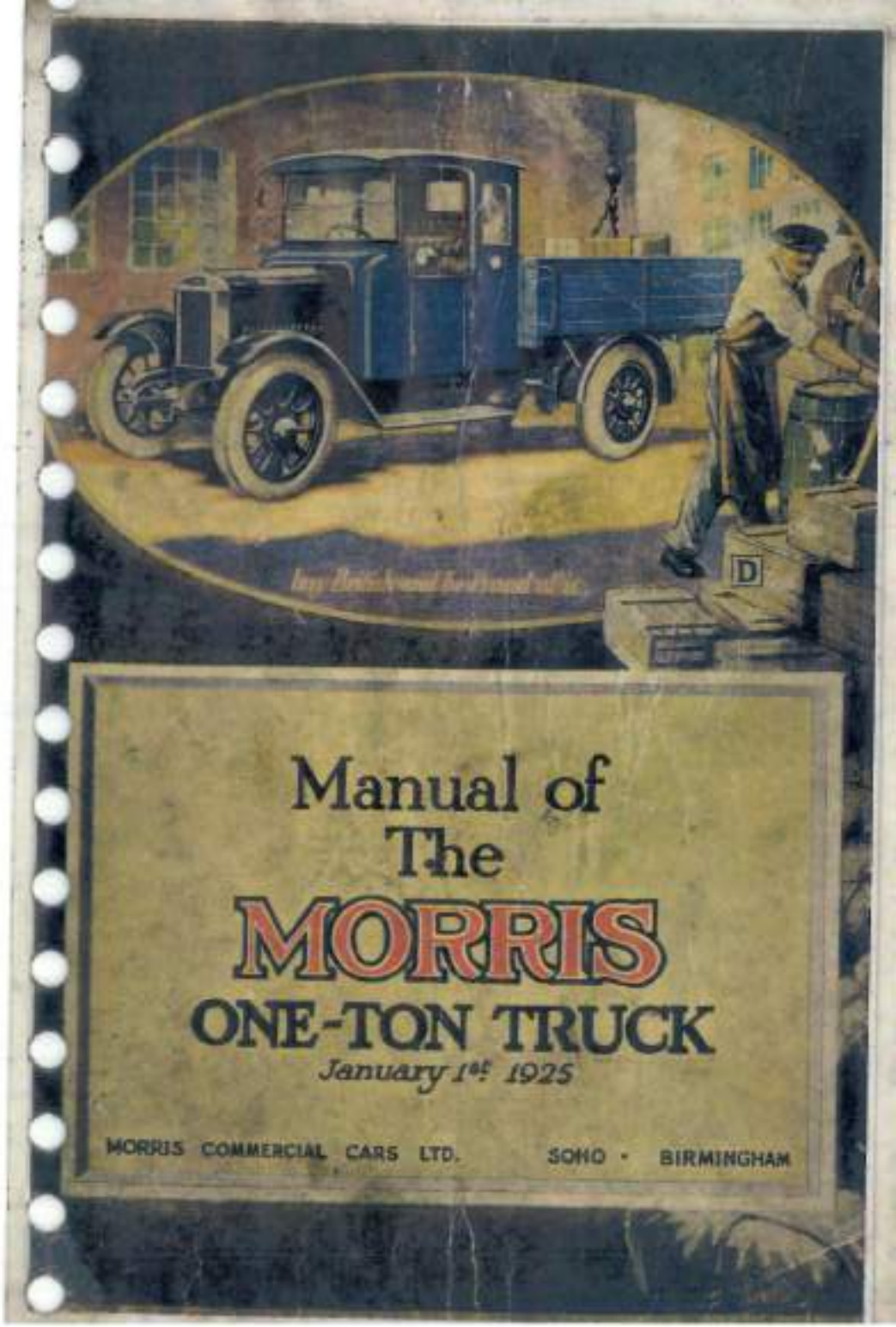

Manual of The MORRIS ONE-TON TRUCK

January 1st 1925

MORRIS COMMERCIAL CARS LTD. SOHO · BIRMINGHAM

THE MORRIS TON TRUCK MANUAL

1925 EDITION

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MANAGEMENT, CARE AND UPKEEP OF THE

MORRIS TRUCKS

The Morris Truck Chassis, as delivered at the Factory.

THE Morris Trucks are serviceable, trustworthy, economical and reliable vehicles, capable of transporting their respective loads over any road in the most economical manner possible. They are built of the finest material procurable, and before they were put into production every care was taken to see that the design was without fault.

The following instructions, if carried out faithfully and regularly, will result in the vehicle giving absolute satisfaction, and it is hoped that all those who have Morris Trucks

under their care will carefully peruse and assimilate the information herein given.

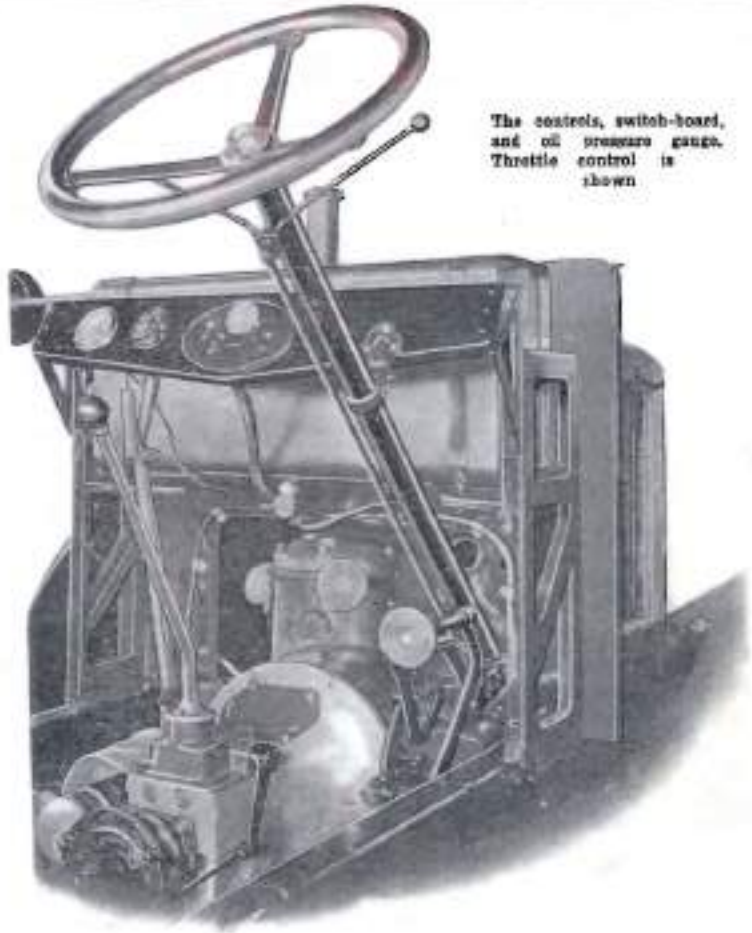
Loading.

There are no hard and fast rules as to the loading of the vehicle. Common sense is the best guide, but obviously, to reduce strain on the bodywork and chassis, the load should be evenly distributed over the floor space so far as is possible. Where half loads are being carried they should be set as far forward as is practicable in the body, so that no undue strain is placed on the rear springs or the rear part of the bodywork. In the case of the open lorry model, the tail board is sufficiently strong to stand normal use, but it should not be used as a platform on to the edge of which packages and cases weighing over 7-cwt. can be hoisted with impunity.

Filling Up and Starting.

PETROL. Before the Morris Truck is taken out on to the road, the Driver should make certain that there is a supply of petrol in the tank, the filler of which projects out of the centre of the scuttle in front of the wind-screen. The neck of the filler although strong, should not be used as a support of a heavy funnel into which a full tin of petrol is carelessly dumped. The tank holds over eight gallons so that four tins of fuel can be poured in when there is still half a gallon or so remaining at the bottom of the tank. The petrol tap is situated underneath the centre of the bottom of the tank, inside the Driver's cab, and to turn on the petrol the brass handle is unscrewed three or four turns to the left. This tap has a petrol-tight seating and no undue pressure need be used when turning off the petrol (screwing to the right), otherwise the seating may be damaged. Either Shell petrol or a benzole mixture will be found satisfactory. The latter eliminates any possibility of "pinking."

OIL. The oil filler of the engine is situated on the right-hand side (facing forward) and the concave conical aluminium cover, when pulled up, will be found to have a flexible shaft attached to its centre. At the bottom of this shaft there is a dipper gauge with marks on it which tell the amount of oil in the sump. If this rod becomes coated with oil throughout its length, it should be wiped, inserted into the hole in the centre of the filling orifice, pressed down to the centre and withdrawn, when it will register the oil level correctly. Before starting out, the oil level should be up to the "full" mark on this rod, care being taken to see that the truck is standing on fairly level ground, otherwise a false reading may be obtained. The water in the radiator should also be inspected, and if it appears low, sufficient should be added until it begins to flow out of the overflow pipe.



The controls, switch-board, and oil pressure gauge. Throttle control is shown

Switches (*see also separate section*).

On the dashboard, inside the Driver's cab, will be found a black oval switch-board which has in its centre an ammeter, and on either side of this are the switches. The left-hand switch controls the dynamo. When turned anti-clockwise as far as it will go, until the line is opposite "D," this switches on the dynamo so that when the engine is running the battery is being charged (see further note on charging). The right-hand switch controls the lights. When vertical, both lights are off; when turned to the "S" position the lamps are dim (suitable for town driving), and when turned in the opposite direction the

lights are full on (for country driving). The tail lamp comes on, no matter whether the forward lamps are dim or bright.

The magneto switch is placed between the oil gauge and the oval switch board.

IGNITION AND THROTTLE. Underneath the steering wheel will be found two levers, one on the right and one on the left. The one on the right controls the throttle and thereby the amount of gas being supplied to the engine. Its main use, however, is as a slow running and starting adjustment which enables the throttle to be kept away from the fully shut position when starting up from cold. The chief control for the throttle is the accelerator pedal, the centre one (small) of the three at the bottom of the steering wheel. The left-hand lever underneath the steering wheel is the magneto advance and retard. The retard position is up and the advance down or toward the Driver. The throttle adjustment is shut when it is furthest from the Driver, and open when it is down or toward the Driver. Reverting to the pedals, the left-hand pedal, following the ordinary custom, controls the clutch and the right-hand the foot brake.

Gears.

The gear levers of Morris Trucks have what is known as an "invisible" gate. If the Driver imagines the capital letter H with its cross bar running across the chassis, he will find that on moving the gear lever its motions correspond to the side lines and cross bar thereof. The position of the gears is as follows: First speed, left back. Second speed, to the right and forward. Top, to the right and back. Reverse, to the left and forward. The gears are in neutral when the gear lever can be moved easily from side to side—that is, along the cross bar of the capital H so to speak.

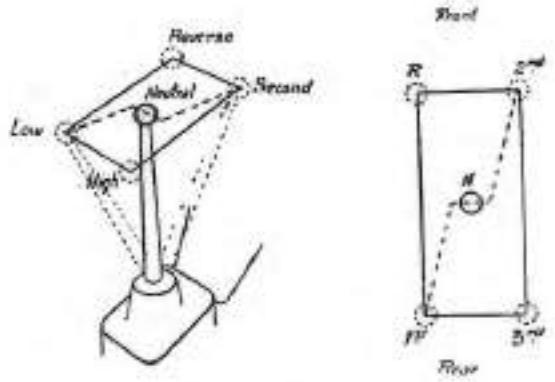
Carburetter Strangler.

When the Driver is at the starting handle facing the radiator, he will find on the left-hand side of the radiator and at the bottom thereof a length of wire with a loop at the end of it. Pulling this wire closes a shutter in the carburetter which reduces the supply of air and creates added suction on the jet. This has the result of providing a stronger mixture for easy starting from cold. A word of warning is necessary here. **Once the engine is started this wire must be released, otherwise the speed of the engine will cause too much suction on the jet, resulting in an over-rich mixture which not only fouls the sparking plug points, but washes the lubricating oil off the cylinder walls.** Also it may be too rich to fire, the result being that the engine will stop. If this strangler be closed and the engine swung when it is warm, too rich a mixture even to start will be drawn into the cylinders. If this cause of difficult starting is suspected, the engine should

be switched off, the throttle opened fully and the starting handle given four or five brisk swings. This is only likely to happen if the strangler is used when the engine is warm in hot weather.

Starting Up.

Before endeavouring to start the Morris Truck the following points should be checked over. The hand brake lever (in the centre of the Driver's cab) should be pulled back as far as it will go. The gear lever should be in neutral, that is, should be free to move sideways easily. The petrol tap should be turned on (two or three turns to the left) and the magneto switch should be moved to the "ON" position. The ignition control lever (left-hand underneath steering wheel) should be set half way



The gear positions of the Morris Truck.

between its two limits of travel. The right-hand lever (slow running adjustment) should be pulled down about 1in. or 1½in. from its fully shut position (the throttle is shut when it is right up). The Driver then goes to the starting handle and holding the wire that controls the carburetter choke with his left hand, engages the starting handle by pushing it inwards and gives the engine a brisk swing. There is a certain amount of knack in swinging any car engine, but the Morris Truck requires less effort than do most. It is preferable for the handle to be engaged at the bottom of the stroke and for the first motion to be an upwards pulling movement. The thumb should never be placed round the starting handle. This is a safeguard against injury from possible back fires.

If the above points have been carried out, the engine will start, and immediately it does so, the carburetter choke chain should be released. The speed of the engine can be controlled

by the right-hand lever underneath the steering wheel. Pulling it down speeds up the engine, and *vice versa*.

WARMING UP. It is always advisable—and particularly is this so in the case of a new vehicle—that the engine should be allowed to get warm gradually before it is called upon to do any heavy work, and it is well, therefore, to let the engine run gently in "free" for about five minutes before the truck is taken out on to the road. The warming up process can be assisted in winter by placing a rug or some sheets of paper over the radiator. It can be presumed that the engine is warm enough when the top of the radiator is hot enough to feel just uncomfortable to the hand.

Driving Hints.

The low gear of the Morris Truck is particularly low and the engine should not be allowed to race on this gear, a change into second being made almost immediately the vehicle is started, if it be on level ground. The gears will be found to change perfectly easily and care should be taken to avoid "kissing" the teeth of the reverse gear when changing from first to second. This can be very easily done by applying a diagonal pressure with the hand on the gear lever, the pressure being directed towards the right-hand front wheel. This will both disengage first gear as soon as the clutch is depressed and also move the lever across the gate when it has travelled forward sufficiently. Gears on the Morris Trucks are best changed fairly slowly with the clutch fully depressed. This applies both from first to second and from first to top. When changing down from top to second, we strongly recommend the practice of double declutching—that is, letting in the clutch and speeding up the engine with the gear lever in neutral. It makes for better gear changing, less noise, and is the hall-mark of the practised driver.

When no night driving is being done, the dynamo should be kept on "charge" for about half an hour each day. When the lights are in use, the dynamo should charge while the lights are on and also for a corresponding period during the day time.

Brakes.

Both the hand and foot brakes of the Morris Truck take effect on the back wheels, and when descending a very long hill it is advisable to use the foot and the hand brake alternately to check the speed, this practice preventing the fabric on the shoes from heating up and burning. When descending a very steep hill which apparently requires both the brakes to check the speed of the truck, we strongly recommend the practice of changing into second or even first gear, which causes the engine automatically to act as a brake. The ignition switch should not be

turned off during this procedure, otherwise plug points may become foul with unconsumed oil and petrol.

New Engines.

When the truck is given its first run, it will be noticed that power is lacking for about 150 to 200 miles. The reason for this is that the engine is stiff on account of the bearings being a very close fit. As the truck is further used, however, this lack of power will gradually disappear as the bearings are being run in. If the engine was not built with very tight bearings, a knock would very soon develop and the life of the bearings diminish. There will be a progressive improvement in the engine and the truck generally for the first 1,000 miles, if proper care is exercised. It is a great mistake to drive a new truck fast. If the owner will content himself with speeds up to 20 miles per hour on top gear, and 12 miles per hour on second gear for the first 1,000 miles, the working surfaces will become well polished and bedded down, and the life of the truck very considerably prolonged.

Note.—Articles dealing fully with road courtesy and correct truck driving are regular features of *The* MORRIS *Owner*, the monthly motoring journal published by Morris Motors, Ltd. It can be obtained to order from any newsagent, or the Morris dealer who sold you your truck will supply copies regularly.

The Magneto *(see also separate section)*

When ignition trouble is suspected, before interfering with the magneto verify that the sparking plugs, cables and connections are correct. Check the spark gap at the plug points. These points are liable to distortion from heat and sometimes open up too wide, when difficult starting and spitting back will occur.

If these are in order, turn the engine slowly by hand with the lower cover off the magneto and watch if the contact-breaker lever works properly. This is bedded in a fibre insulating bush, and in damp weather there is an occasional danger of this material swelling and sticking. If this happens, ease it out very slightly in the hole and clean the steel pin with fine emery cloth.

The platinum points on the contact-breaker should open to a maximum distance of 0.5 millimetre or a full 1-64 inch. The points only need adjustment at very long intervals. Should they become pitted or burnt they may be dressed with a dead smooth file, the least amount possible being taken off, but this is rarely necessary.

The distributor should be cleaned every 1,000 miles. Undo the securing nuts, remove the distributor and wipe out the inside with a dry rag. See that the brush on the rotating arm is clean before replacing.

Give the magneto two or three drops of oil every 500 miles at the lubricator.

Valve Timing.

