



# Engine Tests

## No 79. The Frog 500 5 c.c.

ONE of the most popular of the larger engines, not only in its native Britain, but overseas as well, is the Frog 500. Designed and built by International Model Aircraft Ltd., a subsidiary of the vast Line Bros. organisation, the Frog 500 first appeared six years ago, about two years after the advent of glowplug ignition had swept the United States. At this time, engines of 3 to 5 c.c. were still considered quite a "normal" size and anything of much less capacity was a "small" engine. The majority of C/L aerobatics enthusiasts (at that time stunt flying was at the very height of its popularity) were using 5 c.c. or larger engines and the Frog 500 undoubtedly filled a long-felt need for a reliable general purpose engine of this capacity capable of matching the performance of American engines of similar type then available.

In this respect the 500 undoubtedly succeeded and upon its introduction at the end of 1949, it immediately enjoyed a ready sale. In one small club of our acquaintance, for example, two-thirds of the membership bought Frog 500's within the first few weeks of the engine becoming available. This was due in no small measure to the very moderate price of

the unit—only £3 15s. od.—which has remained unchanged. The 500 still represents exceptional value.

The Frog 500 has, of course, been previously dealt with in the "M.A." Engine Tests series. However, as this was more than five years ago and as the present model embodies one or two improvements on the original, it was considered that a new report on the engine would be of interest to both new and old readers.

The principal modifications to the current model, both of which are recent innovations and concern the crankshaft, are the addition of a ball thrust bearing and the substitution of a new main bearing of Vandervell manufacture in place of the original phosphor-bronze bush. Another small but important improvement can be seen in the beam mounting lugs, which are thicker and stronger than on the earlier engines.

The standard engine is, of course, of the glowplug type intended for operation on alcohol base fuels. It is, however, available with

a contact-breaker (costing a further 10s.) to permit operation as a normal spark-ignition petrol engine. A test report on the spark-ignition 500 was contained in the January, 1952 issue of MODEL AIRCRAFT. The standard glowplug unit is well suited to stunt models of around 400 sq. in. wing area, to C/L scale types and to F/F models of 5 to 6 ft. span.

### Specification

Type: Single cylinder, air-cooled, two-stroke cycle, glowplug or spark ignition. Shaft type rotary valve induction. Cross-scavenged, two-port cylinder with baffle piston.

Swept volume: 4.92 c.c. (0.3005 cu. in.).

Bore: 0.750 in. Stroke: 0.680 in.

Compression ratio: 7 : 1 approx.

Stroke/bore ratio: 0.907 : 1.

Weight: 7.75 oz. (complete with F/F tank).

