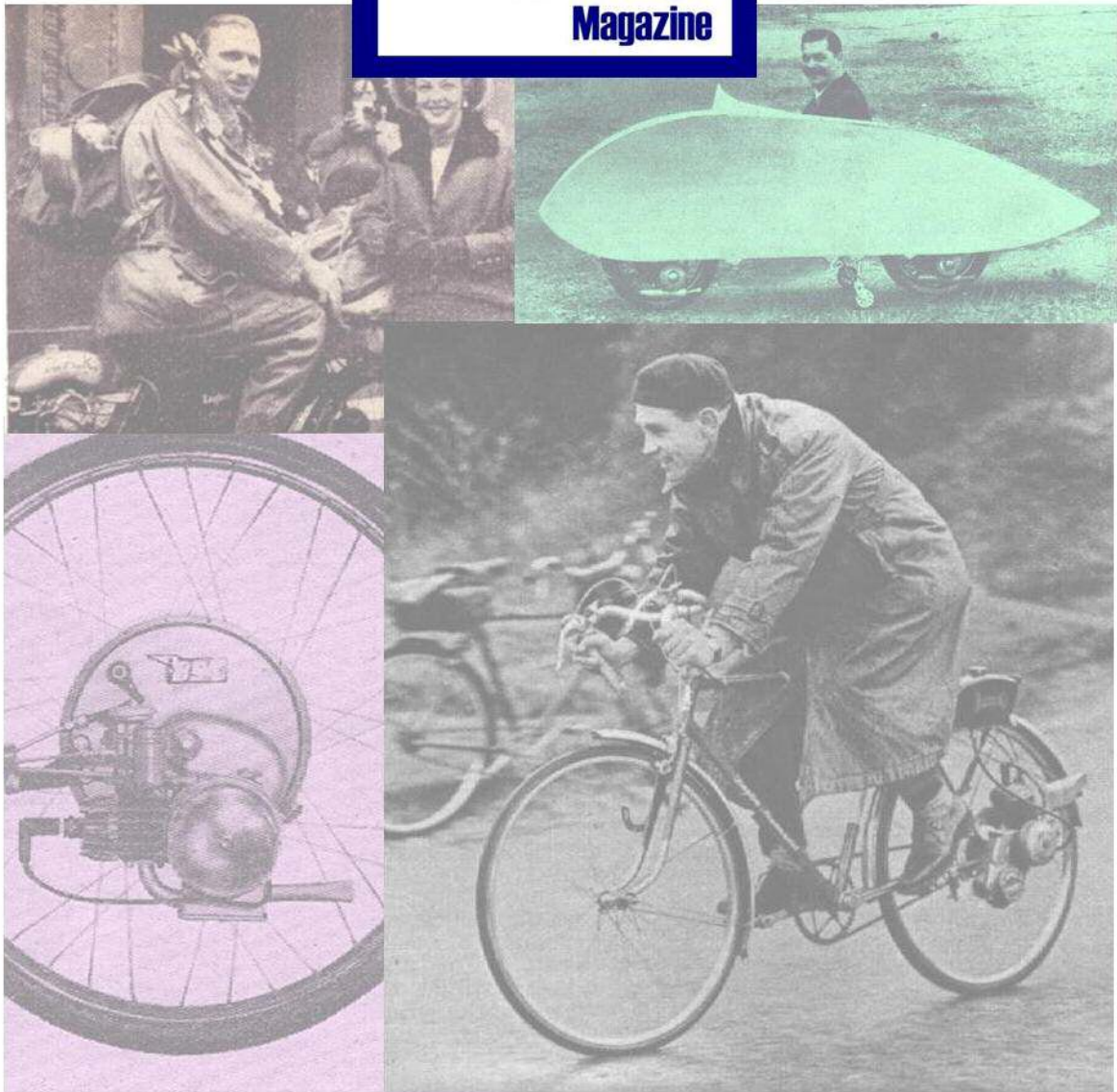


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"THE TRADER" REPAIRERS' SUPPLEMENT-17

SERVICING MOTORISED CYCLES

CYCLE traders are selling and servicing motorised cycles. Before this article was put to paper we made several enquiries which revealed that, naturally enough, many bicycle experts, good mechanics themselves, are entirely unfamiliar with even the principles of the two-stroke engine. Therefore, we make no apology for a rather elementary dissertation upon the two-stroke unit and the way it works, for we are aware that we are introducing something that, however familiar to some, is yet strange to many. Actually, the servicing problems are few and simple. The modern engine gives little trouble and, provided that initial care is taken, there is not much to fear on the score of reliability. We take it that most of our readers are competent to overhaul cycle parts, and in any case we already have dealt in previous issues with major cycle components at some length.

