New Two-stroke Engine

Stylish Two-fifty Unit Embodying Four-speed Gears Introduced by Associated Motor Cycles: Unusual Scavenging System

CONVINCING proof of the upsurge of British interest in lightweight machines is that Associated Motor Cycles, for so long connected with 350 c.c. and larger-capacity four-stroke engines, have put into production a 249 c.c. two-stroke engine-gear unit incorporating four speeds. It is a unit of modern design, neat appearance and robust construction. As several members of *The Motor Cycle* staff can confirm, it provides a refined yet potent performance and two-strokes unusually well under light load. To enable the engine to be produced in addition to the firm's other commitments, a considerable extension of the Plumstead factory has been necessary.

An especially interesting feature is that the scavenging system differs from that of most current flat-top-piston two-strokes in which the Schnürle or "loop-scavenge" principle is followed—the transfer gases are directed towards the rear of the combustion chamber and swirl over and down, pushing the exhaust gases ahead of them towards the port.

In the A.M.C. engine a so-called "laminar-flow" scavenge is employed. The gases entering the combustion chamber are kept in jet form by special design of the transfer passages and the embodiment in the piston crown of guiding recesses which further ensure that the jets keep close to the sides of the cylinder. Projections in the cylinder head direct the charge streams to the top of the combustion chamber where they come together and turn downward, displacing the burnt gases towards the exhaust outlet. Scavenging is aided by the fact that a relatively cool gas layer will not mingle readily with a much hotter layer.

The full length of the transfer passages in the 66mm-bore cylinder is open (i.e., there is no dividing wall between passage and bore) so that more accurate control of the profile is possible and the angle of emergence of the transfers can be shallow. The passages are disposed axially in the cylinder and on the transverse diameter; their cross-section width tapers each way from the middle, a method of avoiding line wear on the piston. Inlet and exhaust ports are on the longitudinal diameter, and the exhaust tract enlarges sharply just outside the port and then veers to the right.

Spigot depth into the crankcase is about ¾in and the barrel is held down by four short studs. Finning is extensive and is continued down to base level; to keep fin resonance at a minimum, cast-in ties are employed at front and rear of the barrel.

The Amal Monobloc carburettor has a choke diameter of 1⅛in and is protected from engine-heat conduction by an insulating washer. Enclosing most of the carburettor is a cast-aluminium cover which is bolted to a face on the back of the cylinder. Embodied in the rear of the cover is an air-filter chamber which is sealed from the rest of the cover by a rubber ring seating on the carburettor bell mouth. The top of the mixing chamber is embraced by a large synthetic-rubber grommet through which pass the cables and which fits on top of the cover.

Of low-expansion aluminium alloy the piston has three rings, the topmost chromium plated and taper faced. In the skirt, immediately below the gudgeon-pin bosses, are diametrically opposed transfer ports. On each side of the flat crown is a part-conical recess which occupies a little over a quarter of the circumference and has a cone angle of about 25 degrees.

Extending from the underside of the head into the cylinder are the projections. They are of a shape corresponding to that of the piston recesses within which they mate as top dead centre is approached. As the piston recesses begin to move over the head projections a squish effect is given to promote turbulence and scour the sparking plug, which is located on the left of the combustion chamber just above the projection on that side. There are additional squish areas above the unrecessed sections of the piston-crown periphery because the maximum diameter of the combustion space is smaller than the bore.

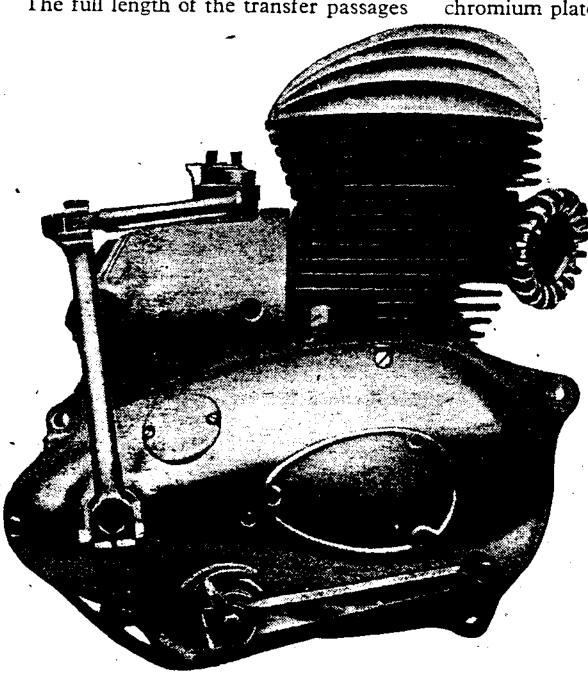
The head fins have local thickening of the section to break up the length and avoid sympathetic resonance. In the middle of the head the finning is vertical but at each side there are three radial fins and a final horizontal fin. Apart from adding to the appearance the fin layout improves the cooling because the air can really get between the radially disposed fins.