The plug provided in the cylinder head of No. 4 cylinder should be removed, and a thin rod inserted. The engine should now be turned until the piston of No. 4 cylinder comes to the top of its stroke. This position is called the top dead centre. The engine should then be slowly turned by means of the starting handle until the piston has gone down on the suction stroke a distance of 5½ millimetres. The exhaust valve of this cylinder should then be just closing, the tappets having *previously been set to a clearance of* 8-1,000ths of an inch. This is necessary owing to the slight rise at beginning of lift, making it difficult to get a correct reading. When the valve timing is finally adjusted, the tappets can be reset to 6-1,000ths of an inch all round.

(*See timing diagram on page* 80.)

Timing the Magneto.

When our trucks leave the Works the magneto is set to fire the charge when fully retarded, with the piston at top of stroke. Should it be necessary to recover this setting, proceed as follows.

Turn the engine slowly till the exhaust valve of No. 4 cylinder is just closed. No. 1 cylinder will now have its piston at the commencement of the working stroke.

In all trucks a plug is provided in the cylinder head over No. 4 cylinder. By removing this and inserting a thin rod the piston movement may be observed, and the engine timed accurately.

Slacken the nuts locking the coupling between the magneto and the engine. Turn the advance and retard lever till it is as far forward as it will go. Remove the cover of the contact-breaker and turn the armature of the magneto till the fibre block rises on the inclined plane just enough to separate the points and the carbon brush in the distributor is immediately opposite terminal No. 1. This is the firing position. Lock the magneto coupling and check the timing again to see that no movement has taken place during the fixing. The magneto is now set fully retarded.

Valve Tappets.

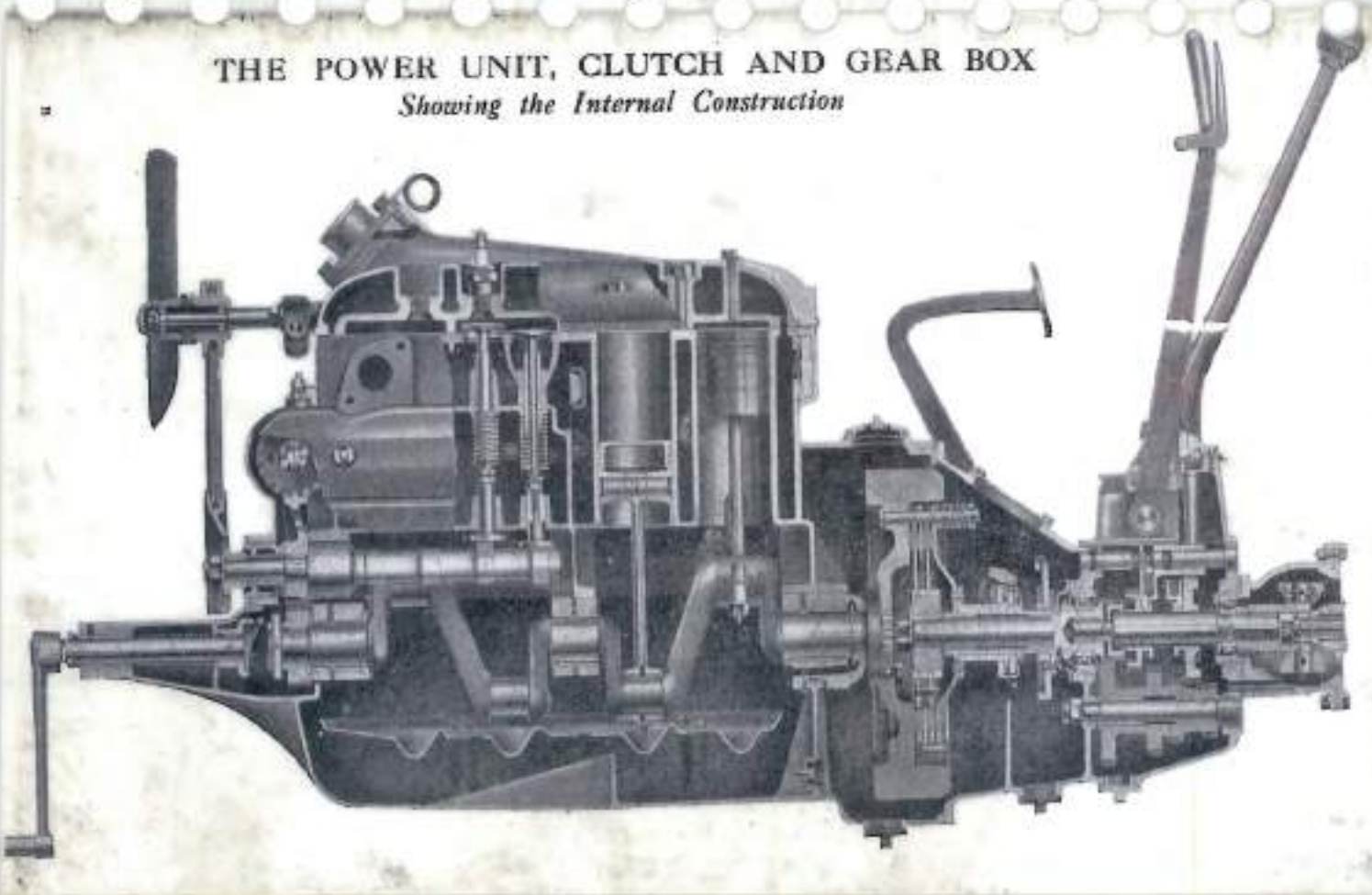
These should be adjusted to give a play of .006 inch for both inlet and exhaust valves between the end of the valve stem and the head of the tappet adjusting screw, this clearance obtaining when the engine is hot. If the tappets are set with the engine cold an extra .001 inch must be allowed to compensate for the expansion inevitable with the rise in temperature.

When the valves are ground in the tappets *must* be reset and it is advisable when the car has run 50 to 100 miles after resetting to again check the clearance as valves have a tendency to "bed down" a little after having been disturbed.

When checking clearances turn the tappet through one complete revolution and make sure that the figure given above is the

THE POWER UNIT, CLUTCH AND GEAR BOX

Showing the Internal Construction



minimum in all positions. When tightening the adjusting screw lock nut it is not impossible sometimes to throw the adjusting screw slightly out of line with the result that different positions of the tappet give slightly different clearances.

Cam Shaft.

To adjust this for end play, first remove fan pulley. Two holes will be found in this to enable an extractor to be used. Then remove cam-shaft front cover and take out a sufficient number of the thin washers which will be found at the back of it to allow an end play of .003 inch to .004 inch only. This adjustment is seldom, if ever, necessary; but occasionally a slight knock in the engine may be traced to this cause.

Crank Shaft.

To take up wear of crank-shaft bearings, commence with the centre bearing by taking off the bearing cap and removing one pair of the thinnest washers. When all the bearings have been taken up, it should just be possible to turn the crank round with the starting handle. Care should, however, be taken to ensure that this tightness is not caused from one bearing only. The aluminium bottom half of the crank-case must, of course, be removed before the above operation can be commenced, care being taken not to damage the joint faces.

Connecting Rod.

The big-end bearings are taken up in a similar way to crank-shaft bearings.

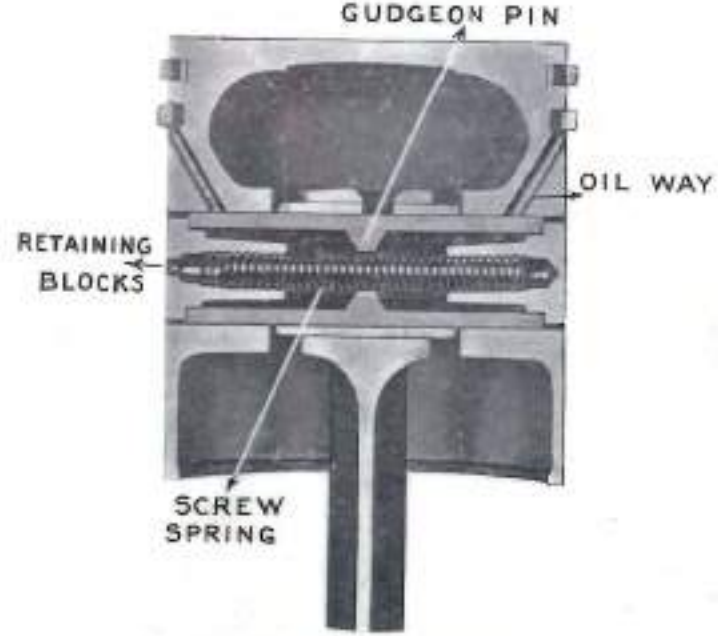
If it is necessary to draw a piston from its cylinder, note that the connecting rod is not symmetrical, but that the big-end bearing is offset from the centre line of the rod. It is therefore most important to see that the connecting rod is replaced correctly. The elongated portions face one another on crank-pins Nos. 1 and 2 and 3 and 4 respectively. See also that the oil dipper is the right way round and will lift oil to the bearing as the crank-shaft revolves.

Piston Rings.

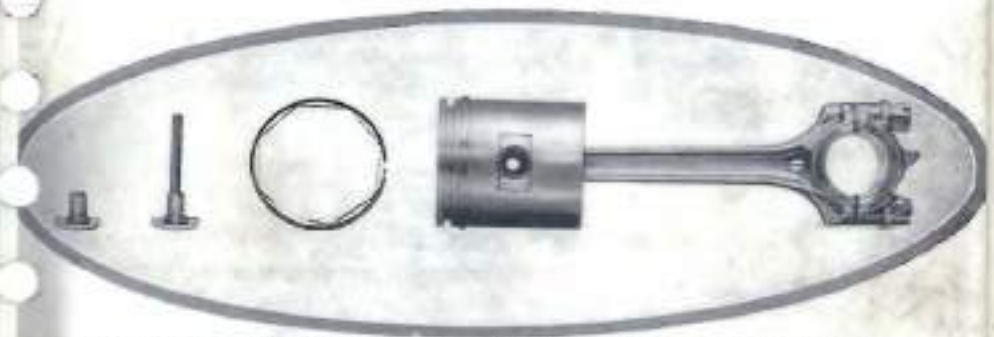
To remove a piston take off the big-end bearing cap, when the piston can be withdrawn through the crank-casing. Piston rings can be removed by working one or two pieces of strip tin underneath the rings, which may then be lifted out of the groove. The grooves should be scraped quite clean from any carbon deposit before replacing the rings. When fitting new rings, try these in the cylinder bore to see that the ends do not butt up, but leave a space of about .004 inch. The rings should move quite freely in the grooves, but should have no vertical movement.

When replacing piston and connecting rod, see that the opening of the oil dipper in the big-end bearing cap points towards the off side of the engine.

To remove the gudgeon pins in the latest engines the following method is employed. On each side of the piston a brass segment will be found. One of these has a hole in its centre. A piece of



Section of piston showing gudgeon pin and fixing.



The component parts of the piston assembly. Left, keeper blocks and retaining spring screw; centre, the top piston ring with internal pressure spring; and, right, the piston and connecting rod

stout wire or thin rod pushed through this hole will cause the opposite segment to come out of its seating against the tension of an internal spring. The protruding segment can now be unscrewed, pressure still being retained on the piece of wire. The segment will unscrew right off, after which the other segment can be shaken out. This enables the gudgeon pin to be pushed out.

To replace the segments, the one without a hole should be screwed into the other when it is in position, the spring being kept extended by the wire or rod until the screw action is "home," when the spring will bed the segment into place.

The top piston ring has the majority of its "spring" lent to it by the internal centering ring. Therefore, it is essential that these rings should not in any circumstances change places. The bottom

Scraping carbon from the cylinder head after it has been removed.

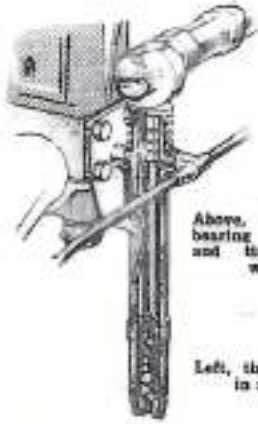
piston ring is a piston ring of the normal type which exerts spring pressure without any centering ring. Care must be taken not to change the rings and to state, when ordering spares, which ring is required. Also the spring ring, which must always go under the top ring, must be fitted with its opening opposite the gap in the cast iron ring.

Where possible, for adjustments to cam-shaft, crank-shaft, connecting rods, piston, etc., a competent mechanic should be employed.

The Cylinder Head.

The cylinder head is easily and quickly removed for decarbonization purposes by removing the fifteen holding-down nuts, having first slackened the clamping bolt on the fan stud and taken off the fan assembly; carefully scrape off all carbon deposit from the inside of the cylinder head and the top of the pistons. When replacing the cylinder head, care should be taken that no loose

ENGINE DETAILS



Above, the three-bearing crankshaft and timing gear wheel.

Left, the oil pump in section.

An endwise section of the engine showing dipper troughs, oil filler and dipper rod, etc., etc.

particle of carbon or dirt is adhering to the top face of the gasket. The valves should also be inspected for any loose carbon which may have adhered to the seating.

The gasket should be covered on both sides with "Goldsize" before being placed in position. When clamping down the cylinder head, a start should be made with the inside row of nuts, commencing with the centre one, before the outside ones are touched. Care should be taken to get an even pressure on each stud. This is obtained by going over all the nuts in rotation three times, gradually increasing the nut pressure. If one end is tightened up at the first, it will be found impossible to get a joint. Having done this, start up the engine and allow it to run till thoroughly warm. Then go round all the nuts and screw down as tightly as possible. It is most important that this instruction be closely followed. After having removed the cylinder head three or four times, a new gasket should be fitted. Before fitting a new gasket examine it to see that it is uniform in thickness, otherwise it may prove impossible to make a satisfactory water-tight joint.

Clutch.

The clutch provides four friction surfaces. The driving surfaces comprise (*a*) the rear face of the flywheel, (*b* and *c*) both faces of a floating plate, (*d*) the forward face of the clutch pressure plate. Six clutch driving pins pass through the flywheel, the floating plate and the pressure plate, all of which consequently revolve with the engine.

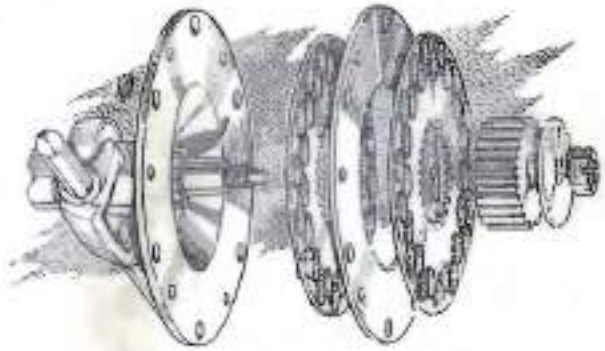
The driven surfaces comprise a double line of cork insets in two steel plates, the plates themselves being mounted on a toothed driving hub keyed on to the driving shaft carrying the direct drive, *i.e.*, top speed, one plate being between the flywheel and the floating plate, the other between the floating plate and pressure plate.

Driving pressure for the clutch is derived from helical springs on the driving pins outside the pressure plate. Sketches showing the general construction are given herewith.

The clutch must run in oil. Persistent slipping of the clutch must not be resorted to.

Owing to its granular structure, cork consolidates considerably under pressure. The effect of this in the clutches under consideration is to allow the pressure plate to take up a position closer to the engine flywheel, and as this plate carries the withdrawal hub with which the withdrawal fork engages, and which is attached to the clutch pedal, a corresponding movement takes place in the pedal itself, causing it to come forward and project into the body of the truck. There is a possibility that when this happens, the clutch pedal may move to such an extent that it touches on the bottom of the slot cut for it in the foot-board. Assuming that this has occurred, it will be at once seen that some of the useful

tension of the clutch springs will be dissipated at this point instead of being concentrated in keeping the driving and driven plates of the clutch in close contact. The more pressure there is on the foot-board the less pressure is available in the clutch, and consequently there is a danger of slip starting. Special provision is made in the hub of the clutch pedal, whereby the exact position of the pedal in the truck can be regulated, and an adjustment here must be made to compensate for any movement which may occur through the above cause. This point is of particular importance



The clutch, showing the cork inset driven plates.

The two halves of the ball joint housing with ball joint locking ring.

The torque tube ball joint which should be lubricated weekly via the Tecalemit nipple on top of the ball joint housing.

during the first 2,000 miles of running, as by the time this mileage has been covered, the natural consolidation of the corks will be practically completed, and very little further movement is to be expected.

Should the clutch show signs of slipping at any time, examine the clutch springs, as the trouble may be due to the breakage of one of these.

Steering Gear.

If the steering-column shaft shows signs of end play, this may be corrected by slacking back the lock-nut and giving the adjusting nut a fraction of a turn. Care should be taken to lock the lock-nut in position again.

If it is desired to alter the slope of the steering-column, loosen the lock-nut securing the steering-column adjusting bracket to the steering-column support bracket, and slack back the clamping bolt which holds the steering gear box rigid in the bracket which supports it from the engine. Remove also the three bolts which hold the steering-column steady bracket to the instrument board, easing off at the same time the screws in this bracket which clamp it to the column itself.

The column may now be set to the desired slope and securely locked in position again. Some attention, however, will be found necessary to the holes in the instrument board and a thin wedge packing when re-fitting the steady bracket.

A complete worm-wheel is provided, and may be set in either of two positions. Should the steering wheel show an excessive amount of play, all the connections between the steering-gear box and the front axle should be examined to detect any looseness. If no looseness is apparent, there is probably some wear in the steering worm-wheel, which should be turned 90° to a new position. If the steering lever is removed, the worm-wheel can be turned through 90° by rotating the steering wheel, and the lever put on in the new position.

