

OPERATING INSTRUCTIONS  
AND  
SPARE PARTS LIST

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Mark 4F and Mark 6F

98 c.c. TWO - STROKE

ENGINE / GEAR UNITS.



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TWO SHILLINGS  
AND SIXPENCE

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THE VILLIERS ENGINEERING CO. LTD.

WOLVERHAMPTON, ENGLAND.



## CONTENTS.

### General.

	Page
Carburetters ... ..	10—15
Clutch and Gear Control Cables ... ..	7, 8
Dismantling the Engine ... ..	10
Estimates ... ..	40
Engine Service Exchange ... ..	35
Fuel Tank ... ..	3
Fault Finding Chart ... ..	36, 37, 38
Gearbox ... ..	3
Guarantee ... ..	Inside back cover
Gear Control ... ..	4
Ignition and Timing adjustment ... ..	8, 9
Lighting Sets and Flywheel Magneto ... ..	15, 16, 17
On the road ... ..	5
Running the Engine ... ..	3
Running-in ... ..	6
Routine attention ... ..	6
Starting ... ..	4
Terms of business ... ..	40
Tracing troubles ... ..	18

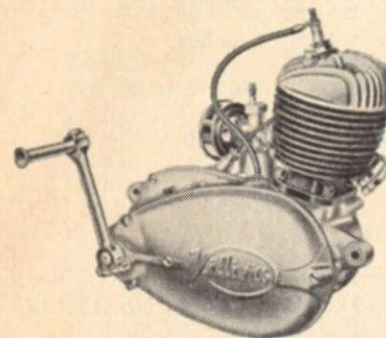
### Spare Parts Lists.

Alternative Gear Ratios ... ..	27
Carburetter—S.12 ... ..	29
Carburetter—Junior ... ..	31
Engine, Contact Breaker and Gears ... ..	19, 22, 23, 26, 27
Flywheel and Armature Plate ... ..	33
Gear-change Mechanism, 6F ... ..	32
Lighting Set (Direct) ... ..	34
Lighting Set (Rectifier) ... ..	34
Tools ... ..	27

### Illustrations.

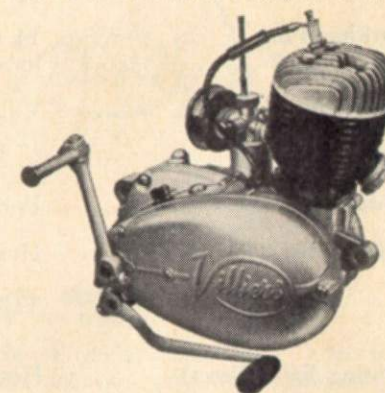
	Fig.	Page
Carburetter—S.12 ... ..	9	28
Carburetter—Junior ... ..	10	30
Contact Breaker Assembly ... ..	4	9
Engine and Contact Breaker ... ..	7	20, 21
Engine and Gears ... ..	8	24, 25
Engine, Right-hand side ... ..	1	3
Engine, Left-hand side ... ..	3	7
Flywheel and Armature Plate ... ..	12	33
Gear Control, 4F ... ..	2	4
Gear-change Mechanism, 6F ... ..	11	32
Wiring Diagram—Rectifier Lighting ... ..	5	15
Wiring Diagram—Direct Lighting ... ..	6	17

**Villiers**



**Mark 4F**

*and*



**Mark 6F**

**98 c.c. TWO-STROKE  
ENGINE/GEAR UNITS.**

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

TELEPHONE:—  
WOLVERHAMPTON  
22399 (20 LINES).

TELEGRAMS:—VILLIERS,  
WOLVERHAMPTON.  
CODE:—BENTLEY'S.



## GENERAL DATA.

Engine Unit ... ..	Mark 4F or Mark 6F.
Bore ... ..	47 mm. = 1.8504 inches.
Stroke ... ..	57 mm. = 2.244 inches.
Capacity ... ..	98 cc. = 6 cubic inches.
Horse Power, Maximum ...	2.8 at 4,000 r.p.m.
Engine Sprocket ... ..	17 Teeth, $\frac{3}{8}$ inch Pitch.
Clutch Sprocket ... ..	42 " " " "
Ratio, Engine to Clutch ...	2.47—1.
Final Drive Sprocket ...	14 Teeth, $\frac{1}{2}$ inch Pitch for "COVENTRY" Chain No. 112045.
Chain Line, Final Drive ...	2.56 inches.
Gear Ratios ... ..	Top 1 : 1 Bottom 1.64 : 1 or Top 1 : 1 Bottom 1.715 : 1.
Exhaust Pipe ... ..	1 $\frac{1}{4}$ inch external diameter.
Sparking Plug ... ..	14 mm. Lodge H14, Point Gap .018" to .025".
Carburetter ... ..	Villiers: Junior or S.12.
Ignition Timing ... ..	$\frac{1}{8}$ " before top dead centre.
Contact Breaker ... ..	Point Gap .012"/.015".
Lighting Set (Rectifier) ...	Head lamp (main) 6-volt 12/12 watt. (pilot) 6-volt 3 watt. Tail lamp (main filament) 6-volt 3 watt. (stop filament) 6-volt 18 watt.
Lighting Set (Direct) ...	Head lamp (main) 6-volt 24/24 watt. (pilot) 3.5 volt 0.15 amp. Tail lamp 6-volt 3 watt.
Lubrication, Engine ...	Petroil mixture in fuel tank 1 part Castrol XL (S.A.E. 30) to 20 parts petrol OR 1 part Castrol Two-Stroke Self-Mixing Oil to 16 parts petrol.
Lubrication, Gearbox and Chaincase ... ..	Castrol D (S.A.E. 140) filled to level plug. (See Fig. 1).
Weight ... ..	38 lbs. approx.

## RUNNING THE ENGINE.

### BEFORE STARTING FOR THE FIRST TIME.

**Gearbox.** Remove the gearbox oil filler and oil level plugs (see Fig. 1.) With the motor-cycle off the stand, pour in CASTROL "D" oil (SAE 140) until it starts to run out at the hole from which the oil level plug has been removed.

Screw both plugs firmly back into position after oil has ceased to run from level hole.

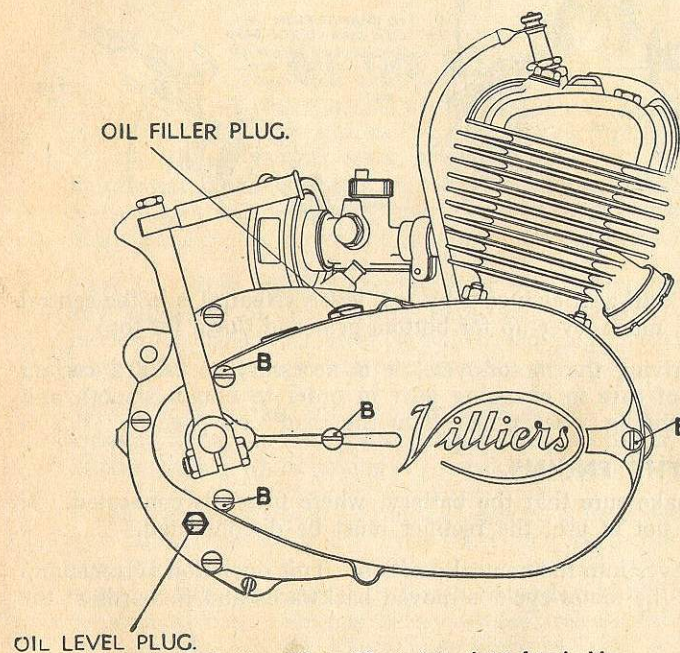


Fig. 1.—Mark 4F engine, right-hand side.  
(Remove screws marked "B" for access to flywheel).

**Fuel Tank.** Fill up the fuel tank of the machine with "petroil" mixture. This is made by thoroughly mixing one part of CASTROL XL (SAE 30) with 20 parts of petrol. It is best to pour the petroil mixture into the tank through a fine mesh gauze or strainer, to make sure that no dirt or grit gets into the engine. ON NO ACCOUNT must Castrol XL oil be put into the fuel tank before mixing with the petrol. If this is done the oil and petrol will not mix, the engine will not be properly lubricated, and the operation of the carburetter will be affected.

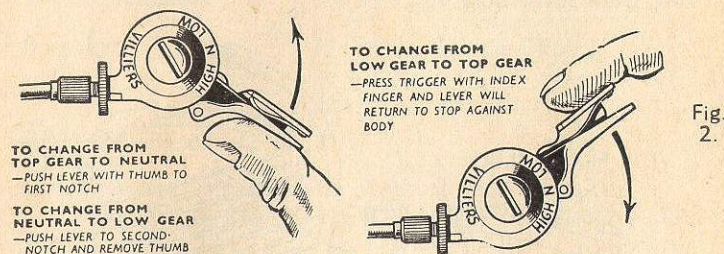
No pre-mixing of Castrol Two-Stroke Self-Mixing oil is necessary, but it is essential to turn off the petrol tap and put the oil into the tank before the petrol.



### Gear Control.

The Mark 4F two-speed gearbox is controlled through a Bowden type cable by a hand-operated gear-lever which is clipped to the right-hand handlebar. Three positions are marked on the cover plate of the gear-lever; LOW for bottom gear; N, which is the neutral or free engine position; and HIGH for top gear.

Operation of the gear change lever is given below.



The Mark 6F gear change is by foot lever. Neutral is in the central position; move lever up for bottom gear and down for top.

When driving the motor-cycle, it is necessary to take a certain amount of care in changing gear in order to obtain smooth and steady running. See under "On the road" on page 5.

### STARTING THE ENGINE.

First of all make sure that the battery, where fitted, is connected. If the battery is not in use, the rectifier must be disconnected.

Put the gear-lever into the neutral position. This operation is sometimes made easier if the motor-cycle is moved backwards and forwards at the same time.

### When the Engine is Cold.

Turn the petrol tap to the ON position.

Close the strangler shutter.

Junior Carburetter:—Throttle to be opened one-third of full travel and float chamber flooded by means of tickler.

S.12 Carburetter:—Throttle to be opened fully. Flood float chamber only under cold weather conditions.

A firm push or two on the kickstarter pedal should start the engine, and as it warms up the strangler should be gradually moved to its fully open position.

In very cold weather it may not be possible to do this immediately, in which case leave the strangler shutter partly closed until the engine is thoroughly warmed up.

### When the Engine is Hot.

Junior Carburetter:—Follow the same procedure as given above, but do not flood the carburetter or close the strangler.

S.12 Carburetter:—Open throttle one-third.

### Failure to Start.

If the engine will not start after a reasonable number of attempts, the cause of the trouble may be found by a systematic check-over as given under the heading "Tracing Troubles" on page 18. Read this section carefully before doing anything to the engine.

### ON THE ROAD.

Having started and warmed up the engine, sit astride the motor-cycle, and with both feet on the ground free the clutch by pulling up the clutch control lever, which is usually fitted on the left handle-bar. At the same time, with the right thumb push the gear-lever outwards to the low gear position, or, in the case of the Mark 6F Engine, move foot-change lever upwards.

NOTE:—When engaging bottom gear with the machine stationary, any tendency of the driving parts to "snatch" will be much reduced if the clutch lever is pulled right up, and the engine is kept down to a slow tick-over speed.

Slowly release the clutch lever, and as the motor-cycle moves forward under its own power, open the throttle to prevent the engine stalling whilst taking up the drive through the clutch.

When a speed of about 12 miles an hour has been reached, HIGH gear should be engaged. Free the clutch as before, and at the same time almost close the throttle; then while the clutch is disengaged move the gear-lever smartly inwards to the HIGH position. As soon as high gear has been engaged, release the clutch lever and open the throttle. To change down to LOW gear, disengage the clutch and regulate the throttle control to give an increase in engine speed, in step with the low gear ratio, then smartly move the lever into "LOW" position.

Do not "hang on" to top gear too long when climbing a hill; make full use of the lower gear, which is provided for this purpose.

Never control the road speed by disengaging the clutch just enough to let it slip. This should only be done when travelling very slowly in traffic, otherwise great wear of the clutch surfaces will take place, and eventually the clutch will slip at all times.

NOTE:—Certain machines are fitted with gear controls not of Villiers manufacture, and for details of these the machine hand-book should be consulted.



## RUNNING-IN.

For the first 500 miles the engine must not be over-driven, and during this period the throttle should never be fully opened. The engine must not be allowed to race, or run at a high speed under a light load. Until the first 500 miles have been run, do not exceed the following speeds:—

LOW gear      ...      12 miles per hour.

HIGH gear     ...      20 miles per hour.

