A Book of

THE ALPS

ARMSTRONG
SIDDELEY

To be kept on the Car

THE BOOK OF THE

14 h.p.

ARMSTRONG SIDDELEY

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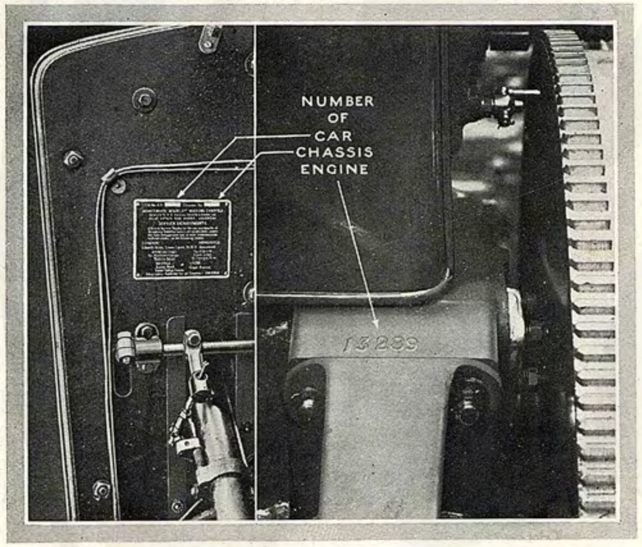

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Introduction

THE particulars of the four-cylinder Armstrong Siddeley Car, and the instructions and advice concerning its upkeep and management given in the following pages, are provided to assist users in running and maintaining their cars to the best advantage. Simplicity in maintenance is an acknowledged feature of this chassis, and the instructions as to lubrication and adjustment are such as can easily be carried out, even by drivers with a very limited knowledge and experience.

Some of the methods by which access to various parts is obtained are described to enable the parts to be reached, and if necessary removed with the least possible waste of time. In cases where large overhauls are necessary the work is best done at one of our Service depots which, being staffed and stocked from headquarters, are always at the service of owners.

No attempt has been made to describe in detail those parts that require no attention in the course of upkeep, it being considered that such information would serve no useful purpose in a booklet of this nature. Nevertheless an endeavour has been made to give the user a general idea of the design and function of the various units, for it is believed that interest in the upkeep and running of the car, and appreciation of its qualities, will be respectively stimulated and enhanced by the descriptions of its various parts and the particulars concerning their individual purpose and operation.

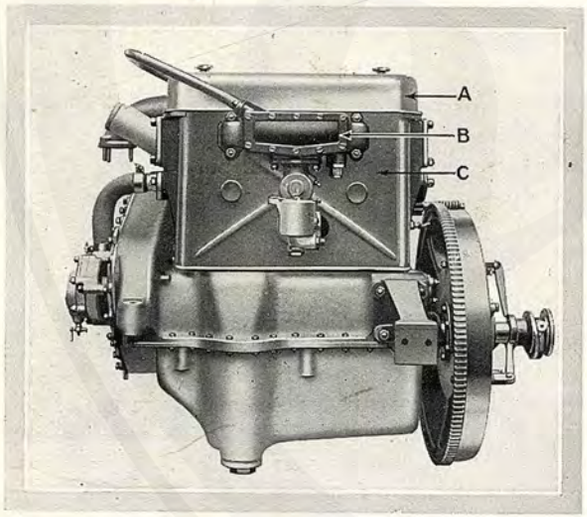
In two or three cases reference is made to means of adjustment provided for no purpose other than to facilitate erection in course of manufacture and re-erection after an overhaul. They are mentioned only to provide information that should prevent their being interfered with in ignorance as to their purpose, and a warning is given in each instance that the adjustment in question should not be varied by users. If these warnings be heeded there will be no risk of either damage or unsatisfactory running occurring as a result of mal-adjustment.

The Engine—General Description.

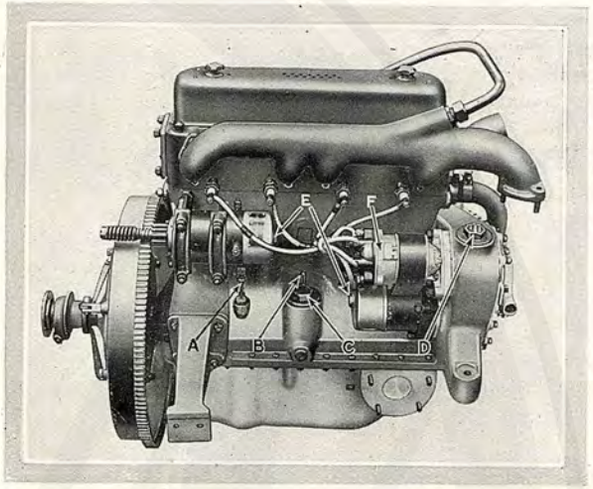
THE main features of the four-cylinder engine are the detachable head covering the push rod operated overhead valves, the cylinder block and upper half of the crank case which are cast in one piece, and the aluminium oil sump which has a capacity of from $1\frac{1}{4}$ to $1\frac{1}{2}$ gallons. The three bearing crankshaft is housed in the combined crankcase and cylinder block, to the rear of which are bolted two engine bearer arms with their outer ends attached direct to the side members of the frame. The forward end of the main casting forms the major portion of the timing case and also the front two bearer arms which rest on diagonal frame members. The front of the timing case is sealed by an aluminium plate.

The push rods and overhead rocker gear are enclosed by easily detachable covers, the former being driven by a three-bearing camshaft located on the near side of the crankcase and operated by a roller chain. The centrifugal water pump is coupled to the front end of the camshaft and located outside the timing cover.

The single roller chain not only drives the camshaft but also the magneto and dynamo, these two accessories being located one above the other on the off side of the engine. The carburettor with its exhaust



Near side view of the engine, showing A, easily detachable valve cover ; B, detachable jacket on the inlet pipe and C, the push rod cover. The oil drain plug at the base of the sump should also be noted.



Off side view of the engine, showing A, oil level indicator ; B, oil pressure relief valve ; C, oil strainer cap ; D, oil filler cap ; E, starter and dynamo lubricators and F, magneto lubricator.

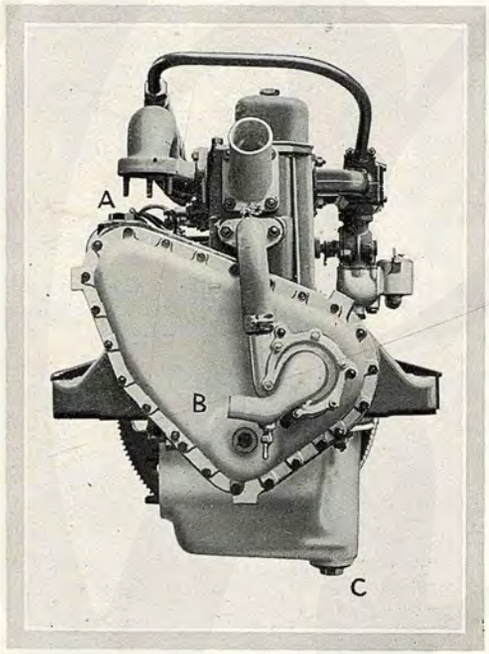
heated branch inlet pipe is located on the near side, while the exhaust manifold which discharges forward is found on the off side. The sparking plugs, oil filter, oil filler and oil level gauge are also conveniently situated on the off side, as is the electric starter.

For all general work the main portion of the engine casting should be left in the frame, the head being removed for decarbonising purposes, and the aluminium base chamber dropped to secure access to the pistons, connecting rods, main and big end bearings.

DECARBONISING THE ENGINE.—The carburation, lubrication and cooling systems are so efficient that it is very seldom necessary to decarbonise the combustion chambers, distances of over 10,000 miles often being covered before the head need be removed. The operation is then a perfectly straightforward task. To commence with, the water must be drained out of the system by turning on the main drain tap at the base of the pump and the secondary drain tap at the back of the rear cylinder. The former is " on " when turned in a horizontal position, while the latter is " on " when the handle is pointed upwards, the object of these settings being to prevent either tap vibrating on in the ordinary course of running.

When the water system is empty the taps should be turned off. The water connection between the cylinder head and the radiator

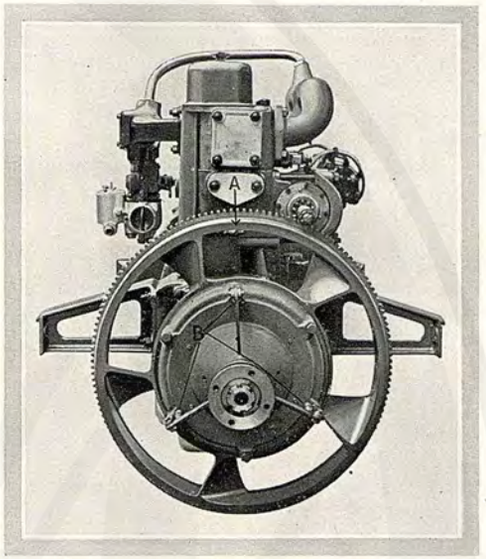
must next be broken and the exhaust manifold separated from the exhaust pipe. The high tension wires must be removed from the sparking plugs, the petrol pipe disconnected from the carburettor, and the branch inlet pipe freed from the ports of the cylinder to let the carburettor and inlet pipe be removed as one unit. The rocker cover having been raised, the eight nuts which hold the two rocker shafts to their supporting posts must be removed to enable the shafts to be withdrawn upwards as two complete units. The eight push rods must be



A front view of the engine. A shows where the exhaust pipe should be detached from the manifold, B indicates the water pump and drain tap and C the oil drain plug at the base of the sump.

withdrawn from their passages and the 14 cylinder head holding down nuts can be removed. The head should now come away from the cylinder block. If it is at all reluctant it can be wriggled sideways by grasping the front water connection or the exhaust manifold, as a certain amount of clearance is provided between the cylinder block studs and their holes in the head.

The combustion chambers and piston crowns can now be cleaned, care being taken to prevent carbon deposit from finding its way between



A rear view of the engine. A shows the water drain tap at the back of the cylinder block, while B indicates the three adjustable plungers that regulate the clearance between the clutch operating pad and clutch. (See page 47).

the pistons and cylinder walls. The best method of overcoming this difficulty is to fill up with clean rag the two pistons which are at the bottom of their strokes, while the other two, which are at the top of their strokes and lie practically flush with the cylinder platform, are being scraped.

TWO HINTS.—When raising the head it is inadvisable to attempt to force a screwdriver or other sharp instrument between the head and cylinder platform, as this procedure will almost certainly damage the copper and asbestos gasket. A tap with a wooden mallet on the side of the head should assist in breaking the joint. Another method is to crank the engine and allow the compression to raise the block.

When the head has been replaced the corner nuts should be tightened equally gradually, the intermediate nuts following so as to distribute the pressure evenly on the whole surface and ensure the making of a water and compression tight joint.

When the engine has been run after a top overhaul, it may be possible to tighten up the holding down nuts slightly.

REMOVAL OF PISTONS.—It is necessary to drop the aluminium base chamber to undo the big ends of the connecting rods and to withdraw the rods and pistons sideways and downwards. To enable the base chamber to be dropped the trays around it must first of all be undone. It is then necessary to loosen the clip at the bottom of the steering column, the two control rod clips above it, the spherical housing which accommodates the column and is attached to the driving side of the dashboard and the bracket locking the column against the instrument board. The column can then be pulled upwards out of the steering box, which is then dropped with the base chamber.

The pistons are attached to the small ends of the connecting rods by fully floating gudgeon pins, located in the piston bosses by spring rings. Two compression and one scraper ring are used, a row of holes below the latter allowing the oil which has been scraped from the piston walls to return to the interior of the piston.

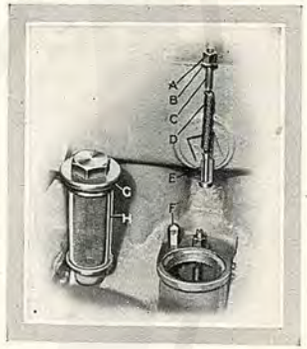
THE LUBRICATION SYSTEM.—Oil can be introduced into the engine either by removing the plug on the off side top of the timing cover, or by pouring it through the hole which is disclosed in the head between the two rocker shafts when the rocker cover has been removed. The oil then takes up its level in the sump whence it is sucked up by a submerged, self priming gear type pump driven from the camshaft and forced through the oil filter into a gallery, the front end of which is tapped so as to feed the timing chain. The gallery supplies the three main bearings from which the big end bearings are lubricated through the drilled crankshaft. Passages from the main bearings convey the oil to the three camshaft bearings, splash alone being relied upon to feed the alloy pistons and fully floating gudgeon pins. Below the suction pipe on the pump is the crankcase drain plug which incorporates a gauze strainer so that all the oil passing into the pump receives a preliminary filtering at this point. The overhead rocker gear and the push rods are lubricated by hand and require periodical attention, for which purpose it is necessary to remove the rocker cover occasionally. A lead from the rear end of the main oil gallery is connected to the oil pressure gauge on the instrument board. The pump housing is attached to the upper half of the crankcase and can be removed when the base has been dropped.

RE-FILLING WITH OIL.—As stated above, the oil can be poured in through the cylinder head orifice, or through the hole in the off side top of the timing case. The former method makes it possible to lubricate the rocker bearings, balls and push rods at the same time, while the latter, by enabling a large funnel and strainer to be employed, probably saves time. When re-filling care should be taken to see that the car is standing level, otherwise an erroneous reading of the oil level gauge will be obtained.

Oil should be filled in until the head of the level indicator, which is located almost midway along the off side of the crankcase, reaches the red line marked " full " on the vertical plate behind it, and under no circumstances should the indicator be allowed to drop below the lower red line. The action of the indicator is controlled by a cork float which is covered with shellac and rests in the oil in the base chamber.

The indicator spindle should be kept clean so as to allow it to work freely in its guide, the head of the indicator being revolved occasionally to ensure that the spindle is not sticking.

When filling up with oil it is always advisable to use a strainer of fine mesh, as impurities are sometimes present in the oil or oil can. It is therefore better to prevent them entering the engine than to depend upon the filter to hold them back from the oil ways. The recommended oil is Armstrong Siddeley Filtrate, the high lubricating value of which was proved by us during the war in the course of testing aeroplane engines, developing a total of over 2,000,000 h.p. This oil maintains



Details of the oil filter and pressure relief valve, the latter being shown both in position and exposed separately. A, lock nut; B, washer; C, adjusting screw; D, spring; E, valve; F, cap, G, filter cap and H, gauze filter.

an exceptional body under heat and yet retains its fluidity at cold temperatures so as to ensure a ready flow through the feed pipes. Lastly, it is of the correct weight to give the best results on Armstrong Siddeley engines.

After the first 500-1,000 miles' run, the oil left in the sump should be drained off from the plug in the base chamber. The engine can then be re-charged with fresh oil, the old oil being drawn away. The cleaning out of the sump with paraffin preparatory to refilling with fresh oil is unnecessary and only tends to stir up or loosen the residue which would otherwise remain safely out of the way at the bottom of the sump.

THE OIL FILTER.—The oil filter, which is discovered by removing the brass hexagon nut located midway along the off side of the crankcase, should be removed and cleaned after every 1,000 miles

run. Its upper end is sealed by the brass hexagon nut, and care should be taken when replacing the gauze and the nut to see that the latter fits over the rounded outer edge of the former. The oil enters the interior of the cylindrical filter from the lower end and passes through the gauze, thus leaving all the impurities inside. If the gauze is obstructed the pressure indicated by the gauge on the instrument board is proportionately reduced, this being the usual cause of any reduction of pressure as shown on the oil gauge.

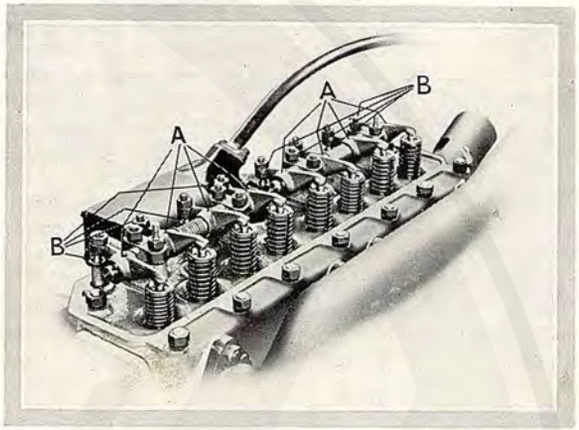
THE OIL PRESSURE GAUGE.—The oil pressure gauge is located on the instrument board, an external pipe connecting it with a union fitted on the rear end of the main oil gallery in the crankcase.

The pressure is generally adjusted at the works, when the engine is warm, to between 20 and 25 lbs. per sq. inch at 25 to 30 m.p.h., and in no case should fall below 10 lbs. pressure at touring speeds, although it may do when the engine is idling. When the engine is started from cold the pressure may rise until the lubricant is warmed up, but no anxiety should be felt on this account, as the pressure will soon return to the normal.

