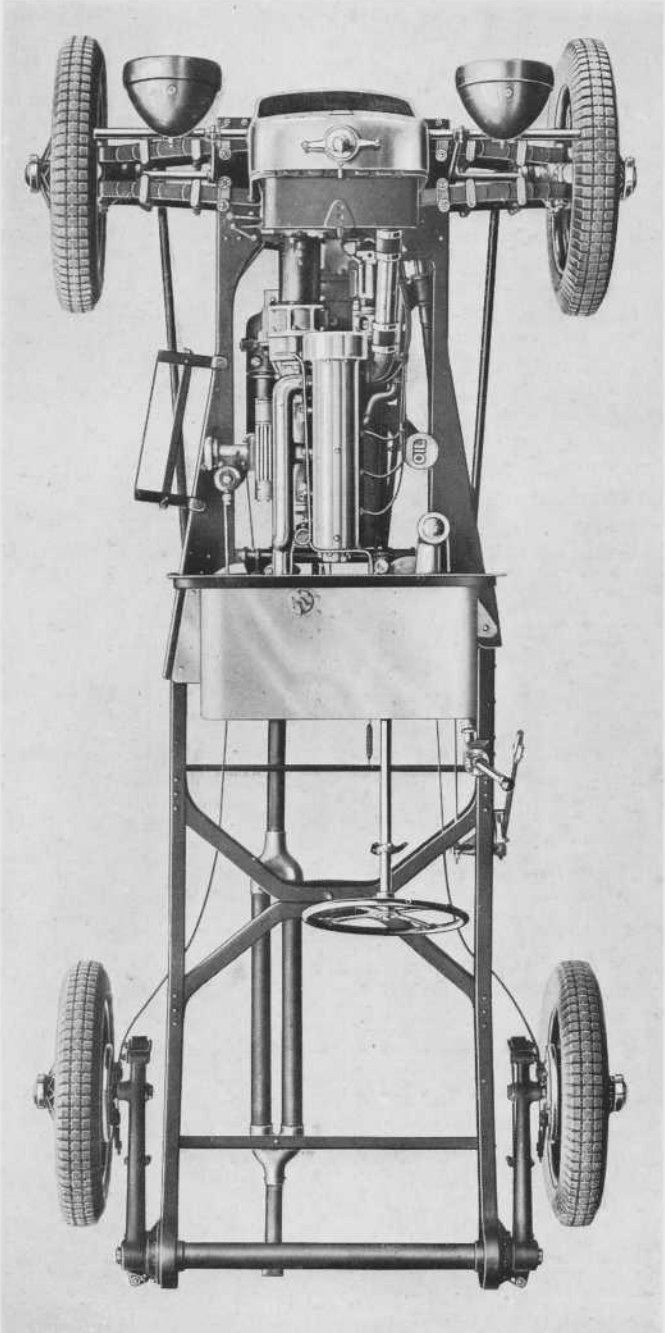
INSTRUCTION BOOK

ALVIS

FRONT WHEEL DRIVE

MODELS F.A. & F.B.
F.E. & F.D.

PRICE
10/-



Plan View of Alvis Front Wheel Drive Chassis.

THE OWNER of the front wheel drive Alvis will have realised that, with the exception of the rear suspension, the whole of the working parts of the chassis are in front of the dashboard. The engine, gear-box and differential are built up in the one unit, which is fitted in the frame of what is known as "three point suspension."

One is accustomed to talk of the front and back end of an engine but, of course, in the case of the front wheel drive Alvis, these terms are reversed.

In order to get a proper perspective of the general layout of the chassis and the engine unit it is desirable that illustration No. 1 should be well studied, not so much to absorb the particular mechanical details but the general layout, because it is essential that this should be well understood, particularly by those motorists who are not so accustomed to motor car practice.

Illustration No. 1 shows the heavy section of the frame employed, and how a cross member is introduced behind the engine to receive the rear trunnion engine mounting.

The pedal shaft to which the clutch, accelerator and brake pedals are fitted will be noted, also the hand brake and change speed lever mechanism.

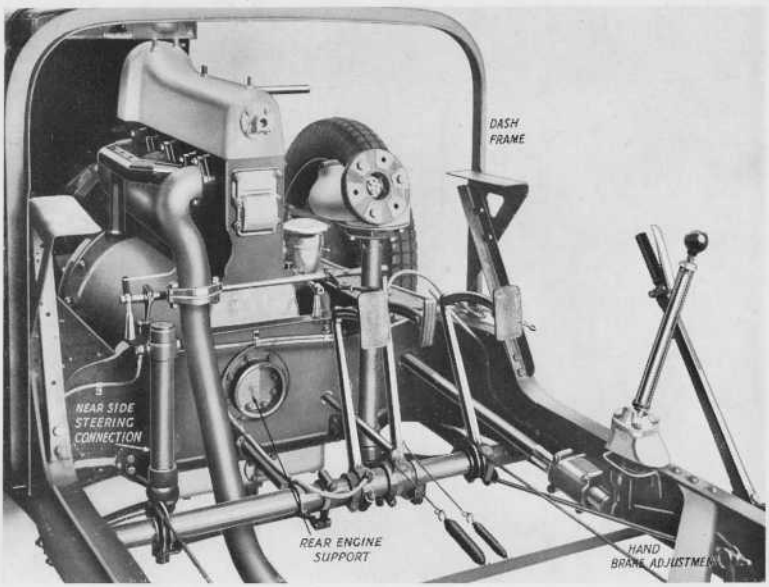


Fig. 1.
General view of the chassis of the front wheel drive Alvis, in which many details can be seen that are covered up when the body is fitted. As, for example, the rear end of the engine is supported in a trunnion housing in the large cross member of the frame. The steering, with the exception of the rods that operate the front wheels, is all behind the engine. This illustration also shows how, by means of a length of flexible piping, lubrication is effected from a central point on the dashboard to the numerous moving parts, such as the steering, shackles and cross shafts.

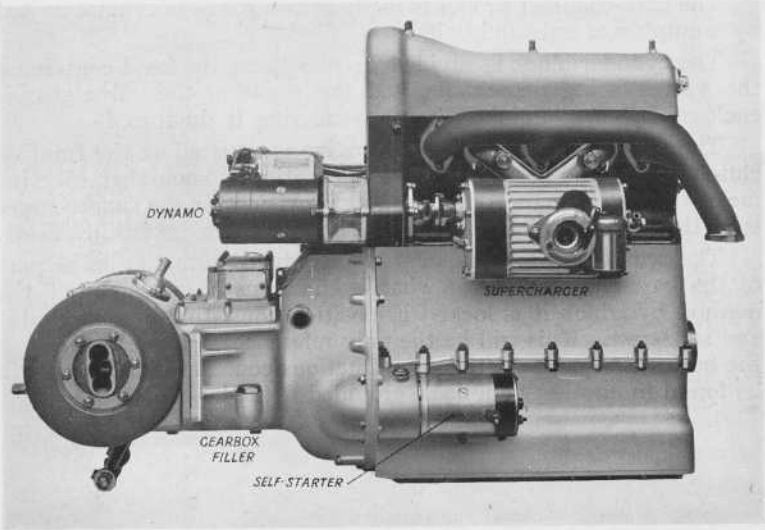


Fig. 2.
Nearside view of the four-cylinder supercharger model front wheel drive Alvis engine. Self-starter mounting is clearly visible and the dynamo is situated on this side of the engine also. The gear-box filler is situated on this side and this illustration clearly indicates another feature, the composite unit employed.

The steering gear-box will be seen on the right of the engine, but this will be dealt with in more detail subsequently.

The owner should note the adjustment for the hand-brake which is situated on the right-hand corner of the illustration and the method by which the brake rod couples up to the pedal shaft.

The next obvious illustration to study is a general view of the engine, clutch, and gear-box unit as it presents itself when this has been removed from the chassis. This particular illustration shows an engine fitted with a supercharger, but in order not to overburden the instruction book with details that would be common to all models, explicit instructions concerning the supercharger will be given separately on page 47.

Illustration No. 2 should be carefully examined, and it must necessarily be assumed that the owner has some mechanical knowledge in order to appreciate the contents of this book, without which it stands to reason that the normal size instruction book would have to be so extended as to make it a treatise of motor cars, rather than instructions and explanation of the particular product. This type of unit construction has many advantages ; it eliminates universal joints and affords a better opportunity to remove the whole working parts of the car from the chassis in a very simple manner whenever necessary, to carry out either overhaul or specific repair.

Starting from below on the right-hand corner, it will be noticed that the base-chamber is fitted with a large plate, removal of which gives a good inspection to the interior of the engine.

The base-chamber proper is made in two parts, which are united by a number of nuts and bolts.

The cylinder block is divided in two parts, the head containing the valves being detachable, and the whole of the valve gear is enclosed by an aluminium cover, rendering it dustproof.

The timing mechanism of the engine is situated at the front or clutch end of the engine and the disposition is such that effective means for driving the dynamo and provision for the supercharger is on the nearside ; the water pump and magneto are on the offside.

The self-starter is conveniently introduced into the lower part of the base-chamber, being what is known as barrel mounted, the method by which it is locked in position consisting of a large nut and set screw. This will be the only reference to the self-starter in the book, as separate detailed instructions concerning this unit will be found in another handbook provided with the car.

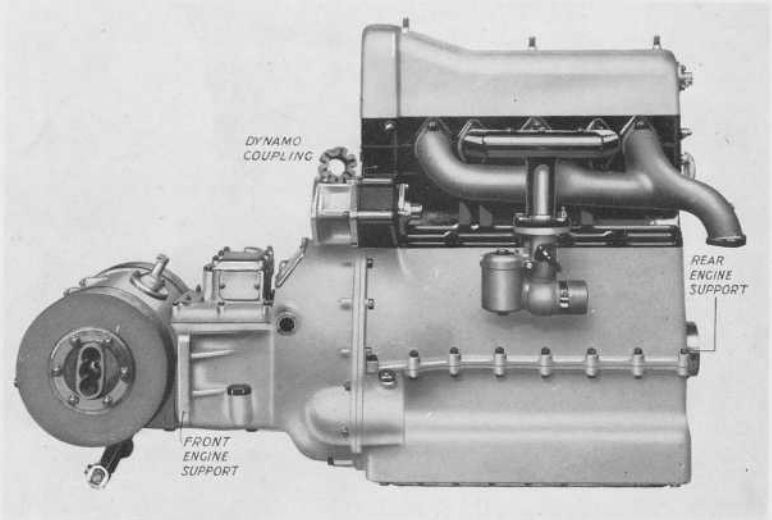


Fig. 3.
Carburetter side of the engine of the un-supercharged model, with dynamo and self-starter removed ; the dynamo coupling is shown resting on the top of the casing. The engine has three point suspension, two at the front and one at the rear.

We next notice the clutch housing which is a common casting with the gear-box and half the differential housing. The gear-box filler will be noticed on this side of the unit and on top of the gear-box the striking forks are contained in a separate casting readily detachable. The brake drums and inner universal joint housing can be seen on the extreme left of the illustration.

Having thus described the general layout, it is as well to consider the same side of the engine with certain parts dismantled and the unsupercharged type, see illustration No. 3. From this it will be noted that advantage is taken of the proximity of the exhaust and

inlet manifolds to unify these, in order to form a "hot-spot," the object of which is a well-known principle in carburation.

The dynamo has purposely been removed from this illustration, in order to indicate more clearly the inspection cover over the clutch housing.

Before attempting to deal with any particular features of the engine the offside should be carefully scrutinised, as there are more details on this side of immediate concern to the owner as, for example, oil filler and oil level indicator, water pump and magneto, and position of the sparking plugs. See illustration No. 4.

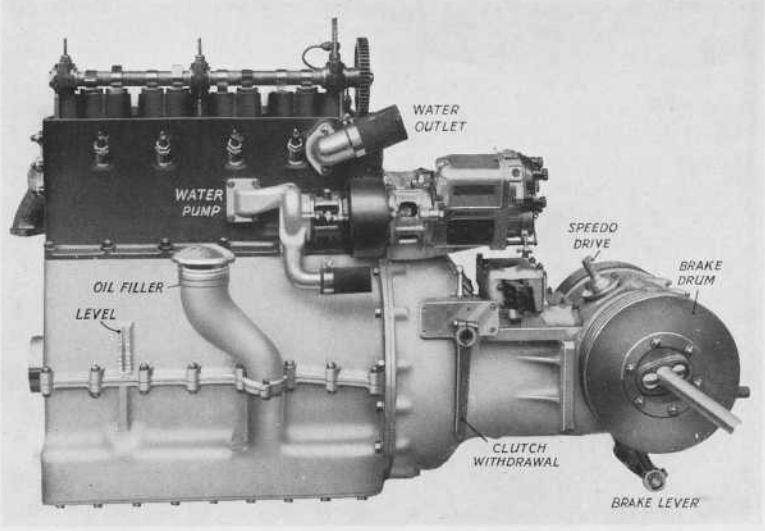


Fig. 4.
Offside exterior view of the four-cylinder Alvis front wheel drive engine, showing water pump and magneto in position. Below the magneto the clutch operating lever is situated and a shaft is shown in position to indicate how the drive is transmitted to one road wheel. Water passes from the pump to the cylinder block, then by a transfer passage at the rear of the engine to the cylinder head and returns to the radiator by the pipe beneath the timing gear.

The aluminium valve cover has been removed in order to illustrate overhead camshaft and valve mechanism, and it is as well to state at the beginning that there are no actual adjustments to the valves, correct clearance being obtained by means of washers that are fitted on the top of the valve stem ; the cams operate direct on to cylindrical dashpots which encircle the upper end of the valve stems. All these fittings will be dealt with later under illustration 15. No useful purpose can be served by dealing with all the various points in this illustration, because they will be shown in detail elsewhere. Before passing, three items alone could be usefully referred

to. A long lever will be noted attached to a cross shaft, which is employed for clutch withdrawal and is coupled to the clutch pedal. The small housing set at an angle on the top of the differential case is, in point of fact, the speedometer drive. The ball-jointed shaft has been introduced into the housing inside the universal joint without any fittings, to show its disposition. It stands to reason that with the knowledge possessed by the majority of drivers concerning the general details of the ordinary rear wheel drive, with the case of the front wheel drive Alvis he will be particularly interested in the manner in which the front wheels are driven.

Reference should now be made to illustration No. 5, which shows the independent springing of the offside front wheel and it will, of course, have been realised that all four wheels are independently sprung. Here we see the driving shaft entering a split hub housing, which is attached, top and bottom, to the springs. The outward end of the driving shaft can take up any position inside the interior spherical housing, extension of which forms the pivot, equivalent to the steering head pin of the ordinary car, the lower extremity being attached to the steering arm. There is no coupling between the steering arms beneath the engine, as examination of the car will show. A more detailed description of the steering will be found in the subsequent illustration.

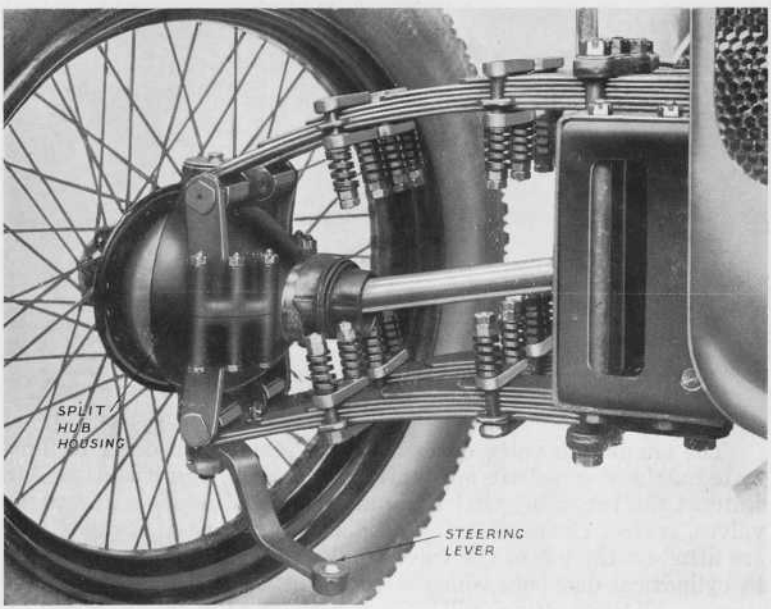


Fig. 5.
General view of the offside front wheel drive, showing method of suspending the hub housings through four springs, two top and two bottom: the drive shaft is universally jointed on both ends and the wheel has purposely been inclined in order to show the spherical ball swivelling hub, which moves to and fro inside the hub housings.

