Matchless

IN NAME & REPUTATION

INSTRUCTION BOOK

350 c.c. O.H.V.

WAR OFFICE

MODEL

CONTRACTS 294/C/5506 and 9841

AMC

EDITION 5506-9841-5

DRIVING AND ADJUSTMENT INSTRUCTIONS

for

1941-G3L MATCHLESS MOTOR CYCLES

(With War Office Modifications)

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19400 to 24399 ***(inclusive)***

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DRIVING.

CONTROLS.

Throttle	... ...	Twist grip on right bar. Turn inwards to open.
Air	... ...	Small lever on right bar. Pull inwards to open.
Ignition	... ...	Small lever on left bar. Pull inwards to advance.
Valve lifter	...	Short lower lever on left bar.
Clutch	... ...	Large upper lever on left bar.
Front brake	...	Large lever on right bar.
Rear brake	...	Foot pedal on left side of machine.
Gears	... ...	Foot pedal on gear box. See below for gear positions.

FUEL.

The fuel tap push slide has two knobs. One is hexagon and is marked **" ON."** Push this end in to allow fuel to pass to the carburetter. The other knob has a round knurled edge and is marked **" OFF."** Push this end in to turn off the fuel. This variety in the two ends enables the tap to be used with certainty in the dark

A SUGGESTION.

Before using a new machine sit on the saddle and become familiar with the position and operation of the various controls. Pay particular attention to the gear positions as detailed in the next paragraph.

GEAR POSITIONS.

Neutral is indicated by the pointer on the foot change pedal being in line with the pointer bolted to the gear box. The neutral position is between the first (lowest) and the second gears. There are four gear ratios and the fourth is called **" Top."**

Every time the gear foot pedal is fully depressed a gear is engaged and every time the pedal is raised to the limit of its upward movement a gear is also engaged. The downward movement is best made with the toes and the upward by the instep.

The gear foot change pedal is raised upward, from the neutral position, to engage first (lowest) gear. Then, to engage all the higher gears, the pedal must be pressed downwards, step by step, till, after three movements, the top gear is engaged. The next lower gear can always be engaged by an upward movement and the next higher gear engaged by a downward movement.

NOTE.

Before starting the engine, make sure the gear is in the neutral position and always place the gear in neutral after a run on the machine.

STARTING THE ENGINE.

(a) See there is sufficient fuel in the tank.
(b) See there is sufficient oil in the oil tank.
(c) Verify the gear is in the neutral position.
(d) Turn **" ON "** the fuel supply tap.
(e) Close the air control lever.
(f) Fully advance the ignition control lever and then slack it back a trifle so the ignition is slightly retarded.
(g) Open the throttle not more than one-sixth of the total movement of the twist grip.
(h) Depress the plunger in the top of the carburetter float chamber until it can be felt the chamber is full of petrol.
(i) Raise the small lever on the left bar (valve lifter) and while keeping this raised, turn over the engine by depressing the kick-starter several times.
(j) Finally, give the kick-starter a vigorous downward kick and, when it is almost at the bottom of its movement, release the valve lifter lever, when the engine should commence to fire.
(k) Do not jab at the kick-starter. A forceful, swinging push is required, and do not release the valve lifter lever until the engine has acquired sufficient momentum to carry over compression, otherwise a back-fire may result.

(l) The starting method favoured by the expert is to depress the kick-starter until compression is felt, then raise the valve lifter lever and ease the engine just over compression. Then, after allowing the kick-starter to return to its normal position, give it a long swinging kick, with the valve closed, and the engine should immediately fire.

Observe the kick-starter crank is secured in its normal upright position before moving away. In the event of a broken or weakened spring the crank will tend to lie in a horizontal position and for this reason it is essential to see that it is securely held upright by means of the spring catch provided (see page 51) until the defect has been remedied.

After the engine has started, slowly open air lever until it runs evenly. Then set throttle so engine is running at a moderate speed (neither racing or ticking over) and allow to warm up. While doing this check the oil circulation as detailed on page 9. The machine can then be taken on the road. Do not race the engine up from cold.

Beware of allowing the carburetter to become flooded to such an extent that petrol is oozing all round the mixing chamber and is dripping, because then, in the event of a back-fire, there is grave danger of the machine catching fire. If a fire occurs do not panic. Immediately turn off the petrol and so isolate the main petrol supply. In no circumstances let the machine fall to the ground. If it is placed on the stand the carburetter fire can be extinguished without difficulty.

STOPPING THE ENGINE.

To stop the engine, close the throttle, raise the valve lifter lever on the left bar and keep it raised till the engine has ceased to revolve.

ON THE ROAD.

Having started and warmed up the engine, take the machine off the stand, sit astride it, free the clutch by pulling up the large lever on the left bar and engage the lowest gear.

Next, slowly release the clutch lever and the machine will commence to move forward. As it does this the engine speed will tend to drop as it picks up the load so it will be necessary to slightly increase the throttle opening, bit by bit, to keep the engine speed gently rising as the speed of the machine is increased. When well under way, disengage the clutch, slightly close the throttle, engage

second gear and release the clutch lever, then open up the throttle to increase the speed of the machine. Repeat these operations in order to engage third and top gears.

Finally, fully advance the ignition and leave it in that position unless it is necessary to retard to ease the engine to prevent pinking when pulling hard on a gradient.

NOTES ON DRIVING.

If, at first, the lowest gear will not engage, release the clutch lever and, after a second or two, make another attempt. This condition may exist in a new machine but it tends to disappear after a little use.

Always endeavour to make the movements of hand (on the clutch) and foot (on the gear pedal) as simultaneous as possible, and remember, in all gear changes a steady pressure of the foot is desirable. This pressure should be maintained until the clutch lever is fully released. It is not sufficient to just jab the foot pedal and then release the clutch lever. When actually in motion, it will be found sufficient to merely free the clutch a trifle, to ease the drive, when changing gear and, with reasonable care, changes of gear can then be made without a sound.

Do not race the engine unnecessarily or let in the clutch sufficiently suddenly to cause the rear wheel to spin. Take a pride in making a smooth get-away.

When changing up to a higher gear, as the clutch is freed, the throttle should be slightly closed so that the engine speed may be reduced to keep in step with the higher gear ratio. Conversely, when changing down to a lower gear, the throttle should be either left, or, perhaps, slightly opened more, so that the engine speed may be increased to keep in step with the lower gear ratio.

Avoid slipping the clutch to control the speed.

When travelling slowly, such as may occur in traffic or on a hill, and the engine commences to labour, it is then necessary to change to a lower gear. Engine "knocking" or "pinking" and a harshness in the transmission are symptoms of such labour and, although relief can sometimes be found by retarding the ignition, it is generally much better to change down. A good driver is able to sense such conditions and will make the change before the engine has reached the stage of distress. The gear box is provided to be used and consequently full use should be made of the intermediate gears to obtain effortless running and smooth hill climbing.

STOPPING.

To stop the machine, close the throttle, declutch by lifting the large lever on the left bar, and gently apply both brakes, increasing the pressure on them as the speed of the machine decreases. Place the gear change foot pedal in the neutral position and stop the engine.

Before leaving the machine, turn off the fuel supply, because, should the carburetter flood while the machine is stationary, there is a possibility of neat fuel entering the cylinder via the inlet port. When this occurs, there is a risk of fire, when re-starting, and real danger of oil dilution with the consequent risk of engine seizure.

When using the machine on wet or greasy roads it is generally better to apply **both** brakes together because sudden or harsh application of either brake only, under such conditions, may result in a skid.

In all conditions it is advisable to make a habit of always using both brakes together rather than to habitually using the rear brake and reserving the front brake for emergency purposes.

RUNNING IN.

The first five hundred miles of an engine's existence is far more important than the next five thousand. Therefore, driving on full throttle should be avoided for the first five hundred miles. A speed of thirty miles an hour should not be exceeded during that period, the engine should not be allowed to labour (so freely use the gears) and it should not be allowed to attain a high rate of revolution in the intermediate gears or in neutral.

After this initial **"running in,"** short speed bursts are permissible, but it is recommended not to indulge in extended high speeds until at least a thousand miles have been covered.

At the conclusion of the first one hundred, and first five hundred miles, the adjustments of tappets, chains, brakes, contact breaker points, wheel bearings, steering head bearings and all nuts should be checked, and corrected if necessary. After the initial settling-down process attention to such details will only be necessary at very infrequent intervals.

Special attention should be given to the adjustment of the steering head bearings because these settle down within the first one hundred miles and, if run in a slack condition, will soon ruin the bearing ball races.

LUBRICATION.

ENGINE LUBRICATION SYSTEM.

The engine is lubricated by the **dry sump** system. The main bulk of oil is carried in a tank and the engine oil pump forces the oil to the various parts requiring lubrication, after which it drains into the crankcase sump, from which it is extracted by the pump and returned to the tank This process is continuous while the engine is revolving and, because the oil pump is capable of exhausting a greater amount of oil than it is capable of injecting into the engine, the crankcase sump is kept free of excess oil.

ENGINE OIL CIRCULATION.

The oil pump has only one moving part. This is the plunger, which rotates and also has a reciprocating motion. The plunger is rotated by a worm on the timing side flywheel axle and, while rotating, moves forwards and backwards because of the influence of the small guide screw which engages in the profiled groove cut in the rear end of the plunger.

Oil is fed to the oil pump by gravity.

As the plunger moves in its housing in one direction, the large end draws oil from the crankcase sump, while, at the same time, the smaller end is delivering oil to the various channels provided. Upon the reverse movement of the plunger, the large end returns to the tank the oil it has already drawn from the sump, while the smaller end takes in a fresh charge of oil from the tank in readiness for delivery to the engine on the following movement of the plunger. This action goes on all the time the engine is revolving.

In the oil tank is a filter in the form of a felt cartridge, through which the returning oil is compelled to pass before emerging through the spout immediately underneath the oil tank filler cap, from which it rejoins the main supply of oil in the tank. The felt filter effectively removes all dirt and other foreign matter that the oil may have collected during its passage through the engine.

The oil pump forces oil through:—

(a) A channel in the timing side flywheel axle bearing, and then through a drilled passage in the flywheel, to the big end bearing, the splash from which passes into the interior of the cylinder.

(b) A channel, controlled by a ball valve, direct to the cylinder, so that this, the most vital part of the engine, receives an adequate supply of oil, particularly at high engine speeds.

(c) A channel to the timing gear case, in which the oil is allowed to "build-up" to a predetermined level, after which all surplus oil drains back into the crankcase sump, via a hole cut between the timing gear case and the flywheel chamber.

(d) A pipe fixed to the oil pump housing front cap and leading to the rocker box, by which all the overhead rocker mechanism and valves are positively lubricated, by an ingenious arrangement of oil jets that pass a predetermined quantity of oil, which eventually passes down the push rod cover tubes and through grooves machined in the tappet guides into the timing gear case, and from there it drains back into the crankcase sump, as detailed in paragraph (c).

THE OIL TANK.

Oil for engine lubrication is carried in the tank under the saddle. The level of the oil in the tank should never be allowed to fall below the half-full mark that is on the outside of the tank.

The felt cartridge oil filter is in the oil tank and on each occasion the engine is decarbonised, or not less frequently than every two thousand miles, this filter should be removed and thoroughly washed in petrol.

The felt filter is situated under the hexagon headed cap in the top of the tank. By unscrewing this cap and lifting away the spring and dished washer, which will be found under it, the filter is exposed.

Access to the filter is obtained by slackening the two nuts on the saddle rear spring retaining bolts, removing the saddle nose bolt and swinging the saddle backwards. This should be done when decarbonising because, the tank being removed for that operation, allows access to the saddle nose bolt.

CHECKING OIL CIRCULATION.

Provision is made to observe the oil in circulation and it is necessary to do this before each run. If the filler cap on the oil tank is removed, the returning oil can be seen running from the small spout just inside the filler cap orifice. This check should be made immediately after starting the engine from cold. This is because, while the engine is stationary, oil from all parts of the interior of the engine drains back into the crankcase sump, so that until this surplus is cleared, the return flow is very positive and continuous. Therefore, if the oil circulation is deranged, the fact is apparent at once, by the lack of a steady return flow.

It should be remembered that normally the return flow is somewhat spasmodic and mixed with air bubbles. This is partly due to the fact that the return portion of the oil pump plunger has greater pumping capacity than that delivering fresh oil, and partly due to the variations in the amount of oil in suspense in the crankcase according to the engine speed. For example, upon a sudden acceleration, the return flow may completely cease for a time, only of course, upon deceleration, to resume at a greater rate than normal.

OILING ADJUSTMENT.

The correct delivery of oil to each part of the engine is arranged internally by suitably dimensioned passages, and no provision is made for external adjustment of the oil supply except for the oil feed to the inlet valve stem. The adjuster for the inlet valve stem oil feed consists of a needle pointed screw that can be locked in position by a thin nut. This screw is located in the cylinder head. Once the adjuster is set it requires little, or no adjustment. The approximate correct setting is half a complete turn from the fully closed position, and, unless troubled with valve squeak or excess oil, we advise the adjustment to be left as set by our testers during the road tests of the machine.

Valve squeak generally indicates this valve is not passing enough oil, in which case the needle should be unscrewed a trifle. Excessive oil consumption, an oily exhaust or an oiled plug (in the case of a new machine) usually indicates this needle valve is passing too much oil, in which case it should be screwed home, a trifle at a time, till the symptoms disappear. (Note that immediate relief will not be noticed because it will take some time for the excess oil in the combustion chamber to be dispersed.)

EXHAUST VALVE STEM LUBRICATION.

An oil channel is cast in the cylinder head to lead oil direct to the exhaust valve stem. No adjustment is provided for this oil feed because, in use, the oil passage allows oil to flow against the stem, and oil not immediately used by the stem is then by-passed back to the crankcase sump via the push rod cover tubes. This constant flow of oil against the stem, followed by the instant removal of the surplus, prevents the oil passage becoming choked with burnt oil.

REMOVING THE OIL PUMP PLUNGER.

To remove the oil pump plunger, it is necessary to proceed as follows:—

Remove the foot gear pedal.

Drain the oil tank, remove the four bolts holding the oil pump housing rear cap to the crankcase and take away the cap. Unscrew the guide screw for the oil pump plunger and then the plunger can be extracted from its housing. The guide screw is located in the underside of the housing at right angles to the plunger. It has a hexagonal head and a reduced diameter at the tip, this reduced diameter engages in the profiled groove cut in the rear end of the plunger. If, for any reason, the engine is dismantled, the oil pump plunger **must** be removed before the two halves of the crankcase are separated.

REPLACING THE OIL PUMP PLUNGER.

To replace the oil pump plunger, it is necessary to proceed as follows:—

The interior and exterior of the plunger and its housing should be cleaned free of dirt and the plunger smeared with clean engine oil. Insert the narrow end of the plunger in the rear end of the housing and gently push it into place. Next, introduce the guide screw into its hole and, while screwing same in with the fingers, slightly move the plunger in a to and fro motion until the narrow end of the guide screw is felt to engage in the profiled groove of the plunger.

Finally, screw the guide screw fully home.

If the screw does not engage in the groove, and it is tightly screwed against the body of the plunger, the plunger will be prevented from rotating, so that, when the engine is turned for starting, the teeth on the plunger

and the timing side flywheel axle will be stripped. Therefore, great care must be taken to prevent this by ensuring the guide screw is correctly located in the plunger groove before fully tightening it.

There now only remains to replace the housing end cap. It will be noticed there is a paper washer under each end cap and if either or both are damaged, it is necessary to replace with new. (Paper washer for oil pump end cap, part number **STD582.**) It is most essential both end caps are an airtight fit on the housing. Consequently it is desirable to smear one side of each paper washer with a small quantity of jointing compound and to place that side in contact with the end cap. Note the cap on the front end of the housing is retained by four screws having cheese heads, and the cap on the rear end is retained by four small bolts having hexagon heads.

