

INSTRUCTION MANUAL . . .

for

THE UNAPPROACHABLE

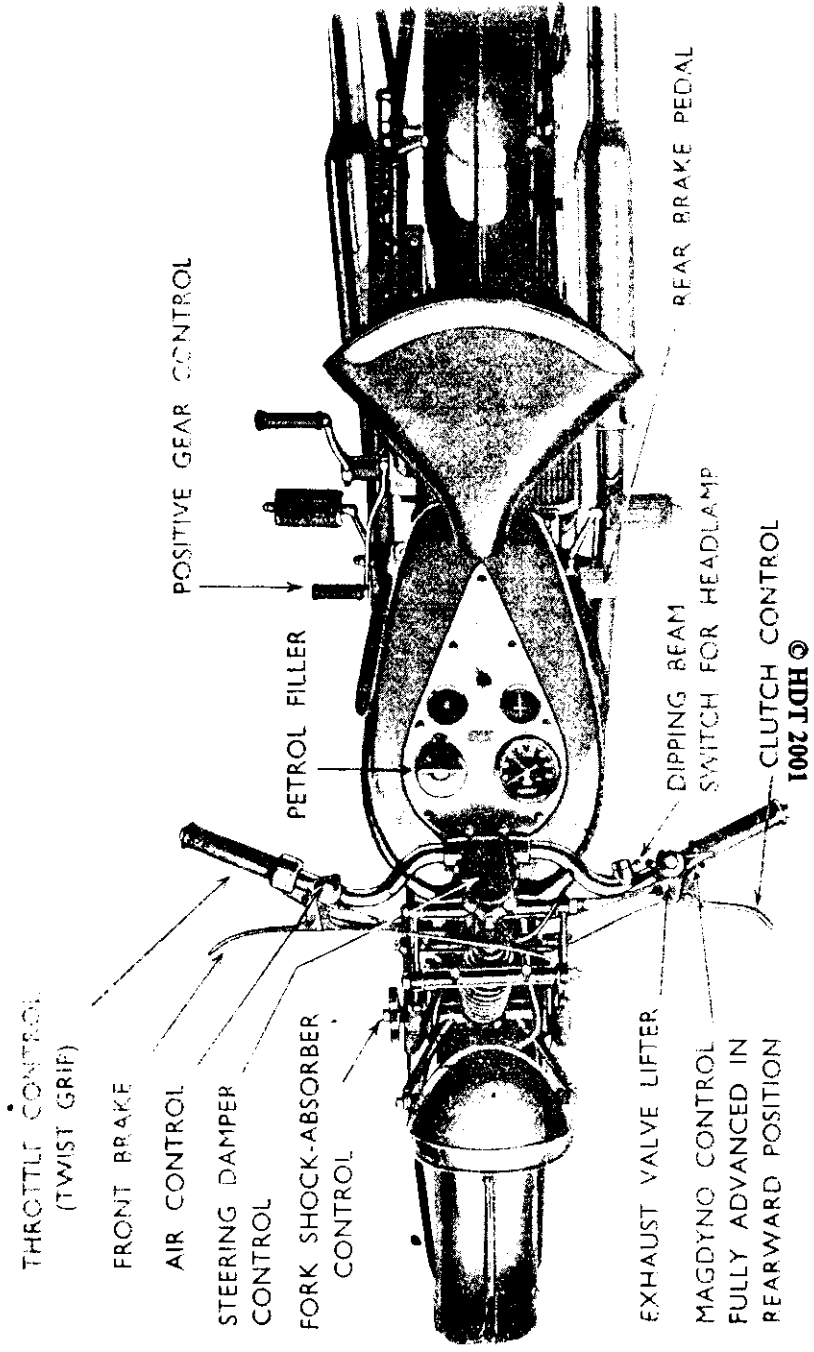
Norton
REGD. TRADE MARK
Motor Cycle

NORTON MOTORS LTD.

Telephones:
ASTon Cross 0776, 0777, 0778
3 Lines P B Ex

Telegrams:
"NORTOMO"
BIRMINGHAM

BRACEBRIDGE ST., BIRMINGHAM, 6, England.



INTRODUCTION

In preparing these instructions we have omitted the elementary details and preliminary information that perhaps is necessary for an absolute novice, in the assumption that the majority of riders of Norton machines are fully acquainted with the elementary details for efficient maintenance. Our services are, however, at all times available to give any information that may be required which will facilitate obtaining the maximum efficiency, and we invite Norton riders to enlist our aid whenever in doubt; our services will be freely and willingly placed at their disposal.

Starting Fill petrol tank petrol benzole mixture being most suitable, although petrol only will be quite satisfactory. Fill oil tank.

At present Works Wakefield Patent Castrol Oils have been used for many years exclusively with highly successful results.

For running purposes WAKEFIELD PATENT CASTROL "X.N.L." could be used in Summer, in Winter, however, WAKEFIELD PATENT "X.L." should be used. This applies to all models with the exception of the overhead camshaft type; for this in Summer or Winter WAKEFIELD PATENT CASTROL "R" should be used.

Other very suitable oils for NORTON machines are PRICE'S MOTORINE "B" DE LUXE, MOTORINE "C" DE LUXE and AEROSHELL. The grades recommended are as follows:—

PRICE'S MOTORINE "B" DE LUXE for all models, including O.H.C., in Summer.

PRICE'S MOTORINE "C" DE LUXE for all models, except O.H.C., in Winter.

WAKEFIELD PATENT CASTROL has been used by the successful team of NORTON works riders in all the World's International Road Races in which they have been so successful.

PRICE'S MOTORINE "B" DE LUXE for O.H.C. type in Summer and Winter.

AEROSHELL is suitable for all models for either Summer or Winter use.

When changing grades of oil, the crankcase should be drained and thoroughly rinsed before replenishing.

With gear lever in neutral, slightly flood carburetter, place ignition lever midway between advance and retard, leave air lever closed, open throttle very slightly, lift exhaust valve lever and depress kick starter crank as smartly as possible, at the same time releasing the exhaust lever just before the kick start reaches the end of its stroke. If engine is warm, or does not start immediately, open air lever slightly. In very cold weather when the engine is stiff or if the machine appears difficult to start, the following method will prove easier. Depress kick start crank without lifting exhaust valve lifter until resistance of compression is felt, raise exhaust lifter and depress kick start crank a further one or two inches, allow crank to return to its upright position.

and without lifting exhaust valve lifter, depress kick start crank as smartly as possible. A frequent cause of difficult starting is excessive flooding of carburetter (float chamber). Gear changing, etc., can be effected in the usual way, the bottom gear being in engagement when the indicator on the foot change mechanism has moved as far as possible in an anti-clockwise direction. Remember that this is a high efficiency engine and do not be afraid to change into a lower gear at the first sign of labouring, or if the engine speed is so low that the motion of the machine becomes jerky. All gear changes are effected by moving dogs and not by sliding gear teeth, so that there is no danger whatever of damaging the gear box under normal usage.

For normal running the air lever should be fully or nearly fully opened. If engine smokes when starting up, ignore this, the return pump will quickly return the surplus oil to tank. Under all ordinary circumstances, when the machine is travelling over 25 m.p.h. on the level in top gear, the ignition lever should be in the fully advanced position. Only retard ignition when the engine revolutions are comparatively low, such as, when hill climbing, and at any other time when the engine shows a tendency to pink, but if the machine still tends to labour with ignition retarded, change into a lower gear. With the Lucas Magneto or Magdyno the ignition is fully advanced when the control lever is moved towards the rider, that is, when the cable is in tension. In the case of the B.T.H. Magneto this is reversed the ignition is advanced when the lever is away from the rider and there is no tension on the cable.

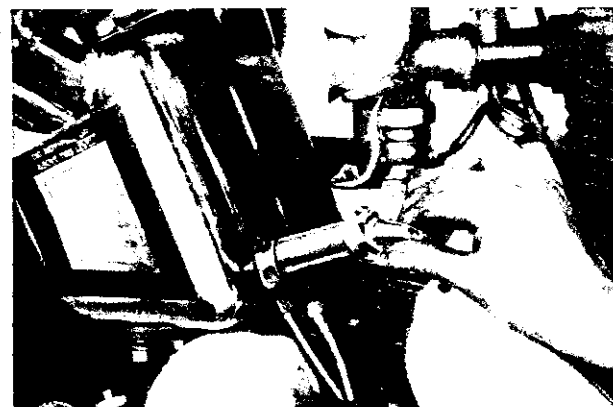
LUBRICATION

Engine. The lubrication system is operated on the dry sump principle and has been designed to give the correct amount of oil to all parts, under all conditions, the oil being fed with pressure from the oil pump to the big end bearing from which it is carried to the cylinder and piston. A separate feed is taken to the cam gear and another feed to the cylinder wall, which lubricates the piston skirt in addition to that provided by the big end. The oil which has been circulated to the various bearings is drawn to the bottom of the crankcase, where it is immediately picked up by the return pump and returned to the tank.

To check circulation of oil, open filler cap in oil tank, and if oil is circulating correctly a froth deposit will be noticed on the oil surface.

Be sure not to let the oil in tank fall below half way. The oil tank should be emptied and cleaned out at least once every 2,000 miles.

To empty oil tank it is only necessary to remove the hexagon headed drain plug which is situated in the bottom of the tank. This will allow the whole of the oil to drain off. The first time the tank is drained and occasionally afterwards the tank should be swilled out with petrol in order to remove any trace of dirty oil from the sump. On a new machine it is necessary to drain and clean the oil tank after the first 1,000 miles.



Removal of Union and Filter

New machines should not be driven more than 35 miles per hour for the first 500 miles in top gear, or a correspondingly slower speed in the lower gears. The best way to insure that the engine is carefully run in during this period is by never opening the throttle more than $\frac{1}{4}$ to $\frac{1}{2}$, and more important still, by not allowing the engine to slog or labour, i.e., run jerkily at slow speeds, but under these conditions always change into a lower gear. It is always recognised that a machine which has been carefully run in is superior to one with which due care has not been exercised in the early stages of the life of the machine.

Cycle Parts. All bearings upon which movement takes place are fitted with nipples for grease gun lubrication. It is necessary to employ a good quality light grease, such as: WAKEFIELD CASTROLASE LIGHT, PRICE'S BELMOLINE, or SHELL RETINAX. If grease is not available, engine oil will make a good substitute, but owing to its tendency to leak more frequent application will be necessary.

Transmission. Oil bath lubrication is provided for the primary chain. Oil should be replenished approximately every 1,000 miles. Instructions for refilling are given on page 25.

Rear Chain. Smear inside face of chain with grease every 1,000 miles. More frequent application is advisable under bad climatic conditions.

Gear Box. This will require recharging with lubricant every 1,000 miles. Grease can be obtained in special collapsible tubes which facilitate its injection into the gear box. In its absence it will be necessary to warm the grease in order to transform same to a liquid form. About half a cupful will be sufficient for each charge. It is also advantageous to add about one egg-cupful of ordinary engine oil, and in the absence of grease, oil only can be substituted. A little grease should also be injected into the foot gear change mechanism (when fitted), by means of the grease nipple on the end of the foot lever shaft.

Spring Forks. Grease gun nipples are provided for all shackle bearings; these should be lubricated once every 1,000 miles, forcing in sufficient grease to fill the whole of the bearings so that the grease is beginning to be forced out at the end of the spindle.

