The Fox .09

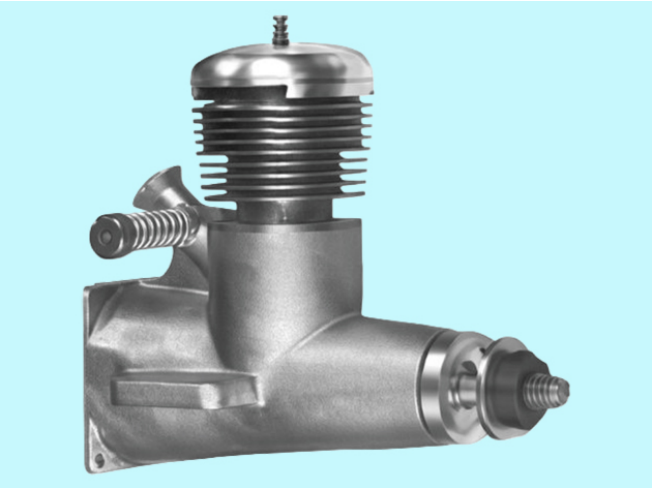
Engine Analysis

An inexpensive easy starter for sport work.

Designed as a low priced sports engine with the emphasis on being suitable for beginners, the Fox ".09" is particularly interesting in employing side port induction. As far as this country is concerned, side port induction, characteristic of the original spark-ignition motors, has survived only in the Mills diesel (and that design dates back some fifteen years). In America, side port induction has been almost unheard of as a production design since the famous Ohlsson series. The limitation, as far as high speed engines are concerned, is that with side porting the intake port cannot be opened as early as desirable without also having excessive opening after top dead center, causing blowback down the intake tube. Hence it has always been considered that a side port arrangement cannot induct enough fuel for high speed running.

The Fox ".09" certainly shows that as far as sheer running speed is concerned, the generalisation docs not necessarily apply. It ran quite happily on load speeds beyond 16.000 r.p.m. and achieved its peak power output between 13.000 and 14.000 r.p.m. However, it must be borne in mind that the power output achieved was only moderate, due principally to the limitations imposed by the method of induction. But Duke Fox makes no claims for this to be a "performance" engine and in producing an engine which will start easily and run consistently and well he has achieved a technical success.

A particular advantage resulting from the .side porting is a terrific amount of suction lift, so that priming by finger choking is no problem at all. Also the engine likes to be quite wet for starting and will run steadily over a whole range of needle settings, whilst four stroking, with a positive transition to two-stroking when the mixture is



finally leaned right out. The slightest movement of the needle past "minimum lean" setting cuts the Fox at once, so a logical running setting would be slightly on the rich side.

A marked disadvantage, is that the timing being perfectly symmetrical, the engine will start and run with equal readiness in either direction. In fact, at one stage on test it was more often running backwards from a normal flick start than forwards. Whilst granting the point that this makes the Fox ".09" an excellent "pusher" motor using standard propellers (looks well as a pusher too), it is equally aggravating and possibly confusing not to be sure which way round the motor is running without "feeling the draught". But we will completely endorse that this motor does start very easily and the plug is reasonably long lasting, provided no more than 1.5 volts are applied to it for healing.

The Fox ".09" was initially run through a series of tests on a 25 per cent, nitrated fuel, after finding a reluctance to two-stroke on standard Mercury No. 5. Later, however, a number of test runs were repeated with perfectly satisfactory two-stroke running on non-doped (methanol-castor) fuel, and with no very marked fall off in performance. The fuel particularly specified for the American market is "Missile Mist" which has a nitromethane content. On our assessment, the compression ratio of the engine was suitable for firing undoped fuels, and the use of highly doped fuel for the majority of runs possibly aggravated the tendency to "fire back" and start in the reverse direction.

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Constructionally, the Fox ".09" features a "solid" tapered crankcase casting which is virtually unrelieved except for (he beam mounting lugs and the lower cylinder housing. The rear of the crankcase forms an integral tank by the fitting of a suitable cover plate and gasket, the normal back cover being screwed well inside the casting and approximately level with the back of the cylinder. The intake tube is cast in with the crankcase, opening into the cylinder housing. Resulting position of the needle valve is most unfortunate right in the line of the exhaust and making any prolonged adjustment a most painful process.

Its cylinder is relatively massive for an American gloss engine and is machined from mild steel and left soft. The bore is finished by honing, the twin exhausts and twin transfer ports, both diametrically opposed are cut in the cylinder walls underneath each other and immediately above and below a thin flange. When the cylinder is screwed into the crankcase this flange scats against the crankcase casting, no gasket being employed.

Cylinder threading is on the bottom portion of the cylinder. The remaining length of cylinder up to the flange thus forms an annular space with the crankcase casting, into which the intake opens, transfer being controlled by movement of the piston. The design relies on the lower cylinder threads themselves to seal this annular intake volume off from the crankcase. To this end a relatively deep thread is used and the threads are well formed. Certainly this is a simple solution to what could have been a difficult production problem and it appears to work quite satisfactorily.