Adjustments.

BRAKES. The only adjustments likely to be encountered in ordinary events with the Morris Truck are those on the hand and foot brake drums. These are extremely simple. On removing the floor boards in the Driver's compartment, there will be found rods running back from the brake pedal and lever. These rods are provided with turn buckles which have right and left threads respectively at their ends. To take up the brakes, the nuts at the end of the turn buckles are slacked off, it being remembered that one of these nuts has a left-hand thread and therefore will undo in the direction opposite to normal. The turn buckles should then be revolved in a right-hand direction,

looking forwards. This will have the effect of shortening the rod and will take up the wear of the fabric on the shoes. Normally, three complete turns of the turn buckles will suffice to take up the brakes, but this naturally varies according to the amount of wear they have had. **It is always advisable to keep the brakes well adjusted so that their full power is always available in case of emergency.**

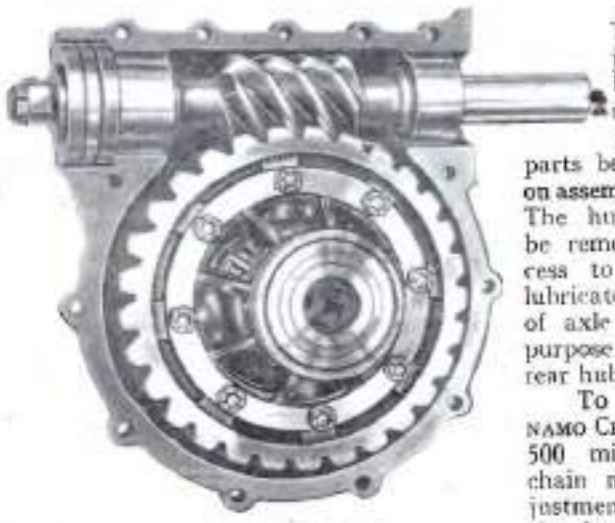
REMOVING BRAKE DRUMS TO RELINE SHOES. When it is necessary to reline the brake shoes these can be reached and detached after the brake drum, which is combined with the hub, has been removed. First of all, take off the brake drum covers or shields, which can be done by removing their holding bolts, the heads of which project. Then remove the hub cover plate and detach the wheel which will expose the head of a counter sunk screw. This screw should be taken out. The special tool shown in the accompanying illustration should then be fixed in position so that its tongue engages with one of the castellations on the hub locking nut. When purchase has been found the brake

The brake assembly with dust shields removed showing special tool in position and engaging with the castellations in the hub locking ring.

drum and hub can be unscrewed. This can best be effected by replacing the detachable wheel on its studs, and it should be noted that both the right-hand and the left-hand hubs have the same thread, the disassembly being carried out by turning the brake drums and hubs anti-clockwise when facing the differential in each case. When the lock-nut has been unscrewed, brake drum and

driving shaft can be pulled out, and this exposes the brake shoes to view. They can then be detached in the ordinary way and relined on the bench.

To re-assemble, the driving shaft is inserted in the axle and engaged in its splines in the differential, and with the special tool still holding the locking ring, the hub and brake drums are screwed up tight. It will be found that there are three holes drilled for the grub screw which holds the brass locking device and a selection of one of these three holes ensures that the hub can always be locked absolutely tightly. In the latest type of back axle, however, the construction is somewhat different, and the following procedure should be adopted when removing brake drums and hubs. The removal of the road wheel exposes three counter sunk locking screws securing the brake drum in position on the hub. When these screws have been taken out the brake drum, which is a tight fit on the wheel studs, can be drawn off, exposing the brake blocks. The removal of the outer pair of blocks from the brake camshafts will then give access to the five stud nuts, locked by turned-over tab washers, on the hub flange. Ease up the tongue of the tab washer and unscrew the nuts from the hub studs. This will then release the hub shell which can be drawn off, leaving the ball bearing and bearing cover mounted on the axle tube. The axle shaft when the stud nuts are removed will also come away as part of the hub shell.



The construction of the Morris back axle worm drive and differential.

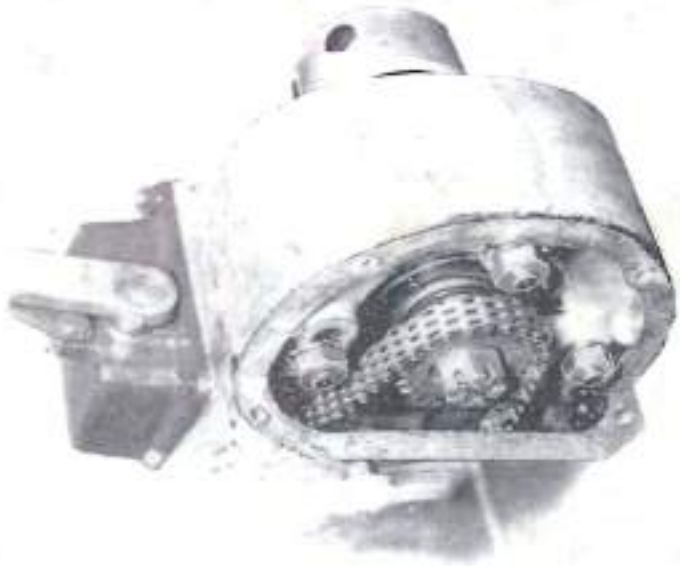
BACK AXLE. There are no adjustments of any kind that can be made to the back axle gearing, all parts being correctly set on assembly at the works. The hub covers should be removed to give access to the Tecalemit lubricators fitted in end of axle shafts for the purpose of lubricating rear hub bearings.

TO TIGHTEN DYNAMO CHAIN. After about 500 miles the dynamo chain may require adjustment. This is very simply effected by removing the cover plate which is found on the left-

hand side of the gear box and which covers the forward end of the dynamo housing. The dynamo itself is held into its housing by three bolts and nuts, the upper two of which are fitted in slots, the lower one being ordinarily fitted in its hole. The three nuts should be slacked off about one and a half turns each, when the dynamo can be pressed outwards away from the gear box, pivoting, as it were on the lowest bolt. As much pressure as can be applied by hand is sufficient to ensure correct tension of the dynamo chain and while pressure is still being maintained one of the top nuts should be tightened home after which the other two can be similarly dealt with. When replacing the cover plate, care should be taken to see that it is oil tight, that the washers are not damaged, otherwise oil leakage may take place.

The new type of hub design in which it is not necessary to use any special tools for the removal of the hub and brake drum.

Showing the three counter sunk locking screws which hold the brake drum in position.



The dynamo cover plate removed showing nuts and slots for adjusting tension of dynamo driving chain.

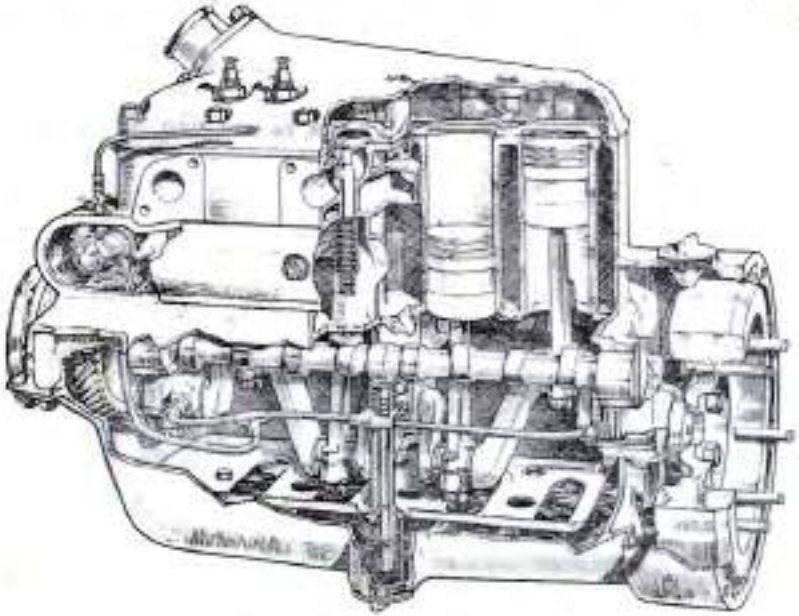
Another view of brake blocks and hub showing special tool, used for removal of brake drums, in position.

SECTION II.

Lubrication

Engine.

THE oil supply is carried in the sump of the bottom case. To the side of the top case an oil-indicator rod is fitted. This rod is graduated at its lower end, while the upper end carries a large head, which pushes into the crank case. By drawing the indicator rod out, the quantity of oil in the sump can be read off



A cut-away view of the Morris engine, showing all the lubricating system.

from where the oil adheres to the rod. When the oil level reaches the mark "Full" on the indicator rod the sump contains one gallon approximately. This should suffice for 250 miles, when the loss should be replenished. The oil level should never be allowed to fall below the ½ mark.

In checking the quantity of oil in the sump, the rod should be withdrawn, wiped clean and re-inserted before taking the reading. Owing to the surging and splashing of the oil when the engine

and truck are in motion an accurate reading is not otherwise possible.

A plunger pump is carried on the upper half of the crank-case, the plunger being operated from the cam shaft. The oil is pumped from the sump to troughs under the different bearings, having to pass a filter before reaching the pump. An oil pressure gauge is provided on the instrument board. The actual reading on the gauge may be found to vary considerably, not only on various trucks but also on the same truck under varying conditions. The action of the lubricating pump, which is driven automatically by the cam shaft, is to keep the three main crank shaft bearings constantly washed with oil, this oil passing from the bearings to the tray under the connecting rods, where it lubricates the "big-ends" and cylinders, and to deliver oil to the timing wheels and cam shaft.

For the latter duty no pressure is required, as there is a free delivery of oil through an outlet of suitable size in the piping system. A pressure, however, is developed at the main bearings, the amount of which will vary with the viscosity of the oil used, the depth and extent of the oil grooves cut in the bearings and the bedding of the crank-shaft journals in the bearings.

It will be found on first starting up the engine from cold, a reading up to 10 to 12 lbs. per square inch will be obtained. As the engine warms up and the oil consequently becomes more fluid this pressure will steadily drop, till a reading of 1 to 4 lbs. only is registered. It must be understood that so long as **any** pressure is registered on the dial it is an indication that the pump is functioning, and the **amount** of pressure shown is immaterial. The function of the pump is to keep the main bearings washed with oil. It is powerful enough to do this with thick viscous oil, which involves a pressure of say 12 lbs., but pressure of itself is no advantage, and exactly the same quantity of oil is delivered whether the pressure registered is 1 lb. or 12 lbs.

The filter should occasionally be dismantled and cleaned. To do this, unscrew the large plug at the bottom of the sump, when the oil filter, which is attached to it, may be withdrawn.

In the bottom case are fitted the troughs for feeding oil to the connecting-rod big ends through the oil dippers which are fitted to same. It is, therefore, most important to watch that this dipper is fitted on the right way, if the connecting rod has been taken out and refitted. The cylinder walls are oiled by splash. The pistons are slightly bevelled off below the bottom piston ring, and a number of small holes drilled through the piston. This allows any surplus oil to be scraped off the walls, thus letting only the exact amount of oil necessary for perfect lubrication to pass; this gives that faint blue smoke from the exhaust on first starting-up which

assures the experienced motorist that "All's well" with pistons and cylinders.

The gudgeon pin takes its bearing in the piston, and therefore gets ample lubrication from the cylinder walls.

The tappets run in an oil bath, the tappet chamber itself being full of oil normally. This ensures perfect lubrication, but when the tappet chamber cover plate has been removed for tappet adjustment it is important to see that the joint between it and the cylinder block is perfect when replacing since any persistent leakage at this joint will put up the oil consumption considerably. As such leakage would only occur while the car is in actual use there is a possibility of its being overlooked.

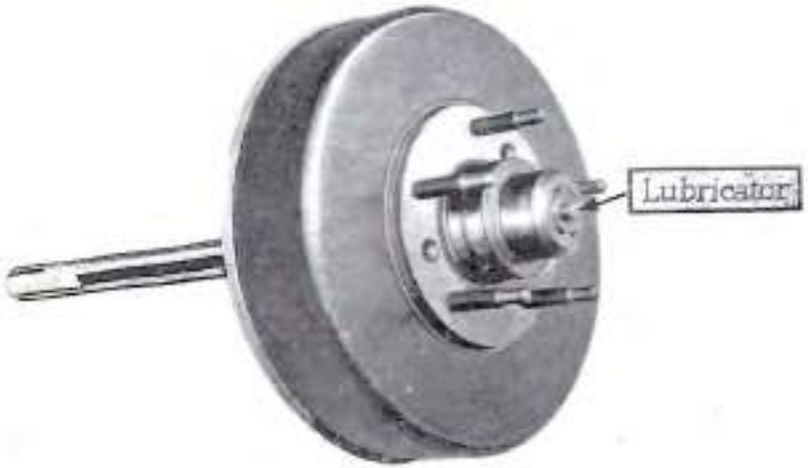
An observant driver will pay as much attention to his supply of lubricating oil as to his petrol supply. Neglect of this results in harsh running and an overheated engine, loss of power, and finally "seizing-up" of pistons or connecting rods.

To remove or drain the whole of the oil from the engine, it is only necessary to remove the large drain plug screwed in the bottom of the case, afterwards replacing and filling up through the filler. Never omit to strain the oil through a fine mesh when filling up. We recommend the following oils for summer and winter use respectively:

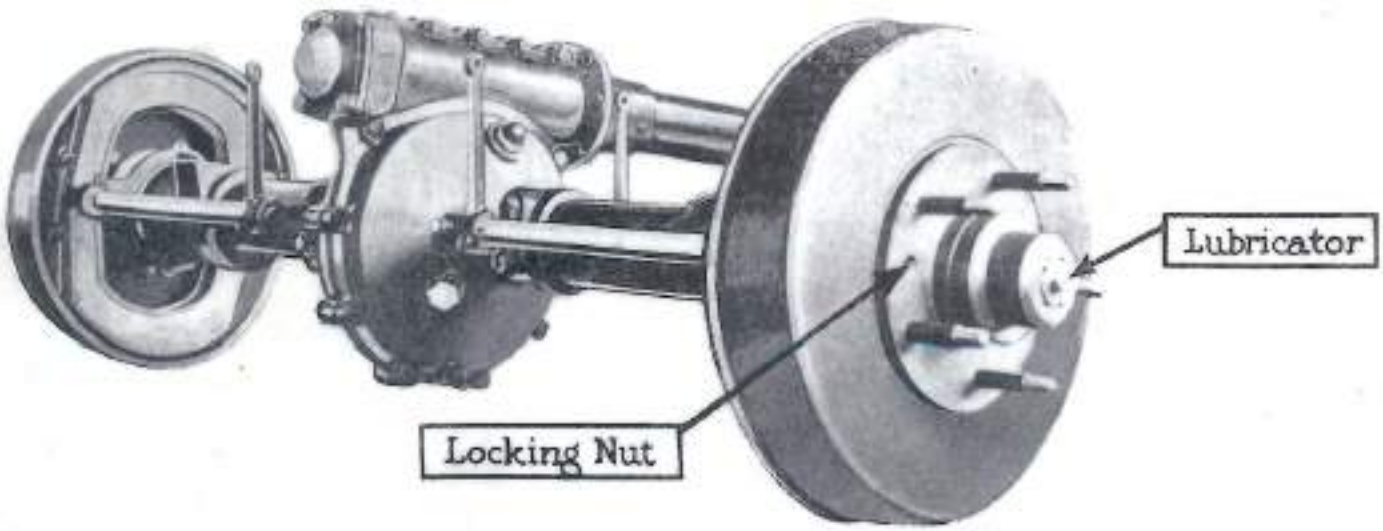
Summer. Double Shell, or Gargoyle Mobiloil A.

Winter. Single Shell, or Gargoyle Mobiloil A.

The Magneto should have two drops of magneto oil in the oil filler every 500 miles.



A lubricator is provided on the end of the axle shaft for lubricating the wheel hub.


Lubricator
Locking Nut

BACK AXLE. It is of utmost importance that the correct level of lubricant and equally the correct type of lubricant be used in the worm drive back axle of the Morris Truck. There is no better form of transmission than the worm drive, provided it is properly treated, but neglect may lead to loss of power, bad running and other evils. On the back axle casing of the Morris Truck will be found four plugs; the uppermost of which is situated on the square casing that contains the worm. When filling up the main casing, a small quantity of oil should be poured in through this orifice to ensure thrust bearing lubrication. The combined filling plug and breather, the nipple-shaped plug in the illustration, is the oil filling orifice, the next lower down is the level inspection plug, and the square headed plug at the very bottom is the drain plug. We recommend Golden Shell Oil or Gargoyle Mobiloil "B" for back axle lubrication. To fill up, the two top plugs should be removed and oil poured into upper holes until it begins to issue from the lower orifice (the vehicle standing on level ground). Both plugs should then be replaced.

FRONT HUB BEARINGS. To lubricate front hub bearings, the hub covers should first be removed, which will give access to a small $\frac{1}{8}$ gas screw, which when removed and replaced by a Tecalemit greaser will enable the hubs to be charged with grease by use of the ordinary grease gun supplied in the kit.

The reason for fitting a screw is because there is insufficient room for a Tecalemit greaser to be fitted behind the hub cover. The driver should, therefore, carry an extra $\frac{1}{8}$ Tecalemit lubricator in his kit for this purpose.

