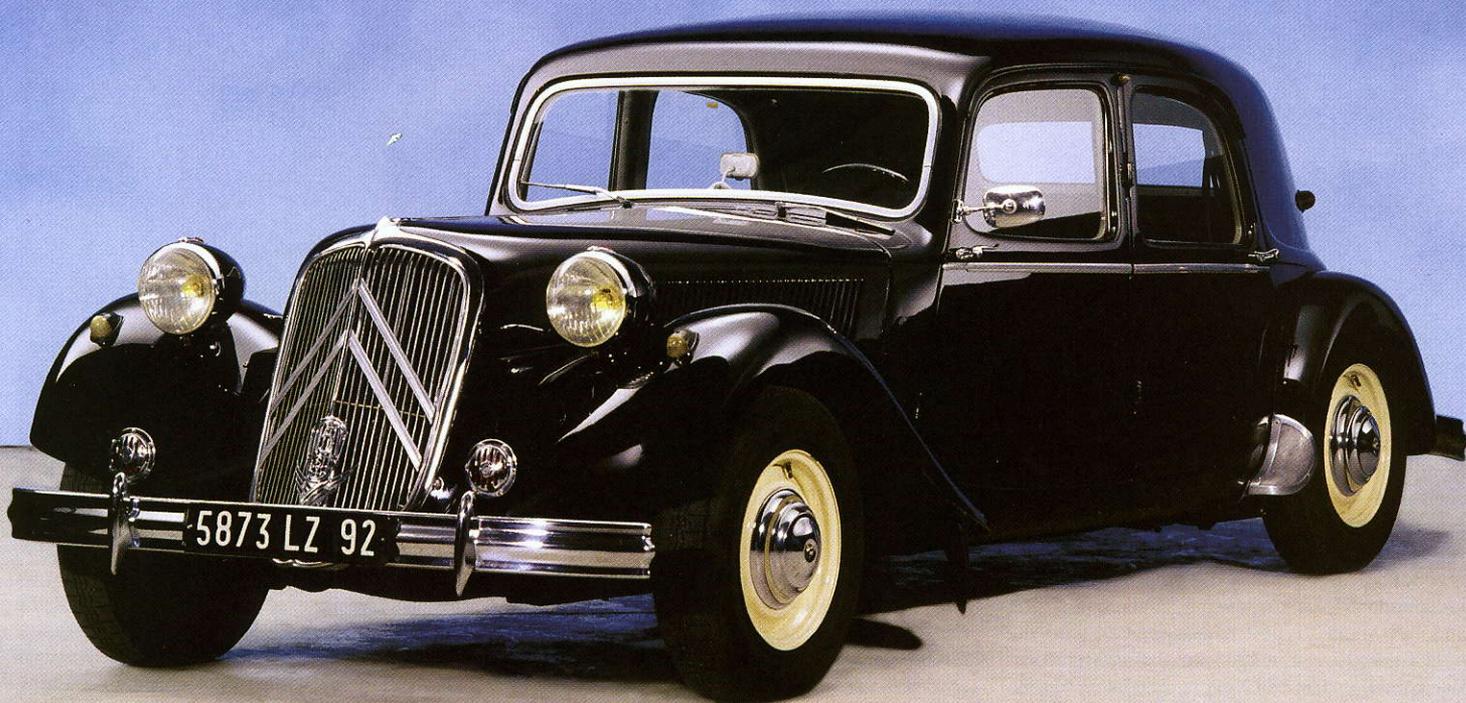


Citroën

FORWARD THINKING



As Citroën celebrates its 90th birthday, Jonathan Wood explains how the French firm influenced a generation of British automobile engineers



Top: The *Traction Avant*, introduced in 1934, survived until 1957, by which time some 760,000 had been built. This is an example of the six-cylinder 15-H, introduced in April, 1954, which incorporated the as-yet unannounced DS's hydropneumatic suspension at the rear. Above: André Citroën (1878-1934) was of Jewish origin, his father and mother being respectively of Dutch and Polish extraction. He gave the world the *Traction Avant*, but lost control of his company in the process

This year Citroën celebrates the 90th anniversary of its foundation. In May, 1919, the first example of its first car, the 1.3-litre Model A, left the company's factory on the Quai de Javel in Paris. Of conventional design and appearance, it gave little inkling of what lay ahead. A succession of wholly orthodox models followed, although the B12 of 1924 has the distinction of being Europe's first mass-produced pressed steel saloon. This was thanks to Citroën adopting patents sourced from the Budd Corporation in America.