OIL PRESSURE RELIEF VALVE.—The oil pressure relief valve is situated immediately behind the brass filter cap nut, and as it is adjusted at the works to suit the engine, should not require any attention in the usual course of maintenance. Its function, as its name implies, is to allow any surplus pressure of oil to pass back into the crankcase instead of flooding the bearings. The valve operates against a coiled spring, the upper end of which is hung on to a rod which can be screwed into or out of the crankcase and so located in any desired position. If the rod is unscrewed the tension on the spring is obviously increased, and the surplus pressure of oil will have greater difficulty in opening the valve. The adjustment of the valve is covered by a thimble nut which is visible in a vertical position behind the brass filter cover nut. Unscrewing the spindle increases the tension on the spring and so also increases the oil pressure. The spindle is secured by a locknut.

CHOICE OF OIL.—Recommended grades of lubricant for different purposes will be found on page 67, but, when these are not available, it must be remembered that to attempt to mix with these mineral oils a vegetable oil, such as castor, is highly deleterious to the bearings. If an owner desires to change over from a mineral to a vegetable oil, or vice versa, the whole lubrication system should be drained out before refilling with the new lubricant.

LUBRICATION OF OVERHEAD VALVE ROCKERS.—Every 200 miles the cover enclosing the overhead valve rockers should be removed and the eight rocker bearings and push rod cups should be douched with oil from the oil can which is conveniently mounted on the engine side of the dashboard. No harm is done by allowing some



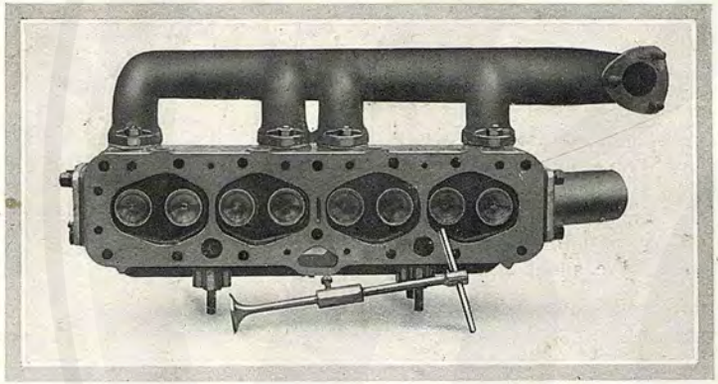
Oil should be periodically applied to the rocker bearings at A, and the cup and ball joints between the push rods and adjustable tips of the rockers at B.

of the oil to flood into the recesses on which the valve springs are mounted, for a certain amount of lubricant is beneficial to the valve stems and their guides.

It will be noted that a wick is provided in the roof of the rocker cover. This may be saturated in oil through the holes provided and will help to maintain the silent and efficient running of the overhead valve gear.

Illustrating a simple method of removing a valve described on the next page. The cylinder head is laid on four specially shaped blocks of wood similar to those shown and thus prevents the valve from sinking when the spring is depressed in the manner shown.

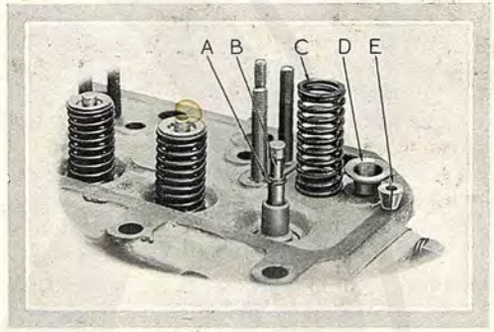
CARE OF THE VALVES.—The valves are interchangeable and can be removed for inspection by raising the cylinder head and placing its combustion chambers downwards on a lump of wood roughly conforming to the plan of the chamber. The valve springs can then be depressed without the valves dropping, and the split cones pushed out of the collars with a sharp pointed instrument. The best tool for depressing the valve spring is a steel strip provided with a hole rather smaller than the valve cup. The strip of steel can then be placed over the cup, and pressure being applied to it, results in the freeing of the split cones. Before removing the valve the circlip round the outer end of its stem must be withdrawn, the object of this clip being to prevent the valve dropping into the combustion chamber in the unlikely event of a breakage of the collar occurring.



Looking up into the combustion chambers towards the heads of the valves. Below is shown how the special valve grinding tool is attached to a valve.

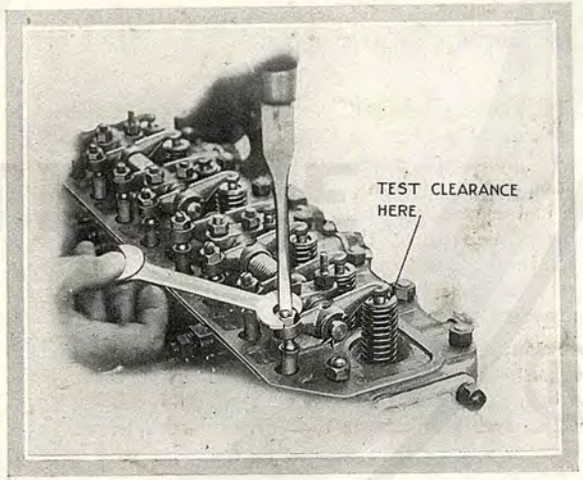
GRINDING IN THE VALVES.—Valve grinding can only be done when the cylinder head has been removed and necessitates the use of a special tool provided in the kit. The valve face should be smeared with valve grinding compound and the stem inserted in the guide. The special tool is then applied to the end of the stem and locked to the recessed portion by means of the grub screw. The valve should then be rotated backwards and forwards and occasionally raised from its seat to prevent the formation of rings instead of the nice even surface which is a characteristic of perfect grinding. Grinding should be continued until all pit marks or rings have disappeared. With modern engines valves require very little attention to maintain their seats and faces free from pit marks, some engines running for 10,000 or 15,000 miles without the valves having been touched.

ADJUSTMENT OF VALVE CLEARANCE.—Occasionally it is necessary to verify and adjust clearance between the valve stem and rocker arm. For this purpose a special gauge is provided in the tool kit, the correct clearance being .008″. To set the clearance commence



Valve details : A, circlet ; B, recess for collar ; C, spring ; D, cup and E, split cone collar.

with number one, i.e., the front cylinder, and turn the flywheel towards the near side until the inlet valve is just closing. Then turn the flywheel on another quarter of a revolution so as to ensure the piston being well up on its compression stroke. The two rockers should now be free and should be adjusted by unscrewing the lock nuts and screwing in the ball-ended fingers until the desired clearance between the other end of the rockers and the valve stems is attained. The lock nuts can then be tightened and the setting for number one cylinder is correct.



How to set the valve clearance.

The firing order for the cylinders is 1, 2, 4, 3, number one being the front cylinder and number four the back.

The remaining valve clearances can be set in a similar way to that described for number one cylinder. The clearance should be set while the engine is cold, care being taken to ensure that the pair of push rods of the rockers receiving attention are free, i.e., not rising or falling. As one proceeds from one pair of rockers to another the crankshaft will have to be slightly rotated, either by means of the starting handle or flywheel, so as to free the push rods.

The actual adjustment is very simple, the lock nut on the rocker tip being loosened with one hand, while the tip itself is adjusted by means of a screwdriver in the other. The lock nut is then tightened while the tip is held by the screwdriver, the correctness of the setting being ascertained by inserting the single tongue of the feeler gauge between the head of the valve stem and the tip of the rocker.

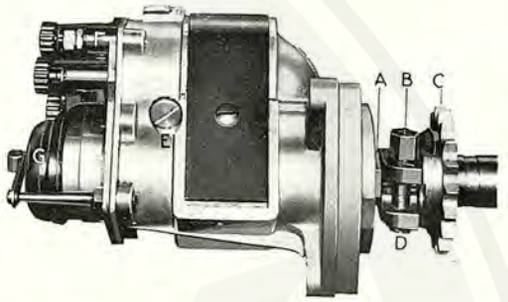
Insufficient clearance at this point will result in the valves failing to seat themselves. They will then burn away and compression and power will be lost. For this reason a greater clearance than normal, say up to twelve-thousandths of an inch, is to be preferred to an error in the opposite direction, although the latter may be accompanied by a tendency for the stems to tap.

With a new car it is advisable to run over the clearances after the first few hundred miles' running. By this time the valve mechanism will have bedded itself in, and when reset, should run without further adjustment for many thousand miles.

STICKING VALVES.—Sticking valves are sometimes indicated by misfiring or uneven running, troubles which are nearly always overcome by a dose of paraffin or lubricating oil.

THE MAGNETO: ITS REMOVAL.—The magneto is held to the back of the off side of the timing cover by three studs, an oil-tight connection being obtained by means of an aluminium flange joint. Passing through this flange is the magneto drive sleeve which is keyed and tightened on to the front end of the armature shaft. The rear of this sleeve is provided with an oil thrower which isolates the armature from any oil which might tend to work through from the timing cover, while the front of the sleeve carries a hexagon nut for facilitating the setting of the armature for purposes of timing.

Fitted on the front end of the sleeve is the magneto sprocket, which is clipped in position by a bolt easily visible and accessible through the main oil filler orifice on the off top side of the timing cover, when pistons number one and four are at the top of their stroke. This sprocket takes its main bearing in a phosphor bronze housing let in to the front of the timing cover.



The magneto drive sleeve A is attached to the driving sprocket C by the bolt B, which is made fast by a split pin D. E, stopper disclosing lubricating wick. F, distribution cover. G, contact breaker cover.

CARE OF THE MAGNETO.—The magneto requires very little attention, and provided that the platinum points of the contact breaker are free from oil, clean and separate the requisite amount of twelve thousandths of an inch, no trouble should be experienced. Its care and maintenance are explained in detail in the manufacturer's pamphlet supplied with the car.

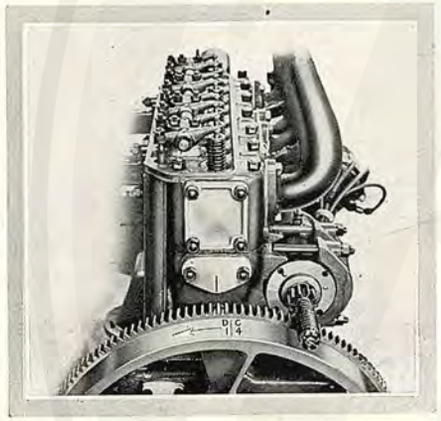
THE PLATINUM POINTS.—Should the points require cleaning they should be rubbed with fine emery cloth, and under no circumstances should a file be used. If the points become pitted an expert should be employed to true them up with a hand tool in a lathe, care being taken to leave them slightly convex.

THE DISTRIBUTOR.—Owing to the use of a metal distribution brush, with an air gap between the brush and the protruding contacts, there is no chance tracking or producing a spark close to the insulating material, and consequently it is rarely necessary to remove the distributor for cleaning.

THE ARMATURE: ITS LUBRICATION.—The rotating armature is fitted with two ball bearings which are packed with grease when the instrument leaves the works. A screw stopper is fitted on the off side of the magneto, and when removed discloses a wick which should be saturated with oil supplied by way of the oil hole on the top of the instrument. A lid seals the oil hole which should be treated to a few drops of lubricant after every thousand miles. Over-lubrication at this point may cause oil to reach the contact points and prevent good electrical contact when they are closed owing to oxidisation.

IGNITION HINTS.—The timing of the magneto is effected by means of a box spanner, provided in the kit, being inserted through the oil filler hole on the timing case at the front of the engine and on its off side. The variable coupling on the magneto armature shaft is held by frictional contact, so that the most minute adjustment can be made when necessary. The magneto timing is, however, very carefully set at the works, and there should be no need to disturb it or make any variation in the setting. But the following hints are given in case of necessity, as, for instance, when the engine is dismantled for overhauling.

TIMING OF THE MAGNETO.—To time the magneto rotate the flywheel towards the near side of the engine until number one inlet valve begins to open, and a line and the figures D.C. 14 on the periphery



Top dead centre is obtained in number 1 and 4 cylinders when the mark on the rim of the flywheel is two teeth to the off side of the imaginary vertical mark drawn in on the triangular end-plate of the cylinder casting.

of the flywheel come into view near the top of the flywheel. The wheel must then be turned one complete revolution until the mark comes to the top again, thus indicating that number one cylinder is on top dead centre and just about to commence its firing stroke. Actual top dead centre is obtained when the line on the flywheel is just two teeth to the off side of the nozzle of the water front drain tap at the back of the cylinder block.

It is assumed that the oil filler plug on the timing cover has been removed and that the bolt which clamps the magneto chain wheel to the armature coupling sleeve has been loosened a few turns so as to free the armature from its drive. The bolt must not be unscrewed too far, otherwise the split pin at its lower end will be sheared off.

The contact breaker cover and distributor moulding must be removed and the armature revolved by means of a special spanner

which fits the nut on the armature coupling sleeve, until the central brush on the distributor comes approximately into line with the number one high tension lead on the distributor cover. The contact breaker timing cover is then pushed downwards, i.e., into full retard position, and the armature is set by means of a special spanner which engages with the nut on the armature and sleeve until the platinum points are just breaking. This setting means that with the fully retarded contact breaker ignition is taking place on top dead centre of the piston.

The setting having been proved correct, the bolt which clamps the magneto sprocket to the armature end sleeve must be tightened up by means of the special box spanner provided in the kit.

MAINTENANCE IN SERVICE.—Car owners are recommended to examine periodically their magnetos and to carry out the following instructions. A *little attention* of this kind will ensure that the magneto is always rendering the best possible service and may even avoid unnecessarily returning the magneto for repair.

(1) LUBRICATION.—The rotating armature of the magneto is fitted with two ball bearings which are packed with lubricant before the magneto leaves the works.

The only part requiring lubrication is the distributor gear wheel bearing, and a few drops of light oil poured into the oil well at the distributor end of the magneto are all that is required.

(2) DISTRIBUTOR AND BRUSH HOLDER.—*Remove the distributor* and, with a cloth soaked in petrol, clean the inside of the distributor. Any dust or foreign matter that may accumulate inside the distributor is liable to cause leakage, the symptoms of which are misfiring or poor starting.

In a similar manner wipe the surface of the brush holder, particularly between the safety gap electrodes.

(3) SLIP RING AND COLLECTOR BRUSH HOLDER.—*Remove the aluminium dust cover* at the driving end of the magneto and take out the collector brush holder, which is secured to the top of the main housing by two screws and, with a cloth soaked in petrol, wipe off any dust from the cone of the collector brush holder. *Do not unnecessarily remove the carbon brush from the collector moulding.*

The flanges of the slip-ring should then be cleaned in a similar manner. This may be done by *lightly* pressing one corner of the cloth between the slip-ring flanges and slowly turning the engine crankshaft.

(4) CONTACT BREAKER.—The contact breaker is readily accessible by removing the cover and can be withdrawn from the magneto after unscrewing the centre fixing screw.

Examine the contacts, and if these are dirty the surface of each contact should be cleaned with a piece of very fine emery cloth or paper, and any emery dust should be carefully removed with a cloth.

Examine the bell crank lever bearing bush, and if dry smear with a little light oil. After refitting the lever on the bush it is important that any excess of oil should be wiped off.

Refit the contact breaker, *taking care to locate the key on the contact breaker base in the keyway of the armature spindle.* With the feeler gauge on the spanner supplied with the magneto check the contact gaps when the heel is on the high part of the cam. This gap should be 0.012", and if necessary, should be carefully adjusted to this dimension by the aid of the feeler gauge and spanner.

DISMANTLING THE MAGNETO.—Total dismantling of the magneto should be rarely necessary, but instructions are given below in case this should be required. In the ordinary way the only attention that need be given to the magneto, apart from occasional lubrication, is to examine the contact breaker. This part is readily accessible and can be quickly removed and replaced without disturbing any other working part. If possible, a faulty magneto should be sent to the makers or agents as an amateur may do more harm than good by tinkering.

In dismantling, the following procedure should be closely followed :

(1) The contact breaker cover should be removed by rotating the securing spring on its pillar, enabling the timing lever to be withdrawn.

(2) The steel hexagon-headed screw in the centre of the contact breaker base should be unscrewed, allowing the contact breaker to be withdrawn bodily.

(3) The distributor should be removed after unscrewing the two fixing nuts, and the distributor brush may be drawn out.

(4) The dust cover, at the driving end of the magneto, should be removed next by unscrewing the two fixing screws, and after unscrewing the collector moulding fixing screws, the moulding may be withdrawn.

(5) The contact end-plate may be unscrewed, and the half-speed wheel and spindle can be removed then, after detaching the retaining ring upon the inner end of the spindle.

(6) The earthing brush-holder, screwed into the side of the aluminium housing, should be withdrawn.

(7) After this stage, it will be possible to withdraw the armature from the tunnel.

If the armature is actually removed from the pole piece housing, it will be necessary to re-magnetise the magneto after replacing the armature.

It is important to note that the collector moulding, collector brush and earthing brush must be withdrawn before any attempt is made to remove the armature. Failure to observe this will result in damage to the collector or slip-ring, or both.

OVERHAULING.—After the magneto has been dismantled and cleaned, the various components should be assembled together, leaving the distributor and contact breaker covers off in order that the necessary timing adjustments can be made.

When fitting the distributor gear wheel sub assembly, great care should be exercised to ensure the correct meshing of the two gear wheels. The two teeth which are spotted in the large wheel must embrace the spotted tooth on the smaller wheel.

