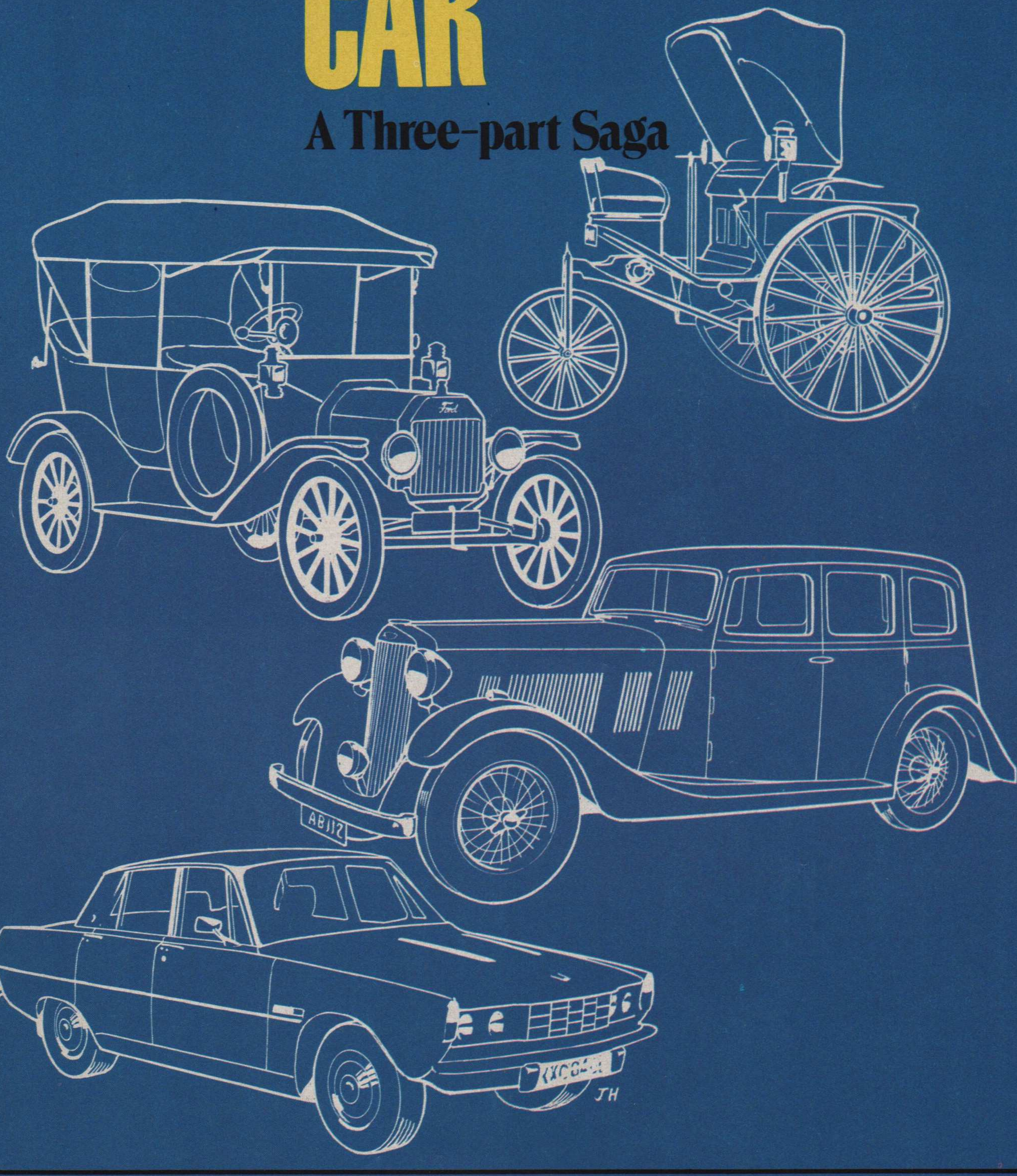
THE DEVELOPMENT OF THE PASSENGER CAR

A Three-part Saga



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This story of the passenger car's development—from the frail, hesitant experiments at the end of the last century to the fast, reliable and superbly sure-footed cars of today—will be told in three parts. They do not follow in chronological order, each being a separate, self-contained entity, dealing with a particular aspect of the story. They will appear in the following order:

In this issue
Part 1: *Mechanical Limitations and Traditional Influences*
by Anthony Bird

and Part 3: ***Present and Future Trends***
by George Oliver

4 April
Part 2: *Shape, Fashion and Style*
by D. B. Tubbs

The supplements have been arranged so that Part 2 can be inserted between Parts 1 and 3 to make a separate booklet.

SINCE THE EARLY beginnings of the passenger car it is very difficult to believe that so many variations on the basic "box-on-four wheels" theme should have been conceived. Some have been poised, delicate and high-stepping, some ponderous and overbearing; some have had dignity and prestige while others have been almost laughable; a few have looked dated almost from the day they first appeared, while fewer still have been so "right" and so superbly balanced that after 40 years or more they seem scarcely to have aged. Designers through the years have allowed themselves to be influenced by contemporary ideas—from the horse-drawn carriages in the beginning, via boats with their planked decking and ventilator cowls, to features of the jet aircraft age which in their place are functional and necessary, but on a car become foolish—vertical tail fins, spinners, jet intakes and outlets, and even gun sights. There was even a period, just following the war, when some would say that the chrome-happy American stylists had been influenced by the buffalo or walrus!

Public taste has been fickle enough to follow the designers' trends—infinitely malleable, as it must be, to accept with enthusiasm stilletto heels in one era, and heavy, inelegant baulks of timber or cork in the next! At one time, a long, high bonnet indicated a huge engine, with the implied speed and performance that went with it—the owner readily sacrificing the view of the road immediately ahead, and peering through a diminutive, pillar-box slit of a windscreen, like the driver of an LMS "Coronation" class locomotive. Nowadays, many of the cars in this exotic, expensive and envied category have mid-engines and no bonnets at all—yet the public endows them with the same speed and power.

Conversely, designers have been guided by public taste, of course—well aware that the car can impart to its owner an aura that he neither possesses nor deserves. Otherwise, why the spoilers, go-faster stripes, fancy wheels, batteries of driving lamps, and wheelarch "eyebrows" on perfectly standard, family cars? These have become particularly prevalent today, in an age of decreasing individuality among cars.

These and other influences have dictated the shape, fashion and style of successive generations of passenger cars—from the marginal motorists' hard-won, basic family saloon to the rich man's exotic toy. Each, in its time, has its own particular beauty; but one cannot help wondering why some inspired designer should not have picked out the best features from each generation, and welded them together into something with a less transitory appeal—something which, like a great painting, would give pleasure for ever.

In this, and the following issue, we have tried to pick out—from files containing thousands of photographs—cars which have been singular for their beauty, individuality, or general utility— explaining in the text the reasoning behind their design. **PG**

Part 1

Mechanical Limitations and Traditional Influences

By Anthony Bird

MOTOR cars have been on sale to the public for 85 years, the merest blink of an eye historically, yet the changes have been so comprehensive that it is hard to believe the 1888-model Benz is the direct ancestor of, say, the Rolls-Royce Corniche.

Of all the forces which have influenced the shape and nature of passenger cars at different times tradition is one of the most potent. The manufacturer catering for the mass market is always ready to try a new gimmick, but feels uneasy without the support of traditional features. Or rather, he supposes the customer will be uneasy without them. This produces the chicken-and-egg situation that the makers go on keeping the links with tradition to please the buyers who, in the main, accept them because they think the manufacturer must have good reason for keeping them. This thinking produces the pointless novelty of an un-circular steering "wheel" with its spokes faced with bogus wood.

Tradition played a big part in the development of all horsed vehicles and the makers of horseless carriages have followed suit. At first they had little option as it made sense financially to buy many items such as springs, wheels step-irons and other fittings from existing carriage-trade sources.

Wheel diameters provide a good example. Every cart-wright and coach-builder of old knew that his products would have to traverse deeply rutted and pot-holed roads; he also knew that the bigger the wheel the more easily it rolls over uneven surfaces and the less work the suspension system (if any) has to do. Therefore waggons and carriages had the biggest possible wheels; and it would have made sense for the front wheels to be as big as, if not bigger than, the hind ones. This conflicted with the common arrangement of steering by a centre-pivoted front axle; in order not to restrict the turning circle the front wheels had to be smaller than the hind ones even though this meant more work for the horses and greater risk of an overturn if the wheels "went on the lock".

The drawback that the further the axle pivoted round the less stable the vehicle became was met in 1818 by Georg Lenkensperger's invention of the "divided axle" system on which all modern steering arrangements are based, however remotely. The English patent was taken out on Lenkensperger's behalf by Rudolf Ackermann (hence the term "Ackermann steering"), but neither he nor the inventor could interest the carriage trade. Nor did W. Bridges Adams have any better luck with his "Equi-Rotal" carriages. Carriages and waggons always *had* had unequal-sized wheels; and equal-sized ones were not acceptable to the public—or so it was thought. When four-wheeled motor cars came on the scene towards the end of the century they had Ackermann, divided axle, steering (with a few exceptions) but they still had unequal-sized wheels though the mechanical necessity for them had vanished.

It took a few years for pioneer motor manufacturers and their customers to discover that God would not strike them dead if the wheels were made of equal sizes fore and aft. The arrangement had obvious advantages, particularly when pneumatic tyres were used, as it was a nuisance to have to carry different sizes of spare tyre. Now, 76 years later, racing cars and dragsters again have unequal-sized wheels; but this is for legitimate functional reasons and not because of clinging to outmoded tradition.

The first motor cars therefore had very large hind wheels by modern standards and this influenced body design, as tradition and mechanical factors also dictated a very short wheelbase. If more than two passengers were to be carried the extra seat had either to be put over the front axle, *vis-à-vis* fashion, or be arranged between the big hind wheels in which case it could not easily be entered from the sides. The alternatives were back-to-back seating, like a dog-cart, or a rear-entrance "tonneau". As many people find riding backwards nauseating, the latter became popular. *Tonneau* is the French for a cask and the arrangement was an adaption of the ordinary tub-cart or governess-cart of the period.

