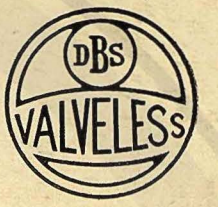


THE "VALVELESS" CAR HANDBOOK

BY

F. T. BURGESS.

DAVID BROWN & SONS, LTD.,

HUDDERSFIELD.

ROYAL AUTOMOBILE CLUB

CERTIFICATE OF PERFORMANCE

(Under the Open Competition Rules of the RAC)

No. 109.

in a 1000 Miles Trial

of a 25 h.p.

"Valveless" Car (live-axle)

November 2nd to November 7th 1908.

This is to certify, [illegible]

Examination at end of Trial. [illegible]

[illegible]

Day	Miles	Weight of passengers in lb.	Time occupied on Road: Involuntary Stops	Time occupied on Road: Voluntary Stops	Time occupied in Depot in attending to adjustments	Petrol in gals.	Lubricating Oil in pints	Water in pints
1	[illegible]	[illegible]	Nil	[illegible]	Nil	[illegible]	[illegible]	
2	[illegible]	[illegible]	Nil	[illegible]	Nil	[illegible]		
3	[illegible]	[illegible]	Nil	[illegible]	Nil	[illegible]		
4	[illegible]	[illegible]	[illegible]	[illegible]	Nil	[illegible]		[illegible]
5	[illegible]	[illegible]	Nil	[illegible]	Nil	[illegible]		[illegible]
6	[illegible]	[illegible]	Nil	[illegible]	Nil	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]	Nil	[illegible]	[illegible]	[illegible]

Petrol and Lubricating Oil Consumption.

Miles	Total average weight in lb.	Petrol consumed in gals.	Ton-miles consumption	Car-miles consumption	Lubricating oil consumed in pints	Pints per 100 miles
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Particulars of Involuntary Stops on Road.

No. of Day	Duration	Details
4	[illegible]	Applied grease to front end of the cardan shaft between the clutch and gear box

[signature] Secretary [signature] Chairman

[illegible] 1908. Date [signature] Chairman of the Technical Committee

89, Piccadilly, London, W.

Introduction

THE objects of this book are: to demonstrate the simple principles underlying the "Valveless" motors, and to enable the reader to thoroughly understand the running and management of the car.

The diagrams of the engine, coupled with an explanation of the system, have been carefully compiled, and illustrations of the various parts of the chassis are also reproduced.

Simplicity and absence of unnecessary mechanism is the keynote of the designs throughout.

The Engine working on the two stroke principle and being entirely original in design, the following remarks will not be out of place.

Numerous attempts in the past have been made to produce a successful two cycle engine for automobile work, and the variations in designs and principles have been remarkable.

Notwithstanding the time and capital expended, these early motors suffered from certain defects, and it was realised by the designers of the "Valveless" engine that if success was to be attained, it would be necessary to work on entirely new principles.

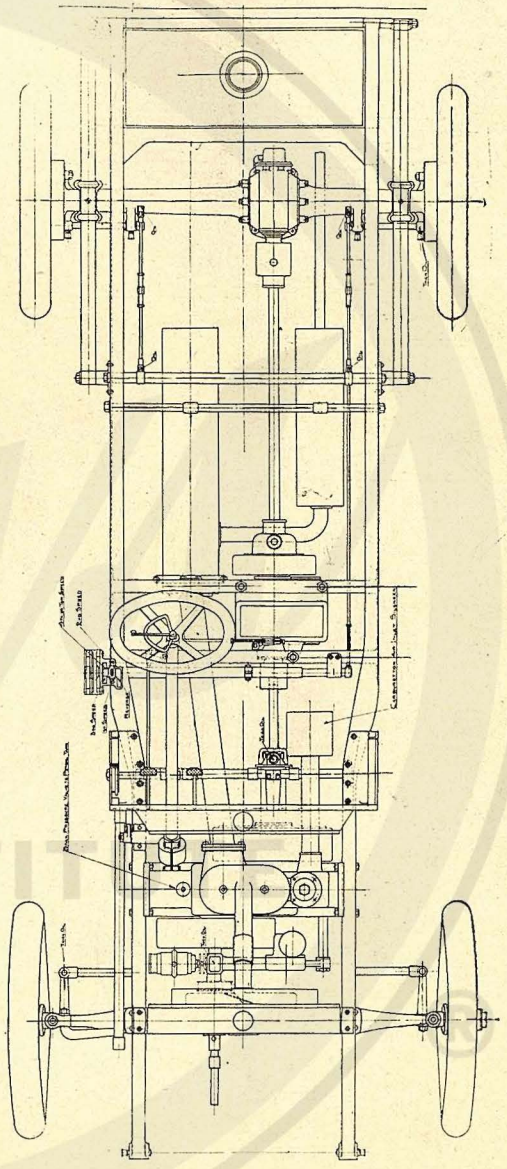
It has always been admitted that the two stroke is the ideal system, and the determination of the makers to strike out on original lines, and to attack one by one, the earlier defects, has been more than justified by the success obtained.

To the motorist the engine just looks a simple straightforward piece of mechanism, in fact it has been more than once remarked, that it is "too simple," but it should be borne in mind, that simplicity is the much sought after feature by the motoring public, and the direct result of simplicity, is reliability, low cost of upkeep, and freedom from trouble.

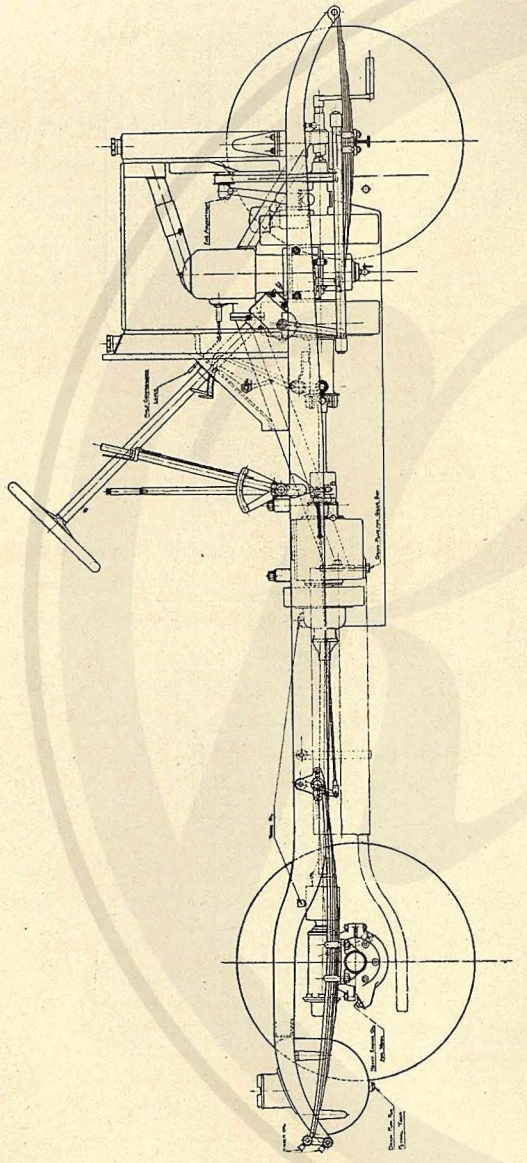
The general features of the "Valveless" Chassis are:—Four-speed gear box, with short shafts of large diameter, thus preventing tonsinal strain, and providing easy gear changing.

Worm driven back axle, the famous D.B. & S. type giving absolute silence with freedom from breakdown, and also a maximum road clearance of 10 inches.

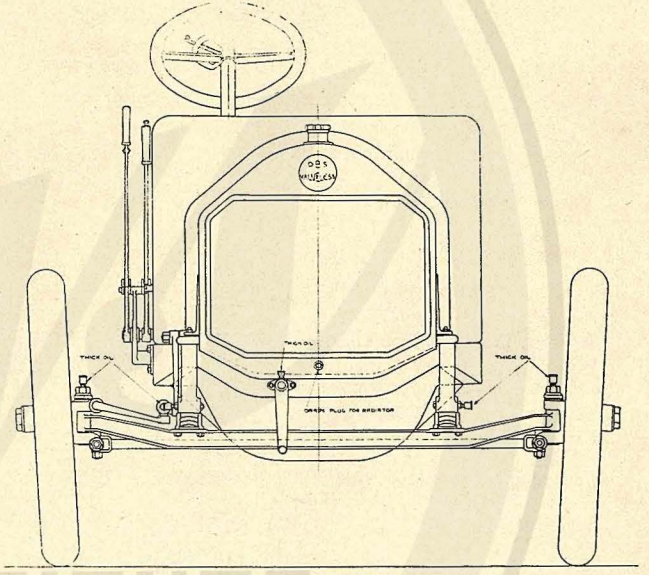
The long flat Road Springs ensure easy riding over the roughest roads. The rear springs do duty as radius rods and drive the car, and also take the driving tongue. This system has been in use for several years, and when correctly designed is undoubtedly the best method. It forms a spring drive, allowing the car to be started from rest in a gentle manner, and at the same time relieving the transmition of all starting shocks, and perhaps as important as all, saving the tyres.



