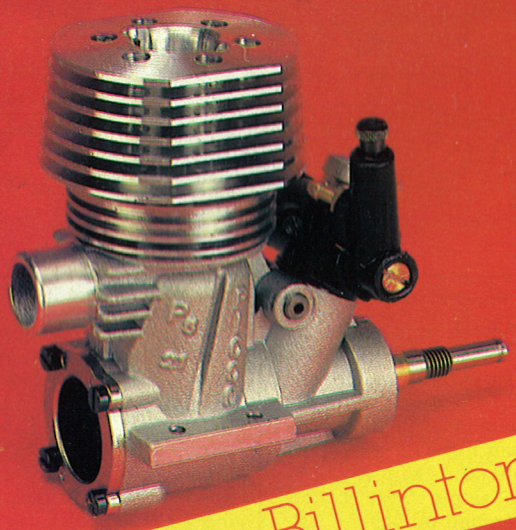
Radio Race Car, January 1987

POWER CURVE

The Picco .21 P5



by Mike Billinton

Mike Billinton tests the new 5-port Picco as an introduction to his regular engine column.

The intent of this new series of model car engine tests is to continue one form of monitoring of the detail design progress which has been such a feature of the 'performance-oriented' Open ⅛ Car class.

Designer Gualtiero Picco is renowned for the continual stream of design changes which, though giving users and distributors a hectic time, are evidence of his insistent search for new answers and an implicit dissatisfaction with the 'status quo'.

In some ways the last two years have been quite turbulent ones for model car engine manufacturers, and must certainly have been so for Picco ... after much delay the long-awaited oil-cooled Rossi burst onto the car scene, but quickly appeared to precipitate a major shake-up in that area with the subsequent appearance of the 'independent' Nova-Rossi 21. This fine engine set such high standards (and hopes) as to temporarily eclipse most prevailing engine performance levels. In practice the awesome task of continually having to meet the high expectations of circuit racers worldwide has apparently led to some 'quietening' of Nova Rossi activity, though it may be much too soon to say that the name itself was prophetic in a stellar sense.

The still awaited entry into the field of the (Ugo) Rossi 5-port engine adds some spice to what is, in other respects, a now less hectic, more down to earth period, in which the longer standing virtues of Picco, OPS and OS products are being re-sampled.

The Picco 21 P5 can thus be seen in this light as a continuance of current good practice laced with those individual touches characteristic of this designer. Not too many manufacturers have committed themselves fully to the '5-port' schnuerle two-stroke design, and it's unlikely that Picco himself will necessarily continue to do so, for the conversion in this P5 engine may well be temporary and part of that continuing 'search'.

Mechanical details:

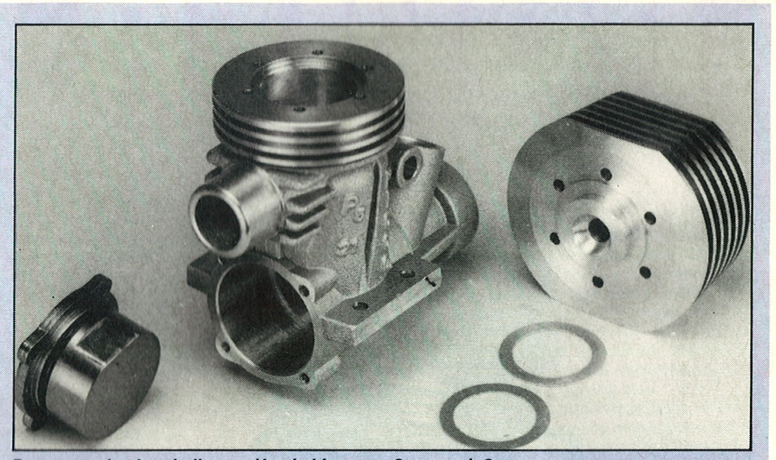
Crankcase: As users will know, the previous model Picco 21 was the base-mount P21 Delta engine, and that temporary 'scrutiny' of the extra-rigid engine has now ceased — being probably considered an unnecessary manufacturing complication, and one too restrictive of the engine's possible use in other areas of modelling activity. The reversion to standard beam lugs in conjuction with the new twin transfer channels either side of the crankcase now gives the Picco a sleeker, more sophisticated and less brutally functional appearance — though this is of little consequence to the parts flailing around inside! The one-piece alum. alloy casting incorporates the exhaust duct with integral extra finning. Bore of case is honed to receive the close push-fit brass liner, whilst the front housing bore is relieved opposite the induction opening — for reasons still not entirely clear to this writer, though friction reduction appears the most likely one.

