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FULLY-FLEDGED FERRARIS

At last! Mondial and GTBi win their wings

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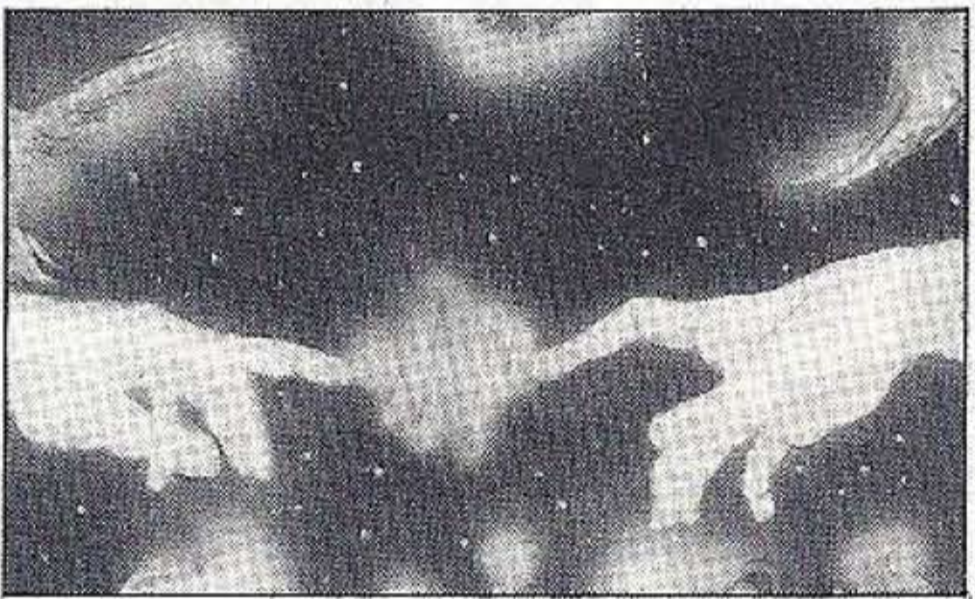
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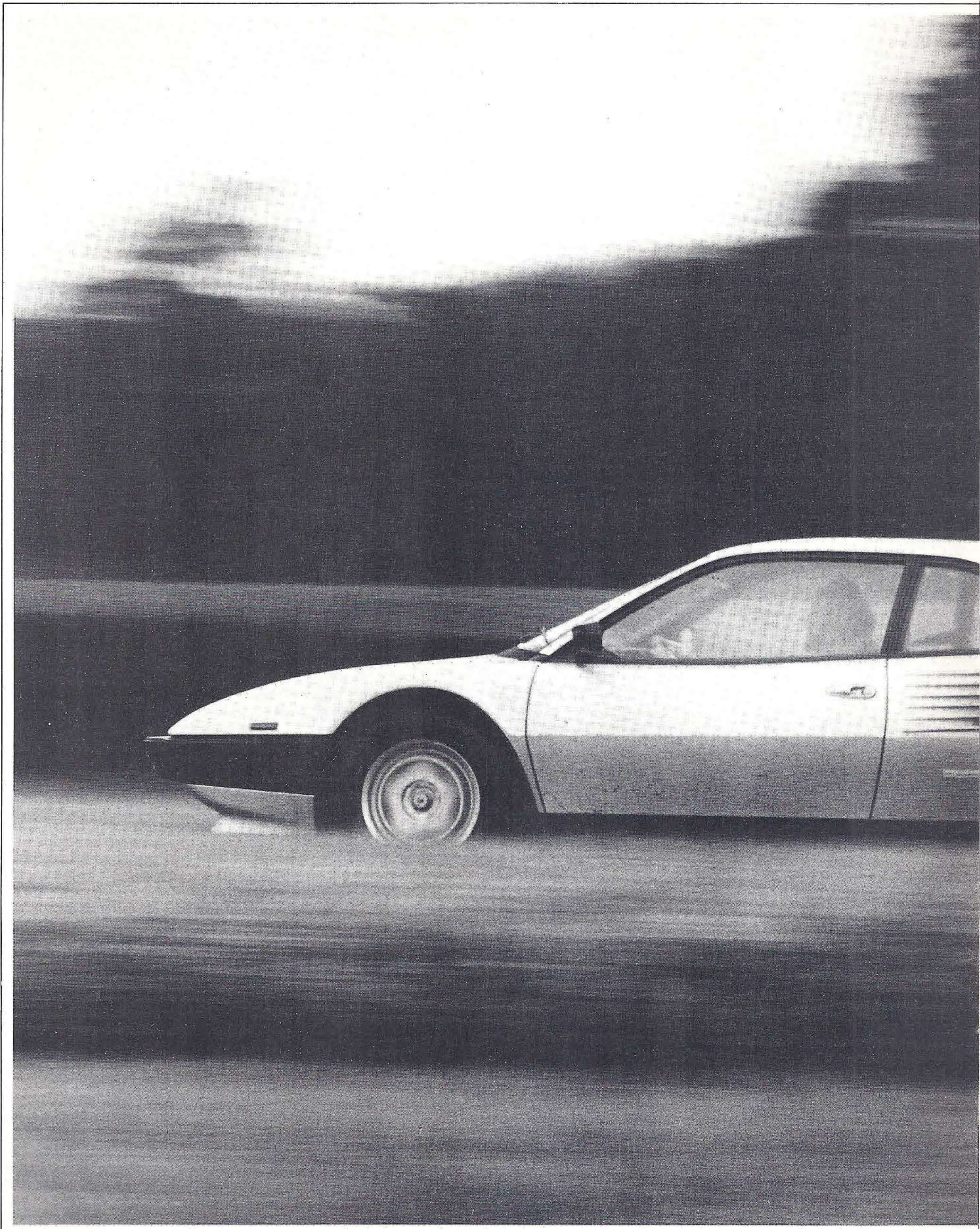
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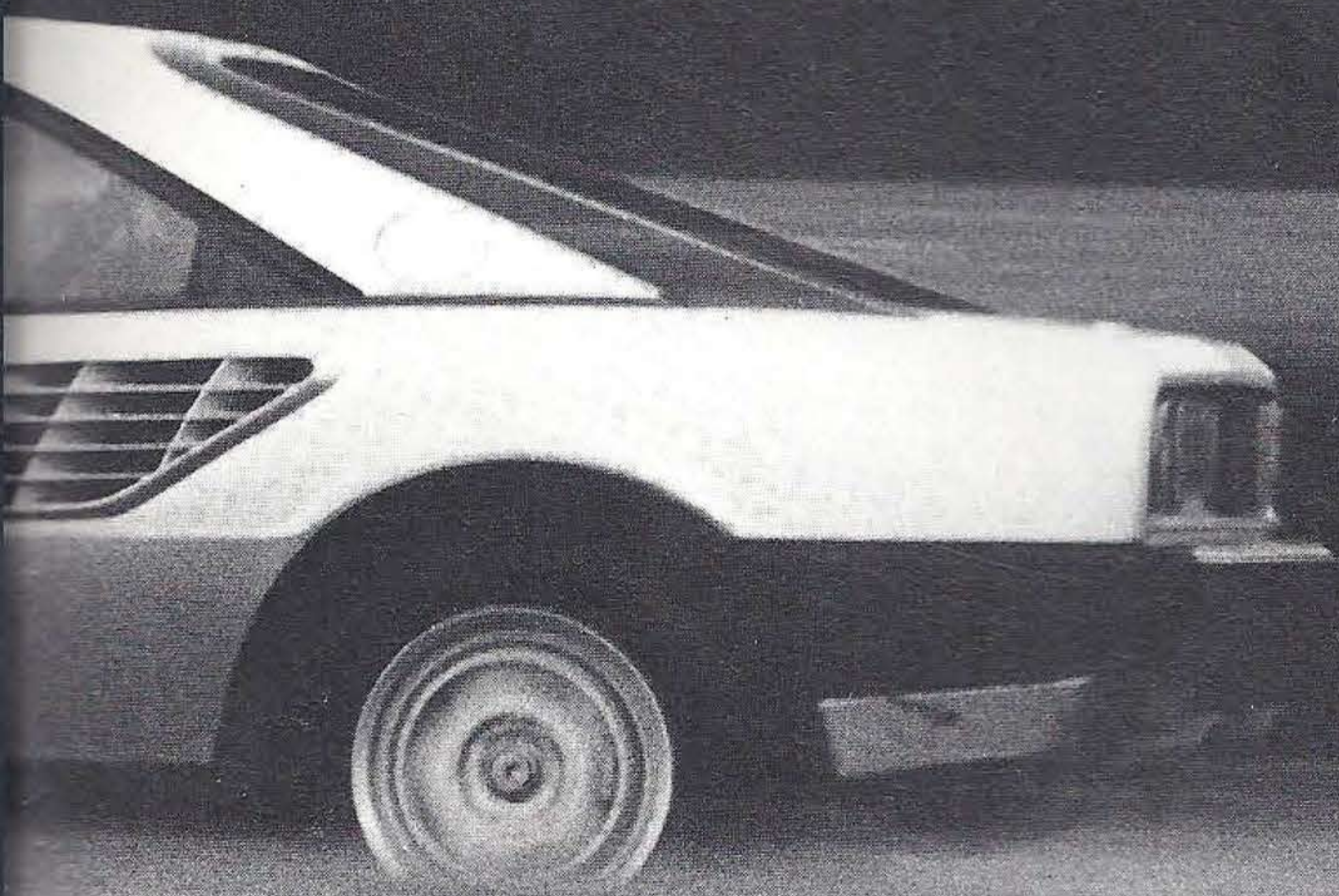
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Richard Davies