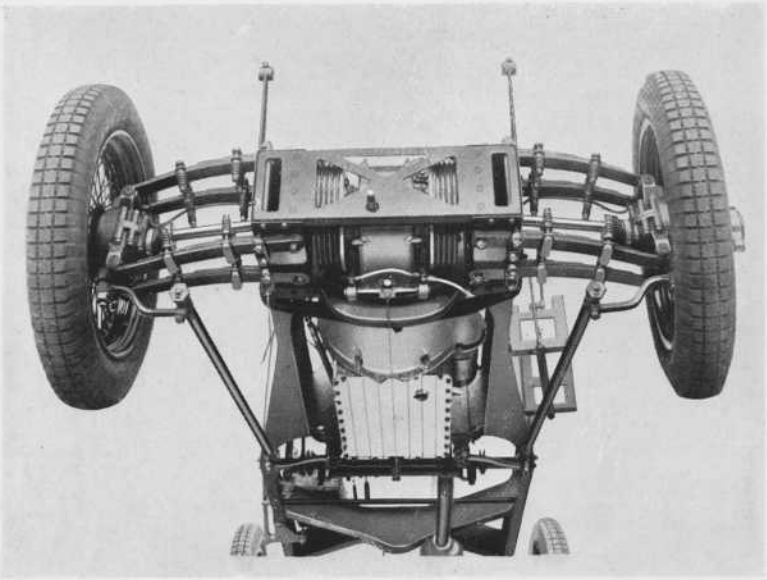


Fig. 6.
General view of the underneath of the front end of the front wheel drive Alvis chassis. Anchorage to the springs can be seen and the method employed to steer each wheel by independent pull and push rods.

One is usually accustomed to look at bird's-eye views of cars, but a much better idea of the general layout of the front wheel drive Alvis will be obtained by looking at the mechanism from below.

Now refer to illustration No. 6. There is a wealth of detail contained in this illustration and it should be carefully studied, as this is a view of the car that the owner very seldom has an opportunity of seeing. Due allowance must be made for perspective.

All the steering connections are clearly visible and the cable coupling the cross pedal shaft, with the toggle joint coupling the brake levers, will be seen passing beneath the engine, terminating in a wing nut, very conveniently situated to afford adjustment of the front brakes.

The heavy section frame members will be noted.

Before passing from the general assembly to the details of the various units, and as a fitting sequel to the underneath view of the front end of the chassis, the owner should examine such details as can be seen in illustration No. 7.

It will have been noticed that a number of small pipes are employed to lubricate various moving parts that would otherwise have to be independently attended to. A small tank is situated on the dashboard, which is filled with thin oil (Castrol " F "), and is conducted through the flexible metallic tubes to the points to be lubricated. There are, however, certain parts that cannot be so supplied,

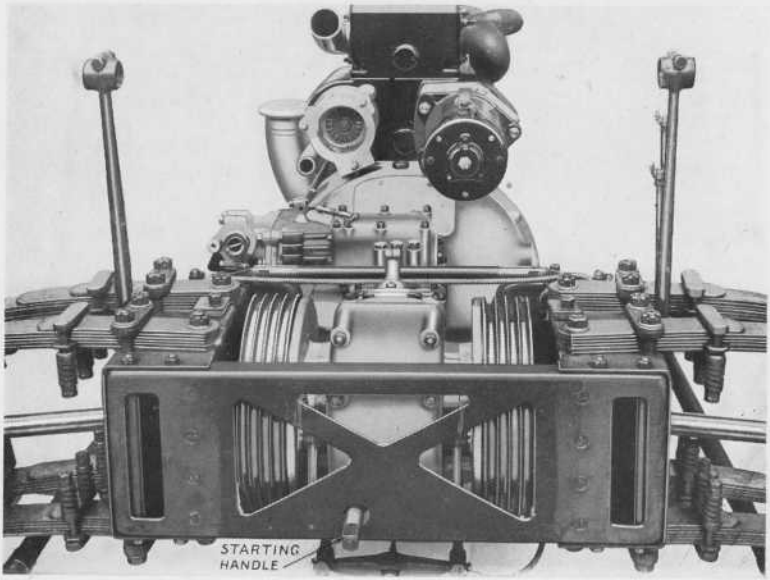


Fig. 7.
Front end view of the front wheel drive Alvis chassis shewing anchorage of top springs and starting handle protruding through front cross member. This front cross member is bolted in position and is detachable.

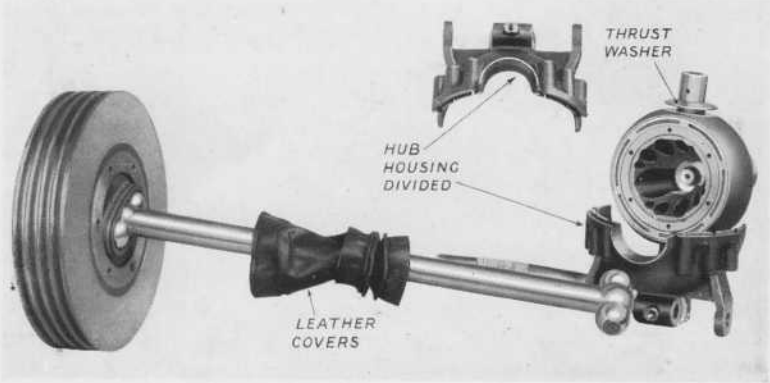


Fig. 8.
The object of this illustration is to indicate the layout of the universal joint inside the brake drum and the interior of the hub, and the method by which the spherical ball swivelling hub is inserted in the hub housings. The load is not taken on the ball itself but on phosphor bronze thrust washers which are fitted to the pivot pins. The pivot pins are part of the sphere and machined out of a single stamping.

such as the steering ball joints and steering head pivots, but these will be dealt with under the general heading of "Chassis Lubrication."

Probably sufficient has been said to arouse in the owner the natural desire to know how the power is transmitted to the road wheels and, before dealing with the internal mechanism of the engine, clutch, gear-box, etc., the method of driving the front wheel will now be discussed.

Before reading anything further, examine illustrations 8, 9, 10 and 11, which show the drive to one wheel assembled and dismantled.

The first thing that would become apparent is that there is a shaft having a cross head at either end, to which are fitted detachable balls. This permits the shaft to drive the hub, no matter in what relative position the road wheel finds itself in relation to the chassis, due to the deflection of the road springs.

After examining illustration No. 8, which is intended to give a general view with certain parts dismantled, more particular attention should be paid to illustration No. 9, because it has been possible, by carefully placing the parts, to see how the drive is affected. The hub housing, which is made in two parts, is bolted together and it should be clearly understood from the outset that the load is not carried on the spherical ball, but on the thrust washers of the pivot pins, there being actually a clearance of .005" (five thousandths of an inch) between the outer hub housing and the spherical hub.

The inner hub, complete with ball bearings, is fitted inside the spherical pivot and locked in position by means of a locking ring, which in turn is held in position by a grub screw. It will be noticed that this grub screw is slightly countersunk and is centre punched on the side to prevent any possibility of its working outwards. Owing to the shape of the locking ring, a special tool is necessary to remove this.

Momentary reference back to illustration No. 8 will show the interior of the inner hub, and it stands to reason that some provision must be made to maintain the driving shaft in such a position that it cannot move endways more than is necessary for the drive. This is obtained by fitting an aluminium container with a thrust on the inner end inside the hub, the inner end contacting with the end of the shaft. This container will be noted on the right-hand of illustrations 9, 10 and 11, and acts as an oil reservoir, affording sufficient lubrication for the outer driving end of the shaft.

In order to prevent an excess of oil the aluminium container is provided with a quantity of wick, which feeds to the thrust oil in sufficient quantities for proper lubrication of this part. The serrated end of the hub receives the wheel in the ordinary way, which is locked in position by a right or left-hand threaded nut; the right-hand being on the nearside and the left-hand on the offside of the car.

There are two main points of particular importance to the owner concerning the front hub assembly: (1) that it should receive sufficient lubrication; (2) that as far as practicable dust and water, or a combination of both in the form of mud, shall be excluded from the spherical housing.

This is obtained by the introduction of small strips of felt, which can be seen in illustration No. 11, and are situated on the outer edge of the half housings. It will be necessary to remove these felt washers from time to time, but this is a comparatively simple operation and does not entail more than removal of the spring shackle bolts and various nuts that unite the two halves of the hub housing which, incidentally, are machined in such a manner that they interlock one into the other and exclude any foreign matter from entering the joints where they are united.

Reference should now be made to illustration No. 10 which shows that at either end of the driving shaft leather covers are provided to prevent foreign matter getting into the universal joints proper; split aluminium collars are fitted on to the shaft in order to form a boss for the covers to be attached.

The inner end of the driving shaft will be seen in illustration No. 10 with one of the balls removed and, for the purpose of illustration only, two housings have been introduced into the picture; the one on the left shows exterior view and the one nearest to the end of the shaft showing the inner view. These housings are attached to the small differential shafts, which will be described later, fitting in splines on the shafts.

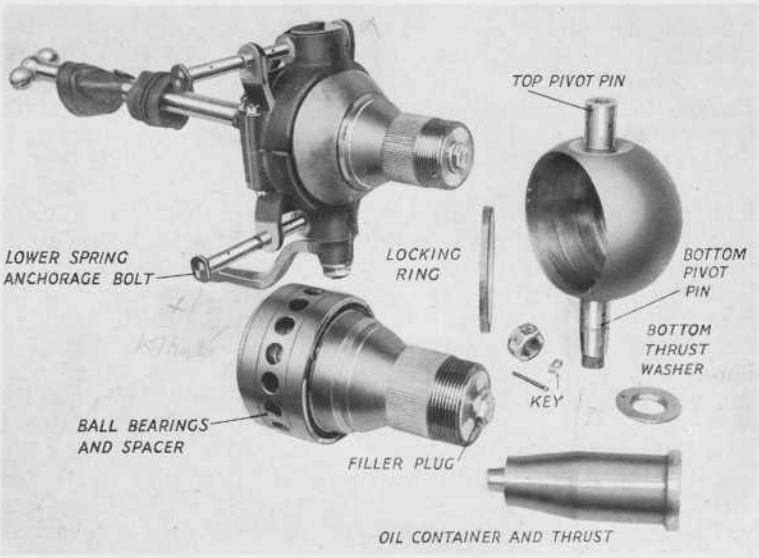


Fig. 9.

This illustration should be carefully studied as it shows a complete hub housing, spherical ball swivelling hub, ready for assembly to the springs. Immediately below this, and to the right, shows how the hub is fitted inside the ball and locked in position, by a special shaped locking ring. This locking ring can be seen in position in illustration No. 8. At the lowest point of the illustration, on the right, the aluminium hub centre is shown, which acts as a thrust for the outer extremity of the drive shaft. Further details of this are shown in illustrations Nos. 10 and 11.

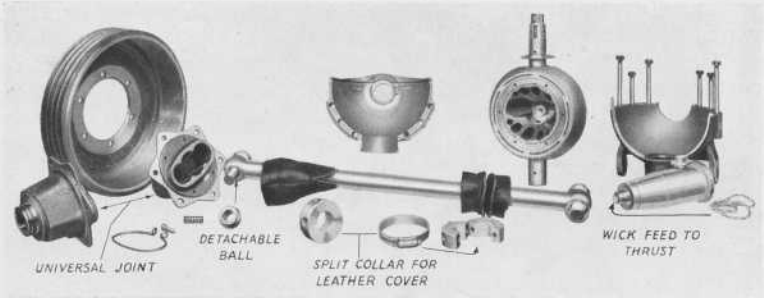


Fig. 10.

General details of all parts connected with the drive from the differential to one road wheel. Two views of the inner universal joint housing are shown, there being a spring inserted into the short differential shaft to force the universal shaft slightly outwards, in contact with the thrust, at the outer extremity. The shaft can be clearly seen, the balls at either end being detachable, thus ensuring proper universal action.

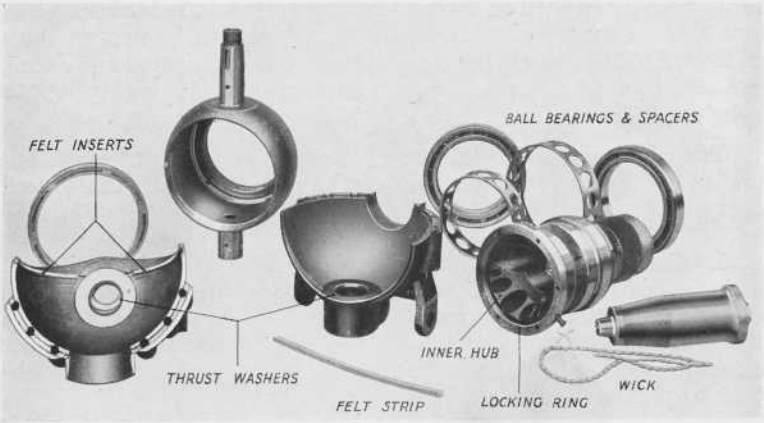


Fig. 11.

This illustration is worthy of careful study : the hub housing is split and machined so that, at the point where the two halves are united, one locks inside the other. The inner faces of the housing are undercut at the point where the pivot pin passes through and are fitted with small felt strips which contact with the spherical ball swivelling hub. This felt prevents dirt from entering. The spherical ball swivelling hub can here be seen, suitably cross drilled, so that lubricant can find its way to all parts. On the right-hand side of the illustration, the hub will be noticed with the ball bearings and inner and outer spacer removed. It will be noticed that the ball bearings are locked in position by a ring, which is screwed to a hub, and in turn locked in position by a set screw. The holes in the locking ring are $\frac{3}{16}$" diameter and they are $4\frac{1}{8}$" between centres, a piece of flat bar drilled to receive $\frac{3}{16}$" pegs can be used. In order to maintain the proper feed of oil to the outer universal joint and at the same time restrict this, the aluminium oil container which is screwed into the hub from the outside is filled with a quantity of wick, the end of which just passes through the point where the thrust of the outer end of the universal joint is situated. There is no necessity to remove this container from the hub for refilling. It is fitted with a plug and can be filled by an oil gun.

The differential shaft is bored out sufficiently to receive a spring, which has the effect of forcing the shaft very slightly outwards in contact with the thrust button previously described. Should it be necessary to remove the engine unit, the aluminium thrust will have to be removed from the hub to allow the shaft to move sufficiently endwise to come out of engagement with the inner universal joint housing, but care must be taken to see that the shaft does not move too much endwise, otherwise the balls will come out of engagement of the slots inside the hub, when it will be necessary to dismantle the whole hub in order to refit them.

The front road wheels should never be rotated with the engine out of the chassis.

A simple means of preventing this is to take an old inner tube and cut a section out of it which will form a rubber ring, and by putting one loop over the shaft, the other over the Tecalemit greaser on the top of the hub, the shaft can be thus held in the desired position.

Mention of Tecalemit greasers brings us to the point of the method by which the face of the ball on the pivot is lubricated. A nipple is fitted both on the top and the bottom steering head pivot pins and by means of suitable drilling, which can be seen in illustrations 8, 9, 10 and 11, the thrust washers are lubricated and excess grease is forced between the spherical pivot and the split hub housing.