HOW THE TWO-STROKE WORKS

A piston in a cylinder is connected to a crank. As the crank is turned through one revolution the piston travels once down and once up. Every down stroke is a firing stroke, i.e., there is an explosion of gases every two strokes of the piston as distinct from once in every four on a four-stroke. In other words, there is one explosion in the cylinder for every revolution of the crank. Study of the diagrams will illustrate the cycle of operations. It will be appreciated that compression of the gas takes place in the crankcase, below the piston, as well as in the combustion head, above

it. It is essential, therefore, that the crankcase is gas-tight. There are three "ports" or entrances to the cylinder. One is the inlet port by which the gas is drawn in from the carburettor, whence it passes into the crankcase. The second is the transfer port, by which the gas is forced from the crankcase to the cylinder, and the third is the exhaust port, from which the burnt charge is expelled into the silencer.

The cycle of operations is as follows:—

1. Piston rises. Uncovers inlet port. Gas is sucked into crankcase. Simultaneously the crown of the piston com-

Bicycle dealers who have hitherto not handled power-propelled machines will welcome these notes on Cyc-Auto and Villiers engines

presses previous charge in cylinder head.

2. When the piston nears the top of the stroke, this compressed charge is fired. Piston travels down, compressing the gas in the crankcase and delivering power to the crankshaft, whence it is transmitted to the wheel.

3. Piston uncovers exhaust port. Spent gas still at fairly high pressure rushes out into silencer. Fractionally later, the transfer port is also uncovered, and the new charge from the crankcase is released into cylinder.

4. Piston rises, closing all ports, and fresh cycle is commenced.

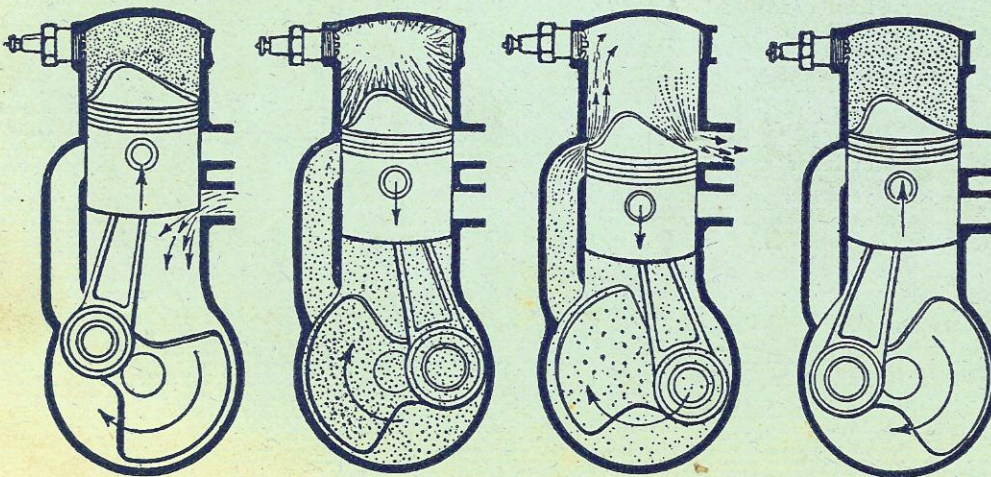
Those who wish to obtain full and complete knowledge of the two-stroke engine are advised to obtain "TWO-STROKE MOTOR CYCLES." It is published by Iliffe & Sons, Ltd., at 2/- and can be obtained from "The Trader."

