remove it from its holder and see whether there is a break in the fuse wire. Before replacing the fuse, inspect the wiring of the units that have failed for evidence of short circuits or other faults that may have caused the fuse to blow, and remedy. If the fuse blows repeatedly and the cause cannot be traced, have the equipment examined by a Lucas Service Depot.

Never fit any fuse other than the Lucas standard fuse as originally fitted. The size of the fuse is marked on a coloured paper slip which can be seen inside the fuse.

AMMETER

The ammeter indicates the current passing into or out of the battery. For instance, suppose the dynamo is generating 6 amperes and that the side and tail lamps are in use, the lamps and ignition coil will take approximately 2½ amperes, leaving 3½ amperes for charging the battery. Therefore, this is the figure shown on the ammeter.

BATTERY

The following are the most important battery maintenance points:—

1. Keep the acid level with the top of the separators.
2. Add only distilled water, never tap water.
3. Test the condition of the battery by taking readings of the specific gravity of the acid with a hydrometer.
4. Never leave the battery in a discharged condition.
5. Keep the terminals spanner tight, and smeared with vaseline.

At least once a month, the vent plugs in the top of the battery should be removed and the level of the acid solution examined. If necessary, distilled water, which can be obtained at all chemists and most garages, should be added to bring the level to the top of the separators. If, however, acid solution has been spilled, it should be replaced by a diluted sulphuric acid solution of the same specific gravity as the acid in the cells. It is important that naked lights should not be held near the vents when examining the cells, owing to the possible danger of igniting the gas expelled from the plates.

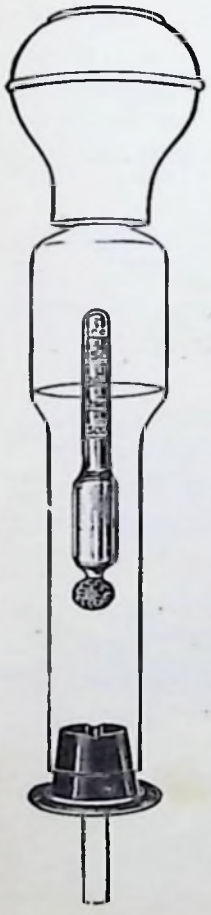


Fig. 5.

Keep the battery terminals tight and smeared with vaseline to prevent corrosion and the top of the battery clean and dry.

If the equipment is laid by for several months, the battery must be given a small charge from a separate source of electrical energy about once in a fortnight, in order to obviate permanent sulphation of plates. In no circumstances must the electrolyte be removed from the battery and the plates allowed to dry, as certain chemical changes take place which result in loss of efficiency.

It is advisable to complete the inspection by measuring the specific gravity of the acid in each of the cells as this gives a very good indication of the state of charge of the battery.

An instrument known as a hydrometer is employed for this purpose (Fig. 5).

For the 14 h.p. model the specific gravity readings and their indications are as follows: 1.285-1.300—battery fully charged; about 1.200—battery half discharged; about 1.150—battery fully discharged.

On the 1½-Litre and 2-Litre models the specific gravity readings and their indications are as follows: 1.225-1.250—battery fully charged; about 1.200—battery half discharged; about 1.150—battery fully discharged.

USE OF BATTERY CHARGING SWITCH. The combined lighting and charging switch at the centre of the steering wheel should, during daytime running, be kept in the appropriate position according to the season. For cars running under average conditions, this will ensure that the battery is kept in a fully charged state.

In exceptional cases, however, it may be advisable to use the switch out of season. For instance, if in Winter the car is run regularly during the day with practically no night running, and the hydrometer readings are always found to be about 1.285, and if the acid level gets unsually low, then it is probable that the battery is being overcharged. In these circumstances, move the charging switch to the half charge position. On the other hand, if exceptional use is made of the lamps and starter in the Summer, causing the battery to be in a low state of charge (hydrometer readings of 1.200 or under), then run with the charging switch in the full charge position.

