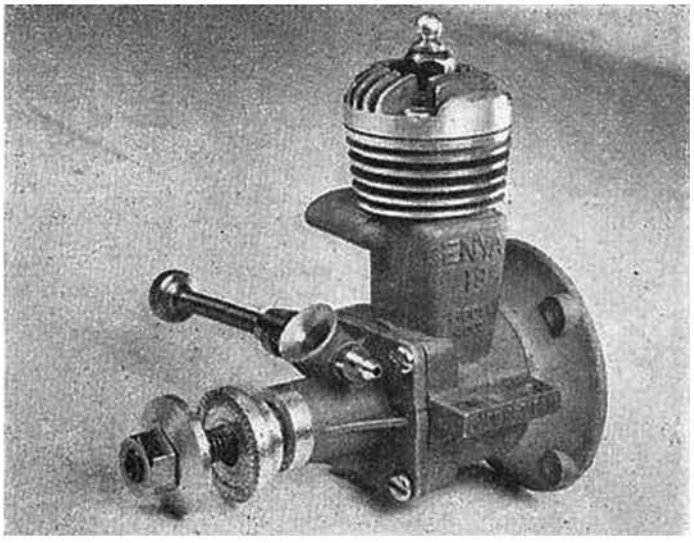
Engine Tests

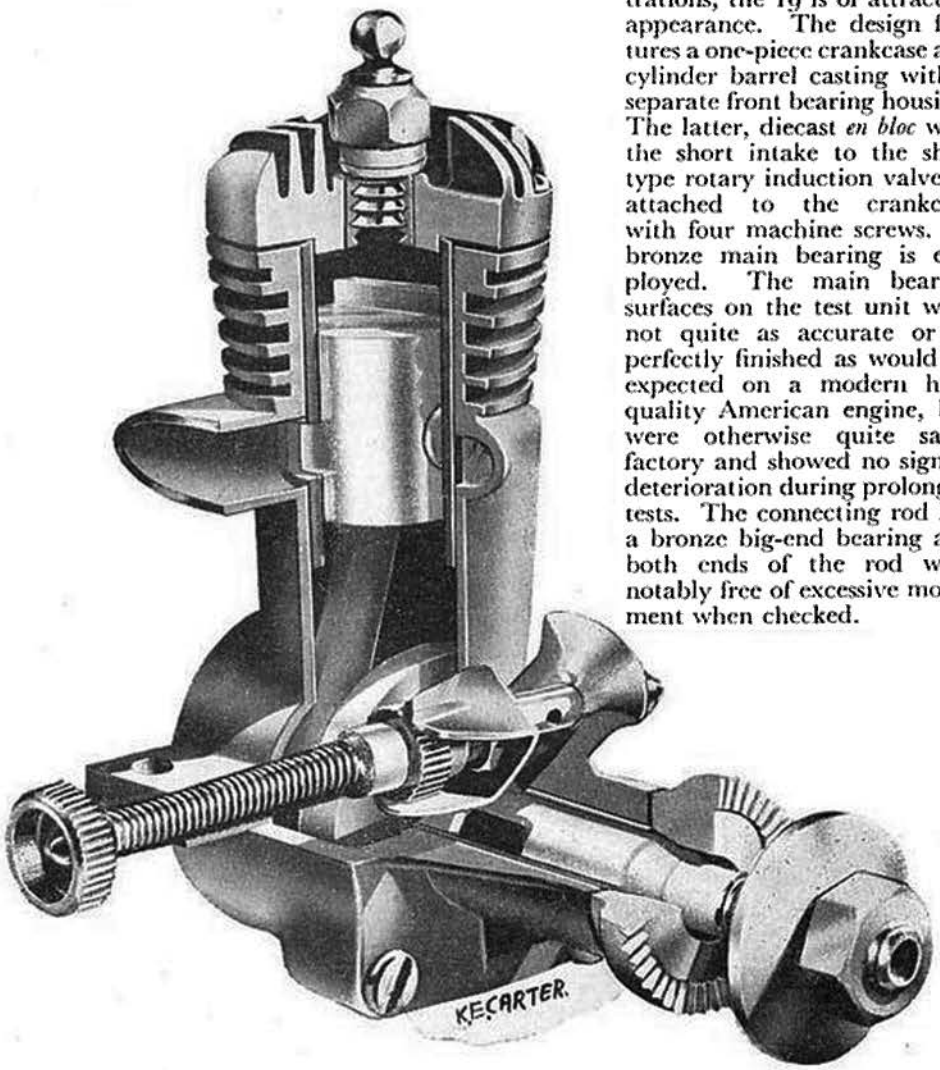


No. 71. The Enya 19 3·2 c.c.

