

Motor Cycle & Cycle

**TRADER**

TRADER AID SERIES

Servicing Data Sheet No. 4

**VILLIERS** Mark 8E-197 c.c.

Two-Stroke **MOTOR CYCLE ENGINE**

Manufacturer: *The Villiers Engineering Co. Ltd., Wolverhampton*

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**T**HE Mk 8E Villiers Engine is the latest production of a firm which has long specialised in the manufacture of efficient, reliable and easily maintained two-stroke engines. It has a detachable-alloy cylinder-head, the piston is of the flat-topped type, fitted with two-pegged piston rings, and a gasket is fitted at the cylinder head joint. The cast-iron cylinder has one exhaust port, one inlet port and two transfer-ports. The crankshaft assembly has a double-row, roller, big-end bearing, detachable small-end bush, and it runs on three ball-journal main bearings (two on the drive side and one on timing side). Crankcase compression is main-

tained by two oil seals (one on each shaft). The engine power is transmitted to the gearbox by means of a pre-stretched endless chain and a two-plate cork-lined clutch. The gearbox on the Mk 8E is a three-speed model and that on the Mk 8E/4 is a four-speed model. Both have positive-stop footchange mechanisms. The ignition and lighting needs are met by a Villiers flywheel magneto generator and two lighting sets are supplied—either direct A/C or A/C rectified to provide D/C for battery charging. The carburetter is also of Villiers manufacture.

**TYPE S25 CARBURETTER. (EARLIER ENGINES FITTED WITH S24 CARBURETTER).**

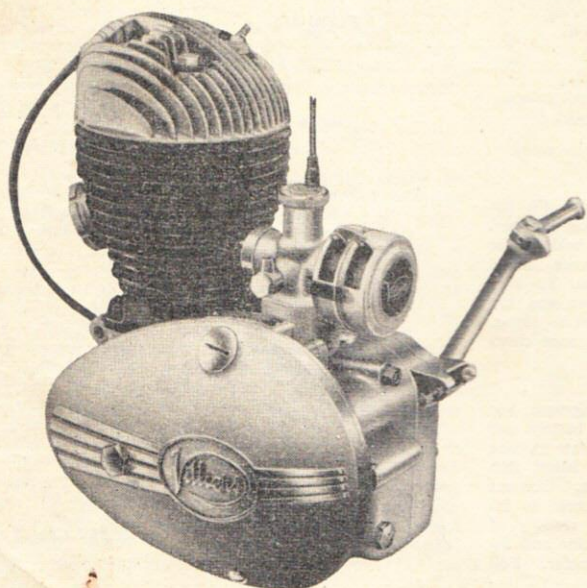
This carburetter has a single-lever control, which operates the throttle slide with adjustable taper needle controlling mixture strength over main "cruising range." Pilot-jet system and main-jet range are linked by automatic progression hole system, eliminating flat-spot when throttle is opened from tick-over position. Adjustments to carburetter include: Size of main jet, throttle-needle setting, size of slide cut-away, pilot screw adjustment and slide-setting on cable-adjuster.

Unless complete dismantling is necessary, most adjustments can be made with carburetter still fitted on engine. Remove fuel pipe connection to banjo union, slacken clamp screw and turn carburetter on stub. This will enable float-chamber base nut to be removed, float-bowl washed out, float examined, main jet changed or cleaned, pilot jet cleaned and fuel needle and lever examined or replaced. Mixing chamber top cover can be removed for throttle needle adjustment or slide replacement. If centre-piece definitely requires replacement, remove float-bowl, float, main-jet and slide, then press centre-piece up and out through throttle bore.

Before tuning carburetter, ensure that spark plug and HT current are good, and check ignition setting, fuel supply and all joints and seals for air leaks. Warm up engine and test on road for:

(1) **Main jet range.** If engine detonates, lacks power or is faster with strangler closed when in top gear at full throttle, fit next larger size jet. Re-test and increase jet size until engine four-strokes at full throttle, smokes badly or runs better for a short time when fuel is turned off. Then fit smaller jet and re-test, decreasing jet size until best performance from  $\frac{3}{4}$ - to full-throttle is obtained.

