

Panther Owner's Cl

OPERATING INSTRUCTIONS

AND

205702

SPARE PARTS LIST



250 c.c. **Mark 2T** TWIN

FOUR - SPEED

ENGINE - GEAR UNIT

INCLUDING

BLOWER-COOLED AND SELF-STARTER MODELS

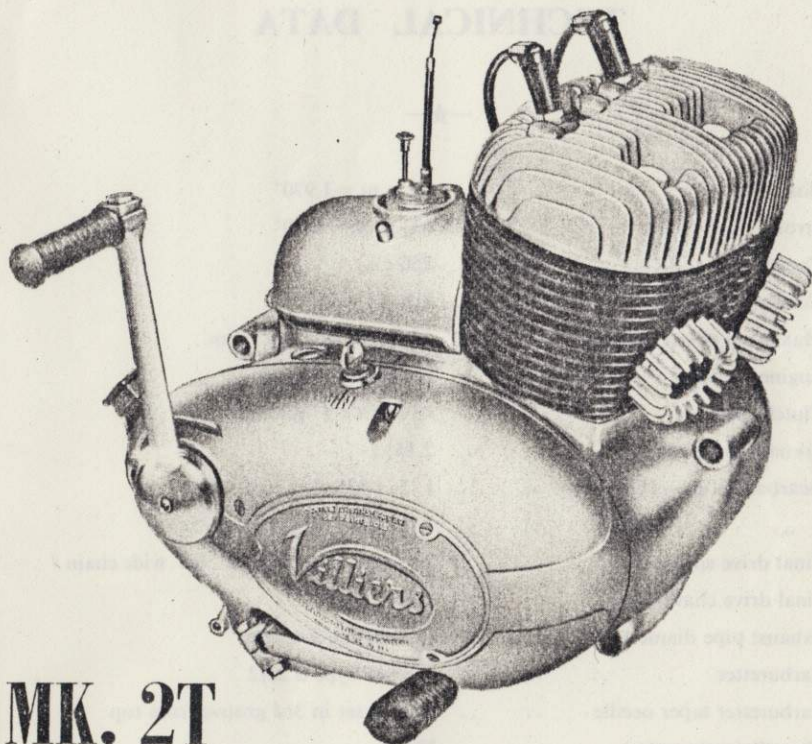
TWO SHILLINGS AND SIXPENCE

THE VILLIERS ENGINEERING CO. LTD.

MARSTON ROAD, WOLVERHAMPTON, ENGLAND.

CONTENTS

General						Page
Air Filter and Carburetter Cover	...	...	...	...	...	8
Battery	...	...	...	...	...	12
Carburetter, description	...	...	...	...	...	8
Carburetter, operation	...	...	...	...	...	8
Carburetter, tuning	...	...	...	...	...	10
Chaincase	...	...	...	...	...	3
Clutch and Primary Drive	...	...	...	...	...	5
Contact Breaker	...	...	...	...	...	6
Data	...	...	...	...	...	2
Decarbonising	...	...	...	...	...	14
Estimates	...	...	...	...	...	39
Failure to Start	...	...	...	...	...	4
Fault Finding Chart	...	...	...	...	...	16
Flywheel Magneto Generator	...	...	...	...	...	6
Gearbox	...	...	...	...	...	3, 4
Guarantee	...	...	...	...	...	Inside back cover
Ignition Coils	...	...	...	...	...	7
Ignition Timing	...	...	...	...	...	6
Lighting Set	...	...	...	...	...	12
Lubrication	...	...	...	...	...	3
Overhauling	...	...	...	...	...	14
Reboring	...	...	...	...	...	15
Rectifier	...	...	...	...	...	12
Repairs	...	...	...	...	...	40
Running-in	...	...	...	...	...	4
Self Starter	...	...	...	...	...	7
Starting	...	...	...	...	...	4
Stopping	...	...	...	...	...	4
Terms of Business	...	...	...	...	...	39
Tracing Troubles	...	...	...	...	...	13
Spare Parts List						
Alternative and Additional Components	...	...	...	...	...	35, 36
Armature Plate and Flywheel	...	...	...	...	...	29
Carburetter	...	...	...	...	...	33
Carburetter Cover and Air Filter	...	...	...	...	...	30
Clutch	...	...	...	...	...	34
Contact Breaker	...	...	...	...	...	29
Engine	...	...	...	...	...	19, 22
Gearbox	...	...	...	...	...	23, 25
Ignition Coil	...	...	...	...	...	31
Lighting Set	...	...	...	...	...	37
Pistons and Crankshaft	...	...	...	...	...	27
Speedometer Drive	...	...	...	...	...	31
Tools, etc.	...	...	...	...	...	22
Illustrations						Fig. No. Page
Armature Plate and Flywheel Group	...	...	...	9	...	28
Carburetter	...	...	...	14	...	32
Carburetter Cover and Air Filter Group	...	...	...	11	...	30
Carburetter, (Sectional)	...	...	...	4, 5	...	9, 10
Clutch Group	...	...	...	15	...	34
Clutch, Push Rod Adjustment	...	...	...	2	...	5
Contact Breaker Group	...	...	...	10	...	28
Contact Breaker (Sectional)	...	...	...	3	...	6
Engine Group	...	...	...	6	...	20, 21
Gearbox Group	...	...	...	7	...	24
Ignition Coil	...	...	...	12	...	30
Lubrication Diagram	...	...	...	1	...	3
Piston and Crankshaft Group	...	...	...	8	...	26
Speedometer Drive Group	...	...	...	13	...	31
Wiring Diagram	...	...	...	16	...	38



MK. 2T **FOUR-SPEED** **ENGINE** **GEAR** **UNIT**

THE VILLIERS ENGINEERING COMPANY LTD.

Marston Road, - - - - - Wolverhampton

TELEPHONES:—22399 (20 lines).
 CODE:—BENTLEY'S.

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 WOLVERHAMPTON.

MARK 2T ENGINE-GEAR UNIT

TECHNICAL DATA



Bore	50 m.m.=1.970"
Stroke	63½ m.m.=2.50"
Capacity	250 c.c.
Compression ratio	8.2: 1
Maximum power output	15 b.h.p. at 5,500 r.p.m.
Engine sprocket	20 teeth x ⅜" pitch
Clutch sprocket	43 teeth x ⅜" pitch
Primary drive ratio	2.15: 1
Gearbox ratios—standard	1: 1, 1.325: 1, 1.9: 1, 3.06: 1
„ „ —wide	1: 1, 1.457: 1, 2.1: 1, 3.75: 1
Final drive sprocket	18 tooth, ½" pitch for .305" wide chain
Final drive chainline	2⅞"
Exhaust pipe diameter	1½" outside diameter
Carburetter	Villiers Type S.22/2
Carburetter taper needle	No. 3½ set in 3rd groove from top
Throttle (carburetter)	No. 3
Sparking plug	Lodge H.H.14
Sparking plug gap .. .. .	.018"/.025"
Ignition timing	⅜" before top dead centre
Contact breaker point gap .. .. .	.012"/.015"
Lubrication, Engine	Petrol 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 $\frac{1}{2}$ -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 capacity of the gearbox is approximately 1.2 pints and the oil level should be maintained to the notch cut in the dipstick. The oil 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.

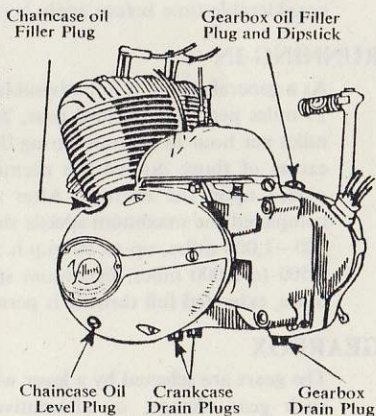


Fig. 1

IMPORTANT

Do not run engine with battery disconnected, otherwise the rectifier will be damaged. (See page 12 for details).

STARTING

When cold. Turn the petrol tap and ignition switch to the " ON " position and flood the carburetter by depressing the tickler on the right-hand side of the carburetter cover. Close the strangler by the means provided in order to obtain a rich mixture. 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 plugs may be fouled, and should this be the case, it will be advisable to remove the drain plugs situated at the bottom of the crankcase, (see Fig. 1). Whilst the sparking plugs are removed rotate the engine to clear the cylinders and crankcase of excess mixture. If this procedure still fails to effect a start, the fuel supply and ignition circuits and connections should be carefully checked.

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 to 1,500 miles, up to 60 m.p.h.; 1,500 to 2,000 miles, maximum speeds for short bursts only, after 2,000 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 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.

The Mark 2T/SFR and SR Engines can be started in either direction, but it is essential that the first gear position only be used when the engine is running in the " REVERSE " direction.

CLUTCH AND PRIMARY DRIVE

The drive from the engine to the multi-plate clutch is by a pre-stretched endless roller chain running in the oil bath chaincase. No attention is necessary beyond that of lubrication and occasional adjustment of the push rod and clutch lever. Whilst the clutch is engaged, i.e. driving, there must be clearance between the end of the push rod and the clutch lever. An adjuster having a slotted end is provided for clutch lever adjustment, and this can be reached with a screwdriver through a hole in the right-hand cover. The adjuster screw should be positioned until there is $\frac{1}{16}$ " free movement between the bottom end of the clutch lever and the right-hand cover. The clutch control cable adjuster should then be positioned to permit the inner cable to move freely over at least $\frac{1}{8}$ ". It is most important that there is no end pressure on the push rod whilst the clutch is engaged.

Adjustment of Clutch push rod (See Fig. 2)

In order to maintain satisfactory operation of the clutch, it is necessary for the effective length of the push rods to remain within certain limits. This adjustment is carried out by means of the adjuster situated in the centre of the clutch cap nut. When carrying out this adjustment, 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. The correct setting is for the push rod to protrude $\frac{5}{16}$ " and the adjusting screw in the clutch cap nut should be turned until this setting is obtained. It is most important that the adjuster screw lock nut is securely tightened after carrying out any adjustments. Under normal conditions of running adjustment of the push rods should not be necessary unless new push

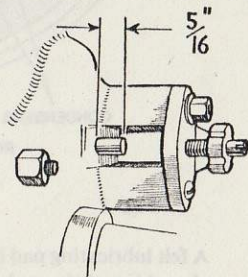


Fig. 2

rods and/or clutch components have been fitted, but it is recommended that the push rod setting be checked at the time of changing the oil in the chaincase as the push rod adjusting screw is then readily accessible. After adjusting the push-rods the clutch lever and cable should be checked for freedom of movement.