The pivot should be lubricated every 2,000 miles at least, but in bad weather several charges of the gun should be introduced every 500 miles.

Engine. It is now proposed to deal with the engine unit and, as far as possible, pictorially dismantle this, dealing with the various components in such a sequence that the owner will get a proper conception of the details of the engine. Only after he has read the complete section through, however, will he realise exactly how the various parts are correlated.

In the first place the engine has a bore of 68 millimetres, and stroke of 102 millimetres, giving a cubic capacity of 1482 cubic centimetres, which brings it well within the $1\frac{1}{2}$ litre class.

In attempting to describe the engine as a composite unit one has to consider first of all the description of the various parts, then the operations involved in dismantling and finally what is equally important, namely, the precautions to take in reassembly. In order not to have to refer back to previous illustrations where it is necessary to give certain instructions, the assembly and reassembly will be considered at the same time. One has also to consider what operations the owner may desire to effect, such as removal of the cylinder block to inspect pistons, and the possible removal of the internal parts of the engine, in order to take up wear at a subsequent date.

Before entering into any of these details, however, it may be as well to discuss briefly the method of timing employed in this engine. Practically every illustration of the engine contains some particular point to do with timing or driving of such parts as magneto, water pump, dynamo, supercharger, valve gear and oil pump, and if a momentary reference is made to illustration No. 4 it will be seen that the camshaft is driven by a gear wheel. The cylinder head is shown in illustration No. 12, as seen at the front of the engine, and alongside of this will be found an idler gear wheel with the pin on which it revolves, together with the washers and end cap which lock the pin in position.

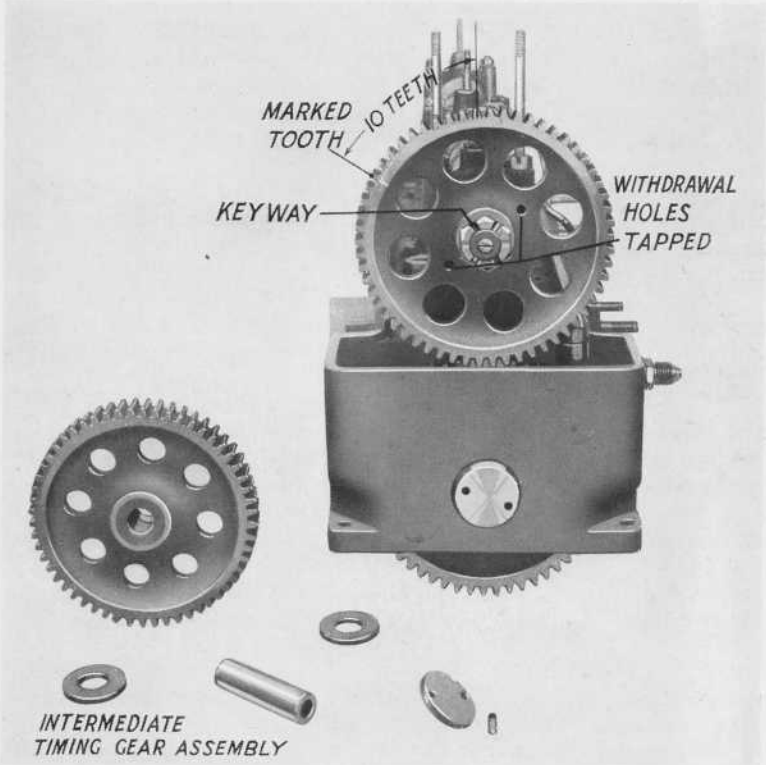


Fig. 12.

Rear end view of the cylinder head after removal, complete with camshaft and timing gears. It will be seen later that there are three idler gears between the crankshaft and the camshaft. To retime the engine, disregard the position of the idler gears. Set the piston on top dead centre, and the tooth opposite the keyway in the camshaft timing wheel, as viewed from the front of the car, should be 10 teeth to the left of the tooth that is then at the top of the wheel. The idler wheel is shown dismantled ; it runs on a hardened steel pin, thrust washers being used on either side of the pin which is locked in position by the end cover plate, which latter is secured in the cylinder block by two set screws.

The drive is obtained from the main timing gear on the crankshaft and an idler wheel situated above it in the base-chamber; above this is situated another wheel which drives two gear wheels, one to the pump and magneto spindle, and on the opposite side one to the dynamo and supercharger. Above this, in turn, there is an idler wheel shown in illustration No. 12, which drives the camshaft wheel.

In order not to confuse the issue, it is well to state at the commencement that all the timing setting is done off the camshaft wheel. There is no necessity to mesh the idler wheels in any particular manner, but it is necessary for the relative position that the crankshaft wheel and the camshaft wheel should have a definite relationship.

Supposing the head has been removed for decarbonization and valve grinding, and the head is being replaced: examine the end of the camshaft and it will be noted that there is a mark on the back end of the gear, opposite the keyway. The gear wheels can then be reassembled, after the pistons of Nos. 1 and 4 cylinders have been placed on top dead centre, in such a manner that ten teeth to the right of the keyway brings the tenth tooth to the top centre of the gear.

It is always possible to time the magneto afterwards, so that the correct segment of the distributor comes into position for the firing stroke. Suitable holes are drilled in the camshaft wheel so that this can be withdrawn from the shaft at any time.

Regarding the idler gears, illustration No. 16 shows the caps covering the ends to these, and from the dismantled unit in illustration No. 12 the method by which these are assembled in the engine will be noted.

The length of the pin is such that, by tightening the end cap, it is possible to lock the pins solid, allowing the gear to rotate on the pin, the necessary side play being taken up and allowed for by steel washers placed between it on either side of the gear, which has a phosphor bronze bush. The pin has a $\frac{1}{16}$" hole drilled in it to let air through while being tightened up. To remove the pin, a $\frac{5}{16}$" B.S.F. bolt and a short piece of tube is sufficient to act as a drawer, tightening the bolt after placing a washer between it, and a piece of tube will withdraw the pin from its housing.

Carburetter. A "Solex" carburetter is fitted, and a separate instruction book is provided, giving all the details as to the general arrangements, but a few short details may be of some assistance before reverting to the "Solex" book.

Unscrewing the nut on top of the float chamber permits the whole of the carburetter to be taken to pieces. A strangler is provided on the dashboard which closes the main air and thus ensures easy starting. The carburetter settings are as follows:—

Non-supercharged.		**Supercharged.**	
Type Solex 40 m/m. MV.		Type Solex 40 m/m MOHD.	
Choke	28	Choke	26
Main jet	155	Main jet	135
Pilot	60	Pilot	60

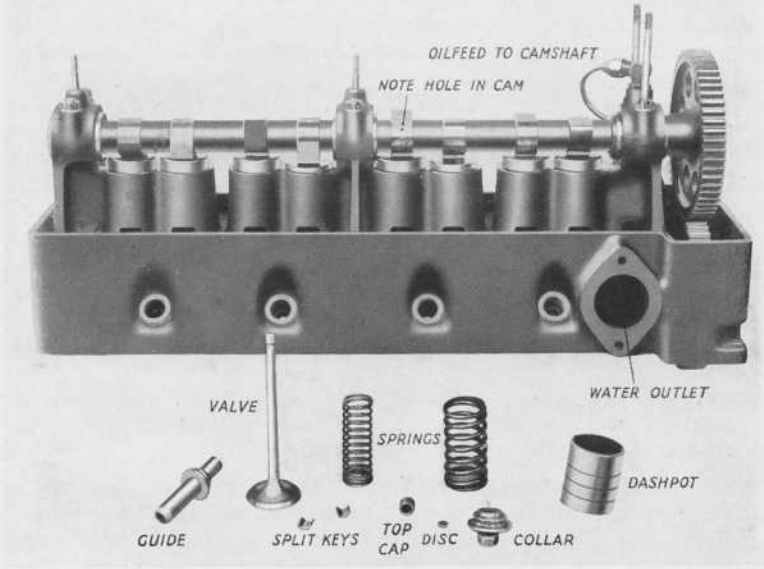


Fig. 13.

Sparking plug side of the detachable cylinder head showing camshaft in position, and below will be found the components of one valve unit. The oil connection to the camshaft is visible and lubrication of the cams is effected by oil being forced through the hollow camshaft, while each cam is cross-drilled, allowing oil to flow over the cam during its rotation. The return feed of the oil lubricates the train of timing gears.

These refer to the numbers stamped on the parts.

If anybody is desirous of altering his carburetter we must strongly urge him to try experiments with different jets from those provided, and if he is satisfied with less power it is possible, by reducing the main jet, to obtain reduced consumption. With the standard setting, the average consumption is about 30 miles per gallon.

Cylinder Head. The cylinder head, as seen externally, is shown in illustration No. 13 and as seen from below, that is to say, the combustion chamber in illustration No. 14. It is held in position by 14 studs and nuts and two short studs at the front end of the timing casing. BEFORE ANY ATTEMPT IS MADE, HOWEVER, TO REMOVE THE HEAD, THE NUT OF THE OIL PIPE NIPPLE AND COPPER WASHER MUST FIRST OF ALL BE DETACHED. It will be seen how mention of one particular part, such as cylinder head, immediately introduces another aspect of the engine, namely, lubrication, but this all-important feature will have to be left until later. Suffice it is to say that there is a direct communication from the oil pump, by means of a copper pipe to the camshaft, and this will be particularly noticeable in illustration No. 19, to which only momentary reference need be made.

It has already been earlier remarked that there is no actual adjustment of the valve clearances, such as is common with tappet operated engines. The valves on the Alvis front wheel drive engine and, in fact, all Alvis engines, are tulip shaped and each valve is fitted with two springs, spring collar, split valve keys, which can be seen on referring to illustrations 13 and 15. The small dash pots, which are forced downwards by the rotation of the cams, do not come into direct contact with the valve stem, because it is necessary to obtain some definite means of ensuring a proper clearance between the dash pot and the cam when the valve is closed. This is obtained by fitting the top of the valve stem with a small steel disc, held in position by a hollow cap, and the clearance is governed by the thickness of a small disc or shim. The only time that these have to be altered is when the valves have been ground in and the Works will be always willing to supply a number of these discs of various thicknesses at any time, if the thickness in thousandths of an inch required is stated. The standard clearance between cam and dashpot is .006" inlet, and .012" exhaust.

The camshaft is held in position in three bearings and is drilled, and each cam is also drilled so that it connects with the centre hole, which permits oil to be distributed on to the face of the cam; only sufficient oil, however, being allowed to pass that will suitably lubricate the valve dash pots.

The interior of the cylinder head which contains the valves is shown in illustration 14. Combustion chamber is carefully machined and polished.

While it is possible to ascertain at any time which particular piston is on top dead centre, care should be exercised in introducing anything into the combustion chamber through the sparking plug hole, to be sure that the valves in the cylinder are not open.

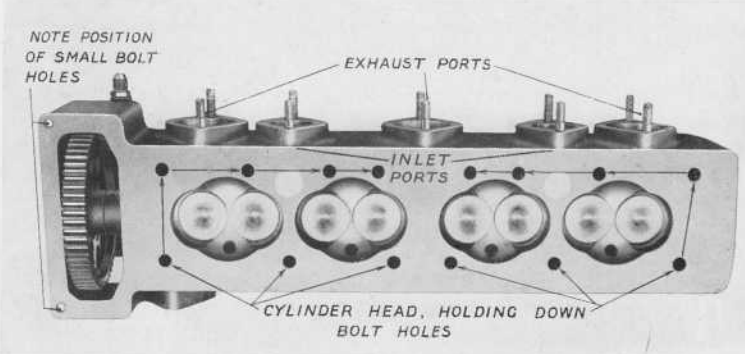


Fig. 14.

Interior of the cylinder head, showing tulip shaped valves and shape of the spherical combustion chamber. It will be noticed that the upper timing gear idler wheel comes off with the cylinder head.

It should be obvious to the owner that it is not possible to change a valve spring without removing the cylinder head. The gasket between the cylinder head and the cylinder block is made of solid copper—not copper and asbestos—.020" (twenty thousandths of an inch thick).

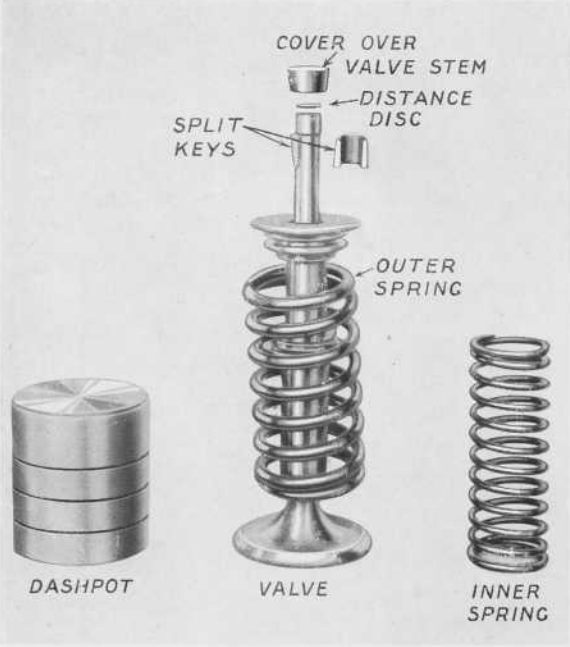


Fig. 15.

Here we see details of the valve assembly: first of all the valve and the detach able valve guide, then the inner and outer valve springs held in position by a valve spring cup, which in turn is held in position by a split wedge-shaped key, that fits into a recess in the cup and into the undercut stem of the valve. In illustration No. 13 it was seen that the cams operate direct on to cylindrical dashpots; correct valve clearance is obtained by interposing on the upper extremity of the valve stem a steel disc of the correct thickness, which is prevented from moving by a hollow cap; when the cam forces the dashpot downwards the dashpot in turn operates on the stem of the valve. The use of the dashpot eliminates side thrust.

In refitting the cylinder head only the outside edges of the gasket should be coated with shellac, otherwise there is a possibility of the shellac getting into the cylinder bore.

Illustration No. 16 shows the cylinder head partially removed, taking with it the top idler gear and showing the gasket. This illustration also shows the two small studs that might be overlooked at the front end of the engine and which help to hold the cylinder block down.

In order to make clearer the method of driving the exterior fittings, the dynamo unit has been removed and the centre idler gear can be seen.

It is now proposed to deal with the question of removing the cylinder block and at the same time it will be necessary to consider the means of driving the water pump and magneto on one side and dynamo and supercharger, when such is fitted, on the other side.

IT CANNOT BE TOO CLEARLY STATED THAT UNTIL THE DRIVE FOR THESE COMPONENTS HAS BEEN REMOVED FROM THE CYLINDER BLOCK THE CYLINDER CANNOT BE LIFTED OFF THE BASE-CHAMBER. External examination will not make this clear, but an examination of illustration No. 17, as well as 18 and 19, will disclose the fact that there are two nuts, one inside each of the housings which contain the magneto and dynamo drive shafts, and before the cylinder can be lifted these nuts have to be removed. Furthermore, until the water pump has been removed,

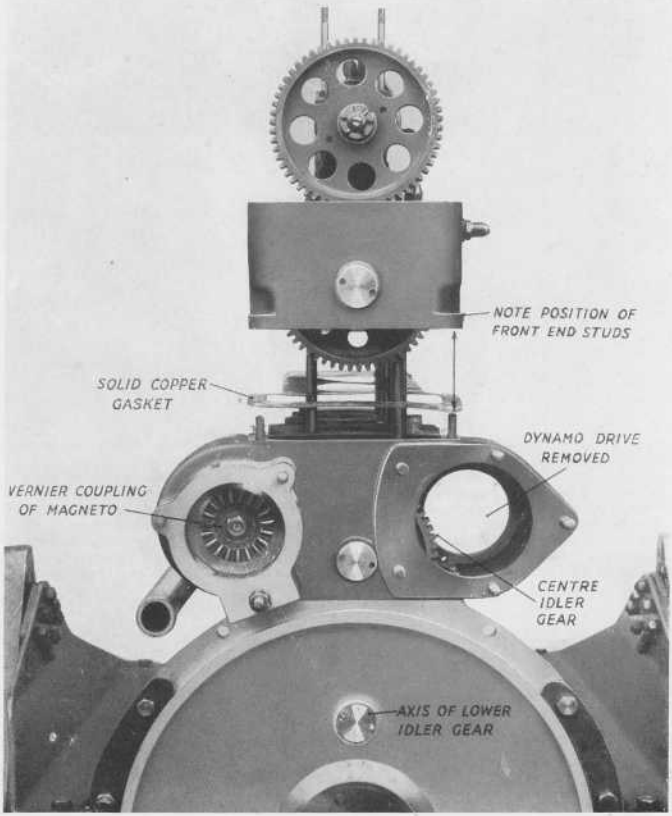


Fig. 16.
End view of the engine showing timing gear layout with cylinder head lifted. The discs seen in each of the castings are the cover plates which locate the pins on which the timing gears revolve.

