The BOOK OF THE MORRIS TEN

(1933-1948 MODELS)

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The Book of the MORRIS TEN

A MAINTENANCE
AND OVERHAULING MANUAL
FOR OWNERS OF ALL MODELS
FROM 1933 TO 1948

BY
R. A. BISHOP

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LUBRICATION CHARTS

Exide

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CHAPTER I

LUBRICATION

THE engine (shown in section in Fig. 1) relies for its functioning, first, last, and all the time, upon the maintenance of an oil film between its moving parts that is not much thicker than the walls of a soap bubble. If that film fails, or is broken by lack of supply, even for the fraction of a second, a minor disaster is bound to occur, for the intense heat generated by undue friction will literally melt the metal of which the bearings are composed.

The system is arranged as follows. First, there is a supply of oil contained in the base-chamber, or sump. This is filled up to the required level, measured by means of a dipstick which can be withdrawn from the outside of the sump, additional oil being poured through a filler at the side of the engine.

The oil is drawn via a filter by a pump and duly delivered to all the working parts of the engine either directly or indirectly. The business of the pump is to maintain a never-failing supply. As to this, there is a pressure gauge on the instrument panel which infallibly tells its tale.

The pump can not only supply at pressure, but also "suck" to some purpose. The function of the filter through which it sucks is to keep out of circulation particles of metal that may become worn off bearings and also particles of carbon.

Let us see now what happens to the oil after it has passed through the pump. It has several services to confer. Primarily, its delivery is connected with the gauge upon the instrument board which, at all times, correctly shows how the pump is working. If the hand, instead of holding a steady figure, wanders now and again from normal to zero, and vice versa, it is an indication to the driver that the sump oil level is too low. Replenishment should be given immediately.

The oil delivery from the pump goes directly to a "gallery" which feeds the main bearings of the crankshaft through drilled ducts in the crankcase casting. Grooved crankshaft bearings ensure that the oil is properly spread. Both pump pressure and centrifugal force make it certain that the oil will make its way to the big end bearings of the connecting rods through drilled passages in the crank webs. At these points, a certain amount of leakage is bound to occur. The lubricant, in ample quantity, is "flirted out," and falls steadily upon the cylinder walls, thus

taking care of the pistons and the gudgeon pins at the top end of the connecting rods.

All these things move and have their being in a fog of oil, for

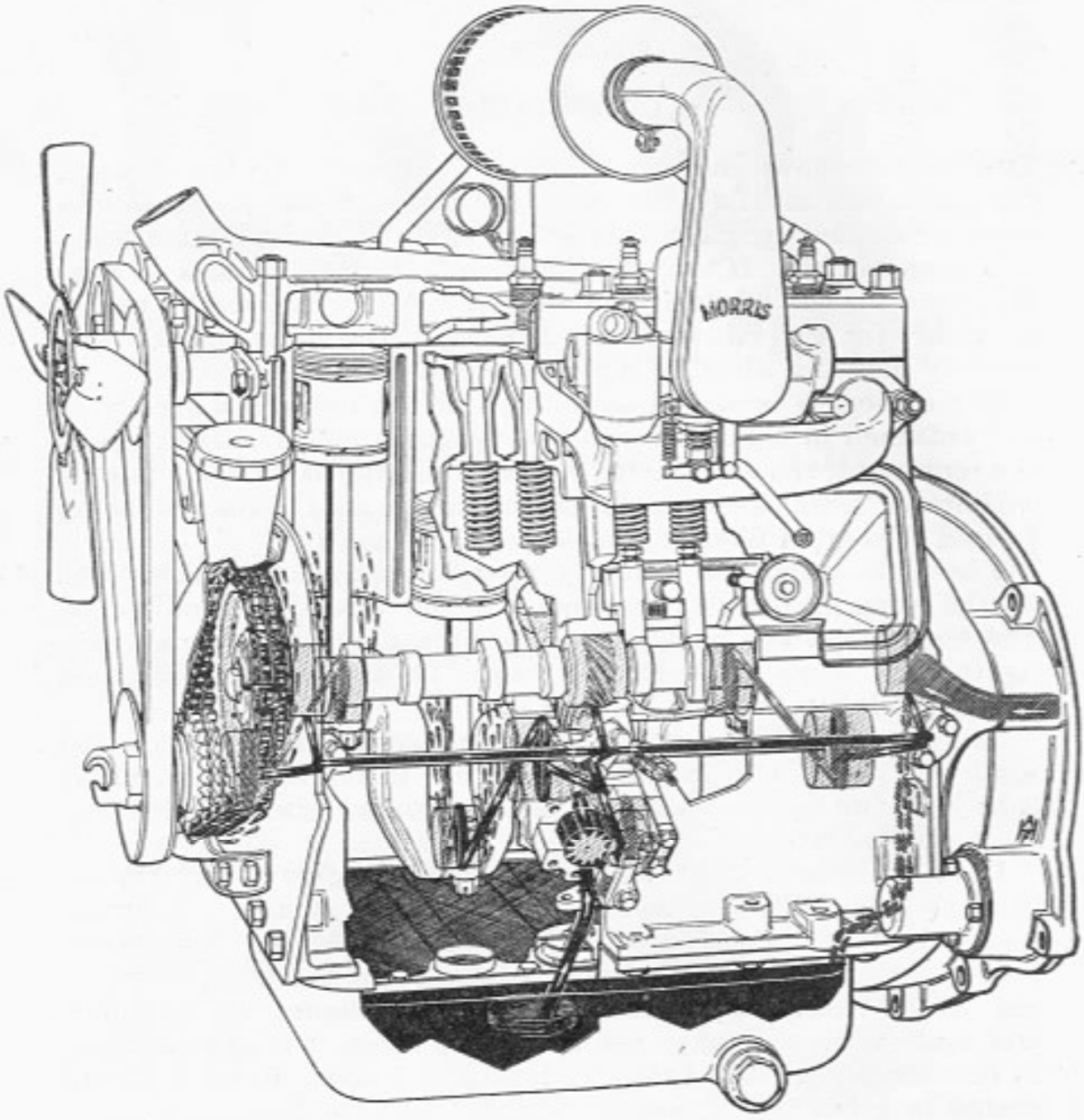


FIG. 1. DIAGRAMMATIC VIEW OF THE MORRIS TEN ENGINE (*Side Valve*)

the atmosphere, if we may call it such, of the crank chamber is charged with this fog, and it descends upon and liquefies upon anything solid.

This will suffice for the lubrication of the cam surfaces, tappets, etc., in an engine which has side valves. On overhead valve engines the overhead gear is fed by an oil pipe located by a

hexagon-headed nut at the near side rear end of the cylinder block. There is no more interesting and important thing than the oil supply of a motor car engine. The pity is that so much splendid work should be done by things that are seldom seen by the car user.

All motor car engines have individual characteristics, such as operating temperatures, oil systems, size of oil-ways, clearances and similar technicalities, and it is therefore extremely important

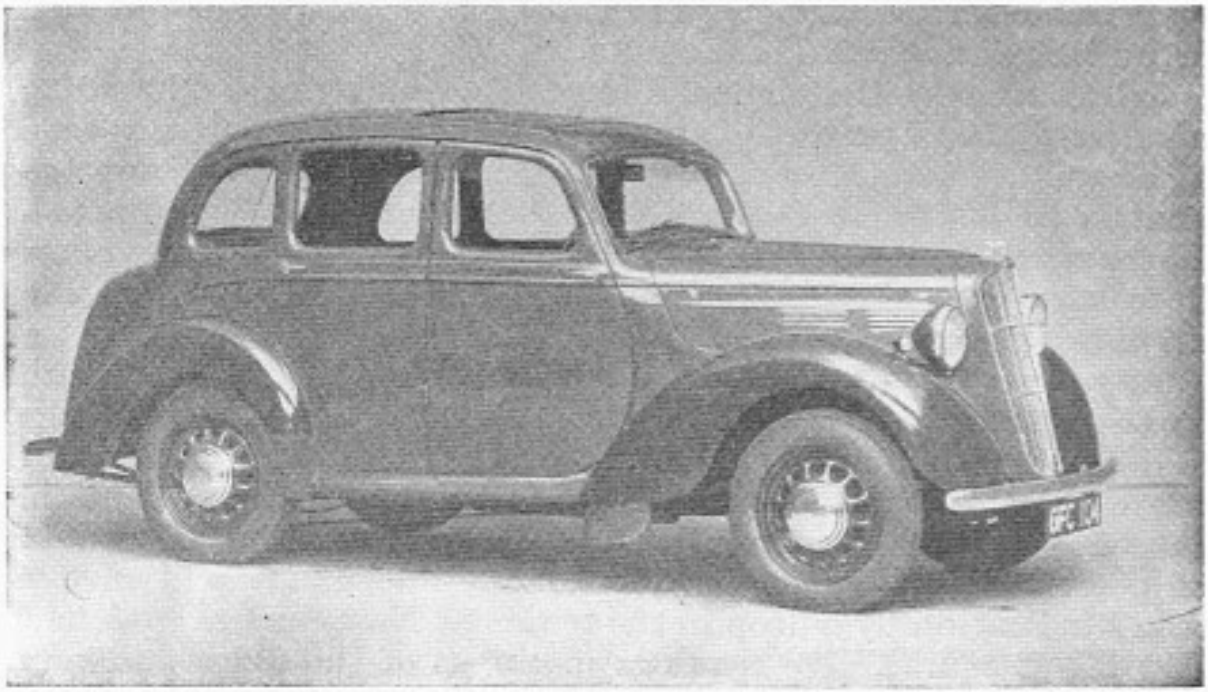


FIG. 2. THE SERIES "M" TEN (1939–1946)

that an oil which is specifically suited to the needs of a particular engine should always be used.

To obtain the best possible results from your car, it is advisable to use those types of oil which have been specially blended in conjunction with Morris engineers and which are listed on pages 9 and 10.

Dark oils always look more viscous than do pale oils. Furthermore, ordinary oils, actually very viscous at ordinary temperatures, rapidly lose their body with increase of temperature. It is, therefore, no criterion to judge oil by its appearance and colour.

Reference has already been made to the method of ascertaining the level of oil in the sump. The indicator rod is fitted on the left-hand side of the cylinder block. By drawing it out, the quantity of oil in the sump will be indicated by the position on the rod up to which oil adheres. When the level reaches the "full" or "normal" mark, the sump contains approximately one

gallon. This should be sufficient for a further 250 miles, but the oil level should never be allowed to fall below the "half" or "low" mark.

Owing to the surging and splashing of the oil when the engine is running and the car in motion, it is not possible to obtain a correct reading of the level without wiping the indicator rod with a clean rag before inserting it again into the sump.

It is advisable to replenish only with perfectly clean oil bought in sealed tins. The Morris company do not hold themselves responsible for damage caused by the use of inferior or dirty oil or by lack of adequate lubrication.

When starting the engine from cold, a high pressure reading may be obtained on the oil gauge. The figure will gradually drop as the oil becomes more fluid, until a normal pressure of approximately 30–60 lb. (40–60 on 1933 models) per sq. in. is indicated. Never race the engine when first starting up from cold, but allow it to turn over at a reasonable speed, not to idle, and you can drive away as soon as it has started.

Any excessive pressure when starting from cold is dealt with by the automatic release in the system. The reading of the gauge is dependent upon the temperature and upon the condition of the oil itself. Thus, oil which has been damaged by dilution, caused by excessive running of a cold engine and the drawing-in of petrol, should be changed at once. The gauge will give a ready indication by a drop in the reading. New engines with new oil will, of course, give readings in excess of the figures already mentioned, but the oil should be changed every 1000 miles.

When a new car has completed its first 500 miles of running, the oil in the engine sump should be drained to free the lubrication system from any impurities that may have accumulated during the running-in process. Thereafter, the oil should be changed at intervals of about 1000 miles.

Practically all engine oil in general use is now produced by distillation of the crude petroleum. Lubricating oils are very susceptible to temperature changes, and in time lose some of their lubricating qualities, apart from the foreign matter which of necessity becomes mixed with them. It is for this reason that it is in your own interest to change the oil at the intervals stated.

Drain out the sump when the oil is fluid and warm, that is, after returning from a run in the car. A brass drain plug is situated at the bottom of the engine on the side of the sump. When this is removed, the oil will drain off into the receptacle which you should provide to catch it. The plug will probably have an accumulation of dirt in its hollow centre, so clean it out, replace it and screw it up tight. Never use paraffin for cleaning out the engine, and do not run the engine without oil in the

sump. Paraffin never completely drains off the bearing surfaces, and afterwards mixes with the oil and dilutes it, while to run the engine without oil is to court absolute disaster.

Replenish the engine with fresh oil through the oil filler on the near-side under the bonnet. Models up to Series II types will require one gallon, while the latter will require one and a quarter gallons and the "M" Ten three-quarters of a gallon of new oil to bring the level up to the normal mark on the dipstick. It is

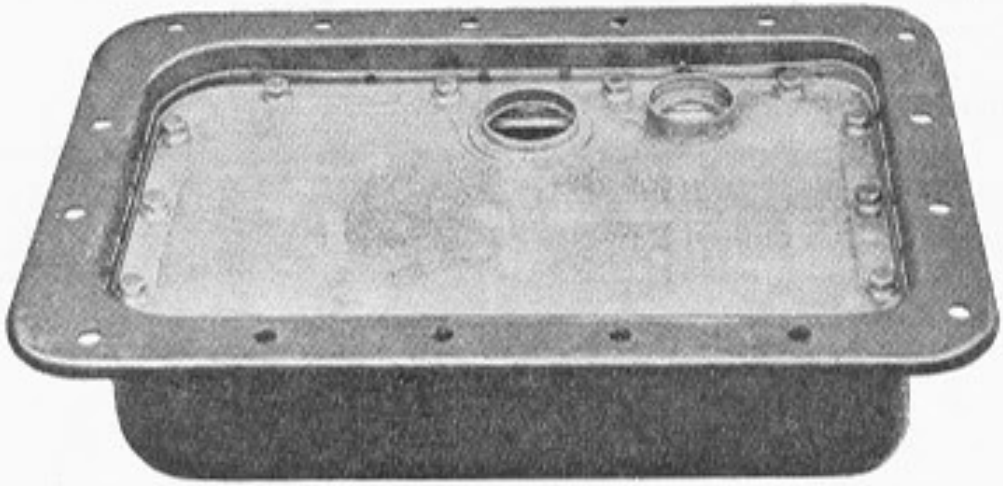


FIG. 3. BE CAREFUL NOT TO DAMAGE THE GAUZE COVERING THE OIL SUMP

important that only fresh oil be used for replenishing the sump. The introduction of dirty oil in a forced feed lubrication system leads to rapid deterioration of the bearings.

It is necessary at intervals of about 10,000 miles to clean out the oil filter and the sump, for which purpose the sump must be removed. Place a suitable receptacle underneath the drain plug to catch the oil, and remove the oil dipper rod. Loosen all the bolts holding the sump to the cylinder block one or two turns, and then completely remove all of them with the exception of two situated one on either side near the centre. These will support the sump and allow the joint to be "broken" without causing the sump to fall to the ground and become damaged. If the cork joint is damaged during this operation, it will be necessary to fit a new one when replacing the sump.

Now enlist some help so that the sump may be supported from each side, and, each operator supporting it with one hand, he may remove the remaining bolt on his side of the engine, and allow the sump to be lowered carefully, taking care not to damage the gauze filter which covers it.

Remove the large gauze filter and thoroughly clean it in paraffin by the aid of a stiff brush until all traces of foreign matter are removed. The gauze must be intact and free from

accidental perforation, and if it is in any way damaged it must be replaced by a new one, or considerable damage to the engine bearings may result.

Thoroughly clean the flange surfaces of the sump and the joint surface of the cylinder block to ensure making an oil-tight joint when replacing. Then coat the sump flange with an even film of

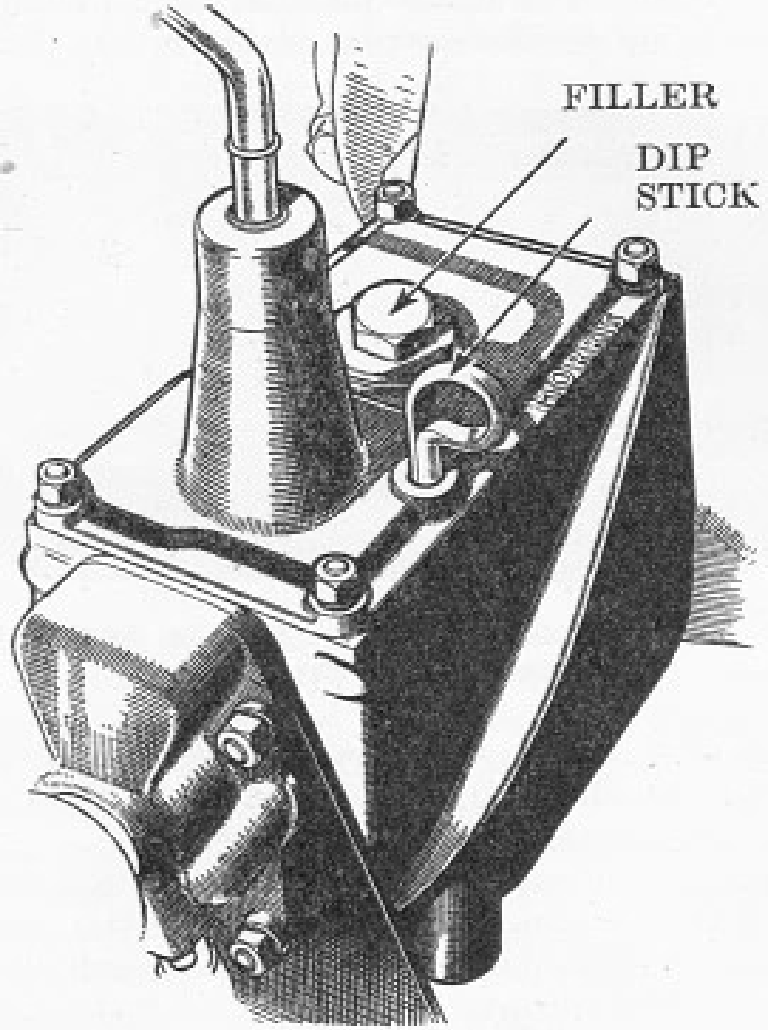


FIG. 4. GEARBOX OIL FILLER

gold size, but do not put this on to the cylinder block flange, and place the cork joint washer in position so that the holes coincide with the holes on the flange.

Enlisting again the help of the assistant, raise the sump into position, taking care that the pump suction pipe passes through the hole provided for it in the centre of the filter tray without damaging the gauze, Fig. 3. Then replace the sump bolts, finger tight, afterwards going over each in turn, giving them a partial turn each time until they are firmly secured. Replace the drain plug, and refill the engine with fresh oil until the level rises to the normal mark on the dipper rod.

If the engine has been turned while the sump was removed, the suction passages in the engine will have been emptied, and

the pump must be primed with new oil through the plug especially provided for this purpose on the pump cover.

The oil filter, which is of generous dimensions, should be cleaned at the same time with a stiff brush and petrol. Where a filter is fitted outside the engine, the filter element may be withdrawn for cleaning, without, of course, dismantling the sump. Unscrew the centre bolt at the bottom of the filter body, and draw the latter downwards, when the element itself may be slipped off the centre tube. While the filter is dismantled, the casing may also be cleaned out. Never use rag for cleaning the gauze in the sump or filter, as pieces of fluff are liable to adhere to the gauze and work their way into the lubrication system.

External Oil Filter. On Series M models, an outside oil filter is situated in the lubrication circuit between the oil pump and the main delivery duct on the near-side of the engine. After 10,000 miles the felt-like filter element should be replaced by a new one obtained from a Morris dealer. The filter is released by undoing the union nuts at the top and side and slackening the clamping bolt. (Fig. 21A.)

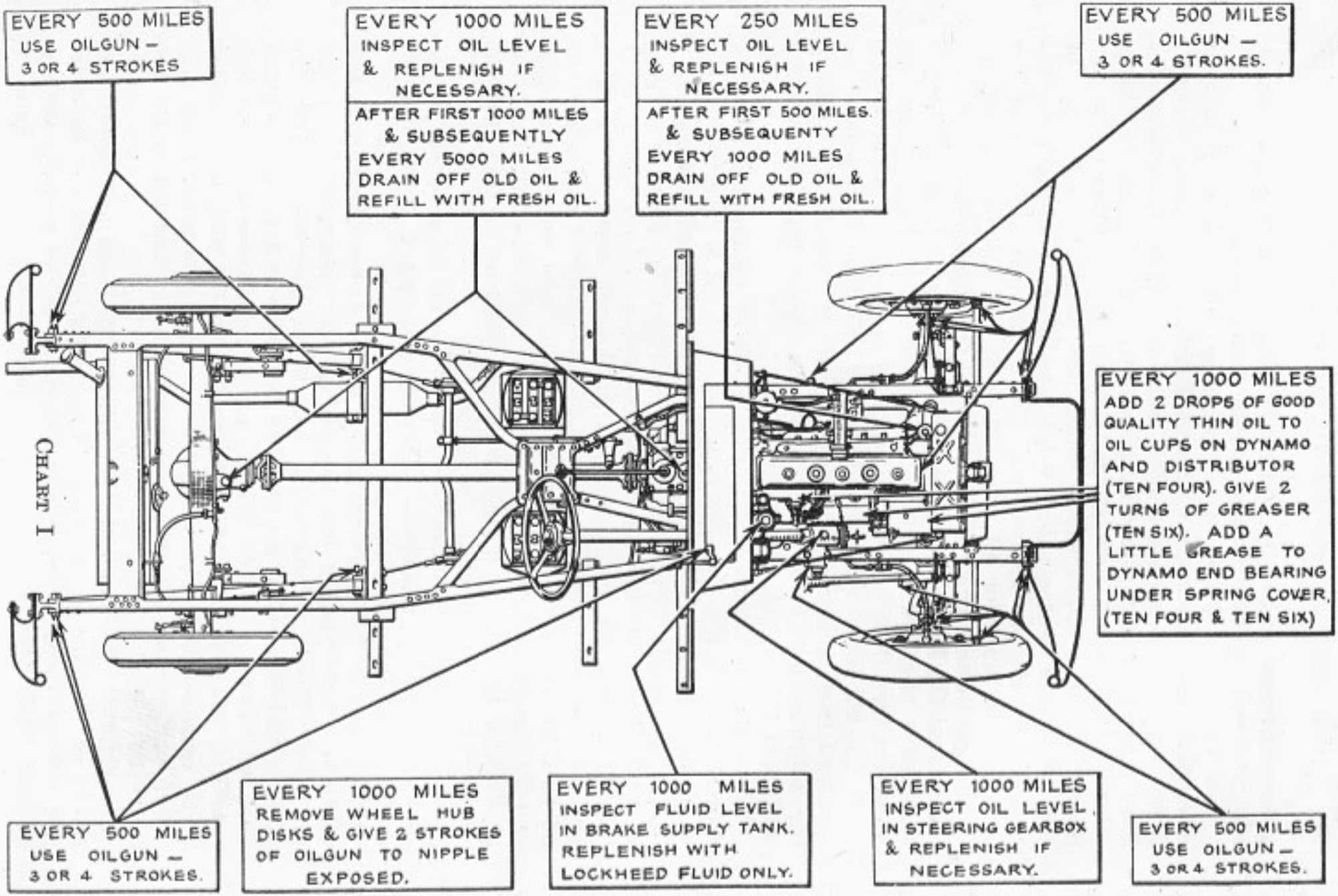
The clutch is automatically lubricated by oil flowing from the rear crankshaft bearing, and any excess of oil is returned to the sump filter by an oil trap and duct in the flywheel housing.

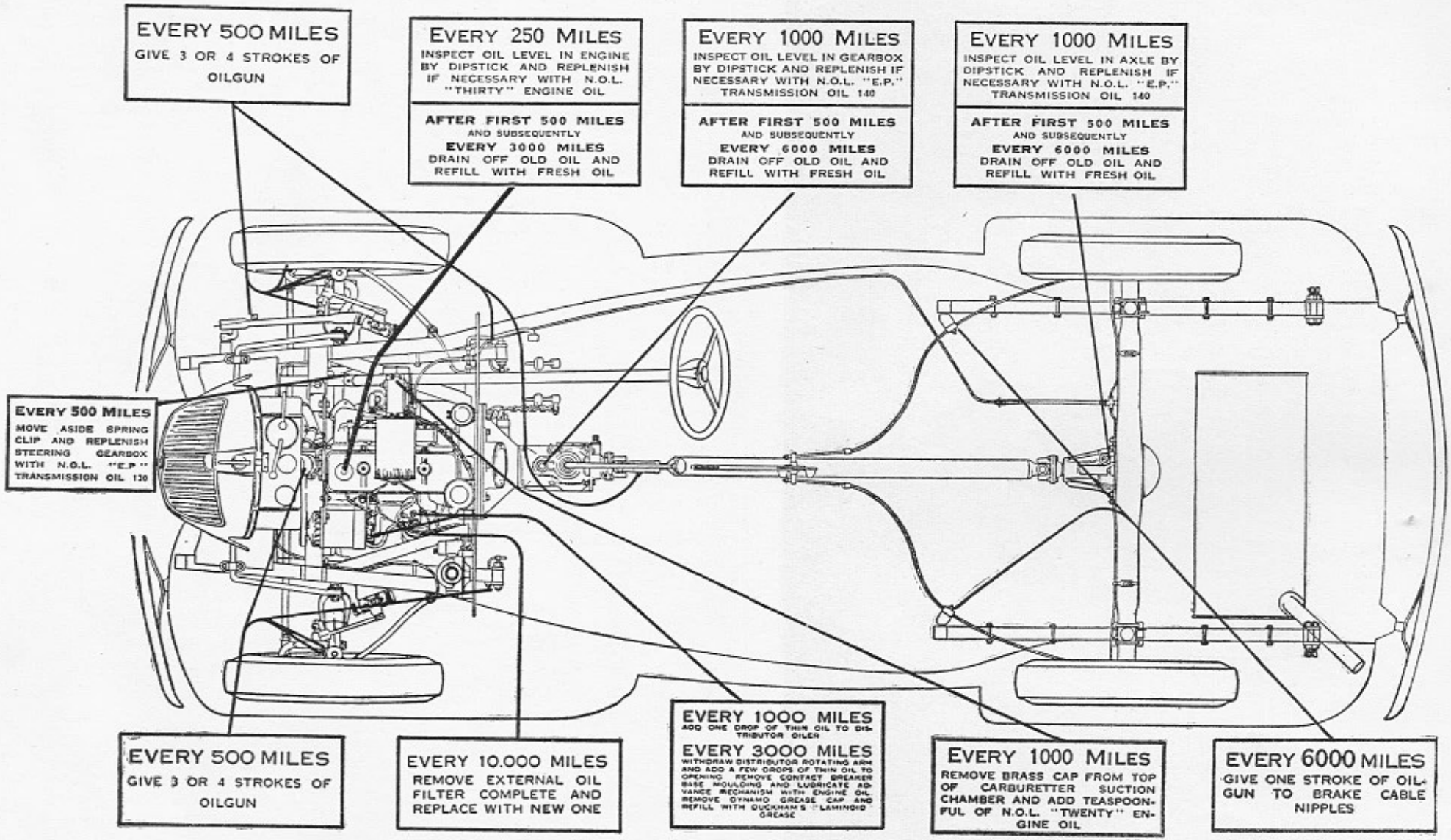
A large filling plug is situated at the top of the gearbox, Fig. 4, and oil should always reach the normal mark on the dipstick indicator. This is most important. About every 5000 miles remove the plug from the bottom of the gearbox and allow the oil to drain away. Then replace the plug and remove the filler and fill the gearbox to the correct level with new oil, using the grade and brand of oil mentioned at the end of this chapter. Treat rear axle similarly.

An oilgun is provided in the tool kit for all those parts of the chassis requiring attention, which are equipped with oilers as indicated on the oiling charts.

Fill this gun by unscrewing the large cap on the end of the container, and pulling out the plunger by means of the chain provided. When sufficient oil has been inserted, replace the plunger and the end of the cap. At the other end, a cover is fitted over an extension piece, which has a strong recoil spring surrounding it. Use the gun by pressing the end of this extension piece against the nipple, when oil will be forced into the nipple. When pressure on the gun is released, the spring will force the extension piece back into position.

Every 1000 miles remove the wheel hub disks and apply one stroke of the gun at the nipple projecting through the aperture in the wheel centre. Do not over-lubricate at this point or surplus oil may be forced into the brake drums.