QUICKSILVER

With Quattrovalvole engine and a fresh sense of quality Ferrari's Mondial is now truly desirable/Ian Fraser



THE SHOCK OF THE NEW must have rocked the die-hards back on their heels at Ferrari. After years of building cars which, with the aid of a stethoscope, you could hear being eaten away by rust and indifferent quality, they finally were made to realise that staying in business meant pursuing high manufacturing standards with the relentlessness of Porsche. No longer were customers to pay only for the mechanicals and get the bodies for free. Ferrari got plugged into the high-tech end of Fiat to solve the problems. Now they are proud to show people around the old Scaglietti works where all but the 400 models are made. Real quality exists in the places where you can see it and in the places where you cannot see it. The *Quattrovalvole* – four-valve – Mondial's quality is now Porschesque, a great compliment which enhances the Ferrari's intrinsic value. I knew I was in charge of greatness by the test Mondial's fine finish and general excellence, but I knew I was in a Ferrari when I pulled on the seat belt and found that it was wet, water having seeped into the reel by some devious route. I was heartened: a Ferrari is a Ferrari no matter how hard it tries to be a Porsche.

The Mondial, of course, is a design achievement in its own right. Attempting to combine four seats and a mid-engine is not a task to be undertaken lightly. Nor one easily or simply achieved. You will recall that Ferrari got conveyed into the controversial configuration firstly by Bertone with the 308GT4 and then by Pininfarina who were responsible for the 308GTB. The latter's vision of a mid-engined four-seater departed substantially from the Bertone concept; by making the car considerably larger, they were also able to make it more imposing and spacious than the lighter weight, low-key Bertone effort. But when the heavier Mondial replaced the GT4 it met a rush of emission regulations which made the Ferrari's horseshoes fall off.

Although the Mondial's injected V8 had 214bhp at 6600rpm with 176lb ft of torque at 4600rpm, performance was pedestrian in the face of cheaper hot-shoe cars.



QUICKSILVER



Besides, those moving from the 230bhp, 203lb ft GT4 could feel their arteries hardening. Yet that interim Mondial was on the right track even though there were insufficient buyers for that fact to be recognised: it was refined, smooth, lighter to drive and easier to drive – virtues well suited to the requirement of the times. To make it go like a Ferrari again and thereby attract some buyers, Maranello redesigned the V8 engine, providing new combustion chambers and four valves per cylinder to shove the output up to a more realistic 240bhp at 7000rpm and 191lb ft at 5000rpm. Compression ratio was raised from 8.8 to one to 9.2 to one but the gearing remained unchanged. Thus Ferrari got the Mondial back into the mainstream of performance without having to do anything too hysterical. Although the torque curve has a different shape, there is still roughly the same urge available at normal urban speeds; that is, around the 3000rpm mark.