On fitting a new jointing washer to the front cap see that the hole pierced in it registers with the by-pass elbow delivery hole.

POINTS TO REMEMBER.

Clean the oil felt filter every fifteen hundred miles, and if necessary, replace with new. Oil filter cartridge, part number **STD796.**

A dirty or choked filter will inevitably cause heavy oil consumption.

Make sure the oil tank has an ample supply of oil. The level should not be less than the half-way mark nor more than within one inch from the top of the filling orifice.

Both end caps on the oil pump plunger housing must be an airtight fit.

Check the operation of the oil circulation by inspection through the oil tank filling orifice before starting each run.

GEAR BOX LUBRICATION.

All mechanism inside the gear box is lubricated with C-600 oil, but, when operating in temperatures between 16° and zero, the C-600 oil should be removed from the gear box and replaced with one and three quarter pints of M-120 oil. In no circumstances must M-120 oil be used in temperate and tropic climates.

A lubrication nipple is provided on the top edge of the kick-starter case cover and this is the only point requiring lubrication gun application.

If desired, instead of using the lubrication nipple and gun, lubricant may be inserted in the gear box through the round screwed plug mounted in the top edge of the kick-starter case cover.

Under normal conditions, the addition of about two ounces of lubricant every thousand miles will be sufficient.

In no circumstances must heavy grease be used for gear box lubrication.

CHAIN LUBRICATION.

The primary and dynamo chains run in an oil bath case. The inspection cap orifice in the chain case determines the correct oil level. It is imperative the level is not allowed to fall lower than about $\frac{3}{16}$in. below the height of the bottom edge of this orifice. Add engine oil to maintain the oil level. It is advisable to check the oil level each week because failure to maintain it will result in rapid chain wear with the possibility of total destruction. The oil in the chain case also lubricates the engine shock absorber thereby ensuring its smooth working. Transmission harshness is generally due to the moving parts of the shock absorber being dry and when this occurs it can be taken as an indication that the level of oil in the chain case is too low.

The chain case inspection cap has a screw passing through its centre, and this screw engages in a plate (situated inside the chain case) that bridges the orifice. Between the back of the inspection cap and the outside of the chain case is a cork washer. To remove the inspection cap, the central screw must be undone about four complete turns. This will enable the cap to be slid sideways out of position, and then, by tilting the cap assembly, the back plate can be slipped through the orifice and the complete assembly removed. It can be replaced in the reverse manner, taking care to centralise the cork washer before screwing home the central screw. It is better to secure the cork washer to the inspection cap with liquid jointing compound.

It is essential the knurled screw on the chain case inspection cap is kept fully tightened, otherwise, because of vibration, the complete cap assembly may become displaced and be lost.

The rear chain should be removed every fifteen hundred to two thousand miles in Summer, and every thousand miles in Winter, and thoroughly washed in paraffin.

After removing the paraffin, by draining and wiping with rag, the chain should be immersed for several minutes in a bath of molten tallow, or, as a poorer substitute, in ordinary engine oil. If the latter is used, the chain should be laid in soak overnight in order to ensure penetration to all joints. If treated in this manner the maximum miles of satisfactory service will be obtained.

The case covering the magneto driving chain is packed with grease during assembly and a small quantity of grease should be added every thousand miles. A grease nipple is fitted to the magneto chain case cover.

HUB LUBRICATION.

The hubs are packed with grease when first assembled. This lubricates the hub bearings and also prevents the entry of mud and water. A small quantity of grease should be injected through the angular grease nipple in the centre of each hub shell, every five hundred miles. If too great a quantity of grease is injected in the hub there will be a tendency for some of the surplus to work into the brake drum and brake efficiency will be considerably reduced.

FRONT FORK LUBRICATION.

Although actually no part of the Teledraulic front fork requires lubrication it is of vital importance to maintain the correct quantity of hydraulic fluid. A screw level plug is fitted to each aluminium slider just below the bolts securing the mudguard bridge. These screws should be removed every three to five thousand miles and additional oil if necessary added, M.120 being the correct grade. To top up, first unscrew the hexagonal plug at the top of each tubular member. The plug together with the rod attached may then be raised with the fingers and oil injected until it commences to drip from the level holes.

STEERING HEAD BEARING LUBRICATION.

A grease nipple is fitted to the head lug of the main frame to lubricate the steering head bottom bearing. Another nipple is fitted to the head clip lug, at the top of the steering stem, to lubricate the top bearing. These require very little grease and only a small quantity should be injected every thousand miles.

BRAKE CAM LUBRICATION.

A grease nipple is fitted to each brake cam expander bush and a very small quantity of grease should be injected every thousand miles. Excessive quantities of grease may get on the brake linings and will then impair the braking efficiency.

BRAKE ROD JOINT LUBRICATION.

About every thousand miles (more frequently in bad weather) place a drop or two of engine oil on each brake rod joint and on the threaded end of the rear brake rod.

BRAKE PEDAL LUBRICATION.

A grease nipple is provided in the heel of the foot brake pedal to lubricate the bush on which the pedal is hinged. A small quantity of grease should be injected every thousand miles.

SPEEDOMETER LUBRICATION.

The speedometer driving gearbox is attached to the rear wheel and on it will be observed a grease nipple through which a small quantity of grease should be injected every five hundred miles. No other part of the speedometer requires lubrication.

CONTROL LEVER LUBRICATION.

A drop or two of engine oil should be placed on all the moving parts of the various handlebar control levers every thousand miles, and the twist grip occasionally dismantled and the moving parts greased.

CONTROL CABLE LUBRICATION.

Control cables are very susceptible to the influence of dryness and rust and they should be kept flooded out with lubricant to counteract this condition. The effect of efficiently lubricating a dry control cable has to be tried to appreciate the immense difference it causes.

In order to lubricate the control cables we fit to each, in a convenient position, a small metal clip. These clips cover small bared patches on the outer casings through which lubricant can be injected by means of a specially constructed oil gun. (Special oil gun for control cables, part number B.G.G.) This gun is not supplied in the standard tool kit.

To fill the oil gun, unscrew the barrel from the end cap nearest to the nozzle. Unscrew the operating handle as far as it will go and then pour into the barrel engine oil or a very light grease. Finally replace the end cap and nozzle assembly and the gun is ready for use.

The operation of flooding a control cable only takes a few minutes. It is necessary to slide the clip along the casing so that the gun may be clamped to the casing in such a position that the bared patch of the casing occupies a central position on the rubber pad that is on the nozzle of the gun. The clamping pressure is provided by the large milled-edge disc just under the rubber pad. The screwed plunger of the gun is then given a few turns (in a clockwise direction) which action forces oil through the metal spiral of the outer casing and floods the entire length of the cable with lubricant. Avoid oiling the ignition control cable to excess, because if this is done, there is a danger of oil collecting inside the contact breaker cover and thereby causing misfiring.

MAGNETO LUBRICATION.

The magneto bearings are packed with grease during assembly and, at least once every ten thousand miles, the magneto should be dismantled for cleaning, adjustment and re-packing the bearings with grease.

DYNAMO LUBRICATION.

The dynamo bearings are packed with grease during assembly and, at least once every ten thousand miles, the dynamo should be dismantled for cleaning, adjustment and re-packing the bearings with grease.

SPECIAL.

In addition to the parts mentioned in the preceding paragraphs there are several parts of the motor cycle that have a very small movement which can, with benefit, be lubricated. Among these are the bolts on which the stands hinge. It is advised to occasionally remove these bolts and to lightly smear them with grease before refitting.

Because grease prevents the entry of water, it is advisable during the wet season, to smear grease round the contact breaker cover and the high tension pick-up on the magneto.

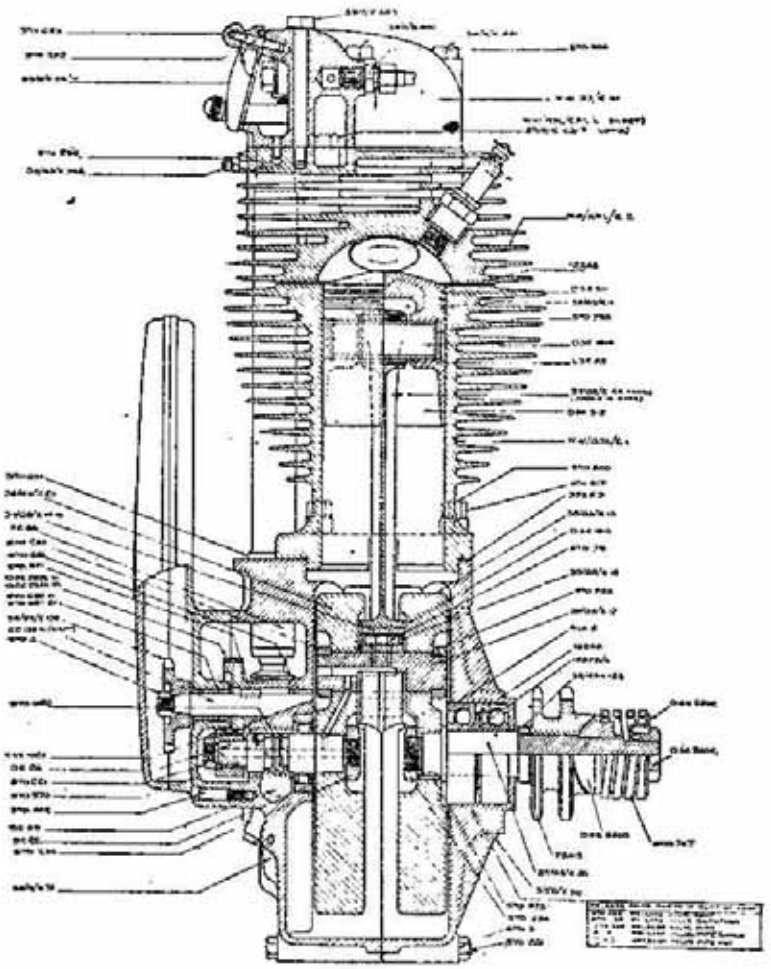

Illustration 1.

ENGINE SERVICE INFORMATION.

TO REMOVE AND REPLACE THE ROCKER BOX.

Before attempting to remove or replace the rocker box, it is essential the valves are closed. In that position the piston is at the extreme top of its stroke.

To remove the rocker box proceed as follows:—

Remove the petrol tank, disconnect the oil pipe that feeds oil to the centre of the rocker box.

Remove the tappet inspection cover on the side of the rocker box and turn over the engine until both valves are closed. This can be easily determined because both long tappet push rods will be free to be revolved without any binding. Remove the seven bolts that secure the rocker box to the cylinder head and then by raising the right hand side of the rocker box the two long tappet push rods may be lifted away from the engine, after which the complete rocker box may be removed. To do that, it is necessary to raise slightly the forward end of the rocker box and swing it round in an anti-clockwise direction to clear the frame tube and to then lift it away from the inlet valve spring assembly.

(Lay aside the push rods so that they may be identified when re-fitting because, although they are identical in design and size it is not advisable to interchange them.)

The box complete with the rockers can then be taken away. **Beware** of losing the steel cap that is on each valve stem. These will be disclosed when the rocker box is removed, and, of course, should be in position on the valve stems, before the rocker box is replaced. **Do not forget to re-fit these valve caps.**

To replace the rocker box, first thoroughly clean the top of the cylinder head and the lower face of the rocker box and see that the composition washer is located between the cylinder head and the rocker box.

Lay the composition washer on the cylinder head, making sure it is the "right side up" (So that the small lip, or extension, surrounds the small hole through which oil passes to the inlet valve).

It is essential this composition washer is faultless so it may make an oiltight joint. Therefore, if not in a perfect condition, replace with new. (Composition washer, for rocker box, part number 39-8-E440.)

Then, holding the rocker box so that it is in a position more to the left than it normally is, place the rocker box over the inlet valve spring assembly and swing it, in a clock-wise direction, till it is in position. Next, slightly raise the right hand side of the box which will allow the two long tappet push rods to be slipped into position, lower the box and insert its seven holding down bolts. Engage each holding down bolt a few threads and finally tighten each bolt, in turn, bit by bit, until all are fully home. Remember there is a plain steel washer under the head of each rocker box bolt.

Tappet clearances must always be checked after re-fitting the rocker box and, if necessary, adjusted. (See page 25.)

TO REMOVE AND REPLACE THE CYLINDER HEAD.

To remove the cylinder head proceed as follows:—

Remove the tank and rocker box.

Remove the exhaust system by removing the nuts that secure the exhaust pipe and silencer to their stays, and taking away the pipe and silencer as one unit. Remove the petrol pipe from the carburetter, unscrew the top cap of the carburetter mixing chamber and withdraw the throttle and air slides and also remove the sparking plug.

Remove the four bolts retaining the cylinder head to the cylinder barrel and the head is then free to be taken away. While doing this, the push rod cover tubes will come away with the head.

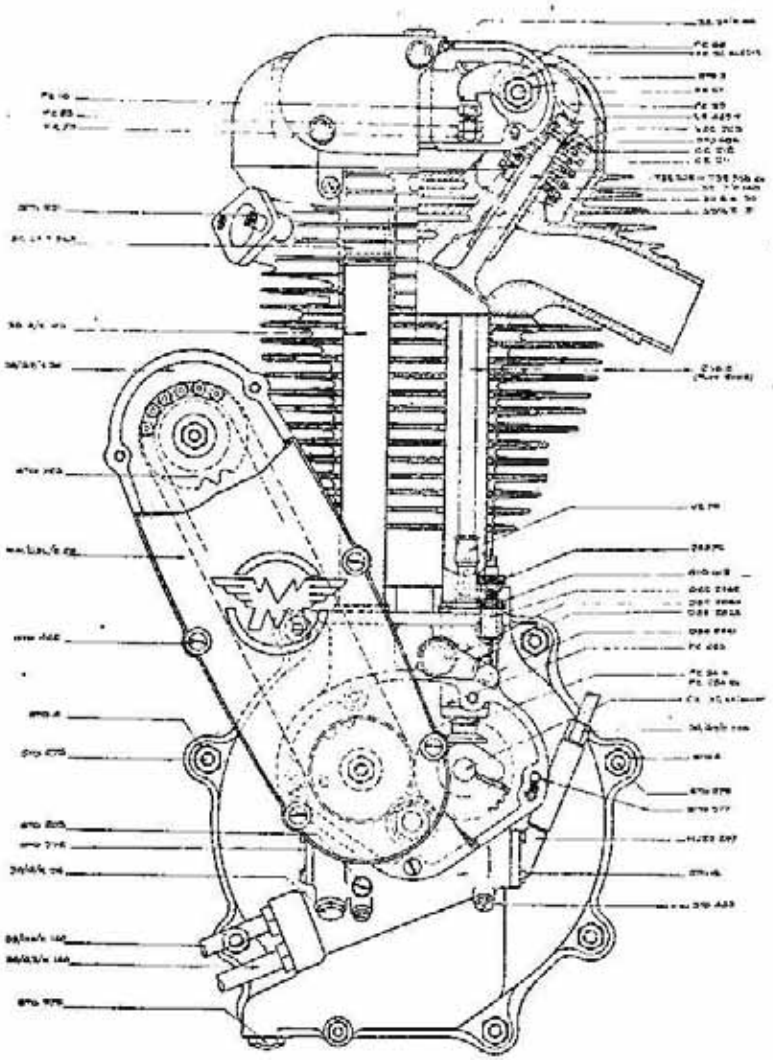

Illustration 2.

A gasket is fitted between the cylinder head and the cylinder barrel. If this is damaged a new gasket should be used when re-fitting the head (head gasket, part number 12268.)