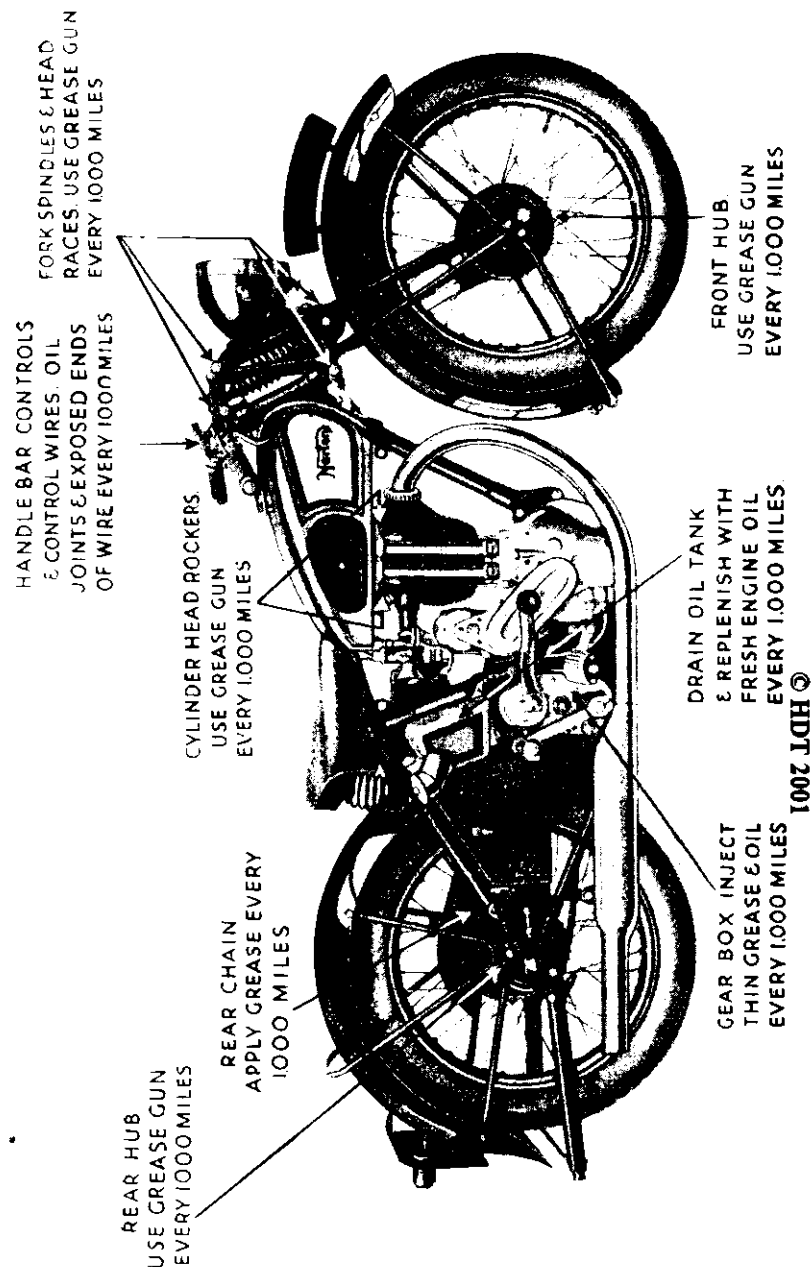
Road Wheels. A grease gun nipple is provided in each hub. About one egg-cupful of grease should be injected every 1,000 miles. Do not use too much grease, otherwise the surplus may work through to the brake linings.

Controls. All controls should be lubricated once every 1,000 miles; this will noticeably make the machine more pleasant to drive. Ordinary engine oil or thin grease to be used for this purpose. These controls will include the handlebar levers, gear change lever and jaw joints, and brake mechanism. A little oil or grease should also be applied to the exposed portions of the Bowden cable inner wire so that this tends to work to the interior of the casing.

Magneto or Magdyno. No lubrication is necessary. The bearings are well packed with grease before leaving these works and will run definitely without attention. Full magneto or magdyno instructions are given later in this booklet.

Cylinder Head Rocker Lubrication (O.H.V. Engines only). These rocker bearings are lubricated by oil mist from the crankcase, but this should be supplemented by grease every 1,000 miles. It will be noticed that two grease gun nipples are provided on the side of each rocker bearing boss on the rocker box fixed immediately above the cylinder head.

Tappet Clearances. Periodically check, and adjust if necessary, the clearances between tappets and valves on Side Valve engines and between rockers and valves on O.H.V. and O.H.C. engines. The correct clearances are given under timing information later in this book.



SPARKING PLUGS

An engine will not run efficiently unless fitted with a suitable sparking plug.

The following plugs are recommended:

Models 30 and 40, K.L.G. L.K.S.5. 14 mm.

Models 1 and 16H, K.L.G. S.1.

Other models, K.L.G. 583, or Lodge H14

TRACING FAULTS DEVELOPED ON THE ROAD

The reliability of NORTON productions is such that trouble of a serious nature on the road is practically unheard of. The following hints, however, may be of assistance in the event of an involuntary stoppage, since they are in no way connected with the actual reliability of the machine and are points which are normally under the rider's control.

In the event of an engine stoppage the following points should be examined; it is almost certain that the cause will be one of the undermentioned.

Absence of Petrol. Symptoms of irregular firing for a short period, after which the engine would probably cease to fire. Make sure there is plenty of petrol in tank, if so, disconnect petrol pipe at carburettor end and turn on petrol; if a good flow of petrol is present, stoppage is either in the carburettor jet or in the float chamber, these should be examined and any dirt removed. Full instructions dealing with these points are given under the heading of CARBURETTER in this book. We may here mention that water in the float chamber or carburettor will cause an engine stoppage.

Faulty Ignition. Symptoms in this case are sometimes that the engine suddenly ceases to fire or will not run at slow speeds. If riding in rain or on wet roads, examine the mica or porcelain portion of the sparking plug to ensure that this is not wet, if so any moisture must be removed, and exactly the

same remark applies to the high tension wire, i.e., the wire which connects the magneto to the sparking plug. If this is in order, remove sparking plug and hold it with the body touching the engine cylinder but with the terminal end of the plug connected to the high tension lead, and hold so that this end of the plug and high tension wire are well away from the cylinder. Revolve engine by means of kick-starter; if a good spark is obtained the trouble lies elsewhere, but if no spark or a very weak one is obtained, remove plug from end of high tension wire and hold the latter about $\frac{1}{4}$ in. from one of the cylinder faces; again revolve engine by means of kick-starter, if a spark is obtained the trouble will lie with the sparking plug, which must either be cleaned or replaced. To clean, it will be necessary to take the sparking plug apart and the interior of the plug, i.e., the part which is exposed to the gas flame, should be carefully cleaned and all oil and carbon removed. If, however, the plug is in a bad condition or the points are burnt, a new plug must be fitted, preferably of the type recommended under the heading SPARKING PLUGS in this book. The gap between the sparking plug points should be approximately $\frac{1}{32}$ in., if these items are correct trouble lies in the Magneto. Examine the fitting of the high tension wire to see if it has not worked loose where it is connected to the magneto, and also that the rubber covering of this high tension wire has not worn through in any place so that the inner copper wire is exposed. Remove cover from magneto contact breaker housing and examine the clearance between the platinum points; the engine must be revolved by means of the kick-starter until these points are open, when the clearance between the points should be about .010 in. to .015 in., which is roughly equivalent to the thickness of the gauge attached to the magneto spanner which is enclosed in the tool kit. The contact breaker must be quite clean and free from grease, and, if necessary, remove contact breaker complete by unscrewing the centre hexagon screw and withdrawing the contact breaker, using a screwdriver as a lever for this purpose, but of course do not use unnecessary force, and when replacing see that the keyway is correctly located. When removed, clean all grease or dirt from the back housing face of the contact breaker, also if necessary remove the high tension lead holder, where same is attached to the magneto, inside of which will be found a carbon brush; this should be cleaned and the slip ring cleaned with a rag pushed into the hole which was formerly occupied by the high tension lead holder.

Absence or almost entire absence of compression in Cylinder. The most frequent cause is an insufficient or entire lack of clearance between rocker and valve in the case of O.H.V. engines, or between tappet and valve in the case of Side Valve engines. To check, revolve engine until same is in such a position that the valves should be closed; if there is no clearance at this point the

rockers must be adjusted so that the correct clearance, which is given under the heading ENGINE TIMING in this book, is obtained.

This trouble may also be accounted for by a sticking valve, in which case there will be excessive clearance between one of the rockers or tappets and the valve, and the valve is not returning to its seat owing to the fact that the stem is sticking tightly in the guide. To cure, apply oil to the valve stem and revolve engine by means of the kick-starter, which after a few revolutions should free the valve.

The whole of the heavily loaded bearings on this engine are mounted on ball or roller bearings, so that trouble at these points is quite an impossibility. If a seizure occurs through running the engine without oil or through using an unsuitable or inferior grade of oil, the consequences will be serious.

It must be remembered that the symptoms of pre-ignition are almost identical with those of a seized engine; this trouble is invariably caused through the use of an unsuitable type of sparking plug.

Tank Panel. The tank panel (Registered No. 773858) is unique in that it is possible to remove the tank without disturbing or disconnecting any of the electrical wires or connections utilized for the electrical equipment. To remove petrol tank, place petrol taps in 'off' position and disconnect petrol pipes. It is not necessary to drain the petrol tank. Unscrew the four fixing bolts which attach the tank to the frame platforms and remove the slotted head screws which attach the panel to the tank; this will enable the panel to be lifted sufficiently to allow the tank to be removed. If a speedometer is fitted, disconnect drive at speedometer end before removing tank.

DECARBONIZING

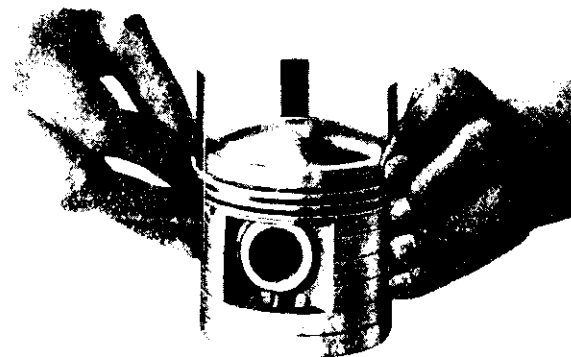
Models 50, 55, 18, 19, 20 & E.S.2. (O.H.V. Push Rod Engines). It is advisable to decarbonize the engine every 2,000 miles, the mileage between decarbonizing should never exceed 3,000; if the machine is used for really fast work, more frequent decarbonizing will be advantageous. It is, however, not essential to grind in the valves every time the engine is decarbonized, about once every 10,000 miles should be sufficient, providing, of course, the engine has had normal usage.

It is more convenient when undertaking decarbonizing to remove the petrol tank. Remove carburetter, exhaust pipe and sparking plug. See that the engine is revolved to such a position

that both valves are on their seats, i.e., that there is a clearance between the rocker adjusters and valves. Unscrew the cheese head screws which hold the rocker box cover in position; this will enable the cover to be removed and the push rod cover tubes can then be slackened in their top housing. Slacken the gland nuts which hold these tubes to the crankcase. The four holding down bolts which hold the rocker box in position can now be removed and the rocker box taken away; this will enable the four nuts to be unscrewed. If difficulty is experienced in detaching the head from the barrel, a tap under the inlet port, using a lead hammer or interposing a piece of wood between an ordinary hammer and the inlet port should loosen same. To remove cylinder barrel, revolve engine until the piston is at the bottom of its stroke; the cylinder can now be removed vertically, taking very great care not to allow same to move sideways, otherwise the connecting rod may be bent. As the barrel is being raised from the piston, the latter should be supported in the hand. Before lifting cylinder clear of the barrel, choke up top of crankcase with rag to prevent any possibility of foreign matter falling into the crankcase.

To remove piston, remove wire circlip from the end of the gudgeon pin hole with the aid of a pair of pliers. Before attempting to remove the circlip, however, choke up the top of the crankcase with rag; this is most important, otherwise if the circlip be dropped in removal it may fall into the bottom of the crankcase and be very difficult to remove.

It is not necessary to remove the piston rings every time the engine is decarbonized, once every other time should be quite sufficient, providing, of course, that the rings appear to be in good condition.



Removal of Piston Rings

To remove piston rings, three thin strips of tin should be cut, say $\frac{1}{4}$ in. wide x 2 in. long. These should be slipped behind the rings one at a time, via the ring gap, and then equally spaced out. The rings can then be removed easily.

The carbon on the piston head can now be scraped off, using a blunt knife, also any carbon which may be present on the inside of the piston head should be removed. Examine ring grooves for carbon and should any be present, scrape out with an old knife.

The rings should also be scraped at the back.

Wash piston and rings thoroughly with clean petrol.

Refit rings in the same manner that they were removed.

To remove the valves it will first be necessary to remove the valve springs; this is an awkward operation unless you have a special tool for this purpose.

The cylinder head can now be decarbonized, i.e., all the carbon and dirt must be cleaned from the inside of the head and exhaust port, using a blunt knife for this purpose and taking very great care that the valve seats are not scratched or touched in any way, it is in fact preferable to clean the carbon from the inside of the head before the valves are removed, since this will protect the seats. For better results the inside of the head should be polished with fine emery cloth, always having the valves in position during this operation.

The carbon must be scraped from the inside of the exhaust port in the same way.

Only grind in valves when necessary; this under ordinary circumstances should not be necessary each time the engine is decarbonized. Use a fine valve grinding compound mixed with oil or paraffin, only a small quantity is necessary. Do not revolve the valves round and round, but give a quarter turn backwards and forwards, frequently raising the valve from its seat and dropping down in a different position. Our Service Department can supply a special tool for holding the valve stem during this operation, but in its absence a small hand vice of the type that is tightened with a thumb-screw will be quite satisfactory. Only a light pressure is necessary when grinding in the valves; very great care must be taken after this operation to remove all traces of valve grinding compound. Any rough places on the valve stem should be polished, using very fine emery cloth. Smear the stems with engine oil before refitting springs. The engine is now ready for re-assembly.

When refitting springs, be careful to see that the valve cup cotters are fitted properly into the recess in the valve stem.