After covering the first 500 miles the road speed can be gradually increased, but when climbing a hill change to the low gear before allowing the engine to labour and become overloaded. In short, "nurse" the engine carefully for this initial period, and such care will be amply repaid afterwards in terms of longer life and better performance from the engine.

It is very likely that when the running-in period has been completed, it will be possible to weaken off the mixture of fuel and air passed by the carburettor to the engine.

## ROUTINE ATTENTION.

Every engine needs a certain amount of attention at regular intervals if it is to give trouble-free service. If the following points are given proper attention, the engine can be expected to maintain its reputation for reliability and economy, while at the same time, very little will be needed in the way of replacement parts.

**After the First 500 Miles.** Examine the contact breaker points. Access to these is obtained by removing the three screws marked "A" on Fig. 3, and the cover they secure. The points may require slight adjustment after their initial "bedding-in," and for this refer to page 8.

**Every 500 Miles.** Inspect the level of the oil in the gearbox casing by removing the oil level screw as shown in Fig. 1 (page 3). If necessary, top up with the grade of oil recommended on page 2.

Take off the air cleaner and wash it in petrol, allowing it to dry afterwards. Then dip it into thin oil or petroil, as specified on the air cleaner, and let most of this drain off before replacing.

**Every 2,000 Miles.** Remove the cylinder head and scrape out the carbon deposit which collects inside. Take care not to remove any metal. The edges of the exhaust port in the cylinder can be cleaned when the piston is at the bottom of the stroke. Clean the top of the piston.

Remove and clean the silencer and exhaust pipe.

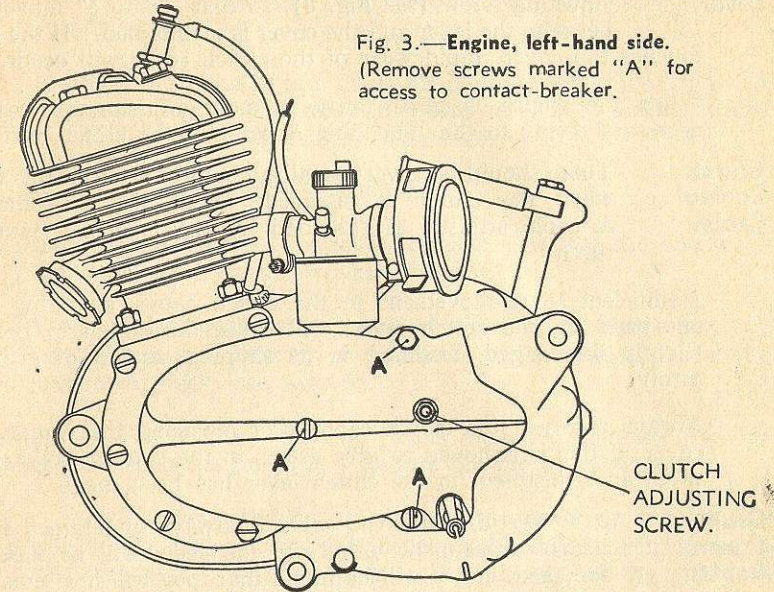


Fig. 3.—Engine, left-hand side.  
(Remove screws marked "A" for access to contact-breaker.)

**Every 4,000 Miles.** At this stage it may be necessary to remove and inspect the cylinder and piston, giving these parts a thorough cleaning. This should not be done, however, unless there is a good reason for it.

**Occasionally.** Examine all joints between parts for gas or oil leaks, and tighten the securing bolts or screws if necessary. This applies particularly to the joints between the cylinder head and cylinder barrel, crankcase and cylinder barrel, and the crankcase parts themselves. All visible nuts, bolts and screws should be checked and firmly tightened if need be.

After a considerable mileage has been covered it may be necessary to renew the piston rings with new rings in a new cylinder bore, the gap should be .007"/.011", maximum permissible gap being .030". If gap is excessive with new rings, a rebore may be required. Rebore when cylinder wear exceeds .008", sizes being .015" o/s and .030" o/s.

## CLUTCH AND GEAR CONTROL CABLE ADJUSTMENT.

It is very important that these two cables, where fitted, are kept properly adjusted, thereby preventing increased wear and tear and possible damage to internal parts.



**Clutch Lever.** The clutch lever should be adjusted, by means of the adjusting screw (see Fig. 3), so that  $\frac{1}{16}$ " to  $\frac{1}{8}$ " movement between the lever and the cover is maintained. If the lever touches the cover, rapid wear of the clutch corks will occur.

When the engine is new, fairly frequent adjustments may be necessary owing to the "bedding down" of the clutch surfaces.

**Clutch Control Cable.** There should be a very small amount of slack in this cable when the clutch is engaged; about  $\frac{1}{16}$ " is sufficient. A cable adjuster is provided by the machine manufacturer.

Insufficient slack movement in the clutch cable, or riding with one hand on the clutch lever, will cause the clutch to become slightly disengaged, resulting in its slipping instead of gripping firmly.

Always re-adjust the clutch cable after replacing the engine side cover, if this is removed to give access to the contact breaker, or when an adjustment to the clutch lever has been made.

**Gear Control Cable.** It is essential that the cable is always maintained in its correct adjustment, otherwise the gears will be seriously damaged, and it will be found that they will not remain in engagement.

There must always be a slight amount of slack movement in the cable when the handle bar gear control lever is in the "HIGH" position,  $\frac{1}{8}$ " slackness being adequate; this ensures that the "HIGH" gear is fully engaged, a spring being used to retain the gears in "HIGH".

This cable has two adjusters, one about half-way between the control lever and the gearbox, and the other on the control lever itself. These will give a good range of adjustment.

The screw on top of the gear control lever must be kept tightened so that the lever is not loose, but has a smooth movement.

If the adjustments given above are correctly made, but low gear still jumps out of engagement, this indicates that the engine has been running with incorrect cable adjustments, thus damaging the gears.

Reference should be made to the machine handbook for method of adjustment of controls not of our manufacture.

## IGNITION ADJUSTMENT AND TIMING.

**Contact Breaker Adjustment.** The contact breaker assembly, Fig. 4 and condenser are secured to the left-hand side of the crankcase, underneath the detachable cover. The contact breaker points may require adjustment at intervals, although this should not be done unless it is definitely necessary.

Turn the crankshaft until the piston is at top dead centre. With a feeler gauge, check the clearance between the two points, which should be .015".

If it is either more or less than this figure, slacken the screw "A" shown on Fig. 4 and move the bracket "B" in the required direction to obtain the correct clearance.

Re-tighten the securing screw firmly.

Check the clearance once more to make sure that the bracket did not move when the screw was tightened.

When replacing the side cover, check that the clutch operating lever is replaced correctly, and that the clutch cable has the correct amount of slack (see page 8).

**Ignition Timing.** The contact breaker points should commence to open when the piston is  $\frac{1}{8}$ " before the top of its stroke.

To check the timing, remove the cover on the left-hand side of the engine to expose the contact-breaker mechanism, and also remove the sparking plug so that the top of the piston can be seen when setting it in its correct position.

After setting the piston, examine the contact-breaker points, which should be just commencing to open. If they have not done so, or have opened fully, the timing is wrong. Correct as follows:—Slacken the three screws "C" Fig. 4, which secure the complete contact breaker assembly to the crankcase, and move the assembly to the left or right according to the adjustment required. Take care not to damage the sealing washer.

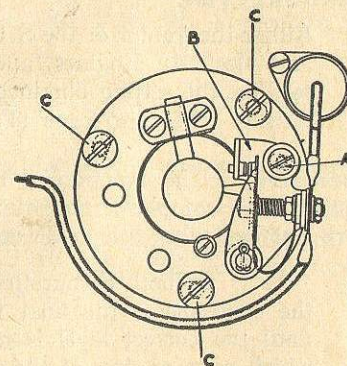


Fig. 4.—Contact-breaker assembly.

Turning the contact-breaker plate to the right, or clockwise, will advance the ignition timing, and turning to the left, or anti-clockwise, will retard the timing.

When satisfied with the adjustment, re-tighten screws "C."

NOTE:—Always set the contact-breaker points to their correct gap of .012"/.015" before timing the magneto.



## DISMANTLING THE ENGINE.

No reference has been made in these instructions to complete dismantling of the engine, beyond that necessary for decarbonising. This is because special equipment is needed for dealing with the lower half of the engine, gearbox, etc.

If anything has gone amiss with any of these parts, rather than attempt to take the engine completely to pieces without the proper tools, it will be far better to entrust the work to the dealer from whom the motor-cycle was purchased. Alternatively, the complete engine can be returned to Villiers service department for the most expert attention.

If for any reason the lower half of the engine has been dismantled, it is **ESSENTIAL** that the clutch spring retaining nut is correctly re-assembled so that the clutch shaft itself has an adequate amount of "end float." If this is not done, replacements will soon be necessary in the gearbox.

The clutch spring retaining nut should therefore be adjusted so that the effective width of the clutch assembly is between 3.665" and 3.680". This width is measured between the outer end of the large splines at the left-hand end of the clutch shaft, and the outer face of the lockwasher securing the nut at the other end.

## CARBURETTER.

Either the Junior or the S.12 Carburetter are fitted to the Mark 4F and Mark 6F Engines, and it should not normally be necessary to alter the setting obtained by the motor-cycle maker after road-testing. (See also page 11).

**Operation of the Carburetter.** The function of the carburetter is to supply a mixture of petrol and air in the correct proportions, no matter what the conditions under which the engine has to work.

In both carburetters the float chamber and float surround the centrepiece, the float rising as the fuel enters the chamber until the correct level is reached. At this point a forked lever which rests on top of the float, lifts a fuel needle valve to stop the fuel supply. In the Junior carburetter fuel enters the centrepiece through a hole in the side and passes through the calibrated jet fitted in the bottom of the centrepiece. The S.12 carburetter has a calibrated jet in the float chamber, and fuel enters the needle jet block from the bottom, via this jet. The throttle is of a cylindrical pattern, and is fitted with a tapered needle which extends below it into the jet block. When the throttle, which is operated by a cable from the handlebar, closes the air supply, the largest

diameter of the needle nearly closes the fuel outlet; but when the throttle is raised to admit more air, the smaller diameter of the needle allows more fuel to pass.

In this way the combination of jet size, needle position and needle taper gives a correct mixture of fuel and air at all throttle settings, making the carburetter automatic in operation. The only adjustment which can be made in the Junior carburetter is to the position of the taper needle in the throttle. The S.12 carburetter incorporates an air by-pass screw which enables the mixture to be adjusted between closed and  $\frac{1}{4}$  throttle. Screw in to richen mixture and vice versa.

It is not normally necessary to alter the setting of the taper needle which has been determined during testing at the works. This setting controls the mixture strength from the point at which the engine is ticking over until the throttle is about two-thirds open. After this the jet controls the mixture up to full throttle position. No alternative sizes of taper needles or jets are necessary for normal running conditions.

In cold weather conditions the mixture may, with advantage, be richened slightly by raising the taper needle slightly. Adjustment in the Junior carburetter is by means of a screw in the centre of the throttle—screw out to richen and vice-versa.

In the S.12 carburetter the taper needle is located by a clip, and raising the needle one groove, e.g. No. 3 to No. 4 (See Fig 9) will richen the mixture.

## DISMANTLING THE CARBURETTER.

Always stop the Engine before removing the Throttle from the Carburetter.

It is recommended that as long as the carburetter—or any other part of the engine—is giving satisfactory service, it should not be tampered with or taken to pieces. If dismantling becomes necessary, carry it out in the following way :—

**JUNIOR TYPE 6/0** (see Fig. 10 for illustration).

**To Remove Throttle from Body.** Open the throttle to its fullest extent, and unscrew the milled ring on top of the throttle body. The throttle can now be withdrawn, but take care not to damage or bend the taper needle.

To detach the throttle from the cable, return the throttle control lever to the fully closed position, compress the throttle spring, and the inner cable can then be lifted out of its slot.



**To Remove Centrepiece and Fuel Needle from Body.** Unscrew the nut underneath the float chamber. Remove the small fibre washer, the float chamber and float, and, if loose, the fibre washer between the float chamber and the carburetter body.

Remove the small locking screw situated below and to the rear of the petrol pipe union, and push the centrepiece up through the throttle bore.

**NOTE:**—Do not attempt to remove the jet from the centrepiece, as these parts are not intended to be separated.

When the centrepiece is removed, the fuel needle lever is freed, and will turn to allow the fuel needle to drop out of its seating. Therefore the fuel needle should be removed at the same time as the centrepiece, and kept in a safe place until it is required.

No attempt whatever should be made to remove the fuel needle lever from the carburetter body.

