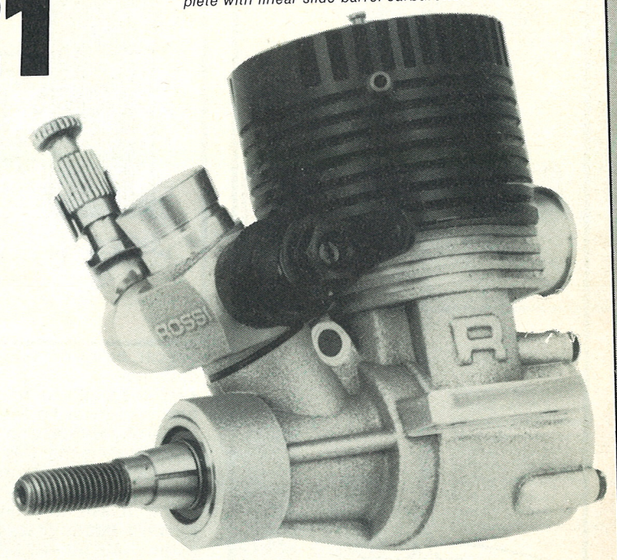
by Mike Billinton

Rossi R21 RC-ABC Car

To start off the new series of Engine Tests Mike Billinton assesses the latest Italian hot shot



Below: the attractively finished Rossi R21 complete with linear slide barrel carburettor.

INTRIGUINGLY LATE in entering the 10 year old Open Car engine fray, *Ugo Rossi's* delay until now is likely related to the uniquely long worldwide dominance of the famous FAI class 2½cc tuned pipe motor which continues to gain honours in the model aircraft area and airscrew driven hydroplane marine class.

Above: the R21 fitted with Rossi exhaust manifold and tuned pipe.

With such an awesome reputation to uphold, any entry into the highly competitive 1/8th Scale Car sector was, with hindsight, going to be a long considered one. The caution appears justified, for their new 1984 range of .21 size engines (available in Aircraft, Marine and Car formats) is already and Car formats) is already establishing a reputation as a major competitor to *OPS* and *Picco* engines.

Additional spice has lately been added to the arrival of these exciting motors — because recent divergence of design philosophy within the factory has led to production of structurally a quite different and larger 5-port design with one-piece head/combustion chamber, and these also bear the *Rossi* name . . . To keep matters clear then — the motor tested here is that produced at the normal *Rossi* home ground of Cellatica Italy — is of 4-port design with oil-cooled cylinder and separate combustion chamber insert. It is hoped to obtain one of the 'alternative' *Rossi* 21's for test later in this series.

Mechanical details

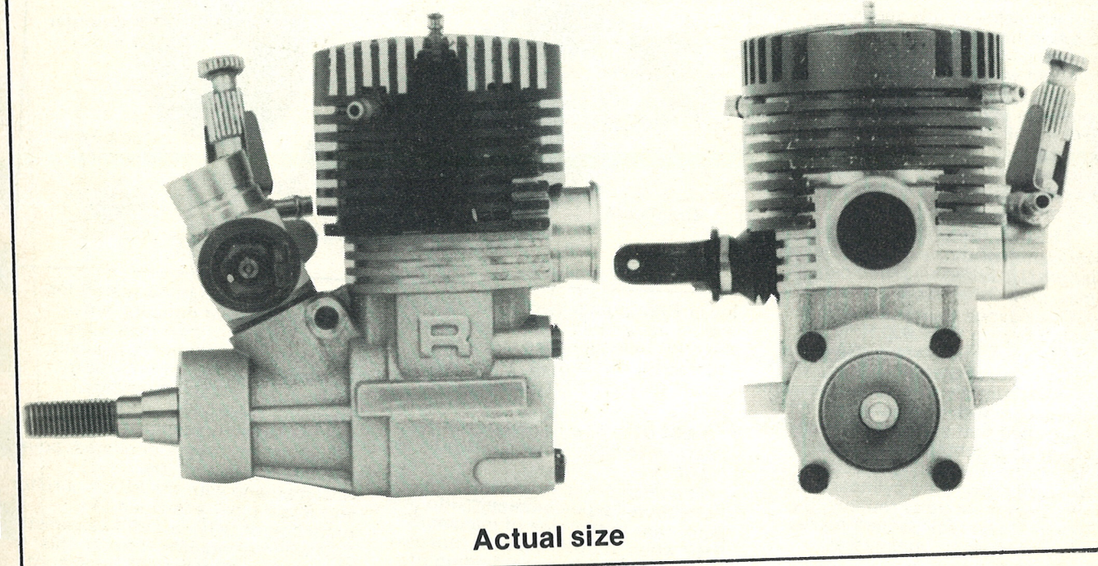
Externally the *Rossi* 21 presents a low, squat and solid appearance of some individuality — caused in the main by the low-slung, black finished, one-piece cylinder and head finning.