Draining and Replenishment of Lubricant.

We strongly recommend that after the first 300 miles the lubricant from the engine, clutch, gear box and back axle should be drained and replaced with a fresh supply. This will have a very beneficial result on the life and operation of the mechanisms concerned.

To drain the engine sump, the large brass plug underneath the centre of the sump should be unscrewed. When this is taken out (it will come away with the filter attached) the filter should be washed in paraffin to remove old oil and any accumulated dirt. There is also a drain plug underneath the fly wheel casing and another one underneath the clutch casing. Both these should be removed. To drain the gear box the fourth and rearmost plug underneath the power unit is taken out.

TO REFILL. When all the plugs have been replaced, the gearbox should be filled up with either Shell Gear Oil or Gargoyle Mobiloil "C" to the level of the filler plug as previously stated.

Before any oil is poured into the sump of the engine a quart of engine oil (Double Shell or Gargoyle Mobiloil Arctic) should be poured into the clutch compartment by taking off the cover plate on top of the clutch case. This is necessary because although the clutch is automatically lubricated from the engine, the supply travels through a valve, and if the truck is put to hard use immediately the oil is replenished in the sump, there may be insufficient time for a large enough quantity to get into the clutch case. It is of course, advisable to drain the clutch case when draining the engine, otherwise old oil will mix with the new. When the clutch case has been replenished the engine sump should be filled up to the full mark on the dipper rod through the ordinary filling orifice. The back axle should also be drained and refilled every 500 miles.

To obtain the maximum life and service from the Morris Trucks we recommend that this process of draining and replenishing the engine, clutch, gear box and back axle should be carried out at 300 miles, 600 miles and 1,000 miles, and on the completion of every subsequent 1,000 miles. By so doing, the life of the bearings will be considerably prolonged and the efficiency of the vehicle maintained at a very high standard.

Showing the location of the Tecalamite lubricator provided on the steering-gear box.

CHASSIS LUBRICATION. On every point of the Morris Truck Chassis that requires lubrication a Tecalamite nipple is fitted. For chassis lubrication we do not recommend grease but gear oil such as Shell Gear Oil or Gargoyle Mobiloil "C." In normal use every nipple on the chassis should receive a supply of grease once a week, presuming an average of about 500 miles a week's running. Three or four complete turns of the handle of the grease gun is sufficient on each nipple and the provision of this system of chassis lubrication means that the operation can be carried out expeditiously and with no inconvenience.

Special points which require attention are the following: Underneath the

pads to which the rear spring, are attached on the back axles will be found two Tecalamite nipples. Lubrication of these points is important, otherwise the springing may suffer considerably and undue strain be put on the back axle casing.

To preserve smoothness on the brake operation, the nipples on the brake rods (those which run parallel to the back axle) should be particularly attended to, as should the nipple on the brake counter-shaft rod which runs across the chassis underneath the floor boards.

Another particular point is the torque ball housing, this being oiled from a nipple just abaft of the gear box, while the front pivot pins should also come in for regular attention. The fan is provided with a greaser nipple and should be kept well supplied, otherwise vibration and rough running may be set up in the engine.

A Tecalamite lubricator is provided on the steering-gear box. The oil gun should be attached and the pump worked till oil begins to exude from the worm wheel bearing.

Periodical Inspection

As it is of great importance to have all small adjustments attended to, and to make sure that the lubrication of all wearing parts is not neglected, the owner of a car should make a point of periodical inspection.

To ensure that no point of importance is being overlooked, a resumé of items to be looked after will be found useful.

Items Requiring Attention

After first 500 miles : Remove old oil from gear box, rear axle, and engine ; wash with paraffin, and refill with fresh gear oil. Refill engine and clutch case with fresh oil.

After 500 miles : Oil magneto ; three drops in each oil hole. See that wheel hub-cap nuts are tight.

After 250 miles : Inspect oil level in crank case, clutch case, gear box and rear axle. Refill if necessary.

Every 3 months : Examine valves and valve seatings, and scrape off carbon deposit from pistons and head. Remove bottom case, clean oil-pump and filter.

Every 1,000 miles : Drain engine, clutch case, gear box and rear axle. Refill with fresh oil.

Every month : Remove all four detachable wheels, clean and rub studs over with grease and then replace, taking care to put

a little oil on the detachable wheel nuts. This precaution prevents the wheels rusting up and thus becoming difficult to detach.

Fill hubs with thin grease.

Clean petrol filter and petrol pipe. Examine valve tappet clearance, and if more than stated on page 8, readjust.

Examine the gaps of the sparking plugs and make sure that they are not too wide; the thickness of a visiting card makes a suitable gauge.

Every week : Oil up the steering gear, inspect **oil level** in engine, attach oil gun to all "Tecalamite" fittings and give pump three or four turns.

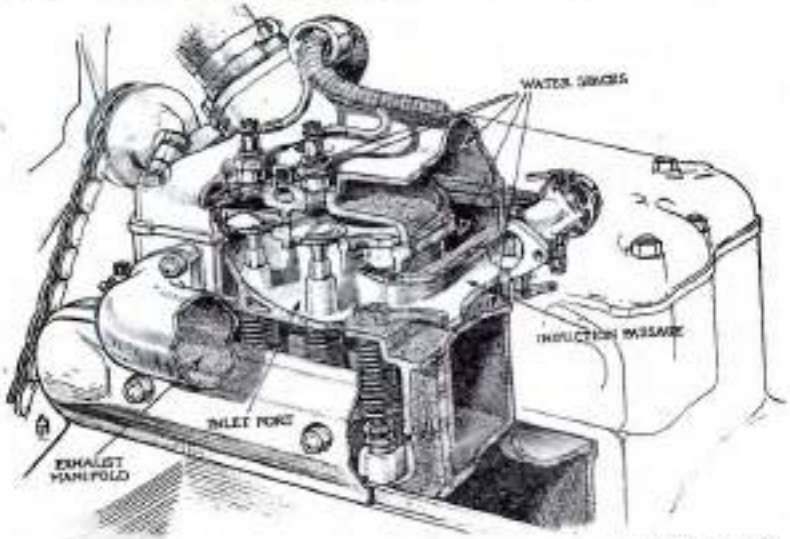
See that **Radiator** is full of water. The water-level should never be allowed to sink so low that the opening for cylinder outlet-pipe is not fully covered. If the water has a lower level the thermo-syphon circulation is destroyed, and this may cause the seizing up of pistons, by allowing the engine to become overheated.

SECTION III.

The Carburetter and Its Adjustments

The Smith Single-jet Carburetter
Model 26 H.K.M.C.

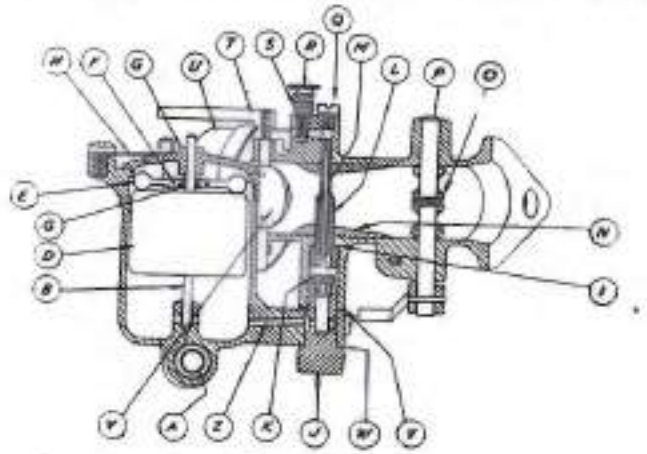
THE Smith Single-Jet Carburetter, which has performed so well on numerous well-known makes of cars since its inception some years ago, is now fitted as standard to all Morris Trucks for the 1925 season. The principle on which this



A sectional view of the Morris engine, showing induction passages and port arrangements

carburetter works is so well known that we shall only refer to i briefly; it is simply a carburetter with the suction on the mai jet controlled by the movement of the throttle. This feature which is patented throughout the world, enables us to design carburetter which will give just the correct amount of mixtur according to the engine demand, *i.e.*, at full throttle position heavy suction is put on the jet, which gives the extreme limit r

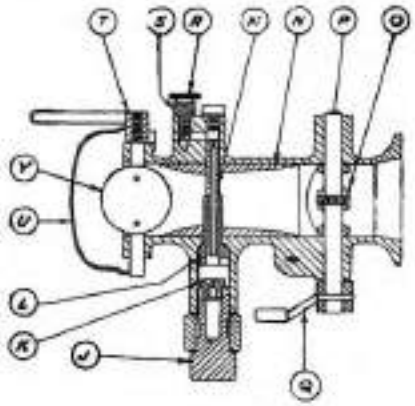
power, and on the normal running position—say 20 miles per hour—the suction on the jet is so arranged that the minimum consumption is obtained. Apart from this special feature the carburetter is known as the straight through or fixed choke type; it is of the very simplest possible construction, and, therefore, should appeal to those car owners who have no experience of motoring whatever. In spite of its simplicity and due to the scientific design, it will be found to give extremely satisfactory



Drawing No. 1.

results, providing smoothness of running throughout the range and excellent consumption, coupled with easy starting, good acceleration, and wonderful tick-over at low speeds. There is nothing to get out of order, and we would strongly advise all owners not to interfere with the carburetter in any way; the only thing necessary to do is to make certain that the carburetter is kept clean. A filter is fitted at the bottom of the float chamber marked "A" in the drawing on this page; this should be entirely removed, and the gauze cleaned and replaced. We would strongly recommend that this is cleaned out after the first few hundred miles as there is the possibility of small pieces of dust and dirt being in the tank when new, which immediately get washed through to the filter; afterwards it should be cleaned regularly, say, once every thousand miles. Should, however, any foreign matter such as water or dirt get through the passage marked "Z" into the jet carrier plug "J," it will possibly stop up the jet "K" and if this occurs the plug "J" should be removed entirely, and it will be found that on removing the plug, the jet fitted in same will come away with it. Remove the jet as shown in illustration, seeing that the plug, float chamber, and particularly the interior of the jet

plug are perfectly clean, and re-assemble, taking care to see that the two washers " W " and " V " are in their correct place. Should it be thought that any dirt or foreign matter has got through into the carburetter (this being extremely unlikely), the diffuser " L " (shown in drawing No. 2) should be entirely removed by means of the special screwdriver end attached to the carburetter spanner provided with each carburetter. It is very important that no screwdriver with a small pointed end should be used to remove the



Drawing No. 2.

diffuser, as it is certain to damage it. When the diffuser is withdrawn, it will be seen that the slow running tube " M " has been withdrawn with it. The slow running tube can be screwed out of the diffuser if desired, but this is quite unnecessary for cleaning purposes, as if the diffuser is held in the hand and put up to the

light it will be quite easy to see whether same is perfectly clean. We recommend washing this in petrol and blowing through the small holes in the centre of the diffuser ; on no account should any instrument be used to clean these holes as they are of a particular size and must remain so for the carburetter to function correctly.

Causes of Bad Slow Running and their Remedy.

To obtain correct slow running, it is necessary that several other items should be in perfect order other than the carburetter, as these have a very big effect on perfect slow running. The most important are as follows :—

(1) *Sparking Plugs.*—These should be quite clean, especially at the points, and the gap should be set not wider than half a m/m.

(2) The sticking of valves or their not closing properly on the seatings has a very big effect on slow running. It should be seen that there is a correct clearance between the valve tappets and the valve stems to ensure their closing correctly.

(3) The magneto contact breaker points should be occasionally examined to see that they are clean and the gap on the make and break set to the correct distance advised by the makers.

(4) Should the engine refuse to run slowly after the above items have been carefully looked to, it is advisable to see that the slow running device of the carburetter is not blocked with dirt. By removing the screw marked " Q," a piece of fine wire (such as is found on the petrol can top) can be inserted down the small hole shown, which should effectively clear any stoppage. It should be carefully noted that no instruments should be used which would tend to enlarge this hole, as this will upset the calibration.

The Jet

The jet in this carburetter which controls the amount of fuel supplied, is shown in drawing No. 1, marked " K." It is screwed into the jet carrier plug, and, as explained previously, is withdrawn with this plug, and, therefore, very easily " get-at-able."

This jet is calibrated on a standard calibrating machine, and is marked 130 c.c.—this marking being equivalent to the amount of petrol passed in cubic centimetres per minute under a given head. It is extremely important that this jet should not be reamered or opened out in any way. The size has been determined by very careful tests made on Morris trucks over several thousands of

Removing the jet.

miles, and will be found to give the best all-round results, including full power and best consumption. At the same time, due to variations in trucks, climatic conditions, etc., a jet of a smaller size might be found more economical. We shall, therefore, be pleased to supply jets of lower or higher sizes as desired, which are calibrated in differences of 5 cubic centimetres. Our range of sizes kept in stock for Morris trucks is :—

105, 110, 115, 120, 125, 130, 135.

The jet setting of 130 c.c. is for use with No. 1 petrol : for benzol or benzol mixture a 120 jet is desirable.

Petrol Consumption.

Owners will appreciate that it is impossible to expect a brand-new truck, which is necessarily stiff, to give the best consumption, and the mileage per gallon will gradually improve up to 5,000 miles, when, everything being normal, it should remain steady. Exhaustive consumption tests have been carried out

with this carburetter on Morris trucks, and the following results obtained with full load :—

At 20 miles per hour under good road and atmospheric conditions, 24 m.p.g. .015 in

At 25 miles per hour under good road and atmospheric conditions, 22 m.p.g. .006 in.

At 30 to 36 miles per hour, or hard " all out " driving, 18 m.p.g.

In giving the above figures, we would wish it to be clearly understood that they are only approximate, as there are so many conditions which affect consumption other than the carburetter, such as engine being in good order, *i.e.* :—

(1) Engine free.

(2) Chassis free ; brakes not binding.

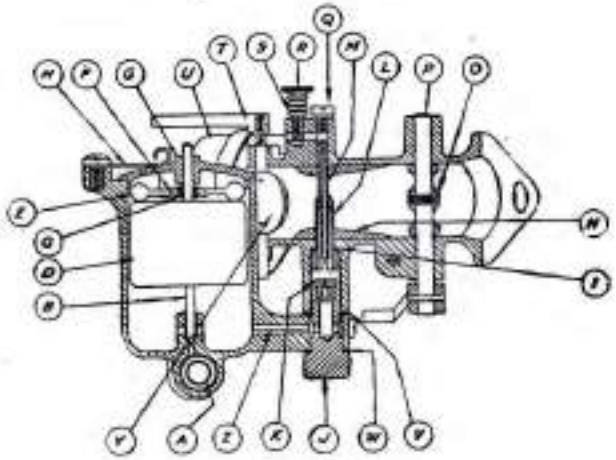
(3) Tyres inflated to correct pressure.

(4) Speed. This has the biggest effect on consumption, the most economical driving speed being between 20 and 2 miles per hour. You cannot expect good consumption if you are invariably driving " all out," or, to use an American expression, " continually tread on the gas " ; also one cannot expect as good a consumption when a truck is used in a hilly district, as when invariably used in a level district.

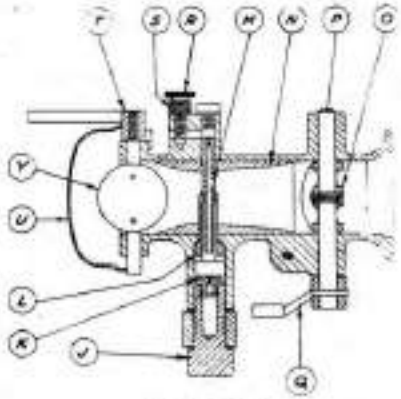
We shall always be pleased to advise truck owners if they are not satisfied with the consumption they are obtaining.

It is advisable to examine occasionally all petrol joints from the tank to the carburetter to see that there is no leakage or dripping.

Location of Parts.



Drawing No. 1.



Drawing No. 2.

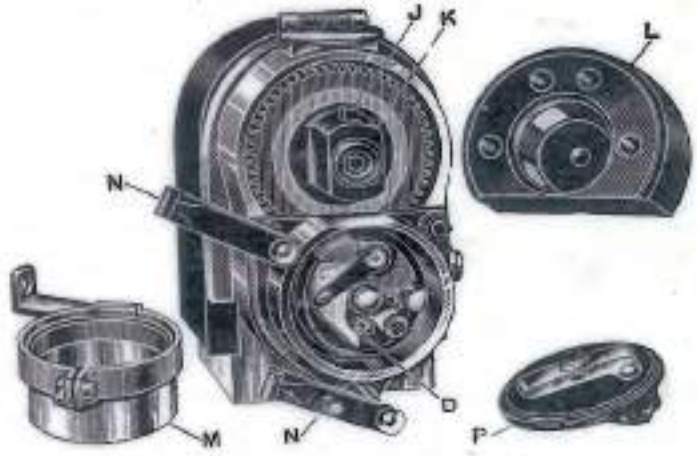
A—Petrol union and filter.
B—Float chamber needle.
D—Petrol float.
G 1—Float chamber needle collar.
E—Float chamber weights.
H—Spring holding float chamber cover.
F—Float chamber weight pins.
G 2—Float chamber cover.
U—Air intake cap.
T—Air shutter lever.
S—Slow running screw spring.
R—Slow running adjusting screw.
Q—Screw over slow running tube.
M—Slow running tube.
L—Diffuser.
P—Throttle spindle.
O—Throttle valve.
N—Choke tube.
I—Diffuser washer.
V—Washer.
W—Washer.
J—Jet carrier plug.
K—Main jet.
Z—Passage leading from float chamber to jet.

