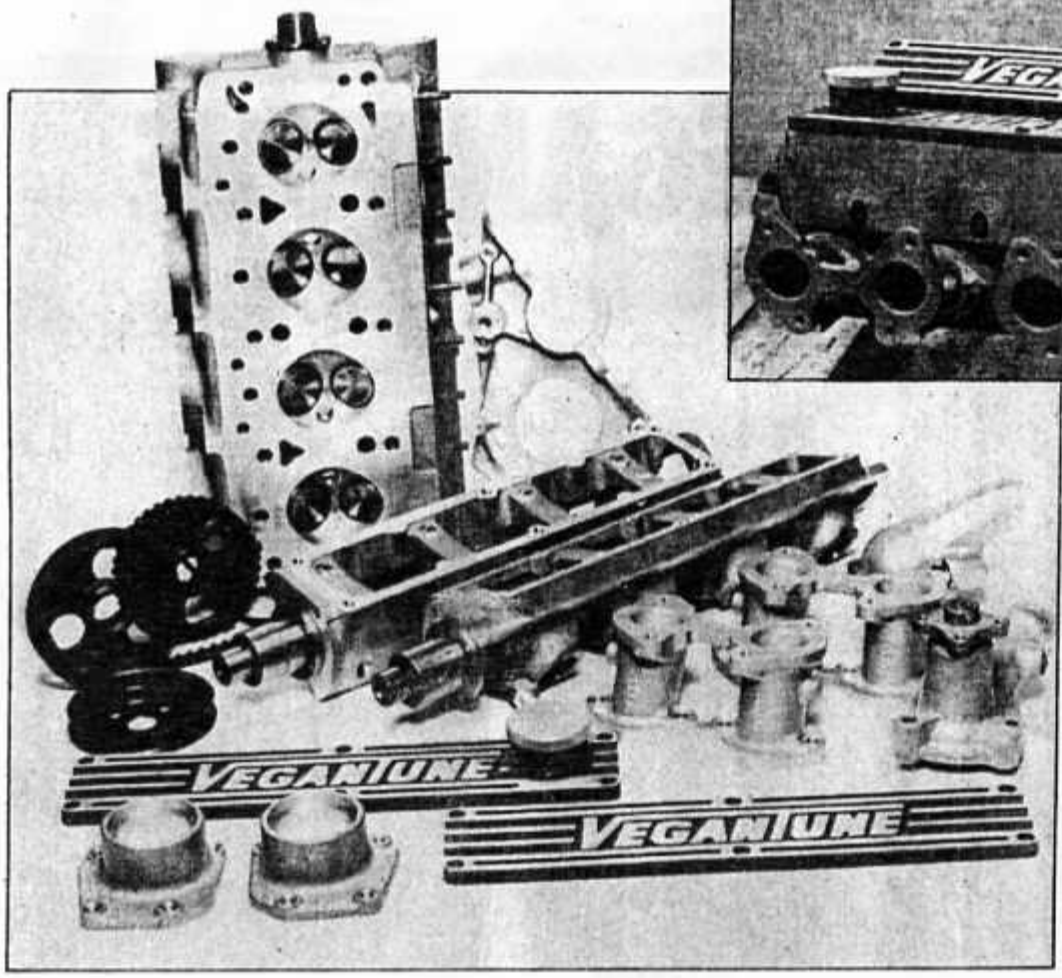




*Assembled VTA head. Note the separate inlet manifids*

# Vegantune VTA

***The recent development of the VTA head with its belt driven cams, by the famous engine tuning and Twin Cam specialists, has provided a source of new and superior heads to Twin Cam owners. It has also made it possible to convert any in-line, four cylinder, pushrod Ford engine to a Twin Cam, from 997cc upwards . . .***

THE Ford based Lotus Twin Cam engine was first introduced in the early sixties, and eventually became one of the most famous and successful twin cam engines ever produced.

The Lotus Elan has always been powered by this unit, as of course have the classic Lotus Cortinas (Mk1 & 2) and the fabulously successful Escort Twin Cam.