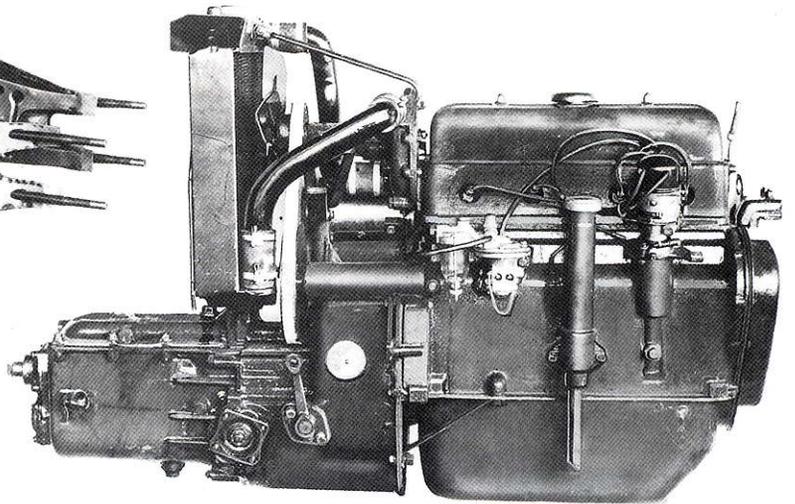
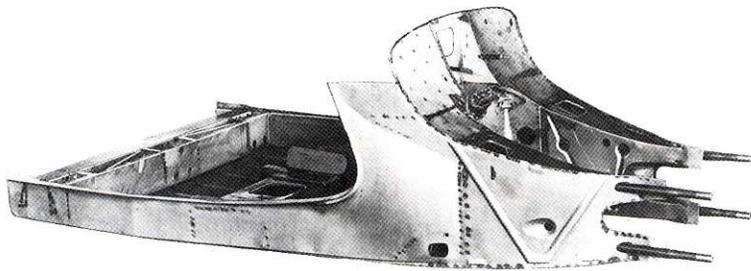
The company's technological *tour de force* was revealed to Citroën concessionaries in March, 1934, in the alluring form of the wholly-new *Traction Avant*. André Citroën had redefined the concept of the motor car. It not only bristled with innovation but made front-wheel drive a practical reality. Designated PV, for *Petite Voiture* (small car), it had been masterminded by André Lefebvre, Gabriel Voisin's 'spiritual son', who had the distinction of having been both a racing driver and a visionary car designer. Trained as an aircraft engineer at the Ecole Supérieure de l'Aéronautique in Paris, Lefebvre had joined Voisin in 1915. He went on to finish fifth in the 1923 French Grand Prix driving one of his master's eccentric wedge-shaped cars, named *La Laboratoire*, which he had helped to design.

Lefebvre subsequently joined Renault but left when it refused to take up his design for a front-

wheel drive car. He was therefore ideally qualified for his role at Citroën, joining in March, 1933, only a year before the *Traction's* launch. Lefebvre was to wield supreme powers at Quai de Javel until his retirement in 1958, even though he was never accorded an official title. Citroën historian John Reynolds has described him as 'the archetypal artist-engineer, worshipping novelty for its own sake and taking a perverse delight in doing things differently...' His credits not only included the *Traction Avant's* DS replacement but also the 2CV, the inspiration of Citroën's then managing director, Pierre-Jules Boulanger.

The saloon version of the *Traction* was not only low slung, to reap the stylistic advantages of front-wheel drive, it was remarkably elegant and imbued with a sense of movement, even when stationary. Beneath the aerodynamically-refined body, the work of Flaminio Bertoni (Italian born, French domiciled and unconnected with Bertone the Turin coachbuilder), was a unitary construction hull, again with Budd input, at a time when a separate chassis was still the norm. For the record, Lancia had anticipated both unitary construction and independent front suspension in its Lambda of 1922.