**To Remove Tickler.** This should not be necessary unless the air vent hole in the carburetter body, at the base of the tickler, has become clogged. If this happens, it will no longer be possible to make a ready check on whether fuel is reaching the carburetter. Remove the tickler by taking out the split pin at its lower end, thereby releasing the tickler and its spring. One vent hole is at the bottom of the hole into which the spring fits, and the other is in the side of the tickler cap.

**Re-assembly of Carburetter.** This is the reverse of the process already described, but the following points should be observed:—  
The fuel needle must be fitted into its seating point first.

The fuel needle lever should then be held so that it holds the needle in place, ready for the centrepiece to be fitted between the two small prongs on the lever.

Fit the centrepiece—with the fibre washer first—so that the small locking screw can locate itself in the slot in the head of the centrepiece. Re-fit the locking screw.

Replace the float on the centrepiece, and check to ensure that the fuel needle lever has not become bent or damaged, allowing the float to rise too high in the float chamber.

When the float is held up against the lever, the distance between the top of the float and the carburetter body should be  $\frac{7}{32}$ ".

Replace the float chamber, not forgetting the fibre washer which goes between the chamber and the carburetter body.

Re-fit the float chamber retaining nut and its fibre washer to the bottom of the centrepiece, and tighten firmly. Do not over-tighten the nut, however, as this may distort the carburetter body.

**Setting the Carburetter.** As stated already, the only adjustment which can be made to the carburetter is to the position of the taper needle in the throttle. Such adjustments should not be made unless absolutely necessary, and then only with the use of care and patience, making several small adjustments to find the best position, in preference to a single large alteration.

In this way the best possible setting can be found with the least amount of trouble.

The best setting of the taper needle is that which gives the most even two-stroking when the engine has attained its usual running temperature and is running at normal loads and speeds.

If the engine four-strokes when pulling very hard, this indicates that the mixture of fuel and air passing to the engine is too rich. As this can cause the sparking plug to oil up and stop the engine, the condition should be corrected at once.

Check that the carburetter float chamber is not flooding, and that the air cleaner is not choked.

If the four-stroking continues, the fuel and air mixture must be weakened by lowering the taper needle in the throttle. This is done by adjusting the screw which is fitted in the centre of the top of the throttle. Turn it clockwise to lower the taper needle, and test the engine after every half-turn.

The adjusting screw is split to make it grip the hole in which it fits; take care that it does not become loose through unnecessary adjustments. Should this happen, remove the screw and prise the split portion apart VERY GENTLY, a little at a time, until it is tight enough to grip the hole properly.

**NOTE:** The taper needle must be fitted with the small spring under its head, so that it is held up against the adjusting screw.

The normal taper needle setting measures  $\frac{39}{32}$ " from the bottom of the throttle to the end of the needle, but this should only be taken as a guide, as each engine requires individual adjustment to obtain the best results.



**TYPE S.12.** (See Fig. 10 for illustration).

**To Remove Throttle from Body.** Open throttle fully and remove the top cap screw. Withdraw throttle, taking care not to damage the taper needle. The throttle may be removed from the cable after releasing the tension on the throttle spring and lifting cable nipple from the slot in the throttle slide. The taper needle can be removed after the spring clip has been moved to one side.

**To Remove Jet Block and Fuel Needle from Body.** A special tool is required to remove the jet block, which is screwed into the carburettor body. Unless the jet is worn, it is recommended that this component is not disturbed.

Removal of the fuel needle and the fuel needle bush is possible after the float cup, float and fuel needle lever have been removed.

The fuel needle bush is screwed into the carburettor body and again it is recommended that this remains undisturbed unless a replacement is required.

**To Remove Tickler.** A circlip retains the tickler in position, and, after removal, the tickler and tickler spring can be withdrawn from the carburettor body.

**To Remove Main and Air Compensating Jets.** These are screwed into the float cup and carburettor body respectively. The jets may be unscrewed for cleaning when necessary. Providing the air filter is kept in position, the air compensating jet should not require cleaning.

**Re-assembly of** This is the reverse of the process already described, but the following points should be observed:—

**Carburettor.** The fuel needle bush, main and air compensating jets must be screwed firmly into their respective positions. The fuel needle must be inserted, point first, into the fuel needle bush, and the fuel lever located by the needle hinge.

With the float in position, ensure that it is clear of the tickler. If not, the fuel needle lever has been bent, and must be reset to give a vertical measurement of  $\frac{7}{32}$ " between the top of the float and the face of the carburettor body where the sealing ring is located.

The float chamber sealing washer must be intact and seated correctly in the recess in the carburettor body.

Replace float chamber and **tighten by hand. Do not use spanner, etc., otherwise damage to threads may occur.**

Replace taper needle in throttle, locating by spring clip in the correct groove, and replace throttle spring and cable.

Place throttle into carburettor body, guiding the taper needle into the jet block. Replace top cap and knurled screw.

**Re-Setting Carburetter.** The main, air compensating and needle jets, and the taper needle, fitted to each carburetter have been selected to give optimum results, for each particular engine, and, therefore, it is recommended that adjustments to the taper needle setting and air by-pass screw only are carried out by the owner.

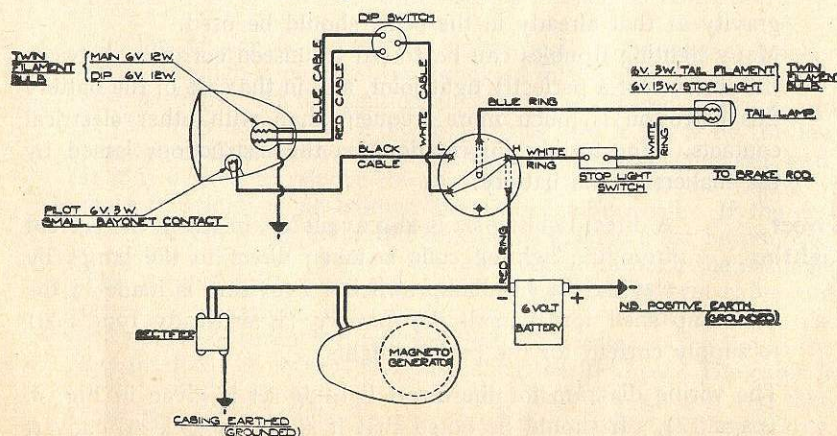
The air by-pass screw enables the mixture to be adjusted between the closed and  $\frac{1}{4}$  open position of the throttle. Screw in to richen mixture and vice-versa.

The taper needle position governs the mixture strength between  $\frac{1}{4}$  and  $\frac{3}{4}$  throttle. The nominal position is with the needle locating clip in groove No. 3. Groove No. 1 is the weakest position. The speed of tickover can be adjusted by the cable adjusting screw. In cold weather, the taper needle may be set one groove richer (one number higher) than standard.

## LIGHTING SETS AND FLYWHEEL MAGNETO.

The Villiers 6-pole magneto provides current for both ignition and lighting purposes. Two types of lighting equipment are available:—

**Rectifier Lighting.** Alternating current from the lighting coils is converted to direct current by passing it through a selenium-type rectifier, and is then used for charging a 6-volt, 10 amp/hour battery.



**Fig. 5.—Rectifier type lighting set—typical wiring diagram.**



**Care of the Rectifier** The wiring connections between the battery and rectifier, and the rectifier and magneto, are given in Fig. 5 **Lighting Set.** (page 15). Note that the **positive** side of the battery is

"earthed" to the frame of the motor-cycle. The rectifier itself is hermetically sealed, and can be fitted to any part of the frame of the machine, provided that metal-to-metal contact is made with the outer plate of the rectifier, which is the earth connection of the circuit.

It should be noted that the output from the generator does not quite balance the load on the battery when the headlight is on. An electric horn and spotlight are additional loads when fitted, therefore some daylight riding is necessary to keep the battery fully charged, without having to charge it separately.

Always make sure that the tail lamp "stop" bulb is fitted the right way round, so that the 18 watt filament lights when the foot-brake pedal is operated, and the 3 watt filament operates on the normal driving or parking circuits. If this is not the case, the battery will quickly become discharged.

**IMPORTANT:** Should it be necessary to use the motor-cycle while the battery is removed, the lead running from the magneto to the rectifier **must** be disconnected.

**Care of the Battery.** Once a month unscrew the filler caps of each battery cell and pour in a small quantity of distilled water to bring the acid level with the tops of the separators. Acid should

not be added unless it is accidentally spilled out of the battery, but if this is done, diluted sulphuric acid of the same specific gravity as that already in the cells, should be used.

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 is much more frequent than with other electrical contacts. For further information see the instructions issued by the makers of the battery.

**Direct Lighting.** A direct lighting set is also available, in which the current from the lighting coils is taken direct to the lamps by way of the headlamp switch. Provision is made in the headlamp shell for a small dry battery (Ever-Ready type 800) to supply current for the parking lights.

The wiring diagram for the direct lighting set is given in Fig. 6. (page 17). It should be noted that it is not possible to convert a "Direct" lighting set into a "Rectifier" type, as the two sets are entirely different.

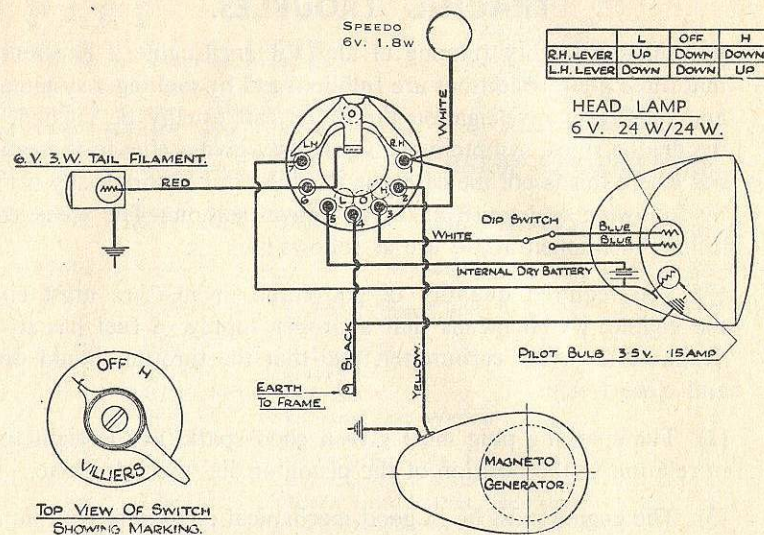


Fig. 6.—Direct type lighting set—typical wiring diagram.

### Magneto Coils and Leads.

The ignition and lighting coils are carried on an armature plate secured to the engine clutchcase by four screws. The high tension lead from the ignition coil to the sparking plug can be detached by unscrewing it from its socket on the top of the clutchcase.

When replacing it, be careful to ensure that the brass pad carried by the spring and secured to the terminal, makes contact with the soldered disc on the outside of the ignition coil.

The low tension lead from the ignition coil to the contact breaker passes through a passage-way provided in the gearcase and crankcase castings. At the ignition coil end it is soldered in place, and at the other end a shoe is fitted which is held in place by the low tension terminal screw. This screw also holds the condenser lead. If it is desired to remove the low tension lead from the engine, it must therefore be unsoldered from the ignition coil. If the coil and lead are to be taken out together, the shoe must be removed from the other end to allow the lead to pass through the castings. The lighting leads from the coils are joined to a twin cable and taken to sockets on the clutch-case casting. If the cable is disturbed, make sure when refitting that it is located in the slot in the coil platform to prevent it from fouling the flywheel. The cable is held by a clip secured by an armature plate fixing screw and then runs through a crevice in the clutchcase casting to the sockets, (see fig. 12).



## TRACING TROUBLES.

For the satisfactory running of any Villiers Engine it is essential that three main conditions are fulfilled, and by making a systematic and intelligent investigation the faults 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 a proper supply of fuel has to be available from the carburetter, and that the throttle should open and close freely.
- (2) The 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 efficient compression of the air in the cylinder and crankcase. This can be easily checked by putting the gear-box into the neutral position, and rotating the crankshaft by means of the kickstarter. On every revolution a definite resistance should be felt, caused by the air in the cylinder being compressed.

**Making a Preliminary Check.** 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 (pages 36, 37 and 38).

Having made sure that there is "petrol" in the tank, and that the tap is in the "ON" position, depress the tickler on the carburetter to ensure that there is no blockage in the fuel supply, either in the tap, fuel pipe, banjo union or fuel needle seating.

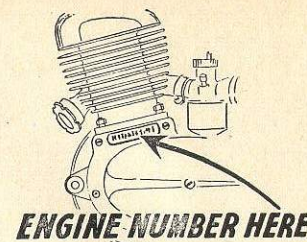
If the fuel supply is clear, fuel will spurt from the vent hole in the side of the tickler.

