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Instruction Book

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COVENTRY

Humber

15·9 H.P. CAR
Instruction Book

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PREFACE

IN the design of the Humber 15·9 Car every effort has been made to render its manipulation as easy as possible. This book of instruction has been compiled to give a few simple instructions for the use of owners.

The book is fully illustrated with diagrams which have been carefully prepared to give useful information in the simplest form, instead of making long technical descriptions. By the use of sectional diagrams of all units, we have endeavoured to show the exact arrangement of all mechanical parts.

In compiling this book an elementary knowledge of the control and operation of autocars has been presupposed.

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, there are several excellent text-books that can be obtained from any bookseller for a very modest outlay.

A chart will be found at the end of the book which has been prepared to enable any fault to be traced, and showing how it can be corrected. Should any further information be required, our Technical Department will be pleased to give every assistance. Should a fault arise which is difficult to diagnose, we are pleased to give such cases our special attention.

The general features of the various units and instructions for making running adjustments are described and illustrated in order, commencing with the engine, and then following through the transmission, steering &c. &c. A latter portion of the book is devoted to the important subject of lubrication, to which every attention should be paid to keep the car in good running order. Strict attention to the lubrication of the chassis will save costly repairs. Information is also given as to the correct method in which the various units may be dismantled.

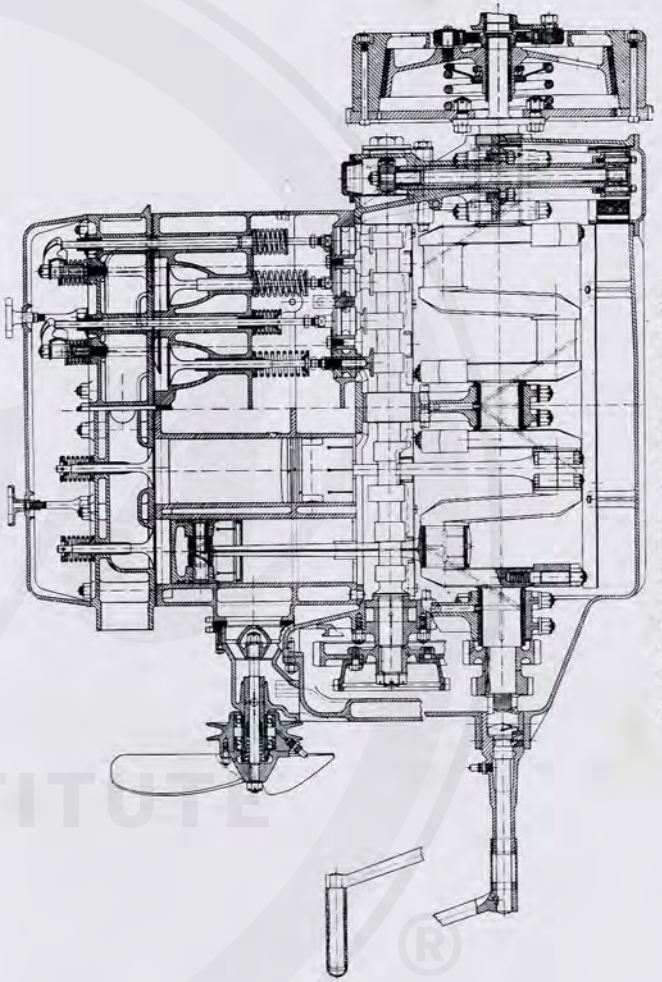
ENGINE

General Description.—The four cylinder engine is constructed with monobloc cylinders and a detachable cylinder head. The inlet valves are situated in the head, and the exhaust valves are placed in the cylinder block. The cylinders are bolted down to the top half of the aluminium crankcase, which carries the crankshaft in three large white metal bearings. The lower half of the crankcase forms the oil sump, having a baffle plate and a large gauze-covered filter through which the oil pump draws oil to supply all bearings.

The camshaft, which runs in three phosphor bronze bearings in the top half of the crankcase, is driven by a silent chain from the front end of the crankshaft, and has a vernier adjustment incorporated with the driving wheel, which enables the valves to be timed accurately and with ease.

The magneto, which is conveniently mounted on a platform at the side of the crankcase, is also driven by a silent chain from the front end of the crankshaft. It is connected to the driving shaft by a flexible fabric coupling which is free to move on four pins, two of which are attached to the magneto and two to the driving shaft flange. This flange has two helical slots in which the pins can be moved when it is necessary to time the magneto.

The dynamo is mounted on the near side of the crankcase at the front, and is driven by a silent chain

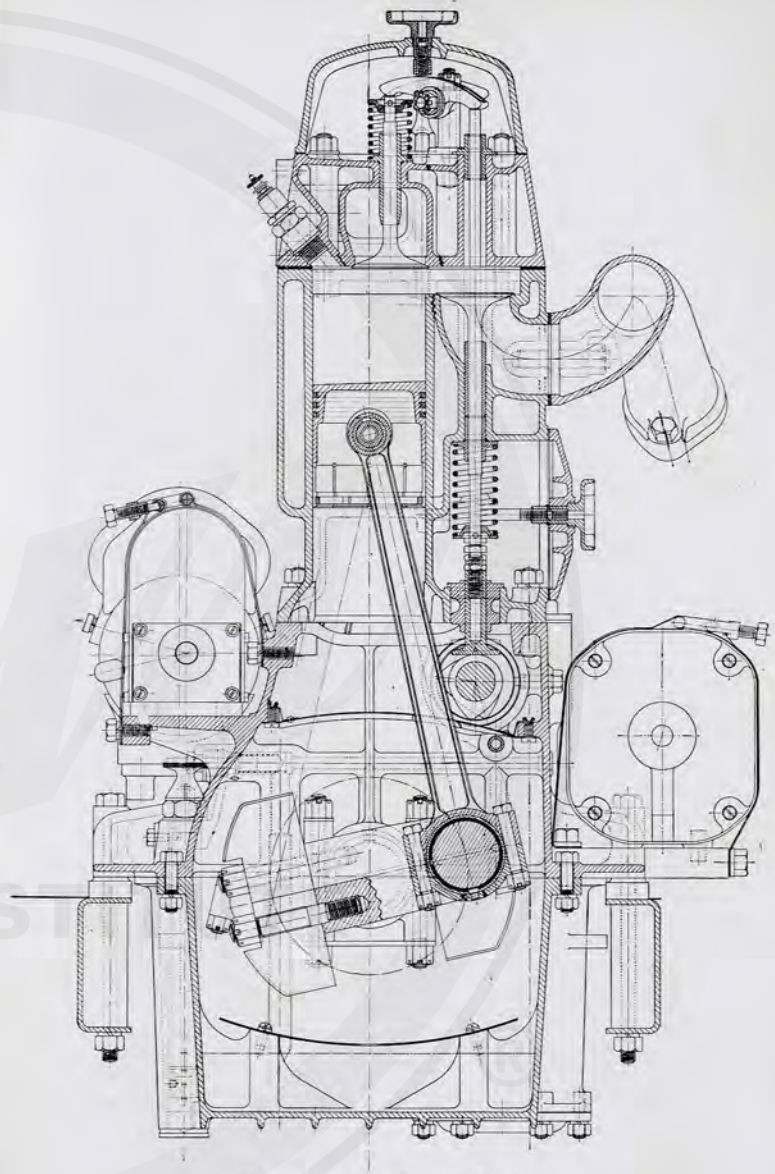


General Arrangement of Engine and Clutch

from a wheel on the camshaft through a flexible fabric coupling.

As the four inlet valves are in the detachable head, they are operated by push rods and rockers, which are carried on rocker standards bolted on the head. These push rods have two guides, one in the cylinder itself and the other in the cylinder head. The inlet valves and push rods are loaded with coil springs which are interchangeable, the one spring controlling the valve the other the tappet and push rod. The valves are operated by mushroom type cams of large area, working on flat tappets which give quick opening and closing, and ensure quiet running. The tappets work in bronze guides, and are entirely enclosed by an aluminium cover on the near side of the cylinder, which is easily detachable, when all tappets and guides may be adjusted or removed.

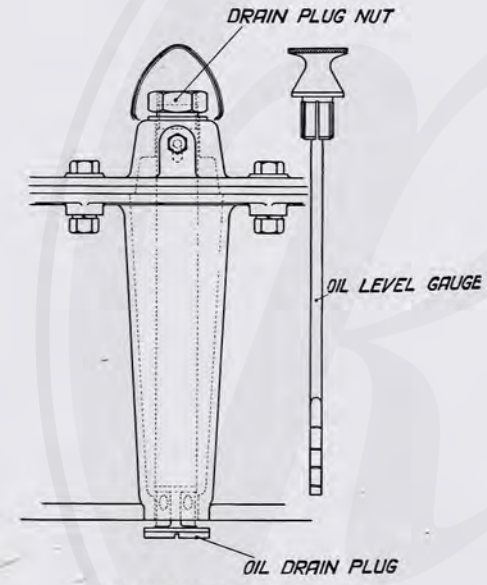
The connecting rods, which are of "H" section high tensile steel, have big end bearings of white metal in brass housings, the small end bearings being bronze. The bearing metals in the cap and rod butt together when tightened up by the four securing bolts. The pistons are of the split skirt aluminium alloy type with the sloping head, having three compression rings and one expander ring at the bottom of the skirt. The pistons are fixed to the connecting rods by gudgeon pins of the floating type made of hardened steel, and having aluminium pads pressed in both ends to obviate any possibility of damage to the cylinder walls when they touch. The gudgeon pins are a running fit in



Transverse Section of Engine

the phosphor bronze bush in the connecting rod, and in the aluminium piston bosses, which ensures even wear on the pin.

At the rear end of the crankshaft an oil return worm is cut, which revolves in a housing in the crankcase and prevents oil leaking out of the sump. There is



Crankcase Oil Release Plug

a small clearance between the worm and the housing. Beyond this, and solid with the crankshaft, is a flange to which a steel toothed plate of large diameter is bolted by six bolts. The pinion of the electric starter engages in the teeth of this wheel. Attached to this plate by

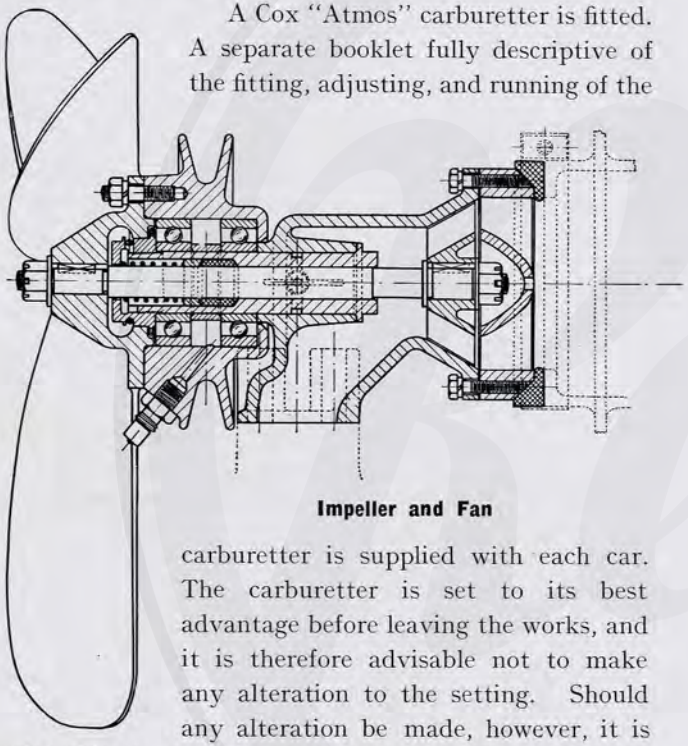
twelve bolts is the flywheel, which houses the clutch cone.

The oil pump is of the spur gear type, and is placed inside the bottom of the sump; the gearing is enclosed in a gauze guard, and is immersed in oil. The whole pump is attached by a bracket to the crankcase, which affords an ample bearing for the driving shaft which connects the pump to the helical spur gearing at the rear end of the camshaft which forms the drive.

The oil level gauge rod is conveniently fitted to the crankcase on the off side of the engine. Immediately below the knob of the rod is a large nut; this is screwed on to a tube which passes down through the sump, and is fixed to a metal plate to which is fitted a fibre washer, which presses up to the outside of the sump. At the bottom of the tube, ports have been cut to allow the oil to flow into it, and a pin passing through the crankcase fits into a slot in the tube to prevent it revolving. By unscrewing the nut at the top, and tapping the tube down, the oil in the sump is allowed to drain out. By screwing up the nut, an oil-tight joint is made at the bottom of the tube by the fibre washer being forced on to the bottom of the sump, and so closing the ports.

The fan and water impeller form one unit, which is secured to the top of the timing cover by four studs. It is driven by a whittle belt from a pulley on the magneto shaft. The pulley is made adjustable to enable any slack in the belt to be taken up. The fan is mounted on two ball races which fit on a shaft, which passes through into the main water circuit of the

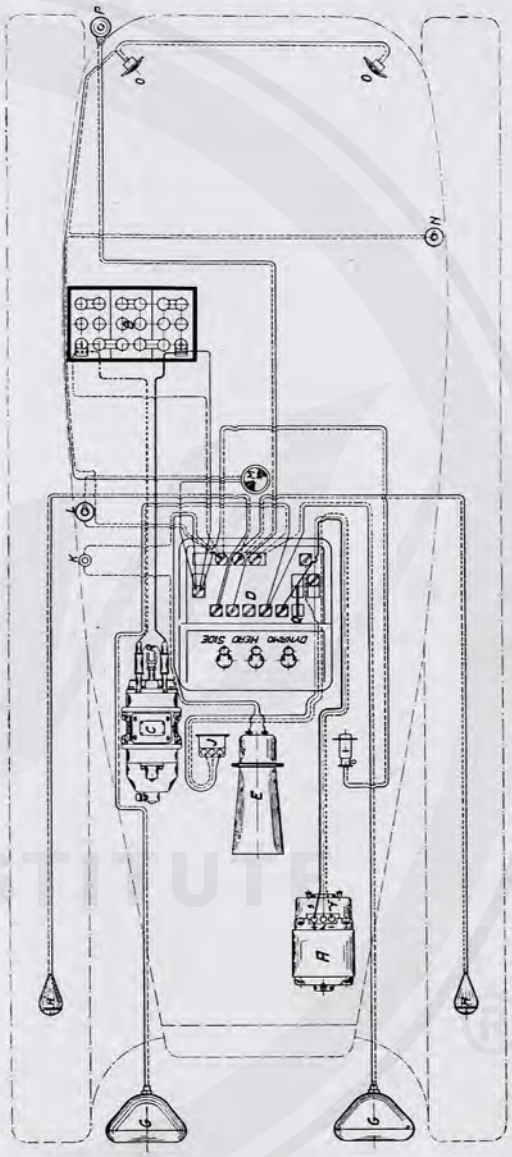
engine. Attached to the end of the shaft is a four-bladed impeller. To prevent water leaking along the shaft to the ball races, a spring loaded gland is provided, which can be re-packed when necessary by taking off the fan and removing the nut.



Impeller and Fan

A Cox "Atmos" carburetter is fitted. A separate booklet fully descriptive of the fitting, adjusting, and running of the carburetter is supplied with each car. The carburetter is set to its best advantage before leaving the works, and it is therefore advisable not to make any alteration to the setting. Should any alteration be made, however, it is advisable to carefully note the original setting in case the new setting should prove unsatisfactory.

Starting Motor.—This is a special type of machine, with which the starting switch is combined, thus con-



A DYNAMO
B BATTERY
C STARTER
R STARTER SWITCH
D SWITCH BOX
Q FUSE
E HORN
K HORN SWITCH
G HEAD LAMPS
H SIDE DO
I DASH DO
J CUT-OUT
L SWITCH FOR DRIVERS ROOF LIGHT
M DRIVERS ROOF LIGHT
N SWITCH FOR REAR ROOF LIGHTS
O REAR ROOF LIGHTS
P TAIL LAMP
S POSITIVE WIRE (RED)
T NEGATIVE WIRE (BLACK)
F FIELD WIRE (GREEN)

Wiring Diagram

siderably simplifying the wiring and dispensing with exposed terminals. It is a self-contained unit, and is fixed to a platform on the crankcase at the rear off side. The engine is started by means of a toothed pinion, which engages with a corresponding gear ring on the flywheel; the pinion is automatically thrown out of action when the engine is started. The switch is controlled by a system of levers, which are actuated by a finger grip fitted in a convenient position on the facia board. It is important that the grip be pulled out slowly, and quickly released immediately the engine has started. In cold weather the engine should be turned a few times by hand to ease the pistons and other moving parts, thereby materially reducing the amount of current taken from the batteries when the starter is applied.