The top ends of the cover tubes are a push-in fit in the cylinder head with a tubular shaped rubber washer between each cover tube and the head. If the cover tubes are removed from the head (by pulling them away) these rubber washers will probably remain in the head. There is a metal ring washer at the top of each rubber washer. (Rubber washer or gasket, for top of cover tubes, two used in a machine, part number 38-G4-E368.) (Metal washer, thin, for top of cover tubes, two used in a machine, part number 38-G4-E379.)

A rubber gland ring is fitted at the bottom of each cover tube. This is used to ensure an oil tight joint between the cover tube and the crankcase. It is generally advisable to use new glands when re-fitting the cover tubes. (Rubber gland, for cover tube, two used in a machine, part number STD691.)

To replace the cylinder head, reverse the procedure described above, taking care to replace the cylinder head gasket, the rubber gland rings at the bottom of the cover tubes, the rubber gaskets at the top of the cover tubes.

(The cover tubes, with their rubber tubular washers and metal washers, should be fitted in the cylinder head before replacing the head on the cylinder barrel.)

When re-fitting the cylinder head bolts, screw each down, bit by bit, in turn, until all are fully home.

If the cylinder head retaining bolts resist removal, brush paraffin round the heads and leave to soak for some time before making further efforts. Smearing the threaded portion of each bolt with graphite grease before re-fitting, will ensure easy removal subsequently.

TO REMOVE THE CYLINDER BARREL.

To remove the cylinder barrel, proceed as follows:—

Remove the petrol tank, the rocker box and the cylinder head. Remove the four nuts that retain the cylinder barrel to the crankcase and this will leave the barrel free to be taken away. While doing this, take care the piston assembly does not receive damage.

Do not disturb the steel compression plate or the fibre washers encircling the tappet guides.

TO REMOVE A PISTON.

To remove a piston, having already removed the cylinder barrel, proceed as follows:—

Fill the throat of the crankcase with rag. Then, using the special pliers (included in the tool kit) compress the two ends of one of the gudgeon pin circlips and extract the circlip from the piston. It is immaterial which clip is extracted because the gudgeon pin is parallel. Next, push the gudgeon pin out of the piston, withdrawing it from the side from which the circlip was removed. This action frees the piston from the connecting rod so that it may be taken away. The gudgeon pin is an easy sliding fit in the piston and the gudgeon pin bush so that no difficulty should be met in removing it.

All pistons are grooved to accommodate three rings. The two top grooves are for rings $\frac{1}{16}$in. wide and the bottom groove is for a ring $\frac{1}{8}$in. wide. Plain compression rings are fitted in the two top grooves and a slotted scraper ring is fitted in the bottom groove.

Piston rings may be removed from a piston by "peeling" them off with a blade of a pocket knife or by introducing behind the rings three pieces of tin, spaced at approximately 120 degrees from each other, and then sliding the rings off the piston. These pieces of tin should be about two inches long and about a quarter of an inch in width.

TO REMOVE AND REPLACE THE VALVES.

After the cylinder head has been removed in the manner already described, to remove the valves it will be found convenient to rest the head of each, in turn, on a small wooden block while the valve springs are compressed to allow the valve spring collar divided collets to be removed from the grooves cut in the valve stem. These collets are a taper fit and it may be necessary to give the valve spring collar a sharp tap in order to release them.

To replace the valves, clean out the valve guides with clean rag, smear each valve stem with engine oil, and then reverse the procedure described above.

The inlet valve has a head larger in diameter than that of the exhaust valve. Therefore, the valves are not interchangeable.

VALVE GUIDES.

Valve guides have parallel bodies with a tapered end. The tapered end projects into the valve port. All guides are drilled with lubrication holes, and are pressed into position.

Valve guides should be removed and fitted in an arbor press. Each guide should be fitted so that the hole bored in it registers with the lubrication hole drilled in the cylinder head and with a projection of ½in. from cylinder head (inlet) and ⅝in. (exhaust).

TO REFIT A PISTON AND CYLINDER BARREL.

All parts should be clean and the rings placed on the piston.

Smear the gudgeon pin with clean engine oil, and placing the piston over the connecting rod so that the slit in the piston faces to the **front** of the machine, and so that the holes for the gudgeon pin are in line with the bush in the connecting rod, introduce the gudgeon pin in the piston and centralise it.

Then fit the gudgeon pin circlip (or circlips, if both have been removed). To do this, the rounded ends of the special pliers (included in the tool kit) should be inserted in the holes in the circlip and the pliers gently compressed. The circlip should then be introduced into the piston, with a rotary movement, until the whole of the circlip lies snugly in the groove which is machined in the gudgeon pin boss of the piston. This is **most essential** because, if the circlips are not fitted correctly, there is a possibility of the gudgeon pin working out of position and scoring the wall of the cylinder.

One paper washer (part number 37-8-E3) is fitted between the compression plate and the top of the crankcase and another between the cylinder base and the compression plate. Upon renewing these it is desirable to coat one side of each washer with a thin coating of liquid jointing compound One washer should then be applied to the compression plate and the other to the cylinder base. Make sure that the jointing compound does not choke any of the holes for lubricating the cylinder base. Apply the compression plate with the paper washer underneath.

Next, smear the cylinder wall and the piston with clean engine oil and space the three piston rings so that the gaps are evenly spaced at approximately 120 degrees to

each other and proceed to fit the cylinder barrel, taking care that the piston rings are fully compressed into the grooves, in turn, as the barrel passes over them. When the barrel is down on the crankcase, replace the holding down nuts, screwing down each, bit by bit, in turn, until all are fully home.

DECARBONISATION.

The period for which an engine will run satisfactorily without being decarbonised depends, to a great extent, upon the driving conditions. Generally this process should be carried out every fifteen hundred to two thousand miles. The need for decarbonising will be indicated by a tendency to "pink" or knock when ascending hills or upon accelerating after rounding a corner and particularly so when the engine is hot.

Although it is only necessary to take off the cylinder head to remove carbon deposit, it is also advisable to remove the cylinder barrel every five thousand miles to inspect the piston rings and to remove any carbon there may be in the piston ring grooves. All piston rings should have a uniform matt appearance on their exterior, and any having black portions on their exterior (a sign leakage has occurred) should be replaced with new. All carbon should be scraped off the top of the piston and the inside of the cylinder head. Also remove any deposit there may be in the inlet and exhaust ports. A blunt screwdriver having a wide blade makes an excellent scraper for both piston and head. Do not use emery cloth or any other abrasive to remove carbon from the crown of the piston.

VALVE GRINDING.

It is advisable to grind in the valves upon each occasion the engine is decarbonised.

Remove the valves. (See page 21.)

Scrape off all carbon deposit that is on the valve heads and clean the stems with very fine emery cloth by holding the cloth between the thumb and forefinger and moving up and down each stem. Then smear the face of each valve, in turn, with valve grinding paste and revolve the valve on its seat in a slight forward and backward direction, at the same time maintaining moderate pressure on the head of the valve to keep it on its seat. During this operation, occasionally raise the valve off its seat and turn it a partial rotation, afterwards lowering the valve to the seat and repeating the forward and

backward movement. One application of grinding paste is usually ample for the inlet valve, but two or three applications may be necessary to restore the seating on the exhaust valve. The grinding may be considered satisfactory and completed when a continuous matt ring is observed on both valve and valve seat. Finally, every trace of grinding paste should be removed from the valves and seatings by washing off with petrol. Also pass a piece of rag through each valve guide to remove any abrasive that may have collected.

Make certain the combustion chamber and both valve ports are perfectly clean before re-fitting the valves.

Valve springs should be tested for length on each occasion an engine is decarbonised. The free length of the outer valve spring is $2\frac{1}{16}$in. and that of the inner valve spring is $1\frac{13}{16}$in. If an outer spring is less than $1\frac{13}{16}$in. in free length it should be replaced and, likewise, if an inner spring is less than $1\frac{5}{8}$in. in free length.

TAPPETS AND GUIDES.

The tappet guides are pressed into the crankcase.

The lower ends of the tappet guides are chamfered to permit easy centering when fitting to the crankcase.

The tappets are dissimilar. That for the exhaust valve has a split collar on it. This collar is used to raise the exhaust valve when the valve lifting mechanism is operated. The tappets cannot be removed from the guides when "in situ."

To remove a tappet with its guide it is necessary to warm the crankcase and then press the guide and tappet out of the crankcase, locating the pressure on the lower end of the tappet and guide so that these parts are extracted from the top edge of the timing gear chest

The reverse procedure is adopted in order to refit these parts.

To remove the collar from the exhaust tappet it is necessary first of all to remove the tappet and guide as described above. Then a wedge should be inserted in the split of the collar and the tappet pushed downwards clear of the collar and guide. The collar can then be lifted out of the guide through the cut away portion of the guide. This procedure is reversed when refitting the collar.

The upper end of the exhaust tappet is chamfered to permit easy entry into the exhaust lifter collar when re-fitting.

TAPPET ADJUSTMENT.

The top ends of the two long push rods have screwed extensions. These are locked in position by nuts, thereby providing tappet adjustment.

The correct tappet clearance between the rocker arm ends and the valve ends, when the valves are completely closed and the engine is cold, is the nearest possible approach to nil. This means the push rods should be free enough to be able to revolve them without any binding and, at the same time, there should be no appreciable up and down movement possible.

To adjust the tappet clearance, proceed as follows:—

Remove the nuts that retain the rocker box cap. This frees the cap for removal, and this reveals the adjustable screwed ends, mentioned above.

Revolve the engine until the piston is at the top of its compression stroke, in which position both of the valves will be closed.

With spanners, hold the body C and slacken lock nut B. Then screw, in or out, the head A until the clearance is nil. Next, tighten lock nut B and recheck the clearance. (See Illustration 3.)

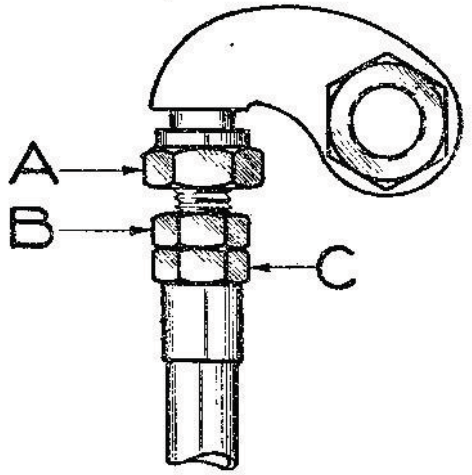

Illustration 3.

Finally, replace the rocker box cap, taking care to replace the fibre washer under each knurled nut. Do not over-tighten these nuts because the joint is made with a rubber fillet, and undue pressure is not necessary to secure an oil-tight joint.

Under normal conditions tappet adjustment should not be necessary more frequently than about every five thousand miles or after decarbonising and grinding valves. If adjustment is found more frequently necessary then the cause should be at once investigated. In no circumstances should the hardened valve end thimble be deleted. These thimbles, or caps, are provided to prevent wear of

the valve ends and although it is possible to lengthen the push rods sufficiently to take up the clearance resulting from the omission of these caps the effect of this would be to bring the edge of the adjusting cup "A" at the top of its travel dangerously close to the oil lug on the rocker box. We particularly mention this because isolated cases of breakage of this oil lug have been reported and this could only occur in the circumstances described.

VALVE TIMING.

The Inlet valve opens 20° Before top dead centre.

The Inlet valve closes 67° After bottom dead centre.

The Exhaust valve opens 78° Before bottom dead centre.

The Exhaust valve closes 28° After top dead centre.

When checking the valve timing the tappet clearances must be set to .016in. so that the tappets may be well clear of the quietening curves of the camshaft.

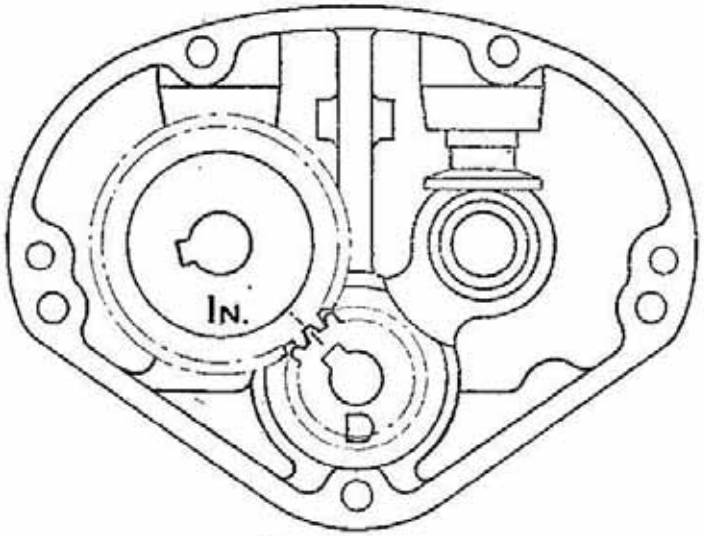

Illustration 4.

The timing gears are marked to facilitate their replacement.

To reset the timing gears, by using the marks on the gears, proceed as follows:—

Turn over the engine till the mark on the small timing pinion D is in line with the centre of the inlet (rear) camshaft bush. (See Illustration 4.)

The exhaust camshaft is that fitted with the shorter centre spindle. The inlet camshaft has the longer centre spindle, with a tapered and threaded end, to carry the magneto chain sprocket.

Insert the inlet cam shaft so that the mark on it is in mesh with the mark on the small pinion D. Then rotate the engine in a forward direction till the mark on the small timing pinion D is in line with the centre of the exhaust (front) camshaft bush. (See Illustration 5.)

Then insert the exhaust camshaft so that the mark on it is in mesh with the mark on the small timing pinion D.

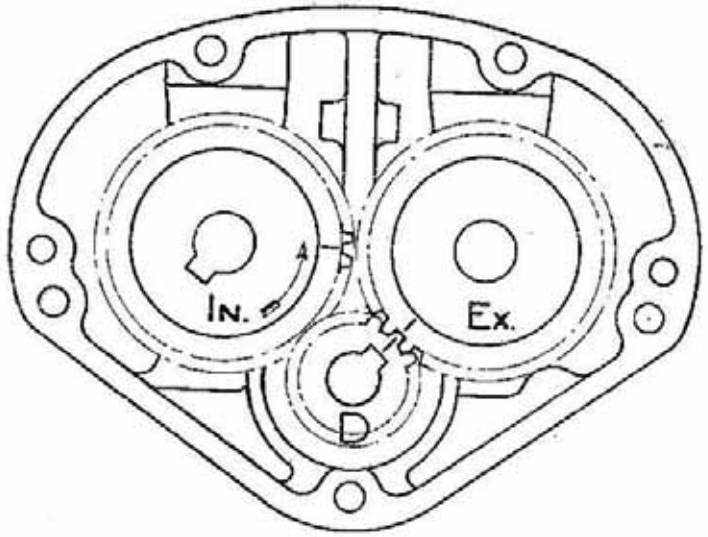

Illustration 5.

The timing gear camshafts are assembled in three parts, the cam, the shaft and a key. The key locates the cam on the shaft and these parts are assembled in an arbor press, the cam being a very tight force fit on the shaft. These three parts are not listed as separate spares. When a replacement is needed it is invariably better to fit a new complete assembly and this is listed in the spares list. If only a new cam or shaft is desired, it is better to send the complete camshaft to us for the new component to be fitted in the factory.

CAM CONTOUR.

On the flanks of the cams are quietening curves which are very slight inclines from the base circles of the cams to the feet of the humps. It is, therefore, necessary to make certain the tappet ends are on the base circles when checking valve clearances and valve timing. It is for this reason valve clearances must be checked when the piston is at the top of its compression stroke, at which position both tappets are well clear of the quietening curves.