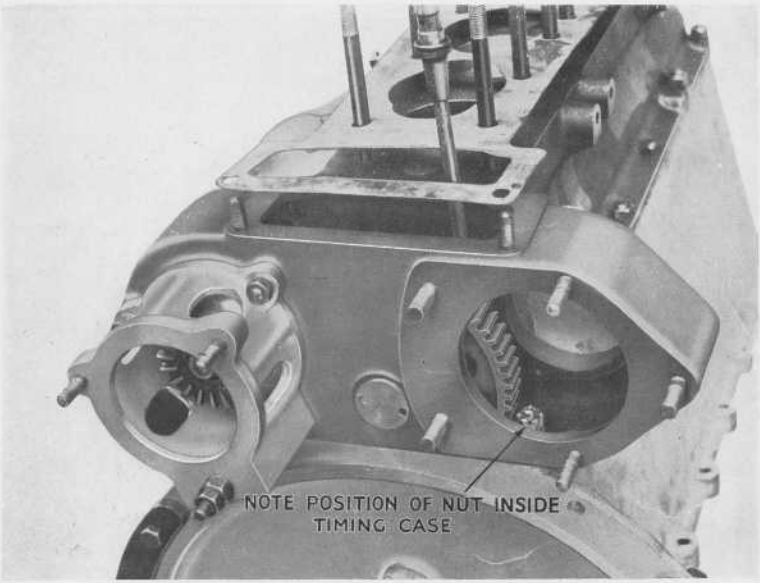


Fig. 17.
Front end view of the timing case and cylinder block with the cylinder head removed. Here the copper gasket is shown, the recommended thickness of which is .020" (twenty thousandths of an inch). The main object of this illustration is to point out that inside the timing case there are two castellated nuts that hold the cylinder block on to the base-chamber, in addition to the other nuts. For this reason it is necessary to remove the pump and dynamo drives in order to obtain access to these nuts. Short box spanners are necessary to remove these nuts.

the nut beneath it holding the cylinder to the base at this point cannot be removed either. The actual removal of the cylinder presents no difficulty and reference to illustration No. 19 shows the cylinder partially lifted.

From this it will be seen that the cylinder is fitted with extension skirts and the pistons will be seen inside these.

Illustration No. 18 shows the cylinder block prior to removal, but with the dynamo drive removed.

Illustration No. 20 shows the components of the dynamo drive which consists of a shaft mounted on ball bearings, together with the gear. A Simms coupling, with rubber buffer, drives the dynamo and the front and rear housings supporting the ball bearings.

READ CAREFULLY BEFORE ATTEMPTING TO REMOVE CYLINDER BLOCK.

To disassemble this unit, first of all remove the dynamo and then the front end housings which gives access to the Simms coupling, which is secured to the shaft by means of a key and bolt. Then remove the nuts holding the rear cover plate in position, when the shaft, complete with its gear and bearings, can be driven out towards the back of the engine, which will then present the appearance shown in illustration No. 17. It will then be necessary to use a small tube spanner to slacken off the castellated nut holding the cylinder down at this point, of course after removal of the split pin.

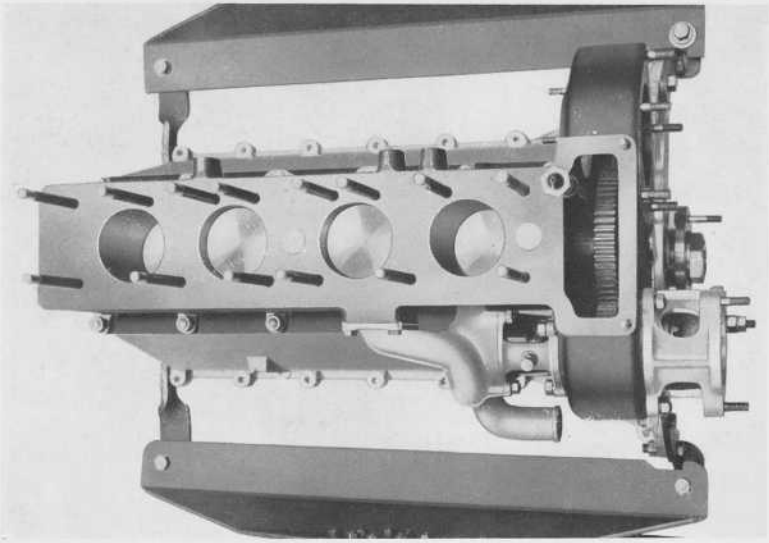


Fig. 18.

Plan view of the engine resting in stand with the cylinder head removed. The pump and magneto drive has been left in position but the dynamo drive has been removed.

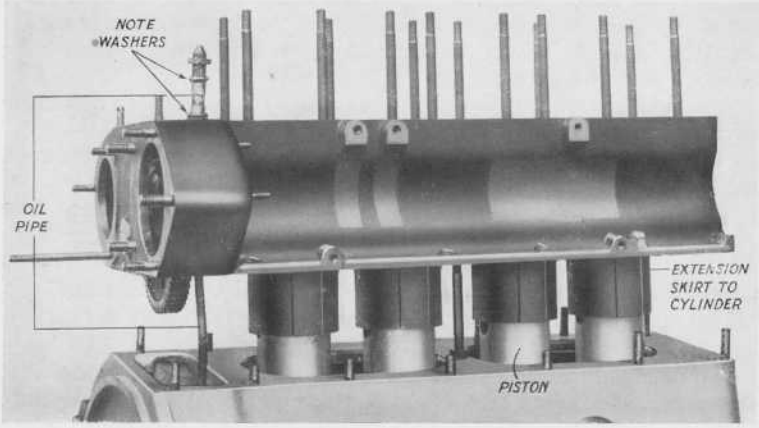


Fig. 19.

Nearside view of the engine (resting in a stand), with the cylinder block being lifted off. Note oil pipe connections passing through the timing case and recesses through which the timing gear passes.

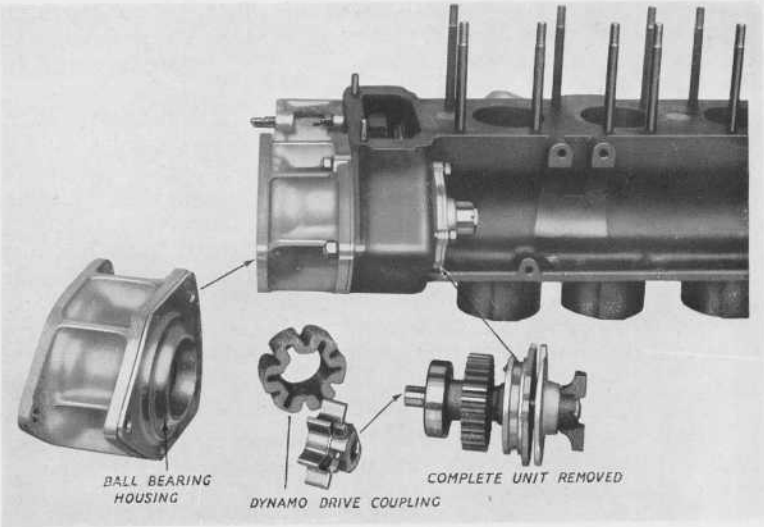


Fig. 20.

Details of the dynamo and supercharger drive. Both the dynamo and magneto drives must be removed before the cylinder can be lifted. This should not be often necessary.

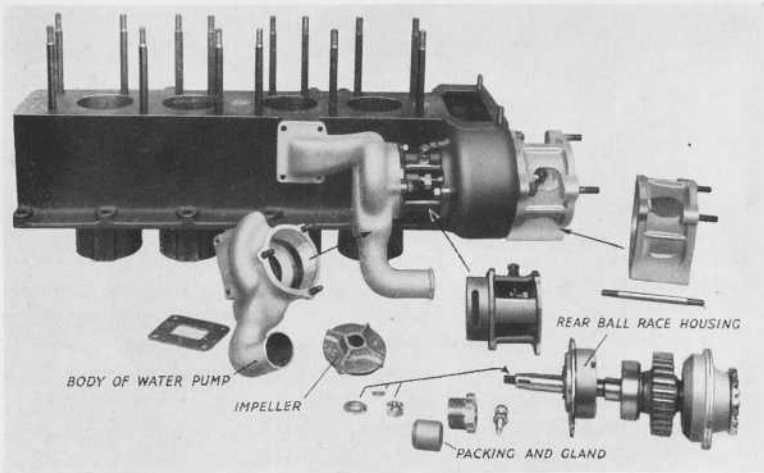


Fig. 21.

Water pump and magneto drive assembly shown in position and also dismantled. Before dismantling the water pump, carefully read text. It is necessary to remove the water pump in order to remove the cylinders. *There is only one way to do this.* See text on page 22.

It stands to reason that, reversing this operation, the parts can be reassembled, care being exercised to see that the gear-wheel on the shaft properly meshes with the idler gear before any attempt is made to drive it home.

Dismantlement of the water pump and magneto drive presents a little more complication and the sequence of operations should be carefully noted :

It is **first** necessary to remove the set screws holding the pump connection to the cylinder block.

Then the three nuts that hold the pump body to the housings.

Now remove the pump impeller, which is held in position by a nut and key. The impeller is drilled and tapped $\frac{1}{4}$" B.S.F. and some form of withdrawal tool is necessary.

Next remove the front housing to which the magneto is attached. Reference to illustration No. 21 shows this in position and also what it appears like when removed.

It will now be possible to drive the shaft carrying the ball bearings and gear wheel forward and thus obtain access to the interior nut inside the timing case.

The cylinders, however, cannot yet be removed, because there is a nut beneath the brass pump gland housing which will have to be taken off ; and

Finally, the rear ball race housing can be removed, giving access to the front cylinder offside holding down nut.

When reassembling the pump the packing gland should be slacked off and tightened after assembly. The gland is shown in illustration No. 21, the locking screw being placed on the top of the gland housing.

For the sake of clearness, the reassembly should be noted :

First fit the ball race housing on the pump side of the timing case ;

Then pump gland housing with the gland nut slightly loose ;

The shaft can then be inserted with gear and front end housing ;

The pump impeller is then fixed in position with key and nut ; and

Finally, the pump body. A washer is provided between the the outlet water pipe and the cylinder block, the final operation being tightening of the pump packing gland.

It will have been realised that two special box spanners are necessary to remove and tighten the nuts inside the timing casing. These spanners should be tubular for $\frac{5}{16}$" nuts $1\frac{1}{4}$" long.

Connecting Rod and Piston Assembly. Once the cylinder block has been removed we obtain access to the pistons and there are several considerations connected with the piston that the designer of a high-speed engine has to consider :

1. Lightness of reciprocating parts.
2. Gas tightness.
3. Efficient lubrication.
4. Method of fixing gudgeon pin.

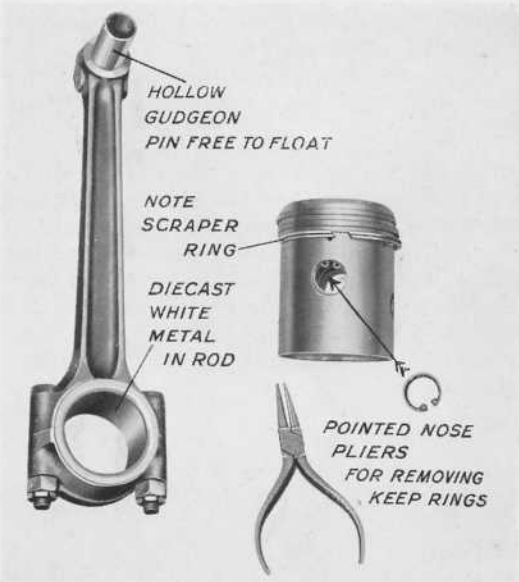


Fig. 22.

Connecting rod assembly with white metal lined big-end bearing, tubular gudgeon pin, piston with rings and method of preventing gudgeon pin moving endwise. The piston boss has a groove in it, and the spring ring is inserted and removed by using a pair of fine pointed-nosed pliers.

This is how these considerations have been carried out in the Alvis :

The piston is of aluminium alloy and has three piston rings, one acting as a scraper ring. No useful purpose can be served in going into the question of clearance of pistons, but the Works will be only too pleased at any time to advise owners by correspondence.

The lubrication of the cylinder and piston is effected by splash of oil, which escapes from the cheeks of the big end bearings as these rotate, excess oil being reconducted inside the piston, through holes suitably drilled, on each downward stroke of the piston ; thus, oil finds its way to the gudgeon pin, which is free to float in both the piston bosses and the small end of the connecting rod.

This method of construction necessitates some form of locking device to prevent the gudgeon pin travelling sideways. The method employed in the Alvis is by cutting two grooves in the boss and introducing spring circular retainers, beyond which the gudgeon pin cannot travel ; this has the effect of preventing the possibility of cylinder wear through contacting with the ends of the gudgeon pins.

Removal of the Base-chamber. The crankcase or base-chamber is divided into two parts, the upper portion carrying the crankshaft and the lower portion formed into a compartment to prevent oil surging, and acting at the same time as an oil reservoir for the engine.

Illustration No. 23 shows the rear end of the engine with bottom plate partly removed. This plate is fitted with a drain plug, but it is desirable occasionally to remove the whole plate to thoroughly clean out the engine, which can be effected without removal of the base-chamber proper.

It will be noticed, on referring to illustration No. 23, that there is a boss on the rear end on the bottom half of the base-chamber ; the object of this boss is to permit the withdrawal of the gauze suction filter and a separate cover has been inserted in the illustration, as would be seen from the inside of the engine, in which it will be noticed that there is a peg. This cover can only be fitted to the base-chamber one way, that is, with the peg to the bottom. The reason for this is that it locates the suction filter in such a position as to prevent it turning round.

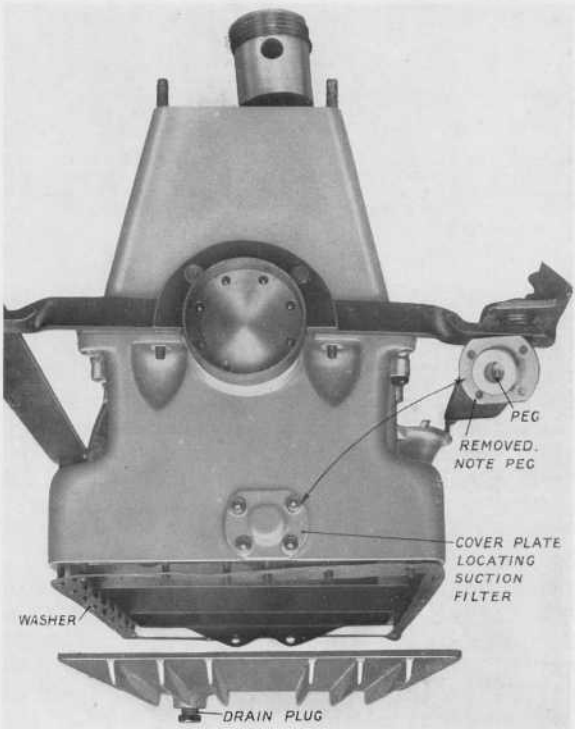


Fig. 23.

