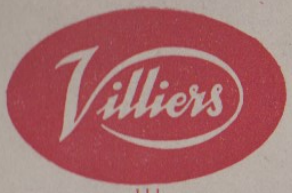


USER'S HANDBOOK

Mark 2H

(246 c.c.)

TWO-STROKE

FOUR - SPEED

ENGINE - GEAR UNIT

THE VILLIERS ENGINEERING CO. LTD.

WOLVERHAMPTON ENGLAND.

TWO SHILLINGS

JULY, 1958. V.E.C. 20.

Introduction

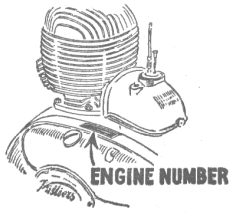
LIKE all Villiers products the engine covered by this book is precision built; every component part conforming rigidly to pre-set standards of the highest quality. Your engine, the heart of the machine in which it is installed, will give many years of efficient and trouble-free service provided it has proper care and attention.

The simple but important routine maintenance suggested in these pages is designed to assist you, and the book should be kept handy for consultation when required.

Because of the fine limits to which this engine is made and assembled we advise you to entrust major overhauling to your nearest dealer or to the manufacturer of your machine, both of whom have the full facilities of our service organization at their disposal.

Important.

Your Dealer and our Service Department will find it very much easier to answer any queries concerning your engine if in all correspondence you will quote the **full** engine number which is to be found stamped on the plate fixed to the inner chaincase as illustrated below.



THE VILLIERS ENGINEERING COMPANY LTD.
Marston Road, - - - - Wolverhampton

TELEPHONES :—
22399 (20 lines).

TELEGRAMS :—VILLIERS,
WOLVERHAMPTON

Villiers

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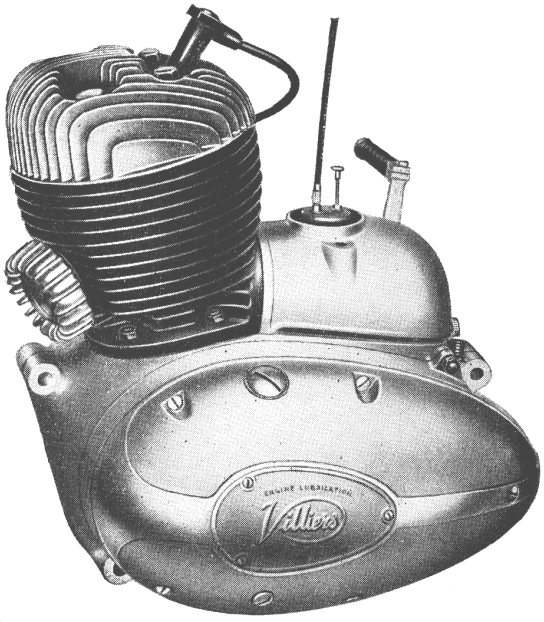


Read pages 3 and 4 before putting Engine into Service.

MARK 2H ENGINE-GEAR UNIT

TECHNICAL DATA

•

Bore	66 m.m.—2.6″
Stroke	72 m.m.—2.83″
Capacity	246 c.c.
Compression ratio	$7\frac{1}{4}$: 1
Maximum power output	11 b.h.p. at 4,500 r.p.m.
Engine sprocket	20 teeth x $\frac{3}{8}$″ pitch
Clutch sprocket	43 teeth x $\frac{3}{8}$″ pitch
Primary drive ratio	2.15 : 1
Gearbox ratios	1 : 1, 1.325 : 1, 1.9 : 1, 3.06 : 1
Final drive sprocket	18 tooth, $\frac{1}{2}$″ pitch for .305″ wide chain
Final drive chainline	$2\frac{11}{16}$″
Exhaust pipe diameter	$1\frac{3}{4}$″ outside diameter
Carburetter	Villiers Type S.25/5
Carburetter taper needle	No. $3\frac{1}{2}$ set 1.9″ out from base of throttle
Throttle (carburetter)	No. 3
Sparking plug	Lodge H.H.14
Sparking plug gap	.018″/025″
Ignition timing	$\frac{11}{64}$″ before top dead centre
Contact breaker point gap	.012″/.015″
Lubrication, Engine	Petroil mixture For the first 500 miles 1 part Castrol XL (SAE 30) to 16 parts petrol, and subsequently, 1 part oil to 20 parts petrol.
Lubrication, Gearbox	Castrol XL (SAE 30)
Lubrication, Chaincase	Castrolite (SAE 20)

Operating Instructions

LUBRICATION

Engine

The engine is lubricated by the petroil system and no lubricant other than that introduced with the petrol is necessary. For normal use and after the running-in period has been completed, we recommend Castrol XL (SAE 30) used in the ratio of 1 part oil to 20 parts petrol. Mix thoroughly before putting mixture into the tank.

Also recommended is Castrol Two-Stroke Self-mixing Oil, in this case the ratio being ½-pint oil to 1 gallon of petrol. (This represents a ratio of 1 to 20 actual lubricant to petrol). No pre-mixing is necessary, but it is essential to turn off the petrol tap and put the oil into the tank before the petrol.

Gearbox.