An extremely thin walled piston is mounted on the connecting rod with a ball and socket joint. It is hardened and ground to bore size and to achieve this and still leave the material inside ductile enough to peen over to trap the ball-end connecting rod, all surfaces of the piston other than the outside walls are copper plated. Thus these surfaces do not harden during the hardening treatment. The connecting rod itself is machined and is extremely thin only .118 in. diameter at the bottom end and tapering off towards the lop ball end.

Photos show salient Fox .09 features.

The crankshaft is also quite tiny, ¼ in. overall diameter stepping down at the front to a 3/16 in. diameter threaded length. It is quite substantially counterbalanced on the web and the whole shaft is hardened with journal surfaces and 1/8 in. diameter crankpin ground to finish, the shaft runs simply in a hole drilled and reamed in the solid front section of the crankcase casting in terms of what can best be described as a "rattling good fit". Certainly there is enough play at the front of the bearing actually to see the clearance space, whilst examination of the shaft itself shows it to be running on two high spots, one at each end of the bearing.

The cylinder head is a light alloy machining which screws into a recessed portion in the (op of the cylinder, incorporating an integral glow plug which is essentially a separate unit pressed into the head and then lightly peened to lock in place. A burnt out element calls for a replacement head, although it would appear readily possible to adapt the head to take a standard glow plug, should (his become necessary (e.g., for engines purchased in this country and failing a supply of replacement heads). It is rather surprising, in fact, that an integral element has been used in an engine of this size.

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Summarising, a very clever design and a nicely made engine which, for its price, must be something quite exceptional in value in the States. We endorse its easy starling and good running characteristics, but it is rather a "lot of engine" for the power it delivers.

PROPELLER ----- R.P.M. FIGURES

diameter x pitch	**r.p.m.**
7 x 4 Frog nylon	10.000
6 x 4 Frog nylon	15.200 (14.500)P
8 x 4 Trucut	8.800
8 x 3 Trucut	9.400 (9.200)P
7 x 4 Trucut	10.800
7 x 3 Trucut	12.600 (12.000)P
6 x 4 Trucut	12.700
6 x 3 Trucut	13.400 (13.000)P

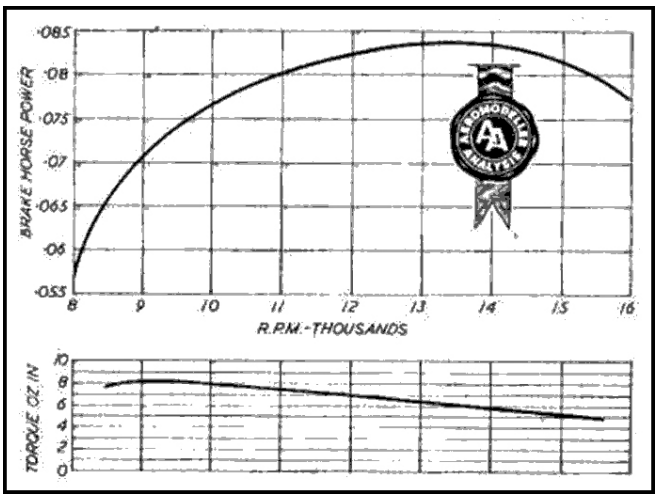
25 per cent, nitromethane content in standard methanol castor fuel.
P straight methanol castor fuel.

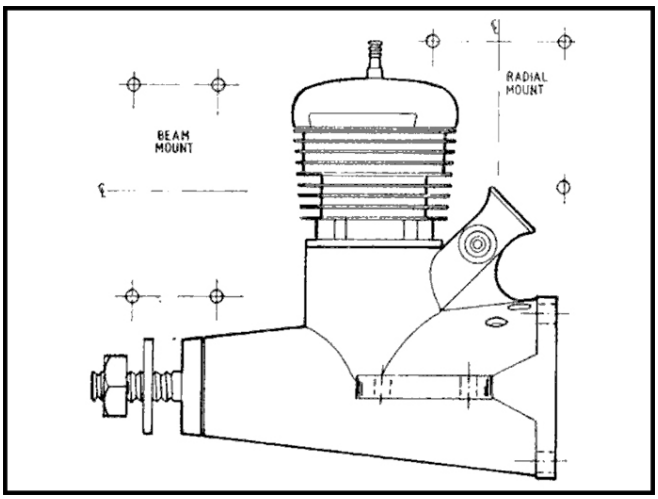
SPECIFICATION

Displacement: 1.639 c.c. (099 cu. in.)
Bore: .530 in.
Stroke: .453 in.
Bore/Stroke ratio: 1.17 Bare
Weight: 3 ounces.
Max. B.H.P: .084 B.H P. at 14.000 r.p m
Max. Torque: 8 ounce-inches at 9.000 r.p.m.
Power rating: .051 B.H.P. per c.c.
Power/Weight ratio: .028 B.H.P. per ounce

Material specification:

Crankcase: Light alloy pressure die-casting.
Cylinder: Mild steel.
Piston: Hardened steel.
Crankshaft: Hardened steel.
Bearing: Plain.
Con rod: Machined from steel (ball and socket little end)
Head: tight alloy (incorporating glow plug as integral unit)
Manufacturers: Fox Manufacturing Co. Inc., 5305 Towson Avenue, Fort Smith, Arkansas, U.S.A





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