

Cox Pee Wee .020



The Cox "Pee-Wee" 0.020 cu. in. glow-plug motor is the smallest American engine in current production. It was introduced in 1957 and its design anti constructional features were dealt with exactly a year ago in *MODEL AIRCRAFT*. At that time, we concluded with the following remarks: "There has (before) been a number of American glow engines below the 049 size, but few of them have become very popular. Whether or not the 'Pee-Wee' will catch on more widely remains to be seen, but, from the design viewpoint, it is certainly an interesting achievement and, production wise, a remarkable example of the fruits of automation in the model industry."

Today there can be no doubt that the "Pee-Wee" has, in fact, captured the imagination of even the most seriously minded model builders. It has even invaded the R/C field, where its low weight and astonishing power has, in conjunction with tiny transistor receivers, led to the development of half pound models no bigger than a small control liner.

In many respects, the model engines produced by the L. M. Cox Manufacturing Company Inc., of Santa Ana, California, are unique. Extremely competitively priced, they are, nevertheless, relatively complicated designs of very high quality construction. That high quality and low cost can be combined, is, in this instance, due to extremely large sales and clever production techniques i.e., the adoption of the most modern rapid production methods involving the use of much special automatic machinery, some of which has, in fact, been designed and constructed by the Cox Company.



COX "PEE WEE"

.032 c.c. Glowplug engine

"captured the imagination of even the most seriously minded model builders"

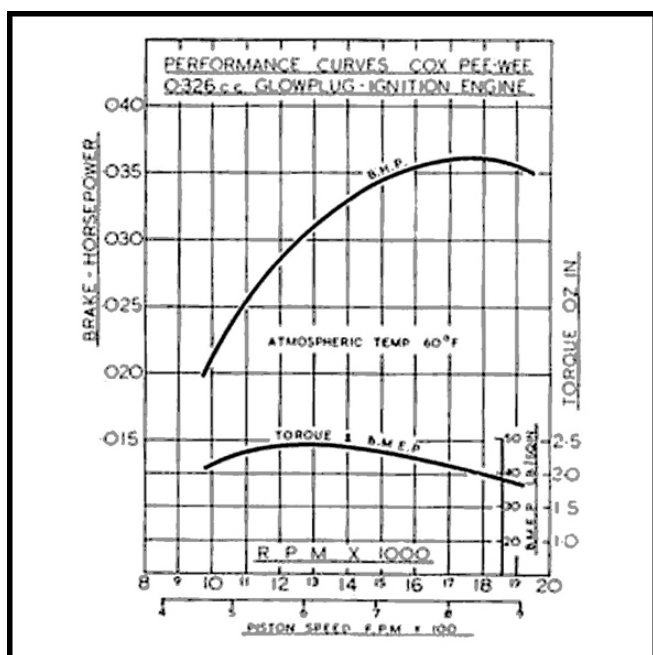
Very close manufacturing tolerances are maintained throughout and, in the case of the piston and cylinder, are to such fine limits as to eliminate the need for matched assemblies and to reduce the effective running-in period to a matter of a few minutes.

An illustrated description of the "Pee-Wee" was contained in our issue of December, 1957. To restate its basic specifications, it is a reed induction, reverse-flow scavenged engine with twin opposed exhausts and twin transfer flutes, a description which, however, gives no clue to its ingenious construction. At the rear of the engine, and embodying a four-point radial mounting, is a combined fuel-tank, carburettor and reed-valve assembly of highly individual design. To examine the latter and appreciate its ingenuity one needs to use a magnifying glass and to fully appreciate the amount of talent that has gone into the production of this motor, one needs to have more than a passing acquaintance with model engine design and manufacture.

In the past, many well-known American model engine designs have been unashamedly copied, with varying degrees of success, by manufacturers in other countries. Sometimes, by virtue of lower labour costs, they have even managed to undercut American prices. But in the "Pee-Wee" the copyists have surely met their match. We doubt whether the Cox Company had any such notions when the "Pee-Wee" was designed, but if they had set out to build an engine specifically to frighten would-be imitators into immobility, they could scarcely have succeeded more decisively.

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Specification

Type: Single cylinder, air cooled, reverse flow scavenged two stroke cycle, glow-plug ignition. Reed valve induction and sub piston supplementary air induction. Flat top piston.

Bore: 0.300 in.

Stroke: 0.282 in.

Swept Volume: 0.01993 cu. in. (0.3258 c.c.).

Stroke/Bore Ratio: 0.94 : 1.

Weight: 0.75 oz. complete.

General Structural Data

Machined aluminium alloy crankcase and main bearing (unbushed). Case hardened crankshaft with machined in crescent counterbalance, two 5/32 in. dia. journals and 5/64 in. dia. crankpin. One piece blued steel cylinder with integral cooling fins, screwed into crankcase. Screw in alloy hemispherical pattern cylinder head with integral glow filament and seating on confined copper gasket. Hardened steel piston with swaged socket for ball jointed steel connecting rod. Machined alloy fuel tank with central intake tube and reed valve housing. Single 0.001 in. copper reed retained by wire circlip. Die-cast alloy tank back-plate with integral needle valve assembly. Complete assembly secured to crankcase with four screws through tank from back-plate. Four point bulkhead mounting.