Rear end view of the engine, showing the upper half of the base-chamber ; lower half of the base-chamber ; bottom cover plate is removed. The rear engine support is shown consisting of a trunnion bolted to the bottom and top halves of the base-chamber.

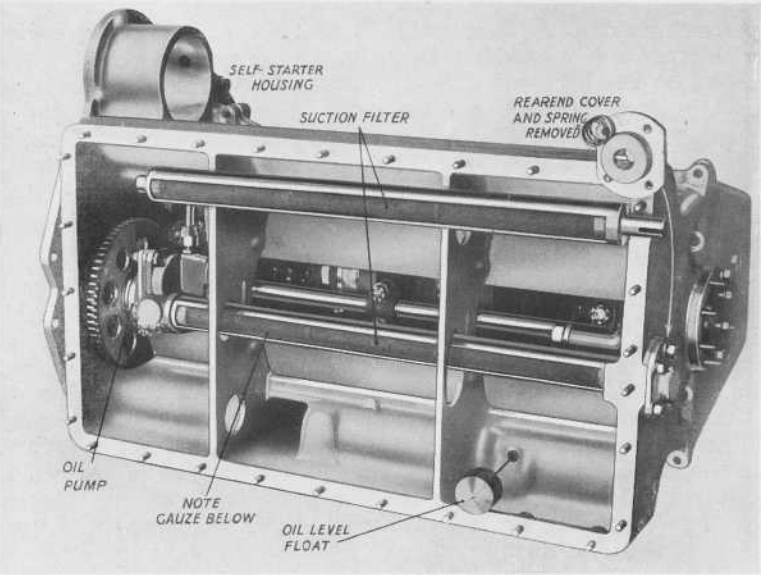


Fig. 24.

Interior of the engine as seen after the bottom inspection plate has been removed. The oil strainer will be noted in position and to indicate more clearly what this looks like another one has been photographed, showing how the end of this registers by means of a slot with a dowel in the rear end cover plate, also shown dismantled. The spring causes the oil strainer tube to register in a taper socket in the oil pump body. On either side of the rear engine bearer there are two recesses in the casting, and before the bottom half of the base-chamber can be dropped the nuts of these recesses must be taken off.

Now refer to illustration No. 24, when the suction filter will be immediately apparent; it runs from the main pump body the complete length of the engine and is held tight in the pump body by the pressure of the spring against the rear end cover.

The rear end cover of the filter has been also inserted in the picture separately, together with the spring, so as to make this point quite clear. As the pump is attached to the upper part of the base-chamber, before the lower half can be removed, it will now be apparent why the suction filter must first be withdrawn.

There is another part that will be almost obvious that it is necessary to remove before the base-chamber can be removed, namely, the rear trunnion which supports the engine in the frame. Immediately behind this trunnion there are two recesses in the casting, in each of which there is a nut. These present no difficulty of removal, but the studs to which they are attached can be seen immediately behind the back main bearing of the crankshaft, by referring to illustration No. 25.

Engine Lubrication. The lubrication of the Alvis engine is particularly simple. Refer to illustration No. 25, which is the engine with the lower half of the base-chamber or sump removed. This shows on the left-hand side the oil pump, driven from the main crankshaft gear wheel, and the pump is in direct communication with a tube feeding the three main bearings. At the rear end of this assembly is situated the oil release valve ; the crankshaft being hollow drilled, oil is delivered to the big end bearings through holes drilled through the webs of the shaft.

We will now deal with the various parts separately. The oil pump, with suction filter, delivery tube and attachment brackets, is shown in illustration No. 26. On the right-hand side of this illustration a very simple relief valve is shown dismantled. It consists of a small plunger, a spring to maintain the plunger against its seat, and a cap which holds the spring up against the plunger. These alone would not afford any means of regulating the oil pressure. If this were found desirable at any time, by simply inserting one or more discs in the plug behind the spring, the tension of the spring can be increased, thus raising the oil pressure in the engine. Access can be obtained to the relief valve by simply removing the bottom plate of the base-chamber.

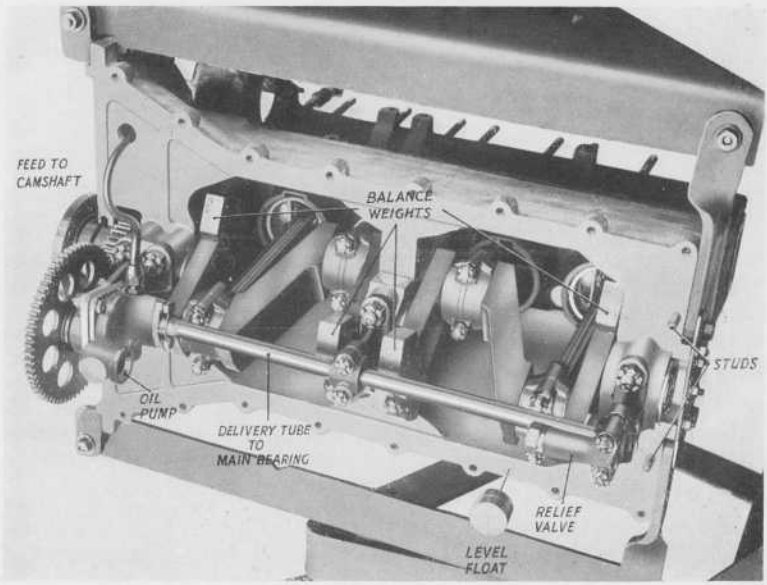


Fig. 25.

View of the interior of the engine, with the bottom half of the base-chamber removed. Here the balance weights on the crankshaft can be seen, the oil pump assembly, the float indicating the oil level and on either side of the rear main bearing of the crankshaft will be noted two studs. The nuts must be removed from these studs as well as the bolts before the bottom half of the base-chamber can be dropped.

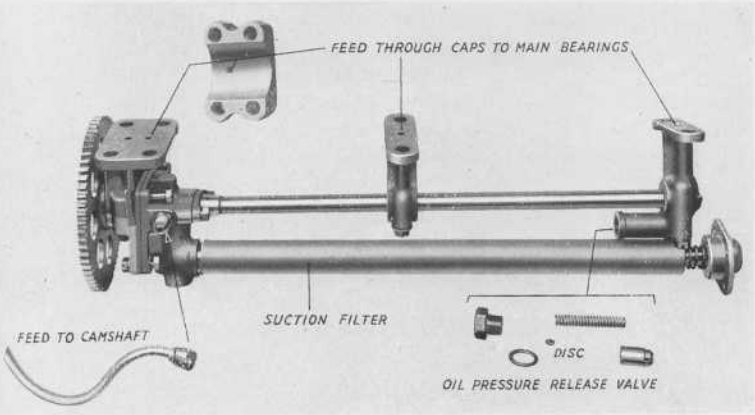


Fig. 26.

Oil pump assembly removed from the base-chamber. The gear wheel on the left engages with the crankshaft timing gear. Oil is collected through the gauze strainer delivered by the pump to the working parts of the engine and the pressure of the oil is governed by the release valve shown in pieces on the right.

On the top left-hand side of this illustration the bottom half of front main bearing cap can be seen and the hole in it through which oil is delivered from the pump into the main bearing. The only other connection necessary to complete the oil circuit of the engine is by means of a pipe attached to the pump body, thence through the cylinder head to the camshaft bearings, the excess oil which passes being sufficient to lubricate the timing gears as it returns to the base-chamber.

The oil pump is of the gear type and is shown in various detail in illustration No 27. It would serve no useful purpose to describe the various passages to the pump body, but these have been worked out so that everything gets its proper proportion of oil.

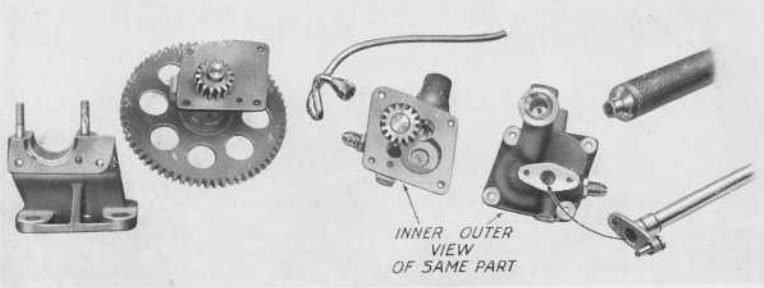


Fig. 27.

Oil pump dismantled, pump body being so drilled as to deliver oil to three exits: (1) rear main bearing, (2) tube to centre and front main bearing, (3) connection to overhead valve gear.

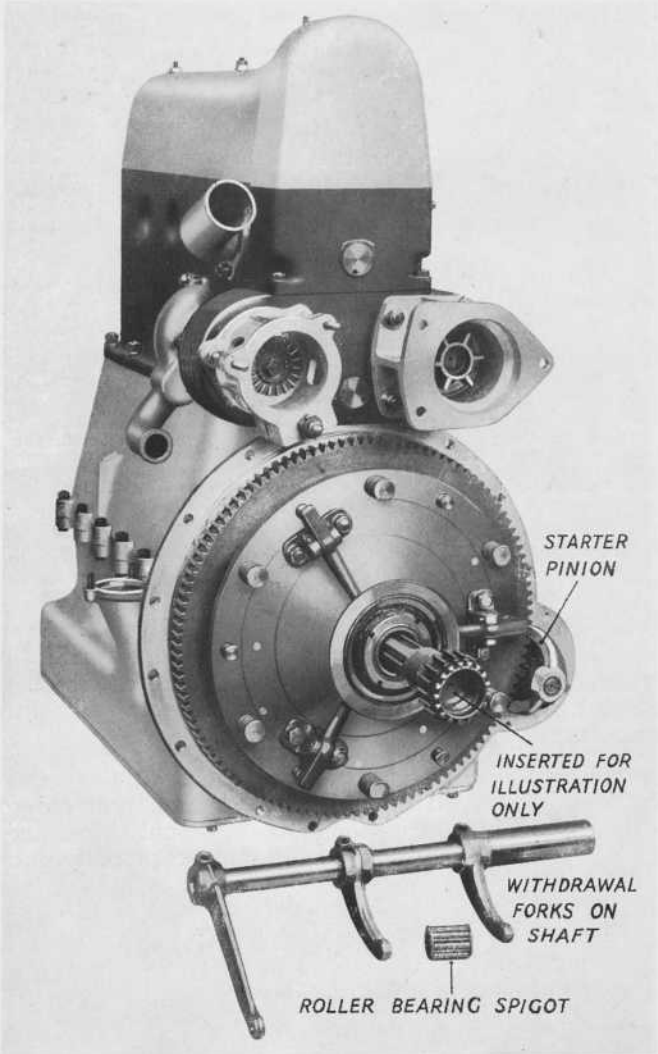


Fig. 28.

General view of the clutch, which is of the single plate type. The flywheel and receding plate are attached by means of a series of pins, and spring pressure is obtained by the series of springs attached to the periphery of the receding plate. The clutch shaft is supported at the forward end in a roller bearing. There is a ball bearing inside the clutch withdrawal collar. The withdrawal fork mechanism is shown below.

Clutch. A cursory examination of the preceding illustrations will have made it clear that, in order to effect any dismantlement of the clutch, it is necessary to remove the unit (that is to say, engine, gear-box and differential) from the chassis. After the gear-box has been removed from the engine what is seen in illustration No. 28 will be disclosed, except that the front end gear-box shaft would not be as shown and the clutch withdrawal forks would have had to be disengaged before the two units could be separated. The clutch presents no particular points that need a lot of description when it can be clearly seen in illustration Nos. 29 and 30.

It will be necessary, however, should it be desired to dismantle the clutch, to first of all drop the bottom half of the base-chamber in order to obtain access to the nuts by means of which the clutch bolts carrying the springs and driving pegs are attached to the flywheel. This is clearly shown in illustration No. 31.

The clutch is what is known as a " single plate clutch," in which a centre steel disc, free to float when disengaged, is gripped between two Ferodo faces, one attached to the flywheel and the other to the plate carrying the withdrawal toggles ; pressure of the clutch pedal causes the two levers (seen in illustration No. 28 and which are, when assembled and shown in illustration No. 30, in engagement

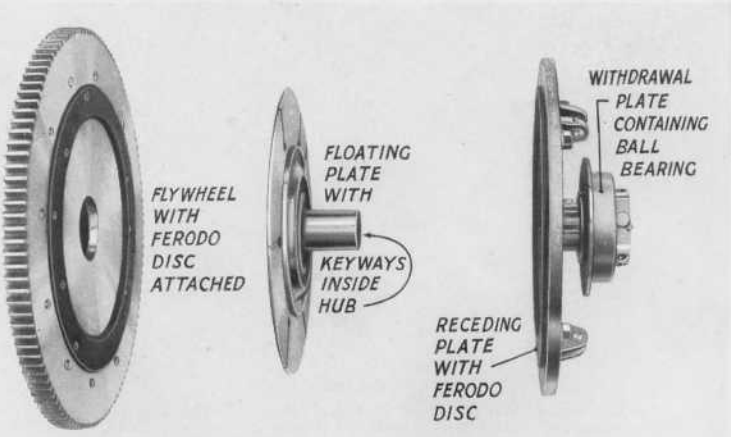


Fig. 29.

Essential details of the clutch with all accessories removed. The flywheel has a Ferodo disc riveted to it and the receding plate also has a Ferodo disc so attached. There is a floating plate placed between these two, this plate being attached to the clutch shaft and revolves when gripped by the Ferodo discs, but when the clutch pedal is pushed down, the spring pressure being released, the floating plate can remain stationary, while the two other plates revolve.

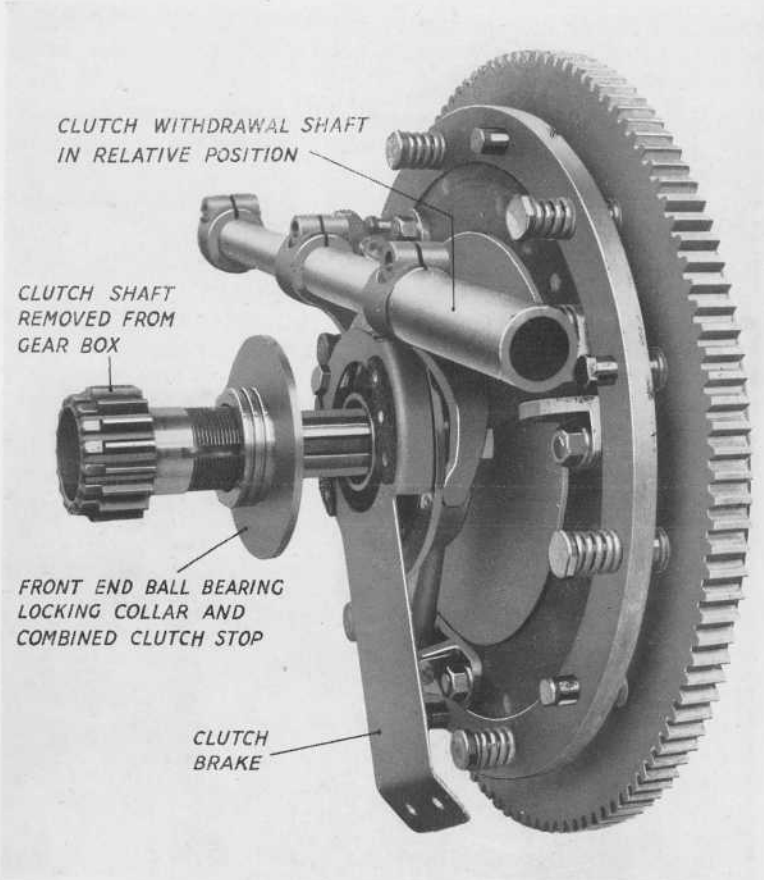


Fig. 30.