(2) **Pilot jet range.** Screw pilot jet adjuster fully-in, and take back  $1\frac{1}{2}$  turns. Set cable ad-



*The Villiers 8E-197 c.c. engine and gearbox.*

# VILLIERS MARK 8E-197 c.c. TWO-STROKE MOTOR CYCLE ENGINE

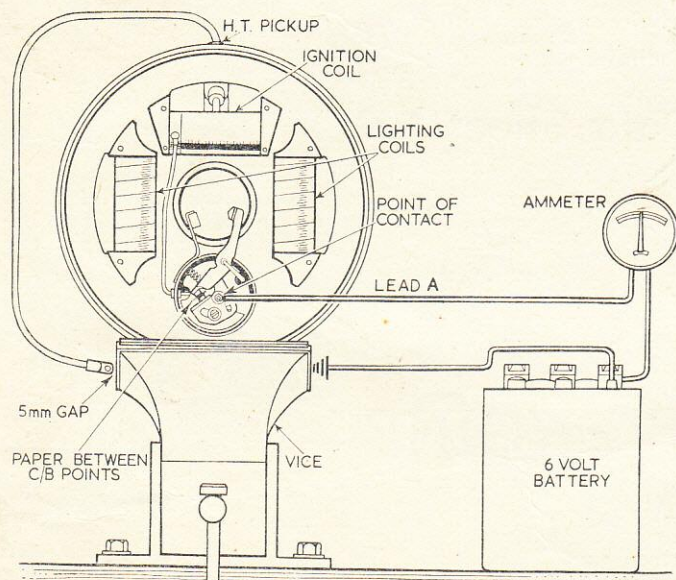


Fig. 1: TESTING IGNITION CIRCUIT: Resistance of ignition coil, 2,000-4,000 ohms. Condenser may be tested on a 200/250 volt D/C circuit. Condenser should hold charge for at least 15 seconds when lead is touched to casing of condenser. A good spark should be seen and heard; (1) When lead A is connected to insulated side of contact-breaker, a discharge of approximately 4 amps should show on ammeter; (2) When contact is made and broken, an H.T. spark should jump across the 5 or (preferably) the 5.5 mm gap to earth.

juster on mixing chamber top so that engine tick-over is as slow as possible. Unscrew pilot adjuster half a turn and screw-in cable adjuster to compensate for speed-up in engine revolutions. Repeat until weakest (farthest out) position of pilot adjuster is reached and tick-over remains constant, with engine increasing speed without mis-firing when throttle is opened to  $\frac{1}{4}$ .

3. Slide cut-away. Run engine at tick-over, open throttle from  $\frac{1}{4}$  to  $\frac{1}{2}$  position, noting (a) mixture weakness shown by mis-firing, or (b) over-richness shown by four-stroking. To cure weakness, fit a slide with a lower number (e.g. 3 to 2 $\frac{1}{2}$ ), which means a smaller cut-away. To cure richness, fit a larger cut-away size (e.g. 3 to 3 $\frac{1}{2}$ ).

## FLYWHEEL MAGNETO GENERATOR

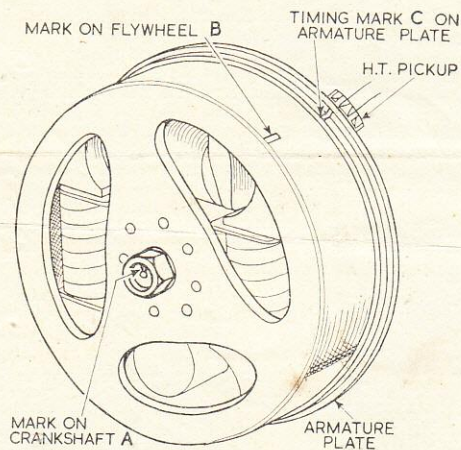
This unit has a 6-pole flywheel, with ignition timing cam (with an internal taper of 1 in 10) externally formed on centre boss. The securing nut, which is flanged to act as an extractor, is built within the centre boss. The armature plate—which is attached to crankcase by six screws, (earlier engines, 4 screws)—carries two lighting coils, HT coil, contact-breaker assembly (including condenser) and the magneto-side crankcase oil seal. HT pick-up is screwed into back of armature plate and 3 clips are fitted for securing flywheel cover.