Being satisfied that fuel is reaching the carburetter, next unscrew the sparking plug, and with the high tension lead still attached, lay the plug on the cylinder head. Turn the engine by means of the kickstarter, and if there is a good spark, it is possible that the ignition timing is incorrect.

Finally, examine the carburetter controls to make certain that the throttle is actually opening when the control lever is moved.

## SPARE PARTS LIST

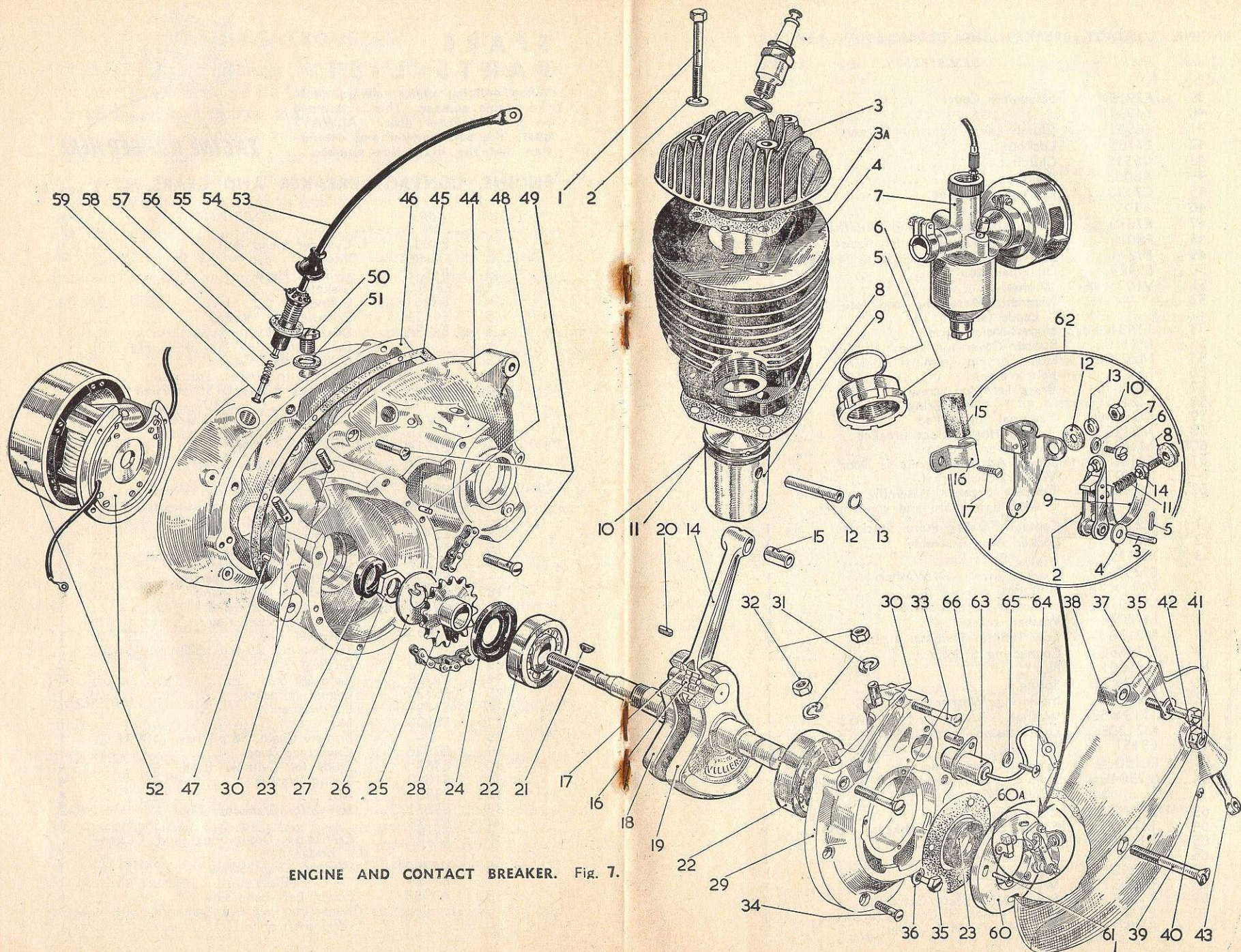
When ordering spares, always quote the engine number. This is stamped on the crankcase door. ALWAYS quote the part number and description, not the illustration number.



### ENGINE, CONTACT BREAKER AND GEARS. Figs. 7 and 8.

ILLUS. No.	PART No.	DESCRIPTION.	No. off.
1	E3907	Cylinder Head Bolt	4
2	FG186	Washer	4
3	B86.8	Cylinder Head	1
3A	E8546	Gasket	1
4	B7261F/1	Cylinder	1
5	E4453	Exhaust Nut Washer	1
6	E3934	Exhaust Nut	1
7	—	Carburetter (see Fig. 9 or Fig. 10)	1
8	E7163	Cylinder Base Gasket	1
9	C7045	Piston with Bushes, Std. size	1
—	D7515	Piston as above, .015" oversize	1
—	D7517	" " .030" oversize	1
10	E6141	Piston Ring, Standard size	2
—	E7516	" " .015" oversize	2
—	E7518	" " .030" oversize	2
11	E8272	Expander Ring	1
12	E7198	Gudgeon Pin	1
13	E5218	Circlip	2
†14	D6130	Connecting Rod—Std. size (bushed)	1
—	D7494	Connecting Rod, .001" O/s (bushed)	1
15	E6192	Small End Bush	1
16	E9777	Rollers for Crankpin	28
†17	E7268	Crankpin—Std. size	1
—	E7493	Crankpin, .001" oversize	1
18	D7971	Driveshaft—Right-hand	1
19	C7875	" —Left-hand	1
20	E5124	Engine Sprocket Key	1
21	E4873	Flywheel Key	1
22	—	Ball Bearing, 25 m.m.x52 m.m.x15 m.m.	2
23	E9718	Oil Seal	2
24	E9728	Gaco Oil Seal	1
25	E6725	Engine Sprocket	1
26	E7197	Lockwasher	1
27	E6930	Nut	1
28	—	Primary Chain, 56 pitches, 110037	1
29	B7936	Crankcase Door	1
30	E363	Studs for Cylinder Base	4
31	E1050	Spring Washer	4
32	E3961	Nut	4
33	E7271	Screw for Crankcase Door	2
34	E7128	" " (Short)	4
35	E3222	Crankcase Drain Plug and Clutch-bridge Bolt	2
36	V476E	Washer, Drain Screw	1
37	E2924	" Plain	1
38	A7935/1	Cover, Left-hand side	1
† Use Standard Size		Connecting Rod and Crankpin, with new driveshaft only.	





ENGINE AND CONTACT BREAKER. Fig. 7.



### ENGINE, CONTACT BREAKER AND GEARS—continued.

<i>ILLUS.</i>	<i>PART</i>	<i>DESCRIPTION.</i>	<i>No.</i>
<i>No.</i>	<i>No.</i>		<i>off.</i>
39	E7915	Screw for Cover ... ..	1
40	E4934	" " " " " "	1
41	E6567	Clutch Lever Adjusting Screw ...	1
42	E7765	Locknut ... ..	1
43	D6546	Clutch Lever ... ..	1
44	A8008	Gearcase ... ..	1
45	C7170	Clutchcase Gasket ... ..	1
46	A7959	Clutchcase ... ..	1
47	E7619	Dowels in Gearcase and Clutchcase...	4
48	E8015	Dowel in Gearcase for Crankcase Door	1
49	E7271	Screw securing Clutchcase to Gearcase	2
50	E9329	Oil Filler Plug ... ..	1
51	V107×3E	Washer ... ..	1
52	—	Magneto Assembly complete with Leads (see Fig 12).	1
53	1148×4 c/p	High Tension Lead ... ..	1
54	M2110E	Rubber Cover for Terminal Holder ...	1
55	M2099E	High Tension Terminal Holder ...	1
56	E869	Felt Washer ... ..	1
57	M2703E	Brass Terminal Screw ... ..	1
58	M2105E	" Spring ... ..	1
59	M2104E	Terminal Spring Pad ... ..	1
60	M2123E	Adaptor for Contact Breaker ...	1
60A	M2368E	Gasket for Adaptor ... ..	1
61	E8180	Screw, Adaptor Crankcase Door ...	3
—	M27072	Washer, Shakeproof ... ..	3
62	M2340C	Contact Breaker Assembly complete with base plate and condenser ...	1
1	M2118E	Contact Breaker Point Bracket ...	1
2	M2141E	Rocker Arm Assembly ... ..	1
3	M2122E	" Pivot Pin ... ..	1
4	E5257	" " Washer ... ..	1
5	V111×2E	Split Pin ... ..	1
6	M1801E	Screw for Point Bracket ... ..	1
7	M1802E	Washer, brass ... ..	1
8	M2138	Low Tension Terminal Bush... ..	1
9	M2365E	Connecting Strip ... ..	1
10	EM1001	Nut ... ..	1
11	1047×3E	Spring ... ..	1
12	M1805E	Insulating Washer ... ..	1
13	1113×5E	Washer ... ..	1
14	M2120E	Low Tension Terminal Screw ...	1
15	E8151	Pad, Oil ... ..	1
16	E8150	Clip for Greaser Pad ... ..	1
17	M2704E	Screw for Clip and Seal Retaining Washer ... ..	3
63	M2262E	Condenser ... ..	1
64	M1670E	Screw, Condenser/Crankcase Door ...	1
65	1113×5E	Washer ... ..	1
66	M2276E	Distance Piece ... ..	1
67	E1962	Oil Level Plug ... ..	1
68	E1905	Washer ... ..	1
69	E7326	Screw, Clutchcase/Gearcase ... ..	5
70	E7129	Screw, Flywheel Cover/Clutchcase Stud (for D10493 Cover) ... ..	3
or	E10502		2

