M.A. Engine Tests

No. 11.—THE FROG "500"

WHEN one has tested scores of engines of all makes and types, it is not difficult to assess the approximate performance of a new unit before submitting it to tests. A brief inspection of porting, combustion chamber design and general construction, will enable a fair estimation to be made of the probable output and revolutions at which this is reached.

Occasionally, however, subsequent tests will disprove any such estimate and this was found to be so in the case of the Frog "500," the actual performance obtained being somewhat higher than that which had been anticipated. There is nothing very unusual about the design of the "500," yet the test engine gave, under favourable conditions, well over 0.4 b.h.p., a very good performance indeed for a 5 c.c. motor and one which is all the more remarkable when one remembers the very moderate price of this engine.

Actually, the Frog "500" introduces, to the British enthusiast, a type which has hitherto been rather neglected by manufacturers in this country. What might be termed a high-performance general-purpose engine, the type is exemplified in the 5 c.c. class by such designs as the American K. & B. "Torpedo," DeLong, Forster "29" and Ohlsson "29." These engines have been widely and successfully used for some years (with the exception of the Ohlsson, only recently introduced) for power-duration, speed, stunt and, more lately, for radio-control. They possess the high power output, at medium to high revolutions, necessary for present-day duration or stunt work, yet they remain sufficiently tractable, at lower speeds, for medium size R/C models and, with minor modifications, have put up some astonishingly good performances in speed events. The performance obtained from the Frog "500" under test seems to promise equal versatility.

Specifications

Type: Single cylinder, air-cooled, two-cycle, glow-plug ignition. Induction through shaft-type rotary-valve. Single transfer and exhaust ports. Baffle piston.

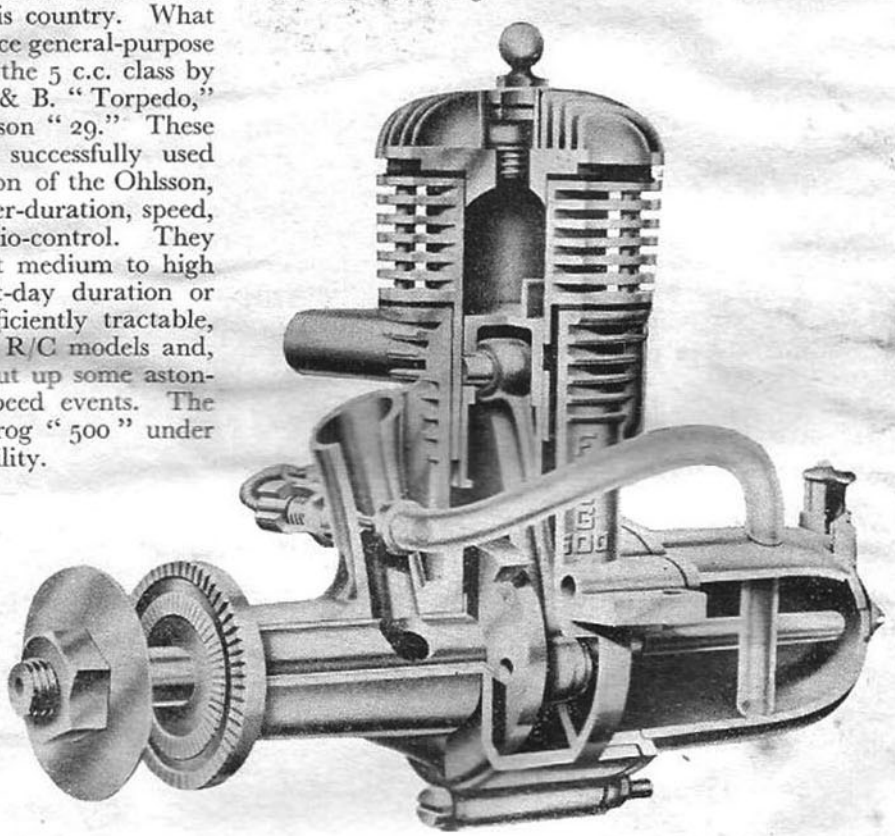
Swept volume: 4.92 c.c. (0.3005 cu. in.). Bore: 0.750 in. Stroke: 0.680 in. Compression ratio: 8 : 1 (approx.). Stroke/bore ratio: 0.907 : 1.

Timing: Rotary-valve opens 15 deg. ABDC, closes 53 deg. ATDC. Exhaust-port opens 64 deg. BBDC, closes 64 deg. ABDC. Transfer-port opens 58 deg. BBDC, closes 58 deg. ABDC.

Port areas: Exhaust, 0.14 sq. in. Transfer, 0.097 sq. in.

Weight: Complete with free-flight tank: 7.75 oz.