ADJUSTMENT AND LOCATION OF FAULTS.—If the engine is firing irregularly, though some portion of the ignition system is frequently at fault, the magneto is seldom the cause of the trouble. The investigator should, in the first case, satisfy himself that the fault does not lie in the plugs, the sparking gaps of which should be about 0.4 m/m. Irregular firing might result from defective operation of the contact breaker. To determine whether this is the case, the contact breaker cover should be removed with a view to observing if the contact breaker fixing screw is securely tightened. In addition, the segment ring, fixed to the timing lever, should be inspected to ensure that the fixing screw is perfectly tight. Special attention should also be given to the platinum screws, which should be securely locked in position. The platinum points should be carefully examined and, if necessary, cleaned with very fine emery cloth. When the armature is revolved the maximum contact gap should be set to the feeler gauge provided on the contact breaker spanner which is supplied with each machine. This gap should, from time to time, be checked, and, if necessary, the longer contact screw should be adjusted.

If sparking persistently occurs at the safety gap of the magneto it is an indication that there is a break in the external high tension circuit and, if the engine stops firing altogether, it is probably due to the conductor from the low tension earthing terminal of the magneto coming in contact with the frame of the car, thus rendering the magneto inoperative.

If the investigation indicated above does not reveal the cause of the faulty ignition, the magneto should be returned for overhauling.

SPARKING PLUGS.—The function of the sparking plug is to deliver the electric current in the form of a full spark at the gap between the firing points. This properly fires the compressed gas mixture in each cylinder and sends the piston downward on its power stroke. It follows that if part of the current never reaches the firing points, due to its leaking away through the porcelain insulator, or because carbon accumulates, there will either be no spark, or it will be so weakened that it will not properly ignite the mixture. If the mixture supplied by the

carburettor is over rich, or the engine is subjected to excessive over-oiling, a deposit of carbon will be found on the inner portions of the sparking plug which are exposed to the combustion charge, and this should be removed periodically by washing off with paraffin.

The sparking plugs are screwed into the near side of the cylinder block, and are best removed with one of the tubular spanners supplied in the tool kit. As regards the width of sparking gap, this should be occasionally verified ; as this is the same as the width of gap at the magneto contact breaker, the gauge available for the latter may be used for the sparking plugs.

If misfiring occurs and a plug is suspected as the cause, it is sometimes possible to locate the faulty one owing to its exterior being hotter than that of the others.

If the cables running from the magneto to the sparking plugs are to be removed at any time, it is essential that they should be replaced in exactly the same order, both on the magneto and on the various plugs. The wires are provided with numbered sleeves for this purpose. The firing order of the cylinders is 1-2-4-3, No. 1 being the cylinder nearest to the radiator.

The sparking plug can be taken to pieces for cleaning by holding the body of the plug in a vice and unscrewing the collar which holds the central electrode.

IGNITION WIRES.—If, after extended service, the rubber insulation should become hardened and cracked, the wires should be replaced, otherwise leakage of the electrical current will occur with its resultant ignition troubles.

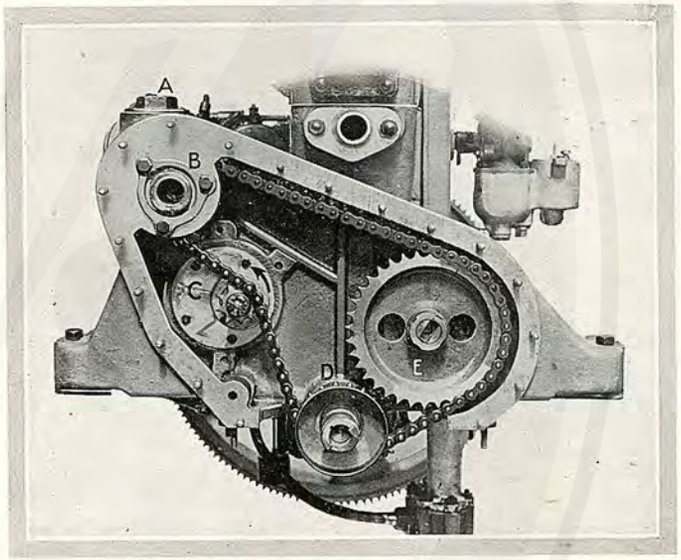
The wires are all marked by means of ebonite collars, No. 1 wire leading to the plug in the front cylinder, No. 2 to the plug in the second cylinder. No. 3 wire on the distributor, however, goes to No. 4, i.e., the rearmost cylinder plug, while No. 4 wire on the distributor goes to No. 3 cylinder plug. It will be noted that there are two collars on each wire indicating at the lower end the number of the distributor brush, and at the upper end the number of the cylinder to which the wire travels.

ELECTRIC LIGHTING DYNAMO.—The six-volt Lucas dynamo, which serves to generate current for electric lighting and engine starting by charging the batteries while the engine is running, is mounted in an eccentric housing at the front of the engine. As previously stated, it is driven by a single roller chain, this chain being adjusted by partial rotation of the dynamo in the eccentric housing.

The rear ball bearing is lubricated through the oil hole in the hexagon plug at the rear end of the dynamo, and should be given a few drops of oil every 1,000 miles.

THE DYNAMO: ITS REMOVAL.—To remove the dynamo unscrew the nut at the rear end of the dynamo cap, and then slide the latter rearwards. The rubber stop on the cable should be slid up the cable, which is long enough to allow the cap to be withdrawn before the cable end is disconnected.

The dynamo is held to the back of the timing cover by three studs, the nuts for which are best reached with a box spanner. The collar must then be worked rearwards off the studs, so as to enable the dynamo and the aluminium housing at its front end to be rotated. The housing is fitted into the timing cover with cement, and it is quite possible that



When the front cover of the engine has been removed the timing chain can be inspected. To tension the chain, the dynamo C must be moved in the direction of the arrow. A is the oil filler plug ; B, the bearing for the magneto driving sprocket ; D, the crankshaft sprocket and E, the camshaft sprocket, which also drives the water pump.

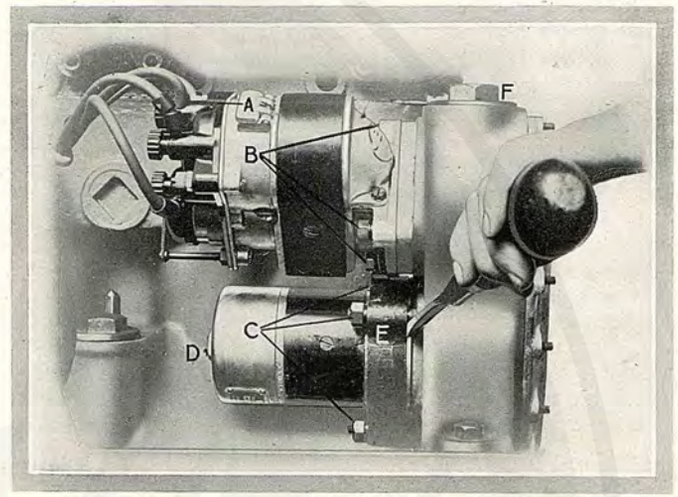
the instrument may be inclined to stick. It may be tapped on the side with a wooden hammer, or paraffin may be squirted into the joint with a view to freeing it. To disengage the dynamo sprocket from the chain, the dynamo must be rotated towards the engine until it is possible to pull it out of the timing cover. The collar which holds the dynamo to the back of the timing cover can only be replaced in one way, i.e., with its two flattened surfaces facing the magneto and off side of the crankcase.

REPLACING THE DYNAMO.—To replace the dynamo it is advisable to secure a strong piece of wire and to push it in through the oil filler hole on the top of the timing cover, so as to hook up the under run of the chain and prevent it from fouling the dynamo sprocket when the latter is pushed in from the back of the case. The lower end of

Before pushing the dynamo into the timing cover the chain should be hooked up clear of the dynamo sprocket in the manner shown, a bent piece of wire being used for the purpose.

the wire should be made into a hook, the best method of holding up the chain being easily ascertained by looking in through the hole in the back of the case which is uncovered when the dynamo has been removed. As soon as the dynamo is pushed home almost as far as it will go, the wire can be pulled up and off the chain. Then, by rotating the dynamo, the chain will be found to assume its proper position on the sprocket.

TENSIONING THE DYNAMO DRIVING CHAIN.—To tension the driving chain the dynamo must be moved away from the cylinder, the correct tension being such as to allow about $\frac{1}{2}''$ up and down movement on the upper length of chain between the camshaft and magneto sprocket. This correct tensioning is best judged by moving the dynamo until the chain is tight, i.e., the dynamo can be moved no further. Then ease off the dynamo backwards, i.e., towards



When the dynamo locking collar nuts C have been removed, the collar E can be slid rearwards and the dynamo either withdrawn or rotated slightly to tension the chain. A is the principal oiler on the magneto, B are the magneto holding nuts, D is the dynamo oiler and F the engine oil filler plug.

the engine for a short distance. Symptons of a chain being too tight are indicated by a whining noise, while should the chain be too loose it can be heard flapping against the interior of the timing case.

THE DYNAMO IN USE.—The dynamo commences to charge at approximately 700 r.p.m., and gives a maximum output of 11 amps. These particulars relate to the machine when cold, the output being slightly less after the instrument has become thoroughly warmed up.

The charging current does not increase above a predetermined maximum when the machine is run at high speeds, as the output is controlled by an extra brush placed approximately mid-way between the two main brushes, the shunt winding being connected from this third brush through the switchbox to the positive brush.

In order to obtain satisfactory running, the brush gear and commutator should be inspected occasionally. These parts are readily accessible by unscrewing the hexagon nut which keeps the commutator end cover in place, when the cover can be withdrawn.

ADJUSTMENT OF THE BRUSHES.—All the brushes should slide quite freely in their holders and should " bed " over the whole surface in contact with the commutator. When in good condition this surface should appear polished.

Worn brushes may be easily replaced in the following manner :— The eyelet on the brush flexible should be released by unscrewing the nut ; then, holding the spring lever back out of the way, the brush may be withdrawn from the holder.

The position of the shunt brush holder is correctly set relative to the position of the other two brushes before the machine leaves the works, and on no account should the position of this brush be altered without first obtaining advice on the matter.

CARE OF THE COMMUTATOR.—The surface of the commutator must be kept clean and free from any oil, brush dust, etc. Should any grease or oil work on to the commutator through over-lubrication, it will not only cause sparking of the brushes, but, in addition, carbon and copper dust will be collected in the grooves between the commutator segments. Therefore, the latter should be examined occasionally, and if found necessary, cleaned out by means of a thin saw blade or a similar article.

The armature is mounted on ball bearings which are packed with grease before the machine leaves the works, but after the car has run, say 10,000 miles, the machine should be dismantled for the purpose of thoroughly cleaning and repacking the bearings with grease.

There are three terminals numbered 1, 2 and 4, which correspond to the positive, shunt and negative connections respectively. The terminals are mounted on an insulated base plate which is secured to the commutator end frame.

THE ELECTRIC STARTER : HOW HELD.—The electric starter is housed in a very accessible position above the rear off side engine bearer arm, and is held to the cylinder by four studs and two clamps. When the split pins and nuts which secure the clamps in position are removed, the starter can be withdrawn, so as to enable the brush gear to be easily inspected or the commutator cleaned. Before doing this, however, the position of the dynamo relative to its housing should be marked, so as to enable it to be engaged again to the correct depth, which is attained when the pinion rests in its normal position $\frac{1}{8}$" away from the teeth on the rim of the flywheel.

THE STARTER PINION.—The armature spindle is provided with a pinion which, on depression of the starting switch, engages with a toothed ring on the periphery of the engine flywheel. Immediately the engine commences to fire, the pinion is automatically thrown out of mesh.

If for any reason the pinion wheel on the motor does not engage with the flywheel teeth, examine the screwed sleeve of the armature spindle to see it is free from grease or dirt ; if necessary, wash over with paraffin. Do not use grease or thick oil on the sleeve, but occasionally give a few drops of thin machine oil.

The battery should be inspected monthly for the purpose of checking the level of the electrolyte (pure dilute sulphuric acid), the correct height being approximately $\frac{1}{4}$-in. above the top of the plates. A naked light must not be used for examining the acid level.

Only distilled water should be added to replace the loss of electrolyte caused by the action of the charging current.

HINTS ON STARTING.—The motor is designed for starting the engine under normal conditions, but any unnecessary or additional strain will undoubtedly considerably diminish the life of the battery. In the event of the engine refusing to fire after being turned by the starter, make sure that the ignition switch is " on."

Before starting up on a cold morning it is recommended that, after seeing the gear level is in neutral and the ignition is switched off, to crank the engine over two or three times to free the pistons and bearings of any gumminess due to the solidifying of the oil. This will save the battery enormously and well repay the owner for the trouble taken.

The procedure is then to turn on the petrol, move the ignition switch to the " on " position, retard the ignition lever slightly. The throttle lever will probably have been left in its correct or minimum running position which gives a strong suction on the starting jet. Do not open the throttle too far. Pull back, without undue force, the carburettor air strangler knob, which will be found on the dash-board, and then depress the starter knob switch, releasing both as soon as the engine commences to run. The ignition lever should then be fully advanced.

If the strangler be operated too long there is a danger of the engine inhaling so much rich mixture as to make starting difficult. The petrol also tends to wash the oil off the cylinder walls and pistons and by diluting the oil in the crankcase to cause excessive wear.

Should it be necessary to start the engine by hand, be sure that the ignition lever is in the mid-position before attempting to crank it. Always pull up and not press down, and never have the thumb over the handle, but let it lightly grip the handle the same way round as the fingers. This will prevent personal injury in the case of a back fire. Always give a sharp pull over or swing, as a slow, steady pull will not rotate the armature of the magneto fast enough to generate the necessary spark.

THE STARTING SWITCH.—This switch is extremely simple in construction, and as there are no working parts liable to get out of order, the lid of the box is fixed to the base by means of three eyelets, through which the screws are passed for securing the switch in position.

ACCUMULATORS.—In the ordinary way accumulators require careful attention, but when they are used with the electric-starter system it is more necessary that every care should be taken to protect them from mal-treatment. In the case of a new car delivered for use

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ACCUMULATORS.—In the ordinary way accumulators require careful attention, but when they are used with the electric-starter system it is more necessary that every care should be taken to protect them from mal-treatment. In the case of a new car delivered for use

in the country of origin, the accumulators are properly charged before the car leaves the works, and under normal conditions will be kept properly charged by the dynamo which is fitted. For export (and in case of accumulator replacements) it is desirable to despatch a dry accumulator, in which case the following instructions should be carried out.

ACID SOLUTION.—The accumulators should be filled with solution of the best brimstone sulphuric acid diluted with distilled water to specific gravity of 1.225 at 60° F., the proportion being roughly 1 part of acid to 4 parts of water by volume. It is important in mixing to pour the water into the vessel first, adding the acid slowly and stirring thoroughly to assist diffusion. A mixing vessel made of glass, glazed earthenware or lead should be employed, and a glass rod used for stirring.

The specific gravity is affected by temperature, and a further allowance should be made as follows :—Deduct .002 from readings of SG. at 60° F. for each 5° F. below 60°, and add .002 for each 5° above. The level of the electrolyte or acid solution used in the battery must not be too low or the acid concentration will fall too quickly, thus limiting the capacity of the cells. The correct height is about $\frac{3}{8}$-in. above the top edge of the plates.

After being filled with acid of the correct density, the battery may, with advantage, be allowed to stand for a period not exceeding 12 hours before charging current is passed into the plates. It is not essential, however, to soak the plates in this way, and no harm will result if the battery is put on charge immediately after being filled with acid, provided that the rise in temperature is not excessive.

No dry uncharged accumulator should be filled with acid solution unless the charge can be commenced within 12 hours.

If the car is laid by for several months, in order to keep the battery in good condition it should be charged up for an hour or so monthly from a separate source of electric supply.

Under no circumstances should the electrolyte be removed from the battery and the plates allowed to dry, as they will become chemically changed.

The maximum rate of charge on this car is seven amps. and should be continued for 28 hours. At the end of this period it will be found that gas is being produced at the surfaces of all the plates and the density of the electrolyte is at a maximum and should not exceed 1.290 at 60° F.

On completion of the first cycle of charge and discharge the battery will be put into regular working condition by charging at eight amps. for twelve hours. The discharge of the battery should not be carried beyond the lower limit of the voltage which is fixed for electro-chemical reasons at 1.8 volts per cell. There are three cells in this battery.

THE BATTERY TERMINALS.—The starter cable is securely soldered to the square cable terminal. For joining up the cable to the battery lug, the threaded portion of the terminal is pushed through the square hole in the lead lug and is tightened up by the hexagon lead-covered brass nut. Each battery to switchbox cable is soldered to a lead eye, which is secured to the battery lug.

Before tightening, all parts should be smeared with vaseline to obviate the possibility of " creeping " acid setting up corrosion in the terminal.

Care should be taken to ensure that the securing nuts are always tightly screwed home with a spanner.

HINTS ON CHARGING THE BATTERY.—It is difficult to lay down any rigid instructions on the period for which the battery should be charged, as the conditions under which cars are used vary considerably, and obviously the amount of charging the battery will require is directly dependent on the number of starts made, and the extent to which the lamps are used. The battery being the reservoir of the system, any power taken from it has to be replenished by charging up from the dynamo.

The cut-out on the switchbox is to prevent the battery from discharging through the dynamo winding, and not for switching off the charging current when the battery is fully charged. The following hints are therefore given as a guide for use with the majority of cars :—

Under normal conditions, providing that the lamps and starter are used fairly frequently, the battery should be kept on charge at all times during the winter and at about half the day-time running in the summer.

