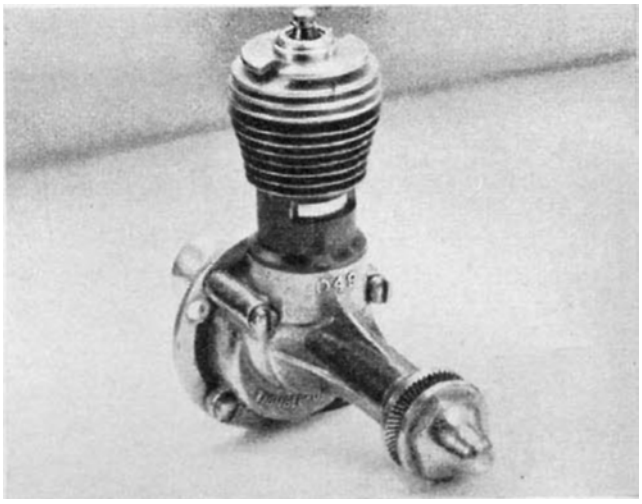
Engine Tests

No. 76. The Cox Thimbledrome .049 c.c.

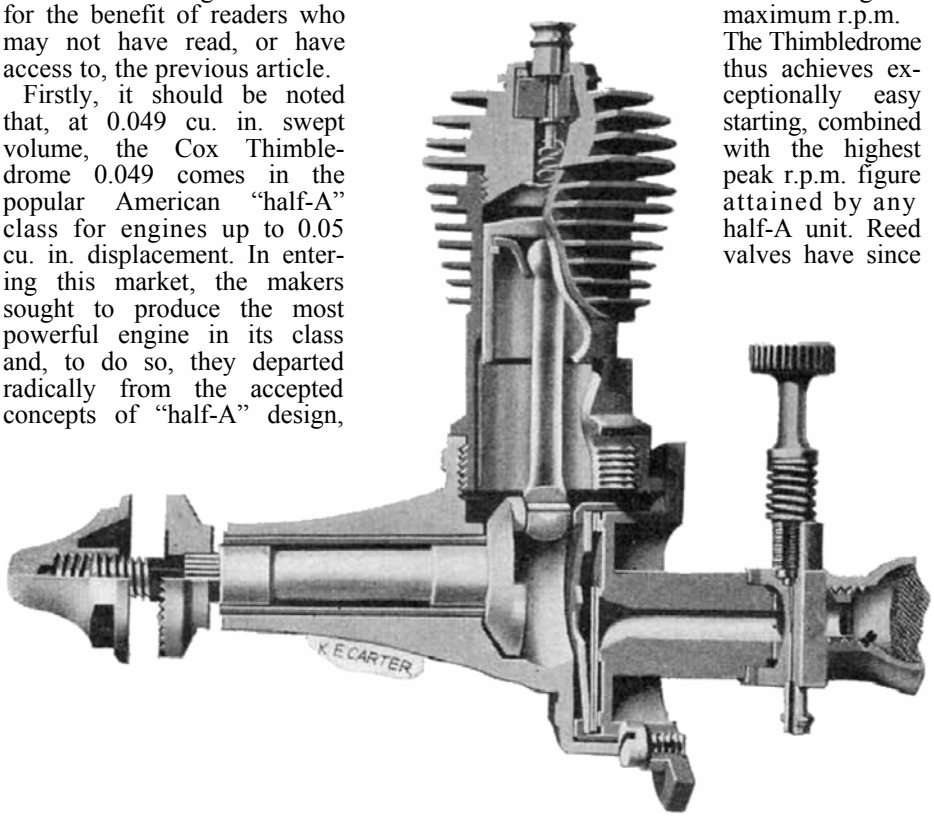


So far this year, we have dealt, in the Engine Tests series, with seven engines from five different countries: three from Great Britain and one each from Germany, Italy, Norway and Japan. This month we have another overseas product in the shape of the Thimbledrome 0.049 "Thermal-Hopper" engine made by the L. M. Cox Manufacturing Co., Inc., of Santa Ana, California, U.S.A.