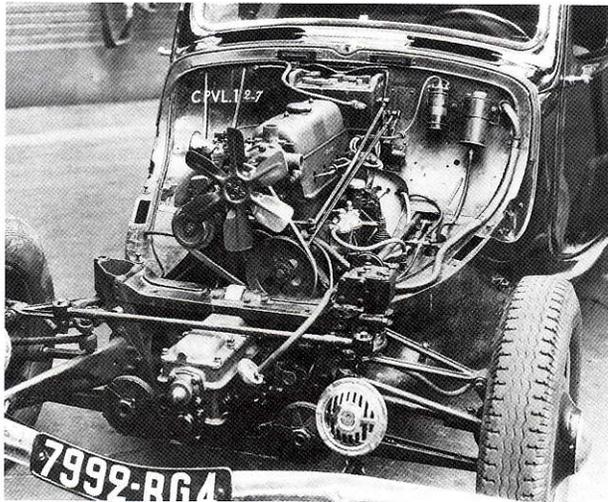
Under the bonnet was a four-cylinder overhead valve engine, designed by former Delage engineer Maurice Sainturat. Reliable from the outset, it was significant for featuring detachable wet cylinder liners. The suspension medium was light,



Above left: The *Traction's* innovative sub structure was light and strong with a flat floor but vulnerable to rusting. The four long, projecting studs secured the car's self contained engine/gearbox/front suspension unit

Above right: Maurice Sainturat's wet liner engine was a bit rough but had the virtue of being dependable from the outset, unlike many of the car's other components which required re-engineering. The three speed manual gearbox was a last-minute arrival, having replaced a De Lavaud automatic unit

Left: The engine compartment of this pre-production 11CV coupé, sans radiator, clearly shows the independent front suspension with its single lower arms sprung by torsion bars. The friction shock absorbers were replaced by telescopics in April/May, 1935



maintenance-free torsion bars, longitudinal at the front and transverse at the rear, from where they controlled the dead tubular back axle. Patented by Porsche in 1931, the front bars used by Citroën were allocated Type 45 in the Stuttgart company's register of designs. A landmark system of independent front suspension, of the coil spring and wishbone type, had appeared on the international arena in 1933, first from Mercedes-Benz and then General Motors. The latter was the work of GM engineer Maurice Olley. However, the *Traction's* ifs, designed by Maurice Julien, differed in significant details, quite apart from the coils being replaced by torsion bars. The system comprised single lower arms with slender wishbones above. Brakes were Lockheed hydraulics, the Citroën being the first French series production model to be so enhanced. On its introduction the car had used worm and roller steering gear but, in May, 1936, this was replaced by a rack and pinion unit, a great improvement on the original. Citroën was following the example of Adler's front-wheel drive Trumpf of 1932.

Although the *Traction Avant* was the most technically and stylistically advanced mass produced car in the world, the downside of its

creation was that André Citroën, an inveterate gambler, over-reached himself in its development. Bankrupted in December, 1934, and already stricken with cancer, he died on 3rd July, 1935, at the age of 56. Later that month the business was bought by Michelin, his largest creditor. Once in control it set about re-engineering the car, which had been rushed into production, but without diluting its unique personality. The *Tractions* that emerged late in 1936 shared few common components with the '34 originals.

Ironically, the new Citroën, which the company claimed to be 'two years ahead of its time', was destined to survive for 23, the last example leaving Citroën's factory in July, 1957. It was replaced by the equally sensational DS, which contrasted with the quirky, idiosyncratic 2CV, introduced in 1948. The *Deux Chevaux* proved to be another long-runner and remained in production until 1990.

