



1920

10 H.P.
2/3 SEATER.
4 SEATER &
COUPE

Kumler
CARS

AND HOW TO
MANAGE THEM

L9

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see page 86.*

3RD EDITION.

PRICE 5/6

PREFACE.

IN the design of Humber Cars, every effort has been made to render their manipulation as easy as possible, and a few simple instructions only are required to enable the beginner to acquire sufficient knowledge of their mechanism to keep his car in good order, and drive it to advantage.

We would specially draw attention to the diagrams and illustrations in this book, which will repay a careful study. We have endeavoured to render them as simple and non-technical as possible.

For the majority of readers the information given will be found sufficient; but to those having little or no knowledge of mechanics, and desiring further information, a copy of the "Motor Manual," for the current year is recommended.

There are also several excellent Text-books, which may be obtained from any bookseller, for a very modest outlay.

The fullest description possible of any replacement required should always be given, with the letter and number of the car. These will be found on the dashboard and front dumb-irons. (The foremost part of the chassis frame.)

An oiling chart is supplied with every car, and contains illustrations and complete instructions for periodical lubrication of the different parts, as printed on pages 44-51 of this book. The type and diagrams are large, and the chart is stiff mounted, so that it may be hung up in the motor house for reference.

Our Technical Department is only too pleased to give any further information that may be required, regarding our cars.

All Humber Cars are made in our extensive works at Coventry, and we employ the most highly skilled labour in their construction. All parts, with the exception of articles we do not manufacture, such as tyres and electrical fittings, etc., are guaranteed for 12 months from the date of purchase, as set forth in our catalogue.

We issue free, on application, a separate list for spare parts, which may be obtained from our Repair Departments, Depots or Dealers.

THE RESULT OF WAR WORK.

DURING the War, the whole of our resources were devoted to the manufacture of munitions, the most notable of which were the famous Rotary Engines, B.R.1 and 2, and it is interesting to know that Humber Ltd. B.R.2 was proclaimed, by those who used it, to be the leading engine of its class.

We installed many valuable scientific instruments to assist in the production of these engines, and ensure absolute interchangeability of the various components, in order that our future products might be brought to a much higher standard of accuracy and finish.

Full advantage was taken of the valuable experiences gained in the use of higher grade materials for the manufacture of those Engines, in other words, the Valves, Gears, Transmission Shafts, and all parts of our cars, are made from materials, best suited to their requirements, and regardless of cost.

All raw materials such as castings, stampings and pressings, are scientifically tested in our well-equipped Laboratory to ascertain their chemical composition, and physical properties. Where necessary, the finished articles are again tested for strength, hardness and finish before final assembly.

The Chassis of our 4-seated model has been further improved, by bringing it into line with the 2/3-seater. The same type of Foot-Brake is fitted to the Gear-box

Mainshaft. The Hand Brake operating on the rear wheels is also of the external contracting type, made larger in diameter to deal with the extra weight of the car. The Steering Gear is also of the worm and sector type, with control levers above the Steering Wheel. By making these different components common to both cars, we shall be better able to deal with the supply of spare parts.

The chassis of the 2/3-seater, however, has smaller wheels, and lighter springs and frame than the 4-seater; the reason being that each is designed to give the minimum of weight with the maximum of comfort.

Both types of chassis are illustrated to avoid confusion; otherwise the lubrication, running instructions and diagrams are identical, thereby rendering the matter in this book applicable to both cars.

THE MOTOR HOUSE.

AN ordinary coach-house will answer the purpose. If a building is to be erected, care should be taken that it is well lighted, ventilated, and thoroughly dry. It should be at least 20 feet long, and contain a bench and vice, which will be found very useful; also a set of drawers in which to keep spare parts, tools, etc. It should be sufficiently high to accommodate a covered-in car, and for convenience in making adjustments and getting round it we recommend that the house should be at least 12 feet wide, the floor should be of concrete or asphalt suitably drained, and if a water connection can be laid, it will be useful for coupling up a low pressure hose with which to wash the car.

It will tend towards cleanliness, and assist in the preservation of the tyres, if a shallow tray 6' 6" x 3' 0" filled with sand or saw-dust, be placed underneath the car, to catch any oil that may drop.

The house should be well ventilated from the floor upwards, so as to carry away any fumes of petrol that may be present. These fumes are highly explosive and no naked light should be used, neither should anyone enter the house smoking, after it has been closed up for a period. As petrol vapour is heavier than air, the fumes have a tendency to descend. Regulations with regard to the storage of petrol are printed on page 74.

INSPECTION LAMP.

The Switch Board of the Lighting Set is provided with two small holes to receive the Adapter and Flexible Cable to which may be coupled an Inspection Lamp. This will provide a safe light for making adjustments, or inspecting the car by night. All parts can easily be reached with a cable length of about 8 feet, and bulbs from the Head or the Side Lamps that have lost their brilliancy, can be put on one side for this purpose. It is always advisable to change the Head Lamp Bulbs when their illuminating power shows signs of falling off.

TOOLS AND SPARES.

A TOOL KIT is supplied with each car, consisting of the following :—

Lifting jack.
Tyre pump.
Oil can.
Screwdriver.
Adjustable spanner.
Pair of pliers.
Three tyre levers.
Set of box spanners and bar.
Sparking plug spanner.
File.
Punch.
Hammer.
Hub cap spanner.
Detachable wheel brace.
Six double ended spanners.
Magneto spanners and carburetter spanner.
Duster.
Spare sparking plug.
Double ended C spanner, for adjusting clutch, nuts and fan.
An assortment of nuts, screws, split pins, and washers.

In addition to the above, we recommend the following spares being carried on long journeys.

Inner tube and tyre repair outfit.
Tin of petrol.
Two valves, with springs, cups and cones.
Magneto parts.
Lubricating oil and grease.
Spare cylinder head joint.

DESCRIPTION OF CAR AND INSTRUCTIONS.

ON arrival of the car it is advisable to examine it carefully. Any damage should be notified to the Dealer or to the Company at once, and the number of the car given. If not already acquainted with cars, compare the principal parts with the various diagrams which accompany this book, and learn to distinguish them. This will simplify the understanding of the instructions which follow.

The parts of the car are dealt with in order, commencing with the engine, following with the transmission, gears, steering, etc.

The Engine. (See illustrations on page 10 and 11). The principle is that of the well-known Otto Gas Engine, there being four strokes of each piston, or two revolutions of the crankshaft, to one explosion in each cylinder. These four strokes are known as :—

1.—*Suction Stroke*, when the piston descends, drawing into the cylinder a supply of air and petrol vapour from the carburetter, which is admitted through the inlet port, whilst the valve is lifted.

2.—*Compression Stroke*. The following upward movement of the piston which compresses the gas in the combustion chamber ready for igniting, both valves being closed.

3.—*Power Stroke*. The compressed gas being ignited by an electric spark from the magneto, explodes, thus forcing the piston down, and so rotating the flywheel.

4.—*Exhaust Stroke*. The piston rising after the power stroke expels the burnt gases through the exhaust port, after which it is again ready for the suction stroke. The crankshaft and valves are set to allow an interval

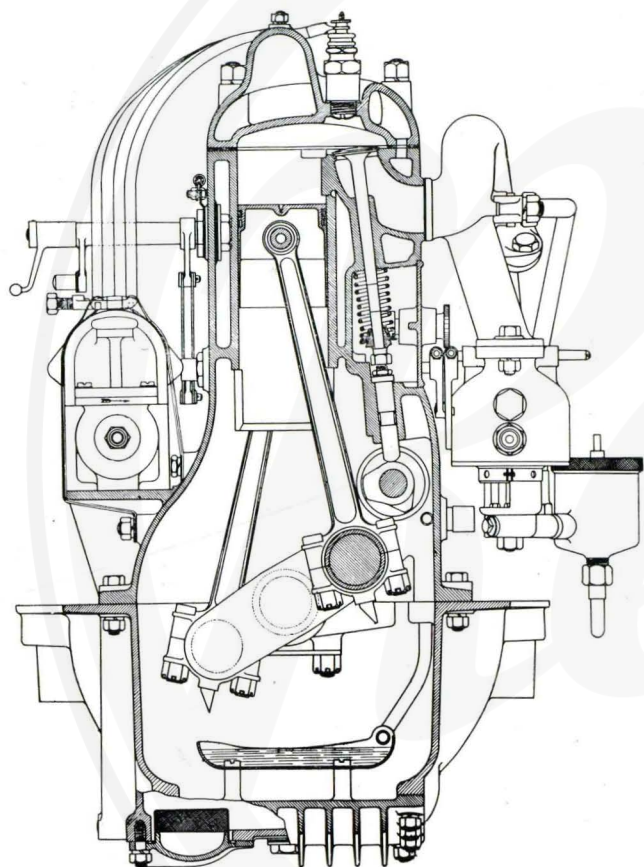
of half a revolution between the firing of each of the cylinders ; they fire in the following order : No. 1, 2, 4, 3, No. 1 being the cylinder nearest the radiator.

Each piston carries two split rings having a suitable amount of spring in them, so that they exert a constant pressure against the inside of the cylinder. This prevents leakage of gas between the piston and cylinder, and assists to maintain good compression, without which loss of power would result.

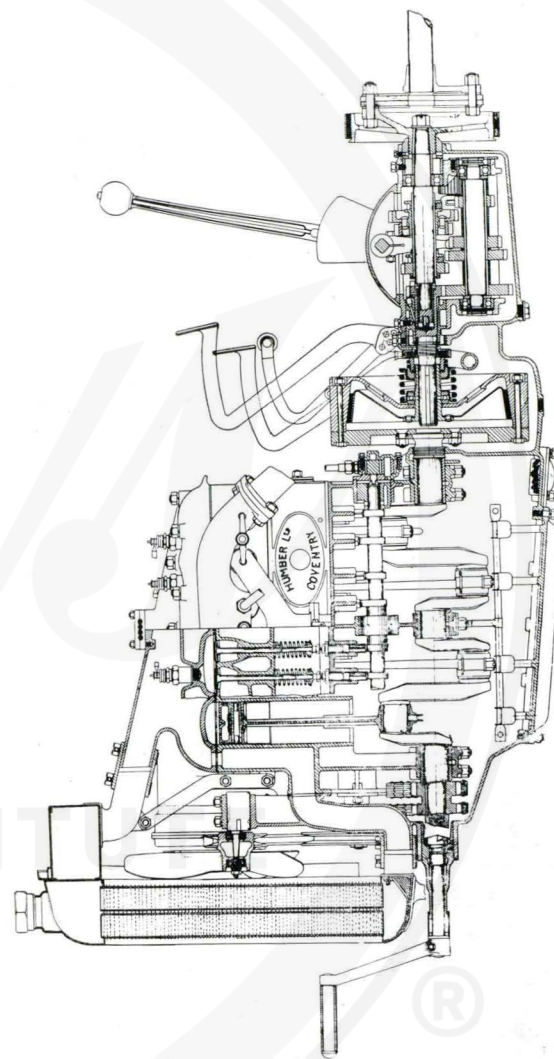
The piston, through the connecting rod and crank shaft, imparts a rotary motion to the flywheel.

Valves.—Each cylinder has an inlet and an exhaust valve. Cams lift them at the correct moment to carry out their functions during the different strokes as previously explained. If loss of power is noticed it may be due to loss of compression caused by leakage of gas past the valves, an indication of wear of the valves and seats. These should then be re-seated by grinding in. The exhaust valve will probably require most attention, as it wears more quickly, being subjected not only to the heat from the exhaust gases, but to the carbon deposit contained in them. It is not desirable to grind the valves more often than is absolutely necessary.

Cylinder Head. (See illustration on page 10 and 11). This is a detachable unit from the cylinder and valve ports. It contains the combustion chambers, water circulation passages and the sparking plugs, and is held down to the cylinder by substantial studs. A gas-tight joint is ensured by sheets of special composition and thin brass. The cylinder head can be removed several times without damaging the joint. One brass sheet should be placed each side of the composition, so that when the head is removed, the complete joint will come away, and leave the top of the cylinders clean.



Power Unit—Sectional End Elevation.



Power Unit—Sectional Side Elevation.

To remove the cylinder head empty the engine of water through the drain plug at the base of the radiator, uncouple the two clips that secure the rubber connection to the cylinder and radiator, slide the rubber sleeve down the neck of the cylinder head as far as possible to bring it clear of the radiator pipe, detach the ignition wires from the magneto and the holding-down nuts round the head, after which it may be lifted clear of the studs.

When replacing the cylinder head after grinding in the valves or cleaning out the carbon deposit, be sure that the surfaces of the cylinder and the brass washer are entirely free from grit, and when tightening up the nuts, do not put all the pressure on one nut but work gradually round the cylinder head, giving each nut a little more tension in rotation. It is important that all these nuts should be finally tightened after warming the engine, by running it light for a few minutes.

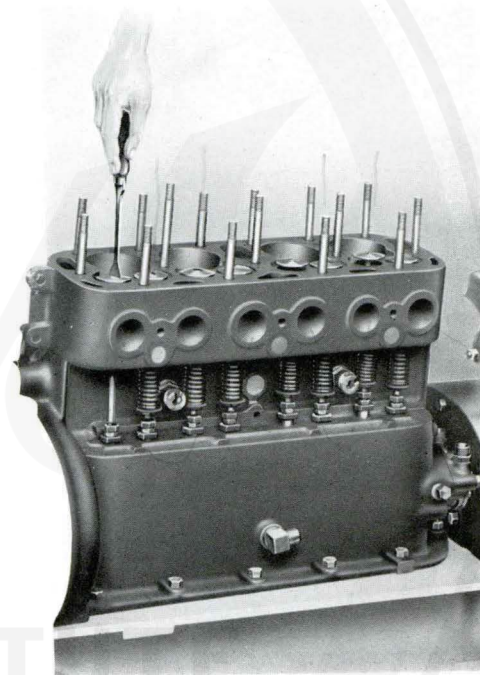
To take out a valve detach the cylinder head, raise the spring, at the same time holding down the valve with a screwdriver, withdraw the split cone from the valve.

To grind in the valves (see illustration on page 13) put a very thin coating of paste mixed with a little thin oil (the paste is obtainable from any Dealer or garage), on the seat of the valve, then lower the valve into position as shown, and with a screwdriver or brace twist it to and fro, at the same time occasionally lifting it off the seat with the other hand.

A small spring over the valve stem can be used to lift the valve from its seating. To keep the grinding even, move the valve round a little before repeating the twisting. Examine the valve and seating, and when the surface of both are perfectly even, wipe off all traces of paste and wash thoroughly with petrol.

On no account must the valves become mixed. It is advisable to remove only one at a time, replacing it in its correct seating before commencing with another.

In grinding valves, the less paste that is used, consistent with the necessary grinding, the better for the valves.



Valve Grinding.

The greatest possible care should be taken that no paste remains, as, should it get into the cylinders, serious damage will be done. The valve and seating will be improved if after grinding they are burnished with lubricating oil, twisting in the manner already described.

When the grinding is complete, put in the spring, with its cup in position, drop in the valve, and replace the split cone. If any difficulty arises in replacing the latter and no valve lifter is available, squeeze the spring in a vice and tie it with string in two places.

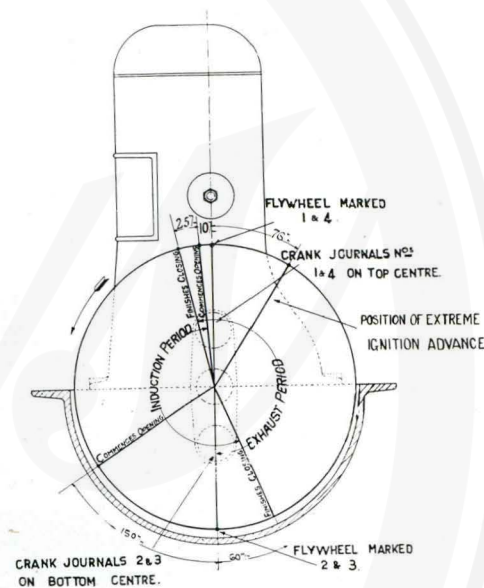
After replacing the valve cut the string.

Do not be afraid to undertake these operations when loss of power is noticed. We recommend this after at least every 5,000 miles, but, if convenient, it would be better after 3,000, thereby keeping the engine up to concert pitch, and economising the consumption of petrol.

Tappet Adjustment.—When the valve is closed there should be a clearance between the tappet and valve stem sufficient to allow a sheet of thin paper to pass between; it can be ascertained whether the tappet is at its lowest position by slowly turning the starting handle and watching the tappet. To adjust the tappet, slacken the lock nut and gradually screw the bolt up or down to allow the required clearance, hold it with a spanner and tighten the lock nut. The correct clearances are .003" for the inlet valve, and .004" for the exhaust.

Valve Timing Diagram. (See illustration on opposite page).—This shows the exact points at which the valves should open and close with relation to the position of the pistons. When the numbers 1 and 4, or 2 and 3 on the periphery of the flywheel are on the exact top centre, the pistons represented by these numbers will be at the top of their stroke, No. 1 being the cylinder nearest the radiator.

To test the valve-timing turn the flywheel until the line marked Nos. 1 and 4 is 10 m/m to the left of the vertical centre (looking from driver's seat towards the engine).



Timing Diagram.