The aluminium back plate now uses the increasingly popular 'O' ring seal, and hard plating is used to prevent wear from con-rod movements.

Cylinder head: Another change from the 'Delta' is the return here to a familiar one-piece 'turned-from-solid' alum. head. Milled holes allow cooling air access to the often under-cooled glowplug. Squish band width is slightly increased to .132in. and chamber shape is now a taller, more pointed bowl shape. These two points would ordinarily lead to higher compression ratio, but for the fact of a third change — an increase of squish clearance from previous .012in. to the present .020in. So, final effective C/Ratio is actually now further reduced to 7.38/1 ... thus clearly pointing to the pursuit of glow-plug and therefore motor reliability at the expense of sheer power. This point has been noted, before and is increasingly part of the way that top competition units are set-up.

Crankshaft: In keeping with trends elsewhere, the P5 is now fitted with the more robust 13mm. dia. shaft and which then enables an increased throughway dia. of 9.5mm. Crankpin continues with the Picco tradition of an angled lubrication hole connecting crank bore with outer face of crankpin/big-end bearing interface, which allows a centrifuging of oil supply to this hard pressed. Induction is slightly altered from that of the Delta engine in opening and closing some 6° later, though with same total opening period at 207°.

Connecting-rod: The Delta's steel rod has been forsaken with this return to a strongly profiled alum. alloy rod — bushed at big-end only — drilled either end for lubrication.



Rear cover is plated all over. Head shims are .2mm and .3mm.

Cylinder liner and piston: The most significant of the changes in the P5 is referred to in the engine's name ... it now has 5 'transfer' ports. The single front 'boost' transfer port is still angled up around 50°, and so continues to perform a slightly different function compared with the other 4 main transfers. Photo shows the new detail work in the side transfer closest to the exhaust port, and the widening of upper half of the exhaust port itself. The upper edge of this port is also angled up — approx 20°. Proof of Picco's continued experimentations are the changes also made to the actual cylinder timings ... at 150° exhaust and transfers of 115° these are somewhat reduced compared to the Delta's 170° and 128°, though overlap (the angle between exhaust opening and transfer opening) is still similar at 21°, below which figure tuned pipe response becomes less and less marked. The medium/high silicon alum. alloy piston is externally honed, and features two small grooves near crown to assist lubrication. Crown diameter is reduced by .0005 in. to reduce 'pick-up' as heat expands piston top.

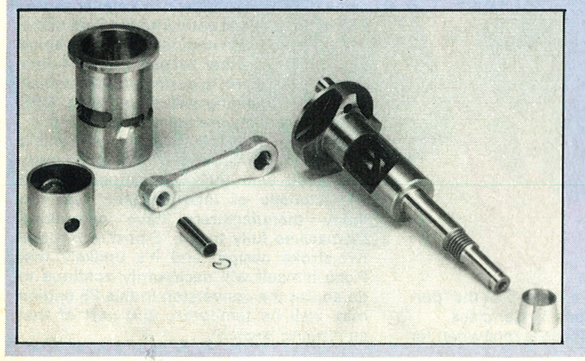
Carburettor: This high-impact 'plastic' unit also represents a change from the alum. alloy carbs. previously used. Choke bore at 8.98mm. is as large as currently deemed necessary for circuit work, though clearly a requirement for flexibility of operation places some restriction on maximum size. The steel barrel slide operates with a brass sleeve insert embedded in the plastic moulding, and this barrel itself has been the subject of quite recent changes to its opening profile, following some reports of inadequate low to mid-range throttle response.. Photo shows the new barrel having a curved cut-away whereas the earlier version had a straight cut-off.