Castrol XL (SAE 30) is also recommended for the gearbox. The gearbox filler plug and dipstick are combined and positioned as shown in fig. 1. The oil level should be maintained to the notch cut in the dipstick. The level should be checked with the dipstick resting on top of the gearbox casing, and with the machine standing on level ground. A drain plug is provided at the base of the gearbox and it is recommended that the oil is replaced every 5,000 miles. **Do not over fill.**

Chaincase.

The chaincase houses the primary drive chain and clutch. Castrolite (SAE 20) is used in the chaincase, filler and oil level plugs being provided (see Fig. 1).

When filling the chaincase both plugs should be removed and oil fed in until it commences to run out of the level plug hole. Allow any surplus oil to drain off before replacing the plugs. Change oil every 5,000 miles.

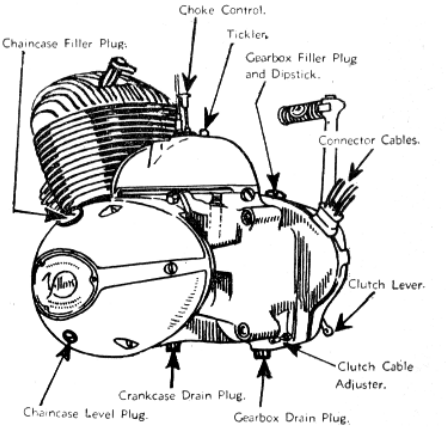


Fig. 1.

Important.

To avoid damage to the rectifier, the engine should not be run with the battery disconnected unless the cables to the outer terminals of the rectifier are first removed and insulated. Alternatively, the lighting switch may be left in the "H" position, though care must be exercised to avoid high engine speeds and consequent overloading of the lamps. The centre lead runs to earth and need not be disturbed.

STARTING

When cold. Turn both fuel tap and ignition switch to the "ON" position. Close the strangler by the means provided in order to obtain a rich mixture. In very cold weather flood the carburetter by depressing the tickler on the right-hand side of the carburetter cover. Check that the gears are in the neutral position, open the twist-grip about one-third and turn the engine over sharply by means of the kickstarter. When the engine fires the throttle should be adjusted accordingly and the strangler gradually opened as the engine warms up.

When hot. Switch on the petrol and ignition only. It is not necessary to close the strangler or flood the carburetter.

FAILURE TO START

If the starting procedure has been carried out correctly and repeated kicks have failed to start the engine, it is possible that the mixture is too rich. The cylinder and crankcase may be cleared of excessive mixture by turning off the fuel supply, opening the strangler and throttle and sharply turning the engine over a number of times. Continue until engine starts, allowing it to clear itself before turning on the fuel tap.

If the engine still fails to start the sparking plug may be fouled, and should this be the case, it will be advisable to remove the drain plug situated at the bottom of the crankcase, (see Fig. 1). Whilst the sparking plug is removed rotate the engine to clear the cylinder and crankcase of excess mixture. If this procedure still fails to effect a start, the fuel supply and ignition circuit and connections should be carefully checked. See Fault Finding Chart on Page 13.

STOPPING THE ENGINE

The engine may be stopped by switching off the ignition, completely closing throttle, or turning off the petrol and allowing the carburetter to run dry.

The latter procedure is recommended when the machine has to stand for a considerable time before again being required.

RUNNING-IN

As a general rule, it is not advisable to exceed 40 miles per hour in top gear, 25 miles per hour in third gear, 20 miles per hour in second gear and 10 miles per hour in bottom during the first 500 miles. Speeds not greatly in excess of those quoted are permissible provided that no undue load is placed upon the engine.

After the initial running-in period has been completed the maximum speeds should gradually be increased as follows; 500—1,000 miles, up to 50 m.p.h.; 1,000—1,500 miles, maximum speeds for short bursts only, after 1,500 miles, extended full throttle is permissible.

GEARBOX

The gears are selected by a lever which returns to its original position after each gear change, or alternatively, by a control having a different position for each gear. To obtain first (bottom) gear, the gear lever should be moved upwards in the case of the foot-change, or in the direction indicated in the case of the remote control. The higher gears are obtained by pressing the foot-change lever downwards, or the remote control to the gear position indicated. The neutral position is between first and second gear, and is selected by moving the gear lever over half the distance required for a normal gear change.

Remember that when in motion and changing to a higher gear the engine speed must be reduced by partially closing the throttle, but when selecting a lower gear the engine speed should be increased to obtain a smooth and silent change. When selecting any gear with the machine at rest or in motion, always fully de-clutch before operating the gear lever.

Do not allow the engine to race, or labour. Full use should be made of the gearbox thus enabling the engine revolutions to be maintained under varying load conditions.

During the initial stages the operation of the gearbox may be slightly stiff, but this condition will disappear as the engine is run-in.

SPEEDOMETER DRIVE

The speedometer drive is built into the gearbox, the drive gears being totally enclosed and lubricated by the gearbox oil. The flexible speedometer drive cable, however, requires periodical lubrication as recommended in the machine handbook.

FLYWHEEL MAGNETO GENERATOR

Both the ignition and battery charging circuits are fed from coils mounted on the armature plate on the right-hand side of the engine. The flywheel is fastened to the right-hand drive shaft to an extension of which is fitted the cam which operates the contact breaker. A wiring diagram of a typical installation is given on page 16, and from this it will be noted that the ignition coil and a selenium rectifier, together with battery and lighting set complete the electrical equipment.