EVERY 500 MILES
USE OILGUN —
3 OR 4 STROKES
EVERY 1000 MILES
INSPECT OIL LEVEL
& REPLENISH IF
NECESSARY.
AFTER FIRST 1000 MILES
& SUBSEQUENTLY
EVERY 5000 MILES
DRAIN OFF OLD OIL &
REFILL WITH FRESH OIL.
EVERY 250 MILES
INSPECT OIL LEVEL
& REPLENISH IF
NECESSARY.
AFTER FIRST 500 MILES.
& SUBSEQUENTY
EVERY 1000 MILES
DRAIN OFF OLD OIL &
REFILL WITH FRESH OIL.
EVERY 500 MILES
USE OILGUN —
3 OR 4 STROKES.
EVERY 1000 MILES
ADD 2 DROPS OF GOOD
QUALITY THIN OIL TO
OIL CUPS ON DYNAMO
AND DISTRIBUTOR
(TEN FOUR). GIVE 2
TURNS OF GREASER
(TEN SIX). ADD A
LITTLE GREASE TO
DYNAMO END BEARING
UNDER SPRING COVER.
(TEN FOUR & TEN SIX)
CHART I
EVERY 500 MILES
USE OILGUN —
3 OR 4 STROKES.
EVERY 1000 MILES
REMOVE WHEEL HUB
DISKS & GIVE 2 STROKES
OF OILGUN TO NIPPLE
EXPOSED.
EVERY 1000 MILES
INSPECT FLUID LEVEL
IN BRAKE SUPPLY TANK.
REPLENISH WITH
LOCKHEED FLUID ONLY.
EVERY 1000 MILES
INSPECT OIL LEVEL
IN STEERING GEARBOX
& REPLENISH IF
NECESSARY.
EVERY 500 MILES
USE OILGUN —
3 OR 4 STROKES.



NOTE:—IN EXTREME CONDITIONS OF COLD CONSISTENTLY BELOW 32°F. AND DOWN TO 0°F. USE N.O.L. "TWENTY" ENGINE OIL IN ENGINE.
IN EXTREME CONDITIONS OF COLD CONSISTENTLY BELOW 0°F. USE N.O.L. "TEN" ENGINE OIL IN ENGINE.
IN EXTREME CONDITIONS OF COLD CONSISTENTLY BELOW 20°F. USE N.O.L. "E.P." TRANSMISSION OIL 80 IN GEARBOX, STEERING GEARBOX AND REAR AXLE.

CHART II

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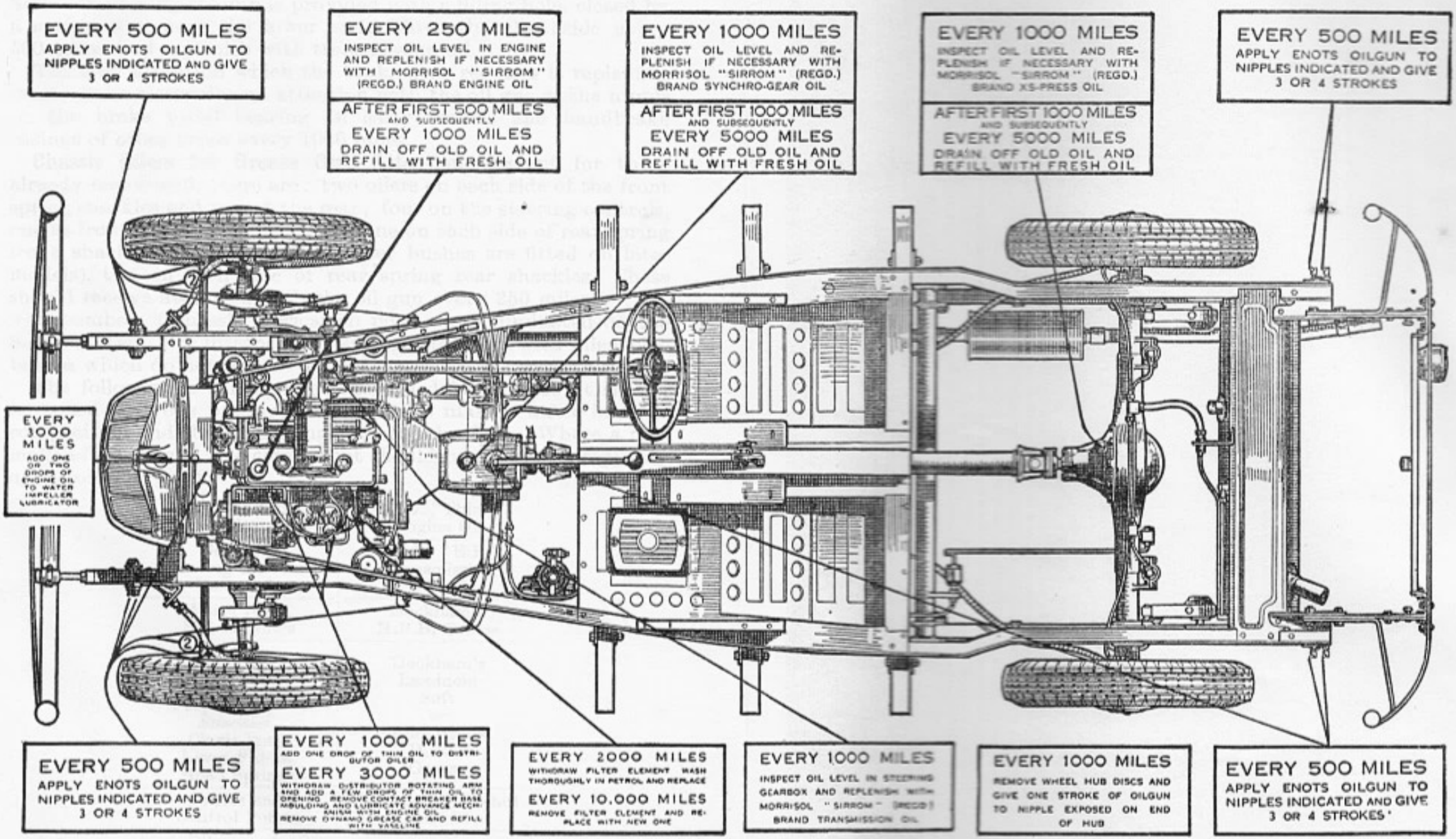


IN ENOTS OILGUN USE MORRISOL "SIRROM" (REGD.) BRAND TRANSMISSION OIL

The steering gearbox should be filled with the same transmission oil every week by pouring oil into the opening revealed when the hexagon nut on the gearbox is removed. Some models have a nipple, to which gun should be applied liberally. The Series M steering column is provided with a filling hole, closed by a spring clip, near the lower end. Move the clip aside every 500 miles, and replenish with transmission oil.

The only attention which the brake gear requires is replenishment of the reservoir and attention with the oil gun at the nipple on the brake pedal bearing on early models and handbrake casings of other types every 1000 miles.

Chassis Oilers for Grease Gun Attention. Except for those already mentioned, there are: two oilers on each side of the front spring shackles and two at the rear; four on the steering controls, one at front end of propeller shaft, one on each side of rear spring front shackles (except where rubber bushes are fitted on later models), two on each side of rear spring rear shackles. These should receive attention with the oil gun every 250 miles.

A number of chassis lubrication points was eliminated on the Series M Ten. For instance, the springs are fitted with Silentbloc bushes which do not require lubrication.

The following is a list of recommended lubricants. It should be noted that oils produced by different makers differ in their composition and that it is dangerous to mix them. Where a new make of oil is used, the component should be drained completely of the old lubricant.

Engine and Air Cleaner	N.O.L. "Thirty" Engine Oil
Gearbox, Steering Gearbox, Rear Axle	N.O.L. "E.P." Transmission Oil 140
Wheel Hubs, Fan Bearings	Duckham's H.B.B. Grease
Steering Connections, King Pins, Propeller Shaft, Shackles, Clevis Pins, Lever Fulcra, Road Springs	Duckham's Laminoid Soft or Duckham's H.P.G. Grease
Cables and Control Points	Duckham's Keenol K.G. 16
Oilcan and Carburettor Dashpot	N.O.L. "Twenty" Engine Oil

The oils shown in the table on the following page are also approved by the Morris Company.

RECOMMENDED LUBRICANTS

	Wakefield's	Esso	Joy's	Mobil	BP	Shell	Sternol
Engine[1]	Castrol XL	Essolube 30[3]	Medium Filtrate 30	Mobiloil A	Energol SAE 30	X–100 30	WW 30
Engine[2]	Castrol XXL	Essolube 40	Heavy Filtrate 40	Mobiloil BB	Energol SAE 40	X–100 40	WW 40
Gearbox	Castrol D[4] Gear Oil	Esso Gear Oil[5]	Synchro Filtrate Gear Oil 90	Mobilube C	Energol[6] EP SAE 140	Spirax[7] 140 EP	Liquid Ambroleum EP 140[8]
Rear Axle, Steering Gearbox	Castrol Hi-press	Expee Compound 140	EP Filtrate Gear Oil 140[9]	Mobilube EP 140	Energol EP 140	Spirax 140 EP	Liquid Ambroleum EP 140[10]
Wheel Hubs and Fan Bearings	Castrolease Heavy	Esso Grease	Filtrate R.B. Grease	Mobil Hub Grease	Energrease C3	Retinax A	Sternoline R.B. Grease
			Solidified Filtrate Oil				
Chassis Grease Points	Castrolease CL	Esso Fluid Grease	Solidified Filtrate Oil *or* Filtrate Gear Oil 140	Mobil Grease No. 4	Energrease C1	Retinax A	Sternoline MM Grease
Cables and Control Points	Castrolease Brake Cable Grease	Esso Graphite Grease	Solidified Filtrate Oil	Mobil Grease No. 4	Energrease C3G	Retinax A	Sternoline Af Grease
Oilcan and Carburettor	Castrolite	Essolube 20	Filtrate Penetrating *or* Colloidal Penetrating Oil	Mobil Handy Oil	Energol 20	Engine Oil	WW 20

1. All seasons 1946–8 models: Winter 1932–8
2. All seasons worn and old engines: Summer 1932–8 models
3. 20W/30 1945-8 Series M
4. Castrol Hi-press 1945-8 Series M and 1945-8 Ten Engine No. 38201 and later
5. Expee Compound 140 1945-8 Series M
6. SAE 90 1936-9
7. Dentax 90 1936-9
8. 1935–40 models use Liquid Ambroleum G.90
9. Steering gearbox alternative—Filtrate Gear Oil 140
10. 1932–4 alternative—Liquid Ambroleum G.140

CHAPTER II

THE PETROL AND CARBURATION SYSTEM

PETROL is carried at the rear of the car in a 6½-gal. tank on models up to Series II types and in a 7-gal. tank on Series II and later types. It has to be drawn or pumped from the tank along the chassis frame and raised to the level of the carburettor. This work is carried out by the S.U. Petrolift on 1933 models and the S.U. petrol pump on subsequent types.

The Petrolift is an electrical pump with an entirely automatic action, which derives its energy from the battery which forms part of the electrical equipment. Constructionally, the instrument is very simple, and it is quite improbable that it will require any maintenance. Should it, however, cease to function, the following points should be attended to.

Remove the top cap (*V*), Fig. 5, from the pump to see if the float chamber contains petrol; if it does, then the trouble is not due to the pump. If it continues to make a pumping noise without delivering petrol, and there is a supply of petrol in the rear tank, there is an air leak or the foot valve (*F*) is held up. An air leak may be due to one of two causes: firstly, a bad joint between the filter bowl (*U*) and the casing. In this event, tightening up will generally correct matters, but if it does not do so, a new washer will be necessary; or, secondly, there is a loose petrol union on the suction pipe, that is to say, at any point between the bottom union of the pump and the tank at the rear of the car. The washer between the filter bowl and its bolt (*T*) should also be inspected.

It is very rare that the foot valve sticks, but if it does, remove the filter bowl (*U*), filter (*H*), and foot valve (*Y*) by means of a tommy bar through one of the holes. The foot valve can then be cleaned. A second filter (*X*) will be found in the foot valve underneath the priming tube (*Z*).

A blocked petrol pipe or filters is indicated when the pump works very slowly without delivering petrol. In this case, the filters or pipes must be cleaned out, or the battery may be run down, in which case fill the float chamber of the pump with petrol. This will probably enable the engine to be started by hand, when, as the dynamo comes into action, it will boost up the battery sufficiently to run the pump.

After reassembly, if the pump works but does not deliver petrol, it should be primed by pouring a small quantity of petrol

into the top chamber, but should the pump not work at all the trouble will be due to—

(*a*) A bad electrical connexion. To test this, remove the terminal from the pump and flash the wire across the pump body. If there is a bright flash, electrical connexions are in order. If

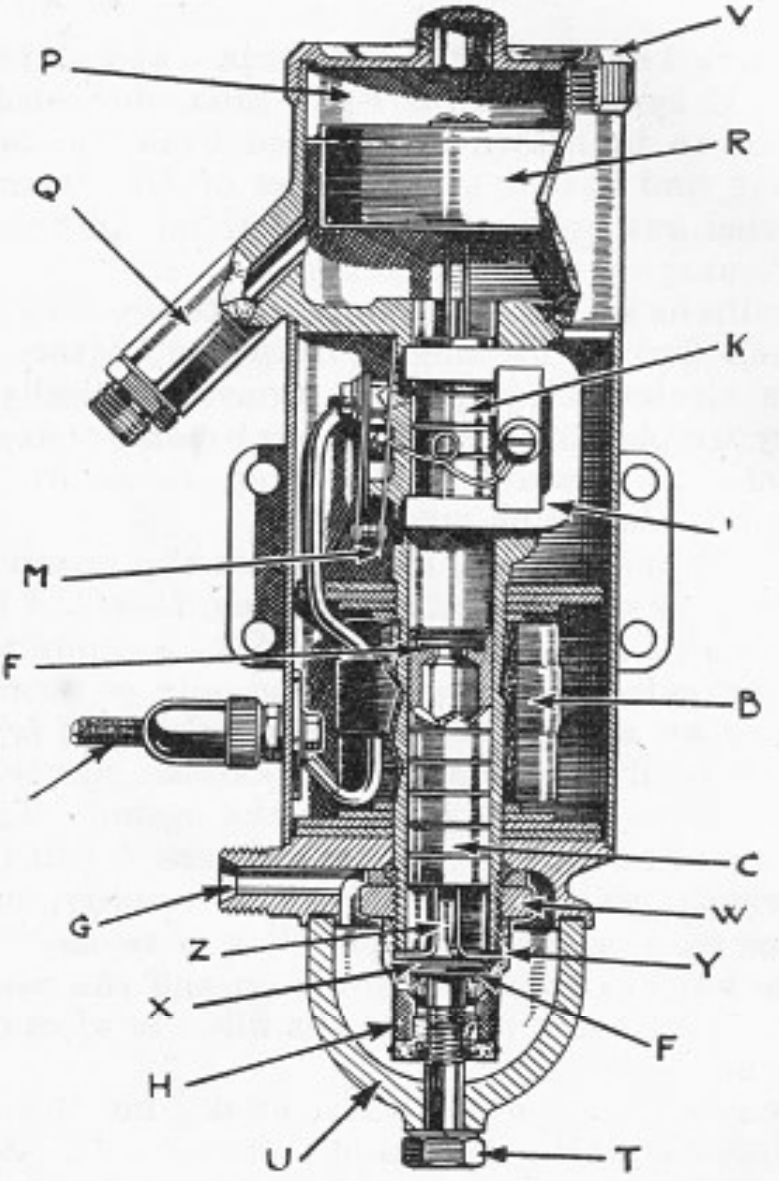


FIG. 5. THE ELECTRICALLY-OPERATED PETROLIFT

not, the trouble is due to the batteries being run down or to bad connexions somewhere in the system.

(*b*) The pump plunger (*C* or *K*) sticking, due to dirt or grit getting between the pump plunger and the body. Often a blow on the pump with the fist is sufficient to get it working again, when the dirt will pass right through. Should this effect not be obtained, however, the remedy is to remove the filter bowl (*U*) and foot valve (*Y*), also the top cap of the pump and the cork float, when it will be possible to push the plunger (*C*) through the bottom, after which a clean rag can be drawn through the

bore of the pump. Care should be taken when reassembling to see that the plunger is fitted into the pump with the valve on top.

Practically the only thing that can cause the electrical side of the apparatus to cease to function is a broken wire or a discharged battery. To gain access to the electrical part of the pump, remove the filter bowl (*U*), foot valve (*Y*), unscrew the large hexagon nut (*W*) holding the inlet ring, when the casing can be drawn off and the internal parts of the electrical equipment and connexions inspected. The cork gland washer which makes a petrol-tight joint between the inlet ring and the electrical equipment must be in perfect condition.

Care must be taken when the casing is removed to see that the wires are not broken, and particularly that the top wire does not come across the rocking contact plate (*M*). To ascertain whether the contacts are in working order, remove the cap (*V*) from the top of the pump, and lift the float (*R*) up and down its full stroke. The rocker plate can be heard to click as it breaks the contact.

The filter and filter bowl should be cleaned periodically to ensure a free delivery of petrol to the carburettor. The filter bowl is readily removed by withdrawing its attachment screw (*T*). Removal of the bowl reveals the filter, which can then be removed by withdrawing its retaining circlip and easily cleaned by the help of a stiff brush and petrol. Never employ rag for this purpose. When replacing the filter bowl, make sure that the joint is airtight, as failure to lift petrol is generally an indication that an air leak has developed at the supply pipe union.

The S.U. Company at Bordesley Green Road, Adderley Park, Birmingham, are always pleased to give further advice on the maintenance of the Petrolift or petrol pump.

The Petrol Pump. Later models are fitted with the petrol pump, Fig. 6, which is of the diaphragm type, designed to give long service with negligible attention.

The removal and cleaning of the filter every 1000 miles is all that is required in the way of maintenance. This is fitted into the bottom of the pump body, and can easily be withdrawn by unscrewing the hexagon attachment screw. It should be thoroughly cleaned in petrol with a stiff brush. Do not use rag.

Assuming there is petrol in the rear tank and petrol fails to find its way to the carburettor, disconnect the pump union of the pipe from the pump to the carburettor, and switch on the ignition. If the pump then functions, the shortage is due either to blockage of the petrol pipe to the carburettor or possibly to the carburettor float needle sticking. If the pump will not operate, then remove the filter as mentioned above, and see if it

is clear. Then disconnect the petrol pipe leading to the tank and blow down this with a tyre pump to ensure the pipe being absolutely clear, and reconnect the petrol pipe.

Should the pump still cease to function or works only slowly, the stoppage may be due to a bad earth return. To test for this, make definite metallic contact between the brass body of the

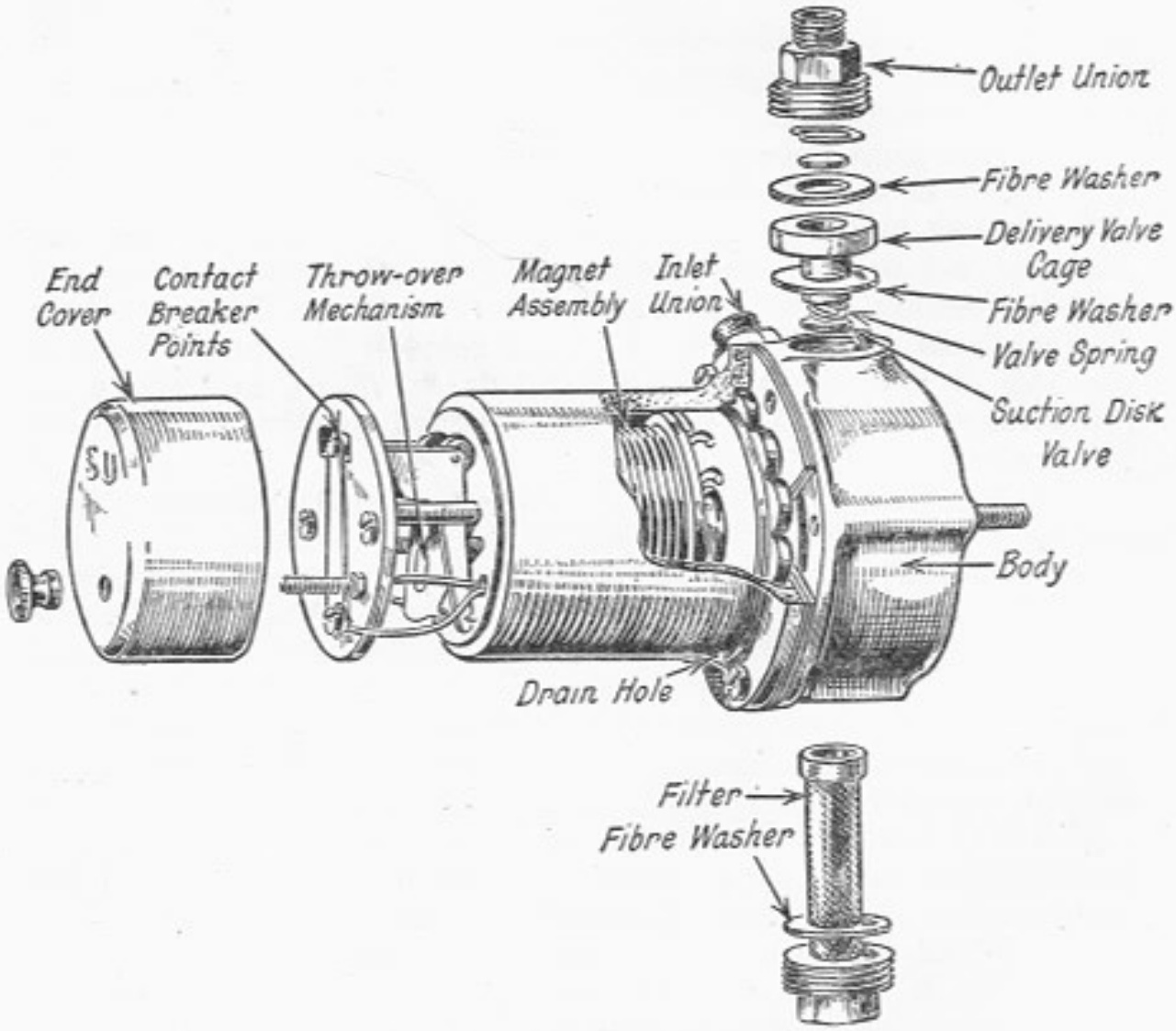


FIG. 6. THE S.U. PETROL PUMP

pump and the car chassis with the length of copper wire fitted. To ensure a good earth, it may be necessary to scrape off a small portion of the black enamel with which the chassis is coated. If the pump now functions normally, the copper earth wire connexion should be cleaned and remade.

A bad connexion in the pump itself may sometimes be traced to the nut on the terminal inside the cover not being firmly screwed down.

If these points are found to be in order but the pump still does not function, the trouble will be in the pump itself, and the cause

will be too much tension on the diaphragm, or blackened contact points, the cause of which is the tensioning of the diaphragm. The remedy is to remove the cover from the contact points and pass a piece of thin card between the points when pressed together, so as to effect the necessary cleaning.

The tension on the diaphragm can be released by removing the body from the base of the pump by undoing the small screws which hold these parts together. The diaphragm adheres to the body of the pump, and the use of a knife will enable it to be separated, but take care to prevent the rollers which support the diaphragm and act as a bearing from falling out. Then replace the body on its base, put in the screws loosely and, before finally tightening up, stretch the diaphragm to its highest possible position. To do this, switch on the pump and hold the contact points together while tightening the screws well up. This will effect a permanent cure.

Should the pump work intermittently or not commence to click when the ignition is switched on after the car has been standing for some time, it is an indication that this trouble is occurring, and it should be given immediate attention to obviate final stoppage on the road.

A noisy pump usually indicates an air leak on the suction side of the pump. Check the level of petrol in the tank to see that it is not too low, and check all the unions and joints, making sure that the filter union and inlet unions are quite airtight.

If the trouble persists and the pump connexions are in order, it is probable that an air leak has developed somewhere in the petrol feed pipe between the tank and the pump. To test this, replace the feed pipe by a short length of temporary tubing, the mouth of which is inserted in a can of petrol. If the pump then functions properly, it is obvious that a leak has developed somewhere in the feed pipe.

Should the pump continue to beat without delivering petrol, it is probable that some dirt has become lodged under one of the valves. They should be dismantled by unscrewing the top or delivery union and lifting out the valve cage, when they can be cleaned and reassembled. If, however, the pump struggles to operate and becomes very hot, it is likely that the pipe line has become obstructed, or, more probably, that the filter has become clogged.

The Carburettor. The petrolift or pump have now brought the petrol from the supply tank to the engine, but the petrol is of no use as an explosive mixture until it is mixed with air. You may not want to drop a lighted match into a can of petrol, but, if it were possible for you to do this without passing through the vapour mixture of petrol and air, you would find that the light

would be extinguished as soon as it touched the petrol, that is if the petrol were absolutely pure.

So, not only do we have to get the petrol into the combustion chambers, but we have to deliver it in the form of a spray mixed with air, and the more petrol you use the richer is the mixture. That is the reason, when starting the engine from cold, that you

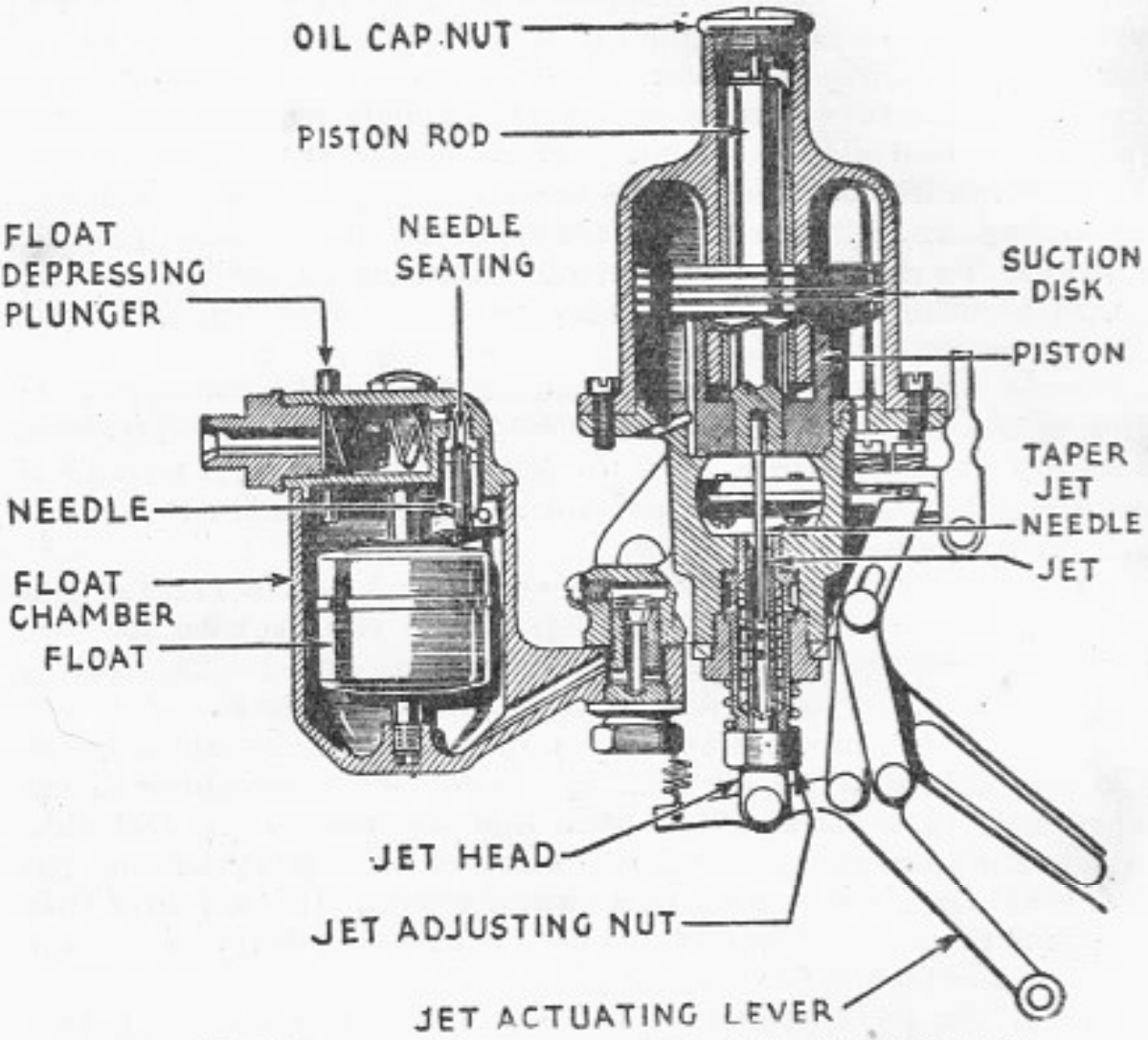


FIG. 7. DETAILED REFERENCE FOR S.U. CARBURETTOR

pull out the knob on the dash-board. By doing so, you increase the supply of petrol. But there is no need to keep the knob pulled out once the engine has become warm, for, besides using too much petrol, the cylinder walls will be washed free of oil, which is dangerous. Moreover, the excess petrol will run into the sump, dilute the oil, and definitely reduce its lubricating properties.

The carburettor is often credited with almost unlimited capabilities. If engine performance drops away or petrol consumption increases, we say that the carburettor needs adjusting. And if a better performance is required, the carburettor is often expected to work wonders. Carburettor setting is important, but

the setting is not necessarily wrong when the engine lacks power. There are all sorts of other factors which are dealt with elsewhere in this book.

But the misconception arises through an incomplete understanding of the functions of the carburettor, whose work, as we have seen, is merely to supply a mixture of petrol and air to the engine in the quantities required by varying conditions of temperature or speed.

The correct balance of air and petrol flow have to be maintained under these varying conditions, but the proportions of air and petrol are not identical under different engine speeds.

Fig. 7 gives a detailed reference to the construction of the carburettor fitted to the Morris Ten, the petrol flow to the jet being governed by a float mechanism of the top-feed type.