Of built-up construction and 72.8mm stroke, the crankshaft has full-disc steel flywheels relieved slightly on their inside faces over that half of the area in which the crankpin is situated; the relief is to aid big-end lubrication. Each flywheel is drilled axially (on each side of the crankpin) for balancing; the holes are covered with discs secured by peening.

Shouldered and of En.351 the crankpin is pressed into the wheels, as are the headed mainshafts (of Ubas steel) which are located by keys. Supporting the drive-side mainshaft are two ⅞in-diameter ball bearings between which is a distance collar. Outboard of the bearings is a double-lipped oil seal bearing on a separate hardened and ground track. The inner races, oil-seal track and sprocket are locked up to the flywheel by the sprocket-retaining nut.

The right-hand mainshaft is carried in an unlipped roller bearing of similar dimensions to the ball bearings. On that shaft is mounted the rotor of a Wico-Pacy A.C. generator; the stator spigots into the crankcase and on the same studs is fitted a plate carrying the contact-breaker assembly, accessible through a detachable panel in the shapely, polished side cover.

For main-bearing lubrication an oil-trapping groove is turned in the base of the recess in the crankcase which accommodates the cylinder spigot. From each side of the groove oil drains down a drillway to the lip of the bearing oil seal.

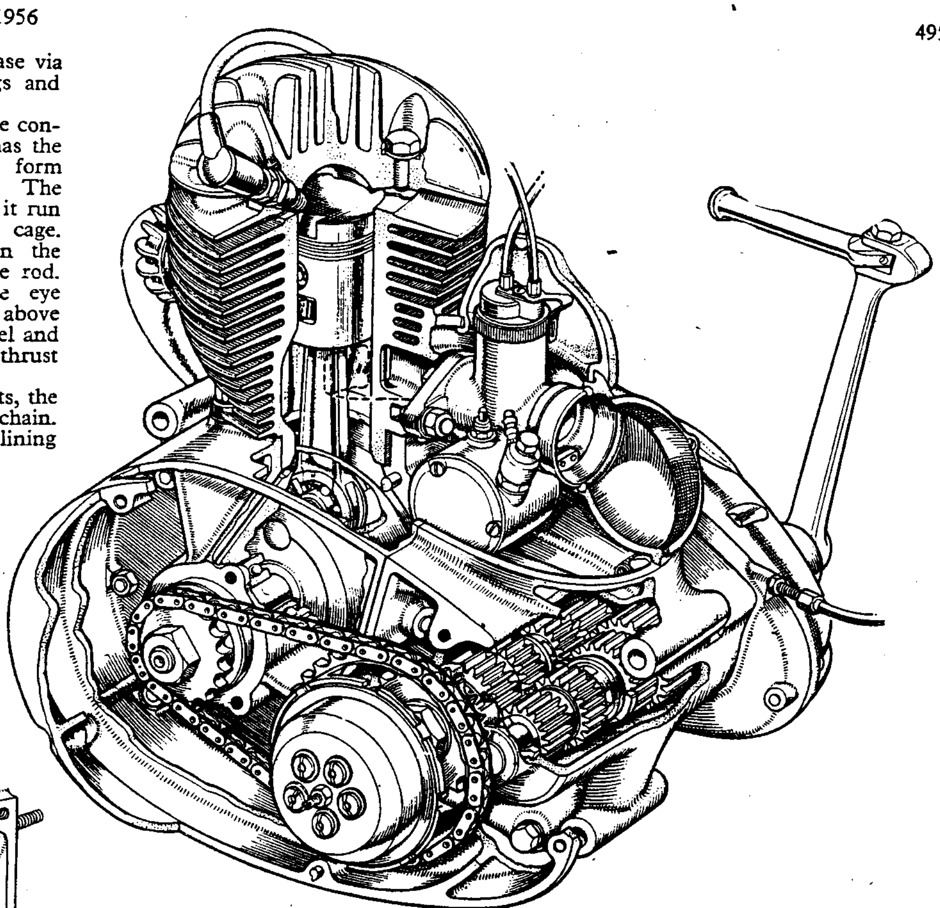


This photograph of the 249 c.c. A.M.C. engine shows the clean lines of the castings, the radial finning of the head and the detachable cover plate over the contact-breaker. A rubber shield normally conceals the top of the carburettor

