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PORSCHE 356 CARRERA ■ INSIDE ALFA'S FABULOUS TWIN-CAM ■ LANCIA HYENA vs ALFA ROMEO S

## MASERATI'S SPEED KING

How the Ghibli battled to be the fastest open-top supercar of the Sixties



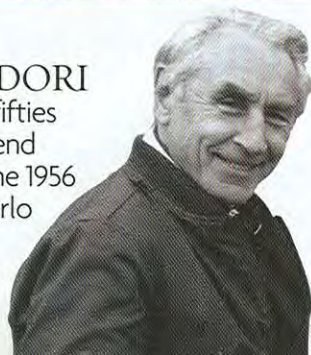
**ROVER SD1:**  
THE BRAVE DESIGN  
THAT SHOULD HAVE  
SAVED BRITISH LEYLAND

**BENTLEY FOR  
A SCOUNDREL:**  
DRIVING A 1928  
BENTLEY THAT STARRED  
ALONGSIDE TERRY THOMAS

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## LEGENDARY ENGINES

# ALFA ROMEO TWIN-CAM

It looked like a race engine yet it began life in a compact Fifties road car and stayed in production for over 40 years.

Alfa Romeo's all-aluminium twin-cam is the first in a new series examining the world's great engines

Words: John Simister Photography: Tim Andrew

**W**HAT MAKES a great engine? Above all, it must showcase its creators' ingenuity and enthusiasm, and do its job with more than mere utility. A great engine can be a reason to lust after a car, even if the rest of the car is mediocre. The engine is the heart, the soul and the voice.

Italy has always understood this, and no Italian engine better encapsulates the idea than the archetypal Alfa Romeo twin-cam, heart of Giuliettas, Giulias, GTVs, GTAs, Duettos and many more (including, even, a few vans).

There have, of course, been many other twin-cam Alfa engines outside the 1955 to 1998, aluminium-block family. The first one was as far back as 1914: a 4.4-litre, four-cylinder monster whose twin overhead camshafts were augmented by Alfa Romeo's first Twin Spark system. But it is to Vittorio Jano, poached by Alfa employee Enzo Ferrari from Fiat in time for the 1924 GP season, that Alfa really owes its twin-cam credibility.

Jano designed a sequence of six- and eight-cylinder road and race engines, mostly twin-cams, which culminated in his 1930 straight-eight 2300. From this point onwards, an Alfa had to be a twin-cam in the public's eye; the template was set. Single-cam cylinder heads wouldn't reappear until the Alfasud in 1972 and, later, the first versions of the modern V6.

**AFTER WORLD WAR TWO.** Alfa Romeo was in poor shape. So was the Italian economy, which meant no-one was going to buy exotic

Alfas any more. A reappraisal of priorities resulted in the 1900, revealed in 1950 as a unitary-construction, four-door saloon whose deliberately plain styling covered an engine of – could it really be? – just four cylinders. But it had the right features to make it a credible Alfa motor, just as Jano had set out.

New engineering and design chief Orazio Satta Puliga, who had joined Alfa Romeo in 1938 from an aeronautical background and would stay there for 34 years, made sure the new engine had hemispherical combustion chambers with valves set 90 degrees apart, crossflow ports (obviously), a camshaft to operate all the inlet valves and another for the exhausts. The result was a decent 90bhp, despite a small single-barrel carburettor and a low compression ratio of 7.5:1. That's considerably more than rival engines of the time could manage: Citroën's Light Fifteen extracted just 56bhp from a similar capacity.

