ENGINE REVIEW

O.S. MAX 40SR

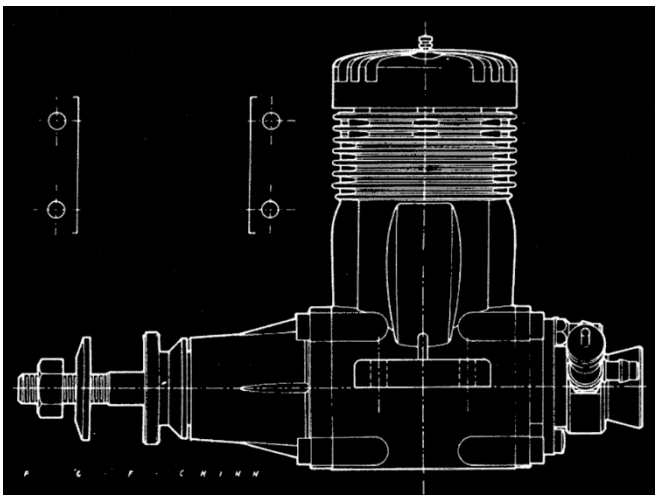
BY PETER G. F. CHINN

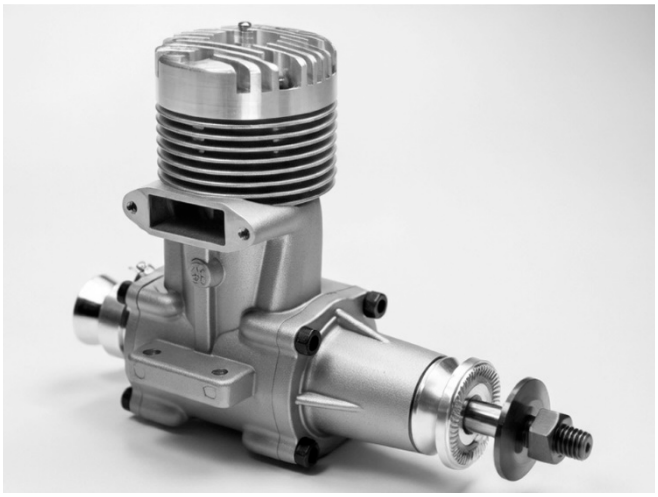
• This entirely new motor from the O.S. Company, their first rear-induction 40 and the first production model O.S. to feature Schnuerle loop scavenging, was introduced towards the end of last year. Intended mainly for R/C pylon racing and C/L rat-racing, it made quite a good start in both classes by first winning the All Japan pylon racing event in November and then placing second in both the 10 mi. and 100 mi. C/L rat-racing events at the King Orange Internationals, in Florida in December.

As originally marketed, the 40SR had a barrel throttle carburetor comprising a pressure cast aluminum body with brass barrel, although as is inevitably the case with large-choke carbs (in this instance 8.5 mm. or 0.335") without any form of low-speed mixture control, the “throttling" ability was strictly limited. This is of no importance to rat-race fans or to pylon race people under present regulations and it was not surprising, therefore, to find most users opting for the plain machine venturi that was made available shortly afterwards. This has a 10 mm. (0.394") i.d. choke and increases effective choke area by over 30%.

Since April of this year an improved version of the 40SR has been in production. In this new version, some changes have been made to the port timing, particularly to the rotary valve and exhaust periods. It is with this model that our present report deals.

Initial impressions on inspecting this new O.S. product are that here is a finely executed piece of merchandise, nicely proportioned and beautifully finished. On stripping the 40SR down to its component parts these favorable impressions remain. Inevitably, one is drawn to making a comparison with K&B's 40S, as the reputation of the K&B is such that it is the engine by which all





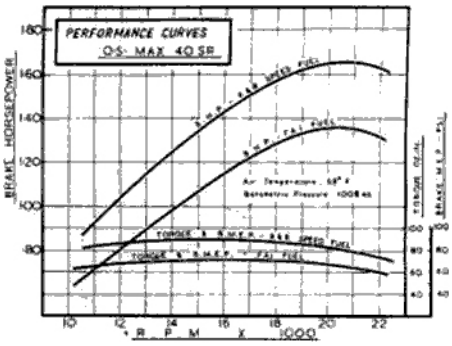
Clean, purposeful-looking proportions and fine finish, inside and out, distinguish new 40SR. first rear valve engine to be produced by O.S. Company.

Modern racing engine features Schnuerle porting, bowl shaped combustion chamber with wide squish band. Dykes piston ring, front and rear plates.

O.S Max-40 SR-STD

racing 40's must be judged. In many ways, the O.S. is closer to the K&B than other engines of this class, although it has some distinctive features of its own.

Rear induction assembly showing drum type rotary valve. 10 mm. racing venturi, angled needle assy.