Vegantune, headed by ex-BRM engineer George Robinson, became involved in the competition development of the engines in 1964 and have subsequently handled over 5,000 Twin Cam units, including extensive and varied competition modifications on an International basis.

## Dilemma

Eventually, the casting patterns for the cylinder heads became unavailable to Vegantune as Lotus were forced to send them to the US due to liability risks under the then new Product Liability Laws.

Vegantune eventually got them back, but incomplete. After manufacturing the missing bits themselves, it was discovered to their horror that the original head was going to be uneconomical to manufacture due to the fact that the original design provided for a first class cylinder head, but not ease of casting. The whole process would be far too labour

*George Robinson, founder of Vegantune, designer of the VTA*

intensive, requiring the castings to be passed from man to man for a variety of separate machining operations. The problem was that existing heads, were, by the late '70s, becoming pretty old and reconditioning of heads with bad damage (either from failure or previous crude attempts at reconditioning) was prohibitively expensive. Caterham Cars were in dire need of re-manufactured units for their Sevens, so something drastic had to happen.

George Robinson thought the only way out was to design a new head and pattern equipment, which would be economical to manufacture, but also lose all the inherent problems of the original design, which were many.

Vegantune had been familiar with the Twin Cam (originally designated 125E) almost since the first production car rolled off

***"We decided to manufacture our own head and pattern equipment. We sat down and looked at the Lotus head for a long time, but we could see that the closer we stayed to the original design, the more expensive it would be to produce."***

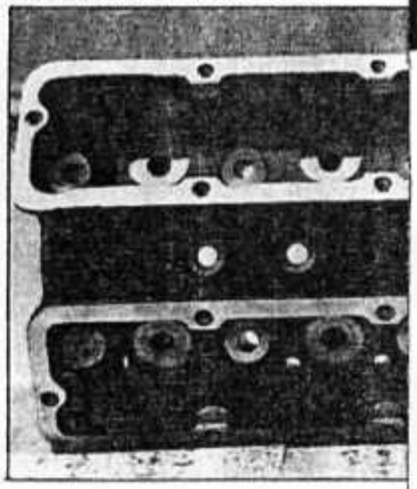
the line with one fitted in January 1963.

## Rethink

It was in his characteristically methodical manner that George sat down in 1980 to rethink the whole problem. The first steps were to identify the drawbacks of the original design. Oil tightness had always been a major problem, especially around the cam covers. This was due in part to the actual size of the cover, but also to the cork gasketry. Cork gaskets have never been that successful due to continual expansion and shrinkage of the material. Two half-moon seals at the front and rear of the cams also contribute to leaks, as does the lack of oil drainage from the head, causing the cams to pick up oil and thrash it around inside the cam covers. The alloy timing chain cover bolted to the front of the block and joining the head at right angles with yet another cork gasket, was asking for trouble.

The second major problem was overheating of exhaust valves. The original head has no waterways anywhere near the exhaust valve guides or seats,

*VTA head minus cam carriers. Two oil drainage (dummy pushrod) holes can be seen in the bottom portion (inlet side)*



leading to sticking or 'lazy' valves, and burning. Lack of water capacity within the head coupled with the relatively low mass of the casting itself made it a prime target for overheating. Vegantune had discovered on a couple of occasions that turbocharging could lead to boiling of water in the heads. And, because of the imprecise method of holding cores during casting, waterways often varied, causing uneven waterflow — very nasty.