Petrol is pumped into the float chamber (to the left of the illustration) and is led from there to a jet, the size of whose orifice, and consequent delivery, is regulated by means of a tapered needle attached to the lower end of a piston control by the suction of the engine. When the suction increases, the needle becomes gradually withdrawn from the jet, enlarging its effective opening and allowing it to deliver more petrol. The jet moves up or down relative to the tapered needle, so that the mixture is weakened or strengthened over the whole working range. It is operated by a lever connected to the control knob, which is familiar to us.

You can set the minimum jet opening accurately by means of an adjusting nut, which forms an abutment for the enlarged head of the jet. The S.U. carburettor is one of the simplest made, and the adjustment is equally simple if it is remembered that the jet is of a fixed size and cannot be altered. The only adjustment is on the slow-running screw, Fig. 8, and the jet adjusting nut, Fig. 7.

To carry out the adjustment, run the engine until it attains normal running temperature, then set the slow-running control to the right of the instrument panel so that the engine turns over fairly fast. Disconnect the mixture control wire from the end of the lever actuating the jet and screw the jet-adjusting nut well downwards.

It will be seen that this lever is kept in contact with the jet head by a return spring, and thus contact must be retained during the whole of the adjusting process. Then screw the jet-adjusting nut upwards slowly, thus gradually weakening the mixture, until the engine idles evenly, firing regularly on all cylinders and running at its best speed. The latter will be the normal position when the engine is hot.

As the jet needle is of the correct size, the general performance of the carburettor should now be satisfactory. Reconnect the

mixture control wire to the lever, taking care to see that the control knob has ample clearance when the jet is in contact with the adjusting nut. Finally, completely slacken off the dash throttle control so that it is quite clear of the accelerator control and adjust the carburettor lever stop screw, Fig. 8, which is

FIG. 8. THE ADJUSTMENT SCREW FOR SLOW RUNNING

spring-loaded for screwdriver operation, until gentle slow running is obtained.

Three troubles may affect the functioning of this carburettor—

(1) The piston may be sticking.

(2) There may be dirt or water in the carburettor.

(3) The float mechanism may have become deranged, so that the carburettor is flooding.

The suction piston consists of the piston itself forming the choke; the suction disk, into which is inserted the hardened and ground piston rod working in a bearing in the suction chamber; and a tapered needle, which regulates the jet opening.

You can easily find out whether the piston is sticking by inserting a finger in the air intake and raising the piston. Access to the piston on models up to and including 1935 is achieved by loosening the air intake pipe from the cylinder head cover, removing the two attachment screws from the carburettor, and swinging it aside. The piston should come up quite freely and

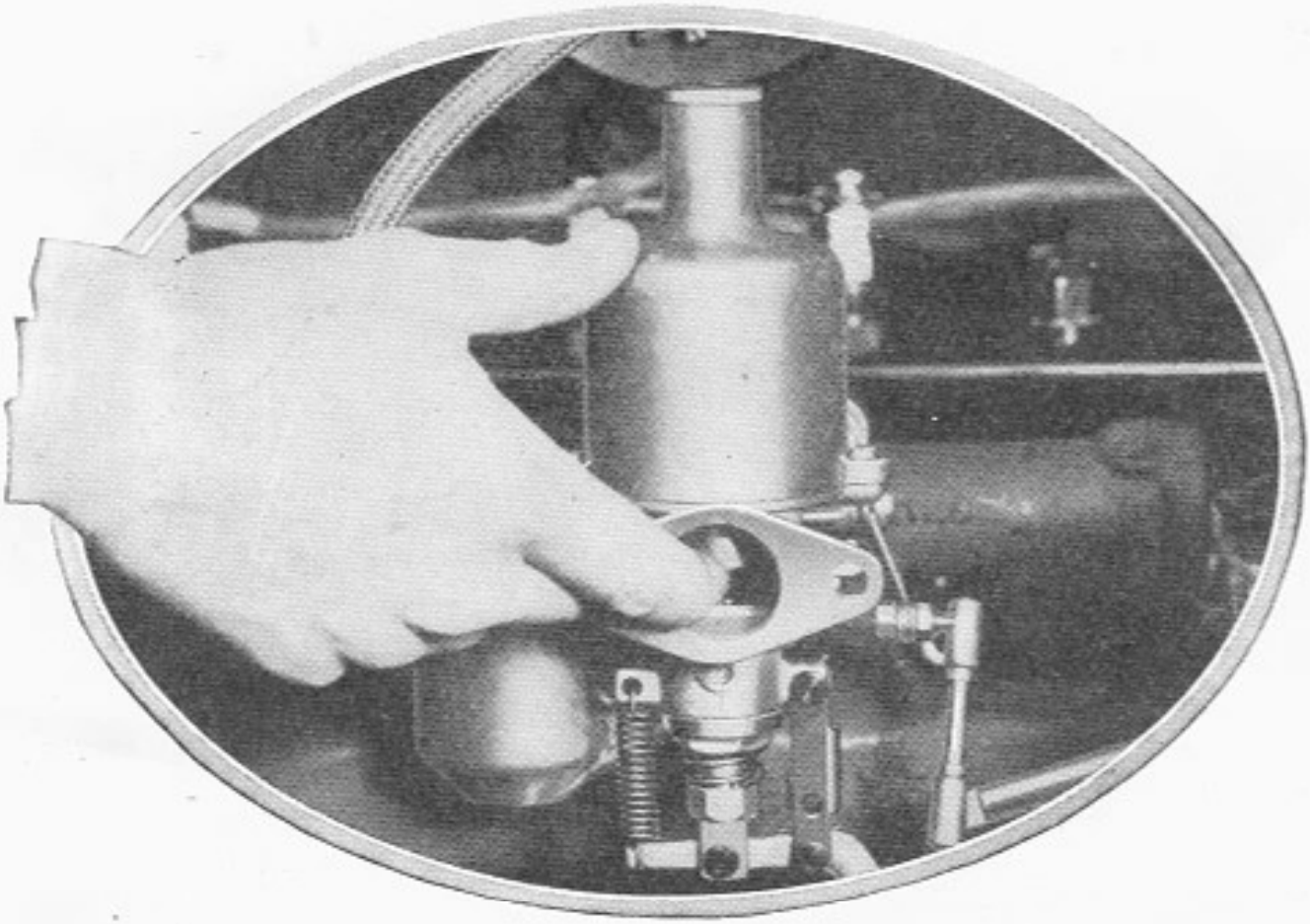


FIG. 9. THE PISTON SHOULD MOVE QUITE FREELY ON PRESSURE BY THE FINGER

return to its seating as soon as released. This operation is shown in Fig. 9.

On Series II types, to obtain access to the piston in this manner, the connecting nuts and bolts for the air cleaner will have to be removed.

Should the piston be dry, remove the oil cap at the top of the suction chamber, pour in a few drops of good quality thin oil, such as sewing machine oil, and replace the cap. In particularly obstinate cases, a little paraffin may be inserted into the oil cap opening, and the piston worked up and down until it is free. Never use a heavy-bodied lubricant, such as engine oil, for this purpose, and do not introduce oil on any other part of the suction chamber.

It is not often that water or dirt causes trouble with the S.U. carburettor, owing to the size of the jet and petrol passages. But if this trouble is suspected, swing aside the air intake after loosening the connexion to the cylinder head cover and removing the small bolt attaching it to the carburettor, or the bolts attaching the air cleaner to the carburettor on Series II models, switch

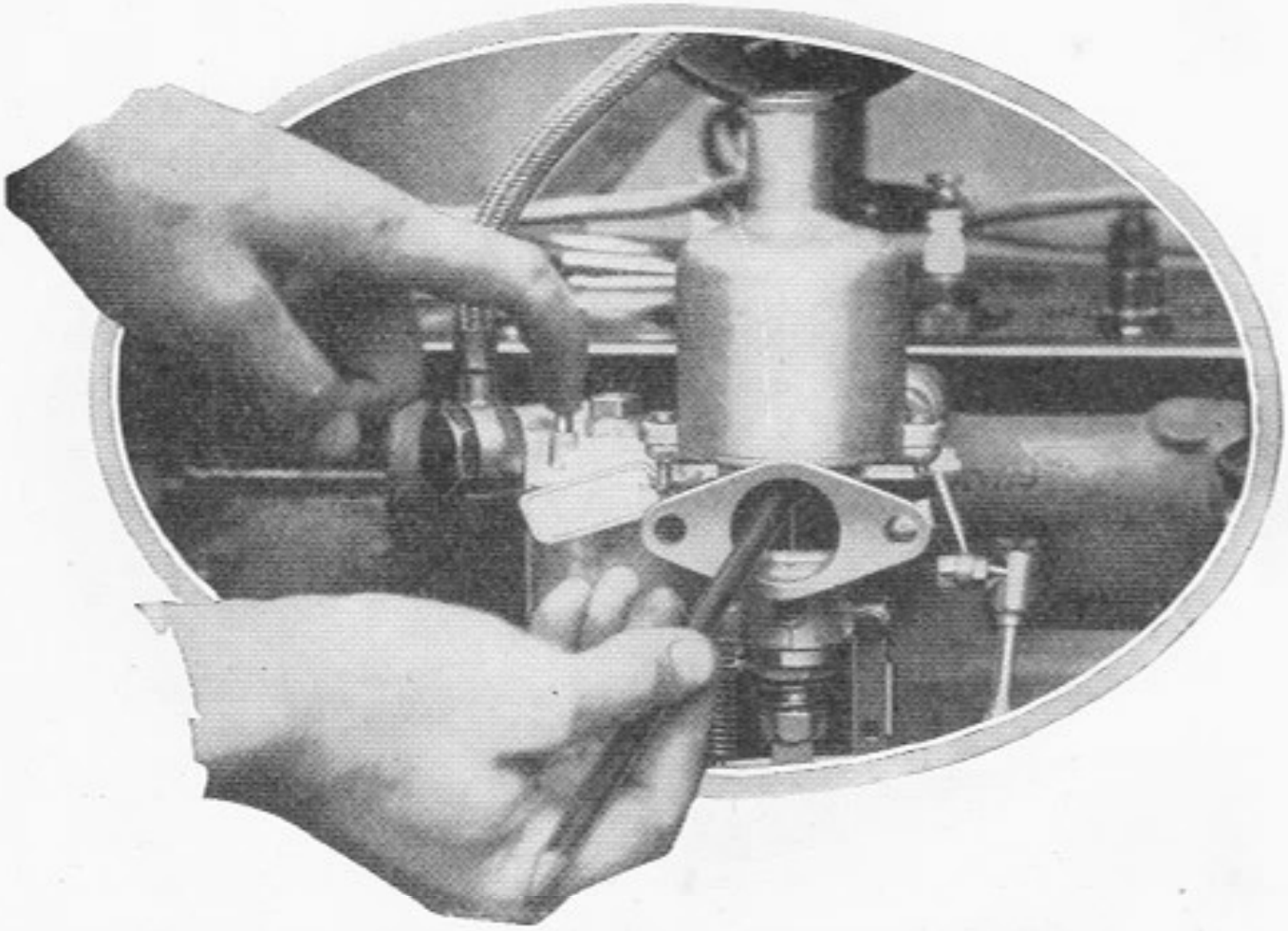


FIG. 10. RAISING THE PISTON TO EXPOSE THE JET

on the ignition, and with a small article, such as a pencil (see Fig. 10), raise the piston so that the jet can be seen. Flood the carburettor by holding up the float-chamber needle and observe if the petrol issues freely from the jet. If it does not do so, there is foreign matter blocking the passage to the jet.

To rectify this, start the engine and open the throttle, then momentarily block the air inlet by placing the hand over it, keeping the throttle open until the engine commences to race.

Float-chamber flooding will be indicated by a quantity of petrol flowing over the float-chamber and dripping from the air inlet. This trouble is generally caused by foreign matter finding its way on to the seating of the float-chamber needle. As incoming petrol washes away particles of grit, this seldom occurs; but it

can be remedied by removing the float-chamber lid and then twisting the needle on its seating a few times with the fingers, but on no account should the seating be ground-in.

The correct and normal position for the tapered jet needle is with its shoulder flush with the face of the piston.

A filter is situated behind the banjo type union at the junction

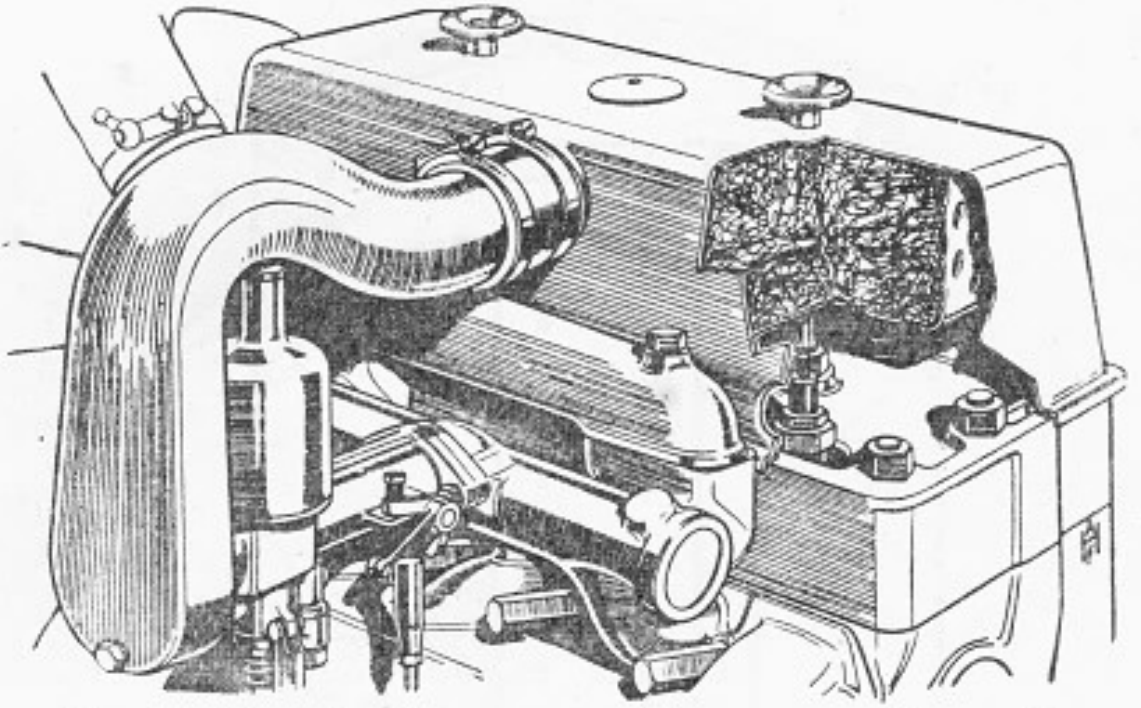


FIG. 11. THE AIR CLEANER ON TYPES UP TO SERIES II

of the petrol pipe to the float-chamber lid, and is released by unscrewing the large hexagon nut. It should be dismantled about once a month, and thoroughly cleaned by means of a stiff brush and petrol, but rag should never be used. When replacing the filter, remember that the helical spring should first be introduced into the filter housing and that the thimble-like filter has its open end bearing against the face of the large hexagon union piece.

The Morris company strongly urges owners not to interfere with these carburettors. The jet and needle fitted as standard have been proved by extended tests to be the correct ones for the best results, and nothing is to be gained by individual experiment.

The Carburettor Air Filter. During ordinary touring, an engine of the size of the Morris Ten consumes in an hour about as much air as is contained in a normal size room. And with it there come particles of road grit and other abrasive material, so that without some form of air cleaner the wear of pistons, cylinder walls, valves and valve-guides would be very considerable. For this reason the air is filtered by an air cleaner before it is allowed to enter the carburettor; and the object of the filter is, while in

no way restricting a perfectly free flow of air to the carburettor, to collect even the smallest particles of dust.

This object is achieved by a woven mesh of extremely fine gauze or curled horsehair, which acts as a mechanical filter.

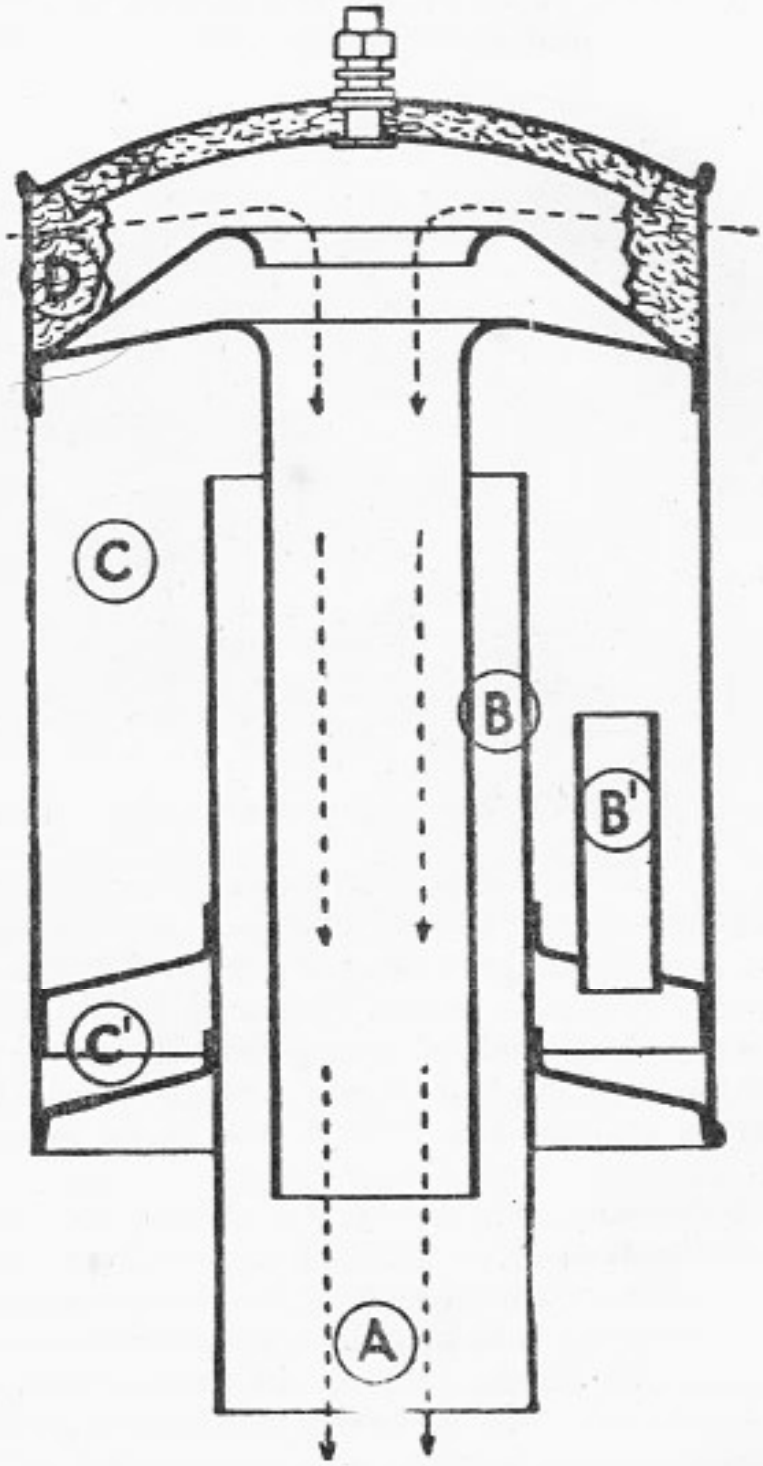


FIG. 12. THE AIR CLEANER ON SERIES II TYPES

The air cleaner is securely attached to the carburettor inlet pipe to prevent any leakage, and it is important that there should be no restriction of the free flow of air, as otherwise the engine will be receiving a mixture which is too rich, with the natural

corollary of lack of power and maximum speed, while the plugs may also tend to carbon up frequently.

On Morris Tens up to the Series II type, the air cleaner consists of a large domed cover for the detachable cylinder head

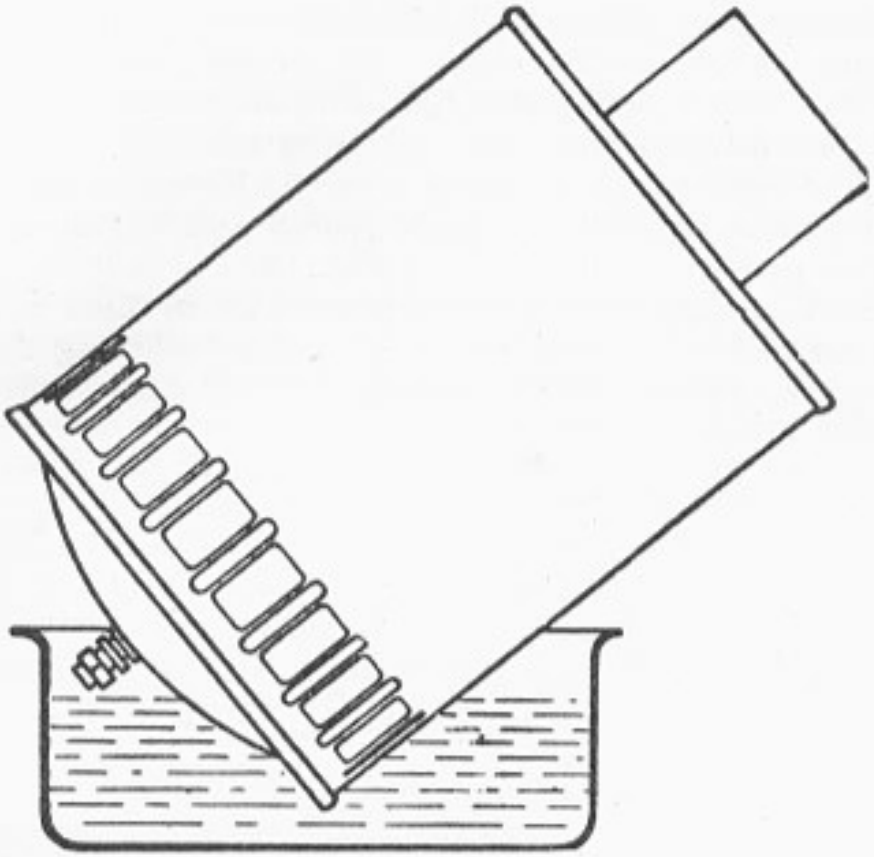


FIG. 13. SWILL THE CLEANER IN A SHALLOW PAN OF PETROL

similar to the orthodox form of overhead valve gear cover, Fig. 11. A horizontal partition converts the upper half of this cover into a chamber for the retention of the air-cleaning medium, which consists of a quantity of curled white horsehair introduced into the cleaning chamber through the large aperture to which the carburettor air pipe is attached. Thus the removal of soiled hair for cleaning purposes or for the introduction of a fresh supply is a very simple matter; but, before replacing the carburettor air pipe, do not forget to replace the wire guard in the mouth of the air-cleaning chamber.

Actually, this form of cleaner requires very little attention, but once a season the horsehair should be withdrawn from the cover, carefully washed out in petrol, and replaced. But if the hair is particularly dirty, a fresh and perfectly clean curled, white horsehair should be used.

On other models, the cleaner combines the function of a silencer.

Air enters the carburettor and passes through a central tube *A*, Fig. 12. Any sound waves produced and passing out of the carburettor would also ordinarily pass through this tube into the car, but in the case of the intake silencer they pass through passages *B* and *B*1 into resonating chambers *C* and *C*1, and thus set up counter waves which eliminate or considerably damp the original waves, so that no sound waves pass out of the air intake tube. The filtering medium *D* is oil-wetted woven mesh, to which dust adheres from the incoming air.

Every 5000 miles this air cleaner needs cleaning and re-oiling. This is best done by swilling the louvered end of the cleaner in a shallow pan of petrol, as shown in Fig. 13.

After drying, the filtering mesh should be re-oiled with engine oil, allowing any surplus to drain off before refitting the cleaner to the engine. Otherwise the excess oil will find its way on to the cylinder head.

CHAPTER III

DECARBONIZING AND VALVE GRINDING

AFTER thousands of miles of running, the engine piston heads, combustion chamber walls, and valve ports become covered with a deposit of carbon. When this deposit becomes excessive, a falling-off in power, accompanied by pinking or over-heating, may be noticed.

When this happens it is necessary for the carbon to be removed and, as this is a comparatively simple task, it can be undertaken by the amateur. If you have not undertaken this work previously, however, be prepared to lay the car up for a day or two, for the work will take you several hours.

There are, too, some special tools in addition to those supplied with your tool kit, and some materials that will be required. These comprise a valve spring compressing tool, to be obtained either from a Morris dealer or direct from Cowley; some valve-grinding paste; a plentiful supply of clean rags; some paraffin; and a supply of gold size to remake the cylinder head joints.

It is also advisable to ensure that you will be able to obtain a new cylinder head gasket at once from your dealer, if one proves to be necessary. Decide beforehand upon a system for storing the parts removed from the engine—tins, for instance, for the small nuts and bolts, for these possess a remarkable facility for becoming lost. When everything is ready, run the engine until it is warm, then manœuvre the car into a position from which the water drained from the radiator will run away. If, however, you are carrying out the job in the winter and the cooling system includes some anti-freezing mixture, drain the water off into a tin bath, so that it can be put back into the radiator when the process of decarbonizing is complete.

While the radiator is draining, you may with advantage proceed to remove the bonnet by unscrewing the bolts which attach the bracket at the rear end of the bonnet hinge to the scuttle rim, and turn off the battery master switch. On the Series II type, tilt the radiator slightly forward so that the bonnet hinge rod clears the socket in the radiator. For safety, disconnect the positive battery leads from the batteries.

Dealing firstly with the side valve models, commence on the left side of the engine, the carburettor should be removed from the manifold after releasing the end of the air intake pipe from

the carburettor and, where the overhead air cleaner is fitted, disconnecting the fume pipe hose and support bracket. Disconnect the petrol pipe union, the throttle control rod, the mixture control wire and, finally, the two nuts attaching the

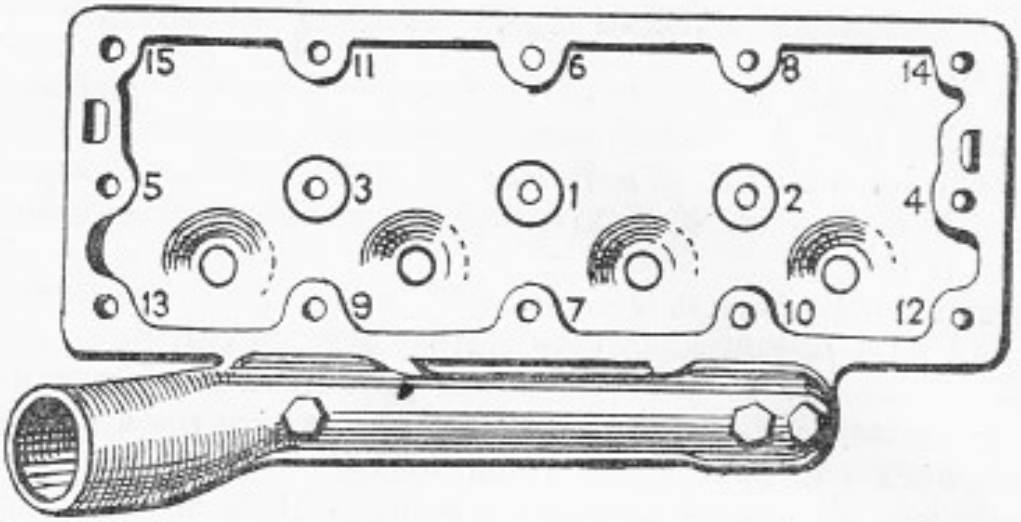


FIG. 14. ORDER OF REMOVING CYLINDER HEAD NUTS—4-CYLINDER MODELS

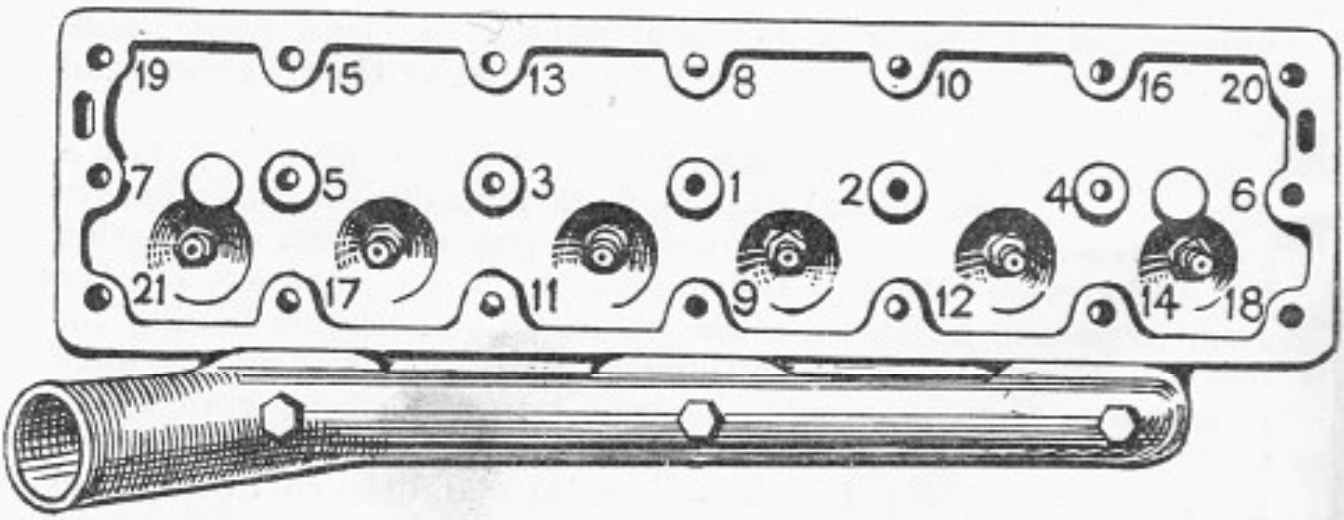


FIG. 15. ORDER OF REMOVING CYLINDER HEAD NUTS—6-CYLINDER MODELS

carburettor flange to the induction manifold. This will enable the air cleaner itself to be removed by slackening off the two nuts at either end.