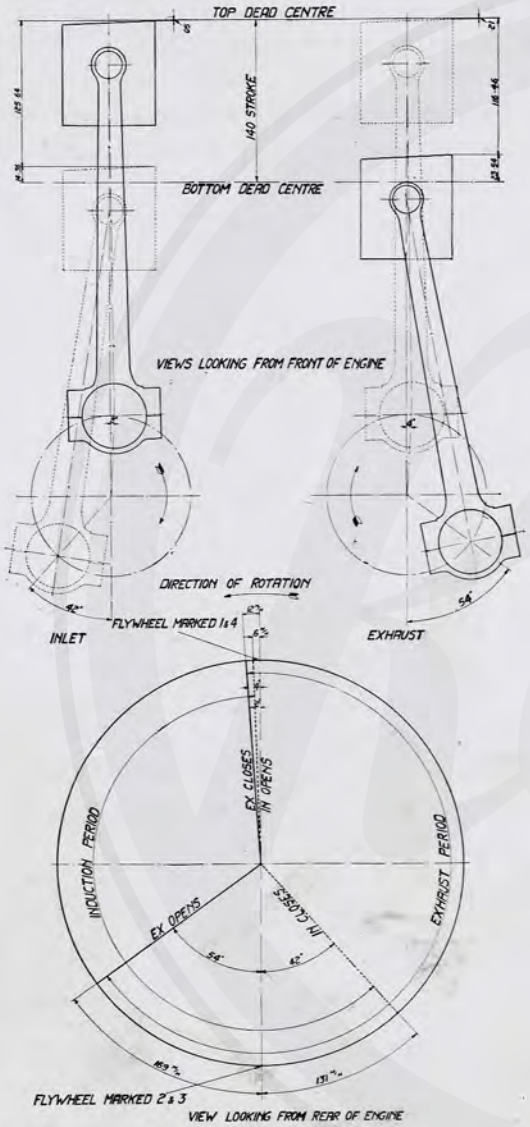
Cooling System.—The circulation of water in the cylinder jackets and radiator is assisted by an impeller, which accentuates the natural flow of the water caused by the thermo-syphon. This impeller helps to urge the cool water from the bottom of the radiator into the cylinder jacket, where it is heated by coming into contact with the cylinder walls and passes out into the top of the radiator. A draught of air is drawn through the radiator whether the car be moving or not, by the three-bladed fan. The water is cooled as it sinks through the radiator, and so returns to the bottom of the cylinder jacket.

In frosty weather the water system should be drained by removing the plug which is fitted at the bottom of

the radiator, and by opening the small drain tap at the rear end of the cylinders near the dashboard; 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. By filling the water system with hot water, this will obviate any starting trouble.

Valve Timing.—If at any time the camshaft driving chain be removed, the normal valve timing can be restored by setting the valves, as shown in the diagram. The valve settings shown are mean settings—slight variations early or late will not affect the results. The numbers 1-4 and 2-3 are marked on the periphery of the flywheel. When the numbers 1-4 on the flywheel are on the exact top centre, i.e., when the mark on the flywheel is exactly opposite the fin cast on the crankcase, the pistons in Nos. 1 and 4 cylinders are at the top of their stroke. Similarly, when the flywheel is turned through 180°, and the Nos. 2 and 3 are at the top centre, then the pistons Nos. 2 and 3 are at the top of their stroke. No. 1 cylinder being



Valve Timing Diagram

nearest the radiator. It is only necessary to re-time one of the valves, as all the cams are solid with the shaft, and will therefore be automatically correctly timed if the tappet adjustments are correct. To correctly time the engine, the flywheel should be turned until the Nos. 1 and 4 on the flywheel are 12 m/m past the top dead centre. This can be accurately measured by pressing a flexible steel rule on to the flywheel. Take out the three bolts holding the camshaft flange to the camshaft chain wheel, and turn the camshaft until No. 1 exhaust valve is just closed, and replace the three securing bolts, making sure they are locked by turning up the edges of the brass locking washers. It is advisable to check the valve timing by making sure that the No. 1 inlet valve opens 6 m/m past the dead centre.

Magneto Timing.—To time the ignition, turn the flywheel until the numbers 1 and 4 are 35 m/m before top centre on the periphery of the flywheel, and both valves on No. 1 cylinder are closed. Remove the contact breaker cover from the magneto, and turn the armature until the points of the contact breaker are just separating, with the distributor arm over No. 1 segment. The magneto can then be coupled up to the engine by carefully tightening up the two securing studs in the flexible fabric to the flange, making sure that the magneto armature is not moved.

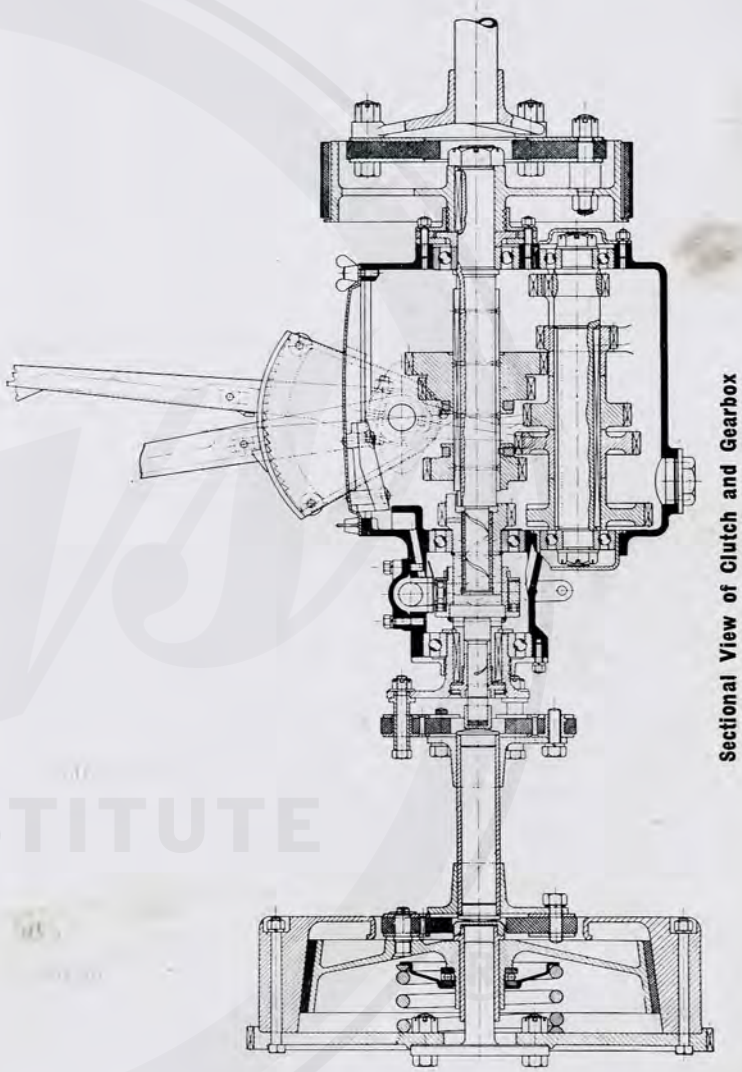
CLUTCH

The clutch is of the cone type. It consists of an aluminium cone having its periphery covered with

Ferodo; a bronze bush of ample bearing surface, which runs on an extension of the crankshaft, carries the cone. The cone is held in engagement with the flywheel by a central spring running on a thrust ball race mounted on the bronze bush, which also carries the cone itself, and is automatically lubricated from the main engine pressure feed. The extension of the crankshaft is filled with wick to damp out the oil pressure, and only allow the right quantity of oil to pass through to the bearing. The lubrication of the clutch cone bush is dealt with fully in the lubrication instructions. The clutch is entirely enclosed, as shown in illustration on page 19, by the flywheel, which forms a dust-proof cover in which two holes are provided for the injection of oil or paraffin as described on page 37.

CLUTCH COUPLING

This is of the double universal type, consisting of two flexible fabric discs between which is interposed a detachable shaft of such length that its removal facilitates the dismantling of either the clutch or clutch withdrawing mechanism in the gearbox without removing the engine or the gearbox. The forward fabric disc is secured to the clutch by three studs riveted into the cone. The rear fabric disc is fixed to the flange of the coupling shaft, and has three steel bushed holes which slide on three pins secured to the flange, attached to the clutch withdrawal mechanism in the gearbox. The coupling shaft has a steel button attached to either end, the front end butting against the crankshaft button, and



Sectional View of Clutch and Gearbox

the rear against the clutch withdrawal pin. When the clutch is disengaged, the load is transmitted direct through the coupling shaft, and not through the fabric discs.

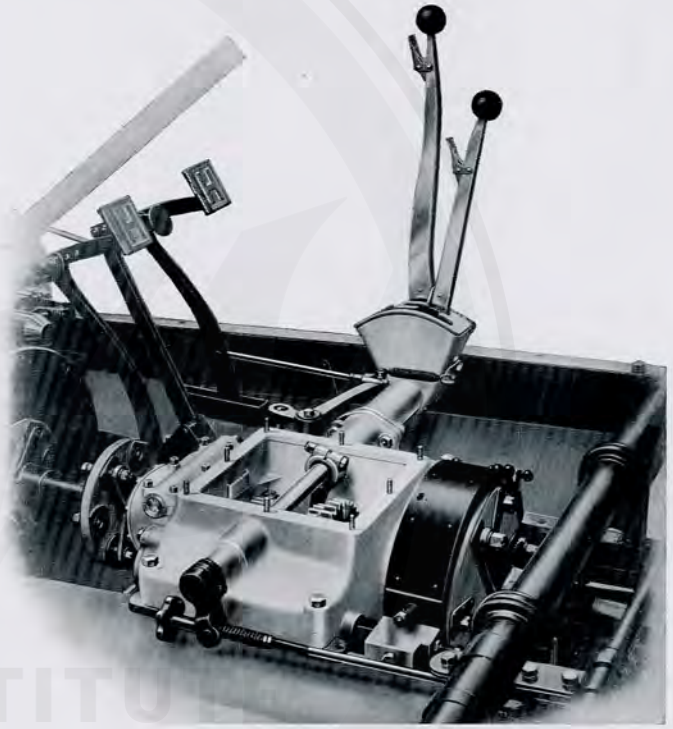
GEARBOX

General Description.—The gearbox provides four speeds forward and one reverse, the forward speeds being so arranged that direct drive is obtained on top gear. The gears are operated by a lever working through a gate on the right hand of the driver. The lever shaft is supported in a housing extending from the side of the gearbox and also forming a bracket for the change-speed gate. The gearbox casing is a one-piece casting in which are housed the two shafts, the main shaft above and the lay shaft below, which are carried in ball bearings front and rear. There are two sliding members, both on the main shaft, which are operated by two forks which slide along the selector shaft, and which are held to their required position by spring loaded plungers, the points of which engage with the depressions in the selector shaft. The sliding forks are themselves operated by a selector lever which is attached to the change speed lever shaft.

The reverse movement of the gears is secured by an idler pinion mounted on a separate shaft, which meshes with the first speed sliding wheel.

The speedometer is positively driven by a flexible cable from a small set of gear wheels, which derive their motion from an auxiliary gear wheel, wide enough to allow the third or fourth speed wheel with which it engaged to slide without losing its drive.

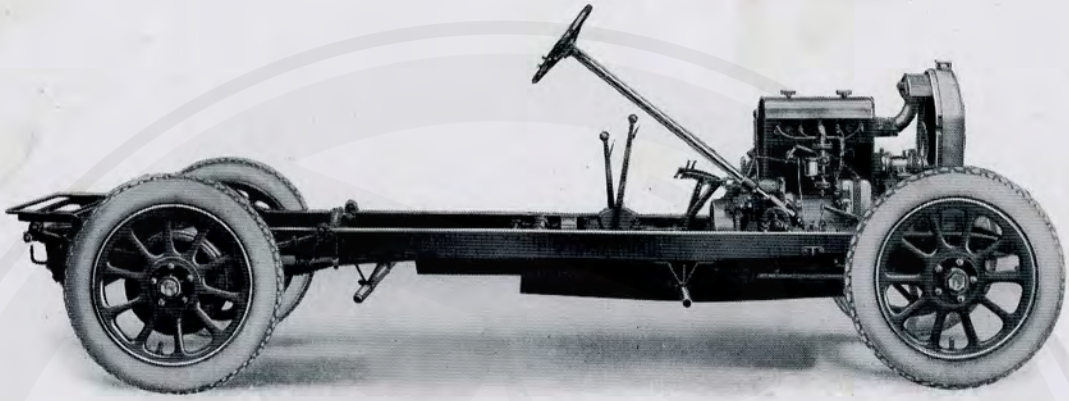
On top or direct drive a set of jaw clutches on the face of the constant mesh driving wheel, and another set on the face of the third speed pinion, are brought



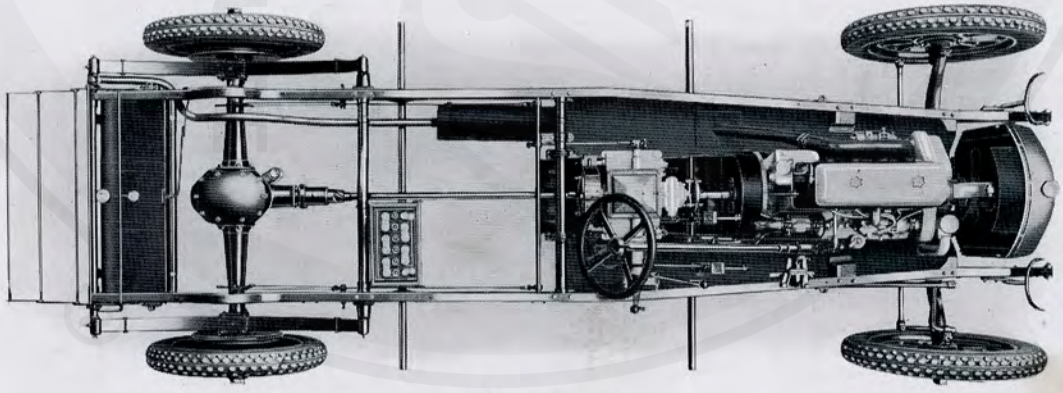
Gearbox showing Control Levers and Pedals

into engagement, the drive then being taken directly from the front to the rear half of the main shaft.

The gearbox is lubricated by splash, the oil being thrown up by the revolving wheels lubricating the



Elevation of Chassis



Plan of Chassis

bearings and speedometer wheel, and also the clutch withdrawal mechanism.

Clutch Withdrawal Mechanism.—This is situated in the front end of the gearbox in line with the main shaft, and is housed in the main gearbox casting, thus making the entire mechanism completely enclosed, and therefore dust-proof and oil-tight. When forcing out the clutch pedal, this causes a pin in the clutch withdrawal to be forced against the clutch coupling, and so disengages the clutch cone from the flywheel.

BRAKES

Two distinct sets of brakes are provided, the first being the foot brake, which is of the external contracting type, and the other is the hand brake, which is of the internal expanding type.

The Foot Brake.—This consists of a flexible steel band lined with Ferodo, which surrounds a large steel drum which is mounted on the gearbox main shaft. The brake is operated by a rocking shaft in the gearbox, which is actuated by a bell crank lever, and taking its bearing on a pin fixed on the gearbox. The whole mechanism is part of the gearbox unit; the foot pedal, which operates the brake, is coupled up with an adjustable link. A self-locking hand nut is provided for adjustment of the brake band, which is anchored to the gearbox in such a way that the band will adjust itself, and maintain an equal tension as the Ferodo lining wears.

The Hand Brake.—This brake is operated by the hand lever at the side of the change speed lever, which

is connected to the brake drum on the rear wheels by a series of connecting rods. The shoes inside the drums are lined with Ferodo, and are expanded by means of a cam. The camshaft works in oilless bearings, which are made from a special composition containing graphite. These bearings will be found to work satisfactorily without periodical lubrication. When wear takes place in the brake shoes, they can be adjusted by detaching the metal links from the levers above the axle shaft; they are accessible by removing the rear seat and seat board, and attaching the links in a hole which gives better adjustment. The levers are made in the shape of a quadrant, and have three holes, so that any of the three holes may be used without losing leverage. When the last hole has been used in the lever, it will indicate that the lining is getting thin, and requires renewing. A further adjustment is also provided by means of a hand nut which will adjust the position of the hand lever on the quadrant.

PROPELLER SHAFT

This transmits the drive from the gearbox to the rear axle. It is coupled to the brake drum on the gearbox main shaft at three points, the joint being made by a substantial flexible fabric disc. There is also a universal joint at the rear end which, by means of sliding blocks working on hardened steel pins, compensates for the rise and fall of the road wheels. The rear universal joint is fitted with an oil retaining cover, and also has a leather cover to seal the space between the cover and the propeller shaft to exclude dirt.