The Cox 0.049 was first described some two years ago in "Accent on Power." A technical assessment of the design, including an account of the characteristics of the reed-valve system of induction, was contained in this article (MODEL AIRCRAFT, September, 1953) and we shall not, therefore, give a detailed description here. However, a summary of the notable features of this outstanding miniature i.c. engine follows for the benefit of readers who may not have read, or have access to, the previous article.

Firstly, it should be noted that, at 0.049 cu. in. swept volume, the Cox Thimbledrome 0.049 comes in the popular American "half-A" class for engines up to 0.05 cu. in. displacement. In entering this market, the makers sought to produce the most powerful engine in its class and, to do so, they departed radically from the accepted concepts of "half-A" design, which, hitherto, had included, almost exclusively, shaft rotary valve induction and annular cylinder porting. The first Thimbledrome 0.049, produced three years ago, was the "Space Bug" model aimed at the C/L field. It was afterwards followed by the "Thermal-Hopper," a F/F version of the same engine, which is the subject of our present test.

The first unconventional feature of the design is, of course, its reed, or flutter-valve, intake system. Used for some years by American outboard motorboat engine manufacturers, the reed-valve consists, essentially, of a simple spring flap over the crankcase induction port, which is thus operated by atmospheric pressure and is, therefore, more readily adaptable to the widely different induction timing ideal requirements between starting and maximum r.p.m. The Thimbledrome thus achieves exceptionally easy starting, combined with the highest peak r.p.m. figure attained by any half-A unit. Reed valves have since been seen on a few other engines, but the design of the Cox reed-valve housing and carburettor unit remains the neatest and most reliable yet encountered.



The carburettor, although of the needle-valve type, is unconventional, in that three jets, placed at 120 deg. intervals, lead into the choke tube, fuel metering being controlled by a needle-valve which is quite separate from the jets.

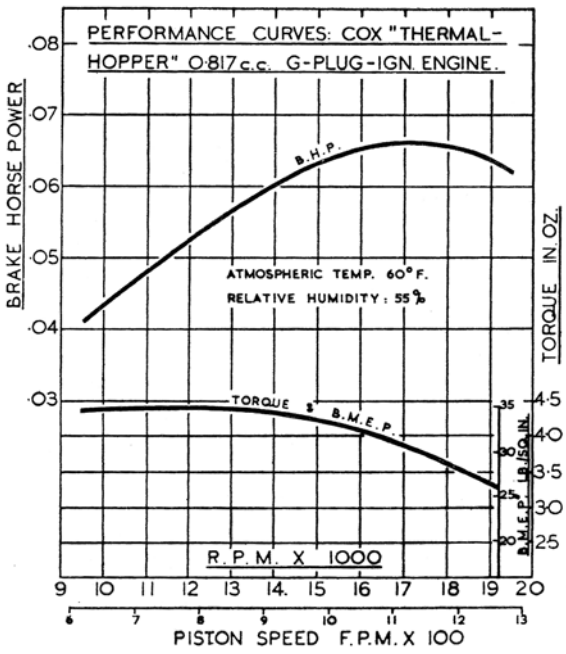
The construction of the engine is of the very highest order. It is the only lapped piston production engine so far produced, in which the pistons and cylinders are finished to such close tolerance that these components are interchangeable and do not require to be selectively matched during assembly. The crankcase is a diecasting of unusual accuracy and finish and contains a bronze bushed main bearing. The crankshaft is beautifully made, with a relieved main bearing centre section to provide two $\frac{3}{16}$ in. x $\frac{3}{16}$ in. dia. journals and has a crescent counterbalance machined in. The lightweight steel piston, which is hardened, ground and honed, employs a ball and socket small end joint.