IGNITION TIMING

A completely separate ignition circuit is used, being energised by one of the coils on the armature plate. The contact breaker assembly is mounted on a separate base plate, and can be rotated round the centre line of the ignition cam, thus providing a means of adjusting the ignition timing.

A felt lubricating pad is provided for the contact breaker cam, and occasional soaking of the pad in molten high melting point grease is recommended in order to ensure silent operation of the contact breaker and to reduce the wear on the fibre heel of the rocker arm.

Reference to fig. 2 will show the three socket headed screws which lock the contact breaker base plate in position. As the ignition timing is correctly set at the works it is not advisable to release these screws unless the replacement of any parts render this necessary. In order to maintain the ignition system at the peak of efficiency it is essential to keep all electrical connections clean and tight, and to maintain the contact breaker point gap at .012″/.015″.

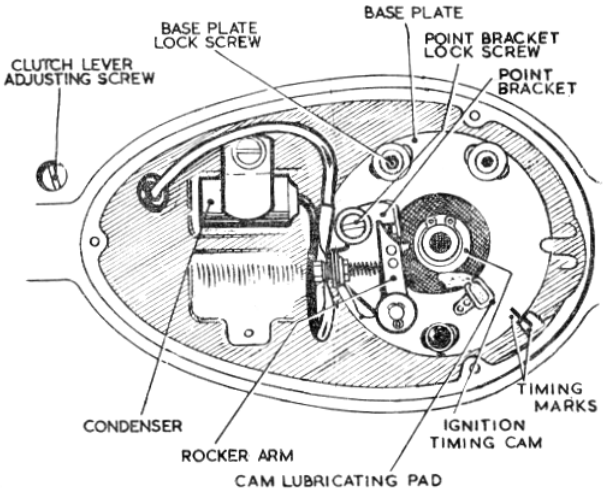


Fig. 2.

Adjustment of the gap is carried out as follows:—

Rotate the engine until the contact breaker is in the fully open position, i.e. with the piston in the top dead centre position. Release the point bracket lock screw and adjust the contact breaker point gap to .012″/.015″, using the screwdriver and feeler gauge provided with the engine. Securely re-tighten the point bracket lock screw.

Should it be necessary to re-set the ignition timing, the solder must be removed from the three socket headed screws so that they can be released. Having checked that the contact breaker gap setting is correct (.012″/.015″), rotate the engine until the piston is positioned $\frac{11}{64}$″ before top dead centre, and then

release the socket headed screws. Rotate the bracket until the contact breaker points are just opening. After checking the timing tighten the socket headed screws and re-check timing to ensure that the base plate has not moved. To accurately check the piston position, the cylinder head should be removed.

IGNITION COIL

The ignition coil is mounted in a moulded case with external screwed connections, and no attempt should be made to dismantle this assembly. An ignition switch with key is mounted on the right-hand cover and this enables the engine to be immobilised when the machine is left unattended. A multi-pin plug and socket carry the electrical connections from the engine to the ignition coil and battery charging circuits, and it is most important to ensure that the plug contacts are clean and secure, otherwise trouble may be experienced with both ignition and lighting systems.

CLUTCH AND PRIMARY DRIVE

The drive from the engine to the multi-plate clutch is by an endless roller chain located in the oil bath chaincase. No attention is necessary beyond maintaining the correct amount of oil in the chaincase and occasional inspection of push rod and clutch lever adjustments.

Clutch Push Rod Adjustment.

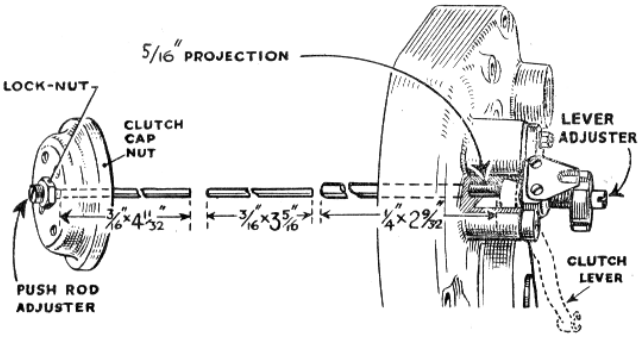


Fig. 3.

For satisfactory operation of the clutch, the effective length of the push rods must be kept within certain limits. Adjustment is carried out by means of the screw situated in the centre of the clutch cap nut. When carrying out this operation, it is preferable to remove the clutch lever so that the extent to which the push rod protrudes through the gearbox end cover can be measured, this should be $\frac{5}{16}$" and the adjusting screw in the clutch cap nut should be turned until this setting is obtained. It is most important that the lock nut is securely tighened after carrying out adjustments. Under normal conditions of running, adjustments should not be necessary unless new push rods and/or clutch components have been fitted. After correcting push rod clearance, the clutch lever and cable should be checked for freedom of movement.

Clutch Lever Adjustment.

Whilst the clutch is engaged, i.e. driving, the lever must not exert pressure on the end of the push rods. A hole is provided in the right-hand cover through which a screwdriver can be inserted in order to turn the adjuster and so correct the clutch lever position. First slacken the locknut on the control cable adjuster and screw in the adjuster so that the cable is not in tension, then turn screwdriver to obtain slight free movement (say $\frac{1}{16}$") between lever and right-hand cover. Finally adjust the control cable to permit the inner wire about $\frac{1}{8}$" slack movement.