REAR AXLE

The rear axle is of the live type, and consists of an aluminium centre, in which is the spiral bevel gearing of the final drive, and tapered steel extensions carrying the weight. The hubs which carry the road wheels and brake drums are fixed to the driving shaft by taper and key, and are locked by a large nut at the end of the shaft, which is pinned. The driving shafts take their bearings in substantial ball bearings housed in the ends of the extension tubes; the inner ends of the shafts are splined to fit the pinions in the differential box.

View of Rear Axle

The casing of the bevel toothed pinion differential has the crown wheel secured to it by six bolts passing right through the case, which is mounted on ball bearings. Roller bearings carry the spiral bevel pinion which meshes with the crown wheel, and which is also housed in the nose of the aluminium centre casing. A separate double ball thrust race is also provided in conjunction with the bevel pinion shaft to take the thrust of the spiral bevel gear. The steel barrel which holds the pinion and bearings fits into the nose of the centre casing, which is threaded at the front end to allow an adjustment, enabling the pinion and crown wheel to be fitted

to correct mesh. The threaded portion of the housing is split, and carries a locking plate fitting into slots in the face of the steel barrel.

The differential box contains a series of bevel gears which allow the rear road wheels to take an equal share of the drive, and at the same time remain independent of each other.

FRONT AXLE

The front axle takes the form of an "H" section steel stamping with integral platforms for the suspension springs. The pivot pins for the swivel axles pass through the ends of the main axle, each being prevented from rotating in the latter by means of taper pin driven in from the front of the axle. The jaws of the swivel axles are free to move round the swivel pins upon plain bearings, but the weight is taken by a ball thrust bearing between the lower bearing and the axle. This ball bearing is entirely enclosed by a pressed metal cup, and is lubricated by a greaser at the bottom of the swivel pin. The hubs are carried on the swivel axles by two Timken roller bearings, the inner one being provided with a dust-proof cover.

The steering coupling rod behind the axle is tubular, and is fixed to the steering arms by pins working in bushes, which are entirely enclosed in grease retaining leather covers. The steering arms are attached to the swivel axles by keys and castle nuts.

STEERING

The steering wheel is mounted at the upper end of a tubular shaft which forms the column and carries the

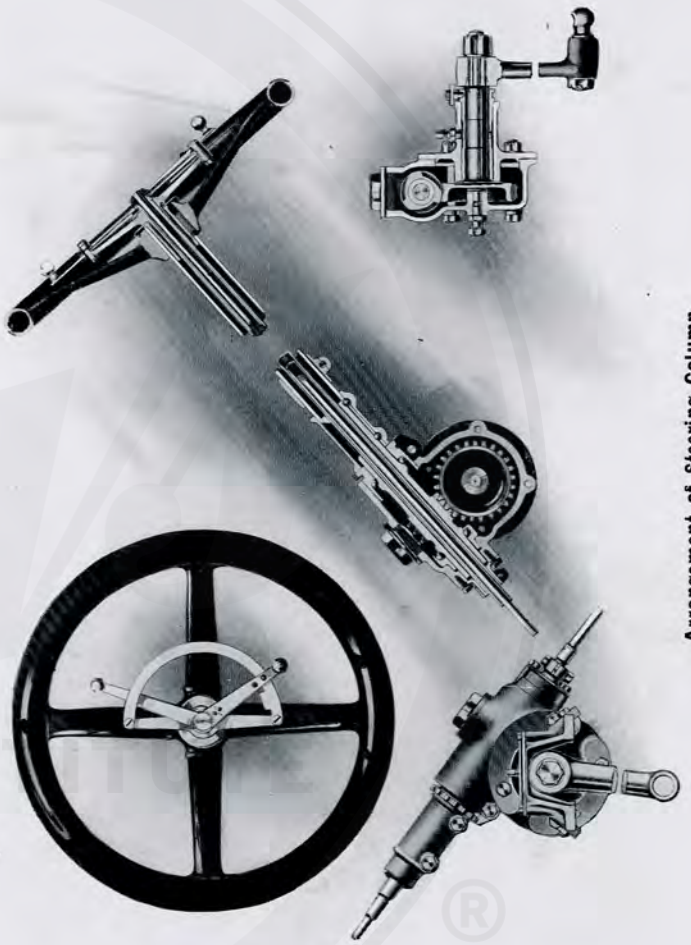
throttle and ignition hand levers. The worm of the steering gear is bolted to the bottom of the column, and engages with a complete worm wheel integral with the cross shaft which carries the steering lever at its outer end. The complete steering gear is housed in an aluminium case which is rigidly fixed between the main frame and the sub-frame. The steering wheel shaft is splined to fit the steering lever, thereby giving six settings to the worm wheel, enabling slackness caused by the wear of any one segment to be eliminated. The worm works between two ball bearings, the top one being adjustable to take up any wear. The worm wheel cross shaft works in an eccentric bronze bush, which gives an adjustment between the worm and worm wheel, therefore governing the amount of play in the steering wheel.

The hand levers on the quadrant are fixed to tubes, which pass through the centre of the column and take their bearings in brass tubes which are covered by a dust-cap immediately under the quadrant.

A stop is provided on the quadrant, so that in driving the ignition lever cannot be taken beyond the full retard position. To switch off the engine, it is only necessary to press a small button in the arm of the lever, and move it to its full extent, so causing the extension of the magneto contact breaker cover to come into contact with the switch wire shown in illustration on page 47.

The steering wheel is held to the column by a pinch bolt fitting a slot in the tube.

The steering levers are fitted with hardened ball ends, which work in spring loaded cups in the coupling



Arrangement of Steering Column

rod, thereby automatically adjusting themselves as wear takes place.

The steering box is provided with a large plug in an accessible position, which can easily be removed to enable grease to be put in.

SPRINGS

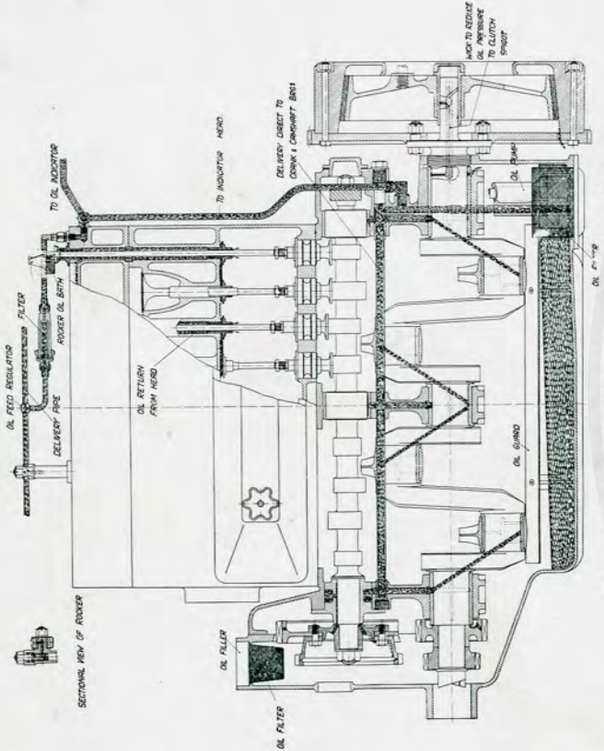
Semi-elliptic springs are fitted front and back, and are anchored to the frame and brackets by hardened shackle pins fitted with greasers. All springs are standardised, and are made to various specifications to suit different types of bodies. If at any time the springs are taken off the chassis, care should be taken not to get them mixed, as the offside springs are stronger than the near side to overcome the extra weight of the off side of the chassis.

LUBRICATION

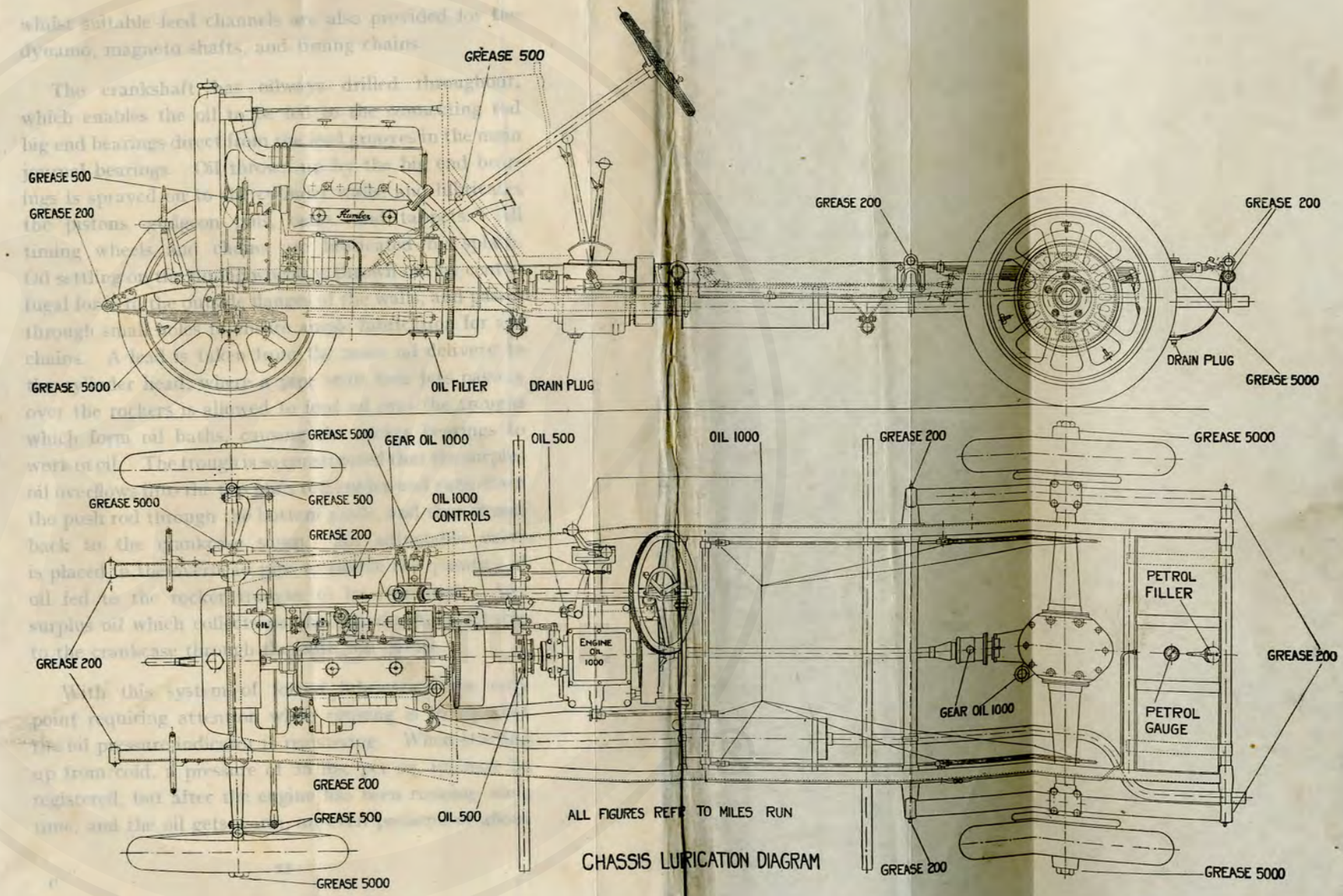
This subject is by far the most important in connection with the driving and management of a car, and if these simple explanations and instructions are carried out, in conjunction with a careful inspection of the diagrams, the trouble incurred will be amply repaid by the more efficient running and absence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

Instead of using grease caps, the chassis has been fitted throughout with the Benton & Stone system of grease gun lubrication. In this system the greasers take the form of nipples, having non-return ball valves. A grease gun is supplied in the tool kit, having a flexible pipe fitted with a screw-on nozzle. When lubricating the chassis it is therefore only necessary to screw the grease gun on to the nipples and give the handle of the gun two turns or more as instructed in the periodical lubrication instructions. In cold weather a mixture of grease and oil may be used in the grease gun, which will be more easily forced into the greasers.

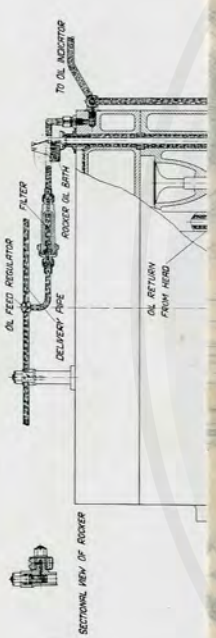
Engine.—The whole of the internal parts of the engine are lubricated automatically by the oil which is contained in the crankcase sump under a forced feed system. The rotary pump which operates in the sump forces the oil through a series of ducts in the crankcase, serving the crankshaft, connecting rods, and camshaft,



Section of Engine, showing Lubrication System



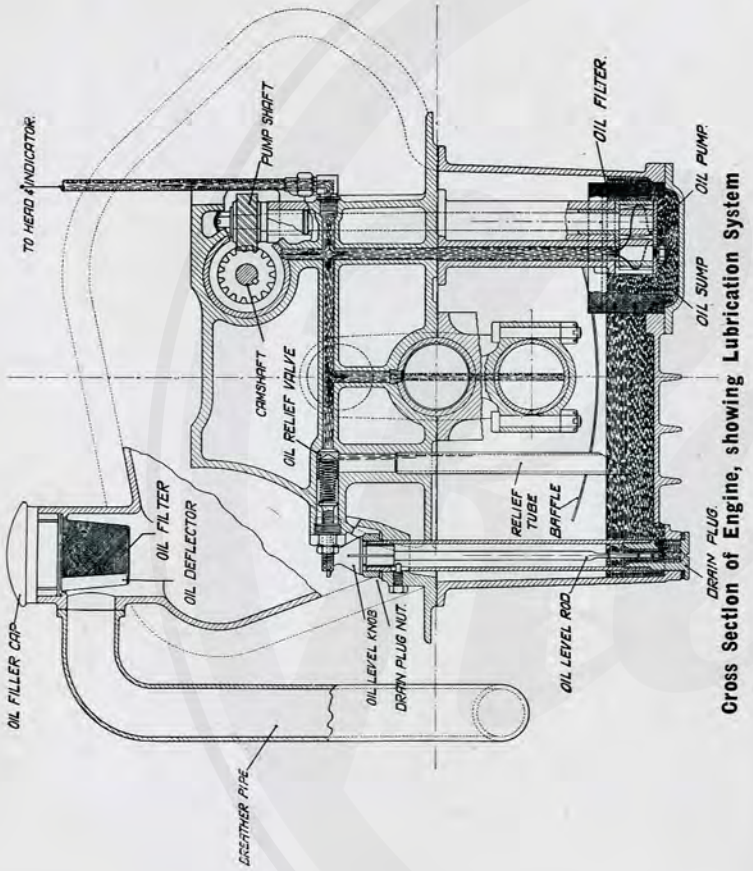
CHASSIS LUBRICATION DIAGRAM



whilst suitable feed channels are also provided for the dynamo, magneto shafts, and timing chains.

The crankshaft has oilways drilled throughout, which enables the oil to be fed to the connecting rod big end bearings direct from the feed grooves in the main journal bearings. Oil thrown up by the big end bearings is sprayed on to the cylinder walls, and lubricates the pistons, gudgeon pins, cams, and tappets. All timing wheels and chains are lubricated by splash. Oil settling on the timing wheels is thrown out by centrifugal force to the outside flanges of the walls, and passes through small holes to ensure ample lubrication for the chains. A lead is taken from the main oil delivery to the cylinder head, where a pipe with four jets passing over the rockers is allowed to feed oil into the troughs which form oil baths, causing the rocker bearings to work in oil. The trough is so constructed that the surplus oil overflows into the top push rod guides and runs down the push rod through the bottom guide, and then drains back to the crankcase sump. An adjustable valve is placed in the overhead pipe to enable the quantity of oil fed to the rocker troughs to be regulated. Any surplus oil which collects on the cylinder head returns to the crankcase through the push rod guides.

With this system of forced lubrication the only point requiring attention while running is to see that the oil pressure indicator is registering. When starting up from cold, a pressure of 35 lbs. per sq. in. may be registered, but after the engine has been running some time, and the oil gets warm, an even pressure of about



Cross Section of Engine, showing Lubrication System

15 to 20 lbs. per sq. in. should be maintained. When the engine is idling the pressure is about 5 lbs. An oil pressure relief valve is included in the pressure system to prevent excessive pressure when the oil is cold. It consists of a spring loaded piston which moves and allows the surplus oil to escape back to the bottom of the crankcase. The valve is always correctly set before the car leaves our works, and there is no necessity to alter it.