The battery charging switch should be kept " on " when any lamps are in use, but if the car is used for long tours in the day-time, it is quite unnecessary to keep the charging switch " on " all the time, as this will cause the battery to be overcharged and this will reduce the acid level.

THE SWITCHBOX.—One of the most interesting features of the starting and lighting system is that all the parts necessary for controlling the various circuits are compactly housed at one central position, namely, in the switchbox situated on the dashboard. At the same time all the parts are readily accessible. In addition, the charging switch is arranged so that in the " off " position it switches off the magneto, thus obviating the necessity of a separate magneto switch.

The cover of the switchbox is held in position under spring tension by the switch levers, which in turn are secured by screws. All the parts of the switchbox are mounted on one moulded base, which can be removed as a whole unit by unscrewing the two nuts on the back of the switchbox casing.

The functions of the various parts are as follows :—

THE SWITCHES.—The left-hand switch has three positions. (1) In position " Off," both dynamo and magneto are off. (2) In position " M " the magneto is on and the engine can be started ; the dynamo, however, is still switched off. In position " D " both dynamo and magneto are on. The right-hand switch in position " H " means that all lamps are illuminated, that is head, side and tail. In position " S," side and tail lamps only are on, while in the " Off " position all lamps are off.

THE AMMETER.—A centre zero instrument is provided, so that the driver can see at a glance whether the dynamo is giving sufficient output to keep the battery charged when the different circuits which are consuming current are switched on. In other words, this type of meter shows the actual current flowing into or from the battery. Thus, if the lamps are switched on and taking 6 amps., and the dynamo is charging at 8 amps., the meter shows 2 amps., this being the current excess of the lamp load which is available for charging purposes.

THE ELECTRO-MAGNETIC CUT-OUT.—The cut-out is provided for automatically closing the charging circuit as soon as the dynamo is driven at sufficient speed to cause its voltage to rise above that of the battery, and vice versa. The reverse action breaks this circuit on the dynamo voltage falling below that of the battery, and thereby prevents the latter discharging through the dynamo windings.

The cut-out is accurately set before leaving the works, and should not be tampered with or adjusted. Should the cut-out fail to close the circuit on accelerating the engine, the cause is likely to be found elsewhere on the system.

The cut-out in no way switches off the dynamo when the battery is fully charged, and no such automatic device is provided.

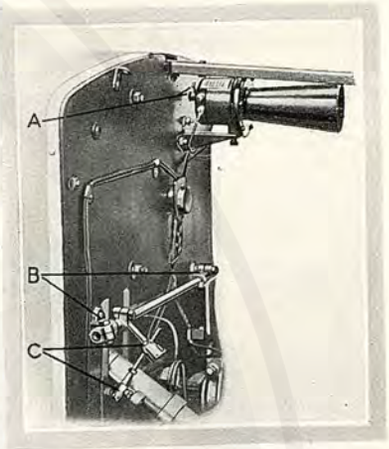
THE FUSE.—Only one fuse is provided, and that is placed in the shunt circuit of the dynamo. This fuse prevents damage occurring to the dynamo windings, if through any cause the battery becomes disconnected whilst the dynamo is running. It is advisable occasionally to examine the switchbox in order to ascertain that the fuse is held tightly in position in its holder. A fuse loose in its holder or a loose fuse clip will cause intermittent or no output from the generator.

SPARE FUSE.—If it becomes necessary to renew a fuse wire it is essential to push the wire down the clip as far as possible, as otherwise it may not be gripped tightly when replaced in position. A spare fuse carton containing a supply of the correct gauge wire cut to the required length will be found above the left-hand switch.

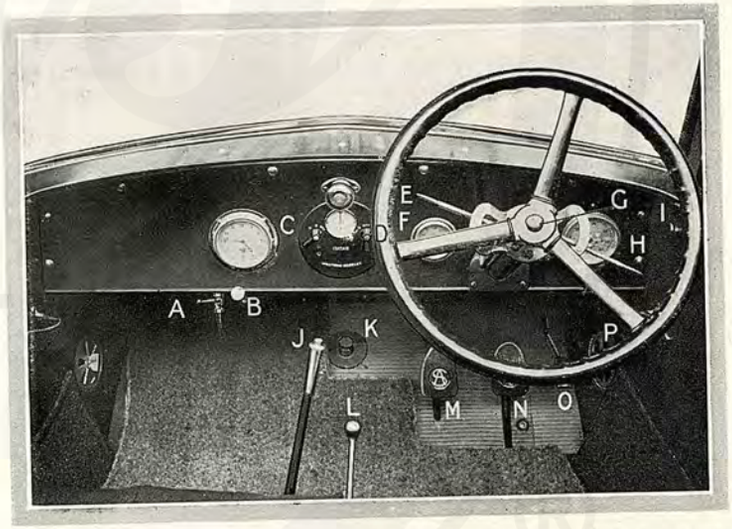
THE KLAXON HORN.—The Klaxon horn is mounted under the bonnet and adjacent to the dashboard. To adjust the note the nut at the rear of the body of the instrument must be slackened with

a spanner, and the lever in front of it moved until the desired note is attained. The lock nut is then tightened. The terminals on the sides of the instrument should be inspected occasionally and kept tight.

THE INSTRUMENT BOARD.—Facing the driver, on the centre of the scuttle dash, is the instrument board, which is held by screws to the scuttle bridge. Low down on the left is the air shutter control, which enables the air inlet to the carburettor to be closed temporarily to facilitate engine starting. In the centre of the instrument board is the switch plate for lighting and ignition, the oil pressure gauge being located to the left of the steering column.



A, the adjustment for the horn. B and C are points in the control requiring lubrication.



The controls :—A, petrol tap ; B, strangler ; C, dynamo and ignition switch ; D, lamp switch ; E, ignition control ; F, oil pressure gauge ; G, steering wheel ; H, throttle lever ; I, horn button ; J, hand brake ; K, electric starter ; L, gear lever ; M, clutch pedal ; N, brake pedal ; O, accelerator pedal ; P, ventilator.

The switch plate embodies two switches. One on the side when moved to " D " indicates that the battery is being charged with the ignition on, " M " means that when the switch is moved to this position the magneto only is in action, and " off " that when this switch is in this position both dynamo and magneto are cut out. The switch on the off side when moved to " H " indicates that all lights are on. When it is moved to " S," side and tail lamps only are on, the " off " position being in the centre.

At the centre of the switchboard is the amperemeter which indicates the rate in amperes at which the batteries are being charged by the dynamo. The normal charging rate of the dynamo is 10 amperes, this applying to all engine speeds above 700 r.p.m.

THE LAMPS.—The set of Lucas lamps comprises two head lamps and two side lamps, all of which are located in universally adjustable mountings on the wings, and one tail lamp. The head lamps are fitted with " Difusa " glass and gas-filled bulbs to eliminate streaky and uneven illumination.

Each lamp can be universally rotated so that its light may be turned on to the engine to facilitate repairs at night. Should the ball joint become loose after long wear the bracket can be removed and the nut on its under face tightened until the ball joint is secure again. This ability to direct the beam of the lamp sideways or downwards is of considerable benefit when driving in fog. Under these conditions it will be found advisable to turn the lamps downwards and towards the near side of the road in such a way that they illuminate the edge of the road a few feet in front of the car.

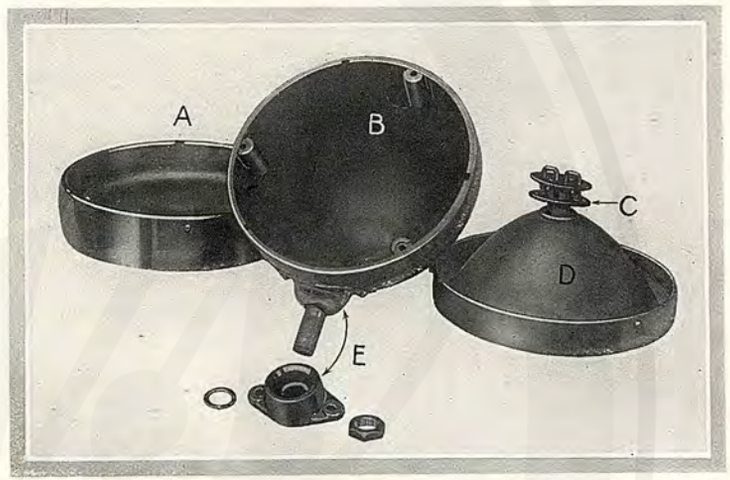
Even for ordinary driving, experiments may show that the best setting is obtained when the off side lamp is set to throw its beam inwards so as not to dazzle on-coming drivers.

Each lamp, the front of which is secured by a bayonet fixing, can be readily taken to pieces. A good method of starting to strip the lamp is to hold the sides of the lamp (towards the back) with the fingers, press the front rim evenly with the thumbs and palms of the hands, and then rotate to the left as far as it will go, when the front may be withdrawn.

The reflector is also attached by a bayonet-type fixing, but it is only necessary to remove this for the purpose of connecting or disconnecting the cables from the terminals.

When replacing the reflector the word " Top " stamped on the rim must be at the top of the lamp, or else it will be subsequently impossible to fix the lamp front as the fixing studs will not engage. Place the reflector so that the studs pass through the slots in the body of the lamp, then turn the reflector to the right until it comes against its stop and the arrows on lamp body and reflector rim are opposite each other.

FOCUSING HEAD OR DRIVING LAMPS.—The very accurate formation and particularly high polish of the surface of the reflectors is the result of many years of research work, manufacturing experience, and prolonged night-driving observations on the road. If, however, the bulb is not correctly focused the advantages of this scientific design

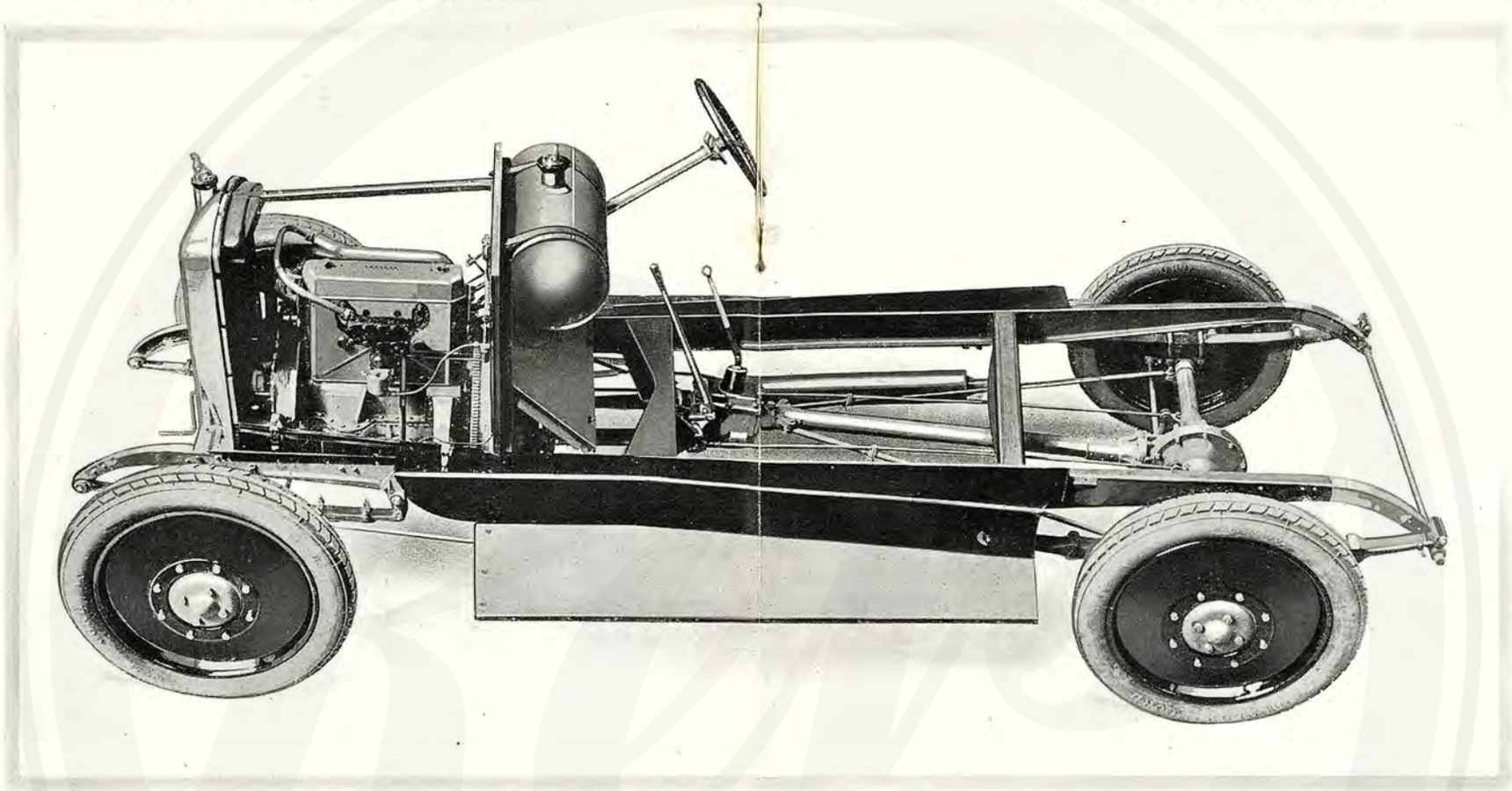


A, the front of the lamp. B, the lamp body. C, cable connections. D, the reflector. E, the spherical joint which enables the lamp to be universally rotated.

are lost ; it is, therefore, essential that the filament should be approximately at the focus of the reflector. In order to arrange this the bulb holder is provided with three notches, so that by trying the bulb in the alternative positions it can be placed as near as possible to the correct focus.

The best way of carrying out focusing and setting is to take the car on to a straight level road, try the bulb in each of the three notches, and then move the lamp on its adjustable mounting until the best road illumination is obtained. Lamps fitted with double filament bulbs should be focused with the " full " light.

At this point it may also be mentioned that the efficiency of the head lamp depends not only on the shape of the reflector but on its surface. When the lamps are used under normal conditions it is not advisable to polish the reflectors ; should they, however, become tarnished in any



CHASSIS SPECIFICATION.

DIMENSIONS.—Wheelbase, 9 ft. 6 in. Track, 4 ft. 8 in. Overall length, 13 ft. Overall width, 5 ft. 6 in. Ground clearance 9 to 10 in.

ENGINE.—Four-cylinder Mono-bloc, detachable head. Bore, 3 in.=76.2 mm. Stroke, 4 in.=101.6 mm. Capacity, 113.14 cub. ins. = 1,852 c.c. R.A.C. rating 14.4.

LUBRICATION.—By submerged self priming pump with positive distribution. Filter can be cleaned without loss of oil. Large accessible filler cap. Capacity of sump, 9 pints.

ELECTRICAL EQUIPMENT.—Lucas six volt. Separate starter with Bendix pinion, chain driven dynamo. Five road lamps.

CARBURETTOR.—Claudel Hobson—inlet pipe bolted to head and warmed by exhaust gas. Lid of heated chamber detachable for cleaning, and a strangler is fitted.

PETROL TANK.—Gravity feed from tank situated in the scuttle. Capacity, approximately 8 gallons. Tap controlled from driver's side of dash. Large filler in scuttle.

CONTROL.—By accelerator pedal and by hand ignition and throttle levers, mounted on quadrants below 16 in. diameter steering wheel.

CLUTCH.—Single plate clutch of special design providing easy engagement and change of speed. Dust and water shield under fly-wheel.

GEAR BOX AND REAR AXLE.—Constructed in one unit with central change speed lever. Three speed gear box in centre of chassis attached by torque tube to rear axle and providing three speeds forward and one reverse.
Spiral bevel drive. Gear Ratios : 1st, 17.5, 2nd 8.63 and 3rd, 4.7 to 1. Reverse, 22.25 to 1.

FRONT AXLE.—Stamped H section. Fitted with jaw type swivel axles on which the front hubs run on ball bearings. Lubricated by grease pump.

SPRINGS.—Semi-elliptics, front and rear, fitted with spring gaiters and rebound plates.

FOUR WHEEL BRAKES.—A pair of fabric lined shoes act internally on each brake drum. The central hand lever and also the pedal control all four brakes. Control by rods fitted with easy adjustment from outside the body.

WHEELS AND TYRES.—Special disc wheels with one spare. Five 29 in. by 4.95 in. balloon or 765 mm. by 105 mm. normal pressure tyres.

EQUIPMENT.—Runner boards, Speedometer, Clock, Oil Gauge, Vertical Petrol Gauge, Kit of Tools, etc.

PERFORMANCE.—Speed range on top gear from 5 to 55 m.p.h.

CONSUMPTION.—Petrol, 26-28 m.p.g.

way, use only a good quality chamois leather and finely divided rouge for repolishing. On no account should any metal polishes be used on our reflectors.

THE TAIL LAMP.—The tail lamp is secured to its bracket by a stud fixed on the back of the lamp. The bulb holder is fixed to an inverted U-shaped bracket, which passes into the body and can be withdrawn by releasing the milled and coin-slotted screw on the top of the lamp.

When ordering spare parts for electrical gear, the type and the number of the machine should be given, and if possible, the date of the car on which it is fitted.

