GRAND PRIX 92

THE OFFICIAL BBC SPORTS MAGAZINE

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MANSELL'S YEAR?
A champion's verdict

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HUNT AND WALKER PREVIEW THE SEASON

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GRAND PRIX 92

BBC Sports guide to the Formula One season

From South Africa in March to Australia in November, the world's top grand prix drivers do battle for the championship. Reigning champion Ayrton Senna is bidding for a fourth title and McLaren aim to dominate again. Can anyone stop them?

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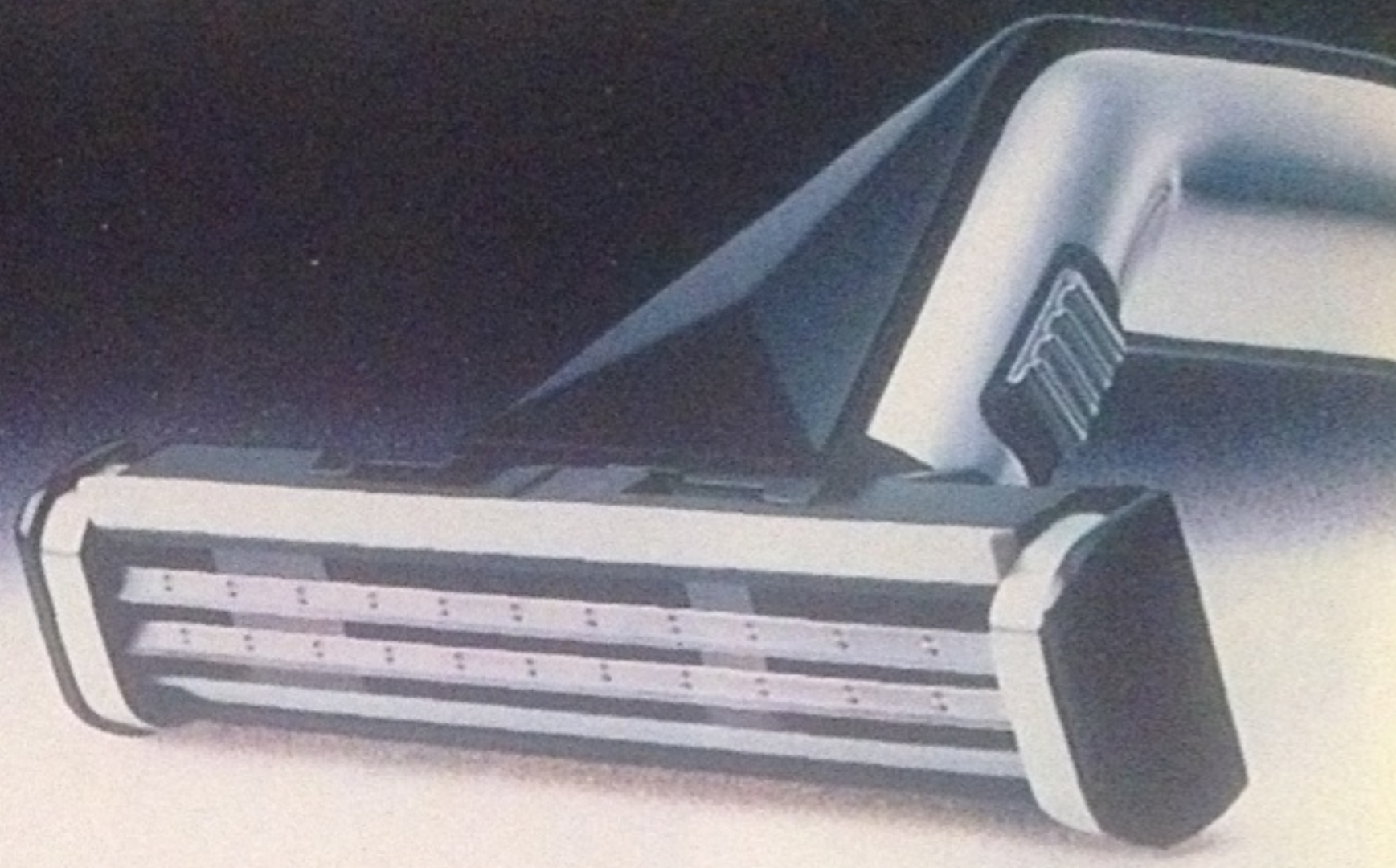

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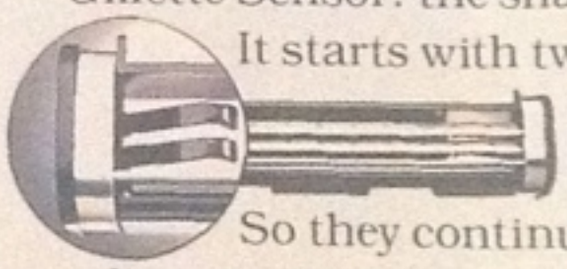

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FORE

JAMES AND MURRAY

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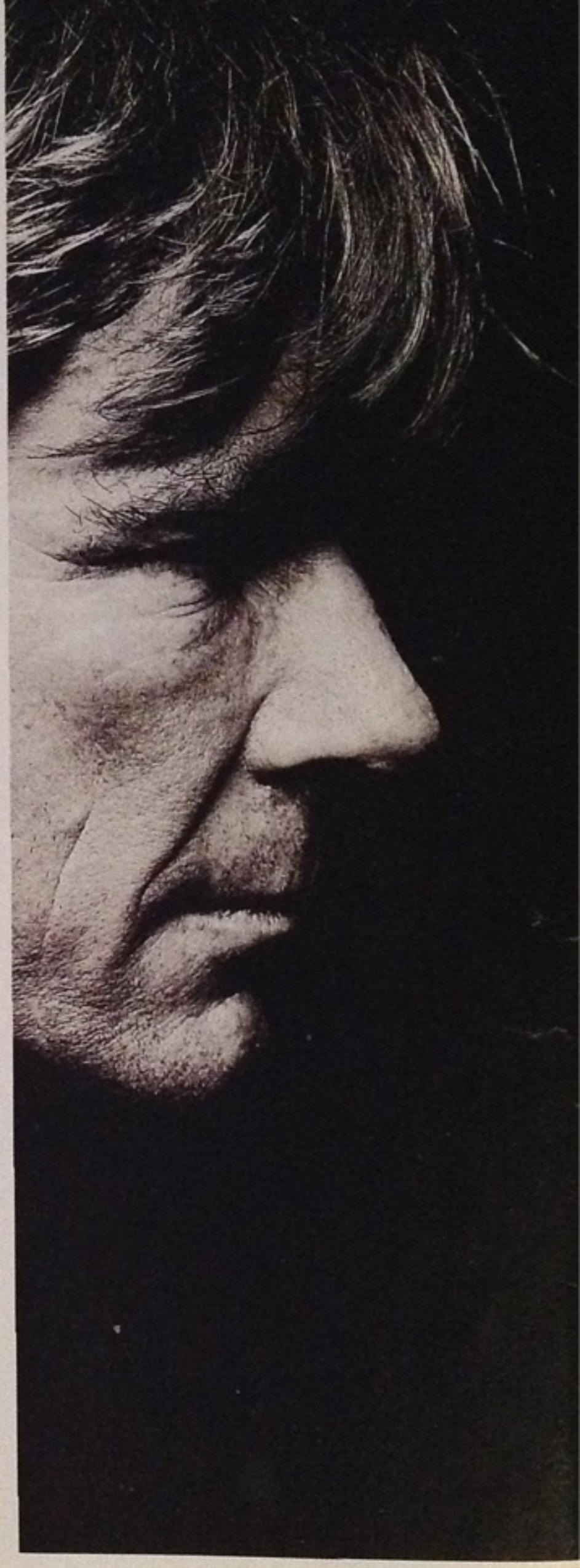
LOOK AHEAD TO '92

On the eve of the 1992 season, Murray Walker and James Hunt put their heads together and find plenty to argue about in their preview of this year's championship. Photographs taken by Nigel Parry



MW People ask if McLaren are unbeatable. The answer is no. Look at what happened in '91: Senna won seven races and Berger won one, while Williams won seven and could have won a lot more if the gearbox had worked properly from the start of the season. This year Williams have got Renault working on the engine in the knowledge that the RS3 engine was not as good last year as they hoped it would be. And, faced with a situation where fuel is so important, Elf will be making a considerable effort.

The joker in the pack for Williams this year is going to be whether or not the active suspension works. I am assuming that they are going to have the semi-automatic gearbox working properly. If the whole Williams thing works, and by that I mean the active suspension, the semi-automatic gearbox, Mansell and Patrese, Elf and Renault, then, hypothetically, McLaren could have a problem.

JH The simple fact of the matter is that McLaren are beatable and always have been, particularly by Williams, because Williams have the better designer. At the end of the day, Patrick Head is the most gifted designer who, ever since he arrived at Williams, has produced good cars. Williams didn't have much success in '89 and '90 but they didn't have the right combination of drivers...

MW Yes, James, I don't disagree with that but...

JH ... and Renault wasn't as good. They got their engine act together last year when the car and engine constituted a good package.

MW I agree that Patrick Head is a better designer than the McLaren committee but the fact is McLaren has done the winning.

JH Yes, because McLaren has got it in other departments. They have a proper management structure, they're well organised, they had a better engine for a lot of the time and, without any doubt, had the best drivers.

MW No, James, that's unfair. In fact, Williams did damn nearly as well as McLaren last year. If it hadn't been for the genius of Senna, Williams would have won the championship.

JH But I'm saying that historically Frank Williams doesn't understand drivers. How could anybody with a car like his put Boutsen and Patrese in what is potentially a grand prix winning car? He never wants to put someone with real talent, such as Johnny Herbert, behind the wheel because he thinks they are going to crash the car.

MW Or, presumably, because he thinks it is not so good for the sponsors.

JH He may think that, Murray, but the sponsors actually want to see races won and they also want to see people drive their cars fast.

MW All right, but moving on to this year, my feeling is that Williams ought to have made more progress by the start of the season than at the corresponding time last year, particularly in terms of having a more advanced and successful car than McLaren and by virtue of the fact that McLaren have still got to prove themselves in the transmission department.

JH Williams already have a very sophisticated chassis. If they stay with their conventionally suspended car or if the active suspension car is no real improvement in terms of sheer speed, then I think McLaren will be closer to them than they were last year. McLaren have had a fantastic incentive to get their act together and they will try everything to close the gap. I don't think they will get in front of Williams but I think Senna will do the rest. We saw that Senna could win the championship despite a considerable gap in performance between the McLaren and the Williams.

MW Well, we're agreed then that if Williams don't take a major step forward then McLaren are likely to do even better.

JH I think Williams will be marginally better but I don't think the gap will be as big this year unless their active suspension car turns out to be a real improvement.

MW Let's not forget there are three other teams to take into consideration: Ferrari, Benetton and Jordan.

Ferrari cocked things up in 1991 because of internal politics and being complacent about improving the 1990 car. Again, hypothetically, Luca di Montezemolo, the man who got it right with Niki Lauda in '74 and '75, ought to be the man to put Ferrari right. Whether it's going to happen in 1992, which is a hell of a challenge, or in 1993 remains to be seen but I am hopeful that Ferrari will win races...

JH We all are...

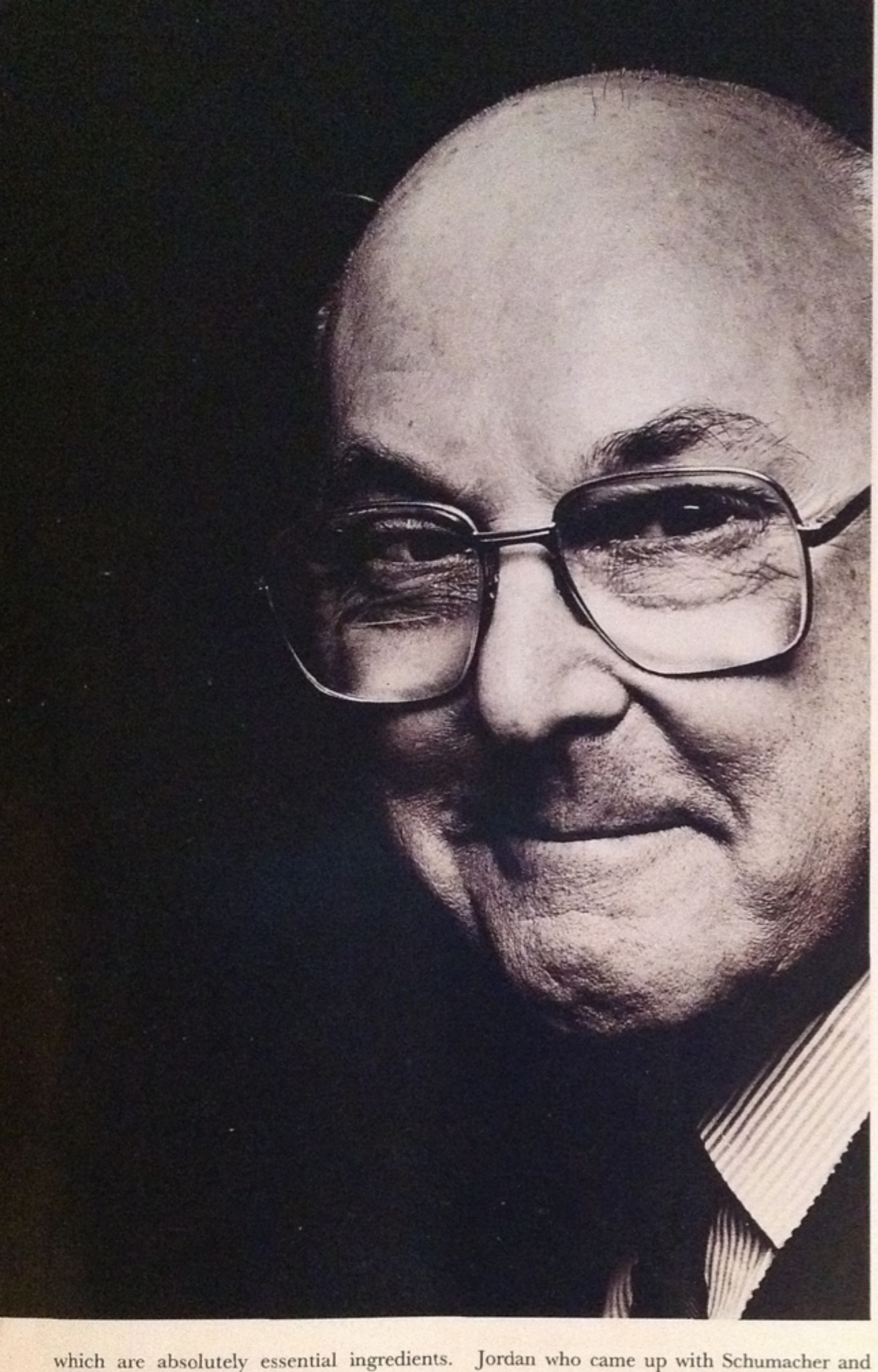
MW ... but I'm not entirely sure it will be this year. Then there's Benetton. They got themselves together in time because Tom Walkinshaw is a hard and experienced man. He has got Ford behind him and I believe in time he is going to get Benetton right.

The final team is Jordan. I was going to say that Eddie Jordan is a vastly underestimated man but after last season I don't think he is anymore. Jordan with Gary Anderson and Yamaha could win races in 1992, but only if they have the right drivers.

JH He's got Modena and Gugelmin, but he made a terrible mistake not hanging on to Schumacher. I believe that Schumacher would have been a lot better off with Jordan, especially in view of the mess he walked into at Benetton. Since then the situation has changed somewhat but I still think young drivers are far better off with Eddie. He really understands them.

MW Yes, well, Eddie has been involved in many aspects of motor racing. In his first year in grand prix racing he was only beaten by McLaren, Williams, Ferrari and Benetton. That is a pretty incredible achievement. He is extremely ambitious, extremely competent and has set his sights high. He has got the facilities, the people, and Yamaha behind him. I think he can succeed.

JH There's no doubt he has the ability, and one thing you've left out is that he's motivated and has a tremendous capacity for hard work



which are absolutely essential ingredients.

MW What Eddie Jordan hasn't got that Ron Dennis at McLaren has, of course, is the ruthless, analytical approach. Charm and emotion don't always bring success the way other, more pragmatic qualities do.

JH Yes it's all about getting results but Eddie does have a great understanding of the art of motor racing. Ron Dennis is the greatest businessman and organiser but he does not understand the art of motor racing so well.

Ron can survive and succeed so long as he has a massive budget but Eddie Jordan will do it without the huge budget. Remember it was Jordan who came up with Schumacher and although he let him go, he was the one who put the German in the car.

MW I think the Schumacher thing is absolutely fascinating because he has emerged from an environment in Germany which, amazingly, considering their industry and their motor racing pedigree, has not produced any truly great drivers post war.

JH But he is a natural talent. The best way to judge a racing driver is out of the car. Looking at Schumacher in the paddock at Monza, one felt the guy had presence, he fitted. He wasn't too big for his boots, he just belonged and handled all the pressures that were going on around him with dignity and aplomb. He got in the car and just delivered. The remarks made by Piquet, saying that Schumacher was driving all over the circuit, like another Villeneuve, were absolute rubbish. He kept the car absolutely in line and it looked effortless.

MW But the real point I was making was about the German industry. While Michael Schumacher is undeniably a natural, Mercedes-Benz at least pushed the bloke and gave him the money he needed to develop his talent.

JH Yes, he has had all the right backing but the time he really came to my attention was last year at Macau. Previously, he had won the German Formula Three championship and was driving well in sports cars but the German Formula Three championship is a very weak championship and he won it in a very unexciting and unspectacular way. But when he got to Macau, which is a difficult street circuit, he raised his game not only to match but actually to beat Mika Hakkinen who was undoubtedly the world's number one Formula Three driver at the time.

What has also delighted me about Schumacher, in my rather old fashioned way, is that he has driven in other categories. I look back with great nostalgia to the days when grand prix drivers also drove in the Mille Miglia and the Targa Florio.

MW But talking of young drivers who else do you rate highly, James?

JH Well the most important one is Johnny Herbert, a very talented driver and one who has a good head on his shoulders in terms of not making mistakes.

MW The way that Herbert disappeared from the Benetton team after he had finished fourth in Brazil – when he could still hardly walk after his crash at Brands – was a real shame. I say hats off to Peter Collins who has always believed in Johnny Herbert and has put his money where his mouth is by giving him a drive in the Lotus.

JH The point is that Collins was right and the Benetton management were wrong. Peter Collins is one of those rare beasts, like Eddie Jordan, who truly understand drivers.

MW Yes, but at the heart of the matter is the importance of money in Formula One. The drivers who are good at talking and winning over sponsors will get drives. There are a lot of drivers coming into the system now who have got backing and money, but no potential, yet here's Herbert struggling along.

JH Being in the Lotus team is not that good for Herbert because the car isn't highly competitive and Hakkinen is also an exceptionally talented driver. So the two of them sail ▷

around mid-division looking like a couple of old grandmothers. What no one must forget is that if you put any one else in a Lotus they would be even further behind.

MW This brings us back to the whole money thing. In a sport that is as technical and as expensive as motor racing, the team managers have got to go to the big money. And if this money happens to come from Japan and they want a Japanese driver then they can't do much about it. Perhaps the British team owners should, as part of their responsibility, find the money to fund home-grown talent.

JH Yes, it's very difficult.

MW British industry is appalling at backing a sport which I believe could do a hell of a lot for it. Why is it that the Brazilians send a non-stop flood of people over here? Brazil is a poor country but they still generate money for drivers like Gugelmin and Senna.

JH Well, for starters, motor racing is a very popular sport in Brazil.

MW Yes, but it's a big sport because they have got people who have done well in it.

JH Yes, Murray, but they have got a healthy club and kart racing scene and not as many drivers as we have in Britain – that makes it easier for somebody to stand out. The big problem in Britain is that we have too many young racing drivers chasing a small pot of gold. The talented ones only get half a budget if they get one at all, and that puts them in an inferior car. If you go to a country like Brazil there isn't anything like the level of competition so a good driver attracts more money, gets put in a good car and is sent to Europe. It doesn't work like that in this country.

MW Yes, apart from Rubens Barrichello there were five other Brazilian drivers in Formula Three last year. But then Britain had David Coulthard, who I think is another natural. He has an old head on young shoulders.

JH I'm very nervous of mature heads on young bodies. Let's remember the point in Formula One is that you have to be quick. Has he proved that he is quick?

MW Oh, yes...

JH Well, why hasn't he qualified on pole?

MW Pass.

JH That's my point. With a bright head you can win races in Formula Three. Look at McNish. He has won Formula Three championships, give or take the odd argy bargy over regulations. But he has not done anything since that suggests he has got basic speed. Coulthard looks similar, though his record is better than McNish's.

MW Well, I can only say that maybe Coulthard didn't qualify well for much the same reasons as Barrichello. He hadn't had enough experience of doing it but certainly proved himself to be bloody quick in racing.

JH Yes, but Coulthard has been around for three years watching and studying it. He hasn't come from Brazil and not known how to use the tyres well and things like that. When you have arrived at Formula Three and you are British you would have been watching it for two or three years and you would know an awful lot about Formula Three already.

MW Neither of us have mentioned Mark Blundell. He is very good indeed.

JH Yes, he deserves a good car.

MW I was very impressed with the way Blundell drove last year – the way he buckled down with a far from good car and scored a championship point. He has been consistently quick and got high praise from Patrick Head when Williams used him for testing. But he suffers from exactly the same problem as Johnny Herbert.

JH Yes, I'm convinced we have too much talent in this country and that makes it difficult to spot the really good ones.

MW A good example is Martin Brundle. He was beating Senna in Formula Three – not consistently and he didn't win the championship – but beating him. If it had been Ayrton

Brundle and Martin Senna it could easily have been a different story.

But let's move on to a guy who was a genius. What's happened to Alain Prost?

JH That's simple. He has collapsed in the face of Senna. Senna has completely destroyed him. Senna isn't a god, and the person who most ably demonstrates that is Nigel Mansell, by taking him on, but in the space of one season Prost has gone from being easily the best thinker in the business to being totally outthought by Senna.

MW I have a great admiration and liking for Prost but I would have to agree.

JH Both on and off the track, Senna has won every confrontation.

MW Speaking of confrontations... there have been a lot of accusations flying around that the Brits are going to run the motor racing show completely, but if the last president of FISA was France's answer to the way grand prix racing should be run, quite right too. I think Max Mosley is the ideal man to run it. He's calm and thoughtful, he has been at the sharp end of motor racing, and, above all, he is politically adroit. I am optimistic.

JH I would agree with you, Murray. After a shaky start with the world sports car championship I've got high hopes for him.

MW As for another major personality, I think the fact that Formula One is better now than it has ever been is thanks to Bernie Ecclestone's organisation and his tremendous ability to get people to do things.

JH Yes, I agree, although sometimes I wonder if the concentration on money and contracts is becoming harmful.

MW Talking of money, people ask how anyone can justify the sort of money that top drivers get. In my opinion, drivers are worth what people are prepared to pay them. I am sure that, as in your day, drivers regard what they earn as the very yardstick of their status and importance in the sport.

JH Yes, it gives them their ranking. But ever since I have been around there have been about five drivers at any one time who have had secure jobs. Nobody else had security and they would come and go for whatever reason – whether political or financial.

MW On the subject of financial comings and goings, how will the withdrawal of Pirelli affect the season?

JH Hopefully Goodyear will do as they say and dump the qualifying tyre. If they come up with a compound slightly softer than the race tyre at least it will last for more than a lap. We should get a more entertaining last hour, though it could prove difficult as there will be more traffic on the circuit.

MW It's an interesting exercise to consider standardising other features of the car. Why stop with tyres? I think standardising anything else would create totally false racing.

JH What about fuel?

MW Yes, I take it all back. Fuel is the other thing that could be standardised.

JH It depends on what Formula One wants to do – if it was a straight drivers' competition and a show (which is not what it is at the moment) you could make it a lot cheaper and regulate it so that everyone has the same car. That would immediately take out an enormous amount of sponsorship. The problem with regulating fuel is that companies like Shell and Agip are not only spending a large amount on developing fuel but are also pumping money into the teams to display these products. For example, in my time there was very little sponsorship from the motor industry because we all used the same engines, apart from Ferrari. In theory you could cut costs, make the racing closer and better and truly make it a drivers' competition.

MW And all the glamour would disappear.

JH Probably. Formula One has to stay a free development formula. It is all part of the excitement – the lovely noise of the powerful engines. In my youth I didn't appreciate the technical development as I came from a pure sports background where the equipment is subsidiary to the ability of the person. To me it was strange that in motor racing you could be doing a great job but if you were in a poor car you wouldn't get anywhere. That was one of the reasons I retired early – I didn't understand it.

MW If it's desirable to have engine suppliers fighting each other and chassis constructors fighting each other it is also right to have tyre suppliers fighting each other. What I would like to see is manufacturers like Bridgestone and Yokohama coming in to challenge Goodyear. There is no doubt that Formula One is at the sharp end of technology.

JH Returning to the subject of fuel, Formula One must think in a greener way. Thought should be given to a fuel formula whereby you get 200 litres of fuel, for example, but are not limited by the size of the engine. You might come up with some very silly engines but you will achieve the most efficient use of the 200 litres. In a road car you are looking for efficient mileage more than power and it boils down to the same thing – burning fuel efficiently.

MW I agree, James, but if I have to start explaining how well a champion has done on 200 litres of fuel in comparison with the rest it will destroy for me the very essence of what motor sport is all about.

JH Well, Murray, I do believe that Formula One, with a bit of constructive thought, can set itself some environmental aims without compromising the racing.

MW That's looking a little way ahead but what I'm really looking forward to is the start of the season on March 1 at Kyalami. I believe we are about to embark on a truly exciting world championship campaign.

JH Yes. I'll agree with you on that. □

James Hunt and Murray Walker will be part of the BBC commentary team providing live coverage of all the European grand prix and highlights of the others

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The frontrunners...

As the teams and drivers make the final adjustments to their cars before the first grand prix of the season, John Watson forecasts those who will take to the front from Kyalami onwards and casts an expert eye over the runners likely to be left back in the pack. To begin, will McLaren, Williams, Ferrari, Benetton or Jordan win?

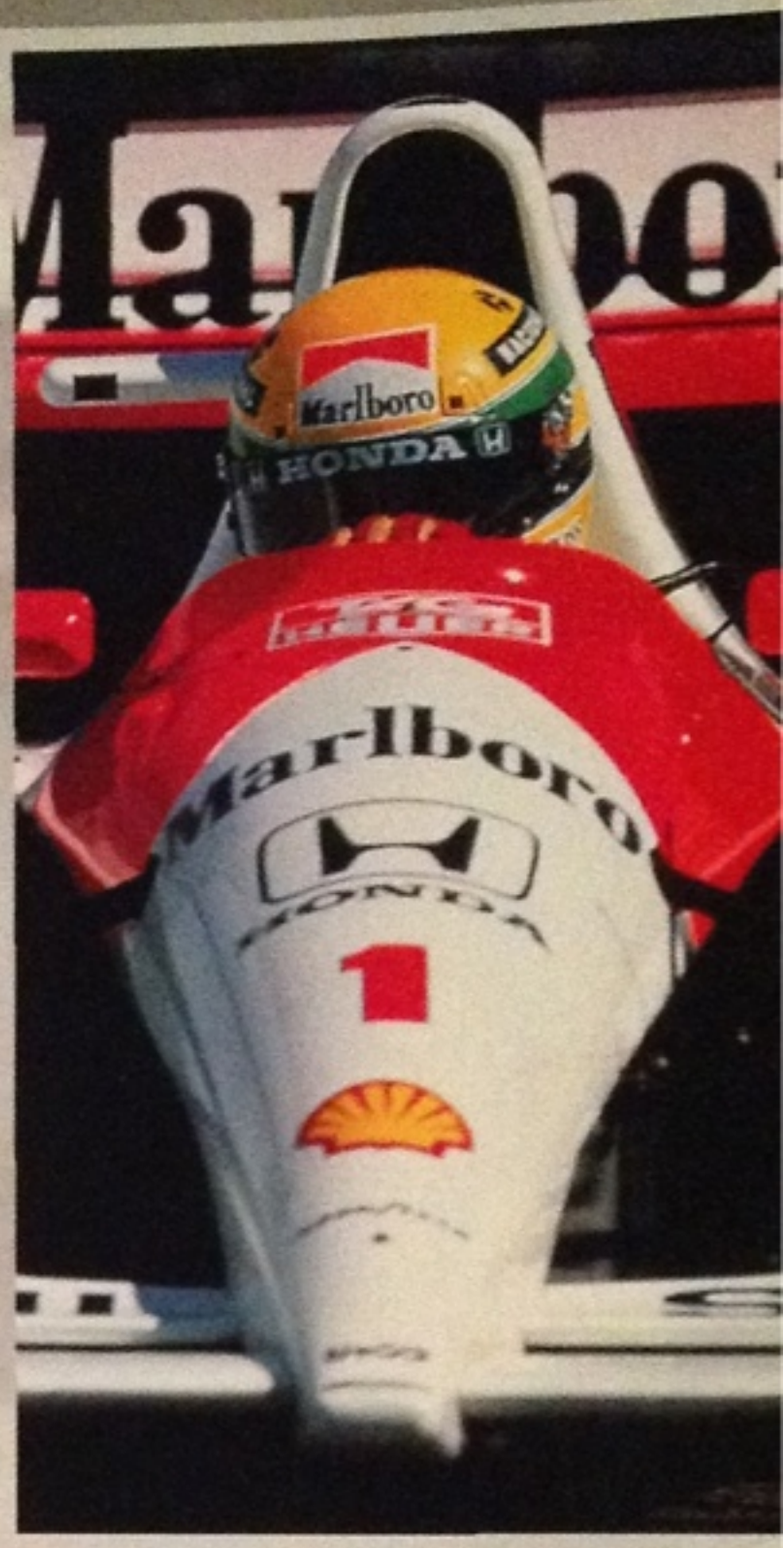
There were only five teams who did the business in 1991. I believe that this year, in the depths of a recession, there will be an even greater divergence between the big grand prix teams and those who are simply doing their best to stay alive.

The development of high technology in Formula One has become so expensive that only four or five teams can compete, because they can afford to develop cars. The others – even well-run operations like Tyrrell – can only hope for sufficient consistency to pick up a point here or there in the revised versions of their 1991 cars.

They will not pose a serious threat, however, to the likes of McLaren, Williams, Benetton, Ferrari and Jordan. The big sponsorship deals have already been snapped up by those teams. Though there is still sponsorship money around, even in a recession, it is much harder to land deals of £20 million. The smaller teams are capable of picking up £1 million or £2 million sponsorships, but you need a lot of those to compete for a 16-race season from March to November.

McLaren and Williams are so strong in all departments. In Ron Dennis and Frank Williams, they have inspired leaders who live for grand prix racing and are focused on success.

Both teams are exceptionally well run, they have efficient back-up staff, excellent designers and technicians and, of course, they have the ▷

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Ferrari's driving team for this season locked horns as adversaries last year – Alesi takes Capelli on the inside

two best drivers in Ayrton Senna and Nigel Mansell. It all adds up to a winning formula. If you are going to run a 10 or 12-cylinder engine you need huge amounts of money as well as an engine manufacturer who is committed to giving you reliable support for the entire season.

The big five have got that: McLaren/Honda/Shell, Williams/Renault/Elf, Benetton/Ford/Mobil, Jordan/Yahama/BP and Ferrari/Agip.

Of the rest, Lotus, who are using the Ford engine which Jordan had last year, have a chance to resurrect their hopes of success.

McLAREN versus WILLIAMS

McLaren, with the world champion Ayrton Senna and Gerhard Berger combining once again, will still be the team to beat. They have the ability to get everything out of their cars and drivers. Boss Ron Dennis often uses the expression 'optimising potential'. That's exactly what he does.

Since 1984 he has led his team and drivers to more championship glory than anyone in recent history. It is not by chance that he secured the services of the best driver, Senna, or that his budget is the biggest in the sport, apart from Ferrari's. And Dennis has also surrounded himself with a team of dedicated high-achievers. Senna and Ron Dennis don't always see eye-to-eye, but ultimately they recognise each other's ability and need each other. They are the best operators in their respective areas of the motor racing business.

I don't see that situation changing. McLaren have become a little more conservative over technical innovations compared with Williams. Remember, Williams have a year's racing experience with a semi-automatic gearbox, their re-active suspension programme could be raced from the first race this year and their superior aerodynamics were a major step forward in '91. But all 16 races count in the championship, so while performance is crucial, so is reliability and a lack of it undoubtedly hurt Mansell and Williams last year.

One area I would expect to see McLaren cover this year is with their Honda engine. Presently, this is the most powerful engine around, as well as the most driveable. I'm sure Ayrton Senna has been at ease over the winter months in his now traditional sabbatical. To have a chance this year, Williams must capitalise on their assets in the first three races, the away ones before the bump and grind of the European season begins. Mansell and his team-mate Patrese will need all the power Renault and Elf can produce to maintain their other technical advantages. Frank Williams is uncompromisingly determined to have his very British team provide their very British driver with his first world championship. As such, expect to see a further sophistication of their gearbox, more neck-straining downforce in conjunction with a re-active suspension controlled by computer. If the total package is reliable, then there will be a hard and close-fought championship battle.

FERRARI

Ferrari ought to win every race, every year. They have limitless funding through Fiat, and they have some incredibly bright engineers. But even with all this they muck it up.

Their organisation is a nightmare and I don't believe there is a driver in the world, including Senna, who can bring about any immediate change in the way they operate. However, they have taken a step in the right direction by bringing back Luca di Montezemolo, who was the highly successful team manager from 1974-76 during Niki Lauda's time. Lauda himself will return as a consultant to the team.

For all his faults, the old man Enzo Ferrari was a figurehead. Since he died management has been operatic and it was left to Alain Prost to try and bring some discipline to the operation. He failed and was kicked out to boot. Now they line up with Jean Alesi and Ivan Capelli, both of whom are undoubtedly quick drivers. Now Alesi will be seen as Ferrari's number one driver, but he needs to re-establish himself after last year's troubles.

Capelli must divorce himself from all the ▷

Working into the night in the Jordan pit. The beauty of a small team is that everyone involved does their bit

infighting, because as an Italian driver in the Italian team he will already be under enormous enough pressure as it is.

Harvey Postlethwaite, the team's former designer, is back and he'll have many of his former team alongside him. The Ferrari engine was not as good as Honda or Renault in 1991 and they have to sort out their chassis.

But, above all, Ferrari must get their hierarchy in order. With the competition masterminded by Ron Dennis and Frank Williams, Ferrari need a figurehead who runs a tight ship, bringing the factions together and getting them to work as a unit. Montezemolo will need to work a miracle. I wish him luck; Formula One needs Ferrari to be successful.

BENETTON

Over the last two years, the team have won races, but, like Ferrari, no one individual has enjoyed full control. Now Luciano Benetton has brought in Tom Walkinshaw, who was to Jaguar in sports cars what Ron Dennis is to Formula One. Benetton have suffered from being a fragmented organisation, with different parts of the team spread across the country. Walkinshaw will try to tidy up the operation. It could make a big difference.

They will start the season with a modified version of the car that John Barnard – now replaced by Rory Byrne – designed last year. They have exclusive use of Ford's development of their V8 engine and there is a possibility of a V12. It's a very good package: simple, easy to set up and develop.

The car should be better than last year and Benetton can be excited about the future. The icing on the cake is the new star of grand prix racing, Michael Schumacher. Here is a future world champion. And his partner, Martin Brundle, for the first time in his career has a car with winning potential.

With Walkinshaw there, Benetton could finish third behind McLaren and Williams. My only reservation is that I don't think their V8 engine will generate sufficient power. They will compete strongly, but I'm not sure it has the raw power to challenge the big two. Ultimately anything Walkinshaw puts his hand to succeeds. The world waits to see how long it is before Benetton are world champions.