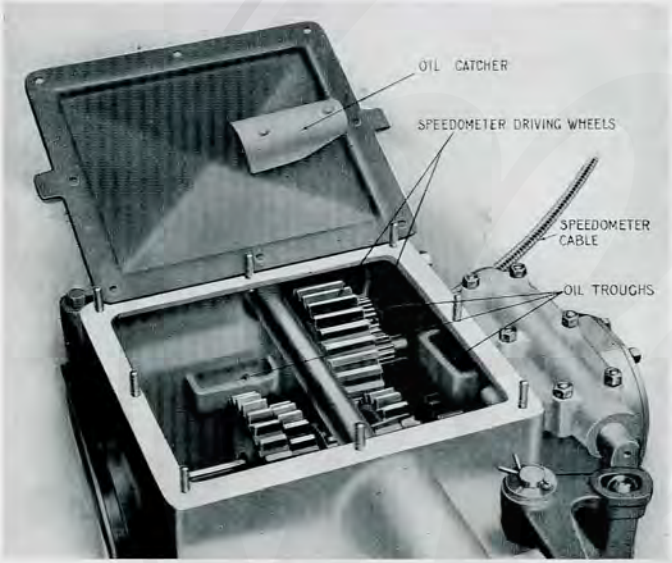
Oil is fed to the engine through the oil filler, which is incorporated in the timing cover on the off side of the engine. A breather pipe is carried from the filler terminating below the under shield, so preventing heat and oil vapour from getting into the bonnet.

Oil Level Gauge.—This is conveniently fitted to the crankcase on the off side of the engine, and is kept in position by a split sleeve. Upon removing this from the crankcase, the level can be readily inspected, and we recommend that the level of oil be kept to the top mark on the indicator, as it is better to put in small quantities of fresh oil occasionally than wait until the sump is nearly empty.

Engines are tested in our works and sent out charged with Duckham's Engine Oil.

Gearbox.—The gearbox will need very little attention as long as there is sufficient oil in the box. The various bearings in the box are lubricated by the oil being splashed about as the wheels revolve. In the case of the plain bearings, troughs are formed in the casting, as shown

in diagram below, which ensures the bearings getting a copious supply of oil. The normal level for the oil is $\frac{1}{4}$" above the lay shaft, i.e., the lower shaft. The notice fixed on the lid to the effect that "engine oil must be used" should be strictly observed. If thick



Gearbox with Cover Removed

oil or grease is put into the gearbox, the clutch withdraw mechanism, speedometer drive &c. will quickly give trouble.

The clutch withdraw mechanism housed in the nose of the gearbox is automatically lubricated by the oil in the box. An oil catcher is riveted to the lid of the gearbox which collects and directs the oil, constantly

thrown up by the revolving wheels, into a trough which is part of the gearbox casting. It then passes through a channel in the wall of the gearbox to an oil cup having an aperture so arranged that a continual supply of oil is directed on to the multiple friction plates, in whatever position the clutch is in. The oil returns to the gearbox by a lower channel through the wall of the gearbox.

Clutch.—The frictional surface consists of a Ferodo lining riveted to the aluminium cone, and it will only need very occasional lubrication. If at any time it should show a tendency to fierceness, one or two tablespoonfuls of Colan oil should be inserted in the holes in front of the flywheel. Drain holes are provided in the geared flywheel plate, and are in such a position that, should too much oil be applied, the surplus oil will drain away. Should the clutch show a tendency to slip, a tablespoonful of paraffin should remove the trouble.

The clutch cone bush which slides on the extension of the crankshaft is automatically lubricated from the pressure system. The extension of the crankshaft is drilled up to meet the main pressure oilway; this is then filled with wick, and the end sealed up with a screw. A small hole is drilled through to the wick, which allows a very small quantity of oil to pass through to the cone bush. Should too much oil get through and cause the clutch to slip, then the addition of a little extra wick will reduce the supply of oil to the bush. Great care is taken at the works to ensure that the correct

quantity of wick is fitted to supply the right quantity of oil.

It will be seen from diagram on page 19 that the rear coupling fabric attached to the coupling shaft slides on the three pins attached to the clutch withdraw star piece. The fabric is fitted with three steel bushes which slide on the steel pins. It is very necessary that these sliding bushes should be periodically lubricated. If they are allowed to rust then the clutch will not be free in action, and will be inclined to slip. The best lubricant is a mixture of graphite and oil, but thick grease may be used.

Rear Axle.—The spiral bevel gearing and differential pinions in the rear axle are lubricated by thick gear oil. This oil is picked up by the crown wheel from the lubricant stored at the bottom of the case, which houses the gearing, and is circulated throughout the whole of the gearing. Oil may be fed to the axle by removing the top plug in the filler box, which will be found on the near side of the casing in front of the axle. The correct level is indicated by the oil reaching the top of the filler. Immediately below the filler cap in the same box is another plug, which, when removed, will allow the oil in the housing to drain away.

The lubricant used should be preferably one of the special oils supplied by most of the well-known makers for use in gear-driven axles. Owing to the thick nature of the oil, it is advisable to replenish after a run, as the oil in the casing is then in a more fluid condition and will quickly find its level.

Under no circumstances should the casing be filled with oil appreciably above the indicated level, for although oil return spiral grooves are provided to prevent oil from leaking along the axle sleeves, these will not function if the level of the oil reaches them.

The rear wheel hub bearings are lubricated separately by filling the hub with grease, and screwing on the hub cap, thereby forcing it through the body of the hub into the bearings. The brake camshafts will need no lubrication, as they are mounted on oilless bearings.

Front Axle and Steering.—The hubs of the front road wheels are lubricated in the same manner as in the rear road wheels. After replenishing the hubs with grease, care should be taken to see that the hub cap is properly tightened.

The wheel swivel pins have greasers top and bottom, and the cross rod pins are provided with greasers at the top in a convenient position. It is important that the lower greaser on the swivel pins should have careful attention, as this lubricates the thrust race, and should be always kept full of grease. When sufficient grease has been put in it exudes from under the dust cap.

The cross rod pins are also packed with grease, and have leather covers. After approximately 2,000 miles running, the leather covers should be removed, and the joints cleaned and packed with fresh grease. After between 5,000 and 6,000 miles it is advisable to remove the pins and clean and oil them before packing with fresh grease.

The side steering shaft has two ball joints, which should be filled with grease every 5,000 miles.

The steering gearbox is lubricated with thick oil, or a mixture of grease and oil. Lubricant can be put in by removing the plug which is placed in the top of the box.

Spring Shackles.—The spring shackle greasers should receive attention after every 200 miles. This is very important, as quantities of dust collect round the shackles and will soon work into the bearings if grease is not frequently forced in. It is advisable to keep the shackle housing packed with grease, and not to entirely depend on the grease which is forced in by the grease gun.

Suspension Springs.—The spring plates should not be allowed to get rusty, as this will prevent the proper working of the springs. It is therefore necessary to lubricate with grease, or a mixture of grease and graphite between the leaves occasionally. The easiest way to do this is to jack up the car, so that the springs are entirely relieved of weight, and then separate the leaves by inserting a screwdriver or chisel. A thin strip of metal dipped in a mixture of graphite and grease can then be passed between the parted leaves.

If spring gaiters have been fitted to the car, they should be carefully examined; if they are not water-tight they do more harm than good by holding moisture and encouraging it to work into the spring.

Controls.—There are many small joints in the operating rods of the throttle, ignition, clutch, and

both brake controls. These should be given occasional attention with an oil can, which will make the handling of the car much easier, and prevent unnecessary wear.

In the case of the clutch and brake joints, it is necestary to take up the floor boards to get at them.

SUMMARY OF LUBRICATION INSTRUCTIONS

Daily, or after 200 Miles—

Replenish engine sump if necessary.

Give grease gun handle two turns on all shackle pin greasers.

Weekly, or after 500 Miles—

Oil foot brake connection under front foot boards.

Give two or three turns to grease gun handle on front wheel swivels and steering cross shaft pins.

Give two or three turns to grease gun handle on greasers on impeller and fan.

Oil pins and sliding bushes on gearbox clutch withdraw star piece under front floor boards.

Monthly, or after 1,000 Miles—

Oil ball joints and bearings of throttle and ignition controls.

Remove brass plug from rear universal joint on propeller shaft, and refill with thick oil.

Examine oil level in gearbox and rear axle, and replenish if necessary.

Oil all rear brake rod joints.

Oil accelerator pedal shaft and rod connections.

Remove plug, and refill steering gearbox with thick oil.

Attend to starting motor and dynamo, as instructed in C.A.V. booklet.

Oil brake and change speed levers, shafts, triggers, and catches on the levers.

Give two turns to grease gun handle to greaser on steering column bearing under dashboard.

Remove cylinder head cover, and see that oil is distributing properly to the troughs on the inlet valve rockers. If this is irregular, detach pipe and clean out with paraffin. If regulating valve has to be re-set, this should be first closed right down and then opened about a quarter of a turn. This should produce a drip of from 20 to 30 drops per minute, or sufficient to keep the troughs full of oil.

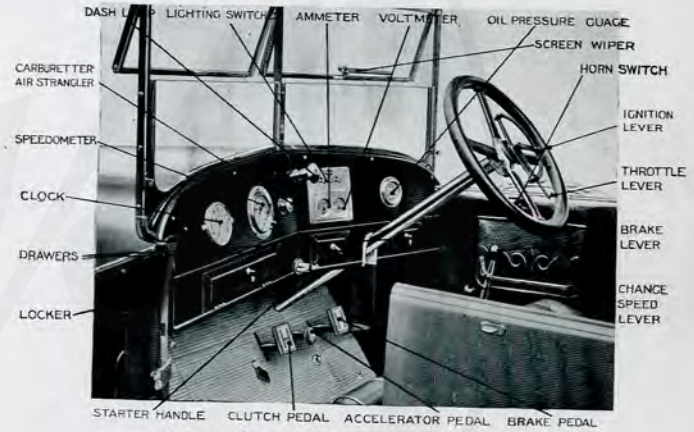
Annually, or after 5,000 Miles—

Drain oil from crankcase, remove oil filter, and thoroughly clean with paraffin. Replace and refill crankcase with fresh engine oil until it reaches to top mark on the indicator rod.

Remove the drain plug from gearbox, and drain out the old lubricant; clean out with paraffin and refill with fresh engine oil to cover the lay shaft.

Remove the drain plug from the rear axle, and drain out the old lubricant; clean out with paraffin, and refill with fresh gear oil to level to the top plug.

The front hub caps should be removed and filled with grease. The recess in the end of the rear hub should be filled with grease, so that in refitting the cap the grease will be displaced and forced through the hub into the bearing.



View of Facia Board and Controls

The leather covers on the steering cross rod joints should be taken off, and the joints packed with fresh grease. Before refitting the leather covers, it is advisable to scrape off the old grease and smear the covers with engine oil before refitting them.

The ball joints of the side steering shaft should be re-packed with grease.

Thoroughly clean out the oilways in the steering wheel swivels by injecting a liberal charge of paraffin, and then re-charge with fresh grease.

Grease the leaves of the suspension springs as explained on page 40.

Remove the road wheels, and lightly cover the fixed hub and studs with a mixture of grease and graphite to prevent rusting, and ensure easy removal any time. Care should be taken when replacing the wheels to screw the nuts absolutely tight. It is advisable to further tighten them after running a few miles if a wheel has been changed.

GENERAL UPKEEP

Apart from the instructions given with reference to lubrication, it is necessary in the course of general upkeep to make certain adjustment if the car is to be kept running at its highest efficiency. No definite times can be given when adjustments are to be made, as these naturally depend upon the conditions under which the car is run. Each month, or after 1,000 miles, it is advisable to look over the chassis, and make any adjustments necessary; these adjustments can easily be carried out if the following instructions are followed—

Valve Clearances—To ensure that silent and efficient running of the engine is maintained, the clearances between valves and tappets should be occasionally checked and adjusted if necessary. A set of special gauges is supplied in the tool kit, two of which give the correct clearances for the inlet and exhaust valves; these are carefully marked to avoid the wrong gauge being used. Remove the tappet cover and slowly turn the engine by the starting handle until the valve has closed and the tappet is free; then slacken the locking nut on the tappet, and adjust the top screw to the correct clearance; keep in position with a spanner, and tighten the lock nut. When the clearance adjustment has been made, the result should be checked, as tightening the lock nut will occasionally slightly alter the position of the tappet screw.

Magneto.—A book of instructions issued by the manufacturers is supplied with each car, which will

give any information required about the magneto. The following points should, however, receive attention—

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 with 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 47. 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.

When washing the car, care should be taken to ensure that water does not get on to the magneto or sparking plugs, for its presence on either will cause short circuiting, and therefore misfiring at the plugs.

It is occasionally necessary to readjust the platinum points of the contact breaker. This can easily be done with the small spanner provided by the manufacturers. Attached to the spanner is a small gauge which gives the correct gap between the platinum points when they are open.

Sparking Plugs.—It is very important that the points of the sparking plugs are set at equal distances in each cylinder, and that the gap should be about twenty-thousandths of an inch; this can be gauged by using the gauge provided, which is part of the combination tool in the kit. If a plug has a larger gap than another, then the engine will not run smoothly at slow speeds, and starting up will be difficult. After about 1,000 miles running, it is advisable to take out the plugs and correct the gap at the points, and thoroughly clean. When returning the plugs, care should be taken to see that the copper and asbestos washer is in good condition, and that the plug is screwed up tight; also that the wire is attached firmly by the terminal.

Fan Belt.—The fan being driven by a Whittle belt, it will be necessary, after running 1,000 miles or so, to make an adjustment to take up any slack in the belt. This can be done by the adjustable driving pulley. Remove the lock wire from the large outside nut, and slack the nut back a shade. Then screw up the outer flange into position desired, that is, until the belt is at the correct tension. Then lock the nut up and secure it with the spring wire. Care should be taken, when making an

adjustment, that the outer flange of the pulley should not be screwed up until the belt is very tight, as it is likely to break the belt when the engine is started.

Foot Brake.—As the Ferodo lining wears, an adjustment must be made to keep the brake efficient. The indication for adjustment of the brake is when the pedal pad is practically touching the floor board. The adjustment is made by a self-locking hand nut, which will be found under the floor board. Screw up this hand nut until a very small movement on the pedal applies the brake effectively. When the hand nut cannot be screwed in any further, it is necessary to renew the Ferodo lining. Never wait until the brake pedal pad is actually touching the floor board before making the adjustment.

Hand Brake.—The hand brake lever operates internal expanding brakes in the rear wheel brake drums, as explained on page 24. When an adjustment has been made by fastening the steel links to a further hole in rear brake levers, the hand lever may not then be correctly set. This can then be adjusted by the hand locking nut to be found on the near side of the gearbox. This brake should be adjusted so that the brake shoes are not touching when the hand lever is in its extreme forward position, but should start to grip when the lever has been pulled on two notches on the quadrant.

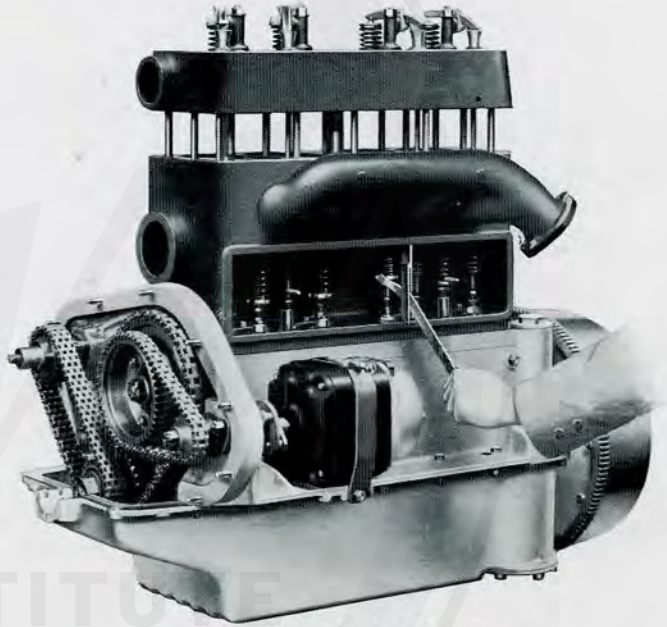
Petrol Feed.—Petrol is supplied to the carburetter by means of an Autovac tank fixed to the dashboard under the bonnet. This apparatus draws petrol from the main

tank at the back of the car, and operates automatically by suction created in the induction pipe of the engine. It is important that all unions on pipes leading from the Autovac to the engine carburetter, and petrol tank should be periodically examined to see that they are tight, as an air leak in the system will interfere with, or possibly stop, the petrol feed altogether. The functions of the Autovac tank itself are fully dealt with in a separate booklet which is supplied with the car. The petrol pipe union to the main tank at the back of the car is accessible by lifting the back cushion and seat board. A petrol level gauge and filler are fitted at the top of the main tank. The filler is arranged so that petrol may be poured in direct from an ordinary can, quickly and without loss, by means of a telescopic sleeve which remains permanently in the tank. When it is necessary to fill the tank the sleeve is drawn out and given half a turn, which fixes it in a position in which it stands well clear of the tank and luggage grid.