The main needle control is very securely held in the plastic thread and this prevented any problems of unscrewing at high RPM. This feature applies also to the throttle stop screw and secondary needle control. 'O' ring sealing is extensively used throughout.

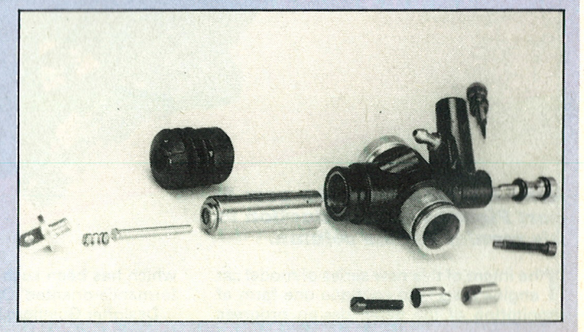
A final touch is the use of the '2-piece' pinch bolt locking screw used to hold carb. firm in front housing. The writer first saw this device in use in the K & B 67 Marine racing engine and its virtues were apparent then ... pinching at two places rather than the usual one, it locks more effectively with less distortion of carb. body, and subsequently released more easily for the same reason.

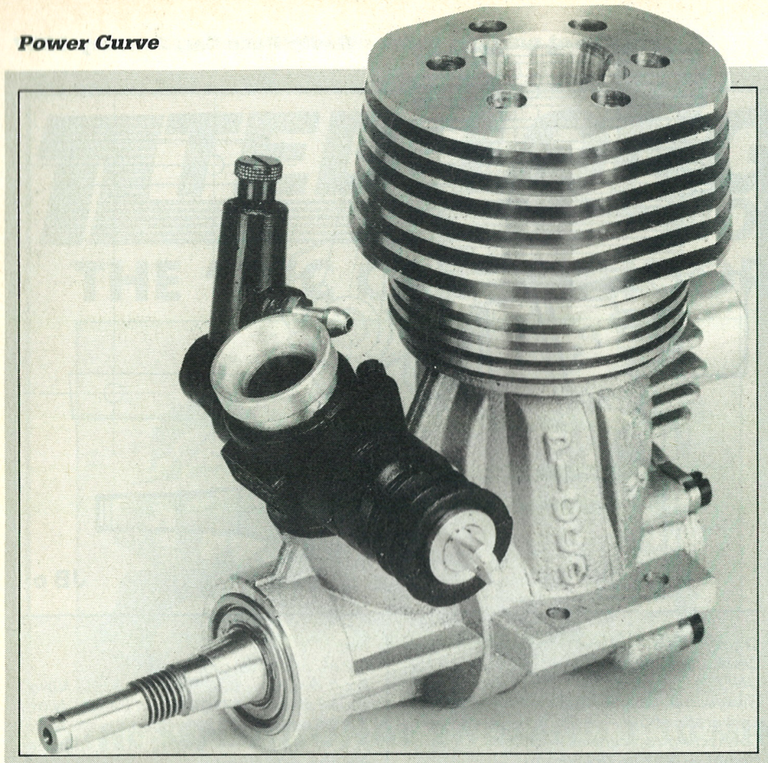
When considering the significance or otherwise of the many and varied changes seen between succeeding models of Picco engines, it may be worthwhile to remember that this designer, like USA's Duke Fox, tends to be continually active and fertile in putting new ideas into practice ... some points may work well; other not so. Such methods are much to be preferred to stagnation of course, and the history of I.C.

