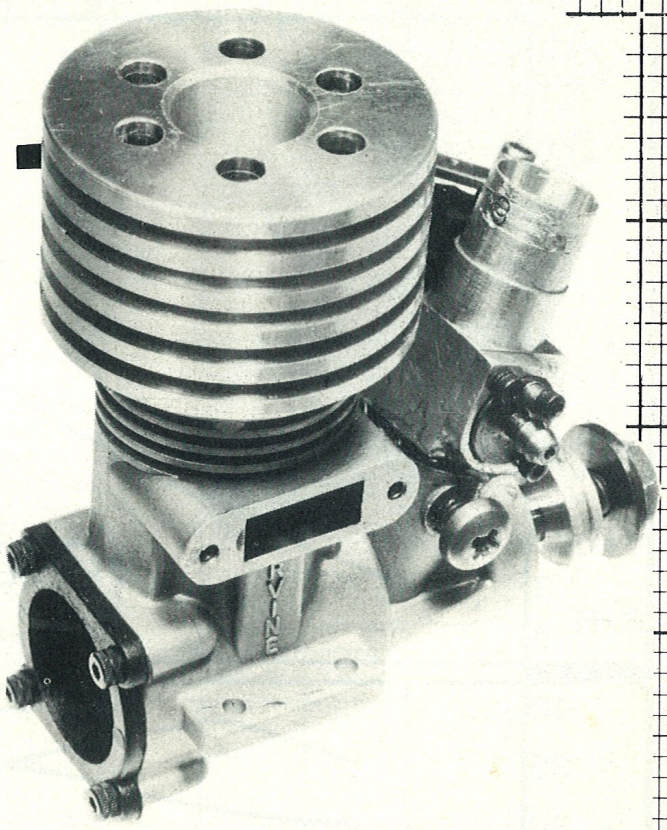
ENGINE TEST No. 9

by Mike Billinton

IRVINE 20 CAR A.B.C.



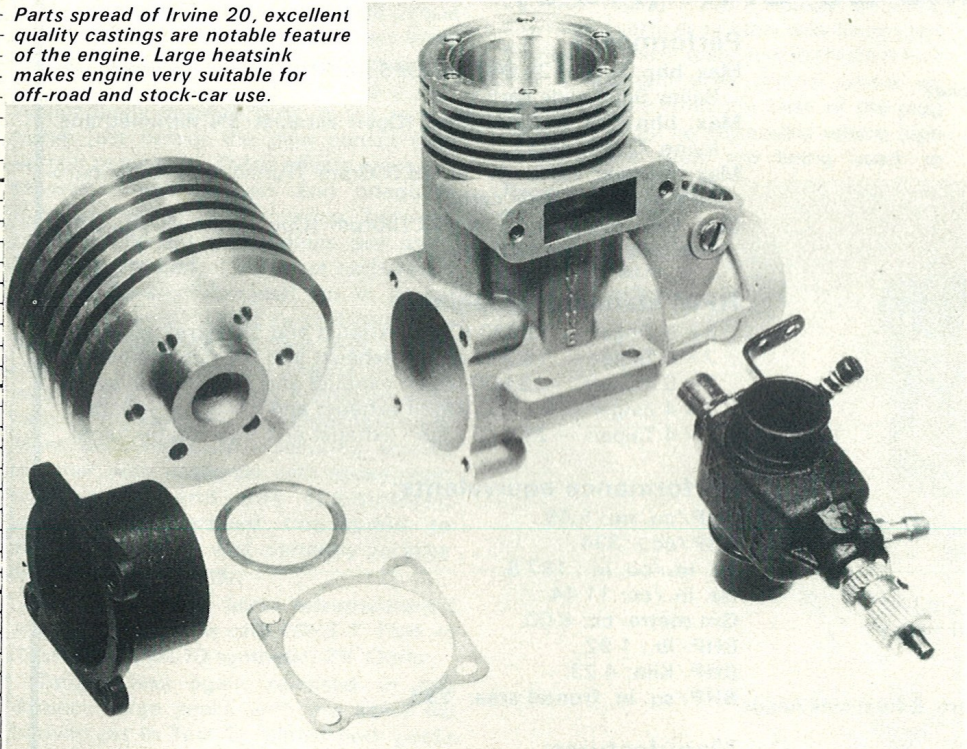
IT DOESN'T take too much detective ability to put two and two together and realise that O.S. Products Ltd. and Irvine Engines Ltd. share the same premises and that Irvine Engines are the appointed UK Distributors for the exemplary range of O.S. model engines. The opportunities of having these supreme examples of quality continually passing through their premises provides useful example to all on the design and engineering side when they have to confront the tasks involved in producing their own Irvine range of engines.