It is advisable to periodically turn on the tap of the petrol filter which is placed in the main pipe line between the Autovac tank and the rear tank, near to the Autovac tank on the dash. A smaller filter is incorporated in the Autovac tank, which should be attended to as instructed in the special booklet dealing with the instrument.

The filler cap on the rear tank should be occasionally examined to see that the air vents are clear; otherwise the Autovac tank will not function properly.

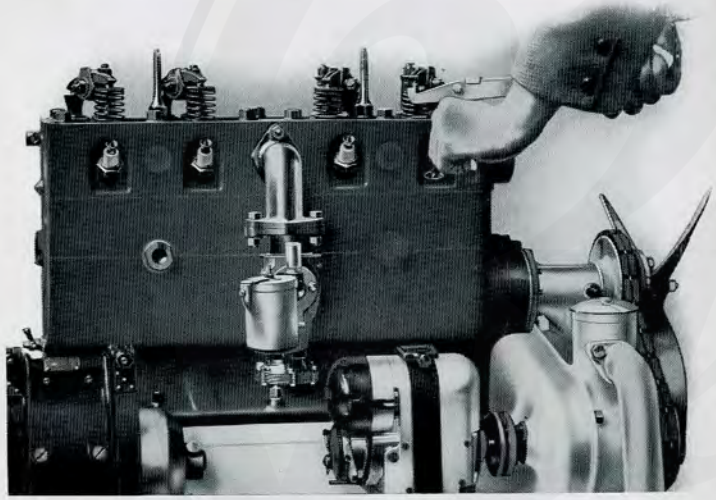
Decarbonising and Valve Grinding.—After the car has run several thousand miles, it becomes necessary to remove the cylinder head, and decarbonise the combustion chamber, and grind in the valves. The cylinder head can be removed by following the



Valve Lifting Tool—Exhaust

instructions given in the latter part of the book. When the head has been removed, the carbon deposit on the head round the valve ports, and on the top of the pistons, should be carefully scraped off. The valves should then be examined, and if the seatings show signs

of pitting or scaling, they should be re-ground. If they are in good condition, care should be taken to see that no carbon is left on the seatings before the cylinder head is replaced. To grind in the valves, take away the valve springs by using the special tool supplied in the tool kit, and put a very thin coating of paste (obtainable from any dealer) on the seat portion of the valve,



Valve Lifting Tool—Inlet

then lower the valve on to its seating, and with a screwdriver or brace twist 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 clean 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 the valves, the less paste that is used consistent with the necessary grinding the better for the valves.

The greatest possible care should be taken that no paste remains, as, should it get into the cylinder, 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, replace the springs and cotters on the valves, and refit the cylinder head.

OVERHAULING INSTRUCTIONS

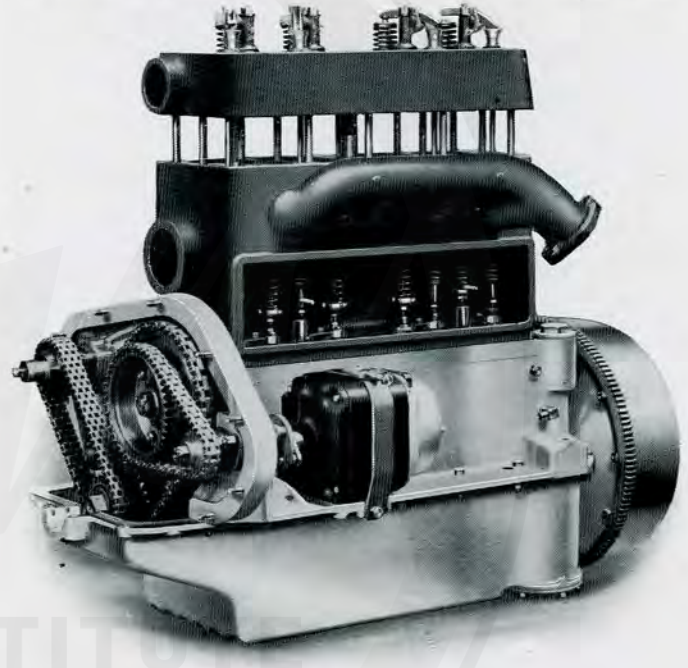
The period for which a car will run before it is necessary to overhaul it depends purely upon the way in which the car is driven, coupled with correct attention to lubrication &c.

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. Many cars are ruined by slipshod overhauling.

The methods 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.

To Remove Engine from Chassis.—Detach bonnet and stay between radiator and dashboard, drain out the water, disconnect the couplings, and take the radiator off. Uncouple the battery cables, and then disconnect the starter by rolling back the rubber sleeves and detaching joints in the starter wires. Disconnect the starter switch lever at its lower joint on the dashboard. Disconnect petrol and oil indicator pipes, exhaust pipe, and breather tube. Remove floor boards, and detach the coupling in between the clutch and gearbox. This is done by withdrawing the three nuts that secure the fabric disc on the clutch to the clutch coupling shaft. At the gearbox end, remove the three pins attached to the clutch withdrawal star piece,

leaving the fabric free. The clutch pedal can then be drawn back so that the star piece will move away and allow sufficient room for the coupling to be withdrawn complete. Remove the four bolts that secure the crankcase to the sub-frame, after which the engine can



Engine—Cylinder Head Lifted

be slung from a pulley block and withdrawn by moving it slightly forward until the flywheel clears the dashboard.

To Remove Cylinder Head.—Take off the bonnet and drain off the water from cooling system by taking out the plug from under the radiator. Release

the water jcint clip and slide back the rubber joint. Uncouple the Autovac suction pipe, the Autovac to carburetter pipe, the crankcase to cylinder head oil pipe, and the oil pressure indicator pipe. Remove the carburetter controls and carburetter, as this will probably get damaged if left on. Take off the head cover by unscrewing the two hand nuts. Unscrew all the nuts which hold the head down; two of these nuts also form studs for the head cover. When all nuts have been removed, ease the head by inserting a screwdriver in the slots provided. No sharp-pointed tool should be forced between the cylinder and cylinder head, as this will damage the packing or the machined faces, which will prevent a gocd joint being made. The head can then be lifted off.

Before replacing the head, the copper and asbestos packing or gasket should be carefully examined to see that it is in good condition. When replacing the head, screw the head down as tightly as possible to avoid a leakage between the cylinder and head; do not screw any one nut down as far as it will go at first, but tighten up each nut a little at a time, so that the nuts will be at approximately even tension.

To Remove Cylinders.—Take off radiator stay and remove cylinder head, as instructed above. Uncouple the exhaust pipe and unscrew all nuts securing the cylinder to crankcase, and then sling the cylinder from a pulley block and lift gently, taking care to see that the cylinder rises square with the crankcase. This is very important, as

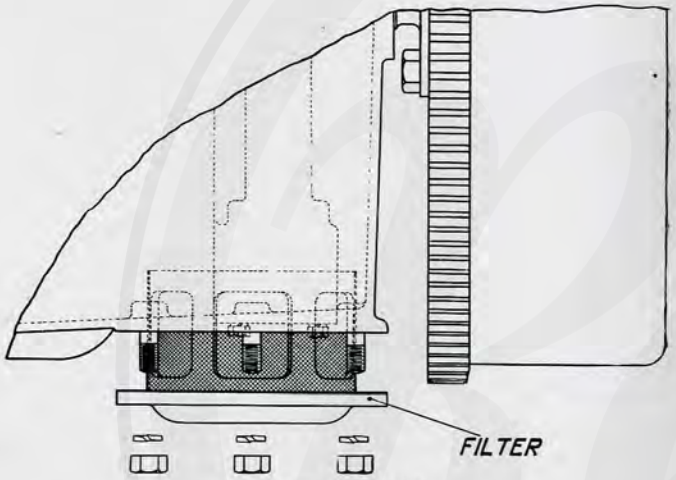
with aluminium pistons there is risk of the split skirts being broken. As the cylinder leaves the pistons these and the connecting rods should be held and gently moved over until the connecting rod rests against the side of the crankcase.

When replacing the cylinder, see that the joint washer on the crankcase is intact, and be equally careful about lowering the cylinder as true as possible. It will facilitate matters if the piston rings are held in place by a thin split spring steel band which can be moved down and taken off the pistons as the cylinder is lowered over the rings.

To Remove Oil Sump from Crankcase.—This is a fairly straightforward job if a pit is available, as part of the undershield covering the sump is detachable by unhooking four spring loaded clips. With this away, the sump can be dropped by unfastening the nuts round the flange which secures it to the crankcase. This will expose the whole of the crankshaft, its bearings, and the oil pump bracket. The latter can be detached by unfastening the three nuts that secure it to the top half of the crankcase and withdrawing it bodily.

To Remove Oil Filter from Sump.—First remove the undershield as instructed above, and drain out the oil from the crankcase by opening the drain plug. Then remove the six nuts securing the oil filter body to the sump; the filter, which is incorporated with the body, can then be withdrawn from the

sump. After the filter has been cleaned, care should be taken to see that the paper packing is intact before replacing the filter; otherwise the oil will leak through the joint.



Crankcase Oil Filter

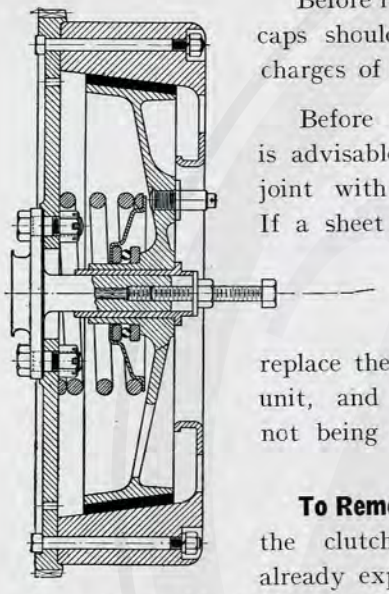
To Remove Timing Gear Cover.—Take off the radiator after draining away the water and releasing the stay. The rubber joints between the cylinder head and timing cover to radiator will, of course, have to be removed. Take off the fan belt, and lever the pulley off the shaft. Remove the nuts securing the cover to the crankcase, and take out the bolts holding it to the sump. The front cover can then be removed, disclosing the timing chains &c. Care should be taken to see that

the joint washer on the crankcase is not broken, otherwise the sump will have to be removed as well in order to replace the paper joints.

To Re-pack Impeller Gland.—A sectional view of this part is shown on page 12. After the car has run several thousand miles, it may be necessary to re-pack the impeller gland, as water may be leaking along the shaft and getting thrown out into the bonnet. To do this it is necessary to remove the complete impeller unit, which can be done as follows—Drain the water from the cooling system by unscrewing the plug at the bottom of the radiator, and detach the belt from the fan pulley. Take off the clip surrounding the rubber joint, and unscrew the four securing nuts at the base of the impeller body. The whole of the impeller unit should then come away. Detach the fan from its spindle and pulley, after which the lock wire and nut can be unscrewed to release the spring, when the old packing may be extracted by means of a hooked wire. The spindle should be polished, and it is also advisable to inspect the impeller blades and remove any corrosion that may be present.

To remove the impeller and its spindle, it will be necessary to detach the delivery chamber from the body. Before re-packing, the spindle should be well polished and re-fitted in its bearing. Re-pack the gland with a tallow cotton wick, and ram it up tightly so that the spring is fully compressed and just projecting from

the end of the bush when the nut and lock wire can be replaced.



Before running, both lubricator caps should be given three full charges of thick oil.

Before replacing the unit it is advisable to re-make the base joint with a little white lead. If a sheet of tin is placed over the water inlet in the cylinder block, it will be a simple matter to replace the rubber joint with the unit, and will ensure the ring not being caught in the jacket.

To Remove Clutch.—Take away the clutch coupling shaft, as already explained, and then take off the flywheel by taking out the bolts holding it to the flywheel plate.

To get the clutch out it will be necessary to remove the flywheel that is attached to the gear plate with which the starter engages, but before doing this there is a very strong spring inside which it is necessary to hold. A screwed hole will be found in the end of the crankshaft on which the clutch cone revolves. This can be exposed by removing the steel cap from the end of the clutch bush, so that a bolt some 3″ in length fitted with a nut and washer large enough to cover the

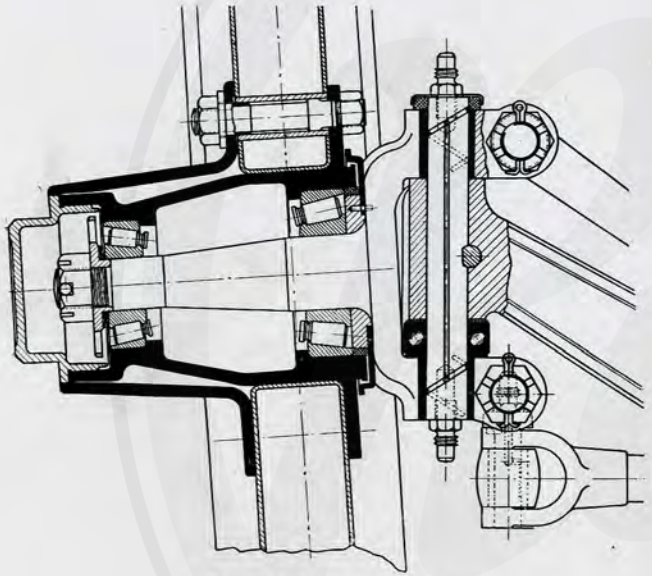
bush in the clutch cone can be put into the end of the crankshaft, and the washer screwed up to the bush, so that it will receive the spring tension when the flywheel is released, as illustrated on page 60. The clutch cone can be then easily taken off the extension of the crankshaft.

To Remove Clutch Withdraw Mechanism from Gearbox.—Remove the coupling shaft, already explained on page 54, and uncouple the clutch pedal from the withdraw arm on the gearbox. Remove the cap in which the trunnion works from the top of the gearbox, and withdraw the trunnion lever complete. Then remove the eight nuts from the circular flange on the front of the gearbox behind the three-armed driver, after which the whole of the withdraw mechanism will come away, together with the driver and its ball races. The stem wheel is withdrawn from the inside of the gearbox, so that it will first be necessary to remove the main shaft and the gears that slide on it.

To Remove Main Shaft.—Uncouple the propeller shaft and the flexible fabric from the foot brake drum. Remove the foot brake band and the nuts from the circular flange at the back of the gearbox. This will enable the main shaft with its bearing and thrust washer to be withdrawn bodily from the back of the gearbox.

To Remove Lay Shaft.—This cannot be withdrawn from the gearbox until the oil is drained off and the speedometer gears, locating shafts, and the gear changing forks are removed. When this is done, remove the plate from the lay shaft bearing at the brake end of

the gearbox, and detach the nut and ball race, so that the shaft with its gears can be lifted up at the front end and drawn out through the gearbox. This operation can better be carried out if the gearbox is removed from the chassis bodily.



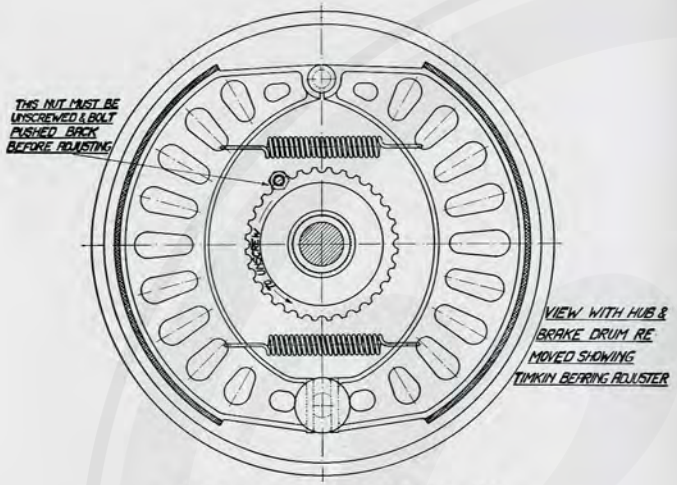
Front Hub Arrangement

To Remove and Adjust Front Hubs.—Detach the hub cap and remove the split pin and nut from the end of the wheel spindle. This will allow the safety washer and the packing washer behind it to

come away, after which the hub can be withdrawn bodily with its two bearings. It will be seen that the nut locks the safety washer up to a shoulder on the wheel spindle, so that the number of packing washers behind it will control the adjustment of the bearings. The wheel should run free when jacked up without any appreciable side shake. Care should be taken to see that the bearings are not locked up too tightly, because if this happens the hub is bound to overheat, which will ultimately destroy the bearings. If anything the bearings should be on the easy side. When fitting the packing washers see that they are flat; bent ones are useless, and should be replaced. It is also important to see that the felt washer at the inner end is in good condition, and that it is not crushed when the hub is re-fitted.