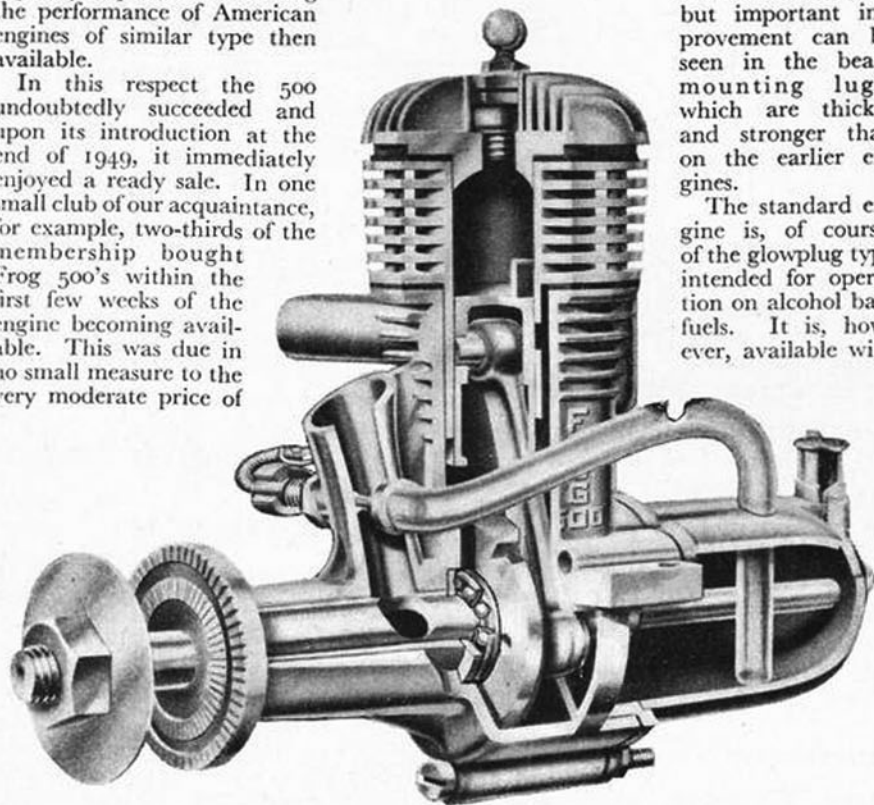
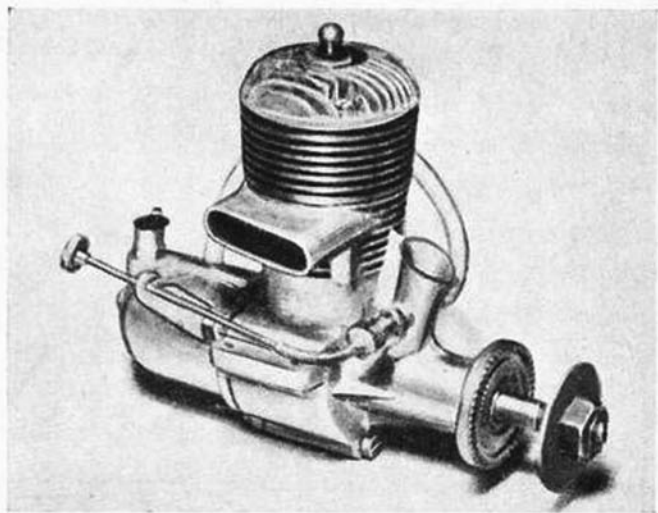
### General Structural Data

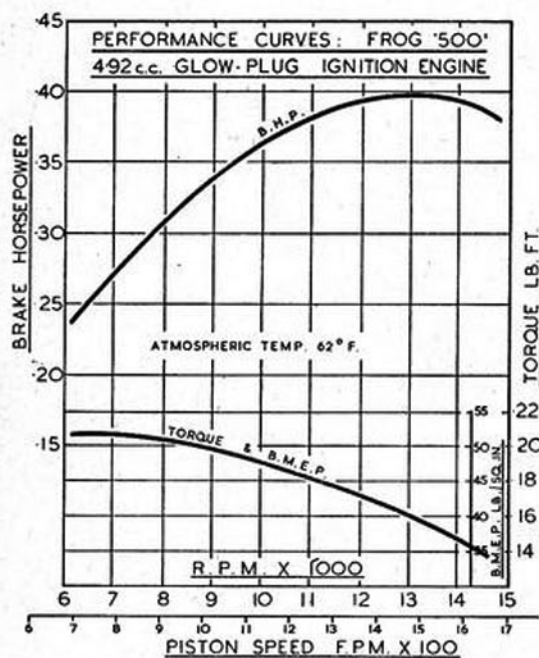
Die-cast aluminium alloy crankcase with integral main bearing housing, carburettor intake, transfer and exhaust ducts. Die-cast alloy detachable rear cover. Hardened steel cylinder with integral cooling fins. Cast-iron piston, ground and lapped. Hardened steel crankshaft, ground and lapped and running in Vandervell main bearing, with ball thrust race. Forged Hiduminium RR.56 alloy connecting rod. Silver steel fully-floating gudgeon pin. Die-cast aluminium alloy cylinder head. Cylinder assembly retained by four machine screws passing through from cylinder-head and screwing into crankcase lugs. Detachable die-cast alloy fuel tank, with spring-loaded filler cap, attached to crankcase rear cover. Spraybar type needle-valve. Beam or three-point radial mounting.

### Test Engine Data

Running time prior to test: two hours.