PLAN OF CHASSIS.



SIDE ELEVATION OF ~~CAR~~ CHASSIS



FRONT VIEW.

THE ENGINE.

The features of the "Valveless" Engine, are:—

No valves or sleeves.

Extreme simplicity.

Few working parts. 6 only.

Reliability.

Silence.

Low speed pulling powers.

The fact that the engine is valveless and sleeveless with no half-time shaft, chains or gears, gives it a tremendous advantage over all other systems. No matter how well a valve or sleeve engine may be made, noise, and the necessity of taking down and fitting new parts, making adjustments, etc., is sure to arise sooner or later after the engine has done a certain amount of work.

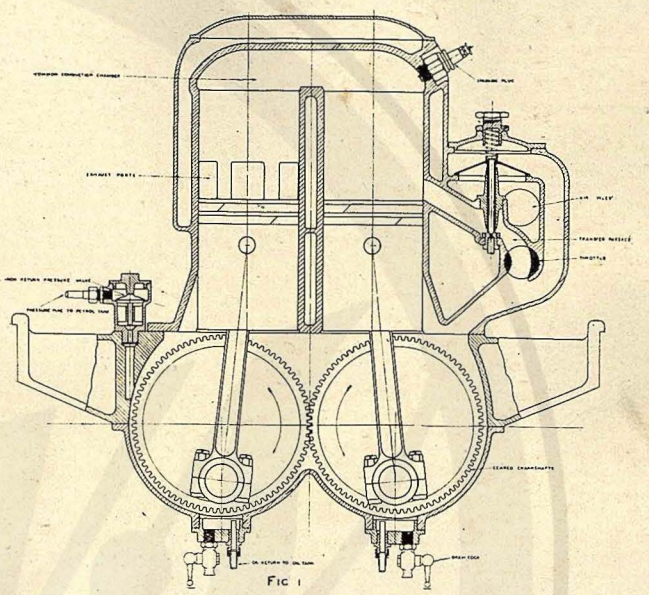
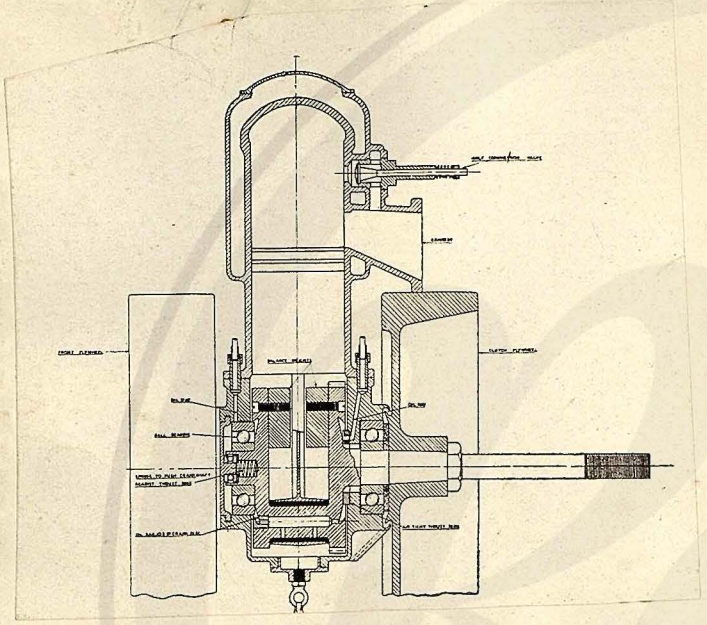


FIG 1

FRONT ELEVATION OF ENGINE

SHOWING

The two cylinders with the common combustion chamber, the carburettor and transfer passage from base chamber to cylinders, the two crank shafts, geared together, and which revolve in opposite directions, the exhaust port, the sparking plug, and the oil return from base chamber back to the oil tank.



SIDE ELEVATION OF ENGINE.

SHOWING

The ball bearing crank shaft, the balance weights, the ½ compression valve, the method of keeping crank case air-tight, together with thrust ring, and spring in end of crank shaft.

These two sectional drawings and the following explanation clearly show the working of the engine.

The engine has two vertical water jacketted cylinders, with a combustion chamber common to both, mounted on an air-tight crank case. It has two crank shafts, each carrying a flywheel, and revolving in opposite directions, thus reducing engine vibration to a minimum.

These crank shafts run on ball bearings, and are geared together by teeth cut in their discs.

The only working parts in the engine are:— 2 pistons, 2 connecting rods, and 2 crank shafts.

The cylinders are provided with 2 ports instead of valves. Their are no sleeves with their many bearing surfaces and lubricating difficulties.

Every time the pistons ascend they compress an explosive charge in the cylinders, and at the same time the vacuum formed in the air tight crank case draws air past the disc (D) through the passage (S) into the crank case, the needle (N) being lifted by the disc, (D) allowing petrol to spray from the jet (K) into the throttle passage (P) only (see Fig. 10), so that *no mixture enters the crank case.*

The charge compressed in the cylinders is then exploded, and the pistons are driven down until the port (E) is uncovered by the piston on that side, permitting the exploded gas to escape (see Fig. 11).

Immediately afterwards the port (I) is uncovered, permitting the compressed air to pass from the crank case to the cylinders, taking with it the petrol vapour in the throttle passage (P). The mixture thus admitted displaces the remains of the exploded gases, driving them out through the port (E) which is still open (see Fig. 12).

The pistons then re-ascend, closing both ports, and the cycle of operations is repeated, one charge is compressed and exploded in the cylinders, while the next is being prepared in the crank case and throttle passage, the exploded charge escaping and the new charge entering the cylinders every time the pistons reach the bottom of their stroke. An explosion therefore taking place at every revolution, instead of at every second revolution, as in the 4 cycle engine.

The first charge is supplied to the cylinders by turning the engine with the starting handle in the usual way. Air under pressure from the crank case is supplied to the petrol tank at the same time.

The three diagrams on the following pages illustrate the action of the engine.