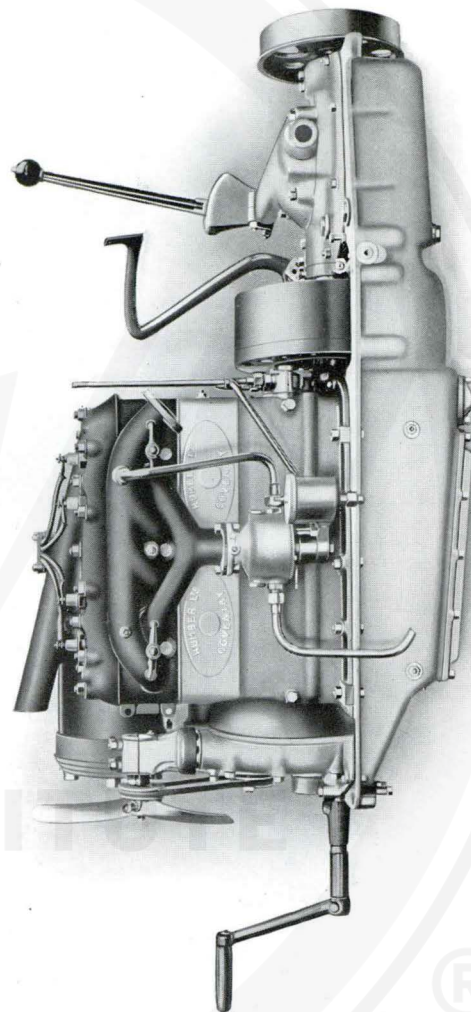
The inlet valve of No. 1 or 4 cylinder should now be commencing to open, or in other words the tappet should actually be touching the valve stem. The opening and closing of the other valves is controlled by the setting of the cams on the shaft, and they should open and close at the points shown on the diagram. If they do not, the cause will be due to incorrect clearance of the tappet.

Water Inlet Pipe.—(See illustration page 27). This is cast en bloc with the timing gear cover, and the joint between the pipe and the cylinders is made with a soft rubber ring, which is pressed between them by the bolting of the timing cover to the top half of the crankcase.

Fan.—This is driven by means of a leather belt from a pulley on the magneto shaft. The fan spindle is made eccentric to enable the belt to be adjusted. Before moving the fan spindle, the clamp nuts on top of the bracket must be slackened.

Water-Cooling.—To prevent the engine over-heating from the continual combustion in the cylinders, the Thermo Syphon System is adopted. The upper parts of the cylinders and valve pockets are jacketed and connected to the radiator by large pipes so that the water may freely circulate. This system is an adaptation of the well-known physical law that the hottest water rises to the top; this in conjunction with a syphon action through the radiator, causes the circulation of the water, and a constant supply of cooled water to the cylinders. The radiator contains a number of thin flat tubes which divides the water into small columns, to facilitate rapid cooling, after which the water returns into the cylinder jackets through the return pipe cast in the timing cover. It is necessary that the radiator should be kept filled within 3 inches of the top of the filler, as the water will cease to circulate if allowed to get too low, and soft water should be used for filling the radiator whenever possible.

Exhaust and Inlet Pipes.—(See illustration on page 17). These are fixed to the cylinder by means of two clamps and one stud. These need not, however, be interfered with, as the exhaust pipe can be uncoupled at



Power Unit—near side.

the flange on the silencer pipe, and the carburetter at the flange on the induction pipe.

Overheating may be caused by driving with the ignition retarded, defective circulation through insufficient water, or a choke in some of the water pipes ; these troubles may be detected by removing the cap in the radiator when the engine is running and observing if circulation is taking place. A more probable reason is insufficient oil in the crankcase.

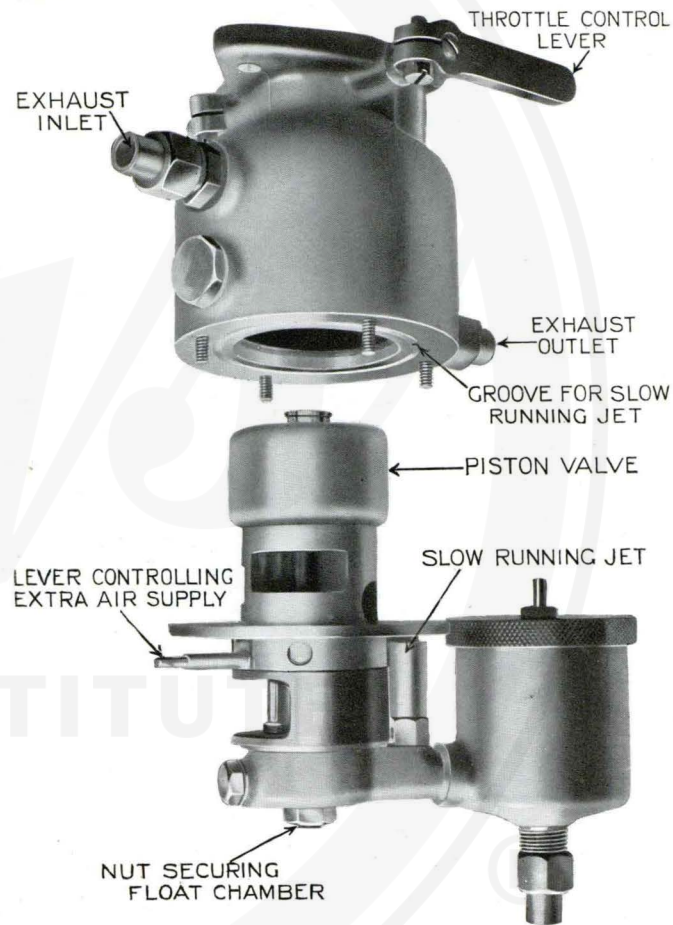
In frosty weather the water system should be drained by removing the plug, which is fitted at the bottom of the radiator ; this will prevent the possibility of cracked cylinders or radiator, which will invariably occur if the water is allowed to freeze.

Where it is necessary that the car should be ready to run at short notice during the winter nights, the motor house should be heated, or if this is not possible, a quilted cover for the bonnet and radiator will keep the engine warm for several hours, and obviate the necessity for draining the radiator, providing the cover is fitted immediately after the car is housed, and the engine switched off. If, however, the motor house is an open one, and the frost severe it will be safer to drain off the water.

Petrol Supply.—The petrol tank, which holds seven gallons, is carried in the dash ; there is, therefore, always an adequate supply to the carburetter whatever the gradient of the road may be.

The filler is placed in a most accessible position on the dash. A filter is fitted to the supply pipe between

the tank and carburetter. A small tap will be found under the filter body, and this should be opened periodically to release any water or sediment that may have accumulated.



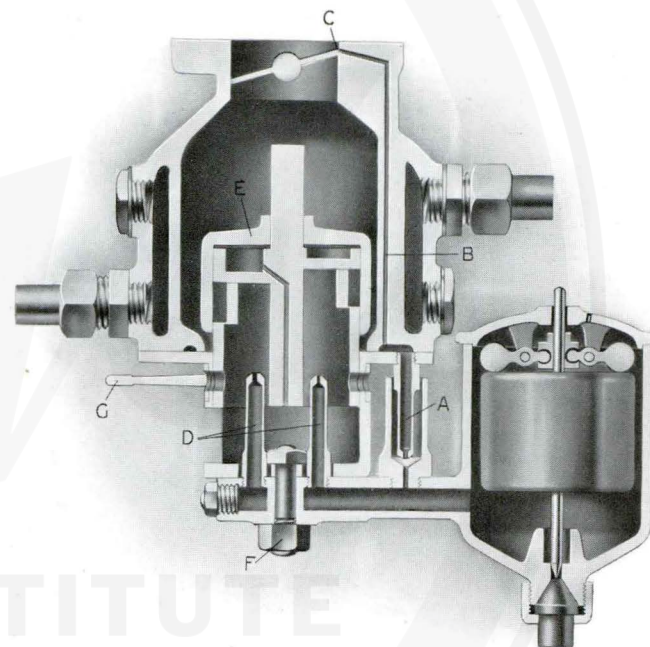
Carburetter dismantled.

Carburetter.—The illustrations on pages 19 and 21 will assist in observing its operation, which is as follows :

To facilitate starting the engine, and to enable it to continue running slowly and smoothly, an improved type of Jet "A" is used, the mixture being drawn into the cylinders, through a small passage "B," terminating in the mouth of the carburetter on the high side of the throttle valve "C." The outer or "Well" jet is open to the atmosphere, causing the petrol to fill it to the float chamber level. The throttle valve being slightly open, exposes the by pass so that the petrol is drawn from the "Well" jet, through the inner jet into the cylinders, and is suitably diluted with air, as soon as the petrol level has dropped sufficiently. An adjustable stop is fitted to the throttle spindle, so that the exact setting can be determined for slow running. As the throttle valve is opened further, the four main jets "D" come into operation gradually through their individual mixture ports becoming exposed by the cylindrical valve "E," which rises due to the increasing suction from the engine, thereby allowing each jet in turn to add its supply of mixture, until at full throttle, all jets are giving their full output. As the throttle is varied, so the piston valve rises or falls, adjusting the supply of mixture, to automatically suit the demands of the engine.

Each jet is marked with a number, representing its flow value, and should not be changed or put into the wrong place under any circumstances ; the float chamber cannot be placed in any other but its correct position. If, therefore, it is necessary to detach any of the jets for clearing a stoppage, they should be removed

one at a time to ensure correct replacement. If it be suspected that one or more jets have become clogged, you may locate them by turning off the petrol tap in the supply pipe, uncoupling the pipe near the filter, removing nut "F," and detaching the float chamber.



Carburetter—Section.

By blowing lightly into this, through the air hole in the centre of the cover, you will see a stream of petrol issue from the jets that are clear.

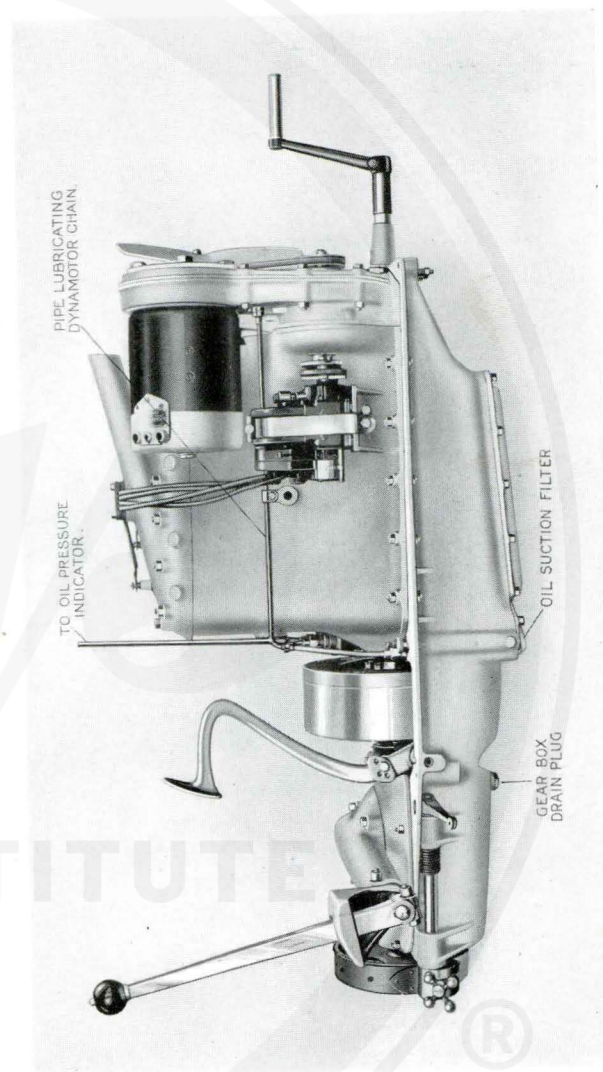
If choked jets are suspected whilst driving, they may frequently be cleared by disengaging the clutch, and racing the engine for a few seconds.

The body of the carburettor is heated by exhaust gases. The pipes should be removed and cleaned occasionally to prevent them becoming choked ; lack of heat in the carburettor body will indicate this condition.

Air Sleeve. An extra supply of air to the main jets is provided, and controlled by a small lever "G." The open and shut positions are indicated by the letters "O" and "S," stamped on the carburettor body. This sleeve should always be opened when the engine is thoroughly warmed, as it considerably economises the fuel consumption. In very cold weather, however, it is better to run a few miles with the sleeve shut, or partly shut. The best position for the lever can readily be judged by the running of the engine, which should accelerate evenly and rapidly when the pedal is depressed.

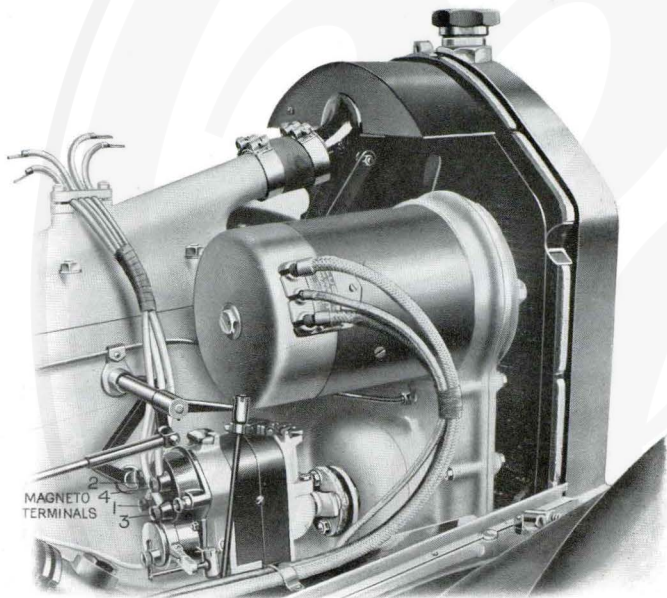
Ignition.—This is caused by an electric spark created by a high tension magneto, which is now of British manufacture. A separate Instruction Book issued by the makers, and supplied with each car, deals fully with this important unit.

Ignition Control. An ignition advance lever is connected with the magneto which enables the driver to vary its position and thus advance or retard the time of the ignition in the cylinders. It should be explained that when the engine is running fast, it is necessary to cause the spark to occur before the pistons are at their full height, so allowing for the small, but (having regard



Power Unit—off side.

to the speed of the engine) appreciable time it takes for the ignition to take full effect. Whilst travelling at full speed the ignition lever should therefore be fully advanced to keep up the speed ; but when the car is travelling slowly, the lever should be retarded to prevent ignition occurring before the pistons reach the top of their stroke. The correct method of using this lever is dealt with under driving instructions.



Ignition Wires and Magneto.

General Remarks on the Ignition System.—Short circuiting will occur through a wire resting upon the cylinders, the breaking of a wire, its disconnection with the terminals on the magneto or sparking plugs, or perished insulation.

It is necessary, therefore, to see that all the above connections are firmly made, and the screws kept dry and clean. Those connected with the plugs are most liable to come loose.

Should one cylinder only misfire, the cause will probably be found in the connections of the wiring of that cylinder. Examine carefully to see that there is no breakage. If a wire is found to be broken, replace it by another ; the old wire may be temporarily repaired by peeling off the insulating material at both broken ends for about half an inch, twisting them into each other, and binding with insulating tape. The sparking plug will indicate if the current is passing effectively.

The method of coupling up the cables from the magneto to the sparking plug is shown on page 24. The numbers referring to the magneto terminals represent the number of the cylinder to which the wire is to be connected, *No. 1* being the cylinder nearest the radiator, thus :—

Couple No. 1 terminal on magneto, which is the lower terminal nearest cylinder, *to No. 1 sparking plug.*

No. 2 terminal, the inside one immediately above *No. 1*, *to No. 2 sparking plug.*

No. 4 terminal, the top outside one, *to No. 4 sparking plug.*

No. 3 terminal, the bottom outside one, *to No. 3 sparking plug.*

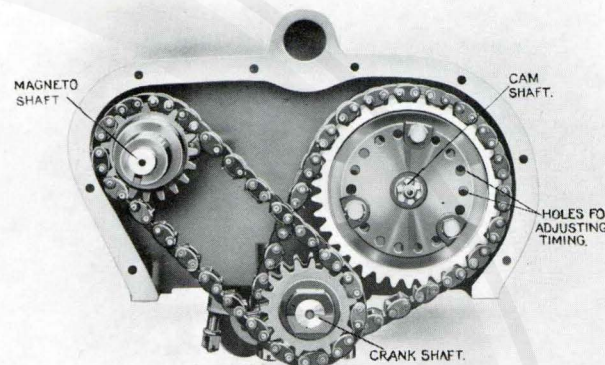
If it is necessary to remove the magneto at any time, care should be taken that the engine is not turned, before the magneto is replaced, as the timing would be upset. A flexible fabric coupling is provided, and the driving

pins on the magneto, can be simply withdrawn from this disc, by slacking off the magneto securing straps.

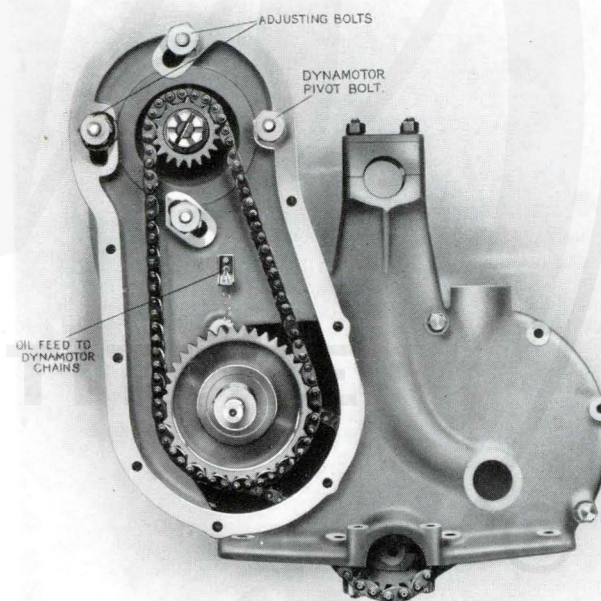
To facilitate accurately adjusting the timing, the flexible fabric is secured to the magneto shaft flange by two studs which are securely locked in radial slots.

Re-timing Ignition.—Turn the flywheel until the marks No. 1 and 4 on the periphery are at the exact top (or opposite the web on the crank chamber) and both valves of No. 1 cylinder are closed. Move the contact breaker arm to full retarded position. Remove the contact breaker cover from the magneto and turn the armature until the points of the contact breaker are just parting, and the arrow inside the distributor box is pointing to the terminal of No. 1 cylinder. The magneto can now be coupled up to the engine. To time a magneto to get the best results is a difficult matter, and we recommend the owner to take his car to a competent mechanic who is accustomed to the job.