Irvine engines are presently available in sizes from 3.5 to 10 cc, they are currently the main UK manufacturer of engines and offer value for money with good spares and service facilities.

The 0.21cu. in. Open Car class of engine has acquired the reputation in recent years as a touchstone of the individual manufacturers desire to be involved in the mainstream of model engine evolution. For those wanting a more serene mode of life it might be more adviseable to steer well clear! This course is somewhat unlikely though, given the previous and current involvement in high performance areas of certain of the Irvine design and production team and of Ron Irvine himself.

The recently produced Irvine CAR engine was required to meet a design brief of 'the creation of a sports engine with a performance equal to the best standards in side exhaust racing engines'. Assessed against that criterion, this test Irvine 20 has succeeded.

Parts spread of Irvine 20, excellent quality castings are notable feature of the engine. Large heatsink makes engine very suitable for off-road and stock-car use.



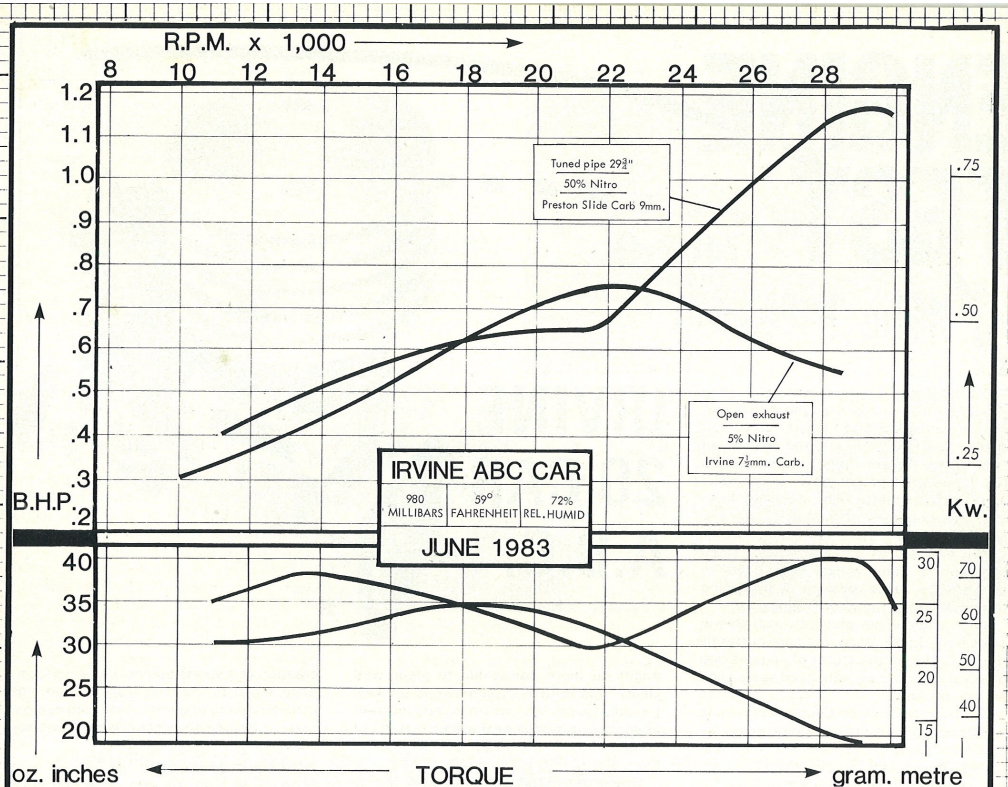
Mechanical details

Characterised throughout by sound, solid practice, Irvine Engines have here opted for the current normal layout of Front Induction/Schnuerle porting/ABC piston liner/Side Exhaust/Exhaust timing 172° for tuned pipe use. Though now appearing slightly unspectacular, this layout has nevertheless proved remarkably reliable over several years of very hard competition — exhibiting few weak links and amply demonstrating an old engineering maxim — that advances achieved by small accumulated changes are more solidly based than those relying on big leaps in technology.