SOME very good model aircraft engines have, during the past year or so, been put into production in Japan and are now being seen in increasing numbers in other parts of the world. Among them is the Enya 19, which is the subject of this month's test.

Like the majority of Japanese engines, the Enya is a glowplug type and, as its designation suggests, is built to come within the American "A" class of .05-.20 cu. in. capacity. The general design of the Enya 19 is similar to popular American engines of equivalent size, although neither it, nor other Japanese engines in general, are, by any means, mere copies of Western designs.

The Enya engines are built by the Enya Metal Products Company, Ltd., of Tokyo. As will be seen from the illustrations, the 19 is of attractive appearance. The design features a one-piece crankcase and cylinder barrel casting with a separate front bearing housing. The latter, diecast *en bloc* with the short intake to the shaft type rotary induction valve, is attached to the crankcase with four machine screws. A bronze main bearing is employed. The main bearing surfaces on the test unit were not quite as accurate or as perfectly finished as would be expected on a modern high quality American engine, but were otherwise quite satisfactory and showed no sign of deterioration during prolonged tests. The connecting rod has a bronze big-end bearing and both ends of the rod were notably free of excessive movement when checked.



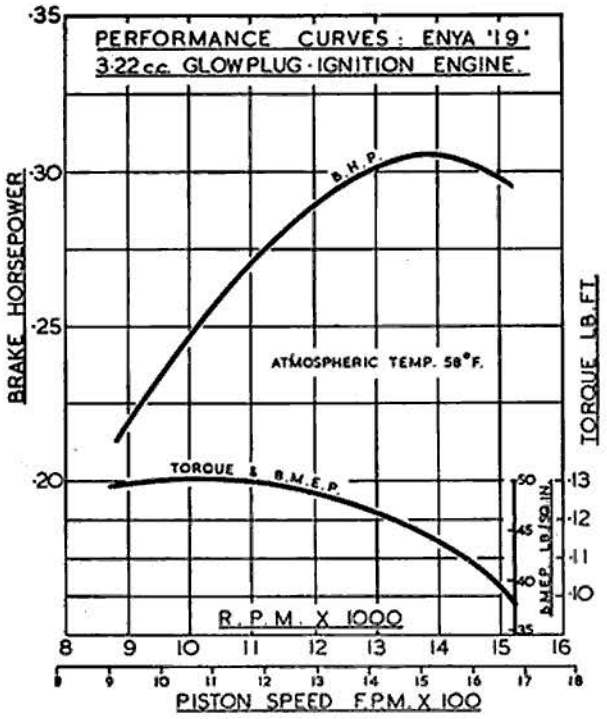
The crankshaft has a rectangular intake port cut in the main journal which is of 9 mm. dia. and is 27 mm. long. The shaft is, of course, in one piece and has a machined-in crescent shaped counterweight. A lightweight lapped cast-iron piston is employed, the skirt being relieved on the inside below the gudgeon pin bosses for lightness. Incidentally, a minor complaint on the test engine was that the gudgeon pin holes had not been bored precisely through the centres of the gudgeon pin bosses. The straight type baffle, however, had been correctly machined parallel to the gudgeon pin and no adverse effect on performance was therefore occasioned by this slight error. Aluminium end pads are fitted to the gudgeon pin.

The engine is of the conventional two port loop scavenged type. A fairly large volume transfer passage is used, together with a large area exhaust port which opens out into a wide, elliptical exhaust duct. The diecast finned head has a centrally located glowplug and is unusual in that the depth of the cooling fins tapers off towards the rear to present a streamlined appearance to the cylinder head when seen in elevation.

The engine is of quite robust construction and generously proportioned beam mounting lugs are cast, in the usual manner, in the crankcase sides. In addition, the rear of the crankcase has four concealed lugs which are tapped to take screws securing a special diecast radial mounting plate. Another useful feature is the strong, flexible needle valve extension. Drive to the propeller is conveyed through a turned aluminium collet which is mounted on a taper on the crankshaft, forward of which is a 6 mm. threaded portion of adequate length to fit all propeller pitches.