Clips fastening the water outlet hose should then be removed and the hose withdrawn from the water outlet pipe; then uncouple the exhaust pipe from the outlet of the exhaust manifold by removing the three flange nuts.

There is a series of hexagon nuts between the exhaust and inlet manifold branches, which should be removed to permit the inlet and exhaust manifold to be withdrawn from the cylinder

block. But it is not essential to remove the induction and exhaust manifold or carburettor to withdraw the head for decarbonizing, only is it necessary to give access to the valves for valve grinding.

To remove the carburettor, on Series II models, uncouple the petrol pipe by undoing the union nut attaching it to the float chamber, uncouple the accelerator connexion and mixture control connexion, and remove the two nuts attaching it to the manifold. Then uncouple the high tension wires from the sparking plugs, marking them to facilitate reassembly.

The cylinder head is attached to the cylinder block by nuts screwed on to studs passing right through the cylinder head. The nuts should be slackened off in the rotation shown in Figs. 14 and 15, half a turn at a time until they are quite loose, and then eventually entirely removed. Do not unscrew any one of these nuts completely before slackening off the remainder, as this is liable to impose uneven stress upon the cylinder head, leading to its distortion.

When the air cleaner or fume consumer pipe is removed, take care to see that the nuts, etc., are not permitted to fall into the crankcase breather ducts at the extreme end of the cylinder head. Any articles dropped into these will find their way into the crankcase, necessitating the removal of the engine sump before they can be retrieved. As soon as they are exposed, it is advisable immediately to close the mouths of these ducts with pieces of clean rag. Removal of the stud nuts releases the high-tension leads and their insulated supporting clips, together with the cylinder head, which is now ready to be lifted from the cylinder block.

The breaking of the joint between the block and the head will be facilitated by smartly tapping the sides of the head with a wooden mallet, or hammer with a piece of wood interposed to take the blow, or by rotating the engine a few times by the use of the self-starter with the ignition switched off, having temporarily turned on the battery master switch or reconnected the leads.

To remove the cylinder head, use a direct upward pull on to the head (Fig. 16), enabling it to be withdrawn squarely off the studs. Then place it on a bench out of harm's way and very carefully lift the copper asbestos gasket. Take it off the cylinder head studs, keeping it parallel with the upper face of the cylinder block, and take particular care that it is not bent or otherwise damaged in the process.

The process of removing the carbon can now be proceeded with. Turn the engine by the starting handle until any two pistons are at the top of their travel, and stop the open ends of the other cylinder mouths with clean rag, not forgetting the breather ducts at either end of the cylinder block. Now take an old screwdriver

or similar blunt tool, scrape the black deposit off the tops of the pistons, the tops of the valves, and the cylinder block around the valves, Fig. 17. Then with a clean rag, damped with paraffin, remove every trace of foreign matter remaining; but do not attempt to polish the surfaces with the use of emery cloth or similar abrasive material, or you will do far more harm than good.

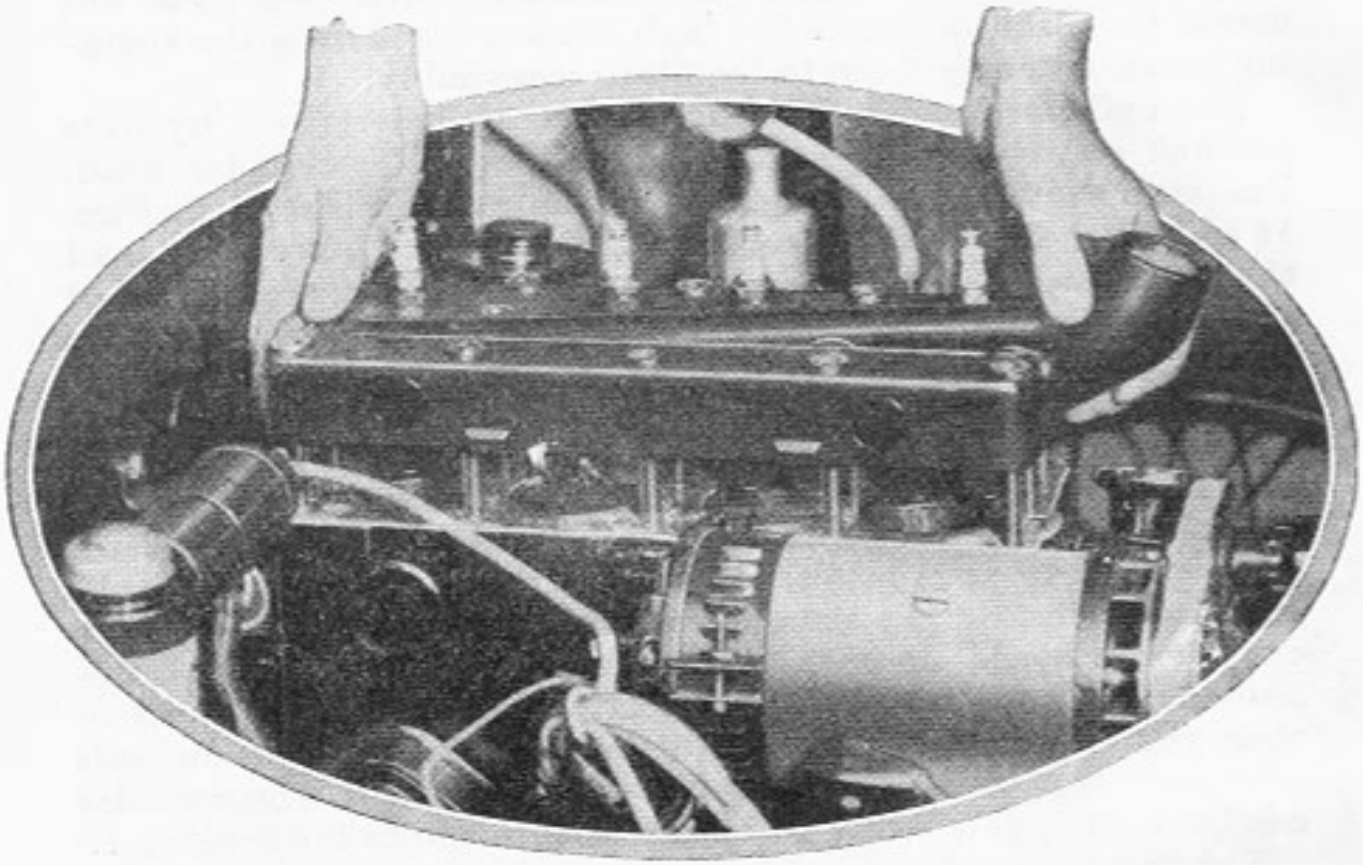


FIG. 16. REMOVING CYLINDER HEAD: USE A DIRECT UPWARD PULL

Having finished two of the piston tops, we remove the rag from the other bores. give the starting handle a half-turn until the remaining pistons reach the top of their stroke, and deal with them in the same way.

With the cylinder head removed, it is a comparatively simple matter to remove the valves for grinding, and this process is necessary at about the same intervals as decarbonizing. The long pressed steel cover to the valve chamber on the left side of the engine should be taken away.

To release the valve, it is necessary to remove the split cone cotters from the groove in the valve stem, and this is achieved with the help of a spring compressing tool (Fig. 18), already referred to. This enables the spring cap to be raised clear of the cotters, which can then be readily withdrawn from their retaining groove. When removing the cotters, care should be

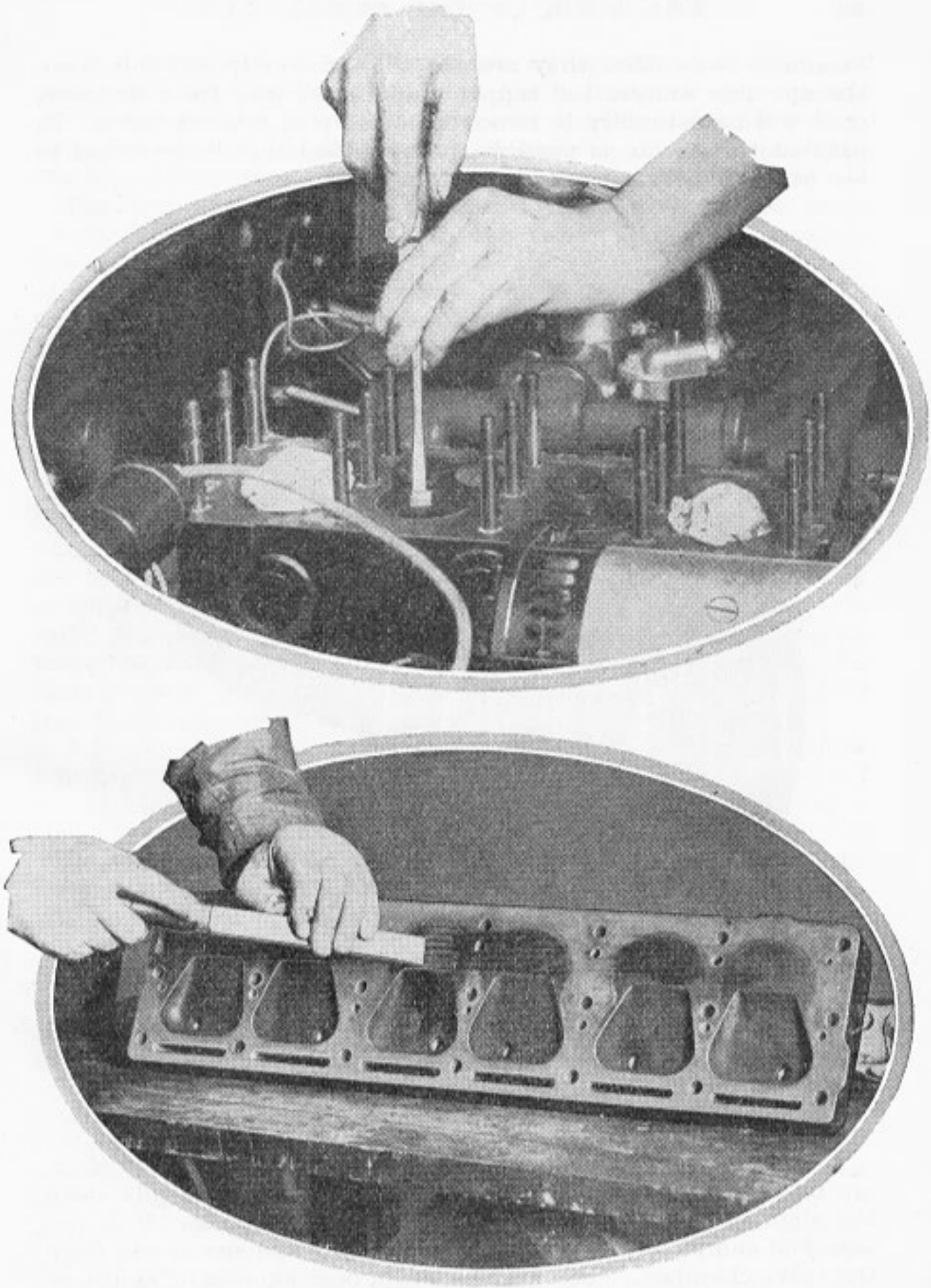


FIG. 17. A BLUNT INSTRUMENT, SUCH AS A SCREWDRIVER, SHOULD BE USED TO REMOVE THE CARBON DEPOSIT

exercised to see that they are not allowed to slip and fall down the aperture around the tappet guide block into the crankcase, or it will be necessary to remove the sump to retrieve them. To prevent this as far as possible, pressed steel shields are fitted to the tappet blocks.

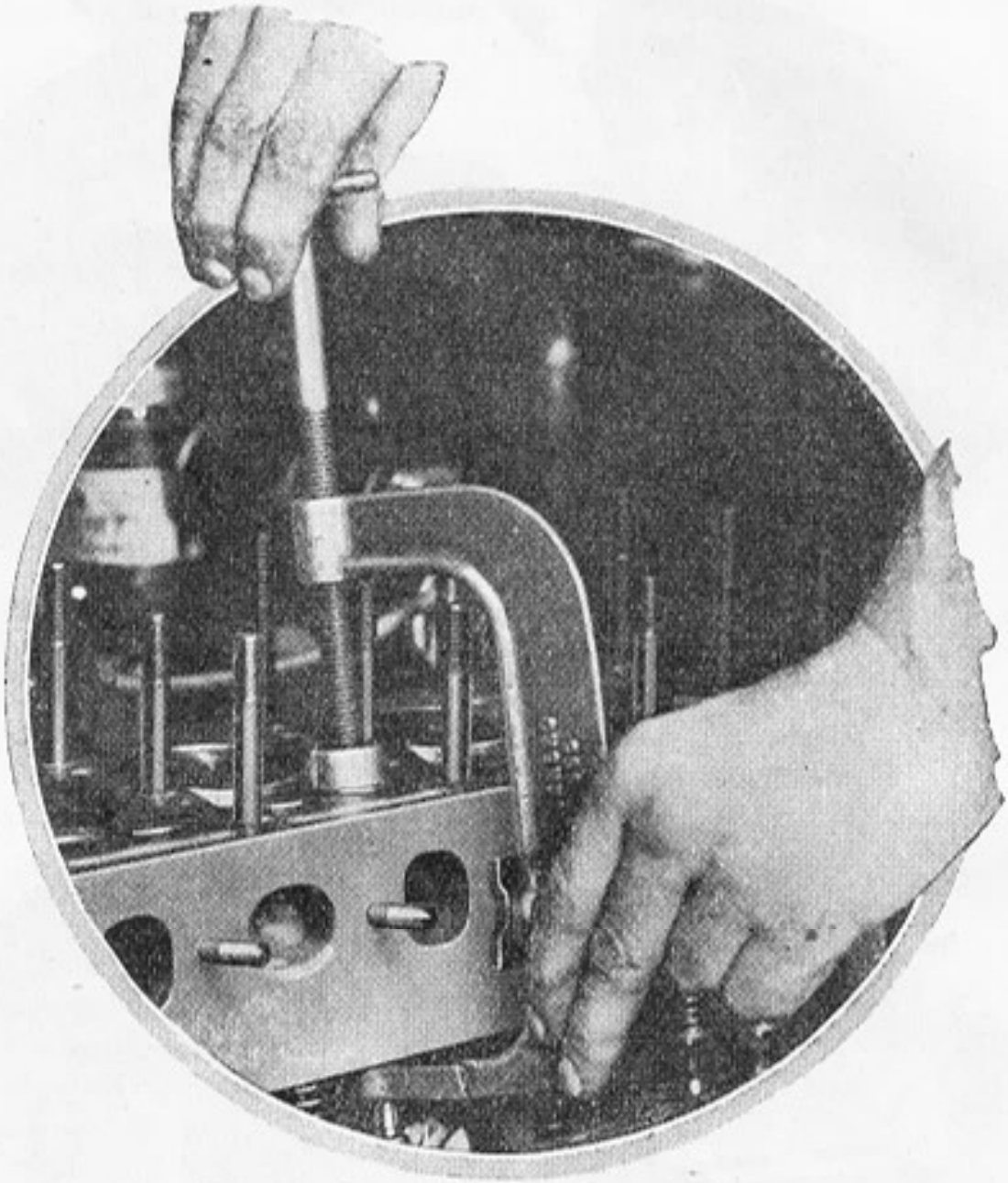


FIG. 18. THE SPECIAL VALVE SPRING COMPRESSING TOOL IN USE

Having released the valve spring by the removal of the cotters, one may withdraw the valve from its guide, and thoroughly clean the stem in readiness for the valve-grinding process. It is not essential completely to withdraw the spring and spring cap from the valve chamber. They may be left in position resting on top of the tappet, if care is taken to see that the end of the valve stem freely enters the hole in the cap.

Each valve is numbered in sequence from the forward end of the engine, and, when grinding in the valves, the utmost care should be taken to see that they are inserted in the correct port. Release the valve tappet screws, and screw one or two turns into the tappet to ensure sufficient clearance for grinding.

The constant passage of hot gases through the valve ports results in the course of time in the valves and valve seatings becoming impaired. Loss of compression and consequent lack of power results, but it is a simple matter to remedy this by the action of grinding in the valves, so that the bevelled surfaces of the valve head and valve seating in the cylinder face makes perfect contact. Special valve grinding pastes are obtainable at practically any garage in both fine and coarse grades. If the valve seats are in a comparatively good condition, it will be necessary only to use the fine paste; but if this is insufficient to produce a clean surface, a little coarse paste may be used. If the valves are badly pitted after many thousands of miles running, that is to say, if a number of small black spots or depressions are to be seen on the valve face, they should either be renewed or refaced at your local dealer's. It is inadvisable to attempt to grind them in, or an undue amount of metal will be removed from the cylinder seat, the steel valves being harder than the seats on which they rest. Any valve which is distorted should immediately be replaced by a new one.

A little paste should be applied to the face of the valve before refitting into the guide. A large screwdriver should then be inserted in the niche provided in the valve head, and the valve turned slowly backwards and forwards under pressure.

Raise the valve slightly after a few turns and press it down into another position, and continue with the turning motion. This will keep the grinding even. The most convenient way of carrying out this periodical lifting is to obtain a coil spring, similar to the valve spring but very much lighter, and insert it into the valve ports beneath the valve head. Then when pressure is released on the screwdriver, the valve will pop up and it can easily be rotated into a fresh position. Later models have valves with plain heads, which require the use of a special suction tool (see Fig. 19).

After each valve is ground-in it should be withdrawn and carefully washed with paraffin, then all traces of paste should be wiped away from the valve and valve seats with a rag moistened with paraffin, for if any of the grinding compound finds its way into the valve guides or cylinder bores it will do serious harm.

In reassembling the valves, care should be taken again to see that they are in their correct ports and that the valve cotters are not permitted to drop into the engine sump. Reassembly of

the valves is not a difficult matter if the standard valve spring tool is used. After inserting the valve in its guide and passing it through the hole in the spring cap, the valve spring tool may be placed in position and the spring compressed until the cotter groove is clear of the spring cap. Then the cotters can be inserted easily, while release of the pressure on the valve springs will

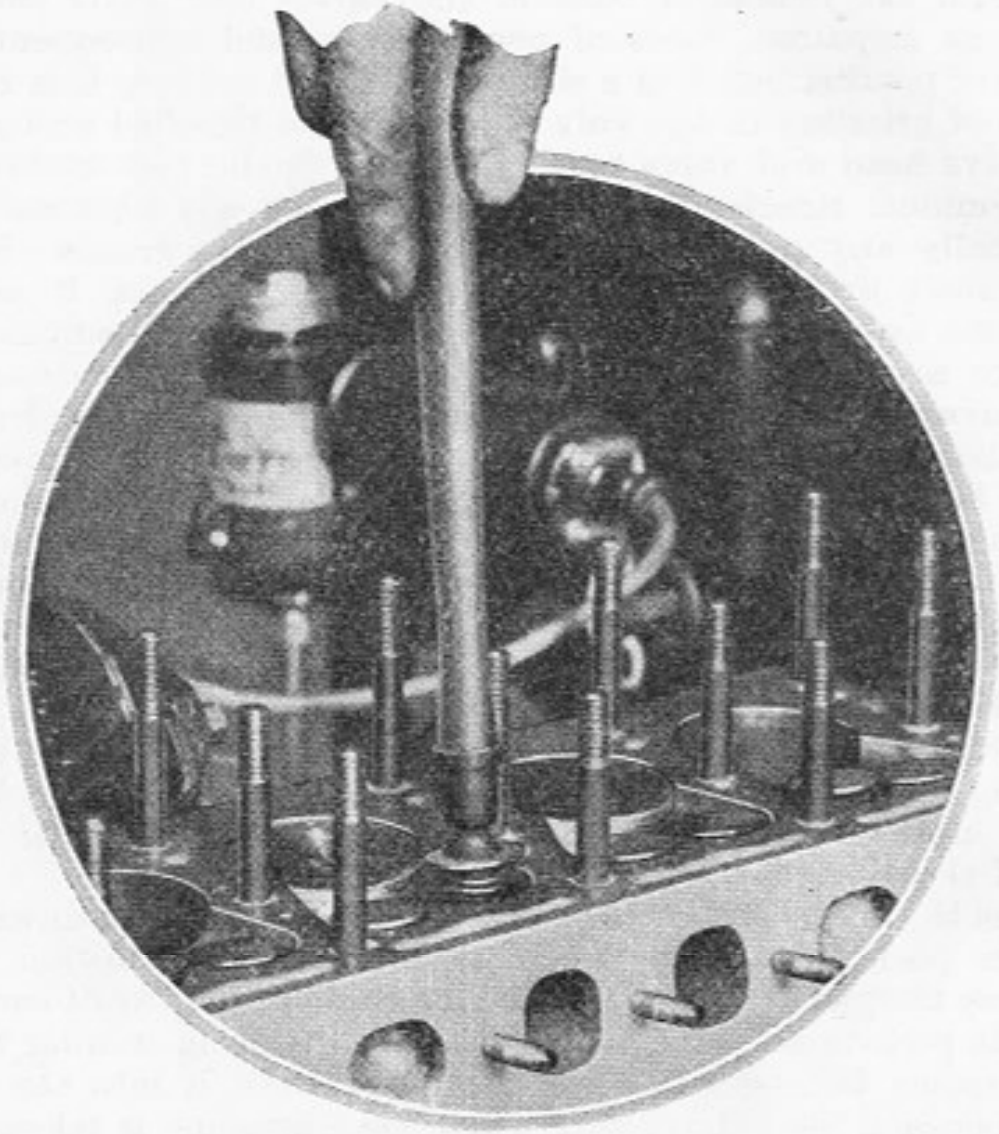


FIG. 19. A COIL SPRING PLACED UNDER THE VALVE WILL FACILITATE GRINDING-IN

cause the valve spring cap to embrace them and firmly to lock them in position. If the cotters are smeared with thick grease, their control will be facilitated, as it will enable them to remain in position in the valve stem groove while the spring cap is released.

The process of grinding-in the valves inevitably removes a certain amount of metal both from the valve face and from its seating in the cylinder block. This tends to reduce the clearance existing between the end of the valve stem and the top of the

valve tappet. But it is essential for the efficient functioning of the engine that this distance should not be less than 0·019 in., so the clearance of each valve must now be checked with a feeler gauge.

While the clearance is being set, the tappet of the valve being operated on should be bearing on that portion of the cam which is concentric with the camshaft. When it is realized that, counting from opposite ends, the pistons are paired together and move in unison, and that while the valve of one is fully open, the corresponding valve of the other is fully closed, no difficulty should be experienced in ensuring this, since it is only necessary to rotate the engine by the starting handle until the corresponding valve belonging to the other cylinder paired to it is fully open. The following are tables of the correct valve-adjusting sequence—

4-CYLINDER

Set No.	1	Tappet with	No.	8	valve	fully open
,,	3	,,	,,	6	,,	,,
,,	5	,,	,,	4	,,	,,
,,	2	,,	,,	7	,,	,,
,,	8	,,	,,	1	,,	,,
,,	6	,,	,,	3	,,	,,
,,	4	,,	,,	5	,,	,,
,,	7	,,	,,	2	,,	,,

6-CYLINDER

Set No.	1	Tappet with	No.	12	valve	fully open
,,	6	,,	,,	7	,,	,,
,,	9	,,	,,	4	,,	,,
,,	11	,,	,,	2	,,	,,
,,	5	,,	,,	8	,,	,,
,,	3	,,	,,	10	,,	,,
,,	12	,,	,,	1	,,	,,
,,	7	,,	,,	6	,,	,,
,,	4	,,	,,	9	,,	,,
,,	2	,,	,,	11	,,	,,
,,	8	,,	,,	5	,,	,,
,,	10	,,	,,	3	,,	,,

Valve tappet rotation is prevented by the provision of spring-loaded plungers between adjacent tappets which bear upon flats milled on the tappet stem, see Fig. 20. The operation of tappet adjustment has to be carried out with the use of only two spanners. It must be realized, however, that these spring-loaded plungers permit the tappet a certain amount of movement, and due allowance must be made for this during the adjusting process. When releasing or tightening up the locknut it is essential that the two spanners be used in opposition to each other, so that no load is placed upon the spring plungers.

To return to the completion of decarbonizing, attention may now be given to the cylinder head. Remove the sparking plugs

and turn the head over, to expose the combustion chambers. The carbon deposit adhering to the surfaces of these combustion spaces and the plug holes should be scraped away with a blunt screwdriver, as before, and their surfaces carefully cleaned with a rag moistened with paraffin. The flat surface on the underside of the head should also be carefully cleaned and all trace of jointing compound removed. Both surfaces of the copper asbestos gasket should be cleaned in a similar manner.

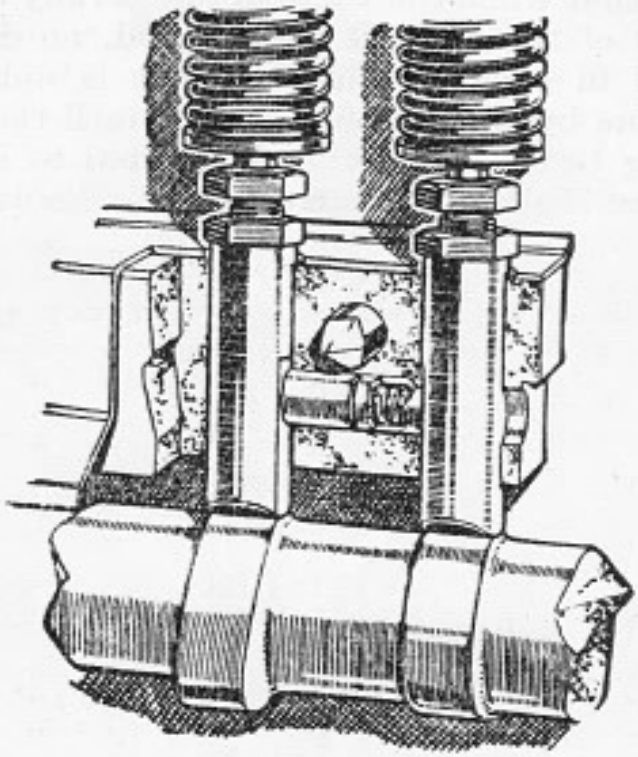


FIG. 20. TAPPET ADJUSTMENT OF SIDE VALVE MODELS, SHOWING THE TAPPET LOCATION PLUNGERS

Now to reassemble the engine. First of all, see that the gasket has been in no way damaged during its removal, and do not attempt to use it again if it has been damaged, but procure a new one, as the slightest inequality will make the joint imperfect.

Coat both sides of the gasket with an even film of gold size, and see that the gasket is perfectly flat and does not burr up around the stud holes. After coating the gasket, locate it over the cylinder head studs and gently push it into position on to the upper face of the cylinder block. It may be found convenient to use a short length of tubing, a box spanner does very well, over the studs in order to put the gasket into position. This should be done very gently, taking great care to keep the gasket parallel with the cylinder head and not to force one end or one side down before the other.

The cylinder head may now be lowered into position on the block and the cylinder head stud nuts replaced, taking care to do

so in rotation a quarter of a turn at a time until all are quite tight, and in the sequence indicated in Figs. 14 and 15.

The valve cover, exhaust and inlet manifold, plugs, plug leads, carburettor, petrol pipe, throttle, and mixture controls may now be replaced, followed by the water outlet pipe.

Then fill the radiator with water, start up the engine, and let it idle quietly until it is thoroughly warm. Then, switching off again, go over each of the cylinder head nuts in turn, giving each a final tightening up in the same order, for when an engine is warm an extra half-turn or so can be given to each nut.

On no account attempt to speed up the engine until this final tightening has been effected.

After 250 miles, the cylinder head nuts should be given yet another tightening and the valve cover removed, so that the valve clearances may be checked, as a certain amount of bedding down takes place after the grinding process.