Lighting and Starting Unit.—We fit the Lucas Single Unit Machine, which is constructed to perform the dual operations of generating current for charging the batteries when the engine is running, or turning the crankshaft to start the engine, by acting as a motor, when the switch knob on instrument board is depressed. The machine is adjustably mounted to the timing gear casing, and is positively driven by an enclosed silent chain as shown on page 27, which is lubricated by a continuous supply of oil from the main lubricating system. A layout of the wiring and full working instructions are dealt with in a separate booklet supplied to us by the manufacturers; one of these booklets is given with each car. Read it carefully.



Camshaft and Magneto Chain Drive.



Dynamotor Chain Drive.

Transmission Gear.—(See illustration page 31.) The power is transmitted from the flywheel of the engine through the clutch to the gear box, thence to the propeller or "cardan" shaft, and back axle. The instructions for lubrication of these various parts should be strictly attended to (see "Lubrication Instructions").

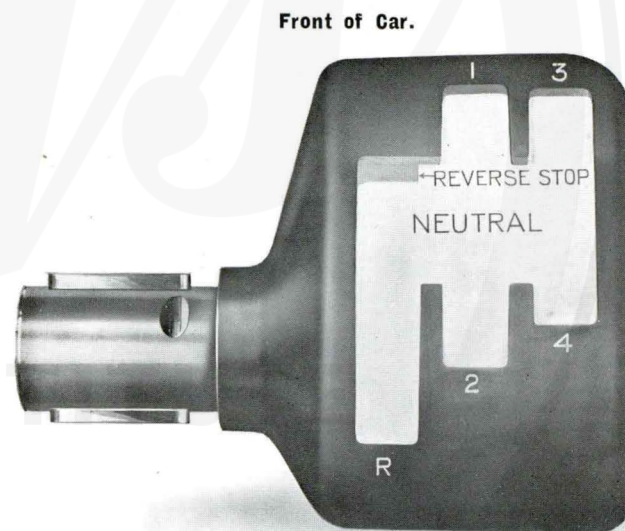
The general layout of both the 2-3/Seater and 4-Seater chassis is illustrated on pages 30 to 33.

Clutch.—(See illustration page 11.) This consists of a leather faced cone held in engagement with the flywheel by a central coil spring. It is entirely enclosed by the flywheel, which is divided to enable the gear box or engine to be detached from the unit independently. A hole will be found on the inside near the spring, through which the special lubricant may be injected. The clutch is withdrawn by the pedal, and by this means the engine is connected or disconnected from the transmission of the car. If at any time it becomes irregular in working, refer to the "Lubrication Instruction," pages 42 and 50).

Gearbox.—(See illustration page 11.) This contains two shafts, a main and secondary, upon which are mounted a number of gear wheels. These, by meshing together, enable the different ratios of gear to be engaged as required. Four forward speeds and a reverse are provided and the general design can be easily followed by examining the illustration.

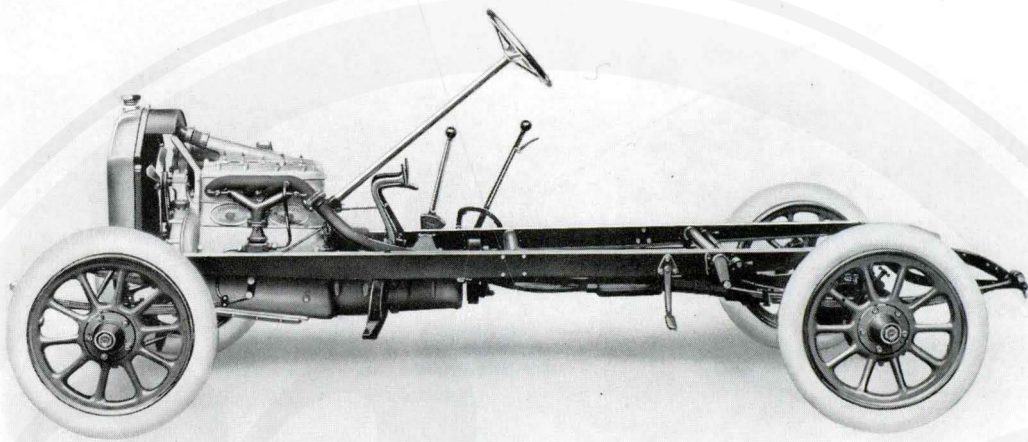
The engine, clutch or gear box must not be removed from the unit by anyone but a competent mechanic.

Change Speed.—(See illustration below). This is of the selector gate type which enables any gear to be engaged direct from the neutral, or free engine position. A catch is fitted on the lever to prevent accidental engagement of the reverse gear ; it is operated by a plunger in the handle which must be pushed down to allow the lever to slide into the reverse slot, marked "R" on the quadrant. The forward speed slots are marked 1, 2, 3, and 4, 4 being the highest gear or direct drive.



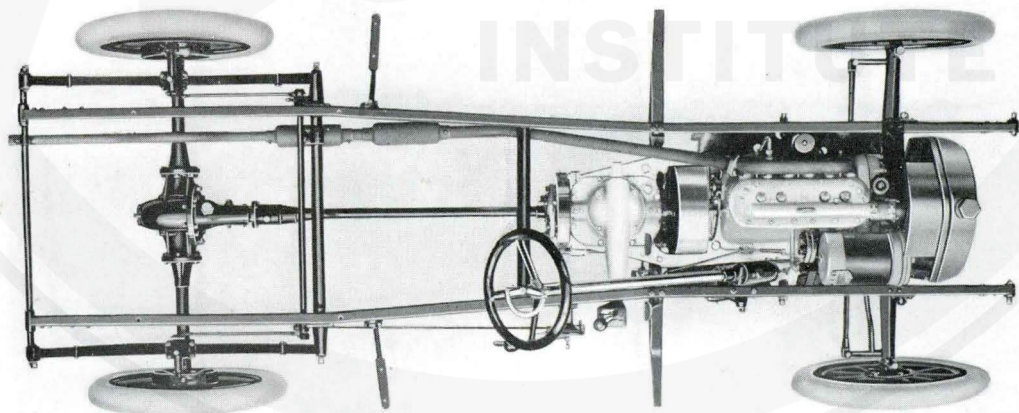
Change Speed Gate.

30



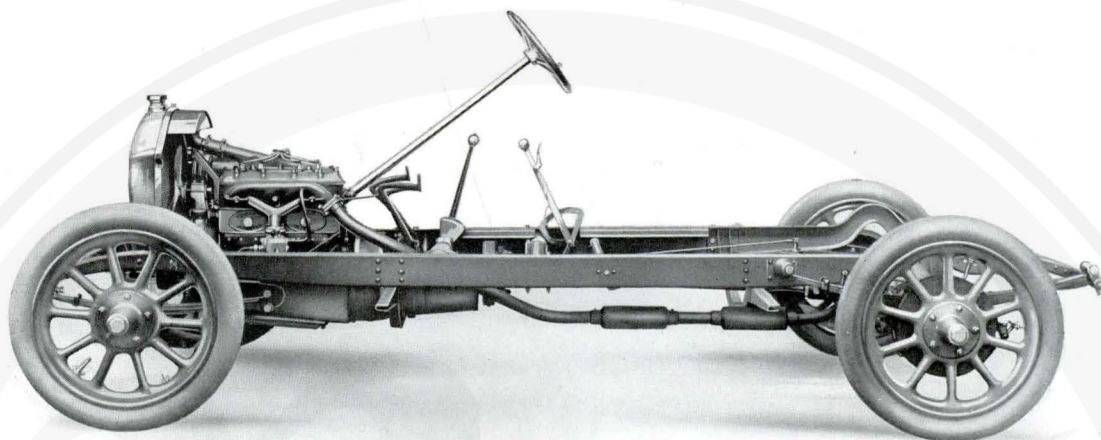
Elevation of Chasis, 2/3 Seater.

31



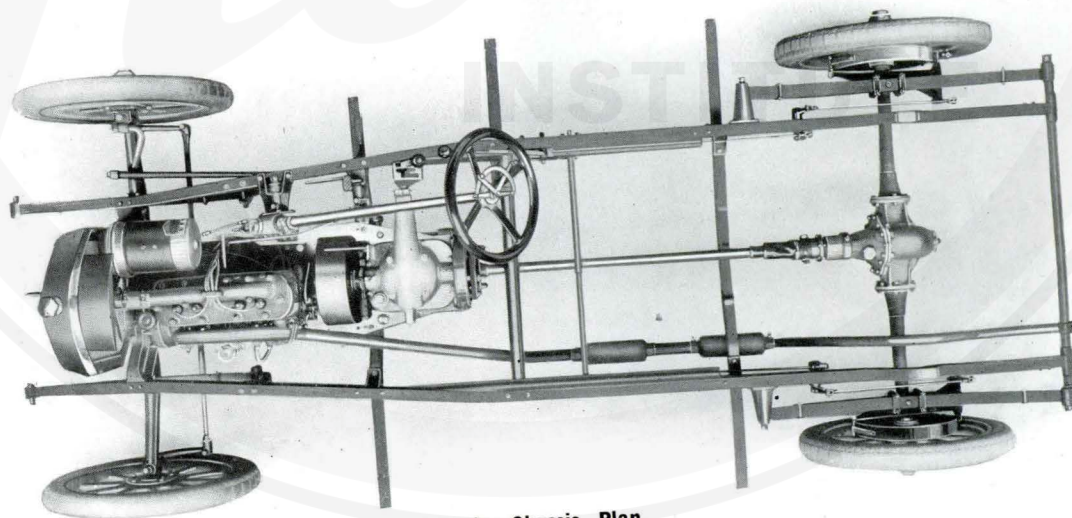
Plan of Chassis, 2/3 Seater.

32



4 Seater Chassis, Elevation.

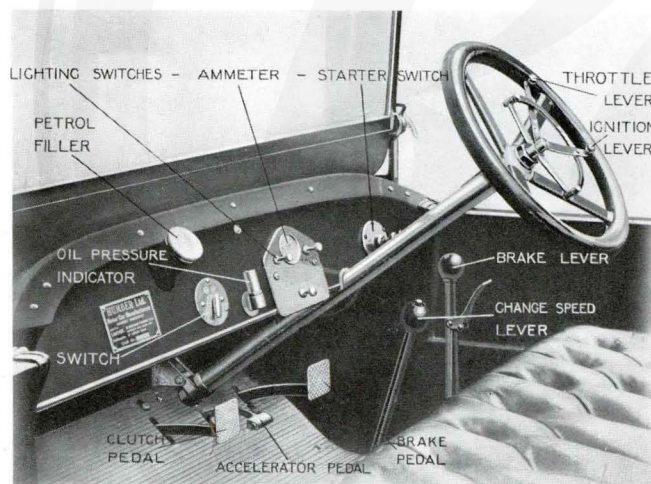
33



4 Seater Chassis, Plan.

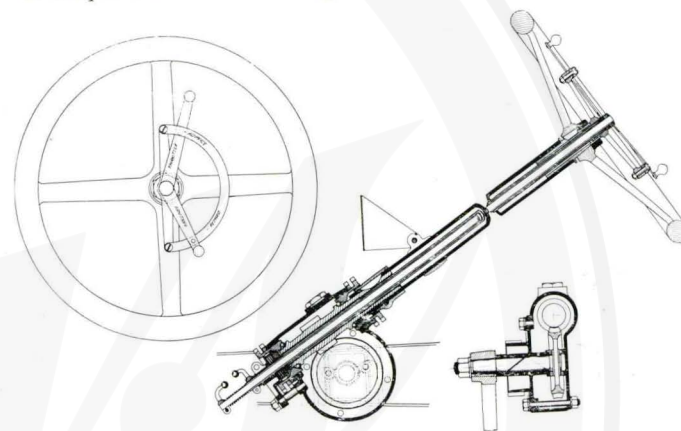
Pedals.—There are three of these, constituted as follows :—

The small one in the centre, called the accelerator, is for controlling the speed of the car. The large one on the left is for operating the clutch, and that on the right for applying the brake on the gear box mainshaft. The accelerator, as already explained, opens the throttle thereby controlling the speed of the engine. This and the brake pedal are operated by the right foot, and the clutch pedal by the left foot, as explained in the driving instructions, pages 56 and 57.



General View of Instruments, Pedals and Levers.

Steering Column.—The illustration below shows the arrangement of the worm gear and control levers on the wheel. The worm shaft is fitted with adjustable cup and cone bearings and the sector shaft has plain bearings of ample diameter and length.



The levers that carry the coupling rod to the front axle are fitted with ball ends, and the joints may be easily adjusted.

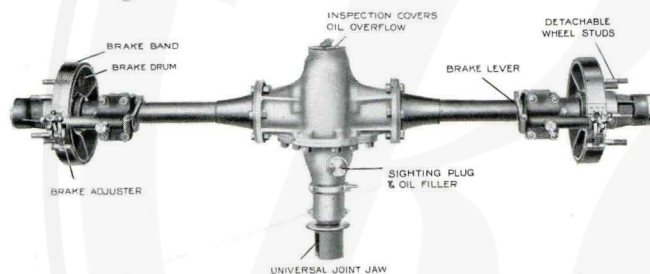
Control Levers on Steering Wheel.—(See illustration above.) The ignition and throttle levers are conveniently placed over the steering wheel, and the correct way to use them is explained in the driving instructions.

On the 4-seater car the switch is contained on the magneto, and is operated by depressing a small knob on the ignition advance lever, which allows it to move beyond the stop and so switch off the engine.

Propeller Shaft and Joints.—This transmits the drive from the gear box to the rear axle. It has a flexible

coupling at the front end (behind gear box brake drum) insulating all sound that might arise from the gears. There is also a universal joint at the rear end which by means of sliding blocks working on hardened steel pins, allows for the rise and fall of the road wheels (see illustration below).

Rear Axle. (Illustrated below). This is of the "live" type, consisting of an outer casing containing the bevel gear and differential mechanism which transmits the motion from the bevel gears to the road wheels through the driving shafts.



Rear Axle with Brakes and Hub.

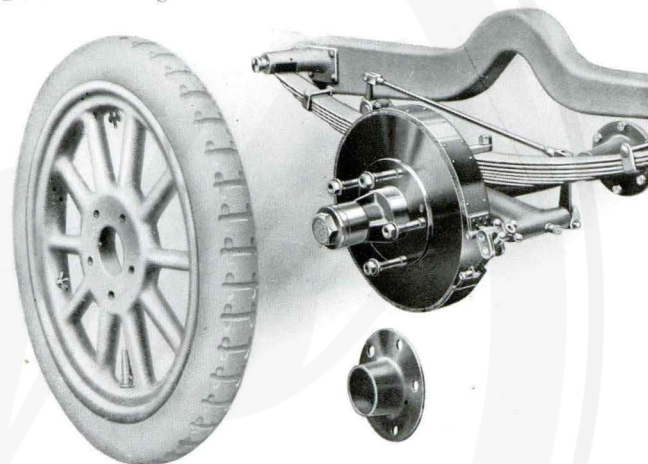
The road wheels are mounted on single ball bearings which are fixed to the ends of the sleeves; these, therefore take the weight. The driving shafts are fixed to the hubs by means of cones and keys.

Differential Gear.—This is carried in the central bevel gear case and is a mechanism that allows the road wheels to take an equal share of the drive, and at the same time remain independent of each other.

It is fitted inside the box in the centre of the bevel crown wheel, the whole of which is mounted on large ball bearings

Brakes.—These consist of a foot brake operating on a drum mounted at the rear of the gear box, and a hand brake operating on the drums of the rear wheels. These require no lubrication.

To adjust either brake a hand nut is provided in an accessible position; this contracts the band, thereby taking up the extra clearance, caused by wear of the Ferodo Lining.



Detachable Wheel and Brake, 4 Seater.

Exhaust Silencer.—This consists of a chamber, in which the exhaust gases are expanded and cooled. After continual use, this chamber becomes coated with soot. The pipes should, therefore, be detached and cleaned every year, or about every 10,000 miles, otherwise power will be lost through back pressure.

Nuts, Bolts, &c.—The chassis should be examined periodically and any loose nuts attended to. An assortment of spare nuts, bolts and washers included in the tool kit.

Lubricator Caps.—Care should be taken when replacing these after refilling with grease, to get them well on the thread ; small ones should be on about three turns, and the large ones should be turned until the safety catch is felt to work.



Detachable Wheel and Brake, 2/3 Seater.

Detachable Wheels.—These are now considered indispensable ; they can be fitted very quickly, and a change once made is a permanent one.

All wheels are interchangeable and a special brace is supplied to facilitate easy and rapid changing of wheels.

LUBRICATION INSTRUCTIONS.

This article is a detailed explanation of the general principles of lubrication throughout the Chassis. Definite instructions for periodical lubrication of the car is given on the pages referred to.

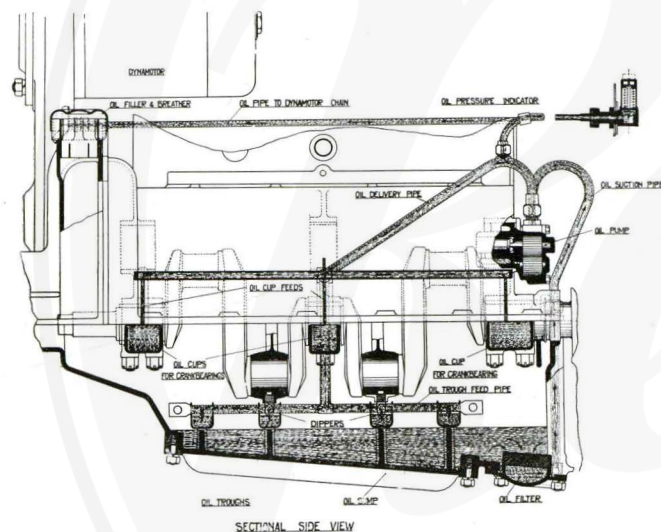
This subject is by far the most important in connection with the driving and management of a car, and if these simple explanations and instructions are carried out, in conjunction with a careful inspection of the diagrams, the trouble incurred will be amply repaid by the more efficient running and absence of wear of moving parts. The various caps, plugs and covers are so arranged that they are as accessible as possible ; their positions in different parts of the chassis are indicated on pages 46—49.