In many respects Citroën epitomised a radical shift in European car design in the 1930s as certain forward-thinking Continental manufacturers departed from the tradition of the front engine/rear drive layout laid down by Emile Levassor for Panhard in 1891. Engineers educated at the technical schools and polytechnics which

challenged convention were producing more advanced designs than their conservative British contemporaries. The resulting models could therefore enjoy long production runs, the Porsche-designed torsion bar sprung Volkswagen Beetle, conceived in 1933/38, its engine location diametrically opposed to the Citroën's, being the most notable example.

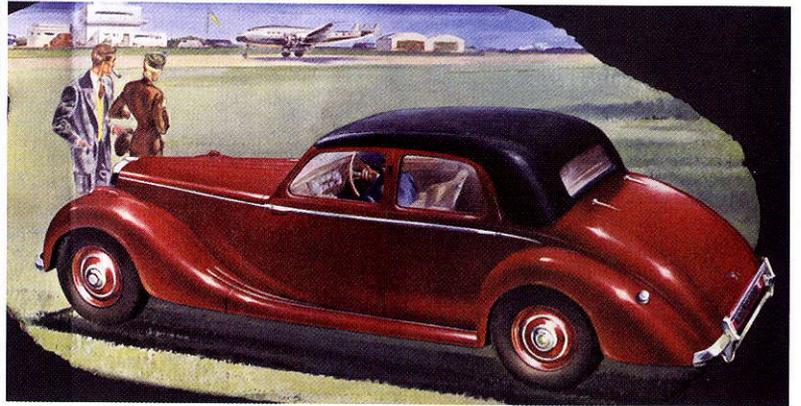
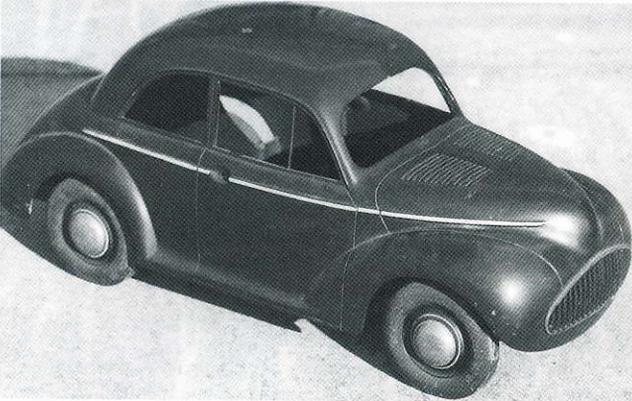
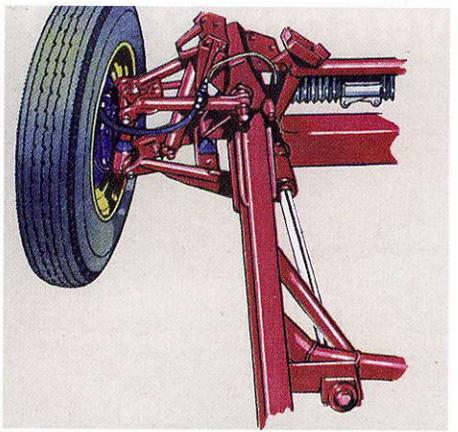
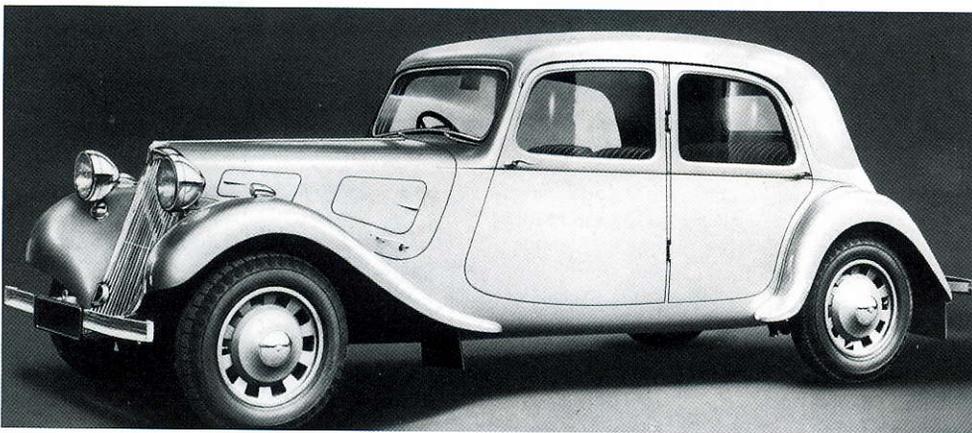
It is worth reflecting that the *Traction Avant* was launched in the same year as Morris's Eight, destined to be the best selling British car of the 1930s. Cowley's finest and the Citroën were light years apart from stylistic and technical standpoints. But Lord Nuffield could have justly countered that Morris Motors was one of the most profitable car companies in Europe, while loss-making Citroën would not return a surplus until 1937.