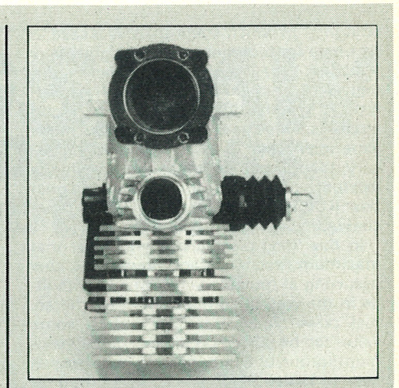
Piston has twin lubrication holding grooves near crown. Design changes to transfer and exhaust ports are clear in this photo. Sturdy 13mm. shaft should maximise reliability.



2-piece pinch-bolt is shown at bottom in front of carb. body. Uses screwdriver slot for tightening. Secondary needle at left is spring-loaded to protect servo travel. 'Plastic' carb. body is complex design to cope with many carb. problems in car use.







engine development reserved a respected place for this instinctive empirical approach.

Performance: First checks on standard propellers revealed the usual instant and fuss-free performance available from the modern ABC 3½cc. car engine. There was some expectation that the low C/Ratio and large squish clearance combined would have a 'calming' effect on power and RPM levels as well as a good resultant plug life. This proved to be the case as the various figures unrolled over the next two hours. No attempt was made to alter those parameters of squish and C/Ratio, though previous experience has shown on occasion that meaningful performance increases are 'on-tap' in this way. Readers may appreciate that this area is a potential minefield of varying effort, opportunity, prejudice etc., and so unless a specific point is being openly pursued and is reported as such, then the wisest course continues to be to test the unit 'as supplied'.

Power test 1. Open Exhaust. Fuel — 5% nitromethane, 10% castor with 5% ML70 synthetic oil./OPS250 plug.

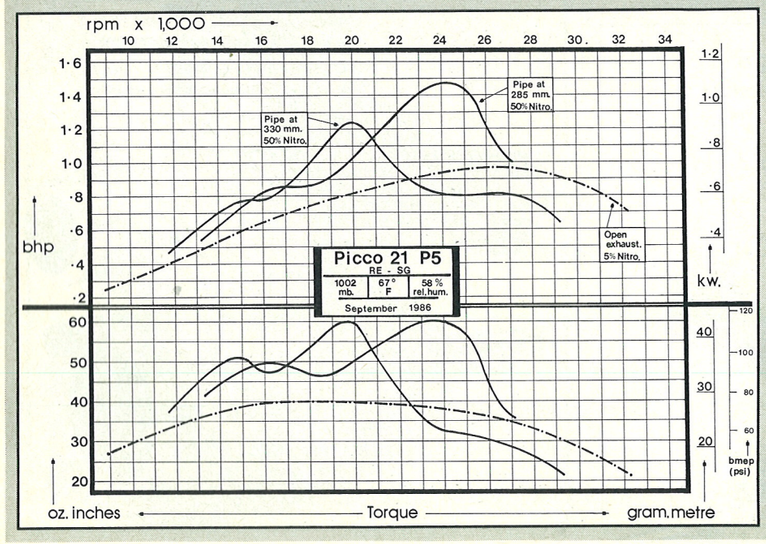
The extremely wide band of torque released by this style of engine was again noteworthy, and in this way differed little from the Delta's performance, though actual torque values were slightly reduced. Final HP of .97 at 26,500 RPM was therefore down on the Delta's 1.12 at 27,000 RPM. using similar equipment.