The method of lubricating the engine is first explained, followed by the transmission gear and other parts of the chassis.

The Engine.—(See illustration page 40.) This is lubricated by a self contained system of automatic feed ; the oil is continually circulated by a rotary pump through a combination of pipes in the crankcase.

These lead to cups on each of the main crank journals, which are combined with the bearing caps, and to four troughs, one being immediately under each connecting rod. The big ends of the connecting rods are fitted with dippers or scoops, these pick up their supplies of oil from the troughs, which are always overflowing. The overflow from these troughs and oil cups returns to the sump, where it is filtered before re-circulating.

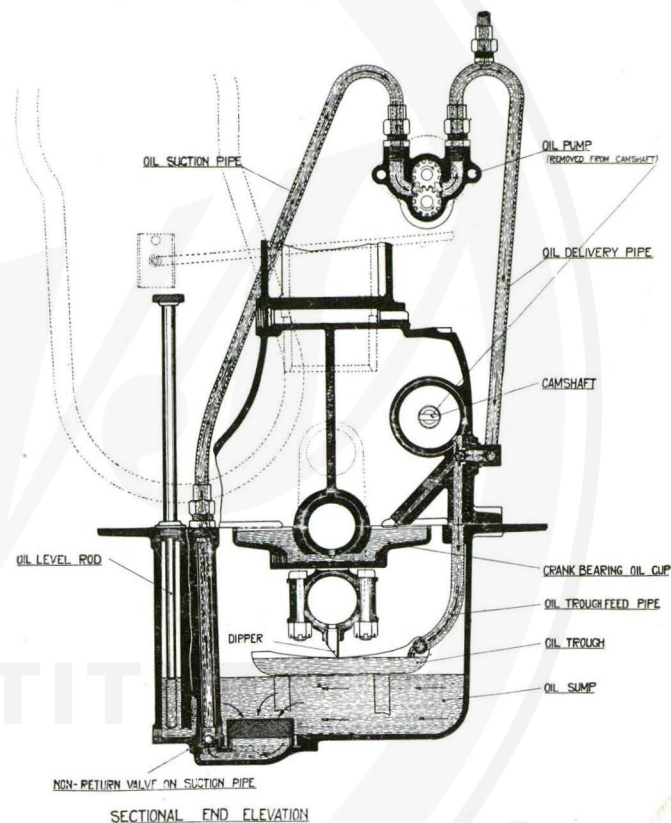
Oil Circulating Indicator.—Is placed in a convenient position on the dash and easily seen from the driver's seat. The only point requiring attention while running is to see that the indicator shows circulation of oil. It consists of a small plunger which should project about $\frac{1}{4}$ inch from the body of the gauge as long as the engine is running; when the engine stops, the plunger disappears into the case of the indicator.



If at any time it does not rise after the engine has been started, the cause should be immediately found.

Probably the oil filter may require cleaning, or there may be too little oil in the sump to circulate properly.

Oil Pump.—This is placed at the rear end of the camshaft, from which it is driven direct. It is so designed that the gears are always submerged in oil. If at any time, this is detached, be sure that it is filled with oil before the unions are coupled up and the engine started.



Oil Filler.—This is of ample size, and will be found on the timing cover over the camshaft. The lid is provided with several vents to act as a breather.

Oil Level Gauge Rod.—(See illustration page 41). This is conveniently fitted to the sump of the crankcase and consists of a rod, which, when detached shows the depth of oil in the sump. The groove indicates the maximum level, and oil should not be allowed to show above this.

The pistons, gudgeon pins, cams and valve tappets are lubricated by the oil that is thrown from the connecting rod bearings as they revolve. It will be seen, therefore, that providing the oil is maintained at the correct level and the indicator on the dashboard is working satisfactorily, the whole of the internal moving parts of the engine will be efficiently lubricated.

It is important that a thinner oil be used in the engine during the winter months, in order that the starter may turn the engine with sufficient speed for starting up. A heavy oil is so thick or sticky at very low temperature, that a considerable effort is required to set the pistons and other moving parts in motion.

Clutch.—(See illustration page 11). This, as already explained, is entirely enclosed by the flywheel cover, which prevents dust and water getting on to the leather and enable it to retain the oil, in which it runs, for a considerable period.

It will not require attention unless it begins to get fierce or to slip, when it should be treated as explained on page 50.

The pedal must always have a little play ; if it has not, the clutch will slip. This can be remedied by adjusting the two lock nuts next to the clutch spring by means of the " C " spanner supplied in tool kit.

The withdraw trunnion now contains a ball thrust race which should be oiled occasionally as instructed on page 45. It is important to see that there is always clearance between this ball race and the revolving clutch nuts when the pedal is out of action. Without a reasonable clearance here, good gear changing is impossible.

Gear Box.—(See illustrations pages 11, 31 and 33). This is correctly lubricated before the car leaves the works and should need no attention apart from the instructions as given on page 50.

Change Speed Gear.—(See illustrations pages 11, 30 and 33.) This is fixed to the gear box and all the striking mechanism is enclosed in same ; being below the level of the lubricant it does not require attention. The outside part of the sliding shaft and the reverse catch should, however, be oiled occasionally, as the lever must slide quite freely for perfectly silent gear changing.

Universal Joint at Rear of Propeller Shaft.—(See illustrations pages 36 and 49). This should be lubricated regularly, as instructed, for unless this is done, a considerable amount of the power is absorbed, and the life of the joint considerably shortened.

Rear Axle.—(See illustration page 36.) The filling cap is shown in the illustration ; this should be removed and the lubrication attended to as instructed on pages 45 and 50.

Steering Gear and Connections. All parts of these should be regularly lubricated as instructed on pages 50 and 51. If neglected the steering gear will quickly become stiff and difficult to manipulate. The front swivel arm joints are covered by leather shields, which should be carefully and tightly replaced after lubricating.

Brake Connections.—(See illustrations on pages 31 and 33). These should be adjusted as explained on page 37, and lubricated to instructions on pages 45 and 50.

PERIODICAL INSPECTION AND LUBRICATION INSTRUCTIONS.

For diagrams of 2/3 seater chassis, see pages 46 and 47.

For diagrams of 4 seater chassis, see pages 48 and 49.

FOR DAILY ATTENTION, OR EVERY 100 MILES.

Before Starting Engine examine oil level by lifting the bonnet and inspecting indicator rod, if the oil is low, fill up to notch.

There is no need for alarm if after a long run, the oil shows rather a low level, but it is advisable to keep the oil level to the high limit, as often as possible. If for any reason you are using a different brand of lubricating oil, it is better to drain the sump and start afresh.

Radiator.—Remove the filler cap and examine water level. It should be within 3-in. of the top, and no more.

FOR WEEKLY ATTENTION, OR EVERY 500 MILES.

Clutch Withdraw.—Fill lubricator on clutch withdraw ring with oil, and apply a few drops to the trunnion pins.

Grease Caps.—Give the caps on each of the parts named below two complete turns :—

SUSPENSION SPRING SHACKLE BOLTS.

FRONT WHEEL SWIVEL AND STEERING JOINTS.

HAND BRAKE LEVER BRACKET.

INTERMEDIATE BRAKE SHAFT BRACKETS.

BRAKE BRACKET ON BACK AXLE.

FAN.

When caps are screwed home remove them and refill with grease.

Throttle and Ignition Controls.—Oil the ball joints that actuate these.

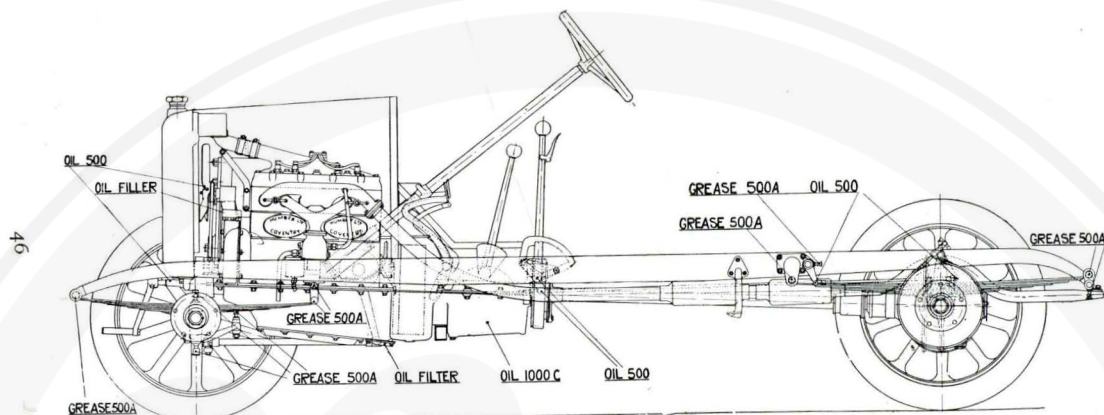
Steering Column.—Apply a few drops of oil to the lug on dashboard, and oil cups on the worm gear box.

Brake Joints and Connections.—Oil all these on foot and hand brakes.

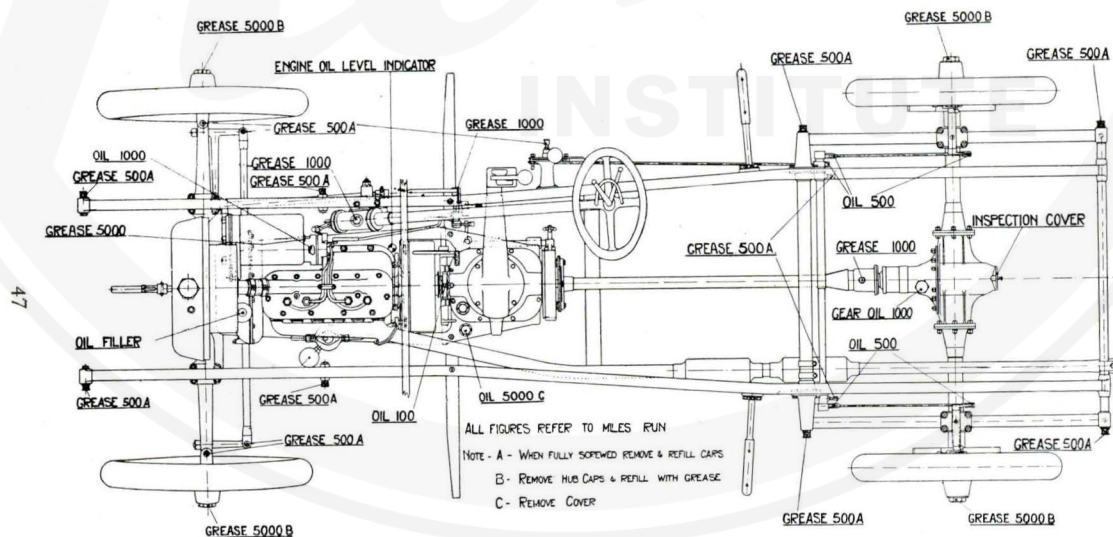
FOR ATTENTION AFTER EVERY 1,000 MILES.

Rear Universal Joint on Propeller Shaft.—Remove brass plug and refill with oil.

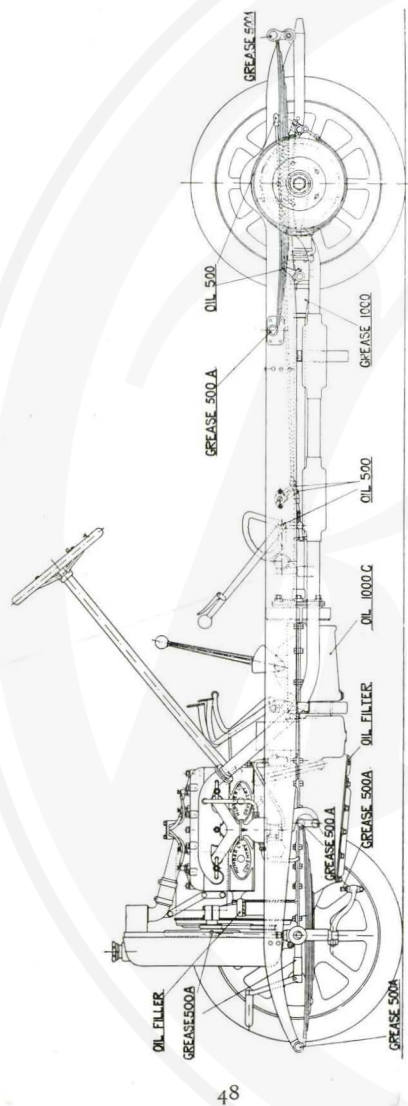
Rear Axle.—Remove rear cover and fill (if necessary) with gear oil until it overflows from inspection hole on the back of casing.



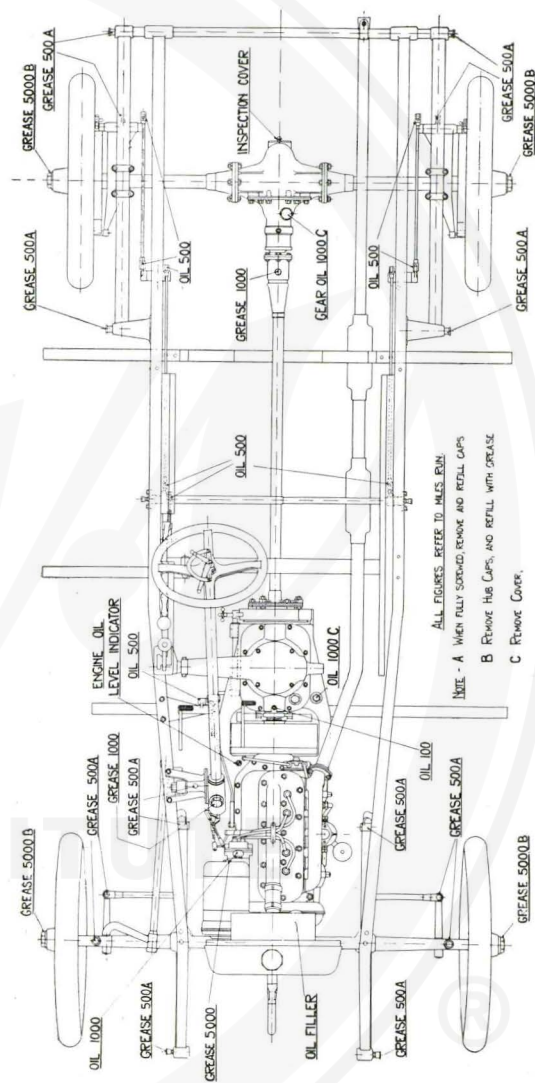
Chassis Elevation, 2/3 Seater.



Chassis Plan, 2/3 Seater.



Chassis Elevation, 4 Seater.



ALL FIGURES REFER TO MILES RUN.

NOTE - A WHEN FULLY SQUEEZED, REMOVE AND REFILL CAPS

R Remove Hair Caps AND BEHIND WITH CARE

C. Prunus lauro-cerasus

Chassis Plan, 4 Seater.

Brake and Change Speed Levers. Oil shafts, triggers and catches on the hand lever, and all intermediate levers and connections.

Steering Gear Box.—Remove brass plug and refill with oil and grease in equal parts.

Pedals.—Give the grease caps on clutch, brake and accelerator pedals, two complete turns.

FOR ATTENTION EVERY 5,000 MILES.

Engine.—Remove the oil filter from the bottom half of the crankcase and carefully clean it with paraffin. Refill the crankcase with best quality engine oil, until the oil reaches the notch on the indicator rod.

Cylinders.—If there is any falling off of power, grind the valves in, and remove carbon deposit from tops of cylinders and pistons ; examine the piston rings.

Clutch.—If this becomes fierce, inject $\frac{1}{8}$ pint of our special lubricant through one of the two holes in flywheel cover ; if it slips, inject a tablespoonful of paraffin.

Gear Box.—Remove the drain plug, drain out the old lubricant, and refill with half a gallon of engine oil.

Rear Axle.—Remove the filler and drain plug, clean out with paraffin, and refill with gear oil until it overflows from inspection hole in the back of casing.

Leather Universal Joint.—This should have a dressing of castor oil to keep the leather discs pliable.

Front and Rear Hub Caps.—These should be removed, completely filled with grease, and re-fitted. This will squeeze the grease into the bearings.

Steering Coupling Rods.—Remove leather covers from ball joints, take up any wear, refill with grease and replace covers.

Suspension Springs.—Jack up the car by the frame and remove the springs, separate the leaves and grease each one.

Dynamo.—Remove plug at rear, and pack bearing with grease.

Steering Wheel Swivels and Connections.—Remove grease caps, and thoroughly clean the lubricating holes by injecting a liberal charge of paraffin ; move the road wheels to and fro, inject engine oil, refill grease caps and replace on one or two threads.

Detachable Wheels.—These should be removed, and the barrel of the fixed hub lightly covered with a mixture of oil and blacklead to prevent rusting, and ensure easy removal at any time. The same treatment should be applied to the studs. Care should be taken when replacing wheels, to screw the nuts home absolutely tight, it is advisable to further tighten after running a few miles, if a wheel has been changed.

LAYING UP THE CAR FOR LONG PERIODS.

If you have any reason to leave the car garaged for several weeks :—

Have the ventilators in the motor house open.

Empty the radiator and petrol tank.

Close the throttle.

Inspect the batteries as instructed in Lucas Book.

Clean all plated parts and rub over lightly with oil or grease.

Cover the body of the car with a dust cloth and stand the cushions upright.

Remove the weight of the car from the tyres by jacking each wheel up in turn and supporting the axles on a pile of bricks or blocks.

See that the paint work of the body and chassis is dry and clean.

CLEANING.