SECTION IV.

Care of the Magneto

SOME PRACTICAL ADVICE
HINTS FOR OWNERS AND DRIVERS

DURING the last twenty years an immense amount of research has been carried out, and experience gained, in the construction of ignition apparatus, and as a result the magneto of to-day has reached a very high level both as regards its performance and its reliability. The best service and the longest life, however, will never be obtained if the magneto is neglected, allowed to get dirty, or is run when out of adjustment. On this account the reader is urged to make an occasional inspection of his magneto, carefully following up each detail referred to below. Such attention as is usually required need take no more than a few minutes and is an important factor in maintaining the ignition system in first class condition.



The Lucas Magneto.

J—Distributor rotating arm brush.
K—Distributor rotating arm.
L—Distributor.
M—Cam ring.
N—Steel spring which secure distributor and contact breaker cover in position.
P—Contact breaker cover.
D—Contact points.

Cleaning.

The distributor, the distributor rotating arm, and at the driving end of the magneto the end cover and pick-up (the last two are combined in one unit) should each in turn be removed, wiped clean, and polished with a fine dry cloth. It is a simple matter to withdraw these components. The distributor can be removed by swinging the steel holding on spring to one side. The distributor rotating arm is then easily withdrawn by pulling it forward. To remove the driving end pickup cover unscrew the two fixing screws and then lift it carefully away. Any carbon deposit should be wiped away, the brush track being cleaned at the same time by means of a cloth moistened with a few drops of petrol. The brush in the rotating arm should work freely in its holder; if it is clogged remove and clean as well as the holder itself.

Next take the pickup end cover and clean it in the same manner, being sure to see that the brushes slide freely in their holders. Before replacing these parts the slip ring track and flanges should be cleaned by holding a soft cloth on the ring while the engine is slowly turned round by hand.

Lastly the contact breaker should be examined. Swing aside the flat holding-on spring retaining the contact breaker cover, and then remove the cover when the contact breaker will be exposed to view. It is essential that the contact breaker should be kept spotlessly clean; above all the contact points themselves must be free from all traces of oil. Want of attention to this precaution may not only be the cause of misfiring but may result in the destruction of the platinum iridium alloy of which the contacts are composed. Instructions for removing the contact breaker, should this be necessary, are given below.

The foregoing hints can be summarised in a very few words; neglect is sure to lead to trouble in the end; dirt, carbon or metal dust, and water in any form: these are the enemies of good insulation, therefore keep the magneto clean and dry.

Adjustment of Sparking Plugs and Contact Breaker.

The plug electrodes are bound to burn away slightly, and thus in time the gap length increases; it is a good plan to examine and clean them at intervals, adjusting them if necessary to the right setting; this should be from 20-25 thousandths of an inch. This gap is a little greater than that to which the contact breaker points should be adjusted, for setting which a gauge of about 12 thousandths thickness is provided on the side of the spanner supplied with the magneto.

Providing the contact breaker points are kept clean and above all, as has been stated already, **free from oil,** they will probably need adjustment only at long intervals. The reader is warned

that it is not desirable to alter the setting unless the gap varies considerably from that of the gauge.

If adjustment is necessary it can usually be made without removing the contact breaker. Turn the engine round slowly by hand until the points are seen to be fully opened, then, using the magneto spanner, slacken the nut "E" (Fig. 11) and rotate the fixed contact screw by the hexagon head "F" until the gap "D" is set to the thickness of the gauge; then screw up the nut "E" again until it is firmly locked. Care should be taken that the gap is not appreciably greater than the standard amount as an unduly wide opening would not only be a possible cause of misfiring, but would also be apt to cause undue wear. Should it be necessary to withdraw the contact breaker, unscrew the hexagon headed securing nut "G" by means of the magneto spanner. The whole contact breaker can then be pulled off the tapered shaft on which it fits. When replacing it care should be taken to ensure that the projecting key on the tapered portion of the contact breaker base engages with the keyway cut in the armature spindle, or the whole timing of the magneto will be upset. The hexagon fixing screw should be tightened up with care; it must be neither too slack nor must undue force be used. If, when the contact points are examined, it is found that they have been burned or blackened (owing probably to the presence at some time or other of oil or dirt) they may be cleaned with cloth moistened with petrol, or if they have worn unevenly, before adjusting with the gap gauge it may be necessary to file the points flat. If this is done a dead smooth file should be used and only the least possible amount of metal removed.

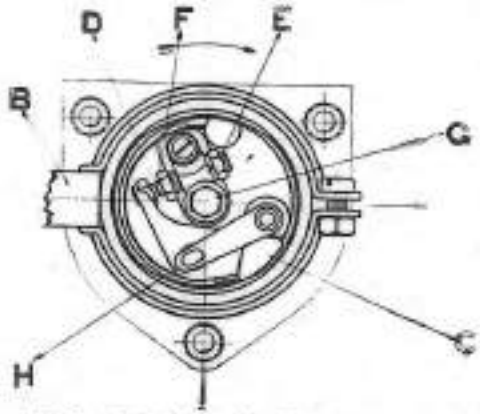


Fig. 1. The contact breaker. The lettered parts are referred to in the text by name.

Retarded Ignition.

A driver is commonly advised to keep his timing lever advanced, retarding it only when necessary, *e.g.*, for starting and for hill climbing. This is sound advice, for it not only enables more power to be developed and petrol economised, but the magneto

is greatly helped, since prolonged and unnecessary running in the retard position causes burning and rapid wear at the contact breaker points.

Lubrication.

The magneto is fitted with ball bearings on the driving shaft and about three drops of oil twice a month is all that is necessary if the car is in regular use. The reader is cautioned that far more trouble is caused by excessive oiling than by too little.

Hints for the Detection and Remedy of Ignition Faults.

If a failure of the ignition is suspected, unless the cause is at once apparent, the reader is strongly recommended to proceed in accordance with the following routine which should quickly enable him to locate the trouble.

If misfiring occurs in only one cylinder either the plug lead or the plug may be at fault. An examination of the high tension cables may reveal the fault; rubber is apt to perish or crack in its old age: it will not last for ever. If a spare plug is at hand it should be substituted for the suspected one, or if it is merely the gap that is too large it should be adjusted. (See page 70.) Missing with full throttle is sometimes due to the plug gaps being too wide. Bad plug insulation is sometimes caused through sooting and may occasionally be remedied by washing the plug out with petrol. It is sometimes recommended to remove the plug and, allowing the body to rest on the cylinder head, to observe whether a spark occurs at the points when the engine is turned by hand. It should, however, be noted that this is only a rough test since it is possible that a spark may not take place when the plug is under compression. If it is suspected that the ignition has failed completely in all cylinders this may be checked by removing from the plug terminals one or more of the high tension cables and observing whether a spark takes place on turning the engine round with the terminal lead held about 1-8in. from some metal part of the engine. If no spark takes place, examine first the earth wire leading from the magneto to the cut off switch; it may have been accidentally earthed. This may be proved by removing temporarily the contact breaker end cap, when the magneto should function correctly again.

If the fault is not yet apparent, before replacing the contact breaker cover, with the engine slowly turned by hand, examine the action of the contact breaker lever; it is possible that the lever is not answering to its control spring and is remaining permanently open as it is rotated. If this appears to be so, remove the contact breaker and applying pressure with the finger on the fibre heel "C," observe whether the points readily open and close. If they are at all sluggish push aside the locating spring "H" and prising the rocker arm off its bearing, examine the steel pin

on which it works, cleaning this if required with fine emery cloth, wiping away all grit and moistening the pin with oil before replacing the lever. We need hardly warn the reader that no trace of oil should be left anywhere near the contact points after this has been done.

If the magneto has recently been replaced it is just possible that it may have been timed incorrectly. Instructions for timing are given on page 8, but unless the reader is used to it, retiming the magneto is by no means a simple matter, and he would be well advised to have this done for him by his nearest service station.

If, after exhausting the above scheme of examination the reader is still in any doubt or difficulty about his ignition system, it is little use continuing the examination, and he is strongly advised to consult the nearest Lucas service station, the addresses of which are given on page 52. If the reader is able to call, this is the best course to adopt, as the engine with its ignition equipment can then be examined as a whole. If it is necessary, however, to write, the reader is reminded to be sure, in addition to describing his trouble to state the type of the magneto and its serial number, both of which should be found engraved on the side of the magneto, and also if possible the make and date of engine to which it is fitted.

The reader is cautioned against needlessly dismantling his magneto as it is of intricate construction, and easily damaged.

Fitting High Tension Cables.

Concealed terminals are provided in the distributor for fitting the high tension cables. To wire up, the cable should not be bared, but should be cut off to the required length. Then remove the distributor and unscrewing the pointed screws (as shown at B)

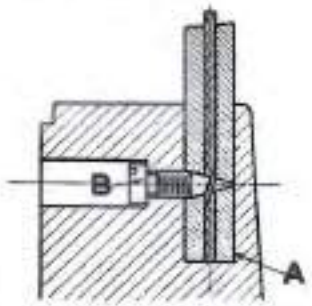


Fig. 2. Pick-up.
A—Cable. B—Cable fixing screw.

push the cable "A" hard home. Replace and tighten up the screw which will then pierce the insulation and make contact with the cable core, and finally replace the distributor.

NOTE.—Use only seven m/m diameter cable. Do not attempt to use a thicker cable pared down to fit.

SECTION V.

Running Instructions

FOR THE

Lucas Lighting System

Type E35F 6 volt.

Dynamo Type E35F 6 volt.

THIS machine is flanged fixed on the near side of the car and is driven by a silent chain.

The armature is mounted on ball bearings, which are packed with grease before leaving the works. After the car has run say 10,000 miles, the machine should preferably be sent back to the nearest Lucas repair depot for cleaning, adjustment, and repacking with fresh grease.

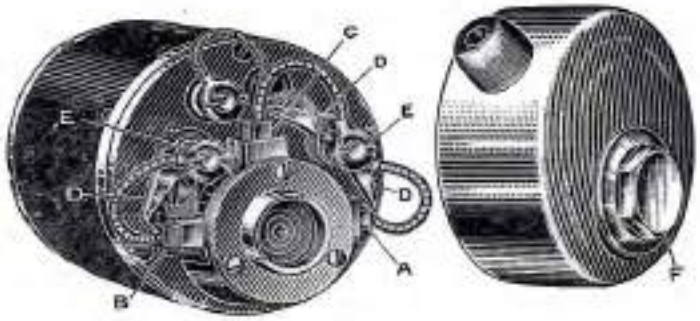


Fig. 3. Dynamo.

A, B, C—Brushes.
D—Springs holding brushes in position.
E—Spring terminals.

The dynamo begins to charge the 6 volt battery at a low road speed, rapidly increasing to its maximum output. The regulation of the dynamo is effected by means of the well known three brush method. The two main brushes lie across a horizontal diameter, while the control brush is placed between the two. The dynamo does not require a great deal of attention, but there are a few

components which should be inspected occasionally to ensure satisfactory running

Brushes.

It is very important to make sure that the brushes work freely in their holders. This can easily be ascertained by gently pulling each flexible lead when the brush should move without the slightest suggestion of sluggishness. It should also return to its original position directly the lead is let go. When testing the brush in this way release it gently otherwise it may get chipped. The brushes should then " bed " over the whole surface ; that is, the face in contact with the commutator should appear uniformly polished.

If any of the brushes become so badly worn that it is necessary to replace them, this can easily be done as follows :—

Having first removed the cover from the commutator end bracket release the eyelet on the brush lead by withdrawing the split pin at the end of the spring terminal (see Fig. 3) then, holding the brush tension arm back out of the way, withdraw the brush from its holder.

View of Spring Terminal.
A—Spring holding brush in position.
B—bared end of cable.
C—terminal hole.

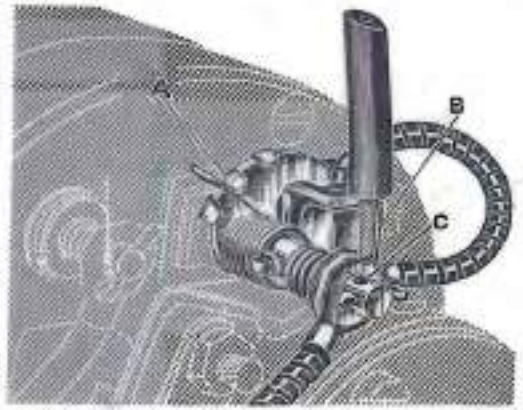


Fig. 4.

The third brush is set in its correct position before the machine leaves the maker's works, and on no account should this adjustment be altered.

Commutator.

The surface of the commutator should be kept clean and free from oil and brush dust, etc.; neglect of this precaution will result in the commutator becoming blackened ; sparking will not only occur at the brushes, but the life of the machine will be shortened. The best way to clean the commutator is to insert a fine duster, held by means of a suitably shaped piece of wood against the commutator surface, causing the armature to be rotated at the same time. If the commutator has been neglected for long periods it may need cleaning with fine glass paper, but this is more difficult to do and should not be necessary if it has received regular attention.

The brush springs should be inspected occasionally to see that they have sufficient tension to keep the brushes firmly pressed against the commutator when the machine is running. It is particularly necessary to keep this in mind when the brushes have been in use for a long time and are very much worn down.

Readers are cautioned that it is unwise to insert brushes of a grade other than that supplied with the machine or to change the tension springs. The arrangement provided has been made only after many years' experience and will be found to give the best results and the longest life.

Terminals.

For connecting up the main and field circuits of the dynamo, spring terminals are provided.

The main terminals are located on the brush holders and the field terminal "S" on the end bracket. They are marked thus: No. 1 the positive, 2 the field, and 4 the negative terminals.

To connect up the cable to these terminals no special sockets or attachments are required nor is the use of solder necessary; the cables merely have to be bared; the spring on the terminal compressed until the hole in the stud is seen into which the bared cable should then be threaded. On releasing the spring the cable will be securely held and good electrical contact made (see Fig. 4).

Battery (Type 640).

This is fitted under the driver's seat. We would impress upon the owner the importance of the battery in the electrical equipment, and the necessity for careful treatment and regular attention if it is to be kept in good condition.

The chemical nature of the secondary battery must always be kept in mind when considering how much attention is necessary in order that it will function properly under all conditions of use. It is the chemical condition of the cell which determines its useful life, and limits the work it can do, and only a much-restricted yield of electrical energy is possible unless the chemical condition of the plates is good. It is for that reason that manufacturers give detailed instructions for the first charge and subsequent care of the battery. The sulphuric acid solution used in filling up the cells must be quite pure and of the correct density (1.225 at 60° F. for Lucas batteries), and it is very important that the level of the electrolyte should be kept well above the top of the plates, but just short of the bottom of the vent plugs. Neglect of this simple precaution will seriously impair the efficiency of the battery. Under ordinary conditions it will be found necessary to adjust the level of the acid solution in the cells by adding distilled water at least once a month.

The initial charge should be given in accordance with the printed instructions sheet supplied with every uncharged battery, and all subsequent charging should be at the correct rate and for a

sufficient period of time to ensure the normal evolution of gas from all the plates.

Only distilled water should be added to replace loss of the electrolyte caused by the action of the charging current. If, however, acid solution is spilled it should be replaced by "topping" up the cells with a diluted sulphuric acid solution of 1.225 specific gravity at 60° F.

A Hydrometer, used for testing the state of the battery.

The porcelain vent plugs in the top of the battery can be readily removed for inspection of the level of the solution in the cells; it is important when examining the cells in this way that naked lights should not be held near the vents on account of the possible danger of igniting the gas coming from the plates. When the battery is under examination it is as well to complete the inspection of the cells by checking the specific gravity of the acid solution, as the density of the solution gives a very good indication of the condition of the battery. An instrument known as a "hydrometer" is employed for this purpose. This should be of the syphon type, as illustrated. Voltmeter readings of each cell do not provide a reliable indication of the conditions of the battery, unless special precautions are taken, and on this account we do not recommend this test for the average owner.

If the equipment is laid by for several months, the battery must be given a small charge from a separate source of electrical energy at least once a fortnight, in order to obviate any permanent sulphation of the plates. Under no circumstances must the electrolyte be removed from the battery or the plates allowed to dry, as certain changes take place which result in loss of capacity.

The battery lugs and cable terminals, which are made of a non-corrosive lead alloy, should be periodically examined to ensure that the nuts holding the cable in position are quite tight.

If for any reason the battery is removed the terminals should be cleaned and well vaselined before replacing.

We may summarise the chief precautions that should be taken to maintain the battery in good condition as follows:

(1) Keep the acid well above the top of the plates.

(2) Add distilled water only, never tap water.

(3) Take frequent readings of the specific gravity with the hydrometer (see page 46).

(4) Do not allow the battery to remain discharged ; if run down, through whatever cause, recharge at once.

Instructions for using the "Lucas" Syphon Hydrometer

Before measuring the specific gravity of the acid solution by means of the hydrometer see that the acid is at its correct level. Readings should be taken after a run on the truck when the electrolyte is thoroughly mixed.

To assemble the hydrometer insert the float, thin end first, into the barrel, then wet the plug carrying the rubber tube and push into position, and the instrument is ready for use, then holding the instrument vertically, compress the bulb and insert the red rubber tube as far as possible into the electrolyte, and gradually lessen the pressure on the bulb until the acid solution rises in the barrel enough to lift the hydrometer float about ½in. Removing the hydrometer from the cell, note the scale reading at the surface of the electrolyte ; this gives the density or specific gravity.