On a new car, during the running-in period, it is advisable to keep the switch in the full charge position all the time in order to compensate for the heavy starter motor load due to the initial stiffness of the engine.

LAMPS

HEADLAMPS. On the 14 h.p. and 2-Litre models, the lamps are provided with an electrically operated anti-dazzle device. By operating the steering column switch, the nearside headlamp beam is dipped and turned to the nearside of the road, while at the same time the offside headlamp is switched off, thus causing no discomfort to approaching traffic.

REMOVING THE LAMP FRONT AND REFLECTOR. To remove the front, take out the fixing screw at the top of the lamp and turn the front to the left as far as possible. The front can then be withdrawn from the lamp body. The reflector is secured by means of three screws.

On the 1½-Litre models the headlamps are provided with an electrically operated anti-dazzle device. By operating the steering column switch, the nearside headlamp beam is dipped and turned to the nearside of the road, while at the same time the offside headlamp is switched off, thus causing no discomfort to approaching traffic.

REMOVING THE LAMP FRONT AND REFLECTOR. To remove the front, slacken the fixing screw at the bottom of the lamp and move aside from the slot in which it fits. The front can then be removed.

To remove the reflector, turn back the two ends of the cork washer at the top of the rim. The screw securing the reflector can then be removed, enabling the reflector to be withdrawn by turning it to the left. When replacing the dipping reflector, it will be noticed that there are two alternative holes at the top of the lamp for the fixing screw. The left-hand one is provided for use in the United Kingdom or where the rule of the road is left-hand, and the right-hand hole for use where the rule of the road is right-hand.

DIPPER FUSE. A fuse is provided with the dipping mechanism in the nearside lamp to protect the equipment in the event of the reflector

failing to function properly. The fuse is of the cartridge type and is carried in spring clips alongside the dipping mechanism. If the reflector fails to function when the switch is manipulated, remove the fuse from its holder and see if there is a break in the fuse wire. The spare fuse which is clipped to the reflector bracket should be inserted in place of the damaged one, and should restore the action of the reflector.

Should the fuse blow repeatedly and the cause of the trouble cannot be found, have the reflector examined at the nearest Service Depot.

ADJUSTING AND FOCUSSING. The lamps are provided with a patented universal mounting which allows the beams of light to be adjusted on the road to the best advantage. This adjustment is obtained by slackening the fixing, turning the lamp to the desired position and then locking by tightening the fixing.

To enable the correct focus to be obtained, the bulb holder is arranged so that it can be moved backwards or forwards when the clamping screw at the back of the reflector is slackened. Care should be taken to tighten the screw after the adjustment.

The best method of adjusting and focussing the lamps is to take the car on a straight, level road and then adjust the lamps and focus the bulbs as described above, until the best road illumination is obtained.

SIDE LAMPS. On the 14 h.p. and 2-Litre models, the front of the side lamp is removed by turning a coin slotted screw at the top of the lamp either left or right. The front can then be eased off from the bottom.

When replacing the front, first make sure that the screw slot is parallel with the front and that the screw is opposite the medallion.

On the 1½-Litre models, the front of the side lamp can be removed when the fixing screw is withdrawn.

The bulb holder can be removed from the back of the reflector. To enable the bulb to be correctly focussed, alternative positions are provided for the bulb in its holder, each of which should be tried for the best results.

STOP TAIL LAMP. The front of this lamp can be removed when the fixing screw is withdrawn.

CLEANING. The reflectors are protected by a transparent and colourless covering which enables any accidental finger marks to be removed with a chamois leather or a soft cloth without affecting the surface of the reflector. DO NOT USE METAL POLISHES ON REFLECTORS.

Ebony black lamps can be cleaned with a good car polish. Chromium plated lamps will not tarnish and only need wiping over with a damp cloth to remove dust and dirt.