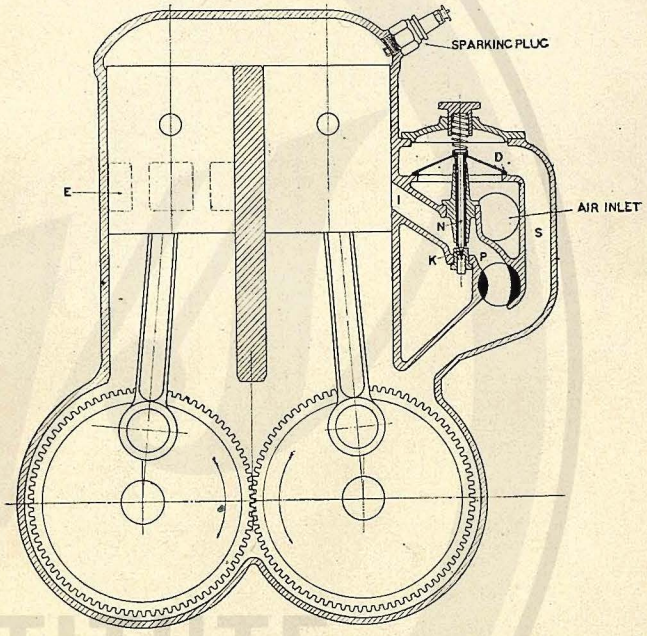


FIG 10

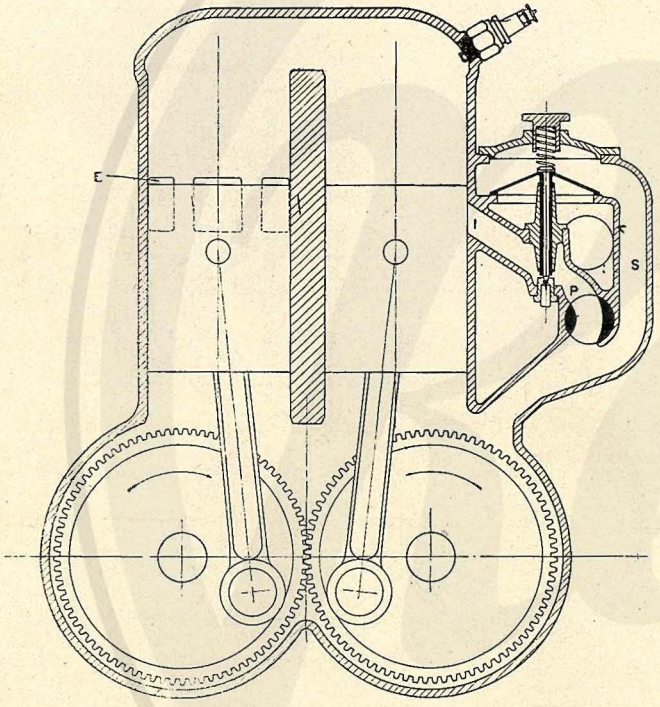


FIG 11

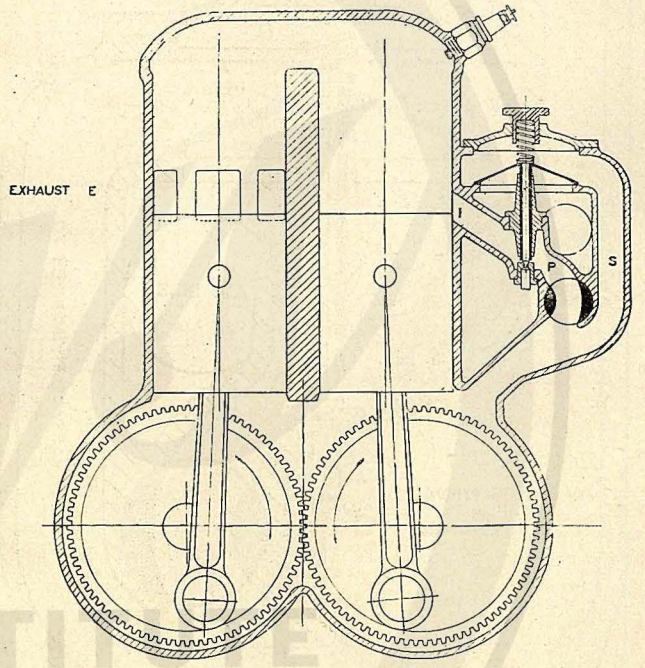
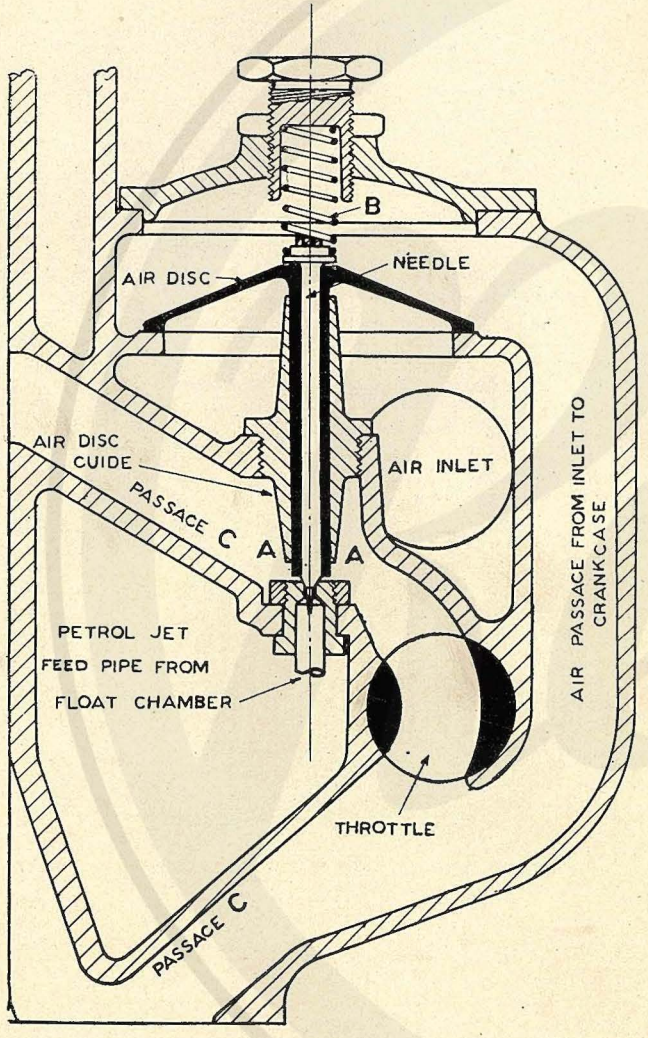


FIG 12



THE CARBURETTOR.

The line drawing on the opposite page clearly shows the simple form of Carburettor used on the "Valveless" Engine.

The working of this Carburettor, adjustments, etc., are dealt with at some length, the reason being, that while it is of simple construction, the original working and principle must be thoroughly understood.

The body of the Carburettor is cast solid with the cylinders, and to this body is attached the float chamber with the jet supply pipe.

The remaining parts of the Carburettor consist of the jet, air disc, air disc guide, throttle, needle, spring, and the gunmetal cover with adjusting screw for spring.

The action of the Carburettor is as follows:— When the pistons ascend, the vacuum caused in the crank case and carburettor passage lifts the air disc and needle off their seats. Thus when the needle is lifted off the jet, petrol is sucked into the passage A. Immediately the pistons reach the top of their stroke the vacuum ceases, the air disc and needle with the aid of spring B close down on the seating and jet respectively.

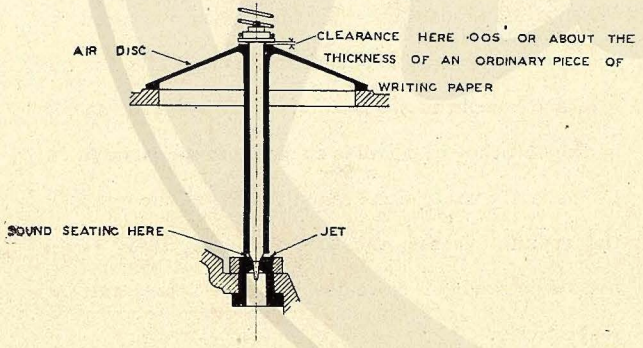
The pistons are now travelling downwards and compressing the air in the air-tight crank case (the air on the upward stroke being drawn through the air disc). Immediately the piston uncovers the carburettor port, the compressed air in the crank case rushes up the passage C, carrying with it the petrol (already sucked from the jet) and entering the cylinders, forms the explosive charge.

The pistons now ascend and compression takes place in the ordinary manner.

There are three adjustments important to this Carburettor, and which after long use may require attention, viz:—

(1) The needle seating.
(2) The clearance between air disc and head of needle.
(3) Tension of spring.

The needle *must always* make a perfectly sound seating on the jet. To make this seating it is obvious the head of the needle must be clear of the air disc thus:—



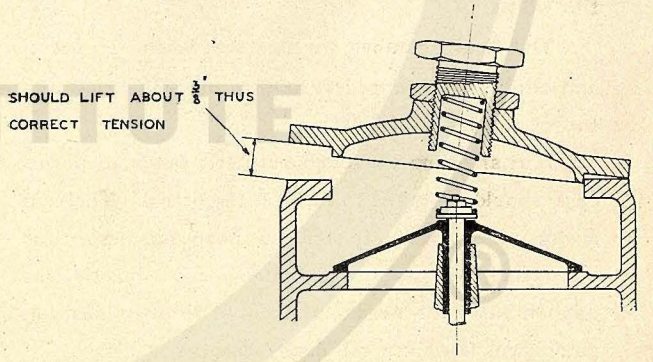
It will be clearly seen if the needle head were bearing on the air disc, the needle would be unable to seat at the jet.

The needle can be ground into its seating with grinding paste.

The clearance between needle head and air disc is of the utmost importance. This clearance should be about ·005 of an inch, or about the thickness of an ordinary piece of writing paper. It cannot be too clearly stated that this clearance is to be measured after it has been ascertained the needle is making a perfect seating on its jet.

The tension of the spring is a simple matter, and the method of adjusting same is as follows:—

Remove the screws holding the gunmetal cover in position and hold down at one edge thus, when the adjustment is correct. The opposite side of the cover should lift about $\frac{3}{8}$".



As already stated, while these adjustments are of a simple character, it is important they should be correct, otherwise the running of the engine will be affected, causing loss of power; hesitation in picking up when throttle is opened; and missfiring.

The carburettor jet should never be removed or disturbed in any way, unless it is necessary to replace same through breakage, etc. It is well to mention here the hole in the jet is of such a large size ($\frac{3}{32}$") that it is impossible for it to become choked with dirt.

It is possible at some time or other through unforeseen circumstances, that some adjustments may be found necessary. The foregoing notes are written so that the principle and theory may be known and understood.

It should never, however, in the ordinary way, be necessary to touch the carburettor after leaving the works.

The float chamber governs the height of petrol and this is so arranged to be $\frac{1}{8}$ of an inch below the top of the jet.

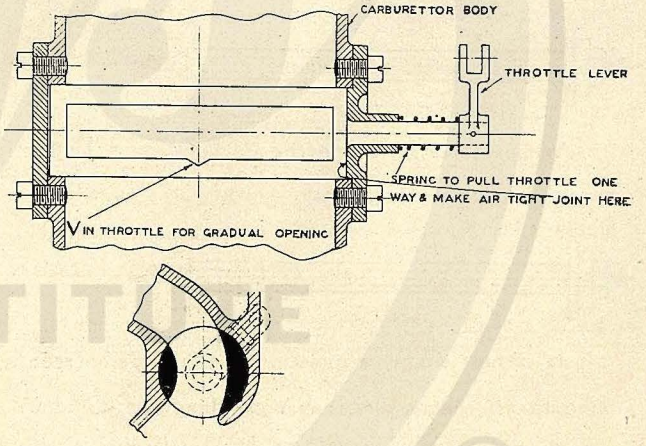
If at any time the Carburettor is taken to pieces care should be taken to turn off the petrol. There is always the possibility of the float flooding, thus increasing the height of petrol, and should this happen when the needle is removed from its seating, petrol will flow into the crank case.