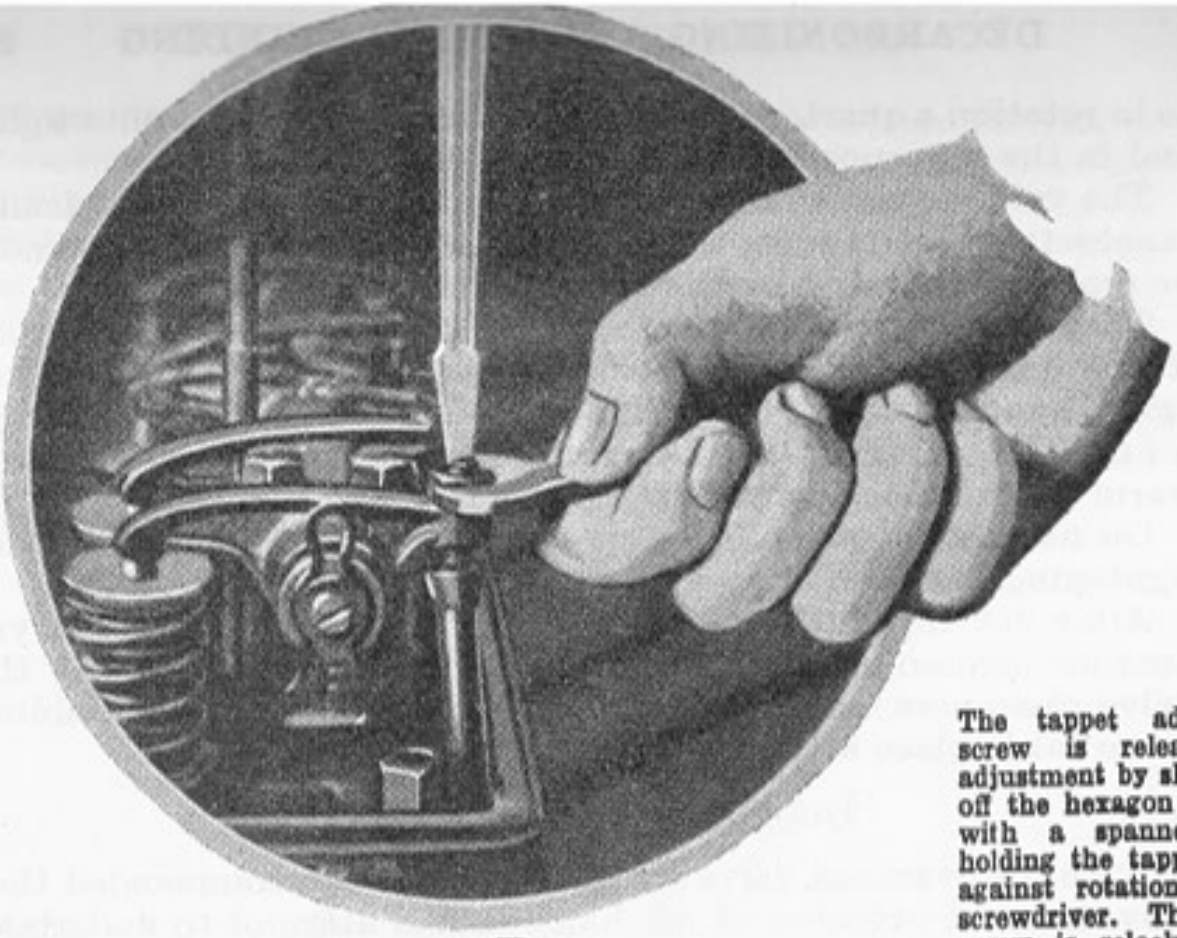
Overhead Valve Engine

With the overhead valve type of engine it is recommended that only the most experienced mechanic should attempt to undertake the work of decarbonizing and grinding in the valves. In all other cases, such work should be left in the hands of a Morris dealer.

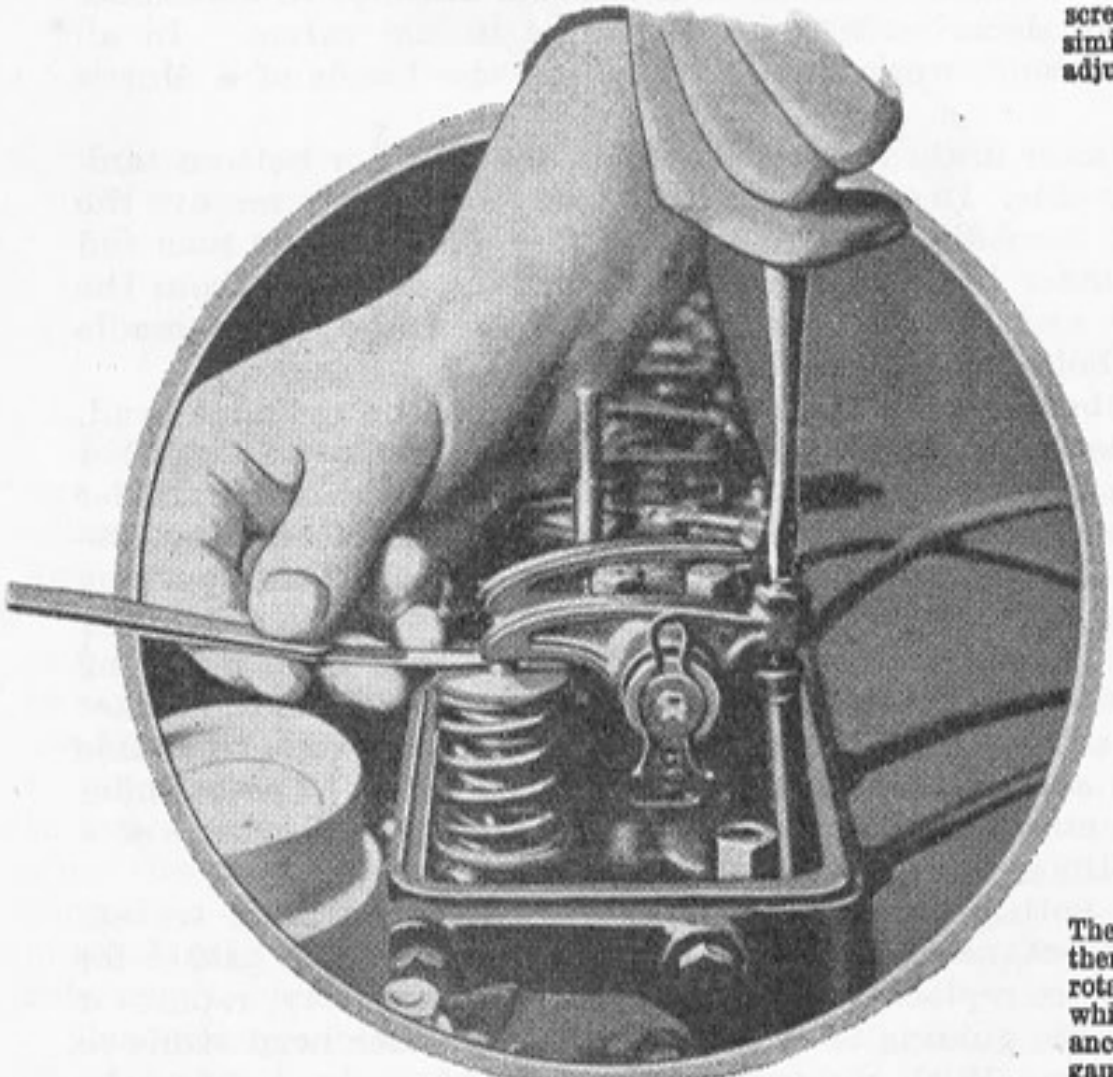
The radiator drain tap is situated in the radiator bottom tank at the near-side. In some cases it may be necessary to remove the brass plug immediately above the starter motor at the rear end of the cylinder block. The blades should be detached from the fan pulley and the fan belt removed when the dynamo cradle adjusting bolts have been slackened.

The rubber hose should be separated from the cylinder head, the cylinder head cover and the air cleaner removed, together with the carburettor and exhaust manifold. With the cylinder head cover removed and the cylinder head oil feed pipe disconnected from its union, the high-tension leads from the sparking plugs may now be detached and marked with their cylinder numbers. Taking care to prevent the push rods from dropping down when the rocker shaft assembly is removed, release the rocker shaft bracket fixing bolts a fraction of a turn at a time to enable the rocker shaft and push rods to be lifted away. The cylinder head stud nuts may now be slackened a fraction of a turn at a time, and the cylinder head removed.

Proceed with decarbonizing as explained in the main section on this subject, carefully examining the cylinder head gasket for damage before replacing. If it is damaged in any way, replace it by a new one, guiding it evenly over the cylinder head studs to avoid damage. With the cylinder head fitted again, tighten the



The tappet adjustment screw is released for adjustment by slackening off the hexagon lock-nut with a spanner while holding the tappet screw against rotation with a screwdriver. The tappet screw is relocked in a similar manner after adjustment.



The valve clearance can then be set by carefully rotating the tappet screw while checking the clearance with the feeler gauge provided in the tool-kit.

FIG. 21. ADJUSTING TAPPET CLEARANCE ON THE O.H.V. TEN

nuts a fraction of a turn at a time in the order shown in the illustration. In replacing the push rods the spherical ball should engage with its appropriate tappet before the rocker shaft assembly is replaced. Now adjust the rockers to give a clearance of 0·015 in. between the rocker tips and valve stems when the tappet is on the back of its cam, carrying out the adjustment as already outlined. When completely reassembled, the engine should be run for about a quarter of an hour when the cylinder head cover may be removed and the cylinder head stud nuts retightened and the rockers readjusted.

Special equipment is needed (a valve spring compressor) for removing the valve gear. When the valve assembly has been removed the carbon deposit should be cleaned from the combustion spaces and valve ports, after which the cylinder head should be washed thoroughly and allowed to dry. If the valves are pitted, they may be trued with a grinder or new replacements fitted. If a valve seat cutter is used as a result of the seats being fitted, care should be taken to ensure that as little metal as necessary is removed. Valves are numbered one to eight, number one being fitted nearest to the forward end. Only fine grade paste should be used for valve grinding.

Valve tappet adjustment is simpler with the overhead valve engine as the valve rockers are exposed when the detachable cover is removed. The play between the end of the valve stem and the head of the rocker (see Fig. 21) when the engine is warm should be 0.015 in. on Series III models and 0.019 in. on the Series M type. While this clearance is greater than normal practice, the camshaft contours have been designed with this in view, and no improvement either in performance or silence will be achieved by reducing the clearance. Any departure from this clearance, decided upon by Morris engineers, is likely to be a source of trouble. Naturally, when the clearance is being set, the tappet of the valve receiving attention should be bearing on that portion of the cam which is concentric with the camshaft.

Though the camshaft is out of sight, no difficulty will be experienced in this connexion if it is remembered that the pistons of numbers one and four cylinders and of numbers two and three cylinders always move in unison, and that while the valve of one is fully open the corresponding valve of the other is fully closed. To ensure this, it is only necessary to rotate the engine by the starting handle until the corresponding valves are paired in this manner.

The tappet adjustment screw is released for adjustment by holding the tappet screw against rotation with a screwdriver and slackening off the lock-nut with a spanner. The feeler gauge from the tool-kit can then be placed between the rocker and the valve,

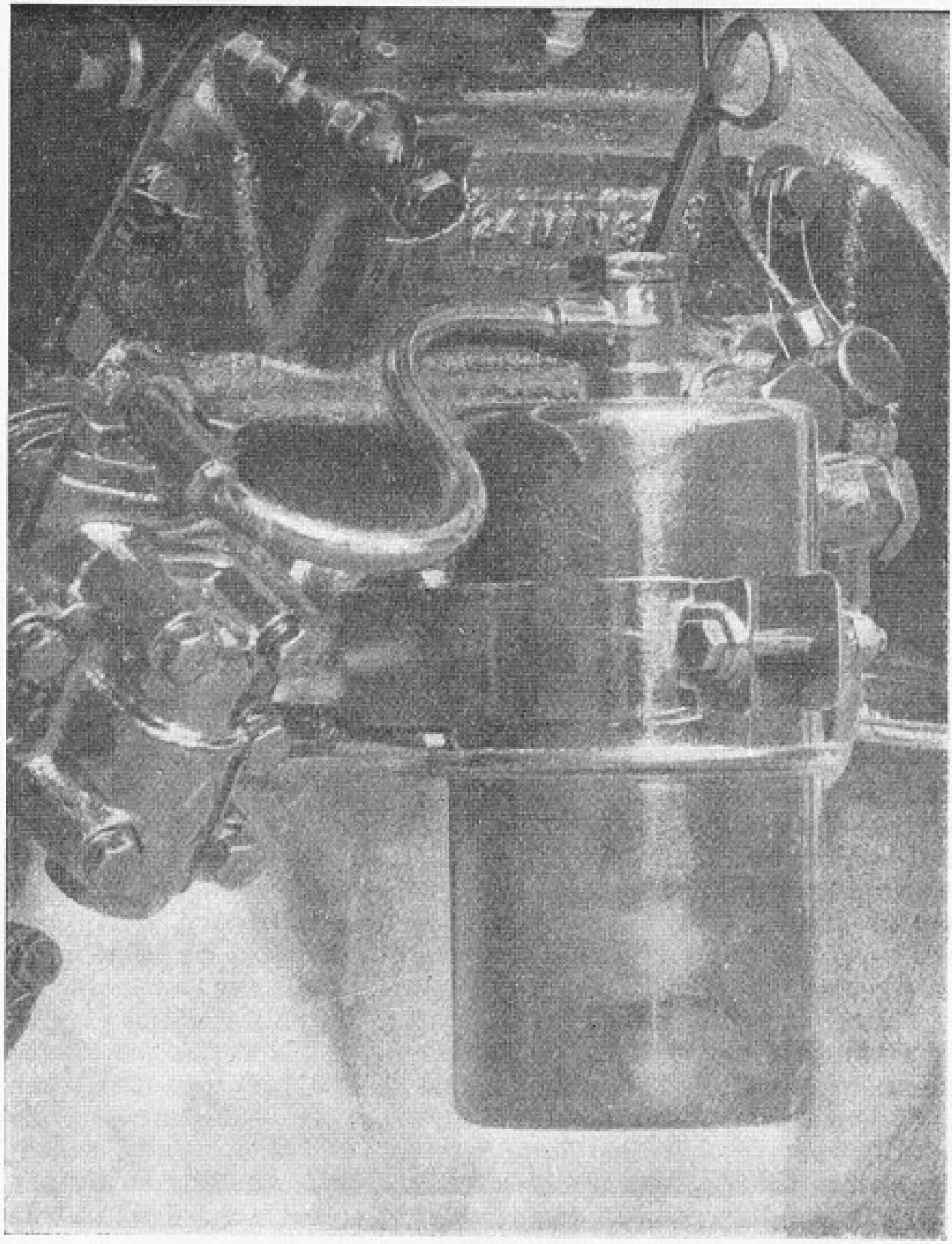


FIG. 21A. THE EXTERNAL OIL FILTER

carefully rotating the tappet screw at the same time and tightening the locking nut when the correct clearance has been obtained.

On these overhead valve models, the drain plug is placed in a more accessible position—at the bottom of the engine on the near-side. After draining the sump, new oil should be put into the engine via the oil filler placed accessibly in the top of the valve cover. The only other item of lubrication differing from suggestions already given is in regard to the water impeller. This is situated behind the fan pulley, and should be treated with a few drops of engine oil every 3000 miles.

The Connecting Rods. It should be emphasized that the two parts of the connecting rod are designed completely to encircle the bearing and make contact with each other without leaving a gap and without the use of packing shims.

The manufacturers clearly state that the bearings should never be closed together but, if it is desired to take up any "play," the procedure to be followed is to obtain remetalled connecting rods from a dealer which are supplied for a small cost in exchange for the old rods complete.

CHAPTER IV

THE ELECTRICAL SYSTEM

THE coil and battery method of ignition is standardized on Morris cars. Its purpose is to ignite and explode the charge of petrol gas and air under compression in the cylinders; its method is by inducing an electric spark in the cylinder at the time when the charge of mixture has been compressed. It is owing to this high pressure that it is essential to employ a source of high voltage electrical current, for the pressure of gas between the sparking plug point is about 75 lb. per sq. in., involving the use of a voltage of the order of 6000.

Now, the battery fitted to Morris Tens is of the 12-volt type, and there is obviously a large discrepancy between this voltage and that required to be effective at the sparking plug point. So an induction coil is incorporated in the ignition system, which has the power to convert the low voltage to the required output. There is no need here to explain the manner in which the induction coil is constructed, for any electrical manual will give this information, but it is as well to appreciate the work which the ignition system is called upon to carry out.

The ignition system does not require a lot of attention, but occasional attention on the lines indicated here will tend to keep the system in good working order.

The distributor and contact-breaker is illustrated in Fig. 22. The distributor moulding should be removed occasionally by pushing aside its two securing springs and making sure that the electrodes are clean and free from deposit. If not, clean them with a cloth moistened with petrol and wipe out the distributor with a dry duster. Also see that the carbon brush "A" moves freely in its holder and is clean.

Clean the outside of the moulding, especially the spaces between the terminals. Apart from this and from seeing that the terminal connexions are kept tight, the coil requires no attention whatever. Then examine the contact-breaker. It is important that the contacts "C" are kept free from grease or oil, and, if they are burned or blackened, they may be cleaned with a very fine stone or emery cloth and afterwards with a cloth washed with petrol. Care should be taken that all particles of dirt and metal dust are wiped away, for misfiring may be caused if the contacts are not kept clean. Moreover, the contact-breaker

surfaces should be flat and the two contacts bed quite flat upon one another. Although the gap is set before the car leaves the works, a gauge is provided on the special screwdriver in the tool kit. The adjustment should be such that the gauge should just make contact with the surfaces when the gap is opened. If the gap does vary

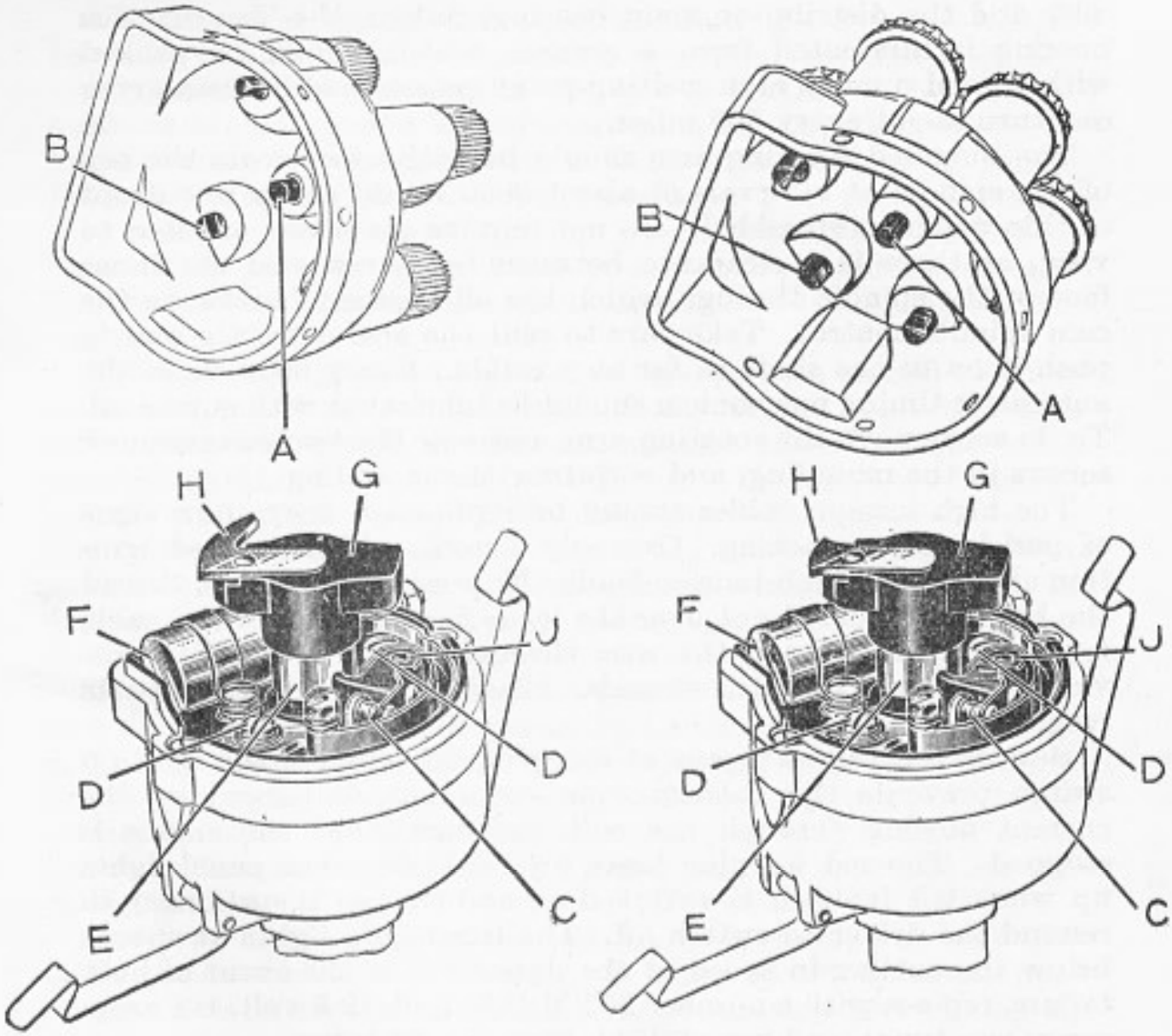


FIG. 22. THE DISTRIBUTOR AND CONTACT-BREAKER

considerably from the gauge, when the contacts are fully opened, slacken the two locking screws on the contact plate and move the plate until the gap is set to the thickness of the gauge. After making the adjustment, retighten the locking screws.

Wear on the fibre heel of the cam should be negligible if the cam is kept clean by means of a cloth wiped with petrol. It should afterwards be given the slightest smear of petroleum jelly. In any case, the cam requires this little attention about every

3000 miles, and every 5000 miles a single drop of oil should be placed on the pivot "J" on which the contact-breaker works.

Very little lubrication is necessary. In fact, it is easily possible to over-lubricate the points requiring attention at intervals. Do not, however, overlook these items. On the four-cylinder models, one or two drops of thin machine oil should be added to the oiler and the distributor main bearing, but on the Ten-Six this bearing is lubricated from a greaser, which should be packed with a good quality high melting-point grease, and the cap given one turn about every 500 miles.

The moulded rotating arm should be withdrawn from the top of the spindle at intervals of about 3000 miles, and a few drops of thin machine oil added. Do not remove the screw exposed to view, as there is a clearance between the screw and the inner face of the spindle through which the oil passes to lubricate the cam spindle control. Take care to refit the arm correctly and to push it on to the shaft as far as possible. Every 3000 miles the automatic timing mechanism should be lubricated with engine oil. To do so, remove the rotating arm, unscrew the two countersunk screws in the moulding, and withdraw the moulding.

The high-tension cables should be replaced if they show signs of perishing or cracking. Use only 7 mm. rubber-covered ignition cable for all high-tension leads. To connect the cable, thread the knurled moulded nut over the lead, bare the end of the cable for about ¼ in., thread the wire through the brass washer provided, and bend back the strands. Finally, screw the nut into its respective channel.

Besides forming a means of stopping the engine, the ignition switch prevents the battery from becoming discharged by the current flowing through the coil windings when the engine is stopped. The red warning lamp on the instrument panel lights up when the ignition is switched on and the car is stationary to remind the driver to switch off. The lamp only lights at speeds below the cutting-in speed of the dynamo. In the event of bulb failure, replace with a number 252 M.E.S. bulb (2·5 volt, 0·2 amp. screw cap type), and type C252A for Series M types.

If a failure of ignition or misfiring occurs, unless the cause is at once apparent, proceed in accordance with the chart on page 53, first making certain that the trouble is not due to a cause outside the ignition system. If the cause cannot be found, the only remedy is to communicate with a Morris service depot.

The Dynamo. This component requires very little attention, as when the car is new all the dynamo bearings are packed with grease and do not need replenishment until the machine is overhauled by a Lucas service depot. Provision is made for the little extra lubrication to be given about every 1000 miles by means

of a single drop of oil in the oilers provided on some of the earlier models. When the engine is being decarbonized, or at intervals of about 10,000 miles, move aside the flap at the commutator end of the dynamo and add a very small quantity of high melting-point grease on earlier models. Later models have a wick-feed lubrication, which should be kept filled with Mobilgrease No. 2.

About once a season the metal cover of the dynamo should be removed and the three brushes inspected to see that they bed evenly on the commutator, i.e. the face in contact with the commutator should present a uniformly polished appearance. Dirty brushes may be cleaned with a cloth moistened with petrol. When the brushes have become worn after long service so that they will not bear properly on the commutator, they should be replaced by genuine Lucas brushes, and it is recommended that the work of replacement should be carried out at a Lucas service depot.

Now turn attention to the commutator, which should be kept clean and free from oil and brush dust, etc., as neglect of this precaution will result in the commutator becoming flattened, causing sparking to occur at the brushes and consequently shortening the life of the machine. To clean the commutator, insert a fine duster held by means of a suitably shaped piece of wood against the commutator surface, getting someone to turn the engine over by hand slowly. If the commutator is very dirty, the duster may be moistened with petrol.

The ammeter on the instrument panel records battery charging and discharging, the needle swinging to the right for the former and to the left for the latter. If when the side lamp and tail lamp are switched on, 2 amps. are being used and the ignition coil is taking 2 amps., but the engine is running at such a speed as to generate 7 amps., a reading of 3 amps. will be recorded on the charging side.

It will be noticed that, when the engine is running at very low speed, no charge into the battery is being recorded on the ammeter. This is because the engine is not rotating fast enough to generate the necessary current. To prevent current from flowing to the dynamo windings, a cut-out is connected between the dynamo and the batteries, and this is an automatic switch acting as a valve and permitting the flow of current from the dynamo to the batteries only. The cut-out is operated electro-magnetically, being a magnetic circuit that is closed by an electric magnet. It is one of the most reliable parts of the electrical system and, being accurately set before the car leaves the works, does not require adjustment, provided that it is not tampered with. It is located on the engine side of the dash, together with the fuses.

The fuses are of the cartridge type. that marked "C," Fig. 23,

being connected to the accessories circuits. The fuse will blow in the event of a short circuit in the wiring of the horn, windscreen wiper, and other accessories, and the failure of these units will indicate that the fuse has blown. The other fuse, "D," is connected in the dynamo field circuit and will blow in the event of any fault in the charging circuit, thus preventing damage to the dynamo.

If the fuse has blown, the dynamo will fail to charge and no charge will be recorded on the ammeter.

Spare fuses "E" which should always be of the correct type

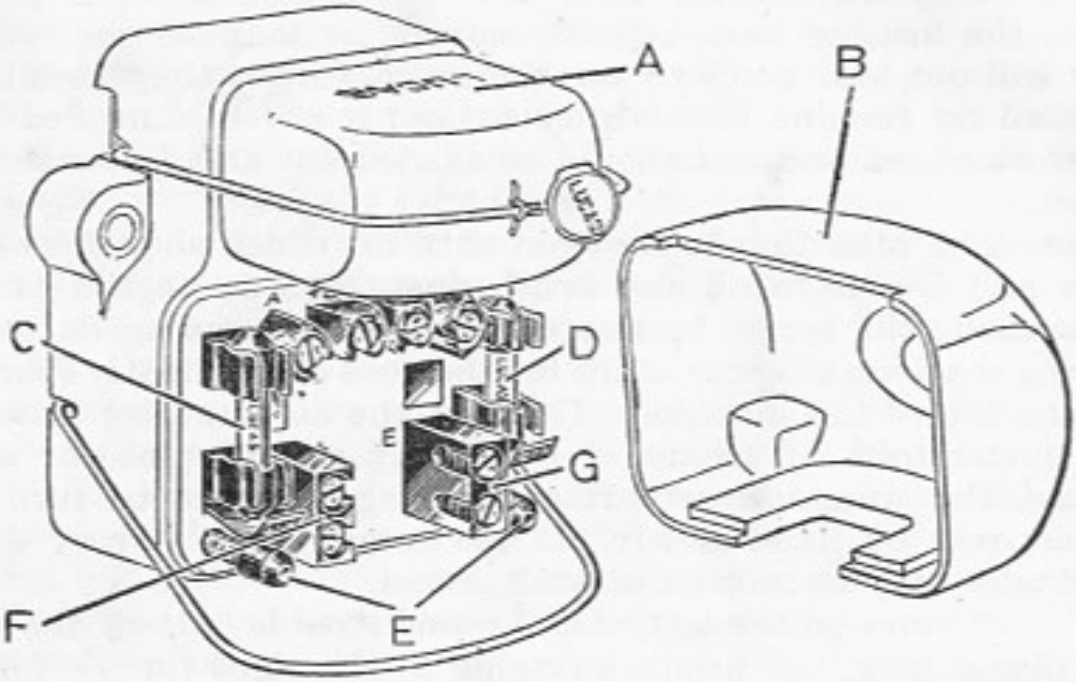


FIG. 23. CUT-OUT AND FUSES

are provided as indicated in the illustration, but, before refitting a replacement fuse, examine the wiring of the units protected by this fuse for shorts and loose connexions, and remedy if necessary. If, after fitting a new fuse, it blows and the cause cannot be traced, you are advised to consult a Lucas service depot.

A little study of the wiring diagrams (Figs. 24–7) will enable you to become familiar with the various fuses on your car and the units protected by them. At first sight, the wiring diagram appears a formidable and complicated affair, but it really is not so frightening. The electrical system comprises three main circuits dealing with the lighting, accessories, and the ignition and charging, and the various units are connected by cables bound together in a protective sheathing, the cables being coloured so that they can be identified by reference to the wiring diagram. The equipment is wired on what is known as the earth return system, in which the current from the batteries and dynamo through the various units is via the chassis frame.