Do not slip the clutch when in motion, except when getting away 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 engage the clutch.

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 breakers. A wiring diagram of the complete installation is given on page 38, and from this it will be noted that two ignition coils and a selenium rectifier, together with battery and lighting set complete the electrical equipment.

IGNITION TIMING

Two completely separate ignition circuits are used, each being energised by one of the coils on the armature plate. The contact breaker assemblies are mounted on separate base plates, and each can be rotated round the centre line of the ignition cam, thus giving independent timing of each cylinder.

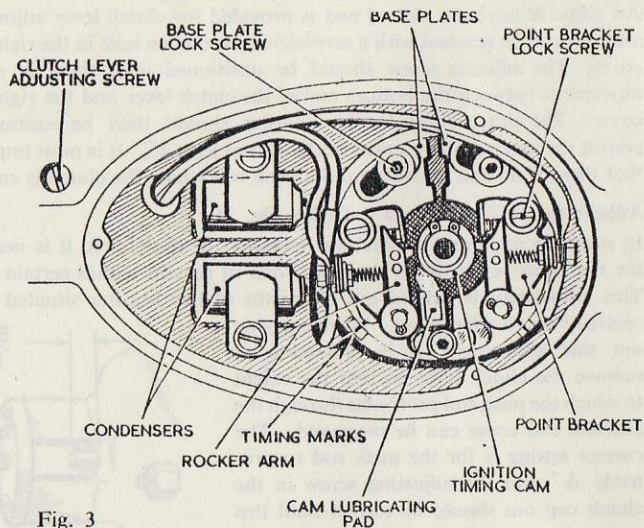


Fig. 3

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 to ensure silent operation of the contact breakers and to reduce the wear on the fibre heel of the rocker arms.

Reference to fig 3 will show the three socket headed screws which lock the contact breaker base plates 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 gaps at .012"/.015". Adjustment of the gap is carried out as follows:—

Rotate the engine until the left-hand contact breaker is in the fully open position, i.e. with the left-hand (drive side) 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. Repeat the operation with the right-hand contact breaker (with the right hand, magneto side, piston in the top dead centre position).

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 left-hand piston is positioned $\frac{1}{16}$ " before top dead centre, and then release the bottom socket headed screw and the screw securing the left-hand contact breaker bracket. Rotate the bracket until the contact breaker points are just opening. Lock the base plate fixing screw, rotate the engine until the right-hand piston is $\frac{1}{16}$ " before top dead centre, and adjust the right-hand contact breaker base plate until the contact breaker points commence to open. After re-checking the timing of each cylinder, tighten the bottom socket headed screw and check that the other two screws are securely tightened. To accurately check the piston position, both cylinder heads should be removed.

IGNITION COILS

Each ignition coil is mounted in a moulded case with external screwed connections, and no attempt should be made to dismantle these assemblies. 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 coils 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 circuits.

ENGINES WITH SELF-STARTER

The letter 'S' in the engine mark indicates that the unit is fitted with self starting equipment. For details and spare parts list, reference should be made to the separate booklet issued with each engine. Additional or alternative components in the engine are listed on pages 35 and 36.

In the contact breaker fitted to this equipment the base plate is in one piece, and no adjustment between the rocker arms is possible. Therefore, when the ignition timing of one cylinder is set, the other is timed automatically. When fitting a new rocker arm, ensure that the "heel" is well "bedded in," i.e. is in contact with the cam over the whole width of the heel.

See also page 15.

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 petrol 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 two dowels and press forward so that the face makes contact with the crankcase when the knurled screw is tightened.

CARBURETTER

The carburetter is the Villiers Type S.22/2 fitted to a detachable inlet pipe connecting the inlet ports of the two separate cylinder castings. 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, slotted to engage in a spring clip attached to 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 bottom of the float chamber, 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. Both the fuel needle and bush are 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 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 Figs. 4 & 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 the 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 carburettor 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 "progression" 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.

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 carburettor body S. When the throttle slide is shut, these

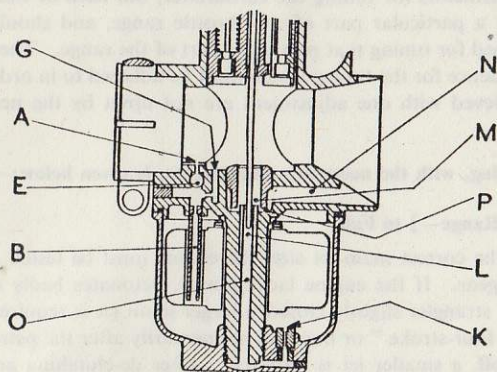


Fig. 4

two line up and air can flow from the front of the carburettor 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 carburettor along passage N, and which enters the centre-piece O through four small holes P. The rich petrol-air mixture then flows from the pre-mixing chamber into the main mixing chamber, where

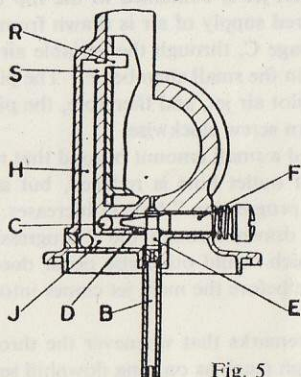


Fig. 5

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 fixed to the slide), 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 carburettor it is essential that the engine is in good mechanical condition. This means that there should be no 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 carburettor is clean internally, and that the air filter is not obstructed.

There are three adjustments for tuning the carburettor, 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 engaging the spring retaining clip in a lower numbered slot and to richen the mixture raise the needle by engaging the clip in a higher numbered slot (see Fig. 14). 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

The retaining spring should be moved to one side after which the taper needle can be lifted upwards and out of the throttle.

TO CHANGE THE FUEL NEEDLE

To obtain access to the fuel needle remove the carburetter float cup, which, incidentally, contains the main jet screwed into the bottom. The fuel needle lever, located in the body, is retained by a pivot pin, the removal of which will release the lever and allow the fuel needle to be taken from its bush, (which also can be extracted by unscrewing should wear make replacement necessary). Fuel needle lever setting is illustrated in Fig. 14.

TO REASSEMBLE CARBURETTER

Clean the various components making sure that the tickler vent hole is clear, and that the main jet is screwed tightly into the float chamber. Replace float and check that float chamber seating ring is properly located in the recess in the carburetter body. Screw float cup 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 hard 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.

LIGHTING SET

The Villiers lighting set supplied for use in conjunction with this engine accommodates the lighting switch, ammeter and speedometer within the headlamp shell, and two lighting coils in the flywheel magneto supply the current for operation of the lights and battery charging. A copy of the Wiring Diagram relative to this lighting set will be found on page 38.

The output of the magneto lighting coils is converted to direct current by means of a selenium rectifier. With the switch in the "OFF" or "L" position only one lighting coil is operative, thus providing a charge to the battery, which is sufficient to more than balance the consumption of the headlamp pilot, tail and speedometer bulbs. The "H" position of the switch brings into circuit the other lighting coil, which is connected in parallel, thus providing the full output of the magneto. The bulbs used in conjunction with this lighting set are listed on page 37.

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.

In order to preserve the tropical sealing of the rectifier, the centre bolt must not be turned, loosened, or disturbed in any way.

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.

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 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 plugs 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 cylinders 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. Twice every revolution a definite resistance should be felt by the air being compressed in the cylinder head.

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 on pages 16, 17 and 18.

Having made sure that the ignition is switched "ON," there is "petrol" 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.

Being satisfied that fuel is reaching the carburetter, next unscrew both sparking plugs and with the high tension leads still attached, lay the plugs on the cylinder head. Turn the engine by means of the starter, and if the magneto and high tension leads 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.

OVERHAULING

DECARBONISING

The places where carbon forms most rapidly are the cylinder head, top of piston, exhaust port, and silencer. Carbon deposits on the piston and cylinder head will reduce the compression space, eventually causing pre-ignition and rough running, whilst heavy deposits in the exhaust pipe and silencer will cause "back pressure" resulting in loss of power, overheating, and high fuel consumption.

In order to maintain engine efficiency, it is advisable to remove carbon from cylinder heads and piston crowns after every 5,000 miles, or when engine becomes sluggish and loses power. Before commencing to decarbonise, remove sparking plugs from the cylinder heads. The exhaust pipe nuts should also be unscrewed, and the silencers and exhaust pipes removed. Unscrew the eight nuts on cylinder head fixing bolts and lift the two heads clear of the cylinders.

Scrape all deposit from the inside of the heads, taking care not to damage the joint faces. With each piston at the top of its stroke, remove all carbon. Wipe off any loose particles from around the edges of the piston, and after turning the crankshaft so that each piston in turn is at the bottom of its stroke scrape out any carbon from exhaust stubs and from the edges of the ports in the cylinder bore. The latter operation is best done from the outside of the cylinder, care being taken to avoid scratching the cylinder bore; a piece of soft cloth placed in the cylinder will help to prevent this, and also stop any particles of carbon from falling through transfer passages. Make sure that all loose carbon is removed before assembling, and that the fins of the cylinders are clean. The gaskets fitted between the cylinder heads and barrels may not be damaged, but it is advisable to renew them.

It should not be necessary to remove cylinders in under 10,000 miles, but when doing so each should be taken off separately whilst the piston is in its lowest position.

To remove a piston from its connecting rod, a pair of thin nosed pliers should be used to take out a spring circlip which will allow the gudgeon pin to be pushed clear of the small end bush. 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. Each piston is marked "front" so that it may be re-fitted in its original position, and care should be taken to fit to original cylinder.

