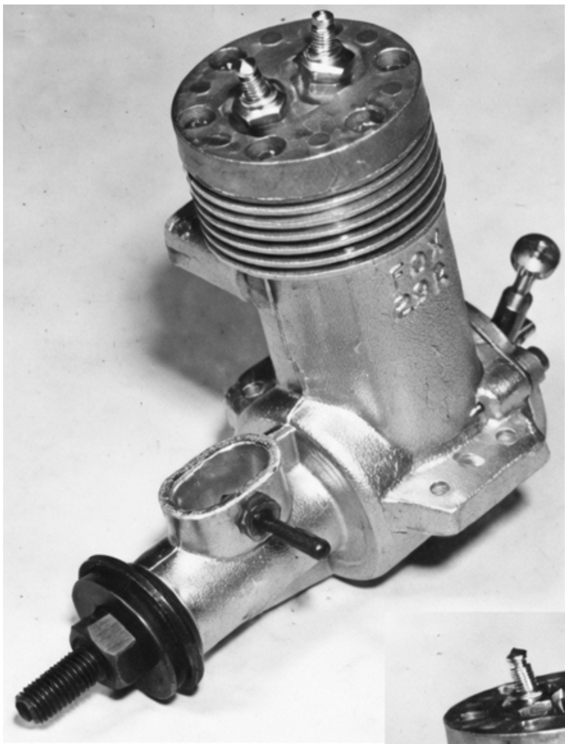
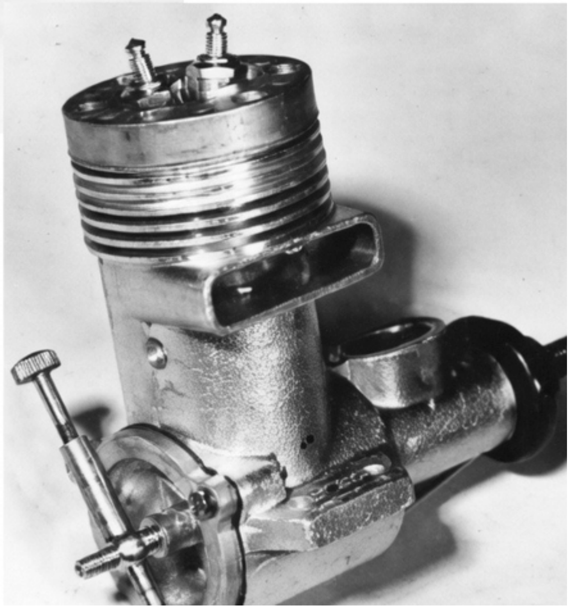
Fox 29R



Engine Review

Fox 29R



Granddaddy of all venturis distinguishes the latest Fox. Double glow plugs spell reliability. In lower picture, rear needle for pen bladder tanks is seen.

Designed expressly for racing, on "jungle juice" fuels, this new engine introduces new, and improved, features. By E.C. Martin.

► There must be something in the theory of thought association because our first view of the exciting new Fox 29R brought back to us the heady smell of castor oil and burning rubber, the scream of tires and engines wound to disintegration. This may be a far cry from model airplanes, but when you look deeper the model racing engine has it all, pocket sized, and it plays on the same emotions. The new Fox has something in common with the mighty Offenhausen. It is big and hairy, completely purposeful, and it sounds like more than oil and metal can stand. In every feature it is a racing engine.

Size is the keynote of the 29R. The rather handsome looking ashtray on the front is, in fact, the daddy of all air intakes, and the skinny looking intake on the back is actually the needle valve assembly. The cylinder head boasts no less than two electric corks, and the manufacturer seems to be using up surplus .59 crankshafts.

Model Airplane News Magazine September 1956 by Hlsat

All this adds up to new standards of performance with a closely approached target of one brake horsepower, or two hundred BHP/litre. This kind of steam has only been equaled by a few highly modified Dooling .61’s in race cars, and never in any unblown engine in the full sized field. Getting such a performance from a .29, where the frictional losses arc relatively higher, is a considerable achievement.