Do not slip clutch when in motion, except when moving from a standing start, otherwise rapid wear of the clutch linings will occur. When stopping for any length of time at traffic lights, etc., move the gear lever to the neutral position and release the clutch pedal.

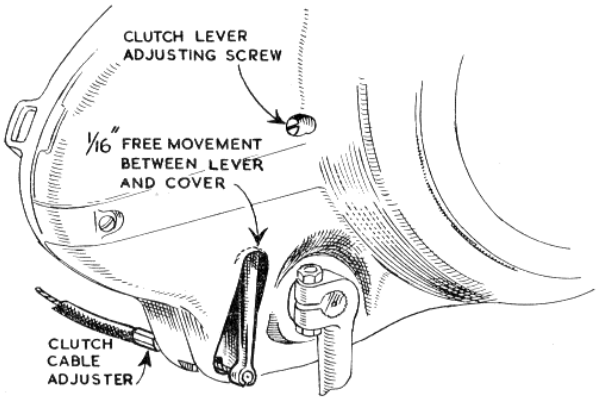


Fig. 4.

AIR FILTER AND CARBURETTER COVER

The filter fitted to the carburetter cover is designed to prevent foreign matter being drawn into the engine with the intake of air.

Despite the large area of the filter periodical cleaning is necessary; the filter element is easily removed for washing in petrol or paraffin and then dipping in petroil before replacing. Care should be taken to ensure correct re-fitting of the filter gauze, as during the cleaning operation it may spring open thus causing difficulty in making proper contact with the felt washer, particularly at the smaller end. An elastic band placed round the smaller diameter will greatly facilitate this operation—the band afterwards being cut through and drawn out.

When re-fitting the cover ensure that the felt washer is in position on the carburetter body, locate the cover on the dowels and press forward so that the face makes contact with the cylinder when the knurled screw is tightened.

CARBURETTER

The carburetter is the Villiers Type S.25/5 fitted to a detachable inlet pipe. Access to the carburetter is obtained by releasing the cover fixing screw and removing the carburetter cover. All air entering the carburetter passes through the filter housed in the carburetter cover. A strangler slide for easy starting operates within the carburetter throttle, control being either by a short rod protruding through the top of the carburetter or alternatively, by an additional Bowden type cable with a control on the handlebar.

Provision is also made for adjustment of the slow-running mixture, by means of a screw on the right-hand side of the carburetter, and for the taper needle, by a screw in the centre of the throttle. As the carburetter is set during initial bench testing of the engine, and again when the complete machine is tested by the manufacturer, it should not be necessary to make other than very minor adjustments to the taper needle or slow-running mixture control screw.

The main jet which controls the flow of petrol through the carburetter at the higher throttle openings is located in the side of the centrepiece, and can be removed, by unscrewing, for cleaning. A petrol filter is incorporated in the banjo fitting connecting the petrol pipe to the carburetter, and the flow of fuel into the float chamber is controlled by a fuel needle seating in a brass bush, and operated by a lever which engages with the top of the float. The fuel needle is accessible after the float cup, float and fuel needle operating lever have been removed.

OPERATION OF CARBURETTER

The handlebar twistgrip (or lever) control operates the throttle slide and thereby regulates the amount of mixture entering the engine, whilst the carburetter itself automatically meters and atomises the correct amount of fuel to give the necessary mixture strength. To achieve this automatic control of the mixture strength, the carburetter incorporates main-jet and pilot-jet systems. At idling speeds the carburetter draws fuel from the pilot-jet and, as the throttle is gradually opened, the fuel is then drawn in turn from the pilot " progression " hole and the main-jet system.

(a) **Pilot-Jet System.** (See fig. 5).

At idling speeds, when the throttle is nearly closed, the pilot outlet hole A is subject to the very high engine suction, and petrol is, therefore, drawn from float chamber through the pilot tube B, and the pilot outlet hole. The calibrated pilot-jet is contained in the top of the pilot tube. At the same time, a filtered supply of air is drawn from the mouth of the carburetter through passage C, through the variable air-jet D, and is then pre-mixed with the fuel in the small chamber E. The pilot adjuster screw F varies the size of the pilot air jet, and therefore, the pilot mixture strength—to richen mixture turn screw clockwise.

When the throttle slide is opened a small amount beyond that required for idling, the suction on the pilot outlet hole is reduced, but at the same time, the suction on the pilot " progresssion " hole G increases. A further supply of petrol is, therefore, drawn through the " progression " hole, and prevents the weak spot which would otherwise occur due to the fall off in supply from the pilot hole before the main jet comes into full operation.