The Irvine 20 incorporates a few of those 'small' points:

1. The Brass liner reverts to the 'old' style of port bars even though a ringless piston is used, for they provide a measure of direction to gas flow and prevent any suggestion of piston tilting and certainly strengthen the liner overall. Reduction of port area and the heat exposure of the port bars are not considered to be serious offsetting disadvantages. Interestingly these ports and bars are cast *in situ*, thus considerably speeding up final production of the liner.

2. Front induction stub is now capable of accepting very large bore carburettors, whilst still retaining adequate wall



Irvine 20 CAR (ABC)

Dimensions and Weights

Capacity: .213cu. in (3.496cc).
Bore: .650in. (tapers .651 to .6495 at top stroke).
Stroke: .643in.
Stroke/Bore: .99/1
Timing Periods:
Exhaust : 172°
Transfer: 130°
Boost: 124°
Front: Induction opens 32° ABDC
closes 50° ATDC
Total: 1980
Exhaust port height: .235in.
Combustion chamber volume: .3cc.
Compression ratios:
Geometric: 12.6/1
Effective: 8.4/1
Cylinder head squish: .020in.
Squish band angle: 0°
Squish band width: .125in.
Crankshaft dia.: .4723in. (12mm).
Crankshaft bore: .3223in. (8.18mm).
Crankpin dia.: .1863in. (4.73mm) (nominal 3/16in.)
Gudgeon pin dia. .1872in. (4.75mm) Nominal 3/16in.)
Con rod centres: 28.5mm.
Piston weight: 3.6gms.
Overall weight: 9¾oz. (.276 kilo) (with slide carb. & heat sink head).
Frontal area: 5.015sq. in.
Mounting hole spacing: 16mm × 36mm with 3mm holes.
Height: 3.55in.
Width: 1.7in.
Length: 2.75in.

Performance

Max. bhp: 1.17 at 29,000rpm (*OPS* tuned pipe/50% nitromethane/Bailey 9mm slide carb.).
Max. bhp: .74 at 22,200rpm (Open exhaust/5% nitromethane/Irvine 7.5mm carb.).
Max. torque: 40oz. in. at 28,600rpm (Tuned pipe/50% nitromethane 9mm slide carb.).
Max torque: 34oz. in. at 18,780rpm (Open exhaust/5% nitromethane 7.5mm carb.

RPM standard propellers:

8 × 6 Zinger — 13,630 (Open exhaust and 5% nitromethane).
7 × 6 Taipan — 16,300 (Open exhaust and 5% nitromethane).
7 × 6 Master — 19,800 (Open exhaust and 5% nitromethane).
7 × 4 Zinger — 21,130 (Open exhaust and 5% nitromethane).
7 × 4 Taipan — 21,770 (Open exhaust and 5% nitromethane).

Performance equivalents:

BHP/cu. in.: 5.49
BHP/cc.: .334
Oz. in./cu. in.: 187.8.
Oz. in./cc: 11.44.
Gm metre/cc: 8.00.
BHP/lb.: 1.92.
BHP/Kilo: 4.23.
BHP/sq. in. frontal area: .233.

Manufacturer:

Irvine Engines Ltd., London N11.

thickness for carburettor security.

3. Front ball-race has double shields of a fabric based phenolic.

4. Crankpin is now integral with the shaft providing greater reliability at the elevated rpms reached in car racing.

5. Con-rod has no lubrication holes at either little or big-end, nor is there a little end bush; so — neatly side-stepping all that agonising over where precisely those holes/slots should be placed in the rod!

The more important consideration being the actual diametrical clearance between crankpin and big-end. This test engine had .0013in., though only .0003in. at the little-end.

6. Piston alloy is harder than usual, having high silicon content. Resulting piston life (in conjunction with those port bars) should be longer than average. No loss of compression was noticeable even after the high nitromethane runs.

7. Gudgeon pin end pads are PTFE.

Performance

Test 1. Equipment used: Open Ex./5% Nitro 20% Castor/Irvine 7.5mm carb. The hard piston alloy led to slightly lengthened running-in compared with usual abbreviated period required for some ABC engines.

These 'standard' open exhaust readings ranged from 6-29,000 rpm with maximum torque of 34oz. in. being clearly identified between 17-21,000 rpm.