Before refitting piston, the crankcase must be drained of all dirty oil and rinsed out with petrol, making sure that all dirt is swilled out from the bottom of the sump. Pour a reasonable quantity of oil over the flywheels, making sure that this runs on to the big end and also main bearings.

Refit piston, gudgeon pin and wire circlip. If circlip does not spring to the bottom of its groove it must be forced into position with pliers, placing one jaw of the pliers on the wire and the other on the outside of the gudgeon pin boss.

Take very great care with the paper washer which makes a joint between the top of the crankcase and the cylinder base. There must be a hole in this washer so that the oil hole in the crankcase and the corresponding hole in the cylinder barrel are not cut off by this paper washer, i.e., there must be a hole in the paper washer slightly larger than and directly over the oil hole in the crankcase.

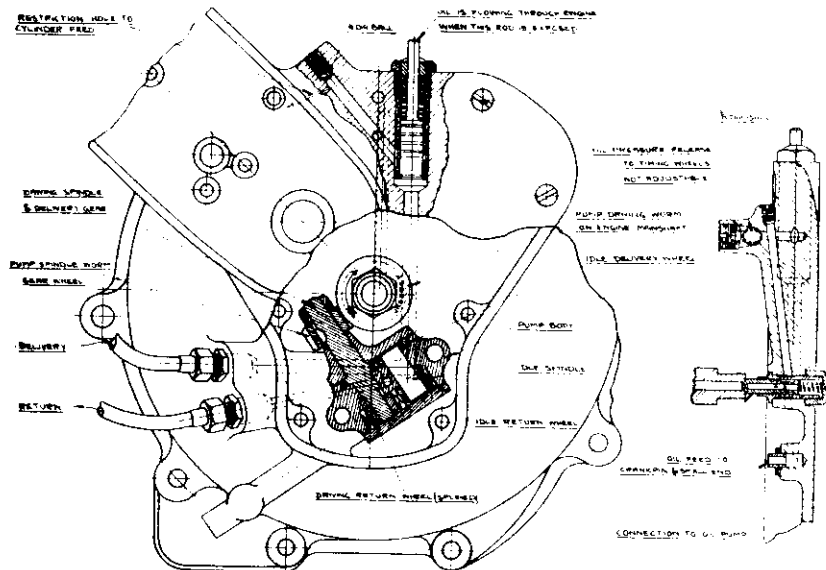
Smear piston and gudgeon pin with oil and refit cylinder barrel.

If any difficulty is experienced in getting the piston rings to enter cylinder, obtain assistance to hold the cylinder whilst the rings are eased into the cylinder barrel.

When refitting head, smear joint with a very small quantity of thin oil; in the case of the head which shows signs of leaking, a little Hermatite Jointing Compound may be advantageous in place of the oil. In this latter case, however, it is far more satisfactory to grind the head on to the barrel, using for this purpose a fine valve grinding compound and only revolving the head on the barrel through a small distance, keeping them as far as possible in the same relative position that they will finally occupy when bolted down.

TIMING GEAR AND OIL PUMP

Models 18, 19, 20, E.S.2. 50 and 55 (O.H.V. Push Rod Engines), and Models 16H and Big Four. If it is desired to examine the timing gear or oil pump, remove magneto chain cover. The magneto chain sprockets must now be withdrawn. For this purpose it is best to employ a sprocket extractor, but in its absence unscrew the spindle nuts one or two threads, wedge a tyre lever tightly between the sprocket and the back of the timing cover and give the spindle nut a sharp tap; this should free the sprocket. The cheese head timing cover screws and the two countersunk head screws inside the magneto chain cover can now be withdrawn; this will enable the timing cover to be withdrawn.



NO ADJUSTMENT IS PROVIDED TO ENGINE OILING SYSTEM.

cover plate, otherwise it will require unnecessary force to revolve the worm wheel on the pump spindle and this may lead to trouble and undue wear with the pump drive worm and the worm wheel. The joint faces where the cover fits on the pump body must be smeared with Hermatite or similar thin jointing compound before final re-assembly.

The oil to the big end is taken through a restriction jet fitted in the timing cover, which abuts the end of the timing side main shaft. This jet should be examined on any occasion when the timing cover has been removed in order to make sure that the restriction hole is quite clear, i.e., that the flow of oil is not impeded by the presence of any foreign matter. It is also a good plan to syringe out all oil holes with petrol in order to remove any foreign matter that may possibly have become lodged.

TIMING

(O.H.V. Push Rod Engines).

Never disturb timing unless compelled. If it is necessary to remove the cams or the pinion on the main shaft, the mesh of the teeth should be marked, and if the pinion is taken from the main shaft, the keyway into which the key is fitted should also be marked since there are three keyways in this pinion which will each give a variation in timing.

Models 18, 20 & E.S.2.

Inlet valve opens - - - 25° to 30° ($\frac{1}{4}''$) before top centre.
Exhaust valve closes - 25° to 30° ($\frac{1}{4}''$) after top centre.

Model 19.

Inlet valve opens - - - 25° to 30° ($\frac{5}{16}''$) before top centre.
Exhaust valve closes - 25° to 30° ($\frac{5}{16}''$) after top centre.

Models 50 & 55.

Inlet opens - 30° to 35° B.T.C. ($\frac{5}{16}$ " to $\frac{3}{8}$ ")
 Exhaust closes 35° to 40° A.T.C. ($\frac{3}{8}$ " to $\frac{7}{16}$ ")
 Ignition - - 48° to 50° B.T.C. ($\frac{11}{16}$ " to $\frac{3}{4}$ ")
 fully advanced.

Clearance between rocker and valve when engine is cold :
Inlet - .002" Exhaust - .004"

These clearances will be slightly larger when engine is warm.

DETAILS OF THE INTERNATIONAL MODELS

Each machine is individually produced and tuned; each engine has to reach a specified performance on the bench before being passed out for assembly into a complete machine.

The compression ratio in the case of the Model 30 is $7\frac{1}{4}$ to 1 and the Model 40 is 7.75 to 1.

For use with alcohol fuel, a piston is fitted or alternatively, it can be supplied as an extra, giving a compression ratio of 10.5 to 1 for the Model 30 and 11.5 to 1 for the Model 40.

Carburation is a very important factor with any machine, but it becomes more important on a highly tuned, high efficiency engine. When the machine is used for racing purposes with a straight through exhaust pipe, in the case of the 490 c.c. International Model a 400 jet with a 109 needle jet is most suitable, with the 348 c.c. Machine a 350 jet with a 107 needle jet; the needle being in the middle position. For general purposes of course, a silencer is essential, and this undoubtedly affects the maximum speed. With a silencer smaller jets should be used; a 310 jet will be approximately correct with the needle in the middle position in the case of the 490 Model and a 260 jet in the case of the 348 Model, with the needle also in the middle position. With alcohol fuel, as an example RD1, a size 700 jet in conjunction with a 113 needle jet will be found most suitable with the 490, and an 660 jet with a 113 needle jet for the 348 Model. Here again, the needle should be in the central position. It is, however, always advisable to determine the best jet setting by experiment.

Valve Timing. The timing for the International Machines is as follows:—

Inlet valve opens - - - 45° to 50° before top centre.

Exhaust valve closes - - 40° to 45° after top centre.

Ignition timing is $47\frac{1}{2}^{\circ}$ before top centre, fully advanced.

Tappet Clearance. Clearance between rocker arm and valve should be:—

Inlet - .010" Exhaust .020"

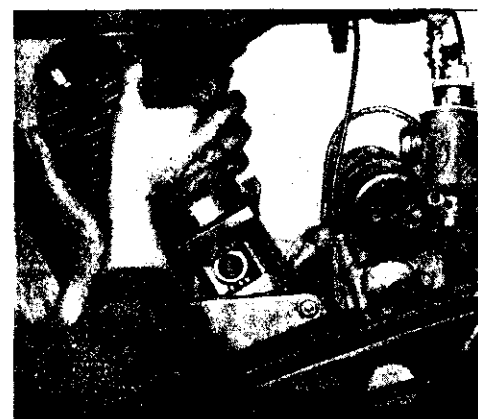
Rocker Adjustment. The adjuster for adjusting the clearance between valve and rocker is situated at the end of the rocker immediately above the end of the valve. The adjuster consists of the pad which makes actual contact with the valve, the central sleeve which governs the position of the pad relative to the rocker, and a small hexagonal nut which holds the pad tightly in the sleeve.

To adjust, slacken the small hexagonal nut at the top of the adjuster, when a tap will free the pad from the sleeve, the sleeve can now be rotated by means of its hexagonal end. To reduce the clearance between the pad and valve screw the hexagonal head closer to the rocker; to increase screw the hexagonal head away from the rocker. Before checking the clearance tighten the small hexagonal nut.

Gear Ratios. The International Model as it is despatched from the NORTON factory is equipped with the most suitable gears for fast road work, but for any particular course it may be necessary to modify these. This can be done by fitting different size engine sprockets. Various sizes are available at the NORTON Works and the Technical Department are always only too pleased to give any information to any rider or prospective rider in connection with this very important matter.

IGNITION TIMING (Fully Advanced). Models 18, 20 & E.S.2.

The platinum points should be just commencing to break when



Removal of Cylinder Barrel.

the piston is 42° ($\frac{1}{4}''$) before top dead centre. For racing 47°

Model 19.

- The platinum points should be just commencing to break when the piston is 42° ($\frac{1}{4}''$) before top dead centre. For racing 47° ($\frac{1}{4}''$).

DECARBONIZING

Models 16H and Big Four (Side Valve Engines). If the engine is in good mechanical condition and you do not intend to examine the piston, it will only be necessary to remove the cylinder head. This is held in position by

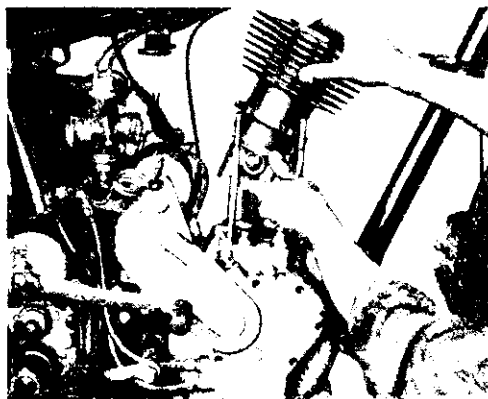
nine nuts, and if the joint does not break easily after these nuts have been removed, give the bottom fins on the head a smart tap sideways, using a lead hammer or interposing a piece of wood between an ordinary hammer and the fins; this should break the joint and the head can be lifted off. To remove valves, detach valve spring cover and compress valve springs with the aid of one of the usual valve spring extractor tools such as are supplied by motor accessory dealers. With the valve spring fully compressed, the cotters can be removed from inside the valve cup and the valves taken out. Remember that both valves are the same dimensions and must not be interchanged. The cylinder head, top of piston and the ports can now be decarbonized in exactly the same way as the instructions given for the Models 18, 19, 20 and E.S.2, and if it is desired to examine the piston, the cylinder barrel can be removed exactly as previous instructions.

TIMING

(Side Valve Engines).

Model 16H.

Inlet valve opens - - - 25° to 30° ($\frac{1}{4}''$) before top centre.
Exhaust valve closes - 25° to 30° ($\frac{1}{4}''$) after top centre.



Re-fitting Cylinder Barrel.

Model Big Four.

Inlet valve opens - - - 25° to 30° ($\frac{5}{16}''$) before top centre.
Exhaust valve closes - 25° to 30° ($\frac{5}{16}''$) after top centre.
Clearance between tappet and valve when engine is cold:
Inlet - .004" Exhaust - .006"

These clearances will be slightly smaller when engine is warm.

IGNITION TIMING

Model 16H.

The platinum points should be just commencing to break when the piston is 25° ($\frac{3}{8}''$) before top dead centre (fully advanced).

Model Big Four.

The platinum points should be just commencing to break when the piston is 25° ($\frac{1}{4}''$) before top dead centre (fully advanced).

Models CS1 & CJ.

The timing of the engine is marked and if the marks on the respective bevels coincide and the peg in the camshaft bevel is opposite the groove on the end of the camshaft, and the scratched line on the bevel, the valve timing should be correct. When fitting a new cam, it is advisable to check the timing, as the key-way in the respective cams may not be in the same position relative to the cam profile.

The timing is adjusted by removing the peg in the camshaft bevel, which is held in position by the camshaft nut, and replacing in the respective holes in the bevel and camshaft which give correct timing.

The valves are correctly timed when the inlet valve commences to open 35° ($\frac{3}{8}''$) before top centre and the exhaust valve closes 40° ($\frac{1}{2}''$) after top centre. It is imperative that the clearance between valves and rockers are correct before checking timing; they should be -- Inlet .006", Exhaust .010". For racing, the clearances should be -- Inlet .010", Exhaust .020", measured when the engine is cold. A rough method of setting timing is to divide the overlap of the cams equally between inlet and exhaust with the piston in top centre.