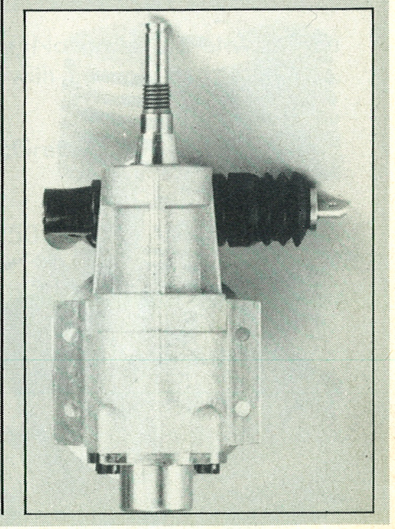
Power test 2. OPS Tuned pipe (set at 285mm. length from end of rubber can to plug.) Fuel — 50% Nitro. with 10% ML 70 and 2% Castor./OPS 250 plug.

Use of this particular tuned pipe was resorted to because of its frequent previous use as a 'base comparator' on many similar engines previously tested. Time prevented use of the Picco pipe itself, though previous 'back-to-back' comparisons between the two pipe styles have not revealed any significant power differences ... however, the P5 is now a different engine, with changed port timings, and really there is no room for certainty in this area. The final power figure with this equipment of 1.47 at 24,300 RPM should therefore be considered as the likely minimum figure obtainable, and adjustments to C/Ratio, pipe style (and its tuned length for maximum resonance at varying RPM levels) may well show some gains. It seem likely that a slight shortening of pipe length to say, 270mm. or so, would lead to higher power in the 26,000 RPM area at the expense of some torque loss below 20,000 RPM.

Power test 3. OPS pipe now at 330mm. length. Other equipment as test 2.

Following some discussions on the relationship of torque placement, track style or gear ratios, the pipe length was now set rather over-long (by comparison with earlier tests), and in a sense the result is predictable and somewhat similar to changing the overall gear ratio. However, there is a best pipe length which leads to maximum power, and generally this should be the one to use unless the track is unusually compact or conversely, has very long

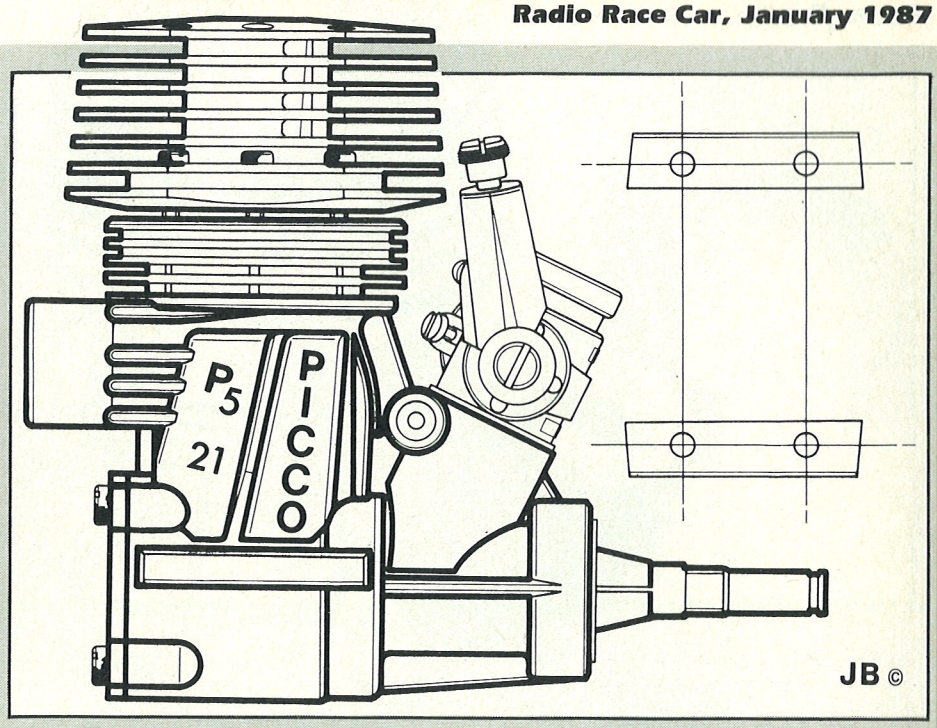




straights: in which event there is a case to be made for lengthening pipe slightly (say 1½-2cms.) for the short tracks, and shortening it a similar amount (from an optimum length) for tracks having long straights. This again is an area where much experimentation is possible, even necessary, though one imagines that ideally the existence of a fully automatic variable gear box (C.V.T.) would eliminate such time-consuming work.