Further useful information on the electrical equipment is contained in the maker's booklet which accompanies each car.

THE CARBURETTOR.—The carburettor fitted is the Armstrong Siddeley Claudel Hobson Power Jet type.

The carburettor, as shown on page 38, is made in two halves, the top half containing the throttle, venturi shaped choke tube, slow running by-pass, and by-pass adjusting screws ; while the bottom half contains the diffuser, power jet, float chamber, float mechanism and the air shutter.

The air flow into the carburettor is through the inlet in the bottom half, in which is fitted the air starting shutter. The diffuser is located immediately under and central with the choke tube, the slow running jet lining up with a slot in the barrel throttle.

The power jet is of the plain spray type, and is situated in the petrol delivery passage between the float chamber and the diffuser ; the latter is shown in the sketch on the opposite page.

The air supply to this jet will be seen to be immediately over the jet orifice, and communicates with the passage leading to the mixing chamber via the throttle barrel, in the fully open position of the throttle. A loose interchangeable choke tube is fitted.

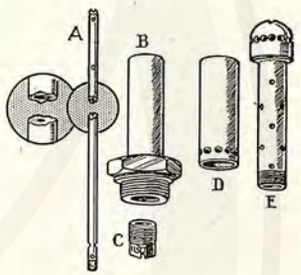
THE POWER JET.—The object of the power jet is to provide the slight amount of extra fuel required at full throttle to convert the economical mixture into that for maximum power.

Carburettor adjustments and tuning up are much simplified by this special feature, as the three functions of the carburettor regarding fuel measurement, i.e., slow running, idling, all ordinary running at less than full throttle, and full throttle running, are each mainly influenced by a particular jet ; therefore an adjustment for any particular purpose can be made without alteration to any other part of the speed and load range.

The power jet (which operates when full power is required and at no other time) enables the most economical mixture strength to be used for all touring speeds, short of full throttle.

THE ACTION OF THE DIFFUSER.—In this carburettor the throttle is placed immediately above the main jet, but the pilot jet extends into the throttle body or mixing chamber, the object being to regulate the pressure at the pilot jet only. The air screw and the by-pass screw only influence the pilot jet, and have no effect whatever on the main jet.

The action of the jet is as follows :—The petrol from the float chamber passes through the submerged main jet C, and in rising, fills the three tubes to a level predetermined by the adjustment of the needle in the float chamber. When the throttle is shut the suction is concentrated on the pilot jet, and the petrol is forced through the small orifice in the tube A. Air enters at the holes above the jet, and breaks up the petrol, which issues in the form of a spray from the top holes. Sufficient of this mixture for slow running is allowed to enter the induction pipe through the by-pass.



The diffuser stripped to show A, the slow running jet ; B, the main jet housing ; C, the main jet ; D, diffuser tube, and E, diffuser.

When the throttle is open the suction is transferred to the main jet at the base of the diffuser. Air passes into the annular space round the diffuser, enters the hole at the base of the outer tube, passes up this tube and forces the petrol in the inner tube out through the top depression holes. During this process the petrol is broken up and blown through the emulsion holes in the dome of the diffuser, and is then intimately mixed with the main body of air passing up through the choke.

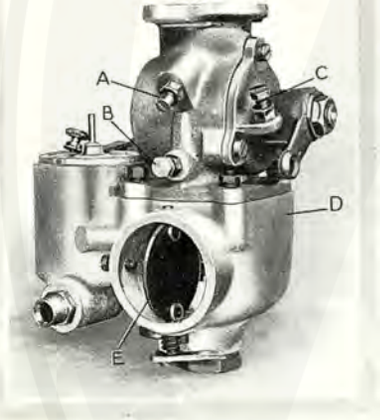
This comparatively large reserve of petrol contained in the diffuser allows of very rapid opening of the throttle and hence instantaneous acceleration. At the same time the advantage of the barrel throttle is retained, and it is therefore equally possible to open the throttle gradually, the change over from the small jet to the main jet being imperceptible. As the engine speed increases the column of petrol in the guard tube rapidly falls until a sufficient number of depression holes are uncovered to establish a balance of pressure relative to the engine speed and throttle opening. Since all the petrol passes through C, it is upon the size of this hole that the quality of the mixture depends, and therefore it must be sufficiently large to supply the requisite amount of petrol for maximum speed and power.

The strength of the mixture for slow running is determined by the size of the hole in the long centre tube A, which for the purpose of reference is called the slow-running jet.

Should it be thought necessary to re-adjust the carburettor, care must be taken not to alter the diffuser. In addition to this, the series of holes in the outer tube, depression tube and diffuser head are in relative proportion to each other, and therefore any alteration to these would upset the action of the carburettor and destroy its efficiency. The only parts that may require alteration are the main jet and the pilot jet.

The use of benzol only is not recommended as it tends to freeze up the petrol pipe and jets. The carburettor has also to be reset for this fuel, the float weighted and a smaller main jet fitted.

The carburettor is adjusted to run on petrol or an equal mixture of petrol and benzol.



The carburettor showing A, the by-pass ; B, the air screw ; C, one of the two throttle lever stops ; D, the base of the carburettor and E, the air strangler.

ADJUSTMENT.—To regulate the " pick up " and " slow running" an air screw B is fitted in the top half of the carburettor, and is used to vary the area of the air slot around the slow running jet when the throttle is nearly closed. The suction on the slow running jet and consequent mixture strength depends upon the position of the regulating screw ; by screwing it in the mixture strength is increased, and withdrawing it has the opposite effect. The air regulating screw should never be used to vary the full throttle mixture strength. For " idling " or " running light " the by-pass screw A is used in conjuction with the throttle lever stop screw C on the throttle cover to adjust the speed of the engine. If the mixture strength is correct the carburettor is set by adjusting the stop screws and reducing the throttle opening until the engine is just turning over at a regular speed without " hunting."

It may be found, however, that the engine runs too fast when set on the throttle stop alone, and stops altogether if the throttle is further closed ; in this case the mixture can be enriched by opening the by-pass screw slightly, and adjusting the throttle stop so that the throttle closes a little further. This dual adjustment enriches the mixture by reducing the area of the slot in the lower portion of the throttle barrel, and allows a richer mixture through the by-pass passage, which is, of course, cut out of action as soon as the throttle is opened to any extent.

The carburettors are carefully tested and the flow calibrated before leaving our works, and notwithstanding the information given above should not be re-adjusted. It is extremely unlikely that, even in the hands of an expert, better all-round results can be obtained, and Armstrong Siddeley Motors Ltd. can take no responsibility if any adjustment is made.

CARBURATION HINTS.—A few supplementary hints connected with carburation may be given. Some of these appear in the sections entitled " Petrol Filter " on page 41 and " General Hints on Body Work " on page 66. In the latter, for example, reference is made to the use of benzole, while in the former the effects of a partially choked petrol filter is dealt with.

POPPING IN THE CARBURETTOR.—An obstruction in the fuel supply, due either to a restricted feed to the float chamber or to some foreign matter in the jet orifice, is often accompanied by an irregular series of " pops " in the carburettor. The latter are also liable to occur when the mixture is from any cause weak in petrol vapour ; for instance, an improperly made induction pipe joint will allow air to leak through into the interior, and this, especially at low engine speeds, upsets the proportion of air to petrol vapour. Even a faulty exhaust washer may upset the mixture and cause uneven firing.

SEDIMENT IN THE FLOAT CHAMBER.—It is advisable occasionally to detach the lid of the carburettor float chamber and remove the float so that the interior may be examined. If any sediment or water be present it should be cleaned out, using a fluffless rag to remove the sediment, and a damp chamois leather to soak up the water. The sediment usually consists of an accumulation of extremely fine particles of foreign matter resembling flour, and, although these individually are so minute that they pass through the jet without causing any obstruction, they may become caked in course of time and cause trouble by blocking the petrol passage as well as the actual jet orifice.

FLOAT LEAKAGE.—A leaking float will cause flooding, but it is a very unusual defect and is generally due, when it does occur, to careless handling of the float. If the latter be suspected, the presence of petrol within it (inferring a leak) can be ascertained by removing and

shaking it. The petrol can usually be removed and the point of leakage found, by inserting the float for a few minutes in water almost at boiling point. The expansion of the air within will expel the fuel, and the bubbles which issue will locate the defective point. The repair by soldering should only be done by a person experienced in the use of a soldering iron, otherwise the float may be ruined by overheating it, for instance.

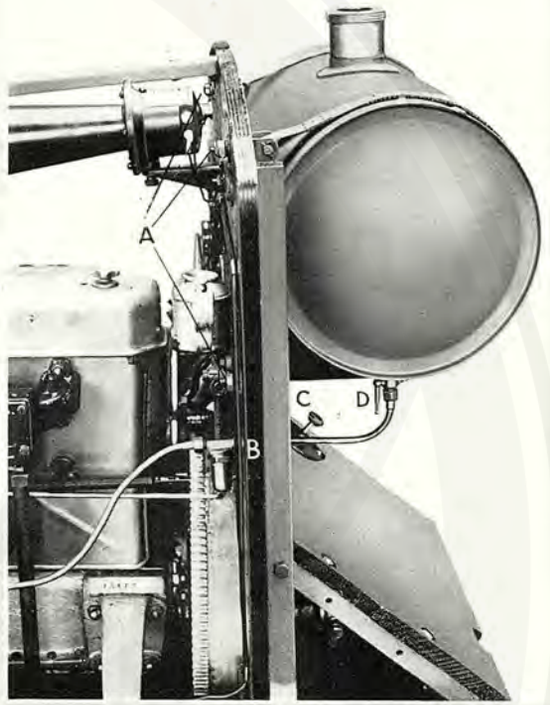
TREATMENT OF FLOAT AND ITS MECHANISM.—Whenever there is occasion to remove the float, it should be treated with care, for it is necessarily a delicate item, though one that will give no trouble in ordinary use and with fair treatment. Care should also be taken not to bend or otherwise damage the float chamber mechanism. A bent valve or a damaged seating will cause waste of fuel by flooding and by allowing the level of the fuel to rise in the float chamber beyond the normal point.

USE OF THE STRANGLER.—The engine should never be run (except when starting up) with the air shutter control drawn out, otherwise the extremely rich mixture thus occasioned will result in the formation of an excessive amount of carbon deposit on the cylinder walls and piston heads, and in the sparking plugs becoming coated with soot—the latter in turn causing more or less serious misfiring so long as the soot be present. A very rich mixture, besides being accompanied by misfiring, is denoted by the issue of black smoke (as distinct from the blue smoke due to over-oiling) from the exhaust outlet. At very rare intervals it may be advisable to clean out the pipes between the exhaust manifolds and the heated jacket round the carburettor and also between the jacket and the silencer. The carbon deposit may previously be loosened in a paraffin bath and then scraped away with a stout wire. This cleaning will enable the exhaust gases to have a free passage through the chamber and pipes, and will ensure the perfect vaporisation of the mixture which is so essential to the best and most economical running.

The Claudel Hobson carburettor, as used on these cars, is fitted with a main jet No. 115, a slow running jet No. 60, and power jet No. 50, and new jets can be obtained from the works or any of the service depots by quoting these numbers.

REMOVING THE TANK.—The actual attachment of the eight gallons capacity petrol tank to the front of the dash is very simple, and consists of two semi-circular strips which surround the tank and are held by easily adjustable nuts, located on the engine side of the dashboard.

Occasionally the tank may show signs of drumming which is an indication that the nuts on the ends of the strips require tightening. At the same time care should be taken not to overdo this and thus strain the tank.



The tank is held to the dashboard by two straps which can be tensioned by means of the nuts A, located on the engine side of the dash. B is the petrol filter ; C, the electric starter and D, the petrol tap.

In order to remove the tank, should it spring a leak, the instrument board must first of all be removed by undoing the series of screws which secure it to the scuttle bridge. The wiring must be disconnected and the various connections on the steering column freed so as to enable the column to be withdrawn backwards and downwards from the steering box. Finally, the petrol pipe connection and petrol filler chimney must be removed and the four nuts which hold the strips round the tank undone. The tank can then be withdrawn rearwards into the front driving compartment.

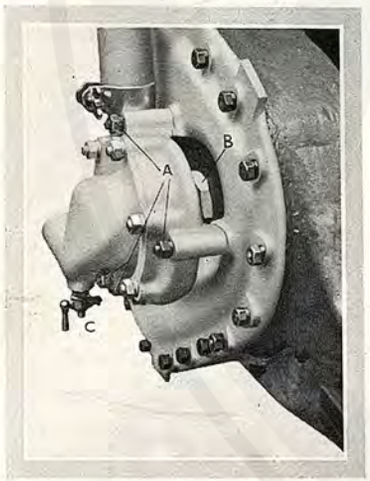
THE PETROL FILTER.—In the open position of the tap the fuel passes through a central passage in the filter into the bottom cap, which forms a dirt and water trap. Thence it passes upward through a cone of gauze to the outlet to the carburettor feed pipe.

Occasionally, say after each 2,000 miles' running, the bottom cap of the filter should be removed and any sediment or water therein cleaned out. At the same time the gauze should be carefully wiped with a piece of linen cloth to remove any fluff or foreign matter that may have become deposited on it.

While in this design of filter the tendency is for any foreign substance in the fuel to settle at the bottom of the cap, the gauze should not be neglected indefinitely on this account. A partially choked petrol filter gauze is sometimes responsible for erratic running of the engine. If the fuel does not flow through the filter freely it may not reach the carburettor sufficiently fast to meet the requirements of the engine. Misfiring and " hesitation," which may be accompanied by " popping " in the carburettor, when the engine is running at medium and high speeds, either on the level or on hills, is often due to a partially choked filter gauze.

Before an attempt is made to clean the filter at any time the petrol tap under the tank should be placed at the horizontal or " off " position to prevent loss of fuel. It is then the work of a minute or two to unscrew the cap at the bottom of the filter body, to remove any dirt and water therein, and to clean the gauze.

To prevent spilled benzol or petrol from spoiling the paintwork on the scuttle, a mat with a hole cut out to allow the entrance of the filler cap, may be used as a protection when refilling with fuel.



The water pump, shewing A, the studs securing it ; B, the gland nut and C, the drain tap.

THE WATER COOLING SYSTEM.—The water circulation is maintained by a centrifugal pump attached by three studs to the front cover of the engine and driven by the camshaft direct. The water passes to the water jacket surrounding the cylinder barrels and through holes to the detachable head and thence to the radiator. The pump spindle is fitted with an adjustable gland to prevent leakage, the gland being locked in position by a large hexagon nut. Special packing is used and should last almost indefinitely. Replacements, if and when necessary, should be obtained from one of our service depots or direct from the works. Ordinary asbestos cord is unsuitable and should not be used (except, of course, as a temporary emergency). The gland should not be tightened more than is necessary to prevent leakage, very little more than finger tightness being sufficient.

Should it at any time be necessary to move the pump the radiator will have to be withdrawn. It is secured to the front cross member of the frame by two bolts and to the top of the dash by a strip of angle section. When these three connections and the two water connections to the engine have been undone the radiator can be removed. The flexible connection between the pump and the engine must then be undone, and when the three nuts holding the pump to its supporting studs have been removed, the pump itself can be drawn off forward.

The water level, which should be within a couple of inches of the filler, to allow for expansion under temperature, must be inspected periodically and if hard water must be used, the radiator should be occasionally flushed out and filled with a strong solution of common washing soda, and the car run for a day, afterwards washing out with clean water. It is always preferable to use rain water, and if this is dipped out of a rain water butt it should be strained to prevent leaves, etc., choking the tubes or other channels.

In cold weather, if there is any danger of the temperature falling to freezing point in the garage, due to the absence of any heating device, the radiator and cylinders should be drained before the car is left for the night (see page 44).

HOW THE WATER IS COOLED.—It will be observed that no separate fan is fitted, its duty being fulfilled by the vaned spokes of the flywheel. By this means air is drawn through the radiator and past the engine and delivered under the car. In this connection it is important that the two side plates, bolted to the crankcase and extending to the side members of the frame, where they are also secured, should always be in position when the engine is run. The same applies to the shield passing across the frame under the flywheel, and to those in front of the engine. These plates not only serve to keep the engine free from mud, but also enable the flywheel to draw air that can enter the space under the bonnet through the radiator only. If the plates are out of position, air can enter without passing through the radiator ; thus a considerable amount of cooling effect is lost and there is a possibility of the engine becoming overheated.

THE RADIATOR.—The radiator, cylinders and heads contain 3 gallons of water, a drain plug, which is located at the near side at the back of its base, being provided for draining purposes.

A subsidiary tap is screwed into the base of the rear cylinder block, and will drain water that the radiator tap cannot draw. The normal position of the subsidiary tap points rearwards.

CARE OF RADIATOR IN COLD WEATHER.—In England it is seldom necessary to drain the radiator to prevent the water freezing. A radiator muff, a rug thrown over the bonnet or a radiator safety lamp may be employed in an unheated garage. On exceptionally cold occasions a mixture of one-third alcohol and two-thirds water may be used in place of plain water. Another anti-freezing solution may be made by adding one part by volume of best quality glycerine to each four parts of water, this solution being claimed to be proof against ten degrees of frost, while one part of glycerine to three parts of water is proof against 16 degrees of frost. As the mixture decreases owing to vaporisation, water alone should be added.

