POWER CURVE

by Mike Billinton

Mike Billington reviews the Super Tigre S21.

This latest 'Buggy' car engine from S. Tigre continues in their tradition of steady, undramatic development resulting in continual increases in reliability even though at higher power levels.

Factory power figures for this S21 engine are .9 HP at 22,000 rpm (equipment unknown) and for their Rear exhaust Open class car engine — the G350 — 1.45 at 27,000 rpm (again equipment unknown).

As can be seen, the S21 Buggy engine itself can reach near to its Open class counterpart when fitted with Tuned pipe and a large bore carburettor plus use of 50% Nitromethane. In this particular case starting from a fairly low Open exhaust figure, the power output almost doubled with those three 'power-improvers'.

As an indication of that steady development, it is instructive to note that the 1984 S21 rear exhaust base-mount engine gave a power figure of 1.2 using the 'full-house' equipment.

Mechanical Detail

Crankcase is as usual a solid one-piece aluminium die-casting which proved robust and trouble-free throughout testing.

The carb spigot mounting boss is assymetrically set over to one side (as viewed from front) which allows fuel/air to enter crankshaft bore tangentially. This S. Tigre feature presumably aids efficiency though few competitor engines use the idea.

Crankshaft is a one-piece construction in hardened steel with partial crescent cut-aways of crank web for balancing purposes. Crank timing at 200° is quite generous and has assisted the engine's ability to run up to high rpm when tuned pipe was used at short length.

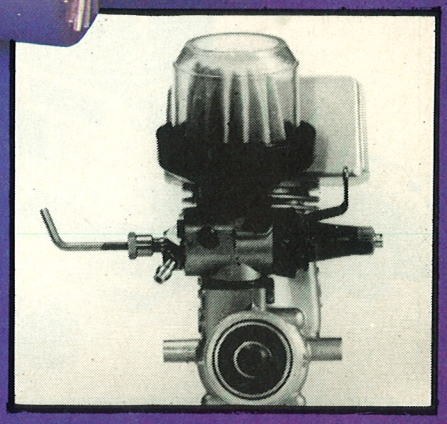
Liner/Piston. S. Tigre have continued with their sound idea of a thick flange at top of liner to prevent variable distortions occurring when cylinder head bolts are tightened down. In their design the piston reaches to top of the liner. In any event there was a resultant very even wear pattern around bore surface at TDC area and low friction at all times once running-in was completed. The Brass liner has the usual chrome plating and uses Schnuerle porting — 1 exhaust, 2 transfers and 2 boost ports, though the latter are fed by one single large transfer passage. Exhaust timing at 163° allows good tuned pipe response in view of the reasonable blow-down period of 17° ahead of the transfer timing of 128°.

Piston is cast in high silicon percentage aluminum alloy — subsequently milled out to give a weight of 4.7 gms. Normal wire circlips secure the gudgeon pin in place.

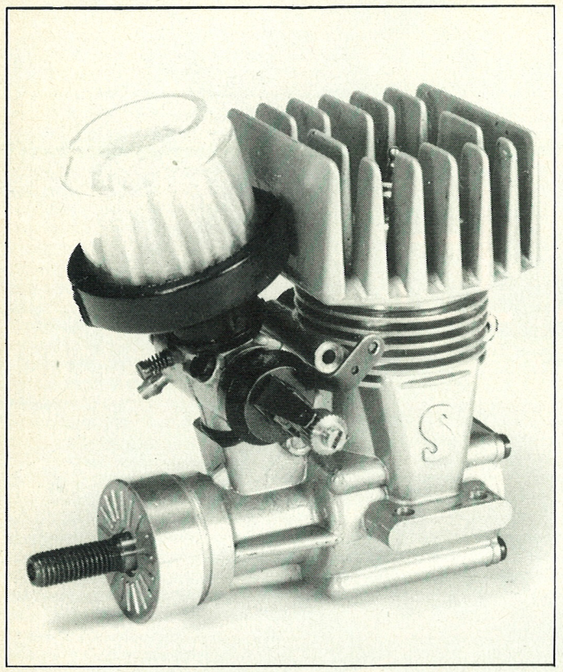
Cylinder head is in 2 parts constructed of aluminium alloy. The combustion chamber having a small squish angle of 3° sits on top of liner, ie. does not insert into top of liner as with many other engines. Clamping this part to top of liner is a finely cast large finned cylinder heat 'heat-sink' weighing some 2 oz (58 g). Compression ratios seem to be creeping down — probably under the twin influences of better tuned pipe responses (giving denser cylinder filling) and need for overall engine and glow-plug reliability. At 6.17/1 effective compression ration the S21 is fixed at a quite low figure as standard and could quite likely generate more power though at lower reliability by use of lower squish clearance than the .021 inch as set up out of the box.

