

THE MORGAN WITH THE THOROUGHbred ENGINE?

Between 1981 and '87 Morgan produced a little over two hundred cars fitted with the FIAT twin cam engine. This engine is also known as the Lampredi twin cam after the man responsible for its design and engineering, Aurelio Lampredi [1917-89]. The form in which it was specified by Morgan and how it came to be used will be explained later, but first a look at its background.

Conception.

To start we go back to what we now know as Formula 1, post World War II. The Formula was for 1,5 litre supercharged or 4,5 litre naturally aspirated cars and the cars used were essentially of pre-war design, as was the formula they raced under from 1946. The dominant car was the Alfa Romeo 158/159 Alfetta, winning 37 out of 41 starts in Grand Prix races and 10 out of 13 starts in Formula 1 races. The Alfa was powered by a supercharged straight eight of 1500cc, which in its final form, unbelievably developed well over 400 bhp at 9300 rpm. This came at a price in terms of fuel consumption, the car barely covering half a kilometre on a litre of fuel. Its success was also due in some part to having Giuseppe Farina and Juan Manuel Fangio on the team. Alfa withdrew from racing at the end of the 1951 season.

The second piece of this jigsaw concerns signor Enzo Anseimo Ferrari who drove for Alfa and for a while managed their racing division. He left Alfa in 1937 and started his own company making mainly racing components for other manufacturers, being prevented under a contract with Alfa to build complete cars. In 1945 he founded Ferrari, building sports racers and Formula 1 cars. The engines used at the time, designed by Gioacchino Colombo, although finding success in sports cars for many years, they were less influential in Formula 1. The supercharged 1,5 litre V12 being a particular gem.

In 1946 Aurelio Lampredi joined Ferrari and started work on a range of naturally aspirated engines, which brought some success to Ferrari in Formula 1. The FIA decided, in view of Alfa's withdrawal that for 1952 the driver's championship should be run under Formula 2 rules that required either 2 litre naturally aspirated engines or 750cc supercharged. The Lampredi designed 4 cylinder 2 litre in the Tipo 500 won the championship in 1952 and 53. In 1954 the new Formula 1 regulations changed the engine capacity for un-supercharged engines to 2,5 litres for which the Lampredi engine was enlarged to suit. Ferrari had some success with this in 1954 and 55 but by then Mercedes Benz and Maserati had entered F1 and became dominant. A familiar story.

In 1955 Aurelio Lampredi left Ferrari and joined FIAT heading up engine development. He was responsible for the design and development of the FIAT twin cam engine. Originally he took, the then current FIAT 1500 block, and fitted it with a belt driven twin cam head with pent roof combustion chambers. This was much the same modification as Lotus and Cosworth did with Ford engines. The Lampredi twin cam first appeared in a FIAT 124 Sport in 1967.



As a footnote which may be of interest, in 1967 Ferrari decided to compete in the new Formula 2, which was for naturally aspirated cars with no more than six cylinders and a maximum capacity of 2 litres. Additionally the engine had to be derived from a production car that had at least 500 examples made in a 12 month period. Ferrari did not have a suitable car or the manufacturing capacity to meet these requirements so approached FIAT. Aurelio Lampredi worked on the rather unusual Ferrari racing V6, it having a 65° bank angle and separate crank pins for each cylinder, and made it suitable for a road car.

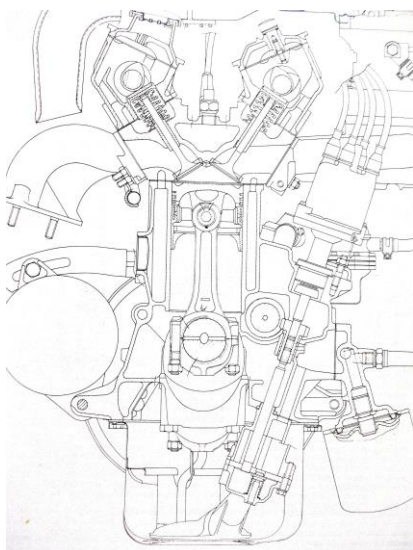
FIAT 124 Spider Courtesy P.Bompas

The connecting rods and crankshaft are forged steel and in the case of the 2 litre variants the crank is nitrided. There is a short jack shaft on the induction side of the engine with a skew gear driving the oil pump, which is mounted in the sump, and incorporates the pressure relief valve. In the case of block mounted distributors they are also driven from this half engine speed shaft. Some engines have the distributor drive by skew gear off the exhaust camshaft whilst on others it is fitted horizontally at the rear of the camshaft as on a Ford CVH. The jack shaft also has an eccentric that drives the block mounted mechanical fuel pump. Just above this is the crankcase breather incorporating an oil separator. The water pump is mounted on the front face of the block and driven by the alternator vee belt.