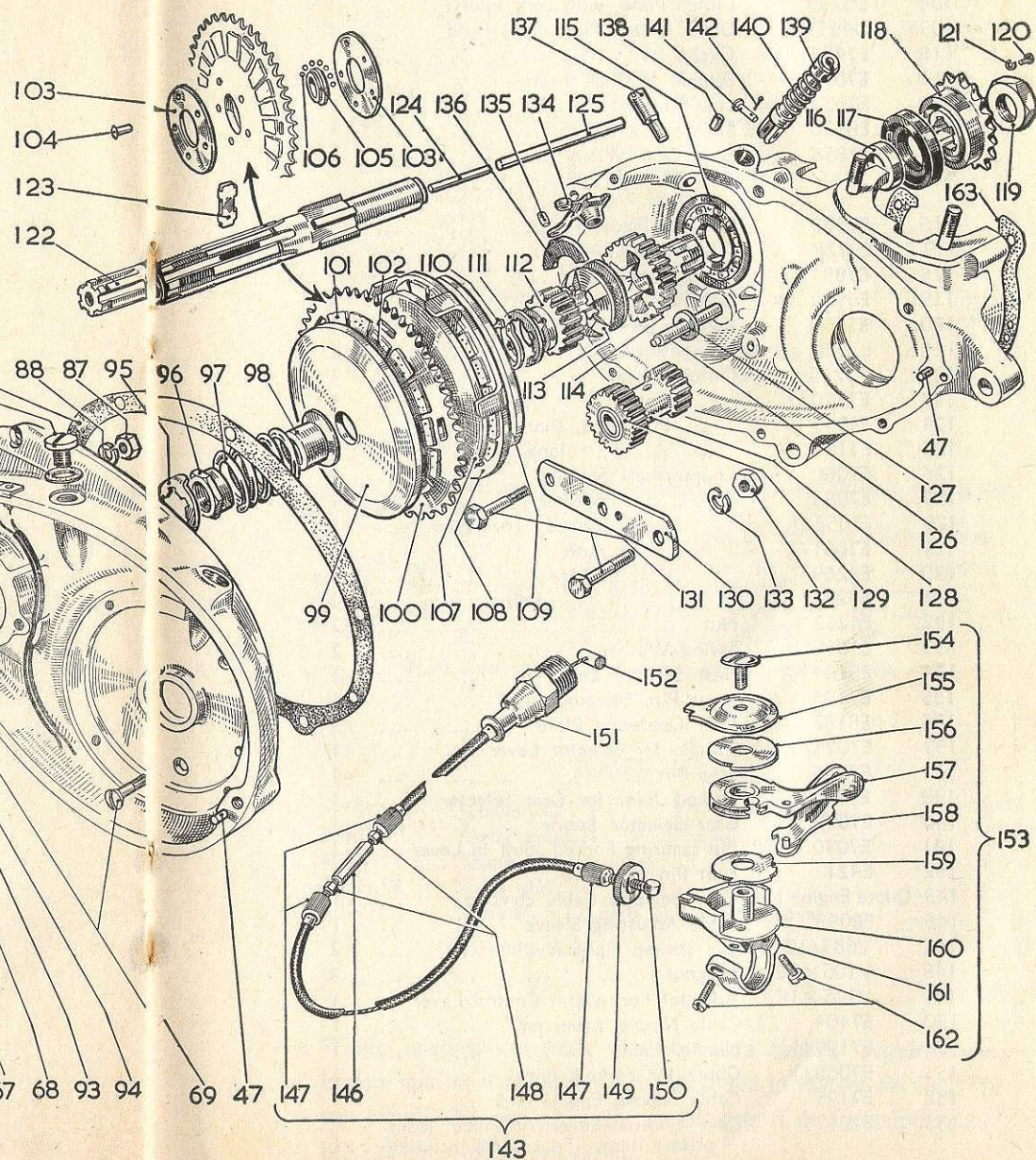
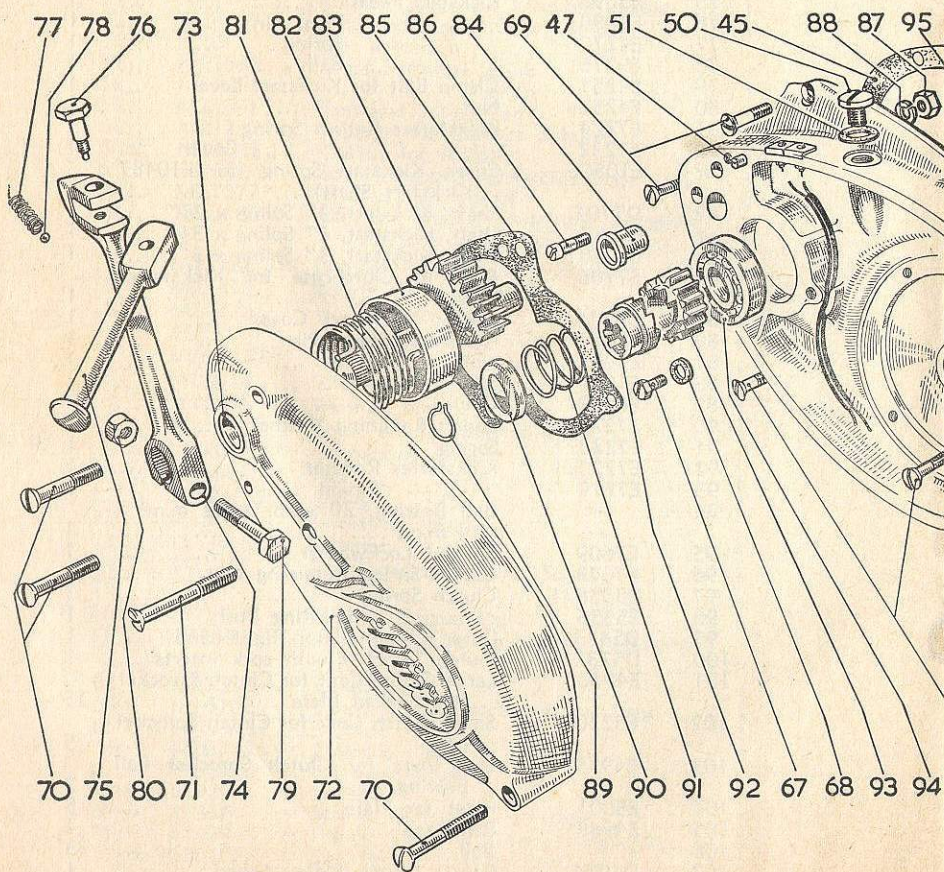
### ENGINE, CONTACT BREAKER AND GEARS—continued.

ILLUS. No.	PART No.	DESCRIPTION.	No. of.
71	E7916	Screw, Flywheel Cover/Clutchcase ...	1
or	E10503	Stud (for D10493 Cover) ...	1
—	E2539	Nut (for D10493 Cover) ...	3
—	E2924	Washer for D10493 Cover) ...	3
72	A7960	Flywheel Cover ...	1
or	C9787	Housing, Kickstart (for exposed Flywheel)	1
or	C10758	Housing, Kickstart ...	1
or	D10493	Cover, Flywheel (for E10487 Kickstart Shaft) ...	1
73	E7217	Bush for Kickstarter Shaft ...	1
or	E10525	Bush Kickstart Shaft (for D10493 cover)	1
74	D7246	Kickstarter Lever, Straight, $\frac{5}{8}$ " Spline	1
or	D4091	Kickstart Lever, $\frac{1}{2}$ " offset, $\frac{3}{8}$ " Spline	1
or	D10760	Kickstart Lever, $1\frac{1}{64}$ " offset, double bend	1
or	D10761	Kickstart Lever, $\frac{1}{2}$ " offset, $\frac{3}{4}$ " Spline	1
or	D10137	Kickstart Lever, $1\frac{1}{16}$ " offset, single bend	1
or	D10540	Kickstart Lever, straight, $\frac{3}{4}$ " Spline ...	1
75	E4096	Kickstart Pedal ...	1
76	E4098	" " Pivot Pin ...	1
77	E4270	" " Spring ...	1
78	E9776	" " Ball ...	1
79	E4251	Clamp Bolt for Kickstart Lever ...	1
80	E4252	Nut ...	1
81	E7224	Kickstarter Return Spring ...	1
82	E7232	" " " Cover ...	1
or	E10506	Cover, Kickstart Spring (for E10487 Kickstart Shaft) ...	1
83	D7704	Shaft, Kickstart, $\frac{1}{2}$ " Spline x $2\frac{7}{8}$ " ...	1
or	E9887	Shaft, Kickstart, $\frac{1}{2}$ " Spline x $3\frac{1}{2}$ " ...	1
or	E10487	Shaft, Kickstart, $\frac{1}{2}$ " Spline x 3" ...	1
84	E7706	Bush in Clutchcase for Kickstarter Shaft ...	1
85	D8116	Gasket, Kickstart Cover ...	1
86	E7222	Kickstarter Stop Pin ...	1
87	E3961	Nut for Stop Pin ...	1
88	E1050	Spring Washer ...	1
89	E6552	Circlip ...	1
90	E7221/1	Spring Retaining Washer ...	1
91	E7223/1	Spring ...	1
92	E7220/1	Kickstarter Ratchet ...	1
93	E7219	" Pinion ...	1
94	—	Ball Bearing, 20 m.m. x 42 m.m. x 9 m.m. ...	1
95	E7609	Splined Lockwasher ...	1
96	E7073	Clutch Spring Retaining Nut ...	1
97	E5558/1	Clutch Spring ...	1
98	E5556	" Locating Bush ...	1
99	D5433	Outer Clutch Plate, Right-hand ...	1
100	D5232	Clutch Sprocket with cork inserts ...	1
101	E4960	Large Clutch Cork for Clutch Sprocket and Corked Plate ...	25
102	E5220	Small Clutch Cork for Clutch Sprocket only ...	5
103	E4955	Side Plate for Clutch Sprocket Ball Bearing ...	2
104	E5001	Rivet for Plate ...	5
105	E4948	Ball Race ...	1
106	$\frac{1}{2}$ "	Ball ...	33
107	D4954	Centre Clutch Plate, dished ...	...



# GEARS AND GEAR CONTROL.

Fig. 8.





# ENGINE, CONTACT BREAKER AND GEARS —continued.

ILLUS. No.	PART No.	DESCRIPTION.	No. off.
108	D5233	Clutch Plate, with cork inserts	1
109	D4951	Outer Clutch Plate, Left-hand	1
110	E7454	Circlip ...	1
111	E7072	Splined Washer, brass	1
112	E7057/1	Low Gear Wheel, 20 T	1
113	E8130	Sliding Dog Clutch	1
114	E7056	High Gear Wheel	1
115	—	Ball Bearing, 25 m.m. x 52 m.m. x 9 m.m.	1
116	E7882	Distance Piece	1
117	E9728	Oil Seal	1
118	E7881	Driving Sprocket	1
119	E6930	Retaining Nut	1
120	E5561	Locking Screw for Retaining Nut	1
121	E7529	Spring Washer	1
122	C7215	Clutch Shaft	1
123	E7270/1	„ Cotter	1
124	E4945	„ Push Rod, short	1
125	E7196	„ „ „ long	1
126	E7060	Countershaft Spindle	1
127	E7063	„ Washer	1
128	E7058/1	„ Bushed, 16/21 T	1
129	E7061/1	„ Bush	2
130	E7269	„ Bridge	1
131	E4251	„ „ Bolt	2
132	E4252	Nut	2
133	E1050	Spring Washer	2
134	E8131	Gear Selector Lever	1
135	E7195	Pivot Pin, Selector	1
136	E8132	Gear Operating Plate	1
137	E7071/1	Spindle for Selector Lever	1
138	E7066	Stop Pin	1
139	E7067	Forked Joint for Gear Selector	1
140	E7092	Gear Selector Spring	1
141	E7070	Pin securing Forked Joint to Lever	1
142	E421	Split Pin for above	1
143	Quote Engine No.	Gear Selector Cable complete	1
146	E8098	Cable Adjusting Sleeve	1
147	V683/1E	„ „ Screw	2
148	V105×2E	Locknut	3
149	V105×1E	Adjuster Locknut at Control Lever	1
150	E7404	Cable Nipple, Lever end	1
or	E7199/1	Nipple, Cable	1
151	E7068/1	Guide for Forked Joint	1
152	E7199	Cable Nipple, Engine end	1
153	E10524	Gear Control Lever Assembly (comprising items 154 to 162 inclusive)	1
154	V117×5E	Screw for Gear Control Body	1

# ENGINE, CONTACT BREAKER AND GEARS—continued.

ILLUS. No.	PART No.	DESCRIPTION.	No. off.
155	E8211	Top Cover Plate	1
156	E8210	Top Plate	1
or	E9773	Top Plate	1
157	E8207	Control Lever	1
or	E9771	Lever, Gear Control	1
158	E8208	Trigger	1
—	E8212	Spring, Trigger Lever	2
159	E8209	Ratchet Plate	1
or	E9772	Plate, Ratchet	1
160	E8206	Gear Control Body	1
or	E9770	Body, Gear Control	1
161	V142×7E	Gear Control Body Clip	1
162	V142×5E	Screw for Clip	2
163	D8547	Joint Washer, Crankcase Door	1
—	E9774	Cover, Control Body	1

## GEAR RATIOS.

By fitting alternative sets of Low and Countershaft Gear Wheels, two ratios are obtainable. These are:—

	COMPONENT.	PART No.	No. OF TEETH.	GEAR RATIOS.
either {	Low gear wheel	E.7057/1	20	1st — 1.64 : 1
	Countershaft gear	E.7058/1	16/21	Top — 1 : 1
or {	Low gear wheel	E.7057/2	20	1st — 1.715 : 1
	Countershaft gear	E.7058/2	16/22	Top — 1 : 1

Gears must only be used in the pairs indicated above.