Dr Lanchester was responsible for the first motor car in the world to be designed as a complete mechanical entity, with no reliance on carriage or cycle-trade sources, and in a lecture delivered in the 1930s he said that most pioneer designers thought of the motor car as an alternative to the carriage and not to the express train. Whilst this view prevailed it made sense to think in terms of 12 to 15 miles-an-hour maximum speeds, for which short, high-pitched, big-wheeled, low-powered machines were adequate.

It soon became apparent that people wanted to go faster than a quick-trotting pony and trap, and to give greater lateral strength to cope with increased cornering forces the wheels had to grow smaller (as well as, generally, becoming of equal sizes); and in order to improve road holding by lowering the centre of gravity it was necessary to make chassis longer. Therefore it became possible to make "side-entrance" tonneaux, although the old rear-entrance variety did not die out until about 1905. It was much easier to arrange folding hoods over side-entrance bodies than the older sort, and the rear-entrance bodies, though handsome and snug, also had the disadvantage that the occupants had to step down into the road which was probably muddy.

The size of the wheels was only one factor in determining the shape of the car as a whole, and the position of the machinery was of vital importance. With a handful of exceptions early motor cars had front-wheel steering and rear-wheel drive, and most pioneer designers followed Benz's example and put the engine near the back wheels. Most of the Benz-type cars had the engine almost directly over the axle whilst Cannstatt-Daimlers, for example, had it behind (and above) the axle in a sort of ventilated cosy like a meat safe. Nearly all these engines, whether vertical or horizontal, were of the transverse kind, with the crankshaft parallel with the axles. There is nothing "new" about transverse engines.

As early engines were very bulky in relation to the power developed (3 h.p. per litre was good going), having the machinery more or less under the seat perpetuated the lofty, sit-up-and-beg style seen in the picture of the Arnold, which was one of many Benz copies. The arrangement was fine for seeing over hedges but the handling was not such as to inspire confidence. Indeed, too abrupt a start in one of the little Benz carriages can lift the front wheels off the ground.

Though it was not immediately apparent, the big breakthrough came in 1891 with the first front-engined Panhard-Levassor. With the passengers'

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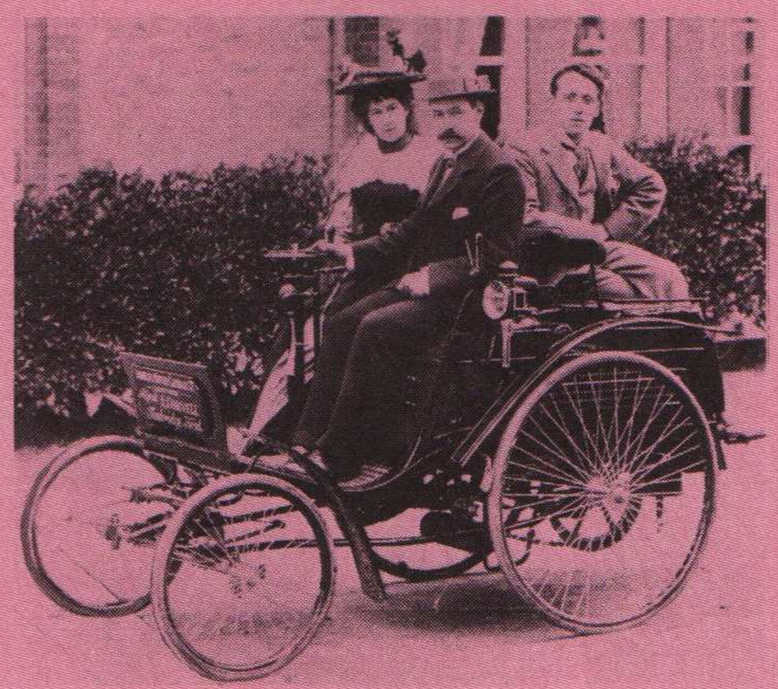
weight near the hind wheels, the big gearbox in the middle and the engine over the front wheels the weight was evenly distributed, and if a little roadside tinkering was needed it was much better to open the cupboard-like bonnet in front than to have to make the passenger dismount in order to lift the seat or floor. Finally the Panhard-Levassor layout, with the crankshaft in the longitudinal line of the chassis, made it easy to accommodate longer engines as the original V-twin Daimler unit gave way to an in-line twin, a four cylinder and, eventually, the six-in-line came along to dominate the luxury car market. The Panhard arrangement made it necessary to lengthen the wheelbase, but also made it possible to lower the chassis and generally to transform the Victorian horseless carriage into the Edwardian motor car.

This new arrangement certainly made sense for biggish cars with biggish engines, but much less sense for the small fry. The best-selling small car of the early 1900s was the reliable little De Dion Bouton voiturette, with its compact vertical single-cylinder engine and unique transmission tucked away under the seat just ahead of the back axle—it would now be called a mid-engined car. Truly mid-engined were the 4¼-litre two-cylinder Lanchesters, the long-forgotten James & Browne, most of the American "gas-buggies" of the Oldsmobile or Cadillac type and many more. Once the front-engined Panhards had made their mark in racing by the late 1890s it became an article of faith that cars *must* have bonnets, from which it followed in popular mythology that the longer the bonnet the better the car must be. Therefore, the little rear-engined or mid-engined runabouts first began to sprout dummy bonnets, after which their makers gradually adopted the front-engined layout which was sometimes a pity as it usually meant sacrificing the "occasional" front seat. The neat little four-seater voiturette grew up into the typical two-seater of the Twentieth Century, and if any provision was made for the occasional adult passenger, or for children, it had to take the form of a not-very-convenient dickey seat which, when occupied, often had a bad effect on the steering.

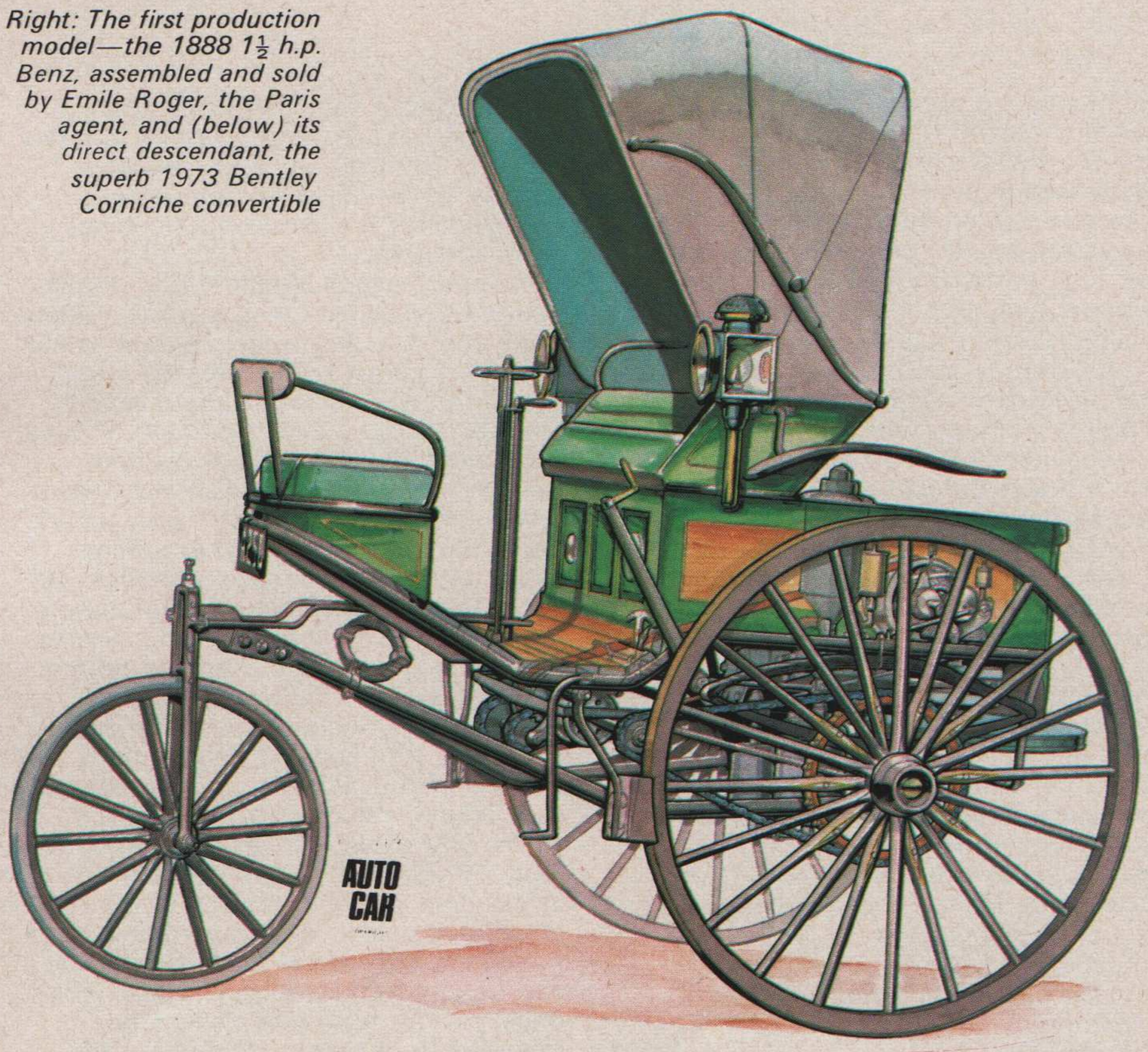
Having broken away from the tradition of the horsed carriage, motor car design was soon strongly influenced by its own traditions. Fashion often proved stronger than common sense and, despite several attempts, the rear-engined small car did not become acceptable again until after the second World War. On the way, one Leslie Hounsfield designed a truly basic utility car, the Trojan, and went back to the old idea of putting the machinery amidships, horizontally, under the floor so as to make all the chassis length available to the cash customers. The prototype Trojan was "bonnetless" but high ideals had to give way to tradition and the production model Trojans were adorned with imposing bonnets which housed the steering column, the carburettor, the horn and several cubic feet of dam' all.