The Cox cylinder is a one-piece unit with machined-on fins and has a blued finish. The alloy cylinder head screws into the top of the bore and provides a hemispherical combustion chamber shape unspoiled by glowplug interference, since the ignition element is built into the head itself. If and when the element becomes unserviceable, a replacement cylinder head is, of course, required, but this is obtainable from the manufacturers at no greater cost than a normal glowplug.

Specification

Type: Single cylinder, air-cooled, two-stroke. cycle, glowplug ignition. Induction via crankcase reed-valve. Dual opposed exhaust ports and twin transfer grooves. Hemispherical combustion chamber. Rotation: clockwise or anticlockwise.

Swept Vol.: .817 c.c. (.049 cu. in.).



Bore: 0.406 in. Stroke: 0.386 in.
Compression Ratio: (standard) 6.5 : 1
Stroke/Bore Ratio: 0.951 : 1.
Weight: 1.35 oz.

General Structural Data

Diecast aluminium alloy crankcase with phosphor-bronze main bearing bush. Heat treated alloy steel cylinder with integral cooling fins, blued for protection against corrosion. Hardened ground and honed steel piston with ball and socket connecting-rod attachment secured with circlip. Aluminium alloy connecting rod. Balanced crankshaft with machined-in counterweight, and with separate front and rear main journal surfaces. Aluminium alloy cylinder head with built-in ignition filament. Machined alloy crankcase backplate in unit with carburettor body and forming base for reed-valve components. Two copper-berrylium reeds retained by special steel back-plate and alloy ring housing. Separate needle-valve body metering fuel to three carburettor jets. Needle-valve complete can be rotated through 360 deg. for any convenient installation angle. Carburettor has gauze air filter. Three point radial mounting.

Test Engine Data

Running time prior to test: 20 min. only (see text).

Fuel used: 50 per cent. blending methanol, 25 per cent. castor oil, B.P., 25 per cent. nitro-methane.

Ignition equipment used: Maker's integral glowplug head (1.6 volts used to start).

Performance

One of the features of the Thimbledrome 0.049 is that, due to the exceptional finish of the working surfaces, the engine requires virtually no running-in period. The makers state, in fact, that the motor may be operated at full power following only one minute of rich mixture operation. A nominal running in period of only 20 min. was therefore given before our dynamometer test.

Starting is as easy as one could wish. No priming is necessary and the engine will start from cold by merely choking the intake just as soon as any thickened residual oil is dispersed. Restarting the engine hot is instantaneous; we did not even bother to connect the glowplug for this but merely touched the lead on to the terminal with the left hand while flicking the prop once with the right. This ease of starting is obtained irrespective of load. To check this, a light 5 in. dia. propeller was fitted, allowing r.p.m. to reach some 22,000 and still no difficulty was experienced.

The running qualities of the engine are first class. It is vibration-free and consistent, especially at the highest speeds. The rearward location, easily adjusted to any convenient position of the needle-valve control, is very helpful. The adjustment to find optimum performance is fairly critical but the needle holds its settings firmly at all speeds. Carburation is undoubtedly very efficient on this engine and the only disadvantage of the jet design is the tendency for these to clog easily if any foreign matter is present in the fuel. An obvious precaution here is effective filtering.

Dynamometer tests for the present report on the Thermal-Hopper were carried out without any special regard to matching compression ratio and fuel to atmospheric conditions (factors having considerable influence on Thimbledrome performace) and it is considered that the maximum output recorded of 0.066 b.h.p. at approximately 17,200 r.p.m., while appreciably above the best figures previously recorded for 0.049 cu. In glowplug engines, may, in fact be pushed up to circa 0.08 b.h.p. at 18,000 r.p.m. under favourable conditions. It will be observed that torque, reaching a b.m.e.p. equivalent of 35 lb./sq. in., is up to 30 per cent. higher than previous figures for half-A glowplug engines.

Specific output (as tested): 88 b.h.p./ltr.

Power/weight ratio (as tested): 0.766 b.h.p./lb.