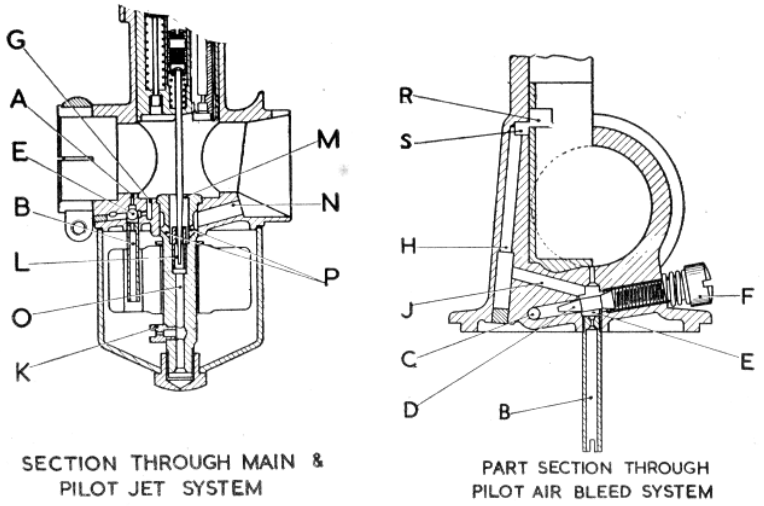


Fig. 5.

It follows from the preceding remarks that whenever the throttle is shut off whilst the engine speed is high (such as on long downhill sections), the pilot system is subject to the full engine suction, and petrol will flow into the engine from the pilot outlet hole. As the engine is not firing under these conditions, this fuel supply will tend to build up in the crankcase and cylinder and cause severe " four-stroking " or " eight-stroking " when the throttle is opened again.

To overcome this an automatic air bleed to the pilot has been incorporated, which relies upon the matching of two slots, one in the throttle slide R and the other in the carburetter body S. When the throttle slide is shut, these two line up and air can flow from the front of the carburetter through the throttle slide and down passages H and J into the pilot system. The high depression on the pilot system is then destroyed. In all other throttle positions, the two slots do not line up, and no air can pass to the pilot system through these passages.

(b) Main Jet System

As the throttle slide is opened further beyond the idling and progression positions, the engine suction has its effect upon the main-jet system, and petrol is drawn from the float chamber through the calibrated main jet K and the needle-jet L and into the small pre-mixing chamber M. There the petrol is atomised by the filtered secondary air which is drawn from the mouth of the carburetter along passage N, and which enters the centrepiece O through four small holes P. The rich petrol-air mixture then flows from the pre-mixing chamber into the main mixing chamber, where it meets the main air stream. The effective size of the needle-jet L depends upon the throttle slide position (as the taper needle is located in the slide by screw T), and the sizes of the needle-jet and the needle are chosen to give correct carburation over the range.

TUNING THE CARBURETTER

Before any attempt is made to tune the carburetter it is essential that the engine is in good mechanical condition. This means that there should not be air leaks at any of the joints, there should be a good spark at the plug points and also that there is no restriction in the fuel supply. It is also important of course, that the carburetter is clean internally, and that the air filter is not obstructed.

There are three adjustments for tuning the carburetter, but each of these has its full effect at a particular part of the throttle range, and should, therefore, only be used for tuning that particular part of the range. There is also a definite sequence for the tuning which must be adhered to in order that the results achieved with one adjustment are not upset by the next adjustment.

The sequence of tuning, with the necessary adjustments, is given below:—

(1) Main Jet. Throttle Range—$\frac{3}{4}$ to Full

In order to obtain the correct main jet size, the engine must be tested at full throttle in top gear. If the engine lacks power, detonates badly or runs better with the strangler slightly closed, a larger main jet is required. Should the engine "four-stroke" or improve momentarily after the petrol has been switched off, a smaller jet is required. After de-clutching and stopping the engine quickly the sparking plug should have a shiny black appearance if the correct main-jet is fitted. As an additional guide the engine should tend to "four-stroke" at full throttle in bottom gear on level ground (or high engine speeds in neutral), but not in any higher gears.

(2) Pilot Jet. Throttle Range—Closed to $\frac{1}{8}$ open

The pilot jet must be set when the machine is stationary with the engine running at the required idling speed. To richen mixture, screw in the pilot adjuster screw, and to weaken, unscrew pilot adjuster. The mixture must be set as weak as possible consistent with a steady reliable idling speed and good engine acceleration from this throttle position. If the mixture strength is set too rich, trouble will be experienced with the fuel build-up in the crankcase when the throttle is shut with the engine still running fast. Should this latter fault be present after adjusting the pilot, unscrew pilot a further half turn.

The throttle slide is made with a cut-away on the carburetter inlet side which influences the depression on the main-jet system between $\frac{1}{8}$" and $\frac{1}{4}$" open.

(3) Taper Needle Adjustment. Throttle Range—$\frac{1}{4}$ to $\frac{3}{4}$ open

The taper needle, which operates with the throttle, controls the mixture strength over most of the "cruising range" and must be set correctly for economic fuel consumption and good acceleration.

To weaken the mixture lower the needle by turning the screw in the top of the throttle in a clockwise direction, and vice-versa. Should it be found necessary to alter the position of the needle re-check the pilot jet setting as this may have been affected by other adjustments.

TO CHANGE THE TAPER NEEDLE

Remove throttle from body after unscrewing the top ring, and in the centre at top of throttle will be found a small slotted screw. This is the adjuster referred to in the previous paragraph, and when this is removed, by unscrewing, the needle with spring can be pushed up from underneath. When replacing the needle make sure that the needle collar and spring are in position.