As far as British motor manufacturers were concerned, examples of the *Traction Avant* were readily available for evaluation. This was because the ground-breaking Citroën was also assembled from the 1935 season at the French company's factory on the Slough Trading Estate, opened in 1926. The French 7CV, a 1.6-litre car, was initially sold in Britain as the Super Modern 12 and the bigger bored 11CV 1.9-litre was its 15 equivalent. The superlatives were soon dropped and the larger model became, in four/five-seater form, the Light 15, while the long wheelbase version was the Big 15. In 1939 a 2.9-litre six-cylinder 15CV joined the range, known at Slough as the Six. It featured double wishbone ifs.

A variety of British car companies, from Rolls-Royce to Morris, acquired examples of the *Traction Avant* to discover what made that remarkable car tick. But no mainstream manufacturer followed Citroën down the fwd road, as the motor industry remained a bastion of *système Panhard*. Citroën's bankruptcy no doubt produced much head shaking at Cowley and Longbridge, having provided an apparent endorsement of the risks associated with too radical a technical leap forward. Britain's car makers would have maintained that their conservative products were reflecting the priorities of a middle class clientele. This was

Arguably Europe's best-looking saloon of the 1930s, this is a launch photograph of the *Traction Avant* as unveiled in March, 1934. This pre-production 7CV is one of many impressive studies by Citroën photographer Pierre Louis





Top left: A Slough-built right-hand drive Light 15 with Michelin Pilote wheels which arrived for the 1939 season and was reintroduced in 1946. These UK cars featured a polished walnut rather than steel dashboard, 12-volt electrics and leather, as opposed to cloth, upholstery. Bottom left: As originally conceived, the Morris Minor, designed during the Second World War, possessed Citroën-inspired torsion bars front and rear, although the latter were discontinued early on. This model belonged to Issigonis's long-serving draughtsman, Jack Daniels. Top right: Riley called its suspension Torsionic. Also apparent is part of the rack and pinion steering gear, both following *Traction Avant* precedent. Bottom right: The torsion bar front suspension and rack and pinion steering of the Riley RM Series were Citroën inspired. This is the 2½-litre model of 1946/53 vintage

confirmed by Slough having produced a relatively modest 5922 *Tractions* between 1935 and 1941, compared with some 218,000 first generation Morris Eights.

Those who did buy Citroëns became ardent apostles of the new order. One was Tim Carson, secretary of the newly-formed Vintage Sports-Car Club. Other influential members also owned Citroëns and prewar examples of this mass-produced saloon were accordingly added to the VSCC's list of Post-Vintage Thoroughbreds, drawn up in 1945.

On its launch the car had enjoyed extensive coverage in the weekly motoring press but was virtually ignored by the heavyweight magazine, *The Automobile Engineer*. W D 'Peter' Fisher, its able but innately conservative editor, clearly did not consider it of interest, so his pages only contained a few passing references to Lefebvre's masterpiece. The mould-breaking Citroën was enthusiastically embraced, however, by many of Britain's talented, aspiring and influential automobile engineers. Not only were they impressed by the road holding advantages of front wheel drive, the *Traction's* innate stability was also recognised, thanks, in part, to Lefebvre's underlying concept of 'a wheel at each corner'.