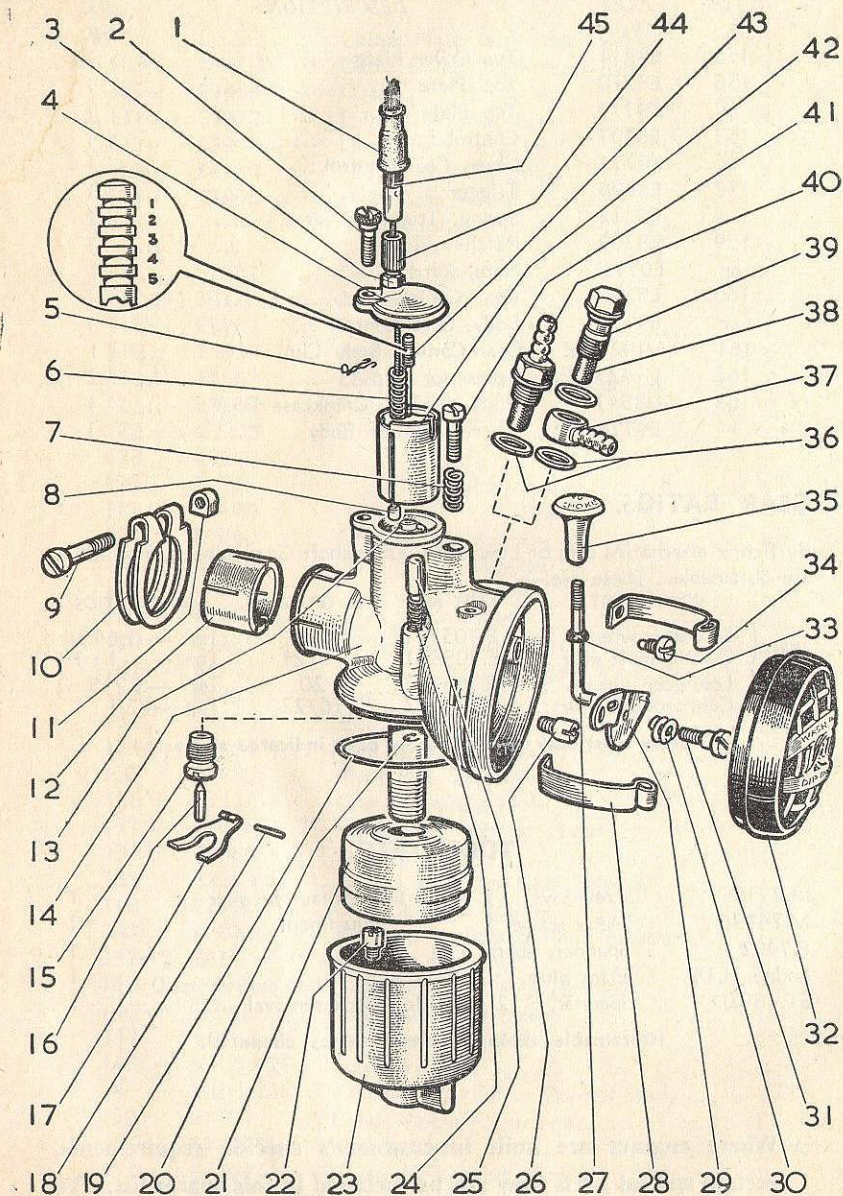
## TOOLS, ETC.

M.2715E	Screwdriver	{ For contact breaker adjustment	1
M.2593E	Feeler gauge		1
E.7402	Spanner, spark plug	...	1
Lodge H.14	Spark plug	...	1
ST.1692D	Spanner, S.12 Carb. Jet Block removal	...	1

(Obtainable through normal spares channels).

★ Where engines are built to customer's specific requirements, certain special parts may not be included in this spares list. We can supply the correct replacement parts if the description and full engine number are given.





TYPE S.12 CARBURETTER. Fig. 9.

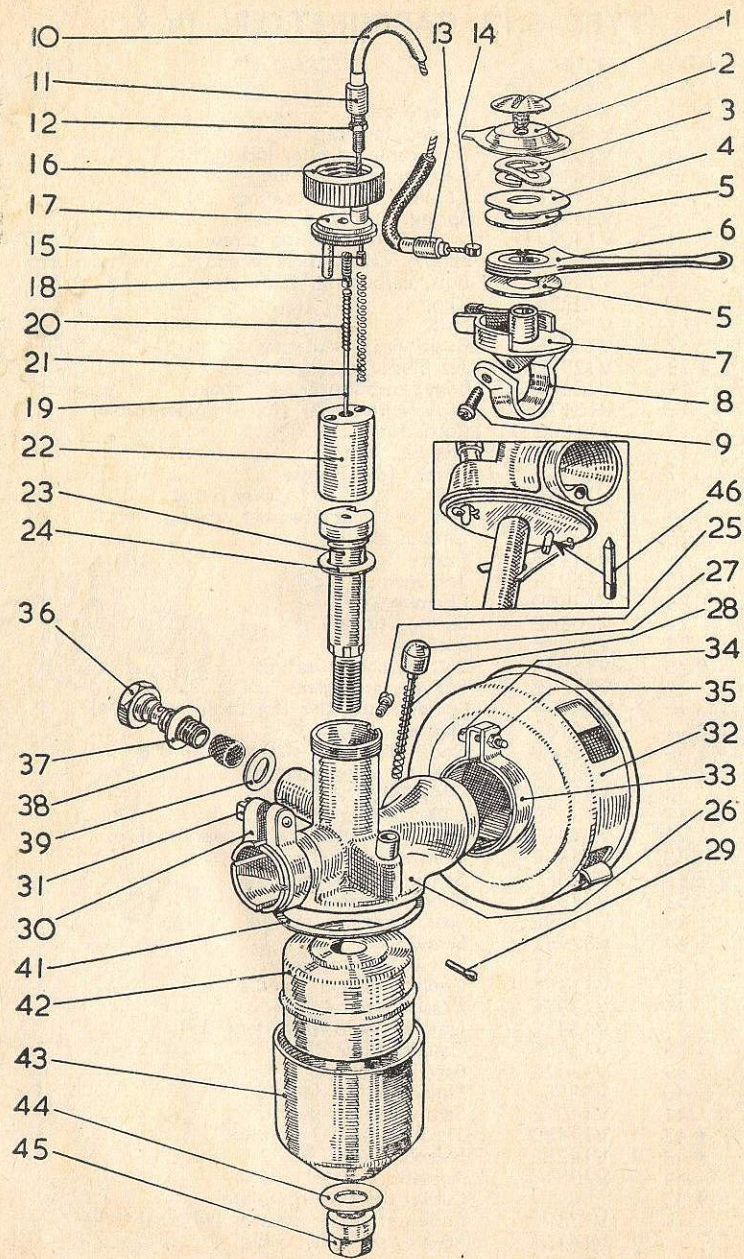
# TYPE S.12 CARBURETTER. Fig. 9.

ILLUS. No.	PART No.	DESCRIPTION	Qty.
1	V826E	Cover, cable ...	1
2	V1400E	Screw, top cap ...	1
3	V105X2E	Nut, cable adjuster locking ...	1
4	V1317E	Cap, carburetter top ...	1
5	V1301E/1	Circlip, needle locating ...	1
6	V309E	Spring, throttle ...	1
7	V1402/1E	" air adjusting screw ...	1
8	V145X16E	Nipple, cable, throttle end ...	1
9	V1440E	Bolt, carburetter body clip ...	1
10	V1426E	Clip, " " " " bolt ...	1
11	V1436E	Nut, " " " " bolt ...	1
12	V1343E	Bush, heat insulating ...	1
* 13	V1251D	Jet block, needle ...	1
14	V1268C	Body, carburetter, 1/2" choke ...	1
or	V1617D	Body, carburetter (for strangler cable) ...	1
15	V1180E	Bush, fuel ...	1
16	V1179E	Needle, fuel ...	1
17	V1396E	Lever, fuel needle ...	1
18	V1237E	Pin, " " lever hinge ...	1
19	V1386E	Washer, float chamber sealing ...	1
20	V1590E	Circlip, tickler ...	1
21	V1419E	Float ...	1
* 22	V1605E	Jet, main, 85 c.c. ...	1
23	V1356D	Chamber, float ...	1
24	V2036E	Spring, tickler ...	1
25	V1398E	Tickler ...	1
* 26	V1592E	Jet, air compensating ...	1
27	V1338E	Spindle, strangler ...	1
or	V1415E	Spindle, strangler (for cable operation) ...	1
—	V1416E	Sleeve ...	1
—	V1801E	Rod, extension, strangler spindle ...	1
—	V1802E	Nut for extension rod ...	1
28	V1349D	Clip, filter ...	2
29	V1337E	Plate, strangler ...	1
or	V1404E	Plate, strangler (cable operation) ...	1
30	V1588E	Washer, strangler screw ...	1
31	V626E	Screw, strangler plate ...	1
32	V1383D	Filter assembly ...	1
33	V1589E	Seal, strangler spindle ...	1
34	V829E/1	Screw ...	2
or	V1684E	Screw, self-tapping ...	2
35	V1339E	Knob, strangler spindle ...	1
36	V1397E	Washer, fibre ...	1 or 2
37	V1341E	Union, banjo (for item 39) ...	1
38	V1387E	Gauze, filter ...	1
39	V1342E	Bolt, banjo ...	1
or 40	V986E	Union, petrol feed ...	1
41	V1401E	Screw, air by-pass ...	1
* 42	V1248D	Throttle (No. 2 cutaway) ...	1
* 43	V1428E	Needle, taper, No. 2 ...	1
44	V105X1E	Adjuster, cable ...	1
* 45	—	Cable, throttle, complete ...	1
—	V1709C	Cable, strangler control (where fitted) ...	1
—	V1416E	Sleeve, strangler cable ...	1
—	V1614E	Spring, cable return ...	1

\* Quote Engine No. in full when ordering.

Standard items only are listed.



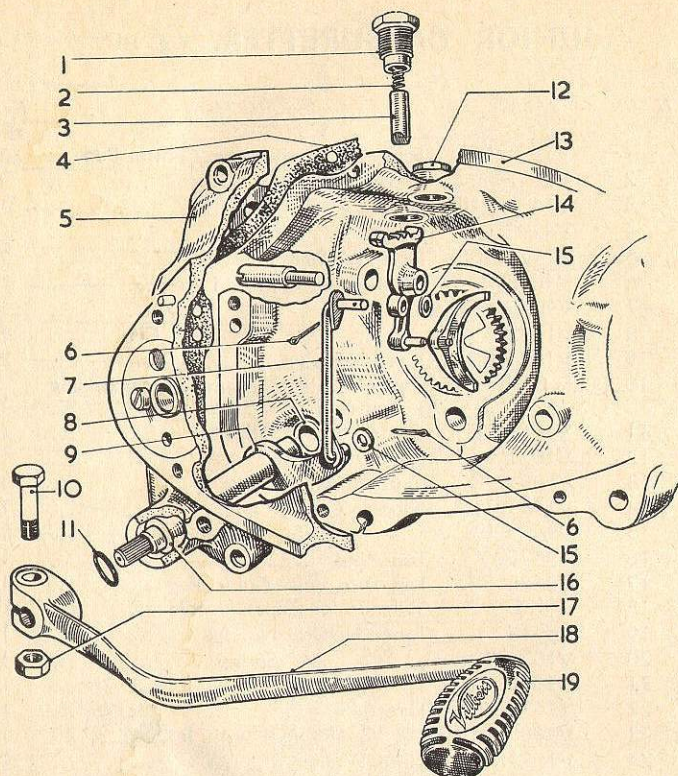


JUNIOR CARBURETTER. Fig. 10.

JUNIOR CARBURETTER. Fig. 10.

ILLUS. No.	PART No.	DESCRIPTION	No. off.
1	V117×5E	Screw for Carburetter Control Body...	1
2	V387E	Top Cover Plate ... ..	1
3	V142×11E	Spring Washer ... ..	1
4	V429E	Friction Plate ... ..	1
5	V142×10E	Fibre Washer ... ..	2
6	V406D	Carburetter Control Lever ... ..	1
7	V405D	" " Body ... ..	1
8	V142×7	" " Clip ... ..	1
9	V142×5E	Screw for Clip ... ..	2
10	Quote Engine No.	Control Cable Assembly (comprising items 11 to 15 inclusive) ... ..	1
11	V105×1E	Control Cable Adjuster ... ..	1
12	V105×2E	Locknut ... ..	1
13	V108×4E	Control Cable Sleeve ... ..	1
14	V123×15E	Nipple, Control end ... ..	1
15	V145×16E	" Carburetter end ... ..	1
16	V367E	Top Ring ... ..	1
17	V368E	Top Disc with Guide Peg ... ..	1
18	V413E	Adjuster for Taper Needle ... ..	1
19	V651E	Taper Needle, No. 2½ ... ..	1
20	V107×7	" " Spring ... ..	1
21	V369E	Throttle Spring ... ..	1
22	V365E	Throttle ... ..	1
23	V408E/V146×1E	Centrepiece with Jet, No. J.120 ... ..	1
24	V107×3E	Fibre Washer ... ..	1
25	V424E	Locating Screw for Centrepiece ... ..	1
26	V649C/1	Carburetter Body, with Fuel Needle Lever and Bush ... ..	1
27	V207E/V223E	Tickler ... ..	1
28	V369E	Tickler Spring ... ..	1
29	V111×2E	" Split Pin ... ..	1
30	V922E	Clip securing Carburetter to Stub on Cylinder Barrel ... ..	1
31	V754E	Screw for Clip ... ..	1
32	EM653	Air Filter with Clip ... ..	1
33	EM618	" " Clip ... ..	1
34	E5102	Bolt for Clip ... ..	1
35	1002×15E	Nut ... ..	1
36	V382E	Banjo Union Bolt ... ..	1
37	H104×8	Washer, large hole ... ..	1
38	V404E	Gauze Filter ... ..	1
39	V383E	Washer, small hole ... ..	1
41	V107×2	Joint Washer, Float Cup ... ..	1
42	V107×1E	Float ... ..	1
43	V146×6E	" Cup ... ..	1
44	V107×4E	Washer for Bottom Nut ... ..	1
45	V581E	Bottom Nut ... ..	1
46	V355E	Fuel Needle ... ..	1

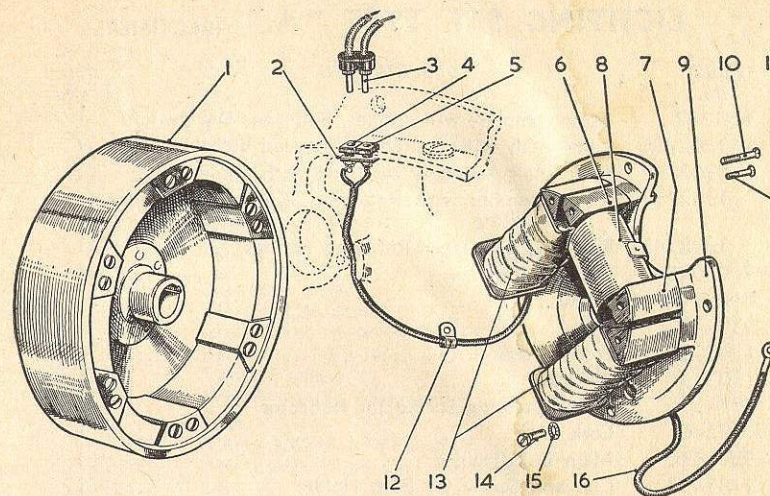




**Mark 6F GEAR CHANGE MECHANISM. Fig. 11.**

Component parts which are illustrated, but not listed, are as for the Mark 4F Engine.