## REMOVAL OF MAGNETO

Remove flywheel cover. Turn engine anti-clockwise against compression; use "hammer-tight" spanner to free flywheel centre nut, and extract flywheel by continuing to unscrew once centre nut is free. Remove HT lead from plug, undo snap connectors of lighting cables. Remove six/four screws securing armature plate to crankcase and remove plate. To dismantle contact-breaker assembly, move retaining arm aside and withdraw rocker-arm and spring. Remove nut at centre of point bracket and take cable ends off screw. Remove screw at slot of point bracket and withdraw point bracket and adjuster cam. Lift out insulating pad. Remove two nuts from rear of armature plate. Remove condenser box from front of armature plate. Undo two studs and remove condenser. To remove coils, undo screws through coil cheeks and lift off coils.

## REPAIR AND REPLACEMENT OF MAGNETO COMPONENTS

If new coils have been fitted, mount armature plate on crankcase with securing screws fitted (but



TO CHECK TIMING  
When piston is at T.D.C. the mark on the crankshaft A should be at 12 o'clock and the flywheel mark B should be opposite armature plate mark C.

Fig. 2: TIMING CHECK, showing positions of marks.

not tightened finally) through coil cheeks. Fit flywheel on crankshaft, turn until pole pieces are passing coil cheeks, and check clearance with feeler gauge through slots in flywheel. Clearance should be .010 in. max. and .004 in. minimum. To alter clearance, remove flywheel, loosen screws and tap coil cheeks inwards or outwards and re-test as above. Ensure that screws are securely tightened once clearance is correct.

## IGNITION TESTING

Accurate testing requires specialised equipment, but a service test can be made, using 2 volt battery and ammeter (see Fig. 1). Mount armature plate in vice and connect one battery lead to vice. Insert thin cardboard between contact breaker points. Connect ammeter in other battery lead, and connect to insulated contact breaker point. Steady reading of approximately 5 amps. will show continuity and insulation of primary circuit to be in order. Full

discharge or unsteady reading will indicate a fault. Making and breaking of ammeter lead connection to insulated point should cause spark to jump 5.5 mm, measured from HT lead to earth on vice. If HT spark is below this standard, suspected faulty components (coil or condenser) can be eliminated by substitution. Burnt contact-breaker points accompanied by intense blue sparking when engine is running indicates faulty condenser.

## RE-ASSEMBLING ARMATURE PLATE

Re-assemble in reverse order of dismantling, paying particular attention to correct replacement of insulating washers in contact breaker box. Renew oil seal if necessary. Fit plate to crankcase with 6/4 screws, taking care not to damage the oil seal on the driveshaft thread.

## RE-TIMING IGNITION

Loosely fit flywheel to crankshaft and rotate flywheel until contact breaker points are fully opened; set gap to .015 in. Set piston 5/32 in. before TDC, rotate flywheel clockwise (keeping crankshaft stationary) until contact points begin to open. Tighten flywheel nut ensuring crankshaft position relative to flywheel remains constant. Check that arrow on flywheel is in line with timing mark on armature plate at HT pick-up when piston is at TDC (mark on crankshaft at 12 o'clock) (see Fig. 2.) Finally, tighten flywheel centre nut, using "hammer-tight" spanner and fit rubber sealing-ring and flywheel cover.

## ROUTINE MAINTENANCE OF CONTACT BREAKER

To adjust contact breaker points, remove flywheel cover, turn flywheel clockwise until rocker-arm heel bears on highest point of cam. Release locking screw X (see Fig. 3). Rotate adjuster cam Y until points gap is .015 in. Tighten locking screw. If lubricating pad is dry, oil with a few drops of heavy oil. Place one drop of oil on rocker arm pivot. Check security of condenser and leads.