MAGNETO TIMING.

The ignition is correctly timed when the platinum points are just commencing to break when the piston is 45° ($\frac{1}{8}''$) before top centre with the ignition lever fully advanced.

DECARBONIZING

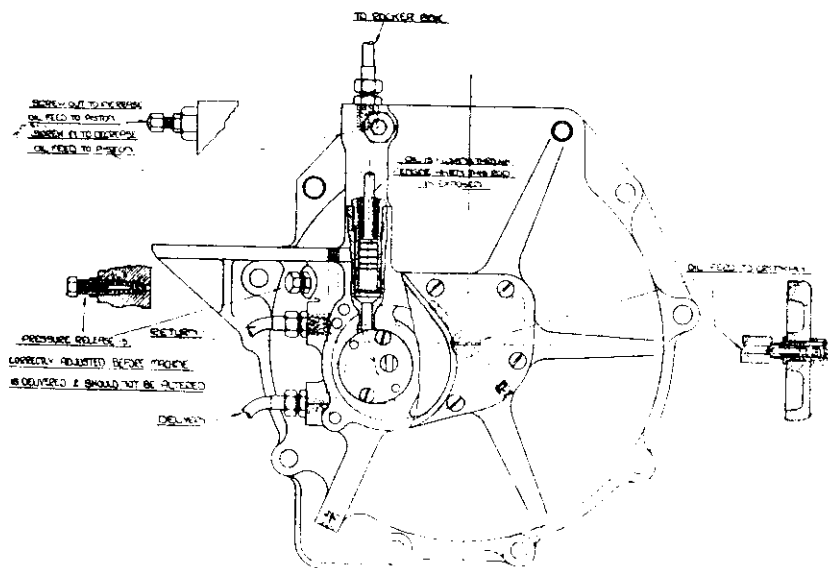
Models CS1, CJ, 30 & 40 (O.H.C. Engines). Remove tank, carburetter, exhaust pipe, sparking plug and remove the four rocker box holding down bolts and take away the distance pieces from between the cylinder

plug will be firing on the wrong stroke and the magneto will have to be re-timed. Do not detach the vertical shaft, vertical shaft bevels or bevel housings from the vertical shaft cover tube.

To dismantle rocker box, remove the two rocker pivot bolts and the cheese head screws. The cover is then held only by the dowels and camshaft roller race. Withdraw cover $\frac{1}{2}$ " when it will be free and can be completely removed. The rockers can now be withdrawn. These rockers are identical and it is important that they are not interchanged. A hardened insert is fixed into the end of the rocker which bears upon the cams; If this has worn unduly, a new insert should be fitted. To remove cam, unscrew the left-hand threaded nut and pull off the roller race and cam. The vertical shaft housings can be removed after unscrewing the four holding down nuts at each end and raising the rocker box so that the housings are clear of the locating spigots.

When refitting rockers care must be taken with the packings, otherwise trouble will be experienced from oil leakage. At the ends of the rocker bosses a resilient cork washer is fitted, but a steel washer is interposed between the end of the rocker and the cork washer in order to avoid the rocker working on the cork itself. If this washer has worn it must be replaced. Felt pads are used to seal the joint on the top and bottom of the rocker boss; these must be adjusted so that they press on to this boss moderately tightly, but not so tight that the rockers bind.

Models CS1, CJ, 30 & 40. The simplest method is to detach the top bevel housing from the rocker box, by removing the four nuts. The mesh of the bevels is marked but it will be necessary to see that the contact breaker in the magneto is in the same position relative to the camshaft when re-assembling as before, otherwise the sparking



To remove pump, unscrew the two screw-driver headed bolts and insert in their place two 1/4" diameter rods, allowing same to protrude from the oil pump body a few inches so that they may be gripped and the whole pump body revolved, which should free same and enable the complete unit to be withdrawn. When refitting oil pump, smear lightly outside of pump body with Hermatic Jointing Compound, or failing this use gold size as a substitute.

The oil to the big end is taken through a restriction jet fitted in the timing cover which abuts the end of the timing side main shaft. This jet should be examined on any occasion when the timing cover has been removed in order to make sure that the restriction jet is quite clear, i.e., that the flow of oil is not impeded by the presence of any foreign matter. Syringe with petrol all oil holes in crankcase and cover, to remove any foreign matter that may have become lodged.

Tell Tale. A Tell Tale is incorporated on the feed side of the lubrication system and in the case of the Side Valve and O.H.V. Models is fitted to the head of the timing cover, and in the case of the Camshaft Engine, at the side of the Magneto

Chain Cover When oil is passing through the feed system, the small plunger in the Tell Tale is raised approximately 2 in., and this gives assurance that the Pump is functioning satisfactorily. The gland nut with packing is fitted at the top of the Tell Tale to prevent oil leakage. The Tell Tale is fitted merely to indicate that the Pump is functioning; if the engine is run with the Oil Tank Empty, the Tell Tale Plunger will rise. It is advisable, therefore, to periodically check over the level of oil in the Tank.

GEAR BOX

This gear box is designed on the constant mesh principle. Gear changing is effected entirely by dogs so that under all normal conditions it is quite impossible for any damage whatever to be done to the gear teeth.

Gear Adjustment. Before proceeding to adjust control, see that the nut on the Rocking Shaft Spindle is thoroughly tight.

Before checking adjustment, make sure that all nuts and bolts on the gear box are tight, particularly the nut which attaches the change lever to its shaft at the bottom of the gear box. The gears will be in correct adjustment when this lever will move an equal amount either side the neutral notch without engaging either the middle or low gear.

To correct adjustment, remove pin from jaw joint connection at the bottom end of the control rod, loosen locknut and revolve this jaw joint connection up or down on the thread in order to lengthen or shorten the control rod as required.

Clutch. This Clutch has sufficient area to prevent slip even when oil is present on the lining, consequently no trouble will be experienced through oil working its way to the clutch.

When fitting up the control wire for the clutch, ease off the bends as much as possible to ensure long life and easy movement of the inner wire. It may be found, even after the control wire has been slackened or disconnected, that there is no free movement in the clutch worm lever; this would be caused through the shoulder on the worm bearing on the face of the felt washer, this washer being held in position by a steel cap on which is pressed a hexagon to accommodate spanner. To cure this trouble, release the steel cap a few threads.

To dismantle clutch, remove clutch spring screws and take out springs together with spring boxes. The circlip round the clutch



body should then be removed, it is only necessary to insert a screwdriver through any of the slots underneath the spring when it can be readily lifted from its retaining groove. The plates can now be withdrawn, noting the order in which they are fitted as it is advisable that they are replaced in exactly the same position as they were removed.

Inside the large body of the shock absorber are the rubbers which form the transmission shock absorber. To remove unscrew the three countersunk head screws which hold the retaining plate on the outside of the clutch body. The rubbers can now be withdrawn, but if they have been in position for a considerable period they may adhere firmly to the clutch body, in which case it will be necessary to run the blade of a pen knife between the rubber and the clutch body in order to free these.

To Dismantle Gear Box. Disconnect clutch control wire, then remove seven cover nuts and gently pull off the cover plate. Do not use a screwdriver or similar tool to part the joint or the latter will fail to retain oil when re-assembled. If the plate sticks, one or two light blows inside the kick-starter crank will loosen it. This will expose the complete interior to view. By disconnecting gear control rod the low and middle gear pinions, also layshaft, may be lifted out.

When replacing, take care that the ball bearings are not tilted. No forcing is necessary when replacing the cover plate. To examine Positive Foot Change mechanism remove neutral indicator and operating lever; next remove the two cheese headed screws which hold the cover in position. There is no necessity to remove the clutch cable and adjuster which are attached to this cover.

Lubrication. Always use a thin, good quality grease, or as a substitute, ordinary engine oil may be employed; especially is this latter advantageous if the machine is to be used for racing, although it must be remembered that this will have a far greater tendency to leak from the gear box, and even when a thin grease is used, it is preferable to add a small quantity of oil in addition to the grease. It is not advisable to use thick grease, as this may prevent the free operation of the kick-starter pawl, and in addition, will be too thick to reach the various bearings.

The various joints in the gear changing lever mechanism should be kept oiled regularly to insure freedom of action.

Front Chaincase Oiling Bath, Removal of Cover. Disconnect brake pedal and exhaust pipe (if this is on the same side as chaincase), re-

move footrest and take off the large nut screwed on footrest tube. This nut alone holds the outer cover in position, so that with the nut removed the cover can be withdrawn.

The oil sealing joint consists of a large oil resisting rubber band encircling the whole of the inner periphery of the case and as far as possible the cover should be eased off equally all round. The removal of the chaincase cover exposes the whole of the primary transmission including the clutch.

When refitting cover, press cover on with hands evenly all round and tighten up the large nut on footrest tube. Do not use unnecessary force when tightening this nut as it is not necessary that this be tightened up hard against the shoulder on the footrest tube, it must be simply sufficiently tight to hold the cover firmly against the rubber washer.

Ordinary mineral engine oil such as WAKEFIELD'S PATENT CASTROL XL, PRICE'S MOTORINE DE LUXE or AEROSHELL, is the correct oil to use in this chain case. Do not use Castor Base Oil. To fill, remove inspection cover from the top of the chain case and the oil level plug from the bottom of the chain case. Oil can now be poured through the inspection cover hole until it reaches the level plug hole with the machine in the vertical position. This is the correct amount of oil and no advantage will be gained by using more oil in the chain case.

FRONT CHAIN ADJUSTMENT

The chain is correctly adjusted when there is between $\frac{1}{2}$ " to $\frac{3}{4}$ " up and down play or movement midway between the two sprockets.

To adjust, slacken the top and bottom gear box bolt nuts. An adjuster is fitted and this protrudes through the rear of the top gear box lug and passes through the gear box top bolt

To tighten front chain, turn bolt in clockwise direction.

After obtaining correct adjustment, both nuts should be securely tightened up.

REAR CHAIN ADJUSTMENT

The rear chain is correctly adjusted when there is between $\frac{1}{2}$ " to $\frac{3}{4}$ " up and down movement midway between the sprockets.

To adjust, unscrew the wing nut on the end of the brake rod, loosen slightly the two hub spindle nuts and unscrew the two spindle adjuster lock nuts, taking care that the adjusters themselves are not disturbed. Turn the adjusting screws so that each side is practically an equal distance, and until the correct adjustment is obtained, tighten up spindle nuts and locknuts on the adjusters.

Also remember that rear brake will require adjustment. To check alignment of back wheel, stretch a string tightly alongside the front wheel and let this pass to the rear wheel, turn the front wheel by means of the handlebars until the string touches both edges of front tyre and adjust the back wheel with the adjusting screws until the string also touches both edges of the rear tyre.

REAR BRAKE ADJUSTMENT

Two distinct adjustments are provided for the brake pedal, one which is in the nature of a permanent adjustment, is to enable the brake pedal to be adjusted relative to the footrest pad in a position which is convenient to the rider. This adjustment is controlled by the small hexagon screw and locknut fitted to the underneath of the brake pedal at the rear of the frame attachment boss.

The second adjustment is provided to take up wear on the brake shoes. This is controlled by the wing nut which is fixed at the rear end of the brake rod. To adjust, place machine on rear stand, with the gear lever in the neutral position, revolve wing nut in the clockwise direction until there is a minimum amount of movement on the brake pedal, and at the same time, the rear wheel must be perfectly free to revolve, that is, there must be no suspicion of the brake shoes touching the drum when the brake pedal is in the 'off' position.

Always pack bearings with grease after they have been dismantled, but do not force an unnecessarily large quantity of grease through the hub grease nipples, otherwise excessive grease will work through to the brake linings.

FRONT BRAKE ADJUSTMENT

This adjustment is controlled by a screwed adjuster which is

fitted in the fork end, and to take up wear on the brake shoes, slacken lock nut and turn adjuster the required amount. As in the case of the rear wheel, the brake shoes must be adjusted as close to the drum as possible, but at the same time the front wheel must be free to revolve, and there must be no suspicion of the shoes rubbing on the drum when the brake is in the 'off' position.

If either front or rear brakes are unduly harsh in action and tend to squeak or grip too fiercely when applied, the brake plate should be removed and the end of the lining filed thin for a distance of about 1" from each end, so that the portion which has been filed is well clear of the brake drum. This will, of course, reduce the area of the brake lining in contact with the brake drum and will make the brake considerably smoother in action without impairing its efficiency when applied reasonably hard.

Whenever the brake shoes or brake plate is removed, see that the shoes are quite free from grease; if greasy, this should be removed with a rag, the linings being cleaned afterwards with petrol. Under no circumstances should paraffin be used for this operation. If the linings are worn very smooth and hard, these should be roughened up with a coarse file.