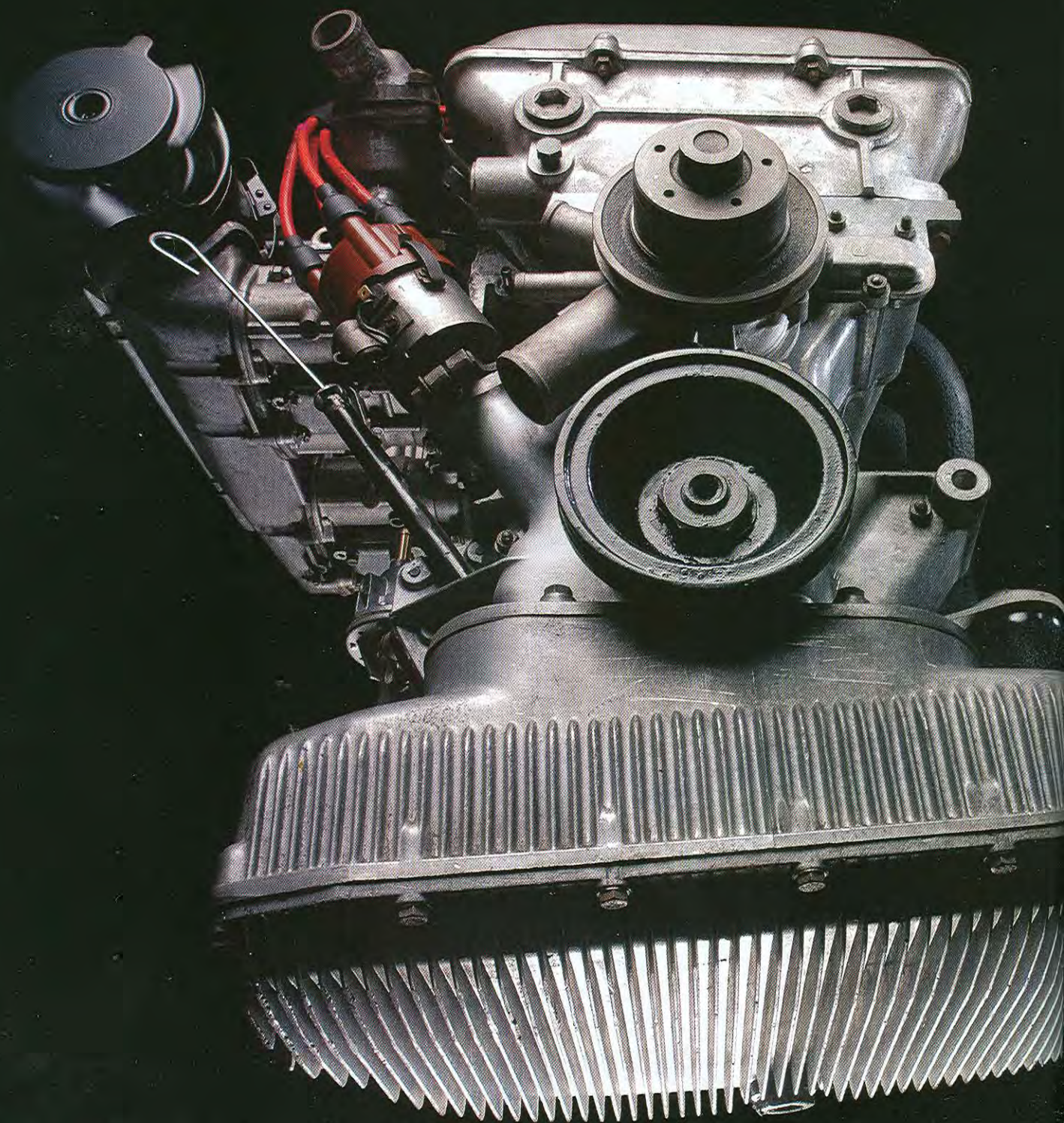
The cylinder head was aluminium, with hard Stellite valve seats (cut to a 30 degrees angle instead of the usual 45 degrees) and sodium-cooled exhaust valves, and the cylinders featured removable cast-iron wet liners.

Later, in the 1900 TI Super, the engine gained the first pair of twin-choke carburettors to be used on a production engine, setting another signpost for the hottest Alfas. But the block was still iron. Alfa Romeo's aero-engine expertise was moving the thinking towards the idea of an aluminium block – and that's exactly what Satta and his team devised next.

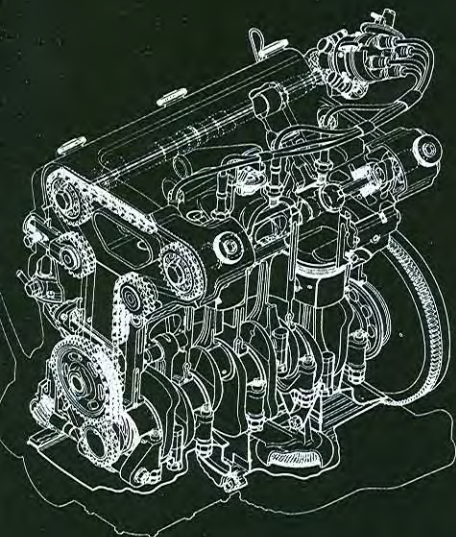


## LEGENDARY ENGINES

UNLIKE THE JAGUAR XK ENGINE, THE ALFA MOTOR'S DESIGN – UNFETTERED BY THE UK'S ANTIEDILUVIAN HORSEPOWER-TAX LAWS – HAD ALMOST EQUAL BORE AND STROKE DIMENSIONS, WHICH MADE ROOM FOR BIG, FREE-BREATHING VALVES







Line drawing shows first-generation 1300 twin-cam; later models looked much the same. Valves in 1970 2-litre (above right) are set at 80-degree angle; portrait is of the twin-cam's creator, Orazio Satta Puliga

### GENESIS OF AN ENGINE 1300

1290cc, 74/75mm bore/stroke, lowest power 53bhp @ 5500rpm (Giulietta Berlina), highest power 96bhp @ 6000rpm (GTA 1300 Junior)