TIMING SIDE FLYWHEEL AXLE.

The timing side flywheel axle must be fitted in the flywheel so that, when the small timing pinion is fitted on the axle, the mark on one of the teeth of the timing pinion directly points to the centre of the crankpin, otherwise the oil way to the crankpin will be obstructed and also the timing gear markings will not indicate the correct valve settings.

The nut retaining the flywheel axle in the flywheel is locked by a small cheese headed screw and on no account should that screw be omitted.

SMALL TIMING PINIONS.

The timing pinion is a tapered fit on the timing side flywheel axle and is located by a key. For that reason the marks on the timing gears are always in the correct position because it is impossible to fit the small pinion other than correctly. The nut that retains the small timing pinion to the timing side flywheel axle has a left-hand thread ($\frac{7}{16}$in. by 26). A washer is **not** fitted between the pinion and the nut. To remove the small timing pinion, after first removing the left-hand thread fixing nut, a special pinion extractor is necessary.

OVERSIZE PARTS.

Pistons and piston rings .020in. larger than standard are available but can only be used after the cylinder has been enlarged .20in. to accommodate same. Crankpin rollers .001in. larger in diameter than standard are also available. These are useful in overhauls of slightly worn big ends.

No other oversize parts than these can be supplied for 1941 G/3L Matchless motorcycles.

FRAME SERVICE INFORMATION.

STEERING HEAD ADJUSTMENT.

The steering head races are of the floating, self-aligning type, and have spherical seats. Therefore they do not fit tightly in the head lug and head clip. The two races in the head lug and the race in the head clip are all identical. The lowest of the four races is dissimilar to the others.

Occasionally test the steering head for correct adjustment by exerting pressure, upwards, from the extreme ends of the handlebars. It is particularly important the adjustment should be tested after the first one hundred miles because of the initial settling down that always occurs in that period. Should any shake be apparent, jack up the front of the machine so that all weight is taken off the front wheel (a box under the engine serves that purpose), slacken the top nut on the steering column and screw down the lower nut until all trace of slackness has disappeared. Then tighten the upper nut, holding the lower nut while doing so, and make quite sure the upper nut is most securely tightened.

A service method of ensuring correct adjustment of a steering head is to tighten the lower nut as much as is possible when using the double ended spanner provided in the tool kit, or a spanner having no greater leverage, and then slacken back the nut exactly one half turn. (Only use the leverage provided by the hands.)

TELEDRAULIC FRONT FORK ASSEMBLY.

To make the various stages of assembly quite clear it is assumed for the purpose that the fork is completely dismantled. To dismantle, reverse the following instructions:—

1st ASSEMBLY.

Fit steering column into the crown lug and secure with circlip 40-G12M-FF92, then fit crown ball race and while holding the column horizontally in a vice fix the top and bottom cover tubes, using countersunk head screws 40-G12M-FF129 head downward necessitating tapped washer 40-G12M-FF128 in the upper tube and countersunk washer 40-G12M-FF127 in the lower tube. It should be noted that the three screw holes in these washers are unequally spaced and time will be saved if it is seen that the holes register before the first screw is introduced.

2nd ASSEMBLY.

Attach the top cover tube caps 40-G12M-FF186 to the steering column handlebar lug and then with steering head ball races and balls *in situ* pass the column up through frame head lug and then slide on the handlebar lug engaging at the same time the two upper cover tube caps with the top ends of the cover tubes. Now fit the steering head adjusting nut and the domed locknut leaving the final adjustment of the steering head bearings until the assembly has been completed.

3rd ASSEMBLY.

On each inner tube 41-G3-FF3 (see illustration 6) slide on in the order mentioned the following parts, leather washer 40-G12M-FF126, main spring W41-G3L-FF32, another leather washer 40-G12M-FF126, cover tube 40-G12M-FF185a (unscrewed end first), paper washer 40-G12M-FF95, oil seal 40-G12M-FF91 (leather side first), fibre bush 40-G12M-FF41 (collar end first), inner tube bottom bush 40-G12M-FF191 and lastly circlip 40-G12M-FF192. Great care must be exercised in the removal or refitting of the leather oil seal and to avoid damage it is advisable to make use of a thin tubular sleeve slipped over the reduced diameter of the inner tube with an external diameter

similar to the enlarged part of the inner tube and with a slightly chamfered or rounded end so as to permit the oil seal to slide on or off without coming into contact with sharp edges.

4th ASSEMBLY.

To each damper rod (see illustration 6) fit pin 40-18-FF59 and then valve 40-18-FF58 (recessed side first). Next slide on seat 40-18-FF57 and secure with nut STD5. Next pass the above into damper tube 40-G12M-FF60a and slide on guide 40-G12M-FF56 until the groove in same registers with the slot in damper tube in which position secure with circlip 40-G12M-FF93. Next fit one assembly into each aluminium slider 40-G12M-FF183 R and L and secure with bolt 40-G12M-FF94 using under the head of each, fibre washer 40-G12M-FF80. A thin tubular box key will be required for the manipulation of these bolts.

5th ASSEMBLY.

Pass both fixed inner tube assemblies No. 3 up through fork crown and cover tube assemblies Nos. 1 and 2, and draw right home by screwing on tightly cap bolts 40-G12M-FF189 with washers 40-G12M-FF190. Note the two fixed tube assemblies differ as regards the aluminium slider and must be fitted with these sliders in their correct location, *i.e.*, the one provided with brake anchorage pin on the near side. Having drawn these tubes right home tighten clamp bolts STD368 and then remove the cap bolts 40-G12M-FF189 and washers 40-G12M-FF190.

6th ASSEMBLY.

Screw STD4 nut on the top end of each damper rod Assembly 4, leaving about $\frac{3}{8}$in. thread projecting through each nut and after passing a piece of flexible wire down through the fixed inner tubes (5th Assembly) loop the lower end round and under nut STD4 and then draw the damper rod assembly up through the fixed inner tube until it protrudes through the top sufficiently to enable the wire to be detached and cap bolt 40-G12M-FF189 threaded on to the end of the rod projecting through nut STD4.* Lock each cap securely by means of this nut and then after pouring 6 ozs. of oil down each inner tube lower the damper rod assembly and screw down cap nuts 40-G12M-FF189.

* Do not forget washers 40-G12M-FF120 on cap bolts.

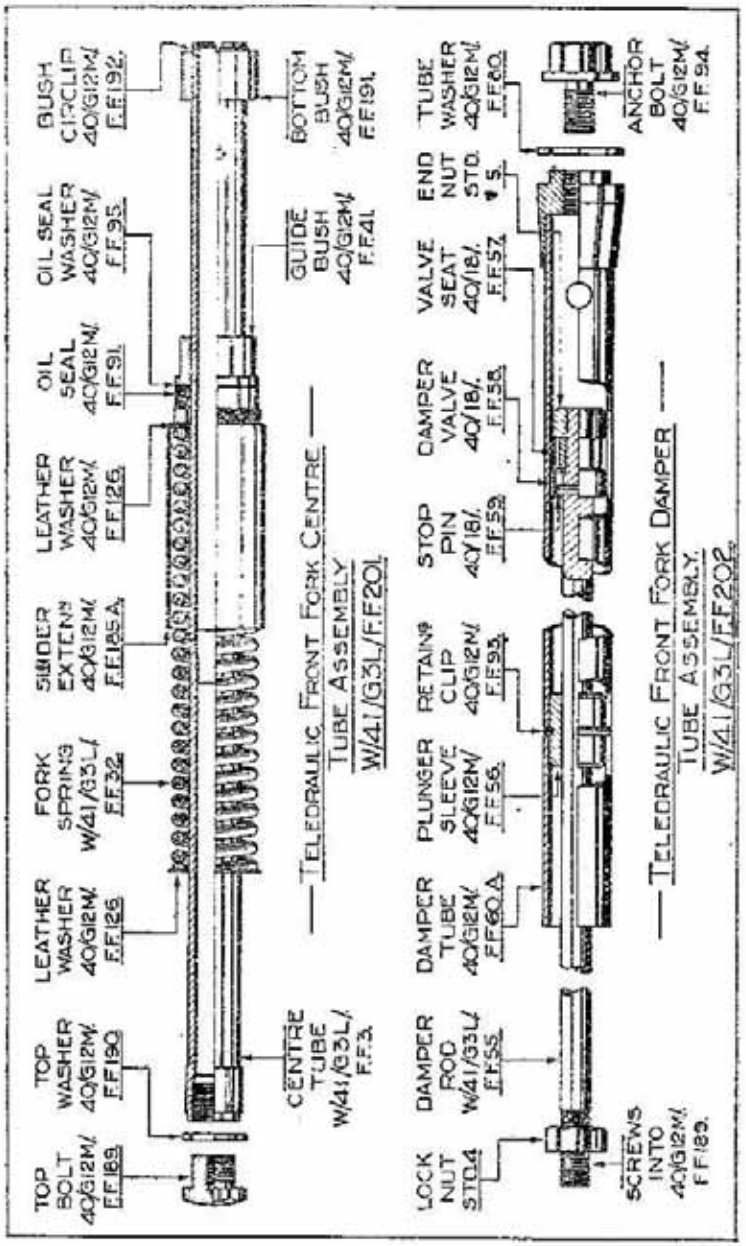

Illustration 6.

7th ASSEMBLY.

Fit front mudguard and stays Then offer up the front wheel and secure with clamps leaving the clamping nuts finger tight only. It must be observed that the slotted brake anchorage correctly engages with the stop pin on aluminium slides. Now lightly screw up the wheel axle end nut and firmly tighten the spindle clamp nuts. Then firmly screw home the spindle end nut and attach the brake anchorage pin nut and split pin. Lastly screw home the two lower cover tube extensions 40-G12-FF185 at the top end of which two holes will be observed. These holes are only exposed when all weight is relieved from the front wheel. The smaller end of the hook hub adjusting spanner can be used in this operation. Test fork for free action and if any stiffness is felt loosen right side spindle clamp and work fork up and down. Then tighten clamp and adjust steering-head (page 29). The assembly is now complete, but before leaving the subject it is desirable to stress the importance of extreme care and cleanliness essential during the whole assembly. Any grit or abrasure matter left on the various sliding parts during erection is likely to cause excessive wear and damage.

TO REMOVE THE FRONT WHEEL.

Place machine on the rear stand and jack the front wheel clear of the ground by means of a stout box or something similar of suitable height under the engine crankcase no front stand being provided. Remove the pin retaining the front brake cable yoke end to the brake expander lever and release the cover plate anchor nut. Then slack off the wheel spindle end nut, then remove the four wheel spindle clamp nuts when the wheel with clamps will fall out of position. When replacing the wheel read carefully the instructions above (7th Assembly).

TO REMOVE THE REAR WHEEL.

Place machine on the rear stand and disconnect the rear lamp cable telescopic connector. Then remove the two nuts which secure the rear portion of the rear mudguard to the fixed forward portion and also slacken off the two nuts which secure the rear tubular arch to the studs in rear fork ends. Next remove the nut and spring washer from the bolt securing the top tool box stay to the tubular arch and also remove the rear bolt securing the tool box to this arch.

The rear portion of the mudguard together with the tubular arch may now be taken away, it being necessary to spring the top tool box outward to disengage the top tool box fixing bolt while doing so. Next disconnect the rear chain but do not remove the chain, also disconnect the speedometer drive cable at the wheel end. Then remove the rear brake rod knurled adjusting nut and spring after which slacken the wheel axle end nuts when the wheel can be twisted sideways to disengage the brake cover plate anchorage and then withdrawn from the slotted fork-ends. The re-fitting is carried out in reverse order and before tightening the wheel axle end nuts it must be observed that the speedometer drive is in correct alignment for the cable attachment.

WHEEL BEARINGS.

The wheel bearings are of taper roller type. The inner bearings for the rollers are an integral part of the wheel axle. The outer bearing cups are pressed into the hub shell with a fixed location on one side and an adjustable location on the other. The adjustment is obtained by a ring screwed into the hub shell that abuts against the movable bearing cup. This adjusting ring is locked in position by a large circular lock ring or nut. On the rear wheel the adjustment is made on the left or brake side, but on the front wheel it is on the right side.

WHEEL BEARING ADJUSTMENT.

It will very rarely be found necessary to make adjustment to wheel bearings and it is of the utmost importance that the bearings are not adjusted too tightly as this would ruin them in a very short distance. There must always exist a slight amount of end play. This should be about .002in. A service method of ensuring correct adjustment is to tighten the screwed adjusting ring A in illustration 7 until all slackness has been taken up and then to slacken it back exactly one half of a turn, taking great care when tightening the locking ring subsequently that the adjusting ring does not creep round. It is necessary to carry out adjustments to the rear wheel bearings with the wheel removed from the cycle, but those of the front wheel can be dealt with *in situ*.

TO DISMANTLE A WHEEL BEARING.

Remove the wheel from the machine. Unscrew the spindle nut on the brake side which will enable the brake cover

plate with shoes, etc., to be taken away. Next slacken locking ring B (illustration 7) and completely unscrew the adjusting ring A which will come away with the locking ring B. A dished plate, felt washer and a plain plate is free to be removed. Having done this turn to the opposite side of the hub where a spring ring will be observed just inside the hub end. Remove this spring ring and this will permit the removal of another felt washer assembly consisting of two metal plates, a felt washer and a spacing ring. The spindle complete with rollers and cages can now be pressed out of the hub shell from either end leaving one outer bearing cup in position. If desired this remaining cup can be pressed out of the shell.

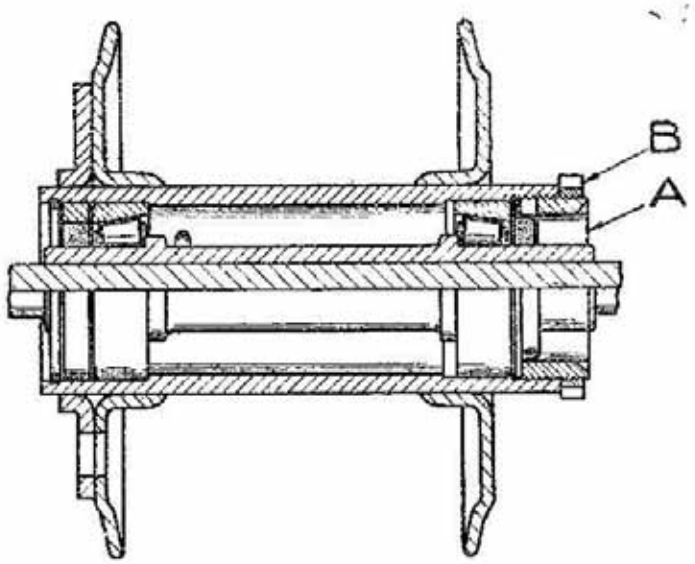

Illustration 7.

TO ASSEMBLE A WHEEL BEARING.

Thoroughly clean all the parts, including the interior of the hub shell, then press one of the outer bearing cups in the unthreaded end of the shell so that its thinner edge is inward and its position a trifle nearer the centre of the hub than it normally occupies.

Care is necessary when inserting these cups to see that they enter quite square to the hub body. Next replace the flat plate that was removed from this end of the hub and then insert the spacing ring, the felt washer, the second flat plate and finally refit the spring ring in its groove. From the threaded end of the hub force back the outer bearing cup until the felt washer assembly is tight against the spring ring. Next from the threaded end of the hub introduce the spindle and rollers entering the correct end first (threaded end in the case of the front axle and longer end in the case of the rear). Next press in the other bearing cup (thinner edge inward) until there is about $\frac{1}{16}$in. end play in the bearings. Then insert the plain plate followed by the felt washer and the dished metal plate. Now screw the adjusting ring with its locking ring into the end of the hub and proceed to adjust the bearing as described on page 34. Finally insert a good quantity of grease into the hub and refit the brake cover plate, etc., taking care to centralise the shoes (see Brake Shoe Refitting). The wheel is then ready for re-fixing to the cycle.