General composite view of the flywheel and clutch, the cross shaft carrying the withdrawal arms resting on it to show the position of these arms; and, in order to show the relationship of the clutch shaft and combined ball bearing locking collar and clutch stop, the shaft has been mounted up without the gear-box.

with the ball bearing withdrawal collar) to force the withdrawal backwards, thus relieving the pressure of the springs and allowing the inner plate to come out of engagement sufficient to float between

the two Ferodo discs. The interior of the rear end of the crankshaft is fitted with a "Hyatt" roller bearing which acts as a front end spigot of the clutch shaft, which is castellated and registers in grooves inside the receding clutch member.

In order to obtain proper gear changes, a clutch stop is incorporated in such a manner that when the clutch pedal is pressed down a clutch brake is forced backwards up against a plate screwed to the rear end of the clutch shaft, just where this enters the gear-box. This plate is shown in position in illustration No. 30 and its method of mounting is more clearly illustrated in illustration No. 32. There is no adjustment to the clutch brake or stop.

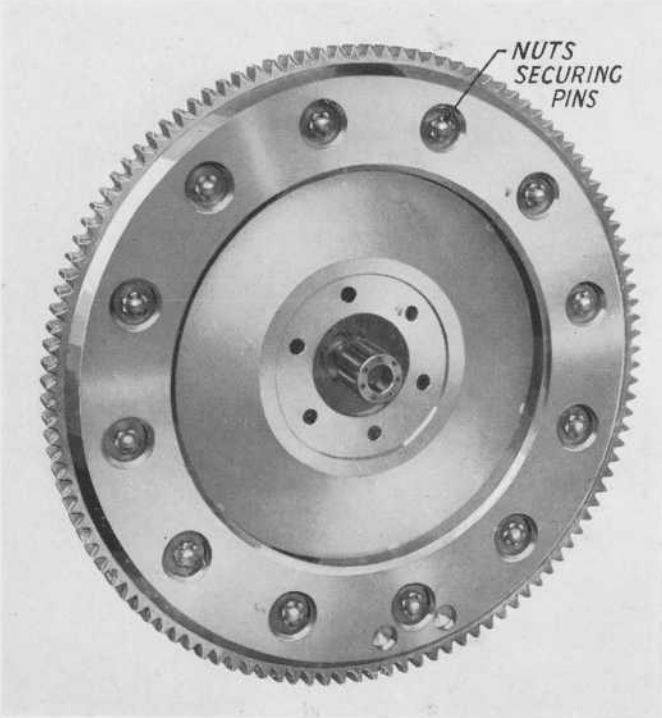


Fig. 31.

Engine side of the flywheel, showing how the pins are locked in position and the necessity for dropping the base-chamber when attempting to dismantle the clutch.

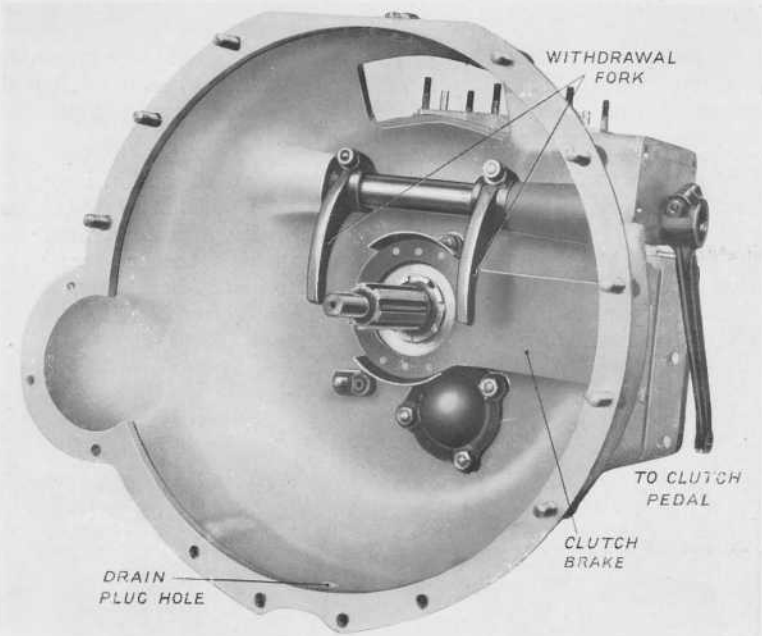


Fig. 32.

Gear box unit removed from engine and clutch showing the withdrawal forks which are keyed and bolted to a cross shaft, it being essential to remove these arms before the units can be separated. The clutch stop mechanism will be clearly visible and the position in which it is bolted into the clutch housing.

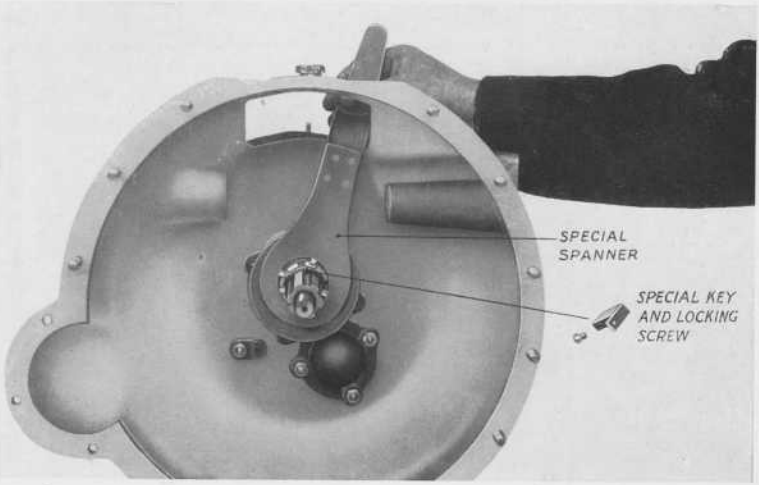


Fig. 33.

After the clutch withdrawal forks have been removed, when it is necessary to dismantle the gear-box, the locking collar, which acts as a clutch brake stop, and front gear box thrust nut must be removed. This is locked on the shaft by means of an " L " shaped key and then a special shaped spanner is necessary to remove the collar. The operator is holding the spanner purposely in order to show its shape ; when it is fitted on the nut the spanner is tightened by being hit with a hammer to ensure proper tightness.

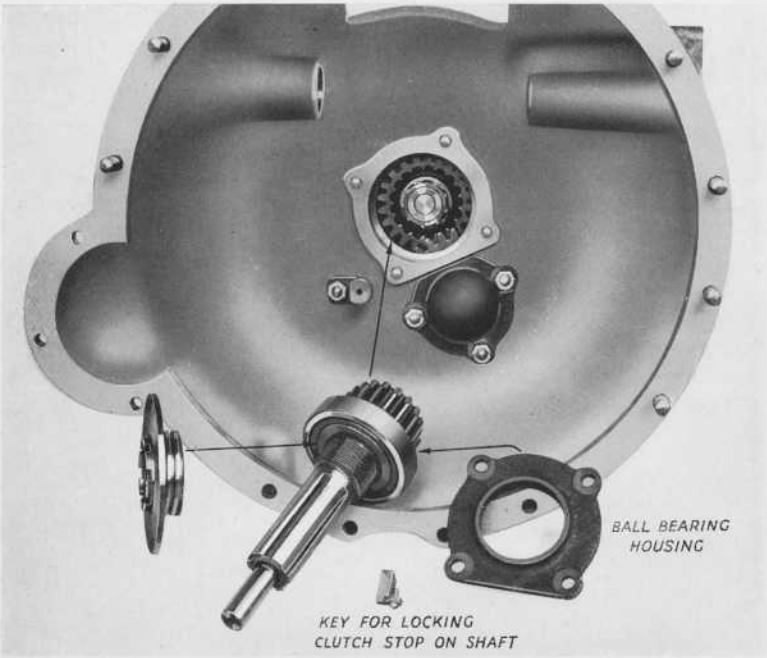


Fig. 34.
The next stage in dismantling the gear box is reached. The clutch brake stop and locking ring is shown removed on the left. The ball bearing housing cover is shown on the right and the constant mesh pinion and clutch shaft have been removed and are lying below. The particular form of key used for locking the clutch stop in position, consisting of an " L " shaped key with grub screw, is shown below.

Gear-Box. As the gear-box and differential are combined in one unit, a common casting is used to house both. It necessarily follows that the interconnection of the two is so bound up that shafts are common to both units. As the contents of what is known as the " clutch bowl " have been described, it will probably be better to continue and examine that portion of this, which is virtually the front end of the gear-box, before proceeding to examine the gear-box internals.

Illustration No. 33 shows the operator using a special tool to remove the combined clutch brake stop and mainshaft gear-box oil seal, or ball bearing locking collar. This clutch brake stop is locked in position by means of an " L " shaped key, clearly visible in the lower portion of illustration No. 34, the key registering a slot in the shaft and held in position by a grub-screw. After this and the nut have been removed the front ball bearing housing of the main shaft is withdrawn, permitting the ball bearing and clutch shaft, with constant mesh gear, to be withdrawn as shown in illustration No. 34.

Beneath this will be found the cover for the layshaft front bearing and the special shaped washer on the left of this, holding the reverse shaft in position. The illustrations have purposely been provided with suitable wording to indicate the operations, so it is not repeated in the text.

It will now be necessary for the owner, before proceeding any further with the text, to examine illustrations Nos. 36, 37, 38 and 39, disregarding for the moment the differential assembly which, of course, has been removed from both illustrations Nos. 37 and 39.

Illustration No. 36 shows the main shaft of the gear-box, the rear end of which is formed into the driving bevel pinion ; below this are the layshaft gears, removed from the layshaft, and on the right is the reverse shaft with the gear attached. On the top right-hand corner the selector fork assembly is shown complete with the housing, after removal from the gear-box.

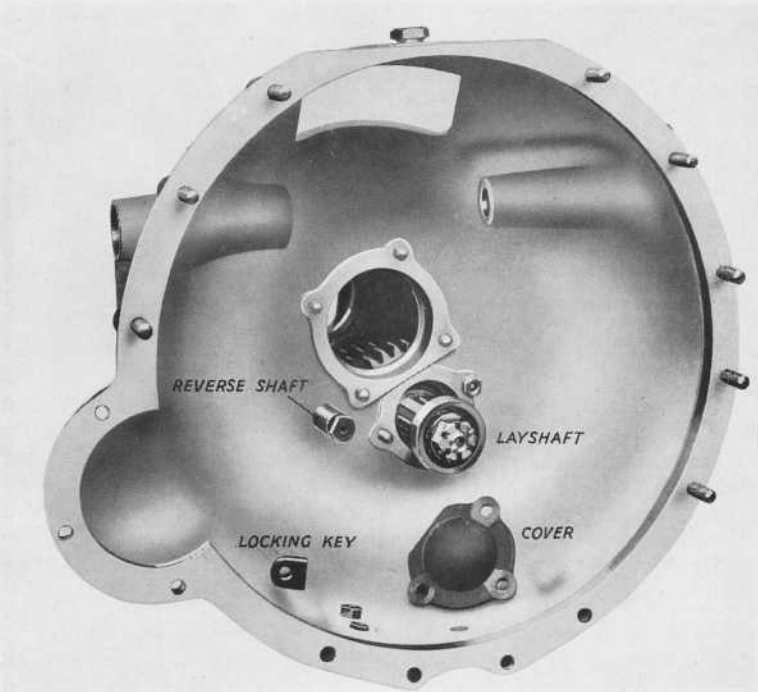


Fig. 35.
Rear end of the gear-box housing, showing cover for layshaft bearing removed in order to drift out layshaft, leaving gears inside box. In reassembly, the position of the spacers between the gears should be noted. The reverse shaft is held in position by the key, removal of which permits the reverse shaft being drifted out from the other end. In reassembly, the gears are put in the box first and the shaft put through them afterwards.

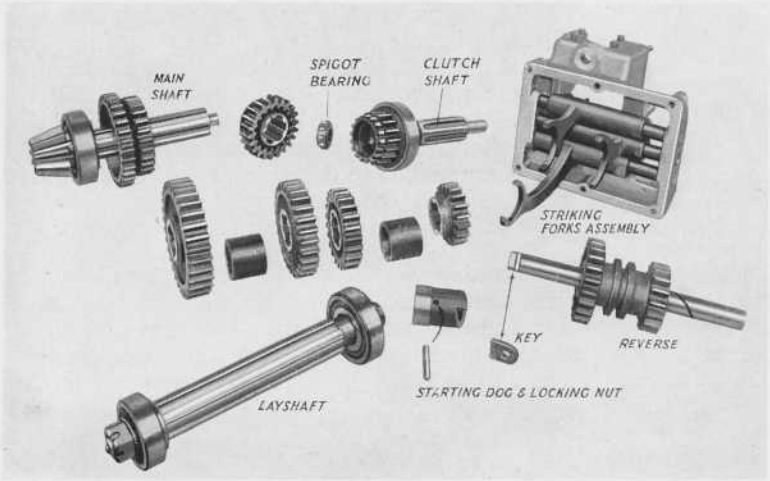


Fig. 36.
The contents of the gear-box removed from the housing in which the main shaft is seen above, the layshaft and gears dismantled below, and on the right the reverse shaft and gears. There are a number of people who read books by looking at illustrations and there is a part in this illustration that must be described by text, namely, the nut that locks the bearing on to the front end of the layshaft; this nut also acts as one of the " hand " starting dogs. The nut is hollow, half an inch square and, until it has been removed, the layshaft cannot be withdrawn from the box.

Each illustration of this series of gear-box pictures will be more or less self-explanatory, so that a considerable amount of detail can be left out of the main body of the text, but it will remain necessary to describe the operations in their proper sequence in order to show how the gear-box is taken to pieces, when it follows that, if the sequence is taken in the opposite direction, how it is built up.

1. In order to separate the clutch and engine housings it is necessary to remove the clutch withdrawal shaft by slacking off the two nuts and bolts in the levers and driving the shaft through the housing.
2. Then remove the clutch stop which has been previously described.
3. Remove lid with striking forks complete.
4. Remove set screw and key holding clutch stop plate in position.
5. Remove clutch stop plate which was dead tight up against ball race acting as thrust.
6. Remove rear end cover plate from main shaft and pull constant mesh gear out.
7. After the differential has been bodily removed, remove the cover plate from front end of main shaft where driving bevel is situated, and the main gear-box shaft can then be tapped through the end of the housing, when it will pass through the gears and can be withdrawn as soon as the ball bearing is free from its housing.

8. It will be noticed after the differential has been removed that the starting handle dog is attached to the front end of the layshaft and this is held in position by means of a No. 4 taper pin which has a slotted end. If these two slots are cut off by hammer and chisel the pin can easily be driven out after removal of the speedometer drive. The starting dog is screwed on to the end of the layshaft and is hollow at the front end, the hole being $\frac{1}{2}$" square. A length of square rod 12" long must be used to remove the dognut.

Refer again to illustration No. 36, and on the left-hand bottom corner will be noticed the splined layshaft and immediately above it are the gears and distance pieces of tube that separate them. Beneath the gears is the starting dognut, which has previously been shown acting as a nut to lock the gears and bearings up on the layshaft solid.