TO CHANGE THE FUEL NEEDLE

After removing the float cup, main jet and float, the fuel needle lever can be removed by easing it off the pivot pin. The fuel needle can then be removed for inspection or replacement. Assembly is in the reverse order and care should be taken not to distort the fuel needle lever in any way.

THE CENTREPIECE

In the type S.25 carburetter the centrepiece is a press fit in the carburetter body and should not be removed unless absolutelv essential.

TO REASSEMBLE CARBURETTER

Clean the various components making sure that the tickler vent hole is clear. Check fuel needle and lever are correctly positioned. Replace float and check that float chamber washer is properly located against the carburetter body. Screw main jet into side of centrepiece. Screw float cup retaining nut and washer into position, taking care not to overtighten.

Replace throttle in body at the same time guiding the taper needle into hole in top of centrepiece. A guide screw in the carburetter body will prevent the throttle being replaced unless it is correctly positioned. Locate top disc in top of body and screw on top ring. If the carburetter has been removed from the engine, make sure when refitting that the body is pushed on to the manifold as far as possible, and that it is set upright. There are four narrow slots in the body to allow the securing clip to function, and if the manifold stub does not extend past the end of the slots, air will be drawn in causing difficult starting and erratic running.

The carburetter has a banjo petrol pipe fitting inside of which is a fine mesh filter gauze which should be periodically cleaned by dipping in petrol. Be sure that when replacing the petrol pipe the fibre washers make a petrol tight joint, otherwise fuel will be wasted.

RECTIFIER

The central fixing bolt is isolated from electrical connections, therefore no special care need be taken to make a clean contact with the frame of the machine. The casing of the rectifier, however, should not be allowed to come into contact with the machine as it can easily be damaged. It is necessary to allow good ventilation around the rectifier, and the position adopted by the machine manufacturer should not be altered.

BATTERY

The battery is supplied by the maker of the machine, and correct polarity must be maintained as shown in the wiring diagram. About once a month the filler cap of each cell should be unscrewed so that distilled water can be added to bring the acid level above the top of the separator. **Do not add tap water as this contains impurities.** Acid should not be added unless this is accidentally spilled out of the battery, when it should be replaced by diluted sulphuric acid of the same specific gravity as in the cells. Keep the battery terminals clean. Many lighting troubles can be traced to unseen corrosion between the surfaces of a perfectly tight joint, and in the case of the battery, this corrosion takes place much more frequently than at other electrical contacts. See also battery manufacturers instructions regarding maintenance.

TRACING TROUBLES

For the satisfactory running of any Villiers Two-Stroke engine it is essential that three main conditions are fulfilled, and by making a systematic investigation any fault can usually be located. If the engine stops, symptoms will generally give a clue to the cause, but where this is not the case, the trouble can be more easily traced by following a definite method of investigation. The three conditions mentioned above are as follows:—

(1) The required quantity of petrol-and-air mixture must enter the engine, which means that an adequate supply of fuel has to be available from the carburetter, and that the throttle should open and close freely.

(2) Sparking plug must give a good spark, at the right time in relation to the position of the piston on its upward stroke.

(3) The engine must be in good mechanical condition, with no air leaks at the various joints.

There must also be no loss of compression either in cylinder or crankcase.

This can easily be checked by putting the gears into the neutral position and rotating the engine by means of the kickstarter. The throttle, of course, must be open so as to allow air to enter the crankcase. Once every revolution a definite resistance should be felt by the air being compressed in the cylinder head.

MAKING A PRELIMINARY CHECK

Having made sure that the ignition is switched "ON," there is "petroil" in the tank, and that the tap is in the "ON" position, depress the tickler on the carburetter body to ensure that there is no blockage in the fuel supply, either in the tap, banjo union or fuel needle seating. If the fuel supply is clear, fuel will spurt from the vent hole in the side of the tickler cap. The carburetter cover must first be lifted to check the above. Being satisfied that fuel is reaching the carburetter, next remove sparking plug and with the high tension lead still attached, lay the plug on the cylinder head. Turn the engine over smartly, and if the magneto and high tension lead are in order, there should be a good spark at the plug electrodes.

Finally, examine the carburetter controls to make certain that the throttle is actually opening when the control lever is moved, and that the strangler slide cable and control, if fitted, are operating satisfactorily.

When the cause of the trouble is not evident, carry out a preliminary check covering the following points. (If this fails to trace the cause, reference should be made to the Fault Finding Chart on pages 13, 14 and 15).

OVERHAULING

DECARBONISING

The points at which carbon forms most rapidly are the combustion chamber, piston head, exhaust port and silencer. It will be appreciated that excessive carbon in the combustion chamber reduces compression space and probably causes pre-ignition and rough running. Heavy carbon deposits in the exhaust pipe and silencer will cause back pressure coupled with heavy fuel consumption, loss of power and over heating.

In order to maintain engine efficiency it is advisable about every 2,000 miles to remove all carbon from inside the cylinder head, the top of the piston and the edges of the ports. The exhaust pipe and silencer should also be cleaned out. Before commencing to decarbonise, disconnect the petrol pipe and carburetter and also remove sparking plug from cylinder head. Unscrew the 4 cylinder head fixing bolts. The head can now be lifted clear of the cylinder, and although the gasket fitted between the cylinder head and cylinder barrel may not be damaged, it is advisable to fit a new one.