One early champion was W O Bentley. Joining Lagonda from Rolls-Royce in 1935, from 1939 he ran a Citroën as his company transport prior to switching to a succession of Issigonis Morris Minors. The *Traction* 'was the last car to influence in any way the design work for which I was responsible,' he recalled. 'The cornering and road-holding on the Citroën were astonishingly good...and the manner at which it remained glued to the ground going round corners, no matter what the road surface might be, was most endearing' (*The Cars in My Life*).

Bentley was the first British automobile engineer to adopt Citroën-inspired torsion bars on

a road car. They were similarly longitudinally located to service the ifs system on his V-12 Lagonda and on the associated LG6, the former having been first seen in 1936 but not ready until 1938. They had already featured on a British racer. H N Charles had used longitudinal bars front and rear on his ingenious, all-independent MG R-type monoposto of 1935.

The *Traction Avant* also encouraged W O to design a small, front-wheel drive Lagonda. Sadly, this project, with a five-cylinder radial engine, replaced by a flat-six, and with torsion bar front suspension, never attained production. Instead Bentley decided to concentrate on the more orthodox 2.6-litre car introduced in 1948. He toyed with the idea of a Citroën-inspired substructure with pressed steel body but had to settle for a cruciform chassis with all-independent suspension and longitudinal torsion bars at the rear.

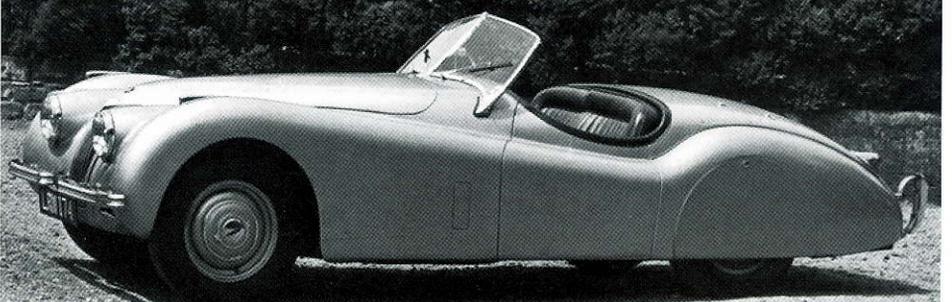
The reality was that the Citroën's influence did not really become apparent in Britain until after the Second World War. Its torsion bars and rack and pinion steering were widely adopted, although the ifs was invariably used in conjunction with wishbones in the Olley idiom. For while torsion bars were subject to a Porsche patent, which in any event expired in 1950, it may be that such

niceties went by the board in the shadow of Germany's defeat in the war. Does anyone know the truth of the matter?

Bentley's new Lagonda – the company had by then been acquired by David Brown – was displayed at the 1948 Motor Show. It kept company with a host of new models, many of them influenced, to a greater or lesser extent, by the Citroën. Of these the most significant was Alec Issigonis's Morris Minor. Its suspension medium and steering followed *Traction Avant* precedent, whilst the French's car 'wheel at each corner' formula contributed to the Minor's excellent road manners.

At Morris Motors, Issigonis had initially been an ardent advocate of Maurice Olley's coil and wishbone independent front suspension. He had been converted to Citroën's torsion bars by his friend John Morris, chief engineer of in-house SU Carburettors. Morris, one of the great British eccentrics and an immensely able engineer, not only enthused about the front-wheel drive Citroën, he was a passionate advocate for *anything* French. His mother's maiden name was André, so perhaps he had Gallic blood. He was accordingly a strictly unofficial but proselytising ambassador for the *Traction Avant*. A resident of the exclusive Edgbaston district of Birmingham, Morris, at the

The first Jaguar sports car to employ torsion bars in the Citroën idiom was the XK 120 of 1948. This is a 1951 example. The concept was perpetuated in the E-type



wheels of a succession of Citroëns, was a regular visitor to many of those Midlands car companies who were customers for his SU carburettors and electric petrol pumps.

The *Traction Avant* was, of course, also displayed at the same '48 Show and the adjoining stand at Earls Court was occupied by Standard. It featured that company's wholly new Vanguard saloon. Whilst the styling was overtly American, its engine reflected Citroën practice. Technical director Ted Grinham had adopted its wet cylinder liners to produce a robust and versatile four-cylinder unit which was to endure until 1967.