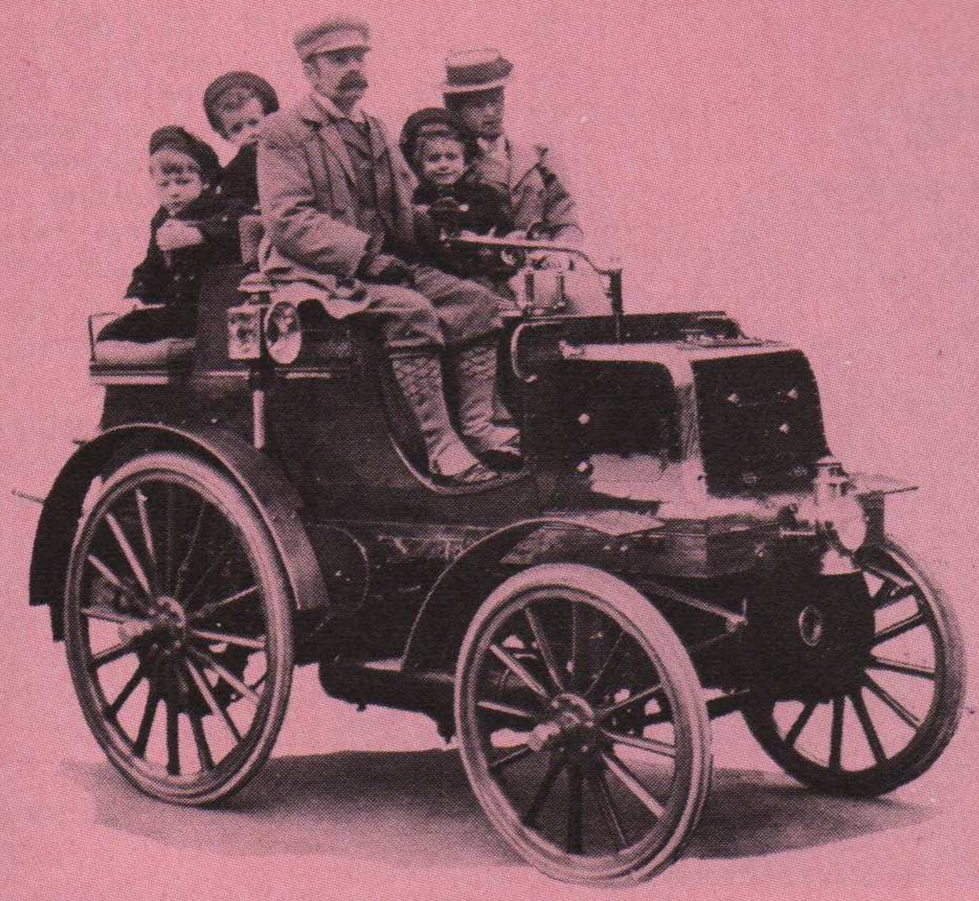
Other mechanical features which strongly influenced the appearance of motor cars were the steering and cooling arrangements. Early Benz, De Dion, Peugeot and many other cars had vertical steering "standards" topped by some kind of handle or bar which was coupled more or less directly to the steering linkage on the front axle. Panhard-Levassor (and English Daimler who copied them) had a "cow's-tail" or bath-chair-type tiller which gave the driver plenty of leverage. It also put

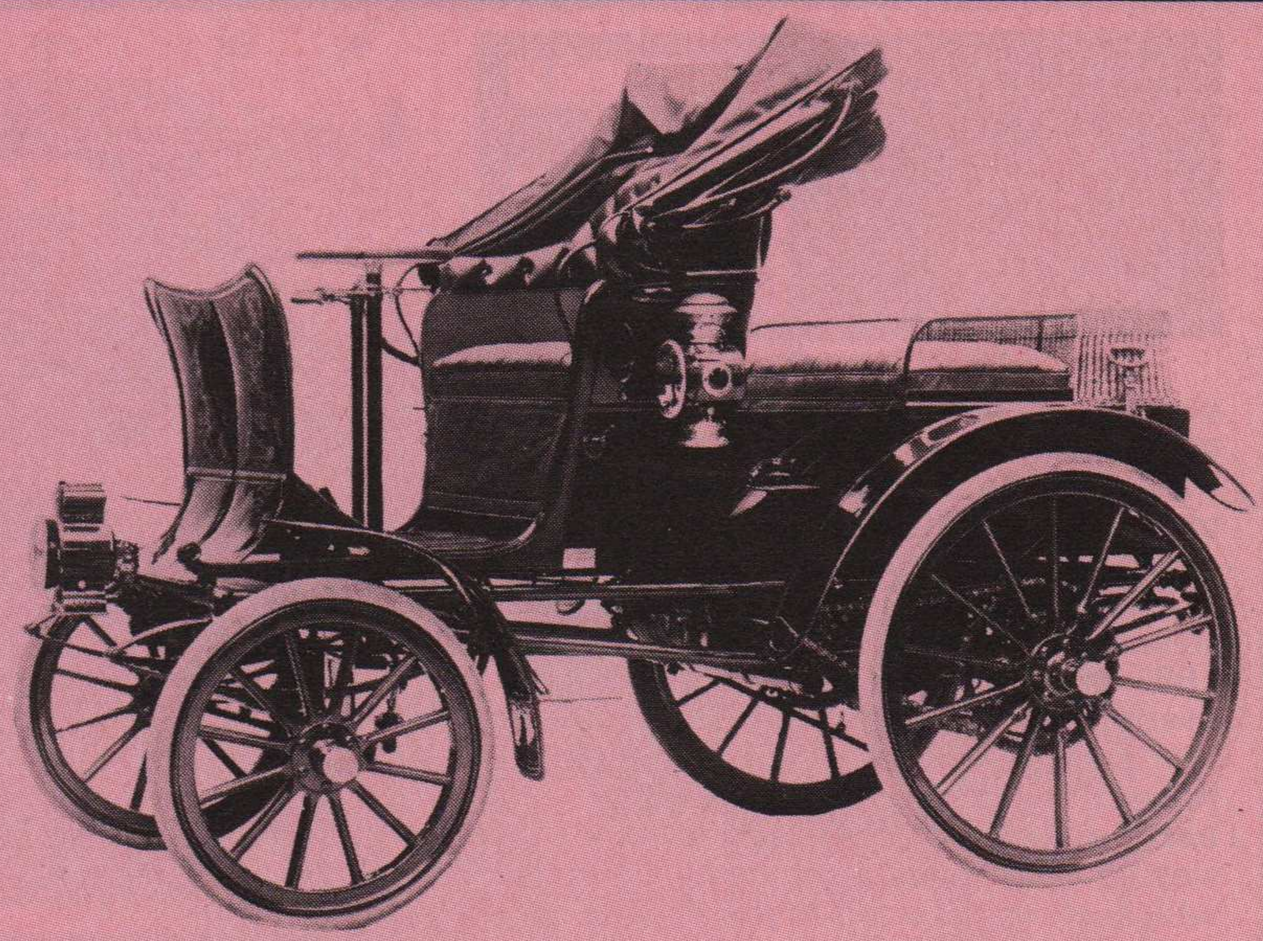
One of the best sellers in the 1890s was the single-cylinder, belt driven Benz. This is an English copy, by Arnold and Co, of East Peckham, Kent



Right: The first production model—the 1888 1½ h.p. Benz, assembled and sold by Emile Roger, the Paris agent, and (below) its direct descendant, the superb 1973 Bentley Corniche convertible