REPLACEMENT OF BULBS. When the replacement of any bulb is necessary, we strongly advise that the bulbs supplied by Messrs. Lucas are used, as these are arranged to be in focus and give the best results with the Lucas reflectors. Particulars of replacement bulbs are given below :—

Lamps	Bulb Types	Volts	Watts
Headlamps	B.A.S. No. 4S ..	12 ..	36
Side, tail, stop, and panel lamps	B.A.S. No. 10S ..	12 ..	6
Ignition warning lamp	No. 3515 M.E.S. ..	3·5 ..	·525

ELECTRIC HORNS

These twin note horns, before being passed out of the works, are adjusted to give their best performance and will give a long period of service without any attention. No subsequent adjustment is required.

If either of the horns becomes uncertain in its action, giving only a choking sound or does not vibrate, it does not follow that the horn has broken down. First, ascertain that the trouble is not due to some outside source, e.g., a discharged battery, a loose connection or short circuit in the wiring of the horn, or a blown fuse.

It is also possible that the performance of a horn may be impaired by the horn becoming loose on its mounting.

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

ELECTRIC WINDSCREEN WIPER

The wiper motor requires absolutely no attention; all moving parts are packed with grease during assembly, and no lubrication is necessary.

When the wiper is not in use, see that the end of the metal handle is located in the top of the switch control. This ensures that the current is switched off.

TRAFFICATORS

Every 2-3 months raise the "Trafficator" arm and apply a little vaseline by means of a feather or match-stick between the brass knob or profile and the small copper spring and copper spindle.

If, at any time, the arm fails to light up when in operation, examine the bulb. To remove the bulb, switch the "Trafficator" on, and then, supporting the arm in a horizontal position, move the switch to the off position.

Now move aside the small trigger projecting from the underside of the arm when the cap of the bulb holder will spring open. Fit a new bulb in place of the one which has burnt out and refit the cover.

BULBS FITTED :—No. T.26F 6-watt festoon type

HOW TO LOCATE AND REMEDY DYNAMO TROUBLE

SYMPTOMS.	PROBABLE FAULT.	REMEDY.
Ammeter fails to indicate charge when running with no lights in use, or gives heavy discharge with lights on.	Dynamo not charging due to : Broken or loose connection in charging circuit causing field fuse to blow. (When fitted).	Examine charging circuit wiring. Tighten loose connection or replace broken lead. Particularly examine battery connections. Fit replacement fuse.
	Commutator greasy or dirty.	Clean with soft rag moistened in petrol.
Ammeter gives low or intermittent charge reading.	Dynamo giving low or intermittent output, due to :—	
	Loose or broken connections in dynamo circuit.	Examine charging circuit wiring. Tighten loose connections or replace broken lead. Particularly examine battery connections.
	Commutator or brushes greasy.	Clean.
	Brushes worn, not fitted correctly, or wrong type.	Replace worn brushes. See that brushes "bed" correctly.
Ammeter gives high charge reading.	Dynamo giving high output due to :—	
	Loose connections in dynamo charging circuit.	Examine charging circuit wiring, particularly battery connections. Tighten loose connections.
	Battery acid level low.	"Top up" cells with distilled water.
	Brushes not fitted correctly.	See that brushes "bed" correctly.
	Control brush position altered.	Have control brush adjustment re-set at nearest Lucas Service Depot.

HOW TO LOCATE AND REMEDY STARTER MOTOR TROUBLE

CONDITION.	PROBABLE FAULT.	REMEDY.
Motor sluggish or fails to move engine.	If engine cannot be turned by hand, then fault is due to a stiff engine.	Locate and remedy cause of stiffness.
	If engine can be turned by hand, then trouble may be due to :—	
	Battery discharged.	Start by hand. Charge battery either by a long period of daytime running or from independent electrical supply.
	Broken or loose connection in starter circuit.	See that connections to battery, starter and starter switch are tight, and that cables connecting these units are in order.
	Starter commutator or brushes dirty.	Clean.
	Brushes worn, not fitted correctly or wrong type.	Replace worn brushes. See that brushes "bed" correctly.
	Starter pinion jammed in mesh with flywheel.	Rotate squared end of starter shaft with spanner.
Starter operates but does not crank engine.	Pinion of starter drive does not engage with flywheel, due to dirt on screwed sleeve	Clean sleeve with paraffin and add a few drops of machine oil.
Starter pinion will not disengage from flywheel when engine is running.	Starter pinion jammed in mesh with flywheel.	Rotate squared end of starter shaft with spanner.