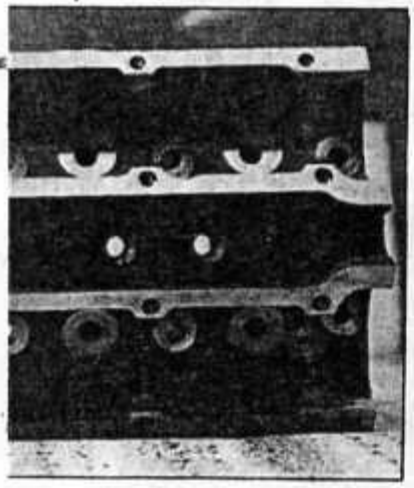
## Blue haze

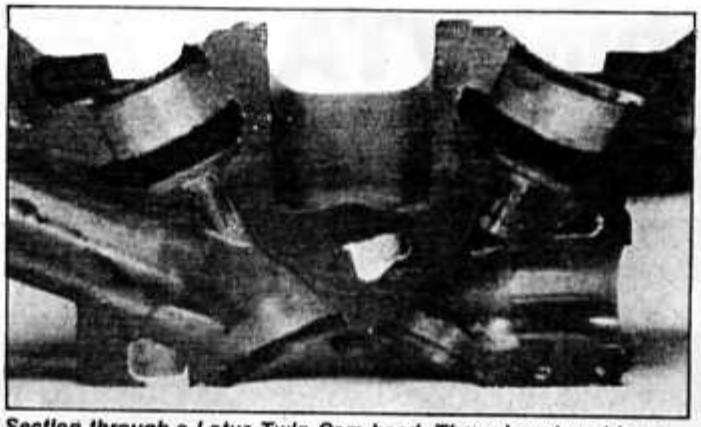
The third problem was oil drainage, particularly at the back of the head. A well on the inlet side, was joined to the block by means of a rubber hose (which leaked) and also by small 3/16" holes — also on the inlet side, drilled vertically to mate with the pushrod holes in the block.

*VTA engine on the superflow dynamometer in test cell 'B'*

Oil on the exhaust side of the head had to find its way over to the inlet side by means of a 5/16" oilway drilled across the head. There were no valve stem oil seals either, which resulted in pretty abominable oil consumption and a characteristic blue haze on starting, where oil had run down the valve stems into the bores while the engine was standing. Engines would sometimes start on 2 or 3 cylinders due to oil soaked plugs.

The new, VTA (Vegantune type 'A') head overcomes these problems. It has core plugs all the way round, three on each side, two at the back and one large one at the front, resulting in complete control over the





*Section through a Lotus Twin Cam head. The exhaust port is on the right. The two small holes either side of the valve guide are the nearest waterways, hence the tendency for exhaust valves to overheat and stick*

***"I stuck a piece of paper on the drawing board and drew in the basics of what we wanted (ie combustion chamber and port shapes), shoved in the valves and decided how we were going to achieve all the other instances."***

cores during casting. It also made for ease of withdrawing the wires afterwards. Some old Twin Cam heads still have the wires in them because they couldn't be removed after manufacture.

This has resulted in even waterways and a 30% greater water capacity, with plenty of it around the exhaust valves. Because of this, the engine can (and is) now turbocharged easily, without any overheating of valves at all.

Cam carriers are cast and machined separately, as coring would again have been a problem. This also makes for a clear oil flow beneath the carriers themselves.

Replacing the tiny 5/16" oilway, is a (cast in) 3/4" job instead. Control over cores has also made it possible to increase the size of the oil drainage dummy pushrod holes from 3/16" to 3/8". There's a generous well at the back of the head and the rubber tube to the block has been dropped altogether.

The new design can be machined in a third of the time taken for the old unit and this is done on Vegantune's multi-head, tape controlled equipment.

The camshafts run in four bearings each, operating valves inclined at 27 degrees and seating in the traditional hemispherical combustion chambers. Valves themselves are the Lotus Big Valve Twin Cam type, and are equipped with heavy duty rubber oil seals. Pistons are flat topped giving a compression ratio of 10.5:1.