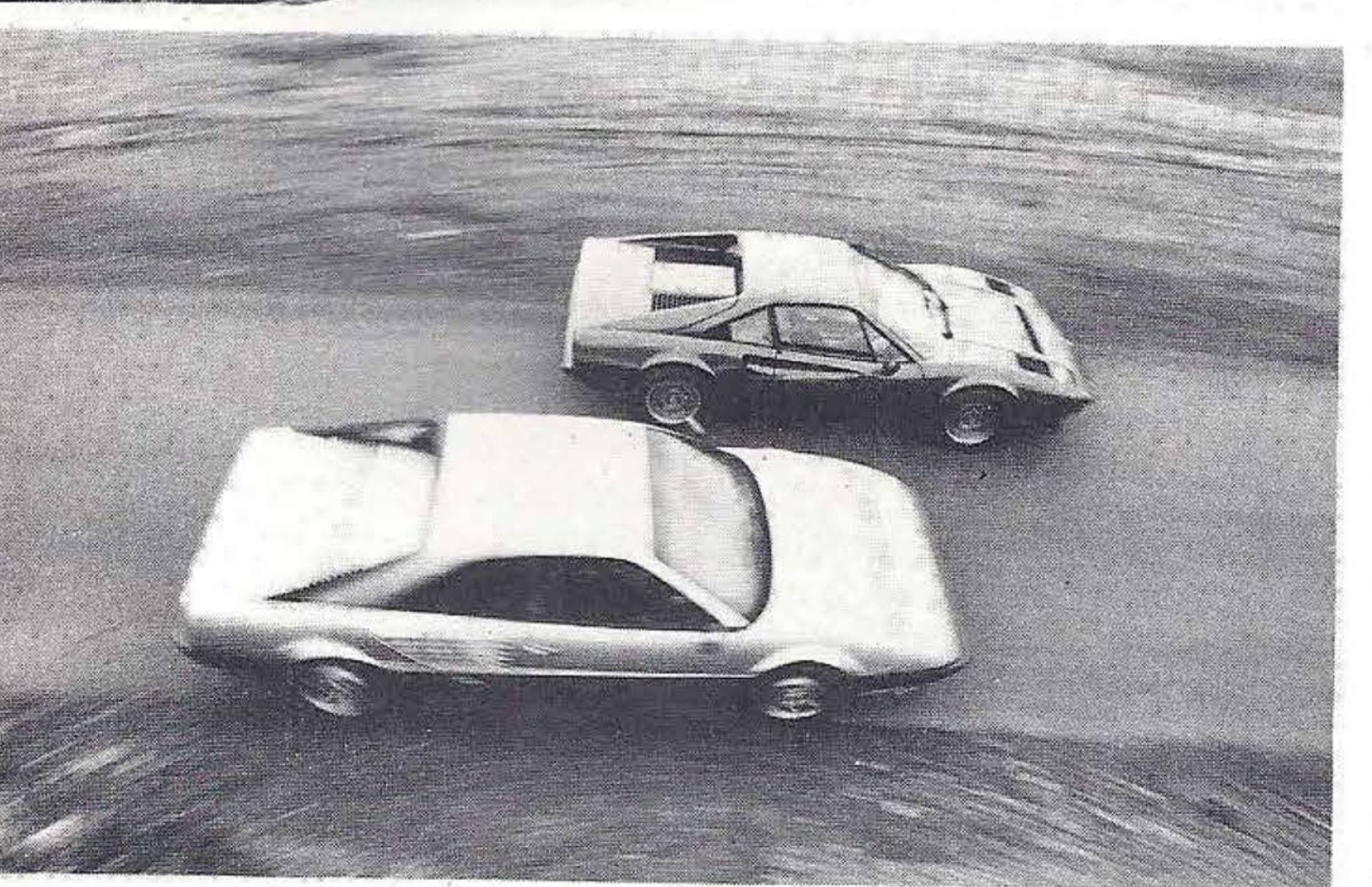
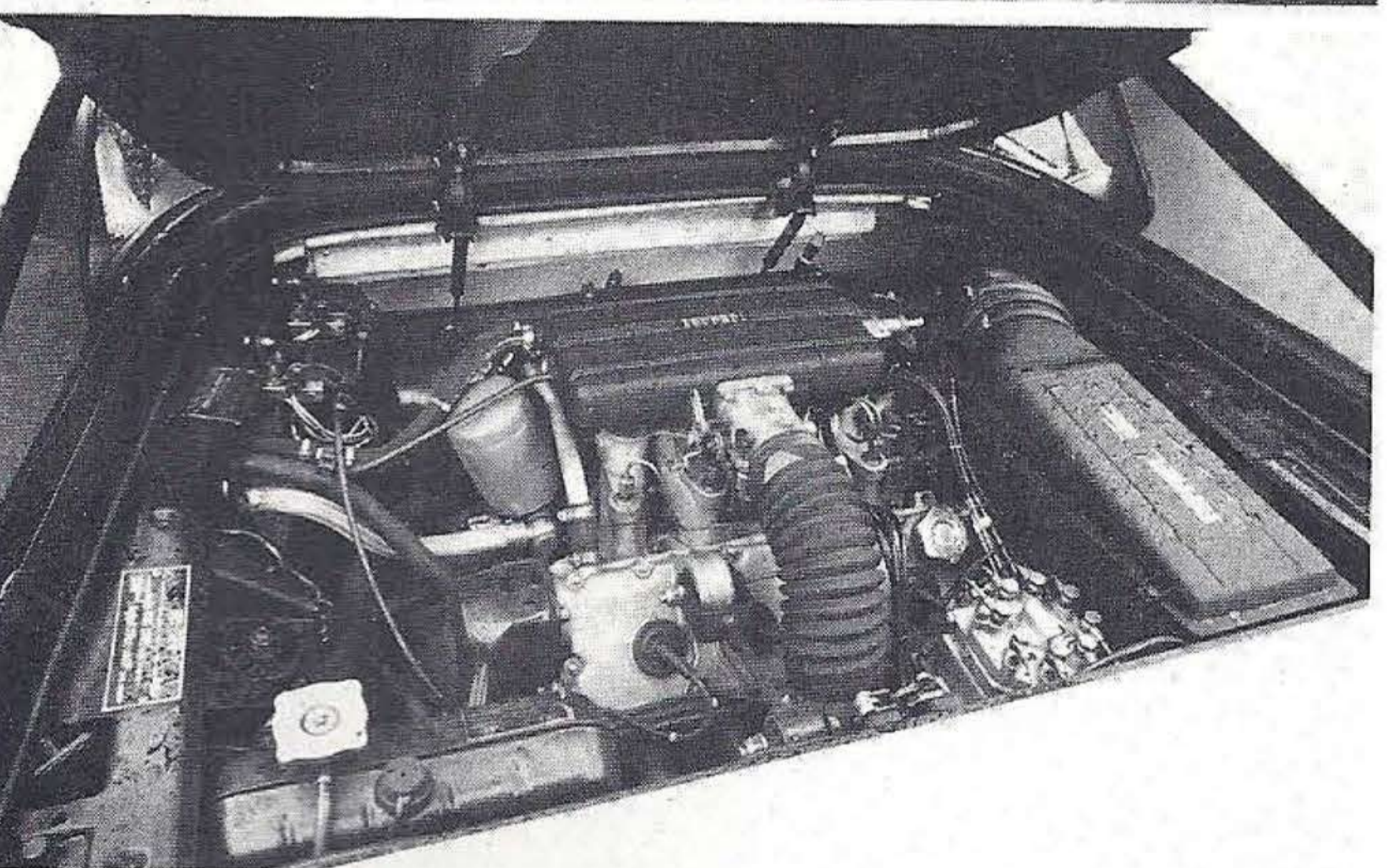
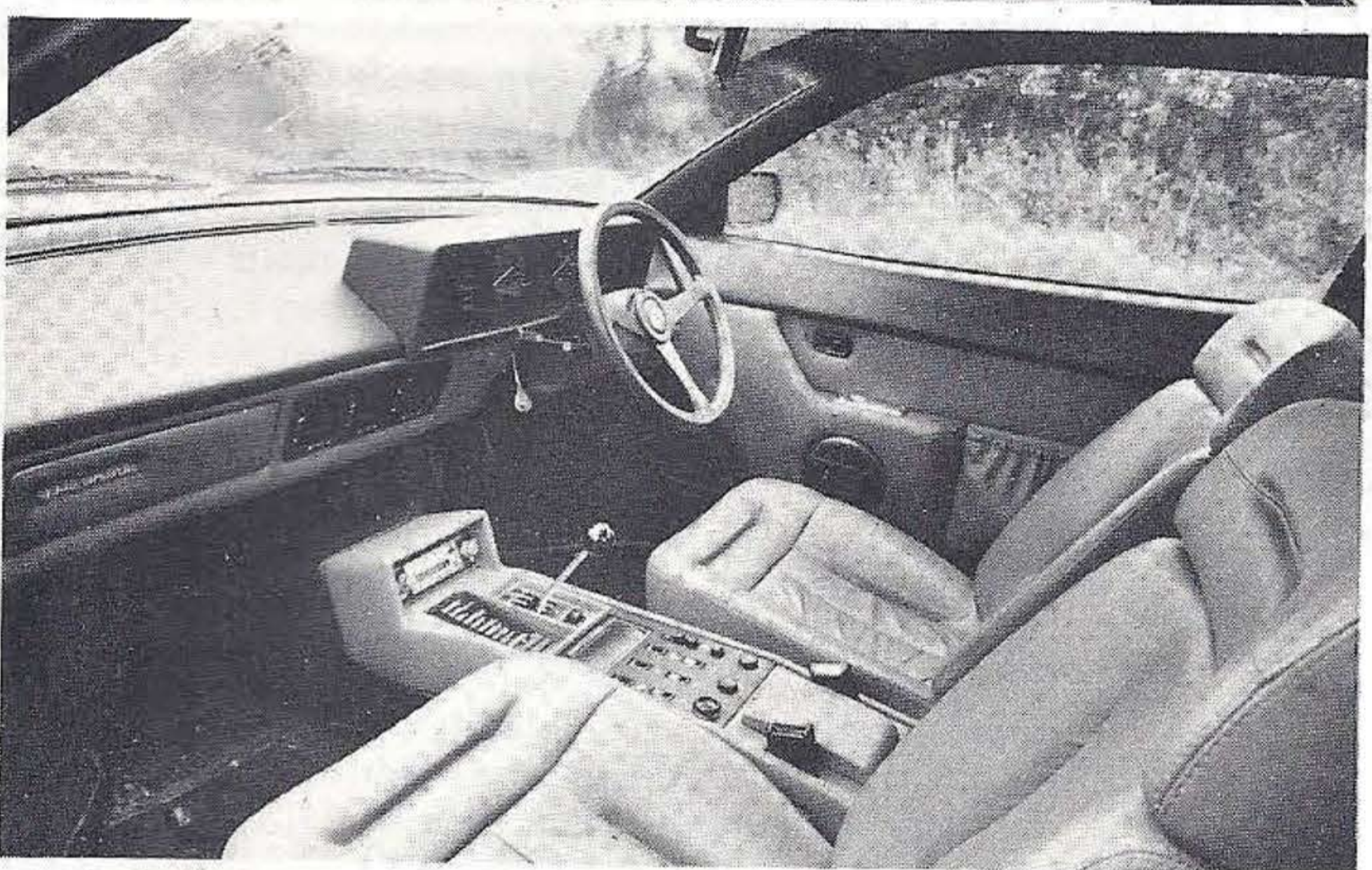
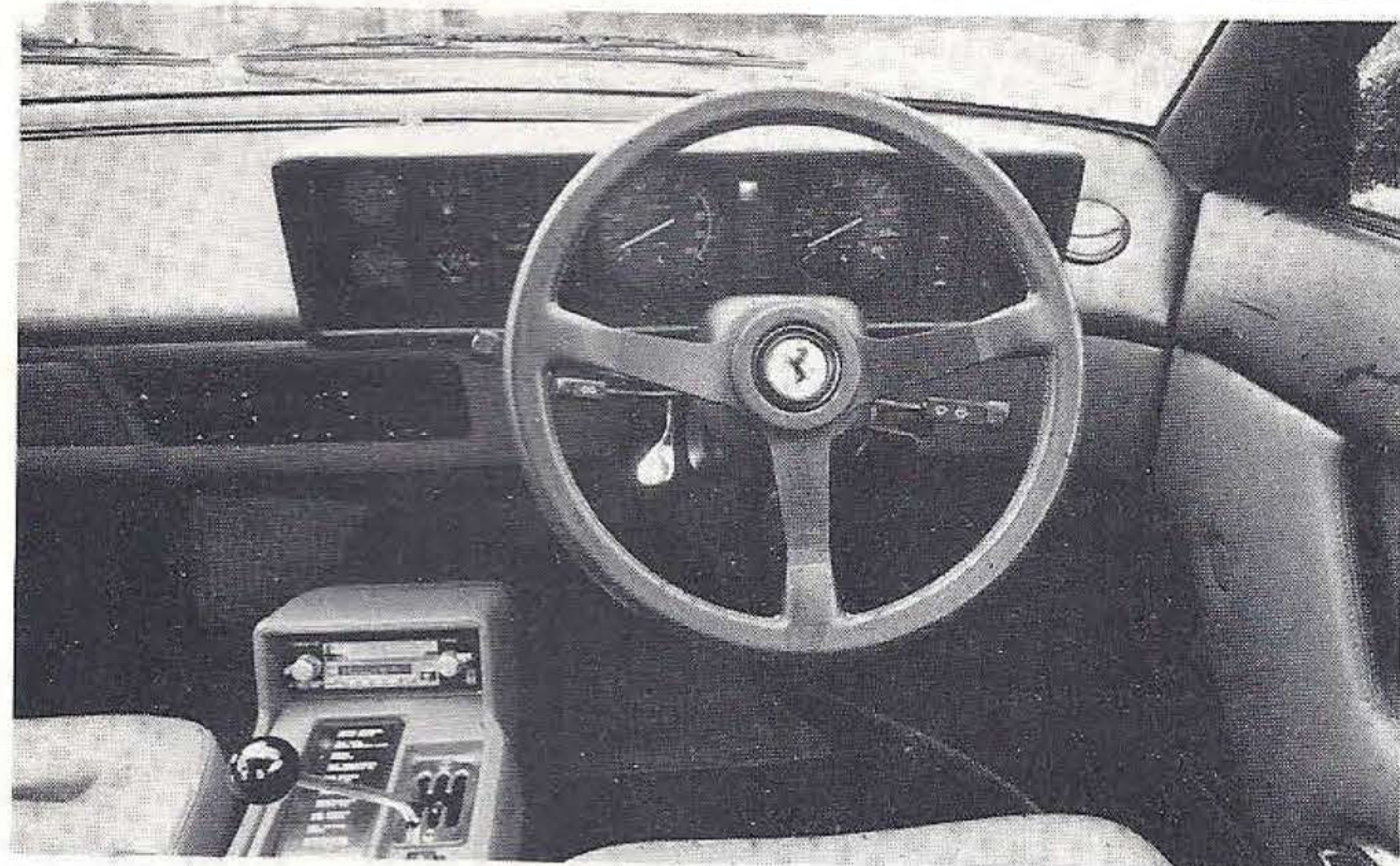
Being normal and urban is what the Mondial wants to be. It wants to join the Mercedes, the Jaguars, the BMWs – and the Porsches – to prove its maturity in the commuter crawl. And – wonder of wonders – it is perfectly good at it. We put a lot of London and provincial-town miles on the Mondial *Quattrovalvole* and it played along with the game better than a supercar had a right to. The key lay in the engine's agreement to flawlessly perform just about any trick in the book, from starting in second to dribbling along cheerfully in fourth before being called upon to deliver a whack of acceleration for hauling past metropolitan slugs in arthritic Datsuns. That and the gearchange, with its decision-maker behaviour made doubly sure by the chromed gate without which no Ferrari would be complete, is the sort of thing that brings endless joy to driving. In reality, that gearchange is the rawest part of a car which in most other ways is as sophisticated and smooth as a Sloane Ranger at a Buckhouse garden party. It is the connection to the beast in the back, the device for rattling the cage, for liberating the passions, for turning cosiness into a Ferrari, for mounting an