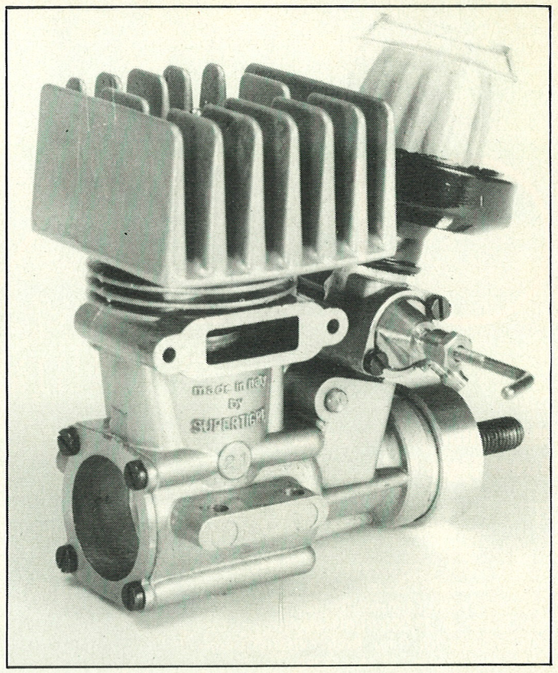
Connecting rod is the normal S. Tigre 'machined from solid aluminium alloy' part, having phosphor bronze bushing at big-end only and where there are two lubrication holes. The little end of the two-stroke con-rod is a less stressful area and so, as in this S21, can often dispense with any bushing — with the aluminium alloy material itself being quite adequate as a bearing surface.

Carburettor is a 7.4 mm bore version of S. Tigre's well known 'Mag' twin-needle unit, which now sees service in all their engines up to their 60 cc twin in-line engine — a fact indicating their satisfaction with the basic design. In this Car unit a rubber seal surrounds the rotating steel barrel to reduce fuel leaks at this point. Also featured is a practical rubber mounted Air filter using paper element — which has seen service in writer's Shell Marathon vehicle!

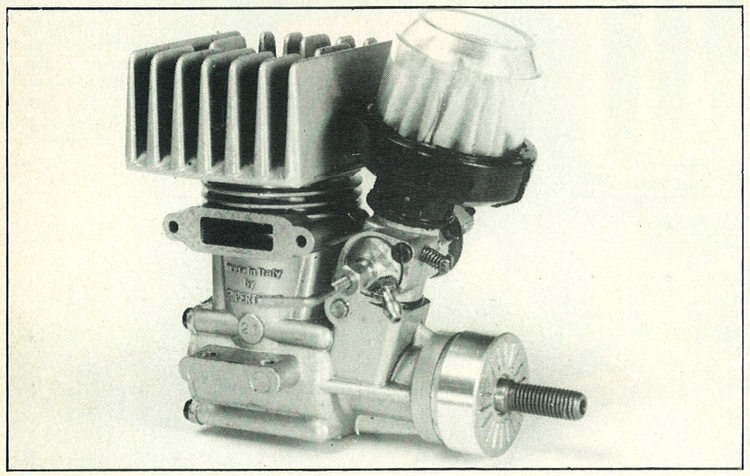


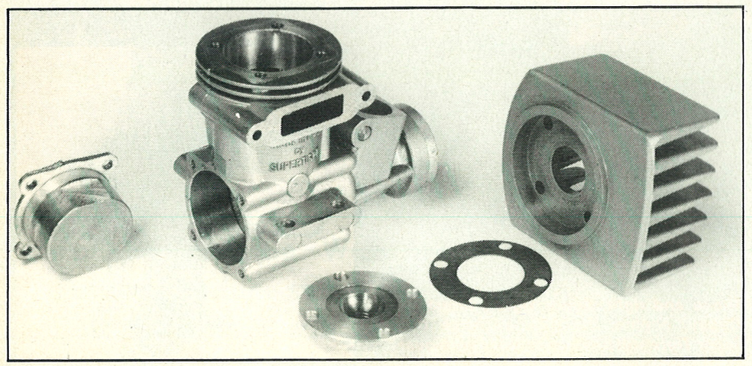
Above and right, Supre Tigre's latest I/C 'Buggy' engine, the S21, evidence that Super Tigre still produce engines with quality of construction and value for money.