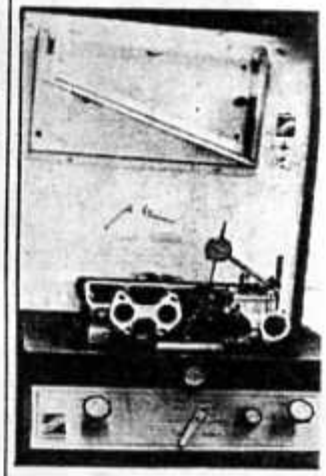
***"Twin Cam water pumps fail with monotonous regularity. We put this down to stresses caused by opposing expansion and contraction forces of the alloy housing."***

Unlike the original Twin Cam of the sixties, which used the 1500 pre-crossflow block, bored from 80.97mm to 82.55mm, raising the capacity from 1498cc to 1558cc, the VTA engine produced by Vegantune, uses the later Kent block with the 80.97mm bore and longer 77.62mm stroke, giving a capacity of 1599cc. One of the most important features is the water pump arrangement. The Twin cam pump is an integral part of the alloy timing chain cover and not only fails regularly, but takes about twelve hours to replace. The VTA engine with its toothed belt cam drive, uses a conventional Ford water pump that can be changed in minutes. There's a glass fibre cover for the belts themselves.

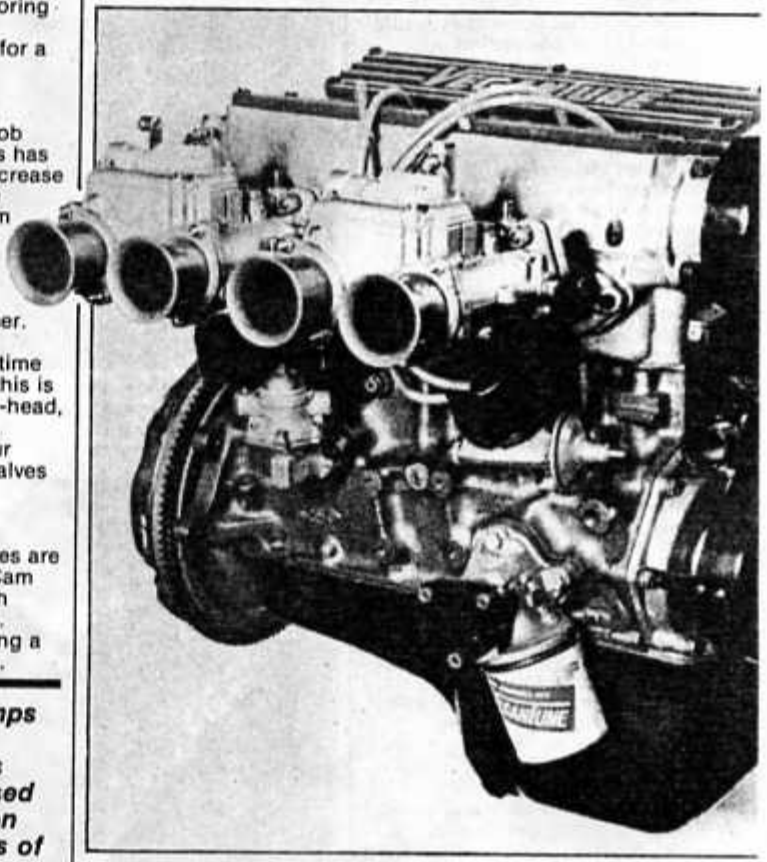
## Bottom end

Fairly conventional this bit. The five bearing unit is already robust and good and reliable.

Vegantune fit a high pressure, high capacity oil pump which produces 50psi at 5,000rpm and produces an oil flow of 6 gal per minute. The bottom end is naturally, balanced to racing standards and there's provision for an oil cooler. Although there's no dry sump version available yet, one is under development for competition use. If you buy a complete engine, ready built, you can be assured that it will be bench and dyno certificated.

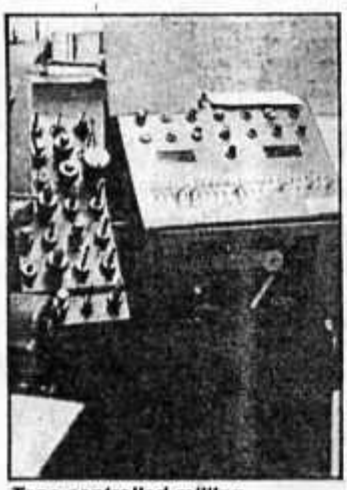


*Top: VTA head on the flow bench, all are checked in this way. Bottom: Three VTA's awaiting delivery to Caterham Cars for the Caterham Seven*



*Complete, and highly desirable looking VTA. Note glass fibre timing belt cover giving easy access to water pump*

# Vegantune VTA



*Tape controlled milling machinery, makes production economical*

*Manifolds in position on bed of tape controlled machinery*

## What's available?

Now comes the good fun bit, and pehaps just a touch outrageous.