In a fully charged "Lucas" battery, the specific gravity of the acid solution should be from 1.225 to 1.250 when the temperature of the solution is 60°. In a half charged condition, the specific gravity should be about 1.200, and when fully discharged to the limiting voltage, the density should be about 1.150.

For fuller particulars regarding temperature corrections, see our "First Charge" instructions, a copy of which can be obtained on application.

Period for which a Battery should be Charged.

It is difficult to lay down rigid instructions on this subject, as the conditions under which the battery is used varies considerably and obviously the amount of charging the battery will require is directly dependent on the extent to which the lamps are used. The following suggestions will serve as a rough guide :

1. Under normal conditions, providing that the lamps are used a fair amount, the battery should be kept on charge all the time during the winter and about half the day-time running in the summer.

2. Always keep the battery charging switch "on" when the head lamps are in use.

3. If the truck is used for long journeys in the day-time it is quite unnecessary to keep the charging switch "on" all the time, as this will cause overcharging of the battery and consequent reduction of the acid level.

Switch box.

One of the most interesting features of our system is that all the parts necessary for controlling the various circuits are compactly housed at one central position, namely, in the switchbox situated on the instrument board ; yet at the same time all the parts are readily accessible.

Two switches are provided in the switchbox; that on the left side controls the charging circuit, while the right-hand switch operates the lamps.

The cover of the switchbox is held in position under spring tension by the switch levers "A" and "A," which in turn are secured by screws "B" and "B" (Fig. 5).

Fig. 5. View of switchbox.
A—Switch levers. B—Securing screws.
C—Inspection lamp plug adapter.

All the parts of the switchbox are mounted on one moulded base which can be removed as a complete unit by unscrewing the two nuts on the back of the switchbox casing and removing the cables. When connecting up the cables to the switchbox terminals, care should be taken that no strands of cable are left straying as this may cause a short circuit.

Switch Positions.

The charging switch has two positions. When switched into position "D" the dynamo is connected for full charge; when switched "off" the charging circuit is broken. The lamp switch has three positions; these are:—

(1) "H." Full light of head lamps and tail lamp.
(2) "S." Dim light of head lamps and tail lamp.
(3) "Off." All lamps off.

When the lamps are switched on the dynamo is automatically connected for full charge irrespective of the position of the charging switch.

Electro-Magnetic Cut-out.

The cut-out automatically closes the charging circuit as soon as the dynamo voltage rises sufficiently above that of the battery. When the dynamo voltage falls below that of the battery the reverse action takes place, the cut-out opens and thereby prevents the battery from discharging itself through the dynamo.

The cut-out is accurately set before leaving the maker's works, and should not be tampered with or adjusted. Should the cut-out

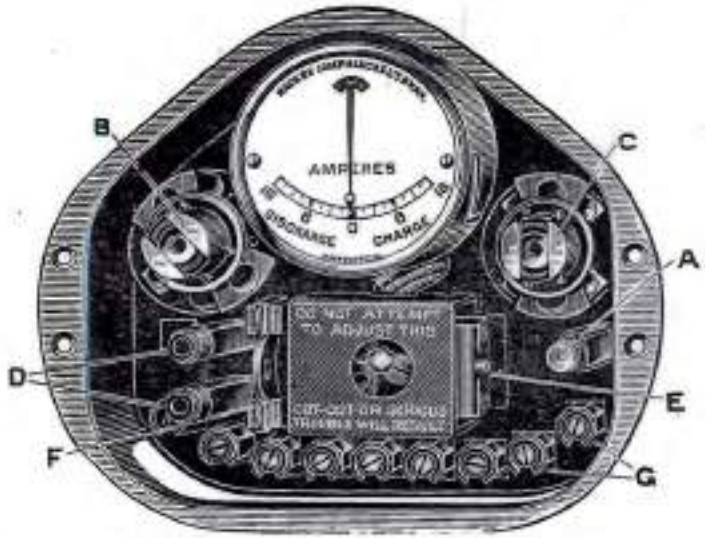


Fig. 6. View of switchbox with front cover plate removed.
A—Spare fuse carrier. B—Dynamo and magneto switch.
C—Switch for lamps. D—Inspection lamp plug adapter.
E—Electro-magnetic cut-out. F—Fuse holder.
G—Terminals.

fail to close the circuit on accelerating the engine, the cause of the damage is likely to be found elsewhere in the system.

The question is sometimes asked whether the operation of the cut-out in any way depends upon the state of the battery. There is no such relation between the two; the sole function of the cut-out is to switch on the dynamo with rising engine speed and to disconnect it when the engine slows down to below a certain speed.

Ammeter.

A centre-zero instrument is provided so that the driver can see at a glance whether the dynamo is giving sufficient output to keep the battery charged in accordance with the load. In

other words, this type of meter shows the actual current flowing into or from the battery ; thus, if the lamps are switched on and take six amps. and the dynamo is generating eight amps. the meter shows two amps. in the charge direction, this being the current in excess of the lamp load which is available for charging purposes.

Fuse.

A fuse is inserted in the charging circuit. This prevents damage to the equipment, should the battery circuit be accidentally closed through the switchbox, when the machine is not charging.

Fig. 7. Inside view of front cover Plate of switchbox showing wiring instructions.

Occasionally examine the switchbox in order to ascertain that the fuse is held tightly in position in its holder. A fuse loose in its holder or a loose fuse clip will cause intermittent or no output from the generator.

If it becomes necessary to replace a fuse wire, it is essential that it is pushed down the clip as far as possible, as otherwise it may not be gripped tightly when replaced in position. A spare fuse carton (" A " Fig. 6) containing a supply of the correct gauge fuse wire cut to the required length will be found below the right-hand switch.

NOTE.—Should it be found that the fuse is continually blowing, do not add two or three more strands to prevent this occurring, but have the equipment thoroughly overhauled to find out the trouble.

Lamps.

The lamps fitted, type R.515, carry twin filament bulbs and serve as both head and side lamps. The wiring is on the well-known earth return system ; only the positive leads are insulated, and as single cable is used instead of twin its insulation is made more robust. Care must be taken to see that the various cables are not chafed or cut in any way through being jammed on the frame,

as an injury to the insulation would be liable to cause a " short " which would run down the battery. See also that the head lamps, tail lamps, switchbox and negative earthed connections, are in good electrical contact with the truck frame. This is just as important as tightening up the insulated connections.

Wiring.

If it becomes necessary to remove or replace the lamp cables, the front of the lamp and the reflector must first be removed.

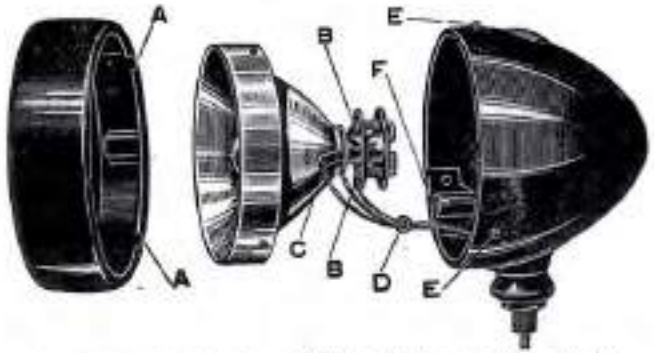


Fig. 8. View of driving lamp with the front rim and reflector detached.
A—Slots in rim which engage with studs E.
B—Spring terminals.
C—Spring terminal for return cable.
D—Knot in cable to take strain from terminals.

To do this press the front rim evenly with the thumbs and palms of the hands and rotate to the left as far as possible, when the front may be withdrawn. The reflector can be removed in a similar manner. When replacing the reflector, the word " top " stamped on the rim must be at the top of the lamp or else it will be subsequently impossible to fix the lamp front, as the fixing studs will not engage.

To expose the terminal holes (C) in the terminal bars compress the movable insulating disc (A) towards the fixed disc (B). Thread the bared end of each wire, that is for high and low filaments respectively, through the holes and release the disc when the coil springs on the terminal bars will cause the cables to be held firmly in position. To ensure that a short circuit will not be caused by the ends of the wires making contact with any part of the reflector care must be taken to see that the ends do not project more than 1-16in. through the terminal holes.

Focussing Head Lamps.

The very accurate formation and particularly high finish on the surface of the reflector is the result of many years' research work, manufacturing experience, and prolonged night driving observations on the road. If, however, the bulb is not correctly focussed the advantages of this scientific design are lost. It is therefore essential that the filament should be approximately at the focus of the reflector. In order to arrange this, the lamp holder is provided with notches, so that by trying the bulb in the alternate positions, it can be placed as near as possible to the correct focus.

The best way of focussing and setting the lamps is to take the car to a straight, level road, try the bulb in each of the three notches and then move the lamp on its adjustable mounting until the best road position is obtained. The full light should be switched on when the focussing is carried out.

At this point it may also be mentioned that the efficiency of the lamps depend not only on the shape of the reflector but on its

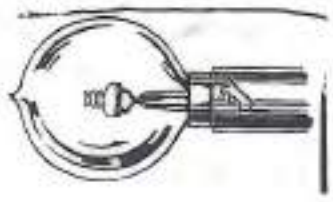


Fig. 10. View of bulb and bulb holder, showing focussing notches.

Fig. 9. View of terminals.
A—Movable fibre disc. B—Fixed disc.
C—Terminal holes. D—Focussing notches

surface. When the lamp is used under normal conditions it is not advisable to polish the reflectors ; should it, however, become tarnished in any way, clean carefully with a fine chamois leather and finely divided rouge wet with petrol. On no account should any metal polishes be used on our reflectors.

Tail Lamp (Type TF. 201).

This lamp shows a red light to the rear and a white light towards the number plate, the illumination of which is greatly

improved by a reflector behind the bulb. To remove cover for bulb replacement compress the studs on either side of the lamp, and pull forward.

When it becomes necessary to replace the cable unscrew the thumb nut at the back of the lamp and withdraw the plug. Take out the two small screws and insert the bared end of the cable into the metal sleeve, and secure by replacing the screw.

Fig. 11. Tail lamp. Type TF 201.

Replacement of Bulbs

When the replacement of any bulb is necessary we strongly recommend that bulbs supplied by us are used. The filaments are arranged to be in focus, and give the best results with our reflectors.

The particulars of bulbs fitted in the lamps are as follows :—

LUCAS 6-VOLT., EARTH RETURN, VACUUM BULBS.

	Bulb.	No.	Watts or approx. candle power.
Driving lamp ..	Double filament	D618	18 and 3
Tail lamp ..	Centre contact	B.A.S. 8S	3

Do not dismantle apparatus needlessly. In the event of any difficulty we shall be only too pleased to give every assistance possible. In communicating, or ordering spare parts, always give type and number of the machine in question, and, if possible, date of the car on which it is fitted. Also do not forget that Messrs. Lucas have for your benefit, Service Stations in the following towns :—

Birmingham	– Farm Street – – – –	– Tele. : Northern 2201.
Bristol	– 25, Temple Street – –	– Tele. : Bristol 661.
Coventry	– Priory House, Priory Street	– Tele. : Coventry 1868.
Glasgow	– 209, St. George's Road –	– Tele. : Douglas 2458.
London	– Scrubbs Lane, Willesden, N.W.10	Tele. : Willesden 2700-1-2.
Manchester	– Chester Road, Gorse Hill, Stretford – – –	– Tele. : Trafford Park 1117.
Newcastle	– 68, St. Mary's Place – –	– Tele. : City 306.

SECTION VI.

The Fitting, Removal and Care of Straight Side Cord Tyres

THE Morris One-ton Truck is equipped with Dunlop Straight Side Cord Tyres, size 32 by 4½, fitted to straight side rims of the same nominal size. In order to meet the rated load conditions the back tyres should be inflated to 65 lbs. per square inch, and the fronts to 50 lbs. per square inch. The 12-cwt. van is fitted with 32 by 4 Dunlop Straight Side Cord Tyres on straight side rims of the same nominal size. The inflation pressure in respect to these tyres should be 60 lbs. per square inch for those fitted to the back wheels, and 50 lbs. per square inch for those fitted to the fronts.

The tyres should be tested periodically, preferably once weekly, but certainly at no longer intervals than a fortnight, with a Schrader Pressure Gauge, No. 2863 or 1561 in the Dunlop Company's accessories price list, when, if the pressures are found to have fallen to a greater extent than five lbs. per square inch, the loss should be immediately restored, as it is only by adopting such precautionary measures that premature failures will be avoided and maximum tyre life obtained.

If for any reason it becomes desirable to adopt tyres of larger size and greater load carrying capacity in respect of either vehicle, 33 by 5 Straight Side Tyres can be readily applied to the 32 by 4½ rims, and 33 by 4½ Straight Side Tyres to the 32 by 4 rims, these tyres being in each case the correct over-sizes for the rims mentioned. Whether the one-ton truck or 12-cwt. van is being considered, the height and width clearances are sufficient to meet the increased tyre overall diameter and sectional width which the adoption of over-sizes entails.

It is important to note that the tyres are not of the more generally known beaded edge type, but Straight-side, that is, having inextensible wire edges. These edges, having a smaller circumference than the overall of the rim, cannot be brought over the rim edge by means of tyre leverage, which should never be resorted to.

The removal and fitting operations are extremely simple, all that is necessary in order to draw the tyres off their rims being the removal of the detachable spring flange. The operations in detail are given below.

Removal.

Deflate the tyre and insert the small end, " A," of the special lever provided (Fig. 1) in the slot which will be found near one end of this flange.

A downward thrust of the lever will then bring a portion of the flange out of the rim groove, enabling the whole to be easily whipped off by hand.

All that is necessary now is to clear the valve stem of the rim hole and to draw the tyre complete off its rim.

Fitting.

To fit the tyre insert the tube (slightly inflated), and the flap in the cover. Apply the complete tyre to the rim, taking care that the valve comes truly through the valve hole.

Insert one end of the detachable flange in the rim groove diametrically opposite the valve hole, and push down by hand as far as it will go. The longer lip " B " of the broad end of the

Fig. 1. The special tyre lever used for the fitting and removal of straight side cord tyres.

lever should then be inserted in the rim recess at a position rather more than half way round the flange circumference from the inserted end, in such a way that the shorter lip " C " engages the flange.

By means of leverage the flange is then expanded and forced towards the tyre until in contraction it finds its way into the rim recess around practically the whole of its circumference.

After making sure that to this point its base is firmly seated in the groove, the lever should be withdrawn and again inserted towards the end of the flange, which, by means of a sharp thrust, can be snapped home.

General Instructions Relating to the Care and Maintenance of Tyres.

Dunlop Straight Side tyres need little in the way of attention apart from the all-important matter of seeing that they are properly inflated to meet the load conditions which apply.

The Removal of Straight Side Cord Tyres

The small end of the special lever provided in the tool kit should be inserted in the slot which will be found near one end of the spring flange. A downward pressure of the lever will disengage a portion of the flange from the rim. The free end should then be grasped in the hand and the flange drawn away from the rim, which it will leave quite easily.

Re-fitting

The end of the flange which is not slotted should be placed over the rim against the tyre and its base pushed down into the groove. The broad end of the special lever should then be used in the manner described on page 54 to expand the spring flange over the rim edge, finally using the lever again as in operation No. 2, but near the disengaged end of the flange, which can be sprung into place, locking the tyre securely in position.

If the contained air in a pneumatic tyre is not maintained to that degree upon which the successful functioning of the tyre depends, curtailment of tyre life is bound to result.

In determining what is correct pressure, the axle weights, when the vehicle is carrying maximum load, need to be known. The only reliable method of arriving at these weights is to weigh the front and rear axles separately when the vehicle is fully loaded.

It is not sufficient to inflate tyres to the required pressure and then neglect the matter. Periodical testing by means of a gauge applied to the valve is essential. It is mere waste of time to endeavour to judge from the appearance of tyres whether they are properly inflated or not, as unless the degree of under-inflation is serious, no appreciable bulging, even to a practised eye, is noticeable. Thus, when a tyre does bulge it is probable that the pressure is somewhere about half that necessary to meet the load conditions. Therefore, if this state has been reached as a result of gradually falling pressure, it will be readily appreciated that a tyre may have done many hundreds of miles in a more or less inadequately inflated condition.

The two ends of the detachable spring flange showing slot into which the end of the lever is fitted for removal.

The effect of under-inflation is to permit that undue flexing or hingeing of the tyre walls which, owing to internal friction, destroys the adhesion between the casing plies and leads to eventual fracture at the position of the hingeing. It also renders tyres more vulnerable to puncturing implements encountered in running, and to concussion fractures.

Granted, then, that it is your intention to ensure that your tyres are at all times properly inflated, you should obtain that satisfactory service to which all users of Dunlop products are entitled, and little else is necessary except as referred to hereunder.

Cuts.

Any cuts other than superficial ones call for immediate attention in order that wet and road matter cannot penetrate to the interior construction of the tyre. If bad cuts, particularly those

which penetrate one or two layers of the casing, are neglected, bursts are almost bound to ensue owing to the deterioration of the casing due to the penetration of the wet and road matter referred to. Therefore, all rubber cuts of any size should be cleaned out and filled with Dunlop Low-temperature Vulcanising Compound. Any cuts which completely penetrate the casing as well as the rubber require more extensive repairs, and such work should be placed in the hands of thoroughly competent repairers.

Avoid as far as possible sharp tramline edges, because these, if encountered in an oblique direction, may slice off a portion of the tread.

Brakes and Clutch.

Reasonable care should be exercised in the use of brakes and clutch, because if the rear wheels are locked by brakes or caused to slip over the road surface, as a result of fierce acceleration, the tread rubber will most certainly be ground off.

Alignment.

