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THE 500 c.c.
ROTARY VALVE CROSS



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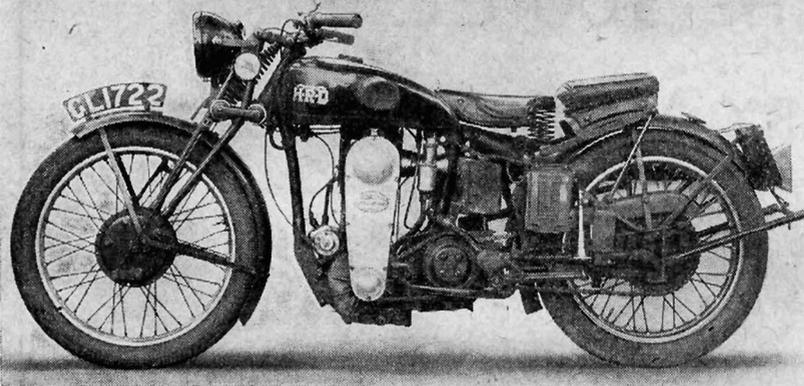
The 500 c.c. Rotary Valve Cross

Road Tests

Recalled—No. 63

THIS series is intended primarily for owners, actual and potential, of pre-war machines. In view, however, of the undoubtable interest that is maintained in rotary valves—as evidenced at the I.A.E. meetings and club discussions—it has been decided to recall our road test of a very unconventional motorcycle indeed, albeit one that cannot be bought. It is the 500 c.c. Cross-engined Vincent H.R.D., which was in our hands in the spring of 1937.

A linerless aluminium cylinder barrel was a principal feature of the engine (as with all Cross products), the Y-alloy piston being prevented from touching the cylinder walls by means of a special hardened, deep-section ring at the top and a series of guide rings, made from high-tensile, square-section alloy steel wire, down the skirt of the piston.



Thus, there was no piston slap; and, incidentally, the compression ratio was $10\frac{1}{2}$ to 1.

Immediately above the combustion chamber was the rotary valve, chain driven from the engine shaft. This valve was divided diagonally so that, as it rotated, connection was made alternately with the inlet port on the near side and the exhaust port on the off side. A point on which the designer, Mr. R. C. Cross, had spent a great deal of time was the lubrication of the valve. Although the amount of oil in circulation was unusually large, not a drop penetrated to the combustion chamber; the flow of lubricant to the valve varied in direct proportion to the engine speed, a form of throttle-controlled oiling being used.

The valve housing was split, the upper half being hinged to the cylinder and also tied to the crankcase. The cylinder was mounted on an adjustable spring so that it floated; thus, expansion of the valve under heat was compensated for and only sufficient pressure was exerted upon the valve for it to maintain its contact with the sealing port-edge lip. As the pressure in the cylinder rose, it endeavoured to press the valve away from the port but always the valve was given a little more pressure to seal

the port than the gas could exert upon it to press it away.

This same system has been used on later engines, except that, the required strength having been determined, the spring incorporated in the cylinder mounting has been tucked away out of sight. So great is the reliability of the prototype model, however, that it has run throughout the war period, and is still running, without alteration.

Performance.—Side-valve flexibility with super-tuned o.h.v. acceleration and maximum speed was the keynote of the Cross engine—and the one tested was just a hack, experimental, touring-type job. It had not been carefully balanced; it had been taken down only once during 15 months of a strenuous life, and that six months prior to our test. Even the plug was 15 months old.

The acceleration was phenomenal. As the graph shows, it needed only 28.5 secs. to reach, from a standing start, the flat-out speed of 87 m.p.h., at which the engine was revolving at the rate of

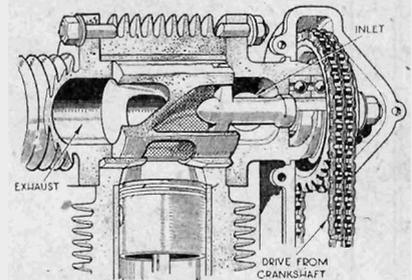
6,300 r.p.m. The maxima in third and second, respectively, were 73 m.p.h. (6,600 r.p.m., reached in 17.5 secs.) and 61 m.p.h. (7,400 r.p.m., in 11.5 secs.). The "standing quarter" was covered at an average of 53.4 m.p.h., 80 m.p.h. being exceeded at the end of the measured straight; and the "flying quarter" was traversed at 85.88 m.p.h.

Whilst the minimum non-snatch speed in top gear was 18 m.p.h., it was easily possible to trickle along in the same ratio at a fast walking pace, provided, of course, one ignored the protests of the transmission. Perhaps, however, an even greater demonstration of flexibility was made on Southstoke, a 1-in-4 hill near Bath, which is approached along a narrow lane and which has a sharp hairpin bend at the top. This was climbed repeatedly in top—even "two-up," although, then, a very little clutch-slip was necessary to negotiate the hairpin. Never was there a sign of pinking, or of any fuss at all except from the chains, which were never intended for such "thumpy" treatment anyway.

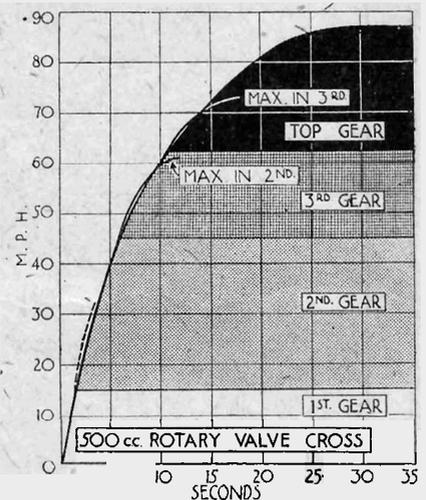
On the open road 75 m.p.h. was a natural cruising speed, at which the engine never seemed to tire or "dry up." Naturally, there was no mechanical clatter; the only sound was a faint whir

from the rotary valve. And Mr. Cross's own design of absorption silencer attended efficiently to the exhaust. Consequently, the machine was in all ways a delightful one to ride.

Handling.—We cannot conclude this review without reference to the Vincent H.R.D. spring frame in which the motor was fitted. The machine could be steered to a hair at all speeds, indifferent surfaces did not affect the ease of control in the slightest, and the well-known Duo brakes pulled the model up from 30 m.p.h. in 29 ft. on the damp Brooklands concrete. The tester wrote at the time: "... a revelation in motorcycles



On the left is the experimental 500 c.c. Cross engine in its Vincent H.R.D. frame; the excellence of its performance is evident from the graph below. Above is a sectioned drawing of a 250 c.c. Cross valve and head; although there are several detail differences between this and the design tested, the principle of the rotary valve is clearly shown.



... the most comfortable we have ever ridden on the (Brooklands) Track."

Consumption and Starting.—Fuel consumption averaged 56 m.p.g., that of oil being 1,250 m.p.g. Starting was always of the first-kick variety, it being necessary only to flood the carburetter and ease the motor over compression once or, perhaps, twice.

Summary.—Whether Cross motors will feature in any post-war design, we do not know. We can say, however, that development has been quietly going on at Bath, even during the war years. If, therefore, you read in some future specification the words "500 c.c. Rotary-valve Cross Engine"—or 350 c.c., or 250 c.c.—you may rest assured that the description is of a well-tried product.