If hard water is employed in the circulating system mineral deposit will form on the inside of the radiator and the water jackets. Special preparations may be obtained which, when mixed with the water, are claimed to prevent this furring up.

LEAKING RADIATOR.—Radiator leaks are seldom experienced nowadays, but when they do occur, there are several excellent preparations which can be obtained in most garages to effect a temporary cure of the " get-you-home " kind.

TIMING CHAIN AND WHEELS : THEIR INSPECTION.—Should it be necessary at any time to inspect the timing chain or any of the sprockets, the front cover and water pump must, of course, be removed, this necessitating the withdrawal of the radiator. The chain is provided with an ordinary detachable link, which is best fitted or removed when positioned between the crankshaft and dynamo sprockets. The former is keyed on to the front end of the crankshaft, and should withdrawal ever be necessary, a special extractor would have to be used. The camshaft wheel, however, needs no special apparatus for its removal, and is keyed, locked and tabwashered into position. The phosphor bronze bush housing the magneto sprocket shaft is bolted into the face of the timing cover, and when removed releases the magneto driving sprocket from the armature shaft sleeve, providing, of course, that the sprocket bolt has first of all been loosened so as to disconnect the armature sleeve from the sprocket shaft. In replacing the sprocket shaft bush care should be taken to position the well in the casting on the uppermost side, as this bearing depends for its lubrication on the oil supplied by the well, which is replenished with oil thrown into it by the timing chain.

In refitting the water pump care should be taken in engaging the flattened end of the pump shaft with the slot in the front end of the camshaft.

The pump must be held in the correct position and pressed gently on to its studs while the flywheel is revolved. Then, as the slot in the end of the camshaft lines up with the front end of the pump shaft, the latter will sink home the last half inch and the coupling will be complete.

SETTING THE VALVE TIMING.—Should the timing chain ever be removed it will be necessary to reset the valve and magneto timing. First, bring the flywheel to top dead centre, i.e., with the line and the letters D.C. 1, 4, two teeth to the off side of the spout of the rear drain tap. Next, note the O on the crankshaft sprocket and turn the camshaft sprocket until the O on it approximately faces the O on the crankshaft. Move the camshaft until No. 1, i.e., the front cylinder inlet valve, is just opening, and then wind the chain round the crankshaft and camshaft sprockets. When the chain is tight it will be found that the inlet valve in No. 1 cylinder is beginning to open over top dead centre, the exact distance being a slightly variable measurement.

SETTING THE MAGNETO SPROCKET.—Next, tension the chain between the camshaft and magneto driving sprockets, threading it over the latter in such a way that the clamping bolt on the sprocket is nearly upright. Next, tension the lower length of chain by rotating the dynamo and turn the flywheel towards the near side almost one complete revolution, the exact amount being indicated when the line and letters D.C. 1 4 are five teeth to the off side of the rear drain tap spout. The sprocket bolt will again be in the upright position and accessible through the oil filler orifice. With the contact breaker lever fully retarded, and the central distributor brush pointing to No. 1 lead on the cover, the armature should be revolved until the platinum points are just breaking. The sprocket bolt may now be tightened so as to clip the magneto driving sprocket on to its shaft and the timing should be correct. Further notes on the timing of the magneto appear on page 18.

THE EXHAUST SYSTEM.—The exhaust manifold is bolted to the off side of the cylinder block, the outlet pipe being connected at the front end, and then passing down under the chassis to the silencer at the rear.

This equipment requires no attention in the usual course of maintenance, though annually, or after 10,000 miles' running, it is advisable to remove the silencer in order to dismantle the interior parts to clear

away any deposit of half-burnt oil that may be impeding the flow of gases through the holes in the central tube, and thus causing slight loss of power.

The silencer is dismantled by first disconnecting the pipes and flanges at either end and then tapping out the central tube, which is the only part that can or requires to be removed.

After many thousands of miles' running the pipe connecting the exhaust manifold with the chamber round the inlet pipe may be disconnected, while the lid on the near side of the heated jacket can be removed so as to enable the chamber to be freed of carbon deposit. This deposit can be softened from the chamber and transfer pipe with the aid of paraffin, and then scraped away with a wire or any suitable instrument.

THE CONTROLS.—The controls are all conveniently positioned. The hand controlled brake lever is the longer of the two levers, located immediately on the left of the driver, and when pulled back applies all four brakes. It can also be locked in any desired position. To unlock the brake it is only necessary to depress the plunger on the top on its handle and push the lever forward. The shorter control lever operates the gear change, and when pushed forward on the right engages the reverse gear ; when pulled back on the right the first speed is engaged, while when the lever is pushed forward on the left and pulled back on the left the second and top gears are respectively employed.

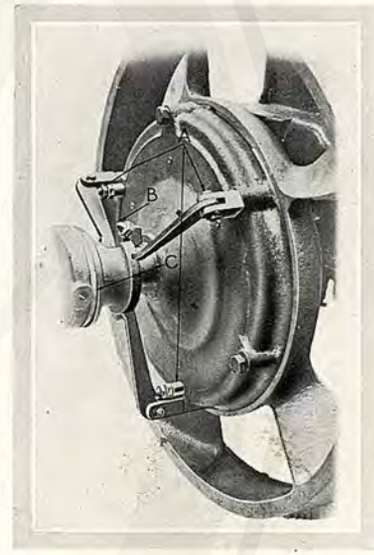
The ignition and throttle levers are found on small quadrants located below the steering column, the ignition being on the left and the throttle on the right. The former is advanced when pushed forward and retarded when pulled back, similar motions of the throttle lever representing open and closed throttle respectively. There are three control pedals in front of the driver, that on the left side operating the clutch, the central one all four brakes, and the third on the outside right the accelerator. To the left of the clutch pedal and rather in advance of it is a knob-headed pedal which, when depressed, operates the electric starter.

The electric horn control is found on the inside of the body, where it is conveniently placed to the right hand while the petrol tap and strangler are also positioned so as to be easily controlled by the driver without the need for him leaving his seat.

In driving, the throttle lever is rarely moved, variations of engine speed and power being controlled by the accelerator pedal, the lever under the steering wheel serving primarily to set the throttle in the best position for slow running, the throttle returning to that position when the pedal is released. On long runs, however, it may be convenient occasionally to give the right foot a rest by using a hand lever only for the time being.

The control rods leading from the bottom of the ignition and throttle levers are fitted with ball joints. These are adjustable, so that any slackness due to wear can be taken up. Occasionally, say once a month, two or three drops of oil should be applied to each joint to prevent the formation of rust and ensure free operation. Also the bearings for the cross tube mounted on the dashboard and the five holes in the pedal brackets should be given a few drops of oil occasionally (see page 31).

THE CONSTRUCTION OF THE CLUTCH. The inner portion of the rear face of the flywheel houses six coiled springs which are arranged circumferentially. A plate, the rear surface of which is faced with an anti-friction material, is located next to the springs and pressed by them against the driven plate of the clutch. The rear face of this driven plate bears against a friction-lined surface formed within the outer case of the clutch which revolves with and is attached to the flywheel. Disposed at equal intervals round the periphery of the clutch and anchored to the flywheel are three studs on the outer ends of which are pivoted three levers. The lower ends of these levers engage with slots on the clutch withdrawal collar which, when moved forward by the action of depressing the clutch pedal, presses on the three adjustable clutch withdrawal pegs. The latter are free to slide in the clutch cover, but are provided with a shoulder which bears up against the front clutch plate. Consequently, when the clutch pedal is depressed, the clutch pad presses the clutch withdrawal collar forward, the movement of this piece forcing the radially-disposed levers against the adjustable ends of the clutch withdrawal pegs. They in turn force the front plate against the springs which are compressed, so that the driving and driven members of the clutch are separated.

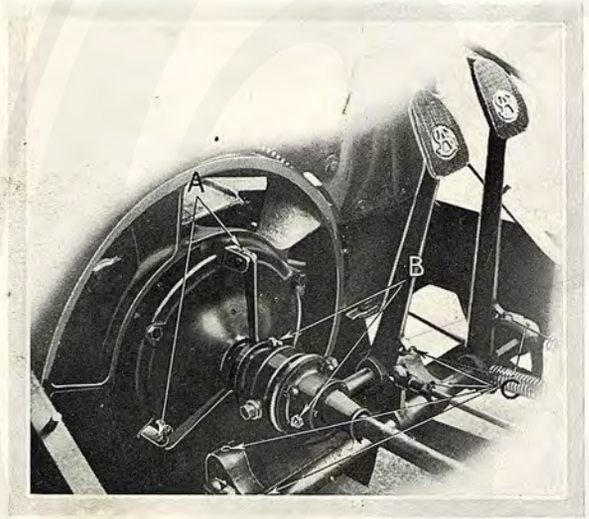


A, adjustable clutch withdrawal pegs by means of which the clearance between the clutch pad C, and clutch withdrawal sleeve can be correctly set at $\frac{1}{16}$". B, greaser feeding clutch spigot.

The single plate clutch requires no lubrication as far as the driving discs are concerned, the friction fabric enabling the drive to be taken up smoothly and without shock when the discs are dry. The clutch

spigot bearing requires oil, however, and a small container is provided, oil being introduced through the grease gun nipple. This spigot should be given a small quantity of thick oil or grease every 500 miles.

If it is found that in negotiating a stiff gradient the engine continues to run or increase in speed whilst the car is actually slowing up, this indicates that clutch slip is taking place. Also on changing speed on a hill sometimes half a minute or more occurs before the clutch really takes hold.



A spot of oil at A and C should be given periodically to ensure smooth operation of the clutch and brake controls. The greasers B should also be charged at regular intervals.

With the clutch operating sleeve touching the inner ends of the three levers there should be 1/16-in. clearance between the sleeve and the operating pad.

It is essential that a clearance is maintained at this point ; failure to do so means that the clutch springs are prevented from exerting the required pressure on the clutch plates, and clutch slip must result.

To adjust, slacken off the locking nuts, and turn in a clockwise rotation the three set screws under each arm, until the required 1/16-in. clearance is obtained between the sleeve and the pad. Care should be taken that each of the arms is adjusted to bear equally on the sleeve, to avoid tipping of the clutch discs, etc.

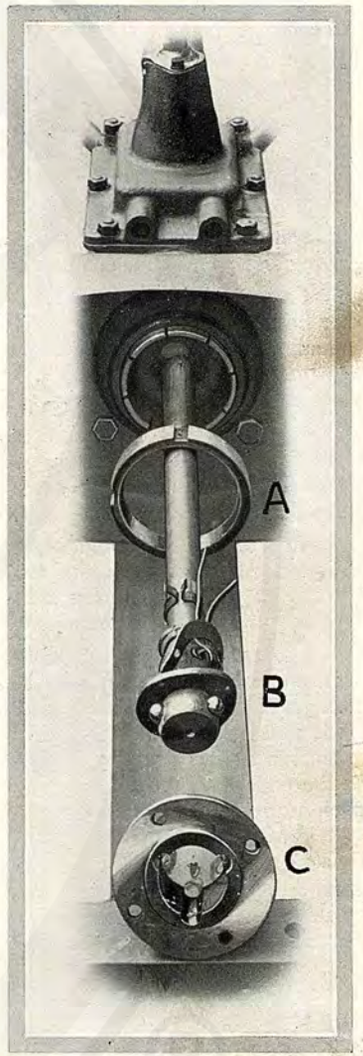
Special spanners will be found in the tool kit for this adjustment.

The shaft connecting the clutch with the gear box has spherical ends in which steel balls are half embedded. The projecting halves of these balls engage with grooves formed within hollow extensions of the clutch and gear box members. The flexible joint so formed provides for the necessary end movement of the clutch member when the pedal is operated. A telescopic leather casing encloses the open end at the front of the clutch shaft. This joint should be given a charge of thick oil or grease when going over the car after every 500 miles, through the grease gun nipple provided.

The rear end of the coupling shaft is enclosed and packed with grease when assembled. This should be replenished at any time the joint is re-assembled.

REMOVAL OF THE CLUTCH.—To remove the clutch it is only necessary to undo all four bolts that hold the two halves of the front clutch coupling shaft housing. The latter, with its leather cover, can then be withdrawn. The three balls drop out of their sockets, and when the necessary control gear has been disconnected the clutch can be stripped down.

THE GEAR BOX.—The three-speed gear box, which carries the change speed, is assembled as a unit with the back axle, the unit being anchored to the frame through a spherical joint between the front end of the gear box and the central cross member. The lower end of the change speed lever actuates the two selector forks which engage the gears. These



The clutch shaft. A, lock ring securing the spherical housing to the cross-member. B, front clutch shaft coupling, and C, clutch member, showing grooves in which the balls ride.

forks are mounted on selector shafts which are slotted, and engage with spring-loaded balls to prevent the gears from jumping out of mesh.

Although no gate can be seen, this is fitted in the top cover, and the change speed lever positions are standard as shown below.

2nd speed — Reverse.

3rd speed, or top — 1st speed.

N

SPEEDOMETER DRIVE.—At the rear of the gear box, beneath the level of the main shaft and driven from it, are the spiral gears driving the speedometer cable.

These gears are lubricated by oil which passes through the rear gear box bearing, the lower gear running in a bath of oil contained in a small sump formed at the bottom of the casing.

The speedometer itself is held to the back of the instrument board by a spring clip, the case of the driving shaft being attached to the back of the instrument by a thumb nut, which, when removed, allows the shaft to be pulled clear away. The other end of the shaft casing and the shaft itself can be equally easily detached from the front end of the propeller shaft casing.

Any excess of lubricant returns to the gear box, an oil retainer on the propeller shaft preventing it from escaping down the casing to the back axle. The brass plug behind the box on the front end of the torque tube is a breather and need never be removed.

The transmission unit, which consists of the gear box, propeller shaft enclosing the torque tube, and rear axle, can be withdrawn as one unit from the frame when the front end of the clutch coupling shaft, front end of the rear brake connections, lock ring securing the front extension of the gear box in its spherical housing, and the lower half of the collars securing the rear spring anchorage to the axle case have been undone.

THE REMOVAL OF THE GEARS.—To remove the primary shaft from the gear box, the transmission unit must first of all be withdrawn as already described. The lid of the box is next raised. Next loosen the tabwashers and unscrew the six nuts which secure the front cover of the gear box. Then, by pulling on the clutch shaft, it is possible to remove the front cover and primary shaft as a complete unit. To strip this further, remove the four screws which hold the rear universal joint cap in position and withdraw the clutch shaft and with it the three balls and the springs. A set screw and a lock nut must next be undone in order to free the primary shaft from the front cover.

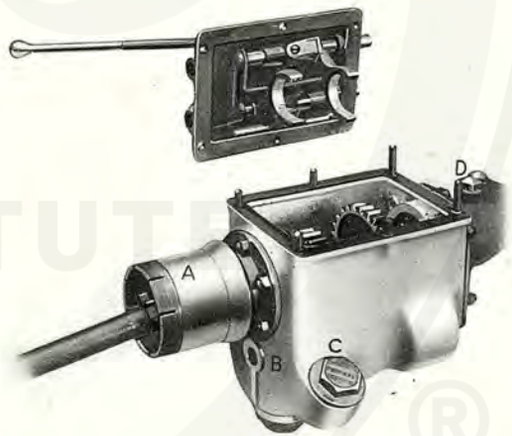
To remove any other gear in the gear box, undo the seven nuts which secure the gear box to the torque tube and then pull the gear box

straight off the torque tube. As the gear box is slid off the main shaft, the first and second gears are freed and can be lifted out of the box. To remove the lay shaft and its gears, undo the small tabwasher and set screw which will be found at the bottom of the rear end of the gear box. This will enable the layshaft to be pushed out from either end of the gear box and the gears to be withdrawn at once.

To extract the reverse idler pinion, screw a stud into the reverse idler shaft which will be found at the rear end of the box and is threaded for the purpose. The shaft can then be pulled out and the pinion withdrawn at once.

GEAR BOX LUBRICATION.—The gear box requires attention very infrequently, and then only to verify the level of the oil and replenish the supply, if necessary. Lubrication of the parts within the gear box is automatic so long as this level is maintained, as the layshaft, when rotating, throws oil in all directions.

The oil filler plug is screwed into an extension of the side of the gear box. The lower edge of the hole for the plug is approximately level with the centre line of the layshaft, and all that is necessary to do is to pour in oil until it is at the point of overflowing, and then screw in the hexagon-headed plug tightly with the spanner provided.



The gear box in detail. A, spherical housing which is supported in the central cross-member of the frame. B, front bush of layshaft. C, the oil filler plug, and D, the breather.

The transmission plan. A and B, front and rear clutch shaft couplings; C, gear box oil filler; D, gear box breather; E, tie rod anchorages; F, speedometer drive; G and H, wing nut brake adjustments; I, axle oil filler.

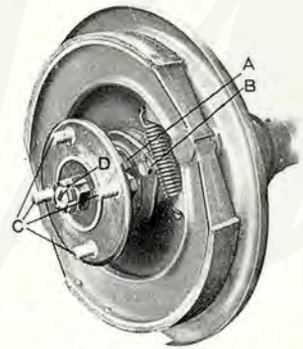
The oil level should be verified and oil added, if necessary, after each 2,000 miles' running, the inspection being made through the filler cap hole. Special gear oil should be used as recommended on page 67

PROPELLER SHAFT AND BEVEL PINION.—The propeller shaft, the front end of which forms the main shaft of the gear box, is machined all over from high tensile steel bar and is enclosed within a tubular casing, which is stiffened by the diagonal tie rods running rearwards from the front end to a point against the spring anchorage on the back axle. Fixed on the rear end of the propeller shaft by means of a taper and serrations is the pinion of the spiral bevel gearing which forms the final drive. The pinion is supported by a roller bearing, of which the inner race, together with a double thrust bearing, is mounted directly on the boss of the pinion itself, and the propeller shaft has an intermediate bearing to stop " whip."