With a soft copper scraper, remove all deposit from the inside of the head, taking care not to damage the joint faces. With the piston at the top of the stroke, remove all carbon from the piston top. Wipe off any loose carbon from around the edge of the piston, then unscrew the exhaust pipe nut and remove silencer and exhaust pipe. Move the piston to the bottom of its stroke and scrape out any carbon from exhaust stub and from the edges of the port in the cylinder bore. This is best done from the outside of the cylinder, taking care to avoid scratching the cylinder bore. A piece of soft cloth placed in cylinder bore will help to prevent the scraper causing damage and also prevent any particles of loose carbon from falling down through transfer passages.

Make sure there is no loose carbon about before assembly. Remove any accumulation of mud or grit from the cylinder fins.

For advice regarding the method of cleaning the exhaust pipe and silencer internally, apply to the manufacturer of your machine.

If it is necessary at any time to remove the cylinder, the 4 nuts and spring washers fitted to the studs securing the cylinder to the crankcase must be removed. Rotate crankshaft until piston is at bottom of stroke. Following this, the cylinder may be taken off, but it is important not to twist the cylinder in relation to the piston, otherwise there is a danger of the ends of the piston rings springing into the ports and consequent breakage.

To remove the piston from the connecting rod a pair of thin nosed pliers should be used to take out one of the spring circlips which retain the gudgeon pin in position. When this has been done, the gudgeon pin can be pushed clear of the small end bush and the piston lifted away. If carbon deposits prevent removal by hand, the use of an extractor of the band type is recommended, in which case it will be necessary to remove both circlips. So that the piston may be re-fitted in the same way it is marked " front."

Carbon will also form in the grooves behind the piston rings and to remove this deposit it will be necessary to spring the rings out of the grooves. Rings may be removed without risk of damage by introducing behind the ring 3 pieces of thin brass strip equally spaced around the piston and then sliding off the rings. It is desirable to ensure that each ring is re-fitted in its original groove. Behind the lower ring will be found an expander ring which is fitted to prevent noise due to 'piston slap' whilst the engine is cold. This ring will have to be cleared of carbon and may, in time, possibly lose its " temper " because of the heat and, therefore, it is advisable to renew the expander ring when decarbonising.

The piston rings should be bright all round and for the whole width indicating that the whole of the piston ring area is in contact with the cylinder bore. If the gap between the ends of the rings when in the cylinder, exceeds .030″, then they should be discarded and replaced. The amount of gap can be checked by placing the ring inside the cylinder bore and pushing in a little way with the skirt of the piston. This ensures that the ring is square to the bore, and the gap can then be checked by feeler gauges.

Where new rings of the standard size are required it is necessary to check the gap before fitting to the piston. Place the ring squarely in the cylinder bore when the gap between the ends of the ring should be a maximum of .011″ and a minimum of .007″.

RE-BORING

After the machine has done a considerable mileage the cylinder bore may become worn as indicated by a ridge at the top of the bore and, therefore, before fitting the cylinder the bore should be checked by means of a dial gauge. If the bore is .008″ or more larger than the original size, the cylinder should be returned to the works for reboring and fitting of an oversize piston with rings.

When refitting the cylinder, fit new base washer to crankcase. Smear cylinder bore and piston surfaces with clean engine oil and fit cylinder barrel over piston, taking every care not to twist the cylinder. Ensure each piston ring is fully compressed in its groove with the ends correctly fitting on the locating pegs as the barrel passes over it. Replace the 4 nuts on cylinder base studs and tighten equally. Re-fit cylinder head with new gasket in position and tighten the 4 bolts in diagonal rotation to prevent any possibility of cylinder head distortion.