In the event at any time of petrol finding its way into the crank case, the engine would be difficult to start, owing to the mixture being too rich, but the petrol is easily removed by opening the cocks at the bottom and giving the engine a few turns.

The float chamber should always be kept clean to avoid any possibility of flooding, and the petrol filter at the side of chassis should also receive occasional attention and any dirt removed.

Care should be taken to see that the petrol supply to the float chamber is constant. (See page).

The accompanying sketch shows the form of throttle used on the "Valveless" Engine.



TUNING CARBURETTOR.

ADJUSTING MIXTURE.

Assuming the adjustments already mentioned are correct, the following is the method of tuning the Carburettor:—

The mixture is controlled by the shape of the needle, that is to say, the end of the needle that enters the jet.

No air adjustment is provided or is necessary.

When the mixture is correct the needle will be a wedge shape, thus:—

FIG 13.

When starting to tune the Carburettor a slight wedge should be filed, thus:—

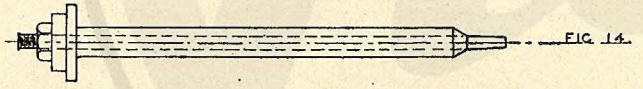


FIG 14.

It is now simply a question of filing the correct amount off the needle, thus controlling the amount of petrol passed at the jet.

To get the correct mixture, the needle will have to be fitted a few times and the engine run.

When the mixture is correct it is possible to run the engine at about 200 R.P.M. with throttle nearly closed, and the engine should fire every time and be perfectly regular when the half compression valve is open. On closing the half compression, the engine will miss fire occasionally. The firing is best noted at the final outlet pipe on silencer.

It is needless to say the slight missfiring mentioned occurs only when the engine is running light under no load. Directly the clutch is engaged the engine will pick up its load quite smoothly.

When the half compression is closed the engine responds immediately to the opening of the throttle. Should it hesitate, it is a sign of weak mixture and a little should be filed off the thick end of wedge—

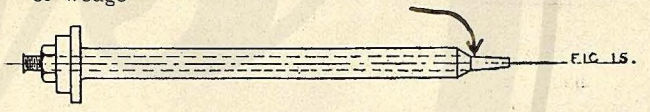


FIG 15.

Should hesitation occur when the throttle is half open, a little should be filed off the middle of the wedge—

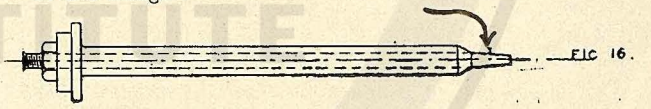


FIG 16.

or if hesitating when throttle is wide open, the end of the wedge should be filed slightly—

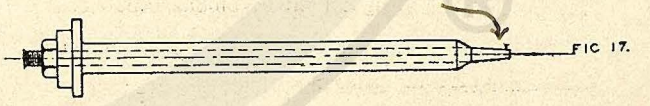
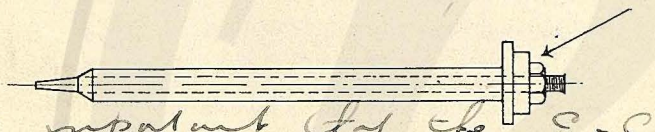


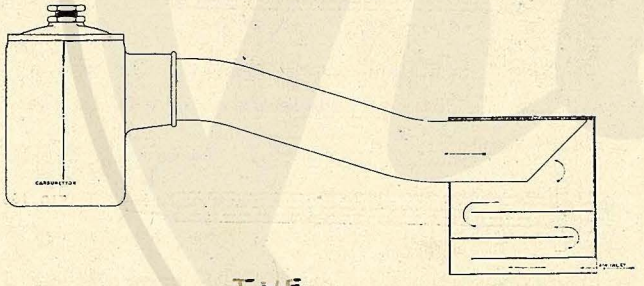
FIG 17.

If the mixture is too weak the engine will hesitate and not accelerate. If too rich, four cycle firing will occur, or in other words, at every other revolution of the crank. This richness is caused by too much being filed off the needle, and if this is so, the needle should be screwed down a little, thus widening the wedge. Care must be taken to tighten the lock nut after adjusting.



21. is important that the C.C. should be perfectly air Tight.

~~To secure good carburation, the crank case should be reasonably air tight.~~ This is not a difficult matter, the pressure being only 8 to 10 lbs. to the square inch.



THE

~~To secure a silencer~~ air intake to the carburettor PASSES THROUGH a small silencer ~~is fitted,~~ as illustrated above.

There are no moving or loose parts, and this device requires no attention.

AIR-TIGHT CRANK CASE.

The construction of the Crank Case and patent air tight joints are clearly shown in the accompanying drawing.

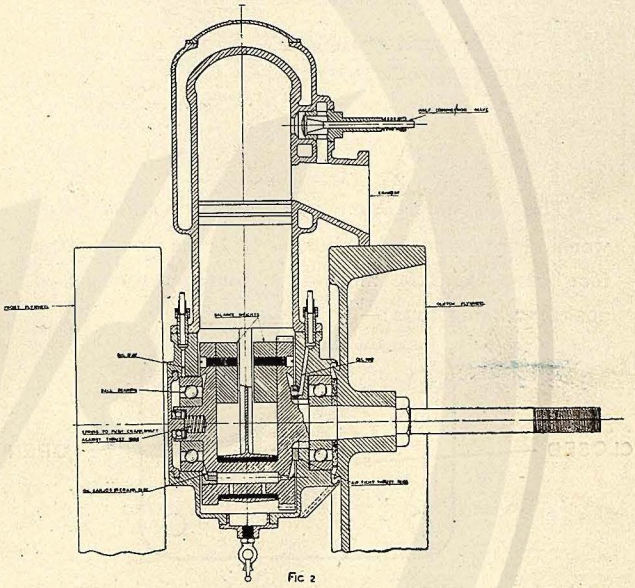


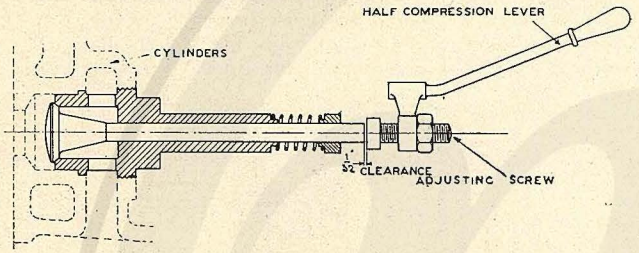
FIG 2

Should at any time a bad leak develop through accident, etc., it should be attended to, otherwise the carburation will vary.

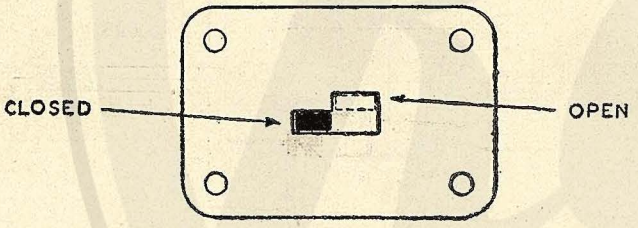
The crank case can be tested by slowly turning the engine by hand, and if on the downward stroke a bad leakage is noted, it should have attention.

HALF COMPRESSION VALVE.

For ease of starting a half compression valve is fitted, the line drawing illustrating this device.



The half compression is operated by a small lever, working through the foot board. A brass plate on the foot board limits the movement, the open and closed positions being thus :—



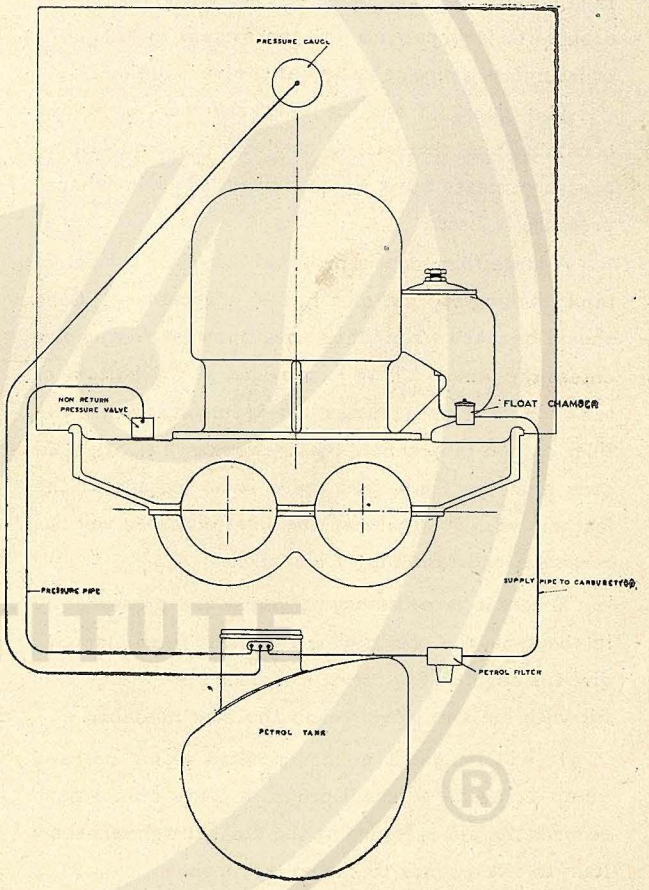
Care should be taken when driving to note that the half compression is closed, and not accidentally left open. Should the car be driven with it open, the engine will get hot, pull badly, and the half compression is liable to get damaged.