THE BACK AXLE.—No attention is required to the back axle beyond the occasional replenishment of the oil within the casing. Behind the central casing is a projecting spout with a hexagon-headed cap. The oil should be introduced through this spout, which also serves as a level indicator and overflow. The oil level should not be allowed to fall more than $1\frac{1}{2}$ inches below the rear edge of the filling spout.

Owing to the oil-tightness of the axle casing, replenishment is called for very infrequently, but it is advisable, nevertheless, to make an examination after each 2,000 miles' running, and if necessary, add fresh oil to make up for any loss that may have occurred. (See Lubricants, page 67.)

The only other parts that need independent attention are the hub bearings. These should be given a further supply of thick oil through the grease gun connection shown on page 54, when going over the car at the end of every 500 miles.



A, packing gland lock ring. B, screw holding the packing gland collar to the axle end bracket. D, axle shaft nut, and C, four studs holding drum to hub.

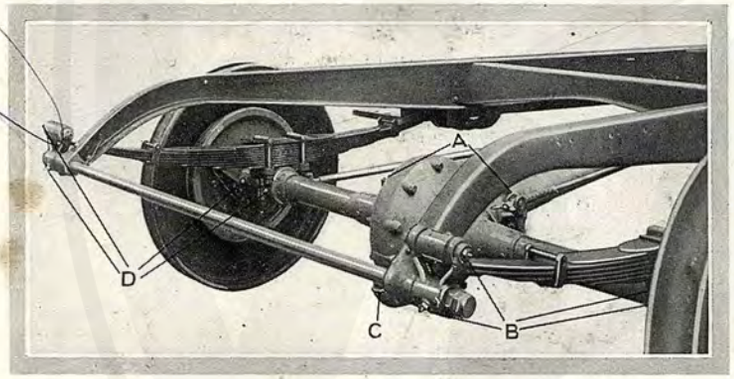
STRIPPING THE BACK AXLE.—To strip the back axle, undo the four central nuts securing the road wheels to the hubs and withdraw the road wheels complete with the rear brake drums. This will disclose the rear hub and packing gland.

Next, remove the axle shaft nuts and their split pins, and then free the tabwashers securing the screws holding the packing gland collar to the axle end bracket, there being no need to disturb the packing gland lock ring. Place the hub extractor on the four central studs and withdraw the hub and packing gland as a complete unit from each side. Disconnect the front end of the diagonal near side tie rod that links the end of the axle casing to the back of the gear box. Strip the differential casing by undoing the 11 split pins and nuts. The near side of the axle casing can now be withdrawn from the axle, the latter being then pulled out towards the near side complete with the differential. Care should be taken not to lose the thrust discs which are used for adjusting

the mesh of the spiral bevel and pinion. These are located on the shaft in the differential casing and should be replaced in the order in which they are extracted. Probably the thrust discs and shims used on the off side of the axle will come away with the axle shaft, and care should again be taken to re-assemble them correctly.

To withdraw the propeller shaft, disconnect the front end of both diagonal tie rods immediately behind the gear box and strip the torque tube from the axle casing by removing the eight bolts, nuts and split pins which connect the two flanges. The propeller shaft, with its spiral pinion and thrust housing, will then all come away together. In the replacing care must be taken to see that the shims bteween the flanges and axle casing and torque tube are correctly re-fitted.

THE BRAKING SYSTEM.—Each of the four-wheel brakes employs one pair of shoes, and all brakes are operated by the pedal and also the hand lever, the latter being attached to a bracket mounted on the central cross member of the frame. The brakes are operated through rods, the ends of which are screwed to provide means for adjustment, which can be easily effected from outside the car. To adjust



The rear brake adjustment is effected by the wing nuts at A. B and D are points requiring periodic attention with the grease gun, while C is the back-axle oil filler cap.

the front brakes, the rear sleeve nut on each rod must be screwed up and followed by the front sleeve nut, the floating pin at the upper end of the vertical lever being thus pinched between the two nuts.

The adjustment for the rear brakes is effected by two brass wing nuts, which are automatically locked in position by springs which encircle the control rods.

The correct adjustment of the brakes is attained by jacking up the wheels in turn, and setting each brake so that the wheel can just be turned round by hand when the hand lever is in the second notch from the front of its quadrant.

THE LAY-OUT OF THE BRAKE CONTROLS.—The inner end of the front brake camshaft is carried in an oil-less bearing formed with and located below the axle. The outer end of the camshaft terminates in a universal joint located below the swivel pin and provided with a grease gun connection. Bowed levers connect the inner end of the camshaft with the horizontal operating rods, the other or rear ends of which are connected to short levers dependent from the brake pedal shaft. Standing vertically from the near side of this shaft is a short lever from which a stout adjustable compression link leads back to the shorter arm and the hand brake lever. This shorter arm is also connected direct to the near side rear brake control rod, the other end of the latter adjoining the short vertical lever actuating the rear brake camshaft. On the off side the rear brake horizontal control rod is coupled direct to the short vertical arm on the brake pedal shaft.

There are four bearings on the brake pedal shaft which require occasional lubrication, holes being provided for this purpose. Immediately in front of this shaft will be found the clutch operating shaft, which is supported on two bearings also provided with holes for the purpose of periodical lubrication. The bearing for the hand brake lever also needs occasional oiling, and is provided with an oil hole for the purpose. Finally, it may be noted that a hole on the top of the spherical housing for the ball joint of the transmission unit should not be overlooked, and can be located immediately behind the central member of the frame. If this bearing runs dry, it manifests itself by a squeak which may be difficult to trace.

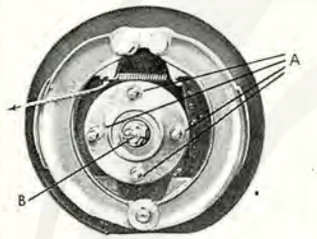
THE FRONT BRAKE.—The front brake shoes are expanded by a common cam which is located near the base of the brake. The upper end of the shoes rest against the two pivot pins which are mounted in elongated slots and provided with eccentric webbs or flanges. As each pin is rotated its flange comes into contact with a raised portion on the inner face of its housing, which presses the pin and with it its shoes outwards. By means of this adjustment the shoes can be set so as to engage accurately and correctly with the brake drums.

The brake cam is held to the inner half of the camshaft universal joint by a spring ring and key.

The front hub is secured to the stub axle by a split pin and lock nut, and can be withdrawn with the aid of an extractor when these pieces have been removed.

REMOVAL OF BRAKE SHOES.—To inspect the brake shoes withdraw the wheel with the brake drum from the hub by undoing the four central nuts. The springs of the shoes can then be disconnected from the hooks on the inner side of the shoes quite easily, and the shoes will then drop off from the pivots and cam.

To remove the rear cam actuating rod it is first necessary to withdraw the screw on the end of the rod near to the torque tube which pinches the lower end of the vertical lever on to the camshaft serrations. The nut and bolt on the outer end of the rod must also be removed, when the brake camshaft can be withdrawn outwards. As the shaft runs on two oil-less bearings there is no need for lubricant at these points.



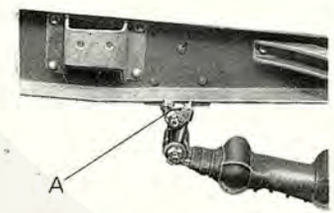
A, the four studs to which the brake drum is attached. B, the axle lock nut. To unhook the brake shoe spring, obtain a bent piece of wire and threading it round the eye of the spring, pull it in the direction of the arrow, clear of the hook in the shoe.

THE SPRINGS.—The front and rear semi-elliptical springs, being enclosed in gaiters, should seldom require attention, other than the regular greasing up of their shackle pins. A greaser will be found at the front end of the dumb irons for the front springs, while two more, which supply the rear shackles of the front springs, are located inside the frame.

The front ends of the rear springs each carry one greaser which protrudes through the valances, another greaser being found at the rear end, while a third points rearwards and downwards, and is located near the end of the rear cross tie rod.

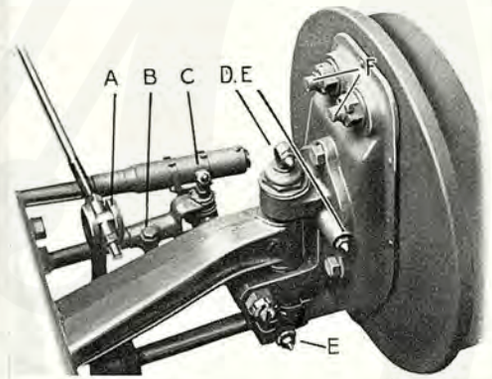
The rear springs are held to the axle casing by semi-circular collars which are provided with grease gun connections, owing to the fact that the spring moves slightly round the axle case. The inverted U clips which hold the rear spring to the upper half of the collar should not be disturbed, except when necessary, as were the clips to be released,

Two grease gun connections supply the upper and lower shackles of the front spring. They are located inside the frame and should not be overlooked.



the separated leaf would be difficult to replace without special apparatus. Consequently, as pointed out earlier in the book, it is best to brake the semi-circular axle clip when it is desired to unship the spring.

ON TAKING DOWN A SWIVEL AXLE.—The steering arm having been disconnected, unscrew the upper brass cap, and then remove the nut and drive out the transverse cotter which positions the swivel pin in the end of the axle. Disconnect the front brake camshaft from its universal joint below the swivel pin, and then turn the wheel to full lock to enable the brake camshaft to be withdrawn, its connection with the control rod having been previously disconnected. Next, unscrew the lower brass cap and drive up the swivel pin, which will then allow the swivel to be freed from the axle end.



Front axle details. A, front brake adjustment. B, track rod adjustment clip. C, track rod greaser. D and E, upper and lower swivel axle greasers, the latter supplying the hub. E, front brake universal joint greaser, and F, pins for taking up wear in brake shoes.

There are two greasers on the swivel, the upper one supplying oil to the swivel itself, while the lower one lubricates the front hub bearing. The bottom one of all, which is mounted on the universal joint of the brake camshaft, supplies this part with lubricant and should receive periodic attention.

RETRACKING THE FRONT WHEELS.—Should it ever be necessary to retrack the front wheels, the pin on the off side end of the tie rod must be driven upwards and the bolts holding the jaw on the rod loosened. The off side wheel can now be turned so as to free the tie rod which carries the jaw. The latter can be screwed into or out of the tie rod, one complete turn of jaw being equivalent to one-sixteenth

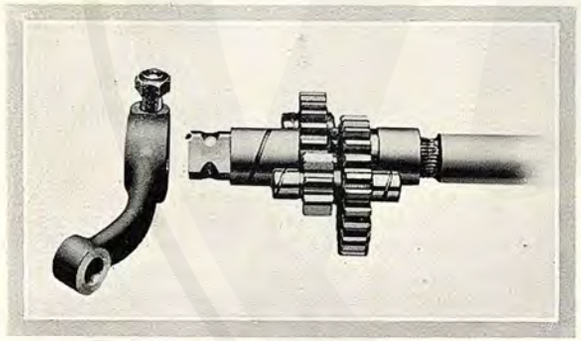
of an inch on the rod. The correct setting is attained when the distance between the extreme front portion of the tyre rims is from $\frac{1}{8}$-in. to $\frac{3}{16}$-in. smaller than the distance between the extreme rear portion. In other words, the wheel should point slightly inwards.

The jaw on the end of the track rod is loosened and the rod screwed inwards to bring the front of the wheels wider apart, or untwisted to bring them nearer together.

Having obtained the correct setting, the pin is then engaged with the jaw of the tie rod and properly secured. Finally, the jaw is locked on to the rod by means of its bolt. It is important to observe this order of reassembly.

THE DETACHABLE WHEELS.—For the purpose of fitting the spare wheel it is necessary only to jack up the car and remove the eight outer nuts with the wheel brace provided. These nuts are very clearly shown in the illustration on page 34. When replacing the wheel, special care should be taken that the nuts are all nipped up tightly. In tightening up these nuts the operator should first tighten up all the nuts slightly; and then, passing from one to another in a clockwise or anti-clockwise direction, each nut should be given a slight tightening until such time as neither of them will yield any further to this treatment.

Attention should be given to these nuts periodically, and they should be tightened if found necessary. In the case of the spare wheel, it should be particularly observed that the countersunk holes, to which the chamfered securing nuts fit, should be entirely free from paint, so that a metal to metal contact may be obtained.



The two pairs of spur wheels forming the steering gear.

STEERING AND FRONT AXLE.—The steering gear is located within the malleable cast iron casing at the lower end of the steering column.

The gear itself consists of two pairs of spur wheels, the connecting rod from the steering box to the front axle being set transversely across

the frame to the near side wheel. A grease gun connection is fitted in the top of the steering box, and the gears should be given a further supply of thick gear oil at the end of every 500 miles.

Fitting and Removal Instructions for Dunlop Cord Balloon Tyres

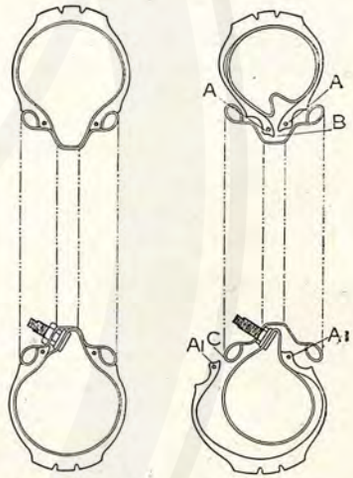
WIRED-ON TYPE NOT BEADED-EDGE TYPE

The outstanding features of the attachment of these tyres to the rim are simplicity and security. Each edge of the tyre encloses an inextensible wire ring of diameter smaller than the edges of the rim. To get the smaller tyre-edge over the larger rim-edge, all that is necessary is the eccentric action of pushing the tyre edges into the depression in the centre of the rim at one point in its circumference, thus permitting the tyre edges at the opposite point to pass over the rim edge without difficulty.

Left, diagram illustrating tyre inflated on rim showing wired edges of tyre seated on shoulder of rim.

Right, diagram illustrating tyre deflated and method of removal and fitting.

When the wired edges A.A. are pushed off the shoulders of the rim into the base of the rim, as at B, the edges A1 A1 can be easily lifted over the rim edges, as at C.



Inflation then automatically seats the tyre edges on the shoulders of the rim midway between the rim edges and the central depression. From this position it is absolutely impossible for them to be moved except by the eccentric action already described, which, of course, is only possible after first completely deflating the tube.

TO REMOVE TYRE.—First completely deflate by removing all valve parts, and push the tyre edges into the base of rim at part opposite valve, then lift the cover edges near the valve over the rim edge. A small lever may be used, but is not essential. *No force is required to do this, but the edges of the cover opposite the valve must be in the base of the rim.*

TO FIT TYRE.—Push one edge of the cover over the edge of the rim. It will go quite easily if you see that the part of the edge first put on is pushed right down into the rim base.

Very slightly inflate the inner tube—do not distend it—place it in the cover, with the valve through hole in rim, taking care that the valve which is fitted inside of tube, is on the right side of rim.

Commence to fit the second edge of the cover at a point diametrically opposite the valve, by placing it over the rim and pushing down into the base of the rim.

A small lever may be used for the last few inches, but is not essential. *On no account use large levers. Force is unnecessary and may damage the cover edges.*

Whilst inflating see that the edges of the cover are seated evenly round the rim.

SPECIAL NOTE.—Do not use force—do not attempt to stretch the wire edges of the tyre over the rim edge: *they are inextensible.* Fitting or removing will be found quite easy, without any forcing, if the wire edges of the tyre are carefully adjusted into the rim base.

Hints concerning Tyres

Dunlop Balloon Cord Tyres are fitted as a standard, the size being 29″×4.95″. Normal pressure tyres, 765 m/m×105 m/m, can also be obtained and are fitted to the Sandown model.

Although the element of luck enters very considerably into the matter of tyre life, methods of driving and attention in upkeep have considerable effect. Releasing the clutch pedal suddenly, driving at high speed round corners, and last, but by no means least, using the tyres insufficiently inflated, all tend to reduce the useful life of covers and tubes of any description or make.

INFLATION PRESSURES.—Every tyre maker issues a table of inflation pressures, showing the most suitable pressure, taking into consideration the weight carried by each tyre and the cross section of the latter. The advice thus available should be followed by users.

For an open touring body with a seating capacity for five adults, the average inflation pressure giving the best results, both as regards tyre life and comfort of passengers, is approximately 50 lbs. per square inch for normal pressure tyres.

It is distinctly unwise to attempt to judge, by mere inspection, whether the tyres are sufficiently inflated. The tyre pressure gauge which is included in the kit, should be used for this purpose, and the air pressure of each tyre, not forgetting that on the spare wheel, should be tested periodically.

For the standard open touring body, with five adult passengers, the average inflation pressure giving the best results with balloon tyres is approximately 28 lbs. per square inch for the front wheels and 30 lbs. per square inch for the rear wheels.