Below, the S21 crankcase is strong and trouble-free. Bottom, large heat-sink head aids steadiness of performance. S21 crankcase is sound and strong. Above, the rubber mounted Air filter is a vital piece of equipment — particularly so for the 'Off-road' vehicle.





Power Tests

Test 1 — Open exhaust/5% Nitromethane/12% Castor oil/ST 7.4 mm carburettor/ST Long reach plug.

The flat wide Torque band given by the S21 is characteristic of current 3.5 cc racing engine performance, though the resultant flat top to the HP curve was a little unusual. HP cut-off was quite abrupt past 27,000 rpm and obviated need to explore higher rpm in this open exhaust mode.

Test 2 — OPS tuned pipe (set at 300 mm from glowplug to end of rubber can)/50% Nitromethane/5% Castor with 11% ML70 synthetic oil/OPS 9 mm carburettor/OPS 250 glowplug.

Using the three 'power enforcers' (pipe/fuel/carburettor) enabled the S21 to generate substantially more power and using what could be considered an average tuned length of 300 mm, kept maximum resonance/maximum power point down to a useable 26,000 rpm and where the highest Torque point of this test — at 48 oz inch — was reached.

Test 3 — Same equipment as Test 2, but pipe now set at 260 mm tuned length.

This use of a shorter 'tuned' length as expected raised best resonance rpm near to 30,000 and at which point the S21 still operated soundly and smoothly. Going further up the rpm scale almost to 34,000 rpm saw Torque swiftly declining as is normal once correct resonance rpm is exceeded. In this mode the engine produced its highest HP of this test — 1.38 HP at 29,575 rpm.

Summary

At end of the tests, the S21 was still in very good shape, having been persuaded to produce power figures which, strictly, are not usually extracted from the normal 'Buggy' car engine.

Dimensions And Weights

Capacity — .2115 cu in (3.465 cc)
Bore — .6535 in (16.6 mm)
Stroke — .6305 in (16.0 mm)
Stroke/Bore ratio — .965/1
Timing Periods:
- Exhaust — 163°
- Transfer — 128°
- Boost — 128°
- Front induction:
  - Opens — 34° ABDC
  - Closes — 54° ABDC
  - Total — 200°

Exhaust port height — .216 in (5.5 mm)
Combustion chamber volume — .44 cc
Compression ratios:
- Effective — 6.17/1
- Geometric — 8.875/1

Cylinder head squish — .021 in
Squish band angle — 3°
Squish band width — .131 in (3.35 mm)
Crankshaft diameter — .472 in (12 mm)
Crankpin diameter — .197 in (5.01 mm)
Crank bore — .332 in (8.45 mm)
Crank nose thread — .247 in x 28 tpi (¼ UNF)
Carburettor bore — 7.37 mm (OPS carb 9.1 mm)
Gudgeon pin diameter — .157 in (4 mm)
Connecting rod centres — 30 mm
Mounting holes — 15 mm x 38 mm with 3.5 mm holes
Width between bearers — 1.13 in (28.7 mm)
Overall height — 3.34 in (84.75 mm)
Overall width — 1.76 in (44.8 mm)
Overall length — 2.76 in (70.2 mm)
Frontal area — 4.9 sq in
Overall weight — 10.5 oz (288 g)
Piston weight — .16 oz (4.7 g)
Crankshaft weight — 1.27 oz (36 g)

Performance

Max BHP

1.38 @ 29,575 rpm (OPS pipe/50% Nitro/9 mm carb)
.70 @ 24,000 rpm (open exhaust/5% Nitro/7.4 mm carb)

Max Torque

48 oz in @ 25,800 rpm (OPS pipe/50% Nitro)
35 oz in @ 15,000 rpm (open exhaust/5% Nitro)