The 29R is a special-purpose competition engine designed entirely around nitrated fuels. It is only meant for jungle juice and is quite unexceptional on any-thing less. But, given the right brew, it is claimed to operate continuously at 20.000 BPM with a life span at least the equal of any other .29, and does not suffer from a lean run. The instruction manual includes a list of polishing operations and other tidying up modifications which the owner can carry out with simple tools in order to extract the last drop of power, although such work will not be necessary until the opposition turns up with the same equipment. Should anyone get the idea that this relatively expensive engine is sold in a condition requiring considerable work to get in the money, let us hasten to say that it comes out of the box a potential winner; but in order to save the time of those who like the most from the least, the correct way to do the job is described, and useless work thereby avoided.

Every feature of the construction war-rants detailed description and though it might be quicker to say "imagine one hot 60 with a small piston and you are thinking of a Fox 29R” there is actually a lot more to it, but you would not be far wrong dimensionally.

The crankshaft is high-quality steel, case hardened, and a full half inch in diameter with an extra high precision ball bearing at the inner end. Each bearing is noise tested as an indication of correct rolling action, and is identical with the inner bearing used in the best .60 racing engines. The crankshaft at a ¼ " diameter is considerably beefier than in earlier Foxes and is balanced by a heavy counterweight which also damps some of the reciprocating weight.

A very rugged conrod, machined from dural bar, with bearings 5/16" long, takes the thrust from a case-hardened wrist-pin, which is tubular and fitted with brass end pads. The Meehanite piston, machined from bar, is milled out around the wrist-pin supports, and has a straight baffle in common with the standard engines. The skirt is not relieved and the wrist-pin bear-ings are 1/16" above the mid-length position, which, in conjunction with the long conrod, reduces piston side loads.

The cylinder liner is machined from a leaded steel having a low frictional coefficient, and a resistance to seizure under conditions of poor lubrication. Part of the unusual power derived from this engine is undoubtedly due to this quality, in combination with the self-lubricating properties of the Meehanite piston.

The permanent-mold casting of the crankcase is extremely interesting in many ways. At first sight, it appears as if no effort has been made to minimize the internal volume to obtain high pumping efficiency, since there is a lot of clearance between the crank disc and the piston skirt at bottom dead centre, and consequent dead space which, in conjunction with the large bypass passage, must give a low base-compression ratio. However, compression above or below the piston absorbs power, and there is a compromise between power gained from efficient charging, and power lost from achieving it, which will give the best performance at the crankshaft, where we want it. It is the old story of borrowing from Peter to pay Paul. You can get tremendous BMEP on paper, and in practice find that all the urge has gone into driving the supercharger. Duke Fox built some engines which had provision for varying the crankcase volume while running. He found the best value, and then designed the 29R crankcase accordingly. Since he apparently feels that piston friction is a major performance bottleneck, he has built the extra allowable dead space into the cylinder height, thus requiring a longer conrod which assumes a shallower angle at mid-stroke than a short rod, and consequently reduces piston side loading. It is contrary to all the rules and regulations, but the acid test is what gives at the end of the crankshaft and not, as it used to be, how many miserable milligrams extra it took to get it.

In addition to these measures for giving the piston an easier time, Duke Fox is almost unique in favoring the Desaxe, or offset, cylinder. It is much easier to machine a mold, and the casting itself and its jigs and fixtures, when everything is on a common centerline, and it is for this reason that the offset cylinder is so seldom seen. However, it has a number of theoretical advantages with no obvious reason for them not being practical advantages. The piston side loads can be equal on both power and compression strokes, thus reducing the maximum value as compared with a symmetrical setup, and the ports stay open longer, thus having the same effect as increasing their height, but without the usual disadvantage of reducing the effective stroke. Important to the modeler is the fact that the bypass does not steal half of one beam mounting lug, add as far as he is concerned the offset cylinder is more symmetrical than a conventional type.