The starting motor switch should always be operated quickly and decisively. Apart from looking after the commutator surface in the same manner as for the dynamo, the starter needs no attention. In the remote possibility of the starter becoming

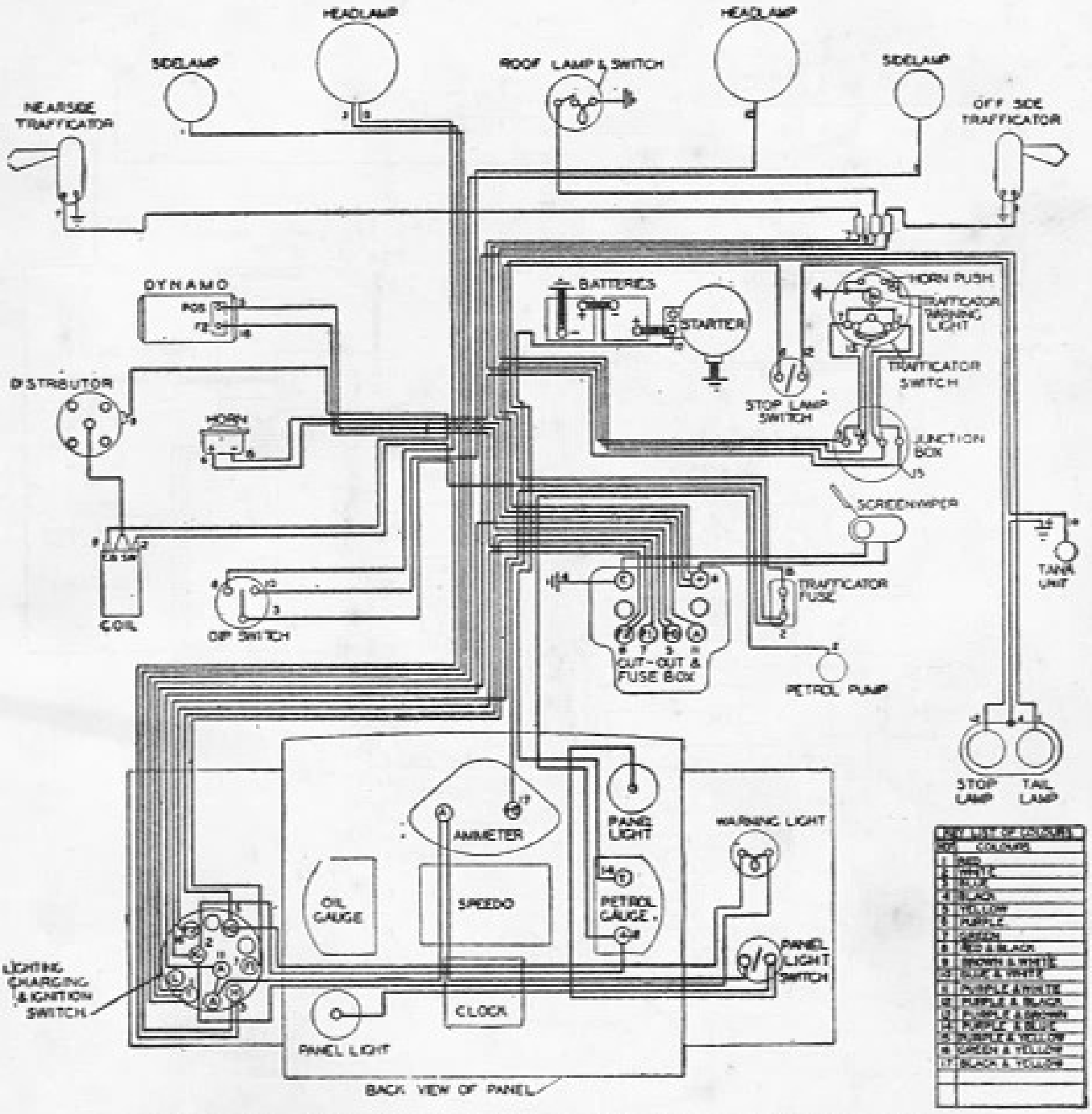


FIG. 24. WIRING DIAGRAMS FOR SERIES II MODELS

jammed, remove the cover on the extended shaft and rotate the squared end disclosed by means of a spanner.

Location of faults in the electrical system will be assisted by reference to the tables on pages 53-5, but in some cases a considerable amount of deduction from the symptoms is needed before the cause of the trouble is disclosed. Much evidence can be gained from the ammeter. For instance, when the car is

running at, say, 20 m.p.h. with the charging switch in the full charge position and the lights are off (1934–5 models), and no charge is being recorded, the dynamo is failing to charge. If the lights are switched on and a discharge then shows on the ammeter,

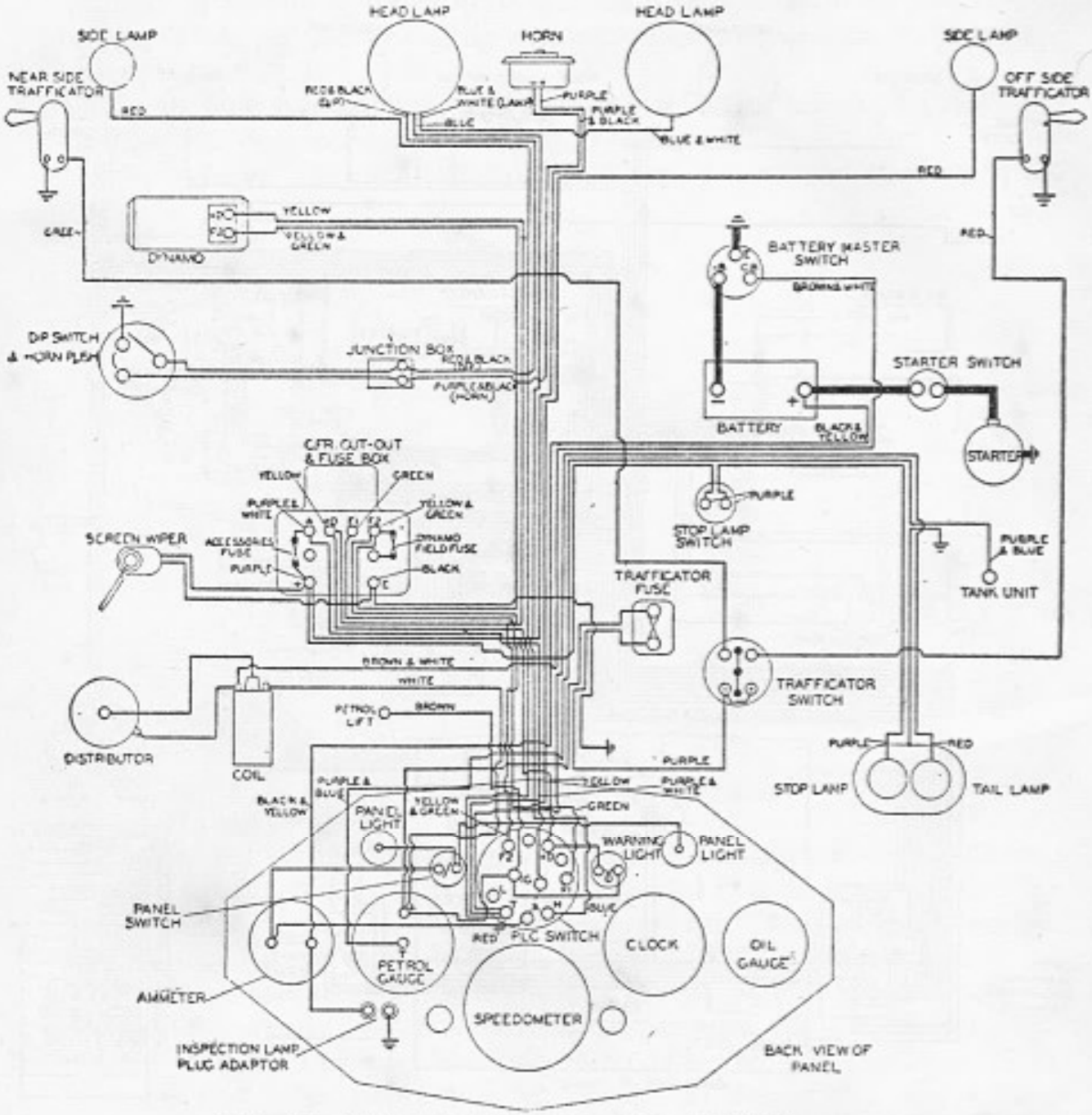


FIG. 25. WIRING DIAGRAM FOR 1935 MODELS

this proves that the ammeter is not at fault. If the maximum ammeter reading is much below normal when the dynamo is charging, or the ammeter needle fluctuates when the car is running steadily, a low or intermittent dynamo output may be suspected as a result of the dynamo having been neglected.

If the lights fail entirely or vary in intensity, this is probably due to the battery terminals having become corroded, with the

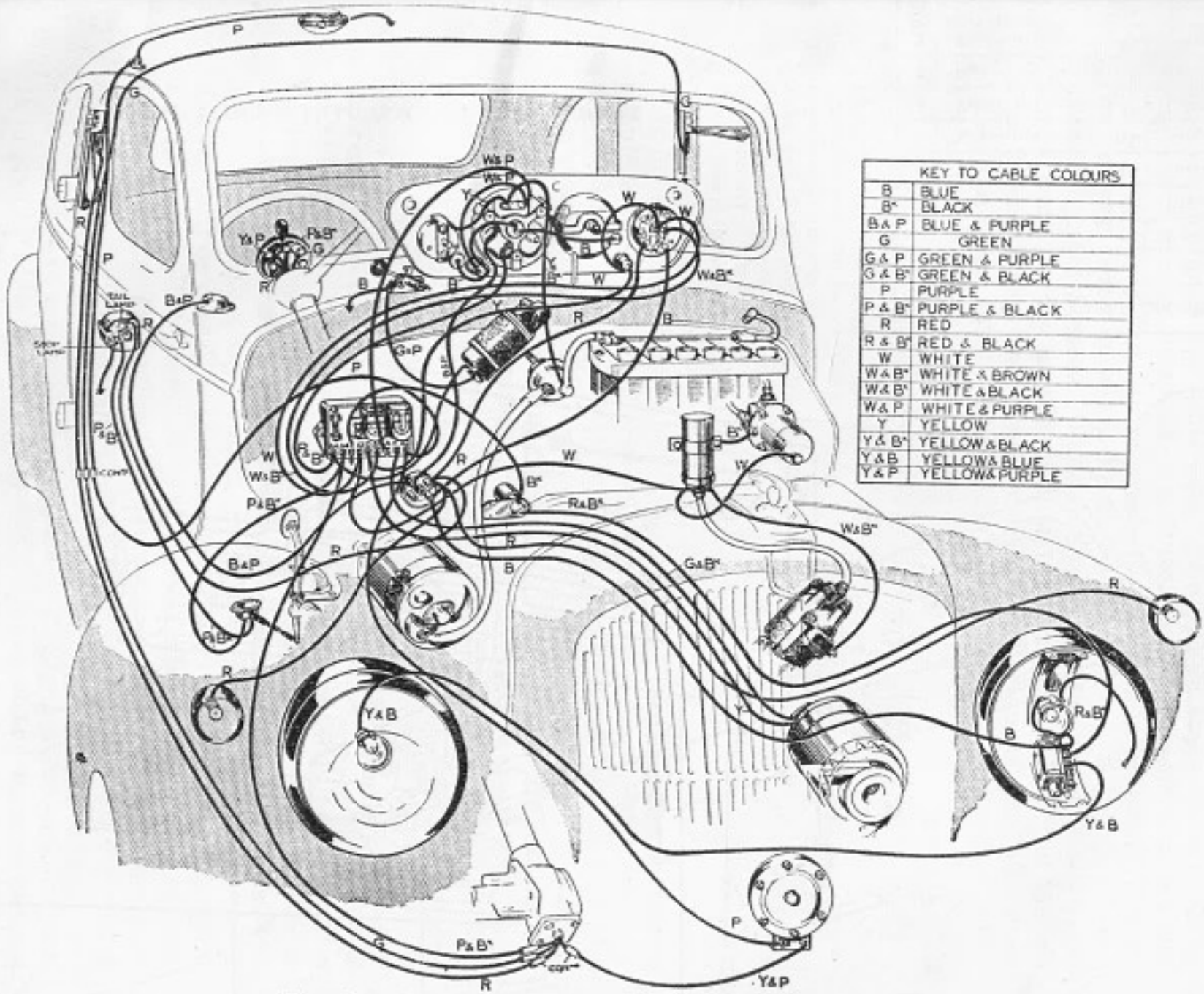


FIG. 26. WIRING DIAGRAM FOR SERIES M 1936–46

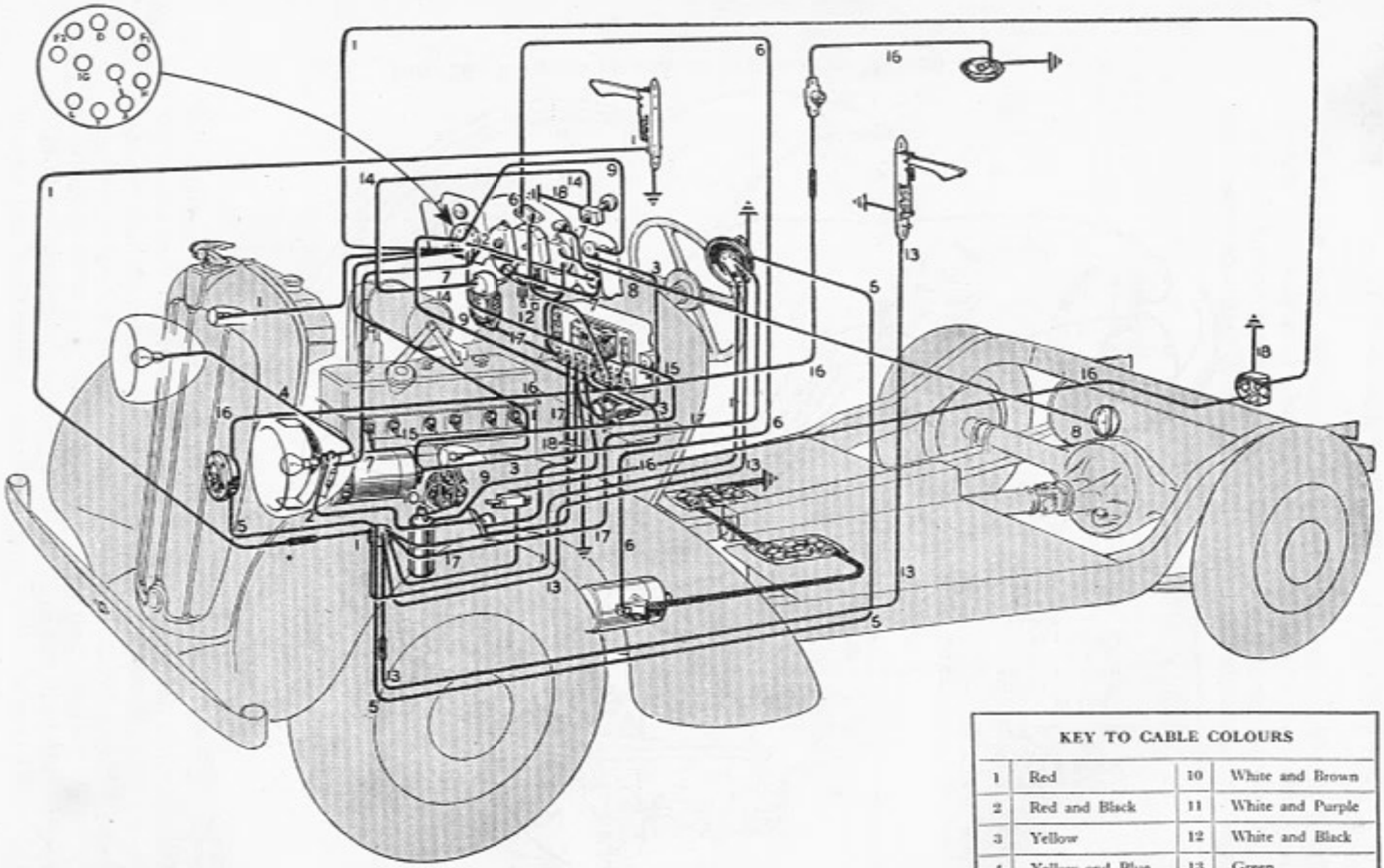


FIG. 27. WIRING DIAGRAM FOR 1936 TEN/SIX

KEY TO CABLE COLOURS			
1	Red	10	White and Brown
2	Red and Black	11	White and Purple
3	Yellow	12	White and Black
4	Yellow and Blue	13	Green
5	Yellow and Purple	14	Green and Purple
6	Yellow and Black	15	Green and Black
7	Blue	16	Purple
8	Blue and Purple	17	Purple and Black
9	White	18	Black

result that the connexion is broken. If this is not the cause, examine the switch base or the junction box and particularly see that all terminals are quite tight. Failure of an individual lamp suggests a broken filament or a loose connexion and, if when the car is stationary the lamps gradually dim, it is probably due to the battery being exhausted.

The Lighting System. This is another system which relies upon the battery for its supply of current. In the case of the Morris Ten, it comprises two headlamps, two side lamps, tail and stop lights; and the sizes of the bulbs are as follows—

		Volts	Watts
Headlamps (up to and including 1935)	B.A.S. No. 4S.	12	36
Side, stop, tail and panel lamps. .	B.A.S. No. 10S	12	6
Ignition warning lamp . . .	No. 252 M.E.S.	2·5	0·5
Ignition warning lamp (Series M) .	C252A	2·5	0·5
Headlamps (Series II) . . .	Lucas No. 54	12	36
Side, tail, stop and panel (Series II) .	Lucas No. 207	12	6
Trafficators (Series II) . . .	No. 256	12	3
Trafficators (Other types) . .	No. T. 126 F. (festoon)	12	6
Panel lamp (where fitted) . . .	No. 1224M	12	2·4

It is important that these bulbs specified by the manufacturers should always be asked for when ordering replacements, as they are designed to be in focus and to give the best results with the reflectors fitted.

During normal running conditions while the lamps are in use all together, there should still be a slight charge into the battery.

The anti-dazzle device consists of a dipping reflector on the near-side lamp. The mechanism is operated by a switch on the steering column or by a floor board button on Series II and later types. When the switch is moved to the dipping position, the near-side headlamp beam is dipped and turned to the near-side of the road, while the off-side headlamp is switched off. The dipping is effected by a movement of the reflector, which is mounted on a bracket pivoted on ball bearings. It is operated by a solenoid, which, when energized, tilts the reflector. A cartridge type fuse is carried in spring clips alongside the dipping mechanism and is provided to protect the equipment in the event of the reflector failing to function properly. If the reflector fails to function, remove the fuse from its holder and see if there is a break in the fuse wire.

A spare fuse is clipped to the bracket carrying the bulb-holder. If it should blow repeatedly and the cause of the trouble cannot be found, have the reflector examined by a Lucas service depot.

To remove the lamp front and the reflector, loosen the fixing screw at the bottom of the lamp and swing it aside from the slot in which it fits. The front and reflector can then be withdrawn.

When replacing, press the front on to the lamp body, locating the top of the rim first. Finally, swing the screw into the slot and tighten it to lock the front into position. With some lamps the front and reflector are secured by a clip at the bottom of the lamp.

An adjustable mounting is provided which allows the beam of light to be adjusted on the road to the best advantage. The adjustment is obtained by slackening the lamp-fixing screw, turning the lamp to the desired position and then locking by tightening the screw. So that the correct focus may be obtained, the bulb-holder is arranged to be moved backwards or forwards when the clamping clip at the back of the reflector is slackened. Care should be taken to tighten the clip after the adjustment. The best method of adjusting the lamp is to take the car on a straight level road at night and then to adjust as described.

The side lamps are fitted with 6-watt bulbs, and these lamps have an adjustable mounting which is locked by a single nut, the method of adjustment being similar to that described for the headlamp.

The front can easily be withdrawn from the lamp body, when the fixing screw is loosened by twisting it to the left. The reflector is combined with the front and, to enable the bulb to be focused, alternative locations are provided for it in the bulb-holder. Try each position for the best results.

The stop tail lamp is inter-connected with the foot brake pedal and operated by a switch worked by pressure from the brake pedal. When the fixing screw is loosened, the front can easily be withdrawn to replace a bulb.

Trafficators are solenoid operated by current controlled by a two-way switch. On some models, when they are in use, a warning lamp shows in the centre of the steering wheel; on some others there are reflecting mirrors at each side of the car, in which they can be seen.

Every two or three months raise the trafficator arm and apply a smear of thin machine oil, such as sewing-machine oil, by means of a match stick or feather, to the brass knob or profile and the small copper tongue spring and copper spindle.

If at any time the arm fails to light up when in operation, examine the bulb. To remove the bulb, switch the trafficator on and then, supporting the arm in a horizontal position, move the switch to the off position. Then move aside the small trigger projecting from the underside of the arm, when the cap of the bulb-holder will spring open. Fit a new bulb in place of the one which has burnt out, and refit the cover. Later models have a screw attachment.

The fuse protecting the trafficators is located on the dash

under the bonnet, and, if the trafficators fail to operate, first examine this. If it has blown, the most likely cause will be a short circuit in the trafficator wiring, so before fitting the spare fuse, examine the wiring for a short circuit or loose connexion and remedy any faults found. If the new fuse blows and the reason cannot be found, have the equipment examined by a Lucas service depot.

The windscreen wiper requires no adjustment. All moving parts are packed with grease during assembly, and lubrication is by oiler. When cleaning the windscreen, the wiper arm can be easily lifted from the glass, but care must be taken that it is not moved from side to side.

Electric horns are adjusted to give their best performance before the car leaves the works, and no subsequent adjustment is required. If the horn becomes uncertain in its action, giving only a choking sound, or does not vibrate, the trouble is not necessarily with the horn. First ascertain that some outside source is not due to the difficulty, and check over the battery or for loose connexions or short circuits in the wiring of the horn, or a blown fuse. It is also possible that the performance of a horn may be disturbed by the horn becoming loose on its mounting, but if the trouble cannot be found, do not attempt to dismantle the horn, but return it to a Lucas service depot for examination.

The Batteries. The batteries fitted to Morris Tens are, for all practicable purposes, merely means of storing electricity in bulk. They suffer more from neglect or abuse than many other parts of the car, and, though it is better to have them in an overcharged than an undercharged state, harm is caused in both cases, for excessive overcharging quickly reduces the acid level and tends to shorten the battery life.

The driver possesses partial control over the dynamo output on early models, there being half-charge and full-charge positions on the instrument panel switch. Additionally, a third and higher charging rate automatically comes into operation when the lights are switched on.

Always keep the charging switch in the position appropriate to the occasion, although, for general purposes, the two positions, half and full charge, will look after the charging rate. If during the winter, however, you use the car extensively during daylight hours and very little after dark, do not strictly adhere to this. There is a definite test you can make periodically to ensure that the battery is obtaining a correct charge, and this will be referred to later.

In the meantime there are several points in connexion with the battery which should have regular attention if you are to obtain the best results. Summarized briefly, they are—

(1) At least once a month remove the vent plugs in the top of each of the batteries and see that the acid is level with the tops of the separators. When examining the cells, do not hold a naked light near the vents, as there is a danger of igniting the gas coming from the battery plates. To bring the level to the tops of the separators, add a little distilled water, obtainable from chemists and garages. Never use ordinary tap or rain water.

If acid solution has been spilled, it should be replaced by a sulphuric acid solution diluted to the same specific gravity (of which more later) as the acid in the cells.

(2) At the same time examine the battery terminals to see that they are tight, and smear them with petroleum jelly to prevent corrosion. If re-tightening of the terminals is necessary, do not exert very much force, or the terminal may be wrenched off its plate. Keep the tops of the batteries clean and dry, and do not spill water over them when adjusting the level of the solution or taking specific gravity readings.

(3) Never leave the battery in a discharged condition for a period of time. If the batteries are not being used, about once a fortnight give them a small charge from an outside source of electrical energy, in order to obviate permanent sulphation of the plates. The electrolyte should never be removed from the battery or the plates allowed to become dry.

(4) Take regular readings of the specific gravity of the acid by means of a hydrometer. With this instrument, tests can be made quickly and simply, and there is no better way of ascertaining the state of charge of your batteries. The hydrometer contains a graduated float, which indicates the specific gravity of the acid in the cells from which the sample is taken.

FIG. 28. USE THE HYDROMETER TO TEST ACID IN BATTERY

The tests with this instrument should only be conducted after the battery has had a good charging and the acid level is at its correct height, and when the electrolyte is thoroughly mixed.

The readings should be approximately the same for each cell, but if one cell gives a different reading from the remainder, it may be due to the fact that the acid has been spilled or has leaked from this particular cell, or there may be a "short" between the plates. In this case, it is advisable to have the battery examined at once at a Lucas service depot.

HOW TO LOCATE AND REMEDY DYNAMO TROUBLE

Symptoms	Probable Fault	Remedy
Ammeter fails to indicate charge when running with no lights in use, or gives heavy discharge with lights on	Dynamo not charging, due to: Broken or loose connexion in charging circuit causing field fuse to blow (when fitted)*	Examine charging circuit wiring. Tighten loose connexion or replace broken lead. Particularly examine battery connexions. Fit replacement fuse. (See page 43)
	Commutator greasy or dirty	Clean with soft rag moistened in petrol. (See page 43)
Ammeter gives low or intermittent charge reading	Dynamo giving low or intermittent output, due to—*	
	Loose or broken connexions in dynamo circuit	Examine charging circuit wiring. Tighten loose connexions or replace broken lead. Particularly examine battery connexions
	Commutator or brushes greasy	Clean. (See page 46)
	Brushes worn, not fitted correctly, or wrong type*	Replace worn brushes. See that brushes "bed" correctly. (See page 43)
Ammeter gives high charge reading	Dynamo giving high output, due to—†	
	Loose connexions in dynamo charging circuit	Examine charging circuit wiring. Particularly battery connexions. Tighten loose connexions
	Battery acid level low	"Top up" cells with distilled water. (See page 52)
	Brushes not fitted correctly	See that brushes "bed" correctly. (See page 43)
	Control brush position altered	Have control brush adjustment re-set at nearest Lucas Service Depot

* Voltage control models—trouble probably due to low state of battery.
† Return voltage control type regulator to Lucas Depot for servicing.

HOW TO LOCATE AND REMEDY LIGHTING TROUBLE

Symptoms	Probable Fault	Remedy
Lamps give insufficient illumination	Battery discharged	Charge battery either by a long period of daytime running or from independent electrical supply
	Lamps out of alinement or bulbs out of focus	Aline lamps and focus bulbs. (See page 49)
	Bulbs discoloured through use, or reflectors dirty	Fit new bulbs (see page 49) or clean reflectors
Lamps light when switched on, but gradually fade out	Battery discharged	Charge battery either by a long period of daytime running or from independent electrical supply
Brilliance varies with speed of car	Battery discharged	As above
	Battery connexion loose or broken	Tighten connexions, or replace faulty cables
Lights flicker	Loose connexion	Locate loose connexion and tighten
Failure of lights	Bulbs burnt out due to battery becoming disconnected	Check battery connexions Replace faulty cables
	Battery discharged	Charge battery either by a long period of daytime running or from independent electrical supply
	Faulty wiring in lighting circuit	Check wiring for defective cables or connexions

HOW TO LOCATE AND REMEDY STARTER MOTOR TROUBLE

Condition	Probable Fault	Remedy
	If engine cannot be turned by hand, then fault is due to a stiff engine	Locate and remedy cause of stiffness
	If engine can be turned by hand, then trouble may be due to—	
	Battery discharged	Start by hand. Charge battery either by a long period of daytime running or from independent electrical supply
Motor sluggish or fails to move engine	Broken or loose connexion in starter circuit	See that connexions to battery, starter and starter switch are tight, and that cables connecting these units are in order
	Starter commutator or brushes dirty	Clean
	Brushes worn, not fitted correctly or wrong type	Replace worn brushes. See that brushes "bed" correctly
	Starter pinion jammed in mesh with flywheel	Rotate squared end of starter shaft with spanner. (See page 45)
Starter pinion will not disengage from flywheel when engine is running	Starter pinion jammed in mesh with flywheel	Rotate squared end of starter shaft with spanner. (See page 45)

The following are the specific gravity figures when the temperature of the solution is about 60° F.—

At full charge: 1·285–1·300.
At half discharge: 1·210.
At full discharge: 1·150.

It cannot be too strongly emphasized that a battery should never be allowed to remain in a fully discharged state. Normal use of the battery in the correct way will keep it in good condition, provided these periodical attentions are given.

A sign of over-charging is provided when the battery readings are always in the region of 1·285 with the acid level becoming unusually low. In such a case, keep the switch on the instrument panel at the half-charge position.

During the running-in period of a new car, the switch should be kept in the full-charge position in order to compensate for the heavy starter motor load due to the initial stiffness of the engine.

On models previous to Series II types, a master switch is provided completely to isolate the battery from the electrical equipment, as a means of protection for a parked car, when carrying out wiring alterations, or in case of emergency. The switch is connected between the negative battery terminals and the chassis, so that, when moved to the "off" position, this terminal is insulated from earth and the coil ignition is rendered inoperative by a connexion across the contact-breaker to earth.

