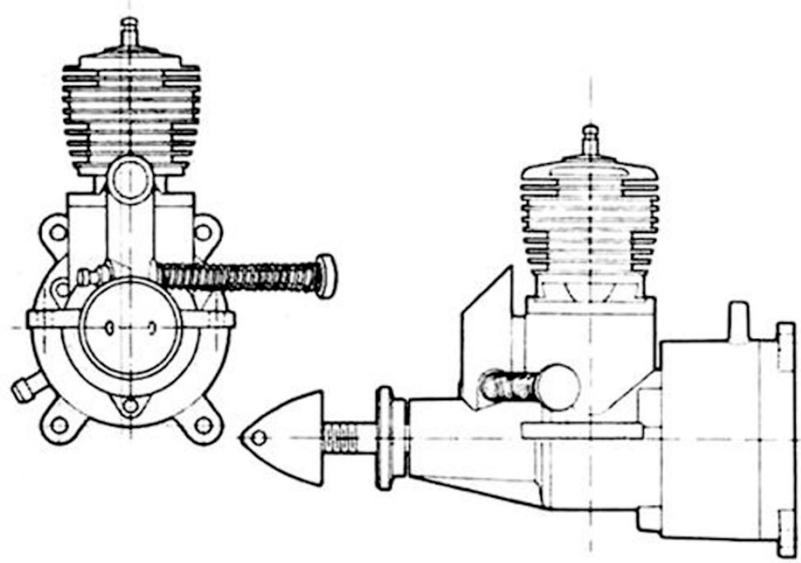


Fox .049 FAI Special

Engine Review

Fox .049 FAI Special

By P. G. F. CHINN



MUCH MODIFIED CONTEST VERSION OF POPULAR FOX .049 FAI-SPECIAL REVEALS IMPRESSIVELY BOOSTED PERFORMANCE AND EXTREMELY INTERESTING PORTING CHANGES.

► We have remarked before that, in the ½ A class, American motors lead the world in performance. This is underlined by the new Fox 049 "FAI-Special" which, by our rating, qualifies among the top two or three contest 049's, on a power output basis.

Outwardly, the FAI-Special version does not, at first sight, look very much different from the standard Fox 049. A machined aluminum spinner-nut decorates the front end and the casting has a matt, instead of polished, finish. However, a closer look reveals a larger diameter intake tube, differently shaped exhaust ports and a much bigger main bearing housing with side webs omitted. The modifications do not stop here either. Dismantling the FAI-Special and comparing it with previous models, we find that it has a new crankshaft, new cylinder and revised porting throughout. In fact, the really significant changes are, in our view, in the porting. Here, by way of explanation, we would like to digress for a moment.

We were asked recently why we do not regularly quote compression-ratios in these Engine Reviews. There are a number of reasons for this. Firstly, to calculate compression-ratio, one must measure the volume of the combustion space at top-dead-center. This can rarely be done accurately in a small engine by geometrical calculations derived from actual physical measurements and the more common method is to determine the volume of the combustion chamber with the aid of a burette or pipette and a suitable fluid. However, even this becomes tricky when one gets down to ½ A sizes, especially as with the wide use of one-piece glow-heads in such engines, an alternative must be found to the usual practice of introducing the fluid via the plug hole. Secondly, even assuming that one evolves a practical method, standard to all engines, of accurately determining combustion chamber volume, the nominal compression-ratio, based on the relationship of the total volume of the cylinder (as swept by the piston) plus the (unswept) combustion space volume and divided by the combustion chamber volume, does not, in fact, give us a true picture.

The fly in the ointment and this applies to all two-cycle engines with piston controlled ports is that, since compression can only begin when the cylinder is sealed, effective compression-ratio is related only to the actual swept volume of the cylinder above the top of the exhaust port. More-over, since the swept volume above the exhaust port, relative to the nominal swept volume, varies according to the location of the exhaust port between TDC and BDC, it follows that the effective compression ratio is also influenced by exhaust port timing.