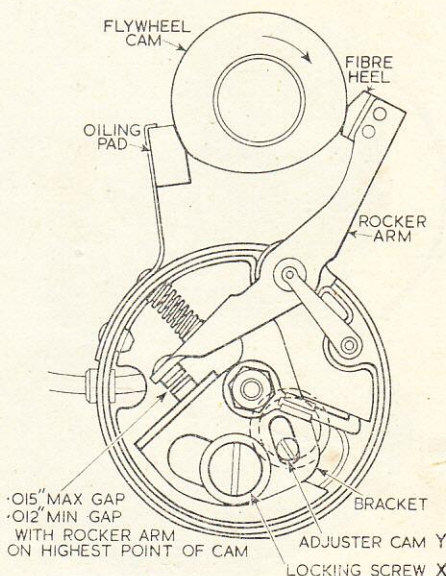
## LIGHTING SETS

Two types are used: Direct and Rectified. Generator is identical in both cases, but wiring connections, etc., are different.

## DIRECT LIGHTING SETS

(See Fig. 4.) In this set, generator provides A/C current direct to lamps via headlamp switch. One

Fig. 3: ADJUSTMENT OF CONTACT POINTS, a simplified diagram.



## MAKERS FITTING 8E ENGINES

VILLIERS 197 c.c. 8E engines are fitted by the following makers of motor cycles: Ambassador, Dot, Excelsior, Francis-Barnett, Greeves, James, Norman, Sun, and Tandon. The engines are also fitted extensively abroad.

end of each lighting coil (2) is earthed inside generator; other leads from coils join and a single cable connects with No. 2 terminal in switch.

### RECTIFIER LIGHTING SET

(See Fig. 5.) A/C output from lighting coils is converted to D/C by selenium rectifier, and rectified current charges 6-volt 10 amp./hour battery. Rectifier casting must be insulated from motor cycle frame. Output cable from generator motor lead from No. 2 switch terminal at rectifier lug. Cable from No. 4 switch terminal (connected to discharge side of ammeter) joins rectifier output leads. Battery positive terminal must connect to earth. In the four-position switch used with this set, first three positions charge battery and in fourth (direct) position, the A/C output is fed directly to headlight and tail bulbs and a trickle charge to the battery is maintained. (Use this position whenever possible). Provided that the negative battery lead is suitably insulated, no damage to the rectifier will occur if the engine is used without the battery. It should, however, be clearly understood that the switch should not be put to the 'parking' position whilst the engine is running.

**NOTE.** This does not apply to the high output type of magneto and circuit employed on certain light cars, etc., where it is essential to disconnect the rectifier from the generator in the event of the engine being run without the battery. With a partly discharged battery, the ammeter should show a charge of 3/4 amps. [Switch in 'Off' position at the higher engine speeds].

### TESTING RECTIFIER

If no charge is passing to battery, check all connections (See Fig. 5). To test rectifier, remove it from machine, and test it using a 12-volt battery with a 12-watt 6-watt bulb in series. Connect negative lead of battery to rectifier case-lug, positive lead to one of the rectifier leads. Bulb should light. Reverse connections and bulb should not light. Connect positive lead to other rectifier lead, and negative lead to rectifier case lug. Bulb should light. Reverse connections and bulb should not light. If bulb lights when it should not, rectifier is shorted. If it does not light when it should, rectifier is open-circuited. In either case, replace rectifier.

### DISMANTLING ENGINE UNIT

Clean unit thoroughly. With gearbox resting on bench, grip crankcase front-lugs in vice, timing side outwards. Remove magneto assembly, as above. Reverse unit in vice, i.e., drive-side outwards. Remove chaincase outer cover and gasket, draining oil into drip-tray. Remove six clutch-spring screws and withdraw springs, pressure-plate, insert-plate and centre-plate. Remove engine sprocket nut and washer (See Fig. 6.) With slotted extractor free engine sprocket from shaft and withdraw with chain and clutch chainwheel. Remove key from crankshaft. Remove clutch centre nut and washer and withdraw clutch centre from gearbox mainshaft. (See Fig. 6.) Remove lockwasher and screw securing cone nut on inner chaincase. Remove nut from stud in chaincase for gearbox. Remove cone nut and withdraw inner chaincase and gasket on crankcase boss. Remove 4 nuts and washers from gearbox holding studs and withdraw gearbox from crankcase. Remove decompressor and spark plug. Unscrew cylinder head bolts and remove cylinder head. Remove base nuts and