assault on the road.

On demand, the Mondial's four-valve V8 launches itself into the action: smooth, confident, quick, responsive. But not blindingly fast. The fellow-commuter in his Granada 2.8i or his Mercedes 380SE may be astonished at the rate the Ferrari overtakes and disappears into the distance but the Boxer BB512 driver or he of the Aston Martin V8 would not be overly impressed. On the other hand, the top speed of just on 150mph is no disgrace and the acceleration and its useability – that's the vital bit – is fully accessible in that you do not have to think too hard before using the accelerator pedal as a carpet-pile depth gauge. The Ferrari's wide rev band – strong from 2000rpm through to the 7700 maximum makes any gear feel like a length of strong elastic which is alternatively stretched and contracted as the car sprints from gap to gap in mainroad traffic. And the sound! Just there, in the back, the transverse 3.0litre vocalises its reciprocating components in the way that only four overhead camshafts can, heard with greater purity now that injection does away with the lusty roar of the Webers' insatiable hunger for air. The proximity of the engine fills the cabin with lovely mechanical sound, when it is being wound out hard in the gears. At cruising speeds, though, the Mondial is not much noisier than a front-engined performance car, but the noise that does exist is a comfort more than an inconvenience: you never want to stop the car and go for a walk. It is simply there to remind you that within certain boundaries you can go as fast as you could reasonably want – faster than all but a few and about equal to a handful more. The performance is stirring but civilised, delivered with the cleanliness of a soap-powder commercial even if the sharp responsiveness of the old carburettor engine is missing.

There's a smugness about conducting a four seater that is quantifiably superior to anything else you are likely to encounter on a long day's drive into night. Clearly, the cruising speed doesn't have much to do with mechanical limitations within the superb engine, but above 130mph the noise level





could make prolonged use of the upper end of performance range just slightly tedious. Nevertheless, the maximum of around 150mph is perfectly tolerable for reasonable distances, the interior trim acting as a baffle to subdue some of the hub-bub.

Putting the Mondial's power onto the road surface is no great problem. Leaving the suspension aside for the moment, the Michelin 240-55VR 390 TRX tyres claw very successfully at the bitumen even when the car is being gunned out of tight corners in second or third gear. The supercar feel is there, the real Ferrari determination to give the driver all the help it can. Overstep the mark and the tail slides positively and quite quickly although not incompatibly with the speed at which the Mondial is invariably travelling when forwards is joined by sideways. Excesses are tolerated with compassion and, given just an inkling of encouragement from the driver the car will snap back into line again. Unlike the old 308GT4, the Mondial is not twitchy and given a modicum of luck and judgement the press-on owner would be unlikely to spin it – and even if he did he would know what was coming in ample time to request Divine intervention.

Not everyone realises that the Mondial is an inflatable car, however. When it slows down and you go to park it, or install it in a garage, it swells sideways and lengthways and gets even bigger as you grope to find the extremities. Yet it shrinks down to a much more manageable size on the open road, the crisp rack-and-pinion steering giving superb directional control with just a trace of stabilising understeer that can be transformed through neutral to a polite oversteer with the throttle, the sensitivity level balanced *down* to the insensitive rather than *up* to the hypersensitive expert driver. Whether Ferrari intended the Mondial to be a car with a broad-based handling characteristic I do not know, but what is sure is that a driver stepping from a cloistered existence in a Jaguar would not suffer cultural shock in the Mondial.

As luck would have it, while we had the Mondial a Ferrari owner wheeled out his GT4 for

a side-by-side eyeball comparison. The newer car appears to be a great deal larger than it actually is although the width is, amazingly, the same. For comparison's sake here are some of the key dimensions, the GT4's in parenthesis: wheelbase 104.3in (100.3in); overall length 180.3in (169.2in); height 49.6in (47.6in); weight 3153lb (2840lb). Clearly, the Mondial achieves its goal in being larger and more imposing, more sweeping in its shape and less understated than the Bertone creation. There are big differences on the road, too. Because it is smaller, the GT4 feels better on narrow lanes and more responsive but it is also more demanding and gets twitchy up near the limits so that the driver's concentration needs to be wound up tightly a lot of the time. Conversely, the Mondial is fluid to drive, less demanding and with larger reserves of both roadholding and handling: it feels more modern in everything from the engine though to the highly refined ride and the handsomely integrated cabin.

For all that, the Mondial demonstrates a fundamentally important point: having a mid-engine and four genuinely useable seats within a body that of necessity must conform with certain design criteria (ie, it must look superb for one) is the next most difficult task after raising the Titanic. The Mondial comes closer to achieving the four-seat goal than the GT4 but given the size difference, so it should. A pair of adults can get into the back to sit on shaped seats beautifully trimmed in leather. Given that the front occupants are prepared to sacrifice legroom for their travelmates – an unacceptable proposition for a tall driver – then the habitability factor starts passing muster. But visit Tower Hill first: your head is really not included in the arrangements. Sure, over a short distance no one is going to fuss too much about the angle at which their head must be tilted but forget it for transporting a cheerful foursome from London to Nice for a spot of sun. The picture changes again, however, if you opt to haul two three-quarter-grown children in the back. *Continued on page 95*

Mondial Quattrovalvole gains more exciting performance from four-valve engine. Injected 3.0litre is extremely manageable and tractable around town. Noise levels have been reduced but 130mph is comfortable maximum for prolonged cruising. Cabin is sumptuously trimmed but is tight fit for four adults. Steering wheel rim can obscure dials, minor switchgear

Continued from page 63

Regardless of who is in the back, tall drivers – and, indeed, passengers – will find that the door opening does not extend far enough forward to permit an easy and/or graceful exit unless the seat is moved back on its runners to provide leg-swinging room. This, of course, has the effect of crushing the legs and feet of those in the rear, thus straining relationships. But even if the Mondials's rear seat were no more than a token gesture, which it certainly is not, it would have a gigantic advantage over the two-place, mid-engined brigade by offering a resting place for coats, jackets, umbrellas, hats and briefcases. Nothing quite compares with the irritation of having to ritualistically open the boot to stow the commonplace paraphernalia that traditionally rides in the cabin. For simple practical reasons the Mondial scores over the two-seaters even if you only ever want to carry two people.

The aura of refinement manifests itself in ways that will make the strained executive-commuter

always feel at home. For example, the instrument binnacle is simply a box of tricks sitting on the dashboard behind the steering wheel, suspiciously in the Rover SD1 mould, complete with similar annoyances as well as virtues. Although the steering column, and its stalks for the primary non-driving controls, is vertically adjustable, the leather-rimmed wheel can end up obscuring some of the dials as well as some of the minor pushbuttons; and to keep reflections out of the steeply raked windscreen, the tachometer and speedometer are set so deeply into the binnacle that tallish drivers lose sight of the top one-third of the dials. The centre console houses several banks of switches, including those for the air-conditioning/ventilation on which I never did successfully impose my will, and an annunciator panel to proclaim warnings of imminent malfunction. All a bit complicated at first, it nonetheless makes sense after a day or so, although I had this strange feeling that Ferrari/Pininfarina were trying a shade too hard to pack in the goodies.