Carbon will also form in the grooves behind the piston rings, and to remove this deposit the rings must be sprung off; care being taken to place them in such a position that they may be replaced on the piston in their original groove. The expander ring, which will be found behind the lower ring and

fitted to prevent noise due to "piston slap" whilst the engine is cold, will also have to be cleaned. In time the expander ring will tend to lose its temper because of the heat, therefore it is advisable when decarbonising to renew this ring

Piston rings should be bright over their whole surface, indicating that they are in complete contact with the cylinder bore. Check the gap between the ends of each ring by placing them in turn inside the cylinder bore and pushing in a short way with the skirt of a piston. Should the gap exceed .030", checked by feeler gauges, wear is excessive and a new ring should be fitted. When fitting new rings, always check the gap before fitting to the piston. This measurement should be not less than .007", or more than .011".

RE-BORING

After the machine has done a considerable mileage, cylinder bores may become worn, as indicated by a ridge at the top of each bore. The cylinder bore should be checked by means of a dial gauge, and if the measurement is .008" or more larger than the original size, the cylinder should be returned to the works for re-boring and fitting of over-size piston with rings.

When replacing cylinders, fit new base washers to crankcase. Smear cylinder bore and piston surfaces with clean engine oil, and fit cylinder barrel over piston taking care not to twist the cylinder. Ensure that each piston ring is fully compressed in its groove with the ends correctly fitting on the locating pegs as the barrel passes over it. Re-fit cylinder heads with new gaskets in position, and lightly tighten the four nuts on each cylinder.

The inlet pipe should then be fitted, and taking care that the four insulating washers are in position, lightly tighten the four nuts ensuring that the two faces of the inlet port are aligned. Finally, on each cylinder head tighten the four nuts in diagonal rotation to prevent the possibility of cylinder head distortion, followed by the final tightening of the nuts on the inlet pipe.

SELF-STARTER

Important. To ensure maximum service from the self-starter, it is essential to keep the commutator and brushes clean. At intervals not exceeding 5,000 miles running, it is recommended that the armature (rotor) be removed, and the commutator and brushes cleaned. See separate booklet and Villiers Service Bulletin M/C.24 for further details.

This Booklet is not intended to contain full details for carrying out major repairs to your engine. In our opinion, it is inadvisable for the owner to attempt full dismantling since without proper tools and facilities, damage may be caused to parts which are machined and assembled within very fine limits.

If your Unit needs expert attention you will be wise to contact your nearest Dealer, or you may approach us direct. Our fully-equipped Service Department is at your disposal to give you any help that you may need.

FAULT FINDING CHART

Sequence of Testing	Possible Trouble	Remedy
Engine will not start		
Depress tickler on carburettor to check whether fuel is reaching carburettor.	No fuel reaching carburettor. 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 carburettor 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 breakers to coils or condensers.	Clean and dry out.
	Bad contact of pins in connector socket or between leads from contact breakers to coils.	Replace.
	Damaged insulation of leads from connector to energising coils causing short to earth, making coils inoperative.	Rectify.
	Faulty condenser.	Rectify.
	Faulty ignition coil.	Replace.
	Faulty insulating plate.	Replace coil unit.
If above tests are satisfactory, but engine will not start.	Mixture may be too rich due to use of strangler, or incorrect setting of taper needle.	Replace.
	Air leaks at carburettor stub or inlet pipe joint, causing weak mixture. Incorrect ignition timing.	Open throttle wide and depress kickstarter several times to clear engine of petrol. Adjust taper needle. Drain crankcase.
		Correct.
		Check, following instructions given.

FAULT FINDING CHART—*continued*

Sequence of Testing	Possible Trouble	Remedy
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 fitting spring clip into a higher slot.
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 carburettor.	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. Un-suitable sparking plugs.	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 (See also page 3).
	Excessive carbon deposit on piston crowns and cylinder heads.	Decarbonise.
	Exhaust system choked with carbon.	Clean out silencer and exhaust pipes.
	Incorrect carburettor setting.	Check and adjust.
	Air filter choked.	Clean. See instructions on air filter.
	Obstruction in fuel supply.	Clean out tap, fuel pipe and filters.
	Incorrect ignition timing.	Check and adjust.
	Brakes binding	Adjust.
	Driving chains too tight.	Adjust.

FAULT FINDING CHART—*continued*

Sequence of Testing	Possible Trouble	Remedy
Engine will not run slowly	Weak mixture due to air leaks at carburettor 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 7.
Engine suddenly stops firing	Sparking plug leads 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. leads.	Dry out.

See separate booklet for fault finding on Self-Starter equipment.

★ Where engines are built to machine manufacturers' 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.

★ Insist on

GENUINE

Villiers SPARES

SPARE PARTS LIST

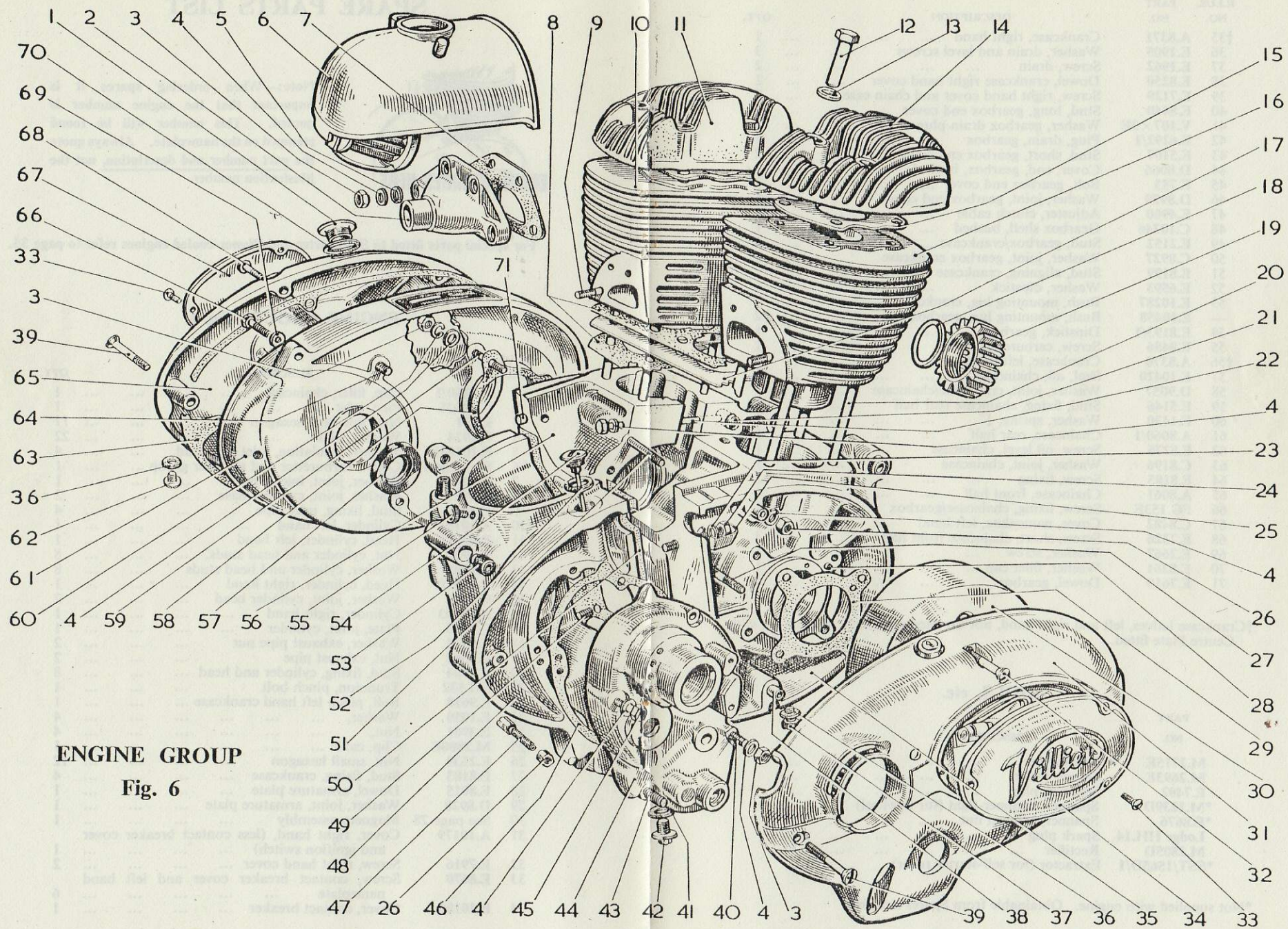


Note:—When ordering spares it is important that the engine number is quoted. This number will be found stamped on the nameplate. Always quote the part number and description, not the illustration number.

For special parts fitted to Self-starter and Blower-cooled engines refer to page 35.