ILLUS. No.	PART No.	DESCRIPTION	Qty.
1	E9711	Plunger box ... ..	1
2	E9713	Plunger spring ... ..	1
3	E7209/1	Plunger ... ..	1
4	C9778	Clutchcase joint washer ... ..	1
5	A9700	Clutchcase, bushed ... ..	1
6	V301E	Split pin ... ..	2
7	E9707/E9708	Link rod assembly ... ..	1
8	E9710	Bush, in gear case ... ..	1
9	E9705/E9706	Pedal shaft assembly ... ..	1
10	E4251	Bolt ... ..	1
11	E9987	Sealing ring ... ..	1
12	E9749	Gearcase plug ... ..	1
13	A9699	Gearcase, bushed ... ..	1
14	E9703	Gear selector lever ... ..	1
15	E5257	Washer for link rod ... ..	2
16	E9709	Bush, in clutch case ... ..	1
17	E4252	Nut ... ..	1
18	D9701	Gear-change lever ... ..	1
19	E9783	" " rubber ... ..	1



**FLYWHEEL AND ARMATURE PLATE. Fig. 12.**

ILLUS. No.	PART No.	DESCRIPTION	Qty.
* 1	R122	Flywheel complete ... ..	1
2	E8548	Locking plate for sockets ... ..	1
3	M2708E	Twin plug for lighting lead ... ..	1
4	M2712E	Socket, large hole ... ..	1
5	M2711E	Socket, small hole ... ..	1
6	M2264E	Coil end, L.H. ... ..	1
7	M2158E	" " R.H. ... ..	1
8	M2151E	Ignition coil ... ..	1
9	A125	Armature plate with coils ... ..	1
10	1124×9E	Screw, coil end ... ..	6
11	M2240E	Screw, coil end ... ..	2
12	M2275E	Clip, lighting cable ... ..	1
13	M2346	Lighting coils complete with twin leads ... ..	1 pair.
14	E5102	Screw, armature plate fixing ... ..	4
15	M2707E	Shakeproof washer ... ..	4
16	M3047E	Low tension lead and shoe (coil to contact breaker) ... ..	1
* —	R135	Flywheel with fan fixing screws ... ..	1
—	1030×8E	Screw, fan fixing ... ..	3
—	1002×15E	Nut, fan fixing ... ..	
—	M2707E	Washer, fan fixing ... ..	
* —	R137	Flywheel, with fan fixing screws ... ..	1
—	C10217	Fan ... ..	1
—	1137×4E	Screw, fan fixing ... ..	3
—	1002×15E	Nut, fan fixing ... ..	
—	M2707E	Washer, fan fixing ... ..	

\* Alternative Flywheels.



## LIGHTING SET TYPE "A." (RECTIFIER)

PART No.	DESCRIPTION.	No. off.
BH1302	Lamp complete with Cables, Bulbs and Dip Switch	1
SA1302/36	Lamp Body with Switch, Cables and Bulb Holders	1
1302/44	Back Shell Assembly complete with Cable	1
1302/31	Rim Assembly with Reflector, Clips, Glass and Cork Ring	1
1302/43	Rim only with four Reflector Springs	1
800/58B	Clip for Rim	1
890-34A	Screw " " " " " "	1
930-12	Nut " " " " " "	1
1302-2	Front Glass	1
1302-3	Reflector	1
897-1	Wire Retaining Spring for Reflector	4
1302-6	Cork Ring	1
930-33C	Main Bulb Holder	1
1185-57	Clip and Screw for Bulb Holder	1
380521	Dip Switch, No. 99	1
380520	Clip and Screw Assembly for Dip Switch	1
	Main Bulb: 6 volt—12/12 watt, s.b.c.	1
	Pilot Bulb: 6 volt—3 watt, m.b.c.	1
1302-45	Spindle Assembly, Light Switch	1
SA1302-46	Switch Lever complete with Spindle and Split Pin	1
608033	Contact for Light Switch	1
608030	Spring " " " " " "	1
182511	Nut for Lamp fixing	2
188471	Shakeproof Washer	1

### TAIL LAMP, TYPE 477.

53182	Lamp complete with Bulb and Rubber Cover	1
526293	Base with Bulb Holder	1
526295	Body with Ruby Glass and Celluloid Window	1
526286	Rubber Cover	1
552101	Adaptor	1
No. 190	Double Filament Bulb, s.b.c., 6 volt, 3 watt main filament. 6 volt, 18 watt stop filament	1

### STOP LIGHT SWITCH.

31281	Switch complete	1
120514	Contact Grub Screw	2
315543	Pull Spring	1

### RECTIFIER.

M3015E	Westalite Rectifier	1
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## LIGHTING SET TYPE "B." (DIRECT).

060088	Headlamp complete, M.35	1
608157	Rim, chrome, less Glass	1
600308	Wire for Glass fixing	4
612220	Packing for Glass	1

PART No.	DESCRIPTION.	No. off.
612103	Glass ...	1
612171	Main Bulb Holder	1
608025	Pilot " "	1
612172	Reflector	1
31157A	Lighting Switch, U39L18	1
31278	Dip Switch, No 99	1
CM2	Cable Grommet	1
182511	Lamp fixing Nut	2
188471	Shakeproof Washer	1
612218	Rim Catch Spring	1
612217	" " " " " "	1
188818	Terminal Sleeve	1
612222	Battery Contact	1
No. 168	Main Bulb: 6 volt—24/24 watt s.b.c.	1
No. 974	Pilot Bulb: 3.5 volt...15 amp m.e.s.	1
993701	Cable Harness	1
351567	Switch Handle Assembly	1
101593	" " Screw	1
<b>TAIL LAMP, TYPE 529.</b>		
53256	Tail Lamp, Type 529 complete	1
526404	Lens	1
526406	Window	1
133551	Screw, Lens fixing	1
554710	Bulb-holder Assembly	1
526408	Rubber Base	1
526410	Screw, Base fixing	1
988	6 V.—3 W. Bulb, M.B.C.	1

## VILLIERS EXCHANGE SERVICE.

### ENGINE UNITS.

When a complete major overhaul becomes necessary, we will accept the old engine providing that it is complete with magneto and carburetter to our catalogue specification, and supply a fully reconditioned engine in part exchange. The reconditioned unit carries the same guarantee as a new unit.

### REBORES.

We can re bore your existing cylinder and supply a suitable oversize piston, providing the cylinder will clean up to our usual oversize of either .015" O/S or .030" O/S.

### DRIVESHAFT RECONDITIONING.

When big end replacement is necessary, we will supply a reconditioned crankshaft assembly in part exchange for the original assembly.

### MAGNETO.

A re-conditioned magneto can be supplied in Part Exchange, but both Flywheel and Armature Plate must be returned as these items are treated as a single unit.

### RECORDING CLUTCH.

We can carry out the following on an exchange basis:—

- Re-Cork Clutch Sprocket.
- Re-Cork Clutch Plate.
- Re-Centre Clutch Sprocket.



## FAULT FINDING CHART.

Sequence of Testing.	Possible Trouble.	Remedy.
<b>Engine will not start.</b>		
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. <b>Turn on reserve tap where fitted.</b>
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 inches. Clean. Replace points if badly pitted.
	Moisture on insulation of condenser.	Clean and dry out.
	High tension terminal not making good contact on ignition coil	Clean and correct.
	Cracked insulation of adjustable contact breaker point.	Replace.
	Damaged insulating sleeving on wires connecting contact breaker to coil or condenser.	Replace with new sleeving.
	Faulty connection to low tension wire of ignition coil.	Correct.
	Faulty Condenser.	Replace.
	Faulty ignition coil.	Replace.

## FAULT FINDING CHART—(continued).

Sequence of Testing.	Possible Trouble.	Remedy.
If above tests are satisfactory but engine will not start.	Mixture may be too rich due to use of strangler, or incorrect setting of carburetter.	Open throttle wide and depress kickstarter several times to clear engine of petrol, adjust carburetter drain crankcase.
	Air leak at carburetter stub or manifold joint, causing weak mixture.	Correct.
	Incorrect ignition timing.	Check, following instructions given.
<b>Engine four or eight strokes.</b>		
Strangler may not be fully open. Air filter may need cleaning.	Mixture too rich.	Check strangler and air filter.
		Check carburetter setting to instructions.
Check by watching for excessive smoke from exhaust pipe or silencer.	Engine may fourstroke 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, sticking fuel needle, damaged seating or punctured float
<b>Engine Lacks Power.</b>	Engine out of tune, bearings worn. Unsuitable sparking plug.	Overhaul. Replace with recommended type.
	Loss of compression.	Tighten cylinder head bolts. Replace worn piston rings.
	Incorrect "petrol" mixture.	Correct mixture is 1 part oil, 20 parts petrol.
	Excessive carbon deposit on piston crown and cylinder head.	Decarbonize.

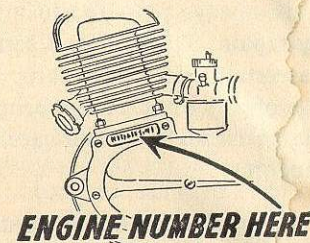


## FAULT FINDING CHART—(continued).

Sequence of Testing.	Possible Trouble.	Remedy.
	Exhaust system choked with carbon.	Clean out silencer and exhaust pipes.
	Incorrect carburettor setting.	Check and adjust.
	Air cleaner choked.	Wash in petrol, re-oil as instructed.
	Obstruction in fuel supply.	Clean out tap, fuel pipe and filters.
	Incorrect ignition timing.	Check and adjust.
	Brakes binding.	Adjust.
<b>Engine will not run Slowly.</b>	Driving chains too tight.	Adjust.
	Weak mixture due to air leaks at carburettor stub or manifold joint, crankcase and cylinder base joints.	Tighten all joints.
	Crankcase drain screw loose or missing.	Tighten or replace.
<b>Engine Suddenly Stops Firing.</b>	Worn crankshaft bearings or leaking seal.	Replace.
	Ignition timing too far advanced.	Correct.
	Spark plug lead detached.	Replace and tighten nut.
	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.

## TERMS OF BUSINESS.

1.—In correspondence, and when ordering replacement assemblies or spares, always quote the Engine Specification and Serial Number stamped on the Crankcase below the Cylinder Base. (See sketch below for example):—



The Engine number is in two parts, the first being the SPECIFICATION Number which is the key to the component parts fitted, and the second the Serial Number by which the date of manufacture, etc., can be determined, e.g. 160A/12345.

The **Magneto** also bears a SPECIFICATION Number (example: R.122/A.125) but no Serial Number. The "R" (Rotor or Flywheel), and "A" (Armature Plate) Number is stamped on the face of the Flywheel.

2.—When sending parts for replacement, repair, or as pattern, the name and address of the sender should always be securely attached. Full instructions explaining what is required should be sent separately by post. Duplicate instructions should **always** be enclosed with the parts.

3.—If an engine is sent for repair, it should be well packed in a strong box. Cardboard or a sack is insufficient, and engines so packed are liable to get seriously damaged in transit. Packing cases are not returnable unless specially asked for by the owner at the time of sending to us.