Is it, I wonder, damning to say that a woman could drive this Ferrari? It is certainly light enough with a superbly silken clutch action and a gearchange that slots positively around gate once the transmission oil has whipped itself up to a reasonable temperature. Until it does you do have to cajole the lever, specially in the lower ratios. With its dual, electrically adjustable rear mirrors and deep windscreen, you can see much of what is important, but not all. The steeply-raked nose drops out of sight so that when you are getting close to other traffic, memory means a lot. Reversing into parking places is awful, too, because the C-pillar is broad and the steering lock, at just under 40ft, is too ponderous to deserve contemplation.

The *Quattrovalvole* engine is a turning point in the Mondial's fortunes. Before the acquisition of the extra power, the Mondial's performance was pleasant but not supercar-ish enough to please those who could be – and were – easily won over to other camps. Now it has the urge to please a wider area of buyers, coupled the refinement of

suspension, ride quality, noise suppression and drivetrain smoothness that makes it uncompromisingly modern. Plus a very high build quality, and enough promise of real durability to set the seal on longevity and a slower rate of depreciation. This is a Ferrari on which the facts of life have been imposed by Fiat and if these cars end up being like Porsches, then so much the better. I can think of few vehicles that would be more satisfying to drive every day than a Mondial – providing it fulfilled the promise. Furthermore, I do not find the £25,851 price tag totally outrageous since the equipment includes radio/cassette, leather trim and air-conditioning, although you will need more ink in the pen if you want an electric sun roof.

But, of course, that sort of money would buy a very nice Daytona. Secondhand, naturally, front-engined and only two seats and an arm and a leg to run, and rust here and there, and monumental performance between regular maintenance bouts. Now there's a Ferrari of the old school.

QUICKSILVER

FERRARI ENGINES DO GO: THEY ALL GO as though they had never known what it was like to be fettered by a flywheel, many of them go as though some secret supernatural agency were dosing them with laughing gas, and some of the older ones were known to go after only 40,000 miles of careful use. As Ferrari engines go, that of the 308 is not particularly remarkable – even though the pure and typical Ferrari engine is commonly reckoned to have 12 cylinders, while this is a V8. There have been V8s in the past: Carlo Chiti produced a brace of 2.5 litre V8 sports-racing engines for the Dino in the early 1960s, the idea being to ease the spares problem by using much of the current SuperAmerica V12, and the same engineer was responsible for introducing the V8 format into the firm's Grand Prix cars before he left. His work was taken over by the great Vittorio Jano and the cleverer but less popularly adulated Franco Rocchi, abetted by the then newcomer Mauro Forghieri, and the engine which made the 1.5 litre Tipo 158 Ferrari supreme in the Grand Prix of 1964 (and which allowed John Surtees to take the World Championship) remained highly competitive the following year, even when Coventry Climax have Jim Clark's Lotus the power it needed by putting a set of four-valved combustion chambers on their engine's cylinders.

Ferrari had done the same sort of thing, less spectacularly, in 1962 when a 24-valved version of their V6 GP engine (that was the really nice V6, with its back separated by 120deg rather than the revoltingly inelegant 65deg of the others) ran 5.0 percent faster and gave 5.0 percent more power. It is therefore by no ardent pioneering that the V8 engine of the current roadgoing 308 (which has been in circulation since 1975) has been graced with 32 new little valves in place of the 16 big ones that have seen it through so many vicissitudes of carburation, injection, and legislation. In that time it fell from an improbable 255bhp to an indubitable 214; now, with its new duplication of valves, it has recovered to develop an attested 240bhp which is probably as much as it ever gave – and it does it within the bounds of regulations governing noise and exhaust contents.

These recent changes have not all been above the head gasket: the shrunk-in iron liners of the erstwhile cylinders have given way to Nikasil-lined aluminium, enabling Ferrari to minimise clearances, improve oil and noise control, reduce frictional losses, and to go proudly even in the company of Porsche and General Motors. However, it is the four-valve treatment which really makes the difference: in the absence of any alterations to the cam timings, this must be given the credit for the power output rising by 11.7 percent at rpm 6.0 percent higher, and for the peak torque rising by 7.0 percent at rpm 9.0 percent higher. These are equivalent to increases in brake mean effective pressure from 144 to 152.3 lb/in² at peak power and from 151 to 161 lb/ft² at peak torque, and are accompanied by a reduction of 20 percent in the amount of carbon monoxide in the exhaust when the engine is idling. The 16 valve Lotus engine has always been exceptionally clean: this new Ferrari reminds us yet again that an engine which burns well burns cleanly.

Burning well is what matters, so long as it be accompanied by breathing well. This

was demonstrated by Honda, who must be acknowledged as the pioneers of the modern four-valved combustion chamber to which all four-stroke racing car engines and a mounting number of street engines are today committed. Honda developed a concept of 'total combustion efficiency' which took volumetric and thermal efficiencies into account, and they demonstrated that there was in theory nothing to choose between the classical part-spherical chamber housing two large valves mutually opposed and inclined, and

FOUR OVER EIGHT

*LJK Setright on
why four valves per
cylinder make such
a difference to
Ferrari's fine V8*

their modern adaptation of the baroque pentroof chamber housing two pairs of parallel valves inclined in opposition. In theory the two-valved hemisphere ought to give superior combustion and at least equally good breathing; but there are other factors which that theory does not take into account, and they make the four-valved arrangement much the more preferable.