HOW TO LOCATE AND REMEDY TROUBLE IN LUCAS STARTIX AUTOMATIC STARTING EQUIPMENT

SYMPTOMS.	PROBABLE FAULT.	REMEDY.
Starter will not turn engine or operates intermittently.	Battery discharged.	Crank engine by hand.
	Faulty battery connections.	Examine connections. Tighten if necessary.
	Stiff engine.	If possible, crank engine by hand. Locate and remedy cause of engine stiffness.
	Faulty earthing of Lucas-Startix switchbox unit.	See that case of unit is secured to metal part of chassis or connection taken from earthing terminal on case to chassis.
Starter operates when engine is running and switch is in "Auto" position.	Idling speed set lower than cranking speed. (Happens particularly when engine is hot and battery is fully charged).	Set throttle for higher idling speed.
	Dynamo not charging or output low, due to : (1) Loose or broken connections in dynamo charging circuit. (2) Field fuse blown. (3) Dynamo brushes and commutator greasy or dirty.	Check charging circuit wiring, particularly battery connections. Tighten connection or fit new lead. Fit replacement fuse. Clean commutator and brushes. See that brushes are free in holders.
	Faulty connection between dynamo and Lucas - Startix switchbox unit.	Examine connection from cut-out unit to "Cut-out" terminal on Lucas-Startix switchbox unit.
	Starter brushes sticking, or commutator dirty.	Clean commutator, brushes and inside holders. See that brushes are free in holders.
	Faulty earthing of Lucas-Startix switchbox unit.	See that case of unit is secured to metal part of chassis or connection taken from earthing terminal on case to chassis.

NOTE.—If fault cannot be located and remedied, use "HAND" position and visit nearest Lucas Service Depot, so that the equipment can be examined and re-adjusted, if necessary.

HOW TO LOCATE AND REMEDY LIGHTING TROUBLE

SYMPTOMS.	PROBABLE FAULT.	REMEDY.
Lamps give insufficient illumination.	Battery discharged.	Charge battery either by a long period of daytime running or from independent electrical supply.
	Lamps out of alignment, or bulbs out of focus.	Align lamps and focus bulbs.
	Bulbs discoloured through use, or reflectors dirty.	Fit new bulbs or clean reflectors.
Lamps light when switched on, but gradually fade out.	Battery discharged	As above.
Brilliance varies with speed of car.	Battery discharged.	As above.
	Battery connection loose or broken.	Tighten connections, or replace faulty cables.
Lights flicker.	Loose connection.	Locate loose connection and tighten.
Failure of lights.	Fuse blown.	Examine wiring for faulty cables and remedy. Fit replacement fuse.
	Battery discharged.	As above.
	Loose or broken connection.	Locate and tighten loose connection, or re-make broken connection.

LUCAS SERVICE DEPOTS

For the convenience of users of all Lucas Productions they have established the undermentioned Service Depots, where specialized service and advice are given on every unit of the equipment.

BELFAST - - - - 3/5, Calvin Street, Mount Pottinger
Telephone: BELFAST 7017 — Telegrams: "SERVDEP, BELFAST"

BIRMINGHAM, 18 - - - - - Great Hampton Street
Telephone: CENTRAL 8401 (10 lines) — Telegrams: "LUCAS, BIRMINGHAM"

BRIGHTON - - - - Old Shoreham Road, Hove
Telephone: PRESTON 3001 (4 lines) — Telegrams: "LUSERV, BRIGHTON"

BRISTOL - - - - - - - - 345, Bath Road
Telephone: BRISTOL 76001 (4 lines) — Telegrams: "KINGLY, BRISTOL"

CARDIFF - - - - - - - - 54a, Penarth Road
Telephone: CARDIFF 4603 (4 lines) — Telegrams: "LUCAS, CARDIFF"