### 1600

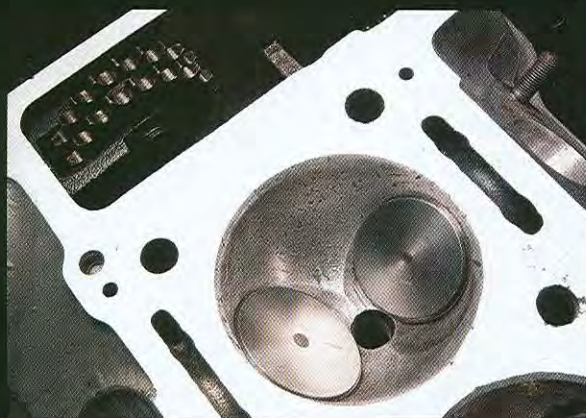
1570cc, 78/82mm bore/stroke, lowest power 92bhp @ 6200rpm (Giulia TI), highest power 115bhp @ 6000rpm (GTA, but GTA Corsa and TZ2 racers developed 170bhp @ 7500rpm)

### 1750

1779cc, 80/88.5mm bore/stroke, lowest power 118bhp @ 5500rpm (1750 Berlina, GT Veloce, Spider Veloce), highest power 122bhp @ 5500rpm (Alfetta Berlina and GT 1.8)

### 2000

1962cc, 84/88.5mm bore/stroke, lowest power 122bhp @ 5300rpm (Alfetta 2000 and GTV), highest power 132bhp @ 5500rpm (2000 Berlina, GT Veloce, Spider – but Twin Spark developed 148bhp @ 5800rpm)



THE 1900 alone was not enough, even with its various sporting body derivatives, to sustain Alfa Romeo. It needed something smaller, cheaper but still clearly Alfa Romeo-ish, otherwise people would simply go and buy a Fiat. The new car, launched in 1955 first as a coupé, was called Giulietta in a reference to the Romeo in Shakespeare's play. And under its bonnet sat what looked like a scaled-down version of the 1900 engine, now reduced to 1290cc.

Look more closely, though, and you would find many detail differences. Quite apart from the aluminium block, the angle between the valves was down to 80 degrees to give a more compact combustion chamber (and therefore a higher compression ratio), and tappet adjustment was by shims between the valve stem and the inside of the bucket tappet, just as in Jaguar's 1948 XK engine and many racing units.

Unlike the XK engine, though, the Alfa motor – its design unfettered by the UK's antediluvian horsepower-tax laws which forced small bores and long strokes – had almost equal bore and stroke dimensions, which made room for big, free-breathing valves. Even the 1900 engine couldn't claim that feature; it was a little more undersquare, as later and bigger versions of the new unit would also be apart from the maddest evolution, the double-supercharged GTA SA version, whose short-stroke design helped yield 220bhp at 7500rpm from 1570cc.

For 1955, the 1290cc engine was a revelation. No other smallish four-cylinder was as advanced or as sophisticated – and no-one had created a volume-production, all-aluminium, watercooled engine before. True, 53bhp wasn't much, but with dual twin-choke carburation, bigger valves and more favourable cam timing, the sportiest 1290s released up to 90bhp. No wonder the breed was set to last for over 40 years.

NOT MANY engines look as good as this one. The main picture is of a twin Weber 40DCOE-fed 2000 (actually 1962cc) of 1970 vintage, which delivers 132bhp at 5500rpm, but it's little different visually from its ancestors of a decade or more earlier. That cam cover, surmounted by a four-pronged oil cap with *olio* writ large, looks

as though it's in two parts, but it's all one piece with just six knurled screws to hold it in place. All the head bolts are accessible without disturbing the cam cover, and you can remove the entire head with all the valvegear still in situ.

The block is deep-skirted, generously ribbed and home to five main bearings and four wet liners. The hottest factory racing engines used a one-piece liner unit with all four cylinder walls coalescing, a modification intended to curb the high-frequency stress-waves that can destroy the block at sustained revs beyond 8000rpm, but that problem is unlikely to concern most of us. The timing chains are of two-row design, the oil pump is a two-gear-wheel type, the cast two-piece exhaust manifold is a masterpiece of free-flowing simplicity.

And the sump... All Alfa 105-series cars, which means Giulias and their derivatives, have the extraordinary 'wing' sump you see here. Its fine fins help keep the oil cool, as does the sheer volume of oil (11.4 pints, or not far off a gallon-and-a-half). No wonder Alfa Romeo exhorted owners to let an engine run for a few minutes from cold before driving off, and to refrain from using all the performance until the engine was well warmed through.

FEW MAJOR changes happened to the mainstream engine up to 1988's Twin Spark cylinder head with its ribbed cam cover. This version's two plugs per cylinder resurrected an idea used in the GTA racers, and it also featured the variable inlet-cam timing already seen in some of the later single-plug engines. Before that, the only significant visual change was in sump design: cars before and after the 105 series had smaller, squarer sumps. A closer look reveals differences in block and head heights to suit the various capacities, but this is subtle stuff.

It's all the more surprising, then, that no other production engine has been made in such a wide variety of capacities while looking outwardly similar. In 1959, when the regular engine was still at 1290cc, Alfa Romeo built a prototype small car, Tipo 103, which featured an 896cc version mounted transversely and driving the front wheels. Development stalled during the factory's