ENGINE GROUP Fig. 6

ILLUS. NO.	PART NO.	DESCRIPTION	QTY.
1	E.8260/1	Cap, filler, chaincase	1
2	C.10035	Pipe, inlet	1
3	E.401	Nut, standard hexagon	11
4	E.2924	Washer, plain	22
5	E.10104/1	Washer, insulating, inlet pipe stud	4
6	See page 12	Cover, carburetter and air filter group	1
7	E.9974	Washer, joint, inlet pipe	1
8	D.9973	Washer, joint, cylinder base	2
9	E.4011	Stud, fixing, inlet pipe	4
10	A.10102	Cylinder, left hand	1
11	B.9291/1	Head, cylinder, left hand	1
12	E.9983	Nut, cylinder and head studs.	8
13	E.9985	Washer, cylinder and head studs	8
14	B.9292/1	Head, cylinder, right hand	1
15	C.9899	Washer, joint, cylinder head	2
16	A.10103	Cylinder, right hand	1
17	C.9733	Plate, joint, cylinder	1
18	E.5578	Washer, exhaust pipe nut	2
19	E.8564	Nut, exhaust pipe	2
20	E.9984	Stud, fixing, cylinder and head	8
21	EG.532	Trunnion, pinch bolt	1
22	E.9618	Bolt, pinch left hand crankcase	1
23	E.1050	Washer,	4
24	E.3961	Nut,	4
25	M.2800E	Clip, cable	1
26	E.2539	Nut, small hexagon	12
27	E.8183	Stud, fixing, crankcase	4
28	E.8015	Dowel, armature plate	1
29	D.8928	Washer, joint, armature plate	1
30	See page 28	Magneto assembly	1
31	A.10179	Cover, right hand, (less contact breaker cover and ignition switch)	1
32	E.7916	Screw, right hand cover	2
33	E.8670	Screw, contact breaker cover and left hand nameplate	6
34	B.10180	Cover, contact breaker	1



ENGINE GROUP

Fig. 6

ILLUS. NO.	PART NO.	DESCRIPTION	QTY.
†35	A.8371	Crankcase, right hand	1
36	E.1905	Washer, drain and level screws	3
37	E.1962	Screw, drain	2
38	E.8250	Dowel, crankcase right hand cover	2
39	E.7129	Screw, right hand cover and chain case	2
40	E.8440	Stud, long, gearbox end cover	2
41	V.107 × 3E	Washer, gearbox drain plug	1
42	E.6292/1	Plug, drain, gearbox	1
43	E.5107	Stud, short, gearbox end cover	2
44	D.8066	Cover, end, gearbox, bushed	1
45	E.783	Bolt, gearbox end cover	2
46	D.8929	Washer, joint, gearbox end cover	1
47	E.4900	Adjuster, clutch cable	1
48	C.10246	Gearbox shell, bushed	1
49	E.2152	Stud, gearbox/crankcase	4
50	C.8927	Washer, joint, gearbox crankcase	1
51	E.8199	Stud, aligning, crankcase	2
52	E.6593	Washer, dipstick	1
53	E.10287	Bush, mounting lug, crankcase	4
—	E.10458	Bush, mounting lug, gearbox	2
54	E.8193/1	Dipstick, gearbox	1
55	E.8456	Screw, carburettor cover	1
†56	A.8370	Crankcase, left hand	1
57	E.10420	Seal, oil, chaincase	1
58	D.9057	Washer, joint, crankcase/chaincase	1
59	E.5146	Stud, fixing, chaincase rear half	3
60	E.1430	Washer, spring, ½"	3
61	A.8060/1	Chaincase, rear half	1
62	E.8275	Screw, oil level, chaincase	1
63	C.8196	Washer, joint, chaincase	1
64	E.8185	Screw, fixing	2
65	A.8061	Chaincase, front half	1
66	FG.153E	Screw, fixing, chaincase/gearbox	1
67	C.8482	Cover, nameplate, left hand	1
68	E.7326	Screw, short, chaincase front half	4
69	E.2667	Washer, screw	1
70	E.8261	Washer, filler cap	1
71	E.7619	Dowel, gearbox	4

†Crankcase halves, left and right hand, not supplied separately but as a set with Centre Plate fitted.

TOOLS, etc.

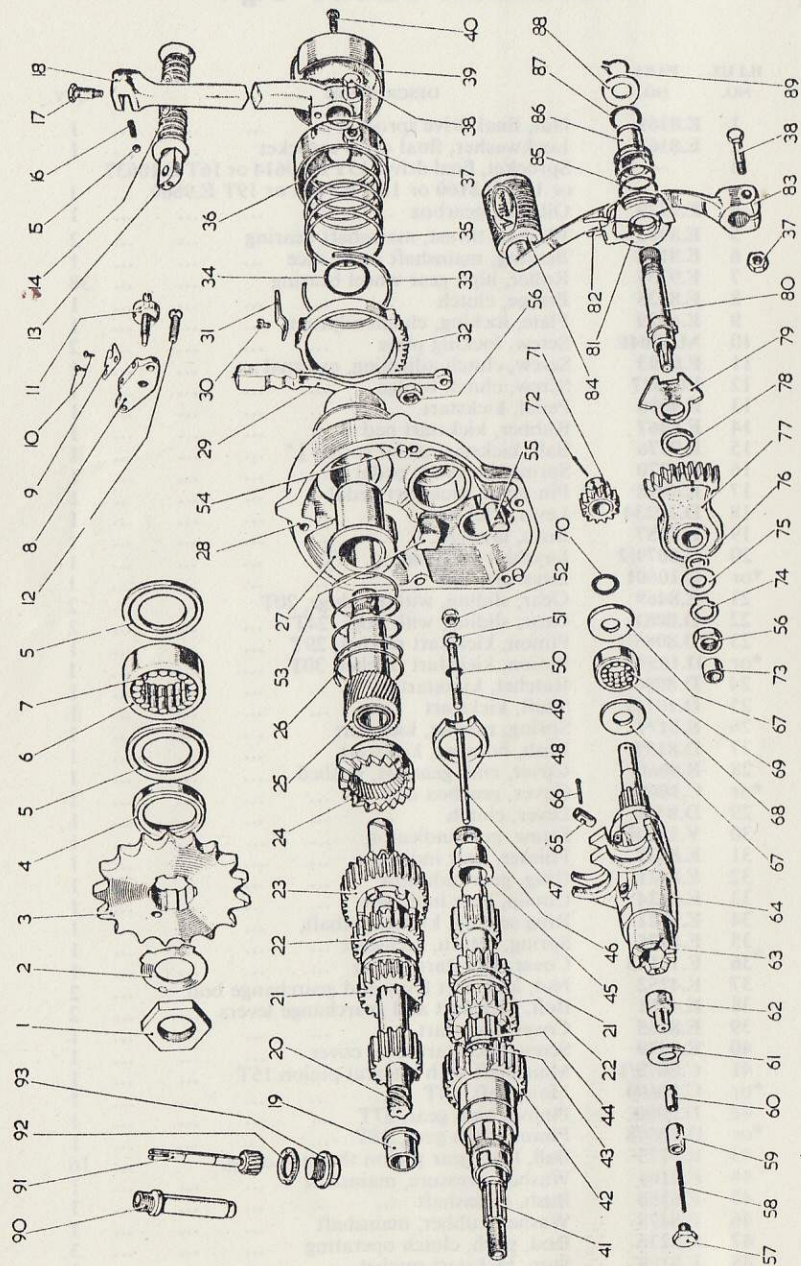
PART NO.	DESCRIPTION
M.2715E	Screwdriver
M.2693E	Gauge, feeler
E.7402	Spanner, plug
*M.1239D	Spanner, hammer-tight (for flywheel)
*E.8676	Spanner, exhaust nut
Lodge HH.14	Spark plug
M.2805D	Rectifier
*SST/1565D/1	Extractor (for self-starter rotor)

*Not supplied with engine. Obtainable from Spares stockists.

GEARBOX GROUP Fig 7

ILL US. NO.	PART NO.	DESCRIPTION	QTY.
1	E.8161	Nut, final drive sprocket	1
2	E.8162	Lockwasher, final drive sprocket	1
3	—	Sprocket, final drive, 15T E.10614 or 16T E.10637 or 17T E.8160 or 18T E.9106 or 19T E.9800	1
4	E.9729	Oil seal, gearbox	1
5	E.8153	Washer, thrust, mainshaft bearing	2
6	E.8152	Bearing, mainshaft outer race	1
7	E.9731	Roller, high gear wheel bearing	38
8	E.8435	Bridge, clutch	1
9	E.6829	Plate, locking, clutch adjuster	1
10	M.2704E	Screw, locking plate	2
11	E.8503	Screw, clutch adjusting, external	1
12	EG.527	Screw, clutch bridge	1
13	E.4096	Pedal, kickstart	1
14	E.8467	Rubber, kickstart pedal	1
15	E.9776	Ball, kickstart pedal spring $\frac{1}{4}$ "	1
16	E.4270	Spring, kickstart pedal	1
17	E.4098	Pin pivot, kickstart pedal	1
18	D.10234	Lever, kickstart	1
19	E.8157	Bush, layshaft	1
20	C.8079/2	Layshaft with pinion, 17T	1
*or	C.10601	Layshaft, 16T	1
21	E.8469	Gear, sliding, without dogs, 20T	2
22	D.8081	Gear, sliding, with dogs, 24T	2
23	D.8085/1	Pinion, kickstart ratchet, 29T	1
*or	D.10599	Pinion, kickstart ratchet, 30T	1
24	D.8086	Ratchet, kickstart	1
25	D.10112	Shaft, kickstart	1
26	E.8177	Spring, ratchet, kickstart	1
27	D.8159	Bush, housing, kickstart	1
28	B.8066	Cover, end, gearbox, bushed	1
*or	C.10093	Cover, gearbox end	1
29	D.8436	Lever, clutch	1
30	V.1304E	Screw, gear indicator,	1
31	E.8422	Pointer, gear indicator	1
32	E.8421	Ring, gear indicator	1
33	E.8424	Circlip, gear indicator	1
34	E.9721	Ring sealing, kickstart shaft,	1
35	E.8175	Spring, return, kickstart	1
36	E.10123	Cover, kickstart spring	1
37	E.4252	Nut, kickstart lever and gearchange bolt	2
38	E.4251	Bolt, kickstart and gearchange levers	2
39	E.8265	Cover, kickstart	1
40	E.8479	Screw, kickstart lever cover	1
41	C.8078/1	Mainshaft with integral pinion 15T	1
*or	C.10600	Mainshaft, 14T	1
42	D.8080	Pinion, high gear, 27T	1
*or	D.10598	Pinion, high gear, 28T	1
43	E.9775	Ball, high gear pinion thrust race, $\frac{3}{16}$ "	16
44	E.8101	Washer, pressure, mainshaft	1
45	E.8158	Bush, mainshaft	1
46	E.8478	Washer, rubber, mainshaft	1
47	E.8236	Rod, push, clutch operating	3
48	E.8100	Stop, kickstart ratchet	1
49	E.8624	Stud, kickstart stop and clutch bridge	1

(continued on page 25)



GEARBOX GROUP Fig. 7

GEARBOX (continued from page 23)