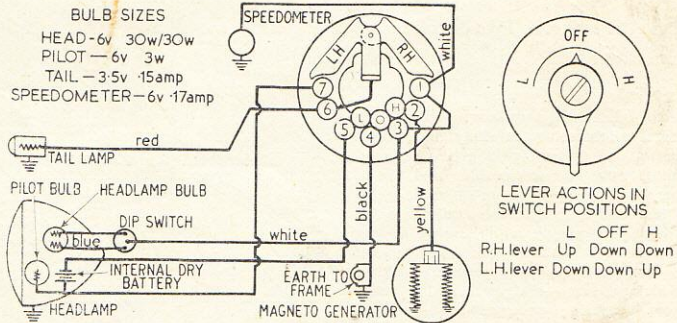


Fig. 4: WIRING PLAN, for direct-lighting set.

withdraw cylinder vertically (if cylinder rotated on withdrawal piston ring ends may be broken by cylinder ports). Remove gudgeon pin circlips, press out gudgeon pin and remove piston. Remove crankcase holding bolts and nuts. Place suitable steel wedge firmly between flywheel webs, grip crankcase with timing-side shaft vertical, and knock drive-side shaft firmly on wooden block to separate crankcases. Heat crankcases and tap out bearings, distance-piece and seal, (one bearing on timing-side; two bearings, one distance-piece and one seal on drive-side).

### REPLACEMENTS AND REPAIRS

(a) **Engine.** Replace bearings if rusty or worn. If "lift" present in big-end bearing, fit service replacement crankshaft. Replace piston rings if end gap (when fitted in bore) is over .030 in., and, if cylinder bore is worn more than .008 in. over standard (measured half-way up cylinder), re-bore cylinder. Check gudgeon pin for wear in small-end bush, replace bush if necessary and ream to fit gudgeon pin. Decarbonise cylinder head and cylinder ports. Strip de-compressor (if fitted), grind in valve and re-assemble. Clean spark plug. Fit piston to connecting rod with gudgeon pin and new circlips.

(b) **Clutch and Primary Drive.** Reline clutch insert-plates if corks burnt, worn thin or loose. Corks should be 13/32 in. thick after grinding. Replace clutch springs if shorter or softer than new springs (approx. free length when new 1.2 in.). Check security of rivets in ball-retaining plates of chainwheel, re-rivet as necessary. Replace steel balls (50 per set), if any missing, before re-riveting

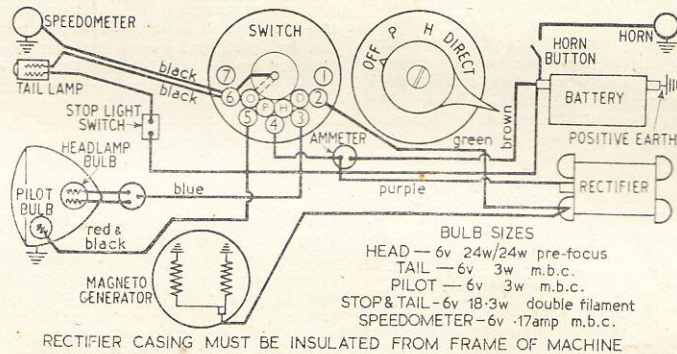
chainwheel. Check bearing race-on clutch-centre for wear. Check chain for broken rollers.