Crankcase: is cast in Aluminium alloy at the *Rossi* foundry on-site. It incorporates normal 2 large parallel sided transfer passages plus 1 smaller boost. The 13mm induction opening in case is offset 1mm in direction of crank rotation. Both main ball bearings are fitted with high speed fibre/plastic cages. Opposite to the induction opening the crankshaft bore is asymetrically relieved to prevent undue wear to crankshaft and thus ensure at all times positive crank timing points. The O-ringed Exhaust stub is cast-in with crankcase to provide generous material section at this thermally heavily stressed area.

Crankshaft. Of hardened steel — also processed within factory. Has full circle web cut away on main shaft side for counter-balance. Crankpin is drilled to transmit lubrication from induction bore to rod bearing on a centrifuging principle. Main shaft is also drilled to improve lubrication and seal of front housing bore between induction opening and rear main bearing.

Cylinder fins/Head. One-piece aluminium alloy, machined from solid and anodised black. In conjunction with a silicon O-ring the fins envelop upper crankcase and liner flange area to provide a wide shallow oil reservoir — the intention of which is to improve temperature stability under both idling and full power situations.

Under normal ambient conditions in the U.K. the captive volume of oil is sufficient for this purpose. Above 28° C the recommendation has been to use external oil radiator and special crankcase oil pump to keep a larger volume of oil continually in circulation from radiator to head and back. However more recent engine developments have made even this complication unnecessary.



Actual size

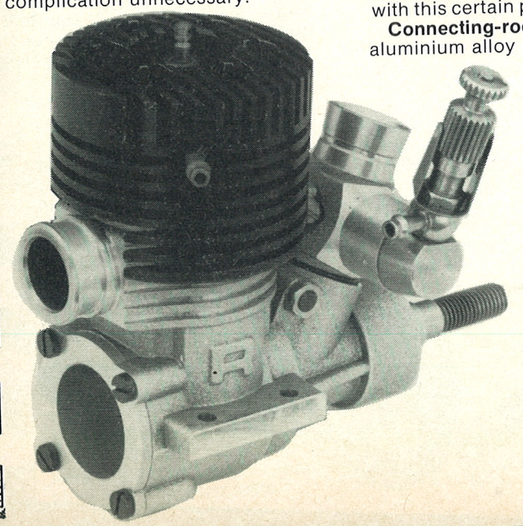
Combustion chamber. Of separate clamped-in button insert style with flat squish and small central shallow bowler hat chamber. One copper gasket is fitted of .008in.

Piston/Liner. Normal high silicon alloy ringless piston running in brass chromed liner. Below ports, the bore is relieved approx 2½ thou. The car engine is supplied with a moderately low exhaust timing of 157° to give wider band and less peaky performance on the tuned pipe. Factory information is that the liner can be raised by .2mm or exhaust alone raised by .3/.5mm to increase power, though they stress that more critical operation will go hand-in-hand with this certain power increase.

Connecting-rod. High-strength aluminium alloy machined from solid. Rod shank is tapered in both side and front views to increase rigidity at both little and big ends. Phosphor bronze bushing at big end only, with 3 lube holes.

Rear cover. Deep plug-in style with O-ring seal. Incorporates a hardened steel shim on inner face to inhibit wear from the connecting rod's sideways thrusts — the debris from which can otherwise be the cause of big-end failure.

Carburettor. Steel slide barrel, rubber bellows sealed into aluminium body and giving 8.3mm dia. choke size. Brass fuel supply needle and jet with O-ring seal and spring clip security.