The most obvious of these is its induction system. Whereas the K&B and its other competitors all use disk rotary valves, the O.S. features a drum type rotary valve. This is of the “reverse drum" pattern similar to that used by the O.S. Max-H80 and the rear rotary valve version of the Max-H60. Instead of the mixture entering the valve through a port in its cylindrical part and then being discharged into the crankcase through an open front end (i.e., the arrangement used by the K&B 15 Schnuerle and. in principle, the same as for a crankshaft rotary valve), the O.S. drum valve is open at the rear (outer) end and the valve port opens into the crankcase immediately below the rear bypass channel. This system has a slight theoretical advantage over the normal drum valve insofar as it reduces the effective crankcase volume. However, in performance, a drum valve induction system does not appear to have any measurable advantage over a good disk valve. In fact, prototype 40SR engines were tested with both drum and disk valves without any significant difference in top end power, but drum valves are regarded by some designers as being rather more serviceable than disk valves. One assumes that this was the reason why the O.S. experimental department opted for a drum valve for the 40SR.

Unlike the K&B 40S, which broke with the previous Torpedo 40 models by unifying the crankshaft housing with the main casting, the O S. (in contrast to the front intake O.S.40 models) has a detachable front end. Again, unlike the K&B which uses a permanent mold casting, the O.S. has pressure castings. The overall dimensions of the two engines are very similar; the O.S. is just about a sixteenth bigger all round but will fit between the same bearers. Unfortunately, the bolt hole spacings are not identical; the fore and aft spacings are the same, but the O.S. calls for a couple more millimeters on the lateral spacing. The weights of the two engines are not significantly different; the K&B is 1/4 oz. heavier but includes a built-in "squeeze-tube" cut-out device.

In detail, the O.S. Max 40SR’s design and construction are as follows.

CYLINDER COMPONENTS.

The Schnuerle loop scavenge system of the 40SR follows the now familiar arrangement of a centrally bridged exhaust port on the right side flanked by two bypass ports, with a third port diametrically opposite. The cylinder liner, of hardened carbon steel with a wall thickness of 1.2 mm. (.047"), is a close push fit in the cylinder casing and is located by the usual top flange. The ports conform with the generally accepted Schnuerle 3 port pattern: the main bypass ports are angled to direct the gas flow away from the exhaust port and towards the opposite side of the cylinder and are open for 118° of crank angle.

The third port has its top edge angled steeply upwards and opens just a degree or two later to sweep the charge well up into the combustion chamber.

O.S Max-40 SR-STD

As on the K&B, the exhaust period is quite lengthy for a free-ported (i.e., non-tuned exhaust) engine and occupies some 156° of crank angle (this compares with approximately 147° for the earlier production models). The main transfer ports are deeper, but narrower, than those of the K&B, and the third port is also narrower so that the three induction ports are more widely separated. The two main bypass ports are fed from angled channels in the main casting, which are not quite so wide as those of the K&B. The third port channel extends to below the cylinder liner to pick up the gas flow, instead of being fed through a port in the piston skirt.

PISTON AND CONNECTING ROD ASSEMBLY.

Like the current O.S. Max 40 R/C pattern engine, the 40SR has bronze-bushed piston bosses and a Dykes ring, but instead of being machined from bar stock, the piston is machined from an aluminum alloy casting. Rather surprisingly for a Schnuerle ported engine, the ring is not pegged. The piston skirt has rectangular cutaways forehand aft which correspond with similar cutaways in the piston to avoid masking the entry to the main bypass channels. The piston, complete with ring, weighs 7 gr. (just under. 0.25 oz.) or 8.6 gr. (0.30 oz.) with wrist pin. The hardened tubular pin is 4.5 mm. (0.177") o.d. and is a firm push fit in the piston bosses, where it is retained by wire circlips. The conrod.is machined for high duty aluminum alloy and is bronze bushed at both ends with two oil holes at the lower end and a slit at the wristpin end. It is 33 mm. between centers and weighs 3.7 gr., giving a total piston and rod assembly weight of 12.3 gr. or 0.44 oz.

CYLINDER HEAD.

The deeply finned cylinder head is machined from bar stock and has a 12.8 mm. dia. bowl shaped combustion chamber surrounded by a 4.2 mm. wide squish-band. The head is channeled for a 0.4 mm (.016") soft aluminum the tear) which were chosen for their more compact outside dimensions compared with equivalent metric size bearings. The bearings, which are of Japanese manufacture (NMB R-4 at the front and Koyo EE-3 at the rear), are of the steel-caged type and are fitted into a pressure cast front housing. Drive to the prop is by means of a machined aluminum alloy prop driver fitted on a brass split taper collet.

INDUCTION ASSEMBLY.

The case hardened steel valve rotor has a 13.4 mm. o.d. and an 11.2 mm. i.d.. and its large rectangular valve port remains open for some 220' of crank angle, opening at only 27° after BDC and closing very late at 67° after TDC. It runs directly in the aluminum alloy back plate material and draws mixture from the venturi shaped machined intake immediately behind it. The latter is Hanged and attaches to two tapped lugs in the back plate, which arc set at an angle to bring the needle valve assembly above the engine's center line so that it does not foul the engine bearers. Effective choke area is very large at approximately 65 mm.

Both the back plate and the crankshaft housing, like the cylinder-head, are attached to the main casting with high tensile Allen screws.

PERFORMANCE.