Ensure that the wheels are rotating strictly in the direction of travel of the vehicle, because any attempt on their part to deviate from a straight course will result in rapid tread wear, as also will any play or wobble there may be, due to looseness, or worn bearings.

Clearances.

See that there is no contact between the tyres whilst rotating and any part of the vehicle, especially (when the springs are in a state of depression under excessive load) any projection from the wings. Contact of this kind will result in circumferential cutting of the tyre at the point of engagement, sometimes penetrating completely through the rubber and many—if not all—of the casing plies.

Users of Dunlop tyres are entitled to satisfaction, and they will certainly get it provided the tyres are reasonably treated. To reiterate, *watch the inflation pressure carefully*. The necessity for so doing will be appreciated when it is realised, as is the case, that fully 90% of tyre troubles are attributable in some degree to inadequate inflation pressure.

SECTION VII.

How to Decarbonize

(Reprinted from The Morris Owner)

PETROL is what is known as a hydrocarbon. That is, it is made up, chemically, of hydrogen atoms and carbon atoms in a certain proportion. There are other constituents as well, but these two are basic. When petrol burns, the hydrogen combines with the oxygen in the atmosphere and the carbon is "liberated." All that happens inside the engine is that petrol gas burns.

True, it burns very quickly—"explodes," one might say—but anyway, the carbon is liberated. Some of this passes out of the exhaust in gaseous form but some is deposited on the inside surface of the cylinder head and valve ports in the form of a hard, black coating. If this coating be allowed to accumulate it eventually reduces the volume of the space at the top of the cylinder, thus increasing the compression ratio, causing "pinking," that metallic tapping sound that occurs when the engine is made to pull hard at slow speeds with the ignition advanced—and it also impedes the gas flow into and out of the cylinder. In other words, it reduces the efficiency of the engine, making it sluggish and killing the natural liveliness of a Morris power unit.

Why Carbon Forms.

The formation of carbon, of course, is not peculiar to the Morris engine in particular. It happens in every truck, and as a matter of fact, thanks to good carburation, the Morris engine carbons up very slowly. It only requires decarbonizing about once every 2,000 miles, although it is advisable to clean the head (as described hereafter) and to polish up the valves faces after the first 1,000 miles have been covered by a new truck.

The job is very simple. It can be done properly with the standard tool kit by anyone with an average "handy-man's" mechanical skill in an afternoon. This is due to the fact that the Morris was designed as an owner-driver's truck—easy to look after.

And so when the speedometer and log book say that it is time for the periodical uncoking, this is what to do.

Materials required—for decarbonizing only—are the standard tool kit and a bottle of gold size. (For which go to the local oilman or paint shop.) But as the head has to be lifted to decarbonize, it is not a bad plan to deal with the valves at the same time. And

so get some valve grinding paste (cost about 1/6) and a big tin and some paraffin to make a washing bath. A supply of rags is also indicated.

Then, to prevent one's hands assuming an aspect of deep mourning fill the nails with hard white soap by scraping them down a bar thereof and also rub the soap, dry, all over your fingers and palm. It makes the dirt come off more easily. And so, as Pepys (probably) wrote, to work.

First of all let the engine run until it has warmed up, and then when it has been stopped, open the drain plug found on the bottom nearside of the radiator and let the water drain away either into a bucket or down a drain, or any way arrange so that a sloppy puddle is not made in which one has to stand to work.

The order in which the cylinder head holding down nuts should be loosened and tightened up is as above.

While the radiator is draining the two bonnet sides should be removed and one of the top halves of the bonnet folded back so as to give absolute freedom and a good light whilst working.

When decarbonizing the Morris engine there is no need to touch anything but the cylinder head; it is not even necessary to turn off the petrol. First of all the magneto leads to the plugs should be disconnected and the two nuts on the top of the water pipe flange (as shown in the illustration) should be undone, and if the top water clip be loosened it will be found that the rubber connecting hose can be slipped upwards, thus enabling the head when loosened to be lifted straight off its studs. The sparking plugs should be left in position and, starting with the centre nut and working in the order shown in the accompanying illustration, each of the cylinder head nuts should be slackened back a *quarter of a turn only* with the long handled box spanner that is provided in the kit. It is not advisable to take off the nuts completely one at a time, as this may set up strains and stresses in the middle of the cylinder head. When all the nuts have been eased, however, the one that was first eased can be unscrewed right off its stud, and it will be found that force or violence is absolutely unnecessary to remove any of the nuts, as the threads are properly made. The nuts should be carefully put in a box so that they do not roll about and

get lost. Then if the starter switch be pressed or the starting handle turned, the compression in the cylinder heads will probably be sufficient to break the gasket joint and allow the head to be lifted.

If this is not so, however, there will be found in each corner of the cylinder head a small lug or projection. These are to enable a purchase to be obtained with a tyre lever for lifting the head upward, and usually the joint can be quite easily broken by resting a tyre lever on the exhaust manifold and easing first at the back

The correct way to use the box spanner provided in the tool kit.

and then at the front on the two lugs on the nearside of the power unit. At the same time extra upward pressure can be obtained by putting one's fingers through the top water joint orifice and pulling upwards. On no account should a screwdriver or a chisel or any other sharp pointed tool be used as a wedge between the cylinder block and the head, otherwise the gasket will be spoiled and a proper water-tight joint will not be made on reassembling.

Easing the head off the block is by no means a difficult matter, and once it has been freed it should be lifted straight off and carefully laid on a bench, the sparking plugs being removed so that no carbon drops into their interiors during subsequent operations.

Lifting the head will expose the pistons and the valves to view, but before anything else is done the gasket—that is the copper asbestos washer which makes a gas and water-tight joint between the cylinder head and the block—should carefully be eased up the studs, it being noted that all parts should be lifted the same distance at the same time so that the holes are not torn by side pressure.

Removing the Carbon.

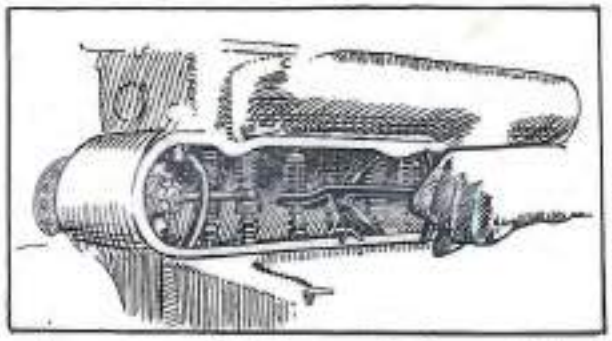
And now we are ready to scrape off the carbon. First of all turn the starting handle (you need not be afraid of upsetting the magnéto or valve timing) so that two pistons are at the top when

The proper way to scrape the piston tops free from carbon. Only a blunt edged instrument should be used.

it will be found that the other two are at the bottom of their cylinders. Stuff these "open" cylinders with clean rag and with a screwdriver or with a carpenter's chisel that has been suitably blunted at its end so that it still has a bevelled appearance but has actually no cutting edge, scrape all the black deposit off the top of the pistons, and also, using a smaller screwdriver as a scraper, going carefully round the valve heads so that the top surface of the cylinder block and the tops of the pistons have a bright, clean appearance free from any trace of carbon. Do *not* endeavour to polish things up with emery paper; it will do far more harm than good. Then when two cylinders have been properly cleaned give the starting handle half a turn and start on the other two.

This article is mainly on decarbonizing, but, as we have said, once the cylinder head is off it is quite appropriate for the valves to be removed and ground in. And this is how to get the valves out. The plate underneath the exhaust manifold on the nearside of the engine should be taken off by undoing the nuts that hold it. This will reveal the valve springs and stems. The way in which a Morris spring is fixed is best seen by reference to one of the illustrations on these pages, which shows that there is a circular groove in the stem of the valve into which fits a small horseshoe cotter. The circular valve collar rests on the cotter, and, of course, the bottom turn of the spring presses down on the collar, the top turn bearing against the cylinder casting.

Therefore, to remove a Morris valve some form of lever should first be placed underneath the valve collar and, with one hand held on top of the valve head to prevent it lifting, and the other one pressing down on the lever, which should be suitably fulcrumed, the spring should be compressed, which will result in the collar moving away from the cotter. There is a special tool made for removing Morris valves, it costs 7/6 and can be obtained on application to the Service Stores, Morris Commercial Cars, Ltd., Foundry Lane Works, Soho, Birmingham.



Above are shown the component parts of the Morris valve. Alongside is the method of using the valve-extracting tool that can be bought from Morris Motors, Ltd.

Removing the Valves.

Pressure can now be released from the valve head and the cotter can be pushed on the two ends of the horseshoe, so to speak, with a half-open pair of pliers so that it slides out of the recess of the valve stem, which allows the collar to come right down and also enables the valve to be lifted right out of the cylinder.

Full instructions for grinding in valves are given in another section, but in passing it may be said that after using valve grinding compound the top of the cylinder block and valve ports should be thoroughly well swilled out with paraffin, and it is important to see that none of the grinding compound finds its way on to the working surfaces of the cylinders and pistons. Additionally, if the valves are ground in, the tappets should be reset afterwards to give 4/1000ths of an inch clearance (the thickness of the paper on which these words are printed) to allow for the valves bedding themselves down after grinding. This information, be it noted, will be thoroughly amplified in a later article.

To return to decarbonizing. The head should next come in for attention, and with the same flat scraping tool all the black deposit should be removed, particular care being taken to see that it is shifted from around the part which goes over the valves—that is, the deepest part of the cylinder head. When using the scraper take great care not to scratch the surface of the cylinder head joint, otherwise gas leaks may set in at a later date.

Then when all the carbon has been removed take a coarse, clean rag, soak it in paraffin and thoroughly clean both the top of the cylinder block and the under side of the head until not a trace of dirt remains. Also lay the gasket on a clean piece of flat board and see that it too is quite free from foreign matter. Then comes the gold size. With a small brush carefully paint both sides of the gasket with this tacky substance, taking care to see that no wet blobs of it are left, for too much of this stuff may result in later troubles. What is wanted is a nice thin and even film. Then, having wiped one's hands to free them from dirt, the gasket is located over the studs in the cylinder head and it is best pushed down by employing a piece of tube (a box spanner does quite well) and, using this gently to force the gasket over the studs on which it seems inclined to stick. Again care should be taken to keep the gasket parallel with the cylinder head and not to force one end or one side down before the other.

Re-assembling the Engine.

Next the cylinder head is taken. It is preferable, incidentally, to try to hold it so that one's fingers do not touch its clean under side, and it too is slipped back over the studs. The cylinder head nuts are screwed down roughly with the fingers and then, starting with the centre nut, and working in the order shown, they are all

given their first tightening down, *the amount of pressure used on the spanner for this first operation being not more than can be given by crooking the forefinger of one hand round the extreme end of its shaft.* This process is continued until all the nuts have received their first tightening, and then the centre one is reverted too and is finally tightened down, the same order of tightening the others being followed as before. *It is most imperatively not advisable to tighten one nut down hard and leave the others loose.* They should all be made to take the strain (like a team in a tug-of-war) before the final pressure is exerted on any one. Incidentally, there is no need for any more force to be used in tightening Morris cylinder head nuts than can be obtained by hand. The spanner most decidedly should not be hammered.

The rest of the assembly is simply the sparking plugs are replaced, the top water joint remade, care being taken to see that the clip through which the magneto leads run is not forgotten, and the top water clip is tightened up. There can be no mistaking which magneto lead goes where, as they are all of different lengths, and then, the drain tap having been closed, the radiator is refilled with water. Usually the engine starts perfectly easily after decarbonizing, but before it is taken out on the road it should be allowed to run fairly fast in " free " for a few moments to allow the oil to get back on the cylinder walls.

After fifty miles or so it may be found that on going round with the cylinder nut spanner again one or two of the nuts can be tightened down a little more ; and usually this is really advisable.

The whole job of decarbonizing should not take more than about five hours even if the operator be quite unskilled. At a Morris Service Depot the charge for the job is 30/- (including grinding the valves and re-setting the tappets), but any way it is nice for the private owner to know that he has even saved this amount by his own personal endeavours, and, what is more, he will have learned a great deal about his truck.

SECTION VIII.

Looking After the Valves

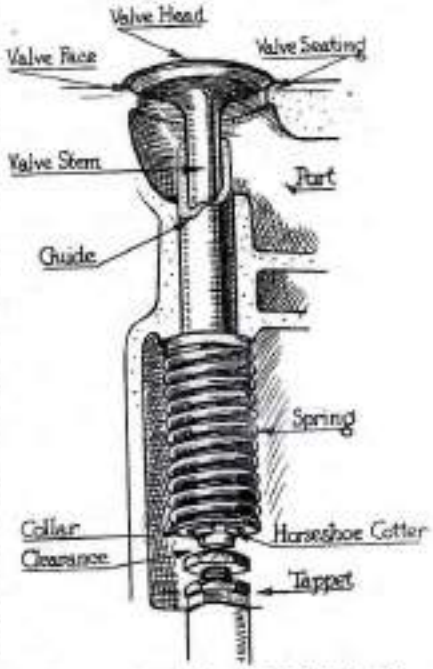
(Reprinted from The Morris Owner)

THERE are only two really important things that the owner-driver has to do to keep a Morris engine in good condition during his normal life. One is to decarbonize it and the other is to grind in the valves.

The valves of the Morris truck are of what are known as the side-by-side type, and they are situated on the nearside of the engine; that is, the left-hand side, looking forward. Underneath the round bulbous projection from the top of the engine on this side (the exhaust collector) will be found a long flat plate running the whole length of the engine, with three nuts in it. Removal of these nuts allows the plate to be detached, and exposes to view the valve springs, each of which is located above what is known as a tappet. The tappet has three nuts on it, which are for adjustment. The springs surround the valve stem, their upper ends bearing on the casting of the cylinder, and their lower ends on a collar or plate with a hole through it, which, in turn, presses against a little horseshoe cotter, which fits into a groove cut in the pencil-like stem of the valve.

These two photographs show a valve before (top) and after grinding-in. Note the different appearance of their seating faces.

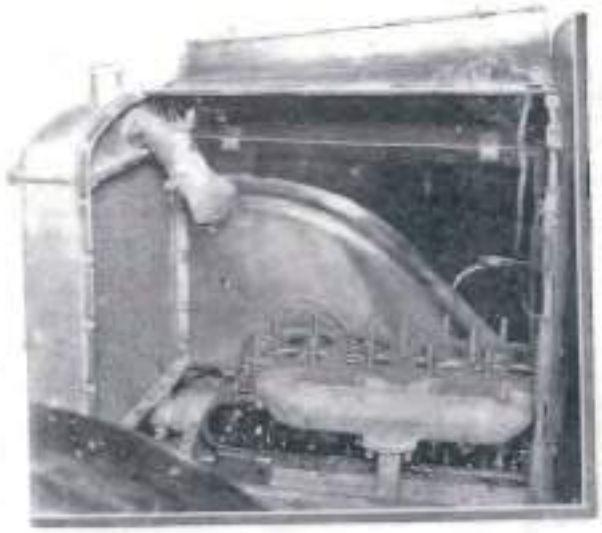
Removal of the cylinder head (see article on decarbonization) discloses on the left-hand side of the engine the valve heads, and in no matter what position the pistons may be, according to how the engine has stopped on switching off, one or more valves will be raised, which shows that a valve consists of a round, flat head attached to a thin pencil-like stem, the whole being rather like an elongated and decidedly tough mushroom.



The component parts of a Morris valve, shown in position in the cylinder block.

The disc-like head of

the valve has, on its underside, what is known as a face, which means that its edge is cut slantwise all the way round, and this face comes into contact with a corresponding face or seat in the cylinder block; and these two, meeting, form a gas-tight joint which seals the cylinder when required. When the valve is pushed upwards against the tension of the spring, by the tappet, the gas is free to travel through the hole in the cylinder block, known as a valve port, and it is the tension of the valve spring that returns the valve to its seat as the rotation of the cam allows the tappet to fall.



A light spring placed under the head of the valve will materially assist in "grinding-in" the valves

Now, gastightness (commonly known as compression) in an engine is very important, for, obviously, if the gas leaks away when it is not wanted to, the full force of the expanding gas will not be exerted on the piston when the spark takes place, and the engine will lose power, requiring constant gear-changing. The valves really have a very thin time of it, particularly the exhaust valves, for the gases that sweep past them are absolutely flaming-hot, and, in a sense, it is really remarkable that a metal face exposed to this heat can and does remain bright, true and gastight for any length of time. Remember that when doing 30 m.p.h. every one of the valves is opening and shutting something like a thousand times a minute.

After about a thousand miles it will be found that the polished face of the seating end of the valve will have become dirty, due to this burning action of the gas, and grinding-in will be required. The grinding-in is nothing more nor less than cleaning the valve faces and seatings by rubbing them together with a certain amount of abrasive material in between, so that they will mate up perfectly and be absolutely gastight. In a sense, it is a cleaning process; but it also evens up the surfaces.

This is how it is done. By using the special tool shown on another page of this manual, the valve spring is kept raised. While the valve is down, the horse-shoe cotter is removed, which permits the valve to be drawn upwards when the cylinder head has been taken off.

The port and the underside of the valve should be cleaned as free from carbon as is possible, by scraping them with an old knife, the whole should be wiped over with a rag soaked in paraffin, and then the face of the valve should be touched here and there with the end of a match that has been dipped in some valve-grinding compound such as Richford's Paste or Carborundum. (On a Morris it is not usually necessary to use coarse-grade paste or compound; the finer grades, if they may not cut so quickly, ultimately give better results.)