There should always be about $\frac{1}{32}$" clearance between the valve stems and the adjusting screw, to allow the valve to make a tight joint on its seating.

FUEL FEED SYSTEM.

The petrol tank is placed at the rear of the chassis, and petrol is supplied to the carburettor by air pressure.

It should be noted that the system employed is unique in its simplicity and absolutely positive in action.



When pressure feed is fitted it is the general practice to use the exhaust gases for this work, which is very apt to give trouble, owing to dirt choking the pipes, etc. In the "Valveless" Car, using the base chamber as a pump, and clear air only going into the tank, none of the usual pressure-fed difficulties occur. It is impossible for the system to get out of order unless a pipe or non-return valve is broken.

The supply from the base chamber is always constant, and there is no need for the troublesome pressure release valve, which is required when exhaust pressure is used.

A large filler cap is provided for filling the petrol tank, making the use of a funnel unnecessary. Care should be taken when filling up with petrol that no dirt enters the tank. A plug is provided at the bottom of tank for cleaning purposes. It is important that the filler cap on tank should be screwed down tightly, and care must be taken that there is no leakage at the leather washer, otherwise the float chamber will not receive a constant supply of petrol.

When it is necessary to pump the pressure up in the tank, the operation is simplicity itself, namely: give the engine a few turns, when the tank will quickly fill with air and petrol reach the float chamber.

It will be noted no complicated piping or hand pump is used. A small pressure gauge on the dash records the air pressure in the tank, and should show four to five pounds to the square inch.

FRONT GEAR ON ENGINE.

This front gear is an aluminium casting carried by the crank shaft. Keyed to the crank shaft is a skew gear meshing with another skew gear on the transverse shaft. This shaft runs the same speed as the engine, and drives the magneto oil pump (and water pump when fitted).

This front gear requires no attention other than the lubrication of the skew gears, which is effected by removing the cover over the gears. A small quantity of lubricating oil should be poured in every 1000 miles.

MAGNETO IGNITION.

Magneto ignition is fitted to the "Valveless" Car. The timing of the spark is fixed. For all-round practical use this is found to be the best arrangement. The starting of the engine with magneto is quite an easy matter, and thus the necessity for fitting the obsolete accumulator and coil ignition is avoided.

Generally speaking, it is well to bear in mind that except for the simplest and most obvious of adjustments and repairs, it is far better to send the complete magneto to the makers in the event of its failure from any cause. Some simple adjustments however, can be undertaken.

The carrying of a spare magneto is recommended with its driving disc set in the correct position. Thus, in the rare event of a magneto failure, the spare machine could be fixed in position in a few minutes, and serious delay avoided.

If the running of the engine is irregular, although frequently *some* portion of the ignition system is the cause, yet it is unwise at once to suspect the magneto, as this is probably the *last* place where the seat of the trouble will be found.

First of all, it should be clearly proved that the fault does not lie in the sparking plug. Too wide a gap at the plug points at once causes misfiring, and this gap must not exceed 0·4 m/m. If the plug misses

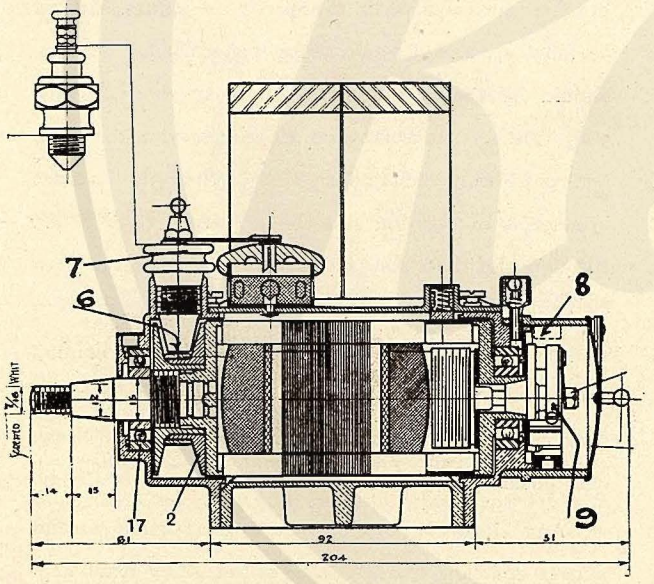
continually, the simplest plan is to change it for one that is known to fire correctly, or else fit a new one, and if this does not effect a cure, then the high tension wire from the plug to the magneto should be examined and tested. Should the plug and wire prove to be in good order, then the carbon brush 6 and the slip ring 2 should be examined to see whether they are making clean contacts. If this does not disclose any cause for misfiring, then the contact cover should be taken off and the platinum points carefully examined.

For this porpose it is best to remove the contact breaker entirely, when the platinum points can be seen better, and if found to be pitted or dirty, they should be thoroughly cleaned and touched up with very fine emery cloth, and if necessary, with a fine and preferably old smooth file. When the contact breaker is in position and the armature is revolved, the two platinum points should break not more than 0·5 m/m., and not less than 0·3 m/m., when caused to separate by the fibre heel bell crank lever 9 coming in contact with the segment 8. Too wide a break gives bad results, and an apparently very small break may possibly be no break at all, and cause misfiring.

Any interruption of the high tension circuit causes sparking to take place at the safety spark gap.

Should the investigations fail to disclose any fault, and the trouble be definitely proved not to be due to carburettor, or other portions of the engine, then it is advisable to return the magneto to the makers, so that they may make a thorough test at their works.

A Simms magneto is used, type S.U.I. When sending orders for any spare parts, the type of machine for which they are required must be definitely stated. A sectional drawing of the magneto is shewn with figures for reference. (Refer to booklet by Simms Manufacturing Co.).



The magneto should be kept clean and lubricated occasionally with good thin oil.

A mark on the flywheel indicates when the piston has reached the top of the stroke.

The spark should occur when this mark is about 4 inches from the vertical centre line of engine. Needless to say the spark occurs before the pistons reach the top of their stroke.

Should the ignition be too far advanced the engine will have a tendency to back-fire when turning the starting handle. In the event of this happening however, the results will not be serious, the starting handle only being pulled out of the hand. There is only one starting jaw, and this is so set that the firing occurs only on the upward pull.

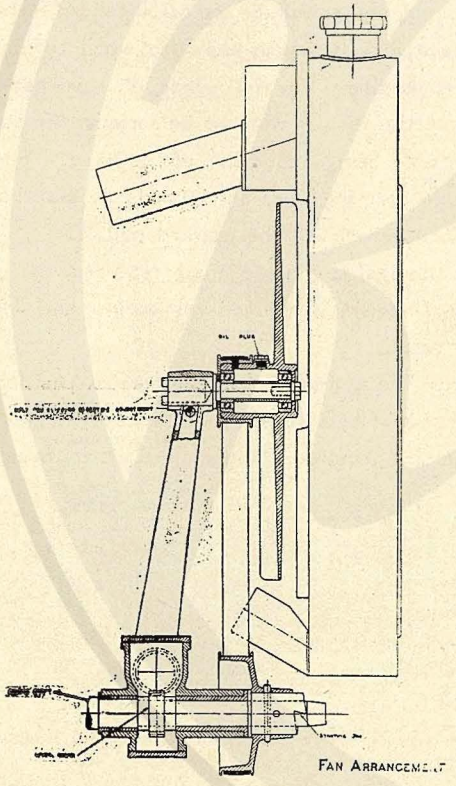
If the ignition is too much retarded, the engine will be sluggish, misfiring will occur, and loss of power result.

With the ignition set in the correct position, the engine should have the slightest tendency to kick when the starting handle is being pulled slowly over.

FAN.

The fan belt need only be sufficiently tight to transmit the drive, and adjustment is provided for by an eccentric, illustrated below.

There is a plug in the fan boss, and this should be filled with oil occasionally.



FAN ARRANGEMENT

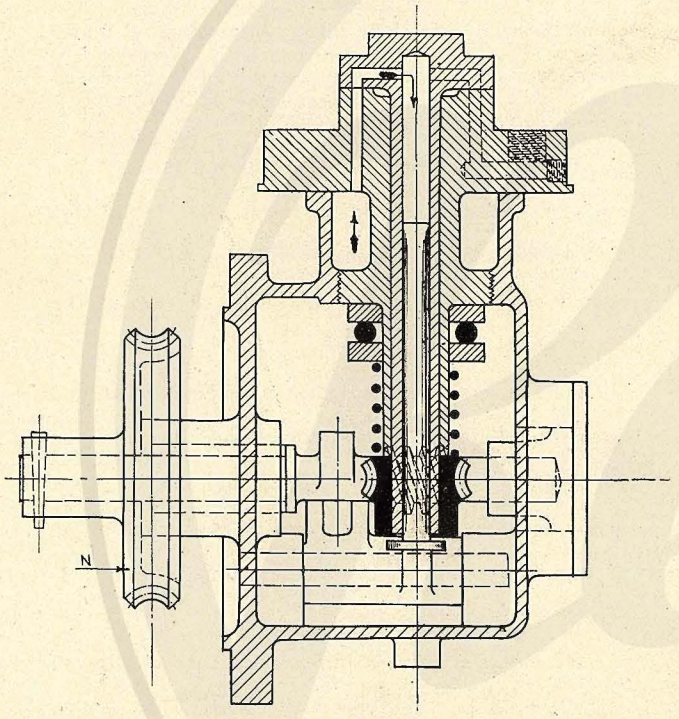
OIL PUMP.