WHEEL ADJUSTMENT

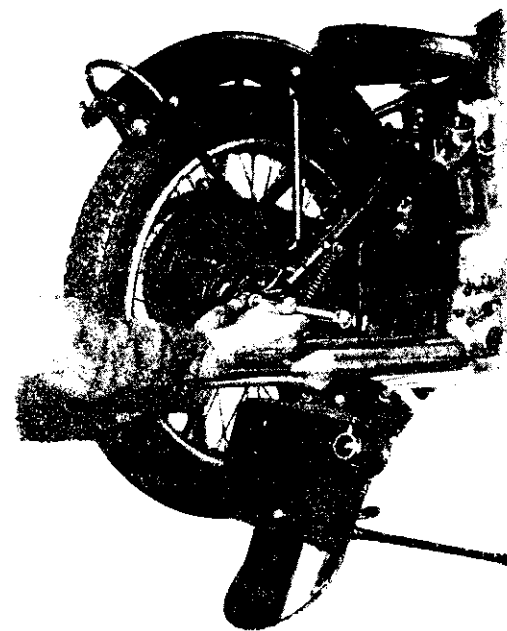
The front, rear and sidecar wheels are quickly detachable and interchangeable. In the case of the rear wheel, it is quite unnecessary to remove the brake drum or rear chain.

Wheel Removal. To facilitate the removal of the rear wheel, the rear portion of the mudguard and mud-guard stay are readily detachable. It is only necessary to slacken the two fixing screws at the joint and also to remove the two nuts which attach the rear stay to the fork end of the frame. To remove the wheel, withdraw the hub spindle distance piece from the right hand side of the machine. Remove the three sleeve nuts which secure the hub to the brake drum. The wheel may now be withdrawn from the brake drum and readily detached, leaving the brake drum and chain sprocket *in situ*.

Front Wheel. Disconnect brake cable 'U' piece from brake lever and slacken both the spindle nuts. It is unnecessary to completely remove these. This will allow the wheel complete to be removed. If it is desired to remove the brake drum, the three sleeve nuts which are identical to those fitted to the rear wheel, should be unscrewed, the brake drum can then be lifted clear from the wheel.

Sidecar Wheel. It is only necessary to withdraw the hub spindle, when the wheel can be quite readily detached.

Wheel Bearings. are fitted, that on the brake side of the journal bearings of generous proportions machine being of the double row rigid type. No provision is made for adjustment, as this is quite unnecessary. Providing that due



attention is paid to lubrication, the bearings will give satisfactory service for a very considerable period. Should it be found necessary for any purpose to remove the bearings, the locking ring of the hub should be detached, a peg spanner if available or alternatively a punch should be used. The inner sleeve on which the inside race of each bearing is fitted, should be tapped out from the opposite side of the hub from which the locking ring is removed. With the bearing on the off-side removed, the bearing on the near-side can quite readily be tapped out by means of a suitable drift placed through the hub.

FORKS

Lubrication. The forks are lubricated by means of grease nipples which, in conjunction with the grease gun supplied with the Tool Kit, enable the four spindles to be properly lubricated. Grease is the most suitable lubricant to be used, but in its absence engine oil will make a good substitute.

Fork Adjustment. The forks are correctly adjusted when they are free to move up and down without binding, but at the same time, there should be no end play in the links.

To adjust, slacken locknut on the left-hand side of fork spindle bolt, turn this bolt in a clockwise direction until the bolt is just tight, slacken back about one half turn and tighten locknut tightly, afterwards checking to see that fork is quite free.

Fork Shock Absorber Adjustment. A hand adjuster is provided for the Fork Shock Absorber Adjustment.

The single knob adjusts both friction surfaces to the same degree. A special form of star washer is fitted inside the knob which avoids the possibility of vibration or road shocks rotating the knob and so causing the adjustment to vary. Under all conditions, it is advisable to have the Shock Absorber in operation to a certain degree. This, however, depends, of course, on road conditions. If the fork movement appears at any time to be too great, then the Shock Absorber Adjustment should be tightened.

Steering Damper. This is an integral fitting with the fork and can, of course, be adjusted to the rider's requirements whilst the machine is in motion.

Steering Head Adjustment. Support bottom of crankcase so that the front wheel is lifted clear of the ground and slacken steering damper. If head bearings are correctly adjusted the handlebars should be free to turn without any suspicion of play in the bearings. This can best be tried by attempting to lift the forward portion of the front mudguard; if play is present, a movement will be visible between the top of the head lug and the bottom of the fork clip. To adjust, slacken the locking bolt in the fork clip and tighten down the nut on top of the steering column until all play has been eliminated.

TYRES

Correct tyre inflation is essential both from a steering and comfort point of view. The pressures recommended by the tyre manufactures are:

	Tyre Size	Minimum Inflation Pressures		
		Front Tyres	Rear Tyres	Sidecar Tyres
		(lbs. per sq. in.)		
Solo Machines	3.25-19	17	20	---
	3.50-19	16	16	---
	4.00-19	16	16	---
	3.00-21	22	---	---
	3.25-20	---	20	---
Sidecar Machines-	3.25-19	17	27	17

In all Dunlop Motorcycle tyres the inner tube is of a type which enables the pressure to be checked.

Pressures should be tested at least once a week with a reliable Pressure Gauge.

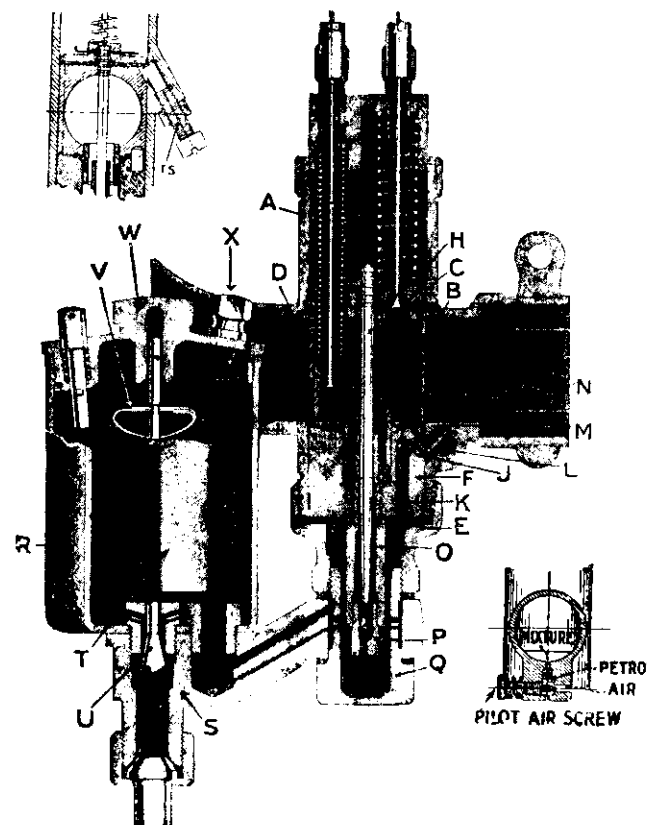
AMAL CARBURETTER

Fitted all models except International Machines.

The Carburetter fitted to NORTON engines is of the two-lever, needle jet type, the mixture at slow or idling speeds being controlled by a readily adjustable pilot jet, whilst at higher speeds the mixture is controlled by means of a needle attached to the throttle slide and working in a restriction jet.

The two-lever control must not be confused with the type of control that has often been previously used on the two-lever carburetter, in which it was necessary to constantly adjust the air lever in accordance with the conditions under which the machine was running. This carburetter is for all practical purposes automatic, the air lever being used only to facilitate starting and occasionally under very adverse circumstances.

The petrol tap having been turned on, petrol will flow past the needle valve 'U' until the quantity of petrol in the chamber 'R' is sufficient to raise the float 'T', when the needle valve 'U' will prevent a further supply entering the float chamber.



CARBURETTER (Section View)

The action of the float can be readily understood, for, as the quantity of fuel in the float chamber is used, the float 'T' will drop, carrying with it the needle 'U,' and admitting a further supply. Thus, automatically, the petrol level is kept constant. No alteration should be made to our standard petrol level.

The float chamber having filled to its correct level, fuel passes along the passages, through the diagonal holes in the jet plug 'Q,' when it will be in communication with the main jet 'P' and the pilot feed hole 'K'; the level in these jets being, obviously, the same as that maintained in the float chamber.

Imagine the throttle valve 'B' very slightly open. As the piston descends a partial vacuum is created in the carburetter, causing a rush of air through the pilot air hole 'L' and drawing fuel from the pilot jet 'J.'

The mixture of air and fuel is admitted to the engine through the pilot outlet 'M.'

The quantity of mixture capable of being passed by the pilot outlet 'M' is insufficient to run the engine. This mixture also carries excess of fuel. Consequently, before a combustible mixture is admitted, throttle valve 'B' must be slightly raised, admitting a further supply of air from the main air intake.

The further the throttle valve is opened, the less will be the depression on the outlet 'M,' but, in turn, a higher depression will be created on the by-pass 'N,' and the pilot mixture will flow from this passage as well as from the outlet 'M.'

The mixture provided by the pilot and by-pass system is supplemented at approximately $\frac{1}{4}$ -throttle by fuel from the main jet system, the throttle valve cut-away governing the mixture strength from here to $\frac{1}{4}$ -throttle. Proceeding up the throttle range, mixture control by the position of the needle takes place from $\frac{1}{4}$ to $\frac{1}{2}$ -throttle, and thereafter the main jet is the only regulation.

The air valve 'D' has the effect of obstructing the main through-way, and, in consequence, increasing the depression of the main jet, enriching the mixture.

The carburetter fitted to these machines is equipped with the correct size jets and the most suitable adjustment for all normal purposes, but under certain exceptional circumstances a different size of jet or position of needle in the throttle valve will be advantageous.

Pilot or 'Slow Running' Adjustment.

There is only one adjustment which will ordinarily be necessary, and this is to the pilot jet, which controls the slow running and also the starting, since it can generally be assumed that an engine which will run slowly will also start easily.

This pilot adjustment is controlled by a knurled screw on the engine side of the carburetter body and is prevented from turning ordinarily by means of a spring.

To weaken the slow running mixture, screw pilot air adjuster outwards.

To enrich, screw pilot air adjuster inwards.

Obtaining most suitable position for Pilot Adjuster.

Screw pilot air adjuster home in a clockwise direction. Place gear lever in neutral. Slightly flood float chamber by gently depressing the tickler until fuel can be observed overflowing from the mixing chamber. Set magneto half-advance, throttle approximately $\frac{1}{4}$ open, close air lever, start the engine and warm up.

After warming up, reduce the engine revolutions by gently closing the throttle. The slow running mixture will prove too rich unless air leaks are present.

Very gradually unscrew the pilot air adjuster.

The engine speed will increase and must again be reduced by gently closing the throttle until, by a combination of throttle positions and air adjustment, the desired 'idling' is secured.

Throttle Stop. If it is desired that the engine should continue 'idling' with the throttle lever closed, the position of the throttle valve must be set by means of the throttle stop screw, the throttle lever being in the 'closed' position during this adjustment. Alternatively, if the screw is adjusted clear of the throttle valve, the engine will shut off in the normal way by the control lever.

Do not take the throttle stop screw out completely.

'Idling.' Failure to secure good 'idling' will probably be traced to one of the following causes :—

Air leaks at the junction of the carburetter and engine, or due to worn inlet valve stem and guide.

Faulty inlet and exhaust valve seatings.

Sparking Plug. Points too close. Try a gap .025".

Sparkling Plug oily.

Too much ignition advance.

Magneto. Contacts dirty or too close.

Examine contact breaker.

Examine slip ring for oil.

Examine for carbon brush jamming in holder, or glazed on contact face.

Examine for fractured brush holder.

Examine high tension cable for shorting.

Magneto insulations may be broken down, or the interior mechanism wet.

Main Jet. The main jet fitted will be the most suitable size for the particular engine under all normal conditions. This main jet governs the mixture only from $\frac{1}{4}$ throttle to full throttle. This jet must be the smallest size which will give maximum speed with the air lever $\frac{3}{4}$ open, or for racing work, with the air lever fully open.

The needle position controls the mixture from the pilot adjustment, i.e., $\frac{1}{4}$ throttle, to main jet adjustment, i.e., $\frac{3}{4}$ throttle. The most suitable position for all normal purposes is that at which the needle is fixed when the machine leaves these works, i.e., the central notch, but under certain exceptional circumstances an alteration may be desirable.

To check suitability of needle position, start machine, open air lever fully, open throttle half way. Note if the exhaust is crisp and the engine lively. Close air lever slightly below throttle, exhaust note and engine speed should then remain practically unaltered.

Weak mixture will be indicated by popping back and spitting with blue flames from carburetter intake.

To cure, raise needle in throttle valve one notch.