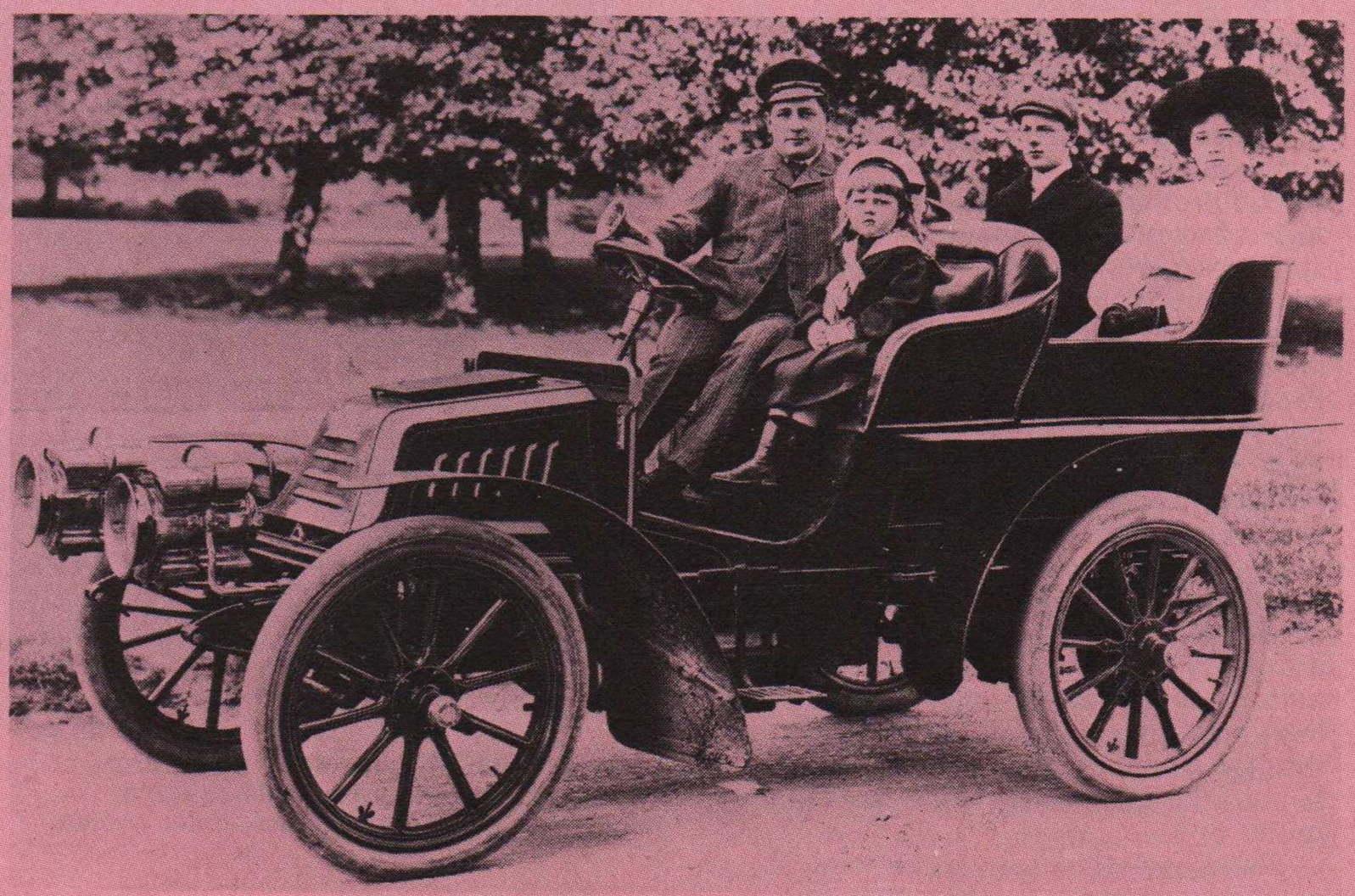




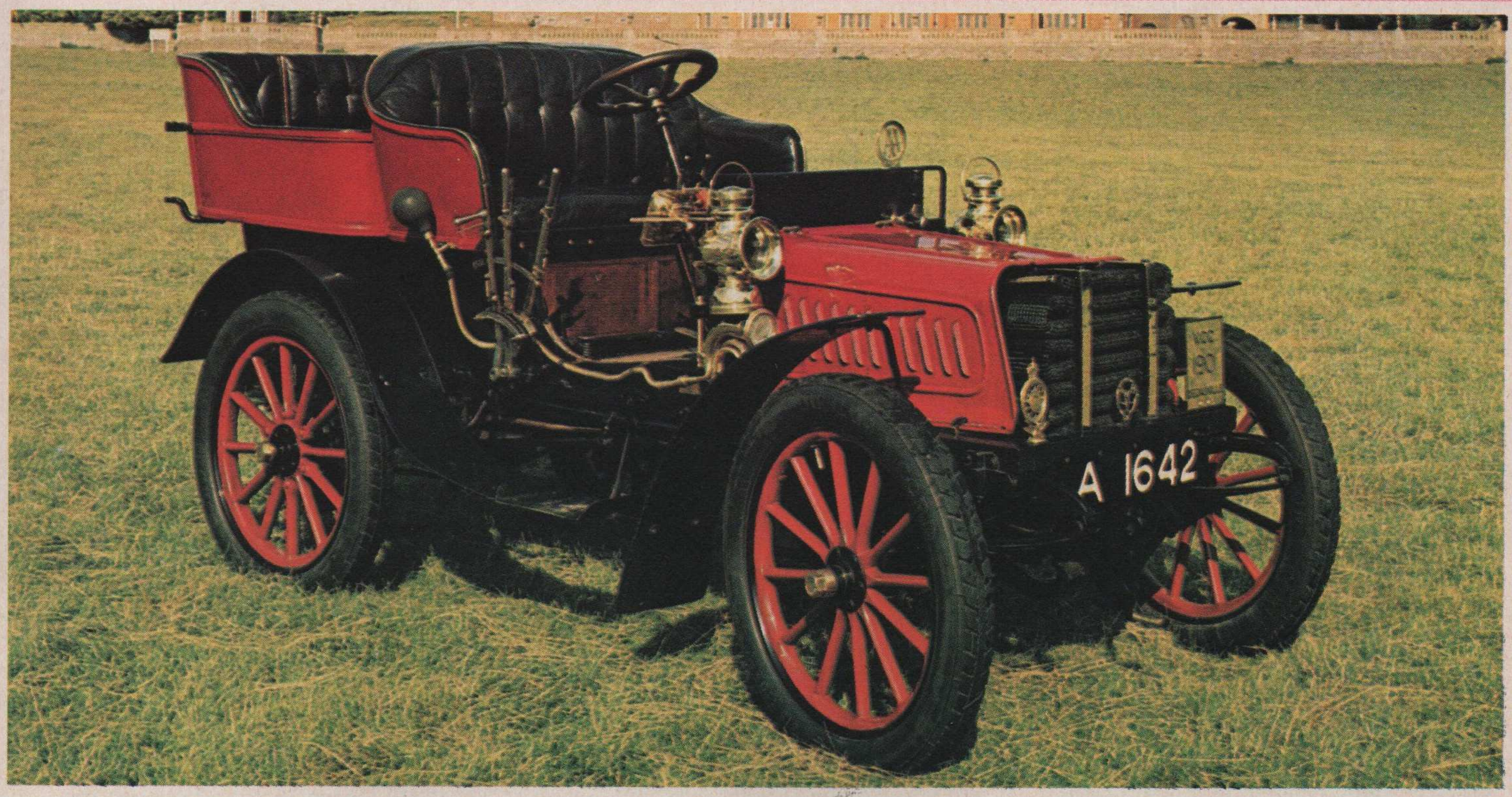
Above: Cow's tail tiller, back-to-back seating, chain drive and unequal wheel sizes characterise the 1898 Coventry Daimler, which was based on a Panhard-Levassor design

Above right: This primitive-looking 1899 Gobron-Brillie has a two-cylinder engine, with four opposed pistons. Four years later a Gobron-Brillie was the first car to exceed 100 mph

Right: Typical of the rear-entrance tonneau *body style is this small 10 h.p. Ariel of 1903*



Below: The 1901 10 h.p. Decauville. A similar car, owned by Henry Royce, was used as the development platform for the first Rolls-Royce



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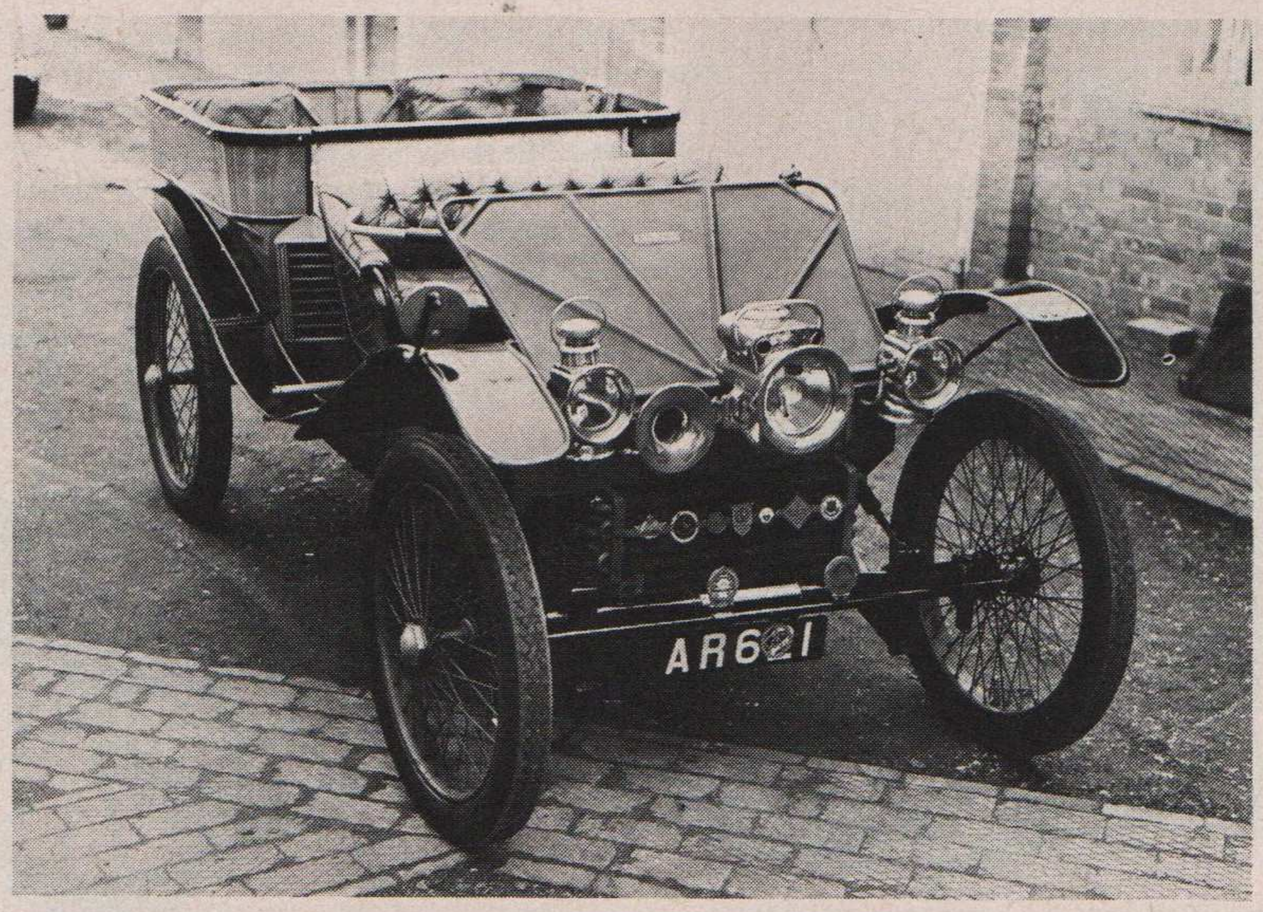


Left: The 4-litre, two-cylinder, two-crankshaft mid-engined Lanchester, with pre-selector gear control and tiller steering

Above: The 1903 Brooke 14 h.p. had a "pudding basin" steering wheel, and a patent Estcourt dashboard-mounted radiator

plenty of strain on his wrist and hand at any speed over rough roads, and as the handle had to be pushed to the left to turn the car to the right it induced bad oversteer which could be dangerous.

Emile Levassor lost control of his tiller steering in the Paris–Marseilles Race in 1897 and was badly crushed as the car overturned. He died early in the following year and the company thereafter fitted their cars with a modified form of traction-engine steering gear, with a sloping column topped by a hand-wheel which was connected to the linkage by worm-and-wheel reducing gear. Other makers quickly followed suit and expressions like "taking the wheel" or "the man at the wheel" soon passed into the language. As most early motor cars were starkly open the steering wheel was starkly prominent, and the stylist soon got to work with every imaginable variation of spoke and rim. The 1901 Humberette had a single spoked wheel, which was hailed as a great novelty when Citroen re-invented it 50 years later, whilst the Brooke concern went to the other extreme and made their steering wheel in the form of an aluminium pudding basin with a thick wooden rim. The object, they said, was to give the driver a place to keep his gloves or tobacco pouch, but contemporary photographs suggest Messrs Brooke feared that those who drove their cars might be overcome by nausea. However, the idea is less silly than providing a square-ish wheel through which it is supposed to be easier to read the instruments than through a round one.