The engine itself, comprising the pistons, connecting rods, big and small end bearings, and crank shafts, are lubricated automatically under pressure by the Patent "Valveless" Oil Pump placed in front of the engine.

The pump receives its oil from the tank on the dash. Great care should be taken when filling this tank to see that no dirt enters with the oil. The tank should be filled within one inch from the top of the gauge glass.

On the pump an inspection plate is provided, and when this plate is removed, the plunger (with engine running) can be seen moving up and down. A set screw and lock nut are provided at bottom of pump to adjust the movement of the plunger. About $\frac{1}{4}$" stroke gives good results.

It is of the utmost importance that all the oil pipes should be kept perfectly clean. This applies strongly to the oil supply pipe leading from tank to pump. Should this pipe at any time get stopped up with dirt, etc., it is obvious the engine lubrication will cease. The sight feed on dash is provided as a means of ascertaining whether the oil is in circulation or not.

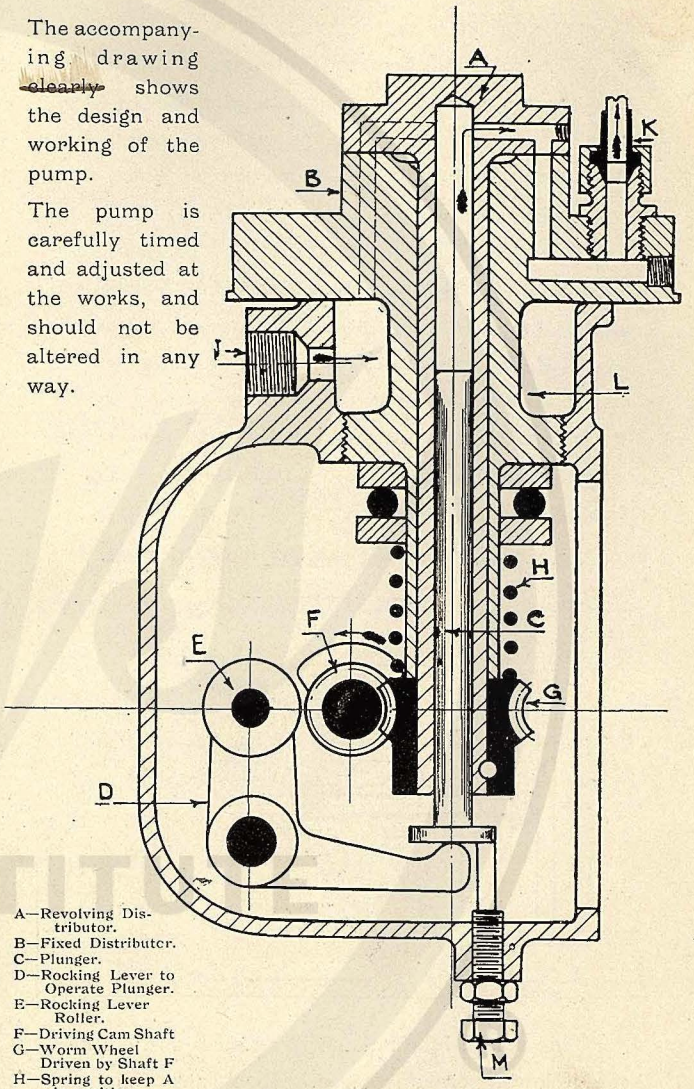


SECTION THRO' OIL PUMP SHEWING

SUCTION STROKE.

The accompanying drawing ~~clearly~~ shows the design and working of the pump.

The pump is carefully timed and adjusted at the works, and should not be altered in any way.



A—Revolving Distributor.
B—Fixed Distributer.
C—Plunger.
D—Rocking Lever to Operate Plunger.
E—Rocking Lever Roller.
F—Driving Cam Shaft
G—Worm Wheel Driven by Shaft F
H—Spring to keep A in position.
J—Delivery from Oil Box on Dash
K—Delivery to Bearings.
L—Oil Well.

M.
N

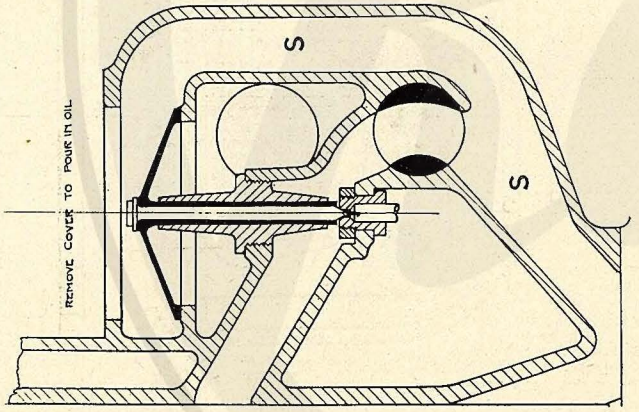
SECTION THRO' OIL PUMP SHEWING

DELIVERY STROKE

As long as the plunger is moving up and down, and the oil is reaching the pump from the oil tank, the lubrication cannot fail, the oil being pumped at high pressure through the respective oil leads, each working part receiving its proper lubrication.

If at any time through damage, or any other reason, the pump lubrication should fail, the car can always be driven home on splash lubrication. In the event of this emergency the following notes will be found useful:—To pour oil into the crank chamber for splash lubrication it is necessary to remove the cover on the carburettor, and pour about ½ pint of oil through the passage S shown on the drawing.

This oil will run the car for about 10 miles.



This splash lubrication will be found useful under the following circumstances. If at any time the engine has been taken down, on the reassembling of

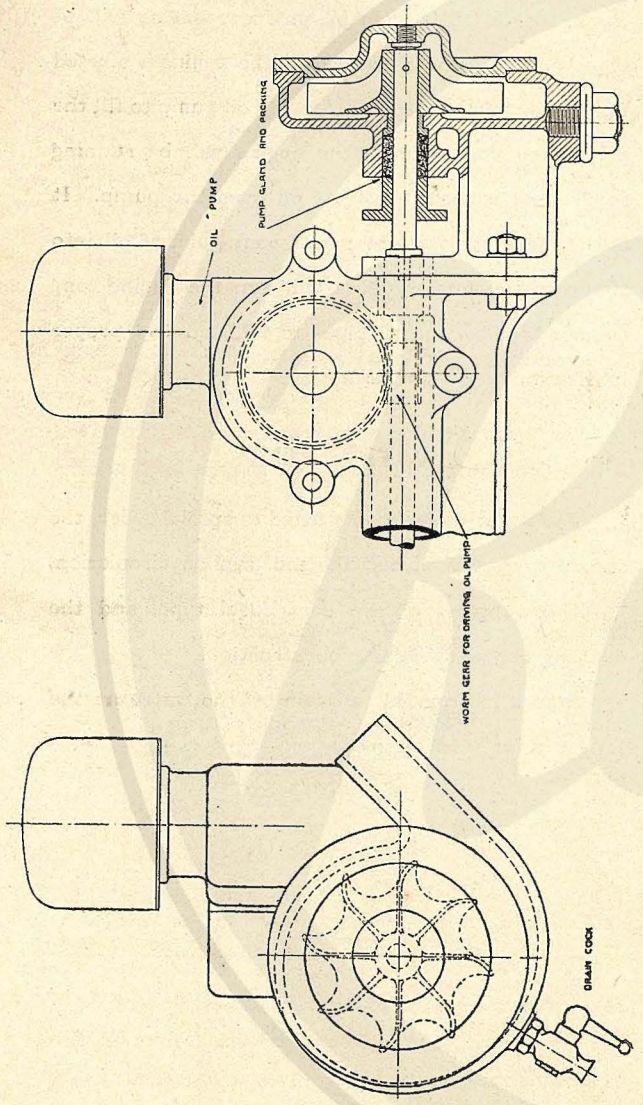
same, the oil pipes from oil pump to engine will be empty, thus it is obvious, when the engine is started up, it will take some time for the oil pump to fill the pipes, and consequently the engine will be running some time without receiving oil from the pump. It is therefore advisable to pour about ½ pint of oil into the crank chamber. This will run the engine long enough to allow the oil pipes to fill, and the proper lubrication to come into action.

WATER PUMP.

The water pump is only fitted to special order, the standard chassis having thermo. syphon circulation.