Rich mixture will be indicated by failure of engine speed to increase progressively as the throttle is raised; a black smoky exhaust and heavy thumpy running of engine; on closing air lever slightly below throttle lever, tendency to mis-fire and eight-stroke is present.

To cure, lower needle setting one notch.

Having found the correct needle position, the carburetter setting is now complete and it will be found that the driving is practically automatic once the engine is warmed up.

Where extreme economy in fuel is desired and where frequent or continuous use of air lever is not objected to, or again in cases where the needle and needle restriction jet have worn considerably, as they may on a machine which has been in use for some time, needle can be lowered one groove, i.e., second from the top.

In general a rich mixture is indicated by heavy thumpy running, emission of black smoke from the exhaust, the inside of the carburetter becomes blackened, and as the throttle is opened, heavy 'blow back' of fuel is observed from the carburetter air intake.

Weak mixture is indicated by difficult starting, tendency for the engine to fire back through the carburetter, indicated by blue flames from the carburetter air intake. Carburetter becomes sensitive to 'drive,' and constant use has to be made of the air lever, engine knocks readily and runs hot, with loss of power. The electrode of the sparking plugs shows indications of intense heat, and the mica insulation becomes white.

Maintenance of Carburetter. To maintain the efficiency of the carburetter this should be periodically cleaned. This is best done by entirely dismantling and washing each part in clean petrol, and in so doing the following points should be observed:—

If the jet block is tight, it should be tapped out by means of a wooden stump in the mixing chamber.

Renew any worn parts, as: needle valve, if the head has a distinct ridge at the point of seating; throttle valve, if excessive side play is present; mixing chamber union nut washer, if worn or damaged; taper needle and clip, if it is possible to rotate the needle freely in the clip.

Be sure that all pilot passages are clear; this is done best by inserting a fine bristle.

In re-assembling, no brute force is necessary. Make sure that taper needle is refitted in correct groove and securely locked by clip; that it enters the central hole in top of jet block; that needle valve enters top of float chamber cover easily; that mixing chamber is fitted vertical and pushed right home on engine stub; that needle valve clip 'V' registers correctly in groove; it will, of course, be necessary to re-set the pilot adjusting screw.

AMAL T.T. CARBURETTER INTERNATIONAL MODELS 30 and 40.

Maintenance of Carburetter. Read remarks on this subject as on page 33, except that the jet block is fastened by means of a screw at the base of the mixing chamber.

Special Notes. To remove the throttle—first free the knurled ring on the mixing chamber top by slackening the square-headed lock screw.

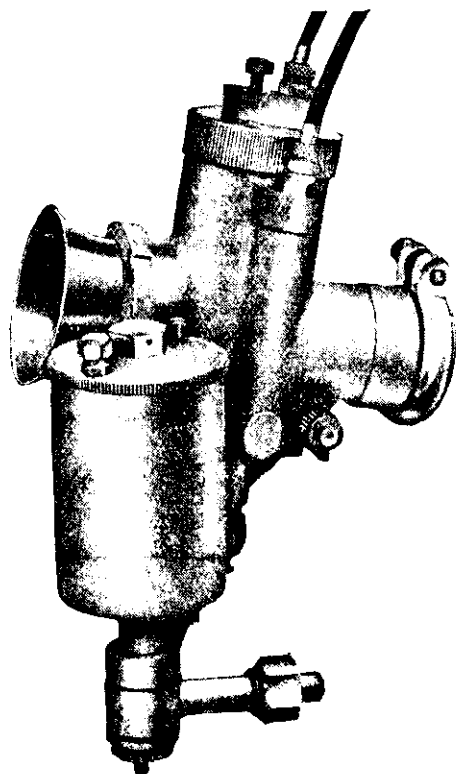
The air control valve is at the side of the carburetter and may be hand operated according to requirements—lowering the slide richens the mixture by reducing the amount of primary air to the main jet, and vice versa for weak mixture. For normal running the air should be fully open.

To get carburation for any stated fuel when the choke bore is correct for the peak revs. of the engine and the correct needle jet for the fuel to be used, the procedure is simple. Start off with an assumed setting, and then tune as follows.

There are four phases :

- (1) Main jet for power at full throttle;
- (2) Pilot jet for idling;
- (3) Throttle cut-away for "take off" from the pilot jet;
- (4) Needle position for snappy mixture at quarter to three-quarter throttle; then final idling adjustment of the pilot jet.

Always tune in this order, then any alteration will not upset a correct phase.



**TUNING INSTRUCTIONS FOR
AMAL T.T. CARBURETTER.**

Sequence of Tuning.

- | | |
|---------------------------|------------------------------|
| (1) Main jet size. | (3) Throttle valve cut-away. |
| (2) Pilot jet adjustment. | (4) Needle attachment. |

1. Main Jet Size. This should be determined first: the smallest jet which gives the greatest maximum speed should be selected, keeping in mind the safety factor for cooling. (The air lever should be fully open during these tests).

2. Pilot Jet Adjustment. Before attempting to set the pilot adjuster the engine should be at its normal running temperature, otherwise a faulty adjustment is possible, which will upset the correct selection of the throttle valve. The pilot adjuster which controls *the amount of fuel passed*, is rotated clockwise to weaken the mixture, and anti-clockwise to enrich it. Adjust this very gradually until a satisfactory tick-over is obtained, but take care that the achievement of too slow a tick-over—that is, slower than is actually necessary—does not lead to a "spot" which may cause stalling when the throttle is very slightly open.

3. Throttle Valve Cut-away. Having set the pilot adjuster, open up the *throttle* a little and note positions where, if at all, the exhaust note becomes irregular. If this is noticed, leave the throttle open at this position and close the air lever slightly; this will indicate whether the spot is rich or weak. If it is a rich spot, fit a throttle-valve with more *cut-away* on the air intake side (or *vice versa* if weak), if the engine "spits" through the carburettor.

4. Needle Attachment Position. This tuning sequence will affect carburation up to somewhere over one-quarter throttle, after which the jet *needle*, which is suspended from the throttle valve comes into action, and when the throttle is opened further and tests are again made for rich or weak spots, as previously outlined, the needle can be raised to enrich or lowered to weaken the mixture, whichever may be found necessary.

With these adjustments correctly made, and the main jet size settled, a perfectly progressive mixture will be obtainable from tick-over to full throttle.

Compensation and Air Control. Petrol through the main jet does not spray directly into the choke bore of the mixing chamber. It first passes through the needle jet and is there partially atomised by a blast of primary air, and passes up as a rich mixture through a primary choke, which can be seen at the base of the main choke. The richness of the mixture as it passes through the primary choke can be handlebar regulated by the air control at the side of the carburettor, less air being admitted to richen the mixture for starting or atmospheric conditions demanding more liquid fuel

to give the correct mixture strength. As the engine speed increases at a given throttle opening so the mixture would tend to get rich, but as the air flow through the primary choke above the main jet also increases, there is a damping effect on the flow of liquid and a compensated mixture is obtained.

Faults. Flooding at the float chamber may be due to impurities in the fuel or a bent needle, and these should be remedied. Otherwise trouble can be due only to a weak mixture or a rich mixture, both of which can be corrected in any or all of the four phases of throttle opening. Generally speaking, a weak mixture causes spitting in the carburettor or at full throttle over-heating of the sparking plug. Richness may be indicated by lumpy running, black smoke in the exhaust, or a dry sooty plug.

Before trying to correct any fault, determine at which throttle opening it occurs, as in 1, 2, 3, or 4, and tune accordingly.

QUICK ACTION TWIST GRIP

To detach grip from bar remove the two cheese headed screws which hold the split clip at the inner end of grip. This enables the cap to be lifted off and the cable readily withdrawn. The grip may now be pulled off. Apply grease to all working surfaces before re-assembly. The friction device may be adjusted by means of the external hexagon head screw.

THE SIDECAR

The 'Norton' Sidecar is of particularly sturdy design, and when fitted to the machine is extremely rigid, unlike so many sidecars it is not prone to mal-alignment, once correctly fitted no further adjustment is necessary. Should, however, the sidecar be removed for any purpose, proceed to refit as follows: Place the sidecar in position, leaving all attachment nuts slack. The sidecar wheel should not run parallel with the machine wheels or there would be a tendency for the machine to constantly pull to the left. The sidecar wheel should run in toward the machine $\frac{1}{2}$ in. over a distance of 6ft.

Alignment is regulated by the clip lug on the centre sidecar arm, which can be moved along the cross tube of the chassis to which it is attached, and the clip lug of the rear arm which slides along the rear tube of the chassis. To align correctly, two straight edges 6ft. long are necessary, which should be placed on the floor, one against the wheel rims of the machine, the other against the wheel rim of the sidecar. Now measure the distance

between the edges immediately in front of the front wheel and at the rear of the rear wheel, the distance between the edges should be $\frac{1}{2}$ in. less at the front than at the rear.

If after reading the foregoing, every 'Norton' owner feels capable of retaining the tune of his machine, our object will have been achieved. The notes are intended to be equally interesting to the novice and the 'man who does his own repairs,' and should the latter consider the detailed descriptions somewhat tedious we would ask him to bear in mind the dual purpose of the notes.

TO ENSURE THE BEST SERVICE FROM LUCAS "MAGDYNO" EQUIPMENT the MOST IMPORTANT POINTS are:

BATTERY. Inspect the battery regularly and keep acid level to the top of the separators by adding distilled water. UNLESS YOU DO THIS YOUR BATTERY WILL QUICKLY DETERIORATE.

WIRING. Keep all connections and terminals tight. See that the cables are clear of moving parts.

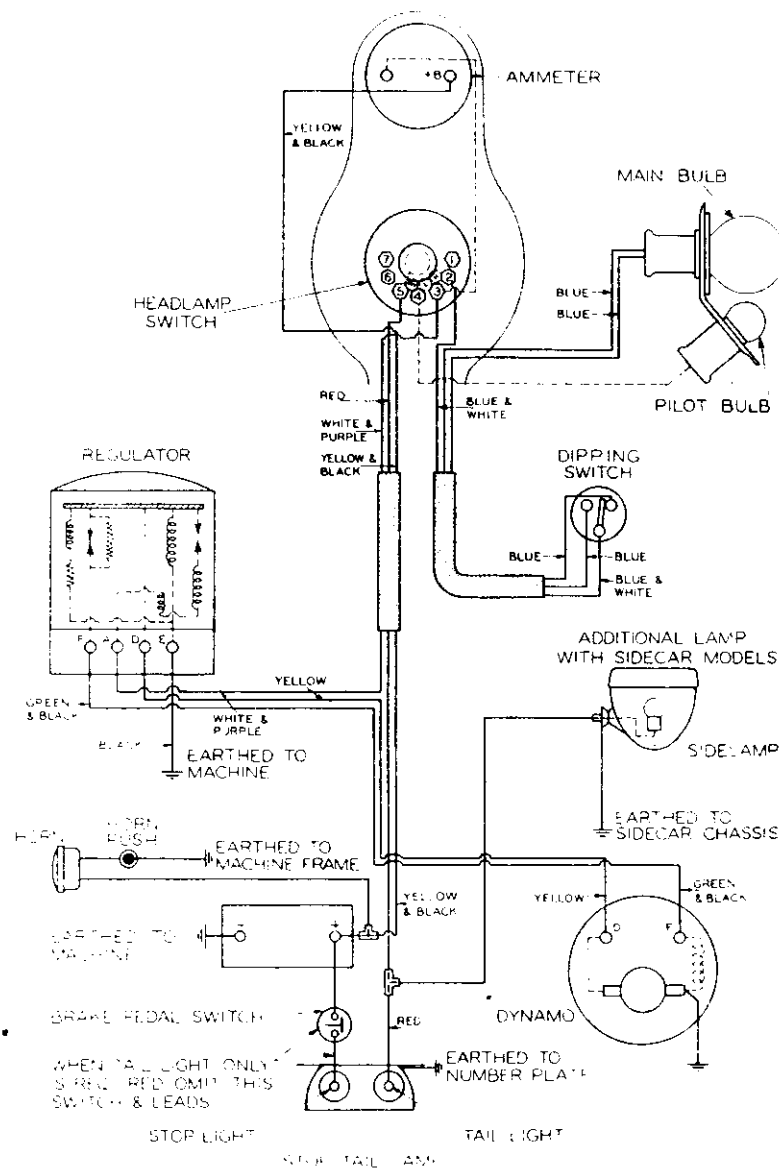
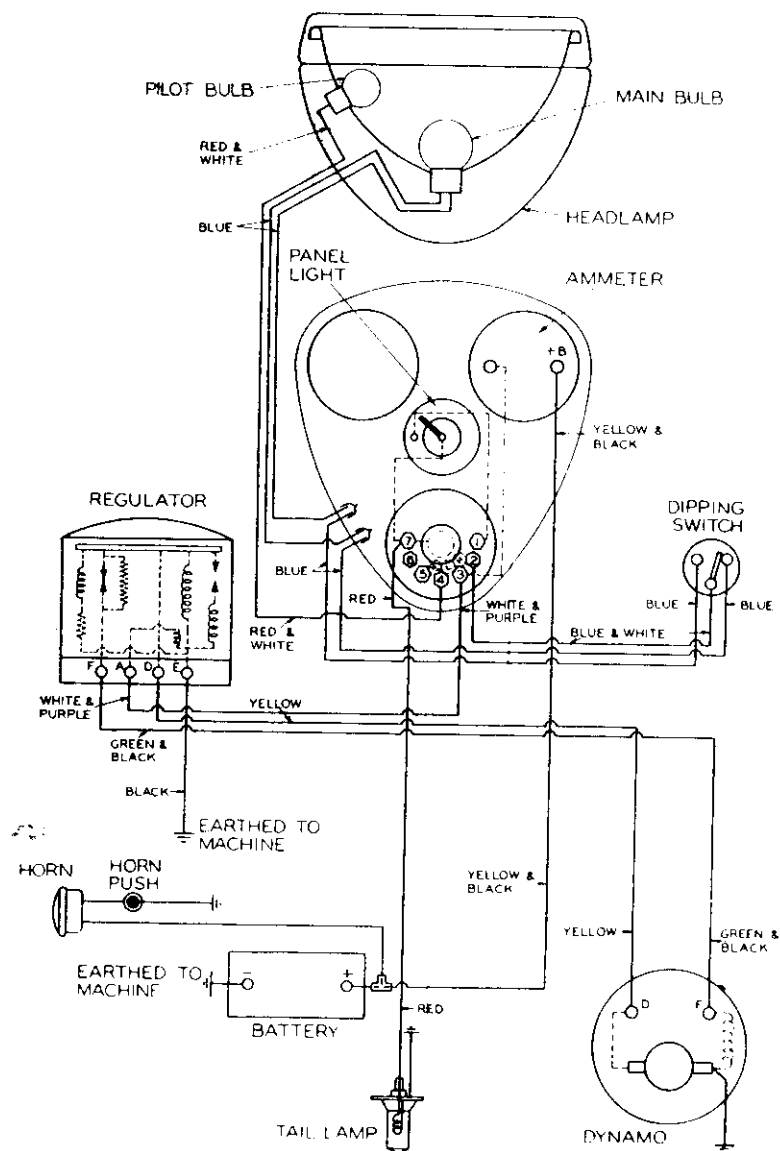
DYNAMO. Keep brushes and commutator clean.