ILLUS. NO.	PART NO.	DESCRIPTION	QTY.
50	E.9789	Washer, sealing	1
51	E.1430	Washer, kickstart stop stud	1
52	E.2539	Nut, kickstart stop stud	1
53	E.8198	Stop, gearchange return spring	1
54	E.7619	Dowel, end cover	2
55	E.6545	Pin, stop	1
56	E.6627	Nut, spring stop and operating spindle	2
57	E.8537	Plug, end, plunger	1
58	E.8783	Spring, plunger	1
59	E.8540	Bush, plunger	1
60	E.8539	Plunger, cam barrel	1
61	E.8097	Washer, thrust, cam barrel	1
62	E.8096	Pin, bearing, cam barrel	1
63	C.8089	Cam barrel	1
*or	E.10499	Cam, barrel	1
64	C.8090	Fork, sliding gear	2
*or	E.10716	Fork, sliding gear	2
65	E.9247	Peg, guide, sliding gear fork	2
66	E.8393	Pin, split, sliding gear fork peg	2
67	E.8155	Washer, thrust, cam bearing	2
68	E.8154	Bearing, outer race	1
69	E.9777	Roller, cam barrel bearing, $\frac{3}{16}$ " x $\frac{1}{16}$ "	24
70	E.9257	Seal, cam barrel	1
71	E.8423	Pinion, cam barrel, (gear indicator)	1
72	E.9734	Pin, split, gear indicator pinion, $1\frac{1}{8}$ " x $\frac{3}{32}$ "	1
73	E.6595	Bush, operating spindle, gearbox body	1
74	E.6544	Lockwasher, operating spindle	1
75	E.6573	Washer, operating spindle	1
76	E.7228	Shim, operating spindle	As required
77	C.8099	Quadrant, gear operating	1
78	E.6542	Distance piece	1
79	D.9444	Plate, operating spindle	1
80	D.6536	Spindle, gear operating	1
81	D.6539	Pawl, operating	1
82	E.7437	Spring, operating, pawl	1
83	D.9175	Lever, gear change	1
84	D.6861	Rubber, gear change lever	1
85	E.6543	Spring, ratchet, gear lever	1
86	E.6537/1	Bush, operating spindle, gearbox end plate	1
87	E.8776	Seal, operating spindle	1
88	E.4150	Washer, operating spindle	1
89	E.6552	Circlip, operating spindle	1
90	E.8171	Bush, speedometer drive	1
91	E.8621	Worm wheel, speedometer drive	1
92	E.8195	Washer, speedometer drive	1
93	E.8172	Plug, speedometer housing	1

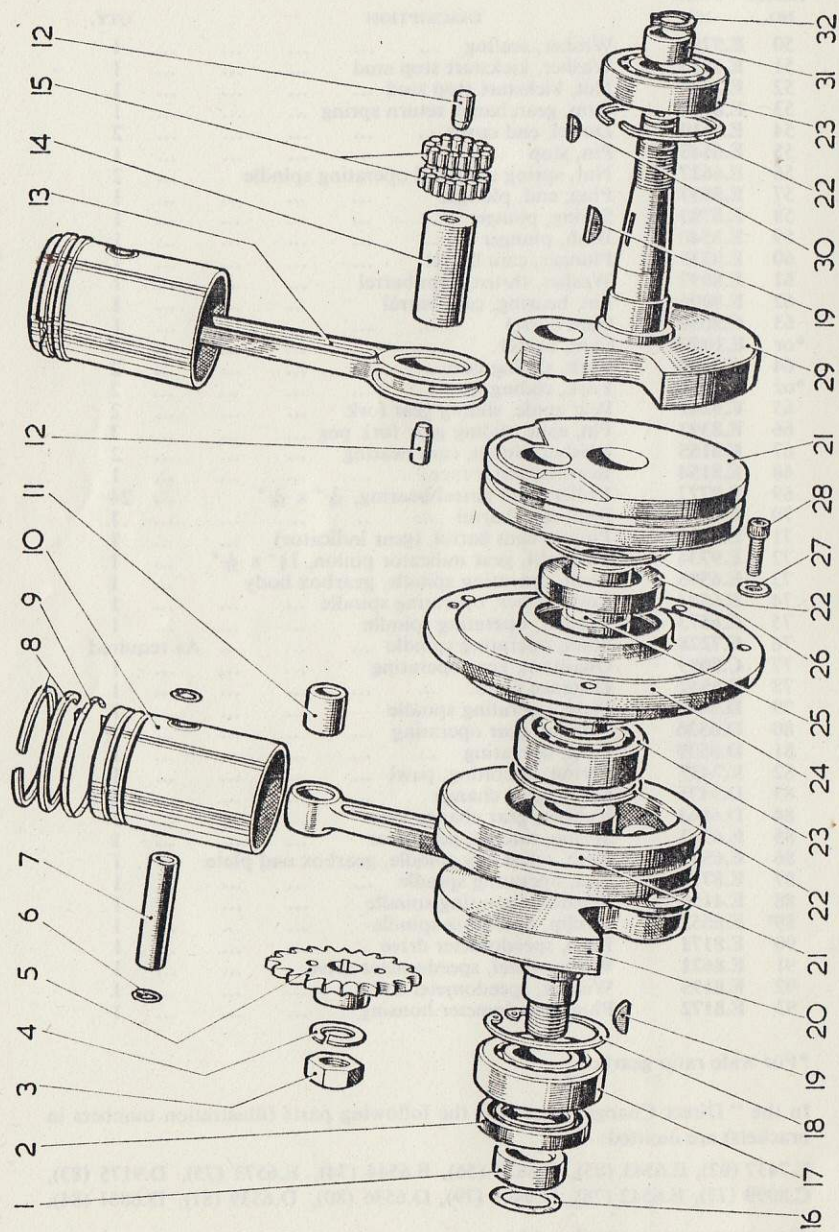
*For wide ratio gearbox.

In the "Direct Change" gearbox, the following parts (illustration numbers in brackets) are omitted:—

E.7437 (82), E.6543 (85), E.6627 (56), E.6544 (74), E.6573 (75), D.9175 (83), C.8099 (77), E.6542 (78), D.9444 (79), D.6536 (80), D.6539 (81), D.6861 (84).

The above parts are replaced by:—

D.7577/E.10489 Gear operating assembly. D.7807 Gear change lever.



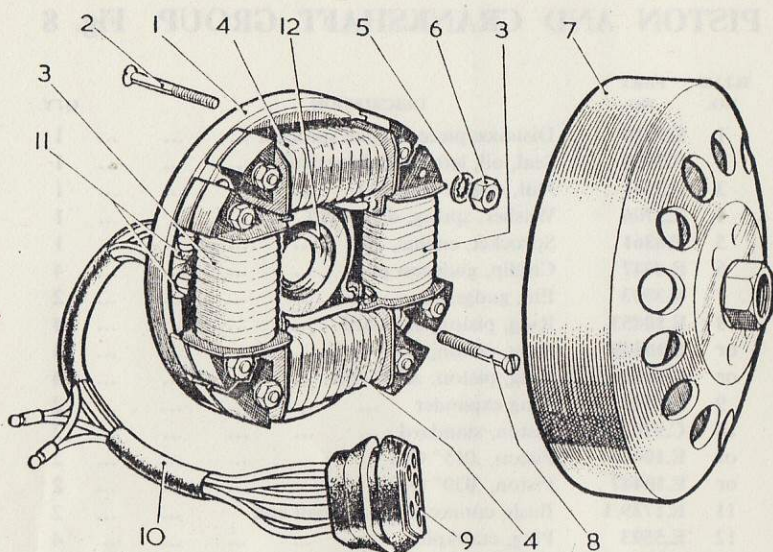
PISTON AND CRANKSHAFT GROUP Fig. 8

PISTON AND CRANKSHAFT GROUP Fig. 8

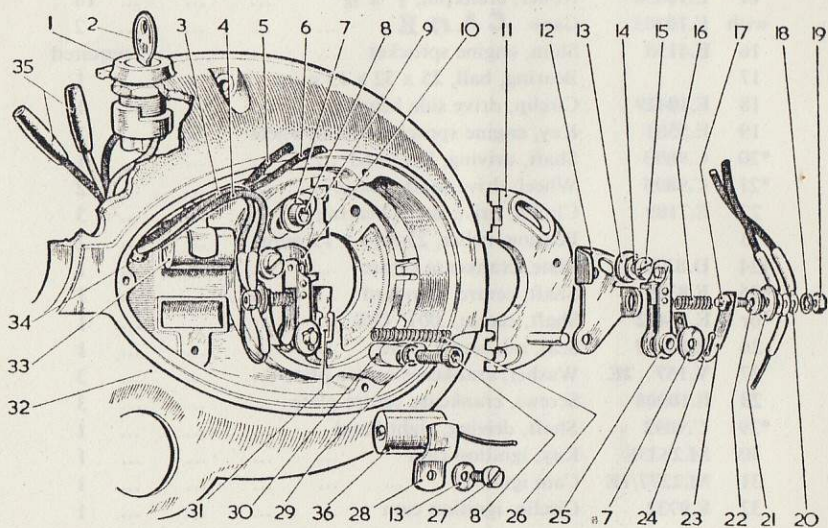
ILLUS NO.	PART NO.	DESCRIPTION	QTY.
1	E.9310	Distance piece, engine sprocket ...	1
2	E.7928	Seal, oil, left hand driveshaft ...	1
3	E.3931	Nut, engine sprocket ...	1
4	E.5706	Washer, spring, driveshaft ...	1
5	E.8361	Sprocket, engine, 20T ...	1
6	E.4047	Circlip, gudgeon pin ...	4
7	E.3903	Pin, gudgeon ...	2
8	E.10453	Ring, piston, standard ...	4
or	E.10448	Ring, piston, .015" O/S ...	4
or	E.10449	Ring, piston, .030" O/S ...	4
9	E.8249	Ring expander ...	2
10	C.9767	Piston, standard ...	2
or	E.10446	Piston, .015" O/S ...	2
or	E.10447	Piston, .030" O/S ...	2
11	E.1729/1	Bush, connecting rod small end ...	2
12	E.5593	Plug, crankpin ...	4
*13	E.8368	Connecting rod with bush ...	2
or	E.10450	Connecting rod .001" O/S ...	
*14	E.8400	Crankpin, standard ...	2
or	E.10451	Crankpin, .001" O/S ...	2
15	E.9731	Roller, crankpin, $\frac{1}{4}$ " x $\frac{1}{4}$ " ...	52
or	E.10658	Roller, crankpin, $\frac{1}{4}$ " x $\frac{5}{16}$ " ...	18
with	E.10383	Cam C.A.B.E. ...	2
16	E.4150	Shim, engine sprocket ...	As required
17		Bearing, ball, 25 x 52 x 15 m/m ...	1
18	E.10419	Circlip, drive side bearing ...	1
19	E.5581	Key, engine sprocket and flywheel ...	2
*20	C.9893	Shaft, driving, left hand ...	1
*21	C.9895	Wheel, drive shaft, centre ...	2
22	E.7189	Circlip, drive shaft, bearing ...	3
23		Bearing, roller, 25 x 52 x 15 m/m ...	2
†24	D.8377	Plate, crankcase centre ...	1
*25	E.8399	Shaft, centre, standard ...	1
or	E.10452	Shaft, centre, .001" O/S ...	1
26	E.10297	Seal, oil, centre plate ...	1
27	V.157 x 2E	Washer, crankcase centre plate ...	3
28	E.10008	Screws, crankcase centre plate ...	3
*29	C.9892	Shaft, driving, right hand ...	1
30	M.2333E	Key, ignition cam ...	1
31	M.2277/1E	Cam ignition ...	1
32	E.9732	Circlip, ignition cam ...	1