The wheel-steering was certainly a great improvement on the cow's tail tiller, but other forms of steering, notably Lanchester's dynamically stable side-lever system, gave nimbler control and quicker skid correction—at least, for cars weighing up to a ton and with maximum speeds of less than 50 mph; but just as the public believed cars *must* have bonnets so was the steering wheel regarded as an essential. Very light cars, such as the first Vauxhalls and Jowetts, or the A.C. Sociable, were fitted with side-lever steering which was logical, but tradition was already against them. Today, with power assistance, some form of tiller or handle bar control might make sense again, and remove the hazard of being impaled on the steering column in a collision; but such a radical breach with tradition would meet with fierce resistance.

The first cars had water-cooled engines but no radiators, and the contents of a large water tank slowly boiled away. Rows of "finned" or "gilled" cooling tubes began to be fitted about 1897, and were generally slung under the floor somewhere—Panhard-Levassor put theirs behind the back axle. By the end of the century the usual arrangement was to have a rather untidy stack of gilled tubing either hanging in front of the front axle or standing up above it, partly covered at top and sides by the projecting bonnet. The water tank, now much smaller, was still separate. The great step forward came from Cannstatt-Daimler who fitted neat "honeycomb" coolers to their 1898–1901 models and then, in 1901, with the first Mercedes, combined tank and cooler into one neat unit shaped to blend smoothly into the front of the bonnet.

For the next quarter century the radiator was the dominant distinguishing feature of each different make of car or lorry; even the famous Renault dashboard radiator (copied by a few firms) being prominently displayed and emphasised with brass top and sides. Whether circular, oval, lozenge-shaped, heart-shaped, pointed, bullet-nosed, sloping, fluted or based on the portico of a Grecian temple (Rolls-Royce) the humble cooling apparatus became the foundation stone on which the whole motor car depended for its outward shape. Air-cooled cars from the handsome Franklin to the cheap and cheerful Rover Eight were given dummy radiators and when, in the 1930s, to the regret of the old brigade, the radiator retreated behind a false front, that false front had to be shaped like a debased version of the real radiator it had usurped. This tradition lingers on in such cars as the Wolseley, the Rolls-Royce and the Mercedes—which started it all.

Some years ago Laurence Pomeroy condensed the history of the motor car in one neat paragraph:

> "From 1885 to 1895 men struggled to make the car go. From 1896 to 1905 they contrived to make it go properly. Between 1907 and 1915 they succeeded in making it go beautifully."

Even before 1907, indeed, there were many cars which "went beautifully", but Pomeroy doubtless had in mind the appearance of the Silver Ghost Rolls-Royce in that year. This landmark in development at the upper end of the scale was matched a year later by the arrival of the Model T Ford. In their respective spheres both these cars were unbeatable, and the essential fact that the motor car was to become a tool of everyday living for quite ordinary people, not merely a plaything for rich eccentrics, is underlined by the numbers. In approximately 19 years Rolls-Royce Ltd made 7,876 Silver Ghosts whilst in roughly the same period 15,007,033 "Flivvers" took the road.

If we ignore steam and electric cars and concentrate on the main stream of progress, the only fundamental innovation in motor car design since the days of Queen Victoria has been the

Wankel engine—and its chances of dominating the field are by no means assured. If a young motorist who has just passed his test and bought a 1973 motor car were to be placed at the wheel of a "conventional", or Panhard-type, car of 1900 he would be all at sea. He might look in vain for a foot accelerator and be puzzled by the hand-throttle, governor, extra air and ignition advance levers, whilst the warning to keep the pedal brake in reserve for emergencies and to use the push-on side brake for ordinary driving might ieave him ill at ease; but after a little practice he would forget the differences and find how little, fundamentally, the motor car has changed in 73 years.

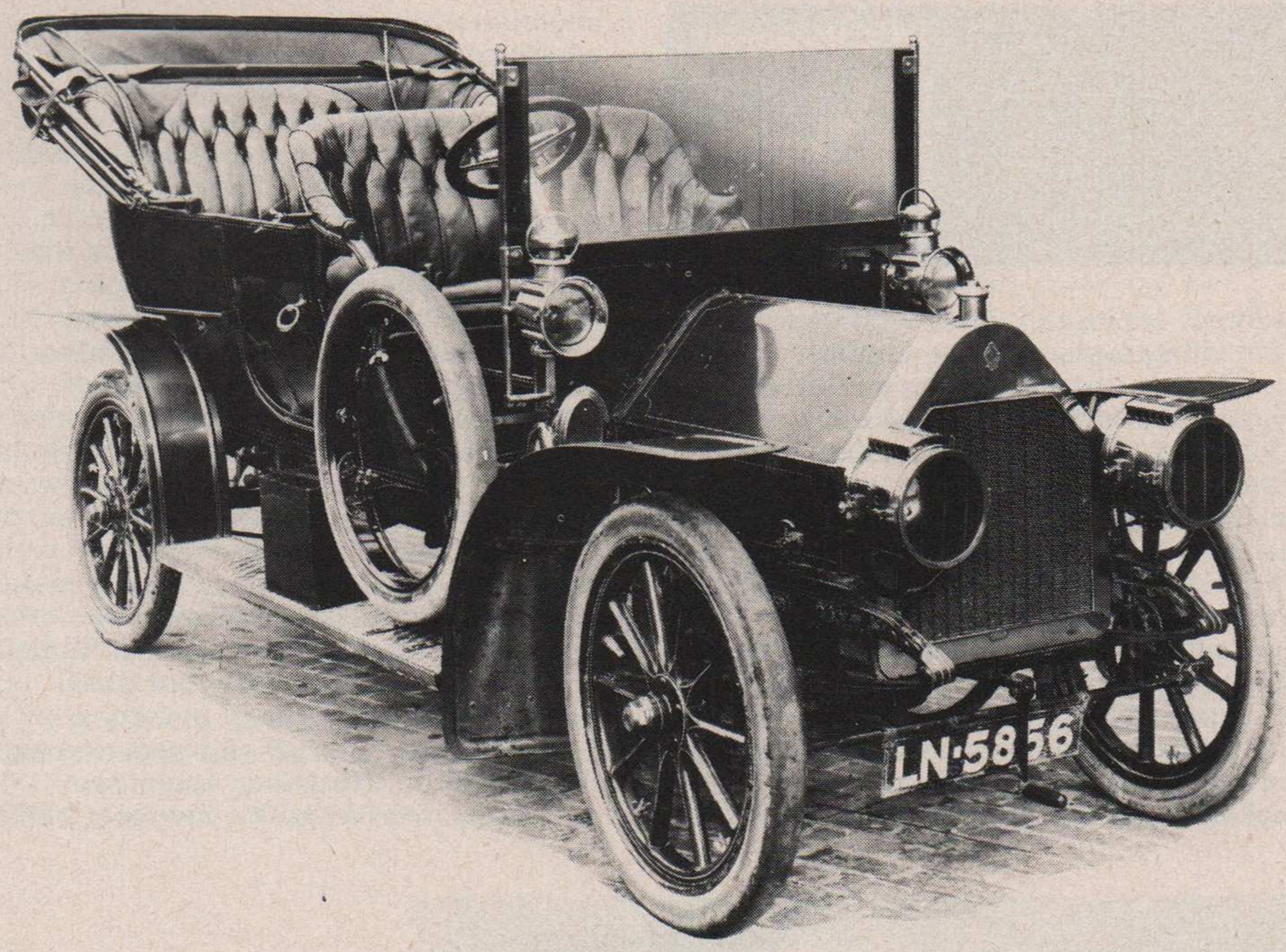
The processes of refinement which continue to advance the "going beautifully" concept may be summarized as:

1. Continual reduction in engine size in relation to power developed, with corresponding increases in rotational speed. (In 1900 average output was about 4 bhp per litre of swept volume at 1,000 rpm).
2. Great improvements in change speed system, making gear changing less difficult; culminating in "synchromesh" in the 1930s and, now, the increasing popularity of "automatic" gearboxes mostly based on the Lanchester compound epicyclic pre-selective system.
3. Improvements in brake power to keep pace with the higher performance.
4. Similar improvements in suspension and general handling characteristics, particularly since the second World War.