Two stands down from Citroën's display, Jaguar was exhibiting its stop-gap Mark V saloon. Its essentially prewar lines and pushrod engine concealed a new chassis, complete with longitudinal torsion bar sprung ifs. Chief engineer William Heynes had been another admirer of Citroën practice and Jaguar was destined to use torsion bars for longer than any other British manufacturer. They featured on the XK sports car series, the 120 having a truncated Mark V chassis, and continued on the E-type until it ceased production in 1974. They were also employed, both front and rear, the latter transversely, on Heynes's sports racing C and D-types.

His enthusiasm was shared by another British engineer, whose first car, the Jowett Javelin, was also on display at the Show. Gerald Palmer had worked previously with Issigonis at Cowley and, whilst there, was also exposed to John Morris's zealous enthusiasm. Morris was 'a fanatical advocate of front-wheel drive and used nothing but *Traction Avant* Citroëns,' Palmer remembered. Gerald often drove one himself – Jowett's all-too-appropriate company car, in fact. The Javelin bristled with individuality. Whilst its flat-four engine was inspired by the Type 50 Steyr, it will come as no surprise to find it featured longitudinal front torsion bars and transverse rear ones. John Morris had made another convert. Another Citroën owner was Hugh Rose, technical director of Lea-Francis. His post-war 12/14hp models featured *Traction*-inspired front longitudinal torsion bars. It was the same story at Armstrong Siddeley, another Coventry company, where they featured on the new Lancaster and Hurricane lines.

We again encounter the peripatetic John Morris in charting Riley's adoption, in essence, of the entire *Traction Avant* front end on its post-war RM series. His rôle apart, the RM's origins reached back to 1937. It was through the good offices of Bob Ayre, previously of Bentley, MG and ERA, who then worked for Citroën at Slough, that Riley secured a brace of Light 15 saloons for evaluation. The outcome was an experimental hybrid, a Riley chassis with its half elliptic front springs replaced by the Citroën's detachable front suspension assembly. Riley named 'its' suspension Torsionic and it became the first British manufacturer to adopt rack and pinion steering, the 1½-litre RMA of 1945 being so equipped.

A similar experiment had been undertaken by Rolls-Royce when it was developing the 3½ Litre Bentley. One of four prototypes, 4-B-1V was in June, 1936, rebuilt with Citroën ifs. But Derby Bentleys remained cart-sprung until the all-too-brief appearance of the Mark V in 1939. It used coils and wishbones in the General Motors tradition.

All of these cars employed, to a greater or lesser extent, Citroën's suspension. But a *Traction Avant* also featured in the development of an advanced front-wheel drive prototype, the Duncan Dragonfly, completed in 1948 (see *The Automobile*, February, 2008). Designed in North

Walsham, Norfolk, it was purchased by Austin for £10,000. A Citroën had been acquired to familiarise the design team with the essentials of front wheel drive, building on their experiences of a 15/6 owned by merchant banker Gerard d'Erlanger.

Alex Moulton had been responsible for the Dragonfly's rubber suspension. He, John Morris and Alec Issigonis were also united in their enthusiasm for another Citroën, the 2CV. Its ingenious, if crude, interconnected suspension was of particular interest. 'We said, all three of us, it's a marvellous damn thing but it's a primitive way of doing it by rods and springs,' Moulton remembered. 'I bought one, a little van, and took measurements of its mechanical interconnection.' John Morris also acquired a 2CV and soon converted it to run on gas via a modified carburettor, supplied from a 16lb Calor gas canister that occupied the front passenger seat.

Moulton's initial work paved the way for his more sophisticated, interconnected fluid system that featured on the stillborn TA 350 saloon which Issigonis produced for Alvis in 1954. It can be seen as a progenitor of Moulton's Hydrolastic suspension that so enhanced the Morris 1100 of 1962. Arguably the most advanced medium-sized car of its day, the 1100 was destined to be the Britain's bestselling model of the decade.