†The centre plate is not supplied separately as it must be paired with the crankcase.

*Standard size connecting rod, crankpin and centre shaft must only be used with new drive shafts and wheels.



ARMATURE PLATE AND FLYWHEEL GROUP Fig. 9



CONTACT BREAKER GROUP Fig. 10

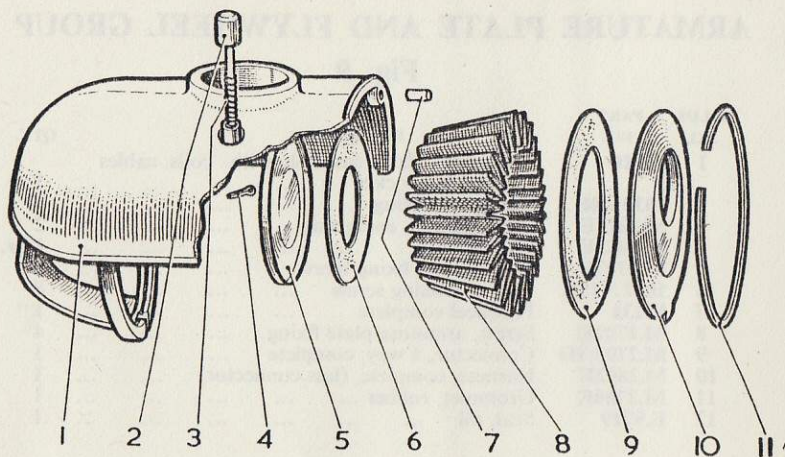
ARMATURE PLATE AND FLYWHEEL GROUP

Fig. 9

ILLUS. NO.	PART NO.	DESCRIPTION	QTY.
1	A.141	Armature plate assembly with coils, cables and 6 pin socket	1
2	1030 × 8E	Screw, coil fixing	8
3	M.2821E	Coil, ignition, energising	2
4	M.2822E	Coil, lighting	1 pr.
5	M.2707E	Washer, coil fixing screw	8
6	1002 × 15E	Nut, coil fixing screw	8
7	R.138	Flywheel complete	1
8	M.1702E	Screw, armature plate fixing	4
9	M.2793/1D	Connector, 6 way, complete	1
10	M.2892E	Harness, complete, (less connector)	1
11	M.2788E	Grommet, rubber	1
12	E.9719	Seal, oil	1

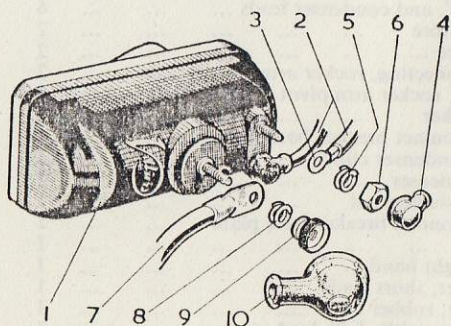
CONTACT BREAKER GROUP Fig. 10

ILLUS. NO.	PART NO.	DESCRIPTION	QTY.
1	M.2740E	Switch ignition with two keys	1
2	Quote Engine	Key, ignition switch (two per set)	1 set
3	M.2891E	Lead, rocker left hand/switch (green)	1
4	M.2891E/1	Lead, rocker left hand/connector (green)	1
5	M.2891E/2	Lead, rocker right hand/switch (blue)	1
6	M.2891E/3	Lead, rocker right hand/connector (blue)	1
7	E.5257	Washer, rocker arm pivot pin and contact breaker base plate	4
8	E.10418	Screw, contact breaker base plate	3
9	M.2795D	Plate, base, left hand	1
10	M.2293E	Bracket, point, left hand	1
11	M.2794D	Plate, base, right hand	1
12	M.2118E	Bracket, point, right hand	1
13	M.1802E	Washer, point bracket and condenser screw	4
14	1113 × 5E	Washer, point bracket screw	2
15	M.1801E	Screw, fixing point bracket	2
16	1047 × 3	Spring, rocker	2
17	M.2120E	Pin, point bracket	2
18	M.2714E	Washer, shakeproof,	3
19	1113 × 4E	Nut,	2
20	M.2911E	Shoe, L.T. and condenser leads	6
21	M.1805E	Washer, fibre	2
22	M.2138E	Bush, fibre	2
23	M.2365E	Strip, connecting, rocker arm	2
24	V.111 × 2E	Pin, split, rocker arm pivot pin	2
25	M.2141D/1	Arm, rocker	2
26	V.369E	Spring, contact breaker base plate	1
27	V.1304E	Screw, condenser clip	2
28	M.2342E/1	Clip, condenser	2
29	M.2707E	Washer, shakeproof	1
30	M.2797E	Clamp, contact breaker base plate	1
31	M.2859E	Pad, oil	1
32	A.10179	Cover, right hand	1
33	M.2143E	Condenser, short lead	1
34	M.2788E	Grommet, rubber	1
35	M.2857E	Connector, cable, L.T. lead	2
36	M.2593E	Condenser, long lead	1



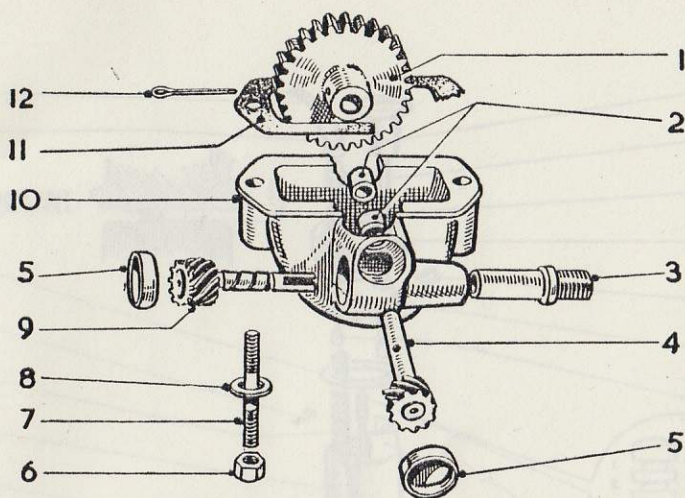
CARBURETTER COVER AND AIR FILTER Fig. 11

ILLUS. NO.	PART NO.	DESCRIPTION	...	QTY.
1	B.10036	Cover	...	1
2	V.912E	Tickler	...	1
3	V.369E	Spring, tickler	...	1
4	V.111 × 2E	Pin, split, tickler	...	1
5	V.1391D	Plate, back	...	1
6	V.1393E	Washer, sealing	...	1
7	E.8015	Dowel	...	2
8	V.1390D	Filter, gauze	...	1
9	V.1394E	Washer, sealing	...	1
10	V.1392E	Plate, front	...	1
11	V.1395D	Circlip	...	1