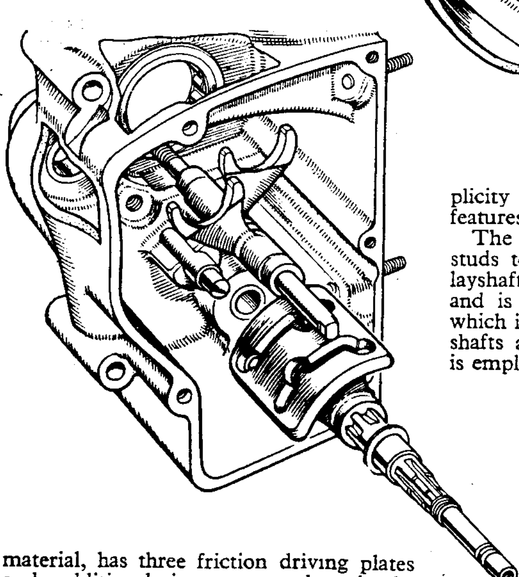
Since the oil returns to the crankcase via the bearing assemblies the bearings and oil seals are effectively lubricated.

Measuring 6in between centres the connecting rod, an En.351 stamping, has the big-end eye grooved externally to form two circumferential stiffening ribs. The bore of the eye is hardened and in it run 10 $\frac{1}{4} \times \frac{3}{8}$in rollers in a Duralumin cage. Lubrication holes are provided in the bronze-bushed small-end eye of the rod. To assist big-end lubrication the eye flange is scalloped out on each side above the crankpin. Between each flywheel and the big-end is a hardened-steel thrust washer.

On 20-tooth and 43-tooth sprockets, the primary drive is by $\frac{3}{8}$in-pitch simple chain. The clutch, which employs Klinger lining



In this cutaway view can be seen the blisters on the head fins and the divided inlet port. The sturdy crankshaft assembly is supported on three main bearings and the big-end bearing is of caged-roller pattern



Pegs on the gear-selector forks engage in profiled slots in a cam segment on the ratchet-plate spindle

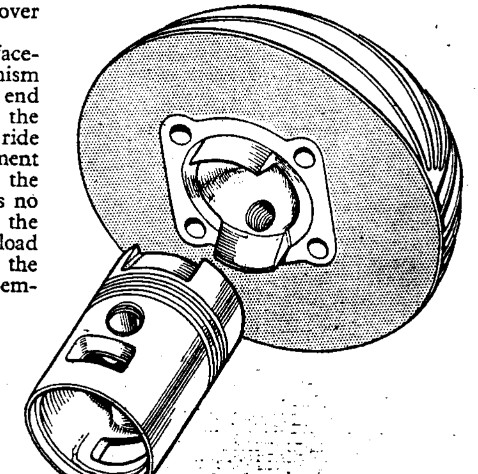
material, has three friction driving plates and additional inserts on the clutch-sprocket face. There are five adjustable springs and master adjustment for the thrust rod is embodied in the pressure plate.

Not the least interesting detail of the new unit is the clutch thrust operation. Located by a pin and secured in the gear box end cover by a locking ring, the operating body is co-axial with the mainshaft. The body has a vertical hole offset from the axis and a smaller-diameter axial hole. An easy-running fit within the axial hole is a bearing ball. The operating-arm spindle fits in the other hole and has a transverse groove of radial depth, towards one side of which rests the ball. As the spindle rotates, the groove acts as a cam and moves the ball (and with it the thrust rod) axially to disengage the clutch. Simplicity and high mechanical efficiency are features of the mechanism.

The four-speed gear box is held by studs to the rear of the crankcase. The layshaft lies to the rear of the mainshaft and is carried in bronze bushes, one of which is within the kick-starter axle. Both shafts are of En.351 steel whereas En.34 is employed for the gears. The mainshaft sleeve gear is supported in a roller bearing and is bronze bushed to take the mainshaft, the other end of which runs in a ball bearing in the detachable end cover of the box; the cover is concealed by the side cover of the engine unit.

One member of the face-ratchet kick-starter mechanism fits on helical splines on the end of the axle; depression of the pedal thus causes the member to ride along the splines and into engagement with the other ratchet member on the layshaft bottom-gear pinion. There is no chance of jumping a tooth because the splines ensure that the greater the load applied to the pedal, the higher is the engagement pressure between the members.

The gear cluster is entirely orthodox and provides internal ratios of 1, 1.30, 1.85 and 2.95 to 1. Closely resembling the arrangement used in the new heavyweight box, the positive-stop mechanism employs a double-ended pawl. Gear selection is by means of two co-axially mounted selector forks, each carrying a peg which engages with one of two tracks on a cam segment splined to the ratchet-plate spindle. Gear indexing is by means of a spring-loaded plunger in the shell and dimples in the cam-segment web.



An unusual feature of the engine is the scavenging system which incorporates correspondingly shaped piston recesses and cylinder-head projections. The piston skirt contains transfer ports and the sparking plug is located immediately above one of the projections