Fuel used: 44 per cent. Power Blending Methanol, 28 per cent. 2-Nitropropane, 28 per cent. Castor-oil B.P.





Ignition equipment used: K.L.G. "Miniglow" short-reach glow plug. 1.5 volts to start.

#### Performance

Frog 500's are generally remarkably consistent. That is, one seldom finds any substantial variation in performance between one example and another; unlike some makes in which wide variations in power output and even in handling characteristics, exist between individual samples of the same model. The intending purchaser need have no qualms about buying an off-the-shelf 500. There will be no question of Joe Smith's 500 being "a thousand revs better than anyone else's."

The average diesel user has no difficulty when graduating to a 500. The first difference he will notice is that, despite its greater capacity, the engine is quite docile. Admittedly it makes more noise, but it is quite easy to start, has no unpleasant tricks to play on its owner (such as the knuckle-rapping habits of some diesels) and runs with less vibration than many of its smaller diesel brothers.

In starting the 500, the procedure laid down in the maker's leaflet can be relied upon. Priming the engine through the exhaust port will normally be required for a start from cold, but re-starts can be obtained quickly merely after choking the intake for a single flick. Any good methanol/castor-oil base fuel can be used and the maker's own "Red Glow" mixture is entirely satisfactory. Where higher performance is desired, a nitroparaffin content blend, such as the nitromethane formula given in the instruction leaflet, or the blend used in our test and mentioned above, can be used to advantage. Incidentally, we should here mention that the two castor base oils recommended in the manufacturer's leaflet, namely, Castrol R and Shell Super Heavy are *not*, in

fact, suitable for methanol base fuels. We would suggest Castrol M or Pratts or Duckhams Racing Castor-oil, or Castor-oil B.P. obtainable from any chemist.

The Frog 500 has an extended needle-valve control on a flexible connection and, with this, there is no risk of getting one's fingers too close to the propeller. The needle-valve stem is provided with a spring ratchet device and if the spring is properly tensioned, this gives smooth and positive control of mixture strength. The engine responds particularly well to mixture strength adjustment and can be "throttled down" satisfactorily by enriching the mixture to produce "four-stroking."

The performance of the engine on test is indicated by the accompanying performance graph giving torque/b.m.e.p. and b.h.p. curves. The maximum output of approximately 0.40 b.h.p. obtained with a 2-nitropropane content fuel developed for stunt work, is, of course, a very good figure. Similarly, the performance at 7,000/8,000 r.p.m. where 0.27/0.30 b.h.p. is available, is very useful for installations calling for larger propellers and lower shaft speeds, such as R/C models. This, of course, is due to the useful torque figure which reaches

a maximum value equivalent to a b.m.e.p. of 52 lb./sq. in.

To summarise, the Frog 500 is a robust, hard wearing unit, easy to handle and of good performance. It represents exceptional value in the larger engine groups.

Power/weight ratio (as tested) : 0.82 b.h.p./lb.

Specific output (as tested) : 81 b.h.p./litre.

#### Engine Materials—4

**Deep Drawing.** A process, allied to the drawing of seamless tubes, sometimes used in the production of aluminium fuel tanks, also engine cowlings, from light gauge aluminium sheet, as an alternative to spinning.

**Die Casting.** Light alloy diecasting is widely used in the production of crankcases, also cover plates, bearing housings, cylinder heads and, occasionally, light alloy pistons, connecting-rods and cylinder barrels. The low cost of the modern mass produced model engine can be largely attributed to this method of production, by which components can be turned out quickly and require a minimum of machining and finishing. Specifications may refer to *gravity diecasting*, *pressure diecasting*, or *permanent mould casting*. Gravity and pressure casting are distinctly different processes. Permanent-mould is American usage and refers to gravity diecasting. Gravity diecasting consists, essentially, of casting low melting point alloys in metal dies instead of sand, the dies usually being of iron or steel and, of course, re-usable. In pressure casting, the molten metal is injected into the mould under pressure. The latter process produces intricate castings more accurately and with better surface finishes than gravity casting, but is less favourably regarded structurally due to a tendency towards porosity in the finished product.