The cylinder head is where some of the innovative engineering has been applied. Looking at the above drawing it can be seen that the gas flow is virtually straight through the combustion chamber, which is serviced by large valves. The valves are operated by camshafts via inverted buckets. This is the clever bit, instead of the tappet shim, which is about the size of a half crown, or two pound coin for younger readers, being located under the bucket it sits in a recess above it. Anyone who has worked on a Jaguar XK, Lotus Twin Cam or similar will know how time consuming, and frustrating setting valve clearances can be, having to remove the camshafts to replace the shims then refit the camshaft. With the FIAT method the valve is held open with a simple tool and the shim removed and replaced in the bucket recess without disturbing the camshaft. The camshaft is in its own housing, and supported by large bearings big enough to allow the cam lobes to pass through for the camshaft to be removed. This entire top end is fed with generous quantities of oil.

A toothed belt drives the camshafts and the jack shaft, with a built in tensioner for setting the initial belt tension.

The fuel system in the Morgan applications follows two different systems. The 1600 is serviced by a manual progressive twin choke downdraught carburettor with an automatic cold start system. The air to the carburettor is fed through an air cleaner via an automatic hot/cold butterfly valve. The exhaust manifold is a four into two thin wall casting, which has good gas flow characteristics. The 2 litre +4 engines are fitted with a Bosch L Jetronic fuel injection system. This system was widely used by many manufacturers at the time and is considered to be simple and reliable. The larger capacity engines had a fabricated four branch exhaust manifold.



The Engine

The engine is a very robust design incorporating some interesting features, and although developed has remained basically unchanged throughout its production. The one major change that did take place, in the early '70's, was a new block identified by 84mm bore, which has remained the same on all subsequent engines. The block is of a fairly conventional layout with a deep crankcase and provision for a five main bearing crankshaft.

The outcome was the FIAT Dino, which was produced as a Spider with body by Pininfarina and as a longer wheelbase coupe by Bertone. Between 1966 and 1973 nearly eight thousand of these cars were built around 75% of them being coupes. This engine was also used in the Lancia Stratos which won the manufacturers rally championship in 1974, '75 & '76. This seems a fairly impressive pedigree so maybe the Lampredi Twin Cam can qualify as a thoroughbred.

Finally a word or two about the transmission, which originates from 131 and 132 models, it is a synchromesh five speed unit with overdrive fifth. Although data from Morgan suggests that the two litre cars had a very slightly longer fifth gear, the original transmission fitted to my 1600 had the higher ratio. The gearbox is operated by a remote control developed by FIAT competition department [Abarth] for the 131 Racing model.

The Morgan Connection

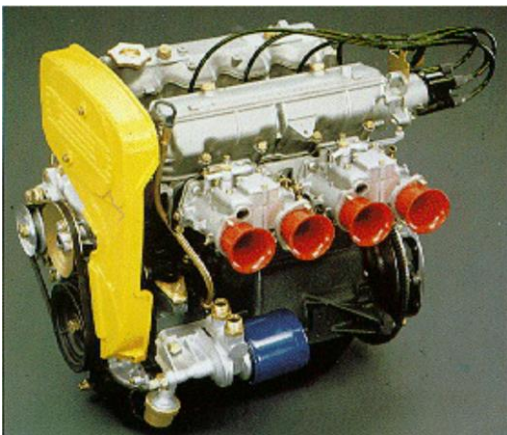
This is my basic understanding as to how Morgan came to use the FIAT Twin Cam engine. In the late '70s the Ford Kent engine was coming to the end of its life and was to be replaced by the CVH unit for the forthcoming Escort model, which, had the engine, installed transversely driving the front wheels. This engine together with its transmission was clearly not suitable for an in-line application. Morgan then came to an arrangement with FIAT for the supply of the twin cam engine and transmission for the 4/4 model. In the meantime things changed, Ford having decided to offer the CVH engine in the RWD Sierra model. This engine then became available to Morgan initially with a four speed and later with a five speed transmission.

The result of this was that when the Kent engine ceased to be used in the 4/4 there was the option of a Ford CVH or FIAT twin cam. All this happened around 1981-82, exact dates are difficult, as the factory required the customer to agree a specification about six months before the target completion date. Over the space of three years a little over a hundred 4/4's were built using this engine. In 1985 Morgan reintroduced the +4 with the same FIAT Twin Cam engine but in 2 litre capacity and fuel injection. Again just over a hundred were built until 1987 when it was replaced by the Rover M16 unit. This is not the full story as when I visited the factory to confirm my final specification I saw at least one car with a 2 litre FIAT engine fed by a twin downdraught carburettor, destined for USA I believe. Every Morgan installation I have seen is slightly different in some way.