JORDAN

I must declare a vested interest here. Eddie Jordan is a friend who allows me to drive his cars at Silverstone. But looking at Jordan objectively, Eddie's personality is a breath of fresh air in Formula One. He is a young, open kind of guy and people like him.

Last year Jordan had the ideal car with which to make their debut. It performed well, with the help of a neat Ford HB engine. To finish in the top five in the constructors' championship was extraordinary. They ran a sensible, uncomplicated car that embarrassed the other Ford team in 1991, Benetton.

Now they need to consolidate. They have a new V12 engine from Yamaha. They could have stayed with a fixed-spec Ford V8, but in the long term it is a better deal with Yamaha. Without direct engine manufacturer involvement it would not be possible to move further up the championship table. Gary Anderson has again designed a set-up that makes the driver's job easy. Stefano Modena and Mauricio Gugelmin will be the new drivers for the Jordan team. Given self-belief and a competitive car they can succeed.

In the early part of the season, much will depend upon the progress Yamaha make with their engine. An engine manufacturer produces an engine which he thinks is wonderful. However, it is only when the driver gets into the car that the real performance can be assessed. But Yamaha have many years at the top in motorcycling behind them, so they must know how to be successful.

The beauty of Jordan at present is that they are a relatively small unit. Everyone pools resources and gets stuck in. There is no reason why they cannot give Ferrari and Benetton a rude shock by improving still further and taking third place behind McLaren and Williams. ▷

...and the chasing pack

While the Big Five fight it out at the front, the rest are hoping for occasional glory, as John Watson explains

For all but the very top teams, the Formula One season is much more about taking part than winning. The likes of Dallara, Footwork and Minardi compete in the hope of snatching a few points during the course of season, and rely on fitful sponsorship that makes development on the scale of a Williams or a McLaren impossible. But the progress of the less well-off teams is always interesting to follow.

Among the smaller grand prix teams, none is more typical than Tyrrell, whose boss, Ken Tyrrell, has survived more ups and downs than anyone in Formula One.

Two seasons ago, Tyrrell did well with a Ford V8, but the relationship with Honda last year turned out to be a disaster. The car didn't really marry up to the engine, which also failed them too often. The resulting loss of confidence affected the team's performance to the extent that poor Modena eventually became accident prone.

This year, Tyrrell will have a neater, more user-friendly package, with an Ilmor V10 engine, that could help them pick up a few points along the way. Ken Tyrrell's experience of running an ultra-tight business could pay off if he channels it in the right direction. Tyrrell have been involved in grand prix racing since 1969 and are sure to keep going.

Ligier, now based at France's latest grand prix venue, Magny-Cours, have the advantage of the second best engine in Formula One, the V10 Renault, and, possibly, Alain Prost in the driver's seat. But despite their lofty ambitions, they'll still be fighting for a place in the top 10.

For Lotus, who are like a smaller version of Jordan, a decent chassis to go with their Ford HB8 engine could make them reasonably competitive, especially with drivers of the

calibre of Johnny Herbert and Mika Hakkinen. Herbert is definitely the potential long-term successor to Nigel Mansell as the top British driver.

I was a Brabham driver in 1977-78 and I find it sad to see them struggling. The key to their decline is money, or rather, the lack of it. This year, they have a revised 1991 car with the Judd V10 engine used by Dallara last year. It's a good package for a team in their situation but I don't see them being a threat. Brabham's driver Eric van de Poele is professional and intelligent, and he drives hard. He is streetwise and I think this is a good stepping stone for him as he begins his second year in Formula One.

Leyton House are drastically reducing their input into Formula One, and there is even talk of them reverting to their old name of March.

Money really is the root of all evil. Of all their testing times in recent seasons, 1992 could well prove to be the most crucial year for Brabham, March and their like as the spiralling research and development costs necessary to remain competitive make the problem of securing enough sponsorship even more difficult than ever. It is now de rigeur to have an engine manufacturer as a partner to underwrite the astronomical engine programme costs. Even McLaren could never begin to afford the bills from Honda for their exclusive V12 engine. Remember, it wasn't that long ago that McLaren were able to take precisely that route with Porsche who manufactured the victorious V6 TAG turbos. In the current economic climate all the midfield runners will simply be hoping to survive. □

John Watson who won five grands prix in his Formula One career, spoke to Brian Alexander

ON THE STARTING GRID

These are the 16 teams who will contest the 16 races beginning in South Africa on March 1, complete with the make of their engines and the names of drivers and behind-the-scenes men.

ANDREA MODA — *Ford V8*
Drivers — Alex Caffi (I)/E Berraggia (J)
Manager/Designer — tba/Nick Worth

BENETTON — *Ford V8*
Drivers — Martin Brundle (GB)/Michael Schumacher (D)
Manager/Designer — Joan Villadelprat/Ross Brawn

BRABHAM — *Judd V10*
Drivers — Eric van de Poele (B)/Giovanna Amari
Manager/Designer — Ray Boulter/Tim Densham

DALLARA — *Ferrari V12*
Drivers — JJ Lehto (Fin)/Pierluigi Martini (I)
Manager/Designer — Pierpaulo Gardella/Nigel Cowperthwaite

FERRARI — *Ferrari V12*
Drivers — Jean Alesi (F)/Ivan Capelli (I)
Manager/Designer — Claudio Lombardi/Steve Nichols

FONDMETAL — *Ford V8*
Drivers — Gabriele Tarquini (I) Andrea Chiesa (I)
Manager/Designer — tba/Sergio Rinland

FOOTWORK — *Mugen (Honda) V10*
Drivers — Michele Alboreto (I)/Aguri Suzuki (Jap)
Manager/Designer — John Wickham/Alan Jenkins

JORDAN — *Yamaha V12*
Drivers — Stefano Modena (I)/Mauricio Gugelmin (Bra)
Manager/Designer — Trevor Foster/Gary Anderson

Venturi-LAROUSSE — *Lamborghini V12*
Drivers — Ukyo Katayama (J)/Bertrand Gachot (B)
Manager/Designer — Gerrard Larrousse/Michel Tetu

LIGIER — *Renault V10*
Drivers — Thierry Boutsen (B)/Erik Comas (F)
Manager/Designer — Dany Hindenock/Frank Dernie

LOTUS — *Ford V8*
Drivers — Johnny Herbert (GB)/Mika Hakkinen (Fin)
Manager/Designer — Peter Collins/Chris Murphy

MARCH — *Ilmor V10*
Drivers — Karl Wendlinger/Paul Belmondo (F)
Manager/Designer — Charlie Moody/Gustav Brunner

MCLAREN — *Honda V12*
Drivers — Ayrton Senna (Bra)/Gerhard Berger (A)
Manager/Designer — Davey Ryan/Neil Oatley

MINARDI — *Lamborghini V12*
Drivers — Gianni Morbidelli (I)/Christian Fittipaldi (Bra)
Manager/Designer — Tadashi Sasaki/Aldo Costa

TYRRELL — *Ilmor V10*
Drivers — Olivier Grouillard (F)/Alessandro Zanardi (I)
Manager/Designer — Rupert Manwaring/Mike Coughlan

WILLIAMS — *Renault V10*
Drivers — Nigel Mansell (GB)/Riccardo Patrese (I)
Manager/Designer — Peter Windsor/Patrick Head

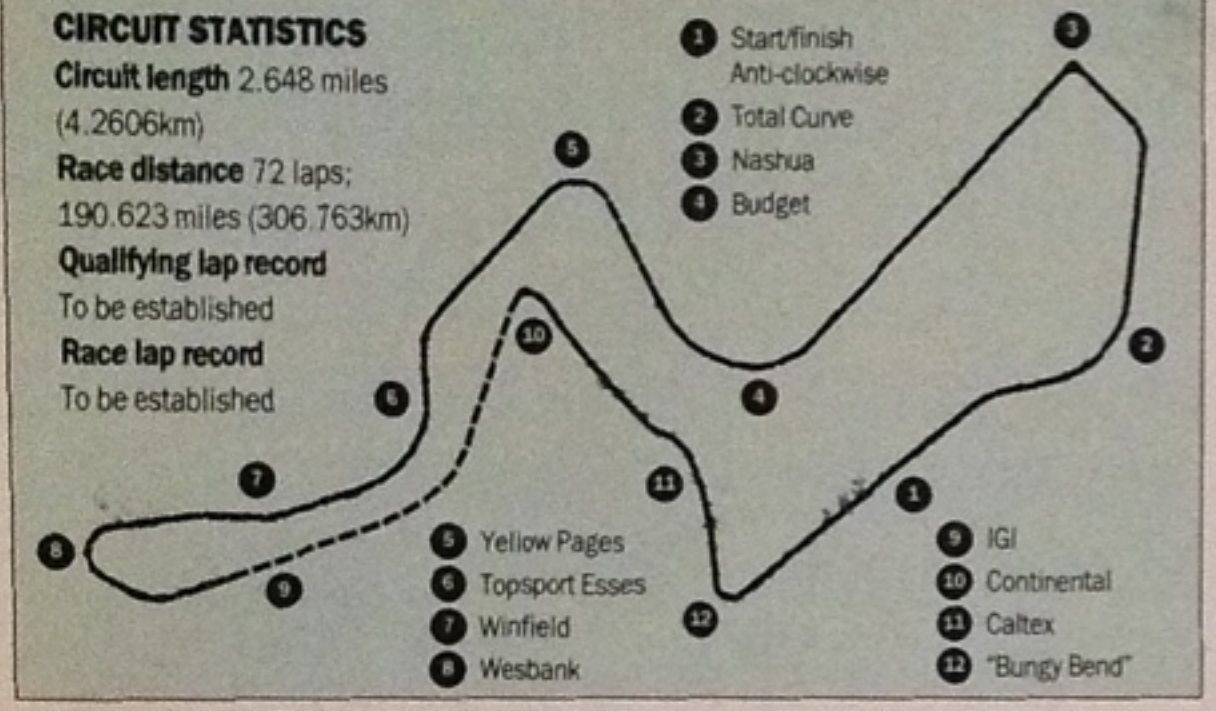
PHOTOGRAPH: PASCAL RONDEAU/ALLSPORT

THE CIRCUITS

The following pages include a comprehensive guide to all 16 circuits in the 1992 Formula One season, from the opening Kyalami Grand Prix to the final round at Adelaide in November. Jonathan Palmer, who after six years of Formula One driving now test drives for Marlboro McLaren, gives a personal view of the outstanding challenge awaiting the drivers at each race. As part of the BBC's commentary team Jonathan will join James Hunt and Murray Walker for live coverage of the European races and highlights of the others

South Africa

MARCH 1 1992
ROUND 1
Kyalami



CIRCUIT STATISTICS
Circuit length 2.648 miles (4.2606km)
Race distance 72 laps; 190.623 miles (306.763km)
Qualifying lap record
To be established
Race lap record
To be established

South Africa returns to the Formula One fold for the first time since 1985, the year in which the Ligier team controversially complied with a French government request not to participate and Nigel Mansell went on to record only the second victory of his career at the Kyalami circuit near Johannesburg. At an altitude of 5,000 feet, Kyalami, home of the South African Grand Prix since 1967, is one of the world's highest circuits, but drivers who raced there in 1985 will find that the track has been extensively reworked.

The new Kyalami circuit is smaller and more convoluted than its predecessor but as before the main characteristic is its altitude.

The major effect on a car of being at that high an altitude is that the air is about 18 per cent thinner than at sea level. (Most other circuits, apart from Mexico, are at sea level.) This means the engine is burning 18 per cent less oxygen and so the engine power is correspondingly down 18 per cent. If it produces 700bhp normally, the power output would be down 125bhp.

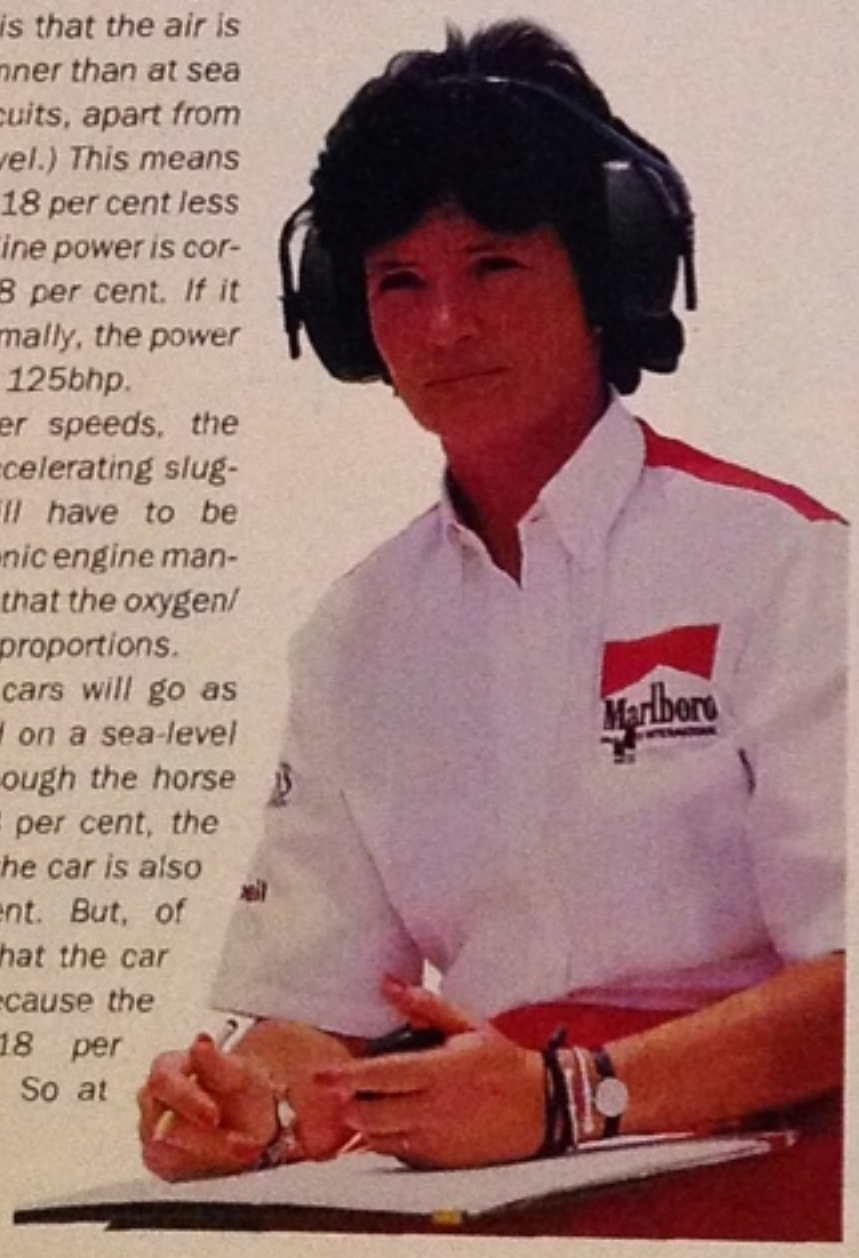
Particularly at lower speeds, the cars will feel to be accelerating sluggishly. The chip will have to be changed in the electronic engine management systems, so that the oxygen/fuel ratio is of normal proportions.

At high speed the cars will go as quickly as they would on a sea-level circuit, because, although the horse power is down by 18 per cent, the aerodynamic drag of the car is also down by 18 per cent. But, of course, that means that the car also has less grip, because the wings have got 18 per cent less downforce. So at Kyalami you tend to run more wing to try and regain some downforce.

It's not only the engines that don't produce as much power at altitude. It affects the drivers too. Like a Formula One car, a human being is down on power, which makes driving the circuit here more tiring than it should be because you have to breathe faster to get enough oxygen into the lungs. Lap times will fall off and mistakes and careless driving are more likely.

Physiologically it's impossible for drivers to acclimatise to the altitude, because that takes weeks. Fortunately, Kyalami isn't as physically demanding as many other circuits. JP

For up-to-the-minute GP information, call 0839 335544. Details p98.

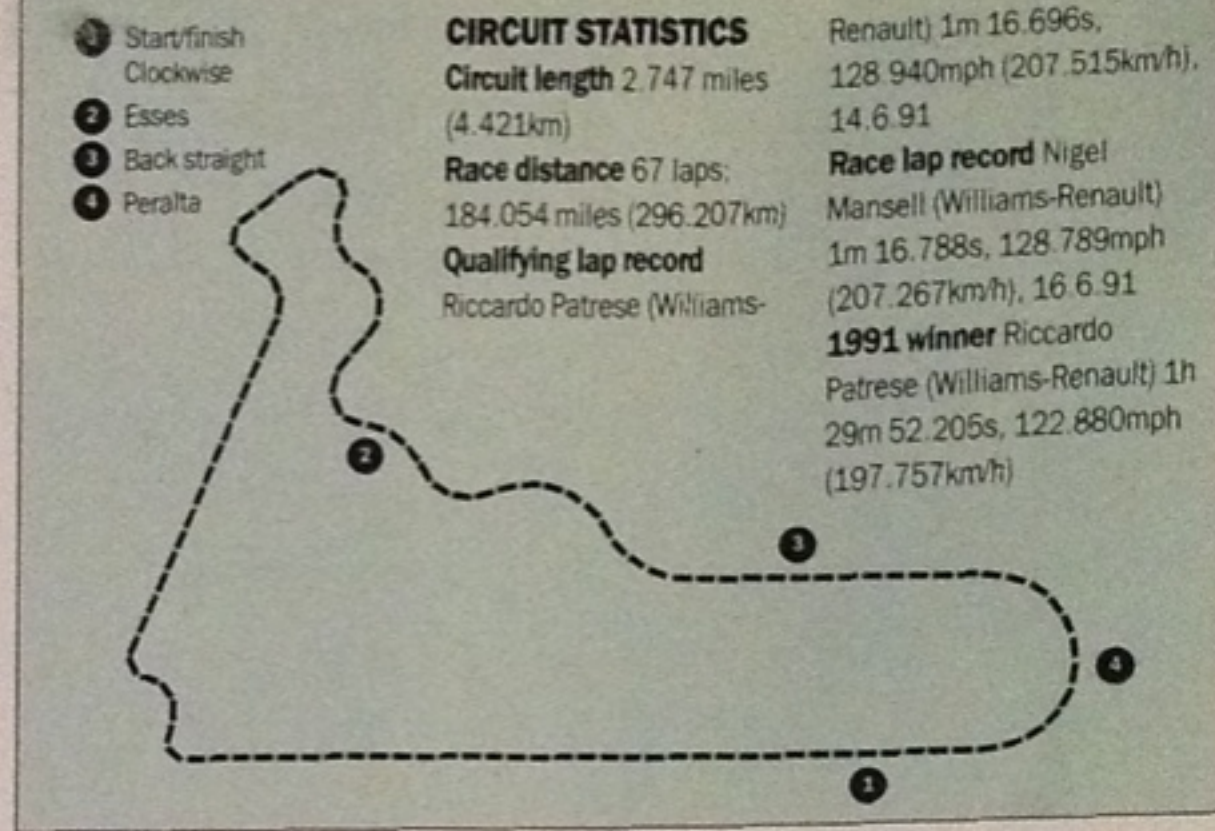


Kyalami awaits its new lap records

PHOTOGRAPHS: LEFT: YANN GUICHAOUA/VANDYSTADT. RIGHT: ALAIN PATRICE/VANDYSTADT. CIRCUIT DIAGRAMS: DOMINIC THOMPSON

Mexico

MARCH 22 1992
ROUND 2
Mexico City



CIRCUIT STATISTICS
Circuit length 2.747 miles (4.421km)
Race distance 67 laps; 184.054 miles (296.207km)
Qualifying lap record
Riccardo Patrese (Williams-Renault) 1m 16.696s, 128.940mph (207.515km/h), 14.6.91
Race lap record Nigel Mansell (Williams-Renault) 1m 16.788s, 128.789mph (207.267km/h), 16.6.91
1991 winner Riccardo Patrese (Williams-Renault) 1h 29m 52.205s, 122.880mph (197.757km/h)

Energy-sapping heat and the effects of driving at altitude characterise Mexico City's Rodriguez circuit, where the bumpy surface forces drivers to take a tight line through the testing mixture of sweeping corners and a fast straight. The thin air at 7,500 feet means that speeds of up to 200mph can be reached on the straight. The dangerous bumps and dusty surface make it a demanding and challenging circuit, particularly on the banked curve, the famous Peralta, that leads into the main straight, but they also make for exciting, and sometimes dramatic, races.

In an era when grand prix circuits have become more and more tortuous as the racing authorities try to bring the speeds of the cars down, Peralta stands out as the most awesome corner on the calendar, simply because it is so very fast and bumpy.

Drivers approach at 190mph and lose 30mph on the way in, choosing either to scream it in fifth or risk sixth gear, as Senna did in qualifying last year, to his ultimate cost. Realising on the way in that he'd need to shift down into fifth to get maximum acceleration, he went to change gear. Just at that moment he hit the bump with one hand on the wheel and with 4-g cornering force on the car. If you get a slide through Peralta your chances of holding on are very slim.

Which makes it awe-inspiring to come up to. Every time you approach you take a deep breath, grip the steering wheel that little bit harder and prepare to attack it. Dab the breaks, slide it down to fifth, balance the power on a steady throttle for about half the corner and then floor it from mid-corner onwards. Choosing the line of your entry carefully is vital because the bump is definitely worse on the outside.

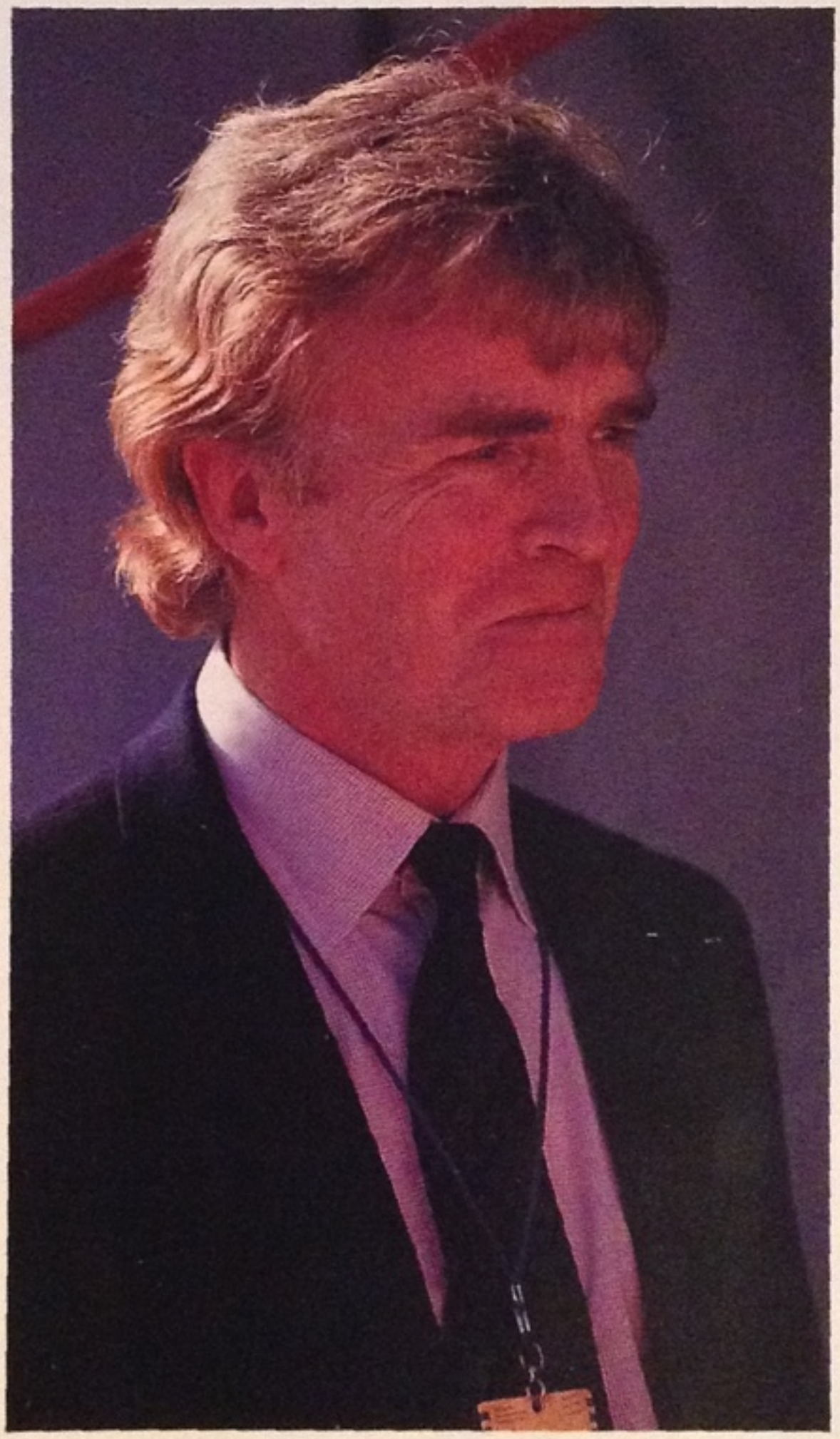
I had a big spin there in '89 in one of the practice sessions. The car hit a bump and bottomed out. Boomph, gone. It spun like a top and the next thing I knew I was out of control and going backwards into a pile of tyres.

On a lot of corners, how quickly you get through is about how delicate you are. At Peralta it's sheer bravado. JP

Senna's crash during qualifying last year showed just how dangerous Peralta can be

The Max factor

Last year, Max Mosley ousted FISA's abrasive president Jean-Marie Balestre, inset, from office. Maurice Hamilton profiles the new man at the wheel



Max Mosley has become the most powerful man in world motor sport and anyone who has been involved in grand prix racing during the past 20 years still can't quite believe that he's pulled it off. Neither, for that matter, can Max.

Becoming president of the sport's governing body, FISA, is not what Mosley had in mind when he raced without notable success in the Sixties. And it was hardly a prime objective when he helped establish March Engineering, a grand prix team and racing car manufacturer which would astound motor sport with its audacity. Only now, two decades later, is it becoming clear how Mosley, using quick wits and copious charm, kept March running on promises and borrowed money.

And neither was the leadership of FISA a likely prospect 10 years later when Mosley and Bernie Ecclestone, chairman of the Formula One Constructors' Association, led a vigorous campaign to undermine FISA and its veteran president, the rumbustious Jean-Marie Balestre. A compromise was reached which allowed Balestre to maintain his powerbase in Paris while FOCA looked after finance and important matters such as television rights.

Mosley, his interest in March long since relinquished and his role as adviser to FOCA (he is a qualified barrister) now diminished, disappeared from the front line to concentrate on legal work.

He turned up again as president of the FISA manufacturers' commission, a position which gave Mosley a seat on the World Motor Sport Council and brought him into contact with the motor industry. It also permitted him to witness at first hand the lack of esteem in which Balestre was held and the frequent shambles behind FISA's facade.

But as long as Balestre held imperious sway, there seemed little hope of improvement. Balestre had been voted into the presidency in 1978 after a hectic campaign which saw the prosperous French publisher fly round the world and massage the egos of delegates representing the member countries.

No one could match Balestre's energy and increasing influence. With each subsequent re-election, the result was a foregone conclusion. But the thought of another four years of Balestre's dictatorial methods and irrational responses to the problems facing the industry was too much to take as the October 1991 elections drew close. Mosley was persuaded to stand against him.

In fact, he needed little prompting. The son of British politician Sir Oswald Mosley and author Diana Mitford, Max had been interested in politics but the chances of a successful future at Westminster were always likely to be compromised by the lingering effects of his father's controversial activities. Now he had the opportunity to use his political skills and, more important, make a positive contribution towards setting right the ways of a business he knew and loved so well.

The response was surreptitious but positive. Countries keen to oust Balestre in the past, but worried about the unspoken threat of losing their flag-carrying international motor sport event, quietly grabbed the opportunity. Mosley defeated Balestre by 43 votes to 29.

The contrast between the two men could not be more extreme. Balestre is 71, Mosley 51. When Balestre came to power, he set about restoring the governing body's waning authority. But he did it by confrontation and table-thumping, by the issuing of arbitrary fines and the framing of rules which were frequently as impracticable as they were capricious. There was little stability. Calendars were never finalised until the last minute; regulations governing the design of cars were likely to be changed at the drop of the president's hat.

When Mosley arrived, his immediate aims were to eliminate controversy, provide full consultation and give more consideration to the environmental, political and financial problems gathering on the horizon. Formula One, said Mosley, would not require much of his time because it worked reasonably well; certainly, much better than areas such as sports cars and rallying which clearly needed help.

Mosley would not, therefore, make his presence felt at the grands prix; a far cry from Balestre's insistence on running the drivers' prerace briefings, usually to chaotic effect, and then putting in a grand appearance on the victory rostrum.

Mosley's gimlet eye misses nothing, but he will act upon his findings in a subtle and proper manner; and the evidence so far suggests that he will stand for no nonsense.

One question remains. Does Mosley's view that grand prix racing is in reasonable order, give his old mate carte blanche to run Formula One as he sees fit? Perhaps anticipating such potential criticism of Bernie Ecclestone's sometimes autocratic methods, Mosley has offered to stand for re-election after one year instead of the usual four.

Twelve months allows little time to set matters right. But the feeling is that anything Max Mosley achieves is almost certain to be more effective and less theatrical than the efforts of an ageing but well-intentioned predecessor who thrived on furious, divisive combat. □

Maurice Hamilton is the motor racing correspondent of The Observer

MAIN PHOTOGRAPH: JOHN DUNBAR/ZOOOM, INSET: ALLSPORT

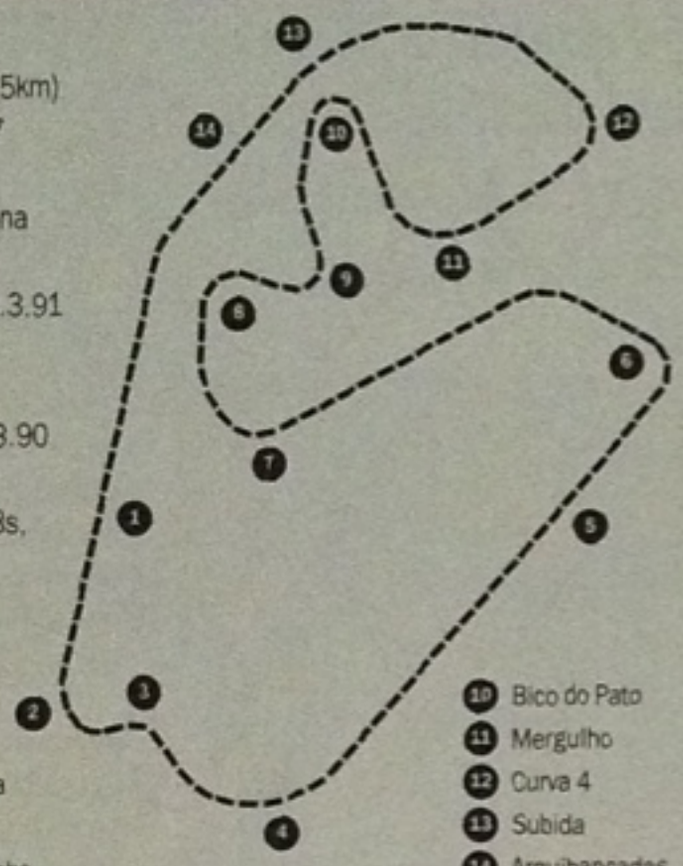
Brazil

APRIL 5 1992
ROUND 3

Autodromo José Carlos Pace, Interlagos

CIRCUIT STATISTICS

Circuit length 2.687 miles (4.325km)
Race distance 71 laps; 190.807 miles (307.075km)
Qualifying lap record Ayrton Senna (McLaren-Honda) 1m 16.392s, 126.625mph (203.817km/h), 23.3.91
Race lap record Gerhard Berger (McLaren-Honda) 1m 19.899s, 121.086mph (194.871km/h), 2.3.90
1991 winner Ayrton Senna (McLaren-Honda) 1h 38m 28.128s, 116.264mph (187.110km/h)



1 Start/finish Anti-clockwise
2 Curva 1
3 Curva do Sol
4 Curva 2
5 Reta Oposta
6 Curva 3
7 Feradura
8 Laranji
9 Pinheirinho
10 Bico do Pato
11 Mergulho
12 Curva 4
13 Subida
14 Arquibancadas

The Brazilian race returned to Interlagos from Rio de Janeiro in 1990 and the São Paulo crowd will be hoping to see local hero Senna repeat his victory of last year. Driven anti-clockwise, the Interlagos race is tough and physically demanding, especially on the long left-hander that leads the cars into the pit straight and is banked in such a way that drivers are eye-to-eye with the spectators. The winding series of bends in the infield behind the pits calls for controlled, rhythmic driving, as Senna discovered in 1990, when his nose-cone – and the race – was lost in a collision with Satoru Nakajima's Tyrrell on the slow Bico do Pato bend.

Apart from being very fast, Interlagos is characterised by its undulations. The circuit winds its way up the hill, back down, over brows and through dips before bringing the cars to the fast, banked left-hander that sweeps past the pits.

Undulations give the driver something else to think about. If the car is going up and down while cornering or braking, the amount of grip you have at your disposal changes radically.

On a flat corner you tend to take a fairly smooth arc, keeping the same radius of turn throughout the whole corner. But if a corner starts off flat but then begins to rise, the car is forced into the road even more than by the downforce exerted by its wings. That gives the driver extra grip at that part of the corner. The way to take advantage of that is to do more of your turning when you've got more grip, so you turn in earlier and faster than normal and as the ground rises you tighten your line and the cornering force increases.

You therefore modify the theoretical line, and intimate knowledge of a circuit enables local drivers to be very quick on an undulating circuit. JP

Local boy Senna sets his sights on victory

PHOTOGRAPHS: PASCAL RONDEAU/ALLSPORT

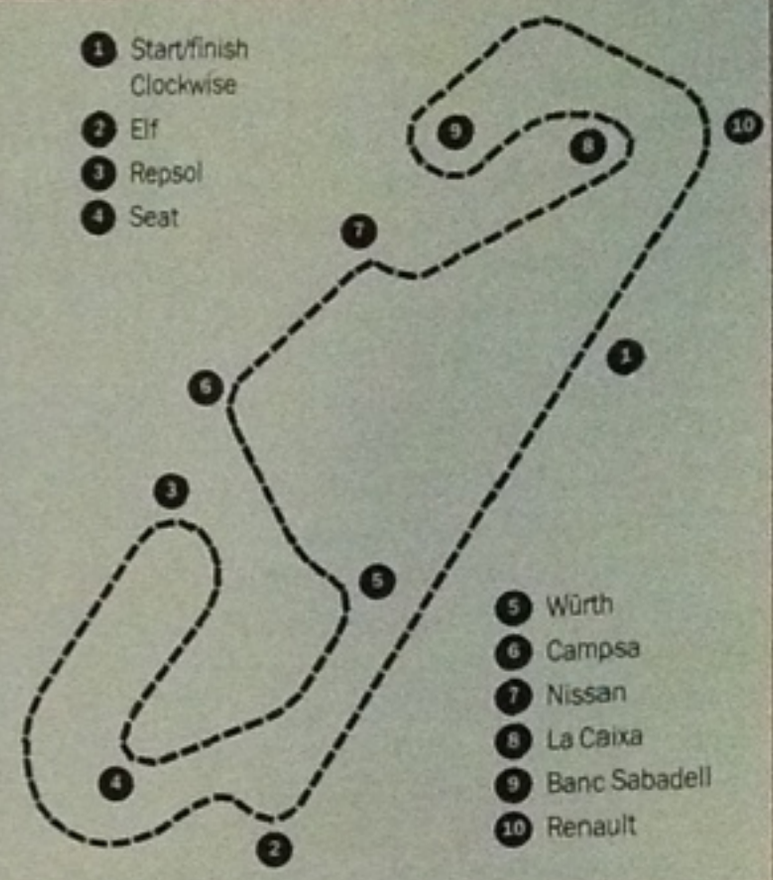
Spain

MAY 3 1992
ROUND 4

Circuit de Catalunya, Barcelona

CIRCUIT STATISTICS

Circuit length 2.949 miles (4.747km)
Race distance 65 laps; 191.727 miles (308.555km)
Qualifying lap record Gerhard Berger (McLaren-Honda) 1m 18.751s, 134.809mph (217.003km/h) 27.9.91
Race lap record Riccardo Patrese (Williams-Renault) 1m 22.837s, 128.888mph (206.299km/h) 29.9.91
1991 winner Nigel Mansell (Williams-Renault) 1h 38m 41.541s, 116.561mph (187.586km/h)



1 Start/finish Clockwise
2 Elf
3 Repsol
4 Seat
5 Würth
6 Campsa
7 Nissan
8 La Caixa
9 Banc Sabadell
10 Renault

Nigel Mansell won last year's inaugural grand prix at Barcelona's purpose-built Circuit de Catalunya, and the racing fraternity generally welcomed the move from the heat and small crowds of Jerez, where the previous three Spanish Grands Prix were held. There's no danger of a disappointing attendance in sports-mad Barcelona, especially in Olympic year, and French Formula One fans can pop across the border for the occasion. The new circuit was lacking in grip for last year's race, but the tight bend at the end of the very long pit straight presented drivers with plenty of opportunities to overtake. As time goes by, the Catalunya circuit is certain to become increasingly popular with competitors and punters alike.