### DISMANTLING AND RE-ASSEMBLING OF GEARBOX

(a) **Three-speed.** Drain oil from gearbox. Slacken pinch bolts and remove kickstart and foot-change levers. Remove dust cover (held by three screws) and clutch lever (held by pressure of adjuster). The bushed-end cover of the gearbox is secured by three screws and three nuts. Remove screws and nuts and pull off end-cover. The clutch having already been taken off, the gearbox mainshaft may be removed, leaving high-gear pinion and final-drive sprocket in position. Remove selector quadrant pivot-pin and remove quadrant, layshaft, gears, and sliding-gear operator. Wrap an old chain around final drive sprocket and grip chain in vice to lock sprocket. Remove lock-screw and washer and then unscrew the sprocket nut. Withdraw sprocket and distance-piece outwards and high-gear pinion inwards. Examine all bearings and bushes for wear, and, where necessary, replace (after heating gearbox shell and cover). Ensure that oil seal at final-drive sprocket, and kickstarter shaft sealing ring are serviceable. Examine kickstart pawl and ratchet pinion, and if edges are worn or chipped, replace. Make sure that pawl plunger operates freely.

It is unlikely that foot-change mechanism will require attention, but, if so, dismantle as follows: Remove circlip and washer from operating spindle, slide spindle out of end cover. Turn down tab-washer and remove nut and washer. Remove spindle-washer, shims, lever, distance-piece, operating

Fig. 5: WIRING PLAN for rectifier-lighting set.



**Villiers Mark 8E-197 c.c. Two-Stroke  
Motor Cycle Engine**

pawl and spring. Examine for wear, replace any faulty parts and re-assemble carefully in reverse order. Replace spindle assembly in end cover, ensure that sealing ring is serviceable and re-fit pressure washer and circlip. To re-assemble gearbox, reverse dismantling sequence. Lubricate all bearings. Fit high-gear pinion with bearing sealing washer in position. Fit distance-piece and sprocket from outside box and tighten sprocket locknut securely. Fit locknut screw and washer. Fit mainshaft and gears, ensuring pressure washer is in correct position, against high-gear pinion. Fit layshaft with gears and sliding-gear operator, pressing layshaft well home into bush. (The layshaft ratchet pinion may be fitted last). Ensure that operator engages correctly in selector-quadrant forks, and fit quadrant pivot pin. Turn kickstarter shaft against its stop-piece and ensure that felt washer is positioned between two steel washers in mainshaft end cover bush. Engage neutral gear. Coat joint with suitable jointing compound. Fit end cover and ensure knob on selector quadrant engages in fork of foot-change operating lever. Make sure that end plate presses home without using force, and secure with hexagon nuts and screws (fit washers in recesses). Tighten up selector plunger box nut. Adjust mainshaft end float to approximately .002 in. by means of barrel adjuster and make sure that adjuster locknut is tightened. Clutch push-rods must be lightly lubricated and fitted in correct order, viz: "headed" rod at clutch end of mainshaft, long rod, short rod. Re-fit clutch lever and dust cover. When positioning kickstart lever, ensure that adequate clearance is allowed between it and clutch adjusting screw in dust-cover.

(b) **Four-speed.** Drain oil from gearbox. Remove kickstarter and foot-change lever. Remove gear-operating shaft-pin, dished washer and indicator. Unscrew six securing screws and remove outer cover. Lift out clutch lever. Remove foot-change outer bush. Undo two nuts and remove foot-change stop plate and spring retainer. Remove control ratchets (male and female), and take off short control-lever. Do not remove foot-change adjuster plate, secured by two pins and bushes, unless necessary, or this will have to be re-set to give correct operation of the positive stop mechanism. Remove kickstarter spring and clutch adjuster. Unscrew bearing cap pins (2) and remove bearing cap. Unscrew mainshaft nut (LH thread) and remove oil thrower. After removing remaining three end-cover fixing screws (access to one through hole in foot-change adjuster plate), and selector plunger nut (top right hand of inner cover), remove end-cover, (tapping mainshaft lightly if necessary). Removal of gears, etc., is now straight-forward. All bearings should be examined for wear or roughness and replaced where necessary (warm gearbox shell, etc.) Examine gears and shafts for damage. To examine large ball-race and oil-seal at final drive, remove lockscrew, sprocket gland-nut, and withdraw mainshaft low-gear pinion. Examine carefully kickstarter pawl and internal teeth of kickstarter ratchet pinion. Re-assemble gearbox in reverse order of dismantling, ensuring that final-drive oil seal, sprocket gland-nut felt-washer and kickstarter-axle oil seal-ring are in good condition. Make sure that Penn steel washer is correctly fitted on kickstarter end of layshaft. When re-fitting short control-lever, make certain it sits correctly between the ends of the lever return-spring. When finally assembled, the correct amount of SAE 140 oil should be put into box, (approx. ¼ pint, see mark on dipstick). The nipples on the kickstarter shaft and clutch lever should be greased. Later engines are fitted with nipple on the clutch lever only.