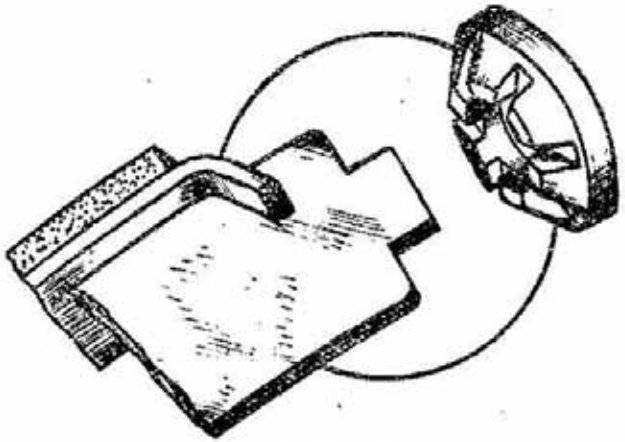

Illustration 8.

BRAKE SHOE ADJUSTMENT

Brake adjustment to compensate for lining wear is normally made by means of a finger adjuster on the rear brake rod and a cable adjuster for the front brake cable. After a very considerable mileage this continual adjustment causes the brake expander to occupy a position whereby the available leverage is considerably reduced and consequently the brake loses efficiency.

To overcome this the brake shoes are fitted with adjustable heel pads (see illustration 8). These pads consist of collars in which are machined slots of varying depths. Adjustment is obtained by turning the collar to the next shallower groove. It is of course necessary to adjust each shoe pad simultaneously one with another to be instantly discernable.

BRAKE SHOE RE-FITTING.

When wear is taken up in the manner described above it is necessary to slack out the brake rod or cable adjustment and to re-set that adjustment to suit the new position of the brake shoe expander. When a brake cover plate and shoe assembly has been disturbed it is advisable to centralise the shoes in the brake drum upon re-assembly. This can best be done before re-fitting the wheel and before finally tightening down the spindle nut securing the cover plate. With this nut slightly loose expand the shoes as fully as possible by placing a tubular spanner or something suitable over the expander lever in order to increase the leverage. While maintaining pressure on the expander fully tighten the nut securing the brake cover plate to the spindle. If a brake tends to squeak when applied that is generally an indication the brake shoes are not centralised in the drum.

BRAKE PEDAL ADJUSTMENT.

The position of the rear brake pedal can be adjusted within narrow limits. This is done by means of a small bolt screwed into the heel of the pedal. The adjusting bolt is locked by a thin nut. The best position for normal use is to position the pedal so that, when the brake is "off," it is just clear of the underside of the footrest arm.

After altering the adjustment of the brake pedal, the rear brake adjustment should be checked.

FRONT BRAKE ADJUSTMENT.

Major adjustment of the front brake shoes is made on the heel pads as described above. Minor adjustment of the front brake shoes is made by the front brake cable adjuster. When adjusting the front brake it is advisable to place the machine on the rear and front stands.

TO REMOVE AND REPLACE THE OUTER HALF OF THE FRONT CHAIN CASE.

The outer half of the front chain case is retained to the back half by a centre nut and an exterior metal band. Between the metal band and the chain case is a rubber band or fillet.

To remove the outer half of the front chain case, proceed as follows:—

Place a tray under the chain case in which to collect the oil that will be released when the outer half of the case is free, and remove the finger adjusting nut from the rear brake rod.

Remove the battery from its carrier because it will probably be necessary to slightly strain upwards the battery carrier base to provide sufficient clearance for the metal band to be taken away.

Remove the screw that binds the two ends of the metal band that encircles the case, remove the band and also the rubber band. Remove the centre nut and washer, and then if the rear brake pedal is fully depressed, the outer half of the case can be taken away.

To replace the outer half of the front chain case, proceed as follows:—

Clean both sides of the outer half of the case and also the outer face of the rear half of the case. Place a line of liquid jointing compound on the face of the front half of the case, and, depressing fully the rear brake pedal, place the outer half of the case in position. Replace the centre nut and washer, and when tightening the nut, move the outer half of the case, as necessary, to make it register with the back half.

Before re-fitting the rubber band clean off any jointing compound or oil that may be on it.

Smear some liquid jointing compound round the edge of the case and press the rubber band in position so that the two free ends meet at the rear of the larger end of the case. Refit the metal band, starting at the front narrow end of the case, and, drawing the two free ends of the band together with one hand, replace the binding screw with the other. Replace the rear brake rod finger adjusting nut and adjust the rear brake as described on page 36.

Finally, after the jointing compound has set, remove the inspection cap in the outer half of the case and fill the case with engine oil to the level mentioned on page 8.

TRANSMISSION.

FRONT CHAIN ADJUSTMENT.

To provide front chain adjustment, the gear box hinges on its lower fixing bolt, while the top fixing bolt can slide in slots cut in the engine plates to allow the hinging movement. This movement is controlled by an eye bolt which encircles the top fixing bolt, and the threaded end of which passes through the block that is secured to the right side engine plate. By altering the position of the eye bolt in the block the gear box top fixing bolt can be moved in the slots in the engine plates. This action swings the gear box and, according to the direction of the swing, the front chain can be tightened or loosened. The gear box must be swung backwards to tighten the chain. The movement of the eye bolt in the block is controlled by two nuts that are threaded on it and are located on either side of the block.

To adjust the front chain remove the inspection cap from the front chain case and proceed as follows:—

Slacken the nuts on the right-hand ends of the gear box top and bottom fixing bolts and screw up (two or three complete turns) the forward nut that is on the eye bolt. Then screw up the rear nut that is on the eye bolt until, by testing through the front chain case inspection cap orifice, it is felt the front chain adjustment is correct. If the chain can whip or move about ⅜in. as it is pressed up and down, mid-way between the sprockets, the adjustment is correct. Check the adjustment in more than one position.

Finally, unscrew the forward nut on the eye bolt till it is tightly down on the block, tighten the nuts on the gear box top and bottom fixing bolts, re-check the amount of whip and replace the chain case inspection cap.

REAR CHAIN ADJUSTMENT.

To provide rear chain adjustment the rear wheel is bodily moved in the frame rear fork ends, which are open-ended and slotted.

To adjust the rear chain proceed as follows:—

Slacken the wheel spindle end nuts and slacken about three complete turns the nut on each chain adjuster bolt.

Then, in turn, screw each bolt further into the fork end until the chain adjustment is correct, taking care to move each bolt an equal distance If the chain can whip, or move above ⅜in. to ½in. as it is pressed up and down, mid-way between the sprockets, the adjustment is correct. Check the whip in more than one position. (See below)

Finally tighten the wheel axle end nuts and lastly tighten down the nuts on the chain adjuster bolts.

NOTES ON CHAIN ADJUSTMENT.

Before tightening the rear chain, the adjustment of the front chain should be checked, and, if attention is necessary, this should be adjusted first.

It should be remembered that altering the adjustment of the front chain affects the adjustment of the rear chain. Also, that altering the adjustment of the rear chain will probably upset the adjustment of the rear brake. Therefore, after altering the adjustment of the rear chain, always check the adjustment of the rear brake, and, if necessary, re-adjust the brake.

The whip of chains should always be tested mid-way between the two sprockets, and the sprockets should be turned and tests made in several positions. The adjustment should be set for the tightest position found. This is because chains never wear evenly, and there is usually one position where the chain is tighter than in any other.

When adjusting the rear chain care should be taken to leave the rear wheel in correct alignment. When correct, a piece of thin string stretched taut across both wheels about four inches from and parallel to the ground, should just touch each tyre at both sides of the wheel centres. Alternatively, a straight wooden batten, about five feet long, is handy to use for checking wheel alignment. This should be applied, as in the case of string, parallel to and about four inches from the ground.

DYNAMO CHAIN ADJUSTMENT.

The dynamo armature shaft is eccentric to the body of the dynamo. Therefore, by partially revolving the dynamo in its housing (the engine plates) the distance between the two dynamo driving sprockets can be varied, thereby allowing latitude for chain adjustment. Provision is made to revolve the dynamo and this is done by applying a thin spanner to the boss that is cast on the driving side of the dynamo body. A thin spanner to fit the boss is included in the tool kit.

To adjust the dynamo driving chain proceed as follows:—

Remove the inspection cap from the front chain case and slacken the dynamo strap clamping bolt, then rotate the dynamo in a forward direction, until, by passing a finger through the inspection cap orifice, it can be felt the dynamo chain has a whip of about ¼in. This adjustment is important.

Finally, tighten the dynamo clamping bolt, re-check the whip and replace the inspection cap.

MAGNETO CHAIN ADJUSTMENT.

The magneto platform hinges on its rear fixing bolt, and this provides movement to enable the magneto driving chain to be adjusted.

To adjust the magneto driving chain proceed as follows:—

Slacken off the four nuts on the two bolts that retain the magneto platform to the engine plates, and remove the cover of the magneto driving chain case. Insert a lever such as a screwdriver underneath the front edge of the magneto platform and lever it upwards until the whip of driving chain is ¼in. Finally, tighten the nuts on the platform fixing bolts, re-check the chain whip, place a supply of grease on the magneto driving chain, and replace the chain case cover.

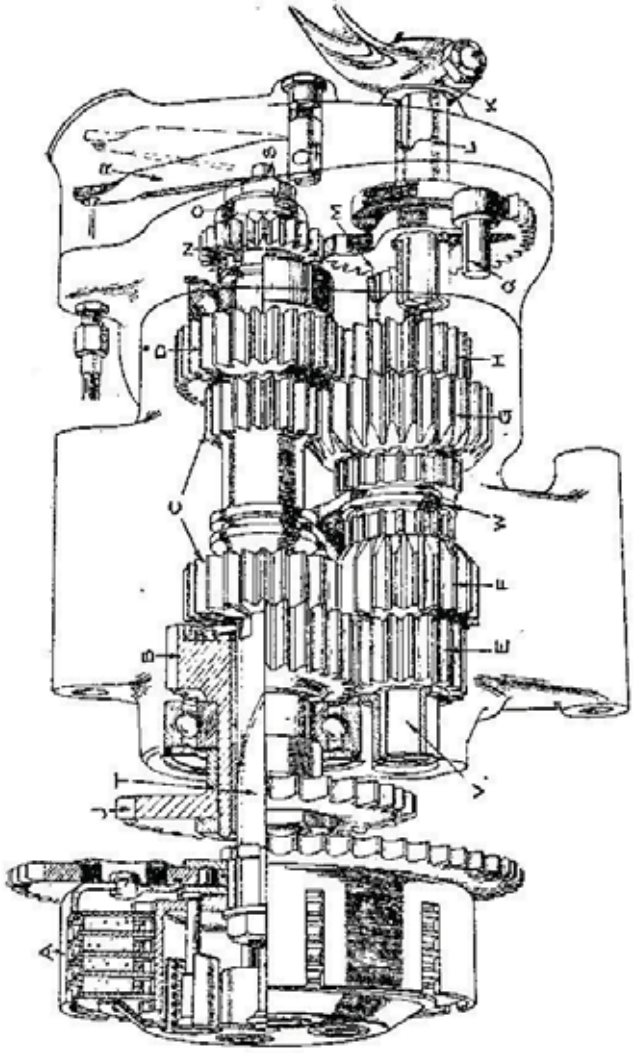

Illustration 9

GEAR BOX SERVICE INFORMATION.

TRANSMISSION OF POWER THROUGH GEARS.

A is the clutch assembly.
B is the main gear wheel.
C is the mainshaft sliding gear. (It has a pinion each end.)
D is the mainshaft third gear.
E is the layshaft small gear.
F is the layshaft second gear.
G is the layshaft first gear.
H is the layshaft third gear.
J is the gear box final drive sprocket.
K is the kick-starter crank.
L is the kick-starter axle.
M is the kick-starter quadrant.
N is the kick-starter ratchet pinion.
O is the kick-starter ratchet driver.
P is the kick-starter return spring.
Q is the stop for the kick-starter.
R is the gear box clutch operating lever.
S is the clutch thrust rod.
T is the gear box main shaft.
V is the layshaft.
W is the sliding clutch on the layshaft.

The transmission of power, or the drive, through the various gears may be easily traced on illustration 9 as follows:—

When the first, or lowest, gear is engaged the sliding gear on the mainshaft remains in the position shown in the illustration—i.e., disengaged from pinions B and D, and the sliding clutch W moves to the right and engages with pinion G. The drive is taken through the clutch A, to mainshaft T, to sliding gear C, to pinion G, to clutch W, to layshaft V, to pinion E, to main gear B, to chain sprocket J, and thence, by the rear driving chain, to the rear wheel.

When the second gear is engaged the sliding gear on the mainshaft remains in the position shown in the illustration—i.e., disengaged from pinions B and D, and the sliding clutch W moves to the left and engages with pinion F. The drive is taken through the clutch A, to mainshaft T, to the larger gear on sliding gear C, to pinion F, to clutch W, to layshaft V, to pinion E, to main gear B, to chain sprocket J, and thence, by the rear driving chain, to the rear wheel.

When the third gear is engaged the sliding clutch on the layshaft remains in the position shown in the illustration—i.e., disengaged from pinions F and G, and the sliding gear on the mainshaft moves to the right and engages with pinion D. The drive is taken through the clutch A, to mainshaft T, to sliding gear C, to pinion D, to pinion H, to layshaft V, to pinion E, to main gear B, to chain sprocket J, and thence, by the rear driving chain, to the rear wheel.

When the fourth, or top, gear is engaged the sliding clutch on the layshaft remains in the position shown in the illustration—i.e, disengaged from pinions F and G, and the sliding gear on the mainshaft moves to the left and engages with main gear B. The drive is taken through the clutch A, to mainshaft T, to sliding gear C, to main gear B, to chain sprocket J, and thence, by the rear driving chain, to the rear wheel.

No adjustment to any of the parts mentioned above is ever required, and no provision is made for adjustment.

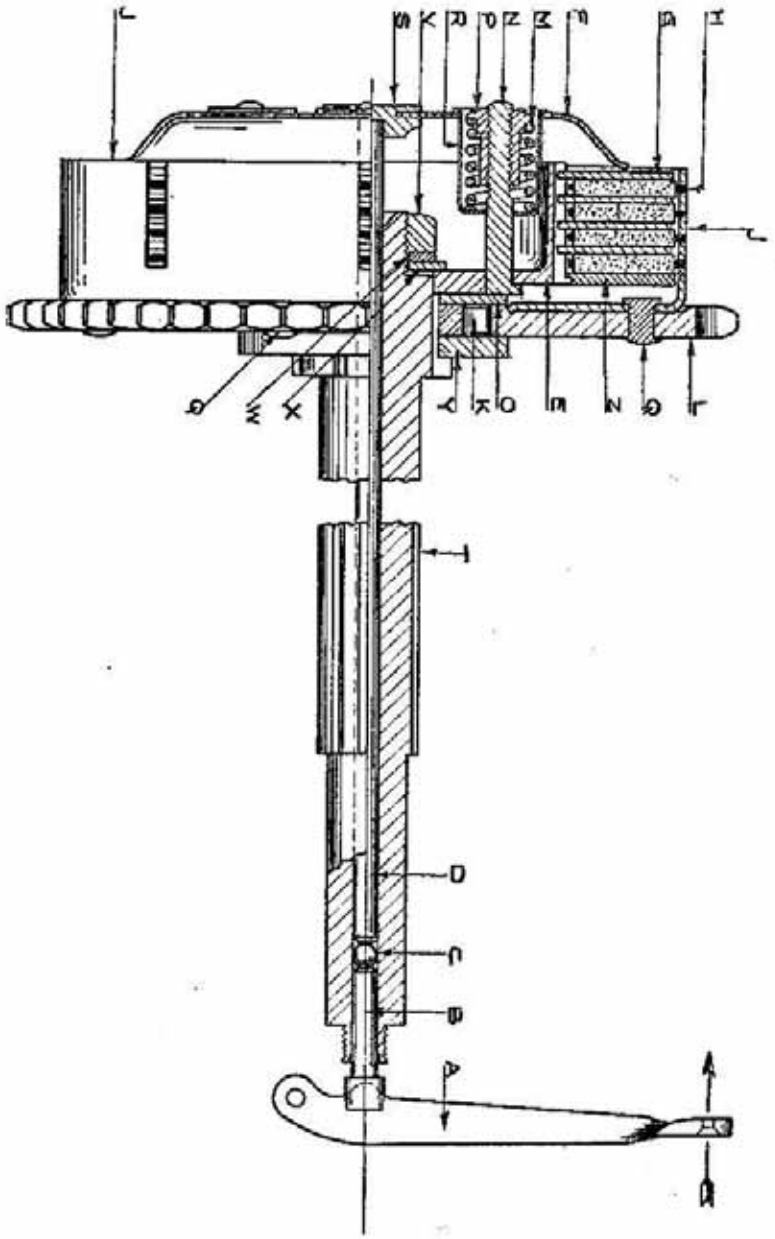

Illustration 10.