Last year's Barcelona Grand Prix provided a classic example of the tyre dilemma that faces drivers in unsettled weather. The cars came out on wet tyres after the warm-up had taken place under grey skies, but the rain had stopped and the forecast was good. The question was: should the drivers change to slicks, even though the track was still wet?

The problem with starting on wets is that if you stay on wet tyres two or three laps more than you should on a drying track, you will find you are losing perhaps seven seconds a lap on somebody who is on slicks.

But if you start on slicks the chances are you will flounder around over the opening laps and rapidly find yourself at the back of the field. Following cars in the wet hinders visibility and the consequence of not spotting any standing water on the road often means spinning off. On the other hand, if you get a bit of a dry line, you can quickly warm up the tyres and pick up significant amounts of grip.

Tyre choice depends on how wet the track is, how quickly it dries, and on which way the weather is blowing. All this is unsettling before a grand prix, which is stressful enough as it is, and making a black-and-white choice between tyres is a critical and often impossible question to answer.

Last year, when everyone chose wets for the Barcelona race, Prost had wanted to start on slicks, thinking such a gamble was his only hope of winning in the Ferrari, but he was overruled by his own team management. Mercifully for them, and the rest of the teams, it started to rain within seven minutes of the race starting. JP

For all the up-to-the minute grand prix information, call 0839 335544. See p98 for details

A Pirelli technician hand-cutting a slick

NOT SO GREEN

1991 was the year in which Eddie Jordan won his spurs as a race team owner and proved he could compete with the best. But he learned some hard lessons along the way. Norman Howell reports on the Irishman's bid to challenge the top four Formula One teams this season

Eddie Jordan has made it. He survived a full Formula One season. Well, he did more than survive. He scored 13 points and ended the championship in fifth place, ahead of 13 other teams, all of whom had many more years' experience at this level than Jordan's merry band of green-clad Irishmen.

But the proof that Jordan has made the big time lies not in the points and figures that make up those end-of-season statistics. Rather it is in a phrase muttered by one of the hard men in this sport. The time was September last year, the place was Monza and Eddie and his team were at their lowest. They had just been mugged. Michael Schumacher, the German driver they had found to replace Bertrand Gachot, jailed for spraying a London taxi driver with CS gas, had just changed sides and gone to the Benetton team. The contract, it seems, was not watertight. Some very heavy people indeed had made sure that Jordan would come a cropper.

It was a sort of initiation ceremony. That, at least, was the suspicion. And sure enough, one of the muggers, when asked whether he had any animosity towards Jordan, replied: 'None at all. In fact, he's doing much better than all the no-hopers and dead-beats that inhabit the paddock. What can I say... welcome to the piranha club, Eddie.'

And that was it. Eddie Jordan had been blooded. Now he was in the big league, or at least on the fringes and looking in. Not that he saw it that way. He seethed and threatened just about anybody who he perceived had been a party to the mugging, and promised legal conflagrations.

But he was beaten. What the others couldn't do to his team on the track, they did behind the doors of the air-conditioned motorhomes. After that he never quite recovered the momentum and limped on to the end of the season. By then five drivers had raced his cars, he was running out of spares and much of his energy was devoted to looking for the new sponsorship that would allow him to find the budget of around $20 million to race in the forthcoming season.

To say that Jordan's 1992 specification is a completely different team from the small and hungry 1991 version is maybe an exaggeration, but only just. The car is still green, as 7-Up came in at the eleventh hour to renew their ▷

Jordan's season: Gachot, top, spun off in Mexico before being jailed for assaulting a London cabbie. Belgian fans at Spa gave Schumacher their views on British justice. When Schumacher was poached Moreno stepped in, before Zanardi took over, bottom

PHOTOGRAPHS, TOP TO BOTTOM: ALAIN PATRICE/ALLSPORT, PASCAL RONDEAU/ALLSPORT, HERKE DE VRIES, SPORTING PICTURES, PORTRAIT: PASCAL RONDEAU/ALLSPORT

sponsorship, but now the team have a significant new backer, a cigarette company. Gone is the Ford V8 engine, in comes the Yamaha V12. Bigger and thirstier, the Japanese power unit will have forced Gary Anderson, the much admired designer who got last year's car so very right, to rethink a totally new concept.

He got it right once, and he should do so again. But it isn't at all easy. The engine itself is only a year old, a far cry from the super-reliable Ford, and dealing with one of the biggest engine manufacturers in the world that is still new to Formula One will be a severe test of the team's ability to handle the transition from the 'small is beautiful' style of management to becoming a fully-fledged and backed works team.

Eddie Jordan has much experience of running racing teams. He has a free engine, has found the money to run the team and has put together one of the most impressive pit crews in the sport. He has hired one driver, Stefano Modena, who has yet to fulfil his undoubted promise, and given Mauricio Gugelmin the opportunity to make his mark on the grid. He has a way with drivers: what he got out of the Italian Andrea de Cesaris last season astounded many insiders.

In theory, Jordan should repeat last year's success, anticipated in these pages, and become one of the 'Top Teams', especially now that Ferrari and Benetton are going through big organisational upheavals. The Irishman has also come under the protective umbrella of Ron Dennis, the owner of McLaren, who has given him much advice through the year, some of it crucial.

Jordan has described Dennis as the only team owner he respects. Something that Alain Prost might have said about Eddie himself. The Frenchman was cheekily asked by Jordan whether he wanted to try his new car before it was launched in mid-January. The former world champion declined, but was moved to say: 'Eddie is a very honest man, I like him a lot.'

But theory and reality are rather distant from each other in the pressure-cooker atmosphere of Formula One. The fact that he has done it once is no guarantee that he will do it again. Indeed, there are many who feel that the second year might turn out to be a lot harder than the first.

Expectations, not least from the sponsors and the public, will be higher, the margin for making mistakes, and the tolerance thereof, much smaller. In short, Jordan's honeymoon period will now be over and the team will have to come to understand that being at the top of the second division is not the same as being at the bottom of the first.

In some races the also-rans were a couple of seconds adrift of the front-runners in qualifying. That is a lot. And that is the gap that Jordan must fill before they can be taken truly seriously as a new and major force in Formula One. And there will be rivals from the second division ready to ambush them. Lotus for one. They have inherited the Ford engine, they have two excellent young drivers in Johnny Herbert and Mika Hakkinen and a genial designer in Chris Murphy. Then there is Dallara, and maybe Minardi too.

So it will not be an easy year for Eddie Jordan and his team. But there is no doubt that, given an even break, Eddie will make the most of it. He has a new factory, symbolically built just outside the front gates of the Silverstone circuit. But this has stretched him. Financially he is exposed, and the strain sometimes shows: he must have one of the biggest mortgages in the country. But he is a battler, an exciting mixture of swashbuckle and blarney that has captured the imagination of fans and the admiration of insiders.

Last year he bet £50,000 on his team finishing in the first six. The odds were not very good for him but he bettered his forecast by one place. What money on him denting the 'Big Four' by the time the F1 circus rolls into Adelaide for the last race of the season? □

Norman Howell is the motor sports correspondent of The Sunday Times

Jordan surprised many insiders by getting the best out of the experienced but not always effective Andrea de Cesaris, above, who finished the season in a creditable ninth place

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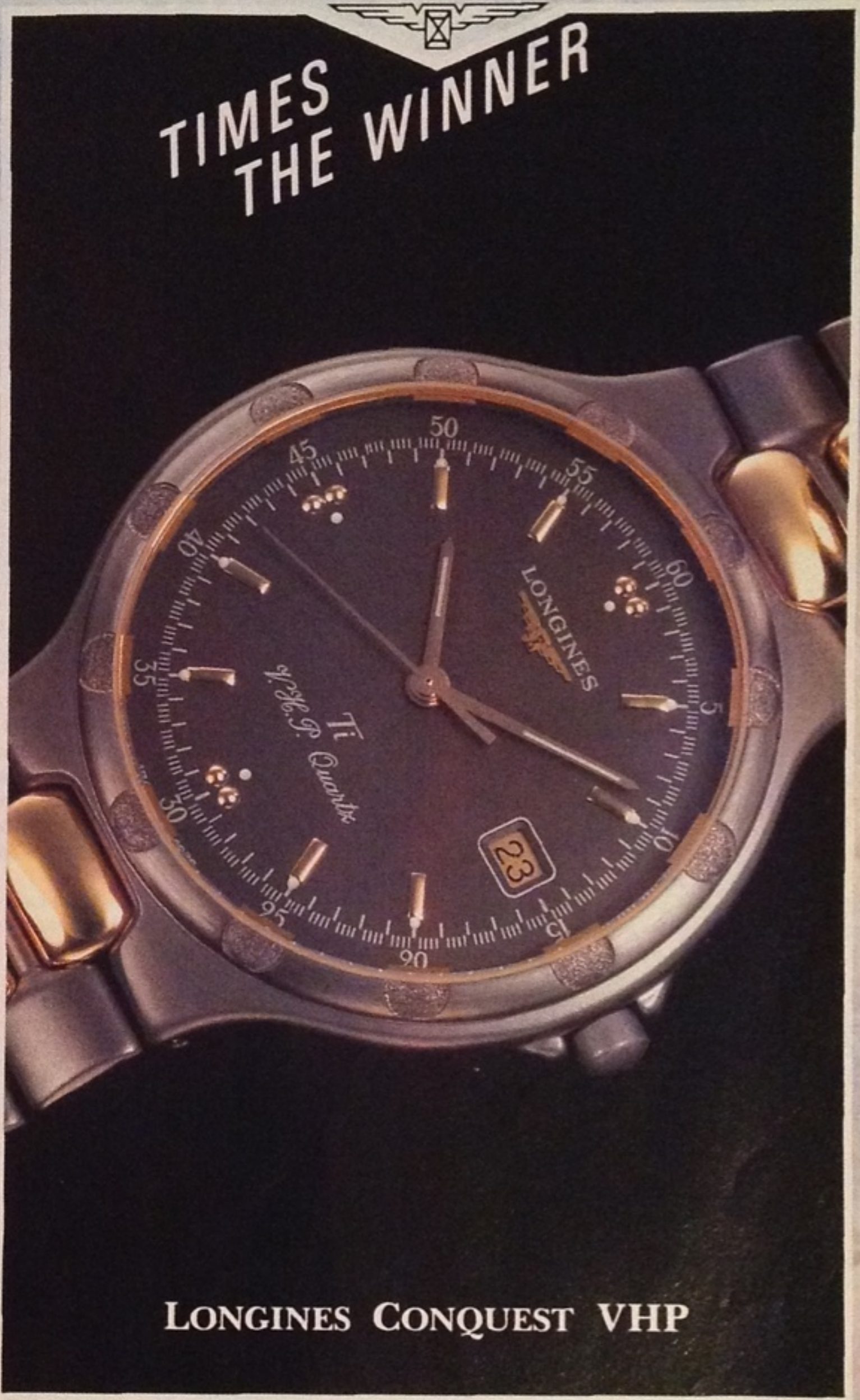

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San Marino

MAY 17 1992
ROUND 5
Imola

CIRCUIT STATISTICS
Circuit length 3.132 miles (5.040km)
Race distance 61 laps; 191.033 miles (307.440km)
Qualifying lap record Ayrton Senna (McLaren-Honda) 1m 21.877s, 137.709mph (221.601km/h), 26.4.91
Race lap record Gerhard Berger (McLaren-Honda) 1m 26.531s, 130.290mph (209.682km/h), 28.4.91
1991 winner Ayrton Senna (McLaren-Honda) 1h 35m 14.750s, 120.341mph (193.671km/h)

The Imola circuit, where Senna has triumphed in three of the last four years, is actually 50 miles from San Marino, but the Italian *tifosi* aren't fussy about what their second grand prix is called as long as it gives them another chance to roar on their precious Ferraris. The circuit includes what Nigel Mansell has described as the most worrying corner in the world, the Tamburello, and top teams often take advantage of Imola's variety of cornering speeds and the wear and tear it takes on brakes and engines to test new cars and develop new ideas.

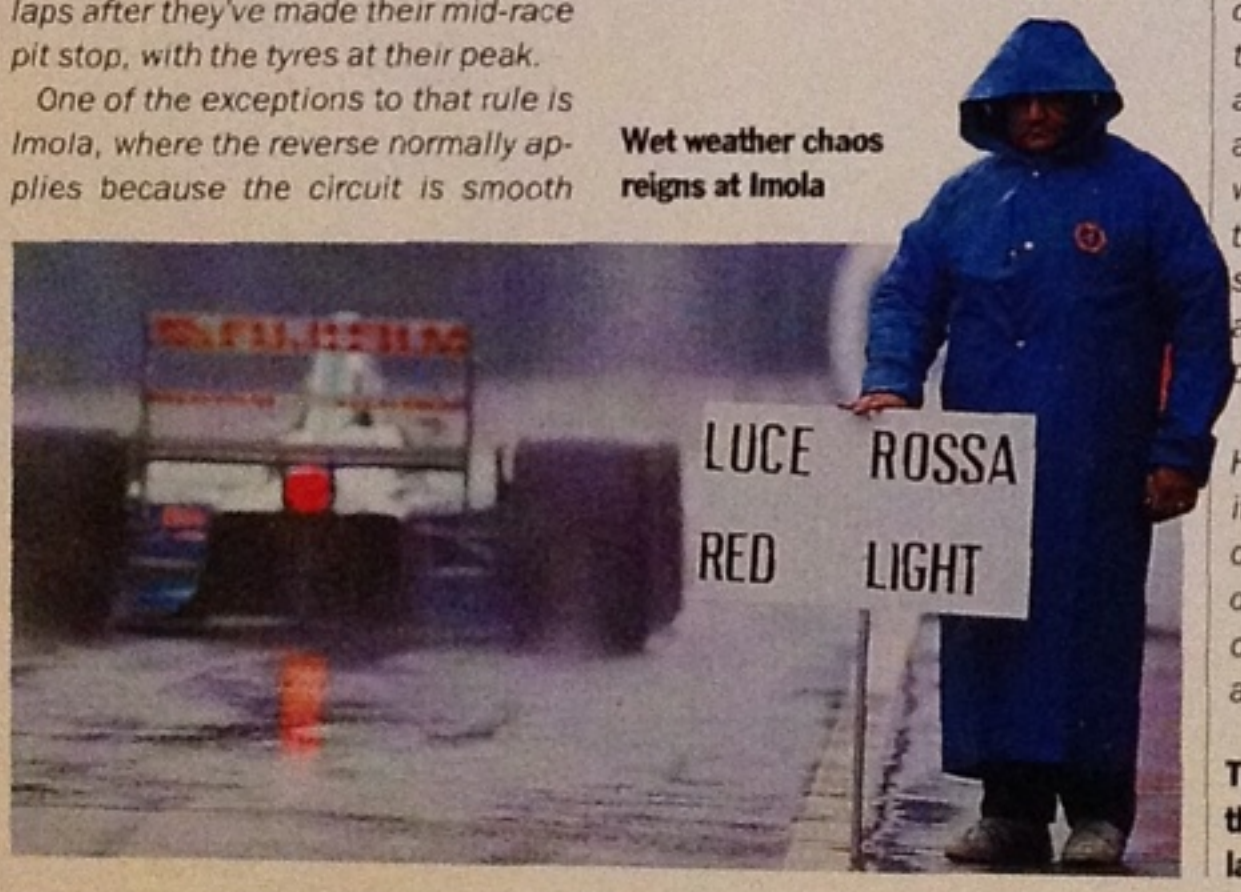
On race circuits the world over, the more laps you do the slower the car will go as the tyres' performance drops off. This is due partly to wear, partly to the change in their chemical make-up once they get hot.

After 20 laps you can lose up to one second of performance. Normally, cars set their fastest laps three or four laps after they've made their mid-race pit stop, with the tyres at their peak.

One of the exceptions to that rule is Imola, where the reverse normally applies because the circuit is smooth and unabrasive. As a result, the tyres don't get embedded into the grain of the road and so wear out much slower, probably lasting the entire race. Unless it's wet when you start you don't stop to change tyres here.

As the fuel load gets lighter, the cars go faster because what you gain in weight loss you don't lose in tyre performance. To prove the point, last year's statistics show that Berger set the fastest time on lap 55 of the 61 lap race (he did change tyres early on, but only because he began on wets). Most drivers agree that the chance of chipping away at your lap times makes Imola an inspiring circuit.

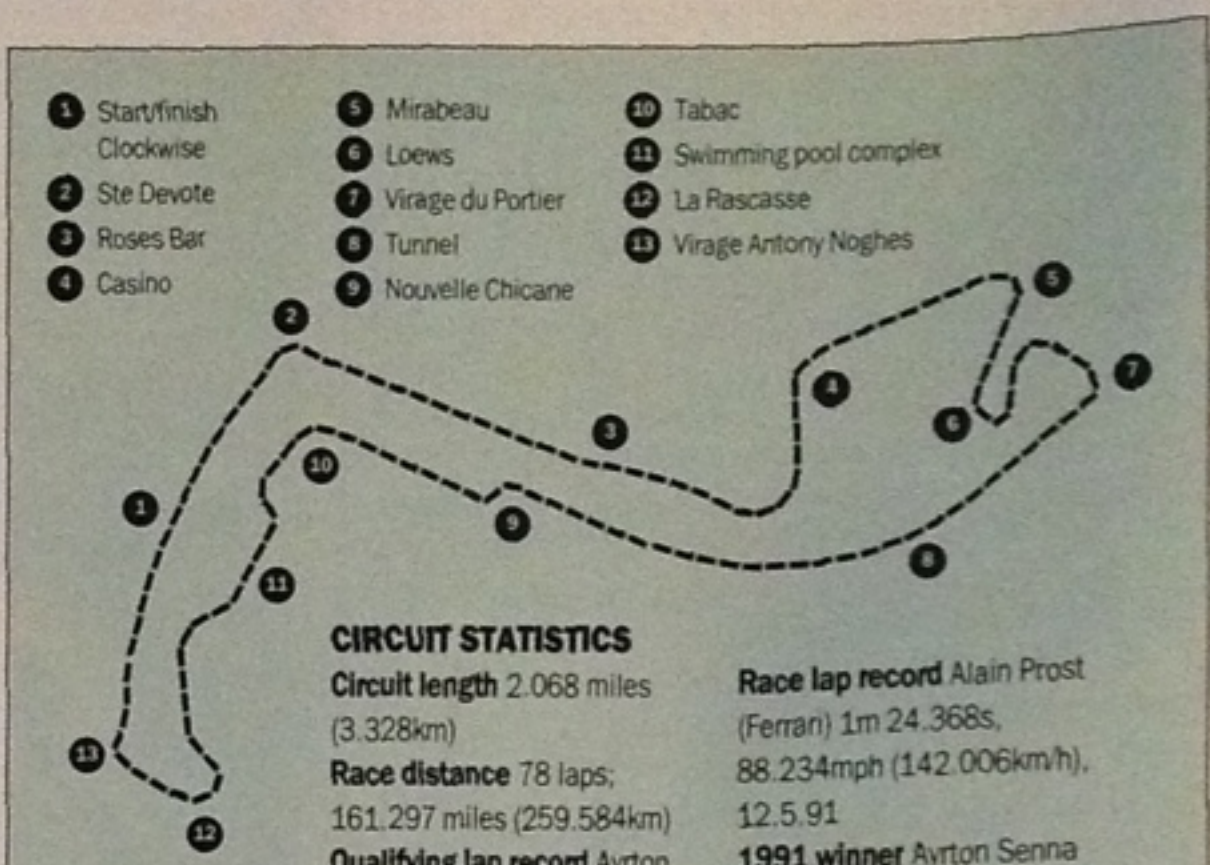
Elsewhere, how fast you lose tyre performance during a race depends not only on the track's abrasiveness, or, in the case of circuits like Imola, lack of it, but also on the temperature and how much rubber is put down, making the surface smoother. JP



Wet weather chaos reigns at Imola

Monaco

MAY 31 1992
ROUND 6
Monaco



CIRCUIT STATISTICS
Circuit length 2.068 miles (3.328km)
Race distance 78 laps; 161.297 miles (259.584km)
Qualifying lap record Ayrton Senna (McLaren-Honda) 1m 20.344s, 92.661mph (149.119km/h), 11.5.91
Race lap record Alain Prost (Ferrari) 1m 24.368s, 88.234mph (142.006km/h), 12.5.91
1991 winner Ayrton Senna (McLaren-Honda) 1h 53m 02.334s, 85.611mph (137.785km/h)

A good spot on the grid is vital if a driver wants to get into the points at the most glamorous grand prix of all, so the pressure during qualifying sessions is intense. The circuit is so tight that most successful overtaking manoeuvres are the result of mistakes. The drivers spend most of the race concentrating on keeping the right line, particularly around Loews, and in the tunnel. Monaco, the slowest race of the season, is the ultimate test of discipline and professionalism, so it is perhaps not surprising that Ayrton Senna is going for four victories in a row this year.

In qualifying the rules allow each car two sets of tyres only – if it's dry. And these are marked up and checked at the end of the pit lane.

This year they'll be qualifying on race tyres. With the qualifying tyre set-up there was no point in going out for more than two hard laps, because the tyres wouldn't last. With the race tyre situation you've got more laps to do your time in, with the chance of doing at least two hard laps, but there'll be twice as much traffic out on the circuit.

Some people go out at the beginning of the session, but in my experience that is no good. Although you can get a clear track there's still a bit of dust around from the one-and-a-half hour wait. People don't seem to set good times in those first 15 minutes. It seems inevitable that the best times are always set from mid-way to the end of the qualifying session.

Senna normally goes out pretty late. He might do one run about 30 minutes into the session and keep the other one to the very last minute. The big danger of going out late is that someone might blow up and dump oil on the circuit. A good strategy is to get a good time in the bag mid-way through the qualifying session, while the track is in good nick, and then take a chance on a late second one. JP

For up-to-the-minute GP information, call 0839 335544. Details p98.

Team timers monitor the crucial qualifying laps in Monaco

PHOTOGRAPHS: LEFT: HOWARD DOYLAN/ALLSPORT. RIGHT: DARRELL INGHAM/ALLSPORT

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Pressure change in tyres

The last thing a tyre company wants is a Formula One monopoly, but that's exactly what Goodyear has ended up with after seeing off Pirelli. As Maurice Hamilton reports, the only publicity Goodyear will get in 1992 is likely to be unwelcome

Despite being certain of winning all 16 grands prix this season, Goodyear are in a position where they can only lose. Such is the drawback of having won yourself a sporting monopoly.

It will be taken for granted during 1992 that Goodyear supplied the winning team. The driver will not eulogise over tyres during the post-race briefing. Why should he? He had the same as everyone else. Goodyear will, at best, receive a passing mention in the media.

But should a tyre give trouble – say in a spectacular manner similar to Nigel Mansell's celebrated departure from the 1986 Formula One championship in Australia – then the previously mundane pieces of rubber on each corner of the car become back-page news.

The failure of the driver to finish will be seen as Goodyear's fault, even if the problem had nothing to do with the quality of the rubber. Hardly a fair reward for bringing more than 2,250 tyres to each race; small thanks for literally keeping Formula One on the move.

Of course, Goodyear only have themselves to blame. By seeing off the latest challenge from Pirelli, the American tyre company has wound up once more as sole supplier. And that, ironically, is the last thing Goodyear wants. You can shout as loud as you like about winning a race but the boast will have a hollow ring if there was no one to defeat. The only publicity is likely to be bad publicity.

Also, from a technical standpoint, the absence of a competitor means that the pace of development slackens off. But it does not disappear. Goodyear are in Formula One to learn. Leo Mehl, the director of international operations at Goodyear since 1979, says the benefits are split evenly between advertising benefit and technical feedback.

There is no point, claims Mehl, in sitting back and making a standard tyre with a very hard compound, one which could be used at every circuit. It would do little to enhance the performance of cars on which the teams are lavishing millions of pounds in an attempt to extract an extra tenth of a second. And the learning curve for the tyre company would be as flat as the Formula One teams' level of enthusiasm for Goodyear's products.

In any case, there is always the thought that a rival company could arrive, full of new ideas, at any time. Michelin waged a superb war with Goodyear for several years. When the French company quit in 1984, Goodyear then faced Pirelli, who withdrew at the end of 1986, only to return three years ago.

Much was expected of Pirelli in 1991, particularly when they signed a deal with Benetton-Ford. Finally, Pirelli had netted a potential winner; until that point, the big teams were not prepared to risk going with a tyre company that was not up to competitive speed.

Benetton gambled – and lost. The Pirelli tyres were not consistent. Good at the start, they would quickly lose grip, forcing drivers to stop and change tyres more than once during the race. By mid-season, despite a somewhat lucky win for Benetton in Canada (after Nigel Mansell had broken down on the last lap), everyone knew that Pirelli could not match the standards set by Goodyear. And this despite the fact that Goodyear were supplying more teams than Pirelli.

The Goodyear crew would mount more than 600 tyres during the course of a grand prix weekend. There would be wet weather rubber and usually two different types of dry weather 'slicks'. And, of course, there would be 'qualifiers', the super-sticky tyres designed to be at their best for just one lap as the drivers bid for a decent grid position.

Qualifying tyres were the direct result of rivalry, the desire for a team and tyre company to claim the many benefits which came from winning pole position. The arrival of qualifiers was a mixed blessing. With each driver being limited to just two sets in each qualifying session (thus avoiding the escalating costs as the wealthy teams simply threw qualifying tyres at their cars throughout the 60 minutes of practice), activity on the track would be limited. But, when it came, the action during that one lap was explosive, spectacular stuff, the driver giving his utmost while the tyre was at the peak of its performance.

Now that Goodyear are alone, qualifying tyres are redundant. But, as with everything connected with grand prix racing, it is not as simple as that. Any dry weather tyre is at its best for one or two laps. We speak here of a tenth of a second during the course of two or three miles. It may not sound much but that can make the difference between the front and the third row of the grid.

After that, the performance of a normal tyre will tail off, not so dramatically as a qualifying rubber but, even so, drivers will be out to make the most of any advantage to be accrued early in the tyre's life.

The difference in 1992 is that all will not be lost if, say, the driver makes a mistake or is inadvertently blocked by another car during what should have been his best lap. There will be the opportunity to try again. The tyre may not be absolutely brilliant. But the driver may be able to make up the difference by extending his skills to the very limit. It should be a spectacular year, monopoly or no monopoly. □

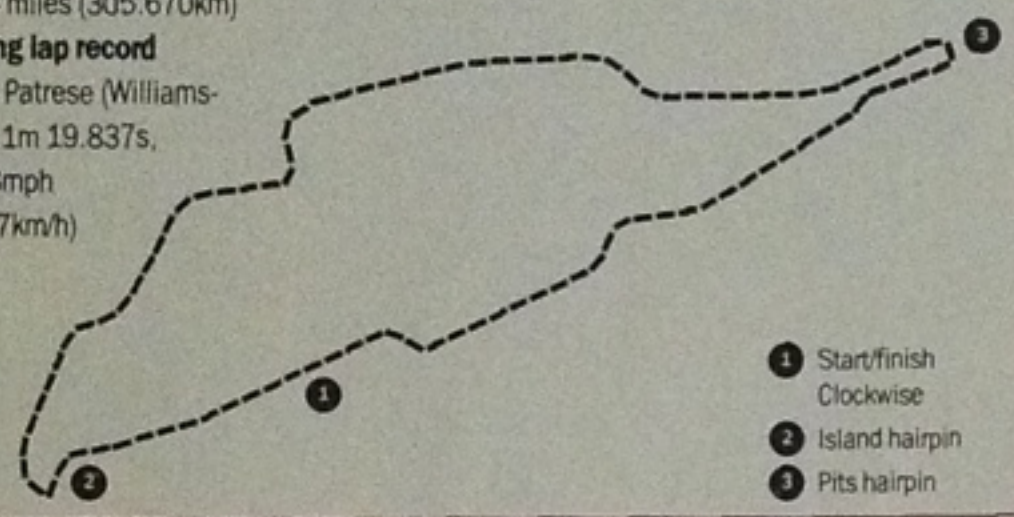
Maurice Hamilton is motor racing correspondent of The Observer

BERNARD ASSET/ALLSPORT

Canada

JUNE 14 1992
ROUND 7
Circuit Gilles Villeneuve, Montreal

CIRCUIT STATISTICS
Circuit length 2.752 miles (4.430km)
Race distance 69 laps; 189.934 miles (305.670km)
Qualifying lap record Riccardo Patrese (Williams-Renault) 1m 19.837s, 124.093mph (199.757km/h) 1.6.91
Race lap record Nigel Mansell (Williams-Renault) 1m 22.385s, 120.284mph (193.579km/h), 2.6.91
1991 winner Nelson Piquet (Benetton-Ford) 1h 38m 51.490s, 115.276mph (185.520km/h)



The Circuit Gilles Villeneuve, named after the top Canadian driver who was killed in Belgium in 1982, is something of a paradox: in design terms the track appears to be rather unexciting and the race is long (190 miles), but it is one of the most popular circuits among drivers, perhaps because the city of Montreal offers an abundance of recreational distractions including easy access to a number of golf courses. Situated on the Isle Notre Dame in the St Lawrence river, the circuit takes its toll on brakes and concentration, with a hairpin bend at each end and a series of short straights and chicanes in between. The form driver in Montreal is Nelson Piquet, whose rather fortunate 1991 victory was his third Canadian win in 10 years.

Frequently you come to a grand prix meeting being pretty sure of the car's set-up. Suspension settings, spring settings, gear ratios, balances and tyre wear characteristics are just some of the issues you'll have already sorted out. But there are some circuits where you can't test and Montreal, because the race track is in a public park, is one such place.

Generally on such circuits teams have to make do with the knowledge gained from the previous year's racing. However for a new team like Jordan, or for teams with new engines or new cars, they have to work very quickly to get the cars to race standard.

Getting the gear ratios right is all-important and you have to establish aerodynamic balance. Because Montreal is pretty bumpy you have to get the suspension right – if it is too stiff the car will hop and skip across the bumps and the tyres won't bite the road properly. If you make it too wallowy it won't turn in crisply and will roll around too much.

This process starts during the first practice session. You'd probably make four or five changes to the car in one of those sessions on Friday and Saturday and after each one you'd almost certainly change the gear ratios.

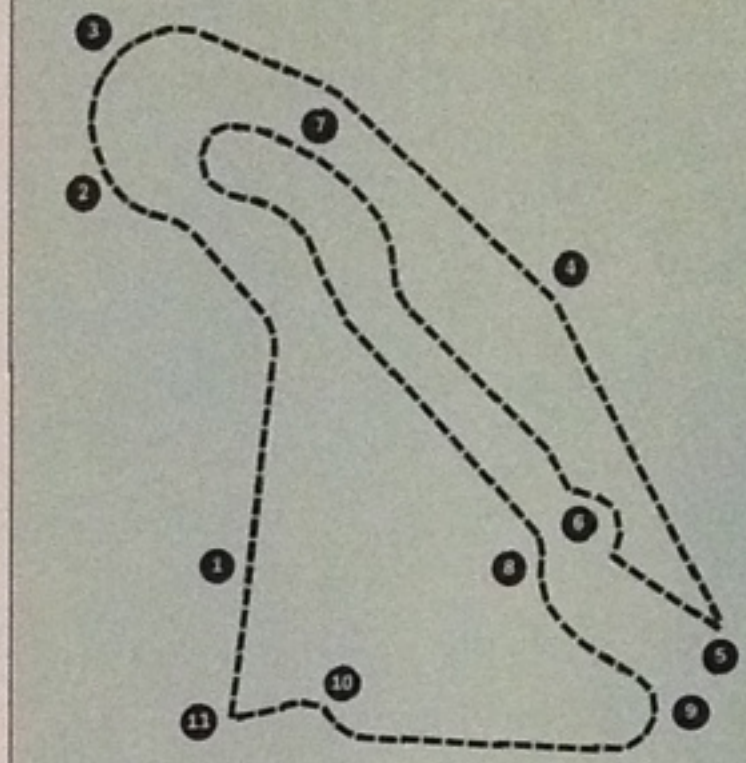
Among all this setting-up activity you still have to find time to do your tyre testing and set your qualifying time, so when the race comes round you're left with a much less perfect car than you'd ideally want. That makes the race more interesting because the performance of the cars is less predictable. The grid positions at Montreal are less likely than normal to be the final race positions. JP

For up-to-the-minute GP information, call 0839 335544. Details p98

Piquet takes the chequered flag at Montreal

France

JULY 5 1992
ROUND 8
Magny-Cours



CIRCUIT STATISTICS
Circuit length 2.654 miles (4.271km)
Race distance 72 laps; 191.078 miles (307.512km)
Qualifying lap record R. Patrese (Williams-Renault) 1m 14.559s, 128.145mph (206.220km/h), 6.7.91
Race lap record Nigel Mansell (Williams-Renault) 1m 19.168s, 120.679mph (194.215km/h), 7.7.91
1991 winner Nigel Mansell (Williams-Renault) 1h 38m 00.056s, 116.985mph (188.271km/h)

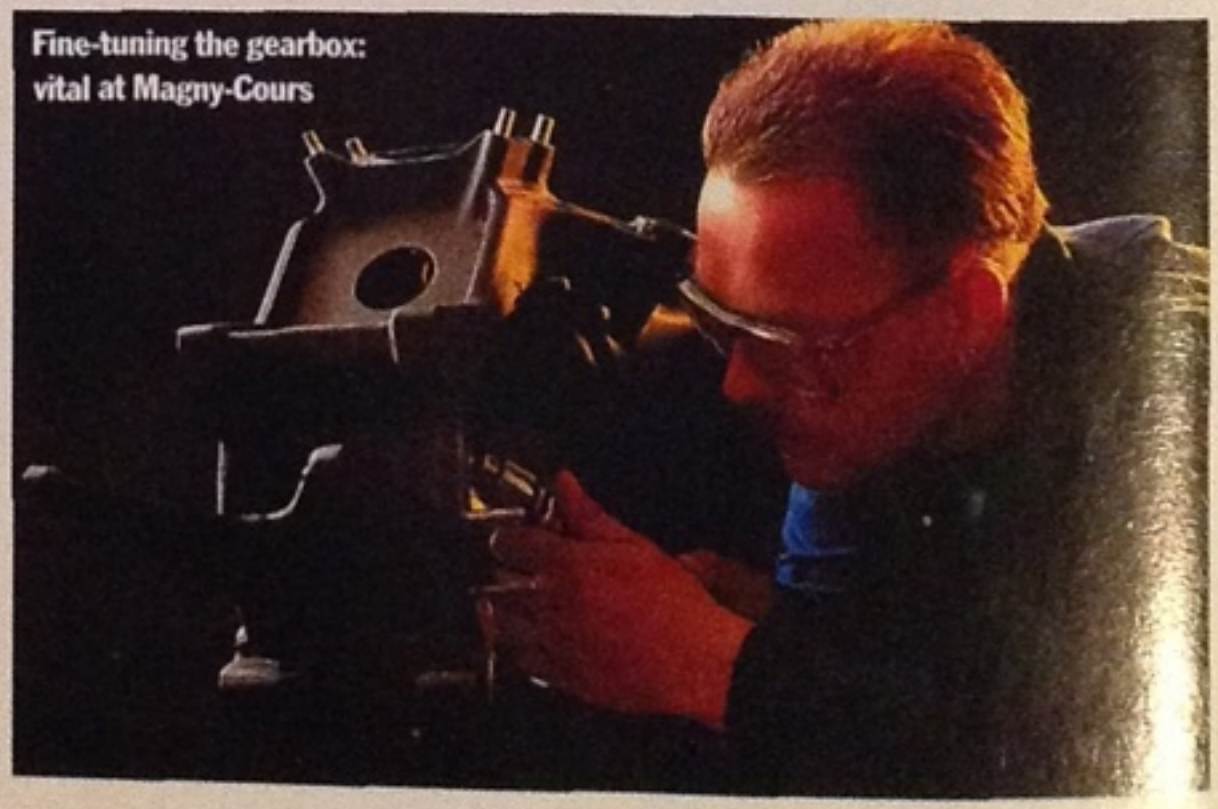
Just as he christened Barcelona's new circuit with a win in 1991, Nigel Mansell powered to victory at France's brand new racing arena, the country's sixth grand prix venue since the war. A tight circuit that doubles back on itself in several places and lacks one really long straight, Magny-Cours got a mixed reaction from the drivers, though the state-of-the-art facilities were widely appreciated. Despite being based at the circuit, the Ligier pair of Erik Comas and Thierry Boutsen could only manage eleventh and twelfth places respectively.