You can, of course, purchase a complete engine from Vegantune for £2,205-09 plus VAT. But there are also kits available for converting your Twin Cam in the kitchen at 'ome. This consists of a complete head, pulleys, belts, water pump and inlet manifolds. These are separate on the VTA and not integral castings as on the old Twin Cam. You also get a new head gasket, in fact everything you need to do the conversion. Exhaust manifold is the existing Twin Cam item.

There's also another kit for converting a Kent engine to Twin Cam. This will, of course, involve changing the pistons to flat top. So this kit consists of head (plus bits), pistons and twin 40 DHLA Dellorto carburettors, and retails at £1,3[illegible] plus VAT. You'll also need a Twin Cam exhaust manifold and an exhaust pipe to fit.

Have you sussed the good bit yet? Yes, you've got it. Vegantune tell me that it is now possible to convert any in line, four cylinder, pushrod Ford engine to twin cam. And that includes mum's 997cc 105E Anglia. And because the manifolds are not integral with the head, they could theoretically be specially made to suit a particular application (at a high cost).

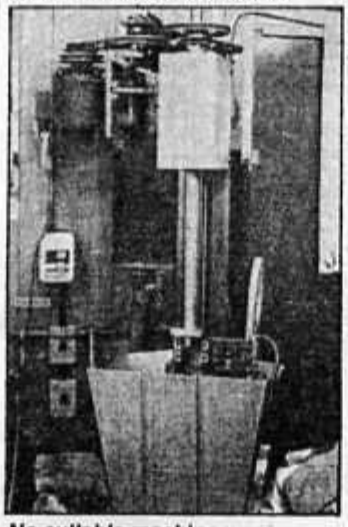
In fact an actual trial showed that you would get over 90bhp from a 997cc engine, which for a road going conversion, is quite impressive. This is all fairly theoretical really, because if you were looking for power on the road, the 1600cc size would be the obvious choice. But it's a fun thought. Just imagine mum climbing into her little Anglebox on a Saturday morning, to get to the hairdressers in a hurry, and somebody's done a quick switch overnight without telling her. It doesn't bear thinking about.

On a more serious note though, a 997cc or 1300cc Twin Cam lump, with all that torque and horsepower, could be very useful to the club competitor who's looking for a lot of power in a certain class. Camshafts are supplied to suit the capacity.

Probably more relevant to the 1600cc size is the type C head. The standard head produces about 130bhp (the original Twin Cam developed 105-115bhp, depending whether it was an early or later model) but the type C delivers 150bhp.

## Driving impressions

I drove the engine as fitted to the Vegantune 'Q' car which is, believe it or not, a MkIII Cortina Estate, which is used as a hack. The idea of this is to give the VTA unit a long term test to find out how well it survives continual short journeys and so on. It seems to survive quite well and when I drove the car at dusk, across the dyke flanked lowland of Lincolnshire, the engine responded with that familiar long legged wallop, and characteristic blood curdling bellow from the 40's.



*No suitable machine was available for line boring cam carriers, so Vegantune manufactured their own*

Trouble was, as I got more carried away by the sound and tractability of this delicious power unit, I began to forget what I was actually driving . . . until I got to the first corner, that is. The VTA isn't for the faint hearted however, letting the driver know in no uncertain manner what he's got under the bonnet. I'm talking of course about induction noise, the type that goes with all twin choke carburettor set-ups. Some people love it (I do) but it's certainly an enthusiast's noise.