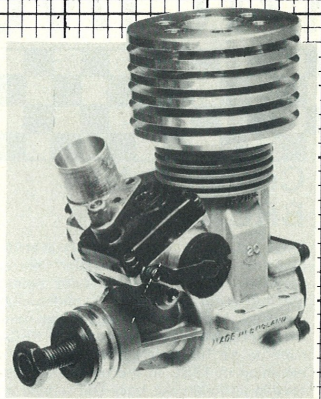
Test 2. This used an *OPS* tuned pipe (9¾in. piston face to tail pipe ending inside rear silencing can)/5% nitro. 20% castor/*OPS* 9mm slide carb. The high exhaust timing of 172° here led to a large and clearly defined leap in rpm and torque at the 27,000rpm area, and as has been noticed in previous tuned pipe tests, when going up the rpm range there is a correspondingly distinct 'hole' in the torque curve just before the pipe comes onto correct resonance. These effects are much clearer where correct and adequate exhaust timing and overlap between transfer and exhaust timings are used. Towards the end of this test carburettor security became marginal, so in anticipation of a worsening of the problem when the high nitromethane test was undertaken, a more effective adaptor bushing was machined to match a Preston slide carb. to the large induction crankcase stub. More substantial 2BA securing screws together with assembly with epoxy resin were used, and this combination subsequently proved impossible to dismantle; and it was certainly rocklike during the final tests.

Test 3. Used 50% nitromethane/Preston 9mm slide carb./*OPS* T. Pipe as Test 2. 14% ML70 synthetic. 2% Castor.

Torque was again released in two distinct, large peaks with the same dip betwen (as in Test 2). Whilst both peaks were higher resulting from the increase in nitromethane content, there was only a small increase in power in the 21,0000rpm trough. Though such comparative findings have not been noted before in the previous car engine tests, it is nevertheless in keeping with other test results which indicate that where the tuned pipe is clearly *not* in resonance, then most methods of power increase (nitromethane content/carb. size/compression ratio) have little relative effect.

The final leap in torque at 28,000rpm resulted in a bhp just short of 1.2. One point of interest is that the recent use of the tuned pipe proper in these tests has placed a limit on maximum rpm attainable (unlike the non-peaky minipipe used in earlier tests), i.e. with each reduction of load past the nominal 30,000rpm point, there is not the normally expected increase in rpm because the torque is dropping as fast as it was rising on the up-side. If it were possible to make the engine rotate at, say 40,000-plus rpm in the first place, then the pipe probably would come onto resonance yet again and then would be producing the necessary torque to turn that particular load at those rpms. In practical terms the price one pays for the tuned pipe's high power possibilities is that it also acts as a 'brake' past a certain rpm point. Strictly, this effect should be observable on the racing circuits.

During this test a brief period of illumination was noted — a strong white light emanating from the top of the large heat-sink cylinder head. This led to a closer though wary inspection whilst the engine was still running quite happily. Glow plug body and post were at white heat (who's for 24-hour racing?) even though a strong downward vertical air blast was being used throughout these tests. It is likely therefore that a stagnant area occurs where air cannot escape from the base of the plug recess. It might be adviseable where high nitromethane fuels are being used, to ensure some ventilation to the plug area by provision of drilled hole(s) in the large recessed heat sink heads which have horizontal finning.

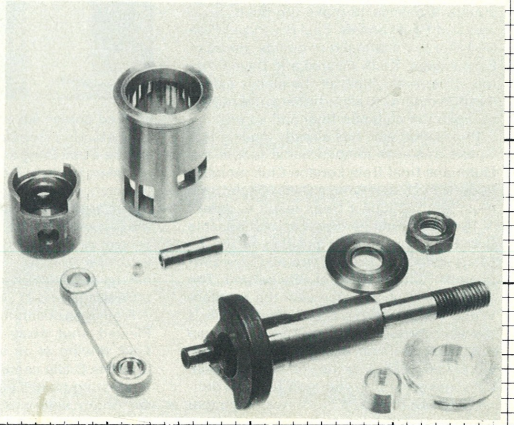


Finally, it is worth mentioning that, as set up ex-factory, this particular engine had quite a large squish band clearance of .020in. and an effective compression ratio of 8.4:1. It is quite possible that more power can be extracted by those wishing to experiment with tighter clearance. Other engines tested to date have had squish clearance of .012in. or less.

Summary

Irvine Engines deserve credit just for taking up the challenge of producing a UK competitor in this most competitive of all engine classes. As the resulting engine is a very practical and solid performer, then it is maybe fortunate that they are 'flying the flag' on our behalf.

In sheer power terms the *Irvine 20* is not the equal of some of the more powerful rear-exhaust motors but well holds its own against other side-exhaust units worldwide.



Reciprocating parts, piston and cylinder are investment castings. PTFE pads are fitted at each end of the gudgeon pin.