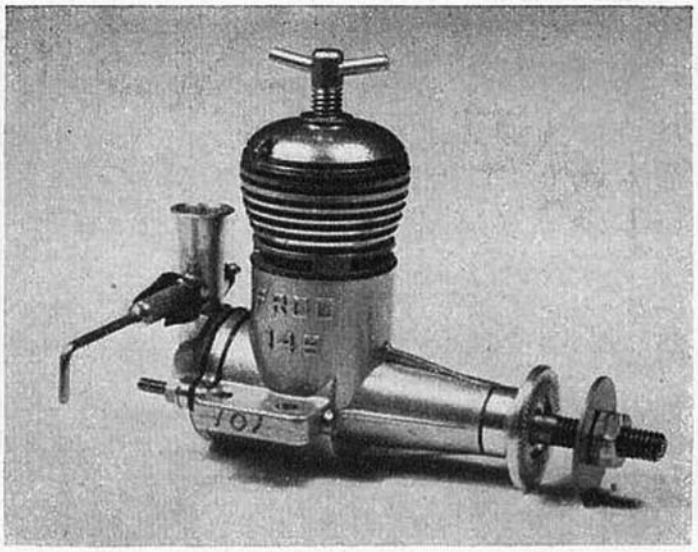
Engine Tests



No. 84. THE NEW FROG 149

THE Frog 149 is the second new model aircraft engine to appear recently from International Model Aircraft.

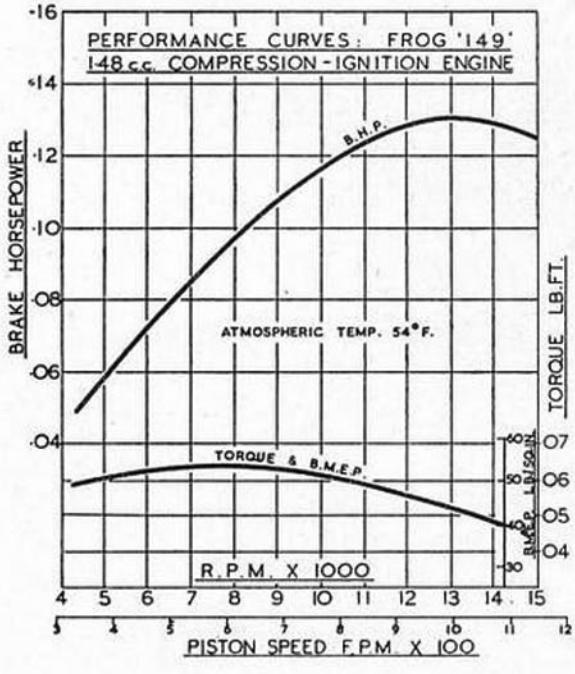
Unlike the 249 model (see January 1956 M.A.), which was an entirely new engine, interesting by virtue of original treatment of details, although otherwise of conventional layout, the new 149 is based on the well-established Frog 150 model but embodies something completely new in the system of induction employed.

This is " Vibra-matic " induction, the name under which a new Frog system of automatic intake valving is to be known. Fundamentally, the system is similar to the reed valve in so far as the valve is automatically opened and closed by crankcase depression and compression. Instead of a flexible copper-beryllium or spring brass reed, however, a shim steel disc backed by a coil spring is used. The idea is not exactly new and a similar scheme, in principle (albeit to supplement a conventional shaft rotary valve and not to replace it), is standardised on certain small McCoy engines, but the Frog is, at present, the only engine in production with this type of induction valve, and the design of the "Vibra-matic" valve unit is most interesting.

The unit consists essentially of four parts, which can best be described as follows: (a) a carburettor unit with downdraught intake opening into a large volume induction chamber, the rim of which is ground flat and is covered by (b) the valve disc, of 21/64 in. dia., which is held in contact by (c) a coil spring of similar diameter. The latter two components are housed within (d) a deeply recessed crankcase backplate which has sections cut away top and bottom to allow gas entry into the crankcase.