General structural data: Die-cast aluminium alloy crankcase, rear cover, cylinder-head and fuel tank. Hardened steel cylinder, ground and honed. Cast-iron piston, ground and lapped. Hardened steel crankshaft, ground and lapped. Phosphor-bronze main bearing. Silver-steel fully-floating gudgeon-pin with aluminium end-pads. Forged connecting-rod of Hiduminium RR. 56 alloy. Fuel tank attached to rear cover with one screw and may be rotated for inverted or side-mounted operation, or removed for C/L work. Beam or three-point bulkhead mounting.



Test Engine Data

Total time logged prior to test : 1½ hours.

Ignition equipment used : K.L.G. " Miniglow " short-reach glow-plug. 1½ V to start.

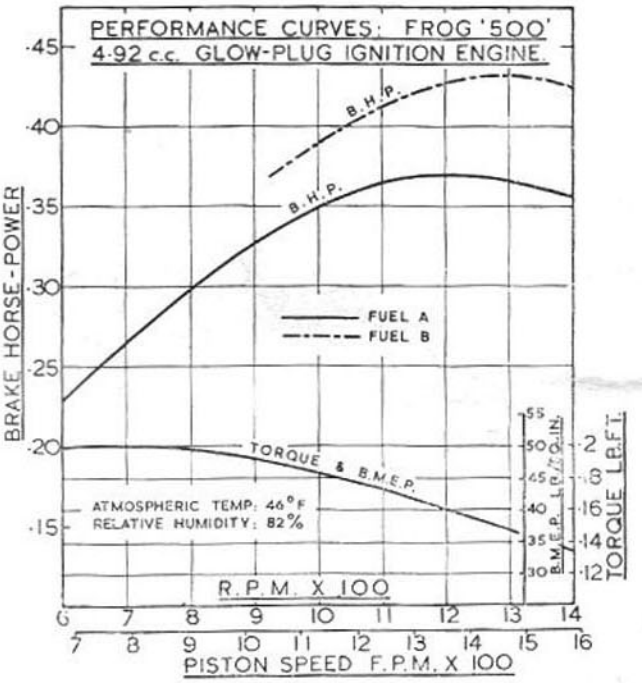
Fuels used : (a) : Frog " Red Glow." (b) 37½ per cent. B.D.H. nitro-methane. 37½ per cent. " Record " racing methanol. 25 per cent. B.P. castor oil.

Performance

Running-in commenced with a series of short runs at speeds up to 8,000 r.p.m. It was quickly noticed, however, that, as the " 500 " warmed up, it did not suffer the falling off in power which, although less evident with petrol-type engines than with diesels, is usually encountered with newly assembled lapped piston engines and, on checking on the reaction dynamometer, it was found that the engine would hold a steady torque reading of 0.2 lb/ft., while running out a complete tank of fuel. Since this represents a b.m.e.p. of some 50 lb./sq. in.—a good figure for an engine of this type—it appeared obvious that the frictional losses of this particular engine were quite low.

To determine b.h.p. on standard " Red Glow " fuel, the engine was then run at speeds varying from 6,000 to 14,000 r.p.m. The decline in torque, noticeable beyond 8,000 r.p.m., as speed was pushed up, was fairly steady and, on plotting the b.h.p. curve, this was found to be very flat, indicating a peak of 0.37 b.h.p. at approximately 12,000 r.p.m. and an output rather above average at the lower end of the speed range.

The " 500 " was later checked on a nitro-methane fuel, using the standard Arden formula containing 37½ per cent. nitro-paraffin as recommended in the manufacturer's leaflet. The response to this fuel was remarkably good and resulted in a maximum of just over 0.43 b.h.p. being developed with the peak pushed up approximately 1,000 r.p.m.

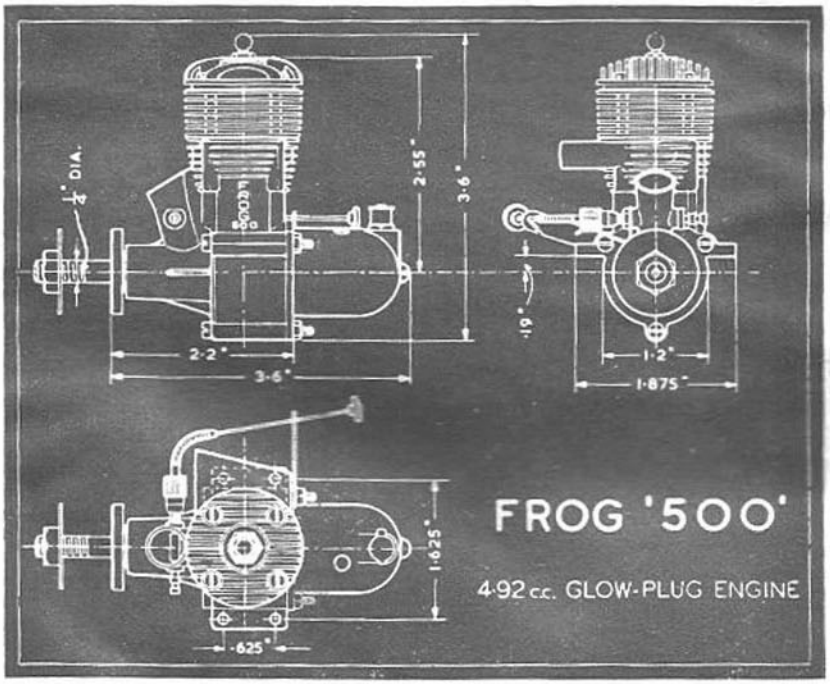


No difficulty was experienced in starting the " 500 " and the procedure laid down in the leaflet accompanying the engine can be adopted to good effect. Normally, priming through the exhaust port is required, but, when warm, the engine can be restarted after a couple of choked flicks only.