The manufacturer's instruction leaflet issued with the 40SR calls for a break-in in short rich runs totaling a minimum of 60 minutes, during which time it is suggested that a fuel containing not more than 15% nitromethane and not less than 20% castor oil be used. Suggested prop size for the break-in is a 9x6, and. obviously, a good strong wood prop, such as a Top Elite maple, is the thing to use.

For FAI pylon racing on straight fuel, the manufacturer recommends an.8-3/4 x 7 prop in order to achieve static rpm in the 17.000 to 18.000 bracket. Our motor, on such a fuel and prop (9x7 Top Flite Speed cropped to 8-3/4") held a steady 17.800 on 80/20 methanol/castor oil fuel. This is very slightly belter (by 200 rpm) than we have previously obtained on FAI fuel with any other .40, and. in fact, the 40SR s peak output of slightly over 1.35 bhp at between 20.000 and

O.S Max-40 SR-STD

21.000 rpm is, by a short head (i.e., about 4% more power, equal to 250 to 300 greater prop rpm at the peak), the best we have recorded to date for a pylon 40 engine running on straight fuel.

On nitromethane racing fuel we used K&B Speed Fuel the 40 SR was virtually level- pegging with the K&B 40S ail the way to 22,000 rpm. The peak output indicated of 1.65 bhp is very slightly below the figure shown in our test of the K&B published in the February 1974 M.A.N., but was recorded under less favorable climatic conditions, and if one corrects these figures to a common barometric pressure the balance is restored.

Handling and running qualities of the Max-40SR were good. Starting was trouble-free and a particularly low level of vibration was noted. The engine has an unusual needle-valve assembly in which a pair of 0-rings are fitted on the o.d. of the outer part of the jet assembly and are then enclosed and compressed by the i.d. of the needle-valve thimble to effect a firm and air-tight hold, combined with extremely smooth and accurate control. We found that the 0 rings tended to cause some “stiction” after the engine had been run for a while, and it is understood that the manufacturer is planning to revert to a conventional ratchet assembly because of this, although we found it could be dealt with by the periodic application of a little lubricating oil.

Needless to say, the 40SR requires a forced-feed fuel supply. One of the items supplied with the engine is a nipple which replaces the upper carburetor attachment screw, enabling crankcase pressure to be used to pressurize the fuel tank in the usual way.

Our test motor was not at all hard on glow plugs. O S. #9 plugs were used for our tests and proved capable of standing up to sustained running at 20.000 rpm. We also tried the new Fox racing plug and this gave much the same results.

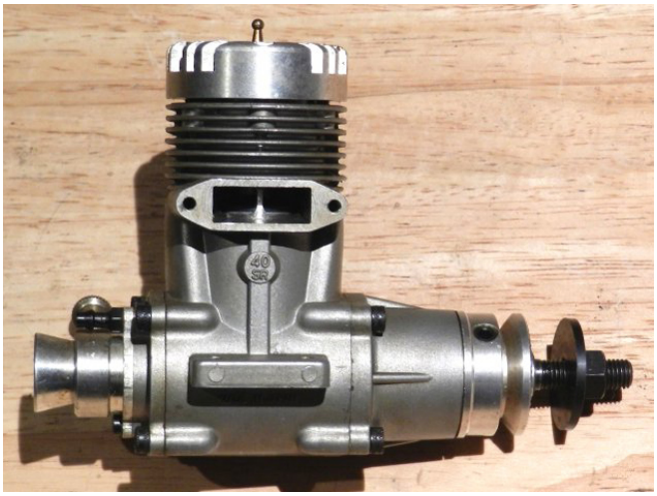
One final point. Although the test motor did quite well on FAI fuel, the 40SR, like the K&B, was actually developed primarily for use with nitro fuels, as Japanese pylon racing rules are basically the same as U.S. Formula I.

This being so, there are, inevitably those enthusiasts who, intending to use their 40SR's in FAI, will automatically think in terms of raising the engine's compression ratio. For their benefit we would add that a check on the compression-ratio of the test motor, with the standard 0.4 mm. head gasket, revealed this to be approximately 11.7:1 nominal or geometric (equal to about 8.2:1 effective) which is somewhat lower than we measured for the K&B. One could, in fact, halve the 0.4 mm. gasket thickness without exceeding the compression-ratio of the K&B and still have adequate clearance between the piston and squish- band at top-dead-center. Such changes to the engine's compression-ratio may, or may not, have any beneficial effect, but we have no doubt that some owners will wish to try them.

SUMMARY OF DATA.

Type: Single cylinder, Schnuerle loop scavenged two-stroke cycle with rear rotary drum valve and twin ball bearings.
Checked Weight: 9.7 oz.
Displacement: 6.495 c.c. or 0.3964 cu.in.
Bore: 21.2 mm. (0.8346")
Stroke: 18.4 mm. (0.7244")
Stroke /Bore Ratio: 0.868:1
Specific output (as tested, less muffler):
3.42 bhp/cu.in. on FA1 fuel.
4.177 bhp/cu.in. on 50% nitromethane
Power/Weight Ratio (as tested, less muffler):
2.24 bhp/lb. on FA1 fuel
2.72 bhp/lb. on 50% nitromethane

O.S Max-40 SR-STD



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