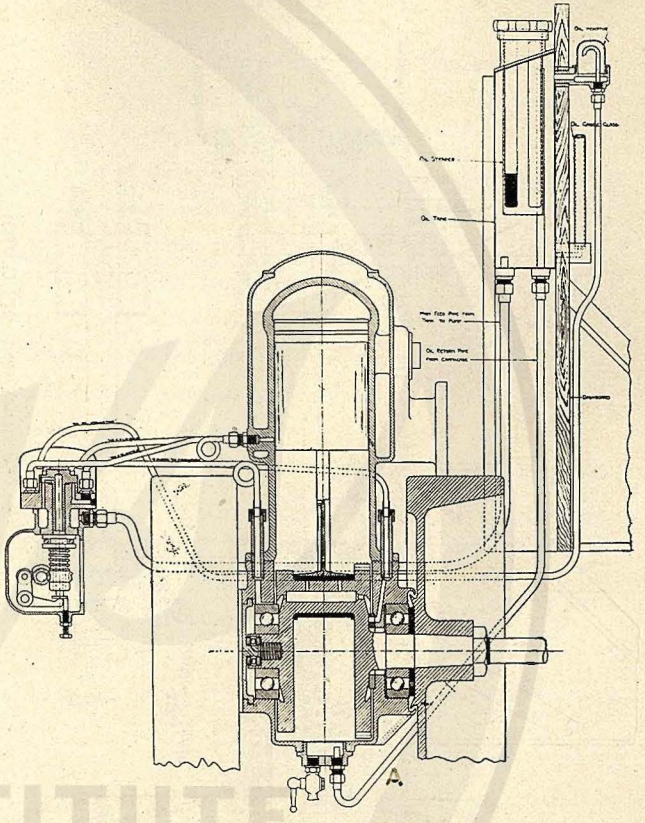
The pump is of the centrifugal type, and the drawing shows its simple construction.

A cork is provided to drain off the water at the lowest point when desired.



ENGINE LUBRICATION.

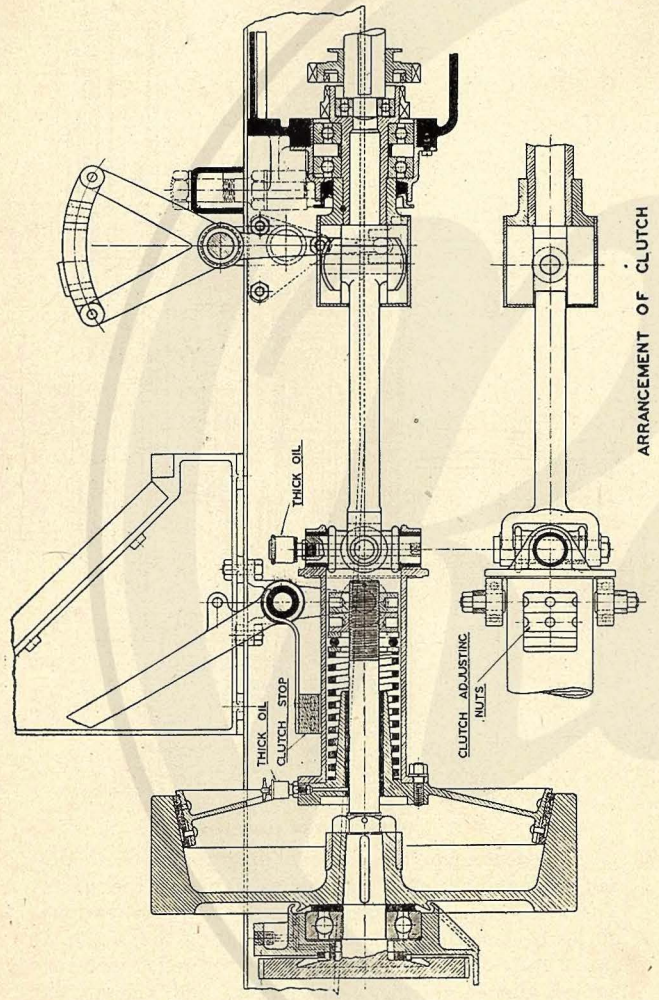
DIAGRAM.



ARRANGEMENT OF LUBRICATION

The accompanying sectional diagram is practically self-explanatory, showing the oil tank on the dash. The glass sight feed, the oil pump with its various oil leads, and the method of lubricating the big and small ends of the connecting rod. Oil is led into the banjos turned in the crank discs, and thence by centrifugal force to the hollow crank pins and up the pipe on the connecting rod to the small end.

The oil pipe marked A is for the purpose of returning surplus oil from the crank chamber to the oil tank.



ARRANGEMENT OF CLUTCH

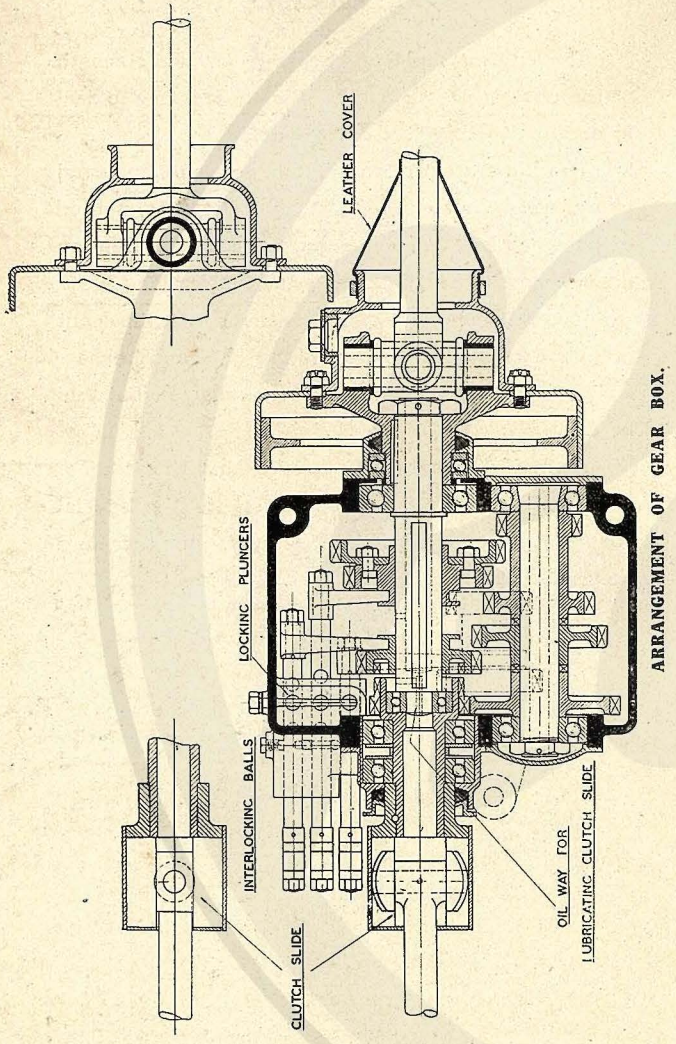
THE CHASSIS.

The extreme simplicity, accessibility, and strength of the chassis are such that it is unnecessary to deal in detail with this part of the car.

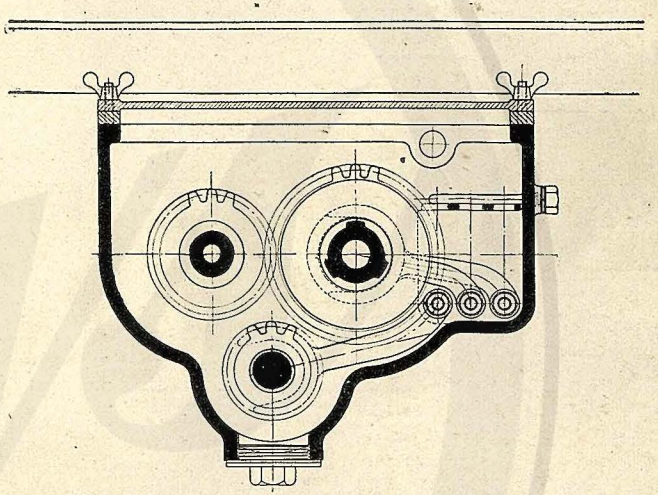
The illustration of the clutch, gear box, universal joints, worm driven axle, etc., etc., show the method of construction, and these parts need no attention other than the usual cleaning and lubrication.

It may be as well to note here that a thick lubricant is advised for the gear box—a mixture of oil and grease—and for the worm a good air-cooled engine oil should be used.

It may be remarked in passing that the exhaust silencers cannot get choked, owing to the special construction and large gas passages, and therefore they need never be taken apart.