In this 'long-pipe' test it was clear that maximum resonance and power was now occurring at much lower RPM and with little in the way of compensation for the actual power loss ... unless that is, some value can be placed on the fact of the maximum torque of 60 oz. ins now appearing at near to 19,000 RPM. — a speed not too far above some clutch engagement points.

Summary: The Picco P5 proved to be a very solid, trouble-free performer having smooth running characteristics. In common with some other competitor engines at the present time, it is made available in this slightly 'de-tuned' format in order to maximise its chances of real success in competition ... i.e. 'to win, it is necessary to comlete the course' .. and this latest Picco design appears even more capable of doing so than earlier models.



Dimensions & Weights

Capacity — .209 cu.in. (3.43cc.)
Bore — .651 in. (16.53mm.)
Stroke — .629in. (15.97mm.)
Stroke/Bore ratio — .966/1
Timing Periods — Exhaust — 158°
— Transfers — 115°
— Boost — 113°
— Front induction opens 33° ABDC, Closes 60° ATDC, Total 207 °.
Exhaust port height — .197in. (5mm nominal).
Combustion chamber volume — .37cc
Compression ratios
— Effective — 7.38/1
— Geometric — 10.2/1
Cylinder head squish — .25in. (.64mm)
Squish band angle — 0°
Squish band width — .132 in. (3.37mm)
Crankshaft dia. — .511in. (13mm)
Crank bore — .374 in (9.5mm)
Crankpin dia. — .196in. (5mm nominal)
Crank nose thread — .244 in. x 28 TPI (¼ UNF)
Gudgeon pin dia. — .158in. (4mm nominal)
Carburettor bore — 8.98mm
Connecting rod centres — 30mm
Height — 3.52 in. (89.56mm)
Width — 1.734 in. (44.04mm)
Length — 2.482 in. (63.05mm)
Mounting holes 36mm. x 16mm. x 3mm. holes.
Width between bearers — 1.19in. (30.42mm.)
Frontal area — 4.8 sq.in.
Overall Weight — 10.1ozs. (286 grams.)

Performance:

Max. BHP — 1.47 @ 24,300 RPM. (OPS pipe/50% Nitro.)
— .97 @ 26,500 RPM. (Open Exhaust/ 5%Nitro.)
Max Torque — 60 oz ins. @ 23,500 RPM. (OPS pipe/50% Nitro.)
— 40 oz ins. @ 16,900 RPM. (Open Ex./5% Notro).
R.P.M. on Stand propellors:
8 x 6 Zinger — 14,600 (Open ex./5% Nitro.)
7 x 6 Taipan — 17,820 (Open Ex./ 5% Nitro)
7 x 4 Taipan — 23,200 (Open Ex./5% Nitro)
7 x 4 Taipan — 25,010 (OPS pipe @ 285mm./50%Nitro)

Performance Equivalents:

BHP/cu. in. — 7.03
BHP/cc. — .428
Oz.in./ cu.in. — 287.08
Oz.in./cc. — 17.49
Gm.metre/cc. — 12.53
BHP/lb. — 2.33
BHP/Kilo. — 5.14
BHP/sq.in. frontal area — .306

Manufacturer:
Picco Gualtiero, Monza, Italy.
U.K. Distributor:
Weston U.K., 84/88 London Road, Teynham, Nr. Sittingbourne, Kent, ME9 9QH.

Secondary jet and main jet are both securely held by natural friction of plastic body. Crankcase is finely designed and constructed.