Never operate the battery master switch when the engine is running or there will be a danger of fusing the lights, and, when using it, be careful to operate the switch to the full extent of its travel in both directions.

Care of the Sparking Plugs. There appears to be considerable misconception as to the use of sparking plugs, and there exists a widely held belief that merely to change the type of plug will be to improve the car's performance.

A mixture which is too rich is not the only cause of soot formation on the plugs, although this is one of the most regular causes. A sparking plug can be over-cooled, which may result when the incorrect type is fitted, so that even a correct carburettor setting does not cause the soot to be burnt off.

There are other considerations of a highly technical nature which affect efficient plug functioning. If you are to obtain the best results from your plugs, however, replace worn plugs—at intervals of about 10,000 miles—with those which are designed for your particular engine. Those suitable for the Morris-Ten engines dealt with in this book are as follow—

SPARKING PLUGS

	LODGE	A.C	K.L.G.	CHAMPION	SETTING
1933 18 mm.	BBL	86	M50	7	0·020–0·025
1936–51 14 mm.	CN	F10	F50	L10	0·018–0·022

Much can be done by the owner to keep the plugs in efficient working order. Figs. 29 and 30 illustrate the Lodge and Champion plugs of the types required. The gap positions detailed

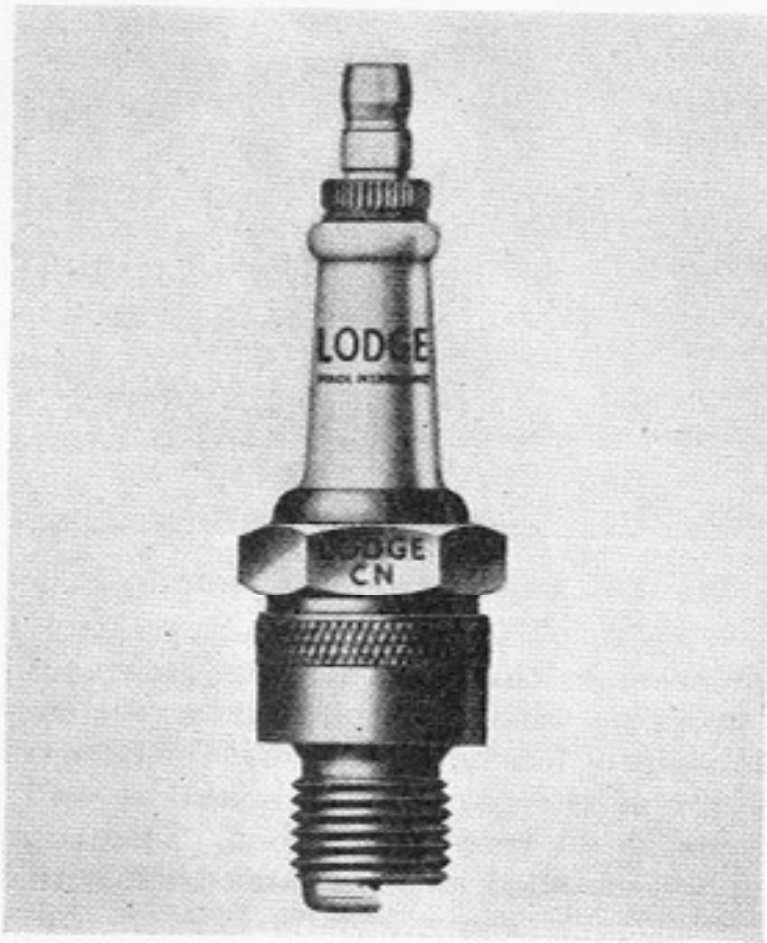


FIG. 29. THE LODGE CN (14mm.) SPARKING PLUG

above should be strictly adhered to, as a gap which is too wide will cause misfiring at high speeds and under heavy pulling at full throttle on low speeds, while too small a gap results in poor idling. All plugs should be adjusted to the same gap, and before new ones are fitted they should be tested to make sure that they conform to the correct gap setting.

The A.C. plug, type 339, has a detachable ceramic insulator, which may be removed from the plug body for cleaning or renewal when necessary. This plug retains its high insulating properties under the varying conditions of extreme heat or when coated with oil or carbon deposits, ensuring that a full spark is available at the firing points. The gland nut is a compression-tight unit

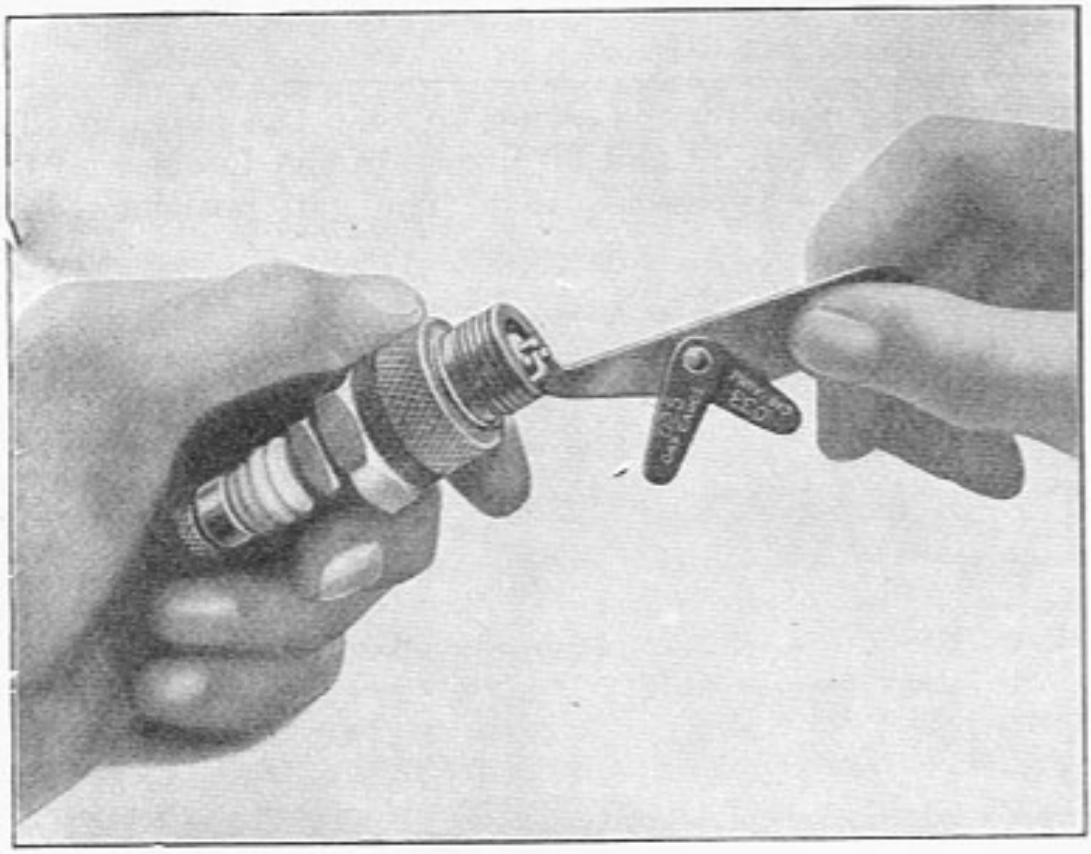


FIG. 30. THE CHAMPION SPARKING PLUG

with the insulator, so that the plug can be readily dismantled for cleaning purposes without impairing its efficiency.

When the insulator has been removed, the nose of the insulator and the interior of the plug body should be well washed with paraffin to remove all traces of carbon. Then the parts might with advantage be washed in petrol and dried with a clean cloth. Afterwards, reassemble the plug and tighten the gland nut by means of a box spanner.

Those plugs which are of two-piece construction are easy to take apart for cleaning. When refitting, see that the copper gaskets are correctly replaced. The insulator should be kept clean at all times, as the presence of oil, dust, or paint may cause leakage of the spark and, in damp weather, result in difficult starting.

This cleaning operation should be carried out at regular intervals and, in any case after the first few hundred miles of running

a new car. During the early part of a car's life an excess amount of oil is generally used while the slow-speed carburettor adjustment is a little rich, with the result that carbon may be deposited on the plug insulator to cause a fouling condition. When the engine has been well run-in and fresh oil introduced, this effect quickly disappears.

Reference has already been made to the fact that it may be necessary to change the plugs every 10,000 miles. The intense stresses and strains imposed in modern high-compression engines are of such a nature as to cause a gradual deterioration of the plug's efficiency. This results in waste of petrol through incomplete combustion in the cylinder combustion chambers and unburnt gases passing out through the exhaust system.

For those owners who do not have the time to give attention to plugs when engine performance seems to be falling off, and the correct diagnosis is plug trouble, nearly every modern garage possesses a plug tester and cleaner, and carries out the work at a very moderate charge.

There is one other aspect allied to plug performance which is often overlooked. It is important that the low-tension terminals on the coil and distributor body should be kept free from oil and dust to ensure good metal-to-metal contacts, while the earthing of the distributor body should occasionally be checked over to guard against misfiring, since the current returns to the battery through the chassis frame.

CHAPTER V

BRAKES, WHEELS, AND TYRES

THE four-wheel brakes, working on the internal expansion system and operated hydraulically, are fitted to Morris Tens. The great merit of the Lockheed system standardized by Morris is that

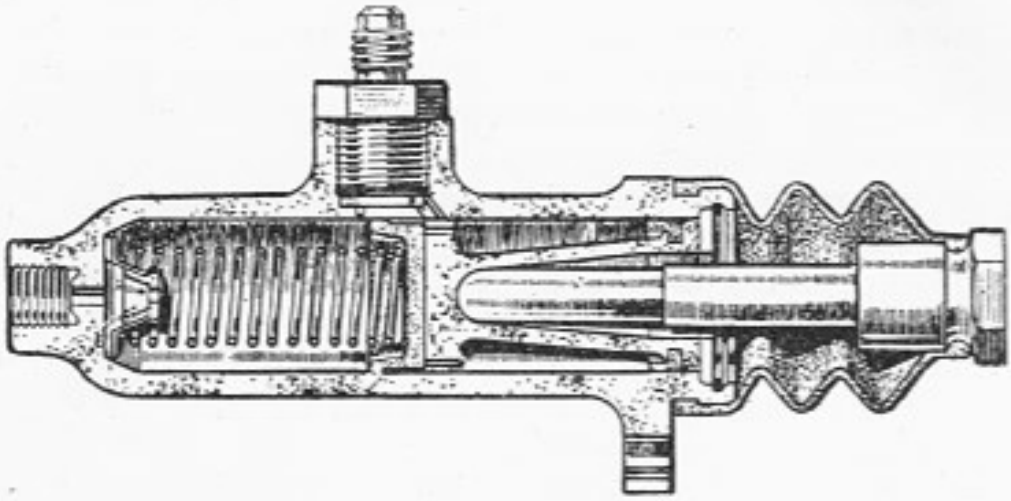


FIG. 31. THE LOCKHEED BRAKE CYLINDER AND MECHANISM

equalization of power is guaranteed, while it possesses the added merit of simplicity.

A main cylinder and piston are connected with a fluid reservoir, and the piston is also connected to the brake pedal by means of a crank, the whole being submerged in fluid contained in the reservoir, Fig. 31. When pressure is applied to the pedal, the piston moves inwards in the cylinder, forcing fluid through an outlet valve to which pipe lines, running to the various brake shoe assemblies, are connected.

Located within the brake drum is a small cylinder, Fig. 32, equipped at the two open ends with opposed pistons fitted with cup washers and push rods for connexion to the brake shoe ends. To prevent the entry of dirt, the open mouths of these cylinders are covered with rubber boots.

The central chamber of the cylinder is in communication with the pipe, so that pressure applied at the brake pedal forces each piston outwards, and this action expands the shoes, causing them to come into contact with the brake drum.

Pull-off springs attached to the shoes allow the pistons to return to their normal position as soon as pressure of the pedal is released, and the fluid returns in the pipe lines through an automatic check valve to the main cylinder.

Should the quantity of fluid returned to this cylinder be less than that withdrawn by the operation of the pedal, a partial vacuum is created, and a quantity of fluid is drawn from the reservoir and flows through a number of small vents in the piston head to maintain the supply.

It is obviously important that no air should be allowed to enter the system, so means to prevent this are incorporated in the design. A coil spring is arranged in the main cylinder to

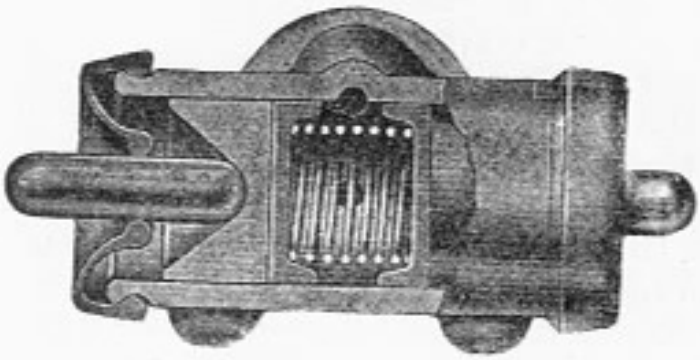


FIG. 32. THE BRAKE DRUM CYLINDER

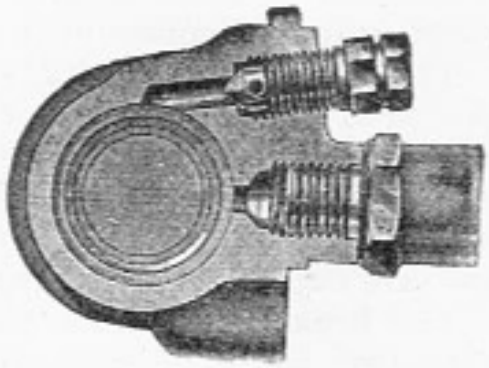


FIG. 33. A BLEEDER VALVE IS SITUATED AT THE TOP OF EACH BRAKE DRUM CYLINDER

operate against the piston, so that pressure is maintained on the fluid in the pipe line.

It is important that the supply of fluid in the supply tank should be maintained, and every 1000 miles this should be examined and the supply replenished, if necessary. If air is allowed to get into the system, the efficiency of the brakes, as we have seen, will be impaired, indicated by a falling off in power. Special provision has been made in the design of the system to bleed the pipe lines in the case of the entry of air. A bleeder valve, Fig. 33, is situated at the top of each brake drum cylinder immediately above the pipe line union; but as the operation of bleeding entails special equipment to obtain the best results, it is recommended that the work be entrusted to a Morris dealer who is also a Lockheed service agent.

The Lockheed fluid used in the Morris-Ten braking system is specially prepared for the purpose, and it is important that no other fluid be introduced into the system for replenishment, or serious trouble will ensue. This special fluid is unaffected by high temperatures and is immune from freezing. Oil, petrol, paraffin, and similar media are definitely injurious to some

parts of the system, and should on no account be introduced or used for cleaning purposes. If any parts of the braking system require cleaning, they should be washed either in the special brake fluid supplied, or in alcohol; but if alcohol is used, the parts should be well dried and treated with brake fluid before being replaced. The fluid is known as "Lockheed Orange Fluid."

A leak in the system is indicated by excessive consumption of brake fluid, and may be traced by applying very heavy pressure to the brake pedal with the car stationary, and checking over the various connexions until the point of leakage is found. Never remove the pistons of the wheel or master cylinders. Special tools are required correctly to assemble these components, and there is nothing in them to give trouble. In cases of damage, a complete cylinder replacement should be employed.

The pipe lines are of stout gauge copper tubing especially prepared and cleaned, and should not be replaced by piping of an inferior quality. Where spring deflection and steering movement must be provided for, special patent flexible hose connexions are fitted, and these, though flexible, are non-expansible, and are capable of withstanding a pressure of 6000 lb. per sq. in.

The brake mechanism on Morris cars should require very little attention for a lengthy period, beyond seeing that the supply tank contains sufficient fluid. It should never be less than half full, and it is safer to keep it three-quarters full.

Since the pressure applied to the brake shoes is always equal, no equalization adjustment is required. The presence of oil, grease or similar foreign matter on the braking surfaces, however, may seriously affect the coefficient of friction and, in consequence, the retarding effect on that particular brake shoe, in spite of the fact that it is being applied with the same force as the others, does not give the same efficient operation. In such cases, thoroughly clean the brake lining with petrol and slightly roughen the surface with a file.

Adjustment to compensate for wear of the brake shoe linings is, however, arranged. Adjustments may be necessary after the first 500 miles and also when the linings have worn so far that the brake pedal is in danger of coming into contact with the floorboards. Then the brake shoes must be brought closer to the brake drums, as it is advisable to have at least 1½ in. clearance between the head of the foot pedal and the floorboard when the brake is fully applied.

To make the adjustment, jack each wheel in turn, spinning the wheel and slightly rotating the hexagon adjustment bolts which are to be found on either side of the wheel cylinder, until the brake shoes just come into contact with the drums, then slackening back this adjustment until the wheel just rotates freely and

without drag. The adjustment bolts can easily be rotated with a spanner into the desired position. To bring the shoes closer to the drums, they should be rotated away from the centre of the wheel, and to bring the shoes farther away from the drums they should be rotated towards the centre of the wheel with the spanner above the nut. When these operations have been carried out on all four wheels, all brakes should be in correct adjustment.

Equalization of the braking will not be achieved unless all brake linings are of the same kind. They should be of the correct size and material supplied by your Morris dealer.

Access to the brake shoes for attention is achieved by jacking up the wheel and removing it from the hub. This will reveal countersunk screws spaced between the wheel studs. Withdrawal of these screws will permit the brake drum to be drawn off, and removal of the drum reveals the entire brake shoe assembly for examination. Do not interfere with the wheel brake cylinders unless they are found to be leaking, and obviously need attention, and do not operate the brake pedal while the drums are removed, or the wheel cylinder pistons may be forced out of their cylinders.

As special tools, comprising a hub withdrawing tool and a hub nut spanner, are required for relining the brakes; and in view of the low charge plus the cost of the linings that the garage will make, it is best to leave the work of relining the brakes to the Morris dealer.

The centrally-situated hand-brake lever is provided with an instantaneous adjustment by means of a wing or other nut close to the base of the lever. It adjusts both sets of rear brake shoes in unison and can be operated from the driver's seat. Take care, however, not to make the adjustment too tight, or a tendency may exist for the brake to come on of its own accord when additional passengers are carried. There should be at least three teeth free on the brake ratchet when the lever is lightly applied.

Care of the Tyres. The length of service which your tyres will give is in direct relation to the care with which you use them and the manner in which you look after them. Briefly, maintain the inflation pressures as recommended by the manufacturers, occasionally change the tyres round, and use the engine for braking as far as possible.

When it is realized that most of the forces of retardation of the car are applied through the tyres, it will be seen that they can be worn very quickly if the brakes are used extensively. In most cases, the driver knows that he will have to stop the car at a certain point, owing to traffic lights or some other cause, and if, when still 50 to 100 yards from the point at which he must stop the car, he merely releases pressure on the accelerator pedal and allows the engine to act as a brake, he will be saving his tyres.

For the same reasons, the careful driver does not attempt rapid acceleration or quick take-up of the drive by the clutch. To do so imposes tremendous strains on the tyres, causing not only excessive wear of the treads, but also creating internal strain which may cause the fabric to part from the rubber.

Try to avoid driving in tram lines, for, quite apart from the danger of skidding, especially on wet days, the lines may cut into the tyres. Do not drive consistently over sharp-edged kerbs and try to avoid kerbside wear, as this naturally weakens the walls of the tyres, apart from tending to throw the wheels out of alinement.

The following are the correct inflation pressures for the tyres fitted to various types of Morris-Tens, and it is essential that they be maintained.

Tyre Size	Pressure in Lb. per Sq. In.	
4·75–18	30	
4·50–19	32	
5·00–16	26	
5·75–16	Front 20	Rear 23

Results of under-inflation are that the edges of the tyre, as well as the treads, are liable to come into contact with the ground. Tyres are not constructed to withstand this abuse, and there is also a hinging action on the shoulders of the tyre which causes unnecessary friction, creating a tendency for the layers of material from which the tyre is constructed to slide over each other.

Test the tyre pressures frequently by means of a gauge, which can be obtained from any reputable motor dealer, and include the spare wheel as well as the running tyres, and restore any loss. Do not leave a punctured tyre on the spare wheel carrier, but have it repaired as soon as possible, so that it is always ready in cases of emergency. Examine the tyres periodically for flints or other foreign matter which is liable to become embedded in the tread. If they are not removed, they may work into the tyre and result in a puncture. Fill up the spaces then revealed by means of a suitable compound, but any serious cut should be vulcanized at a garage. Keep the tyres free from oil by means of a cloth moistened with petrol.

It is a good point about every 5000 miles to change the tyres over, i.e. transfer the wheel and tyre complete from, say, the near-side front wheel to the off-side rear wheel position, and so forth.

To remove a tyre, undo the valve parts which prevent the

valve from passing through the rim and push both tyre cover edges into the base of the rim at the part diametrically opposite the valve, and then lever the cover edge near the valve over the rim edge, as shown in Fig. 34.

To refit the tyre, very slightly inflate the inner tube, place it in the cover with the valve through the hole in the rim, taking care that the valve which is fitted in the side of the tube is on the correct side of the rim; push one edge of the cover over the edge of the rim, and it will go quite easily if the part first put on is pushed right down into the rim base; and then fit the second edge of the cover, commencing at a point diametrically opposite the valve, and push the edge down into the base of the rim. Small levers provided in the tool kit may be gently used to ease the last few inches of tyre over the rim edge. Whilst inflating, see that the edges of the cover are seated evenly round the rim.

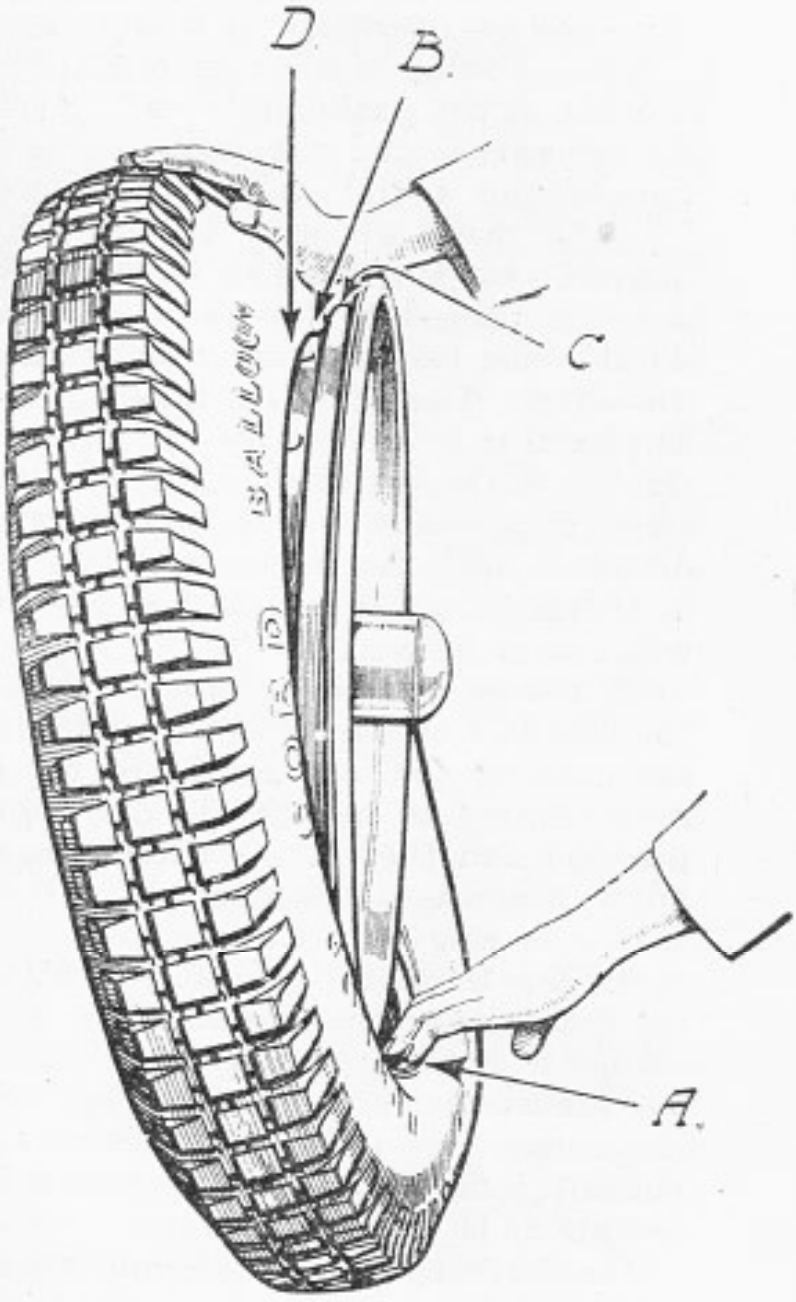


FIG. 34. METHOD OF REMOVING THE TYRE

A valve cap is fitted to provide an additional air seal and to prevent the entry of dirt into the valve interior. The airtightness of the valve depends upon the proper functioning of its interior. To test for airtightness, rotate the wheel until the valve is at the top, and insert the end in an eggcupful of water. If bubbles appear, in spite of the fact that the valve interior has been well screwed down, it is evident that its seating is faulty. It should be removed and replaced by a new interior. It is always advisable to have spare interiors handy, and these are obtainable

suitably packed in all metal containers. Keep the hexagon rim nut screwed tightly up on to the rim on models so fitted.

The Hydraulic Jacking System. Some types of Morris Ten have, as standard equipment, the Jackall hydraulic jacking system. By means of this fitting, either the two front, the two rear, or all four wheels can be lifted from the ground within a few moments by operation of a lever inside the car.

The operating mechanism is situated beneath the front flooring in front of the passenger's seat. Access to it is obtained by lifting the carpet and felt, and raising a hinged cover in the floor. This reveals a dial on which the positions are clearly marked: "F" for front wheels, "R" for rear wheels, and "all" if the complete car is desired to be raised from the ground. The point is to be turned to the position desired, and the release valve should then be firmly screwed down in the direction opposite to the arrow. The operating handle, fitted under the bonnet, should be placed in position over the short extension piece projecting to the left of the indicator, and the pump worked by backward and forward movement of the handle, making the full travel in each direction until the wheels are clear of the ground. A relief valve is provided in the system to operate against excessive pressure which may be generated.

To release the jacks, unscrew the release valve by turning in the direction of the arrow, opening the valve slightly so that the car may be lowered gently to the ground. When the jacking device is not in use, the pointer should be turned to the "all" position and the release valve unscrewed to prevent the possibility of accidental damage.

If it is necessary at any time to remove one or more of the jacks, the indicator should be turned to the rear position while the front jacks are attended to, and vice versa, to prevent the escape of fluid other than that contained in the pipe line between the distributor box and the jack being worked on. To remove the pump, the connexion between the pump and the most convenient joint should be broken and the fluid pumped into a receptacle to prevent wastage.

The correct level for the fluid when the jacks are not in use is indicated by a dotted line round the supply tank about $\frac{3}{4}$ in. from the top, and the fluid level should not be allowed appreciably to fall below this mark and never above it, or there will be insufficient room for expansion to take place. Beyond seeing that the level is correct, this system requires no attention, but it is important that only genuine Jackall fluid be inserted, as use of any other fluid is not only liable to render the jacking system inoperative, but automatically cancels the guarantee.