THE CLUTCH.

Illustration 10 shows the clutch and gear box mainshaft with clutch operating mechanism.

The clutch operating lever A is moved in the direction of the arrow in order to disengage the clutch.

When the clutch handlebar lever is lifted it moves this lever A in the direction of the arrow and causes it to press against the fork B which, in turn presses the steel ball C against the clutch thrust rod D which pushes against the clutch spring pressure plate F. This action compresses the clutch springs M so that their pressure is released from compressing the clutch plain plates G and the clutch friction plates H, thereby allowing the engine to drive the clutch sprocket L without imparting motion and power to the mainshaft T. Consequently no power is transmitted to the rear wheel and the clutch is said to be "out" or free.

On allowing the handlebar clutch lever to return to its normal position so that the gear box clutch operating lever A is free, the clutch thrust rod D, ball C and fork B, move to the right, under the influence of the pressure exerted by the clutch springs F. The whole of the spring pressure is thereby transferred to the clutch spring pressure plate F and this forces the clutch plain plates G tightly against the clutch friction plates H so that the power transmitted by the engine to the clutch sprocket is transferred, via the clutch case J to the friction plates H and through them to the steel plates G, to the clutch hub E which causes the mainshaft T to revolve.

Upon dismantling the clutch it will be observed that one of the five plain steel plates is about three times thicker than the other four. This thick steel plate is recessed on one side and it should be fitted on the clutch hub so that the recessed part overhangs the flange on the back of the hub. This plate is marked Z in illustration 10.

CLUTCH OPERATION ADJUSTMENT.

Illustration 11 shows the gear box clutch operating lever, and its parts.

175-X-4 is the gear box clutch operating lever and 66-X-7 is the pin on which it hinges. 329-X is the fulcrum for the lever and this slides in the kick-starter case cover, its position being determined by the sleeve nut 331-X.

The fork 330-X transfers the pressure from lever 175-X-4, through ball 67-X to the clutch thrust rod that passes through the centre of the gear box shaft.

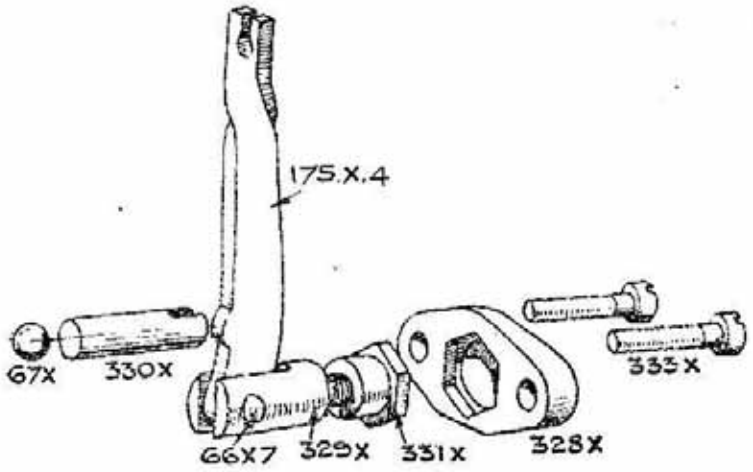

Illustration 11.

The cap 328-X is secured to the outside of the kick-starter case cover by the two screws 333-X. The inner side of this cap has a hexagonal recess that just fits over the sleeve nut 331-X, thereby locking the position of that nut.

It is essential that there is about 1/32in. clearance between the fork 330-X and the nose on the lever 175-X-4 when the clutch is engaged.

It will be appreciated that, as the result of wear on the clutch inserts (in the clutch friction plates) the plates will tend to close up towards each other. This action increases the effective length of the clutch rod,

while, on the other hand, the clutch operating inner wire tends to stretch in use. Although these two actions will neutralise each other, inasmuch as the first (plates closing down) makes the effective length of the clutch thrust rod longer, and the second (inner wire stretch) will make the clutch rod effective length shorter, the fact remains it is necessary from time to time, to adjust the rod clearance as well as take up cable stretch.

Clutch slip caused by the clutch thrust rod permanently bearing on the spring pressure plate will rapidly ruin the fabric inserts in the clutch friction plates and cause the clutch rod to wear in a most rapid manner. In addition, the slip may be so intensive that very considerable heat is generated, and this may ruin the hardening and tempering of the clutch springs and the two ends of the clutch thrust rod. Therefore, we must stress the importance of seeing that the clutch operating gear is adjusted correctly, and also the importance of regular inspection to see the adjustment is maintained.

Generally, it may be assumed that minor adjustments should be made by adjusting the cable stop and major adjustments by altering the position of the operating lever fulcrum 329-X. This is done by removing the two screws 333-X which will be observed on the outside of the kick-starter case cover. The cap 328-X may then be withdrawn, exposing the hexagonal sleeve nut 331-X. To take up slackness, turn this nut in a left, or anti-clockwise, direction. One or two complete turns should be ample.

CLUTCH CABLE ADJUSTMENT.

To decrease the effective length of the clutch operating cable—i.e., to take up play between the control and the clutch thrust rod, the adjuster should be unscrewed from the kick-starter case cover. The amount of play, or free movement, can easily be discovered by virtue of the greatly increased resistance of the handlebar lever as the declutching action commences.

ACCESS TO CLUTCH CABLES.

Access to the gear box end of the clutch control cable can be obtained by removing the screwed cap that is located on the top edge of the kick-starter case cover.

CLUTCH ADJUSTMENT.

In the event of clutch slip being experienced, the most likely cause is incorrect cable adjustment. If the cable adjustment is found to be satisfactory—i e., there is the clearance mentioned on page 47, then the clutch spring adjuster nuts should be adjusted.

Each of these nuts should be screwed in exactly one-half of a complete turn, when a re-trial should be made. If necessary, repeat, but be careful to adjust each of the nuts a similar amount.

If it is necessary to nearly completely screw home the clutch spring adjuster nuts in order to remedy clutch slip, this is a clear indication the springs have lost their strength and/or the fabric inserts in the friction plates have worn so they are past further useful service. The obvious remedy then is to replace with new.

The maker's standard setting of the clutch spring adjusting nuts is obtained by fully tightening all four nuts and then unscrewing each exactly four complete turns.

GEAR BOX CAMSHAFT AND FORKS.

The shaft A has profiled grooves cut in it and the pegs B, in the forks C and D, engage in these grooves. The fork C engages in the sliding gear on the mainshaft and the fork D engages in the sliding clutch on the layshaft.

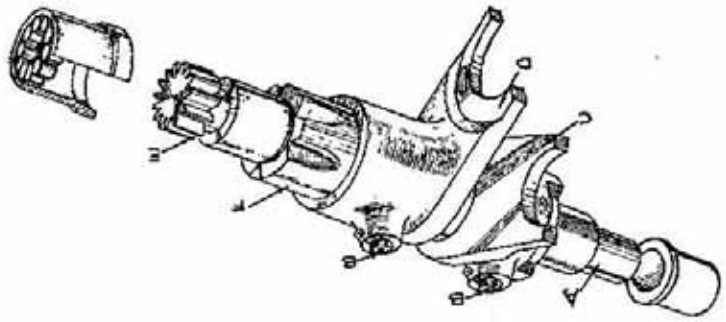

Illustration 12.

These forks cannot move in an up and down direction, in virtue of their fork-like construction, but are free to slide endways on the shaft A. These sliding movements are controlled by the profiled cam grooves cut in the shaft and the partial rotation of the shaft will set up the endways sliding movements.

The rotation of the shaft is made by the small pinion E, which is an integral part of the shaft. This pinion meshes with the toothed sector which is a part of the foot control mechanism. The notches F which are cut in the shaft accommodate a spring loaded pawl, the function of which is to positively lock the shaft in any of the desired gear positions and thereby prevent the shaft from moving on its own account under the influence of vibration or other outside cause.

A tooth of the small pinion E is marked for correct assembly, one of the tooth gaps in the engaging quadrant being similarly marked. (See assembly instructions on page 54.)

The sliding fork with the smaller jaw engages in the mainshaft sliding gear and the fork with the wider jaw engages in the layshaft sliding clutch.

KICK-STARTER OPERATION.

When the kick-starter crank K is depressed (see illustration 9) the toothed quadrant M engages with the ratchet pinion N which is clutched by ratchet teeth to the ratchet driver O which, in turn, is fixed to the mainshaft T. When the kick-starter crank is released, it returns to its normal position under the influence of the return spring shown coiled round the kick-starter axle and adjacent to the toothed quadrant. In the normal position the back edge of the quadrant is in contact with the rubber covered stop pin Q, as illustrated, and the engaging side is quite clear of the ratchet pinion so that, when the mainshaft is revolving, the pinion revolves with it

It will seen that, if the kick-starter crank is depressed with the engine running, this ratchet pinion is held stationary by reason of its engagement with the kick-starter quadrant. In no circumstances should this be allowed to happen for any length of time as the bearing of the ratchet pinion is designed to permit of very infrequent movement of short duration such as applies to normal starting up the engine.

Mention is made of this owing to the fact a case came to our knowledge of the breakage of a kick-starter spring, subsequent to which the rider allowed the starter crank to hang down. This meant that the ratchet pinion was being prevented from rotating with the mainshaft and the result was the pinion eventually seized on its bearing causing extensive damage to the gear box. In such

circumstances the crank must be pushed back by hand until it is held by the external spring clip now provided. This spring clip is secured under the 328-X cap on the kick-starter case cover.

TO DISMANTLE AND RE-ASSEMBLE THE GEAR BOX.

Should it be desired to dismantle the clutch this should be done, as per the instructions on page 61, before proceeding with any of the dismantling described below. If it is intended to remove the main shaft from the gear box the clutch should first of all be taken away as above. Should it be desired to remove the gear box sprocket the clutch must first be removed If it is desired to remove the main gear from the gear box the clutch and gear box sprocket must be taken away first. It is essential to perform the above operations before any of the gear striking mechanism and pinions are removed because for each of those operations it is essential to be able to restrain the parts from revolving by placing top gear in engagement and applying the rear brake.

To dismantle the gear box:—

Remove the right side footrest arm and pad, the moving gear indicator which is secured to the control quadrant by a nut, unscrew the oil filler cap from the top of the kick-starter case cover and, by operating through the orifice, disengage the clutch control inner cable from the clutch operating lever which is inside the case. (It will probably help if the clutch cable adjuster is screwed into the kick-starter case as far as possible.)

Next, remove the nuts that retain the kick-starter case cover to the kick-starter case and the cover then may be withdrawn, which will come away with the kick-starter and gear change mechanism in position. The dissembly of the gear change mechanism will be apparent upon inspection and the kick-starter axle and quadrant may be removed by taking out the bolt that retains the kick-starter crank to the axle and pulling the crank off the axle. The outer end of the kick-starter return spring is anchored to the kick-starter case cover by a pin and the inner end engages in the splines on the axle.

To obtain access to the gear pinions and other parts located within the gear box shell it is necessary to remove the kick-starter case. To do that, proceed as follows:—

Remove the clutch thrust short rod (330-X in illustration 10) and the steel ball (67-X), unscrew the nut on the main shaft which will permit the withdrawal of the ratchet driver, the ratchet pinion (N and O illustration 10), the bush for the pinion and its spring.

Next, disconnect the clutch cable from the case by unscrewing the cable adjuster and remove the four nuts securing the case to the gear box shell. The kick-starter case is then free for withdrawal from the shell and, while doing so, the twelve rollers on the right-hand side of the camshaft will fall away.

It will then be observed that a pawl engages with grooves cut in the camshaft (to positively locate the various gear positions) and this is kept up to its locking position by a spring that is situated in the gear box shell and retained by a plug screwed into the shell. This plug has a screwdriver slot in its head and is located in the bottom of the gear box shell. Both plug and spring must be removed before attempting the removal of any of the pinions or shafts

Having removed the plug and spring the whole of the gear pinions (except the main gear), the layshaft and the camshaft can now be withdrawn.

The mainshaft ball bearing, located in the kick-starter case is retained by a washer and a spring circlip.

The mainshaft is withdrawn from the clutch end of the box.

The removal of the clutch is described on page 60.

The main gear can be removed (see page 60) by unscrewing the nut retaining the gear box sprocket, pulling away the sprocket and removing the washer and spacer under it and pushing it (the main gear) from its ball bearing into the interior of the gear box shell.

The main gear ball bearing is retained by a spring circlip.

The dismantling is now completed.

To re-assemble the gear box, proceed as follows:—

Replace the main gear ball bearing in the shell, with its oil retaining washers and circlip.

Replace the main gear by passing it from the interior of the gear box shell through its ball bearing, replace the spacing washer and collar, the gear box small sprocket, the spacing washer and collar and its retaining nut. (This nut is locked by a special washer having a turned up edge.)

Note that this nut should be fully tightened after the pinions and the gear operating mechanism have been fitted but before replacing the clutch because to do so it is essential to prevent the sprocket from revolving by placing the top gear in engagement and applying the rear brake.

Next, assemble the layshaft gears on the layshaft. To do this place the sliding clutch (W, illustration 9) on the centre of the layshaft, the two free pinions may then be placed on the shaft, one on either side of the clutch, and then place the small fixed pinion next to the smaller of the free pinions and the large fixed pinion on the opposite end of the shaft.

Then, holding this assembly in the hand, so that the small fixed pinion is to the left, take the camshaft, so that its small pinion is to the right, and engage the larger of the two bronze forks with the centre of the sliding clutch, follow this by taking the mainshaft double sliding gear in the right hand and, laying it alongside the layshaft assembly so that the smaller fork on the camshaft engages with its central groove, insert the entire assembly of shafts and gears into the gear box shell, and, while doing so, slide the mainshaft double gear over the mainshaft. Push this assembly right home until the inner ends of the layshaft and the camshaft can be introduced in their respective bushes at the far end of the shell. Then slide on the main shaft the remaining large free gear pinion and replace the pawl spring and its retaining plug screw.

Next, place some thick grease round the bearing end of the camshaft and press into position the twelve camshaft bearing rollers.