THE DEFLECTOR PISTON

It will be noticed that the piston crown has one steep side, and one more shelving. This formation is the deflector. The steep side must *always* face the transfer port. Never replace a piston any other way. Object of the deflector is to direct incoming gas from transfer port upwards along one side of the cylinder, while exhaust gases are being expelled on the other.

PISTON RINGS

The piston is fitted with rings in grooves to maintain compression. In these grooves are locating pegs. These are to prevent the rings turning so that the "open ends" do not catch in any of the ports. Always note position of rings and gaps for replacement when dismantling.



Looking from left to right the four operations in the two-stroke engine as described above are diagrammatically illustrated.

SERVICING MOTORISED CYCLES—continued

ENGINE OVERHAULS

DECARBONISING

When an engine has run for some thousands of miles hard deposits are formed on the top of the cylinder, the piston crown and round the edges of the ports. This deposit affects the efficiency of the engine and must be removed.

With piston at bottom of its stroke, undo the four bolts at the base of the cylinder and lift off cylinder. It is advisable also to remove piston to attend to rings. If engine "fluffy" also dismantle and clean out silencer and exhaust pipe. Do not turn cylinder when removing or ports may catch against ring gaps. See also notes on dismantling the engine. Remove cylinder base washer and examine. If damaged, replaced with new. See that slot in it registers with transfer port. Stuff mouth of crankcase with rag to exclude dirt. Be careful that piston suffers no sharp contact with hard surfaces.

Remove carbon from inside cylinder head with suitable scraper, e.g., screw-driver. Clean out ports with screw-



Alternative method of piston ring removal.

driver and/or old penknife. Take especial care not to scratch or damage the cylinder walls.

Remove rings from piston with great care since they are very brittle. Alternative methods of their removal are shown by accompanying sketches. Clean out the grooves and the carbon from the rings. A section of old piston ring ground to a point is an admirable tool. A knife will do, however. Be careful, with aluminium pistons, not

to remove any metal. Scrape piston crown clean with stick of solder cut to chisel shape and also underside of piston. If the piston has a narrow "inertia" ring (above top ring and below surface level) do not disturb it, as it will not return to shape after being bent. Rings are brittle components and need careful handling.

Piston crown may be lightly polished. Wipe off all traces of polish and do not let it touch piston skirt.

FITTING NEW RINGS

When fitting new rings, test in cylinder by pressing them slightly inside with the skirt of the piston. The gap between the ends should be between 0.006 or 0.008in. Too small a

gap may cause seizure. File accordingly. An old ring with gap more than about $\frac{1}{32}$ in. needs replacing. Note way rings were fitted. Replace exactly the same, dead square in their grooves.

Never hold piston by its walls in a vice, unless between wood chocks, and even then be careful not to apply undue pressure.

The bulk of this work is quite straightforward if only common sense is applied. It need hold no terrors for the purely cycle dealer.

Take care to replace parts in correct order and positions, *piston with steep side of crown toward transfer port*, and see all joints are gas-tight. Consumption may rise a little and performance fall a shade immediately after decarbonising. This should correct itself after a slight initial period.

Tighten down cylinder by tightening "opposite" nuts each a little at a time.

THE VILLIERS UNIT

REMOVING UNIT FROM FRAME

We will now go through the process of completely dismantling the Villiers 98 c.c. engine, as fitted to Raynal, Excelsior and James machines. Once this has been grasped, routine operations, whether minor or major, with engine in or out of the frame, will be clearer. Method of attachment to frame varies. In most cases the method of engine removal is apparent. Disconnect rear chain, together with all controls and connections, take off carburettor and exhaust pipe stays. Engine and engine plates will usually come away together after removal of the securing bolts. On the Cyc-Auto unit remove top engine bolt, bottom support tube bolt, silencer pipe bolt, then slide forward on the tube clear of the bracket and drive.

take out the Woodruff key on the shaft. Undo the magneto flywheel nut ($\frac{1}{8}$ in. spanner and hammer) and take off the flywheel. Special "hammer-tight" spanner is marketed by Villiers.