It is important that the car be kept clean and dusted. Dust should not be brushed off, or even wiped with a dry duster, as the varnish is bound to be scratched. A soft sponge repeatedly rinsed in water will enable you to swill it off, the varnish work afterwards being finished with a clean and dry chamois leather.

When the wheels and under carriage of the car are thickly coated with dust after a journey, it is best and quickest to swill it off these parts with the hose pipe.

Mud should be removed with a soft sponge, dipped from time to time in water and dabbed on the mud until it is quite soft. Do not wipe it as this will scratch the varnish. A low pressure hose may be used afterwards to swill the mud away.

Keep all cloths, leathers and sponges used for this purpose clean and free from grease, and have a different set for removing grease and dirt from the chassis. Wash the tyres, and if any serious cuts or scratches appear on them, clean them out with petrol and fill with tyre stopping.

Use the hose carefully on the bonnet as water may be forced through the hinges and louvres on to the cylinders, causing a short circuit of the sparking plugs by filling the recesses in which they fit.

TYRES.

Particulars of the tyres we include in the price of our standard car will be found in our catalogue.

They are selected by us as being the most suitable.

Keep the tyres well inflated, but bear in mind that it is quite possible to pump them too hard. When the car is fully loaded, a small depression only should appear in the tyre. If they are made tighter than this, it will be uncomfortable for the passengers. More frequently, however, the tyres are not pumped sufficiently hard, and consequently get gashed by stones and wear badly. Skidding is also much more probable with tyres not well inflated.

A tyre pressure gauge is very useful, as showing when the desired pressure is reached. Each tyre company issues a table showing the pressure for various sizes of tyres under given loads. With 90 m/m tyres, the front should be 70 lbs., and the back 80 lbs. pressure.

Do not allow grease or oil to get on to the tyres as both are very destructive to the rubber. It is better

also not to leave them exposed to a very strong light, or in a temperature of more than 75 degrees F. Do not let them become dry, otherwise they will crack.

The "life" of the tyres depend very much upon the way the car is driven.

Always take one spare inner tube so that when necessary it can be exchanged and the old one repaired.

Taking off Tyres.—Lift the wheel off the ground by means of the jack. Take off the butterfly nuts, washers, dust cap, nuts, etc., on the valve stem, and knock the bolts and valve stem inwards until they are flush with the rim. Work the cover with the hands laterally until it is loosened from the flange of the rim ; then carefully insert a tyre remover between the tyre and the rim, lift the bead and insert a second remover 10 to 12 inches from the first. Steady pressure on both will get the tyre over the edge of the rim. Take care not to nip the inner tube.

Punctured tubes can be sent to a garage and have patches vulcanized on.

Replacing Tube and Cover.—Before replacing the tube inside the cover, carefully examine the inside of the latter and make sure that the object which caused the puncture has been removed. Dust French chalk into the cover. Pull down all bolts until the flanges rest in the rim, and then insert the tube, first getting the stem of the valve through the hole in the rim. Take the greatest care to avoid a twist in the tube. After it has been inserted, slightly inflate it, and then pass the hand all round between the cover and the tube to ascertain

if it is in its place. See that the tube is over the flanges of the security bolts, and that it is not nipped by them, as many burst tubes are due to this cause.

To replace the cover, push the stem of the valve well away from the rim, and get the edge of the cover, where there is a nick in it, under the flange of the valve and work it into the proper place in the rim with the hands, turning the wheel from time to time as it gets in.

Take care that the edge of the cover slips under the bolts. To ensure this it is best before getting in the cover to push each bolt up until it is flush with the rim.

When the tyre is on, knead it well all round to make sure that everything is all right and then screw home the valve nut and washer ; inflate the tyre and then tighten the washers and nuts on the security bolts. After the car has been run a few miles, it is well to stop and again screw these up, as they sometimes get loose.

Before starting on a journey remember :—

To lubricate the car as directed.

Fill the petrol tank.

See that spare wheel is properly inflated.

See that you have in the car :—

Tools.

Tyre repair outfit.

One spare inner tube.

Spare tin of petrol.

Pump.

Jack, etc.

Before starting the engine :—

Examine the oil level (see page 42).

Turn on petrol.

See that gear lever is in neutral position.

Advance ignition lever fully.
Open throttle lever on steering wheel about one quarter of its range.
Switch on the engine and start it by depressing the starter switch on the instrument board.

If it does not start readily make sure that there is petrol at the carburettor by lifting the float needle and flooding it.

When the engine is running, close the throttle lever until it runs slowly.

The driving instructions on the following pages are intended chiefly for those of our customers who are about to take up driving, but if they already have some experience in driving, perusal of these instructions may assist them.

If they have been used to cars fitted with much larger and higher powered engines, we would remind them that the 10 h.p. car is designed for touring at moderate speeds, and if it is considerably driven and attended to as directed, it will serve them well, but it is not a high powered car, and should not be treated as such.

DRIVING INSTRUCTIONS.

Release the hand brake, push the clutch pedal forward, and move the change speed lever into first gear. Gradually allow the clutch to take up the drive by releasing the pedal gently, at the same time accelerating the engine by depressing the accelerator pedal with the right foot. A little practice will enable the driver to obtain a soft gliding start.

As soon as the car has proceeded a few yards, the clutch pedal should be again depressed, and the gear lever moved into the second gear, again releasing the clutch pedal and accelerating. Repeat this operation until the top gear or direct drive is engaged.

The speed of the car can now be controlled by the accelerator pedal alone, leaving the hand throttle lever set to allow the engine to run slowly when the accelerator is released.

Most ordinary hills can be ascended on top gear, provided that you commence the ascent at a reasonable speed. Always bear in mind that on hills, a small engine must be kept revolving at speeds within the ranges of figures printed in heavy type on page 77. At the slightest sign of labouring, a lower gear should always be engaged.

In a traffic check, it will not be necessary to drop down into first gear, unless the car has come to a standstill. As long as it is moving you can generally get away easily by just moving into third gear, unless you are ascending a hill, in which case second or first speed may be required.

It is generally found more difficult to change down to a lower gear silently, but with practice this can be accomplished by double clutching as follows :—

Declutch and move the lever into neutral. Let the clutch in and accelerate the engine again, withdrawing the clutch slightly and simultaneously moving the lever into the next lowest gear.

In effect this operation causes the clutch shaft and the gear wheels driven by it to be momentarily speeded up to somewhere near the same velocity as the gear wheel about to be engaged, thereby enabling them to slide into engagement without resistance. Grating the gears is simply due to the fact that the speed of the respective wheels is incorrect. Double clutching is not by any means as difficult an operation as you may suppose, and you will be well repaid by taking an interest in gear changing.

The best speeds to change down at when climbing hills are :—

From top to 3rd, at 22-25 miles an hour.

From 3rd to 2nd, at 15-18 miles an hour.

From 2nd to 1st, at 10-12 miles an hour.

A table showing the relation of the engine speeds to that of the car on any gear, is printed on page 77.

It is comparatively easy to change up by simply disengaging the clutch and moving the lever quickly into the higher gear. There is no need to put all your force behind the lever ; an easy quick movement is all that is required.

The correct use of the ignition advance lever on the steering wheel is next in importance to good gear changing. It is a mistaken idea to put this lever at full advance, and leave it there, regardless of the speed at which the engine is running. Whenever the engine slows down, due to the extra work imposed on it when ascending hills, the lever should be moved back to retard the ignition. An infallible signal for this operation is given, when a crackling sound known as "pinking" occurs in the cylinder, in

fact, this is a direct warning that the engine is being over-worked. If, however, you have to change into a lower gear, the lever should be advanced again as soon as the engine has gathered speed.

To decrease the speed of the car, simply release the accelerator pedal, the engine is a good brake and will quickly bring the car speed down, but if you must pull up quicker, the foot brake can also be applied as required. The clutch only need be disengaged when you are obliged to stop. It is quite unnecessary to use it every time you are approaching traffic or corners.

Exactly the same procedure can be followed when descending ordinary hills, as here again the engine can be used as a brake, by releasing the accelerator, but if the hill is steep and dangerous, the 1st or 2nd gear should be engaged, and the throttle closed just before commencing the descent. This will make it impossible for the car to get out of control, and saves undue wear of the brakes.

Do not, however, under any circumstances, attempt to engage these low gears without bringing the speed of the car to somewhere near a walking pace, otherwise there will be risk of damage to the gear wheels.

When the descent is long and gradual, the use of the hand or the foot brake will be sufficient to prevent excessive speed, and you can economise your fuel consumption by putting the gear lever into neutral and leaving the engine running slowly ; this is known as "coasting." When you have descended the hill, and the car loses its speed, the top gear can be easily re-engaged

by depressing the accelerator, speeding up the engine slightly, releasing the clutch, and gently moving the lever back into the top gear. The best speed to do this is about 15 to 20 miles an hour.

Always drive carefully and slowly round corners, taking them at as large a sweep as possible, without unduly encroaching on the wrong side of the road. A sudden swerve is not only bad for the tyres, but it is dangerous.

Steel Studded Tyres.—These are very convenient for use on muddy roads to prevent skidding, but in dry or frosty weather it is better to change for rubber treaded tyres, as there is a risk of dry skidding when applying the brakes on roads treated with tarmac, which, due to its hard glossy surface, causes the steel studs to act as skates. With four rubber treads therefore, brakes can be used more effectively.

In wet weather skidding is much more prevalent, and often occurs with very little warning. Fully inflated tyres and the use of a studded non-skid cover will reduce the tendency, but careful driving, especially in towns, is the best remedy.

To check skidding, disengage the clutch, release the accelerator pedal, slightly turn the steering wheel slightly in the opposite direction. Avoid using the brakes, as this will increase the tendency.

Conditions that encourage skidding are :—

Crossing tram rails at too acute an angle.

Running too close to the kerb.

Turning corners or swerving out of your track too quickly.

Applying brakes too suddenly.

The following hints indicate the best way to obtain a long life for the car, and a minimum outlay for its upkeep :—

Use the accelerator lightly. To jamb it down and roar away on a low gear may be spectacular, but it is extravagant with petrol and tyres.

Travelling at moderate speeds also conserves your petrol and tyres.

Use the brakes gently and keep them adjusted ; violent application locks the wheels and causes serious tyre wear.

Slow down on rough roads, fast travelling over pot-holes increases tyre wear through the wheels continually bouncing off the road, causing them to race and slip badly when again making contact.

Slow down also when approaching a corner, even on a clear road, as fast cornering is dangerous, apart from the heavy load it imposes on the tyres, wheels and their bearings.

Avoid turning the steering wheel when the car is stationary, it is bad for the tyres, and may strain the steering connections.

Pay particular attention to the batteries, and keep them fully charged by using the charging switch when necessary. Full instructions will be found in the Lucas Booklet, but for town work or shopping, the charging switch should be left on, as the rate of charging will be small, due to the low average speed of the car.

Stopping.—When stopping the car, disengage the clutch, and put the speed lever at neutral. The clutch can then be let in again, and the engine switched off, if the car is to remain standing.

When stopping, take care to stop the car reasonably near the foot-path, but do not, under any circumstances, let the tyres rub along the edges of the kerb, as the sides of the covers will ultimately be very badly worn.

Forced Stoppages en route.—Any ordinary trouble may be quickly located by means of the chart at the end of this book. It is so arranged that the actual source of the trouble is found by analysis, for example :—If the engine lacks power, it will be running imperfectly, but as many things will cause this condition, the actual source must be traced by following the serial lines from left to right, thus :—

Engine runs imperfectly—by lacking power : does it lack power constantly or at intervals ? If constantly, the controls will either be in or out of order ; examine the throttle and ignition advance connections : if these are in order the fault will be due to one of the items bracketed to the words “controls in order.” Analyse these separately as instructed, and when the trouble is found, read the remedy given opposite.

In wet weather, when housing the car, leave the hood up to dry ; folding it wet will cause the canvas to rot.

Wipe off all rain spots from the body with your cleaning cloths. If left to dry over night, dull patches will be found on the varnished surface.

If you have time, also swill off mud spots ; this is easier and much better for the paint work than allowing it to dry on.

A small quantity of glycerine rubbed over the front of the wind screen will prevent rain spots collecting, and enable you to see quite clearly when driving.

OVERHAULING THE CAR.

The period for which a car will run before this is necessary depends purely upon the way in which the car is driven, coupled with correct attention to lubrication, etc.

The car should be returned either to our Works in Coventry, the Kilburn Repair Depot, or one of our authorised agents, so that the work may be properly done. If, however, this is not possible, the next best thing is to see that it goes to a repairer of repute, and not necessarily the cheapest man. Many cars are ruined by slipshod overhauling.

The method of dismantling the various parts of the chassis are described for the benefit of mechanics who will have the work to do, but may be unfamiliar with the construction of the car. Operations that can be carried out in your own garage with safety are already explained.

Power Unit.—It will be seen by examining the illustration on page 17, that the engine, clutch, clutch pedal and withdraw mechanism, gear box, change speed lever, foot brake, and the front universal joint of the propellor shaft, are built up into one self contained unit, which may be detached from the chassis, either bodily or in sections. The illustration on page 66 shows the

various components detached to assist in following the methods of dismantling, which are explained in detail as follows :—

To remove Dynamotor.—Disconnect the cables at the battery terminals, and then detach the other ends from the dynamotor. Unscrew the four large nuts from the adjusting bolts, illustrated on page 27, and remove the circular cover. In doing this, the dynamotor must be supported, so that it may be allowed to gently drop into its lowest position. It is a heavy machine, and damage will occur if the nuts are carelessly unfastened. The chain will now be found sufficiently slack to enable it to be lifted clear of the pinion, when the dynamotor can be bodily withdrawn from the timing gear casing. There is no need to unfasten the links of the chain, and it can be prevented from dropping into the case, if a short rod is passed through the timing case, and under the links.

The complete chain drive, however, is accessible by removing the outer lid, as shown on the illustration, just referred to, but to do this it is necessary to first remove the radiator and the pulley driving the fan.

To remove Magneto and Camshaft Chains.—Detach the remaining nuts that secure the main casing, and on 4-seated cars, the lower left-hand stud which is close to the cross member, is rendered removable by two flats just below the thread. This must be unscrewed and withdrawn before the case can be lifted ; the large chain wheel on the magneto shaft must also be withdrawn.

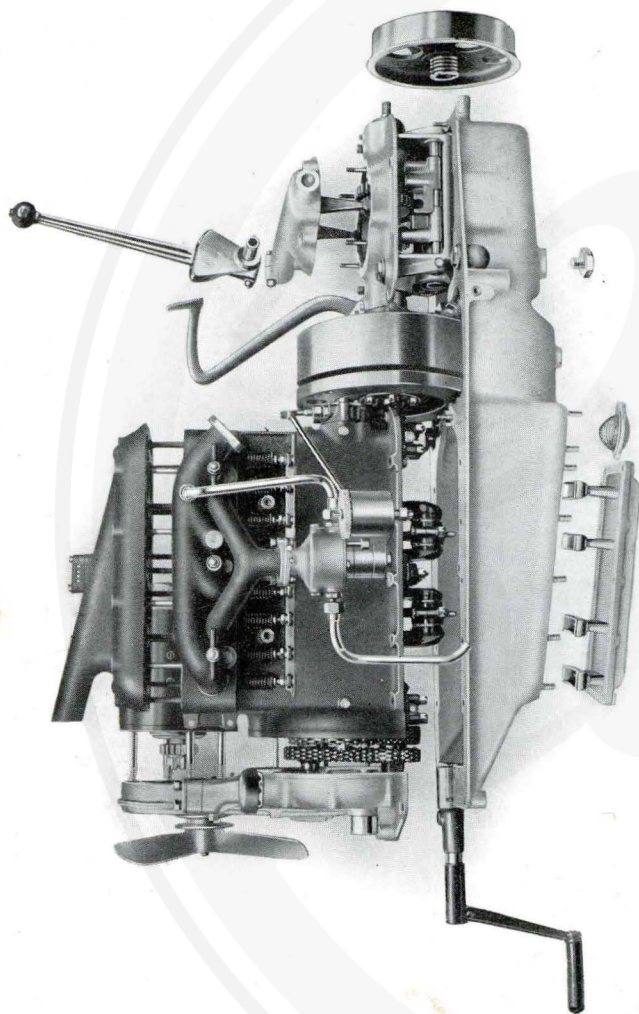
To remove Camshaft.—Assuming that the cylinder head, valves and timing casings are removed, it will be possible to withdraw the camshaft from the front by

lifting the tappets, removing the chain wheel. When replacing chain drives, each pair of wheels must be accurately lined up, otherwise damage will be done to the side plates of the chains. This can easily be checked by holding a straight edge across the faces of each pair of gears.

When new chains are fitted, it is essential that there should be a slight amount of slack. Under no circumstances, must they be allowed to run when dead tight. A correctly fitted chain is indicated when one of the free sides between the wheels can be depressed $\frac{1}{8}$ " or 3 m/m from the straight.

To remove Oil Pump.—Uncouple the unions that secure suction and delivery pipes to the pump, remove the two set pins securing the pump body to the cylinder casting, and the pump will then come away complete. When replacing, engage the tongue on the pump driving wheel spindle with the slot in the end of the camshaft, and fill both outlet and inlet nozzles with oil to prime the pump before connecting the pipes.

To inspect Crank Bearings, or to remove Connecting Rods and Pistons.—Remove oil filter to drain the crankcase. Detach the ribbed aluminium cover under the bed plate. This contains the connecting rod oil troughs, and is so made that they can be withdrawn complete, rendering the whole of the crankshaft and connecting rod bearings accessible from a pit. The big end nuts can now be detached, and the pistons and the rod withdrawn complete by turning the crank to bring the journal from which the rod has been removed into a horizontal position.