To Remove Rear Hubs.—Jack up the car and take off the road wheel, and remove the hub caps. After removing the split pins, unscrew the nut and take off the washer on the axle shaft. Insert the hub removal block, which will be found in the tool kit, and by using the largest bolt, also supplied, screw this up until the hub is forced off the tapered shaft. The brake drum will come away with the hub, so it is therefore necessary that the brake should be off before attempting to take off the hub.

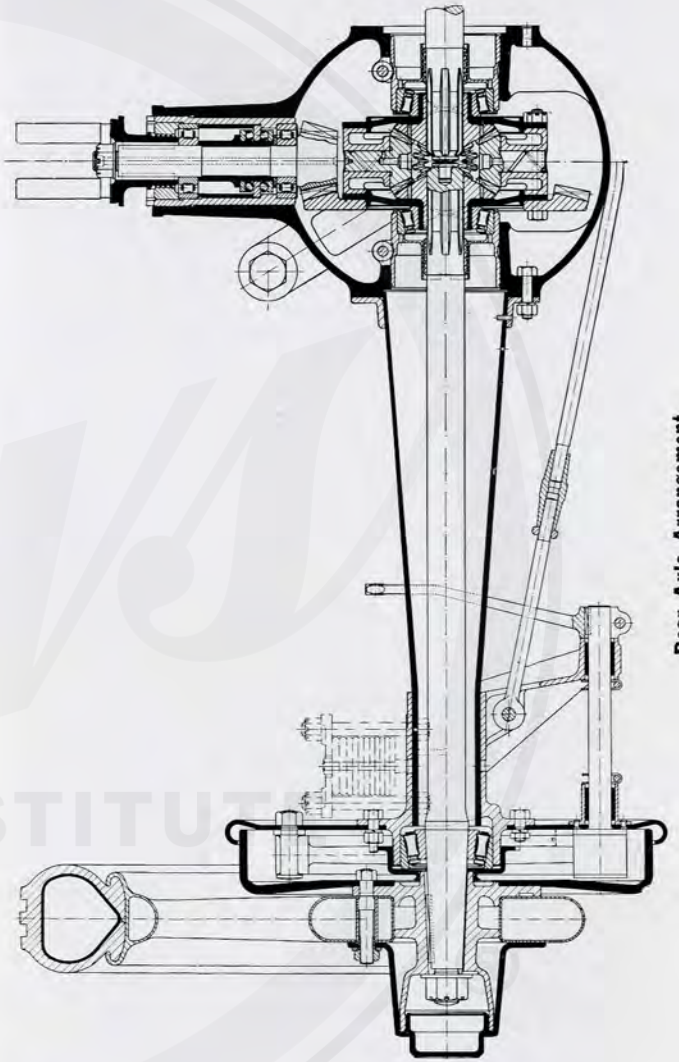
To adjust the bearings, slack off the spigot bolt and adjust the outer serrated sleeve until there is no slack in the axle shaft. Care should be taken to see that the sleeve holding the race is not screwed up too tightly.



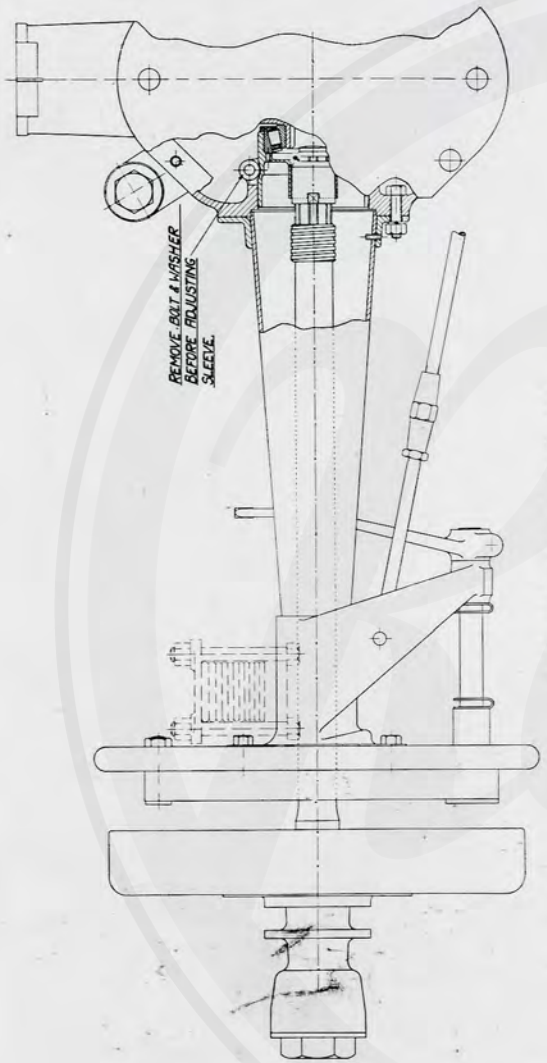
Rear Hub Bearing Adjustment

To Remove Bevel Pinion.—Remove the universal joint cover at the axle end of the propeller shaft by taking out the six small bolts. This will enable the propeller shaft to be dropped away from the jaws attached to the pinion. Remove the pinch bolt and locking plate in the ends of the axle casing, and unscrew the axle sleeve by using the "C" spanner which is provided in the tool kit. The sleeve will come away carrying the bevel pinion and its bearings.

The thread in the pinion sleeve which screws into the main casting is a very fine one in order that fine adjustment can be made on the pinion. If at any time it is necessary to adjust the mesh of the gears, a lock nut is provided with a suitable number of slots to assist in getting the correct adjustment for the gears.



Rear Axle Arrangement



Rear Axle Sleeve Adjustment

To Remove Bevel Gear Complete.—Remove the rear hubs, as explained above, and take out the hub bearings by unscrewing the sleeves. Draw out the axle shafts and remove the lid from the rear axle casing. Take out the two inclined pinch bolts inside the box, place the splined piece (which will be found in the tool kit) on the ends of the axle shafts, and insert the shaft slowly until the dogs on the splined piece engage with the slots in the bearing sleeves. Lightly replace the hub, which will enable the axle sleeve to be turned in a left-hand direction until the sleeve comes up against a stop. Repeat this operation on the other side, and then lift out the differential box complete with the crown wheel.

BODY WORK

In order to retain the lustre of the varnish, and to preserve the condition of the paintwork, it is necessary to take a small amount of trouble after each run. We therefore give below a few hints with regard to the upkeep of the body work.

Mud and dust should never be removed with anything dry, but always by using plenty of water. Should the body be covered with mud, it should be hosed very lightly, or the mud soaked with a sponge, when it can easily be removed. After the mud has been removed, the body, bonnet, and wings should be sponged, and finally a chamois leather should be used. The paint will become badly scratched if mud or dust is removed with a dry duster.

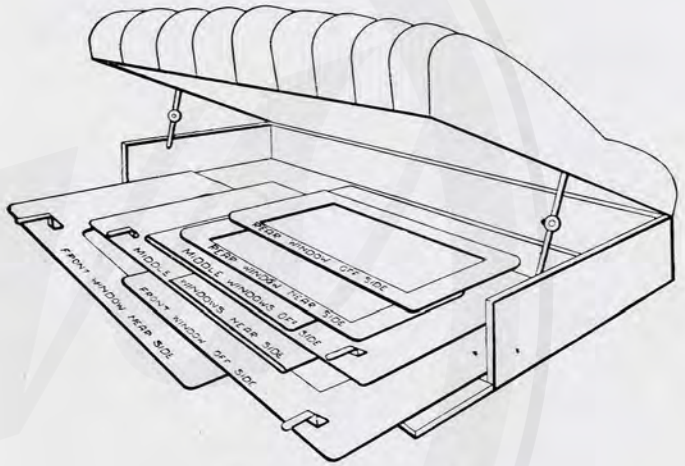
No chemicals, such as methylated spirits, paraffin &c. should be put into the water, or used in any way on the body, as it has a tendency to destroy the varnish.

All plated parts should also be washed and rubbed dry, and then rubbed over with a cloth soaked in vaseline to preserve the plating. The vaseline can easily be removed before it is necessary to polish the plated parts.

All hinges, dovetails, locks &c., and any working parts in the body should be wiped dry, and periodically the hinges and locks should be oiled and the dovetails greased, which will not only make the doors work more easily, but will prevent any chipping of the paintwork, which invariably happens owing to the fact that the

dovetails and striking plates get rusty, and thus doors are difficult to close and the vibration causes the paint to chip.

All mechanical window lift devices where provision is made for a trap door to adjust the lazy-tongs should be greased periodically.



Storage of Side Curtains

Loose carpets and mats should be removed, shaken, and brushed. If the carpets get wet they should never be allowed to dry on the floor of the car, but should be hung up to dry.

Cushions should be periodically taken out and brushed, and in the case of closed cars the doors should be left open when the car is in the garage.

Leather hoods of closed cars, i.e., landaulettes, all-weather models &c., should be treated every three months with Neatsfoot Oil. Leather hoods should never be left down in the garage.

In the case of the landaulette, care should be taken before the head is dropped to see that the body curtain rails are detached from the rear fixings, and let down to the pillar in a vertical position where a small bracket is fixed to accommodate them.

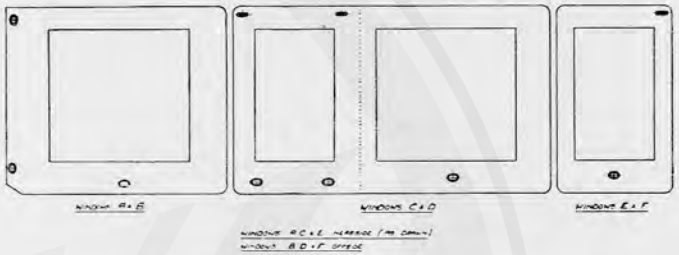
The removal of grease spots from the interior cloth upholstery can easily be obtained by the application of flannel soaked in benzine and rubbed lightly.

The application of a little soap and water will greatly improve the appearance of the leather upholstery, and will remove any deposit.

The hoods on the touring cars should always be left up for the material to dry, whether waterproof or leatherette. The hood joints and rivets should be oiled periodically.

The side curtains on the touring cars are housed in an accessible compartment under the front seat, and should be stored exactly as shown in the illustration. This is very important, as the celluloid panels will be scratched or otherwise damaged if the curtains are stored in a slipshod manner. The illustration is self-explanatory, and it will be seen that the metal tongue in all cases projects upwards, and that there is sufficient room for the upper panels to drop in between these projections.

Erection of Side Curtains.—The illustration shows one side set of curtains in position as fitted to the car. The rear windows "E" and "F" must be fitted first, followed by the double windows "C" and "D." The



rear door should be opened to permit the easy fitting of the metal tongue into its socket in the door; the eyelets can then be pushed over the turn buttons and the door closed.

The front panels "A" and "B" can then be fitted, and in this case also it will be found easier if the door is opened slightly. These panels are all supported by stiff frames, so that the front ones can be left in position independently of the hood for use as side curtains.

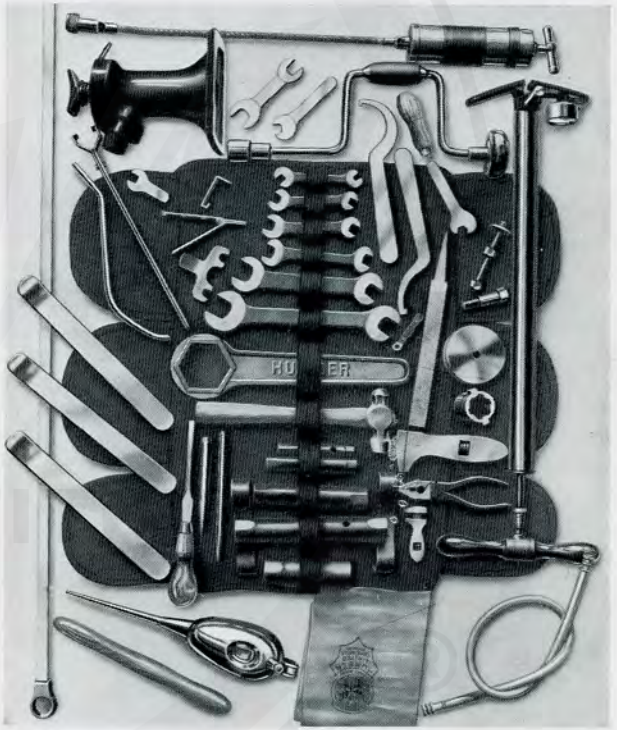
TOOLS AND SPARES

A tool kit is supplied with each car, consisting of the following—

***Wheel brace.**
Hub cap spanner.
***Lifting jack and handle.**
Three tyre levers.
Tyre pump with gauge.
Two adjustable spanners (large and small).
Set of box spanners and bar.
Six double-ended spanners.
One "C" Spanner.
Valve lifter (complete).
Valve holder.
Sparking plug box spanner.
Magneto spanner.
Two tappet spanners.
Tappet holder.
Union Spanner.
Carburetter union spanner.
Bearing sleeve adjusting tool.
Sleeve adjusting spanner.
Clutch removal screw, nut, and washer.
Hub removal block and bolt.
***Oil can.**
File.
Punch.
Hammer.
Screwdriver.
Pair of pliers.
Duster.
Spare sparking plug.
Grease gun.
Assortment of nuts, screws, split pins, and washers.

The tools marked with an asterisk are fitted under the bonnet, so that road wheels may be changed without disturbing the passengers. The remainder are fitted in a box provided under the front floor board on the near side.

When the car is despatched, a small box is put in the locker in the dash, which is filled with an assortment of bolts, nuts &c.



Tool Kit

LEGAL HINTS

Notes on Roads Act 1920

First licenses in respect of new cars can be obtained through a Local Authority, and can always be renewed by a Local Authority either on personal application, or by post, and in connection with any class or description of license. Applicants need not send in their old license, but should destroy it on receipt of the new one.

Renewals can be effected at certain post offices subject to the following conditions—

(a) You must go to a post office in the area of the Council with which your vehicle is registered.

(b) You must go there not later than 14 days after the old license has expired.

(c) You must give up your old license.

(d) You must get a new license of the same sort as the old one (i.e., a quarterly license if the old one was a quarterly, or an annual if the old one was an annual).

Licenses should only be issued by Local Authorities or at post offices in respect of vehicles which are ordinarily kept within the administrative area of the County, or in which the applicant has a permanent address.

Licenses cannot be issued without the Registration Book is produced. In the event of loss of the latter a duplicate may be issued by the Local Authority on payment of a statutory fee of 5/–.

The license when issued attaches to the vehicle, and not the owner thereof, and cannot therefore be transferred to another vehicle under any circumstances whatever.

In the event of loss or destruction of a license a duplicate can be issued on payment of a fee of 5/–.

Licenses can only be issued to expire at the end of the quarter in which obtained, or to the 31st December following. There are no statutory "days of grace" allowed for renewal, but licenses may be renewed 14 days before the period of expiry and 14 days after, and Local Authorities do not in fact take any action before the 14 days after the license has expired.

In the case of cars "proceeding to registration," Section 6 (2), Roads Act 1920, applies only to cases where a person proves that he has had no reasonable opportunity of registering the vehicle in accordance with this Section, and that the vehicle is being driven on a public road for the purpose of being so registered.

Where a car is used for more than one purpose, e.g., Hackney and Private, the vehicle must be assessed at the highest rate of duty applicable to any purpose for which it may be used.

Application forms are obtainable at any money order office, or from the County Licensing Authorities.

The index mark and registration number originally assigned to a vehicle can be used only on the vehicle to which such mark and number has been assigned.

Change of Address.—When the owner of a motor vehicle changes his address, the new address must be

inserted in block letters in the appropriate change space on the Registration Book signed and forwarded to the Authority with whom the vehicle is **then** registered.

Changes of Ownership.—When the ownership of a vehicle changes, the old owner must insert the name and address of the new owner in block letters in the appropriate change space in the Registration Book, **sign underneath the new entry as old owner,** and forward the book to the Authority with whom the vehicle is **then** registered.

The new owner must notify his (or her) Local Authority of the Purchase of the vehicle, quoting Index Mark and Number.