COVENTRY - - - - - - - Priory Street
Telephone: COVENTRY 3068 & 3841 — Telegrams: "LUCAS, COVENTRY"

DUBLIN - - - Portland Road North, North Circular Road
Telephone: DRUMCONDRA 434 (6 lines) — Telegrams: "LUSERV, DUBLIN"

EDINBURGH, 11 - - - 32, Stevenson Road, Gorgie
Telephone: EDINBURGH 62921 (4 lines) — Telegrams: "LUSERV, EDINBURGH"

GLASGOW - - - - - 227/229, St. George's Road
Telephone: DOUGLAS 3075 (5 lines) — Telegrams: "LUCAS, GLASGOW"

LEEDS - - - - - - - - 64, Roseville Road
Telephone: LEEDS 28591 (5 lines) — Telegrams "LUSERDEP, LEEDS"

LIVERPOOL - - - - - - - 450, Edge Lane
Telephone: OLD SWAN 1408 (4 lines) — Telegrams: "LUSERV, LIVERPOOL"

LONDON - - - - Dordrecht Road, Acton Vale, W.3
Telephone: SHEPHERD'S BUSH 3160 (10 lines) — Telegrams: "DYNOMAGNA, ACT, LONDON"

LONDON - - - - - 759, High Road, Leyton, E.10
Telephone: LEYTONSTONE 3361 (3 lines) — Telegrams: "LUSERDEP, WALT, LONDON"

LONDON - - - 155, Merton Road, Wandsworth, S.W.18
Telephone: PUTNEY 5131 (6 lines) and 5501 — Telegrams: "LUSERV, WANDS, LONDON"

MANCHESTER - - - - - Talbot Road, Stretford
Telephone: LONGFORD 1101 (5 lines) — Telegrams: "LUCAS, STRETFORD"

NEWCASTLE-ON-TYNE - - - 64/66, St. Mary's Place
Telephone: CENTRAL 25571 (3 lines) — Telegrams: "MOTOLITE, NEWCASTLE-ON-TYNE"

GENERAL

IT is of great importance to bestow care and attention upon the engine and chassis of the car, but the appearance of the car too, must not be neglected.

It is therefore advisable to give the following hints for the care of the coachwork.

In general coachwork can be treated successfully by the ordinary methods of washing, but Singer coachwork is finished with cellulose and dust can therefore be removed with a soft duster. Mud should be removed by washing the coachwork with a hose or a large sponge and water, and the body should then be dried with a chamois leather and afterwards polished.

The appearance of cellulose is actually improved by frequent polishing, and there are many well-known polishes on the market which may be used if desired, but on no account should metal polish be used.

Roof fabrics are best cleaned with a good soap and plenty of water—do not use petrol or paraffin.

Wings and valances are stove enamelled, and should only be cleansed with a sponge and plenty of water, a chamois leather being used for drying purposes.

It is advisable to run over the body bolts occasionally with a spanner, and at the same time examine all chassis nuts and bolts, shackle pins and split pins, etc. The floor boards and pedal boards are often a frequent cause of rattles and squeaks, and the screws should be tightened occasionally to prevent this.

If at any time the car is to be laid up for a considerable period, it is advisable to drain the water system and remove the battery so that it can receive periodic attention as indicated in this book under the heading of electrical equipment. It is also advisable to drain the oil from the engine, and to take the weight of the car off the tyres by jacking up each wheel in turn and placing blocks under the axles, taking care that the weight of the car is taken directly on the axles and not upon the track rod or brake levers.

Attention to the tyres is always time well spent, comfortable riding, easy steering, safe braking and long tyre life all depend to a considerable degree upon the care bestowed upon the tyres.

The tyre pressures for each model are as here-under, and a reduction of 4lbs. per square inch is permissible in the front tyres at any time and in the rear tyres when the rear seats are unoccupied :—

	Lbs. per square inch.			
1½-litre	29	Front	29	Rear
14 h.p. Saloon and Coupe	35	„	35	„
14 h.p. Continental Saloon	33	„	33	„
2-litre Saloon and Continental Saloon ...	25	„	25	„

Take care to keep the two tyres on one axle at the same pressure. unsteadiness of the steering is often due to under-inflation or unequal inflation of the front tyres, and this also results in a tendency for the steering to pull to either side.