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Shown here with optional tank mount, FAI Special is easily identified by larger bearing housing and intake, also new tapered exhaust ports.

On the new Fox 049 FAI-Special, the exhaust port closes early: only 58 degrees after bottom-dead-center. This is 12 degrees earlier than on the stock 1964 049 and 18 degrees earlier than on the original Fox 049 of 1962 and means that the effective compression ratio is appreciably higher.

In theory, this also means that there is less loss of fresh mixture through the exhaust port immediately before it is closed by the raising piston and that, during the power stroke, more energy is extracted from the expanding gases by delaying their release. On the other hand, these latter two advantages are, to some extent, nullified by the reduced time available for scavenging the cylinder of burnt gas, which may mean that the incoming charge is more heavily adulterated with residual exhaust gas.

These conflicting factors are, of course, old stuff and as is so often the case, an engine designer has to aim for an exhaust timing that will strike the best balance. However, it is equally true that, as i.e. engine design develops, emphasis tends to shift from one part of the engine to another and, as a result, it may be found that rules which have held good in the solution of one particular problem, may, with advantage, be modified later, to blend in with a development in some other part of the engine.

There has been just such a shift of emphasis in regard



Parts of FAI Special. Engine features new crankcase, large diameter shaft, optional tank mount, also new cylinder with special dual bypass.

to exhaust port areas and timing. During the early development of high performance model engines, much was made of the need for free and unrestricted discharge of exhaust gases and designers struggled to accommodate the biggest possible exhaust port area along with generous timing. Many engines were grossly over-ported on the exhaust side and, in due course, it became abundantly clear that filling the cylinder was far more important than emptying it. Intake valves and passages and ports have, as a result, become highly developed during recent years.

As we remarked earlier, the significant changes made to the Fox FAI are in these departments. Firstly, gas enters the engine via an appreciably larger carburetor intake tube (its actual cross-sectional area being approximately 60 percent bigger than that of the standard 049) and through a very much larger crankshaft. This latter has a 5/16 in. dia. journal (instead of 1/4 in. dia.) which accommodates a large rectangular valve port (approximately 100 percent greater area) and a 15/64 in. bore intake passage (69 percent more cross-sectional area). Rotary-valve timing (measured) is 54 deg. ABDC to 41 deg. ATDC.

From the crankcase, gas reaches the cylinder through two internal bypass flutes which total about three times the cross-sectional area of the standard engine's single bypass. These flutes extend well up between the exhaust ports to give a bypass period of

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108 degrees which, although less than the bypass duration of the stock engine, reduces exhaust lead when the ports open, to only 4 degrees. To accommodate these wider bypass flutes, between the two opposed exhaust ports, the latter are now tapered in width from top to bottom. The lower one-third of the port height is ineffective as exhaust area, serving instead as a sub-piston supplementary air intake port, when the piston skirt clears the bottom edge of the port, for 28 degrees of crank rotation each side of TDC.

Structurally, the FAI Special follows the basic specification of the standard Fox 049. The crankshaft has a crescent counterbalance, is hardened and runs direct in the pressure-east aluminum crankcase. The piston is hardened, with a ball joint hardened steel rod and runs in a leaded steel cylinder which screws into the crankcase. The head is the stock Fox 049 type with integral glow filament. The engine has drilled beam mounting lugs but is supplied complete with an optional radial lank- mount of substantial die-cast aluminum construction.

Two FAI Specials were received for test. As is our usual practice, both engines were checked out after break-in and the best of the two was used for subsequent tests. These engines were stock specimens and had not been specially selected: there was, in fact, an appreciable difference in the performance of the two examples still amounting to over 1000 r.p.m. on a 5x4 prop at the conclusion of the initial break- in period (15 minutes intermittent running) although the slower engine began to pick up with further running. Of course, the Fox 049 does not, in any ease, call for the type of break-in that we normally associate with larger lapped-piston motors. A few runs with the needle set slightly rich will normally be sufficient to enable the 049 to be given its head, straight off, without risk.