That the unit has certain advantages to offer over the conventional shaft valve 150 was soon made apparent in the course of our tests. Maximum power output was increased by nearly 10 per cent. over that of the 150, which has identical cylinder dimensions and porting, while fuel consumption was noticeably reduced. The more convenient and safer position of the needle-valve at the rear of the engine was also appreciated.

Compared with the earlier type 150s, the new 149 scores on appearance. Apart from the more interesting shape occasioned by the use of the new rear induction unit, the engine is better finished, the castings being tumbled (in sawdust) to a smooth satin surface, while the cylinder barrel is colour-anodised to an attractive copper colour.



Specification

Type: Single-cylinder, air-cooled, two-stroke cycle, compression ignition. " Vibra-matic " clapper-valve induction via the rear crankcase unit. No sub-piston supplementary air induction. Circumferential exhaust and transfer porting with flat top piston.

Swept Volume: 1.480 c.c. (0.0903 cu. in.).

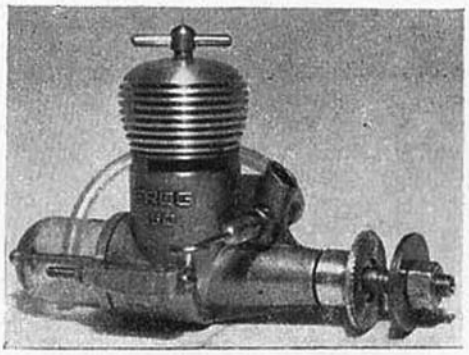
Bore: 0.500 in. Stroke: 0.460 in.

Compression Ratio: Variable.

Weight: 3.3 oz.

General Structural Data

Pressure die-cast LAC.112A alloy crankcase and induction unit housing. Cylinder sleeve of case-hardening mild steel with three radial exhaust



The old 150; compare with heading photo for main differences between the two models.

ports and three inclined transfer ports. Piston and contra-piston of "Brico" centrifugal cast iron. Drop-forged RR.56 alloy connecting-rod. One piece crankshaft of case-hardening mild steel with splined hub fitting and steel-backed sintered-bronze main bearing. Induction valve disc of 0.005 in. shim steel. Spraybar type needle-valve assembly with positive spring ratchet. Beam mounting lugs.

Test Engine Data

Running time prior to test: 1 hour.

Fuel used: 37 per cent. technical ether BSS.579, 30 per cent. Shell "Royal Standard" kerosene, 30 per cent. Castrol "M," 3 per cent. amyl-nitrate.

Performance

Initial tests on our test 149 were carried out during somewhat severe weather, outside temperature being 7 deg. below freezing point. The first start was attempted before the test-house had warmed up when the air temperature was only about 35 deg. The 149, however, started readily after a generous prime. The engine does seem to prefer fairly generous priming (especially into the rear intake) for an initial start. There is no great danger of flooding the engine, since excess fuel can be worked off quite easily with the compression reduced.

The engine has similar running characteristics to the rotary valve model, but for two exceptions. Firstly, there is a noticeable time lag (due to the long intake and large volume induction accumulator chamber) between the moment of making an adjustment to the mixture strength and its effect on the running of the engine. Therefore, needle-valve readjustments should be made gradually and one should be ready, when weakening the mixture, to open up again quickly at the first sign of starvation, to avoid stopping the motor. The second point concerns all auto-ignition engines without timed induction; namely, the ability of such motors to run in either direction and their habit of sometimes starting in the reverse direction. On the Frog, this only happened when starting on small, light propellers (allowing speeds of over 11,000 r.p.m.) and when the mixture was a little too rich. Stopping the engine and restarting was generally a first-time cure.

Actually, the general behaviour of the engine was more pleasing than that of the 150. Over a wide range of speeds (8,000-12,000 r.p.m.) it was particularly noticeable how the 149 would hold extremely steady readings. Equally obvious was the fact that "Vibra-matic" induction on this particular engine gives considerably reduced fuel consumption.