NOTE.—This nut, right-hand thread, has a flange which draws the flywheel off as it is unscrewed. After the first turn or two it will be found to tighten, because flange is pulling against face of flywheel.

Place a piece of wood against the face of the nut and give a sharp hammer blow. Flywheel will then be loosened on its taper, and nut can be removed with the fingers. Note that in any case the contact-breaker points are accessible without removing the flywheel.

When flywheel is off, the other components of the armature plate are accessible. *Important*.—Place a piece of iron, e.g., a spanner, across the

STRIPPING DOWN

Hold engine by bottom lug upright in vice. Remove silencer (2 nuts on cylinder flange, one at base). Base nut holds silencer end to clip. Use box spanner; clip can be left in place.

Remove the two screws in the clutch cover in order to lift off the clutch "bridge" and lever complete, thus revealing the sprocket.

MAGNETO

It is essential to undo the drive sprocket nut on the clutch shaft extension before attempting to take off the magneto. Use $\frac{1}{8}$ in. spanner and hammer. Remove sprocket by means of two levers placed beneath it, and



Removing the silencer.

SERVICING MOTORISED CYCLES—continued

pole shoes to prevent loss of magnetic flux at this stage.

Note.—A connection is provided in the lighting cable, a short distance from the magneto; unscrew this when removing engine from frame. Do not attempt to remove cable from inside magneto; keep in position the rubber sleeve over the connection, otherwise a short circuit may occur.

Releasing four screws in the centre now enables the armature plate, all magneto components and contact breaker to be taken off as a unit. If these screws are obdurate, tap the end of the screwdriver sharply with a hammer before turning. Timing is dealt with later.

REMOVING CYLINDER

Next remove the four base stud nuts and take off the cylinder *without turning it*. [See also under "Decarbonising."] Note position of piston and rings for replacement. Piston is carried on gudgeon pin in a fully floating bush. Remove the two gudgeon pin circlips, with pliers or end of screwdriver, and the pin will push out from



Removing flywheel with special "hammer tight" spanner

either end. If seizure has occurred here, a special extractor of the band type is useful. Remove cylinder base washer. For replacement, note that the cut-out section registers with the transfer port. Lay engine on its side on bench. Remove the seven nuts and washers holding the clutch cover. Note that on reassembly these must be tightened down evenly, taking "opposite" nuts in turn.

CLUTCH

Soundest way to remove clutch cover is to use a sleeve-type extractor on mainshaft, and claw type on to clutch shaft pinion, tightening each down in turn. If these are not available, tap gently against the backs of the two ear pieces on the cover, predominantly on the ear nearest the cylinder. There is a ball race in the cover. So far as can be traced its replacement has never been needed.

With the cover off, the primary

chain, the engine sprocket and clutch sprocket are revealed. On the other side of the engine is a small nameplate. When this is removed the clutch shaft can be drifted through from that side to fetch away the clutch complete.

If the chain is very tight it may be necessary to remove the mainshaft sprocket assembly (which has a lock washer), but after some service the chain is usually slack enough to dispense with this, as it will ride off when clutch sprocket is tilted. In any case, it is necessary, before drifting out, to remove the clutch driveshaft nut. While doing this the clutch shaft should be locked either by wedging the chain (not recommended) or by wedging the connecting rod, to prevent the engine turning.

CLUTCH (REASSEMBLY)

Clutch must be assembled as a whole before replacing. Order is (a) inside plate (keyed to splined shaft), (b) cork insert plate with retaining flanges outwards, (c) thin centre plate with the "bulge" inwards, (d) cork-inserted clutch sprocket, (e) outer plate.

To engage outer plate with splines, the whole clutch assembly has to be

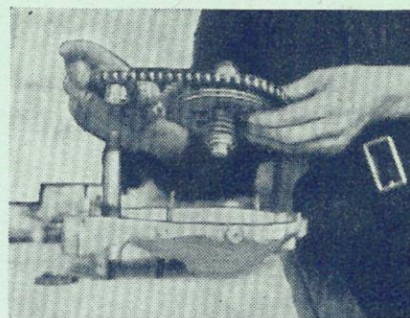


Compressing clutch and fitting nut and distance piece.

compressed. In the works a special jig is used. In service it can be done by levers, or by fitting the shaft nut loosely, turning plate till splines

are "felt" and then tightening down the nut. In any case, it is necessary to knock out bearing from case, place on shaft over plate, and then to fit between it and the nut a short tubular temporary distance piece. Having compressed the clutch and fully locked it up, replace chain and whole assembly into position. Then fit the cover. Nut will protrude. Take it off. Remove distance piece. Place external sprocket on shaft. Lock down with nut.