RPM on Standard propellors

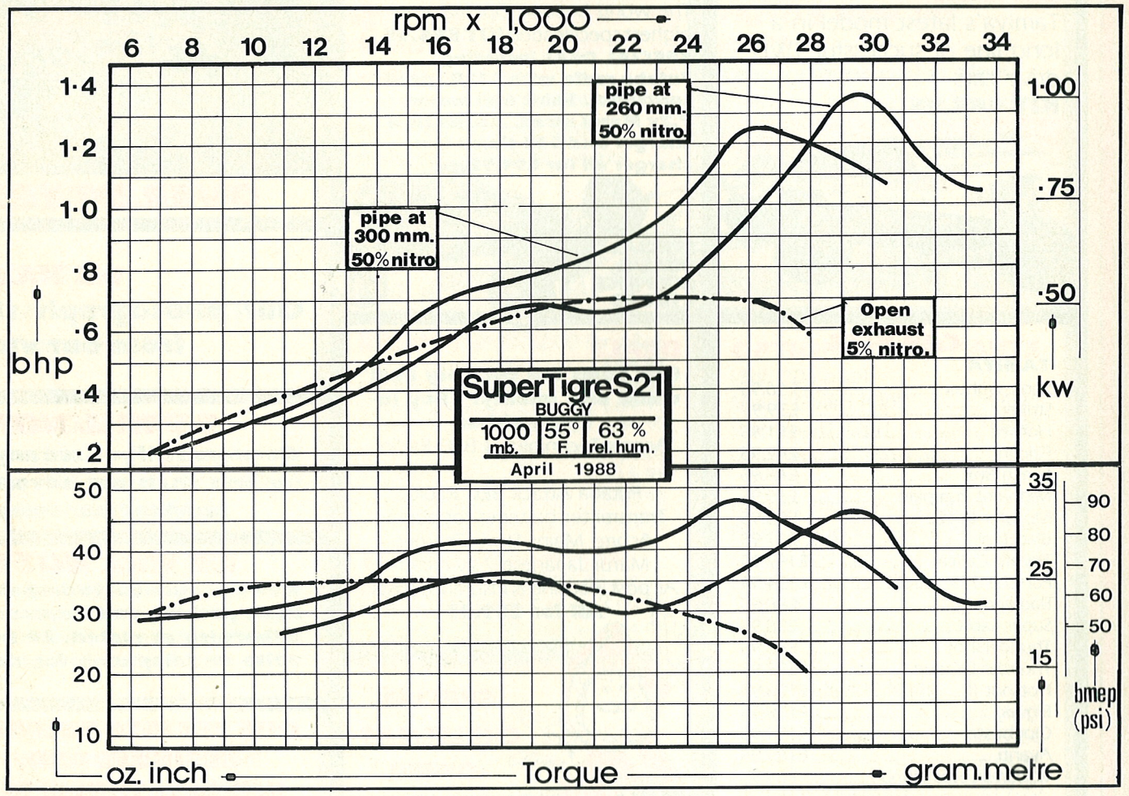
	Open ex	*Pipe 300 mm*	*Pipe 260 mm*
7 x 6 Taipan	16,926	17,832	
7 x 4 Taipan	20,524	23,682	20,819

Performance Equivalents

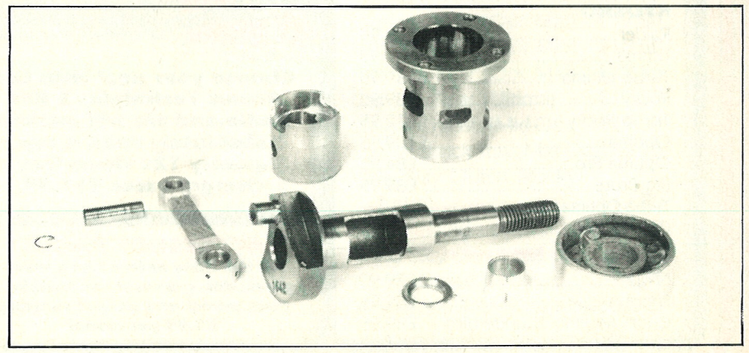
BHP/cu in — 6.62
BHP/cc — .398
Oz in/cu in — 227
Oz in/cc — 13.8
G metre/cc — 9.8
BHP/lb — 2.1
BHP/kilo — 4.8
BHP/sq in frontal area — .28

Manufacturer

Super Tigre SRL,
Bologna,
Italy.



Solid upper flange of liner brass liner is noteworthy.



However, as these are frequently designed and constructed on virtually similar lines to their 'full-house' ⅛ open class racing counterparts, so then there is probably no harm and maybe some value in extending them somewhat — at least towards the end of a normal test regime.

Judged by dynamometer test at least, the S. Tigre soundness and quality of construction is still evident and continues to offer good value for money.