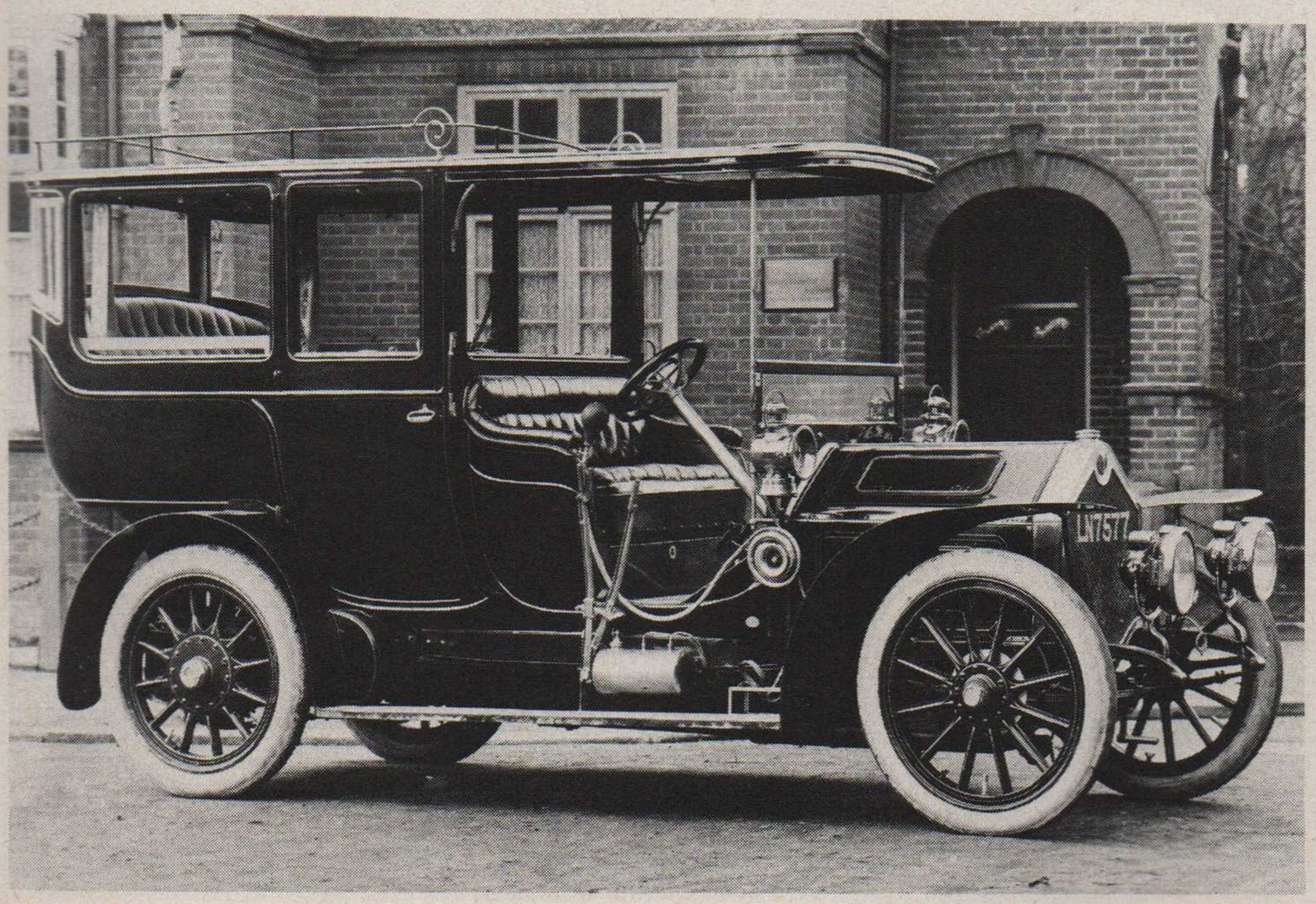
These are the areas in which improvement has been most marked although, on the way, some of the new virtues have pushed aside older ones; such as accessibility and low-speed torque. None of the improvements would have been the slightest use without the almost unbelievable development of the pneumatic tyre. In 1900, when 40 mph was considered fast, a tyre which lasted 2,000 miles was almost unheard of and a journey of 100 miles without a puncture was something to boast about. Now, when 60 mph is dawdling, tyre life of 50,000 miles is not exceptional and 25,000 miles without a puncture nothing extraordinary.

One aspect of tyre development sheds light on the difficult path the motor engineer has to tread. In 1924-5 most manufacturers began fitting their cars with the newest thing, the wide-section or "balloon" tyre which was made with a "corded" carcass in place of the old woven canvas; simultaneously with this change came an advance from the old beaded-edge or "clincher" rim to the well-base rim which was, in fact, an older invention. The new construction allowed tyres of much wider section to run without internal heating at much lower pressures than had been necessary with the old beaded-edge tyres. The result was better insulation from the bumps which is what the pneumatic tyre is for, and better adhesion; but a whole raft of problems accompanied the advantages, firstly, as Part Two shows, the new fat tyres looked hideous until general design was modified to suit them, and they also made it necessary to move the springs nearer the centre of the front axle in order not to reduce the turning circle; this added to the tendency to roll on corners. Worse, the new fat tyres weighed more than the old skinny ones and their use chanced to coincide with the gradual adoption of front-wheel brakes. With big brake drums and balloon tyres the front wheels of a 1925 motor car probably weighed twice as much as those of ten years earlier, and with this weight spinning some distance from the suspension points gyroscopic precession, as Dr Lanchester demonstrated, set up a new and very nasty phenomenon, wheel wobble or shimmy. The "shakes" afflicted cars as far apart as the Phantom I Rolls-Royce and the little Humber Nine and it was not until designers, following Lancia's example, evolved usable independent front wheel suspension systems that the problem was finally solved. Worst of all, the big-section tyres made the steering heavier, so the gearing ratios had to be lowered and cars lost the delightful responsiveness of a good Edwardian. This particular problem is still with us, which is why many modern cars of quite modest size have to have the complication of power assistance if they are to be as nice to handle as their ancestors were thanks to those primitive looking high-pressure tyres.

All the other improvements we take for



Typical of the side entrance touring body was this 1907 15 h.p. Rothwell, with the Cape cart hood, and Stepney clamp-on spare wheel



Despite its height, the limousine body on this Crossley 40 h.p. chassis was well proportioned, and typical of the Edwardian town carriage

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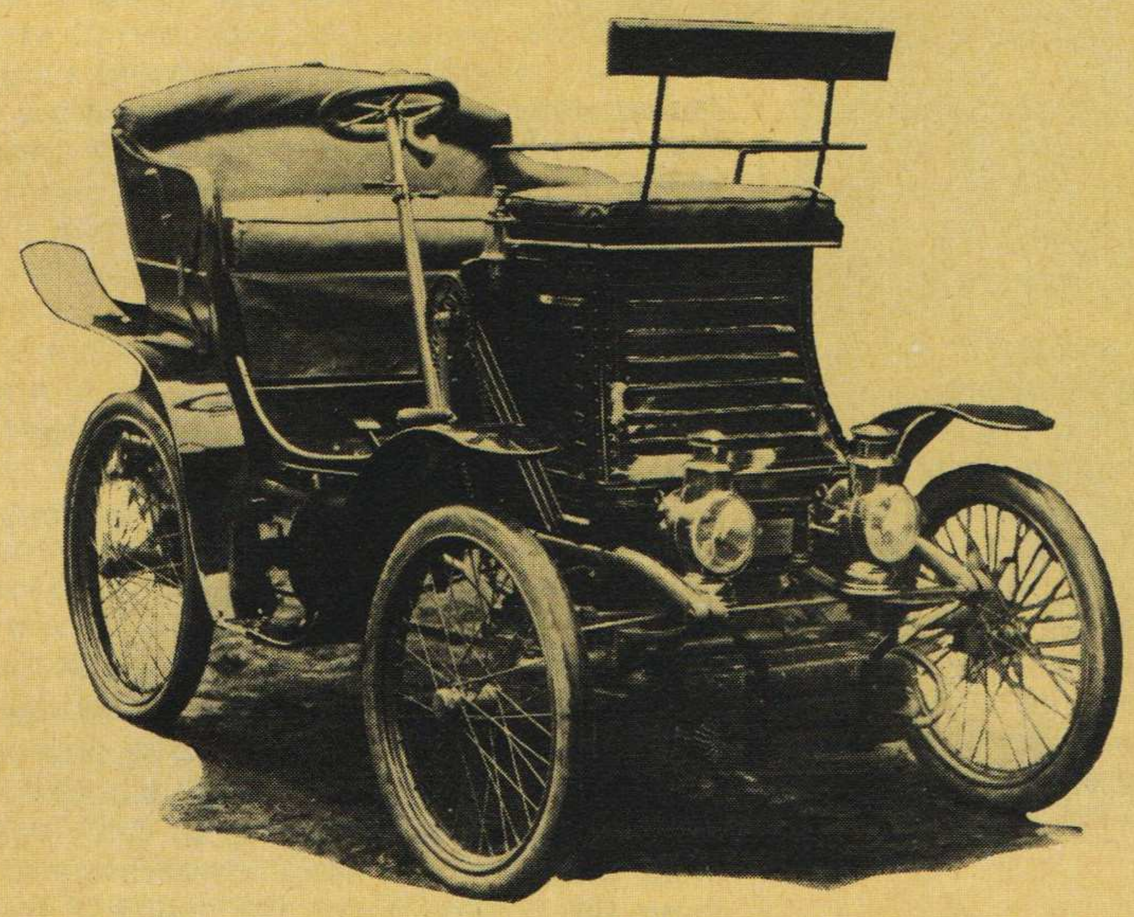
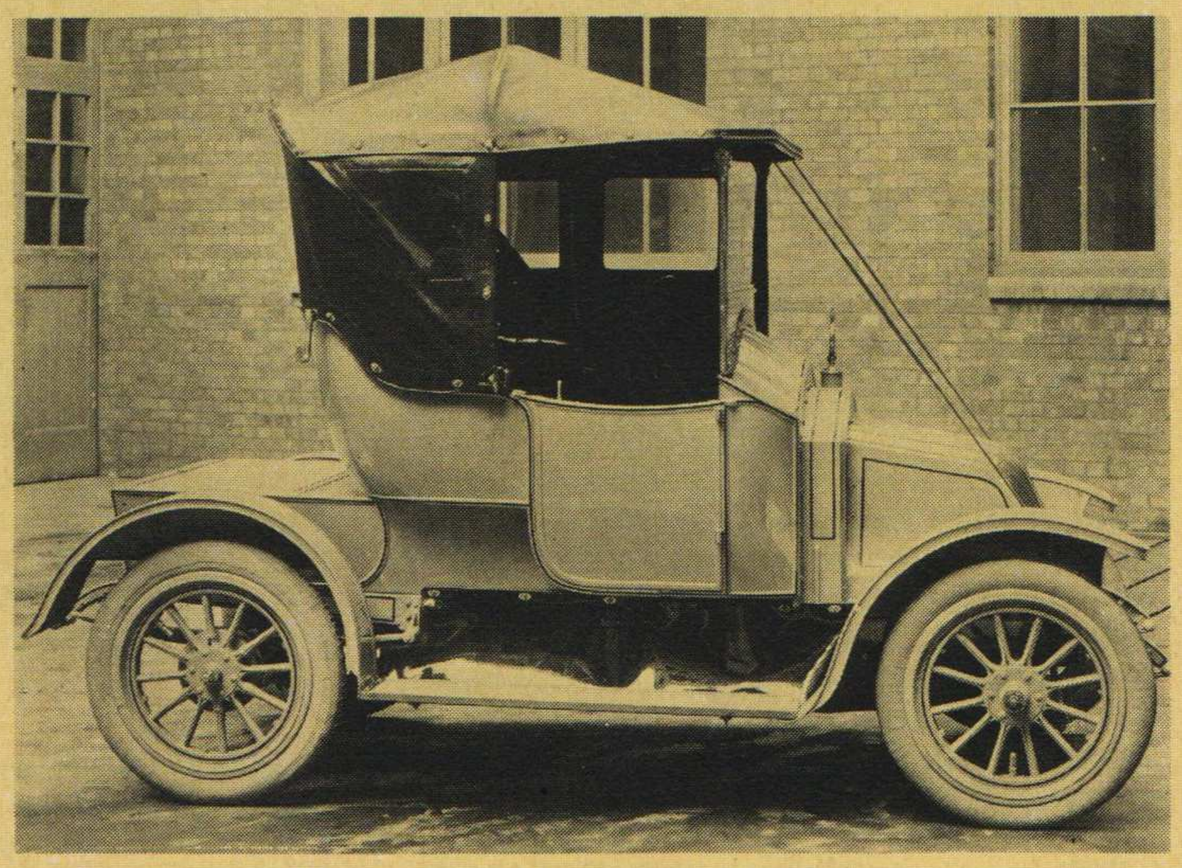
granted, enclosed bodies with heating and ventilating systems, large luggage containers, speedometers, windscreen-wipers (still a novelty in the early 1920's), traffic-indicators and all the other creature comforts are merely icing on the cake, and one can motor perfectly well without them. The one "innovation" above all others which made possible the automobile "population explosion" was the electric starter, which was occasionally fitted as an expensive optional extra about 1910 but first appeared as standard equipment on the 1912 model Cadillacs. Other makers followed suit in due time and the abolition of the hand-cranking chore, which could be both fatiguing and dangerous, greatly extended motor usage; particularly by women.