The valve is then dropped into position, a screwdriver inserted in the slot in its head, and, while a comfortable amount of pressure is employed, it is twisted backwards and forwards in its seating. Here we come to the secret of good valve-grinding. The valve should be lifted away from the seating after every two or three twists. If this is not done, the grinding compound spreads unevenly into streaks, the result being that minute circular grooves are cut into the valve-face and the corresponding seating, and these absolutely prevent the formation of a good gastight fit.

The most convenient way of ensuring that this lifting process is done, is to obtain a light spring, which will fit under the head of the valve, and to drop it into the port as shown in one of our illustrations. Then, when pressure is released on the screwdriver, the valve will pop up and the capillary action of the compound will let it spread itself.

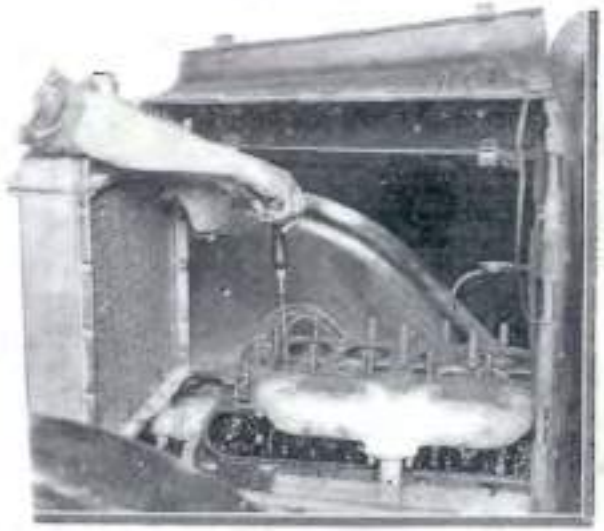
How it is done.

On a Morris engine that has done about a thousand miles, it only takes two or three minutes' continuous twisting to grind in each valve, and one notes that the operation is finished when the valve face has a clean, even, matt-surfaced ring around it. It is sometimes thought that the valve face should be absolutely polished bright, but this is not so; it should simply have a nice white appearance, smooth and even.

If the engine has been run without being decarbonized for long

periods, the valve face may be pitted; that is, it will have little black specks on it, these being caused by small pieces of carbon getting between the face and seating, and being hammered into the metal by the continual operation of the valve. If these pits appear to be very deep it is best to have the valve face trued up by a special cutter at a garage, but usually the grinding process can be continued until they disappear.

After a valve has been ground in it should be very carefully washed with paraffin and, what is more important, the valve port should also be swilled out thoroughly and cleaned, preferably by using an old tooth-brush or something similar. It is of utmost



The screwdriver provided in the tool kit is quite suitable for "grinding-in" the valves.

importance that valve-grinding compound should not find its way on to the working surfaces of the engine, otherwise all sorts of undesirable parts would be ground in, ruining the engine altogether and costing the owner a great deal of money. The great thing to observe when handling valve-grinding compound is to use very little indeed. An ordinary small tin costing about one shilling should last several years.

When all the valves have been finished and the cylinder block thoroughly cleaned, there comes the operation of replacing the valve springs. If the valve-lifting tool shown herewith is used, this is a simple matter; otherwise it may be a two-person job, one holding down the valve-head by pressing on it with the thumb,

while the other operator raises the collar against the tension of the spring with a tyre-lever suitably fulcrumed, say, on a block of wood, and this enables the horse-shoe cotter to be slipped into its groove.

After valve-grinding it is always necessary to reset the tappets. The way to do this was described in the article on decarbonizing. It is done by using the three nuts on the top of the tappets, the centre one of which is a lock-nut, which should be undone first, and then the top nut should be screwed relative to the bottom one until the piece of paper on which these words are printed can just be pushed between the stem of the valve and the tappet —just, and just only.

Resetting the tappets is necessary, because the valve-head will have been ground down further into the seating, thus reducing the clearance, and, if the valve is held off its seating the flaming gases will destroy the faces, absolutely undoing all the good work of valve-grinding.

The operations described above should not take an average handy-man more than about six hours, including decarbonizing the engine as previously described. All that is needed is a little care, and it will be found that the engine has improved very greatly as the result of valve-grinding, which, therefore, is well worth while.

SECTION IX.

Care of the Sparking Plug

(Reprinted from The Morris *Owner)*

THE most painstaking and conscientious owner-driver will often go to endless trouble when tuning his engine to trim the magneto points, adjust the carburetter setting, the tappets and the oiling system, and then leave the sparking plugs severely alone.

It is a peculiarity of human nature that a costly article—be it a motor tyre or a gold wrist watch—is treated with more respect by the owner than a less expensive article, such as a sparking plug or a fifteen shilling alarm clock. Therefore, it is not surprising

that the plugs fitted in the majority of engines receive little or no attention, while more expensive components are carefully adjusted and kept in good condition.

Loss of Tune.

It is not generally realised that sooty or oiled-up plugs will cause erratic running, loss of power and, most serious of all, increased petrol consumption. Unless an intense spark takes place between the plug points in the cylinder complete combustion of the petrol mixture will not take place and a certain amount of petrol vapour will be wasted with every revolution of the engine. If the plug points are covered with oil or if the plug itself is choked with carbon deposit, it will be impossible to obtain a good spark in the cylinder.

In this article a brief description will be given of the plugs fitted to Morris trucks and simple means of cleaning and keeping them in good condition. Although primarily written for the benefit of the Morris owner, the hints on adjustment and choice of correct plugs will apply equally well for any other make of car.

The A.C. Titan.

The A.C. Titan plug in part section.

All Morris trucks are fitted with A.C. Titan plugs, new type B11, ½ reach, a specially sectioned view of which is shown herewith. This particular plug is fitted with a detachable ceramic insulator which may be removed from the plug body for cleaning or renewal when necessary. The insulator is made by a special process which enables it to retain its very high insulating properties under varying conditions of extreme heat or moisture, or when coated with oil or carbon deposit. This enables a full fat spark to be delivered at the firing points, thereby ensuring instantaneous combustion of the petrol mixture and consequently maximum power from the engine.

Although the insulator of the A.C. Titan is detachable for cleaning purposes by unscrewing the gland nut, it is very seldom necessary to take the plug apart, because it can be easily cleaned by immersing it completely in paraffin for a few hours and then brushing the carbon deposit away with a small stiff brush. Beyond occasional cleaning in this way, it is not necessary to tamper with the plug, except to adjust the distance between the sparking points.

The gap between the actual sparking points is a most important detail and even new plugs should be tested before being placed in the engine. An exceedingly useful little tool, known as "a feeler

gauge" may be purchased quite cheaply and will enable anyone to adjust the plug points correctly. These should be set to eighteen-thousandths of an inch.

Tracing Troubles.

As previously mentioned, the sparking plugs, unless kept in good condition, will cause any amount of trouble, which is often attributed to some part of the power unit. It is quite a common thing for a driver to go to the trouble of overhauling his carburetter, valves and magneto and, after looking in vain for the cause of the trouble, decide at the last moment to clean his plugs—and hey presto! the truck is at once a different thing, full of life and vigour. It will sometimes be found that only one or two plugs are firing erratically, causing the engine to run in a jerky fashion; to ascertain which plug is actually faulty without removing it from the engine, the motorist should try each plug in turn with the aid of a "spark tester." The tester consists of an insulated body fitted with a mica window and two projecting prongs. One prong is placed on the centre terminal on the plug, the other touching the plug body. If the plug is firing correctly in the cylinder, a strong "blueish" glow will be seen through the mica window; but if the plug is partially oiled up or not firing, the glow will be very faint or cease to show at all.

Points in Plug Design.

The plugs as fitted to the Morris trucks were only adopted after exhaustive tests; there is no advantage therefore in fitting new ones of some other type. This brings up an interesting question which motorists repeatedly ask—why will a certain plug work splendidly in one engine and yet be hopeless in another? The answer is that in designing a plug, two features must be considered; firstly, the amount of heat, and secondly the amount of oil, which it will have to withstand. These two features are invariably at opposite ends of the scale; thus we find that a plug suitable for a racing car will have to be proof against extraordinarily high temperatures, but at the same time it will not be required to function in a particularly oily atmosphere. On the other hand, in a touring car used under ordinary touring conditions the plug will seldom get exceptionally hot, but will be subjected to an unusual amount of oil. The whole secret, then, is to choose a plug which will get just hot enough to keep itself clean and yet not hot enough to pre-ignite.

Now, the principal factor in obtaining this result is the amount of gas space available inside the plug. A plug built to withstand an exceptional amount of heat will not stand oil and *vice versa*. Therefore rely on the maker's choice.

SECTION X.

General Service

ANY owner of a Morris truck who is in doubt or difficulty over the behaviour of his vehicle is particularly asked to write to the Works. At the same time, however, it is most advisable whenever possible to consult our Agent in the owner's locality, since the very best verbal description is a poor substitute for a personal examination. This is the main reason why we are so anxious that customers should always purchase their trucks through our Authorized Agents in the district in which they live. These Agents handle our trucks in large numbers, are frequently at our Works, and take an individual interest in every truck of which they dispose. In many cases they send their mechanics to the Works for a special course of training whereby they learn the best, quickest and easiest methods of carrying out any repair or adjustment which may be required.

What is, perhaps, even more important, while at the Works they have the opportunity of noting the symptoms of the various complaints that the commercial vehicle is heir to, and are thus able rapidly to diagnose the trouble and prescribe the remedy. Far more time is usually spent in searching for the cause of a knock or a squeak than in remedying it when found, and instances are frequently brought to our notice where a great deal of over-hauling work has been carried out, entirely unnecessarily, with resultant heavy bills and without the desired result being attained.

This is not written to disparage the work done by the average garage, but it is self-evident that men who see and attend daily to trucks of one particular type have a great advantage, so far as this type is concerned, over others—perhaps equally skilled—who deal with it occasionally only.

If our local Agents are unsuccessful in remedying a trouble, the Works should be at once advised. All questions relative to Morris trucks put on the road are dealt with by the one department only and are tabulated under the various portions of the truck affected. If any trouble occurs with a truck, we can therefore tell instantly whether a similar case has happened previously, the origin of the trouble and the treatment that is necessary to overcome it. If there is no similar case recorded, steps are at once taken to carry out a thorough investigation, with a view not only to curing the particular case, but to prevent, if possible, the recurrence of other cases.

SECTION XI.

Chart for Diagnosing Trouble

The following list of possible troubles that might occur at one time or another have been arranged so that if the symptom or outside evidence of the trouble is determined, a process of elimination should show the actual cause. Symptoms have been grouped according to the units of the truck in which they are likely to occur.

Engine Faults

Engine will not Start.

Ignition switched off.
No petrol.
Slow running control not adjusted properly.
Too much petrol.
No spark from magneto.
Magneto contact breaker points dirty.
Petrol feed obstructed.
No compression. (Valves or piston rings bad.)
Magneto contact breaker bush stuck.
Air leak between carburetter and cylinder block.
Camshaft gear wheel key sheared.
Water or dampness in magneto.

Engine Starts with Difficulty.

Sparking plug electrodes out of adjustment.
Mixture too weak.
Poor compression.
Air leak at carburetter joint.
Valve stem guides worn.
Carburetter control improperly set.
Magneto magnets weak.
Magneto contact breaker points sticking.
Petrol level of carburetter too low.
Magneto contact breaker points dirty, burnt, or out of adjustment.
Inferior petrol.
Mixture too rich. (If engine is warm.)
Wrong oil being used.

Engine Misses at all Speeds.

Sparking plugs dirty.
Sparking plug electrodes too wide or too close.
Weak valve springs.
Short circuit in high tension leads.
Mica flaking or insulator cracked on plugs.
Poor compression.
Improper adjustment of carburetter control.
Choked petrol supply. (Dirty jets.
Magneto high tension leads loose.
Contact breaker points worn or burnt.
Condenser burnt out in magneto.
Bad petrol.
Contact breaker arm sticking.
Carburetter adjustment wrong.
Water in magneto.

Engine Misses at High Speed.

- Carburetter adjustment too rich or too weak.
- Magneto contact breaker arms sticking.
- Magneto points dirty.
- Valve timing wrong.
- Valve stems too tight in valve guides.
- Sparking plug points not correctly adjusted.
- Weak valve springs.

Engine Misses at Low Speeds.

- Mixture too weak or too rich.
- Poor compression.
- Worn valve stem guides.
- Tappets not adjusted properly.
- Sparking plug points too close.
- Air leak at carburetter washer.
- Magneto out of order.
- Leaky cylinder head gasket.

Ignition Knock. (Sharp metallic "Clink.")

- Engine requires decarbonizing.
- Ignition set too early.
- Mixture too weak.
- Wrong grade of petrol. Try benzole.

Engine Knock.

- Ignition knock (see above).
- Gudgeon pin worn or broken.
- Main bearings worn.
- End play in the camshaft.
- Little end bearing worn.
- Big end bearing worn.
- Pistons worn.

Piston Slap.

- Pistons worn.
- Connecting rod or gudgeon pin centres out of alignment.
- Cracked cylinder block.
- Positioning spring under top ring too weak.
- Cylinder walls worn.

Noisy Valve Gear.

- Too much clearance between tappets and valve stems.
- Insufficient lubrication to camshaft wheel.
- Worn cams on camshaft.
- Tappet heads worn.
- Tappets worn.
- Camshaft half-time wheel worn.

Loss of Power.

- Compression poor.
- Carburetter out of adjustment.
- Ignition timing set too late.
- Exhaust pipe choked.
- Universal joint seized.
- Weak ignition.
- Tappets adjusted too closely.
- Engine over-heats (see later).
- Contact breaker points out of adjustment.
- Brakes too closely adjusted.
- Sparking plug points out of adjustment.
- Road-wheels out of track.

Loss of Compression.

- Leaky valves.
- Piston rings worn.
- Broken valve spring or cotter.
- Tappets out of adjustment.
- Leakage in cylinder-head gasket.
- Cylinder scored.
- Valve seating warped.

Engine Over-heats.

Insufficient water in radiator.
Fan belt slipping.
Wrong valve timing.
Lubrication pump not functioning properly.
Insufficient oil in sump.
Ignition set too late.
Engine requires decarbonizing.
Carburetter out of adjustment.

Engine Carbons up too Quickly.

Carburetter mixture too rich.
Inferior or wrong grade of oil.
Over oiling.
Piston, rings, cylinder worn or scored.

Carburetter Flooding.

Carburetter float sticking.
Petrol level too high.
Carburetter top loose.
Carburetter float petrol logged.
Dirt on seating of carburetter needle valve.
Carburetter needle valve seating worn.

Popping Back through Carburetter.

Mixture too weak.
Air leak at carburetter joint.
Inlet valve sticking.
Foreign matter in petrol supply pipe.
Carburetter float sticking.
Petrol level too low.
Inlet valve spring broken.
Plug points too far apart.

Banging in Exhaust-pipe.

Mixture too weak.
Mixture too rich.
Engine misfiring.
Exhaust valves not seating properly.
Ignition timing set too late.

Hissing Noises when Engine is Turning Over Slowly.

Leakage in sparking plug.
Exhaust pipe union with manifold, loose.
Exhaust manifold gaskets leaking.
Valves require grinding in, or are not seating properly.

Note.—A blow-back past the piston rings gives a hissing noise through the crank case filling orifice which may often be mistaken for a hissing noise in some part of the exhaust system.

Smoky Exhaust.

Oil level too high (blue smoke).
Mixture too rich (black smoke).
Piston rings and pistons worn.
Inferior or incorrect grade of oil.

Water in Cylinder.

Cylinder head gasket leaking.
Cracked cylinder head.
Cracked cylinder block.
Cylinder head nuts not sufficiently tight.

Oil Gauge does not Register.

Gauge broken.
Leakage in oil pipe.
Pump not functioning.
Tap of gauge shut off.
Oil pipe obstructed.
Wrong oil being used.

Note.—With the lubrication system employed in the Morris car, the oil gauge is only used to show that the pump is functioning and the pressure registered is immaterial as long as the needle is showing some slight movement.

Oil Pump does not Function.

Oil level too low.
Ball valves sticking.
Pump worn.
Oil pipes choked.
Pump plunger seized.
Leakage in oil pipes.
Pump broken.
Pump spring broken.

Oil Leaks at Joints.

Broken or burnt cylinder-head gasket.
Cylinder head warped or not seating properly through unequal tightening of bolts.
Dirt under gasket.
Bottom case washer worn or damaged.
Crankcase bolts loose.

Engine Stiff.

Pistons tight.
Bearings tight.
Bearings or pistons partially seized.
Oil too thick.
Piston or connecting rod out of alignment.
(All new engines are stiff.)

Seized Engine.

Lack of oil.
Inferior or wrong grade of oil.
Pistons or bearings set up too tight.
Oil pipes choked.
Pump not functioning.
Oil requires renewal.
Faulty water circulation.
Over-driving new engine.

Seized Bearings.

Insufficient oil.
Oil supply pipes choked.
Bearings set up too tight.
Leaky or broken oil-pipes.
Dirt in oil.
Wrong grade of oil.
Dirt in bearings.
Over-driving new engine.

Scored Cylinder.

No water in cooling system.
Pistons too tight.
Connecting rod out of alignment.
Lack of oil.
Gudgeon pin broken or loose.
Piston rings too tight.

Richmond Printeries, Bournemouth.

CRANK POSITION AT OPENING & CLOSING OF VALVES.

POSITION OF PISTON from TOP DEAD CENTRE POSITION at OPENING and CLOSING of VALVES.