Attention should then be given to the kick-starter case. First of all, replace the clutch control cable in its position by screwing in the cable adjuster and the case can

then be replaced by fitting it over the four gear box shell studs and, when fully pushed home, the four retaining nuts should be replaced on the studs and fully tightened. Next, fit the ratchet pinion bush, the spring, the pinion, the driving ratchet and, finally, the retaining nut which must be firmly tightened down to the enlarged part of the mainshaft.

Considerable care must be exercised during the remaining operations and therefore the following instructions must be closely followed.

First, turn the camshaft till the toothed marked " o " is in a 9 o'clock position and insert the gear change toothed quadrant so that the centre tooth, also marked " o," is in mesh with the marked tooth on the camshaft pinion.

Push the long clutch thrust rod inwards as far as possible, insert the steel ball into the centre of the mainshaft and then place the short thrust rod in position with the forked part almost vertical.

Assemble the spring box, with its cover, on the operating quadrant (the foot gear pedal fits on this part), making sure the pin on the quadrant engages between the two smaller springs in the box, place the rocking pawl on its peg and fit the assembly in the kick-starter case cover so that the steel peg, on the cover, engages between the two larger springs in the box and make sure this cannot move by fitting the foot gear pedal right home on its shaft. (The exact position of the pedal is immaterial because it can be reset later.)

NOTE —Do not, in any circumstances, reverse the position of the foot change rocking pawl otherwise gear changing difficulty may be experienced. In other words, fit it the same way " round " as it originally was.

Next, replace the kick-starter return spring on the axle, insert the axle in the kick-starter case cover, make sure the inner end of the spring engages with one of the splines of the axle, fit the outer end of the spring to its locating pin, place the kick-starter crank on the axle to hold the assembly in position (the exact position of the crank is immaterial because it can be reset later), and wind up the spring two complete turns. This is most important. Then, holding the kick-starter crank so that the spring cannot unwind, introduce the kick-

starter case cover over its retaining studs and press fully home, after which, replace the stud retaining nuts.

Should it be found the kick-starter case cover will not go completely home this may be due to one of two things. Firstly, the gear change rocking pawl may not have engaged properly on its ratchet and secondly the slot on the clutch short thrust rod (330-X, illustration 11) has not engaged with the clutch operating lever (175-X-4, illustration 11). In the former instance it will be necessary to work the foot gear change pedal up and down to locate the rocking pawl and, in the latter instance, the kick-starter case cover should be slightly withdrawn in order that the short clutch rod may be revolved enough to ensure its engagement with the lever.

The clutch control inner cable should then be engaged in the end of the operating lever and the wire suitably adjusted. (Access to this through the oil filler cap orifice.)

Then position the gear foot pedal by completely removing it from its shaft and refitting in the most suitable position and then replace the moving gear indicator and its retaining nut.

Then, if necessary, re-position the kick-starter crank, insert a full charge of lubricant (one and three-quarter pints) and replace the oil filler cap

The operation is then completed.

CARBURATION.

The carburetter is tuned during the road tests of the machine, and it should not be necessary to interfere with the standard setting. However, we give below an outline of how the carburetter functions and how adjustment may be made.

The petrol level is maintained by a float and needle valve, and in no circumstances should any alteration be made to this. In the event of a leaky float or a worn needle valve the part should be replaced with new The petrol supply to the engine is controlled firstly, by the main jet and, secondly, by means of a taper needle which is attached to the throttle valve and operates in a tubular extension of the main jet.

The main jet controls the mixture from three-quarters to full throttle, the adjustable taper needle from three-quarters down to one-quarter throttle, the cut away

portion of the intake side of the throttle valve from one-quarter down to about one-eighth throttle, and a pilot jet, having an independently adjusted air supply, takes care of the idling from one-eighth throttle down to the almost closed position. These various stages of control must be kept in mind when any adjustment is contemplated.

The correct size jet (120) and throttle cut away (5 x 5) should not be altered save for some very good reason. (Needle secured in third notch from top.)

With the standard setting it is possible to use full, or nearly full, air in all conditions, except, perhaps, when the engine is pulling hard up hill or is on full throttle, when some benefit may be obtained by slightly closing the air control. Weak mixture is always indicated by popping, or spitting, at the air intake. A rich mixture usually causes bumpy, or jerky running, and, in cases of extreme richness, is accompanied by the emission of black smoke from the exhaust.

A rough test to ascertain if the setting is correct, is to warm up the engine and, with the ignition fully retarded, and the air about three-quarters open, slowly open the throttle to full open, during which, the engine should respond without a misfire, but, upon a sudden opening of the throttle it should splutter and stop. (The engine should not be run more than a few seconds with the ignition fully retarded.)

To check the setting of the pilot jet and its air control, warm up the engine, then, with the ignition about two-thirds advanced and the air about three-quarters open, the engine should idle positively and evenly when the throttle is almost closed. If it fails to do so, adjust the pilot jet air screw, inwards or outwards, until even firing is obtained. (The pilot jet air screw will be observed at the base of the mixing chamber and its position is locked by a nut.) This adjustment is not unduly sensitive, and it should be possible to obtain the correct adjustment in a few seconds.

In the event of adjustment of the air screw failing to provide the required result, it is possible the pilot jet is obstructed with dirt. The pilot jet is actually a passage cut in the sprayer base, or choke, and is very small, so there is always a latent danger of this becoming choked. Upon removing the float chamber and the large nut at the bottom of the mixing chamber, the sprayer base can be pushed out of the mixing chamber and the jet can then be cleared by using a strand of fine wire.

When about to remove the float chamber from the carburetter it is desirable first to remove the high tension wire by unscrewing the bakelite gland nut that retains the cable in the pick-up.

This is because otherwise the wrench may foul the gland nut and so damage it as well as possibly the pick-up.

Before concluding that incorrect carburation is responsible for heavy petrol consumption, and before carrying out any of the tests and adjustments described above, it is most important to make sure the ignition is set correctly. Late ignition usually causes a great increase in petrol consumption.

Poor idling may be due to :—

Air leaks, either at the junction of the carburetter and engine, or by reason of a badly worn inlet valve stem or guide.
Faulty valve seatings. (Engine valves.)
Sparking plug faulty, or the points set too closely.
Ignition advanced too much.
Contact breaker points dirty or set too closely.
Defective high tension cable.
Pilot jet not operating correctly.
Tappets adjusted too closely.

Heavy petrol consumption may be due to :—

Late ignition setting.
Bad air leaks. (Probably at carburetter and engine joints.)
Weakened valve springs.
Leaky float. (Causing flooding.)
Taper needle extension insufficient.
Poor compression, due to worn piston rings or defective valve seatings. (Test compression with throttle wide open.)

TWIST GRIP ADJUSTMENT.

A screw is provided in one-half of the twist grip body to regulate the spring tension on the twist grip rotating sleeve. This screw is locked by a nut and must be screwed into the body to increase the tension. The most desirable state of adjustment is that when the grip is quite free and easy to turn, but, at the same time, will stay in the position in which it is placed.

ELECTRICAL SECTION.

ELECTRICAL EQUIPMENT.

Either Lucas or Miller Electrical Equipment is fitted and on both the dynamo charge rate is controlled by a constant voltage Unit. This unit functions when the voltage, generated by the dynamo, rises above 7.3 to 7.5 volts and then, with a fully charged battery and under "No Load" conditions, only a small current flows through the system. As the load is switched on, the dynamo output is automatically increased to meet the demand. Therefore, it is only when the battery is in a run down condition, and during daylight running, that the ammeter will show a high charging rate, when a charge rate as high as from 5 to 6 amps may be recorded. Under normal conditions, the charge rate is between 2 and 4 amps, according to the state of the battery. This constant voltage system is designed to maintain a fully charged battery without the risk of over-charging which was once so commonly experienced with lighting sets having only switch charging control.

All the wiring is the single pole type, the frame of the machine being used for the negative, or earth return. The main lighting switch is located in the top of the head lamp.

VOLTAGE CONTROL UNIT.

The voltage control unit consists of a regulator which causes the dynamo to give an output varying according to the load on the battery and its state of charge. When the battery is discharged the dynamo gives high output, so that the battery receives a quick re-charge 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 the possibility of causing damage to the battery by overcharging.

In addition to controlling output of the dynamo according to the condition of the battery, the regulator provides for an increase of output to balance current taken by the lamps or other accessories whenever they are switched on. This compensated voltage control system ensures the battery is charged, even during the winter, and it eliminates the danger of a discharged battery. Should the battery become disconnected, or is removed, the machine may still be used without fear of damage to the electrical equipment.

The cut-out is an automatic switch which prevents the 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 speed rises, and open when the speed drops and the voltage falls below that of the battery.

DYNAMO.

The dynamo is fitted with two brushes, the positive is insulated and the negative is earthed. Before removing the dynamo cover for any reason, disconnect the positive wire from the battery, otherwise there is a danger of reversing the polarity of the dynamo or short circuiting the battery, either of which might cause serious damage.

To 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. Replace the brushes in their original position. After long service, when the brushes have become so worn that they will not bear properly on the commutator, they should be replaced with new. Brushes are sold in complete sets. Keep the commutator clean and free from oil. The best method of cleaning is, without disconnecting any leads (wires), to remove one of the brushes from its holder and, inserting in its place a soft duster, hold the duster by means of a suitably shaped piece of wood, against the surface of the commutator, at the same time, turning the engine so as to rotate the armature.

DYNAMO REMOVAL.

IMPORTANT NOTE.

Electrical breakdown of the dynamo is a most unusual occurrence and, therefore, before assuming this unit is defective, it should be tested, as follows:—

Disconnect the two dynamo leads and join the two dynamo terminals together with a short length of wire. Then clip the negative lead of a good quality moving

coil voltmeter to a good earthing point on the dynamo body or on the engine and the positive lead to the dynamo terminals which have been joined together. Now start the engine and increase the speed slowly. If no reading is shown on the voltmeter the fault lies in the dynamo.

TO REMOVE THE DYNAMO.

It is first necessary to remove the outer portion of the front chain case, as described on page 38.

Then, with top gear engaged and the rear brake applied, unscrew the engine sprocket nut. Next, unscrew the four clutch spring adjusting nuts which will allow the spring pressure plate together with the clutch cups, springs and clutch plates, to be taken away.

Next, with top gear engaged and the rear brake applied, unscrew the nut retaining the clutch hub to the gear box mainshaft. This nut has a spring and plain washer under it.

Then, remove the front chain spring connecting link and take away the chain. This will allow the entire clutch assembly to be withdrawn, taking care not to lose any of the twenty-four rollers which will fall out of position when the clutch is removed from the shaft of the gear box. No drawer is needed for this operation because the clutch hub is a sliding fit on the splined part of the mainshaft.

Next, remove the spring circlip on the dynamo sprocket nut which will release the locking washer and that should be lifted away. Then place a spanner on the two flats that are machined on the back of the dynamo driving sprocket and hold the sprocket by that spanner while the retaining nut is unscrewed and then, with a suitable drawer remove the sprocket from the tapered dynamo shaft and, at the same time, withdrawing the engine sprocket with its cam and washer, together with the dynamo chain, which purposely has no connecting link.

Next, proceed to remove the back portion of the front chain case by straightening the tabs on the washers under the three screws retaining the case to the boss on the crankcase and removing the screws. Also remove the nut on the centre fixing bolt and the washer and spacing piece on that bolt. Finally, remove the long hexagon headed bolt that unites the front chain case and the rear chain guard and which is situated immediately under the

battery carrier and the back part of the chain case is then free and should be removed.

Then, slacken back the double headed hexagon dynamo clamping bolt situated immediately behind the cylinder base. This bolt should be unscrewed about $\frac{5}{16}$in. and not, on any account, be fully unscrewed.

Next, by using the thin flat spanner in the tool kit applied to the two flats cast on the dynamo left-hand side end cover, revolve the dynamo bodily, in a clockwise direction as seen from the driving end, until the cheese headed locating screw in the dynamo body registers with the slot cut in the engine plate.

Then detach the commutator band and also the dynamo leads, noting which terminal the coloured lead is attached to.

The dynamo is now free to be withdrawn from its housing.

It will be noticed that a locating plate is screwed to the dynamo body and this must not be disturbed. Its purpose is to register the dynamo in the engine plates so that the sprocket on the dynamo shaft is in line with the dynamo driving sprocket on the engine sprocket assembly.

TO REPLACE THE DYNAMO.

Insert the dynamo in its housing and, before pushing it right home, clip on the band cover for the commutator and re-attach the two leads to the same terminals as removed from.

Next, proceed to fit the back half of the front chain case. Thoroughly clean the boss on the crankcase and smear it with liquid jointing compound and place the chain case half in position. Replace the screw uniting front chain case to rear chain guard, but do not fully tighten it.

Next, refit the three locking washers and screws by which the case is retained to the crankcase boss, making sure the tabs on the washers are turned up so that the screws are properly locked. Refit the spacer, washer and nut on the centre support bolt and then fully tighten the long headed bolt under the battery carrier.

Next, replace the engine sprocket with the dynamo chain and dynamo driving sprocket and refit the dynamo sprocket retaining nut. It is imperative, while tightening this nut, to hold the sprocket by a spanner applied

to the two flats on the sprocket. The reason for this is to relieve the dynamo shaft of all bending strain while the nut is being tightened down. Then, replace the locking washer that encircles the nut and the circlip that retains it. Make sure that the circlip is a snug fit in its groove.

Next, by applying the thin spanner to the flats cast on the left-hand side dynamo end plate, revolve the dynamo bodily in a left-hand, or anti-clockwise, direction (as seen from the sprocket end) until the correct chain tension is obtained, whereupon, carefully tighten the double hexagon headed clamping bolt. Check the chain tension after fully tightening the clamping bolt.

Next, after cleaning all the parts, the clutch sprocket and clutch hub should be replaced. To do this the thicker of the two roller retaining washers should be placed on the gear box main shaft, then the inner roller race, then "stick" the rollers in position with grease and introduce the clutch sprocket over the rollers, follow with the thinner of the two retaining washers, then the clutch hub, then the large plain washer, the spring washer and, finally, the retaining nut which should be screwed on as far as possible. (It can be fully tightened later.)

Then, replace the front driving chain, making sure the connecting link spring clip is refitted so that its closed end faces the direction of rotation. (This is most important.) Next, with top gear engaged and the rear brake applied, fully tighten the clutch hub centre nut and the nut retaining the engine shaft shock absorber assembly.

Next, proceed to refit the clutch plates, etc., by firstly fitting the thick, plain clutch plate on the clutch hub so that the recess cut on one side is innermost and partly overlaps the flange on the hub. Then fit a friction plate, then a thin steel plate and so on until all have been replaced. (Five steel plates and four friction plates.) The spring pressure plate is then put in position, over the last of the steel plain plates, with the four springs and cups and the four clutch spring retaining nuts should be fully tightened home, as far as possible, and each must then be unscrewed four complete turns.

Then, refit the outer half of the front chain case, as described on page 38. Inject engine oil in the case to the correct level. (See page 8.) Refit the chain case inspection disc. And, finally, refit the left side footrest arm and pad.

BATTERY MAINTENANCE.

The electrolyte is a dilute solution of sulphuric acid. This has a corrosive action on most metals and burns fabric and human skin. Any that gets on the machine, hands or clothes, through being spilt, should be immediately washed off with plenty of water or else neutralised by washing with an alkaline solution made with ammonia or washing soda (sodium carbonate) and water.

At least once a month, the vent plugs in the top of the battery should be removed, and the level of the acid solution (electrolyte) examined. The solution should be just over the top of the lead plates of the battery. If necessary, distilled water, which can be obtained from all chemists and most garages, should be added to bring the level to just over the top of the plates. However, if any of the acid solution has been spilled, this should be replaced by a dilute sulphuric acid solution of the same specific gravity. When examining the cells, do not hold naked lights near the vents because there is a danger of igniting the gases coming from the plates.