If the electric starter greatly boosted car ownership in the 1920s, another boost came in the 1930s with the adoption of "synchromesh". Since the beginning, the business of changing gear on Levassor's system of sliding gear-wheels, which he stigmatized as "brutal", had been a *pons asinorum* which many motorists never succeeded in crossing. Less brutal systems, such as the clever De Dion Bouton constant-mesh-and-expanding-clutch gearbox, or the very advanced Lanchester pre-selective compound epicyclic gear were successful but expensive, and one of the reasons for the huge sales of the Model T Ford was the almost foolproof pedal control of the two-speed planetary or epicyclic gear. Like all two-speed systems though, as on the earlier American runabouts, the Model T's low gear had to be low enough to cope with anything and once committed to it, maximum speed was only about 7 mph. Synchromesh did away with the gear-changing bogey, although the old hands complained it took the fun out of driving (which it did not), just as their children are now complaining about automatic transmission.

No progress is made without setbacks or, as a cynic observed, "every new invention means the loss of one old amenity", and the motor car is no exception to this general rule. The modern high-speed, efficient engine may give an ordinary family car better acceleration and a higher top speed than many a racing car of the past—but many quite ordinary cars of 50 and more years ago could accelerate smoothly in top gear from a walking pace, a most desirable attribute which has had to be sacrificed. Huge rear windows make it easier to reverse into a small space and are safer than small ones; or are they, for

Small Cars





Above: 1901 3½-h.p. Simplex single-cylinder
Right: 1910 8-h.p. Renault two-cylinder
Below: 1920 8-h.p. Rover two-cylinder

they induce much more fatigue at night as it is not possible to shut out distracting reflections from the lights of following cars. Similarly, sharply raked and curved windscreens may look elegant and reduce wind resistance, but may also set up more reflections and cause more eyestrain than ever our parents suffered from their flat, almost upright, screens: the list is almost endless

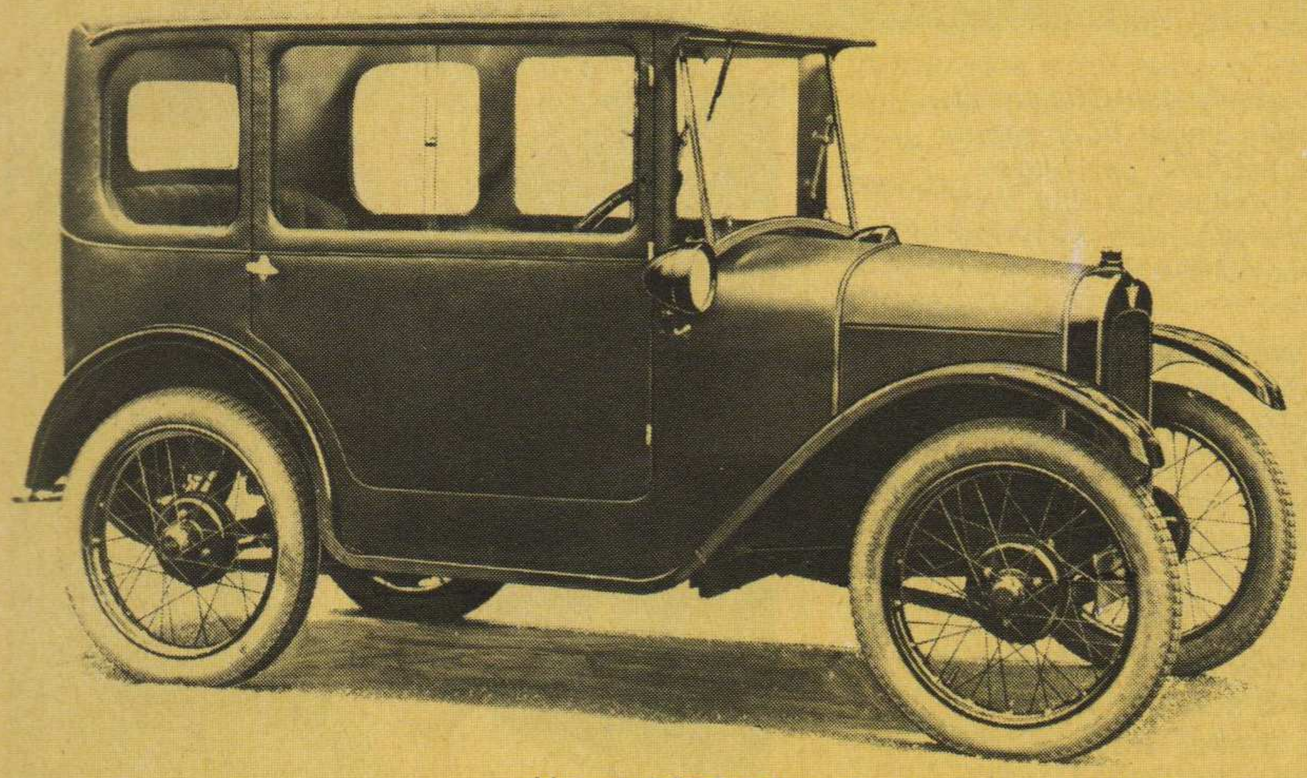
The bodywork of the first cars was pretty rudimentary, as it was largely a matter of somehow perching a seat and floorboards above the machinery, but attention was soon given to making it as comfortable and handsome as the mechanical bits allowed. The work was almost always done by established carriage-builders using their traditional materials and methods many of which were found inadequate for their new role. As far as possible, the coachbuilders adapted existing types of carriage bodies, but sheer necessity soon made it necessary to evolve new designs although the old names lingered on—some of them, such as limousine, to this day.

The first to break away from tradition, both in appearance and methods of construction, was Dr Lanchester who postulated from the start that the motor car should be designed as a complete entity and that, ideally, the body parts should be made and fitted in the factory responsible for the mechanical elements, using the same degrees of accuracy to ensure interchangeability. Other firms gradually followed suit, often from different motives. De Dion Bouton, for example, began making their own bodywork because it was found that some cars sold as chassis were fitted with shoddy bodies by unauthorised agents which did their reputation no good. Those makers producing for the lower-priced end of the trade soon found it was commercially essential to make their own bodies, or at least to have them made to strict specification by "outside" suppliers, and to cut the traditionally laborious and expensive processes of coach-painting and varnishing. Ford started paint-pouring and dipping techniques before the first World War, and the use of sprayed-on cellulose lacquers was established in the 1920s.

Even in the "bespoke" trade the traditional coachbuilders soon had to learn new tricks. Aluminium in place of wood for body panels and mudguards was seen as early as 1900, and sheet iron or steel panelling followed soon after for the less expensive bodywork. "Panel bashing" was a much less expensive process than shaping thin panels in mahogany and birch, with the necessary bending in the steam-box. All-steel bodies, without the traditional wood frames, were tentatively tried by BSA in 1911, and the Dodge Brothers laid down the equipment to make them on a large scale in the following year.

The aesthetic side of motor body development, which has always been

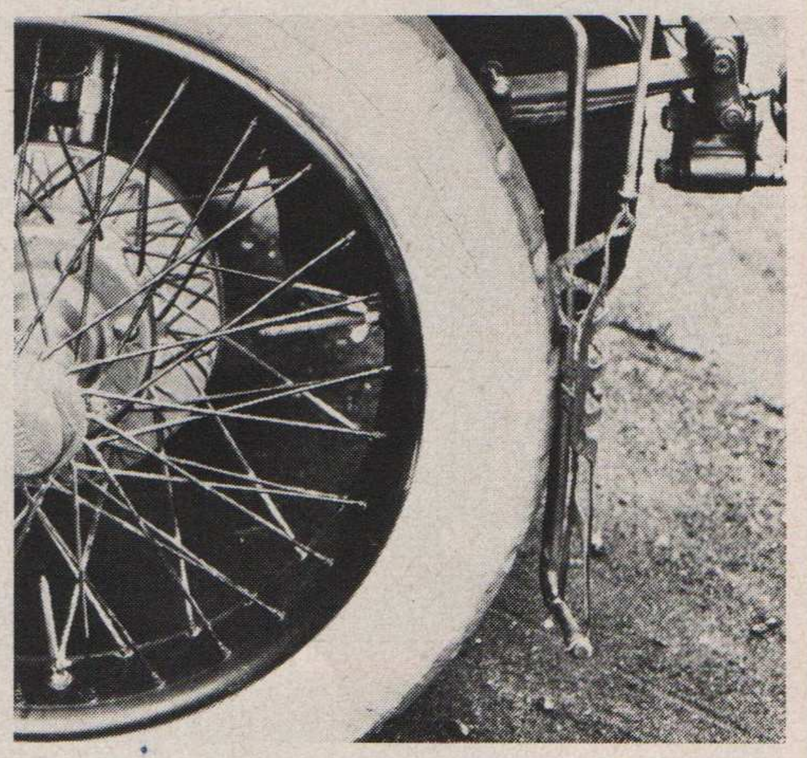
1900-1974



Above: 1928 7 h.p. Austin four-cylinder
Right: 1959 848c.c. Austin Seven four-cylinder
Below: 1974 594c.c. Fiat 126 two-cylinder

THE DEVELOPMENT OF THE PASSENGER CAR

Above: This 1903 curved dash Oldsmobile, with its single-cylinder, under-floor engine, was typical of the American "gas buggy". Right: Rudge detachable centre-lock wire wheel of 1907, with a puncture preventer to knock nails and flints off the tyre



influenced by fashion that sometimes gets in the way of mechanical considerations, will be dealt with in Part Two, but many of the steps which were dictated by practical needs also affected appearance.