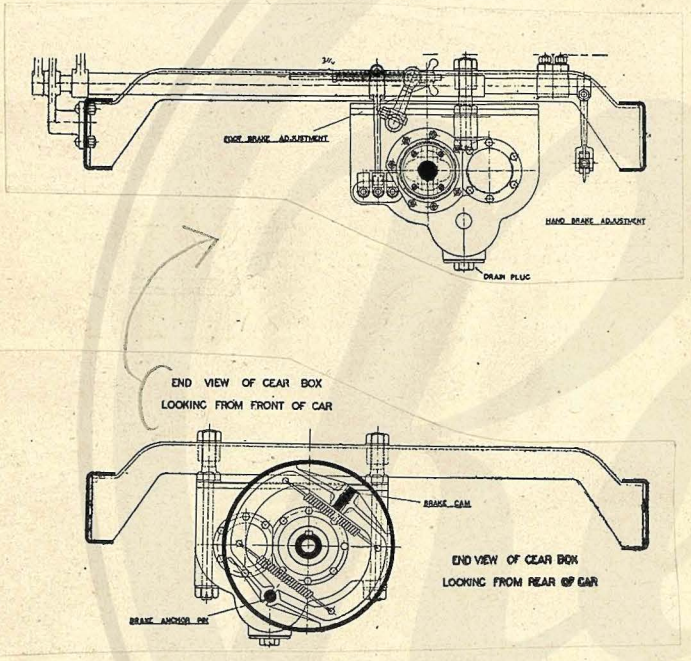


ARRANGEMENT OF GEAR BOX.

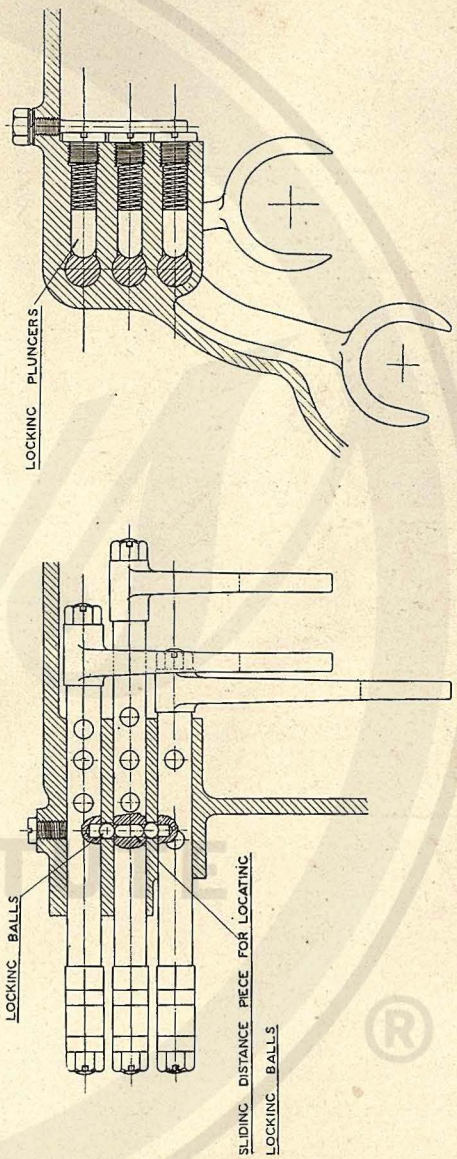


SECTION THROUGH GEAR BOX LOOKING FROM REAR OF CHASSIS.

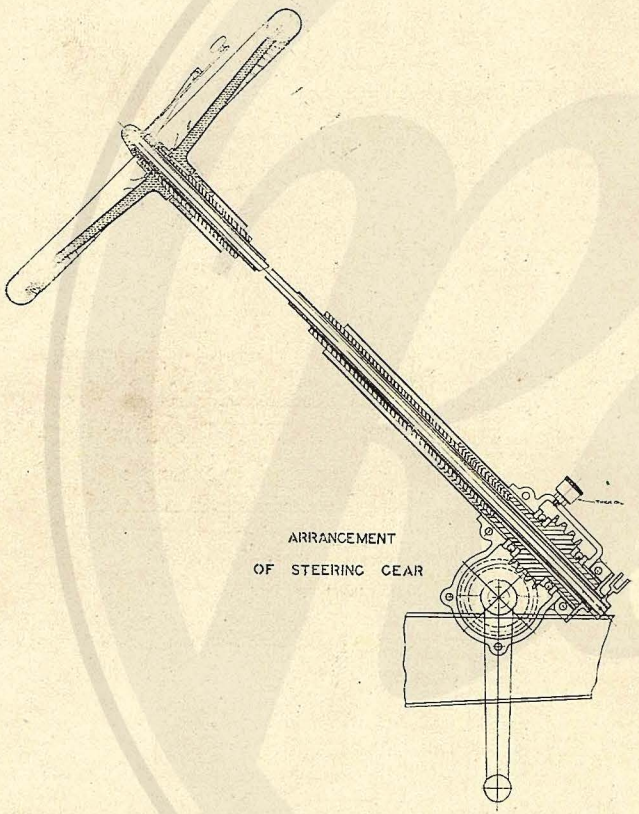
The drain plug for emptying and cleaning the box will be seen in this illustration.



Note the simple three point of the gear box suspension and the thumb nut brake adjustment.

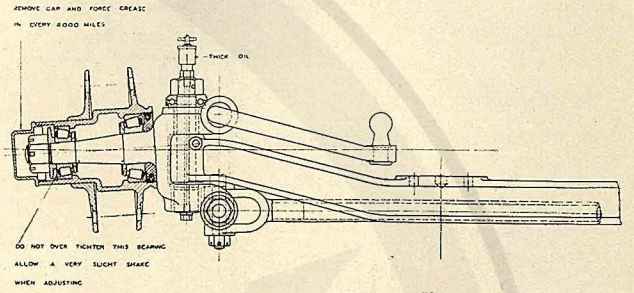


ARRANGEMENT OF CHANGE SPEED LOCKING GEAR.



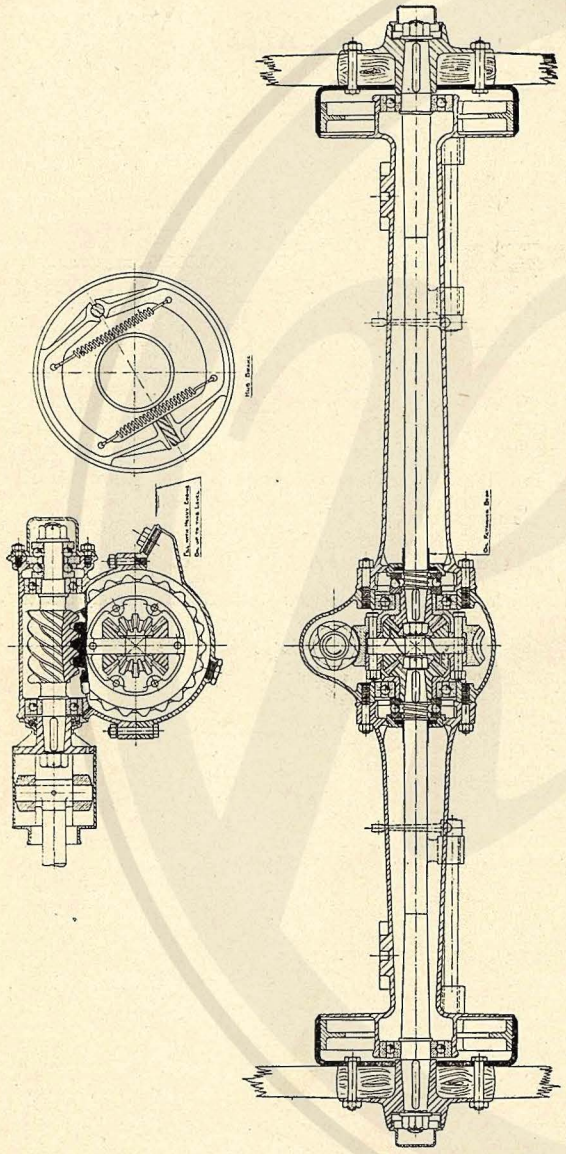
ARRANGEMENT
OF STEERING GEAR

FRONT AXLE.



The Timken roller bearings swivel arm, etc., are cleanly shown.

The spring clips, securing the springs to the axle, should receive occasional attention, and if found at all loose must be immediately tightened up. This applies to both axles.



ARRANGEMENT OF REAR AXLE

NOTES ON OILING, ETC.,

Every 2,000 Miles.

Inspect gear box, and if necessary fill with oil up to correct level, namely: just touching bottom of shafts.

Remove plug in rear axle casing, and fill until the oil is level with the filler.

Lubricate the steering gear case with thick oil.

Pack front wheel caps with grease and screw home.

Weekly.

Fill the following grease caps once with thick oil and screw down.

Clutch spigot.
Spring shackles.
Universal joints.
Break shafts on rear axle.
Stearing heads (front axle).
Starting handle.

OIL WEEKLY

Oil Weekly.

All brake connections.

Change speed sliding sleeve.

The oil tank, gear box and rear axle casing should be carefully cleaned out with paraffin every 5,000 miles, and filled up with clean oil to the correct level.

Draw plugs are provided for these operations.

UNUSUAL OCCURRENCES.

Engine Miss-firing.

Clearance between air disc and needle lead may not be correct.

Needle may not be making sound seating at jet.

Ignition may be too much retarched.

Petrol supply may be choked.

Ignition may be at fault.

½ compression valve may be left open.

Engine Hard to Start.

Clearance between air disc and needle too great.

Ignition too much retarched.

Dirty sparking plug.

INDEX.

Notes.


NETHERWOOD
DALTON &
HUDDERSFIELD