An unusually wide range of speed control, by variation of mixture strength, is claimed for the Frog, a feature which, of course, is particularly useful during the trimming stages with free-flight models.

On the test engine, the tension of the needle-valve ratchet spring was decidedly firm, a good point during a bench test when vibration at excessively high speeds tends to upset slack adjustments, but this resulted in a certain amount of " sponginess " in the action of the adjusting knob, due to the flexible coupling interposed between this and the needle-valve and, under these conditions, precise adjustments were rendered difficult. Later however, when installed in a model, the ratchet tension was eased and it was then possible to appreciate the useful range of speed which can, in fact, be obtained by adjusting the needle-valve.

The flexible needle-valve extension is, of course, a useful feature and helps to keep one's fingers away from the propeller. When the engine is side mounted (as is often the case with stunt models) the needle-valve assembly can be

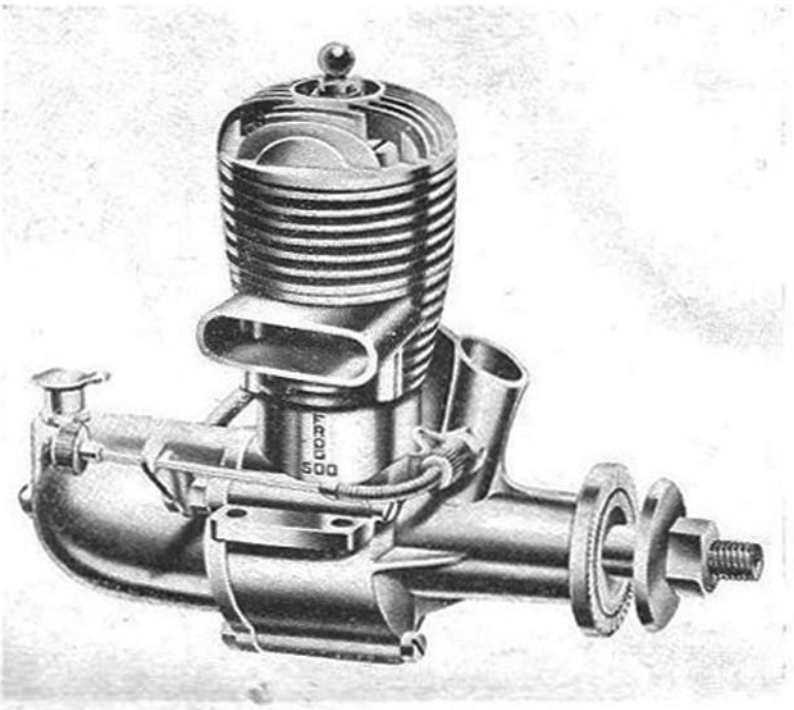


reversed and the adjusting knob stem brought back along the top of the fuselage, a position which is very conveniently located for adjustment with the left hand after starting.

At the time of writing, the " 500 " has also been flight tested, the model used for this purpose being a " Stunt King " with certain minor modifications to keep the c.g. location approximately correct. Side mounted, the jet of the " 500 " is well outside the centre-line of the standard tank position and this has led to richening up which may be minimised by using a finer pitch airscrew, allowing the revs. to rise, and suggest the use of a 9 in. by 6 in. propeller. The speed of the " Stunt King " with the " 500 " is around the 60 mark and, of course, the Frog provides all the power necessary for this highly successful design.

For power-duration work, the " 500 " should be particularly good, due, mainly, to the unusually high output available at around the 8-9,000 mark. Surface areas for power-duration models, of course, are somewhat dependent on individual ideas but a wing area of not less than 500 sq. in. is probably advisable to reduce the hazards of trimming a high-speed climb. The writer's Class B power-duration design planned for the " 500 " will be slightly less than 4 sq. ft. and it is hoped to keep the weight down to 30 oz.

A contact-breaker is shortly to be made available for the " 500." This should be of particular interest to those who prefer spark ignition for free-flight or radio-control.



Power/Weight Ratio : As tested, using standard fuel : 0.764 b.h.p./lb., using nitrated fuel : 0.89 b.h.p./lb.

Power/Displacement Ratio : As tested, using standard fuel : 74.8 b.h.p./litre, using nitrated fuel : 87.5 b.h.p./litre.