The outstanding features of Magny-Cours are its first gear hairpins – the Adelaide bend and the Lycee bend – and its top gear straights.

A grand prix car's standard gear box has six speeds. Each ratio can be changed individually. You arrange top gear so that you reach just under maximum revs at the end of the longest straight and then you space the remaining gears to give a nice progression up to maximum acceleration.

Although it takes about two-tenths of a second to change gear, at a circuit like Magny-Cours the physical effort of changing gear really is tiring. Unlike road cars, the lever is very short, just 4ins high, so it doesn't have much mechanical leverage. And of course a lot of gear changing will be done on corners, when you could do with two hands on the wheel. Often you are trying to deftly position your arm on a gear lever on the right of the cockpit with perhaps 3-g pushing you sideways.

The semi-automatic boxes are really electronic shifting mechanisms. You decide when it shifts by operating a switch rather than a mechanical lever. Considering the edge it gives drivers it's not surprising Williams and Ferrari already run the semi-automatics – it's likely McLaren will run it this year. JP



Fine-tuning the gearbox: vital at Magny-Cours

PHOTOGRAPHS: LEFT ALAIN PATRICE/ANDYSTADT. RIGHT PASCAL RONDEAU/ALLSPORT

Some people might have expected a celebratory mood from him in the press room at Suzuka. Less than an hour earlier, he had locked away the world championship – his third – and other drivers report that you generally feel pretty good in these circumstances. After skimming over the significance of the 1991 Japanese Grand Prix, though, Ayrton Senna – quite unprompted and clearly livid – turned his attention to past wounds, which were obviously still open.

For half an hour he vented his spleen, telling us the whole truth, he said. By implication, that meant he had told us less than the truth in the same room a year earlier.

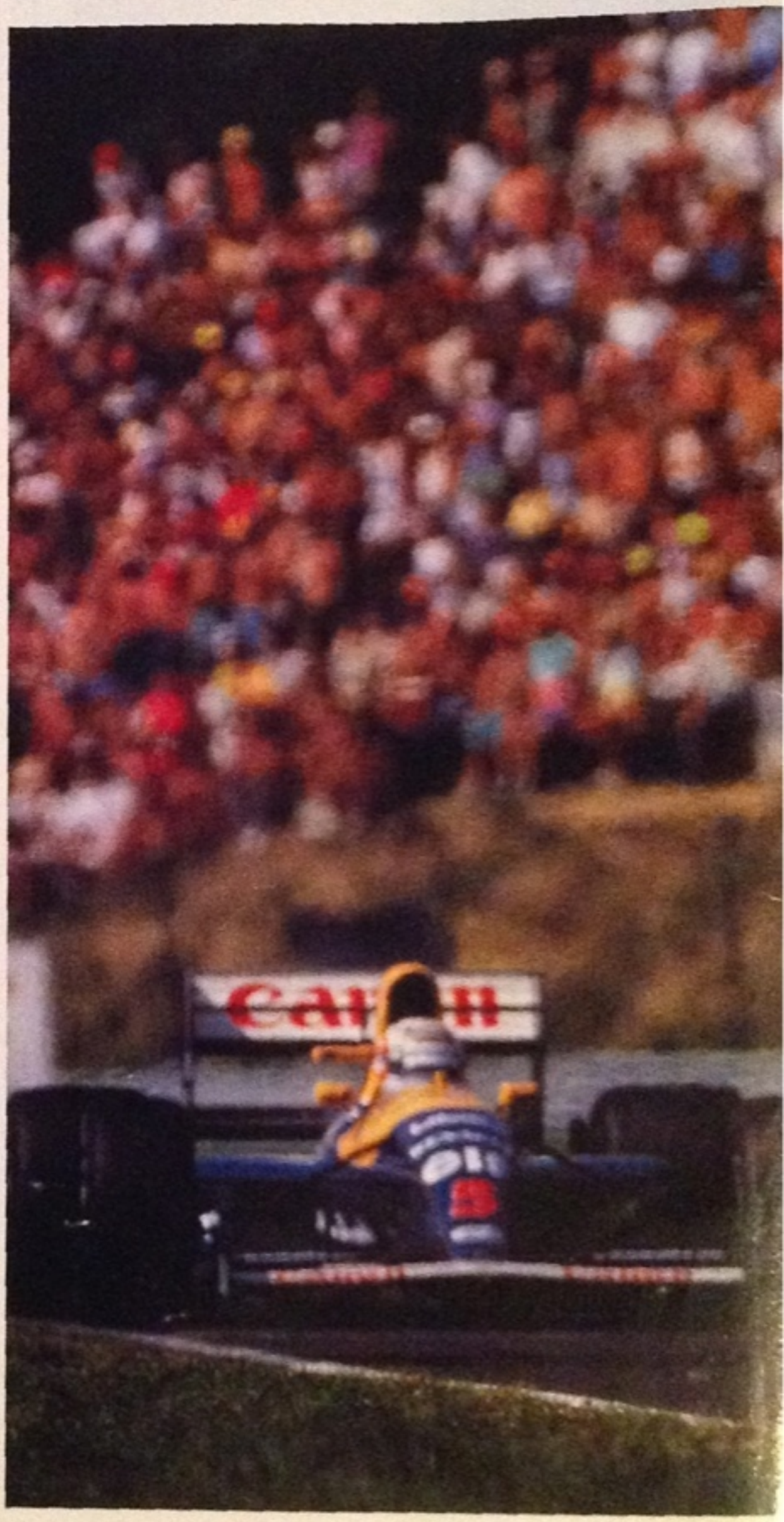
At Suzuka in 1990, the world championship was settled within 10 seconds of the start, when Alain Prost's leading Ferrari was hit from behind by Senna's McLaren-Honda. To keep his title hopes alive, the Frenchman had to win that race; anything less, and the championship was Senna's.

Afterwards, Senna disclaimed any responsibility: Prost had left a gap, he said, then turned across him. To anyone with reasonable eyesight, the McLaren had gone into the corner at a speed incompatible with getting round it, and simply nailed the Ferrari, but some noddingly accepted Senna's account.

Now, 12 months on, he gave us a different version, and most of his venom was aimed at Jean-Marie Balestre, the deposed FISA president. Before the 1990 race he had requested, he said, that pole position at Suzuka be moved from right to left, the cleaner side of the track, where there was most grip. The officials had agreed, he went on, but were overruled by Balestre.

Senna had qualified on pole, with Prost next to him, and now the Brazilian brought his own portable universe into play. 'I said to myself, "If Prost gets the jump on me at the start, because I'm in the wrong place, at the first corner I'm going for it – and he'd better not turn in ahead of me, because he's not going to make it." I didn't care if we crashed. It had to happen. And it was the result of the politicians' stupid decisions,' said the champion.

We listened in mounting disbelief,



Ayrton: a man driven by an obsession

The three-time champion has proved his all-round racing brilliance, yet he remains a mass of contradictions. Nigel Roebuck explores the troubled side of Ayrton Senna

not at what was being said, for it merely confirmed what most of us had concluded at the time, but at the fact that it was being said at all. Most chilling of all was his fervour, his belief that not getting his own way had somehow given him carte blanche to behave as he saw fit.

And all of this from a man who, in the course of his glittering career, has spoken constantly of his fine upbringing, his commitment to integrity, to good manners, his avowed devotion to God. Now there was little sign of any Christian charity, nor any indication that Senna had an awareness of an authority higher than his own.

It is doubtful that anyone has ever *needed* to be world champion as much as Ayrton Senna; doubtful, too, that any driver has ever gone about it with such absolute single-mindedness. When he won the title for the third time, it was inevitable there would be an immediate outpouring of emotion but nearly all of it was channelled into bitterness.

In the car, he was rarely less than brilliant in 1991, although for the bulk of the season the strongest card in McLaren-Honda's hand was reliability. Only once did Senna retire from a race with a mechanical failure, and this was particularly crucial in a year when FISA changed the point-scoring system, so that now a driver's every result counted, rather than merely his best 11 positions from 16 races.

Ayrton won the first four races of the year – which no one, not Fangio, nor Clark, nor anyone else – had ever done, and the psychological damage to any potential rivals was numbing. Especially since the victories came in a car not truly on the same plane as the new Williams-Renault of Nigel Mansell and Riccardo Patrese, a point Ayrton rarely missed an opportunity to make.

When necessary, he exercised considerable self-discipline in 1991, subjugating his need to win every two weeks, accepting that today third place was maybe the best he could expect. At Magny-Cours and Silverstone and Hockenheim he was in no position to think of going for a victory, and drove defensively, in a manner quite alien to his instincts.

In Hungary Senna scored the victory of the season, in the sense that he won with a car that should not have won. Overtaking being almost impossible, the secret of this place is to get the pole, get away well, make no mistakes under pressure, and Ayrton followed the rules to perfection. In race trim, the Williams were undeniably superior, but they finished second and third.

For pure virtuosity, though, probably Senna's Interlagos victory stands alone. Through most of the afternoon he withstood pressure from Nigel Mansell, but after the Englishman had taken care of himself, it looked as though Ayrton would have an easy cruise of it. As it was, his gearbox was shedding ratios, and towards the end he had only sixth. Driving in a downpour for the last few laps, and on slicks, he kept the car alive to the flag.

Senna lives in São Paulo, of course, and flew home in his helicopter each evening. On the Friday night he had a sudden thought about a problem with the car, and prepared to fly back to the track to speak to his engineers: it couldn't wait until next morning. By now, though, there was fog, and the helicopter was necessarily grounded, so Ayrton got in his car, and drove there, an hour and a half each way. An obsessive he may be, but dedication like this explains why the man is world champion, and is one of the reasons why he begins every season as the strong favourite.

He has proved conclusively that he is a magnificent and increasingly complete race driver, currently the best beyond doubt, yet Senna is apparently still some way from peace. He remains full of contradictions, essentially a compassionate man, yet one capable of cold cruelties. In his moment of triumph, foremost in his thoughts appeared to be the need for revenge. This is his time, his era. He should, by rights, be enjoying it more than anyone. □

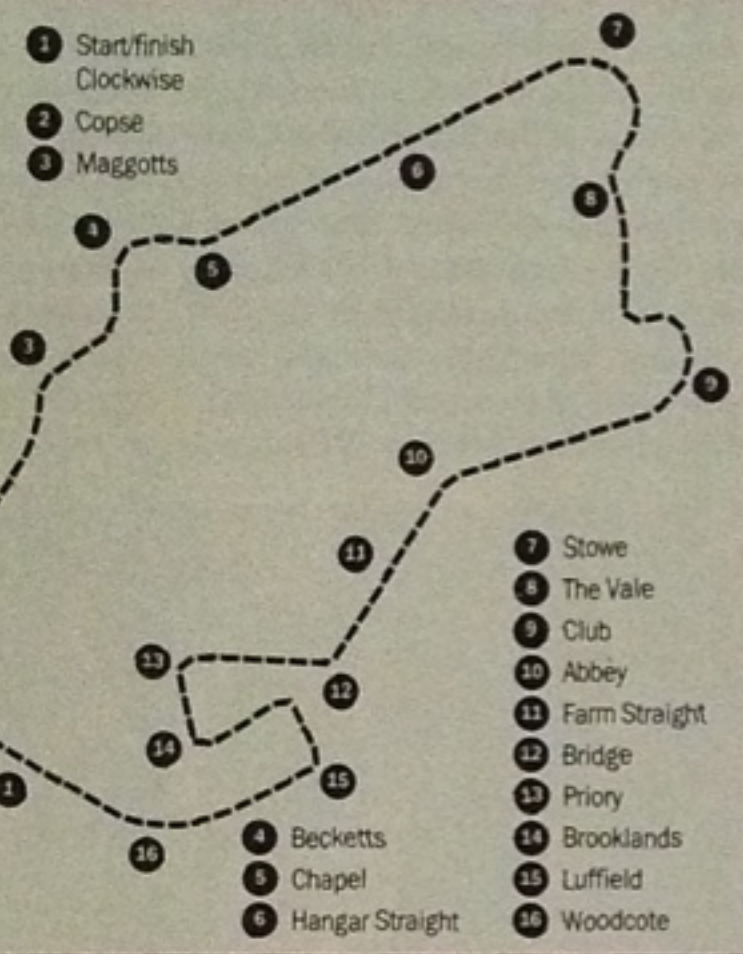
Nigel Roebuck writes for and edits the grand prix section of Autosport

PHOTOGRAPHS: LEFT: JEAN-MARC LOUBAT/VANDYSTADT. RIGHT: PASCAL RONDEAU/ALLSPORT

Britain

JULY 12 1992
ROUND 9
Silverstone

CIRCUIT STATISTICS
Circuit length 3.247 miles (5.225km)
Race distance 59 laps; 191.573 miles (308.306km)
Qualifying lap record Nigel Mansell (Williams-Renault) 1m 20.939s, 144.419mph (232.397km/h)
Race lap record Nigel Mansell (Williams-Renault) 1m 26.379s, 135.325mph (217.761km/h), 14.7.91
1991 winner Nigel Mansell (Williams-Renault) 1h 27m 35.479s, 131.227mph (211.189km/h)



In 1990, Nigel Mansell withdrew from the British Grand Prix with gearbox failure, and immediately declared his intention to retire from Formula One. Twelve months later, he made a triumphant return to the revamped Silverstone circuit. Traditionalists, ever aware of the Second World War airfield's historical significance, argue that Silverstone lost much of its character, possibly because it is now less dangerous. But for drivers it remains one of the most technically demanding circuits, where pre-race fine-tuning is vital to success.

The revisions to Silverstone have been a tremendous success and it is now one of the most challenging tracks for drivers.

The lap times are longer, largely a consequence of the slow Priory/Brooklands/Luffield complex, yet the circuit also now provides two exhilaratingly fast corners, Becketts and Bridge. Whilst the sheer speed through Bridge is awesome – it's virtually flat at a 180 mph – it is the more difficult right left right sequence at Becketts that is more testing. Each successive corner is slower, so driving technique and line are critical.

Stowe is another tricky section; although slightly slower at 130 mph it necessitates a rather frustrating balancing on more or less steady throttle as it continues on, round and round, before finally one can power on in 4th down the Vale. Certainly its wide entrance provides one of the three overtaking opportunities, the others being into Priory and Copse.

At Club an uncharacteristically slow and fiddly 2nd gear left hander opens into the old mega-corner, though after just a few yards of throttle wavering having turned right, its flat all the way as you go up through the gears. JP

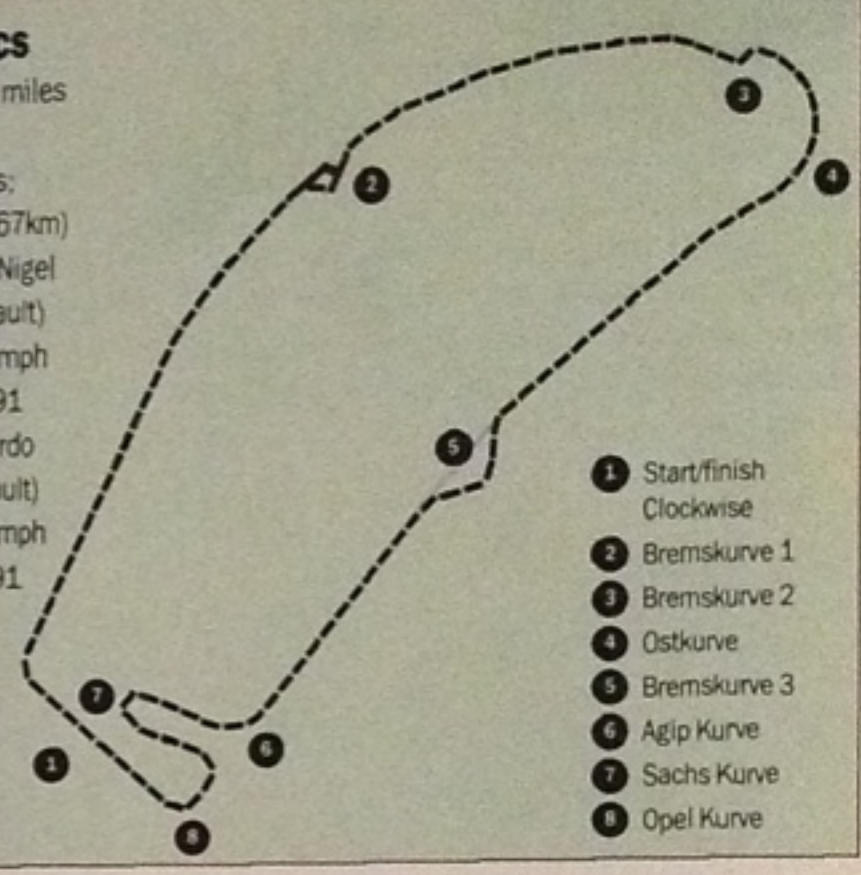
For up-to-the-minute GP information, call 0839 335544. Details p98

Nigel Mansell puts his foot down and powers into the Vale on his way to victory

Germany

JULY 26 1992
ROUND 10
Hockenheimring

CIRCUIT STATISTICS
Circuit length 4.2265 miles (6.802km)
Race distance 45 laps; 190.180 miles (306.067km)
Qualifying lap record Nigel Mansell (Williams-Renault) 1m 37.087s, 156.719mph (252.219km/h), 27.7.91
Race lap record Riccardo Patrese (Williams-Renault) 1m 43.569s, 146.913mph (236.434km/h), 28.7.91
1991 winner Nigel Mansell (Williams-Renault) 1h 19m 29.661s, 143.554mph (231.028km/h)



The Hockenheim circuit, near the historic city of Heidelberg, is one of the least popular racetracks in Formula One (though Nigel Mansell has fond memories of completing a hat-trick of consecutive wins there last season). Three chicanes and an abundance of straights make rhythm and concentration difficult to maintain, and the circuit is notoriously hard on brakes and tyres. Hockenheim is also dreaded for its inclement weather. In rainy conditions, the trees around the circuit create a mist and add visibility problems to the absence of grip on the track.

This is probably the easiest circuit on which to overtake, but overtaking in modern grand prix cars is still very difficult. Formula Ford racing at Hockenheim produces some epic battles because everybody is able to slipstream along the fast straights up to the slow chicanes.

The classic way to overtake is to get up into somebody's slipstream, take advantage of the hole in the air that they're cutting and jink out towards the end of the straight. You use the speed advantage you've gained to pull you alongside, hopefully on the inside in order to get the line into the chicane. It's the old slingshot effect.

With grand prix cars the problem in overtaking is that their wings mean that they don't make as neat a hole through the air as a touring car, so you don't get such a good tow and hence not the equivalent speed advantage towards the end of a straight. Instead of pulling out with a 10mph speed advantage, with a GP car it's perhaps 5mph which will decay down to nothing as you pull alongside.

To exacerbate the problem, braking distances are desperately short, due partly to the sheer power of the brakes and grip of the tyres, but also because corner entry speeds are high, so less speed must be lost. JP

Brakes and tyres take a battering on Hockenheim's chicanes, as Alesi discover

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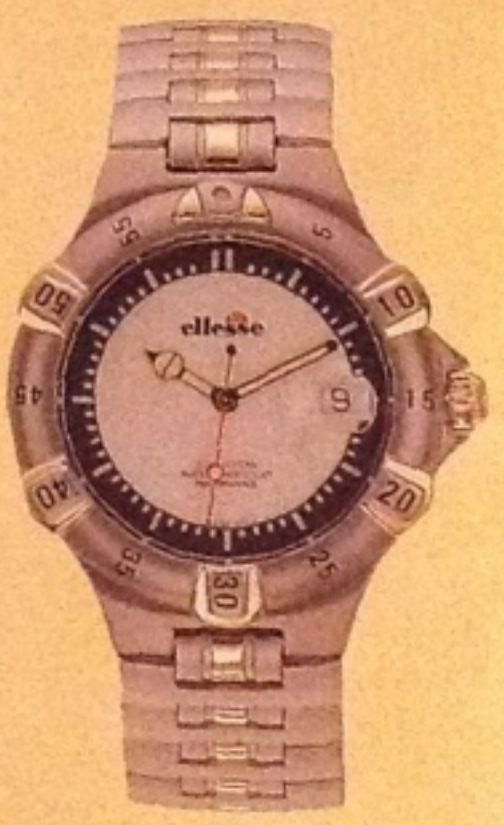

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The test circuit

British Formula Three provides a springboard to grand prix stardom, as Mark Hughes reports

Tomorrow's grand prix stars today. That's what you see when you watch a round of the British Formula Three championship. Other countries have their own Formula Three series but if you are an aspiring racer, Britain is the centre of the motor racing world.

Derek Warwick, Nelson Piquet, Stefan Johansson, Jonathan Palmer, Ayrton Senna, Mauricio Gugelmin, Johnny Herbert, JJ Lehto and Mika Hakkinen were all British Formula Three champions. It's a traditional stepping stone and it's rare to see a driver stay in the formula more than two years. The constants are the successful marques of car – the Ralts and Reynards – and the teams that run them.

Ostensibly the cars are miniature grand prix machines, and much of the technology is shared. All the leading cars in the 92 series will be constructed from carbon fibre. The 1991 championship-winning Ralt RT35 was of aluminium conococque construction but its replacement by the fibre RT36 aligns the marque with the products of its competition, namely Reynard.

Getting the best from the electronic engine management systems is similarly critical in both arenas, as is finding the fine balance between aerodynamic downforce and straightline speed. But, while those in the Formula One paddocks blithely talk of 700bhp, the best Formula Three engine is unlikely to give more than 185bhp. The engines must be normally aspirated, derived from production car units and may not exceed two litres in capacity. The most power-prohibitive feature is the mandatory airbox which restricts the volume of air entering the engine and therefore the power it is able to produce. Top engine in the British Formula Three ranks is the Honda-based Mugen unit which won 14 of the 16 rounds in the 1991 championship.

The combination of relatively low power in a state-of-the-art chassis with monumental grips demands neat driving. Let the car slide too much and the engine will bog down. Where the Formula One driver is delicately balancing his surplus of power over grip, the Formula Three driver will be placing the utmost demands upon his chassis, without crossing that fine divide after which momentum is lost.

The quickest driver in Formula Three last year was the Brazilian Rubens Barrichello (inset, above) who won the title with the West Surrey Racing team that also gave Mika Hakkinen the 1990 crown. Dick Bennetts' WSR operation was born out of an outfit – Project 4 – headed by Ron Dennis which ultimately became the McLaren Formula One team. Fittingly, Bennetts' team is considered very much the McLaren of the Formula Three paddock. There is invariably a pre-season scramble among those race winners graduating from lower formulae to align themselves with Bennetts' team. First to this particular post in 1992 was British Formula Ford champion Marc Goossens. In his first season of Formula Three therefore, the young Belgian seems to have already given himself a headstart.

Highly regarded though Goossens is, much will depend upon who Bennetts selects as his team-mate. At the time of writing there were strong rumours that this could be Oswaldo Negri. If so, this particular Brazilian would undoubtedly be the pre-season favourite. In a WSR car, his combination of pace and experience would be very difficult to beat.

Not that there isn't a whole array of very capable teams lining up to knock WSR off their perch. The Edenbridge team entered the fray for the first time last year, took on the Reynard 913 project that everyone else had steered clear of and, with Gil de Ferran, won three races and stayed in championship contention until the penultimate round. Most of the newly graduating driving talent has been in discussion with the team for this year, among them the Vauxhall Lotus adversaries Kelvin Burt and Warren Hughes, two of Britain's brightest hopes for future Formula One stardom.

In their Formula Ford days Burt and Hughes became very familiar with the name of David Coulthard (main picture) as he romped to the 1989 Junior championships, the Scot last year progressing to Formula Three and winning more races than anyone else, leading the championship for much of the time, but ultimately losing out in the final points battle to Barrichello. He has graduated to F3000 this year, the final step on the ladder prior to Formula One. Aside from Burt and Hughes, other major British talents looking to make a name for themselves in Formula Three include Gareth Rees and Jason Plato.

Emphasising the link between Formula Three and Formula One, a junior Lotus team has been set up to contest the British series, with Lotus principal Peter Collins looking to groom someone to perhaps eventually take over from current Lotus Formula One drivers Johnny Herbert and Mika Hakkinen, British Formula Three champions in 1987 and 1990 respectively... □

Mark Hughes covers the British Formula Three championship for Motoring News

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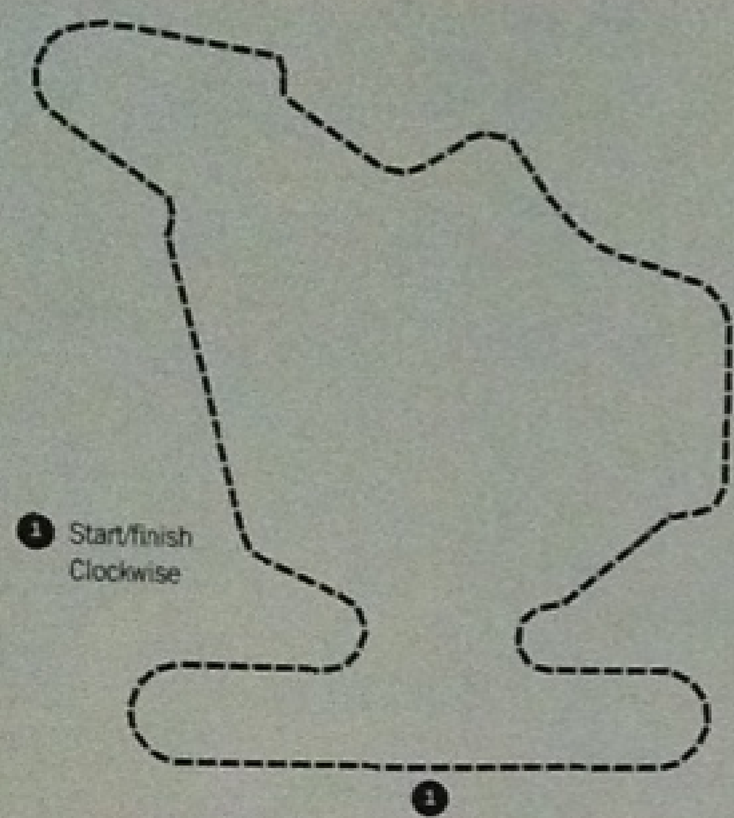
Hungary

AUGUST 16 1992
ROUND 11
Hungaroring, Budapest,

CIRCUIT STATISTICS
Circuit length 2.465 miles (3.968km)
Race distance 77 laps; 189.850 miles (305.536km)
Qualifying lap record Ayrton Senna (McLaren-Honda) 1m 16.147s, 116.538mph (187.595km/h), 10.8.91
Race lap record Bertrand Gachot (Jordan-Ford) 1m 21.547s, 108.847mph (175.173km/h), 11.8.91
1991 winner Ayrton Senna (McLaren-Honda) 1h 49m 12.796s, 104.301mph (167.857km/h)



The Hungaroring, a sinuous, demanding and relatively slow circuit, became eastern Europe's first grand prix venue in 1986, but it has already witnessed several memorable passing movements, including Mansell's outwitting of Senna in 1989. The end of the main straight is the optimum overtaking spot, so spectators in the grandstand expect – and usually get – plenty of excitement. The track gets little use between grands prix and the surface tends to be clogged, forcing drivers to stick to the race line established within a few laps at the start.

Hungaroring is a circuit where race strategy plays an important part. The opportunities to overtake are at a minimum, because the top speed is low, there are no very slow corners at the end of what few straights exist and the braking distances are very short indeed.

To complete the race distance in the least time you should, theoretically, stop for a second set of tyres. From pole position, the right approach, if you ignore race strategy, is to stop just before half distance to put on another set of tyres. You'll lose the normal 25 seconds by doing so but then you should more than make that up on lap times with your new set of tyres.

But when, as in Hungary, overtaking is nigh on impossible, it's quite conceivable that you'll be trapped behind a car that is lapping three or four seconds a lap slower than you.

As Boutsen proved two years ago, the best way to win once in front is to keep on one set of tyres and hold up a queue of cars. All you need do is keep your cool and drive neatly, moving to the inside early coming to the end of the straights before taking the tight inside line into the corners.

Even backmarkers being lapped, running five seconds slower, can be extremely difficult to overtake safely. Hungaroring doesn't offer much of a spectacle. However if you want to see a lot of cars bunched up then this is the place for you. JP

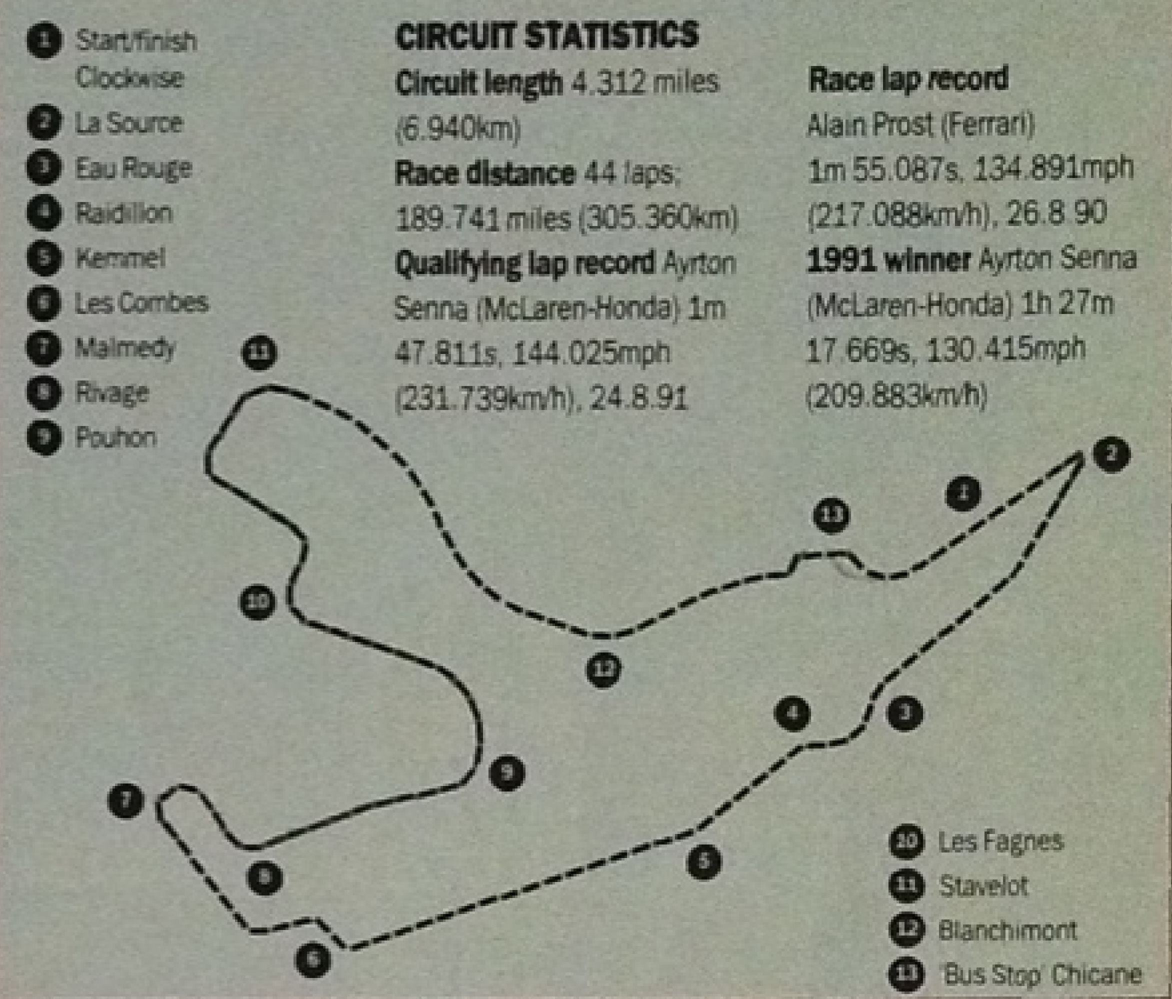
For up-to-the-minute GP information, call 0839 335544. Details p98

Tom Walkinshaw, deep in tactical thought

Belgium

AUGUST 30 1992
ROUND 12
Circuit de Spa-Francorchamps, Francorchamps

CIRCUIT STATISTICS
Circuit length 4.312 miles (6.940km)
Race distance 44 laps; 189.741 miles (305.360km)
Qualifying lap record Ayrton Senna (McLaren-Honda) 1m 47.811s, 144.025mph (231.739km/h), 24.8.91
Race lap record Alain Prost (Ferrari) 1m 55.087s, 134.891mph (217.088km/h), 26.8.90
1991 winner Ayrton Senna (McLaren-Honda) 1h 27m 17.669s, 130.415mph (209.883km/h)



Tucked away in the scenic Ardennes, Spa is one of the most challenging and popular circuits in the world. A hairpin bend just 200 metres from the start causes innumerable problems, and the cars then hurtle downhill into the breathtaking section of Eau Rouge. The rest of the course is smooth and fast; like Hockenheim, though, it can be made treacherous by wet weather. As a test of courage and technical know-how, Spa obviously appeals to Ayrton Senna – the world champion has won the last four Belgian Grands Prix.

The unique feature about Spa is the hazardous hairpin, which leads to heart-stopping moments for team managers as the cars jostle for position approaching the corner from the start.

The safe line to take is on the inside, where, inevitably, the queue will be longer. There's always somebody who'll take a flier from the start and try going up the outside, but that has its dangers because you can get boxed out, and there is not much you can do apart from wait for the queue to go by and tuck in behind them again.

You've got to be ready to expect the cars to slow down a lot more than normal – it's like stopping on the motorway. What seems to be a gentle coming to a halt in the last few yards becomes a big panic as it looks like you won't make it after all.

The law of the start jungle in Formula One is that you capitalise on any gaps in front of you and you let those behind sort themselves out. If there is a gap to your right you dive for it.

The sensible thing to do, knowing that you've got to stop in another few yards, is to back off the throttle slightly earlier, but as soon as you do somebody will charge ahead. You've got to keep up with the lemmings as much as anybody else. JP

The start at Spa is a mass scramble as drivers jockey for position at La Source hairpin

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Senna's natural successor

Maurice Hamilton reports on Formula One's brightest young star and explains why the 1992 season could see him come of age

The significant point about Michael Schumacher is that nothing in grand prix racing seems to hold any fear for him. That could be a major bonus for the young German in his first full season of Formula One. On the other hand, it could lead to the undoing of a very promising and potentially thrilling career.