Subsequent to a change of ownership the license may be renewed only with the new registering Authority and after the particulars of the vehicle have been re-declared.

Drivers' Licenses.—Application forms can only be obtained through a Local Authority, and licenses should only be issued by the Local Authority in whose administrative area the applicant is ordinarily resident.

A license to drive a motor car can be issued in all cases where the applicant is over 17 years of age, and such license will permit of the driving of a motor car or motor cycle.

If a driver's license is lost or destroyed, a duplicate will be issued by the Authority who granted the original on payment of a fee of 1/–.

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 owners' interests may be protected by taking the name and address 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.

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 &c., by applying to head quarters.

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 be built with brick sides and a concrete base. Ventilation holes should be left in the brickwork, and the door should be of galvanised 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 90, 91, 92 and 93, 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 80, but we shall be pleased to give any further particulars that may be required.

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

Speed M.P.H.	1st Gear 15·8–1	2nd Gear 9·42–1	3rd Gear 6·73–1	4th Direct 4·33–1
5	857	511	365	235
10	1714	1022	730	470
15	2571	1533	1095	705
20	3428	2044	1460	940
25		2555	1825	1175
30		3066	2190	1410
35			2555	1645
40			2920	1880
45			3285	2115
50				2350
55				2585
60				2820

GENERAL PARTICULARS OF 15·9 H.P. HUMBER CARS

Number of cylinders	... 4
Order of firing	... 1, 2, 4 and 3
Bore of cylinders	... 80 m/m
Stroke of crank	... 140 m/m
Cubic capacity	... 2,815 c.c. or 169 cu. ins.
Brake horse-power at 1,000 revs. per minute	... 21
Brake horse-power at 2,000 revs. per minute	... 42
R.A.C. Rating	... 15·9
Tax	... £16
Wheel base	... 10′ 3½″
Track	... 4′ 9″
Size of tyres	... 820×120
Type of wheels...	... Detachable steel artillery
Ground clearance	... 9″
Petrol capacity...	... 13 gallons
Oil capacity of engine... ...	... 1 gallon
Number of teeth in crown wheel	... 52
Number of teeth in bevel pinion	... 12
Gear ratio on fourth or direct drive	4·33-1
Weight of chassis	... 1 ton 1 cwt. 3 qrs.
Weight of complete 5-seater car ready for road	... 1 ton 7 cwts.
Complete weight with saloon body	... 1 ton 8 cwts. 2 qrs.
Complete weight with landaulette body	1 ton 8 cwts. 2 qrs.
Overall length	... All models, 14′ 4″
Overall width	... All models, 5′ 8½″
Overall height with hood up—	
5-seater	... 6′ 4″
Saloon	... 6′ 7″
Landaulette	... 6′ 5″

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

BRITISH INDEX MARKS—*continued*

Index Mark.	Registering County or Boro' Council.
HE	Barnsley
HF	Wallasey
HH	Carlisle
HI	Tipperary, S. Riding
HJ	Southend-on-Sea
HK	Essex
HL	Wakefield
HM	East Ham
HN	Darlington
HO	Southampton (Co.)
HP	Coventry
HR	Wiltshire
HS	Renfrew
HT	Bristol
HU	Bristol
IA	Antrim
IB	Armagh
IC	Carlow
ID	Cavan
IE	Clare
IF	Cork (Co.)
IH	Donegal
IJ	Down
IK	Dublin (Co.)
IL	Fermanagh
IM	Galway
IN	Kerry
IO	Kildare
IP	Kilkenny
IR	King's County
IT	Leitrim
IU	Limerick (Co.)
IW	Londonderry (Co.)
IX	Longford
IY	Louth
IZ	Mayo
J	Durham
JI	Tyrone
JS	Ross and Cromarty
K	Liverpool
KA	Liverpool
KB	Liverpool
KC	Liverpool
KE	Kent
KH	Kingston-upon-Hull
KI	Waterford (Co.)
KK	Kent
KL	Kent
KM	Kent
KN	Kent
KS	Roxburgh
KT	Kent
KU	Bradford
L	Glamorganshire
LA	London
LB	London
LC	London
LD	London
LE	London
LF	London
LH	London
LI	Westmeath
LK	London
LL	London
LM	London
LN	London
LO	London
LP	London
LR	London
LS	Selkirk
LT	London
LU	London
LW	London
LX	London
LY	London
M	Cheshire
MA	Cheshire
MB	Cheshire
MC	Middlesex
MD	Middlesex
ME	Middlesex
MF	Middlesex
MH	Middlesex
MI	Wexford
MK	Middlesex
MN	Isle of Man
MO	Berkshire
MR	Wiltshire
MS	Stirling
MX	Middlesex
N	Manchester
NA	Manchester
NB	Manchester
NC	Manchester
ND	Manchester
NE	Manchester
NH	Northampton
NI	Wicklow
NK	Hertfordshire
NL	Northumberland
NM	Bedfordshire
NN	Nottinghamshire
NO	Essex
NP	Worcestershire
NR	Leicestershire
NS	Sutherland
NT	Shropshire
NU	Derbyshire
NW	Leeds
NX	Warwickshire
NY	Glamorganshire
O	Birmingham
OA	Birmingham
OB	Birmingham
OC	Birmingham
OE	Birmingham
OH	Birmingham
OI	Belfast
OK	Birmingham
OL	Birmingham
OM	Birmingham
ON	Birmingham
OR	Southampton (County)
OS	Wigtown
OT	Southampton (County)
P	Surrey
PA	Surrey
PB	Surrey
PC	Surrey
PD	Surrey
PE	Surrey
PF	Surrey
PI	Cork (Co. Borough)
PM	East Sussex
PP	Buckinghamshire
PR	Dorset
PS	Zetland (Shetland)
PT	Durham
PU	Essex
PW	Norfolk
PX	West Sussex
PY	Yorkshire, N. Riding
QQ	London
R	Derbyshire
RE	Staffordshire
RF	Staffordshire
RI	Dublin (Co. Boro.)
RK	Croydon
RL	Cornwall
RM	Cumberland
RO	Hertfordshire
RP	Northamptonshire
RR	Nottinghamshire
RS	Aberdeen (City)
RT	East Suffolk
RU	Bournemouth
RW	Coventry
RY	Leicester
S	Edinburgh
SA	Aberdeen (Co.)

BRITISH INDEX MARKS—*continued*

Index Mark.	Registering County or Boro' Council.
SB	Argyll
SD	Ayr (Shire)
SE	Banff
SF	Edinburgh
SG	Edinburgh
SH	Berwick
SJ	Bute
SK	Caithness
SL	Clackmannan
SM	Dumfries
SN	Dumbarton
SO	Moray
SP	Fife
SR	Forfar
SS	Haddington (E. Lothian)
ST	Inverness
SU	Kincardine
SV	Kinross
SW	Kirkcudbright
SX	Linlithgow (W. Lothian)
SY	Midlothian
T	Devon
TA	Devon
TB	Lancashire
TC	Lancashire
TD	Lancashire
TI	Limerick (Co. Boro.)
TH	Newcastle-on-Tyne
TO	Nottingham
TP	Portsmouth
TR	Southampton
TS	Dundee
TT	Devon
TU	Chester
TW	Essex
TX	Glamorganshire
TY	Northumberland
U	Leeds
UA	Leeds
UD	Oxfordshire
UE	Warwickshire
UF	Brighton
UH	Cardiff
UI	Londonderry (Co. Boro.)
UK	Wolverhampton
UM	Leeds
US	Govan (Glasgow)
V	Lanark
VA	Lanark
VS	Greenock
W	Sheffield
WA	Sheffield
WB	Sheffield
WI	Waterford (Co. Boro.)
WR	Yorkshire, W. Riding
WS	Leith
WT	Yorkshire, W. Riding
WY	Yorkshire, W. Riding
X	Northumberland
XA	London
XB	London
XC	London
XD	London
XE	London
XF	London
XH	London
XI	Belfast
XK	London
XL	London
XM	London
XN	London
XO	London
XP	London
XR	London
XS	Paisley
XT	London
XU	London
XW	London
XX	London
XY	London
Y	Somerset
YA	Somerset
YB	Somerset
YI	Dublin
YK	London
YS	Partick (Glasgow)

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	Serbia
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,
Watergate House, Adelphi, W.C.2.

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 .....

,, ,, Engine .....

,, ,, License .....

Registration Numbers .....

Driver's License Number .....

Date of Car Purchase .....

Insurance Policy Number .....

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

PERSONAL MEMOS.

Name .....

Address .....

Nearest Railway Station .....

Telegraphic Address .....

Telephone Number .....

Notes .....

.....

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.....

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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 preceding same, from the lighting-up times given for Greenwich on page 88. 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	-5	-4	-4	-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
Kendal	-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	5	6	7	7	6	5	5	4	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	-18
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	1/16	1/8	3/16	1/4	5/16	3/8	7/16
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	1/2	9/16	5/8	11/16	3/4	13/16	7/8	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	$\frac{5}{8}$	16	10	31	$19\frac{1}{4}$	46	$28\frac{5}{8}$	60	$37\frac{1}{2}$
2	$1\frac{1}{4}$	17	$10\frac{5}{8}$	32	$19\frac{7}{8}$	47	$29\frac{1}{4}$	70	$43\frac{3}{4}$
3	$1\frac{7}{8}$	18	$11\frac{1}{4}$	33	$20\frac{1}{2}$	48	$29\frac{7}{8}$	80	$49\frac{3}{4}$
4	$2\frac{1}{2}$	19	$11\frac{3}{4}$	34	$21\frac{1}{8}$	49	$30\frac{1}{2}$	90	$55\frac{7}{8}$
5	$3\frac{1}{8}$	20	$12\frac{3}{8}$	35	$21\frac{3}{4}$	50	$31\frac{1}{8}$	100	$62\frac{1}{8}$
6	$3\frac{3}{4}$	21	13	36	$22\frac{3}{8}$	51	$31\frac{7}{8}$	200	$124\frac{1}{4}$
7	$4\frac{3}{8}$	22	$13\frac{5}{8}$	37	23	52	$32\frac{1}{4}$	300	$186\frac{3}{8}$
8	5	23	$14\frac{1}{4}$	38	$23\frac{5}{8}$	53	$32\frac{7}{8}$	400	$248\frac{1}{2}$
9	$5\frac{5}{8}$	24	$14\frac{7}{8}$	39	$24\frac{1}{4}$	54	$33\frac{1}{2}$	500	$310\frac{7}{8}$
10	$6\frac{1}{4}$	25	$15\frac{1}{2}$	40	$24\frac{7}{8}$	55	$34\frac{1}{8}$	600	$372\frac{3}{4}$
11	$6\frac{7}{8}$	26	$16\frac{1}{8}$	41	$25\frac{1}{2}$	56	$34\frac{7}{8}$	700	435
12	$7\frac{1}{2}$	27	$16\frac{3}{4}$	42	$26\frac{1}{8}$	57	$35\frac{3}{8}$	800	$497\frac{1}{8}$
13	$8\frac{1}{8}$	28	$17\frac{3}{8}$	43	$26\frac{1}{2}$	58	36	900	$559\frac{1}{4}$
14	$8\frac{3}{4}$	29	18	44	$27\frac{3}{8}$	59	$36\frac{5}{8}$	1000	$621\frac{3}{8}$
15	$9\frac{3}{8}$	30	$18\frac{5}{8}$	45	28				

CONVERSION OF METRIC INTO ENGLISH MEASURE

1 millimetre is approximately $\frac{1}{25}''$, and is exactly ·03937″.

1 centimetre is approximately $\frac{1}{2}\frac{3}{5}''$, and is exactly ·3937″.

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.
Aberystwyth ...	West Wales Garages Ltd.	Union Street
Aberdeen	Rossleigh, Ltd.	112 High Street
Aylesbury	Orchard Bros.	
Berwick	Station Garage	18-22 Railway
Blackpool	Queen's and Brighton Motor Co.	Rawcliffe Street
Burnley	W. H. Harrison (Burnley), Ltd.	172 St. James Street
Blackburn ...	J. Walsh & Co.	Randall Street
Birmingham ...	Henry Garner, Ltd.	25 Hill Steeet
Buckley	W. G. Richardson	Central Hall Garage
Bath	Bath Engineering Co	3 & 11, Wells Road
Braintree	F. A. Bloomfield	32 Coggeshall Road
Bradford	Central Garage, Ltd.	4 Town Hall Square
Bridgewater ...	Real, Medland & Wills	St. Mary's Street
Bristol	Greer & Saunders, Ltd.	85 Park Street
Bideford	W. J. Pitt	Bideford Motor Works
Bournemouth ...	Motor Mac's	Holdenhurst Road
Blairgowrie... ...	Grassick's Garage	Commercial Street
Boston	Holland Bros., Ltd.	Bargate
Bedford	Wilson & Langley, Ltd.	49 Bromham Road
Buxton	W. R. Sanders (1920), Ltd.	Spring Gardens
Bury St. Edmunds	Mann, Egerton & Co. Ltd.	County Garage
Carlisle	Graham & Roberts	Botchergate
Cambridge	H. Robinson, Ltd.	2 Regent Street
Chelmsford... ...	Cleale & Hadler	London Road
Cheltenham ...	W. G. Tibbles Ltd.	College Road Corner, High Street
Chesterfield... ...	Holywell Motor Co.	Holywell Street
Congleton	J. H. Banks	West Street
Chester	Grosvenor Motor Co., Ltd.	41 Eastgate Street
Crewe	F. Wooldridge & Sons	High Street
Cardiff	J. Thomas & Co. Ltd.	Wellington Street
Cirencester	Bridges Garage, Ltd.	Castle Street
Darlington	George & Jobling	Blackwell Gate
Dorchester	Tilley's	South Street
Dumfries	A. Millar	Nith Street
Dundee	Rossleigh, Ltd.	23 Albert Square
Dunfermline ...	Normand & Thomson	Chalmers Street
Derby	Andrew's Garage	London Road
Dewsbury	E. A. Golby	Foundry Street
Exeter	Yeo & Davey, Ltd.	Sidwell Street
Edinburgh	Rossleigh, Ltd.	32 Shandwick Place
,, ...	Scottish Auto. Co. Ltd.	45 Lothian Road
Elton	W. R. Heighton & Sons	
Ely	A. Cass & Co.	St. Mary's Street
Frome	The Hobbs Motor Co. Ltd.	Christchurch Street
Fort William ...	Marshall & Pearson	
Frinton-on-Sea ...	Ratcliffe Bros.	Reliable Motor Works
Gloucester	Hartwell's, Ltd.	Northgate Street
Guernsey	J. G. Way	Pollett Street
Glasgow	Rossleigh, Ltd.	107 St. Vincent Street
,, ...	Scottish Auto. Co. Ltd.	132 St. Vincent Street
Galashiels	A. Purves & Son	5 Market Street

Town.	Name.	Address.
Gargrave	W. Gill & Sons	High Street
Grantham	Whipples Ltd	17 High Street
Grimsby	J. Plastow & Son	13 Osborne Street
Hereford	J. Fryer Ltd.	Green Dragon Garage
Harrogate	G. Mackay & Son Ltd.	West Park
Hull	J. B. Simpson, Ltd.	71-2 Prospect Street
Hawick	Croall & Croall	Bridge Street
High Wycombe ...	Davenport, Vernon & Co. Ltd.	
Inverness	J. Ferries & Co.	The Motor House
Ipswich	Mann, Egerton & Co. Ltd.	Carr Street
Jersey	Jersey General and Engineering Co. Ltd.	Tunnel Street
Kendal	H. J. Croft	90-2 Highgate
Kelso	Croall & Croall	Roxburgh Coach Works
Kettering	H. Taylor & Sons	Station Road
Kirkcaldy	Rossleigh Ltd.	Carlyle Road
Liverpool	Central Motor Co. (Liverpool) Ltd.	18 Newington
Lancaster	W. Atkinson & Sons (Lancaster), Ltd.	North Road
Leamington ...	G. Main & Co.	36 The Parade
Longton	T. Byatt	Heathcote Road
Letchworth ...	C. J. Mason	Mason's Garage, Eastcheap
Leeds	Central Garage Ltd.	16 Guildford Street
Leominster... ...	J. Fryer Ltd.	Borough Motor Works
Lincoln	Stocks (1920) Ltd.	Newland
Lynn	W. H. Johnson & Sons Ltd	35 St. James Street
Luton	B. E. Barrett	Union Street
Leicester	H. A. Hamshaw, Ltd.	37 Humberstone Gate
Lytham	W. & H. Williams Ltd.	Henry Street
Manchester... ...	T. Garner, Ltd.	12 Peter Street
Macclesfield ...	J. B. Ford	Bridge Street
Middlesbrough ...	C. McAdams, Ltd.	Linthorpe Road
Motherwell	Taggart's	Knowetop
Mansfield	Portland Motor Co. Ltd.	Leeming Street
Morecambe ...	Morecambe Motors	Harbour Garage
Nelson	J. S. Horsfall	40 Leeds Road
Newtown	Cookson's Garages, Ltd.	Severn Square
Nantwich	W. Chetwood	Hospital Street
Newbury	Stradling's, Ltd.	79 Northbrook Street
Newcastle, Staffs. ...	Newcastle Motor Co.	Bagnall Street
Newcastle-on-Tyne	George & Jobling	South Street
Newton Mearns ...	R. Anderson	
Newport-on-Tay ...	J. T. Young, Ltd.	The Motor House
Newport Pagnell ...	Salmons & Sons, Body Builders	
Northallerton ...	Metropo e Garage Northallerton), Ltd.	High Street
Northampton ...	Imperial Autocar Co.	Market Square Garage
,, ...	A. Mul'iner, Ltd.	Bridge Street
Norwich	Mann, Egerton & Co. Ltd.	Prince of Wales Road
Nottingham ...	R. Cripps & Co. Ltd.	Lower Parliament Street
Newark-on-Trent ...	C. E. Ford & Son	35 Appleton Gate
Oxford	F. E. Wootten, Ltd	55-56 High Street
Preston	Merigold Bros.	147 Church Street
Plymouth	R. Humm & Co.	Old Town Street
Portsmouth ...	Wadham Bros.,	Waterlooville