Left: in keeping with current style the R21 carburettor features vertical needle assembly to allow installation into the close confines of the modern R/C car motor pod.

Performance

Test 1. – *Open Exhaust. 5% nitro. 5% Castor/15% ML70 synthetic. 8.3mm carb. Rossi R6 plug.*

Following a brief running-in period and some RPM checks, the Open Exhaust Torque figures were collected. Not surprisingly for a small capacity *Rossi* the peak BHP occurred high up the RPM scale at 31,600, and as a consequence, a highest yet 1.24 BHP was reached. This feature set the pattern for much of the later findings — i.e. reconfirmation of the "more RPM should give more HP" principle.

Test 2. *Rossi non-quiet tuned pipe set at longest of the 2 recommended lengths (170mm plug to maximum dia.) 50% Nitro/10% castor 8% ML70. R8 plugs. Compression unaltered at 12/1 geometric. SAE30 mineral oil in reservoir.*

▷

EngineTest No. 16

Pipe orientation was as usual straight out backwards in order to maintain similarity with all other car engines tested in this series — meaning that the short, tortuously curved, in-car *Rossi* Exhaust manifold was not used here. Highest torque at most effective resonance point was 57ozs at 26,060 RPM with BHP equalling 1.53 corrected for atmospheric conditions. There was evidence of unstable running at maximum BHP with motor coming on and off resonance unaided.

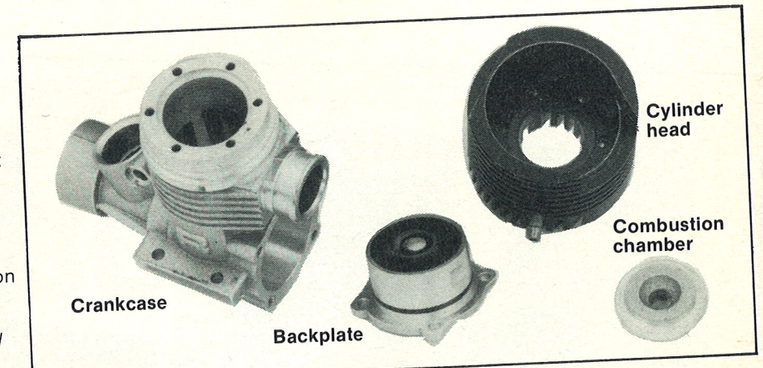
Test 3. *Rossi Pipe now fixed at equivalent of shortest recommended length (i.e. approx. 157mm plug to max. dia.) Other equipment as Test 2.*

This change moved peak resonance up to 29,000 RPM at which point there was again some evidence of unsteady running. BHP dropped slightly to 1.49. Subsequent discussion with the manufacturer suggested that excessive air cooling might be a contributory factor. (Moderate air-cooling is usually directed down onto cylinder head in these tests, though arguably the *Rossi* oil reservoir system makes extra air cooling unnecessary.)

Test 4. – *OPS Quiet pipe at 275mm plug to end of rubber can. PB 9.5mm slide carburettor with remote needle valve assembly. Other equipment as Test 2.*

Both this test and Test 5 took place at a later date — and strictly much against good research practice in that 3 changes in running equipment were made as compared with previous 2 tests. (Fortunately weather conditions were almost identical). The larger carburettor size was used here to give direct comparison with other engines tested, whilst the *OPS* pipe itself had already gained the status of a piece of 'standard equipment' during earlier tests: Lastly, supplementary air cooling was abandoned.

The longish *OPS* pipe length kept the RPM best resonance point down to the 26,000 area, but nevertheless the torque increase was marked — both at the maximum and at the lower RPM points leading up to that maximum. As has been noted before, the *OPS* pipe manages more than most to fill the Torque "hole" which occurs on the run up to maximum BHP.



Test 5. *OPS pipe now at shorter length of 250mm. Other equipment as Test 4.*

The main purpose here was to force motor/pipe combination to a peak near to the area of maximum BHP when in open exhaust format — because of the frequent finding of superior pipe results when so operated. Well — it worked again here, and the realisation of 1.80 BHP at 30,030. RPM was finally a rewarding one. Admittedly though, this is achieved here at the cost of substantial reduction in Torque in the 20-26,000 RPM area.