To remove complete Engine from Bed Plate.—
(See illustration on page 66). Uncouple all control con-

nections, oil and petrol pipes, etc., remove radiator, exhaust pipe and dynamotor cables. Detach bolts securing the cylinder and timing gear casing to the bed plate, and uncouple the two halves of the fly wheel, by removing the bolts in the rim. Remove the set pins on top of the front gear box bearing immediately behind the clutch withdraw trunnion and detach the steel distance piece ; this will enable the wider fly wheel rim to be withdrawn, when the engine can be lifted free of the bed plate, and away from the chassis. This operation is necessary for replacing or re-bedding crankshaft bearings, fitting a new chain sprocket, or renewing crankshaft bearings.

To remove Clutch, Clutch Withdraw Trunnion or Pedal Shaft. For these operations, the gear box must first be raised. When it is lifted clear of the bed plate, the clutch, complete with the fly wheel ring, can be drawn off the extension of the stem wheel, and further dismantled if necessary on the bench.

To remove the Gear Box, unfasten and remove the eight nuts round the outer rim of the gear box, unfasten the propellor shaft coupling and divide the fly wheel as already explained. On the 4-seater cars, the gear box can then be lifted as a complete unit, and removed from the chassis. On the 2-seater cars, owing to the narrower frame, it will be necessary to remove the change speed lever and quadrant. The change speed lever clamp bolt is accessible by removing part of the valance, and the quadrant is detached from the gear box extension by

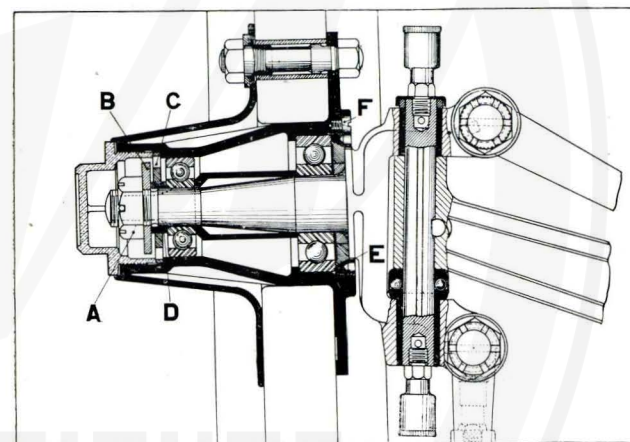
slacking off the clamp nut, which will be found under the floor boards near the inside of the frame. When this is done, the gear box cover can be tilted and withdrawn from the quadrant. The removable part of the gear box contains all gear wheels and striking mechanism, which can be attended to as required on the bench.

It is essential when replacing the engine or gear box, that the same thickness of paper joint be used, as otherwise, the main gear shaft will be out of truth with the crankshaft. The main shaft and its bearings are secured by a set screw on top of the gear box, just in front of the brake drum. If this is removed, the brake drum and the shaft complete with its bearings can be withdrawn. The bearing of the stem wheel on which the clutch slides is also secured to the gear box in the same manner.

To Remove Front Hub.—(See illustration page 69). Detach hub cap and then withdraw the cotter and nut “A,” and washer “B” from the end of the wheel spindle. The complete hub with its bearings can then be completely withdrawn. If the large ball race is to be replaced, it will be necessary to move the screwed ring “E,” which is locked by a small screw “F.” When replacing this hub, the spaces between the ball races should be packed with grease, afterwards further compressing by putting a charge in the hub cap before it is screwed on. Do not forget to correctly place the safety washer “C.” This should be in the position shown clear of the ball races and the washer “B,” as it is only intended as a guard against the wheel coming off in the event of the ball races collapsing.

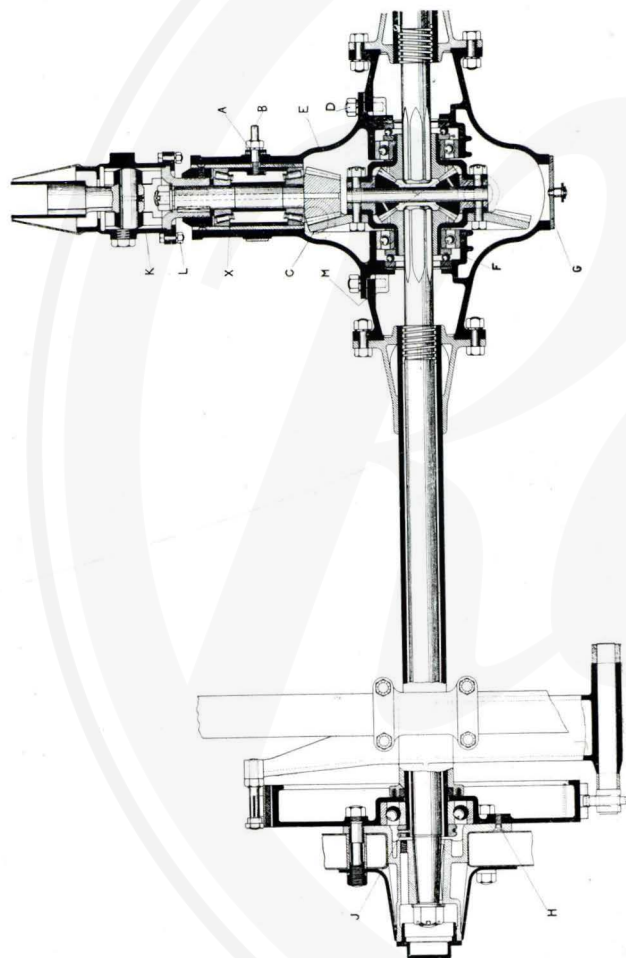
To Remove Back Hub.—(See illustration page 70.)

Detach the wheel in the ordinary way by removing the five nuts. This will expose two countersunk screws “H,” which secure the hub to the brake drum. If these are detached, the hub can be withdrawn complete with the shaft, and thus expose the ball race inside the brake drum. This is secured by nut “J,” which is locked by a spring wire. The removal of this will enable the ball race, brake drum or oil retaining washer to be attended to. Before replacing the hub, see that the driving shaft is tight in the hub.



To Remove Bevel Pinion.—This can be detached bodily by unlocking and removing nut “B,” which is secured by lock washer “A.” The bolt moves in a helical slot in the casing, and is provided with an extension which will allow the meshing of the bevel pinion to be adjusted, by moving the bolt in the required direction

before locking it up. As the pinion assembly can be thus removed complete, any attention or adjustments to the roller bearings can be made on the bench before



replacing. To take up end play in the pinion, packing washers can be inserted, between the outer sleeve and the outer roller bearing ring at "X." This should be adjusted until the roller bearings are a free running fit without end play. The whole assembly is locked by the nut at the end of the pinion inside the propellor shaft driving box. To get at this nut, it will be necessary to remove the driving box cover "K" which will slide away from the coupling, after the bolts "L" are removed. The bevel gear complete with the bevel gear casing "E" can be removed from the axle case by withdrawing the two driving shafts, and detaching nuts "D." The bevel gear can then be detached on the bench by removing the two caps "F." When replacing, note the number and thickness of the packing washers behind the thrust ball race, so that they can be correctly replaced. If the oil joint washer at "M" is broken, see that a new one is fitted of the same thickness, as it is essential that the lining up of the differential gear with the hubs should be accurate.

When adjusting the bevel pinion and crown wheel for gearing, the position of the teeth can be viewed by removing plug "C," which is provided for this purpose.

LEGAL HINTS.

Licences, etc.—All motor cars have to be registered in one of the City, Borough, or County Councils in the British Isles, and drivers licenced by the Borough or County Council of the district in which they reside. No person under 17 can be licenced to drive a car ; or under 14 to drive a motor cycle. Forms of application for licences can be obtained from the Clerk of the Council and these, when filled up, should be returned with the fee of £1 for each car, and 5/- for each driver's licence. A copy of the registration is supplied by the Council.

The driver must have his licence with him when driving and produce it when required by a police constable. Should it be lost, a duplicate can be obtained for 1/-. It remains in force twelve months from date of issue, and must then be renewed at a cost of 5/-. The registration of the car does not require renewal. In case of change of ownership of car, notice has to be given to the County or Borough Council and a fee of 5/- paid.

Identification Mark.—Each car must have its identification mark both in front and at the back of the car. We can supply and fit these on receiving instructions. The back mark must be illuminated at night.

Inland Revenue Licence.—The R.A.C. rating and the tax will be found on page 76, the licence should be taken out on receipt of car, and remains in force until the 1st January following. It has to be renewed every January. The usual male servant's licence (15/-) has to be taken out for a paid driver.

Accidents.—In the event of an accident to any person, horse or vehicle owing to the presence of a car, the driver must stop and, if required, give his name and address and that of the owner with identification mark.

Neglect of the above provision is an offence punishable by fine, as is also the refusal of the driver to give his name and address when required by a police constable. The owner's interests may be protected by soliciting the services of one or more persons who saw the accident occur.

If due consideration is given to other users of the road there will be little fear of coming into conflict with the law. Always give cyclists a reasonable warning of approach and a good clearance when passing them. Signal intentions to drivers that may be behind. It is now generally recognised that :—

To hold the right hand upright means that the car is about to stop.

To hold the right hand horizontally outside the body, that the car is about to turn to the right.

To wave the hand rear to front, that the car behind may pass.

In strange towns particular attention should always be paid to the signals from police constables on point duty.

Insurance.—Policies can now be obtained to cover almost any risk that a car, its driver or passengers may incur when motoring. An excellent "Comprehensive" Policy is issued by Humber Ltd.

Royal Automobile Club and Automobile Association.

It is also recommended that the owner become a member of one of the above associations. Their system of road patrol is too well known to need mentioning. They will inform members which is the best route to take or put them on the right road if they have gone astray, besides help to get their cars running again if in trouble. There is also the advantage of legal advice and assistance in case of litigation, and if a member is contemplating a long holiday tour full particulars can be obtained as to the best route to take, where to stay, etc., by applying to headquarters.

Regulations Regarding the Storage of Petrol.—The quantity of petrol stored must not exceed 60 gallons, including that in the tanks of the car in any one storehouse.

If the storehouse is within 20 feet of any building or timberstack, notice must be given under the Petroleum Act, 1871; this restriction does not apply to petrol kept in the tank of a car.

Every storehouse shall be thoroughly ventilated.

The storehouse shall not form part of a dwelling or be connected to a place where persons assemble.

Petrol shall not be allowed to escape into any inlet or drain communicating with a sewer.

The authorities recommend that the petrol store should be built with brick sides and a concrete base. Ventilation holes should be left in the brickwork, and

the door should be of galvanized iron with the words "**Petrol—Highly Inflammable**" painted on in large letters.

TOURING IN THE BRITISH ISLES.

Touring in the British Isles.—A list of our accredited dealers is printed on pages 86 and 87, from whom you will be able to obtain supplies that may be required whilst on tour.

Continental Touring.—Full information concerning duties and customs may be had from either the Royal Automobile Club or the Automobile Association. A general specification of cars will be found on page 76, and we shall be pleased to give any further particulars that may be required.

GENERAL SPECIFICATION OF 1920 HUMBER CARS.

	10-h.p. 2/3 Seater	10-h.p. 4 Seater
No. of cylinders	4	4
Bore of cylinders	65 m/m	65 m/m
Stroke of crank	120 m/m	120 m/m
Cubic capacity	1592.76 Cu. Cm.	1592.76 Cu. Cm.
Brake horse power at 2,000 revs. per minute	23	23
R.A.C. rating	10.5	10.5
Tax	£3 3 0	£3 3 0
Weight unladen in running order	16 cwts. 2 qrs.	17 cwts. 3 qrs.
Wheel base	8' 2 $\frac{3}{8}$ "	8' 9 $\frac{1}{2}$ "
Track	4' 1 $\frac{1}{2}$ "	4' 7"
Size of tyres	710 x 90	760 x 90
Type of wheels	Detachable Steel	Detachable Steel
Overall length	11' 6"	12' 10"
Overall width	4' 11 $\frac{1}{4}$ "	5' 5"
Overall height with hood and screen up	5' 9"	5' 10"
Overall height with hood down and screen dropped	4' 10"	4' 11"
Ground clearance	7 $\frac{7}{8}$ "	8 $\frac{1}{2}$ "
Petrol capacity	7 gallons	7 gallons
Oil capacity, engine	$\frac{3}{4}$ gallon	$\frac{3}{4}$ gallon
Number of teeth of crown wheel	60	65
Number of teeth in bevel pinion	15	15
Gear ratio on direct drive ..	4—1	4.33—1

NUMBER OF ENGINE REVOLUTIONS PER MINUTE RELATIVE TO CAR SPEEDS PER HOUR.

10 H.P. 2/3 SEATER.

Gear Ratio—15/60 or 4 to 1. Tyre—710 x 90.

Car Speed M.P.H.	1st Speed 14.16 to 1	2nd Speed 8.52 to 1	3rd Speed 5.64 to 1	Top Speed 4 to 1
10	1710	1030	680	485
15	2560	1540	1020	730
20		2050	1360	970
25		2570	1700	1210
30			2040	1450
35			2380	1700
40				1940
45				2180
50				2420

10 H.P. 4 SEATER.

Gear Ratio—15/65 or 4.33 to 1. Tyre—760 x 90.

Car Speed M.P.H.	1st Speed 15.33 to 1	2nd Speed 9.22 to 1	3rd Speed 6.11 to 1	Top Speed 4.33 to 1
10	1720	1040	690	490
15	2570	1560	1030	735
20		2080	1370	975
25			1720	1220
30			2060	1460
35			2410	1710
40				1950
45				2200
50				2450

THE BRITISH INDEX MARKS ALPHABETICALLY ARRANGED.

TAKEN FROM THE R.A.C. OFFICIAL LIST.

All marks containing an "S" belong to Scotland, those containing an "I" to Ireland.

Index Mark.	Registering County or Boro' Council.	Index Mark.	Registering County or Boro' Council.	Index Mark.	Registering County or Boro' Council.
A	London	CH	Derby	ES	Perth
AA	Southampton	CI	Queen's County	ET	Rotherham
AB	Worcestershire	CJ	Herefordshire	EU	Breconshire
AC	Warwickshire	CK	Preston	EW	Huntingdonshire
AD	Gloucestershire	CL	Norwich	EX	Great Yarmouth
AE	Bristol	CM	Birkenhead	EY	Anglesey
AF	Cornwall	CO	Gateshead	F	Essex
AH	Norfolk	CN	Plymouth	FA	Burton-on-Trent
AI	Meath	CP	Halifax	FB	Bath
AJ	Yorkshire, N. Riding	CR	Southampton (C. Bor.)	FC	Oxford
AK	Bradford	CT	Lincolnshire	FD	Dudley
AL	Nottinghamshire		(Parts of Kesteven)	FE	Lincoln
AM	Wiltshire	CU	South Shields	FF	Merioneth
AN	West Ham	CW	Burnley	FG	Gloucester
AO	Cumberland	CX	Huddersfield	FI	Tipperary, N. Riding
AP	East Sussex	CY	Swansea	FJ	Exeter
AR	Hertfordshire			FK	Worcester
AS	Nairn	D	Kent	FL	Soke of Peterboro'
AT	Kingston-upon-Hull	DA	Wolverhampton	FM	Chester
AU	Nottingham	DB	Stockport	FN	Canterbury
AW	Salop	DC	Middlesbrough	FO	Radnorshire
AX	Monmouthshire	DE	Pembrokeshire	FP	Rutland
AY	Leicestershire	DH	Walsall	FR	Blackpool
		DI	Roscommon	FT	Tynemouth
B	Lancashire	DJ	St. Helens (Lancs.)	FX	Dorset
BA	Salford	DK	Rochdale	FY	Southport
BB	Newcastle-on-Tyne	DL	Isle of Wight		
BC	Leicester	DM	Flintshire	G	Glasgow
BD	Northamptonshire	DN	York	GA	Glasgow
BE	Lincolnshire (parts of Lindsey)	DO	Lincolnshire (Parts of Holland)	H	Middlesex
BH	Buckinghamshire	DP	Reading	HA	Smethwick
BI	Monaghan	DR	Plymouth	HB	Merthyr Tydvil
BJ	East Suffolk	DS	Peebles	HC	Eastbourne
BK	Portsmouth	DU	Coventry	HD	Dewsbury
BL	Berkshire	DW	Newport (Mon.)	HE	Barnsley
BM	Bedfordshire	DX	Ipswich	HF	Wallasey
BN	Bolton	DY	Hastings	HH	Carlisle
BO	Cardiff			HI	Tipperary, S. Riding
BP	West Sussex	E	Staffordshire	HJ	Southend-on-Sea
BR	Sunderland	EA	West Bromwich	HK	Essex
BS	Orkney	EB	Isle of Ely	HL	Wakefield
BT	Yorkshire, E. Riding	EC	Westmorland	HM	East Ham
BU	Oldham	ED	Warrington	HN	Darlington
BW	Oxfordshire	EE	Grimsby	HO	Southampton (Co.)
BX	Carmarthenshire	EF	West Hartlepool	HP	Coventry
BY	Croydon	EH	Stoke-on-Trent	HR	Wiltshire
		EI	Sligo	HS	Renfrew
C	Yorkshire, W. Riding	EJ	Cardiganshire	HT	Bristol
CA	Denbighshire	EK	Wigan		
CB	Blackburn	EL	Bournemouth	IA	Antrim
CC	Carnarvonshire	EM	Bootle	IB	Armagh
CD	Brighton	EN	Bury	IC	Carlow
CE	Cambridgeshire	EO	Barrow-in-Furness	ID	Cavan
CF	West Suffolk	EP	Montgomeryshire		

BRITISH INDEX MARKS—continued.