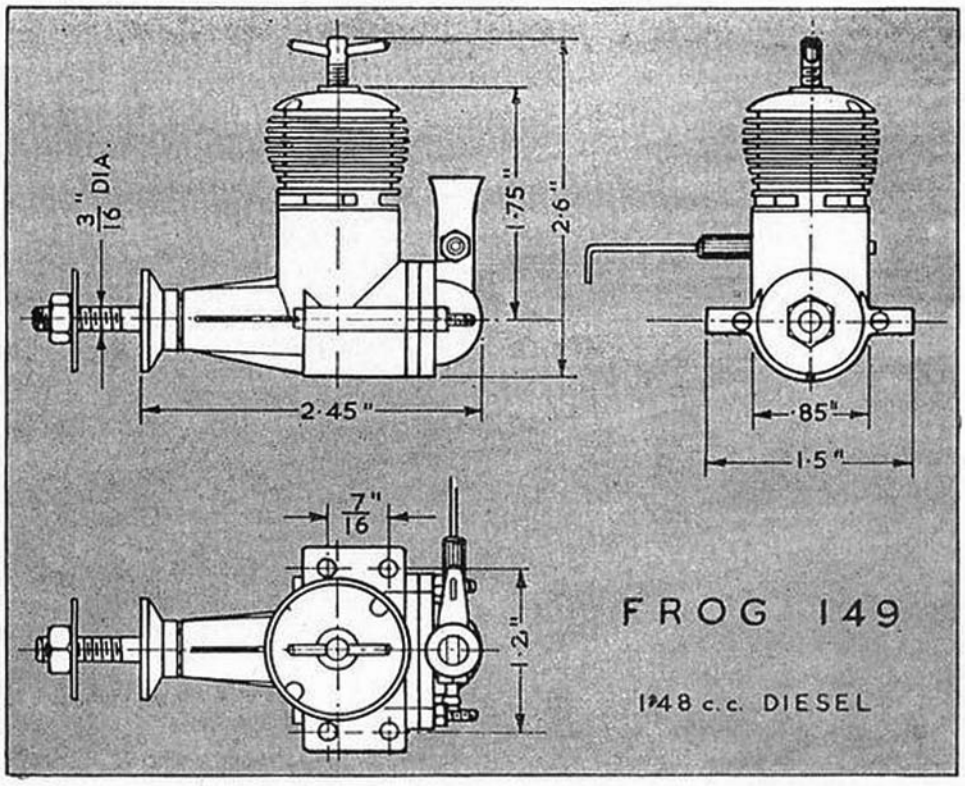
There was no tendency for the contra-piston to seize, but the tommy-bar on the compression lever would seem to be a trifle too short for comfortable manipulation by youngsters. There is a tendency to "bite" when starting on very small props intended for shaft speeds of 12,000 r.p.m. and above, but this is not of any great importance as such speeds are, in any case, outside the most commonly used r.p.m. range.

The peak output reached on our torque-reaction dynamometer test of 0.13 b.h.p. at 13,000 r.p.m. is, of course, very good. Maximum torque was reached at around 8,000 r.p.m. where the equivalent of 53-54 lb./sq. in. b.m.e.p. was registered.

The only bother experienced during tests was the unscrewing of the cylinder from the crankcase when the revolutions had reached about 10,500 r.p.m. This is a not uncommon occurrence with screw-in cylinders during bench tests. It is less likely to happen when the engine is installed in a model and, in any case, a permanent cure was effected on the 149 by retightening the cylinder while the engine was still hot.

Power/Weight Ratio (as tested): 0.612 b.h.p./lb.

Specific Output (as tested): 88 b.h.p./litre.



The component parts of the "Vibra-matic" induction are clearly shown in this exploded photograph. The shim steel disc valve is against the backplate, while the coil spring can be seen protruding from the rear of the crankcase.