FAULT FINDING CHART

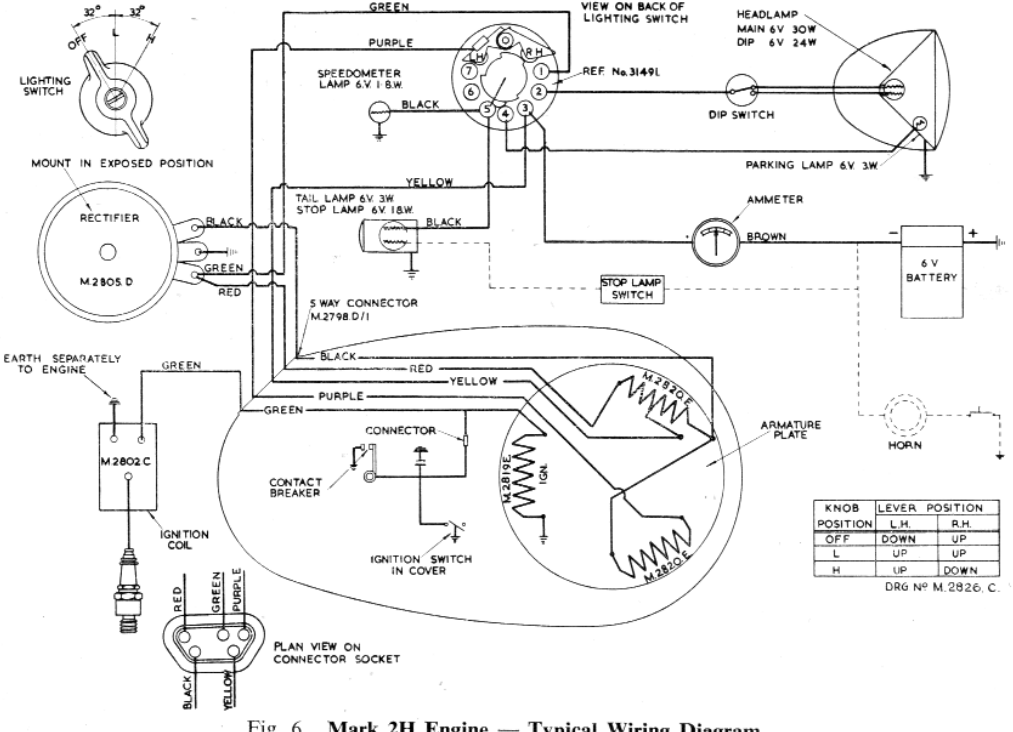
Sequence of Testing	Possible Trouble	Remedy
Engine will not start		
Depress tickler on carburetter to check whether fuel is reaching carburetter.	No fuel reaching carburetter. Air lock in petrol pipe.	Turn tap to ON, refill tank, clear air vent in filler cap. Turn on reserve tap where fitted.
If no fuel, even when tap is on and fuel is in tank.	Choked petrol pipe, filter on tap, filter in banjo. Fuel needle sticking in seating.	Remove and clean out. Dismantle carburetter and fit new needle.
Test for spark by holding sparking plug body on cylinder head.	Leak along insulation of plug or high tension lead.	Try a new plug of the type recommended and/or new H.T. lead.
If still no spark : Test for spark at end of H.T. lead held $\frac{1}{8}$″ from cylinder fins.	Plug points may be oily or sooted up. If no spark at end of H.T. lead, contact breaker point gap may be too narrow, or points pitted or dirty or oily.	Clean plug or fit new one. Adjust point gap to .015″.
	Moisture on insulation of condenser.	Clean.
	Damaged insulation on wires connecting contact breaker to coil or condenser.	Clean and dry out.
	Bad contact of pins in connector socket or between leads from contact breaker to coil.	Replace.
	Damaged insulation of lead from connector to energising coil causing short to earth, making coil inoperative.	Rectify.
	Faulty condenser.	Rectify.
	Faulty ignition coil.	Replace.
If above tests are satisfactory, but engine will not start.	Mixture may be too rich due to excessive use of strangler, or incorrect setting of taper needle.	Replace coil unit.
		Open throttle wide and depress kickstarter several times to clear engine of petrol. Adjust taper needle. Drain crankcase.

FAULT FINDING CHART—(continued).

Sequence of Testing	Possible Trouble	Remedy
	Air leaks at carburetter stub or inlet pipe joint, causing weak mixture.	Correct.
	Incorrect ignition timing.	Check, following instructions given.
Engine four or eight strokes		
Strangler may not be fully open or taper needle too high. Air filter may need cleaning.	Mixture too rich.	Lower taper needle by screwing in adjusting screw.
Check by watching for excessive smoke from exhaust pipe or silencer.	Engine may four stroke for a little while after standing due to accumulation of oil in crankcase.	Usually ceases when engine has been running for a few minutes unless too much oil has been mixed with the petrol.
	Flooding of carburetter.	Persistent flooding is usually due to dirt under fuel needle seating, or sticking fuel needle, damaged seating or punctured float.
Engine lacks power		
	Engine out of tune, bearings worn. Unsuitable sparking plugs.	Overhaul. Replace with recommended type.
	Loss of compression.	Tighten cylinder head bolts. Replace worn piston rings.
	Incorrect " petroil " mixture.	Correct mixture is 1 part oil, 20 parts petrol (See also page 3).
	Excessive carbon deposit on piston crown and cylinder head.	Decarbonise.
	Exhaust system choked with carbon.	Clean out silencer and exhaust pipe.
	Incorrect carburetter setting.	Check and adjust
	Air filter choked.	Clean.
	Obstruction in fuel supply.	Clean out tap, fuel pipe and filters.

FAULT FINDING CHART—(continued).

Sequence of Testing	Possible Trouble	Remedy
	Incorrect ignition timing.	Check and adjust.
	Brakes binding.	Adjust. See Machine Handbook.
	Rear driving chain too tight.	Adjust. See Machine Handbook.
Engine will not run slowly		
	Weak mixture due to air leaks at carburetter stub or inlet pipe, crankcase and cylinder base joints.	Tighten all joints.
	Crankcase drain screws loose or missing.	Tighten or replace.
	Worn crankshaft bearings or leaking oil seals.	Replace.
	Ignition timing too far advanced.	Correct, following instructions given on page 5.
Engine suddenly stops firing		
	Sparking plug lead detached.	Replace.
	Plug points bridged by oil, carbon, or deposit caused by use of leaded petrol.	Clean or replace.
	Short circuit of high tension current by water on H.T. lead.	Dry out.



KNOB POSITION	LEVER POSITION	
	L.H.	R.H.
OFF	DOWN	UP
L	UP	UP
H	UP	DOWN

DRG Nº M.2826. C.

Fig. 6. **Mark 2H Engine — Typical Wiring Diagram.**

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