4.—All goods must be consigned to us carriage paid, addressed to "Service Dept." Goods returned by rail are consigned carriage paid.

5.—We prefer to bench test every repaired engine before returning it to its owner. It is, therefore, always advisable to send the engine complete with its magneto, sparking plug and carburettor.

6.—When forwarding a flywheel magneto for overhaul, send the armature plate and the flywheel complete.

7.—**Old or worn out parts sent as patterns, which we consider unserviceable are not returned unless specially asked for at the time of sending them to us.**

8.—Any engine or sub-assembly sent to our Works for repair and not paid for within 12 months from the date of our estimate or from the date the owner is notified of completion of repair, will be dealt with under The Disposal of Uncollected Goods Act, 1952.



## GUARANTEE.

**W**E give the following guarantee with VILLIERS Engines and Accessories in place of any implied guarantee by statute or otherwise, all such guarantees being in all cases excluded. No statement or representation contained in this catalogue shall be construed as enlarging or varying this guarantee. In the case of engines and accessories which have been used for "hiring out" purposes, or from which our trade mark, name, or manufacturing number has been removed, no guarantee of any kind is given or is to be implied.

We guarantee, subject to the conditions mentioned below, that all precautions which are usual and reasonable have been taken by us to secure excellence of materials and workmanship, but this guarantee is to extend and to be in force for six months only from the date the engines or accessories are despatched by us, and the damages for which we make ourselves responsible under this guarantee are limited to the replacement of a part manufactured by us which may have proved defective. We cannot accept responsibility for the replacement of any proprietary articles or parts not manufactured by us, unless the makers of these parts agree to replacement.

We do not undertake to refit or bear the cost of replacement or refitting such new part. We guarantee, subject to the conditions mentioned below, to make good at any time within six months any defects in these respects. As VILLIERS Engines and Accessories are liable to derangement by neglect or misuse, this guarantee does not apply to defects caused by wear and tear, misuse and neglect.

## CONDITIONS OF GUARANTEE.

If a defective part should be found in our engines or accessories, it must be sent to us carriage paid and accompanied by an intimation from the sender that he desires to have it repaired free of charge, under our guarantee, and he must also furnish us at the same time with the number of the engine, and full particulars of purchase. Failing compliance with the above, no notice will be taken of anything that may arrive, but such articles will lie here at the risk of the sender, and this guarantee or any implied guarantee shall not be enforceable.

THE TERM "AGENT" is used in a complimentary sense only, and those firms whom we style our agents are not authorised to advertise, incur any debts, or transact any business whatsoever on our account other than the sale of goods which they may purchase from us, nor are they authorised to give any warranty or make any representations on our behalf or sell subject to or with any conditions other than those contained in the above guarantee.

The guarantee becomes void if any parts not made or supplied by THE VILLIERS ENGINEERING COMPANY, LTD., are fitted to a VILLIERS engine. To safeguard his own interests, the owner should always insist upon genuine VILLIERS parts.

## ESTIMATES.

If required we are always prepared to give an estimate before proceeding with any repair. This entails a certain amount of labour in dismantling to ascertain what new parts will be required, and therefore, in the case of any estimate not being accepted for special reasons, a small charge is made for our mechanics' time in taking down the parts for report.

Estimates must be treated as approximate only. We reserve the right to include additional parts should these be found, on further examination or on bench test, to be necessary, to make the repair satisfactory.

We do not undertake to fit to engines sent to us for overhaul, any parts specified by the customer when we consider that other parts are necessary to make an efficient repair. In such cases, we are prepared to supply the customers' requirements in spares but we do not undertake to fit them.

## IMPORTANT.

Repairs and spares must always be treated on a cash basis. Ledger accounts will be opened for items of £10 (ten pounds) and upwards for approved accounts.

**An extra amount must always be included in remittances to cover the cost of postage or carriage and packing on spare parts. This is 5% extra up to £10 value. Minimum extra is 1/-. Stamps cannot be accepted for items over 1/- (one shilling) in value.**

When making remittances by telegraph money order, the name and address of the sender must be included in the space provided on the Post Office Requisition Form for a private message from remitter to payee. Unless this is done, the Post Office does not give this information upon the telegram.



*Villiers*

*The Power and the Heart  
of a fine machine*

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Ref. B. & N. V2/1360.

**E. & O. E.**





## MARK 9F (98 cc) "KART" ENGINE

### DATA

(Where different from Mark 6F)

COMPRESSION RATIO	9 to 1.
BRAKE HORSE POWER	4.7 @ 6,000 r.p.m.
FINAL DRIVE SPROCKET	Various according to machine manufacturers requirements.
CARBURETTER	Villiers S.19.
EXHAUST PIPE	13½ ins. long x 1¼ ins. O.D.
SPARKING PLUG	Lodge 3HN.

A special development of the Mark 6F this engine has a different cylinder, head and piston; the last item of low expansion aluminium alloy. To assist in obtaining the required power Villiers S.19 carburetter is fitted, operational and tuning notes for which are as follows:-

### OPERATION OF CARBURETTER

The control operates the throttle slide and thereby regulates amount of mixture entering engine, whilst the carburetter itself automatically meters and atomises the correct amount of fuel to give necessary mixture strength. To achieve this automatic control of mixture strength, the carburetter incorporates main-jet and pilot-jet systems. At idling speeds fuel is drawn from pilot-jet, and, as throttle is gradually opened, from the pilot "progression" hole then from the main-jet system. Details of operation of the two systems is given below:-

#### (a) Pilot-Jet System

At idling speeds, when throttle is nearly closed, pilot outlet hole A is subject to very high engine suction, causing fuel to be drawn from float chamber through pilot tube B, and the pilot outlet hole. A calibrated jet is contained in top of pilot tube. At the same time, a filtered supply of air is drawn from mouth of carburetter through passage C, variable air-jet D, and is then pre-mixed with fuel in small chamber E. Adjuster screw F varies the size of the pilot air-jet, affecting the pilot mixture strength. When the throttle slide is opened slightly



beyond that required for idling, suction on pilot outlet hole is reduced, but at the same time, increased on pilot "progression" hole G. A further supply of fuel is, therefore, drawn through the "progression" hole, preventing a weak spot which would otherwise occur due to the fall off in supply from pilot hole before main jet comes into full operation. From the preceding remarks it will be seen that whenever the throttle is shut whilst engine speed is high the pilot system is subject to full engine suction, and fuel will flow into engine from pilot outlet holes but as engine is not firing under these conditions, this fuel supply will tend to build up in the crankcase and cylinder to cause severe "four" or "eight-stroking" when throttle is opened again.

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

#### (b) Main Jet System

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

#### TUNING CARBURETTER.

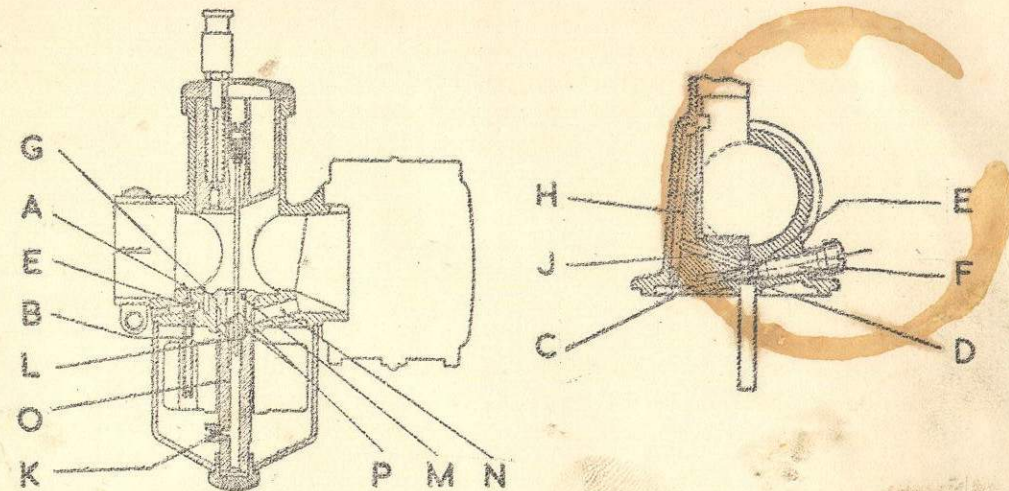
First ensure that engine is in good condition; i.e. there should be no air leaks at any joint, there should be a good spark at plug points and no restriction in fuel supply. Carburettor must be clean internally and air filter not obstructed.

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

#### Sequence of tuning with necessary adjustments:-

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

In order to obtain correct main jet size, engine must be tested at full throttle in top gear. If engine lacks power, detonates badly or runs



better with strangler slightly closed, a larger main jet is required. Should engine "four-stroke" or improve momentarily after fuel is switched off, a smaller jet is required. After de-clutching and stopping engine quickly the sparking plug should have a shiny black appearance if the correct main-jet is fitted. As an additional guide engine should tend to "four-stroke" at full throttle in bottom gear (or high engine speeds in neutral), but not in top gear. Standard jet is 90 o.c.

##### (2) Pilot Jet. Throttle Range-Closed to $\frac{1}{8}$ Open.

Pilot jet must be set when machine is stationary with engine running at required idling speed. To richen mixture, screw in pilot adjuster screw, and to weaken, unscrew 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 mixture strength is too rich, trouble will be experienced with fuel build-up in crankcase when throttle is shut with engine still running fast. Should this latter fault be present after adjusting pilot, unscrew pilot a further half turn. Any weakness on acceleration can be cured by throttle cut-away as follows:-

##### (3) Throttle Cut-Away. Throttle Range $\frac{1}{8}$ to $\frac{1}{4}$ Open.

The throttle slide is made with a cut-away on carburettor inlet side which influences the depression on main-jet system. Throttles are marked with a number which represents, in sixteenths of an inch, the amount of cut-away. A throttle with more cut-away will give weaker mixtures (over the particular range) and vice-versa. If acceleration is weak, fit throttle with smaller cut-away, e.g. change from  $2\frac{1}{8}$  to 2. Should engine tend to "four-stroke" when throttle is shut, fit larger cut-away.



(4) Needle Adjustment. Throttle Range  $-\frac{1}{4}$  to  $\frac{3}{4}$  Open.

The needle controls mixture over most of "cruising range" and must be correct for good fuel consumption and acceleration. Adjustment is by a screw in top of throttle - screw down to weaken mixture, and vice-versa. After carrying out adjustments, it is wise to go back and re-check the pilot setting to see that this has not been affected by other adjustments.

#### TO CHANGE THE TAPER NEEDLE

Remove throttle from body after unscrewing 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, which is No.  $3\frac{1}{2}$  and normally set  $2.1/16$ " out, make sure that the collar and spring are in position.

#### THE CENTREPIECE.

The centrepiece is a press fit in the carburetter body and should not be removed unless absolutely essential.

#### TO REASSEMBLE CARBURETTER.

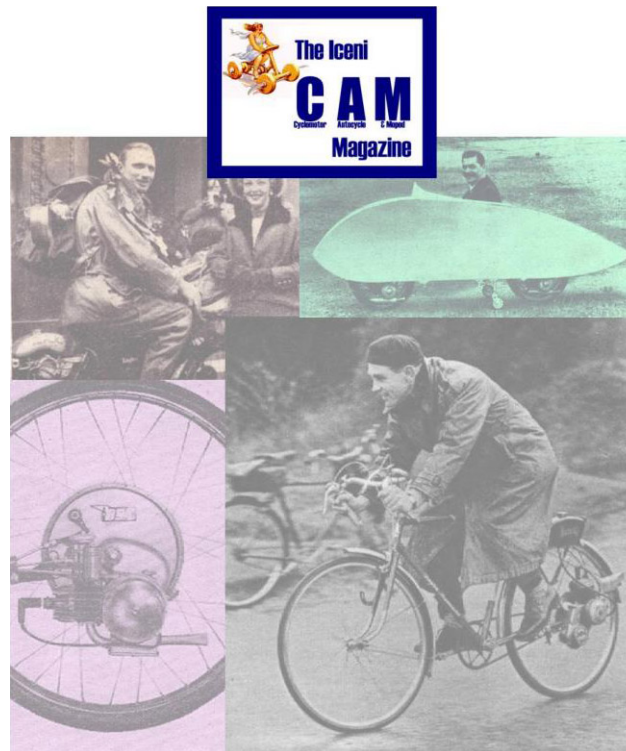
Clean the various components and make sure that tickler vent hole is clear. Replace float in correct position, this is marked "Bottom", and replace main jet in side of centrepiece. Clean out float cup and replace, with large fibre joint washer at top. Replace bottom nut and fibre washer, but do not use too much force, otherwise there is danger of stripping thread of centrepiece.

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

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



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