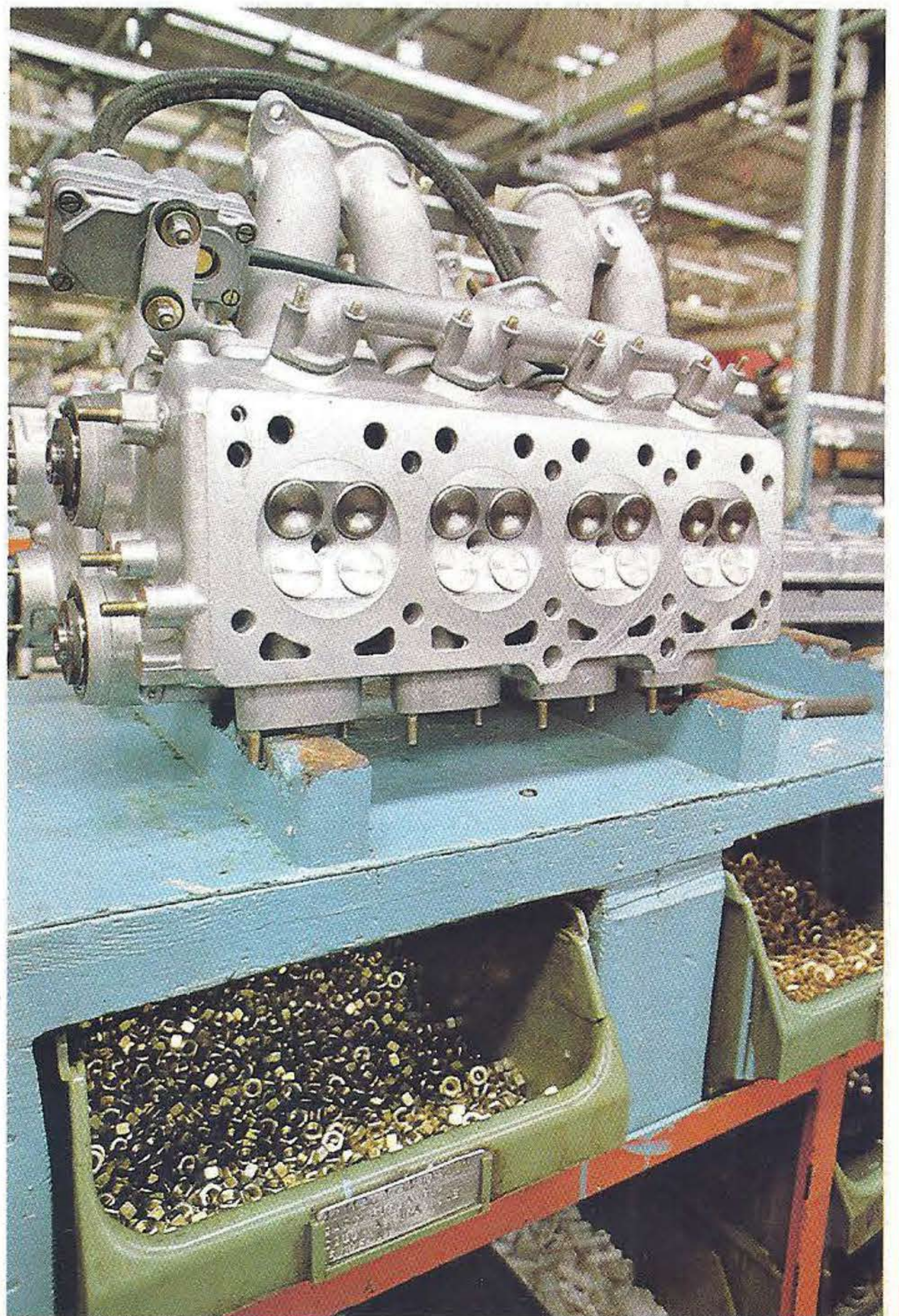
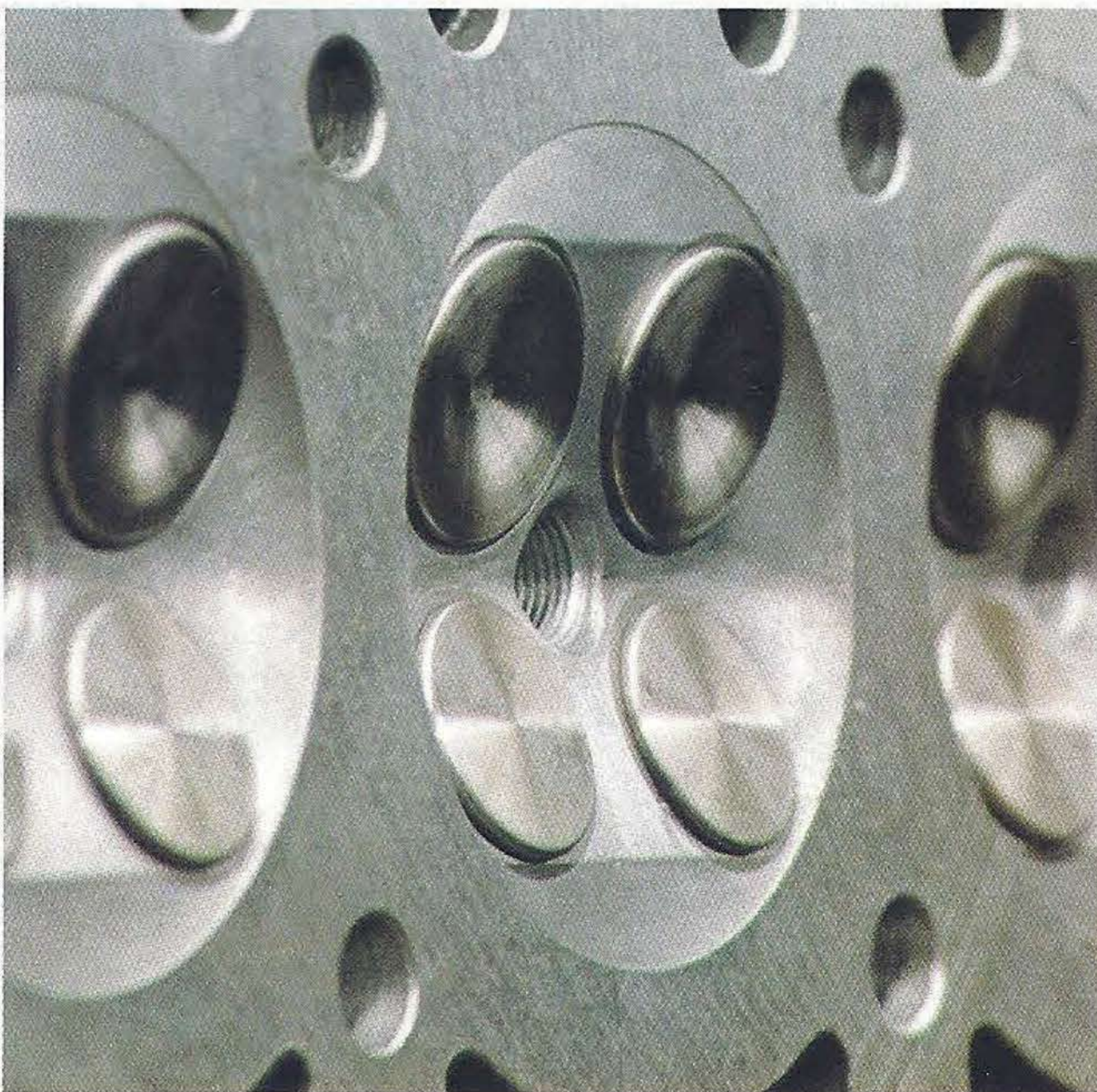
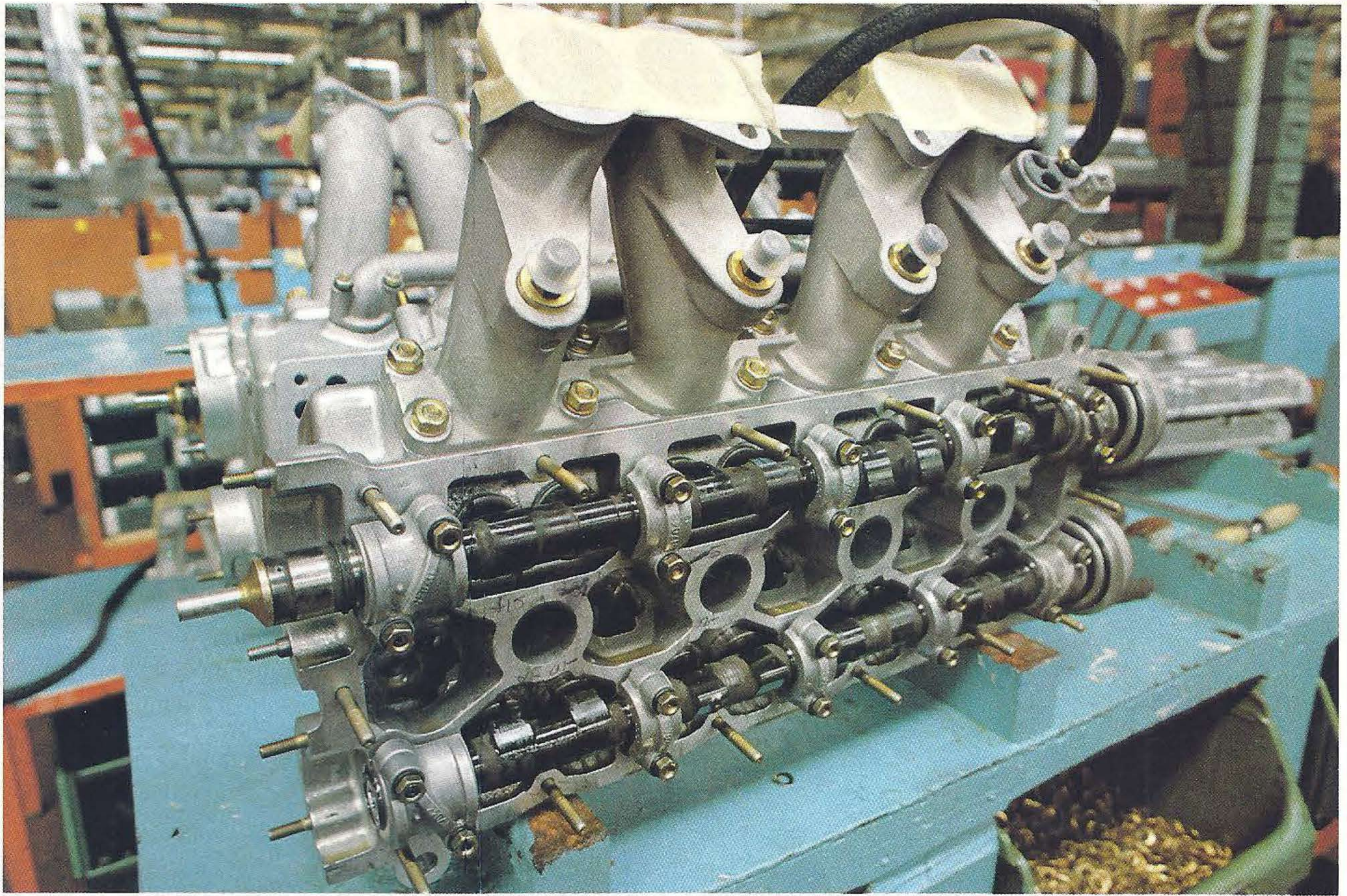
As a starting point for comparison, let us stipulate equal valve area for each type. In that case the two-valve head must be furnished with valves that are 1.41 times larger in diameter than in the other, and assuming geometrical similarity each will be 2.83 times heavier. Because there are unchanging limits to the acceleration to which this increased mass may be subjected if it is to be controlled by springs as valves usually are, then for a given valve timing (or cam profile) the smaller valves – each controlled by its own separate springs – can operate at much higher cyclic rates, thus allowing the engine to reach higher rpm if the valve gear was what had been imposing the rpm limit. That was not the case with the Ferrari 308, in which the rpm limit remains at 7700; so Ferrari have been unable to follow the example of Coventry Climax, whose 32-valved V8 enjoyed a higher percentage increase in rpm than in power, compared with their 16-valved engine, and so could in any given installation be geared down so as further to multiply the torque delivered to the wheels. In the 308, Ferrari have merely achieved a substantial power increase while decreasing the levels of mechanical stress in the valve gear responsible for it. They have also been able to profit from a reduced level of thermal stresses: the large valve specified in our comparisons has 1.41 times as much mass per unit of surface