Examine the tyres periodically and remove flints or other road matter which may have become embedded in the tread, and any large cuts should be vulcanised.

Clean off oil or grease which may appear on the tyre, with a little petrol, drying the tyre with a duster after the cleaning process.

On bad road surface always reduce speed, and at all times avoid violent acceleration and fierce braking.

TOOL KIT

A kit containing the necessary tools for all reasonable adjustments is provided and contains the following items :—

Wheel Lifting Jack and Handle.
Oiler.
Wheel Brace.
Tyre Pump.
Grease Gun.
Set of three Box Spanners with Tommy Bar.
Valve Adjusting Spanner.
Distributor Spanner with Plug Gap Gauge.
Large Adjustable Spanner.
Small Adjustable Spanner.
Screwdriver.
Pair of Pliers.
Tyre Lever.
Pin Punch.
Hammer.
Lead Hammer (1½-Litre Model).
Steering Key Spanner.

For general running the following spares should be carried and should be sufficient for all emergencies :—

Sparking Plugs.
Lamp Bulbs.
Carburetter Washers.

PERSONAL MEMOS.

NAME.....

ADDRESS.....

.....

Telephone Number.....

Make and Model of Car.....

.....

Registration No.....

Engine No.....

Chassis No.....

Name and Address of Insurance Co. :—

.....

.....

Policy No.....

Insurance Certificate No.....

Driving License No .....

Maker's Service Station.....

.....

Telephone Telegraphic Address

....

WITNESS RECORD.

Fill in the Particulars immediately an accident occurs.

PLACE..... TIME.....A.M.
P.M.

DATE.....

Number(s) of.....

Other car(s).....

.....

.....

Weather.....

Road surface (wet, dry, good, bad) .....

Were your head lights on or sides?.....

Did you sound horn?.....

Did a Policeman or Road Scout take particulars?.....

HIS NUMBER.....

INDEPENDENT WITNESSES

Name.....

Address.....

Name.....

Address.....

Name.....

Address.....

Name.....

Address.....

Your description of the accident

Position of cars after impact

NOTEWORTHY RUNS.

Date	From	To	Miles	Total Time	Stops— (Where and how long)	Running Time	Average Speed

PETROL CONSUMPTION RECORD.

Date	Speedometer Reading	Galls.	£	s.	d.
TOTAL					

OIL CONSUMPTION RECORD.

Date	Speedometer Reading	Quantity	Brand and Grade	£	s.	d.

CHASSIS LUBRICATION RECORD.

Date	Speedometer Reading	Minor Adjustments done while greasing	Cost £	s.	d.

SUMP DRAINED AND REFILLED.

Date	Speedometer	Brand and Grade	Cost £	s.	d.

GEAR BOX.

Date	Speedometer	OIL—Brand and Grade	Cost £	s.	d.	Remarks

BACK AXLE.

Date	Speedometer	OIL—Brand and Grade	Cost £	s.	d.	Remarks

ATTENTION TO BATTERIES.
(By Time—not Distance).

Date	Job	£	s.	d.

TYRES RECORD.

Date	Make and Type	Cost £	Cost s.	Cost d.	Which Wheel	Speedometer Reading On	Speedometer Reading Off

DECARBONIZING.

Date	Speedometer	Done By	Cost £	Cost s.	Cost d.	Remarks

BRAKES ADJUSTED.

Date	Speedometer	Done By	Cost £	Cost s.	Cost d.	Remarks

BRAKES RELINED.

Date	Speedometer	Done By	Cost £	Cost s.	Cost d.	Remarks

REPAIRS.

Date	Speedometer	Job	Cost £	s	d.

DECARBONIZING.

Date	Speedometer	Done By	Cost £	Cost s.	Cost d.	Remarks