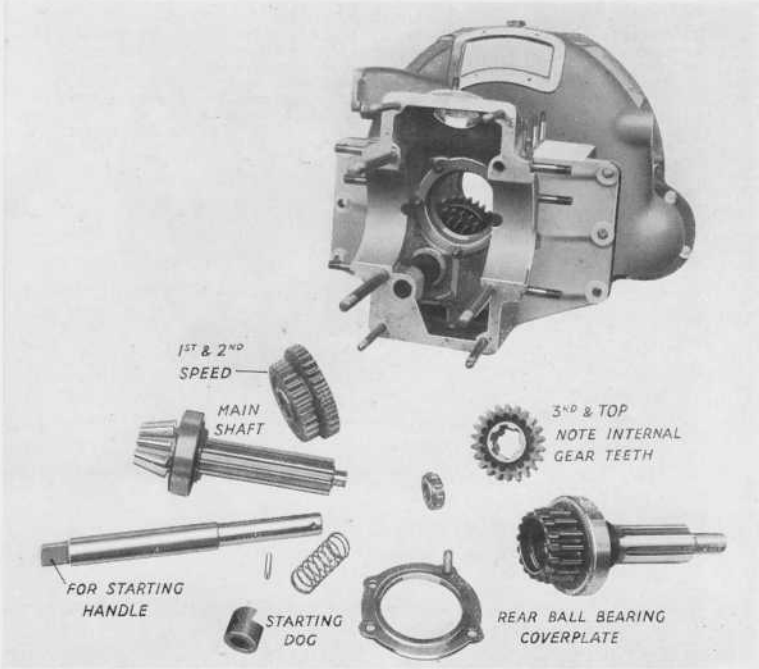


Fig. 37.
Front end of the gear-box after the differential has been removed. The main shaft is seen below the box which has been withdrawn through the rear hole. Before the layshaft can be removed the starting shaft with spring and dog must be withdrawn; the first operation being to withdraw the differential, the front end of the mainshaft is withdrawn from the front end of the gear-box.

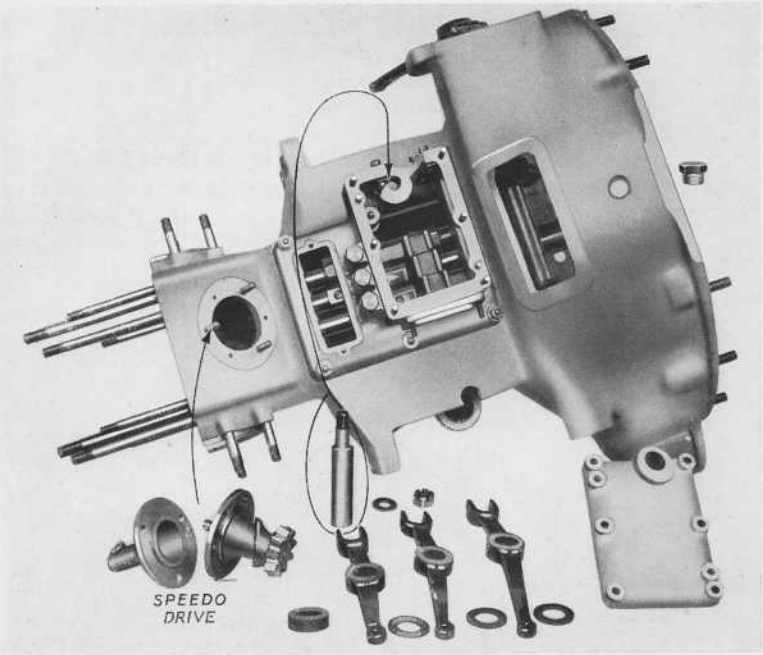


Fig. 38.
Gear-box and clutch housing and front end of differential housing are one casting. Here the cover over the striking forks has been removed, showing how these are built up on a pin and washers are spaced between them. Before attempting to dismantle the gear box the text should be carefully read.

It is now necessary to look at the other end of the gear-box, because it is through this end that the main shaft of the box passes, in order to drive the crown wheel. The composite layout of the main shaft will be seen, including the interior of the top speed sliding pinion, which is caused to engage with the constant mesh pinion, immediately below it in the illustration.

The main starting handle shaft which protrudes through the front end on the differential cover is provided with a spring interposed between the casing and the engaging dog, fitted to the end of the starting handle shaft by means of a taper pin.

The general dismantlement of the gear-box should now be perfectly clear. One should now consider the two accessories to the box, namely, the striking gear and the speedometer drive.

Illustrations Nos. 38, 39, 40 and 41 particularly apply to the striking mechanism, which engages the gears. The change speed lever works in a gate and there are three divisions :

First for reverse ;
Second, for first and second ; and
Third, for third and top gears.

Moving the change speed lever sideways causes the operating shaft to rock in the bearings, so that the lever which is on the front end of the operating shaft rises and falls, carrying with it a guide, the object of which is to prevent two gears being engaged at the same time ; it has no other use, but its presence is a necessity. It is shown purposely removed from its proper position in illustration No. 41, but in illustration No. 40 it will be seen how, when the third or top gear is engaged, the gear below it, namely, the second and first, is prevented from moving. In the event of the gears being difficult to move in their slots this part should be washed and lubricated with a little ordinary engine oil from time to time.

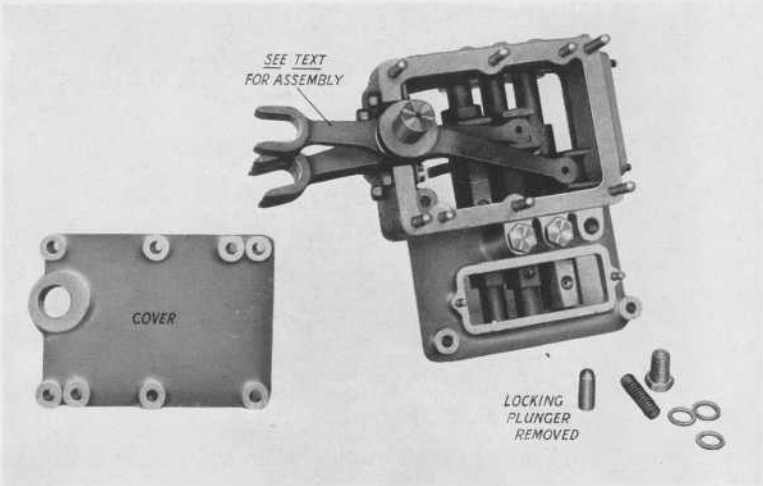


Fig. 39.
The selector mechanism removed from the gear-box, and on the lower right-hand side of the illustration will be seen the method of locking the selector fork shafts in position by a steel plunger which registers in a recess and is held down by means of a spring, the correct tension being adjustable, depending upon the number of washers placed beneath the plug nut.

The striking gear assembly cannot be fitted as shown in this illustration (No. 39), because the shaft on which the gear strikers pivot is slightly inclined. It is first of all necessary to fit the housing which carries the shafts and change speed forks and afterwards fit the pivot pin and the striking forks. For obvious reasons it is impossible to make a mistake which selector fits into which slot, owing to their length, and the fact that it is necessary to space these selectors correctly apart, but the number of shims or washers between each selector should be carefully noted when dismantling.

The correct assembly is as follows : supposing the parts have been taken to pieces, first insert the pin into the hole shown in illustration No. 38, then fit one of the washers over the pin, after which the third and top speed striker fork should be inserted ; this

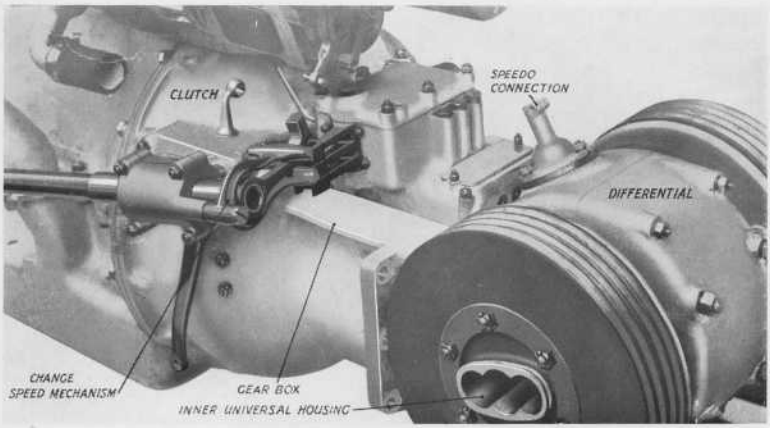


Fig. 40.
This shows the front end of the unit after it has been removed from the chassis. The top cover of the change speed is shown in position. The speedometer connection can be seen bolted to the differential housing, and this affords a good opportunity of inspecting the interior of the inner universal joints in the centre of the brake drums.

is followed by a washer and the second and first striker fork ; another washer is fitted, after which the long reverse shifting fork is fitted, after which a big washer, thicker than all the others, is placed over the pin.

It is now necessary to hold the washers and forks in position with one hand, while the pin is prised up and removed with the other. Now place the cover in position, after which the pivot pin on which the rockers move is replaced and bolted up from below the casing and locked in position by a split pin.

Fig. 41.
Is the same view as No. 40, with the exception that the guide which prevents more than one gear being engaged at the time has been sufficiently far withdrawn to illustrate more clearly the end of the change speed lever and external fork mechanism.

Reference again to illustration No. 38 shows the very simple speedometer drive removed. It will be noticed that this is a bevel cut pinion on a shaft, which engages in the crown wheel. The bearing is self-fed with lubricant.

The usual means of locking the gears is employed, but it is obvious that no instruction book would be clear without explaining the method employed.

Refer back for a second to illustration No. 39, the caption of which will make perfectly clear the fact that spring-loaded plungers with rounded ends are caused to engage with the hollows in the selector fork shafts, thus maintaining the engagement of the gears. This part of the mechanism obviously requires no attention.

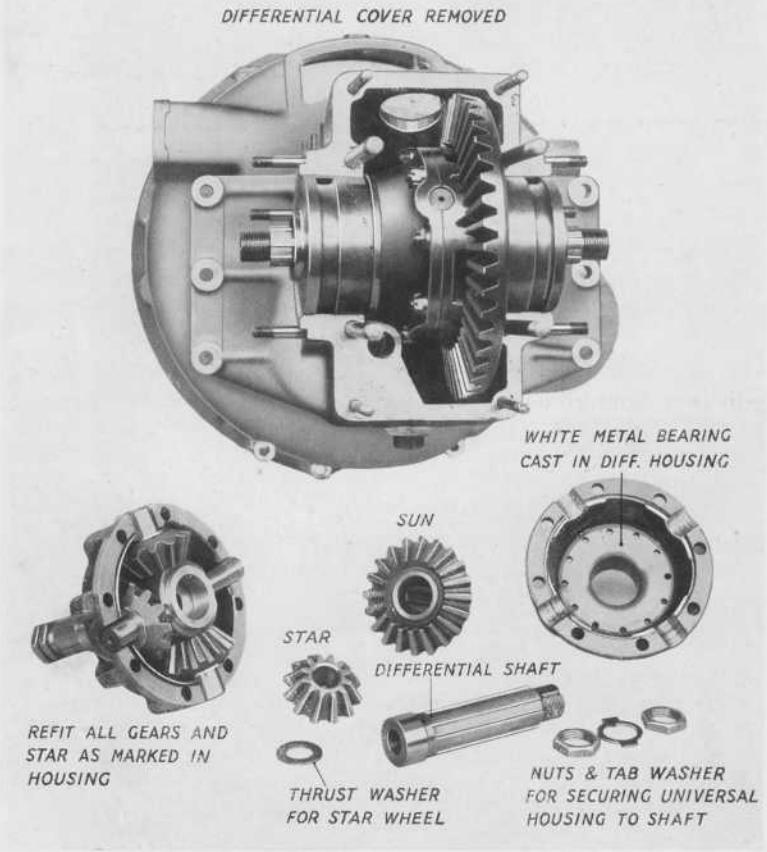


Fig. 42.

The top part of the illustration shows the differential unit after the brake drums and cover have been removed and in the lower portion the differential housing has been dismantled showing the type of differential used, method of mounting the sun wheels on short shaft in white metal lined half differential housing and the nut tab washer and locking nut used to attach the centre universal joint housing and brake drum to the differential shaft. The differential, if taken to pieces, should be reassembled as stamped before leaving the Works.

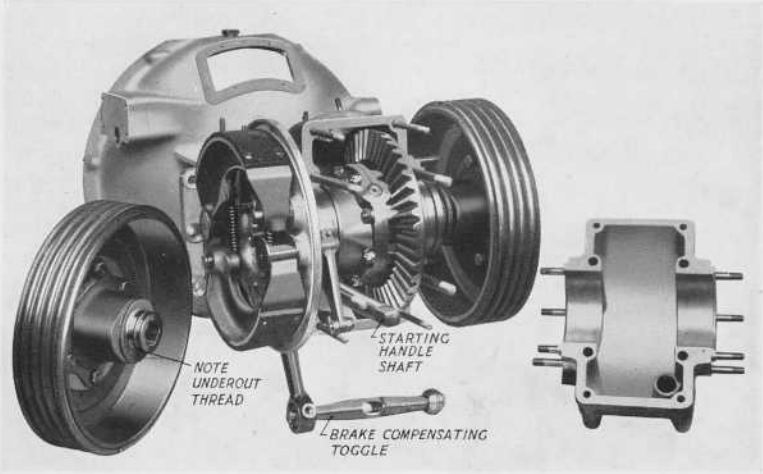


Fig. 43.
This illustration is intended to show the type of brake used and also the compensating toggle which applies to the front wheel brakes. The brake drum cannot be removed without lifting the whole engine unit out of the frame. Note the brake pull-off springs are behind the shoes. To remove these, take out the split pins of the brake shoe pivot pins and lever the shoes off the cams with a screwdriver.

Differential. Having already described the method of driving the front wheels, it now remains to show how the differential is coupled up into a housing bolted on to the front end of the gear-box and this is clearly visible in illustrations Nos. 40 and 41.

To dismantle the differential, it is obviously necessary first of all to remove the brake drums but, so that the reader may follow the sequence better, the question of the brake drum removal will not be dealt with now, but under the heading of " Brakes."

It is now necessary to refer to illustration No. 42, in the upper part of which the differential is shown in position, after the end cover plate has been removed. Beneath it will be seen the differential housing opened up, disclosing the star and sun wheels, the latter being fitted on the short castellated shaft and revolving in white metal bearings which are cast in each half of the differential housing. In order for the parts contained in the differential housing to work satisfactorily, should this part ever be dismantled, *they should be refitted in exactly the same manner as marked;* that is to say, the differential star carrying the star wheels should fit into the slots as marked, and the particular star wheel on to the shaft to which it belongs. The thrust of the star wheels is taken by floating washers, up against the inside of the case. These parts need only a general survey from the user's point of view. Both illustrations should be thoroughly studied in the event of the differential itself being dismantled.

We will now pass to illustration No. 43 which shows the differential assembly cover removed, one brake drum in position and the other brake drum removed in order to show clearly the brakes. The brake drum is a coupled unit with the inner universal joint housing and the two parts having been bolted up are held in position on the differential shafts by means of two nuts and a tab washer. On the left-hand side of illustration No. 43 the inner portion of the universal joint housing is shown, provided with an undercut thread, acting as an oil seal for the differential housing.

After the unit of the engine and gear-box has been removed from the frame, the brakes can be examined by removing the drums, after removal of the nuts and tab washer. It will then be noticed that the springs that cause the foot-brake shoes to contract are fitted behind the shoes, so to speak. Therefore, in order to remove these, the split pins and washers on the pivots, on which the brake shoes articulate, must first of all be taken off, when it is possible by the aid of a screwdriver to lever the brakes off their pivots, first of all arranging that the ends of the shoes clear the cam bosses. *Do not try to take the springs off first.*

The brakes are applied through the cable, which passes underneath the engine, terminating in a thumbscrew adjustment. The cable pulls on an equalizing bar, thus ensuring compensation of the front wheel brakes. The compensator, it will be noticed, is lubricated automatically, the ends of the bar being fitted with detachable ball ends.