Index Mark.	Registering County or Boro' Council.	Index Mark.	Registering County or Boro' Council.	Index Mark.	Registering County or Boro' Council.
IE	Clare	LR	London	SE	Banff
IF	Cork (County)	LS	Selkirk	SG	Edinburgh
IH	Donegal	LT	London	SH	Berwick
IJ	Down	LU	London	SJ	Bute
IK	Dublin (County)	LW	London	SK	Caithness
IL	Fermanagh	LX	London	SL	Clackmannan
IM	Galway	LY	London	SM	Dumfries
IN	Kerry				
IO	Kildare	M	Cheshire	SN	Dumbarton
IP	Kilkenny	MA	Cheshire	SO	Moray
IR	King's County	MC	Middlesex	SP	Fife
IT	Leitrim	MD	Middlesex	SR	Forfar
IU	Limerick (County)	MI	Wexford	SS	Haddington
IW	Londonderry (Co.)	MN	Isle of Man	ST	Inverness
IX	Longford	MS	Stirling	SU	Kincardine
IY	Louth	MX	Middlesex	SV	Kinross
IZ	Mayo			SW	Kirkcudbright
		N	Manchester	SX	Linlithgow
J	Durham	NA	Manchester	SY	Midlothian
JI	Tyrone	NB	Manchester		
JS	Ross and Cromarty	NH	Northampton	T	Devon
		NI	Wicklow	TB	Lancashire
K	Liverpool	NS	Sutherland	TI	Limerick (Co. Boro.)
KB	Liverpool			TS	Dundee
KC	Liverpool	O	Birmingham		
KI	Waterford (County)	OA	Birmingham	U	Leeds
KN	Kent	OB	Birmingham	UI	Londonderry
KS	Roxburgh	OE	Birmingham	US	Govan (Glasgow)
KT	Kent	OI	Belfast		
		OS	Wigtown	V	Lanark
L	Glamorganshire			VS	Greenock
LA	London	P	Surrey		
LB	London	PA	Surrey	W	Sheffield
LC	London	PB	Surrey	WA	Sheffield
LD	London	PI	Cork (County Bor.)	WI	Waterford (Co. Bor.)
LE	London	PS	Zetland (Shetland)	WR	Yorkshire, W. Rding.
LF	London			WS	Leith
LH	London	R	Derbyshire		
LI	Westmeath	RI	Dublin (County Bor.)	X	Northumberland
LK	London	RS	Aberdeen City	XA	London
LL	London			XS	Paisley
LA	London	S	Edinburgh		
LN	London	SA	Aberdeen (County)	Y	Somerset
LO	London	SB	Argyll	YS	Partick (Glasgow)
LP	London	SD	Ayr		

INTERNATIONAL MOTOR INDEX MARKS.

An oval plate is used—the distinguishing mark of the country of origin being painted black on a white ground.

A	Austria	GB	Great Britain and Ireland	NL	The Netherlands
B	Belgium			P	Portugal
BG	Bulgaria	GR	Greece	R	Russia
CH	Switzerland	H	Hungary	RM	Roumania
D	Germany	I	Italy	S	Sweden
E	Spain	MC	Monaco	SB	Servia
F	France	MN	Montenegro	US	U.S.A.

PRINCIPAL AUTOMOBILE INSTITUTIONS.

ROYAL AUTOMOBILE CLUB,
83 Pall Mall, London, S.W.1.

LADIES' AUTOMOBILE CLUB,
Claridge's Hotel, Brook Street, London, W.1.

AUTOMOBILE ASSOCIATION AND MOTOR UNION,
Fanum House, Whitcomb Street, London, W.C.2.

BROOKLANDS AUTOMOBILE RACING CLUB,
Weybridge, Surrey.

INSTITUTION OF AUTOMOBILE ENGINEERS,
28 Victoria Street, London, S.W.1.

BRITISH MOTOR LEAGUE,
23-28 Fleet Street, London, E.C.4.

ROADS IMPROVEMENT ASSOCIATION,
15 Dartmouth Street, London, S.W.1.

COMMERCIAL MOTOR USERS' ASSOCIATION,
83 Pall Mall, London, S.W.1.

ROYAL SCOTTISH AUTOMOBILE CLUB,
163 West George Street, Glasgow.

SCOTTISH MOTOR TRADE ASSOCIATION,
2 Castle Street, Edinburgh.

ROYAL IRISH AUTOMOBILE CLUB,
34 Dawson Street, Dublin.

CAR MEMOS.

Number of Car.....

Registration Numbers :.....

Driver's Licence Number :

Date of Car Purchase :.....

Insurance Policy Number :.....

Date :

R.A.C. or A.A. Number :.....

PERSONAL MEMOS.

Name :.....

Address :.....

Nearest Railway Station :.....

Telegraphic Address :.....

Telephone Number :

Notes :.....

CORRECTIONS OF LIGHTING-UP TABLES FOR LOCAL TIMES IN MINUTES.

The figures in the columns are to be added or subtracted according to the sign preceeding same, from the lighting up times given for Greenwich on page 84. These are made up for the middle of the month—the time for any other date can be easily calculated.

District	Jan.	Feb	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Bedford ...	-1	1	2	3	5	6	6	4	2	1	0	-2
Birmingham ...	4	6	8	10	12	14	13	11	8	6	4	2
Brighton ...	4	3	1	0	-2	-3	-3	-1	1	2	4	5
Bristol ...	10	10	10	10	10	10	10	10	10	10	10	10
Cambridge ...	-3	-1	0	1	3	4	4	2	0	-1	-2	-4
Canterbury ...	-3	-4	-4	-4	-5	-5	-5	-4	-4	-3	-3	-3
Carlisle ...	-4	4	11	20	28	34	30	23	14	5	-2	-8
Chester ...	5	8	12	16	20	23	21	17	13	9	5	2
Colchester ...	-6	-5	-4	-3	-2	-1	-1	-3	-4	-5	-6	-7
Coventry ...	2	4	6	8	10	12	11	9	6	4	2	0
Darlington ...	-8	-1	5	13	20	25	22	16	8	1	-6	-11
Derby ...	0	3	6	9	12	15	14	10	7	4	1	-2
Dorchester ...	13	12	10	8	6	5	6	8	10	12	13	14
Exeter ...	17	16	14	12	10	9	10	12	14	16	17	18
Falmouth ...	25	23	20	17	14	12	14	16	20	23	25	27
Gloucester ...	8	8	9	10	10	11	11	10	9	8	8	7
Hereford ...	9	10	11	12	13	14	14	12	11	10	9	8
Hull ...	-9	-4	0	6	12	16	13	8	2	-3	-8	-12
Kendall ...	-1	5	10	17	25	29	25	19	13	6	-1	-5
Keswick ...	-2	6	12	20	27	33	30	23	15	8	0	5
Leeds ...	-4	1	5	11	17	21	18	13	7	2	-3	-7
Lincoln ...	-5	-2	2	6	10	13	11	7	3	-1	-5	-8
Liverpool ...	3	8	12	16	21	25	22	18	13	8	4	1
Manchester ...	0	5	9	13	18	22	19	15	10	5	1	-2
Newcastle ...	-11	-2	5	14	22	28	24	17	8	-1	-9	-15
Norwich ...	-10	-8	-6	-3	0	2	1	-2	-5	-7	-9	-12
Oxford ...	4	5	5	6	7	7	6	5	5	4	3	3
Peterborough ...	-3	-1	1	3	5	7	6	4	1	-1	-3	-5
Plymouth ...	22	20	18	15	12	10	11	13	16	19	21	23
Portsmouth ...	7	6	4	2	0	-1	0	2	4	6	7	8
Preston ...	1	6	10	16	22	26	23	18	12	7	2	-2
Reading ...	4	4	4	4	4	4	4	4	4	4	4	4
Salisbury ...	9	8	7	6	5	4	4	5	7	8	9	10
Scarborough ...	-10	-4	1	8	14	19	16	10	4	-3	-9	-13
Settle ...	-2	3	8	14	21	25	22	17	11	4	-1	-5
Sheffield ...	-3	2	6	10	15	19	16	12	7	2	-2	-5
Shrewsbury ...	6	8	11	13	16	18	17	14	11	9	7	4
York ...	-7	-2	3	9	16	20	17	12	6	-1	-6	-11
Aberystwyth ...	12	14	16	18	20	22	21	19	16	14	12	10
Brecon ...	12	13	14	15	16	17	17	15	14	13	12	11
Cardiff ...	13	13	13	13	13	13	13	13	13	13	13	13
Carmarthen ...	15	16	17	18	19	20	20	18	17	16	15	14
Llandudno ...	7	11	15	19	24	27	25	21	16	11	7	4
Llangollen ...	7	10	13	17	20	23	21	17	14	10	7	5
Aberdeen ...	-21	-6	6	21	35	46	40	26	11	-3	-16	-27
Dundee ...	-13	-1	10	24	36	45	39	28	15	2	-10	-13
Edinburgh ...	-9	2	12	23	34	42	37	27	16	4	-7	-15
Glasgow ...	-4	6	16	27	38	45	41	31	20	8	-3	-11
Inverness ...	-14	2	15	31	46	57	52	36	20	6	-10	-20

RELATIVE VALUES OF MILLIMETRES AND INCHES.

m/m	Inches.	m/m	Inches.	m/m	Inches.	m/m	Inches.
1	0.0394	26	1.0236	51	2.0079	76	2.9922
2	0.0787	27	1.0630	52	2.0473	77	3.0315
3	0.1181	28	1.1024	53	2.0866	78	3.0709
4	0.1575	29	1.1417	54	2.1260	79	3.1103
5	0.1968	30	1.1811	55	2.1654	80	3.1496
6	0.2362	31	1.2205	56	2.2047	81	3.1890
7	0.2756	32	1.2598	57	2.2441	82	3.2284
8	0.3150	33	1.2992	58	2.2835	83	3.2677
9	0.3543	34	1.3386	59	2.3228	84	3.3071
10	0.3937	35	1.3780	60	2.3622	85	3.3465
11	0.4331	36	1.4173	61	2.4016	86	3.3859
12	0.4724	37	1.4567	62	2.4410	87	3.4252
13	0.5118	38	1.4961	63	2.4803	88	3.4646
14	0.5512	39	1.5354	64	2.5197	89	3.5040
15	0.5906	40	1.5748	65	2.5591	90	3.5433
16	0.6299	41	1.6142	66	2.5984	91	3.5827
17	0.6693	42	1.6536	67	2.6378	92	3.6221
18	0.7087	43	1.6929	68	2.6772	93	3.6614
19	0.7480	44	1.7323	69	2.7166	94	3.7008
20	0.7874	45	1.7717	70	2.7559	95	3.7402
21	0.8268	46	1.8110	71	2.7953	96	3.7796
22	0.8661	47	1.8504	72	2.8347	97	3.8189
23	0.9055	48	1.8898	73	2.8740	98	3.8583
24	0.9449	49	1.9291	74	2.9134	99	3.8977
25	0.9843	50	1.9685	75	2.9528	100	3.9370

RELATIVE VALUES OF INCHES AND MILLIMETRES.

Inches.	0	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$
0	0.0	1.6	3.2	4.8	6.4	7.9	9.5	11.1
1	25.4	27.0	28.6	30.2	31.7	33.3	34.9	36.5
2	50.8	52.4	54.0	55.6	57.1	58.7	60.3	61.9
3	76.2	77.8	79.4	81.0	82.5	84.1	85.7	87.3
4	101.6	103.2	104.8	106.4	108.0	109.5	111.1	112.7
5	127.0	128.6	130.2	131.8	133.4	134.9	136.5	138.1
6	152.4	154.0	155.6	157.2	158.8	160.3	161.9	163.5
Inches	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	$\frac{15}{16}$
0	12.7	14.3	15.9	17.5	19.1	20.6	22.2	23.8
1	38.1	39.7	41.3	42.9	44.4	46.0	47.6	49.2
2	63.5	65.1	66.7	68.3	69.8	71.4	73.0	74.6
3	88.9	90.5	92.1	93.7	95.2	96.8	98.4	100.0
4	114.3	115.9	117.5	119.1	120.7	122.2	123.8	125.4
5	139.7	141.3	142.9	144.5	146.1	147.6	149.2	150.8
6	165.1	166.7	168.3	169.9	171.5	173.0	174.6	176.2

SPEED TABLE.

Time of One Mile	Miles per hour.	Time of One Mile	Miles per hour.	Time of One Mile	Miles per hour.	Time of One Mile	Miles per hour.
Min. Sec.		Min. Sec.		Min. Sec.		Min. Sec.	
0 40	90	1 12	50	1 44	34.6	2 48	21.4
0 41	87.18	1 13	49.4	1 45	34.3	2 51	21.1
0 42	85.6	1 14	48.6	1 46	34	2 54	20.7
0 43	83.8	1 15	48	1 47	33.7	2 57	20.3
0 44	81.8	1 16	47.4	1 48	33.4	3 0	20
0 45	80	1 17	46.7	1 49	33	3 6	19.4
0 46	78.2	1 18	46.2	1 50	32.7	3 12	18.8
0 47	76.6	1 19	45.6	1 51	32.4	3 18	18.2
0 48	75	1 20	45	1 52	32.1	3 24	17.7
0 49	73.4	1 21	44.4	1 53	31.8	3 30	17.1
0 50	72	1 22	43.9	1 54	31.6	3 36	16.7
0 51	70.6	1 23	43.3	1 55	31.3	3 42	16.2
0 52	69.2	1 24	42.8	1 56	31	3 48	15.7
0 53	68	1 25	42.4	1 57	30.8	3 54	15.4
0 54	66.8	1 26	41.9	1 58	30.5	4 0	15
0 55	65.4	1 27	41.4	1 59	30.2	4 6	14.6
0 56	64.2	1 28	40.9	2 0	30	4 12	14.3
0 57	63.2	1 29	40.4	2 3	29.2	4 18	13.9
0 58	62	1 30	40	2 6	28.6	4 24	13.6
0 59	61	1 31	39.6	2 9	27.9	4 30	13.3
1 0	60	1 32	39.1	2 12	27.3	4 36	13
1 1	59	1 33	38.7	2 15	26.7	4 42	12.8
1 2	58	1 34	38.3	2 18	26.1	4 48	12.5
1 3	57.1	1 35	37.9	2 21	25.5	4 54	12.2
1 4	56.3	1 36	37.5	2 24	25	5 0	12
1 5	55.4	1 37	37.1	2 27	24.5	5 12	11.5
1 6	54.5	1 38	36.7	2 30	24	5 24	11.1
1 7	53.7	1 39	36.4	2 33	23.6	5 36	10.7
1 8	53	1 40	36	2 36	23.1	5 48	10.3
1 9	52.2	1 41	35.7	2 39	22.6	6 0	10
1 10	51.4	1 42	35.3	2 42	22.2		
1 11	50.7	1 43	34.9	2 45	21.8		

LIGHTING-UP TABLE, GREENWICH MEAN TIME.

DAY	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1st	4 58	5 45	6 38	7 31	8 20	9 5	9 19	8 47	7 46	6 38	5 33	4 53
3rd	5 1	5 49	6 41	7 34	8 24	9 7	9 18	8 43	7 41	6 34	5 29	4 52
5th	5 4	5 52	6 43	7 37	8 27	9 9	9 17	8 40	7 37	6 29	5 26	4 51
7th	5 5	5 55	6 47	7 40	8 30	9 11	9 16	8 37	7 33	6 24	5 22	4 50
9th	5 8	5 59	6 52	7 44	8 32	9 12	9 15	8 33	7 28	6 19	5 19	4 50
11th	5 11	6 3	6 56	7 47	8 36	9 14	9 13	8 30	7 24	6 15	5 16	4 49
13th	5 13	6 7	6 59	7 51	8 39	9 15	9 11	8 26	7 19	6 11	5 12	4 49
15th	5 16	6 11	7 2	7 54	8 42	9 16	9 10	8 22	7 14	6 6	5 10	4 50
17th	5 19	6 14	7 6	7 57	8 45	9 17	9 7	8 18	7 10	6 2	5 7	4 50
19th	5 23	6 18	7 9	8 0	8 47	9 18	9 5	8 14	7 5	5 58	5 5	4 50
21st	5 26	6 22	7 12	8 4	8 50	9 19	9 3	8 10	7 0	5 54	5 3	4 51
23rd	5 30	6 26	7 16	8 7	8 54	9 19	9 0	8 6	6 56	5 50	5 0	4 52
25th	5 33	6 29	7 19	8 10	8 57	9 19	8 57	8 1	6 52	5 46	4 58	4 53
27th	5 37	6 32	7 23	8 14	8 59	9 19	8 55	7 57	6 47	5 42	4 56	4 55
29th	5 40	6 36	7 26	8 16	9 1	9 19	8 52	7 53	6 42	5 38	4 53	4 57
31st	5 43	—	7 29	—	9 4	—	8 49	7 48	—	5 34	—	4 58

CONVERSION OF MILES INTO KILOMETRES.

Kilo.	Miles.	Kilo.	Miles.	Kilo.	Miles.	Kilo.	Miles.	Kilo.	Miles.
1	$\frac{5}{16}$	16	10	31	19 $\frac{1}{2}$	46	28 $\frac{1}{2}$	60	37 $\frac{1}{2}$
2	$\frac{1}{8}$	17	10 $\frac{1}{2}$	32	19 $\frac{1}{4}$	47	29 $\frac{1}{4}$	70	43 $\frac{1}{2}$
3	$\frac{1}{4}$	18	11 $\frac{1}{4}$	33	20 $\frac{1}{2}$	48	29 $\frac{1}{2}$	80	49 $\frac{1}{2}$
4	$\frac{1}{2}$	19	11 $\frac{3}{4}$	34	21 $\frac{1}{4}$	49	30 $\frac{1}{4}$	90	55 $\frac{1}{2}$
5	$\frac{3}{8}$	20	12 $\frac{1}{2}$	35	21 $\frac{3}{4}$	50	31 $\frac{1}{2}$	100	62 $\frac{1}{2}$
6	$\frac{3}{4}$	21	13	36	22 $\frac{1}{2}$	51	31 $\frac{3}{4}$	200	124 $\frac{1}{2}$
7	$\frac{7}{8}$	22	13 $\frac{1}{2}$	37	23	52	32 $\frac{1}{2}$	300	186 $\frac{1}{2}$
8	1	23	14 $\frac{1}{4}$	38	23 $\frac{1}{2}$	53	32 $\frac{3}{4}$	400	248 $\frac{1}{2}$
9	$1\frac{1}{8}$	24	14 $\frac{1}{2}$	39	24 $\frac{1}{4}$	54	33 $\frac{1}{4}$	500	310 $\frac{1}{2}$
10	$1\frac{1}{4}$	25	15 $\frac{1}{4}$	40	24 $\frac{1}{2}$	55	34 $\frac{1}{4}$	600	372 $\frac{1}{2}$
11	$1\frac{1}{2}$	26	16 $\frac{1}{4}$	41	25 $\frac{1}{4}$	56	34 $\frac{3}{4}$	700	435
12	$1\frac{3}{4}$	27	16 $\frac{3}{4}$	42	26 $\frac{1}{2}$	57	35 $\frac{1}{4}$	800	497 $\frac{1}{2}$
13	$1\frac{7}{8}$	28	17 $\frac{1}{4}$	43	26 $\frac{3}{4}$	58	36	900	559 $\frac{1}{2}$
14	$1\frac{7}{8}$	29	18	44	27 $\frac{1}{2}$	59	36 $\frac{1}{2}$	1000	621 $\frac{1}{2}$
15	$1\frac{9}{8}$	30	18 $\frac{1}{2}$	45	28				

CONVERSION OF METRIC INTO ENGLISH MEASURE.