If the mainshaft pinion has also been removed, the easiest way to re-



Fitting the primary chain.

fit the chain is to pass it round this and the clutch wheel, and drop both over their shafts at one and the same time.

BIG END AND CRANK

When the clutch is down the only material part left to strip is the big end. Remove the right-hand crankcase cover, take out key in shaft. Using soft hammer, tap out shaft, big end, bob weight and crank assembly complete. Detail work on this (if necessary) is not recommended. Special jigs, etc., are needed to ensure accuracy. Such work should be entrusted to the Villiers factory. It is not recommended, however, that ordinary dismantling should go as far as this stage, unless the repairer has the necessary knowledge and equipment.

THE VILLIERS MIDGET CARBURETTOR

CARBURATION

We have spoken of the gas filling the crankcase by way of the inlet port and it may be as well to explain how this gas is formed, for the benefit of those unacquainted with petrol engines.

The carburettor is responsible for this function and on motor-assisted bicycles this instrument contains three main parts—the float chamber, the throttle and the mixture control needle.

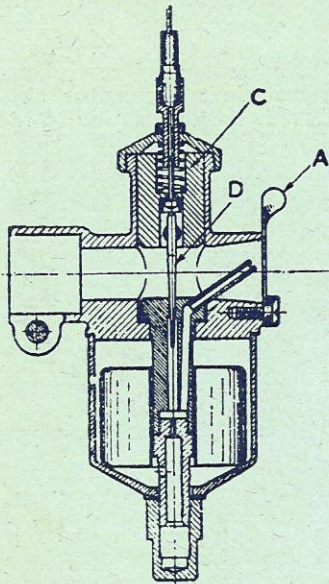
Petrol enters the float chamber from the petrol tank by way of an orifice (E)

which can be sealed by a tapered needle valve (F). The air-filled brass boat rises when the petrol flows in and when it reaches a certain height forces the needle valve on to its seat and stops any further flow of fuel until the engine's demand for fuel has again lowered the level.

Petrol passes from the float chamber from a jet in which slides a long needle with a fine taper (D). This needle is connected with the throttle (C), which is cylindrical in shape and slides up and down across the passage through which air passes to the engine.

SERVICING MOTORISED CYCLES—continued

When the engine is not required to produce much power, the throttle is nearly in its lowest position and the mixture control needle nearly fills the jet orifice. Thus only a small amount of air is allowed to pass and an equally small amount of petrol is sucked from the jet to mix with the fast-moving airstream and thus be vaporised.



When the rider needs more power he opens his throttle lever which raises the throttle plunger and allows more air to pass to the engine. At the same time the throttle plunger lifts the mixture control needle and allows more petrol to emerge from the jet. Thus the proportion of petrol to air is kept constant at all positions of the throttle

TRACING TROUBLE

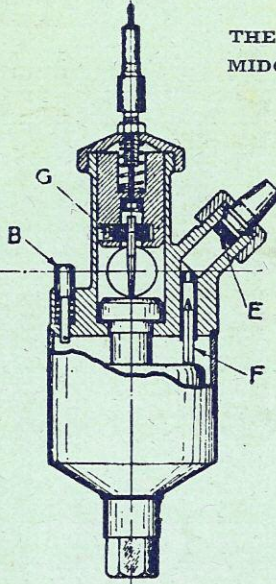
Troubles are usually traceable to dirt on needle, causing creep or flooding, or dirt in filter, loose top cap, punctured float, air leak through fixings becoming slack, air-lock in tank (cure by removing petrol cap and blowing into tank), too much or wrong kind of oil in petrol mixture, choked fuel pipe or tap. Strangler, of course, is only used to give rich mixture on starting. Release when engine is warm or starts to "four-stroke" when running or idling.