It is advisable to complete the inspection by measuring the specific gravity of the acid in each cell, as this gives a very good indication of the state of charge of the battery.

An instrument known as a "Hydrometer" is employed for this purpose. This can be bought at any Lucas Service Station and from most garages.

The specific gravity figures are:—

1.285 to 1.300 when fully charged.
About 1.210 when half discharged.
About 1.150 when fully discharged.

These figures are given assuming the temperature of the solution is about 60 degrees F.

Take readings of the acid in each cell. The readings should be approximately the same for all of the cells. If one cell gives a reading very different from the rest it may be that the acid has been spilled or has leaked from this particular cell, or there may be a short between the plates. In this case we advise the owner to have the battery examined by a service depot to trace the cause and to prevent the trouble from developing.

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 then certain changes take place which result in loss of capacity.

THE MAGNETO.

Occasionally remove the high tension pick-up, remove the carbon brush and spring that slide in the brass lined sleeve of the pick-up and, with petrol and rag, clean away all traces of oil and carbon dust. Then clean the slip ring, which is on the end of the magneto armature and on which the carbon brush presses. The best way of doing this is to take an ordinary lead pencil and, on the unsharpened end, wrap one or two folds of a soft duster, insert this in the opening disclosed by the removal of the pick-up and push gently against the bottom of the slip ring, at the same time revolving the engine.

Then replace the carbon brush and spring in the pick-up and fix the pick-up to the magneto. Take the opportunity of examining the high tension cable, and, if it appears perished, denoted by the surface being covered by a multiplicity of small cracks, it is advisable to replace with new.

About every three months, it is advisable to remove the contact breaker cover and examine the contacts. One contact point is mounted on the narrow end of the spring blade. The other point is adjustable and screws into the face of the magneto and is locked in position by a nut. If the points are burned or blackened clean them with the finest grade of emery cloth and afterwards clean with a rag that is moist with petrol.

Check the gap between the two points by turning the engine till both points are separated and measure the gap. The gap should be .012in. and a gauge this thickness is a part of the magneto spanner. The gauge should just pass between the points without any binding or slackness. If necessary, adjust the gap by slackening the lock nut on the adjustable point and screwing the point inwards to increase the gap, or outwards, to decrease it. Then tighten the lock nut and re-check the gap.

SPECIAL NOTE RE CONTACT BREAKERS.

Check the contact breaker point gap after the first 100 and 500 miles. Owing to an initial settling down, there is a tendency for the gap to alter in the first few hundred miles of use. This may seriously affect the ignition setting. Subsequent adjustment will only be required at long intervals, but it is as well to check the gap every 2,000 miles.

TO RE-TIME THE IGNITION.

Have available a stout screwdriver, or an old type tyre lever having a short turned up end, and a bar of metal not less than $\frac{3}{16}$in. in diameter and approximately 5$\frac{1}{2}$ins. long. (The tommy bar of a tubular box spanner is suitable.)

Prepare by removing the sparking plug, the outer cover of the magneto chain case, the contact breaker cover, and the rocker box tappet cover, then unscrew the nut that retains the lower magneto sprocket and, with the screwdriver or tyre lever, gently lever the sprocket from the taper on the camshaft to which it is attached. Turn over the engine until both valves are closed and, with the rod inserted through the plug hole, feel the piston till, by partially rotating the engine, forwards or backwards, it is felt the piston is at the extreme top of its stroke. Place a mark on the bar, level with the top of the plug hole, remove the bar, measure above the mark $\frac{3}{8}$ of an inch and record the position on the bar.

Place the handlebar ignition control lever in the fully advanced position, re-insert the bar in the plug hole and slightly rotate the engine BACKWARDS until the upper mark on the bar is level with the top of the plug hole. By turning the sprocket on the magneto shaft, rotate the magneto in an anti-clockwise direction (as seen when viewing the sprocket) until the contact breaker points are just about to separate. Tighten the nut on the camshaft, taking care not to move the engine and/or the magneto shaft when doing so. Re-check the setting. Finally, replace the contact breaker cover, magneto chain case cover, sparking plug and tappet cover.

SPECIAL NOTES RE IGNITION TIMING.

Before timing the ignition, check the gap between the contact points and adjust if necessary. To find the exact moment for the commencement of the point separation, place a piece of tissue paper between the points and turn the magneto armature until the paper is just released, and no more, upon a gentle pull.

TYRES.

TYRES AND SERVICE.

Obtaining satisfactory life and service from the tyres is largely a matter within the user's control, because the first essential is proper inflation.

The correct pressure is substantially governed by the load to be carried and it is therefore somewhat difficult to lay down a hard and fast rule. Assuming the driver's weight to be normal, the pressures recommended in the next paragraph may be regarded as satisfactory. All users are urged to make a practice of checking the actual pressure in each tyre by a low pressure Schrader type gauge. This takes only a few seconds to do and will amply repay the user by reason of additional service and immunity from failures. This test should be made at least once a week.

Avoid unnecessary or "stunt" acceleration and fierce braking, which wear out tyres rapidly by causing wheel spin. Do not drive in tram-lines. Apart from its dangers, the upstanding edge often deeply cuts the loaded tyre. Do not allow flints, etc., to remain embedded in the tread. They will work through, puncturing the tube and destroying the canvas casing. Keep oil away from the tyres and from the spokes. If any finds its way on to the tyres, clean it off by using petrol sparingly.

INFLATION PRESSURES (General Table).

The following are correct minimum inflation pressures for specified loads per tyre:—

Load per tyre, 200 lbs.—Pressure, 16 lbs. per square inch.
Load per tyre, 240 lbs.—Pressure, 18 lbs. per square inch.
Load per tyre, 280 lbs.—Pressure, 20 lbs. per square inch.
Load per tyre, 350 lbs.—Pressure, 24 lbs. per square inch.
Load per tyre, 400 lbs.—Pressure, 28 lbs. per square inch.
Load per tyre, 440 lbs.—Pressure, 32 lbs. per square inch.

With a driver of average weight, the load on the front tyre of the Military Model 1941 G3L is 215 lbs, and that on the rear tyre 310 lbs. The correct inflation pressures, for these loads are 17 and 21 lbs. per square inch respectively.

TYRE REMOVAL.

To take off an outer cover and remove the inner tube proceed as follows:—

Take off the valve cap and unscrew the security bolt nut and the nut on the valve stem. Completely deflate the tube by removing the valve inside. (The valve cap is provided with a slotted top to facilitate this operation.) Then, push the edge of the cover, that is immediately opposite to the valve, into the well of the rim, and, using the tyre lever that is included in the tool kit, pick up the edge of the cover close to the valve, so that it comes off over the edge of the rim, and then it will be found quite easy to slip the remainder of the cover off the rim, without the need to use force.

Next, push the valve stem upwards, through the hole in the rim, and the inner tube can be taken away.

Remove the security bolt and the cover can be taken away from the rim by pushing one edge right into the well of the rim and lifting the cover off diametrically opposite.

TYRE FITTING.

To refit an inner tube and outer cover proceed as follows:—

Place one edge of the cover right into the well of the rim, and commencing opposite to that spot and using the hands only, work the cover over the edge of the rim. This is a very easy operation. Replace the security bolt and screw on its nut a few turns. Replace the valve "inside" in the valve and slightly inflate the inner tube. (Do not distend the tube.) Fit the valve into its hole in the rim

and replace the valve stem nut, only screwing it on the stem about half an inch or so. Tuck in the inner tube so that it lies snugly in the cover. Then introduce the outer edge of the cover into the rim, at a spot opposite to the valve. Get this edge right into the well of the rim, and then, by working round the cover equally on either side, the cover will slip into place without excessive exertion. There should be no need to use the tyre lever when refitting the cover. That portion of the cover nearest to the valve should be refitted last. Next, half inflate the tyre and spin the wheel and test for trueness, because it is essential the pattern on the tread of the cover runs quite evenly and the cover must be manipulated until this condition is obtained. The tyre should then be fully inflated to the pressure recommended on page 67.

Finally, screw home the security bolt nut and valve stem nut and replace the valve cap. Never run without the valve cap in position, otherwise dirt will enter the valve and, upon the application of a tyre pump, some will get on the valve seating, thereby preventing the valve making an air-tight seal and deflation will result.

GENERAL INFORMATION.

CLEANING THE MACHINE.

Do not attempt to rub, or brush mud off the enamelled surfaces because this will soon destroy the enamel. Mud, and other road dirt, should be soaked off with water.

The best method is to use a small hose, taking care not to direct the water on to the engine, carburetter, magneto and other such parts. As a poorer substitute, a pail of water and a sponge can be used. After washing down with water, the surplus moisture should be removed with a chamois leather. Such parts as the engine crankcase and the gear box can be cleaned by applying paraffin with a stiff brush, and, with a final application of petrol, will appear as new.

CHROMIUM PLATING.

To preserve the condition of the parts that are plated dull chromium, they should be cleaned with a chamois leather moistened with water.

MECHANICAL TROUBLES.

Sudden failures are generally due to one definite thing. Gradual failure may be due to a combination of circumstances. In any case of failure in operation no adjustment should be made, nor should any part be tampered with, until the cause of the trouble has been located. Otherwise adjustments which are correct may be deranged.

In the following six paragraphs are particulars of failures and troubles that can occur together with the probable reasons. These troubles are arranged in the order of possibility.

TRACING TROUBLES.

Engine fails to start or is difficult to start may be due to:—

Throttle opening too large. Petrol tap closed. Air lever in open position. Ignition not set just off fully advanced position. Not enough petrol in the tank. Lack of fuel because of insufficient flooding. Lack of fuel because of pipe or tap obstruction. Excessive flooding of carburetter. Pilot jet choked. Oiled up or fouled sparking plug. Stuck up engine valve. Valve stem sticky with burnt oil. Weak valve spring. Valve not seating properly. Contact points dirty. Incorrect contact point gap. Water on high tension pick-up. Water on sparking plug. Vent hole in filler cap choked.

Engine misses fire may be due to:—

Defective or oiled sparking plug. Incorrect contact point gap. Contact breaker blade sticking. Tappet adjustment incorrect. Oil on contact breaker points. Weak valve springs. Defective sparking plug cable. Partially obstructed petrol supply.

Loss of Power may be due to:—

Faulty sparking plug. Lack of oil in tank. No tappet clearance or too much clearance. Weak valve spring or sticky valve stem. Valve not seating properly. Brakes adjusted too closely. Ignition lever creeps to full retard position. Badly fitting or broken piston rings. Punctured carburetter float. Engine carbonised. Choked silencer.

Engine Over-heats may be due to:—

Lack of proper lubrication (Quantity or quality of oil.) Faulty sparking plug. Air control to carburetter out of order. Punctured carburetter float. Engine carbonised. Weak valve springs. Pitted valve seats. Worn piston rings. Ignition lever creeps to full retard position. Ignition setting incorrect. Choked silencer.

Engine Stops Suddenly may be due to:—

No petrol in tank, or choked petrol supply. High tension wire detached from sparking plug Choked main jet. Oiled up or fouled sparking plug. Water on high tension pick-up. Water in float chamber. Choked vent hole in petrol tank filler cap.

Excessive Oil Consumption may be due to:—

Clogged, or partly clogged, felt filter in oil tank. High crankcase pressure, caused by inoperative release valve action. (The disc in the valve may be damaged or jammed with dirt.) Stoppage or partial stoppage in the pipe returning oil from the engine to the oil tank. Badly worn. or stuck up piston rings. (Causing high pressure in the crankcase.) Air leak in dry sump oiling system.

TO DETERMINE GEAR RATIOS.

Top gear ratio equals:—

$$\frac{\text{Rear Wheel Sprocket}}{\text{Small Gear Box Sprocket}} \times \frac{\text{Large Clutch Sprocket}}{\text{Engine Sprocket}}$$

For example:—If the rear wheel sprocket has 50 teeth, the small gear box sprocket has 20 teeth, the clutch sprocket has 40 teeth and the engine sprocket has 25 teeth, the resulting equation would be:—

$$\frac{50}{20} \times \frac{40}{25} = \text{Top gear ratio of 4 to 1.}$$

DATA.

Rocker box bushes reamered to $\frac{5}{8}$in. ± .0005in.
Camshaft bushes reamered to $\frac{1}{2}$in.
Valve stems .380in. diameter.
Valve seat angle 45°.
Inlet valve diameter 1.465in.
Exhaust valve diameter 1.370in.
Outer valve spring free length $2\frac{1}{8}$in.
Inner valve spring free length $1\frac{7}{8}$in.
(Renew valve springs when free lengths are $\frac{1}{8}$in less than above measurements.)
Valve clearance (cold engine) nil.
Valve Timing: Inlet Opens 20° before T.D.C.
Closes 67° after B.D.C.
Exhaust Opens 78° before B.D.C.
Closes 28° after T.D.C.
(Above checked with .016in. valve clearance.)
Valve guides protrude from cylinder head: Inlet $\frac{1}{2}$in.
Exhaust $\frac{5}{8}$in.
Magneto contact breaker points commence to open $\frac{3}{8}$in. before top dead centre with the control lever fully advanced.
Cylinder bore 2.7187in. ± .0005in.
(Rebore to + .020in. when cylinder bore is + .008in. on above figures.)
Piston ring gaps .006in to .008in.
Piston ring up and down clearance in grooves .003in.
Gudgeon pin bush reamered to $\frac{7}{8}$in ± .0005in.
Timing pinion retaining nut threaded $\frac{7}{16}$in. by 26 TPI, left-hand thread.
Flywheel axles should run within .001in. from dead true.
Flywheel assembly end play should be not less than .025in.
Driving side flywheel axle ball bearings 1in. internal diameter, $2\frac{1}{4}$in. external diameter, and $\frac{5}{8}$in wide (two used).
Timing side flywheel axle bush reamered to $\frac{7}{8}$in. $^{+.00025\text{in.}}_{-.00075\text{in.}}$
Timing side flywheel axle bush protrudes 1/32in. inside crankcase.
Tappet guide height from crankcase face 9/32in.
Exhaust pipe diameter (outside) $1\frac{3}{4}$in.
Carburetter main jet size 120
Carburetter throttle valve size 5 by 5.
Carburetter jet taper needle located in the third notch from its top.

Engine sprocket 18 teeth, ⅜in. by .305in.
Clutch sprocket 40 teeth, ⅜in. by .305in.
Gear box sprocket 16 teeth, ⅜in. by .380in.
Rear wheel sprocket 42 teeth, ⅜in by .380in.
Front driving chain 66 links, ½in. by .305in.
Rear driving chain 91 links, ½in. by .305in.
Magneto driving chain 58 links, ⅜in. by .380in.
Dynamo driving chain 47 links, ⅜in. by .380in.
Gear box mainshaft 10¼in. overall length.
Ball bearing for main gear 1 9/32in. internal diameter, 2 7/16in. external diameter and ⅝in. wide.
Ball bearing for mainshaft (on right-hand end) 12m.m. internal diameter, 40m.m. external diameter and 17m.m. wide.
Clutch thrust rod 9⅞in overall length.
Lengths of control inner wires and outer casings:

Front Brake	44in.	inner,	38in.	outer.
Clutch	53½in.	inner,	47½in.	outer.
Valve Lifter	34in.	inner,	30in.	outer.
Ignition	45½in.	inner,	39½in.	outer.
Throttle	42½in.	inner,	36½in	outer.
Air	37in.	inner,	31in.	outer.

Rims, front and rear, 19in. by 2½in. (for 26 by 3.25in. tyres).
Spokes: Front Left side 5⅝in. by 8G by 10G.
Right side 8 7/16in. by 9G by 11G.
Rear Left side 8 9/16in. by 6G by 9G.
Right side 8⅝in. by 6G by 9G.

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