Michael Schumacher may have just turned 23, but he has already reached that critical point; he will either go on to greatness or fly off the road as he tries to fulfil the high expectations created by his spectacular arrival on the Formula One scene last August.

He has already proved that he is supremely quick, a natural. That much was evident the first time he sat in a Formula One car. Normally, a novice takes time to become accustomed to the superior performance levels of a grand prix car. Failing that, he will be overawed by the sense of occasion. None of that applied to Michael Schumacher. On his fifth lap, they had to slow him down.

Trevor Foster has spent 15 years working with young drivers, many of them in Formula One. When a deal was done to have Schumacher replace the jailed Bertrand Gachot at Jordan, Foster, in his role as team manager, was given the job of overseeing a brief test run for the newcomer at Silverstone.

'Inside five laps, he was within a second of our best time there,' recalls Foster. 'We brought him in immediately and told him to slow down, not do anything stupid. Out he went again and, straight away, was back to the same sort of speed. I brought him in again for another lecture. He didn't really understand what I was talking about because he told me he found it no trouble at all.'

Events the following weekend were to prove that to be no idle boast. During practice for the Belgian Grand Prix at Spa-Francorchamps, Schumacher qualified seventh, adapting with ease to the specialised demands of qualifying tyres. His race was short-lived thanks to clutch trouble but he had done enough to prove his ability.

Schumacher's presence had been assured by his association with Mercedes-Benz. Chosen as part of a so-called Junior Team to drive sportscars for the motor manufacturer, Schumacher represented a hopeful investment in the future for Mercedes-Benz and for Germany. Mercedes used their influence to find a place for their protégé in Formula One; it would be good for him and, should Mercedes ever find their way back to grand prix racing, then his apprenticeship would have been served and he would be ready to win races for the home team.

In theory, a sound principle. In practice, this investment became nothing more than a commodity in the high-dollar, win-at-all-costs market of Formula One. One weekend, the young star was dressed in the emerald green of Jordan; 14 days later, he was in the canary yellow favoured by Benetton. And in the middle of it all, he had to fend off the voracious media and conduct a 180mph grand prix car in elevated company.

Schumacher sailed through the turmoil as though this sort of thing happened every day. He went out and finished fifth in Italy, scoring his first championship points and out-performing Nelson Piquet, his team-mate and a three-times world champion. You had to remind yourself that Schumacher was only 22. Where would it all end?

A couple of months later in Japan, it almost ended in a heap of wreckage. During qualifying at Suzuka, while rushing through a 170mph left-hander, Schumacher allowed the rear of the Benetton to drift a fraction too wide. Within an instant, the car was beyond even his swift reflexes, spinning wildly and slamming backwards into a metal crash barrier with alarming violence. The impact destroyed the car and brought severe pain to his shoulders and back. Undeterred, he returned to the track in a back-up car and lapped just as quickly as before.

The incident was put down to the fact that this was not his usual car and he was unfamiliar with its handling. But the danger is that, even after such an accident, Schumacher feels himself to be indestructible. That's what they used to say about Ayrton Senna when he habitually stepped out of wreckage during his Formula Three days.

Yet Senna survived, the accidents diminished and he became one of the greatest performers of the current era. If Schumacher ignores the pressure and comes through this next critical period, he could be even better than Senna. □

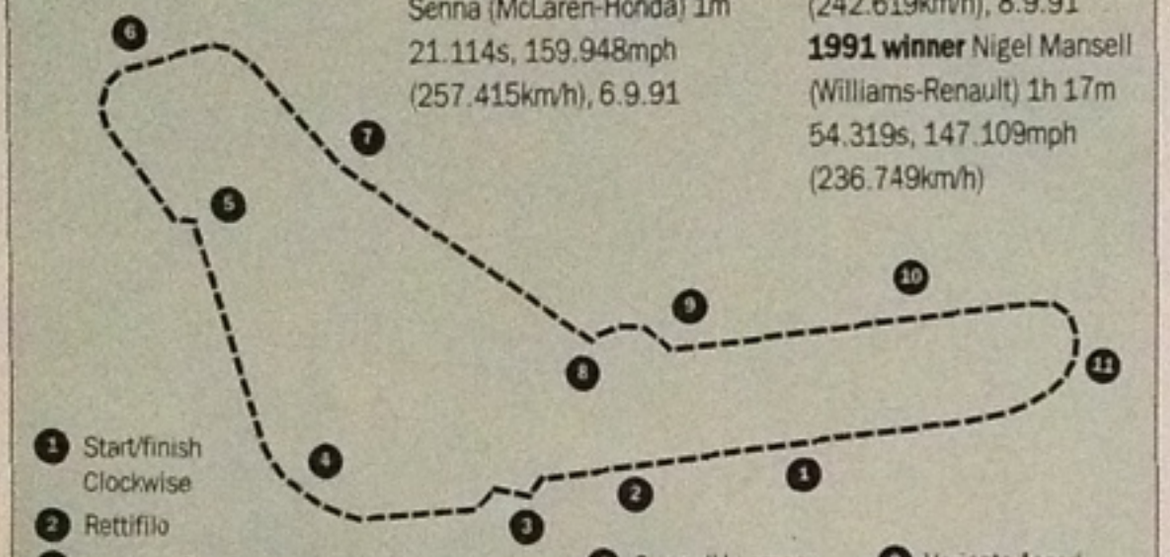
Maurice Hamilton is the motor racing correspondent of The Observer

MAIN PHOTOGRAPH: JEAN-MARC LOUBAT/VANDYSTADT; INSET: HERVE DE VRIES

Italy

SEPTEMBER 13 1992
ROUND 13
Autodromo Nazionale di Monza, Milan

CIRCUIT STATISTICS
Circuit length 3.6039 miles (5.80km)
Race distance 53 laps; 191.009 miles (307.400km)
Qualifying lap record Ayrton Senna (McLaren-Honda) 1m 21.114s, 159.948mph (257.415km/h), 6.9.91
Race lap record Ayrton Senna (McLaren-Honda) 1m 26.061s, 150.756mph (242.619km/h), 8.9.91
1991 winner Nigel Mansell (Williams-Renault) 1h 17m 54.319s, 147.109mph (236.749km/h)



Situated in a leafy park near Italy's most fashionable city, Milan, Monza is steeped in history and tradition and is home to the most partisan motor racing fans in the world. The *tifosi*, while willing to applaud any act of courage or daring, reserve their most intense ardour for Ferrari. An exceptionally fast track with some of the most famous corners in Formula One, Monza has been tamed slightly in recent years by the introduction of the Goodyear and Ascari chicanes. But it remains an exhilarating circuit that rewards adventurous driving, particularly along the pit straight in front of the grandstand where the cars reach speeds of around 200mph.

Because it's so fast in places Monza gives you quite a dilemma concerning wing settings. You need minimum wing setting for the long fast straights, while for the slow chicanes you ideally want to stack on the downforce. Generally the compromise is made with a bias in the direction of straightline speed. You run pretty minimal wing at Monza.

When you run very light downforce levels, the car tends to understeer and oversteer more than it would do normally. On those very quick corners, like the second Lesmos that is taken flat out in fifth, the actual balance of the wings front to rear is very critical. If you have too much front downforce the front will be pinned to the road and the back will slide out first, causing oversteer. The reverse situation causes understeer.

In the race itself you take off a little bit of downforce, because you've got to have competitive straightline speed. But if you're a midfield runner you don't need the same straightline speed as the McLaren. You need downforce levels that keep you competitive with your real rivals. JP

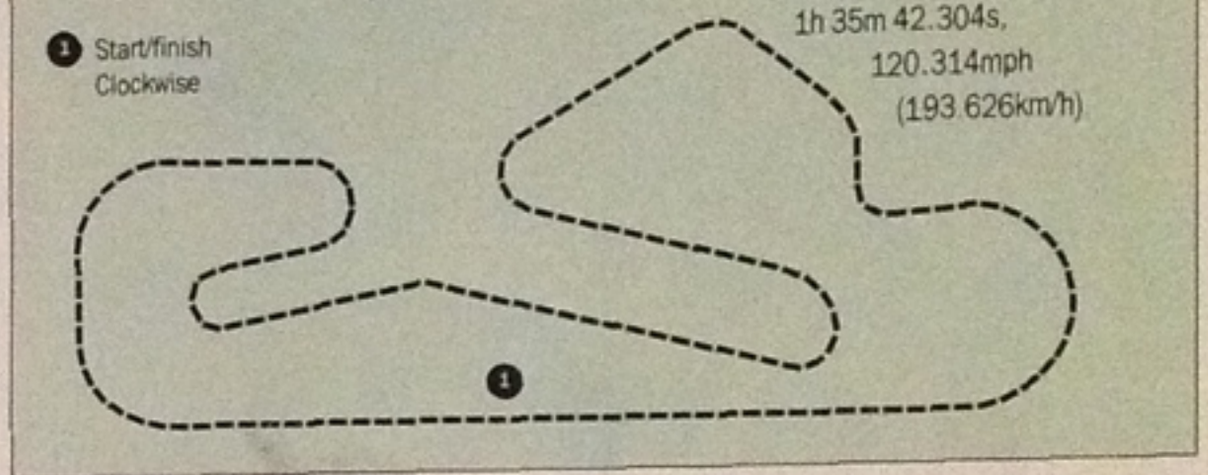
PHOTOGRAPHS, LEFT: HERKE DE VRIES/RIGHT: PASCAL RONDEAU/ALLSPORT

Monza's fanatical *tifosi*, the world's most passionate and partisan grand prix crowd

Portugal

SEPTEMBER 27 1992
ROUND 14
Autodromo do Estoril

CIRCUIT STATISTICS
Circuit length 2.703 miles (4.350km)
Race distance 71 laps; 191.913 miles (308.850km)
Qualifying lap record Riccardo Patrese (Williams-Renault) 1m 13.001s, 133.297mph (214.518km/h), 21.9.91
Race lap record Riccardo Patrese (Williams-Renault) 1m 18.306s, 124.264mph (199.985km/h), 23.9.90
1991 winner Riccardo Patrese (Williams-Renault) 1h 35m 42.304s, 120.314mph (193.626km/h)



Strong neck muscles are a prerequisite for success at Estoril, one of the most physically demanding circuits in the world. Purpose-built in the hills behind one of Portugal's most popular resorts, the track is prone to unpredictable Atlantic winds that can sabotage the technical crews' careful pre-race planning and play havoc with the track surface by blowing dust and dirt onto the tarmac. There are few obvious passing spots at Estoril, the corner at the end of the straight being one of them, and a tight, accurate line is a necessity through the infield. As well as the drivers themselves, brakes and transmissions tend to take a pounding at Estoril.

At Estoril braking control is very important, because you've got a number of corners where braking is very heavy. Braking on a GP car is one of the most violent parts of driving.

The brakes (discs and pads) are carbon fibre. They have two advantages – they're about a quarter of the weight of steel brakes and you are able to get much more bite out of them.

The moment you dab the pedal it feels just like a mighty hand pulling the car back – steel brakes can never give you such instant retardation. If you brake hard at 180mph you will lose 70mph in the first second you brake, and you will probably come to a complete stop within 100 metres.

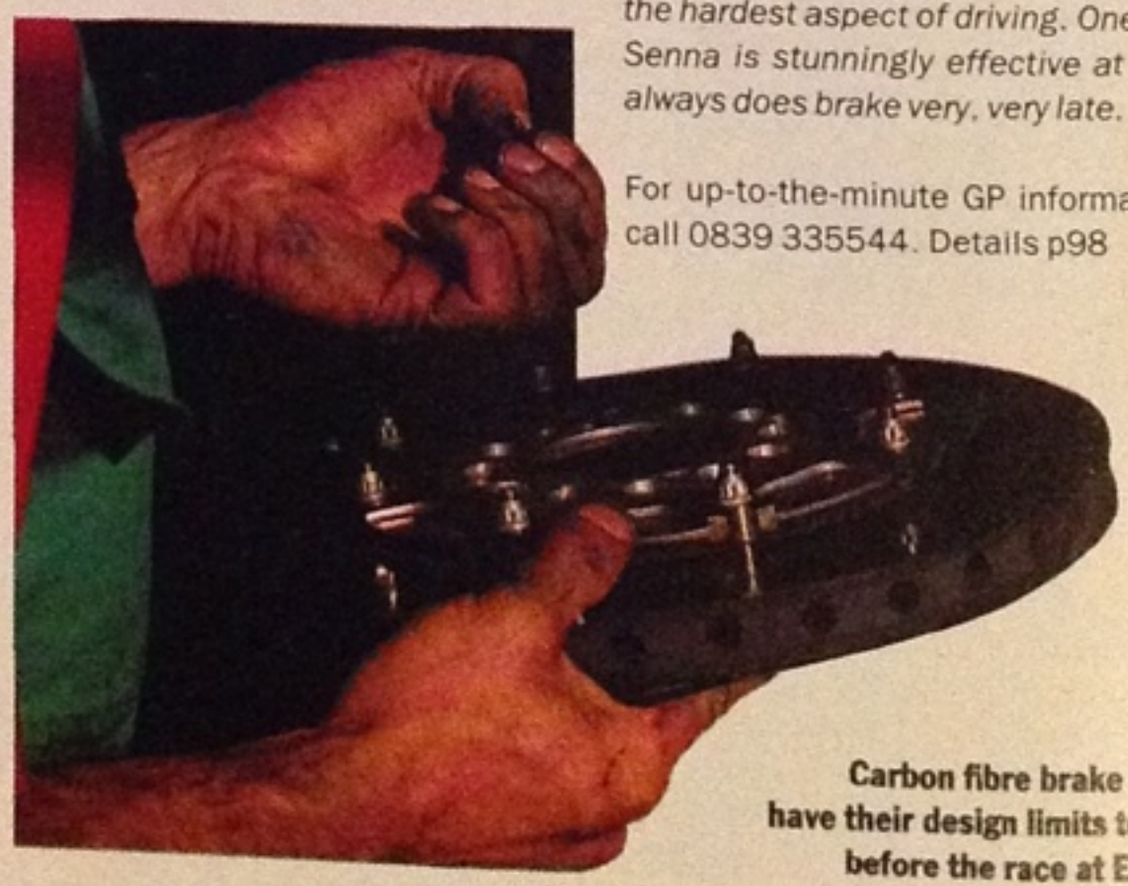
The braking force you can apply has to be reduced as your speed reduces, when the amount of available grip you have lessens as the downforce reduces. If pedal pressure is maintained you are sure to lock the car's wheels at slow speed.

That's why you don't tend to see a driver locking the car's wheels at the beginning of a braking phase, but towards the end of the phase instead.

This is very hard physically on the foot, the neck and the head, and mentally you've got an awful lot to think about. You might be trying to outbrake somebody, so you'll be in close proximity to another car.

Braking and turning into a corner is the hardest aspect of driving. One that Senna is stunningly effective at – he always does brake very, very late. JP

For up-to-the-minute GP information, call 0839 335544. Details p98



Carbon fibre brake discs have their design limits tested before the race at Estoril

THE DECLINE OF FERRARI

Scarlet fever

Ferrari went into 1991 with a renewed self-belief. So what went wrong? Nigel Roebuck reports on the malaise afflicting what was once a great team

Before the start of the 1991 season, Ferrari people were buoyant. The previous year, their 641 had been honed to the point that, in the last few races, it was the best all-round car in Formula One. If the Italian V12 had lacked Honda's raw top-end power and Renault's silky throttle response, a wonderfully balanced chassis and excellent aerodynamics had more than compensated.

Through the winter the confidence built. Wherever they went, it seemed, Alain Prost and new team-mate Jean Alesi set awesome lap times. In 1990 the great Prost had won five grands prix in a Ferrari, the first man to do so for 15 years. For 1991, Prost was everyone's favourite to win a fourth world championship. In the event, he won not one race.

Amid the pre-season euphoria at Maranello, Prost alone had been wary. Ferrari had no new car for 1991, merely a revamp, modified to meet FISA's new wing regulations. These were to contribute to the team's undoing: when applied to the Ferrari, they meant a loss of almost a fifth of the car's total downforce.

When the new McLaren and Williams appeared, the extent of Ferrari's problem became clear. On occasion, indeed, the red cars were unable to match their lap times of the previous year, whereas McLaren (Honda) and Williams (Renault) had conspicuously improved. Prost grew more and more frustrated with the virtual absence of cohesion – management – in the team, and it increasingly maddened him that his suggestions went unheeded. He won a moral victory of sorts when the permanently-tanned, alleged team manager, Cesare Fiorio was sacked in May, but the appointment of a three-man committee to replace Fiori told you all about Ferrari in the modern era.

When Enzo Ferrari was alive, Niki Lauda commented, you knew exactly where you stood. 'For Alain, though, it must be a nightmare,' he added. 'Which faceless Fiat executive does he go to?'

Prost would roll his eyes at the question. 'There are so many bosses, at so many levels,' he would say. 'Make a friend of one, and you automatically make an enemy of three others.'

At mid-season there was a further revamp of the car, now known as the 643, and it briefly raised expectations. On its debut, in France, Prost led most of the way, before giving way to Nigel Mansell's far superior Williams-Renault.

On bumpy circuits, though, the car proved almost undrivable, particularly so when the fuel load lightened in the second half of a race. And reliability was shabby, Prost and Alesi frequently retiring with blown engines.

In the meantime, most of the Italian press followed the time-honoured practice of blaming Ferrari drivers for the poor performance of Ferrari cars. Prost is a proud man and he began publicly to tell it how it was and the hierarchy reacted with displeasure.

Eventually, after a Japanese Grand Prix in which he finished a distant fourth, Alain disgustedly compared his car with 'a truck without power steering'. Within a week, Ferrari fired him, thus severing its ties with the one man who could remember how it was to win championships.

The great irony was that, within a short time, the company had appointed Luca di Montezemolo to take charge of its racing programme, and here was someone Prost could have respected. Montezemolo, after all, had been team manager during the great Lauda years in the mid-Seventies.

Whatever the Ferrari team takes into the 1992 season, there'll be no room for complacency, for the lessons of last year are surely too fresh in the mind. Chassis specialist Harvey Postlethwaite has gone back to Maranello, joining an already strong design team, but it may be some time before the cars are a match for McLaren and Williams.

Alesi had a dispiriting first season with the team of his dreams, but he now inherits the evocative number 27, partnered by Ivan Capelli, whose talent was squandered by Leyton House.

Capelli is well aware of the pressures awaiting him. 'I like Ivan,' Prost chuckled recently, 'and I wish him well at Ferrari. But he must learn to lie. All he has to do is tell the Italian journalists the Ferrari is the best car, with the most powerful engine, and he will have no problems.' □

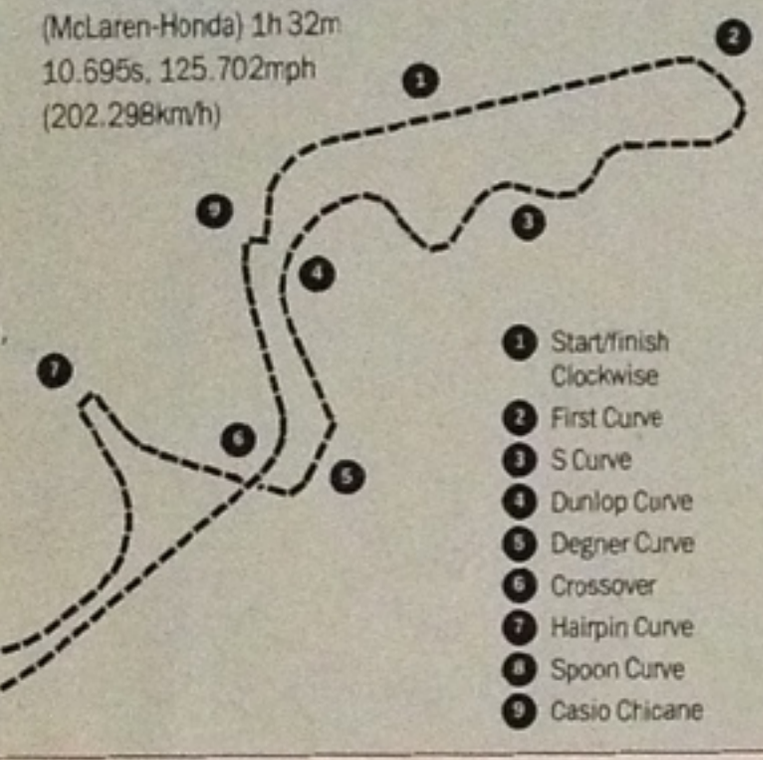
Motor racing writer Nigel Roebuck is grand prix editor of Autosport

Japan

OCTOBER 25 1992
ROUND 15
Suzuka, Shiroko

CIRCUIT STATISTICS
Circuit length 3.641 miles (5.859km)
Race distance 53 laps; 193.117 miles (310.792km)
Qualifying lap record Gerhard Berger (McLaren-Honda) 1m 34.700s, 138.412mph (222.729km/h), 19.10.91
Race lap record Ayrton Senna (McLaren-Honda) 1m 41.532s, 129.195mph (207.919km/h), 20.10.91

1991 winner Gerhard Berger (McLaren-Honda) 1h 32m 10.695s, 125.702mph (202.298km/h)



With typical Japanese resourcefulness, the Suzuka circuit, part of a large leisure complex, was built in a figure-of-eight shape to save space. In recent years it has been the scene of high drama and not a little controversy as championships were won and lost on its corners and through its chicanes. A fast and demanding circuit, it has an unusual downhill straight and frequent changes of elevation and direction that make overtaking extremely difficult. Concentration and a steady rhythm are the keys to success at Suzuka.

Driving at a constant speed round a corner a car has a steady chassis balance and however that balance is set the car will have a characteristic understeer or oversteer. On a steady throttle that characteristic will be consistent throughout the corner, but when a driver accelerates or brakes, the balance of the car will change.

When you increase the throttle in the middle of a corner the front of the car will lift, reducing the grip of the front tyres and inducing understeer. When you lift the throttle or brake the opposite happens as the nose dips and the front tyres have more force exerted through them, increasing the grip at the front end.

These factors allow a driver to change the balance of his car. If he wants more understeer he can accelerate gently, if he wants oversteer he can lift off or touch the brakes.

If you have a car that inherently understeers you can counteract that by being more violent on the brakes. Similarly, if your car tends to oversteer you might slow up earlier to avoid getting too much of a nose-down attitude on the car into the corner. Then the inherent oversteer allows you to power progressively all the way through the corner.

On a combination of corners like the S curves at Suzuka, the driver has to go hard on the power and then lift off for the next corner and so on – on the power, lift, on the power, lift. It's essential for the driver to tune his driving style to optimise the balance of the car and so give himself the chance of a good lap time.

Throttle-opening technique is critical to chassis balance. If a driver chooses to accelerate hard in a low gear he will provoke oversteer in the car while progressive opening of the throttle will induce the opposite, understeer. JP

Senna celebrates clinching his title

PHOTOGRAPHS: LEFT: PASCAL IRONDEAU/ALLSPORT RIGHT: JOHN DUNBAR/ZOOOM

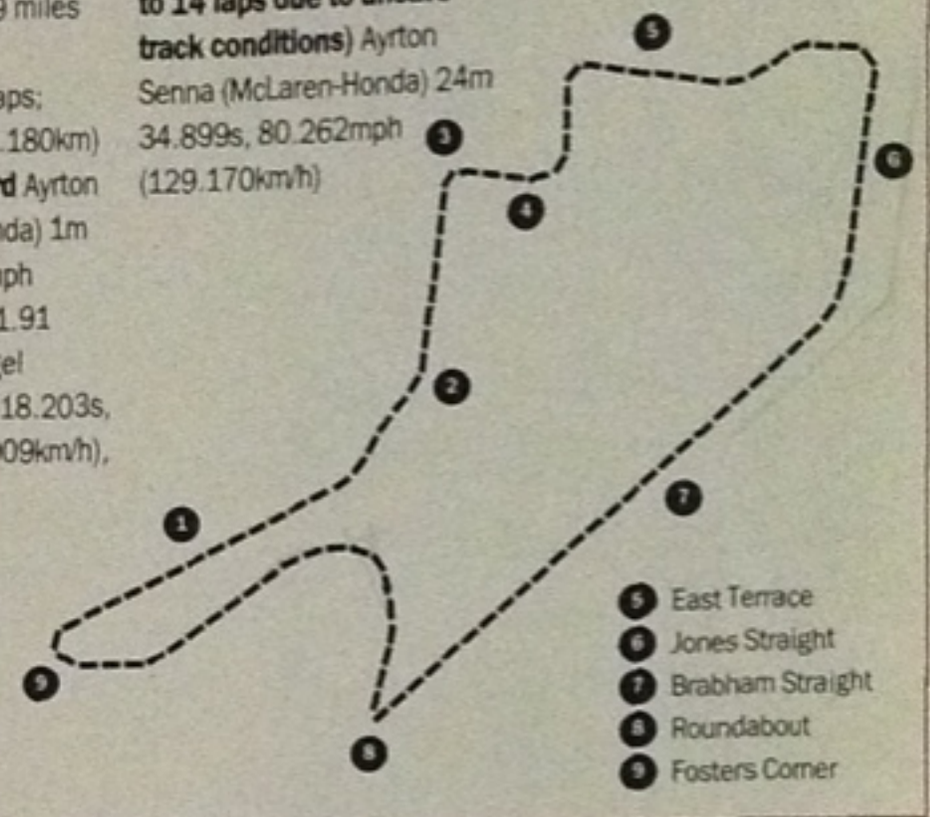
For up-to-the-minute GP information call 0839 335544. Details p98.

Australia

NOVEMBER 8 1992
ROUND 16
Adelaide Grand Prix Circuit, Adelaide

CIRCUIT STATISTICS
Circuit length 2.349 miles (3.780km)
Race distance 81 laps; 190.292 miles (306.180km)
Qualifying lap record Ayrton Senna (McLaren-Honda) 1m 14.041s, 114.115mph (183.693km/h), 2.11.91
Race lap record Nigel Mansell (Ferrari) 1m 18.203s, 108.123mph (176.009km/h), 4.11.90

1991 winner (race reduced to 14 laps due to unsafe track conditions) Ayrton Senna (McLaren-Honda) 24m 34.899s, 80.262mph (129.170km/h)



Adelaide has a reputation as one of the best organised and most welcoming grands prix, so it's appropriate that it brings the season to an end. Unfortunately, the Australian city is also gaining notoriety for its ill-timed rain storms. In 1989, Thierry Boutsen won a race that many felt should never have started, and last year's downpour caused the race to be abandoned after 14 of the 70 laps. On the rare occasions when the race has been run in normal conditions, the street circuit is one of the best of its type, with a greater variety of corners than most.

Adelaide is about the best of all the street circuits, which by their very nature are bumpy and don't have the same grip levels as the purpose-built circuits. The biggest challenge facing the drivers here is the need to alter their driving line to use the road's camber. On street circuits the corners are not banked and the camber predominates. So the highest point of the road is in the middle.

The turn in point and the exit point are almost certain to be cambered in the opposite direction from the normal banking, which means that you will get less grip right on the outside of a corner than you would in the middle of the road.

The quickest line may well not be the same as the classic line on a normal circuit – wide turn in, clip the inside, out on the outside. Take the left-hander at Flinders Street. You come round the right-hander and turn in, not from the right hand side of the road where you will lose grip, but from the middle of the road. That way the camber is working for you. Then you clip the inside, before running out to the middle of the road again. JP

Alesi clips a kerb taking the optimum racing line on Adelaide's cambered corners

East beats West

With Honda once again playing a crucial part in the team to beat in 1992, Mike Doodson reports on how the Japanese have been inspired by the engine manufacturer's unprecedented success

Money talks in Formula One, and the language which is being heard increasingly is Japanese. It was at the British Grand Prix of 1983 that Honda returned to the Formula One fray after an absence of 15 years, and Honda's success has helped to rewrite the record books in association with world champions Nelson Piquet, Alain Prost and Ayrton Senna.

Honda has also set the pace in drivers' remuneration. When Nelson Piquet signed to drive for Williams-Honda in 1986, his record £2 million retainer was three times what he had ever earned before. Only five years later, Honda was rumoured to have 'topped up' (to £7 million) the inducement which would eventually persuade Ayrton Senna not to switch his allegiance to Williams and Renault.

In Japan, motor sport's popularity has turned from a trickle into a flood. Drivers like Satoru Nakajima and Aguri Suzuki are household names, and last year there were no fewer than 4.4 million applications for the 100,000 seats at Suzuka for the Japanese Grand Prix, the penultimate race of the season.

Yet when Honda first reappeared it was a low-key affair which was reported only in the specialist press. The first win for the new turbo came with Williams at Dallas in 1984, and by 1986 the Williams-Honda drivers were in hot contention for the world championship.

Suddenly, the efforts of European manufacturers like Renault, BMW and Alfa Romeo began to look distinctly second-rate in comparison. All three of them eventually pulled out, leaving TAG-Porsche virtually alone to defend European honour. And though Ford redoubled its efforts, and Renault has returned stronger than ever, it is Honda who continue to set the pace. Six consecutive constructors' titles from its association with Williams and, later, McLaren prove the point.

Senior managers at Renault see the racetrack rivalry with Honda as far more than a straightforward sporting contest. It is also a struggle for the prestige which will ultimately sell cars in the showroom. Indeed, although Renault's racing division now wisely concentrates solely on making and developing engines (with Ligier joining Williams as a client this year), its Formula One budget is several times larger than it was when it was racing its own cars between 1977 and 1985.

After three years with Honda engines in the mid-Eighties, Nigel Mansell knows more than most about the strengths of the Japanese. 'Last year, at a point in the season when our engines were developing more power than the Honda V12 in Senna's McLaren, the Honda people performed a miracle,' he said ruefully. 'They produced a totally new engine in three weeks.'

While Honda appear to be on course for more celebrations, elsewhere in the Formula One rock garden everything is not as rosy as it should be. Subaru had a brief and disastrous flirtation with Coloni in 1990, and last year it cost Ken Tyrrell and his sponsors an estimated £3 million to discover that Honda engines were by no means an automatic guarantee of victory.

Nor have Honda's immaculately high levels of technology and commitment been adopted by other Japanese involved in the Formula One market. Japan vigorously embraced the sport when the economy was buoyant, but several of its most enthusiastic converts have since burnt their fingers badly.

Early last season the French-based Larrousse team was hit by the collapse of its part owner, a Tokyo-based speculator, and was put into legal administration. Then the owner of the Leyton House team was arrested following an alleged bank fraud. Having flirted with closure, both teams expect to survive, but with European partners.

If they had to pay for their specialised V10s and V12s – not to mention the cost of developing them – engine bills would constitute the largest item on any Formula One team's budget. Yet the team which enjoys free engines is in a better position than its rivals to secure worthwhile sponsors. It is for this reason that the competitive gap is growing between the front-runners and the smaller fry.

At present the four top teams are secure thanks to their association with major constructors. McLaren has Honda on what *it* describes as an 'open-ended' contract, Williams is with Renault, Ferrari is owned by Fiat and Benetton has Ford. They take most of the *money*.

So, will the Japanese bubble burst? Formula One may have been a fad which will not be sustainable. But local observers believe that it has found a niche there and will continue to attract a large following. Even when the modishness eventually wears off, Formula One offers elements such as its intrinsic knicknackery – not to mention the danger – which should continue to appeal to Japanese spectators.

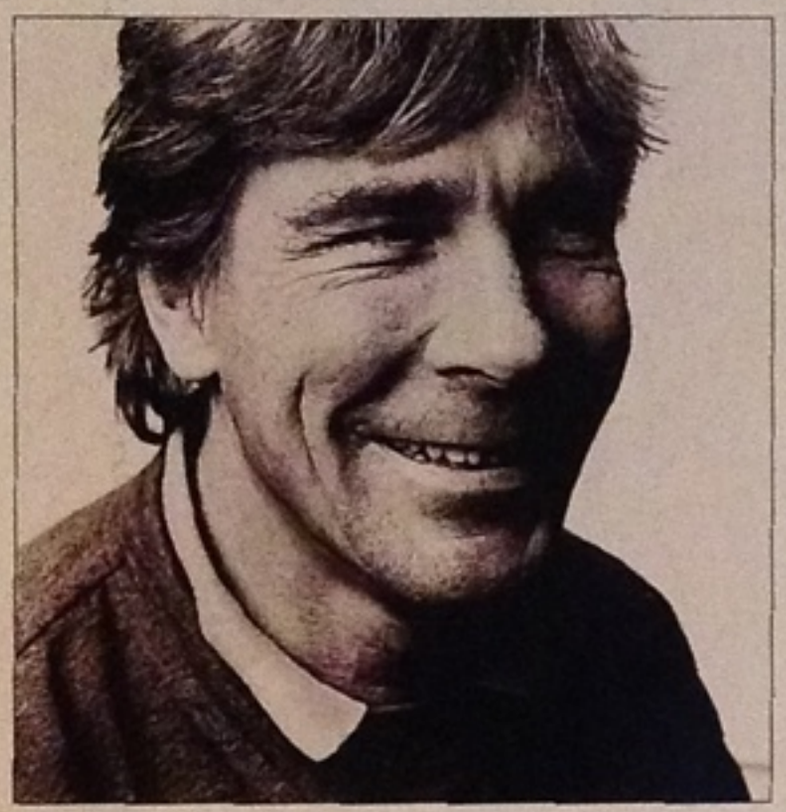
And when the recession fades, will the Nissans and Toyotas be prepared to let Honda steal all the publicity limelight? If they make a commitment to the sport, the quiet revolution which Honda started in 1983 will carry Formula One to still higher levels of popularity. □

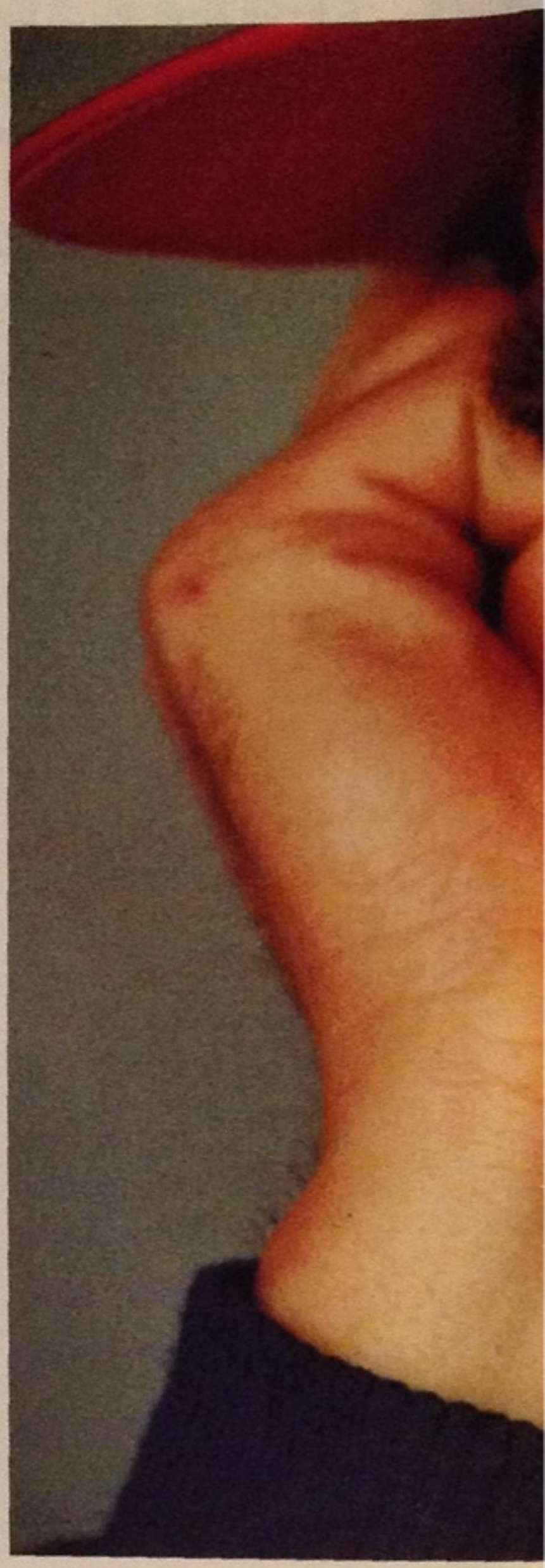
Mike Doodson is a motor sport journalist and the BBC's grand prix lap charter

Japanese appetites for Formula One have been whetted by six winning years of Honda-powered success

PHOTOGRAPHS: PASCAL RONDEAU/ALLSPORT

A CHAMPION'S VERDICT





On March 1 at Kyalami, Nigel Mansell launches another bid for the one title which has eluded him for so long. James Hunt, former Formula One world champion, discusses the qualities which could lead the nearly man of British racing to a successful championship challenge

Nigel Mansell is undoubtedly one of the most exciting racing drivers of the modern era. He is fast, courageous, always willing to give it everything he has got, and overtakes where others wouldn't even dream of it. But he has not won a world championship. If he is to claim the title this year, instead of coming an agonising second, he has to avoid the pitfalls that have spoilt his chances in the past.