Specification

Type : Single cylinder, air-cooled, two-stroke cycle, glowplug ignition. Induction via shaft type rotary valve. No supplementary sub-piston air induction. Lapped piston with straight



baffle, machined from solid.

Swept Volume : 3.216 c.c. (.196 cu. in.).

Bore : 16 mm. Stroke : 16 mm.

Compression Ratio : 7 : 1.

Stroke/Bore Ratio : 1 : 1.

Weight : 5 oz.

General Structural Data : Diecast aluminium alloy crankcase and cylinder barrel. Shrunk in steel cylinder liner. Diecast and machined aluminium alloy cylinder head attached with four screws and seating on liner flange, no gasket being used. Diecast aluminium alloy front housing with bronze main bearing bush and attached to crankcase with four screws. Counterbalanced crankshaft. Connecting rod bushed at lower end. Spraybar type needle-valve with flexible extension. Beam type mounting lugs. Detachable diecast radial mounting flange.

Test Engine Data

Running time prior to test : 2½ hours. Fuels used :

1. (Running-in). 70 per cent. Power Blending Methanol. 30 per cent. Castor oil B.P.

2. (General testing). 60 per cent. Blending Methanol, 25 per cent. Castor oil B.P., 15 per cent. Nitrobenzene.

3. (Dynamometer Test). 50 per cent. Blending Methanol, 25 per cent. Castor oil B.P., 25 per cent. Nitromethane.

Ignition equipment used : Maker's special 2-volt short-reach glowplug; 2.15 volts used to start.

Performance

Unlike British and American engines, the Enya requires a full 2 volts, or slightly more, for starting. The Japanese glowplug will then glow with similar intensity to a standard plug operating on 1.5–1.7 volts.

Starting is very easy. Our first start was accomplished in a matter of seconds. No priming was necessary : the engine started within a few flicks after four preliminary choked turns of the prop. Thereafter the engine would re-start quickly after one choked flick and no readjustments to the needle-valve were required when re-starting the engine hot. The best needle-valve setting was found to be 1½ turns open ; little or no variation being required to obtain maximum performance over the entire range of speeds tested.

After running-in on a plain methanol and castor-oil mixture, two types of fuel were employed during the tests. The most commonly used fuel in Japan is a methanol/castor base mixture containing 10–20 per cent. nitrobenzene, since nitromethane is not generally available there. The engine was, therefore, first tested on such a mixture and was found to perform entirely satisfactorily. However, in order to give a more fair indication of its performance by comparison with that of other glowplug engines, a nitromethane additive was, instead, used for the dynamometer tests. This fuel gave about 15 per cent. greater power output. Nitromethane, or similar nitroparaffin content fuels are, of course, invariably used when establishing the performance figures for modern high-performance glowplug engines.

The general handling characteristics of the Enya 19 are very pleasing. Starting, as we have already mentioned, is very good. In view of the fact that, with the flexible needle-valve control conveniently bent back from the prop, it is naturally a little difficult to make very fine adjustments (although by reducing the tension on the ratchet spring slightly, this can be improved). It is also pleasing to find that the engine is not unduly critical to mixture adjustment. There is a slight tendency for the engine to hunt when it is loaded for speeds of 8,000 r.p.m. or lower, but running is very steady at high speeds and there is very little vibration at any speeds over the range of 10,000 to 15,000 r.p.m.

On the torque-reaction dynamometer, the engine recorded its best torque at just over 10,000 r.p.m. The relative b.m.e.p. of 50 lb./sq. in. developed at this point is, of course, very good. Beyond this, torque declines at a steadily increasing rate, resulting in the peak brake horsepower being reached at approximately 13,800 r.p.m., where an output of 0.31 b.h.p. was recorded. This, equal to .096 b.h.p./c.c. or 96 b.h.p./litre, is, of course, very good.

For F/F use, a prop of between 9 in. and 10 in. dia. and 4 to 5 in. pitch should be suitable for use with the Enya 19. Maximum attainable speeds with these will range from 10,000 to 13,000 r.p.m., the smaller diameters and pitches being generally better suited to high-performance power-duration work. For stunt work, a 9× 5 prop is suggested, with the diameter trimmed down slightly until a ground speed approaching 12,000 r.p.m. is obtained.

Power/Weight Ratio: (as tested—beam mounted) 0.99 b.h.p./lb.

Specific Output : (as tested) 96 b.h.p./litre.