Town.	Name.	Address.
Perth	Valentine Motors, Ltd.	City Hall Square
Peterborough ...	W. R. Heighton & Sons	Lincoln Road
,, ...	Brainsby's, Ltd.	Brook Street
Ross (Hereford) ...	Ross Engineering Co.	The Motor House
Reading	W. Vincent	Broad Street
Rugby	G. T. Hilton & Co. Ltd.	North Street
Retford	C. Clark & Sons	48 Bridgegate
Rotherham ...	J. Clayton & Sons	Westgate
Rhyl	Grosvenor Motor Co.	Bodlor Street
Southport	R. Woodhead & Co. Ltd.	182 Lord Street
Shrewsbury ...	Foulkes, Wales & Co. Ltd	St. Julian's Friars
Swindon	Messrs. Hutton's	Devizes Road
Slough	B. A. Harris	163 High Street
Southampton ...	Motor Mac's	27 London Road
Stafford	Gaol Square Motor Works	Gaol Square
Stratford-on-Avon	F. Guyver & Son	Rother Street
Sleaford	Holland Bros.	
Sunderland ...	F. Turvey & Co. Ltd.	Holmeside Garage
Scarborough ...	Saville & Ezard Ltd.	Falconers Road
South Shields ...	R. Rigbye	Fowler Street
Sheffield	Freeman, Oakes & Co. Ltd.	Devonshire Street
Spalding	E. Blackburn & Son	Station Garage
Scunthorpe ...	Clarke & Co. (Scunthorpe) Ltd.	Oswald Road
Taunton	Marshalsea Bros	East Street
Trowbridge... ...	A. A. Bodman & Co.	Manvers Street
Truro	S. Hicks & Son	10 River Street
Tenby	G. Ace	Warren Street
Torquay	C. Moxham & Co.	23 Torwood Street
Uttoxeter	Miller	Amson Garage
Worcester	W. J. Bladder	52 Sidbury
Whitchurch ...	Joseph Hopley & Son	Dodington
Warrington ...	E. Garland & Son	134-6 Bridge Street
Wellingborough ...	York, Ward & Rowlett	Oxford Street Garage
Wisbech	W. H. Johnson & Sons	Harecroft Road
Wigan	H. H. Timberlake	28 King Street
Weymouth ...	Tilley's	The Esplanade
Westcliff-on-Sea ...	Woodyatt Motors Ltd.	Milton Road Garage
Yeovil	W. Sparrow & Sons	Osborne Garage
York	Leedham's (York) Ltd.	Lendal Bridge
,, ...	Myers & Burnell	Davygate

IRISH DEALERS

Athlone	Poole & Sons	Victoria Place
Athy	Duthie, Large & Co. Ltd.	Leinster Street
Armagh	D. H. McDowell & Co.	College Street
Belfast	Chas. Hurst, Ltd.	Montgomery St. Garage
Carlow	Jackson's Garage	
Castlebar	J. Bourke & Sons	Ellison Street
Cork	Club Garage	Lapps Quay
Clonmel	O'Gorman Bros. Ltd.	
Coleraine	Stuart Bros.	Bridge Street
Downpatrick ...	Porter & Wylie	Market Street
Dublin	J. O'Neill Ltd.	St. Stephen's Green

Town.	Name.	Address
Enfield, Co. Meath	J. A. O'Grady	
Enniskillen ...	J. Maguire	
Galway	J. J. Ward	The Motor House
Kells	G. Cooney, Ltd.	Cross Street
Londonderry ...	Alexander Motor Co.	Great James Street
Newry	Rowland & Harris	
Strabane	J. W. Buchanan	Railway Road

LONDON DEALERS

Ashford, Kent ...	C. Hayward & Son	32 New Street
Balham	H. Burt	60a Trinity Road, Balham
Bromley	Bromley Motor & Engineering Co.	Mason's Hill
Bognor	W. O. Jones	Belmont Street
Chichester	Adcock & Co.	East Street
Canterbury ...	G. R. Barratt & Sons	30 St. Peter's Street
Caterham Valley ...	Caterham Motor Co.	
Croydon	Allen Bennett Motor Co.	8 & 11 Royal Parade London Road
Ealing	Motor Surveys, Ltd.	33-51 Hangar Lane
Eastbourne... ...	Reid & Birbeck	1 Langley Road
Farnham	Heath & Wiltshire	Louth Street
Folkestone	Martin Waller, Ltd.	Sandgate Road
Guildford	A. Gray & Co.	Woodbridge Road
Golders Green ...	Saunders Garage and Motor Co.	31 The Parade
Hove	E. P. Prestwich & Co.	26 St. John's Road
Hawkhurst ...	Wm. Rootes	
London	Car Mart, Ltd.	297 Euston Road, N.W.1
,, ...	Car Mart, Ltd.	46-50 Park Lane
,, ...	Connaught Carriage & Motor Co.	121-2, London Acre, W.C.2
,, ...	Herbert & Mills	75 Great Portland St., W.1
,, ...	Vivian, Hardie & Lane	23 Woodstock Street
,, ...	Wilkins, Simpson & Co.	11 Hammersmith Rd., W.1
Maidenhead ...	C. W. Evans & Co. Ltd.	74 King Street
Maidstone	Rootes, Ltd.	
Putney	S. T. Robbins	96 Upper Richmond Rd.
Reigate	Wray Park Garage	61 London Road
Rochester	Strood Motor and Engineering Co. Ltd.	Strood Hill
St. Leonards-on-Sea	Skinner's	18 Western Road
Tonbridge	Chas. Baker & Co.	150 High Street
Waltham Cross ...	Fell Bros.	High Street
Weybridge	R. J. Shanks & Co.	Baker Street
Worthing	Wade's Garage	Chapel Road
Wimbledon... ...	Wimbledon Motor Co.	29 High Street

ENGINE will not START

- **Carburetter floods on lifting needle**
  - Spark at plug points
    - Air leakage — Throttle worn, flange loose on engine, bad joint — Inspect joint between engine and carburetter, and throttle valve in carburetter
    - Spark too weak to fire under compression — Plug points too far apart — Adjust points to ½ m/m apart
  - No spark at plug points
    - Spark at plug terminals
      - Faulty plug — Porcelain insulator cracked — Fit a new plug
      - Sooted plug points — Remove and clean with petrol and sandpaper
      - Weak spark — Space of plug points incorrect — Adjust points to ½ m/m apart
    - No spark at plug terminals
      - Contact breaker arm sticks — Broken spring or dirty joint
      - Pitted platinum points — Pitted from continual use
      - Faulty contacts — Carbons worn or not rubbing
      - Switch short circuiting — Control levers or rods loose — Examine, adjust and tighten
      - (Pitted platinum points / Faulty contacts) — See Magneto booklet
- **No petrol at Carburetter**
  - Petrol tap closed
  - Petrol tap open
    - Petrol pipe air locked — Filling tank after running dry — Unfasten pipe at carburetter until petrol flows
  - Petrol pipe clear
    - Float needle sticking — Dirt in carburetter — Remove float-chamber cover, clean needle valve and seat
    - Autovac needle valve sticking — Flood carburetter float chamber, start engine and give autovac tank a few smart taps with the hand

ENGINE Runs Imperfectly

- **Lacks power**
  - Constantly
    - Throttle valve does not fully open — Controls out of order — Examine ball joints and levers, adjust where necessary
    - Controls in order
      - Poor compression — Valves or piston rings worn — See if valves seat, grind if necessary; if no better examine piston rings, see pages 51 & 52
      - Valves need grinding — Worn or pitted seats — After grinding valves, test clearance between valve stem and tappet, see page 45
      - Choked silencer — Inside choked with soot — Test by running engine with exhaust pipe uncoupled if engine slows down on replacing pipe, clean out pipe and silencer
      - Incorrect valve timing — Tappets out of adjustment — Examine and adjust if necessary, see page 45
  - At intervals
    - Partial obstruction of petrol — Examine petrol pipe, filter and tap
    - Insufficient lubrication — Lack of oil in sump or dirty filter — Examine oil level gauge, clean filter, see page 57
    - One or more valves sticking — Examine valve springs, if right clean valve stem, push rod and guide hole where tight
- **Engine knocks**
  - Pre-ignition — Overheating or excessive carbon deposit — Examine cooling system, if right look for carbon deposit in cylinders
  - Overheating — Driving with spark retarded or loss of water — Examine position of advance lever and connections, inspect water level
  - Insufficient lubrication — Lack of oil in sump, dirty filter, or failure of oil pump — If knock is very pronounced one or more engine bearings are run out
- **Engine fires irregularly**
  - Spark irregular at plug points
    - Sooted plug — Find which cylinder misses, remove and clean plug
    - Soiled contact-breaker
    - Soiled distributor
    - Occasional short circuit
    - (Soiled contact-breaker / Soiled distributor / Occasional short circuit) — See Magneto booklet
    - Wet or oily plugs, loose connections — Find cylinder, clean plug or examine wire, see page 45
  - Spark regular at plug points
    - Weak mixture
      - Jet stopped, bad inlet flange joint — Remove and clean jet, see carburetter booklet. Inspect inlet flange joint
      - Air leaks in autovac system — Tighten screws round top of Autovac tank, and all union nuts in system
    - Starved carburetter — Poor flow of petrol, needle valve sticking — Remove float-chamber cover, examine and clean test flow of petrol
    - Broken valve or spring — Remove valve cover, replace broken part

ENGINE STOPS

- **Petrol in Tank**
  - Spark at plugs
    - Carburetter working
      - No petrol — Tank empty, or filter choked — Examine tank first
      - Controls not working — Joint disconnected or loose lever — Examine all joints from accelerator and hand lever to carburetter
      - Overheating — Loss of water or spark retarded — Examine water level in radiator, and position of advance lever
      - Air leakage — Loose inlet pipe joint; bad washer, worn throttle valve — Examine by applying thin oil to joints and looking for air bubbles
    - Carburetter not working
      - Choked pipe or filter — Badly filtered petrol — Remove and clean
      - Punctured float in carburetter or autovac tank — 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, extract any fluid by warming the float, and seal with a spot of solder
      - Flooded float-chamber — Dirt in needle, valve, or punctured float
      - Float needle sticking — Remove float-chamber cover, examine and clean valve, seat, weights &c.
  - No spark at plugs
    - No spark at Magneto
      - Contact-breaker sticking
      - Pitted platinum points
      - Broken carbon bushes
      - Failure in condenser
      - Failure of insulation
      - (Contact-breaker sticking / Pitted platinum points / Broken carbon bushes / Failure in condenser / Failure of insulation) — See Magneto booklet
      - Wet terminals or plugs — Examine and clean plugs
      - Magneto coupling unfastened — Clamp screw loose — Re-time and lock up nuts
    - Spark at Magneto
      - High-tension wires short circuit — Insulation worn, cracked or burned — Examine and refit new wires where necessary

Oil Pressure Gauge fails to work

- **Oil in sump**
  - No oil in sump — Always see that level is not too low
  - Oil gauge tube stopped — Uncouple at gauge, clean if no oil issues
  - Oil pump working
    - Insufficient pressure of oil — Filter partly clogged — Remove and clean filter
    - Oil channel choked — See if oil issues from crank chamber when union to indicator is disconnected; if it does not, have

			Spark regular at plug points	Weak mixture	—Air leaks in autovac system	Tighten screws round top of Autovac tank, and all union nuts in system
				—Starved carburetter	Poor flow of petrol, needle valve sticking	Remove float-chamber cover, examine and clean test flow of petrol
				—Broken valve or spring		Remove valve cover, replace broken part
ENGINE STOPS	**— Petrol in Tank —**			—No petrol	Tank empty, or filter choked	Examine tank first
				—Controls not working	Joint disconnected or loose lever	Examine all joints from accelerator and hand lever to carburetter
		—Spark at plugs—	—Carburetter working—	—Overheating	Loss of water or spark retarded	Examine water level in radiator, and position of advance lever
				—Air leakage	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	Badly filtered petrol	Remove and clean
				—Punctured float in carburetter or autovac tank		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, extract any fluid by warming the float, and seal with a spot of solder
			—Carburetter not working—	—Flooded float-chamber	Dirt in needle, valve, or punctured float	
				—Float needle sticking		Remove float-chamber cover, examine and clean valve, seat, weights &c.
		—No spark at plugs—	—No spark at Magneto—	—Contact-breaker sticking		
				—Pitted platinum points		
				—Broken carbon bushes		See Magneto booklet
				—Failure in condenser		
				—Failure of insulation		
				—Wet terminals or plugs		Examine and clean plugs
				—Magneto coupling unfastened	Clamp screw loose	Re-time and lock up nuts
			—Spark at Magneto—	—High-tension wires short circuit	Insulation worn, cracked or burned	Examine and refit new wires where necessary
Oil Pressure Gauge fails to work	**— Oil in sump**			—No oil in sump		Always see that level is not too low
				—Oil gauge tube stopped		Uncouple at gauge, clean if no oil issues
			—Oil pump working—	—Insufficient pressure of oil	Filter partly clogged	Remove and clean filter
				—Oil channel choked		See if oil issues from crank chamber when union to indicator is disconnected; if it does not, have engine examined
			—Oil pump not working—	—Filter choked		Remove and clean filter, If pump still fails to deliver, remove bottom of crank chamber and inspect pump, suction port and gears
				—Gears worn		
Starting motor fails to start Engine		—Turns engine slowly—	—Battery run down—	—Leaving car standing with headlamps on		Use light sparingly and starter not at all until battery is charged by about 5–10 hours' running
				—Leak of current from battery		Battery will gradually run down while car is standing; get electrician to trace leak and rectify
				—Insufficient charging		Charge always while running in winter time and intermittently in summer time
			—Oil in engine too thick		Low temperature or old oil	In case of old oil, clean out sump and recharge with fresh oil.
			—Engine stiff or partly seized up			Examine engine instructions for remedy Analyse in accordance with instructions—"ENGINE WILL NOT START"
			—Switches on starter do not make proper connections			Examine and adjust
		—Fails to move—	—Broken connection—	—In battery		Examine and return for repair
				—At battery, starter or starting switch terminals		Rectify, tighten and smear with vaseline
			—Bad contact at—	—Battery terminals		Examine, clean, tighten and smear with vaseline
				—Starter switch contacts		Examine and clean
				—Brush on commutator		Make sure brush is sliding freely in brush-holder, and trigger is pressing brush on commutator with sufficient spring tension
Dynamo fails to Generate	**Dynamo revolves**	—Fuse blown—	—Open circuit between battery and switchboard		Bad contact at battery or dynamo terminals	Examine, clean, tighten, smear with vaseline and fit new fuse
		—Fuse intact—		—Short circuit in armature		Return dynamo
				—Bad contact of brushes on commutator		Make sure they are all moving freely in their holders, and that trigger is pressing brush on commutator with sufficient spring tension
	Dynamo does not revolve				Broken chain or coupling	Remove timing gear cover and inspect
Lamps burn out			—Brilliance of light increases with speed of car until eventually bulbs burn out		—Bad connection at battery terminals	Examine, clean, tighten and smear with vaseline
			—Bulbs show cloudy appearance		—Cracked bulbs	Replace

Electrical running Instructions are fully explained in the C.A.V. booklet supplied with the Car.