MAGNETO. Keep contact breaker clean*. If necessary polish the contacts with fine carborundum stone or emery cloth and afterwards wipe with cloth moistened with petrol.

Occasionally check contact breaker opening (using gauge on ignition spanner)

Replace high tension cable if it becomes worn or perished

HEAD LAMP. Focus head lamp after fitting new bulb

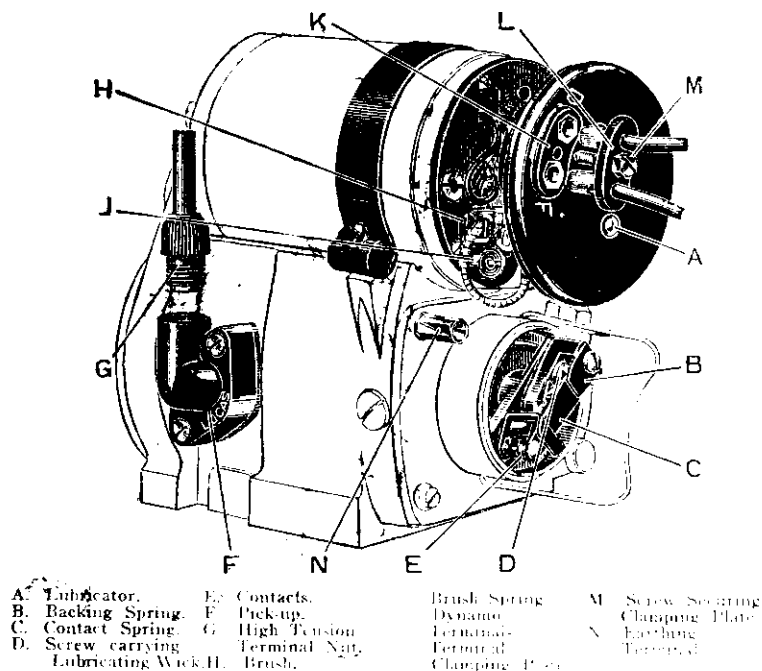


Running Instructions for Lucas "Magdyno" Equipment

The "Magdyno," as the name suggests, consists of two units—the magneto for ignition and the dynamo for charging the battery.

The dynamo unit is detachable, so that owners who wish to use their machines for racing and competitions can easily strip off all their lighting equipment. A suitable fitting can be supplied which protects the gears when it is desired to run the machine without the dynamo unit.

Some "Magdyno" equipments include the type DU142 headlamp, which incorporates the control switch and ammeter, while others include the D142 headlamp together with an instrument panel which houses the switches and ammeter along with the speedometer.



DYNAMO.

The dynamo is mounted above the ignition unit, being driven from the magneto spindle by gears.

The dynamo is fitted with two brushes, the positive is insulated and the negative is earthed. The dynamo is of the compensated voltage control type, and is arranged to operate in conjunction with a regulator unit which is mounted together with the cut-out on the dynamo gear shaft.

CUT-OUT AND REGULATOR UNIT.

The cut-out is an automatic switch which prevents discharge of the battery when the dynamo is stationary. Its contacts close when the

dynamo voltage rises above that of the battery, as the engine is speeded up, and open when the speed drops and the dynamo voltage falls below that of the battery.

The regulator causes the dynamo to give an output which varies according to the load on the battery and its state of charge. When the battery is discharged, the dynamo gives a high output so that the battery receives a quick recharge which brings it back to its normal state in the minimum possible time. On the other hand, if the battery is fully charged, the dynamo is arranged to give only a trickle charge which is sufficient to keep it in good condition without any possibility of causing damage to the battery by overcharging.

In addition to controlling the output of the dynamo according to the condition of the battery, the regulator provides for an increase of output to balance the current taken by the lamps whenever they are switched on.

The cut-out and regulator are accurately set before leaving the Works and should not be tampered with or adjusted.

HEAD-LAMPS.

The headlamp is fitted with a double-filament bulb. One filament is arranged to be approximately at the focus of the reflector and gives the normal driving light, whilst the second one, mounted slightly above the other, gives a dipped anti-dazzling beam for use when meeting traffic or driving in fog or mist. This anti-dazzle device is controlled by a switch mounted on the handlebar or in the instrument panel. A small pilot bulb is also provided for use when the machine is stationary or for town riding.

LIGHTING SWITCHING ARRANGEMENT.

The control switch, which is mounted either at the back of the head lamp or in the instrument panel, has the following positions:

"Off"—Lamps off.

"Low"—Pilot, side-car, and tail lamps on.

"High"—Head, side-car, and tail lamps on.

AMMETER.

This instrument gives a reading of the amount of current flowing into, or from the battery. It gives an indication that the equipment is working satisfactorily.

It must be remembered, when noting ammeter readings, that normally during daytime running, when the battery is in good condition, the dynamo gives only a trickle charge so that the ammeter reading will seldom be more than 1 or 2 amperes.

A discharge reading may be observed immediately after switching on the headlamps. This usually happens after a long run when the voltage of the battery is high. After a short time the battery voltage will drop and the regulator will respond, causing the dynamo output to balance the lamp load.

MAINTENANCE OF BATTERY, DYNAMO AND LAMPS

The equipment should receive regular inspection, and where necessary should be cleaned and adjusted in accordance with the instructions given in the following pages.

BATTERY (LEAD ACID TYPES).

Topping Up. At least once a month, the vent plugs in the top of the battery should be removed, and the level of the acid solution examined. If necessary, distilled water, which can be obtained at all chemists and most garages, should be added to bring the level to the top of the separators. If, however, acid solution has been spilled, it should be replaced by a diluted sulphuric acid solution of the same specific gravity as the acid solution in the cell to which it is added. When examining the cells do not hold naked lights near vents, as there is a danger of igniting the gas coming from the plates.

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

IMPORTANT.

If for any reason a Nife battery is substituted for the normal lead acid type, it is advisable to call at a Lucas Service Depot to have a new regulator fitted. Should it not be possible for the regulator to be changed immediately, the equipment will still function reasonably well, although the charging rate with a discharged battery will not be as high as with the correct regulator.

It must be remembered that you cannot get more energy out of the battery than is put in. If the cycle is left parked at night with the lights on, with very little daytime running, then the battery may end in a low state of charge.

DYNAMO.

Before removing the dynamo cover for any reason, **disconnect the positive lead of the battery** to avoid the danger of reversing the polarity of the dynamo, or short circuiting the battery, either of which might cause serious damage.

The lead from the positive battery terminal (about 1ft. long) is connected to the lead from the switch by means of a brass connector. To disconnect, remove the rubber shield and unscrew the cable connector. Care must be taken that it does not touch any metal part of the frame as this will short circuit the battery. When connecting up again, do not forget to pull the rubber shield over the connector.

Brushes. Examine the dynamo brushes, they can be removed from their holders when the spring lever is held aside. They should slide freely in their holders, and make good contact with the commutator. If the brushes are dirty or greasy, clean them with a cloth, moistened with petrol.

When replacing the brushes care must be taken that they are replaced in their original position.

After long service, when the brushes have become worn so that they will not bear properly on the commutator, they should be replaced. It is recommended that none but genuine Lucas brushes are fitted, as these are specially made and will give the best results and the longest life. We advise owners to have the brushes fitted at a Lucas Service Depot so that they can be properly "bedded" to the commutator.

Commutator. Keep the commutator clean and free from oil. The best way to clean the commutator is, without disconnecting any leads, to remove from its holder one of the brushes, insert a fine duster by means of a suitably shaped piece of wood against the commutator surface, and turn the engine so as to rotate the armature.

Lubrication. About every 4,000-5,000 miles add a few drops of good grade thin machine oil to the lubricator on the commutator end bracket. The bearing at the driving end is packed with grease before leaving the Works. This will last until the motor cycle is taken down for a general overhaul, when it is advisable to have the Mædync dismantled, preferably by a Lucas Service Depot, for cleaning, adjustment and repacking the bearings with grease.

LAMPS

REPLACEMENT OF BULB AND FOCUSING.

Head Lamp The lamp front and reflector can be withdrawn for bulb replacement when the fixing clip is pressed back. When **Types DU142 and D142.** re-fitting locate top of rim first.

To remove bulb holder, press back the two securing springs.

The main bulb can be focussed by removing the lamp front and reflector and slackening the clamping screw which secures bulb holder. Move the bulb and holder until the best results are obtained and finally tighten the clamping screw.

Side-Car Lamp To remove lamp front and reflector, twist the front **Type LD309.** to the left. The bulb holder can readily be unclipped from the back of the reflector.

When replacing, push the front on so that the arrow stamped on the rim is slightly to the left of the top, and then turn the front until the arrow is at the top of the lamp.

Side-Car Lamp The lamp front and reflector may be removed after **Type R370.** the locating screw at the bottom of the rim has been unscrewed. When replacing locate top of rim first.

Tail Lamp The rear portion of this lamp is removed for a bulb replacement by giving it half a turn to the left, when it becomes detached from its fixing. **Type MT110.**

Replacement Bulbs. When the replacement of any bulb is necessary, we strongly recommend that Lucas Genuine Spare Bulbs are used. The filaments are arranged to be in focus and give the best results with our reflectors. Particulars of replacement bulbs are as follows:—

For	Lucas No.	Watts	Remarks
Head Lamp (driving and dipped beam lights).	70	24 & 24	Special double filament gas-filled bulb.
Head Lamp (pilot light).	200	3	Centre contact bulb.
Sidecar, Tail, and Panel Lamps	200	3	Centre contact bulb.

Cleaning. The lamp reflectors are protected by a transparent and colourless covering, which enables any accidental finger marks to be removed with a soft cloth or chamois leather without affecting the surface of the reflector. On no account should any metal polishes be used on Lucas reflectors. Ebony black finishes can be polished with a good furniture or car polish. Chromium plated finishes only need wiping over with a damp cloth to remove dust or dirt.

WIRING OF THE EQUIPMENT

Before making any alteration to the wiring, or removing the switch from the back of the head lamp, disconnect the positive lead at the battery to avoid the possibility of short circuits.

All cables to the Type DU142 head lamp are taken directly into the switch. The switch together with the ammeter is incorporated in a small panel which can be withdrawn from the lamp when the fitting screws are removed.