area as has the smaller, which means that its ability to dissipate heat is reduced and so it must not only be made of more heat-resistant and more costly steel alloy, but it must also enjoy a bigger and better guide, a more copious oil bath, and more painstaking seating arrangements.

There are yet more advantages with duplicated valves. Since there is no point in lifting a well-designed valve more than a quarter of its diameter, it follows that two small valves moving in unison protrude into the combustion chamber only 71 percent as far, at full lift, as a singleton of equal area: thus there are fewer constraints on piston crown design, and there is less need for awkward valve-clearance pockets which can so spoil an otherwise good combustion-chamber shape. Moreover, if the maximum possible valve area is to be attained in a two-valve design, the valves must be mutually inclined by at least 60deg and generally nearer 90deg; in a pentroof it is easy to achieve similar valve area while treating 60deg as a maximum included angle which more commonly approaches 30deg, and this allows the designer far more scope in arranging good fluent porting. In the old Ferrari 308, the included angle between the valves was 46deg, less than ideal for area but at much as could be accommodated if the compression ratio was to be kept decently high at 8.8 to one – but in the new 32-valver, the included angle has been reduced to 33deg, there has not been the slightest difficulty in elevating the compression ratio of 9.2 to one, and the inlet and exhaust ports are so much less spoiled by changes in direction, that breathing must be vastly better.

After all this, it comes as a surprise to compare the sizes of the old and the new valves and to discover that the total inlet valves area of the new *Quattrovalvole* engine is actually less than before! The exhaust valve areas are virtually identical, but the total gross inlet valve area of the new engine is only 95 percent of the generous 17.08 in² summoned by the old one. Is it conceivable that the better porting and higher compression of the *Quattrovalvole* alone account for the improved performance? It is not necessary to believe that, for there is yet another matter to be considered.

Curtain area is an expression we use to describe the effective area opened by a valve that has not yet approached, or has passed well beyond, its maximum lift. Curtain area is the product of lift and circumference, and so for any given lift it is proportional to the valve diameter, not (as is the head or port area) to the square of its diameter. Because the valve must be lifted gently off its seat and lowered gently onto it again, during the greater part of the valve's opening the curtain area is more important, and a more indicative measure of the instantaneous mass flow of gas, than the projected area of the valve head. In the *Quattrovalvole*, the inlet valve curtain area is 38 percent greater than in the earlier version of the 308 engine, and that is enough to pass a significantly greater mass of fresh charge during the unchanged duration of the inlet phase. Ferrari could easily have made their new valves bigger, lifted them faster and opened them longer, taking advantage of all the opportunities duplicated valves allow; but Ferrari have not been greedy. Enough is enough – for now.



Beautiful cylinder head assemblies for Ferrari's new V8 Quattrovalvole engines sit on factory benches at Maranello. **Four valves** of each combustion chamber are clearly visible in pictures above and right while **twin camshafts and induction manifolds** on head of one bank of V8 are pictured top. Compared with 214bhp of superseded two-valve per cylinder V8 new version of 3.0litre that powers Mondial and 308 punches out a more respectable 240bhp. **Peak torque** is up, too, from 176lb ft to 191lb ft and it arrives at 5000 rather than 4600rpm. To complement the valving changes the V8 has **new pistons** with shallow recesses and Nikasil coated aluminium liners instead of shrunk-in iron ones. **Compression ratio** is raised from 8.8 to one to 9.2. The improved fuel charge burning efficiency of the 32valve engine produces much **cleaner exhaust emissions**. Other advantages of four-valve head design include reduced mechanical and thermal stress on valve gear

Dougie Firth