**N.B.** It is most important that the full engine number is quoted when ordering spares, as several components (primary chaincase, clutch centre, clutch push rods, etc.) are not interchangeable between three and four-speed models.

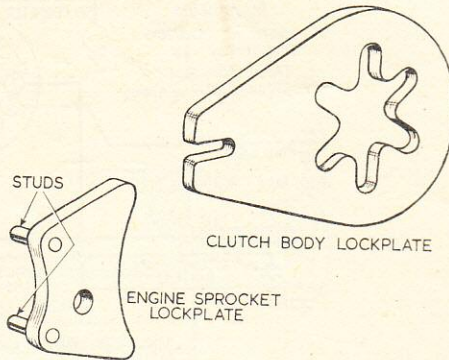


Fig. 6: VILLIERS' LOCKING PLATES for releasing securing nuts on sprocket and clutch body.

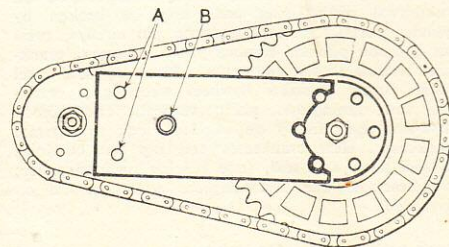


Fig. 7: ALTERNATIVE LOCKING PLATE (3/8 in. thick), with two 1 in. by 1/2 in. studs brazed in plate at A. Plate drilled at B to fit over chaincase fixing-stud and engage in teeth of engine sprocket and spring pegs on clutch-centre, locking sprocket and clutch-centre to facilitate removing and securing of holding nuts.

**ASSEMBLING ENGINE, CLUTCH AND  
PRIMARY DRIVE**

Clean crankcase joint faces. Fit main bearings to crankshaft (distance-piece fitted between drive-side bearings). Heat crankcases and fit crankshaft into drive-side crankcase, smear jointing compound on joint faces. Fit magneto-side crankcase over crankshaft and fit crankcase bolts and nuts, tightening evenly. Press seal over shaft, easing drive-side seal over crankshaft shoulder, tap into crankcase. Fit crankcase in vice. Lightly oil cylinder and piston. With jointing compound on cylinder base gasket, place gasket on cylinder-studs in line with transfer port cutaways. Position ring ends on pegs, and fit cylinder straight over piston on to studs and secure with nuts. Fit de-compressor to cylinder head, using new joint gasket. Align cylinder head gasket (de-compressor hole in line with de-compressor passage in cylinder) and fit cylinder head securing with bolts. Fit gearbox to crankcases. Fit gasket to drive-side crankcase boss and fit inner chaincase, securing with cone-nut, lock-plate and screw, and gearbox stud nut. Fit sprocket key in crankshaft. Fit clutch centre and tighten nut. With chain over sprocket and chainwheel, fit sprocket to engine shaft and chainwheel to clutch centre, securing sprocket with washer and nut. Check that both sprockets are in line. Adjust, if necessary, by shims behind engine sprocket. Fit clutch centre-plate, insert-plate and pressure-plate with springs and screws (screwed fully-in). Place gasket on dowel-pins and fit outer chaincase with dome nut. Reverse engine in vice. Fit magneto and set ignition timing. Fit spark plug. Fill gearbox to mark on dipstick with SAE 140 oil. Fill chaincase to level plug with SAE 140 oil (with engine gear-unit vertical). Set clutch adjuster (knurled head outside dust cover on three-speed box, and adjuster inside dust cover on four-speed box) to give 1/16 in. movement at end of gearbox clutch lever, before commencing to depress the clutch springs. On both three-speed and four-speed units a screwed adjuster gives independent adjustment for the clutch control cable.