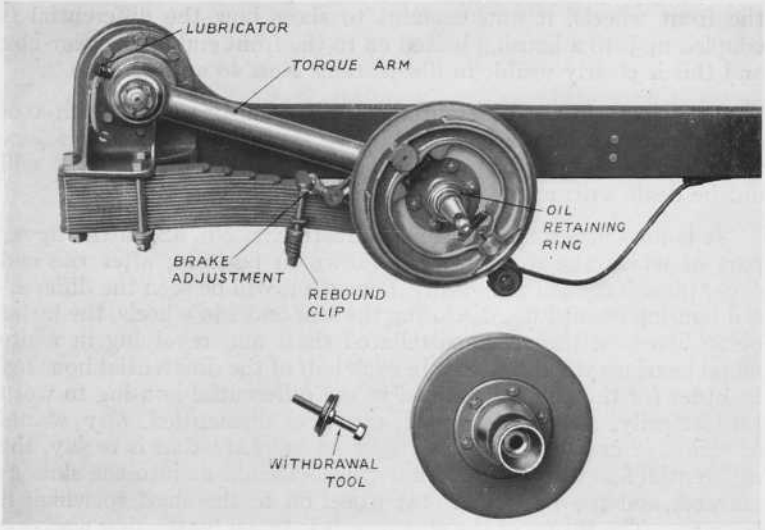


Fig. 44.
Rear of the F.W.D. Alvis chassis with rear wheel and brake drum removed to show torque arm and method of mounting. Alongside the brake drum is shown the tool employed to withdraw the hub. The rear brake adjusting nut can be clearly seen. The inner end of the stub axle is provided with an oil retaining ring, which registers in a groove inside the hub. When the wheel is removed, see that this oil retaining ring does not foul the locking wire in the hub.

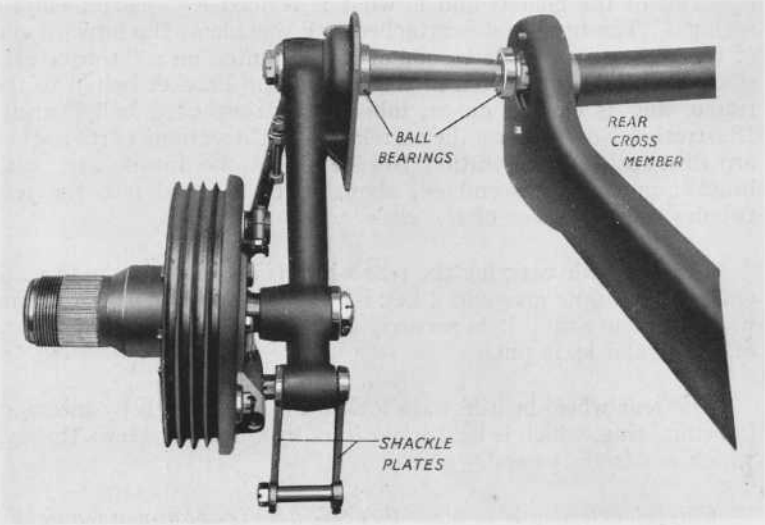


Fig. 45.
General view of the torque arm about to be assembled to the frame. The arm is fitted on a shaft and is supported inside the rear cross member on the ball bearings.

Rear Brakes. The hand brake lever is intercoupled to the pedal shaft, so when the hand brake is applied all the other brakes are applied as well, but the application of the foot brake does not in any affect the position of the hand brake. No useful purpose is served in duplicatiing the illustration so, just for the moment, the reader will refer back to illustration No. 1. It will be seen that the shaft is revolved by pressure of the pedal or pulling on the hand brake. The interior of the rear wheel hub is shown in illustration No. 44, disclosing a very simple but effective brake with a flynut immediately behind the drum for adjustment.

It would, of course, be obvious that independently sprung wheels necessitate flexible connections, but the type employed in the front wheel drive Alvis has been common practice in other models of Alvis cars for some time. Removal of the drum is effected by screwing a special removal tool into the hub after the hub cap has been removed, but care should be taken that the hand brake has been released before any attempt is made to remove the hub and brake drum.

Brake Liners. The same size liners are used on the front and rear brakes. They are $204\frac{1}{2}$ m/m. long, 50 m/m. wide, $\frac{3}{16}$" thick. There are 7 rivets per liner, $\frac{3}{16}" \times \frac{1}{2}"$ long, with countersunk heads.

Rear Suspension. This will be dealt with under illustrations Nos. 44, 45 and 46. A spring is attached in the first place to the

rear end of the chassis and is what is termed a " quarter elliptic spring." The front end is attached to a shackle at the forward end of the torque arm ; the torque arm is mounted on a " torque arm shaft," which is supported in the torque arm bracket bolted to the frame, and is carried on an inboard and outboard ball bearing. Illustration No. 46 shows the correlation of the various parts as they are dismantled ; illustration No. 45 shows the torque arm with bracket and shaft assembled, about to be inserted into the rear tubular cross member of the chassis.

The stub axle carrying the rear wheel is attached to the forward end of the torque arm and a key is provided to prevent it rotating in the torque arm ; it is securely locked up on a taper by means of a nut and split pin.

The rear wheel bearings are locked up in the hub by means of a locking ring, which is held in position by three set screws through which a wire is passed.

Careful note should be made that this wire is not drawn too tightly, otherwise it fouls the oil retainer collar, which registers in the groove in the hub locking ring.

The preceding paragraph will probably appear Greek to the average owner, but the meaning will be probably perfectly clear if ever the rear wheel is removed. The wire can be seen inside the brake drum in illustration No. 46, and the oil retainer is shown on the stub axle after the hub has been removed in (illustration No. 44).

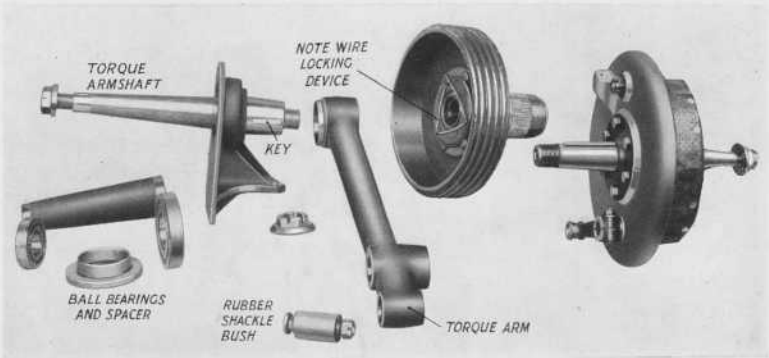


Fig. 46.
Dismantled layout of the rear torque arm, showing the long shaft supported on ball bearings, method of attaching torque arm to shaft by key and stub axle to torque arm. The interior of the brake drum should be noted, as reference is made in the text to a wire which acts as a locking device to the interior screws. This should not foul the oil retainer fitted on the stub axle.

Lubrication. The owner has been relieved of a considerable amount of lubrication on the chassis portion of the front wheel drive Alvis, as he would have realised, as soon as he received the car, that oil is conducted through the container on the engine side of the dash-board which is conveyed through flexible metallic piping to nipples on the various articulating parts. Certain parts, however, cannot be treated in this way ; you will, therefore, have to use the grease gun for the top and bottom of steering pivots. It is essential that the correct grade of oil shall be employed for the various parts and after considerable trial, the following are recommended :

Engine	Castrol	XL for non-supercharged cars. R for supercharged cars.
Gear box ...	,,	XL
Differential ...	,,	XL
Steering Gear-box	,,	S Gear Oil
Tank on the dash-board and oil container in inner front hub...	,,	F
Hubs and front universal joints	,,	Grease.

LUBRICATION INSTRUCTIONS. FRONT DRIVE CAR.

Engine. (SUPERCHARGED)

Fuel.—50% Petrol, 50% Benzol, to which should be added ⅛ pint per gallon of CASTROL XL oil. (Castrol R must not be used in the fuel.)

This oil must be well mixed with a portion of the fuel before it is put into the tank.

Oil.—CASTROL R oil must be used in this engine. Never run engine unless oil gauge shows a pressure of at least 20 lbs. per sq. in., without fluctuation of gauge needle. Engine should be carefully warmed up when starting from cold before it is opened out.

Engine. (NON-SUPERCHARGED) Use CASTROL XL oil in this engine. Fill to high level mark on gauge. Never run engine unless oil gauge indicates pressure.

Gear-Box & Differential. Fill with CASTROL XL to top of oil filler. Inspect level every 2,000 miles.

Steering Box. Fill with CASTROL S gear oil.

Front Wheel Hubs. Use GREASE GUN on top and bottom of swivel hubs every 2,000 miles, or more frequently in continuous wet weather.

Dynamo, Magneto & Starter Motor. Give each several drops of oil every 1,000 miles.

Every other point on this car is lubricated from the oil reservoir on the dash.

Replenish this reservoir as necessary with CASTROL F.

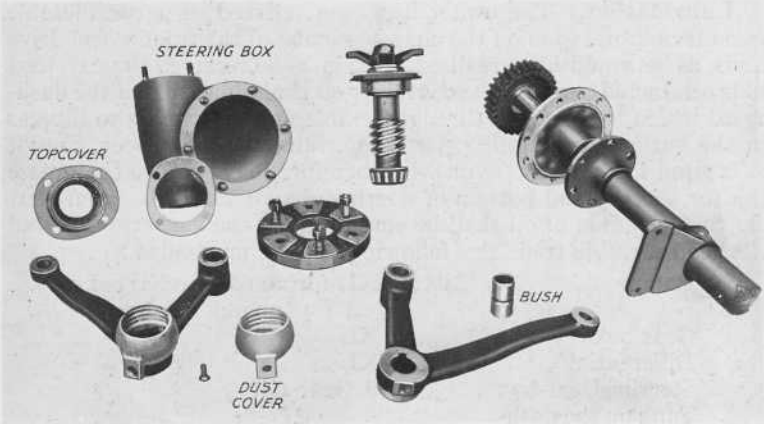


Fig. 47.
Steering gear-box dismantled, showing the worm mounted on taper roller bearings, complete worm wheel, engaging with it and cover plate, having holes so drilled that, depending upon the position of the hole, the adjustment of the steering is controlled.

Steering. The steering layout on the front wheel drive Alvis differs from the usual type of steering, because both front wheels are independently sprung and instead of placing the tie rod beneath the front axle it is placed behind the engine and beneath the clutch and brake pedal shaft.

All steering connections are automatically lubricated, except the front and rear ends of the pull and push rods. The bell crank lever which is attached to the pivots and couples up to the tie rod is drilled to allow the oil reaching the pins that pass through it.

The steering gear-box is coupled to the steering pillar by means of a Hardy disc which, through the spider, rotates the worm shaft which is supported on taper roller bearings at either end.

The general layout of the steering, dismantled, is shown in illustration No. 47, from which it will be seen that the worm shaft engages with a complete wheel, thus allowing for adjustment for wear, both as to the position of the wheel where it engages with the worm and the mesh of the teeth of these two parts.

The aluminium cover, through which the steering operating shaft passes, is drilled in such a manner that it can be fitted to the steering gear-box to permit the wheel being engaged with the worm, so as to get good steering without backlash.

The lower end of the shaft is fitted to the bell crank levers by means of a conventional key, but the ends of these are covered with an aluminium housing, which prevents foreign matter from entering.

DETAILS OF THE SUPERCHARGER IN DISMANTLED FORM.

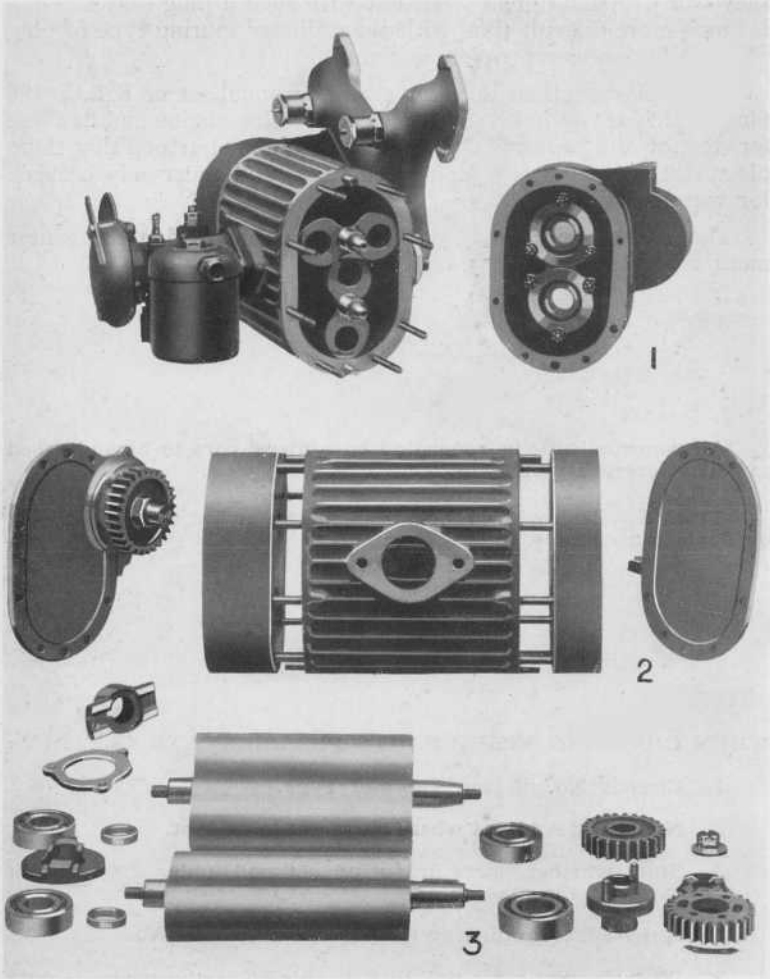


Fig. 48.

The top view (1) shows the supercharger attached to the carburetter on the one side and the inlet manifold on the other, which latter is fitted with release valves. The end cover has been removed to show the rotors. These are supported at either end on ball bearings and are driven through a flexible coupling by a train of gears; (2) Is the side view with the end covers removed, showing that these are held in position by studs. (3) The lower view shows the rotors removed, the coupling on the left and train of gears which are fitted into taper ends with keys. Lubrication of the unit is effected by adding ¼ pint of castrol XL oil (not R) to each gallon of petrol; for full details, see Lubrication on page 45. It is advisable to turn the petrol off at night or when the car is not being used for several hours.

General Hints for Starting. Some difficulty may be experienced when the car is new owing to the clean and polished combustion chambers abstracting the heat of charge and causing condensation. The plugs (K.L.G. 569 non-supercharged, and K.L.G. 368 supercharged) are of such a type that at maximum revs. they will withstand great heat, but with such a plug easy starting is much more difficult than with the ordinary touring type of plug as used in low compression engines.

The easiest method is to have an additional set of K.L.G. 483 plugs which are designed for a low compression engine and fit these for starting and warming up only. It will be understood that these plugs will not stand any high-speed work, and must only be used for warming up.

The above remarks will only usually apply during the winter months.

All communications regarding customers' cars to be addressed to " The Service Department."

TERMS.—Cash with order unless purchaser has already a credit or deposit account with the Company.

WHEN ORDERING SPARE PARTS PLEASE STATE CLEARLY :

1. **Chassis No. of your car and Type.**
2. **Name and Address where parts are to be sent.**
3. **State whether parts are being claimed under guarantee if this is the case.**
4. **If there is a number on the part, give the part No.**
5. **Where there is a possibility of an offside and nearside part not being interchangeable, state which side is required.**

All parts returned for replacement to be addressed to :—

Alvis Car and Engineering Co., Ltd.,
Service Dept.,
Waveley Road,
Coventry.

Fred'k Stroud & Co. Ltd.
PRINTERS
AND
BINDERS
Stroud