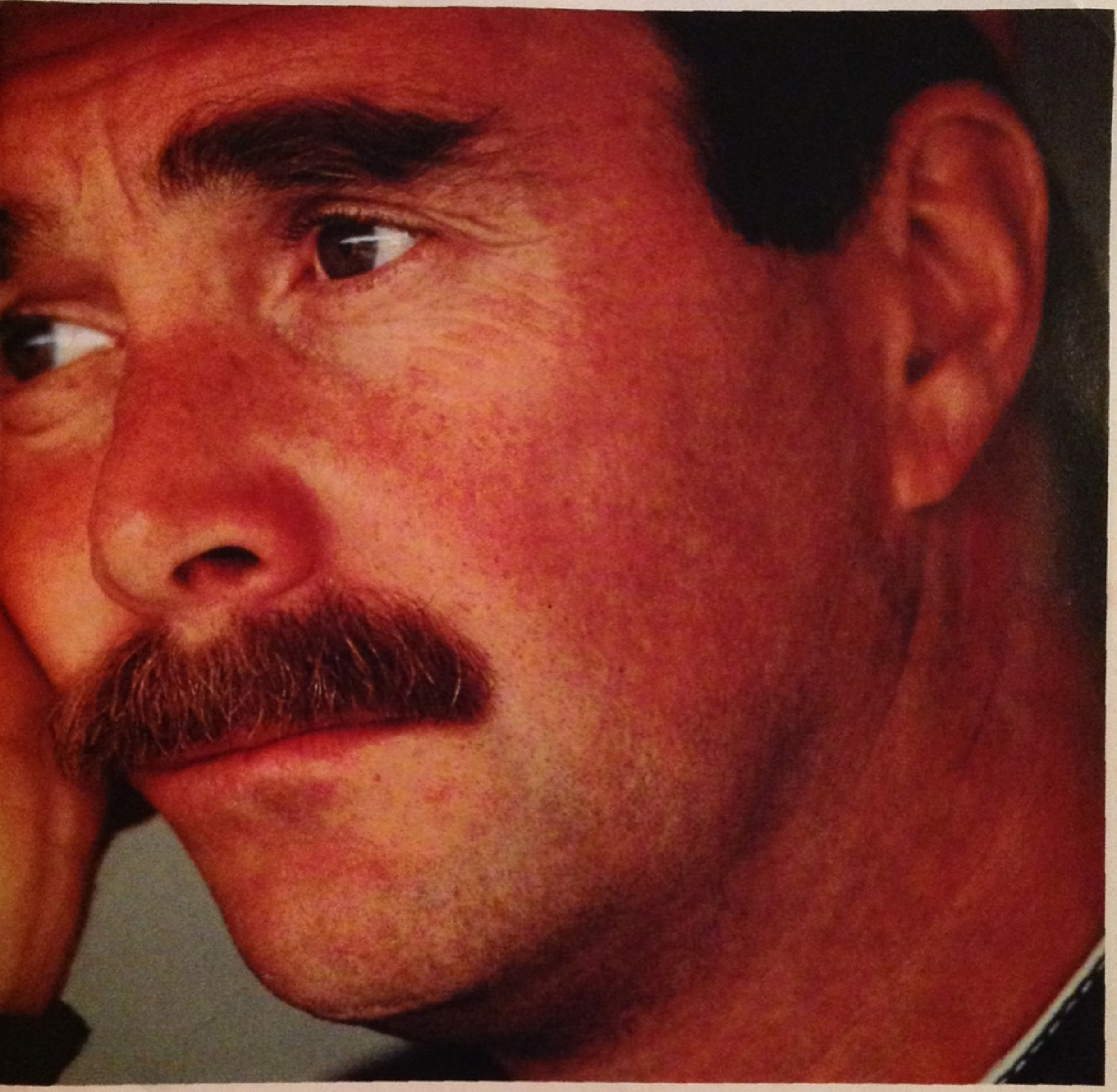
Some observers feel that Mansell is too rough on his car. He looks heavy handed because he throws the car around and really races it but that is what a Formula One car is all about. This sort of treatment is acceptable and if the car can't take it then it is the engineer's problem not the driver's. There is a distinct difference between driving flat out and mechanical abuse. Teams for whom Nigel Mansell has driven have accused him of various things (he is not the easiest person to work with) but mechanical abuse is not one of them. He may not be the smoothest driver, one that makes it all look effortless like Alain Prost, but he really gets to grips with the car. This is his style of racing and motor racing fans and his team would not want to see him drive in any other way. He is one of the few drivers who isn't overawed by Ayrton Senna and is willing to take him on. Here is a driver who will always attack, always try his utmost as soon as the light turns to green and will always try to overtake.

This is not the kind of overtaking which requires lap after lap to set up, he takes his opportunities with confidence. Remember Monaco last year when he muscled his way past Alain Prost under braking for the chicane to set up his best finish at Monte Carlo.

His aggression and motivation are his trademark. The Italian fans loved him when he drove for Ferrari. He drove brilliantly and, because he did not speak Italian, he kept the persona of a great racer, untainted by what he may or may not be outside the car. He simply let his driving do the talking.

So Mansell is a true racer; he is very exciting to watch and that is the reason for his tremendous popularity with the fans. But why has he not been crowned world champion?

In any season several races will be 'lost' through matters beyond the control of the driver – the most obvious being mechanical failure. Therefore to win the championship the driver can afford only one error of his own. History shows that that was the case when only the best 11 results counted. Now that they all count, the drivers 'infallibility' prob-



ably becomes even more crucial. There is no denying that Mansell had car problems last year – so did Senna. A car is always going to break down; you have to build that into your start of season equation. But a driver is only allowed one mistake in the year he wants to win the world championship. Mansell made costly mistakes in '86 and '87 and he made at least two last year – in Canada and Japan. These two mistakes effectively cost him 19 world championship points (nine points in Canada and a potential 10 points in Japan) which were more than sufficient to have changed the whole course of the championship.

At the Canadian Grand Prix Mansell led from the start and appeared to have driven an exemplary and dominant race. He was in total control but on lap 65 of the 69 laps he suddenly put in the fastest lap of the day – a fact which raised eyebrows at the time and set the scene for the near farce that followed.

On the final lap Mansell was waving to the crowd anticipating his first victory of the season. As he was changing down for the hairpin at the top of the circuit, he inadvertantly selected neutral and then compounded the error by letting the engine stall. The result was Mansell had no power to reselect a gear and therefore he couldn't even bump-start the engine back into life. Mansell was awarded sixth place and one point.

Japan was more crucial because it was the end of the season and he still had a chance to wrest the title from Senna. From the start of that race the tactics of the McLaren team were such as to put pressure on Mansell. Berger, starting from pole position, got a good start and began building on a lead. Senna was quite content to drive conservatively and keep Mansell in third position, safe in the knowledge that the Englishman needed the 10 points to have any chance of still winning the title at ▷

MAIN PHOTOGRAPH: PASCAL RONDEAU/ALLSPORT. INSET PHOTOGRAPH: NIGEL PARRY

the final round in Adelaide. Mansell's mistake there was that he lost concentration or rather he was concentrating on the wrong thing. He got too close to Senna at a bend that is not an overtaking opportunity and was so busy thinking about tactics, working out how to overtake, that he forgot about driving the car – a mistake he would never normally make. The car drifted wide, moved too much off line and slipped over the kerb into the gravel trap. He compounded the felony by blaming the brakes (which were fine) an excuse which did not endear him to his team.

His championship challenge also received a severe blow during a routine pit stop at Estoril when a lapse in communication among the Williams pit crew caused him to be waved back into the race before the right rear wheel had been secured. The wheel flew off as Mansell accelerated away and the Williams came to a halt in the fast lane of the pits. A wheel was quickly fitted to the car but in contravention to the regulations and Mansell was later disqualified.

This was obviously not Mansell's mistake but potential world champions shouldn't put their destiny in anyone else's hands. They must be to a large extent masters of their own fate. Mansell had established a lead of 18 seconds but the McLarens of Berger and Senna had both made very quick pit stops – the Brazilian stopping for four fresh tyres in only 5.04secs. However, there was no real pressure on the Williams pit team and Mansell could have radioed in before his pit stop and just told them to take everything slowly, make sure there were no mistakes and not to panic. He had a comfortable lead and the pit crew could have used some of this time advantage to ensure the change was completed without mistakes. As long as he could leave the pits still in front of the McLarens the superiority of the Williams would have re-

For all his ability and courage he must get to grips with the huge pressures of the job

Left: at Monaco last year, Mansell showed typical tenacity to take second place. Above the view from the hot seat

established his advantage.

What happened was not his fault but if a driver is going to win a world championship he must not be afraid of assuming control. For all his aggression, driving ability, experience and courage Mansell must learn to handle the enormous pressures that bear down on today's sporting heroes both on and off the track. Look at his record and you will see he is at his most vulnerable when the pressure is on. His mistakes in Canada and Japan were uncharacteristic, he certainly had the knowledge and experience to avoid them. And in Portugal pressure stopped him from controlling, or at least anticipating, a situation so as to minimise the risks inherent in tyre changing.

I would have thought that Mansell had his best chance of winning the world championship last year. Thanks to the ability of Patrick Head, the Williams FW14 had the best chassis and Adrian Newey developed what was aerodynamically the most superior car in the field. With the very competitive and reliable Renault engine the Williams team was, on its day, virtually unbeatable as victories at Mexico, Magny-Cours, Silverstone, Hockenheim, Monza, Estoril and Barcelona showed.

If they get their active suspension to work along with their autostart system Williams do have a chance of maintaining their superiority over McLaren in 1992 but McLaren have more scope to improve the aerodynamics of their car and I suspect Honda have more scope to develop their engine.

Despite the lack of reliability of the Williams in the early part of last season, Mansell still suffered from a relatively slow start to the year and took some time to display superior driving performance to his team mate. Riccardo Patrese had an excellent, rejuventated year and from the very start of the season the Williams' number two driver was quicker than ▷

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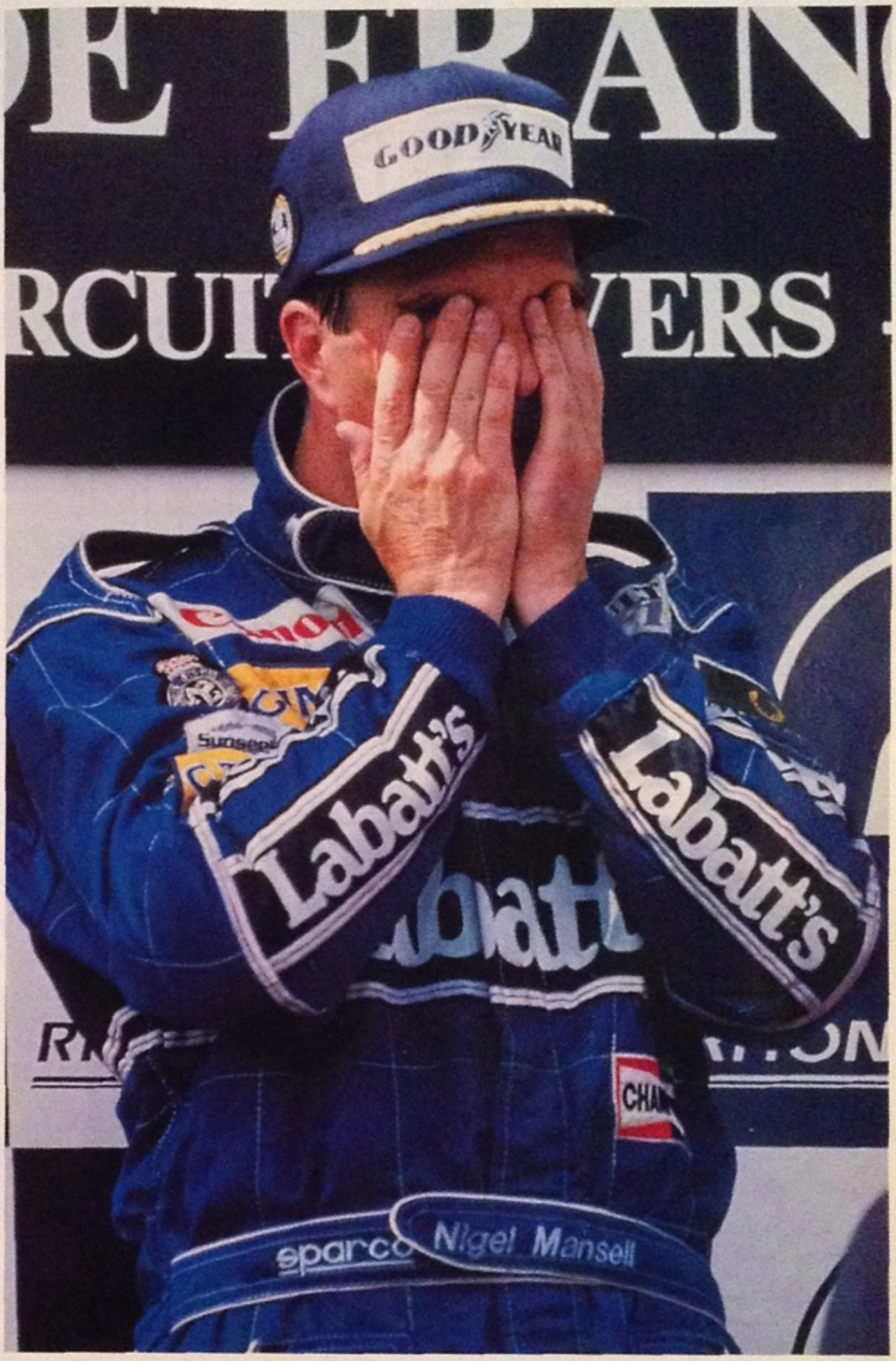
He really gets to grips with the car. This is his style and the fans would not want it any other way



At last. Mansell's first victory of '91 at the inaugural French Grand Prix – the first of five wins

Mansell and qualified higher than him in the first seven races. Admittedly, Mansell often had to resort to qualifying in the 'spare' car but Patrese's pole positions in Mexico and France were ample demonstration of his ability. He translated this qualifying success into race success in Mexico, driving brilliantly to foil a hard-charging Mansell.

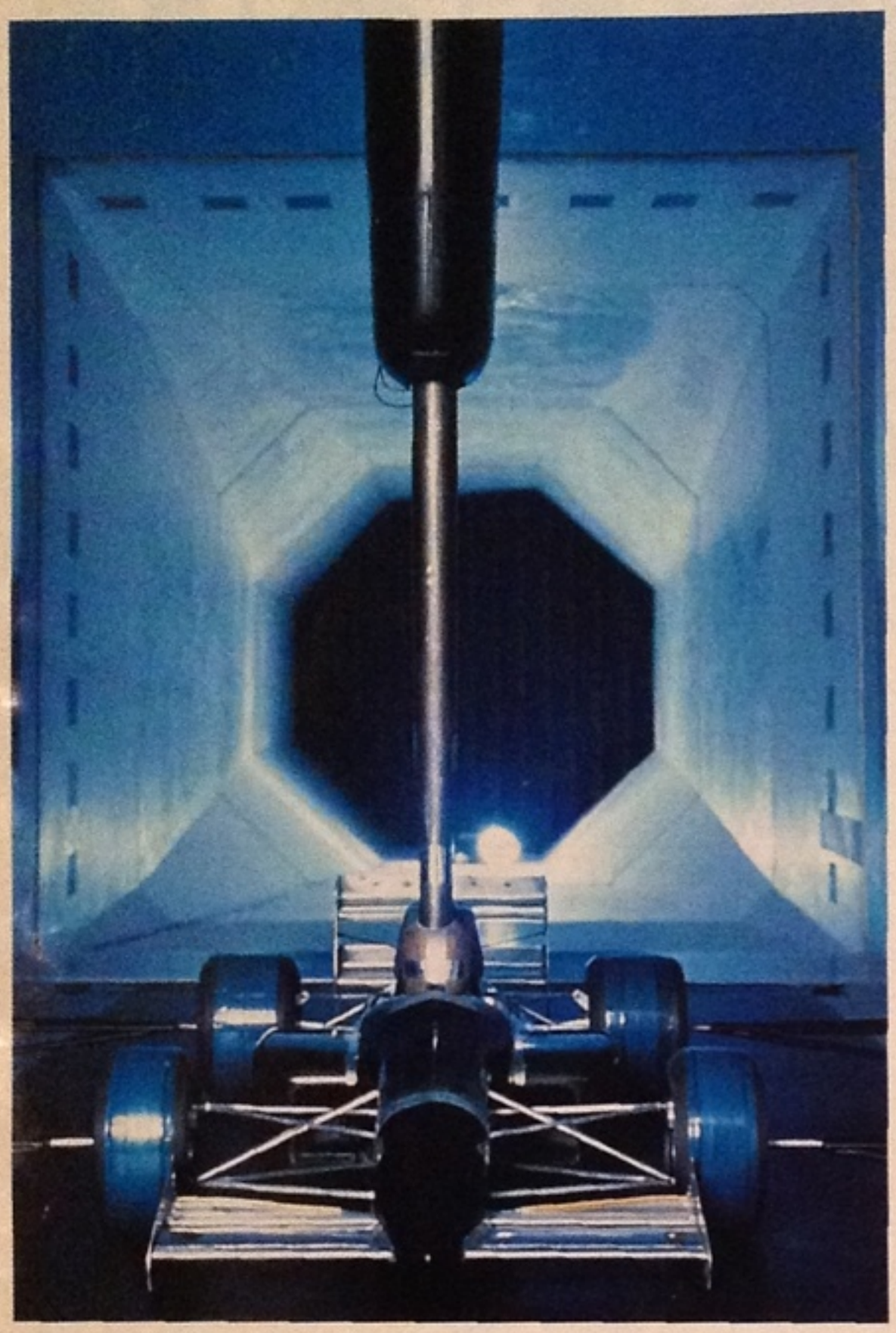
Approaching mid-season Patrese must have harboured thoughts of winning the world championship. These ambitions were dampened at the British Grand Prix after he cut across Gerhard Berger and were effectively extinguished at Spa when he was forced to start from 17th on the grid instead of his expected second place behind Senna. Nevertheless he contributed his all to Mansell's bid for the championship and, as importantly, to his team's challenge of wresting the constructor's title away from McLaren.

Patrese's performance last year will no doubt convince him that he has a great opportunity of winning the driver's championship in '92 and he will prove extremely competitive and push Mansell all the way. If Mansell gets into a good championship-winning position then Patrese will be very helpful in harrying Senna and taking points off the champion.

Meanwhile, Mansell has to examine those mistakes which turned three world championship-winning chances into near misses. That examination should prove to him that all he has to do is drive *normally* – just as he does when the title is not staring him in the face. That should be easy, in theory, but with time running out in his career and the potential for self-doubt cast by those past near misses, let's hope that he can finally translate theory into practice and become world champion. □

James Hunt has joined Murray Walker for BBCtv's grand prix coverage since 1980

PHOTOGRAPH: PASCAL RONDEAU/ALLSPORT



THE WINDS OF CHANGE

The right balance between speed on the straights and downforce on the corners is an essential ingredient of Formula One success and it is up to the practitioners of the obscure science of aerodynamics to find it. Laurie Caddell reports on the ongoing quest to control the air that flows over a moving car

A black art is one that is something of a mystery to most of us, and there is none blacker than the study of aerodynamics. For the most part we can not see what the aerodynamicist does, but their job of work is vital to grand prix car design.

The history of the racing car has seen a steady and continuous development of power, chassis and suspension, to the point where the designer can now set down his brief for a particular engine of a particular size to be incorporated into a chassis constructed with the highest technology materials, attached to state-of-the-art suspension.

And then it is the turn of the aerodynamicist to wave his magic wand over the beast to give it that ideal balance between straight-line speed and downforce for the corners. According to Adrian Newey, the much praised chief designer at Williams, regulations dictate the size of the car and where the fuel and driver will be, but from then on he has pretty much a free hand.

'The monocoque chassis is itself designed with the aid of wind tunnels,' says Newey. 'Then, in model form, the design is tried and tested with wings and wheels in place.'

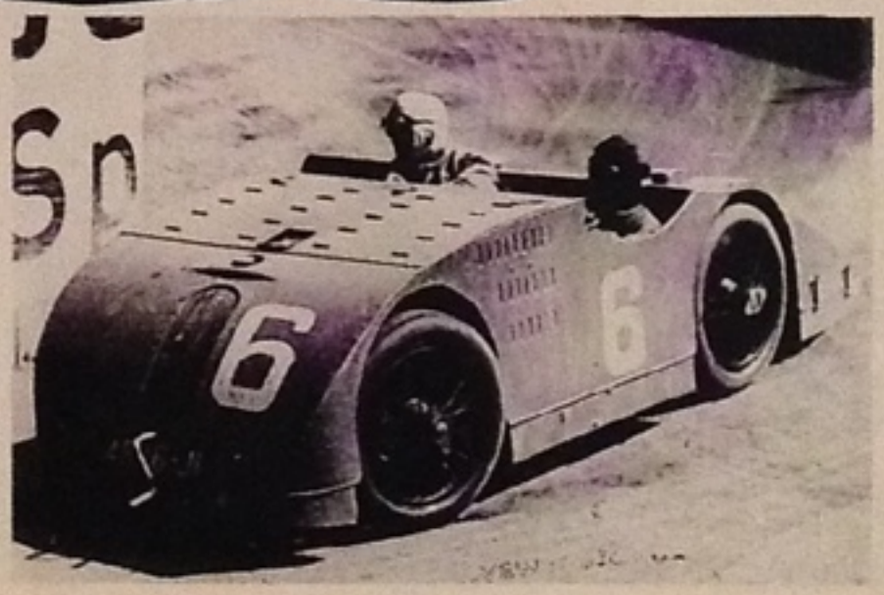
The application of aerodynamics is a precise science, with countless hours of research and modification in the wind tunnel, checking and honing each minute part of the car that has contact with the air flowing over, around or through it. This painstaking fettling can make the difference between a grand prix winner and an also ran.

The science of 'downforce aerodynamics' in the modern grand prix car is relatively new, but the need for more research and knowledge came out of that other, truly black art, tyre development. During the 1960s, Formula One tyres literally grew out of all proportion and to do their job efficiently they needed to be forced hard into the track. Adding weight to accomplish this aim was, of course, the antithesis of what racing-car development is all about, which is the need to be 'lighter and faster'. The problem was how to find the grip without increasing the static mass. The study of race-car aerodynamics was once responsible for finding ways more efficiently to slip through the air; now it was needed to use that air to generate downforce.

As fast as grand prix cars were on straights, they still needed to corner more quickly to reduce their lap times further. To help things along, the tyre manufacturers provided wider and stickier rubber, but this was only going to give of its best if it was pressed hard down on to the track and this somehow had to be achieved without adding extra mass that would impair the car's acceleration and braking.

The answer came up on the other side of the Atlantic, where wealthy Texan Jim Hall was using his money to go racing. Hall was also a gifted engineer, with gifted associates around him, and his Chaparral family of sports cars would ultimately change the direction of

The shape of things to come: Opel's 1928 RAK2 rocket car, top, was the first to use inverted wings. Left: a Leyton House wind tunnel test



Left: 1936 Mercedes-Benz Weltrekordwagen T80, tested in a Zeppelin wind tunnel. Stirling Moss in his Vanwall at Aintree, 1957, below. The Type 32 Bugatti 'Tank' of 1923, bottom right; and Mike Spence in a 1967 Chaparral 2F, bottom left

THE EARLY DAYS

The history of motor sport is punctuated with designs far ahead of their time. The first car officially to hold the Land Speed Record was Camille Jenatzy's La Jamais Contente, a battery-powered device which managed more than 65mph in 1899. Its body was torpedo shaped and thereafter most cars that attempted the blue riband record, with a few notable exceptions, were examples of brute force trying to overcome aerodynamic ignorance.

If designers looked to the skies for their inspiration for streamlining as a necessity rather than a luxury, it wasn't until the appearance in 1928 of Opel's RAK2 rocket car, which featured side-mounted inverted wings to add stability from downforce, that an insight into the real possibilities of working with air started to be noticed.

Mercedes-Benz developed aerofoils for its aborted 1936 Type 80 record-breaker, which had been sculpted in the wind tunnel of Zeppelin. The Bugatti Type 32 'Tank' of 1923 was sleek and fast in a straight line (116mph from a non-supercharged 2-litre was astonishing), but at high speeds it showed signs of 'plane-like lift'.

The Swiss Miche May ran a Porsche sports car in 1955 with a wing mounted on a strut high above the car's rear, but this went largely unnoticed, as did the barn-door-like air dam which was raised on the hump of the Mercedes-Benz 300SLR sports cars.

It was an aeronautical engineer, Frank Costin, who took the streamliner's art close to perfection, when he turned the Vanwall grand prix car into an implausibly slippery machine which, in a straight line, left everything for dead. The Vanwall won the Constructors' Championship in 1958, by which time Formula One had literally been turned around, with Cooper putting their engines behind the driver. The modern grand prix car was born.

Formula One – not once but twice.

Working closely with Firestone, Hall was well aware of the huge grip available from the latest tyres and he reckoned that the best way of sticking them to the ground was by mounting struts on his 1966 2E's hub carriers, and adding a negative-lift wing between their tops. To minimise unwanted drag created with the downforce, the driver could flatten the wing's angle of attack on the straights by means of an extra pedal. The fact that the Chaparral also featured a semi-automatic two-speed gearbox meant that the driver didn't have too many pedals in the car's cockpit to worry about.

It was almost two years before grand prix cars realised the worth of aerodynamic downforce. Lotus fitted nose spoilers (which had been sprouting on sports cars for a few years) to their sleek 49, along with a lipped engine cover. But it was Ferrari and Brabham who first went the whole hog with wings, which then popped up all over the Formula One paddock. Colin Chapman, the genius behind Lotus road and race-car design, attached his wings to his cars' hubs, as Hall had done, so that the downforce of up to 400lb acted directly on the wheels rather than through the springs, where it would be likely to compromise the whole car's aerodynamic set-up.

Wings were 'featherable', too; at one point Graham Hill juggled with four pedals in the cramped cockpit of his Lotus. But Hill and his colleagues had other problems. Little was known about how these wings would react in 'dirty' air following other bewinged bodies, as Hill's team mate Jackie Oliver (now boss of Footwork-Mugen Honda) found out when his 49 suddenly lost all downforce in another car's wake at Rouen and crashed heavily.

Also, if a bewinged car spun and started travelling backwards, the wing would suddenly generate lift. A series of Lotus crashes at Barcelona in 1969, when the load reversal on the cars' wings over a track bump literally broke the aerofoils in half, meant that the wings were banned there and then, as were 'movable aerodynamic devices'.

For the best part of a decade, grand prix cars made do with legal body-mounted wings and spoilers to increase their tyres' grip through corners and everyone seemingly ignored Jim Hall's 1970 Chaparral 2J Can-Am sports car. This featured full body skirts to create a seal ▷

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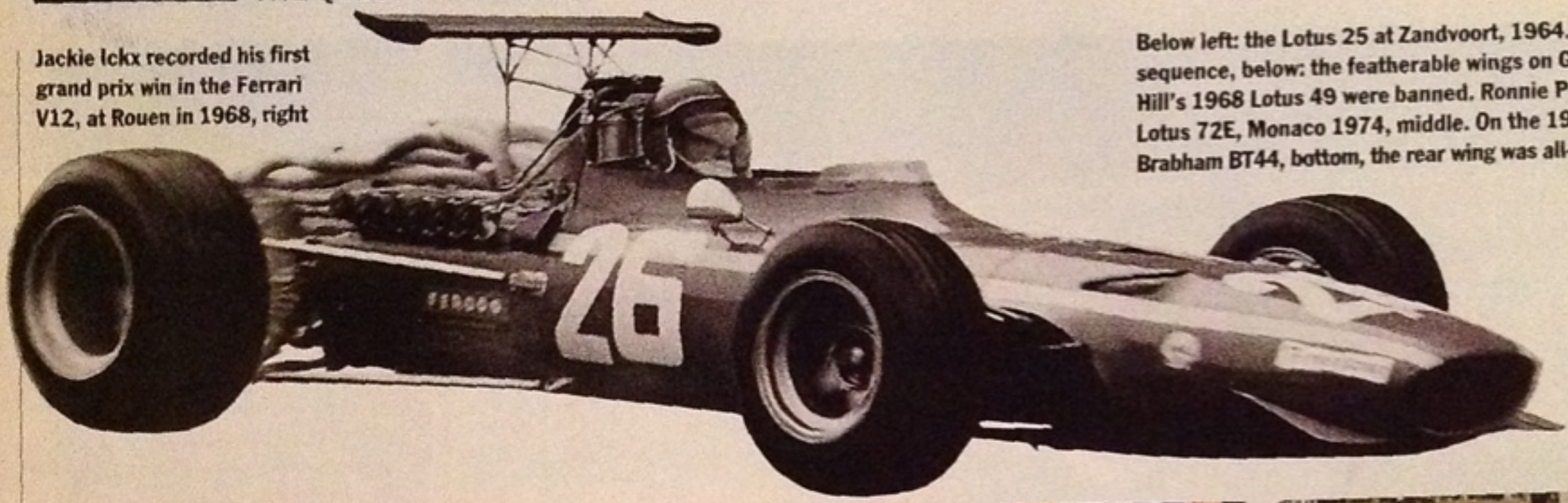
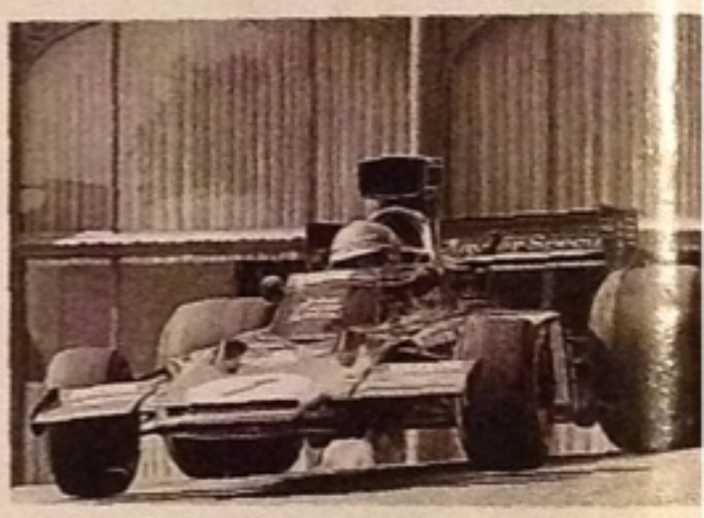


Jackie Ickx recorded his first grand prix win in the Ferrari V12, at Rouen in 1968, right

Below left: the Lotus 25 at Zandvoort, 1964. Top of sequence, below: the featherable wings on Graham Hill's 1968 Lotus 49 were banned. Ronnie Peterson's Lotus 72E, Monaco 1974, middle. On the 1974 Brabham BT44, bottom, the rear wing was all-important



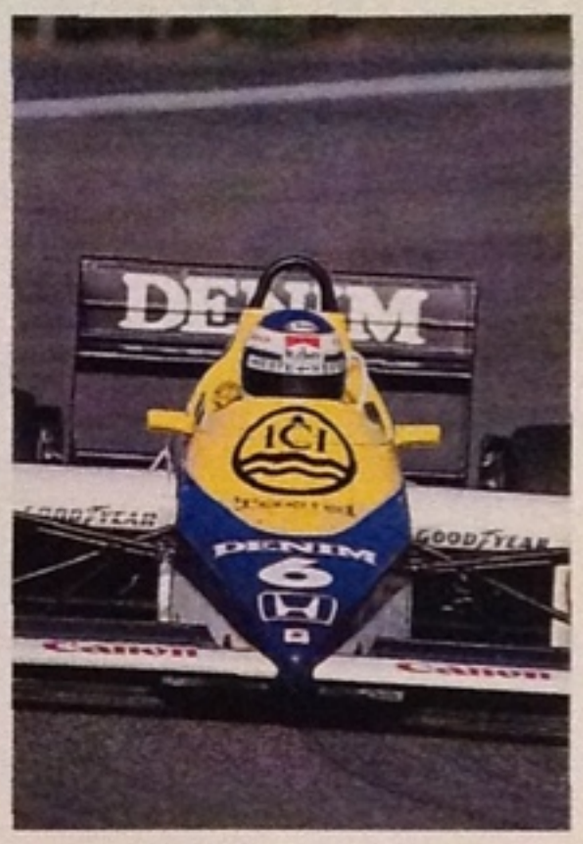
between car and ground and a fan, powered by a separate engine, literally to suck the machine down. This innovation was not to be taken up in Formula One circles until 1978.

As the Seventies progressed, the two previously separate trains of aerodynamic thought (streamlining and downforce) were combined, cars having ever more exotic wings mounted on sleeker and more efficient bodies, running on from the wedge-nosed Lotus 72 of 1970. The front and rear wings could be angled to suit particular circuits and they were moved as far away from each other and the main body of the car as possible both to exert maximum leverage and to find as much clean air as possible. Once again, however, the regulations were changed and the wings came back on board.

In a novel bid to cut down the considerable turbulence from the front wheels, Tyrrell's designer Derek Gardner hit upon the idea of fitting four small front wheels in place of the conventional large pair, tucking them neatly behind the Tyrrell P34's full-width nose. The innovative cars immediately found the pace, but the project came to a halt because Goodyear were unable to devote as much attention to developing the small front tyres, as they were improving the regular-sized tyres for everybody else. March experimented with four rear wheels, to decrease their car's frontal area and gain extra traction, as did Williams much later, but regulations then deemed that two driven wheels and four in total were enough. Looking back with the benefit of what designers know of aerodynamics now, the four-wheel drive solution would have had by far the bigger role to play in the pursuit of the ultimate racer.

The progression from the wedge-design grand prix car was to one whose whole body channelled air towards that all-important rear wing and thence to a completely integrated aerofoil section. This was exemplified in Gordon Murray's 1974 Brabham BT44, which also featured a pyramid-section tub, and skirts to prevent air from creeping underneath the car and upsetting downforce generated atop. It seemed that although car design was heading in a particular direction, most designers seemed unsure of the eventual goal.

Not Peter Wright at Lotus, though. He had developed a com-



The Williams FW11, top, was the first to feature rear diffusers, while the 1990 Tyrrell 019, above, created quite a stir with its anhedral nose and raised middle chassis section. Below, Nigel Mansell in the Williams FW14 that came so close to the title last season

Chris Amon came second in France in 1970 in the March 701, with wing pods, left. Ronnie Peterson was also second, above, at Monaco in 1971, in the 701's disappointing successor, the 711

THE LANDMARKS

Adrian Newey, chief designer at Williams Grand Prix Engineering, studied aerodautics at Southampton University (which has seen many Formula One car designs tested in its wind tunnel) where, in 1979, he did an in-depth study of ground effect.