**VILLIERS MODEL 8E—USEFUL DATA**

**Dimensions:**

Bore: 59 mm (2.3235 in.). Stroke: 72 mm (2.834 in.). Capacity: 197 c.c. (11.71 cu. in.)

**Carburettor:**

Villiers S.24 (up to engine No. 39000). Villiers S.25 (after engine No. 39000). Needle size No. 3½ (1.95 in. out). Throttle slide No. 3.

**Magneto:**

6-pole type. Contact breaker points gap—.015 in. max. Ignition timing 5/32 in. before top dead centre.

**Spark Plug:**

Lodge HH14 or similar. Plug-point gap, .018 in.—.025 in.

**Lubrication:**

**Engine:**

Petrol mixture, 20 parts petrol to 1 part Castrol XL Oil (SAE 30), or 16 parts petrol to 1 part Castrol two-stroke self mixing oil.

**Gearbox and Chaincase:**

Castrol D Oil (SAE 140).

**Standard Sprockets:**

**Engine:**

23 teeth—3/8 in. pitch.

**Clutch:**

51 teeth—3/8 in. pitch.

**Final drive:**

17 teeth—1/2 in. pitch.

**TRACING FAULTS**

**Engine will not start.** Make sure that there is fuel in tank, depress carburettor tickler to check whether fuel is reaching carburettor. If not, examine for choked fuel-pipe or banjo-union filter or sticking fuel-needle. Remove spark-plug, hold against cylinder-head and rotate engine; if no spark, hold HT lead ¼ in. from cylinder-head. Clean or change spark plug if spark good from lead. If no spark from lead, check HT lead insulation and security, contact breaker points for correct gap and cleanliness, insulation of adjustable contact breaker point, condenser security and connections, and HT coil. Clean, repair, adjust or replace. Check ignition-setting. Check crankcase joints and seals, cylinder base and head joints and carburettor fitting for air leaks. If all the above in order and engine will not start, excessively rich mixture in crankcase may be the cause. Turn off petrol, remove crankcase drain plug, open throttle wide and rotate engine. Replace crankcase drain plug.

**Loss of Power.** De-carbonise piston, cylinder head, exhaust port and exhaust pipe and silencer (absolute cleanliness of ports and exhaust system is essential). Clean air-intake filter. Check carburettor needle setting and fuel supply. Check petrol-oil mixture ratio (see data). Check ignition-timing setting and spark plug for cleanliness, gap and correct type. Check for air leaks as above. Check seating of de-compressor (if fitted).

**No tick-over.** Check for ignition setting too far advanced. Clear pilot jet. Check security of carburettor on stub. Check for air leaks as above. Set contact breaker points and plug gap.

The next servicing data sheet in this series will deal with the

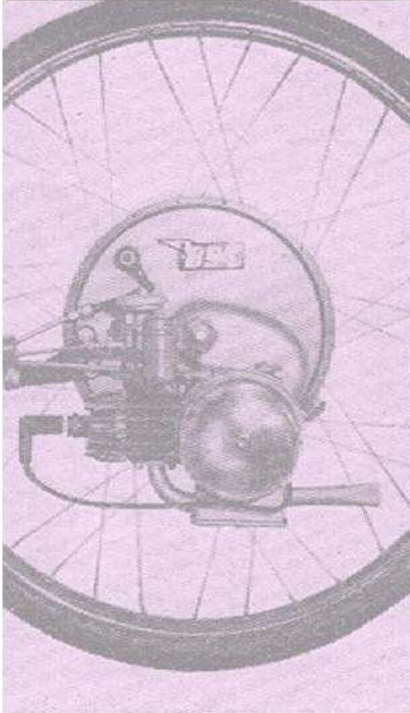
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**AW THREE-SPEED GEAR**

and will be included in the issue dated  
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