Consequential points:

1. During these last 2 *(OPS* pipe) tests there was no trace whatever of the earlier unsteady running which characterised the *Rossi* pipe runs — however . . .

2. Not shown on graph to avoid visual confusion were two sets of Torque figures arrived at on the same day, and using the *Rossi* pipe but this time laid out in normal car position using curved *Rossi* manifold — and again no trace of unstable running!

3. The B.H.P. curves appear to suggest also that switching from small *Rossi* carburettor to larger *PB* unit contributes largely to B.H.P. increase. Such a reading is understandable, but earlier back-to-back results showed the major jump was due to the pipe effect.

4. This slightly untidy search for answers changed direction when, reverting back to the small *Rossi* carburettor (in attempt to evaluate possible H.P. loss attributable to choke size) unstable running at maximum resonance on *OPS* pipe was immediately manifest!

5. Another, though unrelated, point was that the use of 20% Nitromethane with the *PB* carburettor and *Rossi* pipe (short) led to reduction of BHP to 1.26 as against 1.53 when using 50% Nitro. In this format also, a highest RPM point of the rest was realised — 36,050 — and where a healthy 1.05 BHP was still being churned out.

6. A last finding was some indication that use of the actual car layout for pipe and manifold (as opposed to straight out backwards) can lead to a lowering of RPM point at which maximum resonance occurs — of around 1,500 RPM.

There are enough points to be further researched in the above to keep this column active for a while yet! 2½ days testing proved inadequate to cover all — so it is hoped to provide some back-up information to clarify what is clearly an unresolved situation. Meanwhile of some help in sorting out the 'chaff' might be that the *OPS* pipe was the quieter of the 2, whereas the *Rossi* pipe could be skirting dangerously near to some countries sound level requirements anyway.

Summary

For all the complications surrounding this particular test, the *Rossi* easily managed the highest yet BHP figure in this series, and their claim of 1.95 with increase of Exhaust timing seems to be justified, though some longer acquaintance between motor and this writer appears necessary to reach that level using *Rossi* pipe and carb.

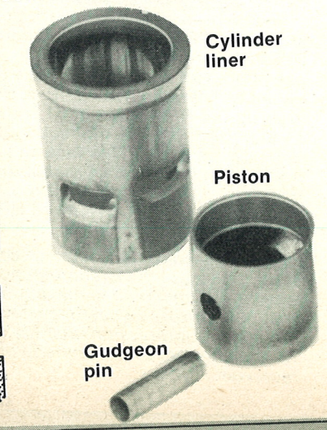
No mechanical problems intruded during the 85 separate runs (many at maximum power) necessary to acquire the information. Plug life was however brief — and probably reflects the fact that compression ratio was not reduced slightly in keeping with the higher than standard 50% nitro fuels.

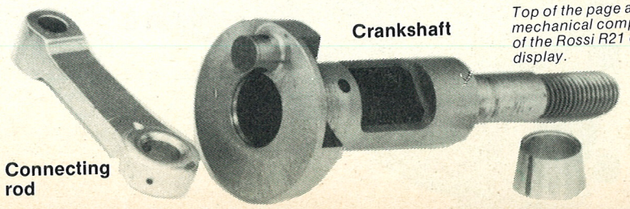
Other problems were limited to the following 'assembly' points —

At termination of test the cylinder liner proved quite difficult to withdraw compared with the initial close sliding fit and so could present 'on-track' delay where quick cylinder/piston replacement was necessary.