It is hardly surprising, therefore, that Newey rates the Lotus 79 as one of the great grand prix cars and its predecessor, the Lotus 78, as a valiant first attempt (see Ground Effect, page 69). But he is sure that if March, with their 701 of 1970, had sealed that car's wing pods to the ground with skirts, they could have had a proper wing car the best part of a decade early.

Looking back, Newey had been impressed by Frank Costin's elegant and ultra-efficient Vanwall, which showed what an aeronautical engineer could do with a body shape, but this made Costin's 1971 March 711 design all the more disappointing. 'The low-drag cigar shape was fine, but it would have been better had the car not had wheels,' says Newey.

'The Chaparral, with its strut-mounted wings, showed the way to go; the Lotus 49 gained a great deal from its aerodynamic appendages. And after the Lotus 79, there was excellent work by Ligier, Williams and Brabham, who all realised the potential of ground effect and produced cars strong enough to withstand it.

'In the turbo and post-turbo era, the development of rear diffusers on the Williams FW11 was an important step and the way the front wing of Benetton worked on air travelling underneath the car was impressive. Latterly, the Tyrrell 019 was a great stride forward from the work done at Leyton-House March.

'Now it is a matter of evolution rather than revolution and the FW14 Williams is just one of a batch of cars that is slowly pushing forward the frontiers of aerodynamic research.'

plete 'wing car' model as early as 1969 at BRM, but it wasn't until he got to Lotus, where he worked alongside Chapman, that he found someone who was thinking on similar lines. Indeed, Chapman had for years been experimenting with various shapes in wind tunnels and finding that certain ones produced negative pressure underneath and hence downforce.

Tests followed in a unique wind tunnel with a rolling road, and such was the magnitude of the 'ground effect' generated as skirts around the model's body and venturi tunnels were lowered, that the car actually sucked up the rubber 'road' running under it. The ground-effect car was born, air accelerating under the car to create a low-pressure area and suction. The sliding skirts were crucial in channelling that air through the carefully shaped venturi section. The Lotus 78 of 1977 had aerofoil sections built into its long sidepods, but it was not until the birth of the all-conquering Type 79 a year later that ground effects were really employed to the full.

In those days, where Lotus led the rest followed, not least Brabham, who turned up at Sweden in 1978 with their cars sporting a fan at the rear, just like the Chaparral had done. The fan, which was driven by the car's own engine, was for cooling the enclosed engine bay, argued team boss Bernie Ecclestone. He smiled enigmatically when asked why at standstill the car squatted on its suspension as the engine revved, the result of a huge underbody pressure reduction. Brabham won first time out, something that brought instant protests from rival teams and resulted in a prompt ban.

Ligier and Williams honed ground effect to the point where drivers were having trouble coping with the enormous cornering forces generated, and the cars themselves were having trouble keeping their sliding skirts fully operative and thus maintaining downforce. Ultimately, a half-inch gap between skirt and road was costing some 10 per cent of all downforce.

In the end, the machines became painful to drive as engineers removed almost all the suspension travel in an effort to maintain the all-important ride height and give the chassis a better chance of staying in touch with the road, on smooth tracks at least. It actually reached the stage where a grand prix car could generate more ▷

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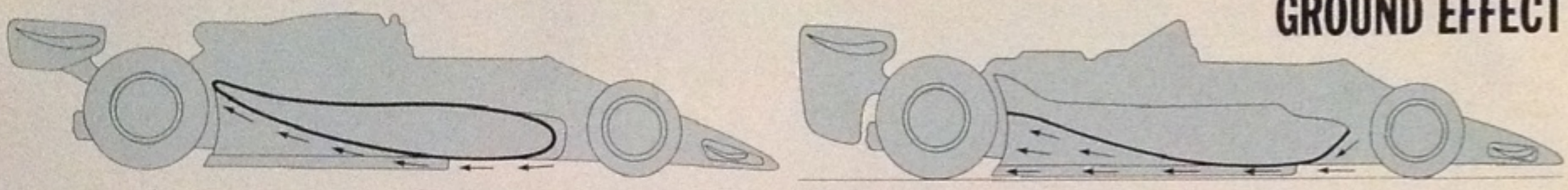
GROUND EFFECT



Peter Wright and Colin Chapman at Lotus took aerodynamic design a stage further in the late Seventies. The Lotus 78, above left and below, had aerofoil sections in its sidepods that created low pressure at the rear to force the car down. The Lotus 79, above right and bottom, added a sliding skirt. Air accelerated through the venturi to pull the car towards the ground

While the ground effect on the Lotus 79 was a development of the wing car the principles used were rather different. In effect the wing car would develop negative lift if it flew through the air – the road surface was quite incidental to the effect.

With ground effect the track surface is crucial. The narrow gap between road and the leading portion of the side pods forms the throat of a venturi through which the airflow accelerates into the upswept 'tunnel' behind (a venturi is essentially a funnel, narrow at the throat and broad at the other end – in a ground effect car, of course, it's much more a tunnel than a funnel).

According to Bernoulli's law, the pressure of a gas drops as its velocity increases so as the air accelerated under the front of the 79's pods into the tunnels behind, its pressure dropped, sucking the car to the road – the faster the airflow the greater the suction. Smooth airflow is quick airflow and so great attention was paid to reducing turbulence both in front and behind the ground effect portion of the car.

Looking from the rear of the 79 the appearance was more that of two large tunnels rather than simply the underside of two inverted aerofoils. The smooth underbody was extended rearwards to mask the 'dirty' areas of engine and transmission and at the same time the rear suspension components were resited as far as possible out of the airstream with both the spring/damper units and the brakes moving further into the body of the car.

than 3,000lb of downforce on top of its 1,500lb weight, and generate up to 3-g (three times gravity) on some of the tracks' fast corners.

The situation came to a head in 1982 when skirts were banned on the grounds of safety and tyre-width limits came in, but you can't 'uninvent' something, and ways were found to get ground effect without skirts. This in turn led the following year to the sport's governing body dictating that the underside of the car between the wheels be flat. But the designers still carried on, gaining their ground-effect downforce from their front wings and large diffusers mounted at the rear underneath the cars' gearboxes.

Proper ground-effect downforce was put on the back burner for a while because, by now, Formula One was well into the age of turbocharged engines with colossal amounts of power, enough to drag barn-door-like wings through the air. As long as engines were developing in excess of 1,000bhp in qualifying and 800bhp in race trim, emphasis was placed firmly on increasing wing incidence for grip.

However, designers like Rory Byrne at Benetton and John Barnard at McLaren were experimenting with front-wing design which directed air under the chassis to the rear diffusers to get back some of the downforce lost in the ever tightening regulations.

Once turbo power had been consigned to history in 1988, emphasis again centred on making more efficient the body which the normally aspirated engine was having to shove through the air. And it was now that designers started to make their cars smaller and smaller. With so little to work with because of the constricting regulations, the science of aerodynamics and the grand prix car became one of diminishing returns. Designers and engneers expended more and more effort for smaller and smaller gains.

But there were still innovations to be found. March used a slightly raised nose and wing formation on their 881 and 891 cars to get the undersides of the cars working more efficiently, but it was the Tyrrell 019 of 1990, the work of Harvey Postlethwaite and Jean-Claude Migeot, which set the paddocks buzzing with its hugely raised anhedral nose. But it was what went on behind that was innovative, with its raised middle chassis section and leading splitter plate, which ▷

PHOTOGRAPHS: TOP AUTOSPORT. BELOW: VANDYSTADT. ILLUSTRATION: BAIRD HARRIS.

allowed a low-pressure area behind to produce downforce by having fast moving air parted either side. Naturally, other teams followed as soon as their designers could catch up, and this innovation, along with ground-rubbing 'skirts' fitted between the front wheels to channel air to the right places under the car, meant that grand prix cars were once again getting close to the standards of downforce achieved in the good old days of full venturi tunnels and skirts.

Williams, for instance, were developing the FW14. 'With the FW14, we spent no more than 30 days in the wind tunnel, which is an incredibly small amount of time for a car which proved so successful,' recalls Adrian Newey. 'But then the study of aerodynamics in Formula One is still at such an early stage that we could have spent another 30 days and not achieved any significant improvements.'

It really is like a driver chipping away at his times to get down to lap-record pace: Newey and his colleagues can achieve most of what they want to relatively quickly, but it is finding and honing those small elements which will give the car that final winning edge that takes up most of the time and effort.

Development continues apace all the time. 'Last season, we came up with a new front-wing design at the British Grand Prix which made a significant improvement,' says Newey, 'but it is rare that something as radical as that comes in the middle of a busy season. Of course, other teams could copy it if they knew what we were doing, but that mostly happens in the closed season, and really there is little point in copying something if you aren't really sure whether what you're copying works or not.'

The really nagging thing about aerodynamics is that it is governed by fundamental laws which don't change. Says Newey: 'The car that we designed this year could have been designed five years ago. But because basically Formula One cars are such nasty shapes and aerodynamically complicated, for each question you answer, you find another three questions to ask yourself. We are working in a complex and still largely unknown area. The more we test, the more we realise how little we actually understand about aerodynamics and the grand prix car. It is still very much a learning process for all of us.' □

RULE BREAKER

The innovative work of designers has always been restrained by the rulemakers who try to strike a balance between allowing Formula One to stay at the forefront of automotive design, yet still keeping the cars, firstly, recognisable as cars (hence the rule limiting them to just four wheels) and trying to keep their speeds in check. But what would the ultimate grand prix car be?

For Adrian Newey, it would have a combination of the banned elements. First and foremost it wouldn't be present-day shape. 'They are such nasty devices: all bumps and lumps with drivers sticking out, but mostly it's the wheels and tyres which screw up the aerodynamics. Their turbulence is immense and negates downforce, so the wheels would have to be enclosed.

'A Group C car has, or should have, about 50 per cent more downforce than a Formula One car, as with twice the bodywork area you get the same downforce from half the negative lift coefficient. Skirts are a very efficient means of containing the ground effect.

'As for fans sucking the car on to the track, that has its drawbacks. A pure ground-effect car should get the downforce it needs from driving through the air, without the aid of an engine-driven fan which would be robbing the engine of its power. But on tighter circuits, as the Brabham BT 48 proved in 1978, the fan-car could have its place. The six-wheeler Tyrrell achieved its success by its greater front-end grip rather than for any aerodynamic reasons.'

So an all-enclosed, multi-wheeled, skirted, winged and possibly twin-chassised fan-suction car may have taken to the grid had the rulemakers not intervened. 'There really were no foreseeable limits to what ground-effect cars of the early Eighties could have achieved, so the possibilities for this hypothetical beast would be just about infinite,' says Newey.

Renault is a name from the very dawn of motor racing. Even before the century had turned, the Renault brothers – Louis the founder of the company and younger brother Marcel – had taken to racing in the city-to-city trials of the day in order to prove the speed and reliability of their cars. It is a rationale which holds true for the company to this day.

In 1902 Marcel Renault won the great Paris to Vienna race and was one of the favourites for the following year's Paris-Madrid competition. Tragically, he was to lose his life in the event. His death, and those of several others, caused the race to be stopped at Bordeaux to avoid further carnage. Ironically, elder brother Louis was classified second, but it was the end of the inter-city races. From this point on, races would be held on circuits made up of closed roads. This paved the way for the grand prix racing we know today and in which Renault still plays such a pivotal role. The very first 'grand prix' – held near Le Mans in 1906 over two days – was in fact won by a Renault driven by Ferenc Szisz, the former mechanic of Louis Renault.

Last year saw Nigel Mansell score a blistering string of victories in the Formula One world championship in his Williams-Renault. 1992 sees the Englishman step up the challenge for the coveted world crown, and helping him do this will be Renault's latest evolution of its formidable V10 engine, the RS4, which will be fitted to the Williams FW14B chassis of Mansell and teammate Riccardo Patrese. Also using Renault power in 1992 will be the Ligier team which will be supplied with the RS3 unit as used by Williams last year.

Nigel Mansell (above) will be attempting to go one better than last season and win the Formula One title for Williams in 1992. Louis Renault and his mechanic Ferenc Szisz (right) during the Paris-Madrid race in 1903

The Renault V10 was designed and built for the normally aspirated 3.5-litre formula introduced fully in 1989, but before this Renault was responsible for bringing turbocharging to Formula One – a concept which, because of Renault's success, eventually became universal before the change in regulations. Jean-Pierre Jabouille in Renault's own car gave the turbocharged engine its first win in the 1979 French Grand Prix. Aside from providing the motive power for Ayrton Senna's early grand prix wins in a Lotus, Renault won

As Renault approaches the 1992 season with the F1 championship firmly within sight, the link between motorsport and road car development remains of paramount importance

A Marque of Success

Two Renault ranges: motor racing's Formula Renault (above), and the new road-going marque, the Clio (top)

several grands prix in the early 1980s with Rene Arnoux and Alain Prost driving Renault-powered Renault chassis.

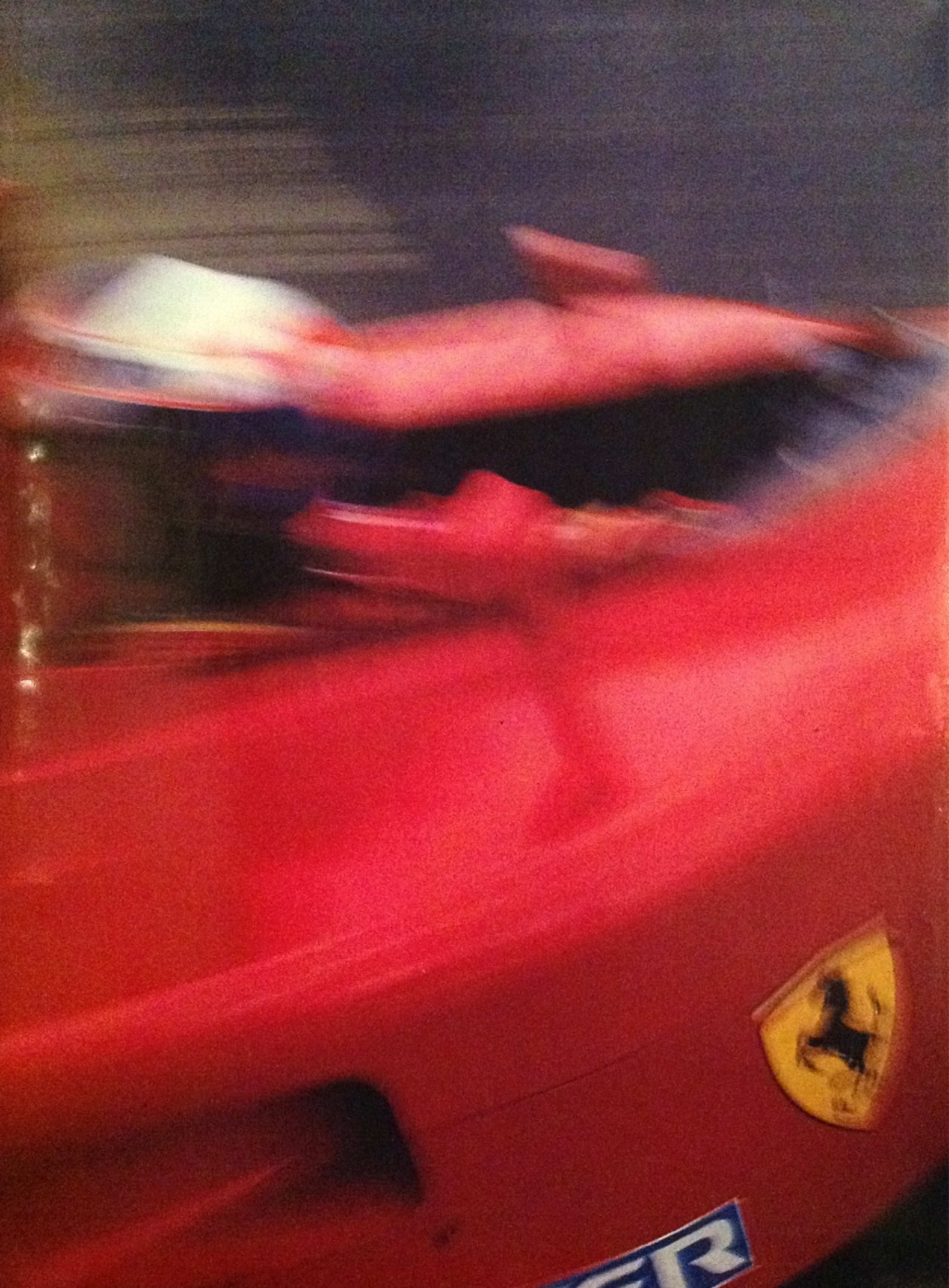
Fittingly, each of the latter Formula One stars began their careers on the first rung of Renault's single-seater racing involvement, Formula Renault. The company has been behind this formula for two decades and virtually every French Formula One driver – Jean Alesi is probably the most distinguished and most recent of these after Prost – began his career in this way. However, Renault has extended the concept outside of France with the P&O European Ferries Formula Renault UK Championship running over 12 rounds on six British circuits this year plus the European series over three rounds. 1992 marks the fourth season of the British-based series for these cars which use the 1.7-litre engine found in the company's 19 and 21 models and mated to the five speed gearbox used in the Renault 25. Eight different chassis manufacturers are involved in building cars to meet this year's demand. Renault UK is contributing towards a £135,000 prize fund over which the cream of British motor racing's future stars will fight.

Renault's racing involvement does not, however, begin and end with single-seaters. 1992 is the second year of the Elf Oils Renault Clio UK Cup for the new Clio 16-valve model. This has only the very mildest of upgrades from standard to adapt to an already supremely competent road car for the race track. Upgraded suspension, brake cooling and modified engine management systems is all that varies from showroom specification. The series will share the same meetings as the Formula Renault championship and will also have a purse of £135,000.

The Renault brothers would surely have been proud of such a series which uses the arena of racing to promote the values of the road going cars. Meanwhile, with Formula Renault, Renault UK is encouraging British talent on a path which could one day lead to Formula One with Renault very much one of the pace-setters. The lineage continues. □

1992 FORMULA RENAULT AND CLIO CUP

22 March	Silverstone
11/12 April	Donington Park
20 April	Thruxton
26 April	Brands Hatch
4 May	Mallory Park
25 May	Thruxton
6/7 June	Silverstone
20/21 June	Donington Park
30 August	Brands Hatch
6 September	Pembrey
27 September	Thruxton
4 October	Brands Hatch



Too fast for comfort

Dr Jonathan Palmer is uniquely qualified to analyse the enormous mental and physical demands of driving grand prix cars that push men to their limits

If you took a man off the street, squeezed him into the cockpit of a Formula One car, and asked the driver to whisk him round a grand prix circuit, the press-ganged passenger would get the fright of his life. Not so much because having your nose hairs ruffled at more than 200mph would scare even the most dangerous of thrill seekers, but more due to the extreme pressures and enormous discomfort visited on the human body.

A medical training and an early career as a doctor qualify Dr Jonathan Palmer to diagnose the sort of stresses drivers suffer, stresses he knows at first hand from six years of grand prix driving and from his present job as a test driver assisting Ayrton Senna and Gerhard Berger at McLaren.

'People don't have any idea of just how tremendously physical it is to drive these cars. Drivers have to be superfit because it involves an awful lot more than sitting on your bum behind a steering wheel going jolly fast,' says the racing doctor. For anyone who can recall the flat-footed performances of certain grand prix drivers in the BBC's potted decathalon, *Superstars*, Dr Palmer needs to prove his point.

'Cars have never lapped anything like as ▷

fast as they do now and that means the forces at work on the driver have never been higher. Even for someone who is capable of driving very quickly, say the next budding Senna in Formula Ford, it would be impossible for him to step into a grand prix car and drive at speed: it would take him a minimum of 20 laps to come near to finding the car's limit. Apart from which, by lap three he wouldn't even have the strength left to drive properly.'

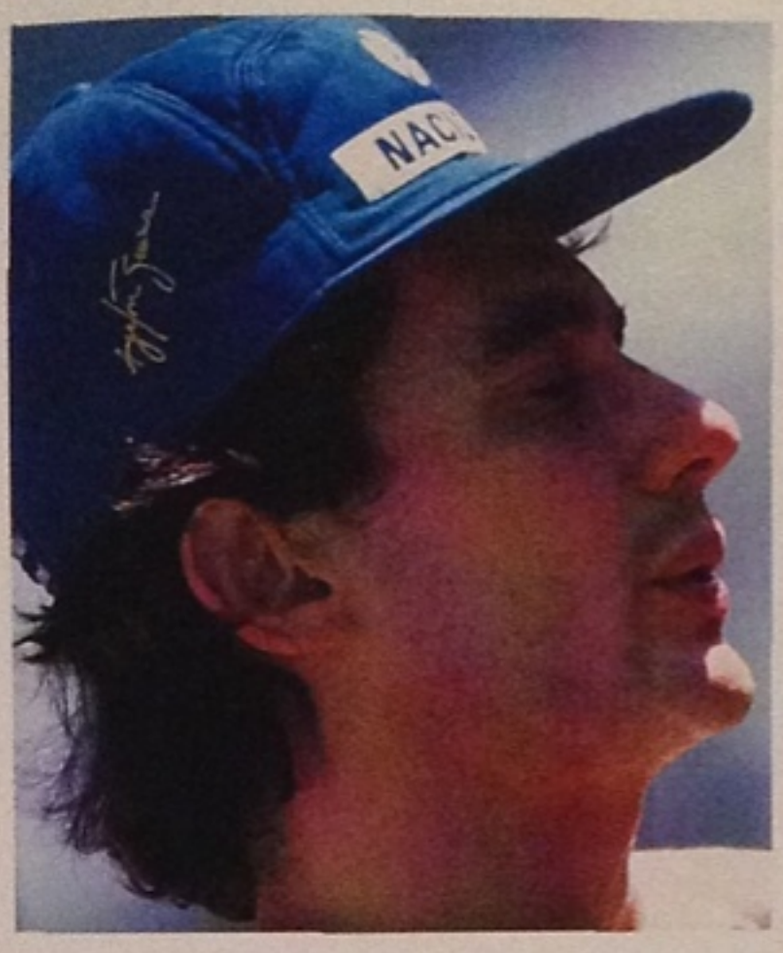
If footballers need strong knees and tennis players robust elbows, a driver's high pressure point is not immediately obvious. 'The first thing to give up on our novice driver would be his neck. If he goes round a corner at say 140mph, he is pulling 4-g laterally through his neck. A head with a helmet weighs about 8kg. Multiply that by four and that makes 32kg pressing against the side of his head. That's a phenomenal amount of force and on a long corner it can be sustained for up to four or five seconds. Our bodies are not designed to accommodate such forces.'

Years of high-speed cornering have given someone like Nigel Mansell an infinitely stronger neck than a Formula One newcomer. And it's technique that is responsible for a bulging neck size. 'A driver angles his head into the corner and as the cornering speed builds, the g force builds and his head starts to get forced upright. But if it ever goes through the vertical, then he's buying time – if he begins by bending his head inwards by 45 degrees, by the time his head is pushed outwards by 45 degrees he will be looking at the corner through a perspective that is 90 degrees different. I certainly don't recommend trying to control your car under such circumstances. Imagine being in the passenger seat, looking up the road with your head on one side, and try positioning the car accurately.'

From the neck down the pressure builds on the driver with each fast bend. 'The seat in a grand prix car is carbon fibre and moulded to the body. While the torso is supported by being strapped in with the seat belt, your legs are not and neither are your arms. For your arms, it helps to be holding the steering wheel, but your longer, heavier legs are merely resting on the pedals. If a leg weighs 14kg and is pulling 4-g, then your hips are having to withstand more than 100kg lateral load. Foam padding in the cockpit stops the legs slopping about, but drivers have to beware – if the leg movement is too constricted, the driver risks the sort of cramp that forced Stefano Modena out of his first grand prix for Brabham in 1987.'

If cornering forces take the biggest toll on drivers today, it hasn't always been that way. Before the Eighties the cars were less stuck to the track by the glue of downforce, something the rapid development of wings and ground effect changed and so helped spawn the monstrous new g forces.

But drivers have always wrestled with the forces of gravity. 'The only time it is peaceful in a grand prix car is sitting on a straight flat out at 180-200mph. When you accelerate from the start you are talking about going from a standstill to 180mph in under four seconds



PREVIOUS PAGE PHOTOGRAPH: MARK BOTHWELL. THIS PAGE: PASCAL RONDEAU

Despite the physical risks, dehydration is the driver's biggest enemy

Ayrton Senna shows the strain of 90 minutes of high speed stress

and when you brake you can lose 70mph in one second. What is also difficult under braking is the mental effort. In less than two seconds you might slow from 180mph to 60mph to turn into a tight corner. This means your perspective changes dramatically as your speed comes down: visually it's very difficult to take on board the difference in speed and adjust your perspective and judgement fast enough. You need to think ahead as a driver and mentally anticipate braking.

'Surprisingly, the acceleration forces are relatively gentle although the cars still generate about 1.3g at 120mph. For the layman, think of the violence of doing an emergency stop in your own car and then imagine that force doubled and that's the violence of accelerating in Formula One.'

Sheer physical strength to resist the g forces is not the only reason drivers want muscles. They also have to control the car. 'There are a lot of factors that make racing cars very heavy to steer: they have wide front tyres, downforce exaggerates the weight of the car so at 150mph you can be trying to control 1.5 tonnes of car, and you're trying to steer with a 10in small steering wheel. Often you almost have to wedge your elbows in the cockpit to hold the wheel in one position. At high speed it feels like driving a fully loaded transit van with no power steering, and it's at times like that you don't want to leave just one hand on the steering wheel – it would just be tugged free.' While the manual shifters struggle to find fifth on the Peralta, the drivers with a semi-automatic gear box might well offer up a prayer for its originator John Barnard.

But changing gear is never an easy business; witness the drivers' hands after completing a gear-heavy circuit like Monaco. 'That grand prix is 80 laps and you change gear 30 times a lap. Blistered, bleeding hands are guaranteed.'

Only someone who had lost the will to live would find inner peace in driving in a grand prix. For anyone else the physical and mental effort behind the wheel would push the heart rate up alarmingly. 'Studies I have done show that during a race a typical driver's heart will beat at 180 beats per minute and that would climb to 210 beats per minute in moments of particular drama. If somebody presented himself in hospital with those sort of heart rates he would be put straight into intensive care.'

It comes as a surprise to learn that, despite all the physical risks, dehydration is the racing drivers biggest enemy. 'All the physical effort makes the body heat up massively. But unlike any other form of exercise there is no way of cooling down. Sweating is the bodies response to getting hot, the latent heat of cooling the vapour on your skin causes the body to cool. But drivers are covered from head to foot in three layers of nomex fireproof overalls, plus a helmet. There is no exposed skin for the perspiration to actually work over.

'You can lose up to two pints of fluid and the fluid you lose generally comes from the blood, so your effective circulating blood volume can drop severely making you weaker as your heart pumps faster. Dehydration can be a killer because you start losing concentration as you get progressively weaker. I used to make sure I was fully hydrated before the start. I'd just keep drinking until I passed clear urine – the body's way of saying it is saturated. I would force down four sips of water on the straights. If I didn't I would soon feel rough.'

In the physiologically fraught two hours of a grand prix a driver must be able to go to his physical limits to take the car to its limits. And it's those very limits that prompt Dr Palmer to prescribe some proscription from FISA. 'The time is right for the slashing of cars' performance for 1993 to prevent any increase in cornering speed. Drivers are pulling 4.5-g now: we're not far off the body's limit. The rule-makers need to come up with more stringent regulations that don't give designers as much scope as now exists to produce cars that generate lots of downforce. Few drivers would object if downforce was cut by 10-15 per cent. I'd like it cut by 50 per cent, not that I can see that happening.' □

Dr Jonathan Palmer, a test driver for Marlboro McLaren, was talking to Tom Loxley

The race of their lives

Every age has its great driver, but over the years there have been those who stand out for more than their abilities behind a wheel. We profile five – Nuvolari, Fangio, Moss, Hunt and Rosberg – who in a flash of genius defied the odds and drove to victory and a place in the record books

July 28 1935

TAZIO NUVOLARI

GERMAN GRAND PRIX

'Victory for Germany seemed certain. Then eight kilometres from the finish, a rear tyre burst and came off the rim. Nuvolari burst into the lead and crossed the line in front of crowds shocked into silence'

Nuvolari scored a moral victory for Italy when he won at Nürburgring (above), and drunk to victory (right) before the stunned German crowd

PHOTOGRAPHS: CORBIS/POPPERFOTO

Long before race day it was clear that the 1935 German Grand Prix was going to be more than just a motor race; it was a personal battle between drivers and a commercial battle between manufacturers, fought against the background of a clash between nations. Hitler and Mussolini both used motor racing as expressions of their countries' technical prowess and national pride, and Hitler had invested heavily in Mercedes and Auto Union, sending them out to conquer Europe on the grand prix circuit.

In 1935, Mercedes had won seven major races and Auto Union one by the time the grand prix circus reached the Nürburgring, and Germany was expecting great things of its racing drivers. Start time was scheduled for 11am and as it approached, uniformed Nazis pushed the cars out on to the grid.

The line up was impressive: the gleaming silver straight eight, 4.3-litre supercharged, mid-engined Auto Unions coming in at 375bhp, and the red Alfa Romeo P3s, or *Monopostos* (single seaters), entered by Scuderia Ferrari, a four-year old design with the engines bored out to 3.8 litres to give them 330bhp.

The star of Mercedes was Rudolf Caracciola, backed up by Manfred von Brauchitsch and the Italian, Luigi Fagioli. Auto Union's Hans Stuck was supported by Bernd Rosemeyer and another Italian, Achill Varzi. The three Scuderia Alfas were driven by the Frenchman, Louis Chiron and the Italians Antonio Brivio and Tazio Nuvolari.

For Nuvolari and Varzi this was a grudge match, as they had been great personal rivals for many years. In 1934, short of talented German drivers, Auto Union started looking for foreign drivers and Varzi got the job. If Nuvolari was hurt, he didn't show it; he wanted to get even by beating the Germans on their home ground.

After a long dry spell, the weather in the Eiffel Forest was drizzly and the track slippery. Grid positions were decided by ballot and Nuvolari had drawn the front row, alongside Stuck. The enormity of challenging the might of Germany on home ground began to sink in on lap two when Rosemeyer, Brauchitsch and Fagioli all managed to overtake Nuvolari.

But Nuvolari knew how to get the best out of the Alfa P3, despite its technical inferiority to the German cars. Once the race had settled down, he started to overhaul the opposition and by lap 10, a battle for the lead had developed between Caracciola, Rosemeyer, Brauchitsch and Nuvolari. The public address system reported the Italian in second place, but as the leaders came into sight, the crowd gasped – Nuvolari was in the lead.

On lap 12 they came in for tyres and fuel. By the time Nuvolari had rejoined the race, he had slipped to sixth, and Brauchitsch was now comfortably in the lead by 1min 9secs with Stuck, Caracciola, Rosemeyer and Fagioli providing a cushion between the leading Mercedes and the troublesome red car.

But to the horror of the spectators, Nuvolari passed all four of them in a single lap, had cut Brauchitsch's lead to 34 seconds by the 18th lap and was now lying second. By now, ominous patches could be seen on the Mercedes' tyres.

Brauchitsch had taken nearly everything his tyres could give. As they started the final lap, victory for Germany seemed certain with Brauchitsch 35 seconds ahead. Then, just eight kilometres from the finish, a rear tyre burst and came off the rim. Nuvolari roared into the lead. Then the other rear tyre went and Stuck, Caracciola and Rosemeyer shot by.

At the finish Nuvolari crossed the line in front of crowds shocked into sullen silence. When Brauchitsch clanked in on his bare rims, in tears, Nuvolari was drinking from a wine bottle. Over at the victor's rostrum, German officials were shuffling nervously; they had no recording of the Italian national anthem. Never mind, Nuvolari had bought one with him, just in case.

Ivan Rendall produced BBC2's history of motor racing, The Power and the Glory

AUGUST 4 1957

JUAN MANUEL FANGIO

GERMAN GRAND PRIX

'I began telling myself: that's a Ferrari and it's leading; you are going to catch it and you must win. I believe I was inspired that day. I had never driven like that before and I never drove quite like that again'

Fangio takes the chequered flag to win at Nürburgring in 1957 (below). It was his fifth world championship, and was to be the last of his grand prix victories

This was the greatest moment in the career of Juan Manuel Fangio.

It was 1957 at Fangio's favourite circuit, Nürburgring, and the sixth grand prix of eight when Fangio, then aged a remarkable 46, produced one of the truly great drives of all time in his 2.5-litre Maserati 250F.

The race was notable for one main thing: would Fangio's tactical brain outwit Ferrari team-mates Mike Hawthorn and Peter Collins? Fangio, who had won the previous grand prix in France, took the ultimate gamble. He had decided to use soft-compound Pirelli tyres and a half tank of fuel to make the most of grip and speed around the world's most demanding circuit.

Repeated practice had proved that a pit stop after 11 of the 22 laps would take just 30 seconds and enable Fangio to return to the track ahead of Hawthorn and Collins (both of whom were using harder tyres and full tanks), as well as Stirling Moss, Tony Brooks and Stuart Lewis-Evans, all driving Vanwalls.

The first of the 14.1-mile laps saw Fangio following Hawthorn and Collins, but Fangio was to say later: 'They were playing around and not racing as a team.' Fangio took the lead on the third lap and had extended his advantage to 28 seconds at the end of lap 12 when he decided to pull in for fresh tyres and more fuel. But fumbling mechanics got the pit stop wrong. Instead of taking just 30 seconds as estimated, it took 76.

On lap 13, Fangio was 51 seconds adrift. But it was then that Ferrari made a mistake when the team manager signalled Hawthorn and Collins to relax.

It was now that Fangio produced the performance of his life. He said later: 'I began to use higher gears through the corners. This gave less precise control when the car was sliding, but as long as I entered the corners absolutely right, I knew I could reach higher revs along the following straight. There was a lack of grip in the higher gears, but it was definitely worth the risk for the time I could make up.'

Fangio had cut his deficit down to 32 seconds by the end of lap 16 and one circuit later Hawthorn and Collins had their lead pegged back to just over 25 seconds.

Fangio takes up the story: 'I believe I was inspired that day. I never drove quite like that before and I never drove quite like that ever again. After the 20th lap, I saw a red speck far ahead and I began telling myself: that's a Ferrari and it's leading the race. You must win and you are going to catch it. The pits had signalled to me that there was only one car in front. I had not realised at that stage that there were two!'

Fangio then had both in his sights. On the penultimate lap alongside the straight behind the pits, he moved inside Collins' Ferrari, overtook him but went too wide at the curve, allowing Collins to edge ahead again. At the next shorter straight, however, Collins allowed Fangio through. Into the next right-hand bend, and Fangio again found Hawthorn in front.

Fangio said: 'I was working out where I could pass him when, after a series of curves, came a short straight ending in a 90-degree left, followed by an equally sharp right. On the straight, Hawthorn pulled to the right to take his line, so I shot inside him. He pulled aside as if I had startled him, but I made a point of pulling away before we reached the straight so he couldn't slipstream me.' Fangio then pulled away to record his famous victory.

His brilliant win at the Nürburgring was his last grand prix victory and gained him his fifth world championship – a record which still stands. In an astonishing race, he broke the lap record 11 times, leaving it at an incredible 91.54mph – nearly 4mph faster than his 1956 record of 87.73mph.

A truly inspired drive by the man regarded as one of the greatest grand prix drivers of all time.

BBC TV's motor racing commentator Murray Walker talked to Brian Alexander

PHOTOGRAPHS: CYRIL POSTHUMUS

MAIN PHOTOGRAPH: NATIONAL MOTOR MUSEUM. CUT OUT: CYRIL POSTHUMUS

Moss heads for victory at Monaco (above), Richie Ginther in a Ferrari hot on his tail. Both drivers recorded the fastest lap time of 1min 36.3secs

MAY 14 1961

STIRLING MOSS

MONACO GRAND PRIX

'Stirling never really entertained any thoughts of victory: "I just couldn't believe I could win until I came round the last corner and took the chequered flag."'