The majority of tyres lose pressure whether they are in use or not, a fact which is frequently overlooked by motorists. Exceedingly minute leaks, so small as to defy detection, may occur at the valve or, owing to almost imperceptible porosity, through the rubber of which the air tube is formed. It must not be taken for granted, therefore, that a distinct puncture or burst must occur before the tyres will lose pressure and require inflating. Hence the advice that the gauge should be applied to each tyre regularly, when, if the pressure is shown to have fallen from normal, the tyre pump should be brought into use.

RUST IN THE RIMS.—Rust is a great enemy of rubber, and its formation within the rims is a frequent cause for the rapid deterioration of air tubes. Moisture sometimes reaches the interior of the rims through the valve holes. To prevent this, the lock nut which screws on to the body of the valve, and clamps a leather washer between it and the rim, should always be kept tight. Water may also enter the rims between their inturned edges, and the tyre beads if the tyres be used insufficiently inflated—another good reason for maintaining pressures with a view to lengthening tyre life.

Periodical Lubrications and Adjustments of the Engine

The advice given in the sections devoted to individual parts of the engine may be summarised as follows :—

DAILY, OR EVERY 200 MILES.

1.—Replenish oil supply in crankcase, adding fresh oil until the indicator registers full on the gauge plate (see page 11).

2.—Lubricate valve rocker, etc. (see page 12).

AT THE END OF FIRST 500 TO 1,000 MILES.

3.—Drain off oil from engine sump by removing the sump plug; replace this plug and recharge with fresh oil to the usual level as shown by the indicator.

AT THE END OF EACH 1,000 MILES.

4.—Remove oil filter gauge and clean (see page 11).

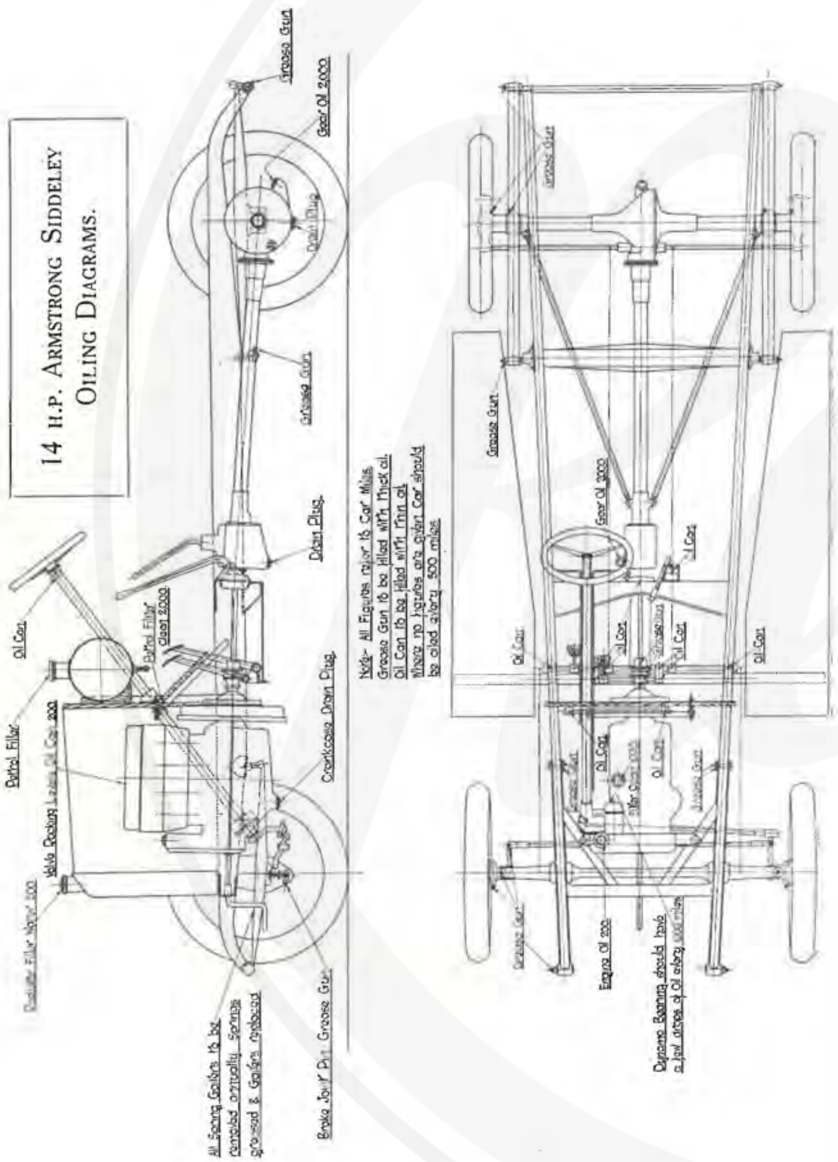
5.—Give a few drops of oil to dynamo bearing (see page 22).

AT THE END OF EACH 2,000 MILES.

6.—Remove bottom cap of petrol filter and clean out any sediment of water therein (see page 41).

ANNUALLY, OR END OF EACH 10,000 MILES.

7.—Clean out silencer (see page 46).



14 H.P. ARMSTRONG SIDDELEY OILING DIAGRAMS.

Periodical Lubrications and Adjustments of the Chassis

The advice given in the section devoted to individual parts of the chassis may be summarised as follows :—

DAILY, OR EVERY 200 MILES.

1.—Examine water level in radiator and replenish if necessary to bring level within two inches of the top of the re-filling orifice.

AT THE END OF EACH 500 MILES.

2.—Use oil gun on the connections fitted to the clutch spigot (1) ; front end of clutch shaft (1) ; rear hub bearings (2) ; front hub bearings (2) ; swivel pins (2) ; cross steering rod pins (2) and front brake universals (2).

For these parts the grease gun should be filled with thick oil or grease.

3.—Using oil gun, fill up steering box with thick gear oil.

4.—Using oil can, lubricate the five holes in the pedal brackets and the two holes in throttle control tube brackets mounted on the dash-board (see page 31).

AT THE END OF EACH 2,000 MILES.

5.—Verify oil level in gear box and back axle, and if necessary, replenish contents to the level of the filling spout on both units.

OCCASIONALLY, i.e., APPROXIMATELY ONCE A MONTH WHEN THE CAR IS IN FREQUENT USE.

6.—Apply three or four drops of oil to the ball connections on the control rods at the bottom of the ignition and throttle levers.

General Hints on Driving

STARTING THE CAR.—Three speeds forward and one reverse are provided, the gate being :—First gear, lever back on the right ; second gear, lever forward on the left ; and top gear lever back on the left ; reverse gear is obtained by pressing the lever forward on the right.

With the engine running slowly, depress the clutch pedal fully, and as it reaches the end of its travel, move the gear lever into the first or reverse speed slot, as the case may be. If the gears cannot be engaged without undue pressure on the lever, allow the latter to return to its neutral position and try again, letting back the clutch pedal and depressing it once more. This second attempt is very infrequently called for, but, when it is needful, it is due to the teeth of the gear wheels on both gear box shafts being directly opposite each other. Obviously, then, the application of more than the light pressure usually required on the gear lever will only result in the edges on the teeth being forced against one another more firmly. Therefore, release the clutch pedal and gear lever, and try again.

CHANGING UP. (Into a Higher Gear.)—In changing from a low gear into a higher one, the accelerator pedal should be released, so that the carburettor throttle may return for the moment to its slow running position. Simultaneously with the upward movement of the accelerator, the clutch pedal should be depressed to its full extent, and the change speed lever moved into the next highest gear position, pausing briefly in " neutral " as you pass through it. Without hesitation the clutch pedal should then be allowed to return to its normal position, quickly, but not with " a bang." Double de-clutching is sometimes desirable, but not always necessary.

CHANGING DOWN. (Into a Lower Gear.)—It is always correct to double de-clutch when " changing down." This is accomplished as follows :—Keeping the accelerator pedal steady the clutch pedal should be depressed, the change speed lever moved into the neutral position, the clutch pedal should then be released, the engine slightly accelerated and the clutch pedal at once again depressed and without hesitation the change speed lever moved into the lower gear and the clutch pedal again released.

The reason for this is that on top gear with the car travelling at say 15 miles per hour, the engine is making 825 revolutions per minute, and on second gear with the same car speed, the engine is making 1,525 revolutions per minute. When changing up, the accelerator has to be released so that the engine speed can accommodate itself to the new requirements and the two gears which it is intended to mesh together can be given the same peripheral (or tooth) speed and so can be engaged without clashing. During the slight pause when changing up, the clutch shaft will lose sufficient speed for this to be accomplished, but when changing down, the necessary additional speed has to be given to the clutch shaft by the engine.

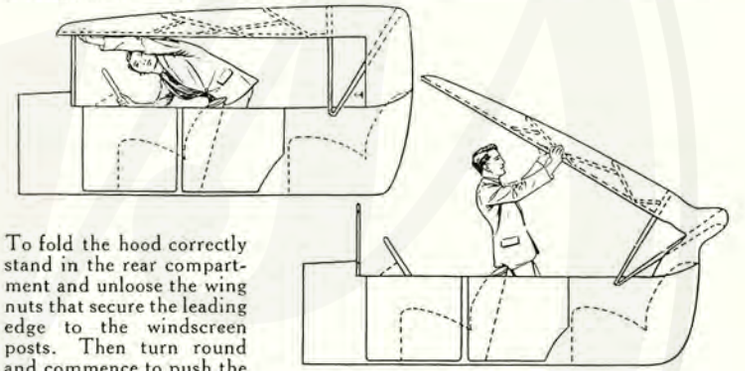
USE OF IGNITION LEVER.—Apart from allowing a variation of the timing of the spark for engine starting purposes, the ignition lever (that to the left of the steering wheel centre) enables the timing to be varied according to the conditions prevailing at any moment when the engine is running under load. It may be taken as an axiom that the ignition lever should always be as far advanced as possible without giving rise to pre-ignition. Results closely approaching the best obtainable in power development, hill-climbing and petrol consumption, can be secured by allowing the lever to remains always in the one position ; but, nevertheless, it is unquestionable that better results follow the correct manipulation of the ignition lever. Economy in fuel consumption is secured, for example, if the ignition lever be fully advanced when the engine is running easily, well within its capabilities, either at a good speed with full throttle, or at medium speeds with half throttle.

When the engine is pulling hard with full throttle, it may be taken roughly that as the speed falls from the maximum, so must the ignition

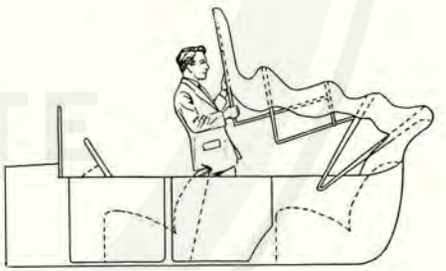
lever be retarded. Allowing the engine to labour at low speeds on a stiff hill with full throttle and the ignition fully advanced is detrimental in two ways : (1) the full power of the engine is not being developed, and (2) an unnecessary stress is being imposed upon the connecting rods and engine bearings by reason of the tendency which then prevails for the explosions within the cylinders to take effect upon the piston whilst it is still rising on the compression stroke.

Generally speaking, then, with a fully open throttle, retard the ignition in proportion to the falling off of engine speed, and vice versa.

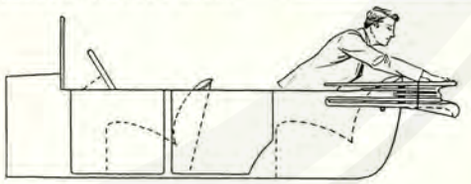
USE OF BRAKES.—In bringing the car to a standstill by means of the brakes it is distinctly inadvisable to use them forcibly, except, of course, in an emergency. Tyre wear caused by brake application may be said to be proportional to the suddenness with which the car is stopped or its speed reduced.



To fold the hood correctly stand in the rear compartment and unloose the wing nuts that secure the leading edge to the windscreen posts. Then turn round and commence to push the hood rearwards, holding it as shown in the second illustration.

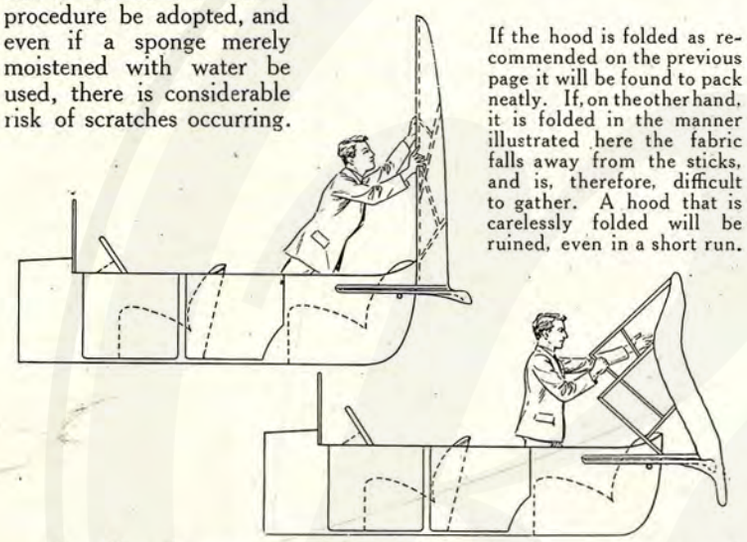


Next brake the joint at the end of the first hood stick so that the whole hood subsides gently backwards on to the hood rests. Care should be taken to see that the fabric is not sheared by the folding irons nor pushed between the rubber spacers on the hood sticks.



Care of the Bodywork

On no account should mud or dust be removed from the body panels, tops of wings or bonnet by means of a dry cloth. The varnish will be scratched if such a procedure be adopted, and even if a sponge merely moistened with water be used, there is considerable risk of scratches occurring.



If the hood is folded as recommended on the previous page it will be found to pack neatly. If, on the other hand, it is folded in the manner illustrated here the fabric falls away from the sticks, and is, therefore, difficult to gather. A hood that is carelessly folded will be ruined, even in a short run.

Providing the sponge used is free from grit, the more water used with it the better the results will be. But even so, mud that has become dry should not be removed with a sponge, without first soaking the mud thoroughly with water issuing at low pressure from a hose-pipe or applied with a can. It may be said that mud should never be wiped off varnished panels, either with a dry rag or wet sponge, but should be floated off with water issuing either from the sponge or from other means of applying it. Paintwork may be preserved, especially that on top of the bonnet and scuttle if, when the car returns from a run in the rain, the rainwater be immediately soaked up with a sponge and the varnished surfaces dried off with a damp chamois leather. If the rain spots be allowed to dry off naturally, on the warm panels of the bonnet for example, they will tend to leave permanent marks where they have dried.

Never allow the full force of water issuing from a hose-pipe under high pressure to be applied directly to body panelling, otherwise the particles of grit thus forcibly removed will scratch the varnish as though they were wiped off with a dry cloth.

Never use paraffin or any other liquid, except water, to clean the panels, bonnet, or the outer surfaces of the mudguards. Paraffin tends to dull the varnish.

Benzol has a very harmful effect upon paintwork. It dissolves the varnish and the paint beneath almost instantly, and not only removes the gloss but in a comparatively few seconds will actually remove the paint itself and leave the bare metal or woodwork exposed. For this reason benzol, although it will rapidly dissolve tar spots, should never be utilised for this purpose. Such spots or splashes should be softened by applying some sort of animal fat, butter preferably, and allowing it some hours to take effect in softening the tar. The latter may then usually be wiped off with a clean linen rag, and, if care be used, and possibly a second application of fat, only the faintest stain will remain. Tar spots should be removed, nevertheless, at the very earliest opportunity, before they have time to harden. If they are taken in time they will leave no permanent stains.

In removing tar, whether it be wet or hard, care should be taken not to increase the area of paint affected by spreading the tar over a wider surface than that covered by the original spot.

Lubricants recommended for use on Armstrong Siddeley Cars

A. S. FILTRATE (REG.) FOR ENGINE LUBRICATION.

We first proved the high lubricating value of this oil during the war, it being used by us for the testing of over two million h.p. aeroplane engines. It is an oil with exceptional body under heat, and yet one which retains its fluidity at cold temperatures so as to secure a ready flow through the feed pipes. It is the correct weight to give the best results on A. S. Engines.

A. S. FILTRATE GEAR OIL, FOR GEAR BOX, REAR AXLE, AND FOR USE WITH OIL GUN.

A clean, very heavy bodied, but fluid oil, for summer and winter. (In very cold weather a small proportion of A. S. Filtrate should be added.)

A. S. FILTRATE GREASE FOR UNIVERSAL JOINTS AND HUBS, AND FOR USE WITH OIL GUN.

This is a solidified "Oil-Grease," specially manufactured for us, which we have found far more efficient than the old style of Yellow Grease. It combines the tenacity of a thick grease with the softness of an oil, enabling it to keep in close contact with the metal instead of being pushed away from its work, as is often the case with a Yellow Grease.

Obtainable direct from our works at Coventry or from any of our Service Depots (see page 3).

A Lubrication Chart on page 62 indicates the position of all fillers, drains, greasers and bearings requiring lubrication. If a car is in daily service it is desirable that the important bearings, such as the front axle and steering cross tube, should be lubricated even more frequently than stated on this chart. The design of the chassis is such that the points requiring lubrication are reduced to a minimum which is all the more reason why those provided should receive regular and conscientious attention.

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