**IGNITION
COIL GROUP**

Fig. 12



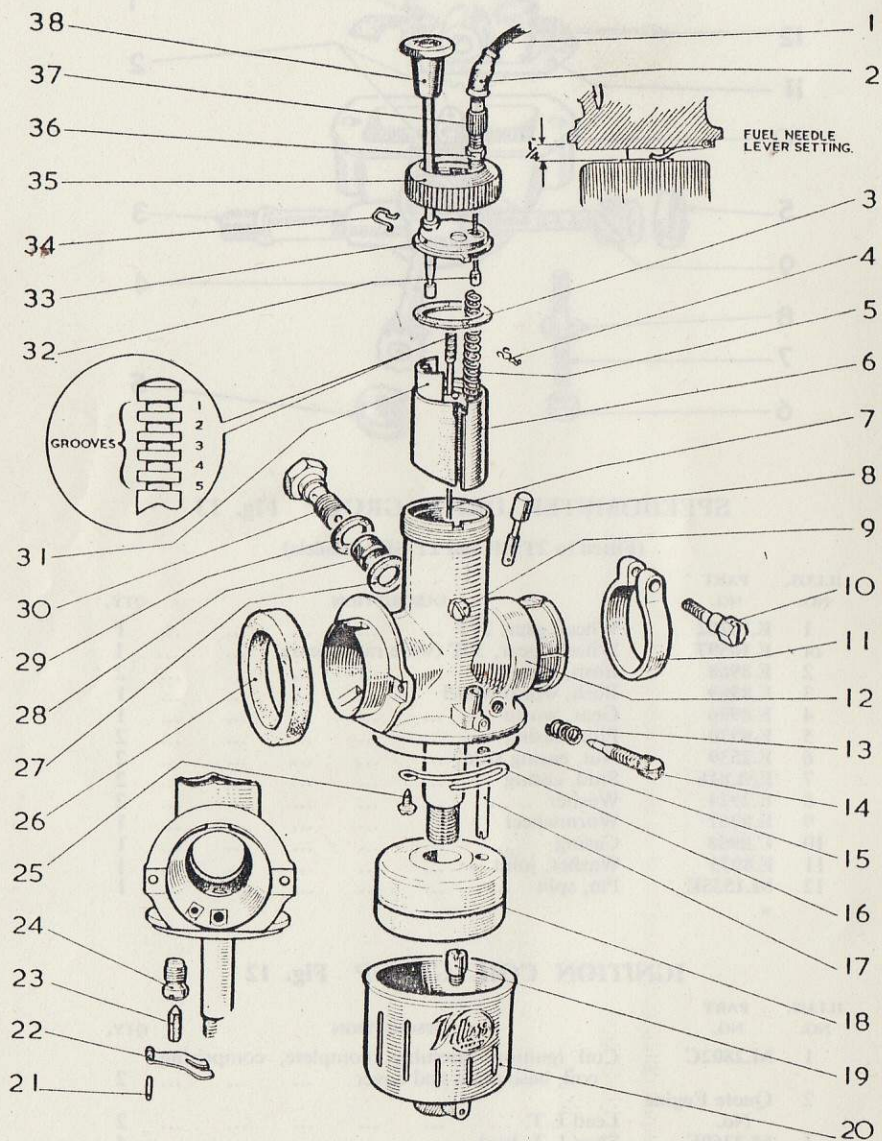
SPEEDOMETER DRIVE GROUP Fig. 13

(Fitted to 2T/SF and 2T/SFR Models)

ILLUS. NO.	PART NO.	DESCRIPTION	QTY.
1	E.10282	Wheel, gear, 29T	1
or	E.10597	Wheel, gear, 30T (wide ratio gears)	1
2	E.8968	Bush, casing	2
3	E.8969	Bush, worm wheel	1
4	E.8966	Gear, worm	1
5	E.8970	Plug, casing	2
6	E.2539	Nut, casing stud	2
7	EM.816	Stud, casing	2
8	E.2924	Washer	2
9	E.8967	Wormwheel	1
10	C.8958	Casing	1
11	E.8973	Washer, joint	1
12	M.1535E	Pin, split	1

IGNITION COIL GROUP Fig. 12

ILLUS. NO.	PART NO.	DESCRIPTION	QTY.
1	M.2802C	Coil ignition assembly, complete, comprising coil, base plate and cover	2
2	Quote Engine No.	Lead L.T.	2
3	M.2369E	Shoe L.T. lead	4
4	M.2710E	Cover L.T. terminal	4
5	V.146 × 2	Washer L.T. terminal	4
6	M.2054E	Nut L.T. terminal	4
7	—	Lead H.T. length as required	2
8	V.146 × 2	Washer H.T. terminal	2
9	1069 × 3	Nut H.T. terminal	2
10	M.2356E	Cover H.T. terminal	2

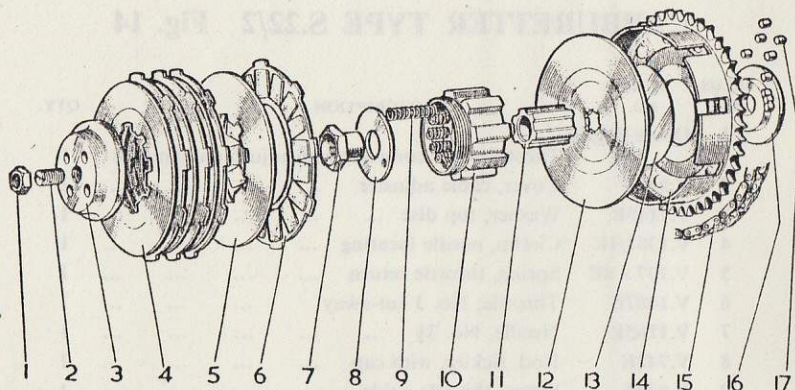


CARBURETTER TYPE S.22/2 Fig. 14

CARBURETTER TYPE S.22/2 Fig. 14

ILLUS. NO.	PART NO.	DESCRIPTION	QTY.
1	Quote Engine No.	Throttle cable complete with adjuster and nipple	1
2	V.826E	Cover, cable adjuster	1
3	V.1145E	Washer, top disc	1
4	V.1301/1E	Circlip, needle locating	1
5	V.107 × 8E	Spring, throttle return	1
6	V.1487E	Throttle, No. 3 cut-away	1
7	V.1265E	Needle, No. 3½	1
8	V.742E	Rod, tickler, with cap	1
9	V.829E	Screw, throttle guide	1
10	V.754E	Screw, body clip	1
11	V.1247E	Clip, carburetter body	1
12	V.1503D	Body, carburetter, complete with diffuser plug and needle jet	1
13	V.749E	Spring, pilot jet needle	1
14	V.775E	Needle, pilot jet	1
15	V.1218E	Washer, float chamber joint	1
16	V.830E	Spring, tickler	1
17	V.717E	Jet, pilot 35 c.c.	1
18	V.1129E	Float	1
19	V.1502E	Jet, main, 170 c.c.	1
20	V.1121D	Chamber, float	1
21	V.1237E	Pin, fuel needle lever hinge	1
22	V.1130E/1	Lever, fuel needle	1
23	V.1179E	Needle, fuel	1
24	V.1180E	Bush, fuel needle	1
25	M.2704E	Screw, tickler spring	1
26	V.797E	Washer, felt, carburetter sealing	1
27	V.383E	Washer, banjo, small hole	1
28	V.404E	Gauze, petrol filter	1
29	H.104 × 8E	Washer, banjo, large hole	1
30	V.382E	Screw, banjo	1
31	V.1264D	Strangler slide	1
32	V.108 × 15E	Nipple, cable, throttle end	1
33	V.1263E	Disc, top	1
34	V.1178E/1	Clip, spring	1
35	V.1120E	Ring, carburetter top	1
36	V.105 × 2E	Nut, cable adjuster	1
37	V.105 × 1E	Adjuster, cable	1
38	V.1422E/25E	Strangler knob and spindle	1
	Quote Engine No. S.22/2 carburetter complete	... ..	1

Note.—See page 36 for parts fitted to S.22/2 carburetter having cable operated strangler slide.



CLUTCH GROUP Fig. 15

ILLUS. NO.	PART NO.	DESCRIPTION	QTY.
1	E.8473	Locknut, internal clutch adjuster screw	1
2	E.8472	Screw, adjuster, internal, with $\frac{3}{16}$ " roller	1
3	E.8359	Nut, cap	1
4	D.8352	Plate, pressure	1
5	D.8462	Plate, intermediate	3
6	E.8348/1	Plate, driving, (bonded facings)	4
7	E.10014	Nut, centre	1
8	E.10015	Washer, springs retaining	1
9	E.9989	Spring	9
10	E.9988	Sleeve, sliding	1
11	E.8354	Hub	1
12	D.8459	Plate, back	1
13	E.9645	Shim for back plate	1
14	E.8347	Chainwheel assembly, 43T	1
15	—	Chain, primary, 60 pitches, 110038	1
16	E.8216/2	Roller, track, chainwheel	1
17	E.9777	Roller for track, $\frac{3}{16}$ " x $\frac{3}{16}$ "	24

ELECTRICAL NEUTRAL GEAR INDICATOR

Where fitted, the following parts are used :—

E.10594	Contact	1
E.10595	Insulator	2
E.10596	Sleeve	2
M.1670E	Screw	2
1113 x 5E	Washer	2
M.2736E	Grommet	1
M.2857E	Connector	1

Additional or Alternative Components required for Mk. 2T/S, Mk. 2T/SR, Mk. 2T/SF and Mk. 2T/SFR Engines

(See separate booklet for self-starter Spare Parts and Operating Instructions).

Mark 2T/S	...	...	Fitted with self-starter equipment.
Mark 2T/SR	...	...	With self-starter for forward and reverse running.
Mark 2T/SF	...	...	With self starter and fan cooling.
Mark 2T/SFR	...	...	With self starter for forward and reverse running, and fan cooling.

DESCRIPTION	2T/S	2T/SR	2T/SF	2T/SFR
Adaptor, oil seal...	—	—	E.9975	E.9975
Attachment, top cowl	—	—	C.10455	C.10455
Barrel, cam	—	D.10499	D.10499	D.10499
Bearing, roller	20x52x15 mm	20x52x15 mm	20x52x15 mm	20x52x15 mm
Bolt, top cowl	—	—	FG.151E (2)	FG.151E (2)
Bush, layshaft, in end cover	E.10094	E.10094	E.10094	E.10094
Crankcase, right hand	C.9972	C.9972	C.9972	C.9972
Cover, gearbox end	E.10460	C.10093	D.10498	D.10498
Cover, contact breaker	D.9563/1	D.9563/1	D.9563/1	D.9563/1
Cowl, top, L/H	—	—	A.10437	A.10437
Cowl, top, R/H	—	—	A.10438	A.10438
Cowl, bottom, L/H	—	—	A.10188	A.10188
Cowl, bottom, R/H	—	—	A.10092	A.10092
Clip, contact breaker lead	—	—	M.2816E	M.2816E
Clip, cable	—	—	M.2743E	M.2743E
Connector, single way	—	—	M.2857E (2)	M.2857E (2)
Chaincase, inner half	—	—	A.10485	A.10485
Cover, R/H, (less contact breaker assembly)	A.10250	D.10559	—	—
Circlip, bearing locating	E.7189 (2)	E.7189 (5)	E.7189 (2)	E.7189 (2)
Disc, cap, layshaft	Z.1009x9	Z.1009x9	Z.1009x9	Z.1009x9
Fan, L/H	—	—	C.10070	C.10070
Fan, R/H	—	—	C.10181	C.10181
Grommet, (rectangular 2 holes)	M.2781E	M.2781E	M.2781E (3)	M.2781E (3)
Grommet, (rectangular 3 holes)	M.2806E	—	—	—
Grommet, (rectangular 5 holes)	—	M.2777E	M.2777E	M.2777E
Grommet, spark plug	—	—	E.10156 (2)	E.10156 (2)
Gearbox, shell, bushed	—	—	C.10483	C.10483
Head, cylinder, L/H	—	—	D.10431	D.10431
Head, cylinder, R/H	—	—	D.10427	D.10427
Key, L/H fan	—	—	E.5581	E.5581
Layshaft	—	—	E.10492	E.10492
Lever, gear change	C.9616	D.7807	D.7807	D.7807
Nut, R/H drive shaft	E.9688	E.9688	E.9688	E.9688
Nut, L/H & R/H cowl bottom stud	—	—	E.401 (3)	E.401 (3)
Nut, regulator box stud	—	—	E.2539E (2)	—
Nut, oil seal adaptor stud	—	—	1002x15E (4)	1002x15E (4)
Plate, L/H cover	—	—	C.10204	C.10204
Plate, R/H cover (less contact breaker assembly)	—	—	C.10231	C.10231