The ends of all the cables are adapted by means of ecdynol sleeves. The colour scheme and the diagram of connections are given in this booklet. When making a connection, peel back the sleeve. Bare about 1/4 in. of the cable, twist the wire strands together and turn back about 1/4 in. so as to form a small ball. Remove the grub screw from the appropriate terminal and insert the wire so that the ball fits in the terminal post. Now replace and tighten the grub screw; this will compress the ball and make a good electrical connection.

Cables to Dynamo Slacken the fixing screw on the terminal block and remove the clamping plate. Withdraw the metal sleeve from each terminal. Pass the Cable through the holes in the clamping plate and bare the ends for 1/4 in. Fit the metal sleeves over the cables, bend back the wire over the sleeves and push them well home into their terminals. Finally screw down the clamping plate.

MAINTENANCE OF THE MAGNETO

The magneto portion of the Magdyno requires very little attention to ensure it giving its best service.

Lubrication. The cam is lubricated by a wick which is contained in the contact breaker base. Add a few drops of thin machine oil to the wick about every 5,000 miles. To render the wick accessible, remove the spring arm carrying the moving contacts, and then withdraw the screw carrying the wick.

When replacing the arm see that the small backing spring is fitted in its original position, i.e., immediately under the securing screw and spring washer and with the bent portion facing outwards.

Cleaning and Adjustment of the Contact Breaker. Dirty contacts may be cleaned by polishing with fine carborundum stone or fine emery cloth. Wipe away any dirt or metal dust with a cloth moistened with petrol.

Examine the contact breaker spring and wipe away any dirt.

To render the contacts accessible for cleaning, remove the spring arm carrying the moving contact by withdrawing the securing screw as described above.

Next remove the pick-up 'F' (Fig. 1). Wipe the moulding clean with a dry cloth. See that the carbon brush moves freely in its holder, being careful not to stretch the brush spring unduly.

With the pick-up still removed, carefully clean the slip ring track and flanges by holding a soft cloth on the ring by means of a suitably shaped piece of wood, while the engine is slowly turned round.

Adjustment of the Contact Breaker. The contacts only need adjustment at long intervals, and unless the gap varies considerably from the gauge (12 thousandths of an inch), the owner is warned that it is not desirable to alter the setting. To adjust, turn the engine slowly by hand until the points are seen to be fully opened. Then slacken the locking nut and rotate the contact screw by its hexagon head until the gap is set to the gauge on the magneto spanner. After the adjustment, tighten the locking nut.

INSTRUCTIONS FOR TIMING

1. Slacken the magneto chain sprocket nut and loosen sprocket on taper. This is best loosened with the aid of a sprocket extracting tool, but in its absence a lever may be wedged tightly at the back of the sprocket, when a sharp tap on the sprocket nut—which must, of course, be unscrewed at least one thread—should slacken the sprocket.

2. Rotate engine until piston is the distance from the top of its stroke, recommended under the heading of Timing in this book, making sure, of course, that it is the firing stroke, i.e., both valves must be seated.

3. Place ignition lever in fully advanced position.

4. Remove contact breaker cover and turn magneto spindle in its normal direction of rotation until the contacts just begin to open. This position is the firing point, and the magneto sprocket should be permanently fixed in this position.

5. It is always advisable to check the timing after tightening up to ensure that no movement has taken place.

FITTING OF HIGH TENSION CABLE

High Tension Cable to Pick-up. Use 7 m.m. rubber covered ignition cable. Unscrew the knurled moulded nut from the terminal and slip it over the lead. Bare the end of the cable for about 1/4 in., thread the wire through the metal washer provided and bend back the strands. Then screw the nut into its terminal.

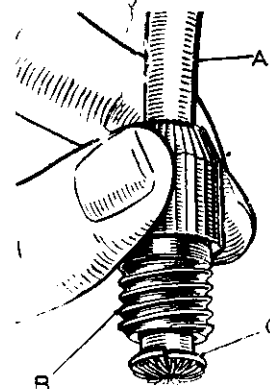


Fig. 2 METHOD OF FITTING CABLE TERMINALS

INSTRUCTIONS FOR FITTING BOWDEN CABLE TO THE SPRING CONTROL

To renew the Bowden cable control, remove the cable casing. It is unscrewed by the hexagon nut at the base. If the cable and plunger are in good condition, which it is attached is drawn upwards to its fullest extent and it will be found that the nipple 'D' into which the end of the cable is soldered comes above the top of the boss on the cam cage housing. The nipple

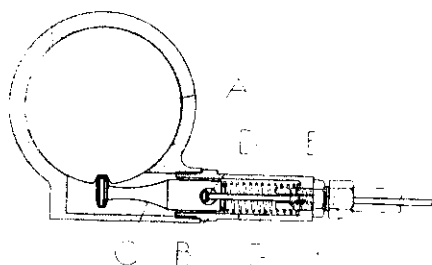


Fig. 3. SECTION OF SPRING CONTROL.

- | | | |
|------------------|-------------|----------------|
| A. Cam. | C. Plunger. | F. Cable Stop. |
| B. Cable Casing. | D. Nipple. | G. Spring. |
| | E. Locknut. | |

may now be slipped sideways out of the hole in the plunger, if it does not fit, thus detaching the cable entirely. Then thread the new cable through the casing and solder the nipple to the end of it. The nipple must be slipped sideways into the hole in the plunger and the casing screwed home. It should be noted that the cable stop 'F' in the casing can be adjusted, if necessary, to take up any slight slackness in the cable covering between the magneto and the lever control.

HINTS FOR THE DETECTION AND REMEDY OF FAULTS

Although every precaution is taken to eliminate all possible causes of trouble, failure may occasionally develop through lack of attention to the equipment or damage to the wiring. The most probable faults are tabulated, according to the symptoms which are displayed in the fault-finding tables at the end of the book.

All connections on the equipment should be examined as follows. Remove the switch from the head lamp after disconnecting the positive battery lead. See that all terminals on the switch are tight.

See that the leads to the two terminals on the Magdyno are tight, and also that the earthing lead from the regulator is secured to the terminal at the side of the contact breaker housing, or some other earthing point.

Finally, re-connect the battery positive terminal and see that the end of the cable from the negative terminal makes good contact with the frame.

HOW TO LOCATE AND REMEDY TROUBLE

Table No. 1 (Lighting).

SYMPTOMS.	POSSIBLE CAUSES.	REMEDY.
Lamps give dim, flickering or no light when the engine is not running.	Bulb filament broken.	Replace with new bulb.
	Bulb discoloured with use.	Replace with new bulb.
	Bulb out of focus.	Focus the bulb until the best illumination is obtained (see page 38).
	Dirty reflector or bulb.	Clean dirty reflector with chamois leather or a soft cloth.
	Severed or worn cable, or loose connections at head lamp switch, dynamo or battery.	Tighten loose connections and replace faulty cables.
	Faulty earthing of head lamp.	See that the headlamp mounting is secure.
	Faulty earthing of battery. The cable from the negative battery terminal must be secured to a metal part of the machine.	Tighten loose connections and replace faulty cables.
	Battery exhausted. Take hydrometer readings when acid level is correct level with top of separators and after a run when electrolyte is thoroughly mixed. When half discharged, readings are about 1.210. When fully discharged, readings are about 1.150.	Machine should be taken on the road for a long daytime run or battery charged from independent electrical supply.

HOW TO LOCATE AND REMEDY TROUBLE

Table No. 2 (Dynamo).

SYMPTOMS	POSSIBLE CAUSES	REMEDY
Battery in low state of charge, shown by dim lights	Dynamo not charging, indicated by ammeter failing to show charge reading when running with no lights on, due to: Broken or loose connection in dynamo circuit, or regulator not functioning correctly.	Examine charging and field circuit wiring. Tighten loose connections or replace broken lead. Particularly examine battery connections and earthing lead from regulator unit. If trouble persists, have equipment examined by a Lucas Service Depot.
	Dynamo giving low or intermittent output, indicated by ammeter showing low or intermittent charge reading when running steadily in top gear, due to:	
	Loose or broken connections in dynamo circuit.	Examine dynamo wiring. Tighten loose connections or replace broken lead. Particularly examine battery connections.
	Commutator or brushes greasy.	Clean with soft rag moistened with petrol.
Battery over-charged, shown by burnt-out bulbs and frequent need for topping up.	Brushes worn, not fitted correctly, or wrong type.	Replace worn brushes. See that brushes "bed" correctly. Fit correct type brushes.
	Regulator not functioning correctly.	Have equipment examined by a Lucas Service Depot.
	Dynamo giving high output, indicated by ammeter giving high charge reading when lights are in use, due to:	
	Regulator not functioning correctly.	Have equipment examined by a Lucas Service Depot.

If, after following the above table, the trouble cannot be rectified, have the dynamo, regulator and battery examined by a Lucas Service Depot.

HOW TO LOCATE AND REMEDY TROUBLE

Table No. 3 (Ignition).

CONDITION	POSSIBLE CAUSES AND METHODS OF DETECTION	REMEDY
	Remove plug and allow to rest on cylinder head. If a spark occurs at plug points when engine is slowly turned over, the ignition equipment is O.K.	Look for engine defects and check ignition timing.
	If no spark occurs at plug points, remove lead and plug, replace with new length of cable, and test independently of plug by holding cable end about 4 in. from metal part of engine. If magneto sparks, H.T. lead or plug is faulty.	Replace H.T. cable, if perished or cracked. Clean plug electrodes, adjust gap to about 20 thousandths of an inch.
	If magneto does not spark possible causes of trouble are:	
Engine will not start or fires erratically.	Contact breaker gap out of adjustment and contacts dirty.	Clean dirty or pitted contacts with fine emery cloth and afterwards with a cloth moistened with petrol.
		To adjust gap, turn engine slowly until the points are seen to be fully opened, then slacken locking nut and rotate fixed contact screw by its hexagon head until the gap is set to thickness of gauge. After the adjustment tighten locking nut.
	Contact breaker rocker arm sticking.	Remove contact breaker and prise rocker arm off its bearing. Clean steel pin (if necessary) with fine emery cloth, and then, having removed all grit, moisten with a few drops of oil before replacing the lever.
	Pick up brush worn or broken.	Fit new brush. Before fitting, clean slip-ring track.

LUCAS SERVICE DEPOTS

BELFAST - - - - - **3/5, Calvin Street, Mount Pottinger**
 Telephone: Belfast 57291 (3 lines) Telegrams: "Servdep, Belfast"

BIRMINGHAM, 18 - - - - - **Great Hampton Street**
 Telephone: Central 8401 (10 lines) Telegrams: "Lucas, Birmingham"

BRIGHTON, 4 - - - - - **85, Old Shoreham Road, Hove**
 Telephone: Hove 1146-1149 Telegrams: "Luserv, Brighton"

BRISTOL - - - - - **345, Bath Road**
 Telephone: Bristol 76001 (4 lines) Telegrams: "Kingly, Bristol"

CARDIFF - - - - - **54a, Penarth Road**
 Telephone: Cardiff 4603 (4 lines) Telegrams: "Lucas, Cardiff"

COVENTRY - - - - - **Priory Street**
 Telephone: Coventry 3065 Telegrams: "Lucas, Coventry"

DUBLIN - - - - - **Portland Street North, North Circular Road**
 Telephone: Drumcondra 434 (4 lines) Telegrams: "Luserv, Dublin"

EDINBURGH, 11 - - - - - **60, Stevenson Road, Gorgie**
 Telephone: Edinburgh 62921 (4 lines) Telegrams: "Luserv, Edinburgh"

GLASGOW - - - - - **Grant Street (St. George's Road)**
 Telephone: Douglas 3075 (5 lines) Telegrams: "Lucas, Glasgow"

LEEDS - - - - - **64, Roseville Road**
 Telephone: Leeds 28591 (5 lines) Telegrams: "Luserdep, Leeds"

LIVERPOOL, 13 - - - - - **450/456, Edge Lane**
 Telephone: Old Swan 1408 (5 lines) Telegrams: "Luserv, Liverpool"

LONDON - - - - - **Donsight Road, Acton Vale, W.3**
 Telephone: Shepherd's Bush 3160 (10) Telegrams: "Dynomagna, Ealux, London"

LONDON - - - - - **757/759, High Road, Leyton, E.10**
 Telephone: Leytonstone 3361 (5 lines) Telegrams: "Luserdep, Leystone, London"

LONDON - - - - - **155, Merton Road, Wandsworth, S.W.18**
 Telephone: Putney 5131 (4 lines) Telegrams: "Luserv, Put, London"

MANCHESTER - - - - - **Talbot Road, Stretford**
 Telephone: Longford 1101 (5 lines) Telegrams: "Lucas, Stretford"

NEWCASTLE-ON-TYNE, 2 - - - - - **64/68, St. Mary's Place**
 Telephone: Newcastle 25571 (3 lines) Telegrams: "Morolite, Newcastle-on-Tyne"

*In addition there are Official Batteries, Service Agents, Official Spares
 Stockists and Official Spares Dealers throughout the Country*