The air intake and crankshaft rotary valve port are no less than 3/8" wide by 5/8" long, and communicate with a 11/32" dia. gas passage. The air velocity through such large openings is so low that if the engine is mounted sidewinder, cylinder outwards, the centrifugal force at speed will throw the fuel out of the intake in opposition to the induction stream drawing it in; consequently the engine will starve and run erratically. A richer needle setting will not cure this trouble, and the best solution is to mount the cylinder inwards and so augment the induction. The reason for this behavior is that since the engine is designed exclusively for pressure fuel feed, there is no need to provide any venturi or restriction in the intake to create suction to draw the fuel from the tank. Volumetric efficiency and maximum power decrease as suction is increased. There-fore, with virtually no suction, a useful amount of extra power is made available. The many people who have increased the intake diameter of their racing engines have no doubt found that the extra power usually goes hand in hand with fuel feed difficulties, owing to inadequate suction, and that relocation of the fuel tank towards the outside of the flying circle is frequently necessary. The Fox 29R, therefore, takes advantage of this source of power, and the modeler is relied upon to lay out his fuel system accordingly. For speed and power duration, where a short run is required, a pen bladder tank, which provides a fairly high pressure, gives an almost constant pressure feed and no problems should be encountered, as long as the engine is not mounted the wrong way. However, when a longer run demands a fuel container of larger capacity, it will be found that finger stalls and toy balloons are capable of only a very low pressure and, consequently, the fuel feed is much more susceptible to attitude and centrifugal force. It is therefore very important to box in, or positively locate, tanks of the large and floppy variety, in a positon similar to that necessary for a conventional stunt tank with the tank and jet centers in line with the aircraft in flying attitude. Those who have never used this type of fuel system before will be highly delighted with the rock-steady engine behavior arising from the elimination of frothing and pressure variation, and will quickly, become reconciled to the untidiness of the installation.

Those who have two-speed control in mind should realize that much of this 29R performance is due to the fuel system, and that modifying the engine for two-speed operation will chop off the top of the power curve. Although with a properly de-signed intake the engine will undoubtedly still be outstanding, it is nevertheless a pure competition engine, and is best used in the manner for which it was designed.

The needle valve assembly is screwed into a boss on the center of the back-plate, and does not communicate with the inside of the crankcase at all. It is simply mounted on the back-plate. The valve body is provided with two connections, one pointing aft for bladder tank attachment, and the other at right angles for the fuel line which goes to the fuel spray nozzle in the intake. The way to use this layout is quite simple but must be carried out intelligently, if flooding and bad starting is to be avoided. The bladder is bound with thread or soft wire onto the needle valve, the needle is opened, and the bladder squeezed to exhaust all air, and the needle closed. The fuel line is also bound onto its connection, but is only slipped over the nozzle connection in the normal way. To fill the tank the line is removed from the nozzle, the end slipped over the nozzle of a fuel can pump, and the needle opened and the bladder pumped up with fuel. A certain amount of air will inevitably get into the tank and, after filling, the model should be held tail down to let this air rise to the needle valve. By opening the needle a crack, this air will escape through the fuel line, after which the line will fill up with fuel. When it is full, the needle should be closed and the line connected to the engine. It is desirable for a first time start to have the line full right up to the nozzle. The engine should now be primed through the exhaust and started. While it is running on the prime the needle should be gradually opened until the engine is running correctly. Be-cause this is a pressure system, the needle will be found to be very sensitive and a little practice is necessary to find the right opening before the prime runs out. How-ever the valve assembly is extremely well made and behaves logically and progressively. Once you have the knack the thing is easy. With larger, lower pressure tanks the needle will be less sensitive and more turns open will be needed.

The reason for having two glow-plugs on the 29R is one of insurance against losing out on a competition start because of a burned out plug. It is not necessary to use both or even have both in working order. For contest use they should be checked and then, after installation, it is a good idea to solder a piece of wire across the two center posts so that the battery leads only have to be connected to two places, ground and one plug. This doubles battery drain, but it is a lot more than double the insurance.