We tried the FAI-Special on various fuels. It ran well on all of them, ranging from a straight 3 to 1 methanol-castor mix, to Fox "Blast." On a 6 x 3 Tornado, it was 1500 rpm faster using "Blast" than on straight methanol-castor. Nevertheless, the FAI-Special was more powerful on straight fuel than the

standard 1964 model Fox 049 had been on "Missile-Mist" which is pretty good. For our dynamometer tests on the FAI-Special, we chose "Blast."

Immediately noticeable was the sub-substantially improved torque developed by the FAI-Special about 15 percent higher than the stock 049. About one-third of this gain can be attributed to the greater power liberated by the use of high-nitro "Blast" as opposed to medium nitro "Missile Mist", but it is clear that the improvement in aspiration gained from the use of bigger intake and bypass passages has been responsible for the major part of the FAI- Special's greater performance.

By contrast, the bhp peaking speed (in the 18.500/19000 rpm bracket, where the excellent output of nearly 0.12 bhp was developed) was no higher than before and it seems reasonable to suppose that this is a product of the more conservative timing of the new engine. It means that, while the FAI Special will turn any size prop faster than the standard 049, it may be advantageous to use a slightly bigger size. This much is, in fact, suggested in the instruction leaflet issued with the engine. On our tests, the FAI Special was 27 percent more powerful than the standard 049 at 18.000 rpm and 26 percent better at 16,000 rpm. However, at 20.000 the improvement had dropped to 23.5 percent and at 21.000 to 19 percent.

For ultimate contest performance, there-fore. it seems logical to aim for an in-flight maximum rpm of 19,000, or just over, which will allow the engine to accelerate rapidly up to its peak, but not too far beyond. A 6x3 Top Flite nylon (17.400— 18,300 rpm according to age, etc of the prop) would seem to be the smallest practical free-flight size. A 6x3 ½ (if available) or a fast 6x4 may be preferable with some models.

We encountered one slight spot of starting bother with both test model FAI- Specials during break-in. This was a tendency for the engine to oscillate, i.e. for it to fire too far advanced, causing the prop merely to flip back and forth as the piston was arrested just short of TDC. This is a phenomenon sometimes

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encountered when starting diesels if there is an excess of fuel in the combustion chamber combined with too much compression. On the FAI-Special, the nominal compression ratio is higher than on the standard t>49: it has only one head gasket instead of two and, as we discussed earlier, its effective compression ratio is also higher. This probably accounts for the tendency to oscillate if one is a bit too liberal when priming for a start.

Any user who encounters this problem and who finds he cannot adjust himself to the required starting techniques, can effect a quick remedy by adding an extra head gasket (or even two gaskets if necessary) and/or using a mild fuel, such as straight 3/1 methanol/castor without additives. An extra head gasket will cost 300-400 rpm; straight fuel and extra gasket 1800-2000 rpm. After becoming used to handling the engine in this "detuned" state, a return can usually be made to stock "contest" condition without further trouble.

For many years, Fox engines have enjoyed a well-deserved following among contest flyers, especially in the C/L stunt, combat and rat-racing fields. With the FAI-Special, Fox now makes a strong bid to extend this appeal to ½ A contest flyers.

Summary of Data

Type: 'two-port, two-cycle with opposed exhaust ports and dual bypass Shaft type rotary-valve intake

Weight: 1.7 oz. (1.9 oz including tank)

Displacement: 0.04993 cu. in. or 0.818 c.c

Bore: 0.390 in. Stroke: 0.418 in.

Stroke Bore Ratio: 1.072:1

Specific Output (as tested on "Blast" fuel): 2.36 bhp/cu. in.

Power/Weight Ratio (as tested on "Blast" fuel) 1.11 bhp/lb.

Price: \$9.95

Manufacturing: Fox Manufacturing Company, Station A, Fort Smith, Arkansas.



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