(continued overleaf)

(continued from previous page)

DESCRIPTION	2T/S	2T/SR	2T/SF	2T/SFR
Plate, air baffle ...	—	—	C.10554	C.10554
Seal, oil, L/H bottom cowl	—	—	E.9720	E.9720
Seal, oil, R/H crankcase (in stator) ...	E.9718	E.9718	E.9718	E.9718
Shaft, driving, L/H ...	—	—	C.10252	C.10252
Shaft, driving, R/H ...	C.10253	C.10253	C.10253	C.10253
Sprocket, engine, 20T ...	—	—	E.10475	E.10475
Strip, sealing ...	—	—	D.10510	D.10510
Strip, insulating ...	—	—	M.2744E	M.2744E
Screw, top cowl attachment ...	—	—	M.1228E (2)	M.1228E (2)
Screw, L/H bottom cowl $\frac{13}{16}$ " ...	—	—	E.7326 (3)	E.7326 (3)
Screw, L/H bottom cowl $1\frac{13}{16}$ " ...	—	—	E.8557 (2)	E.8557 (2)
Screw, R/H bottom cowl $\frac{9}{16}$ " ...	—	—	E.7129	E.7129
Screw, R/H fan ...	—	—	E.10002 (4)	E.10002 (4)
Screw, contact breaker cover ...	—	E.9570 (2)	E.9570 (2)	E.9570 (2)
Screw, contact breaker fixing ...	—	M.2739E (2)	M.2739E (2)	M.2739E (2)
Screw, cover plates ...	—	—	E.9333 (6)	E.9333 (6)
Screw, stator fixing ...	—	E.10008 (3)	E.10008 (3)	E.10008 (3)
Screw, ignition coil ...	—	—	E.6561 (4)	E.6561 (4)
Stud, L/H bottom cowl ...	—	—	E.8392	E.8392
Stud, R/H bottom cowl fixing ...	—	—	E.10549 (2)	E.10549 (2)
Stud, clutch bridge and kickstart stop ...	E.392	—	E.392	E.392
Stud, regulator box ...	—	—	Z.1010x6E (2)	—
Stud, oil seal adaptor ...	—	—	E.10589 (4)	E.10589 (4)
Spindle, gear operating and quadrant ...	—	—	D.7577/ E.10489	D.7577/ E.10489
Washer, top cowl bolts ...	—	—	E.2667 (4)	E.3667 (4)
Washer, shakeproof ...	—	E.9722 (3)	E.9722 (4)	E.9722 (4)
Washer, joint, contact breaker cover ...	—	E.9564/1	E.9564/1	E.9564/1
Washer, joint, chaincase	—	—	C.10497	C.10497
Washer, sealing, contact breaker housing ...	—	—	E.10259	E.10259
Washer, front cowl cover	—	—	FG.161E (6)	FG.161E (6)
Washer, ignition coil screw ...	—	—	V.157x2E (4)	V.157x2E (4)
Washer, regulator box stud ...	—	—	E.1430E (2)	—
Washer, oil seal adaptor stud	—	—	E.5257 (4)	E.5257 (4)

S.22/3 CARBURETTER (cable operated strangler slide).

V.105x1E	Adjuster, cable	V.1483C	Lever, control
V.826E	Cover, cable adjuster	V.1531E	Body, control
V.1037E	Spring, return	V.1371E	Washer, locating
V.105x2E	Nut, cable adjuster	V.1370E	Washer, spring
V.108x15E	Nipple, cable (2)	V.1481E	Clip, control
Quote		V.1525E	Screw, top
Engine No.	Cable, strangler, complete	V.1368E	Screw, control clip
V.1421E	Disc, top (replaces V.1263E)		

All other carburetter components as listed on page 33.

VILLIERS LIGHTING SET—6 volt

COMPONENT	PART No.
Headlamp complete	Type MCH56
Headlamp rim assembly	534343
Rim fixing wire (5 per set)	504665
Light unit (less bulbs)	516828
Light adaptor	85598
Pilot bulb holder with lead	861552
Ammeter	36084
Ammeter rubber ring	523986
Switch	31491
Switch fixing spring	308234
Switch rubber ring	523986
Rim clip	534296
Rim clip screw	144921
Main bulb (pre-focus) 6V. 30/24W.	312
Bulb 6V. 3W. (M.B.C.), parking	988
Lamp fixing screw (2 per set)	516856
Lamp fixing washer (2 per set)	137499
Harness	836241
Speedometer cable grommet	199005
Harness grommet	862217
Stop Tail Lamp type 564 complete	53394
Lens	573839
Window	575200
Lens fixing screws (2 per set)	552928
Rubber gasket	575208
Base assembly	575212
Bulb holder assembly	575209
Bulb holder base grommet	575207
Bulb lead grommet	573825
Bulb 6V. 18/3W., tail lamp	352

Miscellaneous items

Stop light switch (right hand fitting)	31437
Stop light switch (left hand fittings)	31384
Stop light switch spring	315543
Continental light unit for MCH56	516829
Continental main bulb 6V—25/25W (Duplo)	377

TERMS OF BUSINESS

ESTIMATES

If requested at the time of despatch, we are 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, a charge is made for our mechanic's time in taking down the engine for report, the re-building, and return carriage costs.

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, such parts as specified by the customer if we consider that other parts are necessary to make an efficient repair. In such cases, we are prepared to supply the customer's requirements in spares, but we do not undertake to fit them.

IMPORTANT

1.—In correspondence, and when ordering replacement assemblies or spares, always quote the Engine Specification and Serial Number stamped on the plate rivetted to the inner chaincase. (See sketch below).



The number is comprised of two parts, the first being the SPECIFICATION Number, which is the key to the component parts fitted, and the second being the Engine Serial Number by which the date of manufacture, etc., can be determined, e.g. 950A/343.

The **Magneto** also bears a SPECIFICATION Number (example: R.138/A.141) but no Serial Number. The "R" (Rotor or Flywheel), and "A" (Armature Plate) Number is stamped on the Flywheel.

The **Carburettor** identification mark is stamped on the inlet stub, e.g. S.22/2.

2.—When sending parts for replacement, repair, or as pattern, the name and address of the sender should always be securely attached, and full instructions explaining what is required must also be sent separately by post. In no circumstances should instructions be sent only with the parts as they are liable to be lost or damaged in unpacking. Components sent as pattern are not returned unless requested, except where we cannot complete the order ex-stock.

3.—If an engine is sent for repair, it should be well packed in a strong wooden box. Cardboard or a sack is insufficient, and engines so packed are liable to get seriously damaged in transit. Packing cases are not returned to the customer unless the outside of the case is marked accordingly, and a special request is contained in the covering or contents note.

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

5.—As we are not manufacturers of complete vehicles or other machines, **only the engine unit should be sent to us.** If machines are forwarded an extra charge will be made for dismantling the engine from the frame and returning the components that are not of our manufacture.

6.—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 carburetter.

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

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.

9.—All transactions must be treated on a cash basis, unless ledger account facilities have already been arranged.

10.—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.

1.—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 such information upon the telegram.

GUARANTEE

WE 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.

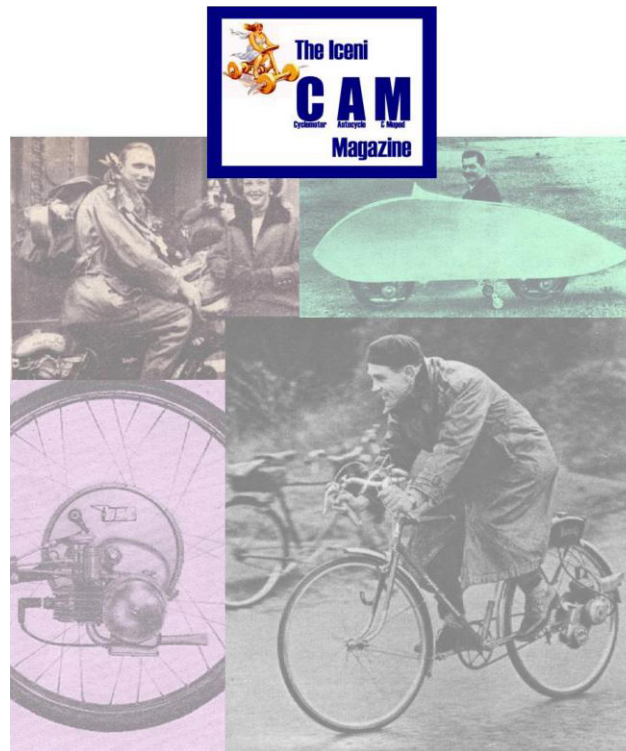
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The guarantee becomes void if any parts not made or supplied by THE VILLIERS ENGINEERING COMPANY, LTD., are fitted to a VILLIERS engine. To safeguard his own interests, the owner should always insist upon genuine VILLIERS parts.

Villiers

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of a fine machine*

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