TO DISMANTLE

Best to detach from engine. Unscrew top ring and remove the throttle slide (C). Reverse instrument; unscrew bottom nut. Take off fibre washer, lift off cup and float. Carefully lift out the small fuel needle thus exposed. Undo small grub screw in side of body. Push out centre-piece and jet, note position of fibre washer.

TO REASSEMBLE

Clean all parts and the filter. Place centre-piece in place with its washer. Place fuel needle in position with pointed end inside the carburettor body. Put float over this. Fit large fibre washer, cup, small fibre washer, bottom nut, tightening without force.



THE VILLIERS
MIDGET CARBURETTOR

- A. Strangler.
- B. Tickler.
- C. Throttle.
- D. Jet needle.
- E. Petrol inlet.
- F. Float needle.
- G. Throttle needle grub screw.

Remainder self-evident. Do not forget grub screw.

ADJUSTMENT

Remove knurled cap. Take out throttle slide (C) and tapered needle (D), slack off screw (G). If mixture is too rich, lower the needle in the throttle, trying it a little at a time. If too weak, raise by some degrees.

Seizure of Engine when new will sometimes occur through weak mixture. Thus, too little oil (petrol system). Engine dries up and seizes. Too rich will cause high consumption and four-stroking. Set carburettor on rich side for first 150-200 miles. Gradually weaken off until correct setting for normality is attained. If no satisfaction, consult factory.

IGNITION

To fire the charge of petrol gas when it is compressed in the cylinder an electric spark is required. This is produced by a magneto, an instrument which produces electricity of a very high voltage.

To produce that voltage a rotating magnet builds up a current in a coil of wire. At the instant when the spark is required that current is prevented from flowing by the separation of two contacts operated by a cam on the crankshaft. A sudden surge of current is caused in the primary coil, and by a process known as induction this surge causes another current of

very much greater voltage to flow in a secondary coil which surrounds the first-mentioned coil. From the secondary coil an insulated cable takes the momentary high voltage to the sparking plug.

The sparking plug is screwed into the top of the cylinder and consists of a central rod to which the high-tension cable is connected. This central rod or electrode is insulated from the main body of the plug, at the innermost end of which is a small projection almost touching the central electrode.

Electricity must always flow in a circle, and here the high-tension current flows through the secondary coil, along the high-tension cable down the central electrode, whence it jumps to the body of the plug over the small gap provided and returns to the secondary coil by way of the cylinder and crank case.

When it jumps the small gap it forms a spark and thus ignites the mixture.

MAGNETO AND TIMING

Read in conjunction with notes in section on "Dismantling." The contact breaker points are "anti-clock." The points should break when the piston is $\frac{3}{8}$ in. or $\frac{1}{4}$ in. before the top of its stroke (top dead centre). To correct the timing, turn engine so that line on end of crankshaft is pointing to T.D.C. (i.e., on horizontal engines, dead level in line with cylinder). Slack off the flywheel nut and turn the flywheel until the mark on its face registers with a similar mark on the armature plate. Check that crankshaft has not turned meanwhile. Timing should then be correct. Lock up everything, allowing no slip.

Check contact breaker over after about first 150 to 200 miles. Turn flywheel to lift rocker arm to its highest position. Undo the lock nut (the lower one) and turn the other nut until the faces of the points are $\frac{1}{64}$ in. apart. Use a 0.016 in. feeler gauge. Then retighten, allowing no slip. Never file the points. Clean, if necessary, with non-woolly rag dipped in petrol. If fitting a new rocker upsets the existing timing, bend rocker slightly to lie flat on its fixed contact point.

SPARKING PLUG

The gap between the side and central electrodes should be 0.020 in. In use the points of these electrodes get burnt, thus causing the gap to widen; close up the gap by bending the side electrode. *Never bend the central electrode.*

If there is plenty of fuel in the carburettor and the engine fails to start, remove the sparking plug and examine the points, which may be bridged by a film of oil. Clean thoroughly in petrol.