All in all though, loads of power (obviously) and loads of torque. Unfortunately the ratios of the old Cortina box weren't quite what I'd choose (felt like about 4,000rpm between third and top). But the engine also seems smooth and unfussed at low speeds, although I haven't driven it in traffic.

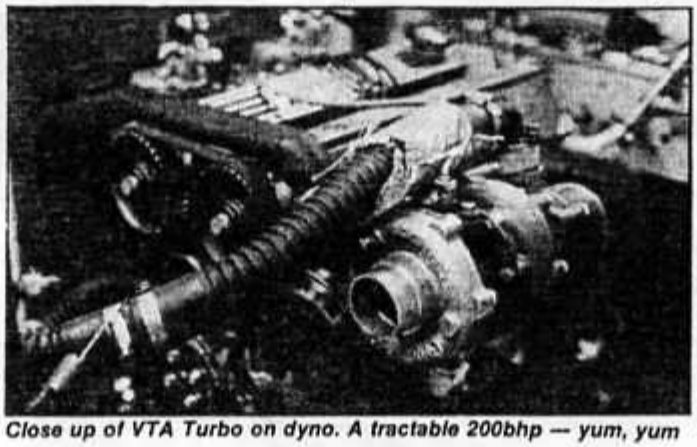
## Turbo

Vegantune have also developed a turbo version of the engine using a Garrett Airesearch Turbo/waste gate system. The block has special rings fitted as well as a head gasket to cope with the extra pressure.

The turbo installation is also available (to be fitted in conjunction with a VTA head) as a kit. This is around a £1,000 on top of the head kit, but will deliver 195bhp at 6,450rpm. Maximum torque of 150lbs/ft, is developed at 5,500rpm, and turbo boost is 5psi.

So, if you're interested in any of these options, contact: Vegantune, Cradge Bank, Spalding, Lincs, PE11 3AB, tel. Spalding (0775) 4846.

**Jesse Crosse**



*Close up of VTA Turbo on dyno. A tractable 200bhp — yum, yum*

**Superflow-800 engine dynamometer test at Vegantune, on a standard VTA 1600 engine**

| RPM | HP | TORQUE (lbs/ft) |
|---|---|---|
| 3000 | 51 | 90 |
| 3500 | 61 | 92 |
| 4000 | 79 | 104 |
| 4500 | 96 | 111 |
| 5000 | 108 | 113 |
| 5500 | 119 | 113 |
| 6000 | 129 | 113 |
| 6500 | 131 | 105 |

**Superflow-800 engine dynamometer test at Vegantune, on a Turbo VTA engine**

| RPM | HP | TORQUE (lbs/ft) |
|---|---|---|
| 4000 | 116 | 152 |
| 4500 | 133 | 154 |
| 5000 | 151 | 158 |
| 5500 | 178 | 162 |
| 6000 | 183 | 160 |
| 6500 | 194 | 156 |
| 7000 | 190 | 143 |

**Specification — standard VTA**
**Cylinders: 4**
**Bore: 80.97mm**
**Stroke: 77.62mm**
**Capacity: 1599cc**
**Valve gear: Opposed in hemispherical head. Twin overhead camshafts, tooth belt driven**
**Compression: 10.5:1**
**Max bhp: x 130 @ 6,250rpm**
**Max torque: 123 @ 5,000rpm**
**Carburettors: 2 Dellorto 40 DHLA**
**Fuel pump: Engine operated diaphram**
**Sump capacity: 7.5 pints**

**Specification — Turbo VTA**
**Cylinders: 4**
**Bore: 80.97mm**
**Stroke: 77.62mm**
**Capacity: 1599cc**
**Boost pressure: 5psi**
**Max bhp: 195 @ 6,450rpm**
**Max torque: 150lbs/ft @ 5,500rpm**
**Valve gear: As std VTA**
**Cams: VJ 30T**
**Fuel pump: Std VTA**
**Carburettors: Dellorto 40 DHLA turbo**
**Turbocharger: Garrett Airesearch T.O.3 waste gate system with fabricated manifold**