1 millimetre is approximately $\frac{1}{25}$ in. and is exactly .03937 in.

1. centimetre is approximately $\frac{1}{32}$ in. and is exactly .3937 in.

1 metre is approximately 39 $\frac{1}{4}$ in. and is exactly 1.0936 yards.

1 kilometre is approximately $\frac{5}{8}$ mile and is exactly .6213 miles.

1 kilogramme is approximately 2 $\frac{1}{4}$ lb. and is exactly 2.21 lb.

1 litre is approximately 1 $\frac{3}{4}$ pints and is exactly 1.76 pints.

To convert metres to yards, multiply by 70 and divide by 64.

To convert kilometres to miles, multiply by 5 and divide by 8 (approx.)

To convert litres to pints, multiply by 88 and divide by 50.

To convert grammes to ounces, multiply by 567 and divide by 20.

To find the cubical contents of a motor cylinder, square the diameter (or bore) multiply by 0.7854 and multiply the result by the stroke.

**OUR ACCREDITED DEALERS IN THE DIFFERENT
CITIES, TOWNS AND DISTRICTS OF THE UNITED
KINGDOM ARE AS FOLLOWS :**

TOWN.	NAME.	ADDRESS.
Aberdeen	Rossleigh Ltd.	Union Street
Bedford	G. Langley	49 Bromham Road
Bideford	W. J. Pitt	Motor Works
Birmingham ..	H. Garner Ltd.	25 Hill Street
Blackburn	J. Walsh & Co.	Suddell Cross
Boston	Holland Bros.	Bargate
Bournemouth ..	Grosvenor Garage Ltd.	Poole Hill
Bradford	Central Garage Ltd.	Town Hall Square
Brecon	J. E. Nott & Co., Ltd.	High Street
Bridgwater	Real, Medland & Wills, Ltd.	St. Mary Street
Bristol	R. F. Jones Ltd.	
Burnley	W. H. Harrison (Burnley) Ltd.	172 St. James Street
Bury St. Edmunds	T. H. Nice & Co.	Abbeygate Street
Cambridge	King & Harper	Bridge Street
Cardiff	J. Thomas & Co., Ltd.	2 Wellington Street
Carlisle	Dias & Co.	53 Lowther Street
Chester	Grosvenor Motor Co.	Eastgate Street
Chichester	Adcock's Garage	East Street
Cirencester	W. G. Bridges Ltd.	Castle Street
Dorchester	M. H. Tilley & Son	South Street
Dumfries	A. Millar	Nith Street
Dundee	Rossleigh Ltd.	23 Albert Square
Eastbourne	Caffyns Ltd.	Seaside Road
Edinburgh	Rossleigh Ltd.	32 Shandwick Place
Egremont (Cumb.)	J. F. Stout	1 Market Place
Elton (Hunts.) ..	W. R. Heighton & Son	
Exeter	Yeo & Davey Ltd.	Sidwell Street
Folkestone	Martin & Walter Ltd.	Sandygate Road
Glasgow	Rossleigh Ltd.	107 St. Vincent Street
Hanley	Hanley Garage Ltd.	Trinity Street
Harrogate	Mackay & Son, Ltd.	West Park
Hawick	Croall & Croall	Bridge Street
Hereford	J. Fryer Ltd.	Green Dragon Garage
Hull	Simpson & Sons	Prospect Street
Ipswich	Botwoods Ltd.	Carr Street
Kelso	Croall & Croall	
Kendal	H. J. Croft	Highgate
Kettering	H. Taylor & Son	Station Road
Lancaster	B. Townley	Penny Street
Leamington	G. Main & Co.	36 The Parade
Leicester	H. A. Hamshaw Ltd.	Humberstone Gate
Lincoln	R. M. Wright & Co.	Newland
Liverpool	Central Motor Co.	18 Newington
Maidstone	Rootes Ltd.	High Street
Manchester	T. Garner	12 Peter Street
Middlesbrough ..	J. W. Nesham	Grange Road; East
Motherwell	Taggart Bros.	Knowetop

TOWN.	NAME.	ADDRESS.
Newcastle-on-Tyne	George & Jobling	South Street
Newport-on-Tay ..	J. T. Young, Ltd.	The Motor House
Newton Mearns ..	R. Anderson	
Norwich	Mann, Egerton & Co., Ltd.	Prince of Wales Road
Northampton ..	Pytchley Autocar Co., Ltd.	Sheep Street
Nottingham	A. R. Atkey & Co., Ltd.	Lower Parliament Street
Oxford	W. R. Morris	Queen Street
Perth	J. Croall & Sons	York Place
Peterborough ..	Brainsby's Ltd.	Brook Street
Plymouth	W. Mumford	Ebrington Street
Pontefract	Ewbank & Co.	Townend
Preston	Merigold Bros.	147 Church Street
Ross	Ross Engineering Co.	The Motor House
Rugby	Hilton & Co.	North Street
Salisbury	Rowland Bros.	Castle Street
Scarborough	Saville & Ezard Ltd.	Westborough
Sheffield	Freeman, Oakes & Co., Ltd.	Devonshire Street
Shrewsbury	Mark Davies Ltd.	Chester Street
Southport	R. Woodhead & Co., Ltd.	Lord Street
South Shields ..	R. Rigbye	Fowler Street
Sunderland	F. Turvey & Co.	Holmside
Southend-on-Sea ..	S. T. Woodyatt Ltd.	
Stoney Stratford ..	C. H. Cave	London Road
Swindon	E. C. Skurray	90 Princes Street
Tenby	G. Ace	Warren Street
Tonbridge	C. Baker & Co.	High Street
Trowbridge	A. A. Bodman & Co.	Fore Street
Truro	S. Hicks & Son	10 River Street
Yeovil	W. Sparrow Ltd.	Osborne Garage
York	Myers & Burnell	Davygate

AGENTS IN IRELAND.

Athlone	Poole & Sons	Victoria Place
Belfast	C. Hurst Ltd.	Montgomery Street
Cork	The City Garage	North Main Street
Dundalk	D. Leavy	Clanbrassil Street
Dublin	J. J. Keating	32-33 Lower Abbey St.
Enfield (Co. Meath)	J. A. O'Grady	
Galway	J. J. Ward	The Motor House
Kells (Co. Meath) ..	G. Cooney Ltd.	Cross Street
Londonderry	Alexander Motor Co.	Great James Street
Strabane	J. W. Buchanan	Railway Road

TROUBLE LOCATING CHART.

THE 10 h.p. HUMBER CARS.

Condition.

Analysis.

Fault.

Cause.

Remedy.

ENGINE
will not
START

Carburettor floods
on
lifting needle

Spark at plugs

No spark at
plug points

Spark at plug
terminals

No spark at
plug terminals

Control Sticking

Incorrect timing

Air leakage

Spark too weak to fire under
compression

Faulty plug

Sooted plug points

Weak spark

Contact breaker arm sticks

Pitted platinum points

Faulty contacts

Switch short circuiting

Spring loose, ball joints tight, want
of lubrication

Magneto coupling moved, advance
uncoupled

Throttle worn, flange loose on engine,
bad joint.

Plug points too far apart

Porcelain Insulator cracked

Space of plug points incorrect

Broken spring or dirty joint

Pitted from continual use

Carbons worn or not rubbing

Wires loose, broken or wet

Inspect springs and ball joints, adjust and oil where
necessary.

Securely refix clamp nuts, see Magneto book for
timing. Inspect advance control

Inspect joint between engine and carburettor, and
throttle valve in carburettor

See page 25

Fit a new plug.

Remove and attend to points, see page 25

See page 25

See Magneto booklet

Remove cover of switch and examine the terminals
test by disconnecting earth wire from magneto ;
if engine starts switch is at fault.

No petrol at
Carburettor

Petrol tap open

Petrol pipe clear

Petrol tap closed

Petrol pipe, air locked

Filling Tank after running out

Unfasten petrol pipe at carburettor until petrol
runs

Float needle sticking

Piston valve sticking

Dirt in Carburettor

Remove float-chamber cover, clean needle valve and
seat, see page 21

Remove and clean, test by trying its movement
before replacing cover, see page 20

Lack power

Constantly

Controls in order

At intervals

Controls out of order

Poor compression

Valves need grinding

Choked silencer

Incorrect valve timing

Throttle valve does not open fully
Valves or piston rings worn

Worn or pitted seats

Inside choked with soot

Tappets out of adjustment

Examine ball joints and levers, adjust where necessary
See if valves seat, grind if necessary ; if no better
examine piston rings, see pages 12, 13 and 65

After grinding valves, test clearance between valve
stem and tappet, see page 14

Test by running engine with exhaust pipe uncoupled
if engine slows down on replacing pipe, see
page 37

Examine and adjust if necessary, see page 14

Partial obstruction of petrol

Insufficient lubrication

One or more valves sticking

Lack of oil in sump or dirty filter.

Examine petrol pipe, filter and tap

Examine oil level gauge, clean filter, see pages 40-42

Examine valve springs, if right clean valve stem
and guide hole where tight.

Examine cooling system, if right look for carbon
deposit in cylinders

Examine position of advance lever and connections,
inspect water level, see page 16

See pages 40-42. If knock is very pronounced one
or more engine bearings are run out

Find which cylinder misses, remove and clean plug,
see page 25.

Pre-ignition

Overheating

Insufficient lubrication

Overheating or excessive carbon de-
posit.

Driving with spark retarded or loss
of water

Lack of oil in sump, dirty filter, or
failure of oil pump.

Examine position of advance lever and connections,
inspect water level, see page 16

See pages 40-42. If knock is very pronounced one
or more engine bearings are run out

Find which cylinder misses, remove and clean plug,
see page 25.

Sooted plug

Soiled contact-breaker

Soiled distributor

Occasional short circuit

Wet or oily plugs, loose connections

See Magneto booklet

Find cylinder, clean plug or examine wire, see page
25

Weak mixture

Starved carburettor

Broken valve or spring

One or more jets stopped, bad inlet
flange joint

Remove float chamber and clean jets, see pages
20 and 21. Inspect inlet pipe joint.

Poor flow of petrol, needle valve
sticking.

Remove float-chamber cover, examine and clean,
test flow of petrol

Remove valve cover, examine and replace if necessary

No petrol

Controls not working

Overheating

Air leakage.

Tank empty, pipe or filter stopped
Joint disconnected or loose lever

Examine tank first

Examine all joints from accelerator and hand lever
to carburettor

Loss of water or spark retarded

Examine water level in radiator, and position of
advance lever

Loose inlet pipe joint ; bad washer,
worn throttle valve

Examine by applying thin oil to joints and looking
for air bubbles

Choked pipe or filter

Punctured float

Flooded float-chamber

Float needle sticking

Carburettor frozen up

Badly filtered petrol, broken filter in
filter.

Remove and clean. Repair the large filter if
necessary

Dirt in needle, valve, or punctured
float

Inspect and clean valve ; if float sinks, remove and
immerse in hot water, if it is punctured air
bubbles will be seen round the hole, seal it
with a spot of solder after extracting any fluid
by warming the float.

Remove float-chamber cover, examine and clean
valve, seat, weights, etc.

Exhaust heating pipe to carburettor

Remove heating pipes and thoroughly clean, see

ENGINE
STOPS

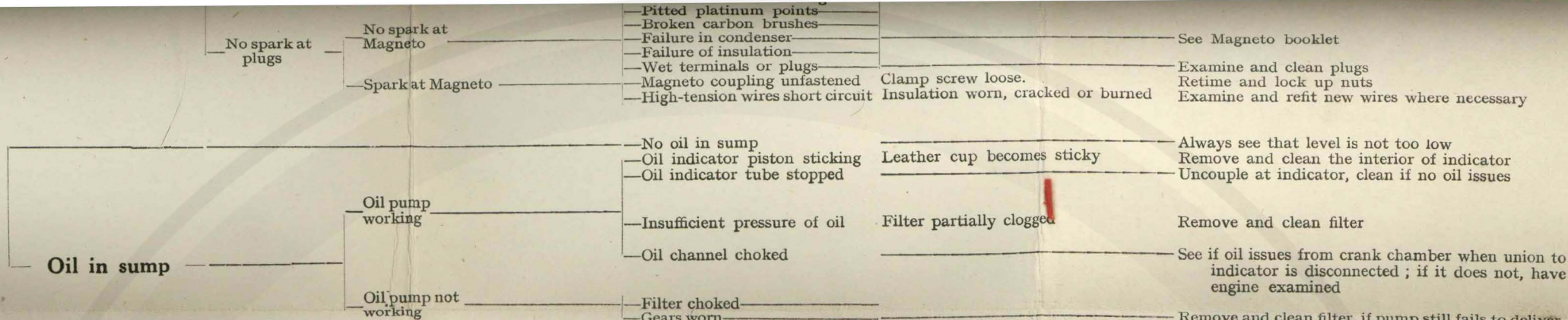
Petrol in Tank

Spark at plugs

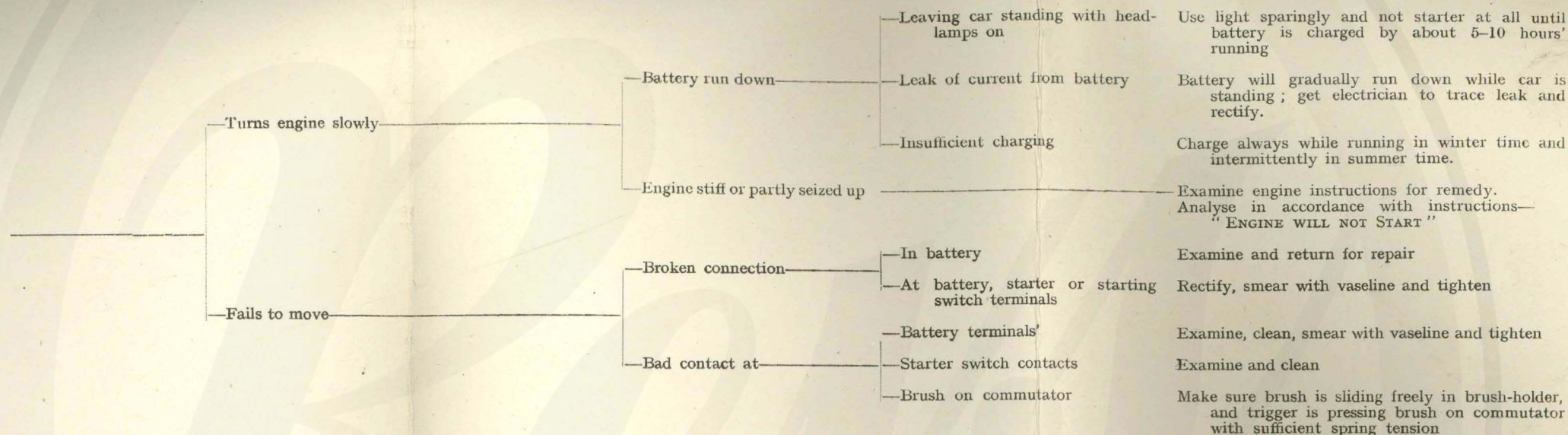
Carburettor
working

Carburettor
not working

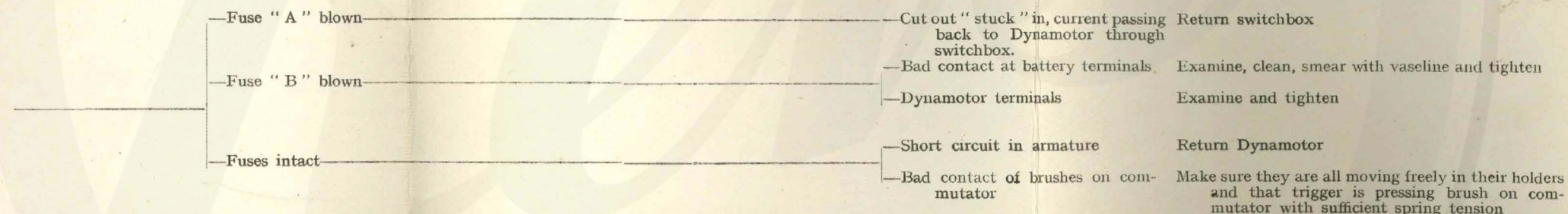
Oil Indicator fails to work



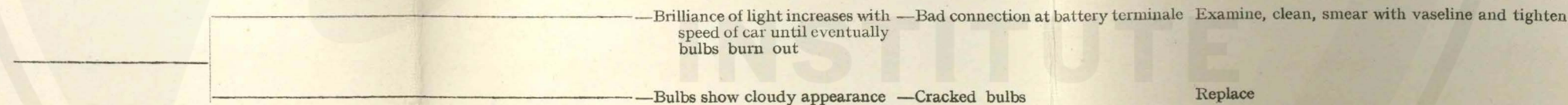
Dynamotor fails to start Engine



Dynamotor fails to Generate



Lamps burn out



Running Instructions are fully explained in the Lucas booklet supplied with the Car.