Since the two plugs screw into the head at an angle, their centerlines forming a V, their bottom ends arc also at an angle with the Hat-topped combustion chamber, so that one side of the plug is in a recess. Apparently it is advantageous to remove some metal from the center of the head so that the plug elements are not masked. The bottom of the plugs would then be Hush with the combustion chamber surface. All this will be self-evident when you look at your engine, and is a tip from the designer. Another point mentioned by Duke Fox is that, unless the engine is thoroughly warmed up on the ground, there is a risk of the plugs cooling off in the air, owing to the slipstream. This is unlikely to become evident on the bench, but can be detected by irregular firing not unlike pre-ignition.

Pressure fuel feed offers an excellent opportunity for taking advantage of the slipstream to provide an air ram to the intake, as it will not effect carburetion materially with regard to mixture strength, and it will pack in a little extra air, the theoretical increase in power being about two percent at 100 m.p.h. The ram effect also helps to overcome induction resistance arising from the centrifuge action of the crankshaft in the front rotary valve.

Handling and Performance

To someone new to pressure fuel systems this engine can be expected to behave in an unusual manner, and one cannot therefore compare it with conventional engines as a measure of handling ease. However, the issue is simply one of getting used to something different which in every important way is a considerable improvement. The exercise of common sense, plus the awareness of two fundamentals, is all that is required to get reliable starting and performance. These two points to remember are; first, that when the needle is open, a fixed amount of fuel is going into the intake regardless of engine speed or whether the engine is running or not; and second, that you have a positive pressure on the needle at all times and therefore finer adjustment is required, with flooding being the most likely danger.

Comparison of the figures below shows the steady progress in the development of the Fox .29, and interpolating the figures of the 29R on special recommended fuel mix, for which the engine was designed, it appears that the gap between the earlier engines gets wider and wider as the RPM goes up. With 16.500 on the ground.

Fox 29R

18.000 would be a normal estimate for operation in the air. However, since the power curve is apparently still rising steeply where our standard test finishes, it is probable that between 19.000 and 20.000 would be reached on 7 x 8 prop. The very large percentage of nitromethane in this mix would only really show at ultra high speeds in an engine having such good breathing equipment as the 29R, because at lower speeds the engine can get almost all the oxygen it wants from the atmosphere. An increase of 1.500 RPM over a standard Fox at the top end represents a very considerable increase in BHP, and even more is claimed to be available after carrying out prescribed polishing.

Test

Plugs: 2 O.K. ¼ x 32 Long Reach as fitted.
Fuel:
Standard test: Supersonic 1000
Special test: 50% Nitromethane
10% Nitromethane.
10% Methanol.
30% Castor Oil
Running time prior to test: 1 ½ hrs.
Bore: .738"
Stroke: .700"
Weight: 7 ozs.

Power prop	Fox .29('55) (SS1000)	Moir Fox .29 (SS 1000)	Fox .29R (SS 1000)	Fox .29R (Special Fuel)
10 x 8	11.500	12.000	12.100	12.200
10x6	12.400	12.800	13.000	13.150
9x8	12.600	13.200	13.350	13.500
9x6	13.700	14.250	14.400	14.600
8x8	14.050	14.600	14.800	15.050
8x6	14.800	15.400	15.750	16.100
7x10 ½	13.900	14.600	14.850	15.100
7x9	14.650	15.300	15.700	16.000
7x8	15.000	15.800	16.200	16.500
Top Flite				
10 x 8	10.400	11.100	11.250	11.350
10 x 6	11.500	12.000	12.200	12.300
9x8	11.650	12.350	12.500	12.650
9x6	12.700	13.250	13.400	13.650
8x8	13.100	13.800	14.000	14.250
8x6	13.900	14.550	14.800	15.050

Fox 29R

More: https://flyinghlsat.com/search.php?search_keywords=Fox-Engines