Test Engine Data

Running time prior to test: 10-15 min. each engine (three engines tested).

Fuels used: Record Methanex (initial running). Record Super Nitrex (dynamometer test).

Performance

There is no doubt that the "Pee-Wee" would have found ready purchasers even if its performance had been quite modest. In fact, however, the power available from this tiny engine is quite phenomenal for its size and completely disproves earlier theories regarding the unfavourable specific outputs of small glow-plug engines as compared with diesels and larger glow motors.

Another disadvantage of very small engines baby diesels perhaps being the worst offenders has been a tendency towards tricky starting. Here again, the "Pee-Wee" scores heavily, for it is exceptionally easy to start and is equally easy to adjust, added to which, of course, its small size makes it a very docile motor for the youngest modeller to handle.

It is seldom, however, that motors tested in this series escape criticism entirely and, in connection with the "Pee-Wee" tests, we have to report an unexpected weak point that was revealed in all three engines used. This concerns the combined cylinder head glow-plug unit and in each case the insulation scaling the terminal in the head was rendered unserviceable after considerably less than 30 min. running time. This caused the terminal post to loosen, resulting, first, in a slight loss of compression evident in reduced power and difficult starting followed by shorting of the post against the plug body. At first we wondered whether we had been careless with the plug connector and therefore took the precaution of lightly connecting a thin flexible lead to a point on the test mount, but the same trouble was experienced with both the other two heads. We afterwards cut one of the defunct heads in half and discovered the insulation to be of a thin plastic like film, which appeared to have softened under heat. There being insufficient time to get in touch with the makers in the U.S.A., we contacted Messrs. Henry J. Nichols Ltd., the United

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Kingdom distributors, who confirmed that similar troubles had been encountered, but stated that this fault was found mainly in the earlier engines imported and that the makers had now effected an almost too per cent, cure.

Most of the under 1 c.c. American glow-plug engines respond to fuels containing a relatively heavy proportion of nitromethane and for the "Pee-Wee," Thimble-Drome Racing Fuel is recommended. Since American fuels are not available in the U.K., the nearest British equivalent, the newly introduced KK Record Super-Nitrex blend, containing 30 per cent, nitromethane and 5 per cent, nitrobenzene, was chosen for our torque tests.

Under these conditions, a maximum torque of 2.4 oz. in. at 13,000 r.p.m. was determined. This, equal to a b.m.e.p. of 40 lb. sq. in., is fantastically good for a baby glow-plug motor and exceeds formerly accepted levels by at least 30-40 per cent. As one might expect, the "Pee-Wee" peaks at very high revolutions just on 18,000 r.p.m. on our test, where the output was approximately 0.036 b.h.p. Unfortunately, due to the plug failure mentioned, it was not possible to double check the top end figures, but it will be observed that, equal to a specific output of no less than 110 b.h.p./litre, this performance is far in excess of standard small glow engine power. 11 gives support to views expressed in the American model Press to the effect that the "Pee-Wee" falls not very far short of normal 0.049 class engine performance and demands almost similar sized F/F models.

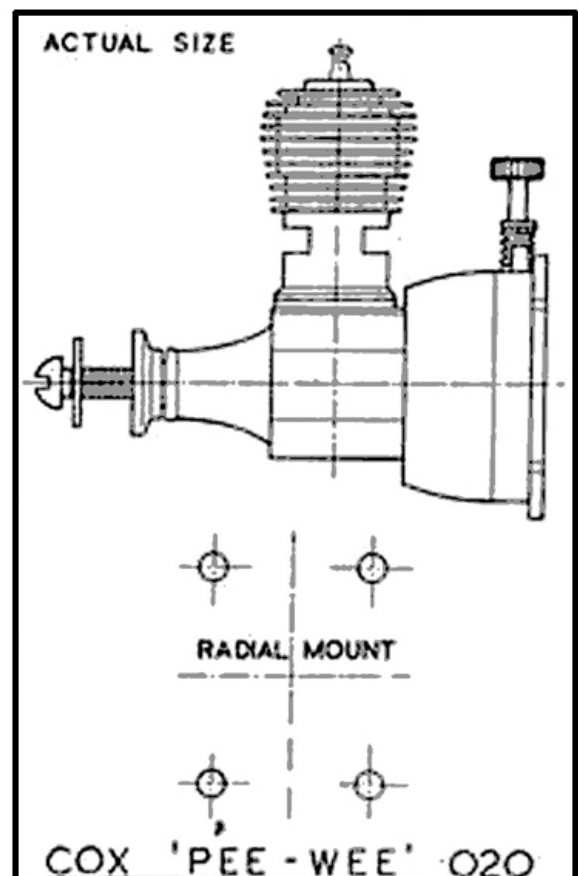
Running characteristics of the "Pee-Wee" were all that could be desired. It runs with great smoothness and consistency from 12,000 r.p.m. upwards. There is little point in running this motor any slower and it is obviously happier at the high speeds. Recommended prop for F/F is 4 ½ in. dia. and 2 to 2 ½ in. pitch. For C/L the diameter can be reduced to 4 in. with a 2 ½ in. pitch.

Power/Weight Ratio (as tested): 0.432 b.h.p./lb.

Specific Output (as tested): 110 b.h.p./litre.



Some of the "inside" story of the Pee Wee is revealed in this photo.



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