There were several non-championship races before Monaco in 1961 such as Syracuse, Brussels and Silverstone. In all of these we had been having awful problems with misfiring due to fuel starvation and barely finished a race.

The root of the problem was that the Monaco Grand Prix was the first in the year that the engine formula changed from 2½ to 1½ litres. The British had stubbornly resisted this because they had a great 2½-litre engine in the 4-Cylinder Coventry Climax, and knew a 1½-litre would cost a lot of money to make. Predictably, Ferrari had an ideal V6 engine already developed. This was giving a good 30bhp more than the old British Formula Two Coventry Climax fire-pump engine which was not designed for Formula One.

The week before Monaco, Stirling won the International Trophy Race at Silverstone in my 2½-litre Intercontinental Formula Cooper, lapping the field in appalling wet conditions. This gave him renewed confidence for Monaco.

In the first practice in Monaco on the Thursday the Lotus was holding back because of fuel starvation and the gear ratio was too high, so we didn't do very well. The following day the fuel pump broke early on; once repaired the gear ratio was improved, but the times were not. On Saturday Stirling just managed to get pole position by 1/5th of a second from Phil Hill and Ritchie Ginther, both in Ferraris. Interestingly, Stirling's pole position time was 1min 39.10secs, whereas in the generally slower race, he clocked 1min 36.30secs.

But Stirling didn't know what Alf Francis had done to the carburettor on Saturday night. Worried by the continuous starvation, Alf met the competition manager of Webers at our garage with a similar set of carburettors and the two men spent the night stripping both sets to see if there was any difference. Eventually they found the root of the problem: a hole that should have been bored in ours, and wasn't.

Stirling told me that he most feared the three Ferraris of Hill, Von Trips, and Ginther, who had a V12 degree special engine, as well as Jimmy Clark who had a brand new Lotus looking like a Formula Two; although our car handled very well, with 30bhp down we didn't have much chance. However, he was still disappointed not to lead on the first lap from pole position and he had Ginther and Clark ahead of him.

Clark dropped out on the second lap with engine trouble and Ginther got about four seconds ahead of Stirling who began to close the gap when his tyres were nicely warmed. On the 14th lap Stirling passed Ginther and then surprisingly pulled away to create a gap of 13 seconds by lap 30. This was mainly because the Ferraris did not handle so well on full tanks, as we were to see again in the German Grand Prix.

On lap 27, Phil Hill, presumably on instructions, passed Ginther and by lap 60 he was only three seconds behind with Ginther right astern of him. I remember thinking that it was only a matter of time before they passed.

Stirling later told me that throughout the race he felt they could pass any time they wished and were only playing a game of cat and mouse. Ginther dropped 11 seconds behind Hill, presumably to have a rest, but then closed right up on him and on lap 74 he was given the signal to pass Hill and put the pressure on. With 20 of the 100 laps to go, Stirling had a three-second lead over Ginther, but on the 84th lap Ginther broke the lap record, clocking 1min 36.30secs. Immediately Stirling replied with an equal time. He said: 'Each lap I tried to do the perfect round but would always make one mistake. If I had got the perfect one maybe I would have gained 0.2 or 0.1 seconds but they always came right back at me. Occasionally I'd come up against a back marker and get past and manage to gain a little.'

I asked him how he managed to speed up even more when the Ferraris got so close. 'I did it by braking that fraction later,' he replied, 'and getting my foot down marginally sooner so that I got the power on the road. I also tried to take a slightly closer line into the curb, which stops the car slowing down, while at the same time trying not to touch the curb.'

About 10 laps before the finish, Romulo Tavoni hung out a signal to Ginther – 'give all'. When I saw this I knew we would win the race as poor Ritchie Ginther had been giving all for the past 20 laps. Stirling was convinced one of the Ferraris would come past him and would pick him off more or less when they wanted. But I had seen this signal before, 10 laps from the end of a race, and I knew it was given in desperation. Stirling really never entertained any thoughts of victory and said: 'I just couldn't believe I could win until I came around the last corner and took the chequered flag. I really choked up and tears came into my eyes. It was an enormous challenge for me to drive for a privateer against the works' teams.'

Rob Walker (below), Lotus team manager in 1963, is a motor racing journalist

JUNE 22 1975

JAMES HUNT

DUTCH GRAND PRIX

'It was a combination of British opportunism and a superb driver. James will always be underestimated; he never drove the most competitive car but gave great performances'

'Racing for Britain, racing for you' was the claim as James Hunt took the Dutch Grand Prix in what was to be the final swansong for Hesketh Racing

From advertising hoardings around the country an endearing teddy bear wearing a crash helmet and waving a Union Jack proudly stated: 'Racing for Britain, racing for you – the biggest little racing team in the world.' British motor racing fans took this character and his team to their hearts and even though Lord Hesketh's grand prix team had only a short life, their brave performances and patriotic approach caught the imagination of press and public alike.

The team finished sixth in the constructors' championship in 1974 and the following year proved even better – fourth place with 33 points, which included the team's only championship race victory, surprisingly in the Dutch Grand Prix at Zandvoort. 'We should have won in Argentina, Spain and Monaco,' remembers Lord Hesketh, 'but I regarded the fast track at Zandvoort as one ideally suited to the Ferraris of Lauda and Regazzoni which were totally superior.'

Indeed, Niki Lauda had enjoyed an effortless victory the year before and when he was fastest in every practice session for the 1975 race it appeared that a repeat performance was in store. Lauda started in pole position and James Hunt, in the Hesketh, lined up third.

Race day dawned bright and sunny but as the morning wore on it became increasingly cloudy and eventually the circuit was hit with torrential rain. The drivers were allowed a few laps to acclimatise to the wet conditions and make suitable adjustments to their cars but as soon as this session ended the rain stopped and there was another rush to change back to slicks.

After the official warm-up lap, the rain returned and on the dummy grid there was another rash of tyre changing. As the flag dropped to start the race, Lauda scorched into the lead but as the racing line began to dry, Hunt, at the end of lap seven, took the brave decision to stop before everyone else and change to slicks – even though there were still plenty of wet patches on the road. Lauda stayed out until lap 13, by which time Hunt had climbed from 19th place to first – Lauda rejoining the race from the pits fractionally behind Hunt. The Ferrari dropped another place while Lauda was warming up his tyres but once the race settled the Austrian gained on both the Hesketh and Jarier's Shadow-Ford.

Hunt had set up his car for dry conditions but Lauda had compromised slightly, and while that had paid off in the wet, the overwhelming superiority that the Ferrari had demonstrated in practice was reduced. Nevertheless, it took a calm, unflustered performance from Hunt to withstand the continual pressure from the Ferrari.

'As far as I was concerned it was James versus Ferrari,' says Lord Hesketh. The race hinged on the Tarzan corner at the end of the long straight. James would lead out of the corner and maintain his advantage – or even slightly increase it throughout – until going back down the straight in front of the grandstand. Niki would once again be right under James' wing but never quite had enough puff to overtake going into that Tarzan corner.

'It was particularly satisfying to win here and it proved that we could have won at Monaco where, in the light of similar changes in the weather, we adopted the same tactics of coming in early for tyres. But we took over a minute on the change,' he recalls ruefully, 'whereas in Holland we took only 14 seconds.

'This win, against the odds, was the most rewarding experience of my racing career. The great thing was the English crowd who lined the whole track and grandstand, madly waving flags as we went round on the victory lap. For all our weaknesses, we had the biggest supporters' club in Formula One.

'The victory was a charming combination of British opportunism and a superb driver. In my opinion, James will be perpetually underestimated; in no season did he drive the most competitive car, even when he won the title, but he produced great performances.'

The following year, having failed to attract the support of a sponsor, Lord Hesketh had no choice but to disband the team. 'In a way it was probably better that Hesketh Racing finished on an up,' he reflects. 'I think we had got too famous and sponsors were afraid we would take the limelight from them. Even so,' he continues, 'it is deeply satisfying to see that many people who once worked at Hesketh have gone on to achieve success with other teams.'

Lord Hesketh, (above left) team owner of Hesketh Racing, talked to Tim Oldham

MAIN PHOTOGRAPH: AUTOSPORT; PORTRAIT: UPPA

MAIN PHOTOGRAPH: AUTOSPORT. PORTRAIT: SPORTING PICTURES

Williams gambled in glamorous Monaco – and won. Rosberg (above) cruised to victory 18 seconds clear of eventual world champion Piquet

MAY 15 1983

KEKE ROSBERG

MONACO GRAND PRIX

'Keke always drove with a bloodstream full of adrenalin. He was never a cool, calculating driver like Senna or Prost, but he was as fast as either of them and had the ability to win even more races'

It was a classic dilemma. When a cloudburst hit the Principality before the start of the 1983 Monaco Grand Prix, 250,000 spectators dashed for cover, a marshall's car spun in front of the grandstand and the pits were full of heated exchanges over whether or not to change from slick to wet tyres.

Brabham, Renault and Ferrari all made the switch but Williams stuck to their guns. Outpowered all season by turbo-charged rivals, the Brits had paid dearly for persevering with normally-aspirated engines, but team-boss Frank Williams consulted designer Patrick Head and decided to preserve the slick-tyre status quo.

It worked like a dream. Starting on the third row of the grid, Keke Rosberg blitzed past his rivals on the very first lap, taking a lead he would never surrender.

Monaco provided a stunning change of fortune for Rosberg, who had seen his best finish of the season – second in Brazil – wiped out by disqualification. The world champion's main opposition would come from his own team-mate Jacques Laffite, but once the Frenchman withdrew with gearbox trouble, Rosberg cruised home 18 seconds clear of Nelson Piquet.

Rosberg's win marked the end of a motor racing era. Monaco was the penultimate triumph for normally-aspirated engines before turbos were outlawed in 1989 – Michele Alboreto adding a final victory in Detroit – and one of the sweetest moments in the long career of Williams designer Patrick Head.

'Normally-aspirated engines put us at a huge disadvantage throughout 1983,' Head reflects. 'We were hanging on by the skin of our teeth but the unique characteristics of the circuit gave us a real chance to make an impact at Monaco.

'Everyone's plans went out the window when it started raining and the logical decision was to change to wets. But local forecasters predicted no more rain, Frank was sure the track would dry out so we took a punt. Let's face it, if you're going to gamble, there's nowhere better to do so than Monaco.'

'Keke took everyone apart on the opening laps. He was always a flamboyant driver and threw the car around with spray flying in every direction. He soon put daylight between himself and the rest of the field and our only real worry was whether he could keep going. A pit stop would have killed us because without a turbo-charged oomph to get back in the race, we were easy meat for those coming up behind.

'Piquet's car was quickest that week and if he'd started on slicks, he'd have been out of sight. But like the rest he came in for a tyre-change and by lap 10 only Lafitte was within 30 seconds of Keke.

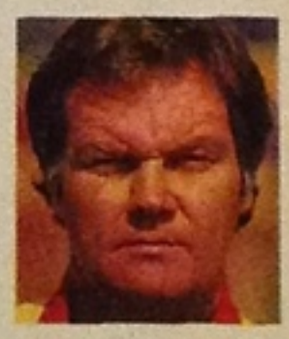
'I remember getting an anguished radio message from Keke, screaming at me to tell Lafitte to slow down. Jacques was gaining on him and Keke didn't want to drive flat-out to stay ahead of his own team-mate. What he didn't realise was that Jacques was also under pressure from Piquet; eventually the situation took care of itself because Lafitte was forced out of the race with gearbox trouble.

'Keke always drove with a bloodstream full of adrenalin and as usual gave us one or two heart-stopping moments. He was never a cool and calculating driver like Senna or Prost, but he was just as fast as either of them and had the ability to win even more races.'

The Monaco drive was an awesome performance. 'By three-quarter distance, we'd built up a 50-second lead and Nelson was never going to make up that kind of distance. Even so, Keke kept him at bay magnificently. His reflexes on a wet track were stupendous and by the time he took the chequered flag, he'd lost the top two layers of skin on his hands from making over 2,000 gear changes.

'It was hardly surprising we didn't win another race in 1983. Had we made different decisions at the end of '82, Williams would already have been running turbos. We'd talked to BMW before deciding to form a long term partnership with Honda which – in the mean time – left us with a choice of paying for second-string BMW engines or waiting for Honda and getting them free. Needless to say, we chose the latter.

'So the grief was to a large extent self-inflicted but that made defeating the turbos doubly satisfying for us all.'

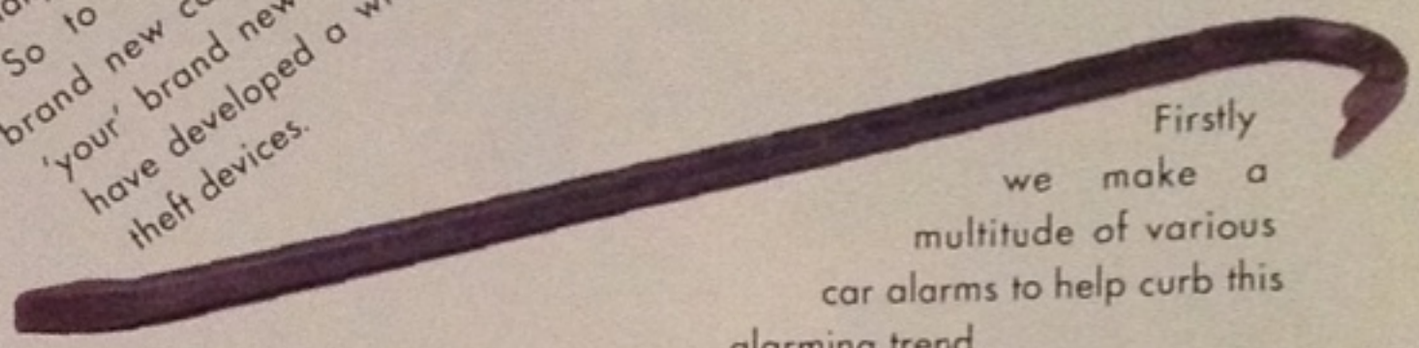


Patrick Head (above), chief designer at Williams, was talking to Gary Leboff

PHILIPS

SOME OF THE LATEST TECHNOLOGICAL INNOV

Very desirable these acquisitions Philips Car Stereos. Especially to a thief. So to make sure your brand new car stereo remains 'your' brand new car stereo Philips have developed a whole range of anti-theft devices.



Firstly we make a multitude of various car alarms to help curb this alarming trend.

But if that doesn't deter him the next step almost certainly will. Retractable units. After you park your car simply remove the stereo and take it with you. After all, how can a thief take something that isn't there.

But let's be negative for a moment. Suppose, horror of horrors, you forget to remove your stereo.

Don't panic, all is not lost (least of all your stereo). Philips have security coding built in to their stereo units. Only you will know the special code that works the stereo.

And even a thief isn't stupid enough to steal something that's of absolutely no use to him whatsoever.

There you have it. Philips are, without doubt, the company who'll do the most to safeguard your new car stereo. Bar none.

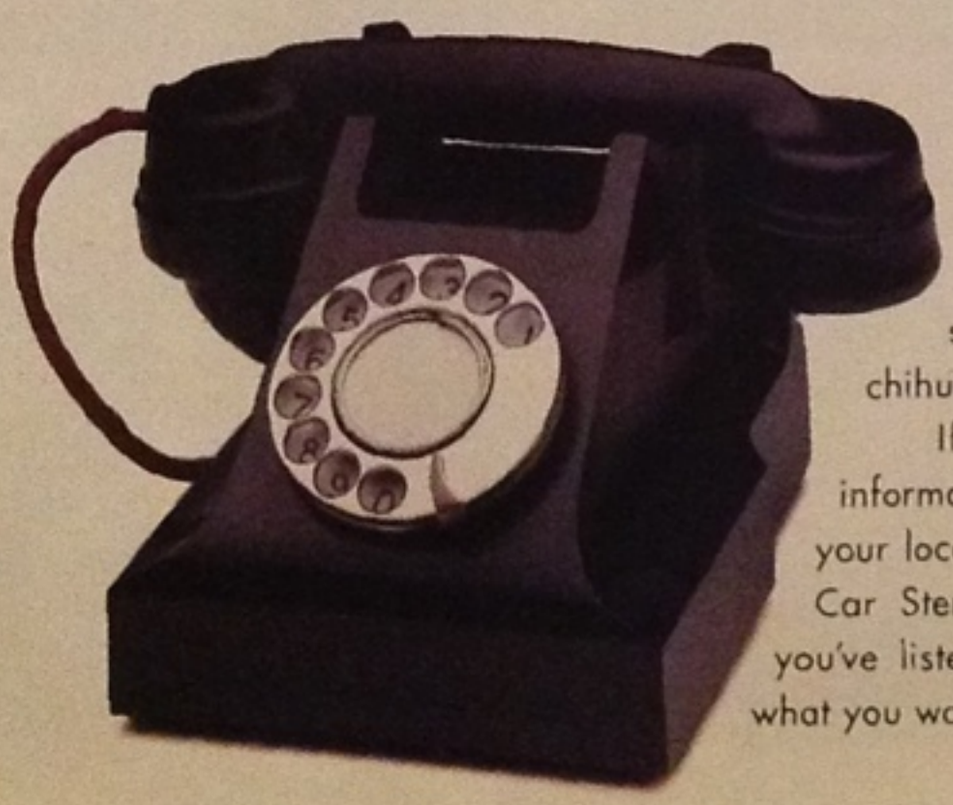
You said you wanted something a bit special.

So, determinded to keep our customers happy, Philips have produced an unparalleled range of powerful speakers. From the 'relatively' small 20 watt, through to the (get those ear plugs ready) huge 400 watt units.

But size you may argue, isn't everything.

That's why throughout the range there are two and three-way speakers which you can mix and match with separate sub-woofer, bass, mid-range and tweeter units. So finding the perfect combination that best exploits the acoustics of your car is easy.

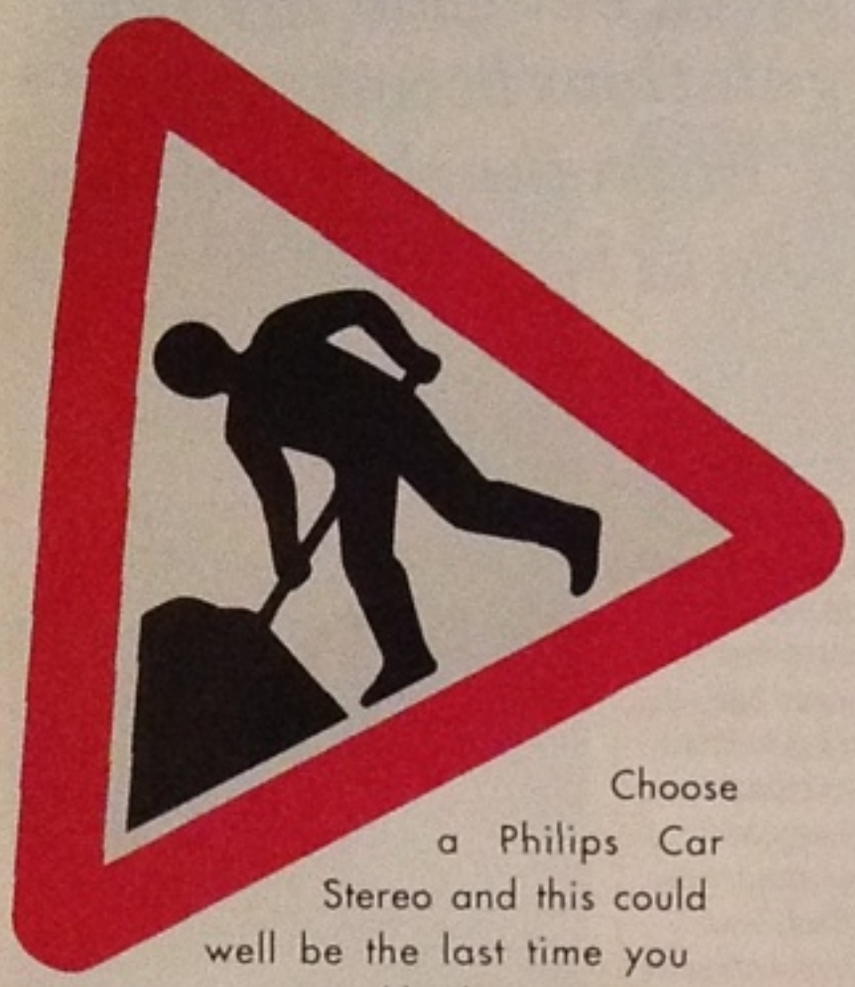
There. As you can see, your requests haven't fallen on deaf ears.



Do you know what a sub-woofer is? No it's not a chihuahua crossed with a sausage dog.

If you want to know any technical information about Philips Car Stereos or merely your local stockists, call our experts on the Philips Car Stereo Help Desk on 0869 365021. Once you've listened to them you'll be able to listen to what you want.

ATIONS THAT GO INTO A PHILIPS CAR STEREO.



Choose a Philips Car Stereo and this could well be the last time you encounter a sign like this.

The Radio Data System (RDS with EON) incorporated in various models automatically tunes itself into BBC local traffic reports without you having to lift a single finger.

It can interrupt whatever you're listening to and dig out the necessary information to help you avoid those battles at Waterloo and those workmen at Woking.

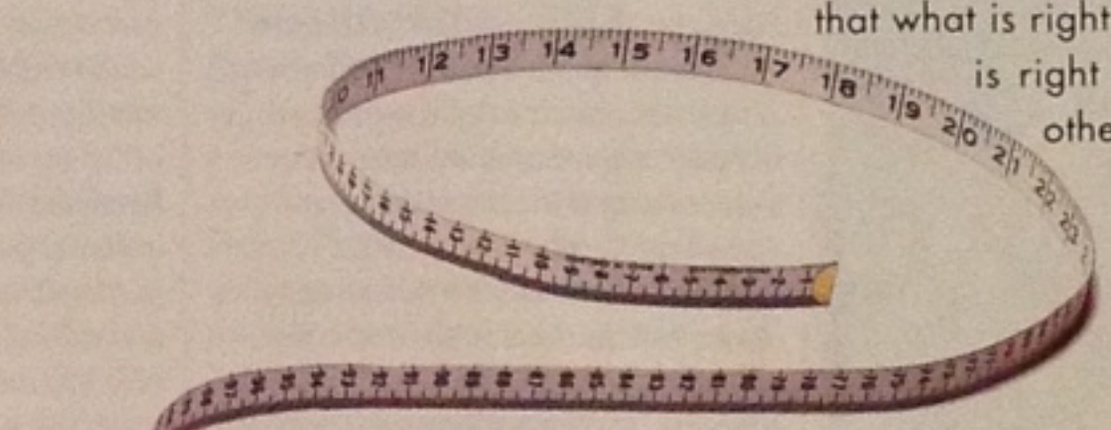
And it's not just traffic reports it looks for. It also automatically searches for, and programmes in, the six strongest stations, wherever you are and wherever you decide to go.

If you want a car stereo that keeps you moving, and on the move, don't settle for anything less than a Philips.

A Saab is an altogether very different car to a Mini.

A straightforward observation you may think.

Though not, it would seem, to certain other manufacturers of car stereo speakers. They would have you believe that what is right for one is right for the other.



At Philips we believe that you should be able to get a set of superb quality speakers tailor-made for whatever you drive.

Round-edged, square-edged, long, short, fat, thin, two-way, three-way, single cone, dual cone. Whatever tickles your fancy, Philips can match it.

In fact, we have over one hundred different models of speakers for twenty five models of car (and yes that does include both the Saab and the Mini). So finding the right mix of tweeters and woofers that's made to measure for your car could hardly be easier.

Say having bought your new Philips stereo you later decide you want the sort of wide frequencies and better quality sounds that would appeal to Fido here.

Fear not. Our latest models are fitted with a CD Changer control ready for the day you decide to install an in-car CD in your boot.

You'd be absolutely barking mad to choose anything else.

Philips Car Stereo

Rules of the road

Everyone knows traffic lights are used at the start of races, but what are the rules governing their operation? Formula One regulations become ever tighter as the ruling body strives to improve safety. From the shape of the car's bottoms to the size of the pit lane, there is a rule to be followed

THE DRIVERS

Licences *All motor sport competitors must have a competition licence of some kind, but that for Formula One is unique. Known as a Super A licence, it is issued on application to drivers who have completed a season of international Formula 3000 or who are the current holders of their national Formula Three title. It can also be issued at the discretion of the FISA Formula One Commission to drivers with lesser qualifications, something which has raised a few eyebrows in the past when Super A status has been awarded to competitors with apparently limited experience.*

Teams *Drivers must be assigned to teams before the start of each new season, although a team may have one or two driver changes per season, depending on the number of cars that they run – or more if force majeure is perceived to apply, as a result of injury, retirement or breach of contract, for instance.*

THE CARS

Weight *The weight limit is a minimum rather than a maximum, designed to ensure that safety is not compromised in the designers' search for lightness and speed. All-up weight must not be less than 505kg, including fuel, oil and water, but not including the driver – which is one reason why most of the top men are of slight build.*

Length *The cars can be as long as you like, but their width is restricted to 215cm and their height, excluding mandatory roll-over bars, to 100cm, which effectively bans the high-mounted wings that regularly fell off when used about 20 years ago.*

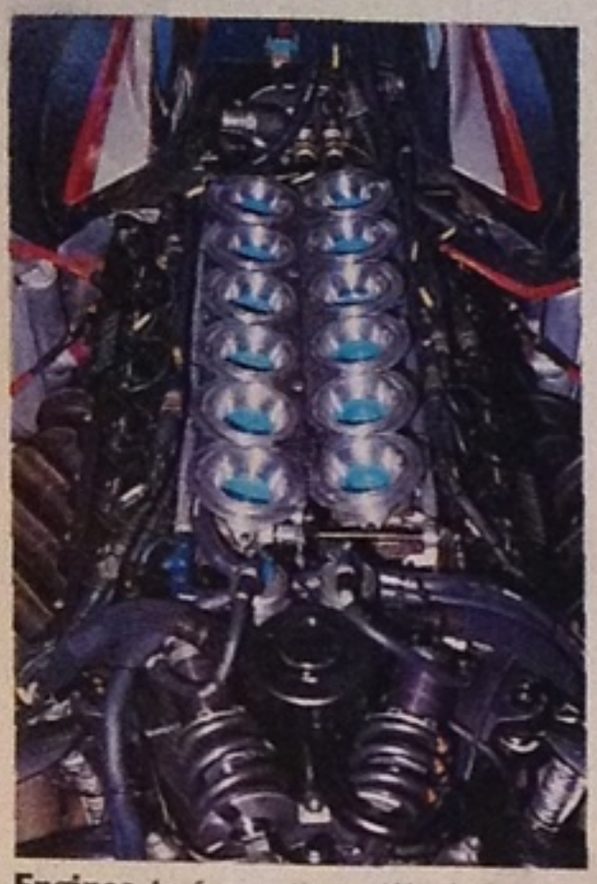
Aerofoils *Similar restrictions on front and rear overhang preclude the outboard mounting of the aerofoils, something which has been tried in an effort to increase their effect, and there are also limits on their width.*

Wings and skirt *The wings themselves ('any aerodynamic device') must be rigidly mounted on the sprung part of the car, which means that they cannot exert their downforce directly on the wheels as they once did. Nor may any device bridge the gap between the body and the ground, so the sliding skirts used on ground-effect cars in the early Eighties are prohibited.*

Wheels *Six-wheelers are out now, four being the maximum wheel count, while the wheel/tyre combination may be no wider than 18ins and no taller than 26ins. And only two of those wheels may be driven, perhaps a superflous rule since the four-wheel-drive fad of the late 1960s took Formula One up what proved to be a thankfully short blind alley.*

PHOTOGRAPHS: ALLSPORT, ZOOOM

Gears *The cars may have any number of gear ratios, but one of those must make the car go backwards. Williams fell foul of this particular rule last season, when Patrese's best practice time at Spa-Francorchamps was disallowed because of an allegedly non-functioning reverse gear.*



Engines *As for engines, Wankels are banned, as are two-strokes, diesels and gas turbines; those with long memories will remember the Indycar-based Lotus 56B belching kerosene fumes, flames and a fog-like heat haze from its huge exhaust stack. You can have any configuration you like, but 12 cylinders (perfectly circular at that) is the maximum, the capacity limit is 3,500cc and superchargers are a thing of the past.*
Fuel *In simple terms, the fuel used in Formula One is equivalent to the late lamented five-star, albeit in unleaded form. It must have a maximum octane rating (Research Octane Number) of 102, around the same as five-star. However, if you filled your own car's tank with it, the car would not run and it has a thoroughly unpleasant pungent aroma.*

Special fuels are used in special engines for the same purpose, for those screaming qualifying laps where longevity does not matter, apparently adding 50 or 60bhp to the normal power output. In the turbocharged days, turbo boost was 'tweaked' to produce massive power outputs.
Refuelling *A fuel capacity limit no longer applies, but refuelling is not allowed (the fire risk was deemed too great after the high-speed fuel and tyre stops of the turbo cars). In fact, most cars now carry about 220 litres of petrol – worth more than £20,000 by current estimates!*
Tyres *Tyre use is unrestricted in the races themselves, but no driver may use more than eight untreaded 'slick' tyres during any qualifying session and no more than 12 in any pre-qualifying session, no matter how many cars he drives. This regulation was used to limit the use of super-sticky qualifying tyres, which this season is unnecessary as qualifying tyres won't be available.*

Cockpits *There are no minimum dimensions for the cockpits, but access must be good and although the steering wheel must have a quick-release mechanism the driver must be able to free himself from his belts and leave the car within five seconds with the wheel in place.*

The belts consist of two shoulder straps, one abdominal strap and one strap between the legs. There must also be at least two mirrors, giving the driver good visibility to the rear and sides of the car.
Safety *The cars must withstand various crash tests, including a 25g (25 times gravity) frontal impact, without suffering distortion to the survival cell which extends from behind the fuel tank to 15cm ahead of the driver's feet, which in turn must be behind a line drawn through the front wheel centres. A fire extinguisher must be situated within the survival cell which directs 5kg of extinguishant towards the driver and 2.5kg towards the engine. There must be a master switch which allows the driver to cut off the electrical circuits to the ignition and all fuel pumps. All cars must have a red warning light of at least 21 watts on the rear of the car.*

Camera *One concession to the voracious appetite of the television viewer: all cars must carry either an on-board camera and transmission unit or the equivalent ballast.*

THE CHAMPIONSHIP

Rounds *There must be at least eight but no more than 16 rounds to the championship, and drivers and teams may accumulate points in each event.*
Points *Points for the drivers' and constructors' championships are awarded on the basis of 10, 6, 4, 3, 2, 1 for the first six places.*
Teams *No team is permitted to enter more than two cars into the championship and only one team may enter a particular make of car.*

THE RACES

Length *Race length is at least 305km, although there is a two-hour time limit which sometimes comes into play in wet weather.*
Numbers *Numbers are agreed with FISA before the season, but the champion driver always carries number 1 and his team-mate 2.*
Spare cars *A driver may use spare cars in practice, but cannot change cars once the race is under way, unless there is a restart.*
Deposits *New teams must deposit $100,000 with FISA at the start of the season and this is refundable if the whole season is completed to the satisfaction of the federation.*

Prequalifying *Twenty-six cars are automatically accepted for official practice according to their classification in the constructors' championship over the previous two half seasons. Four more cars are allowed to join official practice, so if more than 30 cars are entered in total, those classified 27th and above must fight it out in a prequalifying session early on the first practice day, the fastest four joining official practice.*
Qualifying *The nail-biting does not end there, however, because the slowest four in the two hour-long qualifying sessions go out, leaving just 26 cars.*
Practice *There are also two free practice sessions, of one and a half hours each, which teams use to try out race settings for their cars.*

Pole position *There has been plenty of argument between drivers and officials as to which side of the track pole position should be on. According to the rules the fastest driver starts from the grid position that was designated pole in the previous year's race unless a FISA safety representative says otherwise.*
Warm-up *There is always a 'warm-up' lap and this and the start proper are the only times a car may be push-started on the track. Any car that is delayed on the warm-up must start from the back of the grid. When all the cars are stationary once more, the red light will be switched on, followed between four and seven seconds later by the green to start the race.* ▷

PHOTOGRAPHS: HERNE DE VRIES, ALLSPORT, ZOOOM, SPORTING PICTURES

Delayed start *If there is a problem before the red light comes on, a red flag and a 'start delayed' board will be shown, but if the red light is already on, amber flashers will join the red to indicate a delay. A false start will result in a one-minute penalty for the offending driver.*

Stopped race *If a race is stopped and not subsequently restarted, the award of points will depend on the distance covered: less than two laps, no points; less than 75 per cent distance, half points; more than 75 per cent, full points. If the race is restarted with between two laps and 75 per cent completed, the results of the two parts of the race will be aggregated.*

Wet race *You may have heard Murray Walker talking about races having been declared officially 'wet' and what this means at present is that if more than half of the cars have chosen treaded tyres the race will not be stopped unless safety is deemed to be in question. The Clerk of the Course – and only him – can decide that there is too much water on the track even for wet-weather tyres and delay the start by 10 minutes at a time. However, following the debacle of the short and spectacular race that took place on a flooded Adelaide track last year, moves are afoot to change these rules and establish some kind of Formula One safety commission.*

The pits *Fuelling and wheel-changing are allowed only in the pit lane or, until the 5-minute board is shown, on the starting grid. No work may be done outside the pit area during the race, other than by the driver using tools carried on board – which is a highly unlikely scenario today.*

The pit lanes *The pit area itself is divided into three lanes, an outer fast lane, a middle lane for acceleration and deceleration and an inner lane. The last of these is the only one in which cars may be worked on, hence Nigel Mansell's disqualification during last year's Portuguese Grand Prix when his wheel came off while the car was in the middle lane.*

Reversing *If a driver overshoots his pit, his mechanics are allowed to push the car backwards. However, reversing under power is forbidden, another rule that Mansell undoubtedly knows well, since he was excluded from the 1989 Spanish race for doing this amid some typical Ferrari chaos. On the track, the cars may be pushed to safety against the traffic flow by marshals, but driving this way is forbidden.*

Pushing *No driver is allowed to push his own car, something that has been seen in the past when cars have run out of petrol close to the finishing line. Any push that starts the engine brings instant disqualification.*

Non-finishers *You don't have to finish a race to score points. As long as you have covered at least 90 per cent of the winner's distance you will be classified as a finisher.*

THE LIGHTS AND FLAGS

The lights *Grands prix are started by the use of coloured lights. Once all cars have completed the warm-up lap, the red light will be switched on, followed between four and seven seconds later by the green light to start the race. In the event of a delay, flashing amber lights will appear. If the lights fail, the national flag of the country in which the race is being staged will take their place. Raising the flag replaces red, dropping it replaces green.*

The flags *A black and white chequered flag is waved at the start/finish line.*

If the race has to be stopped, a red flag will be displayed motionless at the start/finish line and at marshals' posts around the course. Drivers must go slowly to either the grid area or the parc fermé as directed.

A black flag shown motionless, together with a number on a signal board, informs the driver of that car that he must stop immediately at his pit, usually due to a rule infringement.

A black flag with an orange disc used similarly has the same effect, but warns the driver that his car has a problem that could cause danger.

A diagonally divided black and white flag presented in the same way is used to warn a driver about 'unsportsmanlike behaviour'.

Marshals' flags are shown at marshals' posts around the circuit. If they are waved their meaning is emphasised. Yellow means danger ahead. Drivers must slow down and may not overtake until they pass a green flag to indicate a clear track ahead. Yellow with red stripes means slippery track ahead, often used when there is oil on the track. White means there is a slow-moving vehicle on the track, either a service vehicle or a competing car in trouble. Blue warns a driver that overtaking is imminent, but is not used in close-fought duels or during the first two laps. A portable fire extinguisher may be shown to warn a driver that his car is on fire. □

PHOTOGRAPHS: ALLSPORT, HOWARD DE VRIES