CHAPTER VI

SHOCK ABSORBERS

THE purpose of shock absorbers is not, as is so often thought, to make the springing more supple. Even when the road springs are themselves as near to perfection as it is possible to make them, shock absorbers are essential, for the more supple the springs, the more it is necessary to control the upward and downward movements otherwise transmitted to the body. If these

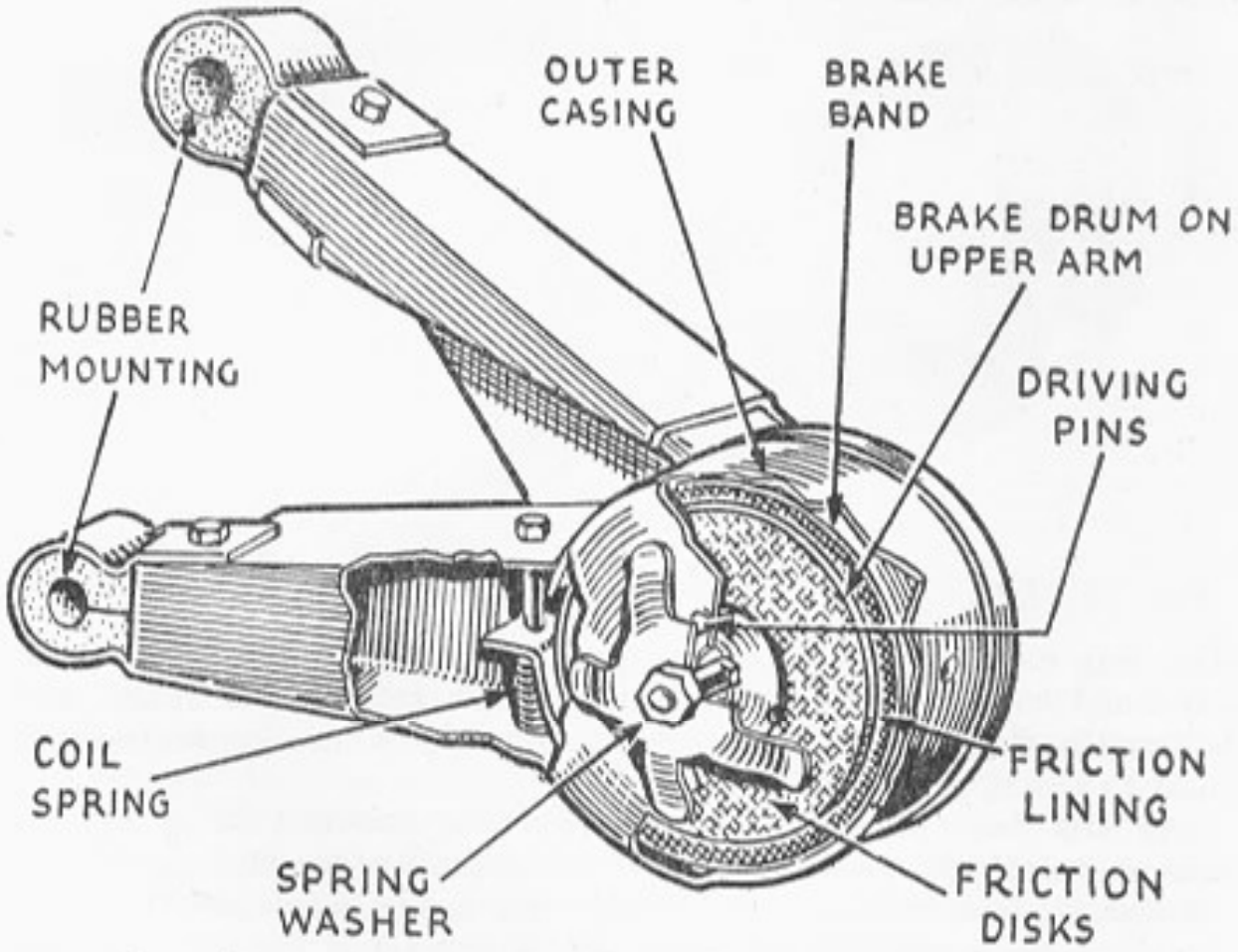


FIG. 35. ARMSTRONG FRICTION TYPE SHOCK ABSORBER

movements were allowed to proceed unchecked, riding would be more uncomfortable than on "hard" springing, which would transmit the reactions of uneven surfaces, but would be reasonably comfortable over good roads.

Again, if the springing is too soft, the car will roll on corners, and there will be backward and forward movement of the chassis and body independent of the wheels when starting and stopping.

The comfort and practicability of the suspension system on

Morris Tens is one of their charms. On Series II types, particularly, bends can be taken without slackening speed, and though this performance may be partly inherent in general chassis design, a practical suspension system of this nature contributes very greatly to the safety element.

Armstrong friction shock absorbers were fitted to 1933 models and hydraulic types on subsequent models.

Fig. 35 illustrates the former type, which combines the features of single-acting and double-acting shock absorbers, for a tension band restricts the springs mainly on the rebound and a separate disk type damping device offers a constant damping force. Two arms are pivoted together at one end, and connected to the chassis frame and axle respectively at their other extremities.

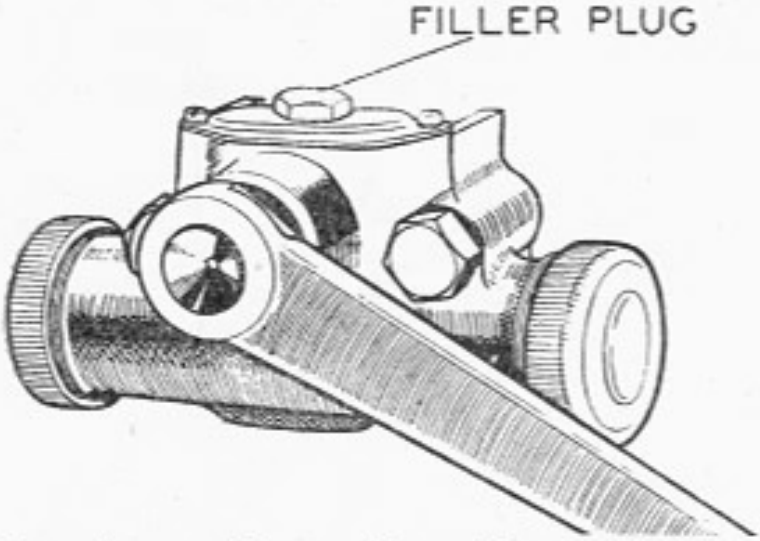


FIG 36. THE LUVAX PISTON TYPE HYDRAULIC SHOCK ABSORBER

The arm connected to the chassis carries a brake drum, and that attached to the axle has a brake band encircling this drum, and is tensioned by means of a coil spring which applies a constant load to the spring band.

As the two arms separate, a certain amount of wrapping action takes place. This adds considerably to the resistance offered to the rebound. Similarly, when the arms are brought together on spring deflections, the brake band partly unwraps itself and facilitates free movement of the arms.

The arm connected to the axle is equipped with three driving pins engaging a pressure plate, which is thus forced to revolve with it. Sandwiched between this pressure plate and the face of the brake drum is a disk of frictional material, and a similar friction disk is sandwiched between the face of the brake drum and the face of the arm. Pressure plate, friction disks, brake drum, and arm are held in frictional contact by a central bolt passing through a star-shaped spring washer, which regulates the pressure applied to the disks.

An indication that the tension has been reduced too greatly will be given by general floppiness of the springs and undue bouncing of the car on bad road surfaces. To apply additional tension to the brake disks, screw up the hexagon-headed nut in the centre of the star washer. This adjustment may be necessary after the first 2000 miles owing to the inevitable initial bedding down of the friction material. Once the lining has bedded down, adjustment should be necessary only at intervals of 10,000 miles;

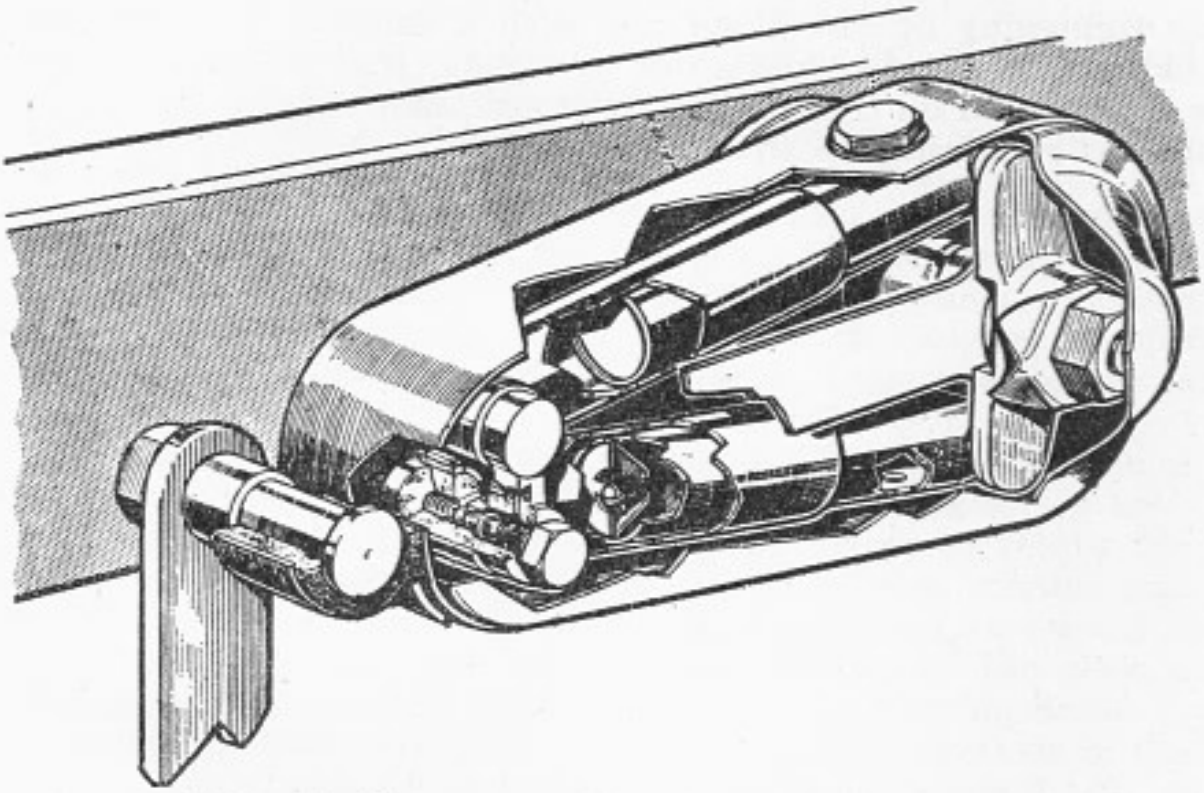


FIG. 37. HYDRAULIC TYPE SHOCK ABSORBER

but the frequency of adjustment is, of course, dependent upon the nature of the roads over which the car regularly travels.

The arms of the shock absorber are attached to the frame and axle by pins having their bearings in moulded rubber bushes. This method of mounting allows freedom of angular movements without stressing the arms or interfering with the proper functioning of the friction surfaces.

The double-acting hydraulic type, Fig. 37, fitted to later Morris-Ten models, are self-regulating in the sense that their shock-absorbing properties are automatically and progressively regulated to meet the prevailing road conditions. They are fitted with a regulating valve, which automatically compensates for differences in the viscosity of the oil due to changes in temperature.

The regulating valve is controlled by springs, is correctly set by the manufacturers, and cannot be altered.

Replenishment of the casing with oil at lengthy intervals is the only maintenance required under normal conditions and, if leakage does not take place, there is sufficient oil in the casing to last for 10,000 miles. Inspect the quantity of oil in the casing every 10,000 miles, pouring in as much fluid as will enter. Care must be taken that no foreign matter shall get in through the filler hole and the correct fluid recommended by the manufacturers should always be used. Be careful to tighten up again firmly.

Oil leakage past the shock absorber spindle should be rectified by tightening up the gland nut with a suitable "C" spanner, taking care not to overtighten the gland nut, or undue strain will be placed on the spindle. It is necessary only to tighten up the nut sufficiently to effect an oil seal.

CHAPTER VII

CLEANING AND ADJUSTMENTS

As the average owner is familiar with the main controls of the car, it is not intended here to go into details of the various controls and instruments, and dealing with one or two of those items which are likely to vary with other makes.

The hand-brake lever is centrally situated between the front seats, and the accelerator pedal to the right of the clutch and gear pedals. In between the front seats, also on models up to and including 1935 types, a circular black knob is recessed into a protective casing and controls the switch which operates the electric engine starter. Next to this is the battery master switch, which should never be operated while the engine is running.

Steering wheel controls on models before Series II types are: on the left, to control the advance and retard of the ignition, which should be pulled towards the driver to retard the ignition when the engine is running slowly or being started, and pushed away from the driver for normal running. On the right is the headlight dipping control, and in the centre the electric horn push. The latter is fitted in the same position on Series II types, but the trafficators are operated by the projections in the centre of the steering wheel and no ignition control is fitted, as there is an automatic advance. The dipping mechanism on the latter model is controlled by a button on the floor boards, which should be operated by the left foot.

On all models, except Series II, the starter is operated by pushing a button on the dash, while on Series II types the knob should be pulled outwards. If operation of the starter control does not turn the engine, do not continue to use it.

New Engines. Power may be lacking for the first 200 miles. This is due to the initial stiffness of the engine, but there will be a progressive improvement during the first 1000 miles. Never drive a new four-speed gearbox car at higher speeds than 10, 15, 25, and 30 m.p.h. on gears one to top for the first 200 miles. At the conclusion of the first 500 miles take the car to your dealer for the 500-miles attention, which is provided free of charge.

Cleaning the Bodywork. Mud should be removed from the cellulose by washing freely in water, using a sponge or a leather

to remove the mud from wings and coachwork. Then finish off with a leather from which the water is continually wrung. Light dust may be removed from the cellulose with a duster, but never from the wings by this method, as they are stove-enamelled. If

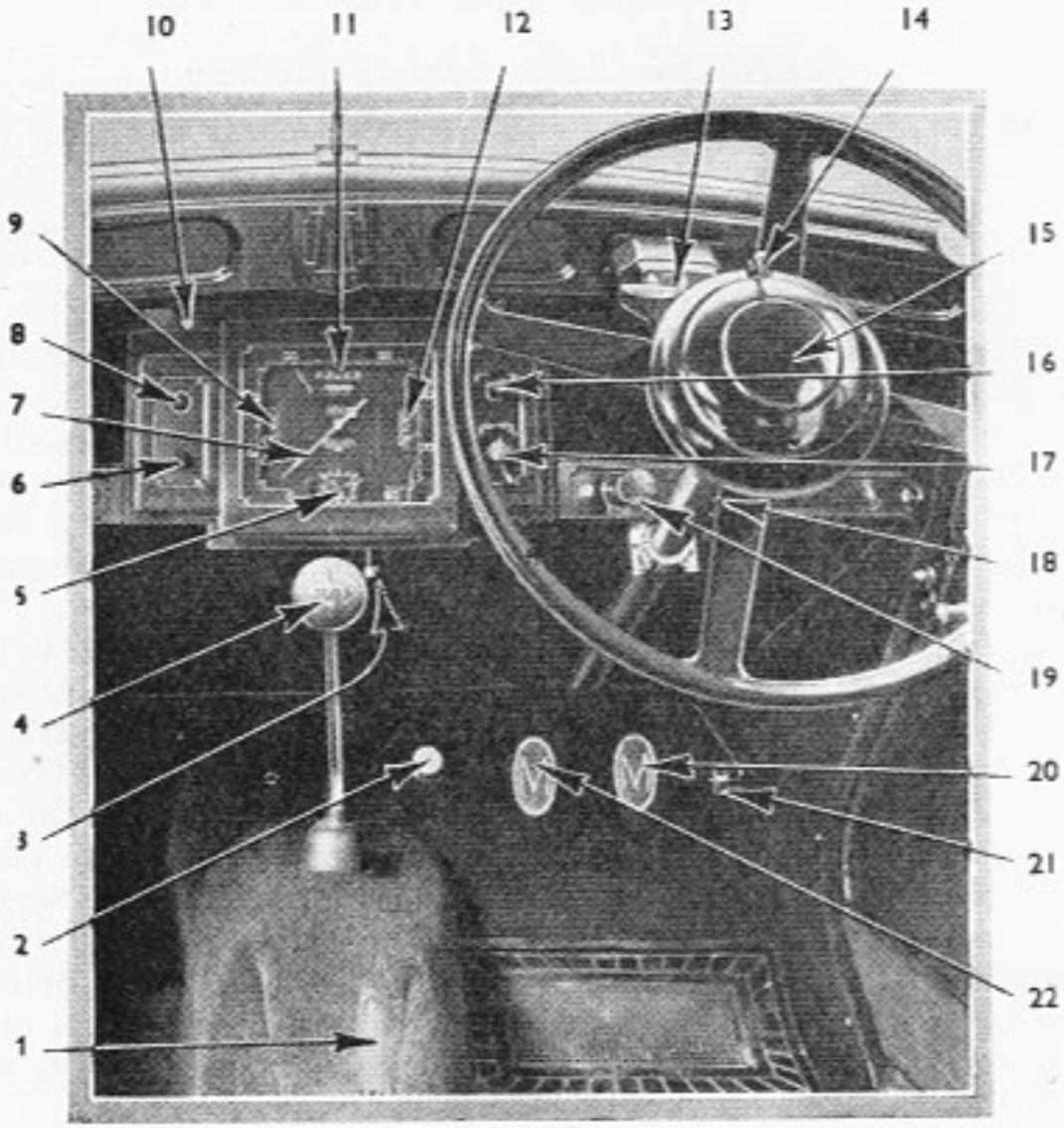


FIG. 38. THE CONTROLS ON A TYPICAL MODEL

1. Handbrake Lever
2. Headlight Dip Switch
3. Clock Key
4. Gear Lever
5. Clock
6. Panel Light Switch
7. Speedometer
8. Ignition Warning Light
9. Petrol Gauge
10. Scuttle Ventilator Control
11. Ammeter
12. Oil-pressure Gauge
13. Windscreen-wiper Switch
14. Trafficator Control
15. Horn Press Button
16. Starter Press Button
17. Ignition and Main Switch
18. Hand Throttle
19. Choke
20. Brake Pedal
21. Accelerator Pedal
22. Clutch Pedal

splashes of tar are found to adhere to the cellulose, they may be removed by using a cloth moistened with benzol, but do not use this treatment for the wings. In this case, you must resort to the use of Karpol Paint and Varnish Cleaner.

About once a week, having freed the body from mud and other foreign matter, thoroughly polish it with the special cellulose preparations, such as "Lifeguard," sold by your dealer. There are many polishes available, and it is up to the reader to find the one most suitable to his tastes.

As to the chromium-plated parts of the car, never on any account use metal polish for cleaning them, as these polishes contain a certain amount of abrasive matter. Remove the dirt by washing chromium parts with plenty of water and then polishing with a leather until bright. Careful washing with soap and water will restore the original brilliance of badly neglected chromium parts.

Leather upholstery may be cleaned with a cloth slightly moistened with water. If dirt is allowed to accumulate, it eventually works right through the pores of the leather and presents a soiled appearance which it is difficult to remedy. If it is found that this method does not properly clean the upholstery, then a little neutral soap, such as toilet soap, may be used.

Where pneumatic cushions are used, it is important that the inflation pressure be maintained correctly. A pressure which is too high does not protect the passengers from shock in the manner intended. Only a relatively low pressure is required, so that the base of the seat can be felt when the closed fist is punched into the centre of the cushion. Pressure is easily adjusted by means of valves situated beneath the protecting flap at the rear of the cushion. The valves at the side inflate the "butt-ended portion" running around the sides and front, and these can be inflated to a slightly higher pressure than the seat interior. The other valves serve the centre portion.

Two protruding tapes are attached to the valves to provide a finger hold. Pull gently on them until about one inch of the valve is protruding to reveal a stout rubber ring encircling the valve stem. Roll this ring down the stem towards the cushion, thus releasing the valve plug, which can then be removed. Do not roll back the valve stem.

Air can be put into the cushions by blowing with the mouth. When the desired pressure has been obtained, seal the valve by moistening the plug and re-inserting it into the valve stem as far as it will go. Then roll back the rubber ring into its original position, close to the head of the plug, which effectively seals the stem, and push back the stem as far as it will go into its socket until the domed head is flush with the surface of the cushion interior.

The carpets should be dusted frequently and, if possible, treated with a vacuum cleaner on occasions, as a carpet brush will not entirely remove all the dust which may work its way into the pile of the carpets.

The screws holding the door hinges to the body pillars should be examined about every 1000 miles, and, if necessary, each screw given half a turn with the screwdriver. Occasionally, the door locks may require some attention, and as the plate on the body pillar against which the bolt of the lock strikes, and the plate in which the pin on the door locates are both adjustable, this is a comparatively simple matter. A simple test can be carried out by closing the door and pressing the outside door handle inwards and then pulling outwards. If the lock bolt can be felt hitting against the inside face of the striker plate on the outward pull, the plate should be adjusted. With both the striker and pin sockets, each consists of a back plate attached to the body pillar, and a top plate attached to it by two cheese-headed set-screws. The abutting faces of these two parts are serrated, and by loosening the set-screws and moving the top plate inwards one or more serrations, the necessary adjustment can be made before re-tightening the set-screws. First set correctly the lock striker plate, and then move the pin socket plate so that it fits well up the pin.

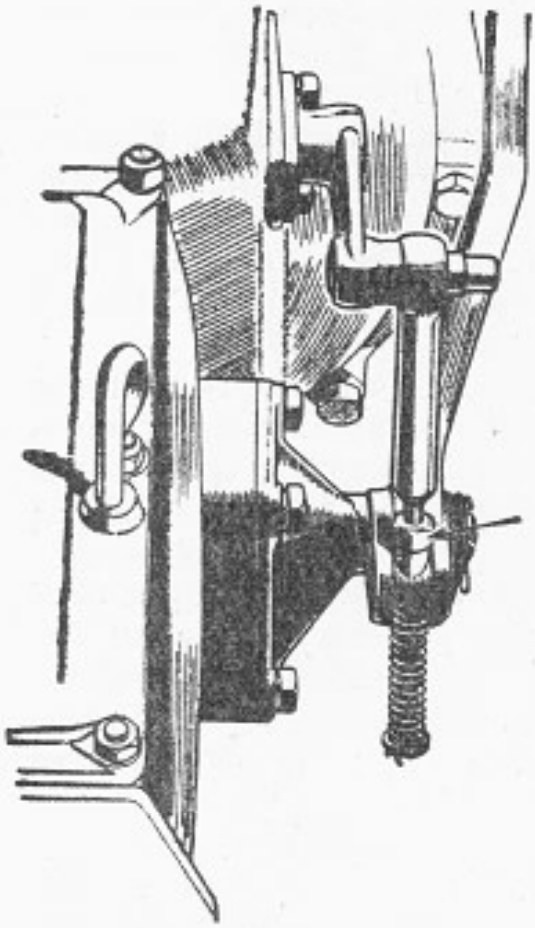


FIG. 39. CLUTCH ADJUSTING NUT

Most of the maintenance work having now been dealt with in previous chapters, it is only necessary to refer to one or two items that may require adjustment or attention.

In course of time the belt that drives the dynamo and fan from an extension of the engine crankshaft may become slack, but there is a method of adjustment readily available. Belt tension may be adjusted by slackening the bolt clamping the dynamo to the front engine bearer plate and raising the dynamo. The dynamo cradle swings on its upper anchorage, and the dynamo can be raised by hand until the required tension is obtained. Avoid placing too great a tension on the fan belt, as this will impose an unnecessary load on the bearing.

The clutch requires very little attention, but after considerable use it may be noted that the pedal is coming into contact with the floorboard when depressed. In these circumstances, the clutch

pedal operation is limited, and special provision is made at the bottom of the clutch lever whereby the exact position of the pedal in the car can be regulated. Adjustment is effected by means of the nut above the clutch pedal hub on the end of the clutch actuating link on models up to 1935, Fig. 39; and the clearance between the clutch pedal and its stop on the engine bearer arm should be set to 2 in., giving $\frac{3}{8}$ in. clearance between the pedal arm and the floorboard. On other types, the nut is situated at the end of the clutch-actuating cable. This should be held against rotation by engaging a spanner on the hexagon of the adjusting screw, so that the cable is not twisted in the process. The clearance between the end of the adjustable clutch pedal stop screw and the frame cross member should be set to 1 in., giving at least $\frac{1}{2}$ in. back play at the pedal.

If proper attention has been given to lubrication of the wheel hub as recommended in the lubrication section, no other attention should be required except that at every 10,000 miles the dust excluder protecting the wheel bearings may be cleaned. But as this work entails the use of a special hub withdrawing tool, you are recommended to have the work carried out by your Morris dealer.

The road spring clips securing the front and rear road springs to the axles should be examined periodically to see that they are bolted up tightly, as the majority of spring failures are traceable to the fact that slackening has occurred at these points and has not been attended to. Also inspect the clips on the nuts to ensure that no slackening has taken place.

CHAPTER VIII

IN CASE OF TROUBLE

THE Morris Ten is one of the most trouble-free of cars, yet, as with anything mechanical, troubles are likely to arise after considerable mileage, through inattention or from causes outside the owner's control. The charts at the end of this chapter will be useful as a ready guide to engine items, and the electrical equipment is dealt with elsewhere in a similar manner.

If ever an unusual sound emanates from the engine, take immediate steps to investigate the cause, and switch off the ignition. See that the oil gauge is registering the correct pressure immediately the noise develops; then examine the oil level in the sump, making sure that the noise is not due to shortage of lubricant.

An excessive accumulation of carbon deposit on the piston heads, valves and combustion chambers may result in a high-pitched metallic ring or "pinking" whenever the engine is pulling hard. This will gradually develop as the engine continues in use without attention, but should not be confused with the noise, ignition knock, caused by advancing the ignition too far. When an engine is caked with excessive carbon deposits, there will be a tendency for it to run rather hot and labour heavily on gradients.

Loose big-end bearings usually produce a rattle noticeable at speeds between 25 and 35 m.p.h. when the accelerator is only partly depressed and the engine is running light. If the engine is speeded up with the throttle a quarter open and the car at rest, the noise will usually develop, and can then be traced to the cylinder concerned by shorting the sparking plugs in turn. When the sparking plug is allowed to operate as usual, a heavier knock will be produced, but it must be remembered that the noise will be only slight even when a bearing has "run."

A loose gudgeon pin is noticed more readily at low speeds and produces a somewhat hollow sound, which is partly reduced by shorting the sparking plug, but not completely eliminated.

As soon as any unusual noise occurs, however, you are advised to consult the nearest Morris dealer, as he will give you an accurate diagnosis. It is bad policy to run an engine in any way faulty, as, unless the trouble is remedied immediately, excessive damage may ensue.

Condition	Probable Fault	Remedy
Engine will not start	Is ignition switch "on"?	
	Is petrol tank empty?	Replenish
	Is carburettor mixture control correctly set?	
	Sparking plugs fouled with oil or carbon	Clean as directed
	H.T. lead from ignition coil to distributor may be broken	Replace
	Filters of carburettor or pump choked	Take out and clean
	Petrol pump or petrolift not functioning correctly	See notes on this subject
	Air lock or stoppage in petrol pipe	Ditto
	Battery run down	Recharge
	Defective ignition coil	Replace
	Distributor points faulty	Reset and clean
	L.T. lead from coil to distributor or coil to ignition switch broken	Replace or repair
	Water in petrol feed	Clear out and replenish
Engine misses at high speeds only	Faulty sparking plugs	Clean and reset gaps
	Shortage of fuel	Remove obstructions in petrol pipes, dirt from filters, examine petrol feed
	Valves failing to function correctly	Inlet valve trouble indicated by "spitting" in carburettor; exhaust valve by banging in silencer. Examine valves
	Incorrect valve clearance	Reset
	Loose electrical connexion	Examine, particularly H.T. lead, coil to distributor. Replace if necessary
	Distributor contact points badly set or dirty	Readjust and clean

Condition	Probable Fault	Remedy
Engine misses at all speeds	Internal fault in sparking plugs, oil on points, carbon deposit, setting too wide	Clean and reset gap
	Faulty valve action	Test setting of valve tappet clearance. Is valve sticking in guide?
	Warped or badly pitted valves arising from faulty tappet setting	Replace
	Broken valve spring	Replace
	Insufficient fuel at engine due to clogged filters	Clean out
	Ignition wire loose or making intermittent connexion, particularly between coil and distributor	Replace or repair
	Distributor points not functioning correctly	Clean and reset
	Carburettor flooding	Remove dirt from needle valve seating, which causes rich mixture
Engine misses at low speeds only	Valves not seating properly	Test for distortion or faulty tappet setting
	Air leaks in induction system	Tighten joints between induction pipe and carburettor and induction pipe and cylinder block. Check joint gaskets and tighten up all nuts
	Carburettor setting faulty	See section of this book concerned
	Battery run down	Recharge

CONDITION	PROBABLE FAULT	REMEDY
Engine stops suddenly	Float chamber not receiving sufficient petrol supply (indicated by one or two restarts before engine finally stops, or by spitting through carburettor)	Check petrol system as already indicated
	Test flow from carburettor jet	See appropriate section of this book
	Test spark at plug points by removing plug, resting it on engine and observing spark when engine is turned by hand	If no spark, check distributor lead connexions to coil and distributor, check distributor contact breaker points, clean and reset, if necessary
		If spark still weak, check all electrical connexions
		If spark still weak, check coil as indicated
Engine "spits" through carburettor	Probable weak mixture	Check fuel supply to carb. float-chamber. Clean filters
	Air leaks in induction system	Proceed as outlined above
	Faulty tappet settings	Ditto
	Valve sticking in guide	Proceed as outlined in appropriate chapter of this book
	Plug gaps too wide	Reset
	Engine running too cold	
"Banging" in silencer	Faulty exhaust valve operation	Check clearance, if valve bent or pitted, replace. Free sticking valve
	Faulty mixture setting	Correct as indicated
	"Banging" in silencer when running downhill	Throttle not closing properly when foot removed from accelerator pedal. Check slow-running position and carburettor setting

Condition	Probable Fault	Remedy
Engine lacks power and is sluggish	General tightness of new engine	Will wear off after about 1000 miles
	Faulty ignition control setting	Keep at full advance for normal running conditions on models up to and including 1935
		On Series II types, automatic control may be seized. Lubricate
	Faulty carburettor mixture control setting	Readjust
	Excessive carbon deposit after long use	Decarbonize
	Faulty valves or valve clearances	Reset or renew
Engine runs hot	Radiator water supply too low	Replenish so that water is covering base of upper tank
	Ignition too far retarded	Advance, or check over automatic ignition
	Carburettor control at "rich" position too long	Return to "weak" position as soon as possible after starting
	Handbrake "on" or foot brakes adjusted too closely	Readjust
	Fan belt broken	Indicated by no charge on ammeter. Replace

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