Engine Development & Evolution

After its first appearance in the FIAT 124 Sport in 1967, it went on to be fitted to 32 different FIAT, Alfa, FSO & Lancia models, as well as the two Morgan models over the next thirty four years. It was produced in a number of different capacities and power outputs ranging from 77bhp for the 1300cc to over 280bhp for the Lancia 037. Of course it could not stay away from its competition roots and in 1977 FIAT won the world rally manufacturers championship with a FIAT 131 taking over from where the Stratos left off, with wins continuing in '78 & '80. The twin cam made a brief reappearance winning the championship again in 1983, this time in a Lancia 037. In 1987, fitted initially to a Lancia Delta and subsequently developed into the Integrale. it won the first of six consecutive World Rally Manufactures titles. Installed in the Lancia Monte Carlo it won world titles on the race track in 1978, '80 & '81.

The twin cam clearly lends itself to tuning and upgrading, and owners and specialist firms have, extensively modified it outside the many variations offered by the manufacturer. The engine has also been popular as an 'implant' for Morris Minors, Ford Escorts, Lotus 7's, Caterhams, Westfields and many more. The fuel injected



The engine has had many incarnations, such as eight and sixteen valve heads, supercharged, turbocharged, fitted with balance shafts and even briefly as a SOHC direct injection diesel. Restricting ourselves to the engines offered by Morgan the carburettor cars can be expected to produce around a 10% increase in power and an extended torque curve by just improving the breathing. The original progressive twin choke carburettor is rather restrictive so a change to DCOE's or similar will resolve this. The cast iron exhaust manifold is considered to offer quite good gas flow characteristics and suitable for

moderate degrees of tuning. Lotus 7's, Caterhams, Westfields and many more.

2 litre models are a good compromise offering a good power output without the fuel consumption penalty of twin carburettors. The original Bosch FI system has a single throttle plate so can be likened to a single carburettor that tends to be a bit restrictive. Any serious tuning of these engines really requires reverting to carburettors or the fitting of separate throttle bodies and a programmable system.

Personal Experiences.

Towards the end of 1982 I was informed that my car was to be built during the following spring. At that time the options published for a 4/4 were a Ford CVH with a 4 speed transmission or a FIAT engine with a 5 speed transmission for an extra £70. By the time I visited Malvern early in 1983 the Ford engined cars were being fitted with a five speed transmission. There were relatively few CVH engines about so I had no indication of their reliability or longevity. I had previously had experience in 1967 of the twin cam in a FIAT 125 and was impressed by the performance. In my quest to investigate its reliability I sought out a work colleague who owned a 2 litre automatic 132. This car carried him and four workmates to work each day, passing most other vehicles on M4. I was surprised to find it had recorded 200k trouble free miles and looked like new, although he did wash it most days during his lunch break. I made my decision, coughed up the extra £70 and confirmed my specification for a FIAT engined 4/4.

Until I collected the car from the factory I had only driven a Kent engined 4/4 and a +8 so driving it home was a new experience. Once loosened off a bit it would cruise at an indicated 60-70 mph on the primary choke and return a fuel consumption in the high thirties but once use was made of the second choke this dropped to low thirties. The transmission derived from a saloon, does not really have 'sports car' ratios with a bit of a gap between second and third. I tow with my car so the deep first and second have probably been to my advantage.

Endeavouring not to write a boring log of all the trivial things that have happened in the thirty odd years with my Morgan, I will try to be brief. The original engine was starting to consume a little oil by 160k miles so I had it rebored and fitted new pistons, there being no measurable wear on the crankshaft or any other major parts. After another 65k miles I exchanged this engine for a 2 litre version adding twin DCOE 40's. In this form a rolling road suggests that it is developing about 120 bhp. The noticeable features are its strong torque spread over most of the rev range, and the dream of achieving 30 mpg.

In Conclusion

Firstly I have to say I have no particular reason to sing the praises of **Fabbrica Italiana Automobili Torino**. FIAT have never enjoyed a big market share in the UK, and had a reputation for suffering from corrosion and bits falling off. Back in the '50's and for the next couple of decades many cars suffered badly from corrosion, even much more expensive models from manufacturers who had a reputation for quality. I think we all will have experienced these problems. Generally quality, reliability and longevity of all cars seemed to have improved so one can hope this is also true of Italian cars. I think we would all agree that in the past some exciting cars have come out of Italy so with the recent introduction of a couple of affordable rear drive models we may see some again.



Finally my car.

David Philpot