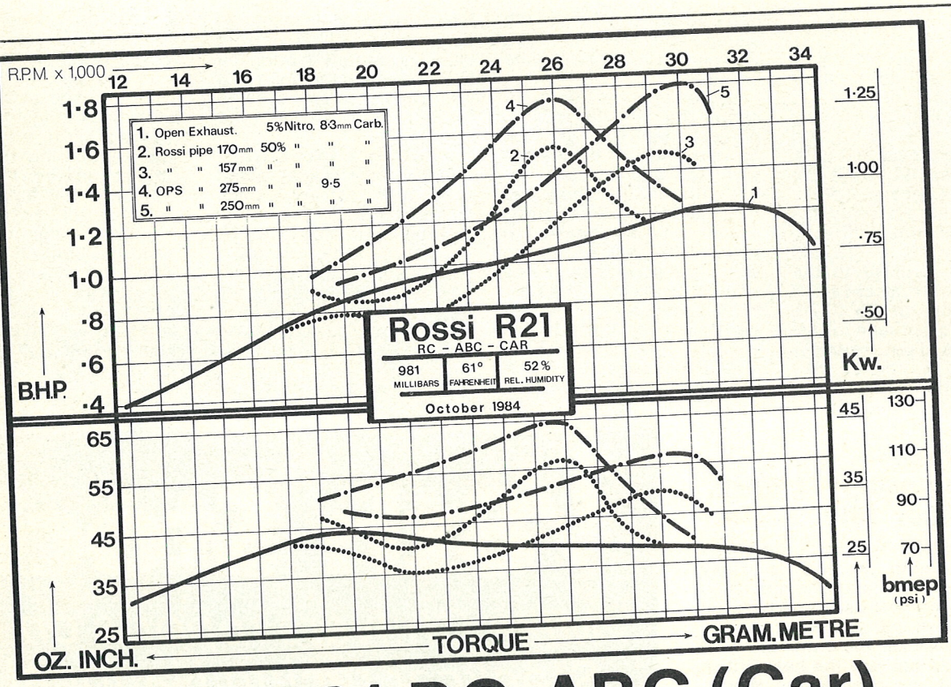
The exhaust header silicon O-ring had limited life when coping with high heat releases from 50% nitro fuels; whilst the cylinder oil sealing O-ring was subject to different stress — reassembly easily cut the thin section soft ring used here. The main cause was sharp edge on lower cylinder fins — and this is rectified by 'radiusing' of that corner by fine file.

These small points do not detract from the high quality of this new Rossi so it seems inevitable that 1985 track results will reflect this late but welcome arrival to the '21' Open car scene. □





Top of the page and left: mechanical components of the Rossi R21 on display.



Rossi R21 RG-ABC (Car)

Dimensions & Weights:

Capacity — .2106 cu.in. (3.452cc)
Bore — .652in. (16.56mm)
Stroke — .631in. (16mm nominal)
Stroke/Bore ratio — .968/1
Timing Periods — Exhaust — 157° Transfer — 123° Boost — 122°
Front Induction — Opens 41° ABDC Closes 65° ATDC Total — 204°
Exhaust port height — .205in.
Combustion chamber volume — .312cc
Compression ratios — Geometric — 12.06/1 — Effective — 8.56/1
Squish band angle — 0°
Squish band width — .12in.
Squish band clearance — .013in.
Crankshaft dia. — .4722in. (12mm nominal)
Crank bore — .354in. (9.0mm)
Crankpin dia. — .1968in. (5.0mm)
Crank nose thread — .248in. × 28 tpi. (¼ UNF)
Gudgeon pin dia. — .157in. (4.0mm)
Con rod centres — 28.5mm
Weight overall — 9.5ozs (with Rossi carburettor) (.27 Kilograms)
Width — 1.7ins.
Length — 2.42ins.
Height — 3.02ins.
Frontal area — 4.29 sq.ins.

Performance:

Max. BHP — 1.8 at 30,030 RPM. (OPS pipe/50% Nitro./Large carb.) 1.2 at 30,830 RPM. (Open ex./5% Nitro./Small carb.)
Max. Torque — 65oz ins. at 25,800 RPM (OPS pipe/50% Nitro./Large carb.) 44oz ins. at 18,460 RPM (Open Ex./5% Nitro/Small carb.)
R.P.M. Standard propellers:
8 × 6 Zinger — 14,560 (Open Ex./5% Nitro/small carb.)
7.× 6 Taipan — 17,820 (Open Ex./5% Nitro/small carb.)

Performance Equivalents:

BHP/cu.in. — 8.54
BHP/cc. — .52
Oz.in./cu.in. — 308.6
Oz.in./cc. — 18.8
Gm. metre/cc — 13.6
BHP/lb. — 3.05
BHP/Kilo — 6.66
BHP/sq.in. frontal area — .42

Manufacturer: *Rossi,* Cellatica, Italy.
U.K. Distributor: *Turbofan,* 5, St. John's Road, Clevedon, Avon.