Issigonis's enthusiasm for Citroën had been expressed by XC9001, the first experimental car that he designed for BMC following his arrival at Longbridge in December, 1955. Rear-driven, with Moulton's interconnected suspension, its visual resemblance to the newly introduced DS was striking. But then BMC's assistant engineering coordinator was driving one of those every day, the corporation having acquired an example for evaluation.

Citroën had introduced the DS, its replacement for the *Traction Avant*, at the 1955 Paris Salon. Laurence Pomeroy, technical editor of *The Motor*, a friend of Issigonis and confidant of BMC's chairman Leonard Lord, was much impressed. He enthused that the new Citroën 'represented one of the biggest advances in car design in the whole history of motoring.' Cornering Lord at the London show the following week, Pomeroy told BMC's chairman it was high time he progressed from cart springs and built "something a little more interesting". Lord responded: "You bloody well tell us what to build and we'll build it."

In retrospect this conversation represents the first step towards the creation of a Citroën-inspired policy dubbed 'engineering excellence' by BMC. The idea was to produce technically advanced cars that would enjoy long production runs, avoiding the need for costly body changes. This approach was diametrically opposed to that of Ford, which was reliant on conventionally engineered front engine/rear drive models that benefited from regular styling updates.

Issigonis's Mini, with important contributions from Moulton and Morris, was the first expression of this approach, thanks to the 1956 Suez crisis and a resultant escalation in petrol prices. Launched 50 years ago, the Mini was destined to survive for 41, not being discontinued until 2000. Its Morris 1100 derivative was to enjoy a run of 11 years, production ceasing in 1973. But the policy was fatally flawed because the cars were over-engineered and underpriced. BMC, and for that matter Citroën, lacked the financial and marketing skills that were so apparent at Ford. If the original strategy had been successfully implemented, the cars would have undergone a continual programme of refinement, and might have stood a chance commercially, but



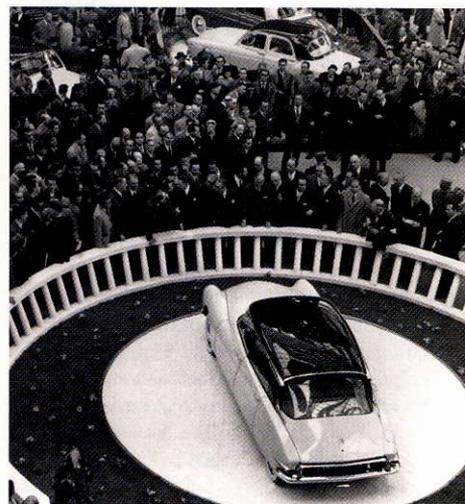
The 2CV's basic but ingenious interconnected suspension provided inspiration to Alex Moulton. Here a family is enjoying the AZL version of 1957

Issigonis tended to lose interest in his designs once they had been completed.

So BMC gave way to British Leyland. The oil price rise and resultant world recession of 1974 saw a collapse of the business, to be followed by nationalisation. Coincidentally, Citroën was taken over in the same year by Peugeot. For the company had also succumbed to an engineering-led policy characterised by the fearsomely complex, Maserati-engined SM of 1970. Veteran French motoring journalist Edouard Seidler wrote in *The Autocar* that Citroën 'would have to learn cost control, which has always been one of its weakest points, marketing, or more generally modern management techniques.' His wise words might also have been BMC's epitaph.

That these lessons have been learnt is indicated by the fact that Citroën still has a significant presence in the European motor industry. So let us raise our glasses to toast a company 90 years young that is looking forward with confidence to 2019, when it celebrates its centenary.

With acknowledgement to Citroën Traction Avant by Jon Pressnell, Citroën by John Reynolds, Gerald Palmer's Auto-Architect, Barney Sharratt's Men and Motors of 'The Austin' and the writer's Alec Issigonis: The Man Who Made the Mini. Additional thanks go to Citroën UK and Automobiles Citroën for supplying many of the photographs.



The 1955 Paris Salon was dominated by the DS, designed by key members of the team that had been responsible for the *Traction Avant*. Beneath the DS's aerodynamically refined bodywork was innovative hydro-pneumatic self-levelling suspension