A look back to the Victorian horseless carriage shows, for example, that the dashboard (or splashboard to use the older name) was exactly the same as on a horsed carriage. That is, it was a vertical, rectangular structure of wood or leather sticking up from the front of the vehicle to keep draught and mud off the occupants' feet. A little backwards-facing occasional seat was often fixed to the inboard side whilst the "motor bonnet" of the Panhard-type car protruded from the outboard side of the dash. The inside of the dashboard made an obvious place to mount the sight-feed lubricators, oil tank and pump, or pressure gauges and, in due time, a speedometer if the motorist chose to buy such an expensive optional extra.

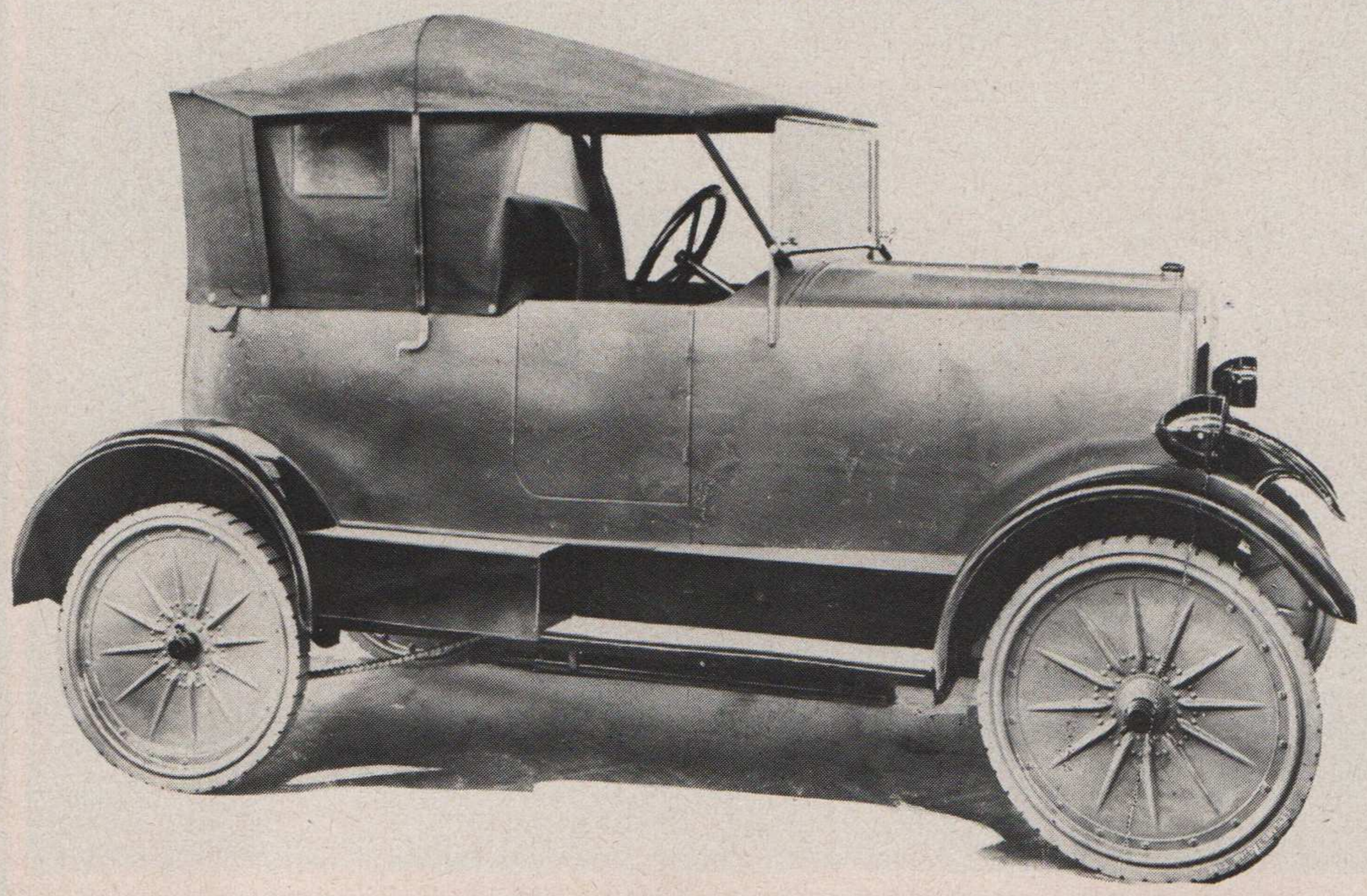
As time went on, engines grew more powerful, bonnets longer and speeds fast enough to make it necessary to fix a glass screen which, at first, rose vertically to a considerable height above the top edge of the dashboard. This was better than no windscreen, but the protective glass was rather too far away from the front seat to be really effective. Following the example of the English Daimler Company, Rover and some others, body designers began to fit an upward-sloping "cowl" or "scuttle" behind the dashboard, with the windscreen, now lower and neater, mounted on its rearward edge where it gave the occupants much better protection from draughts, just as the scuttle itself helped keep their legs and feet warm and dry.

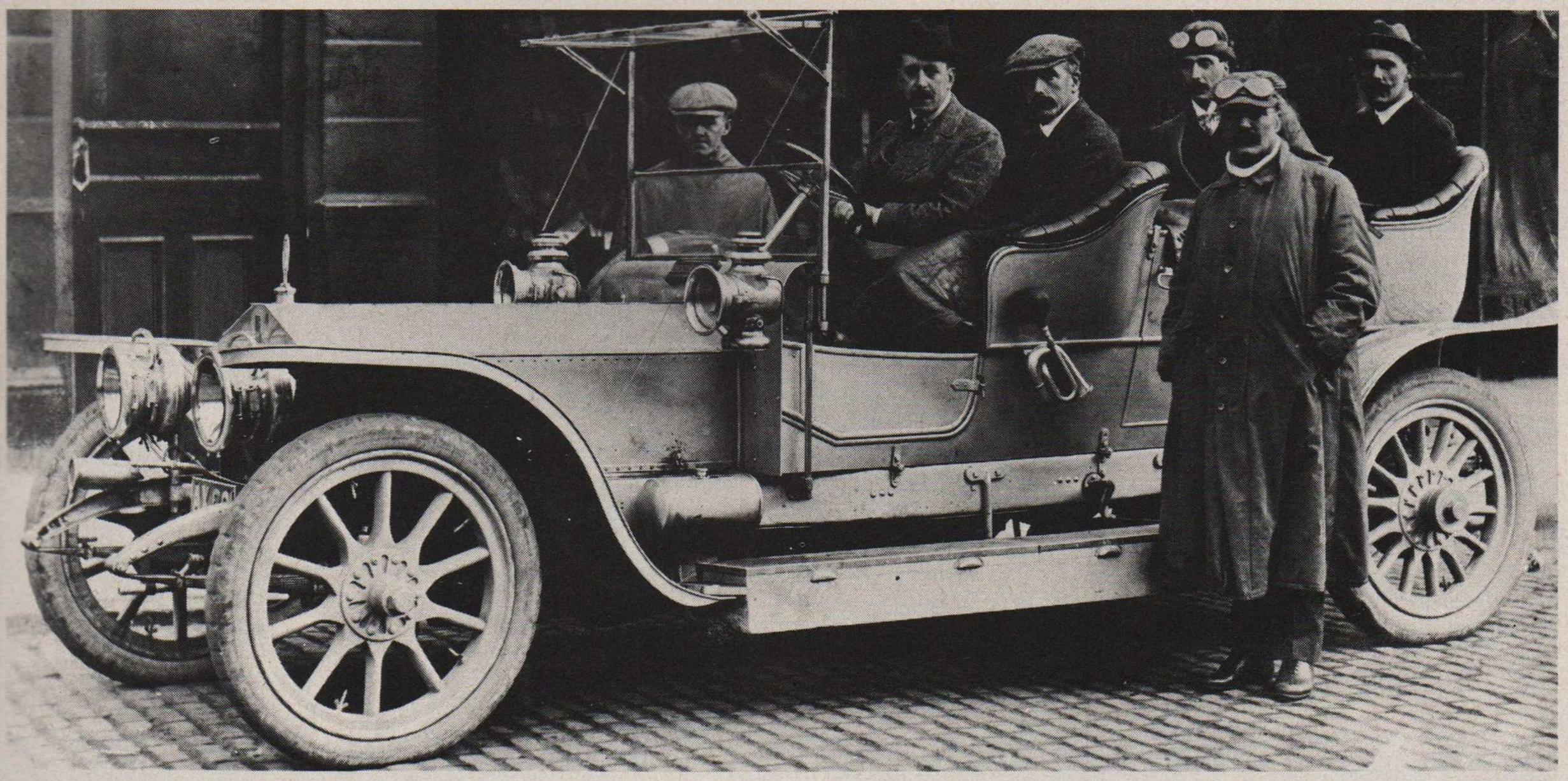
The instruments were still screwed to the back of the wooden dashboard, which had really degenerated into a bulkhead, where they were now obscured by the scuttle. So a second board was fixed below the rearward top edge of the scuttle and the instruments were transferred to it. Although the modern car shows almost no trace of the original form of bonnet and scuttle, we still speak of "scuttle shake" and still refer to the instruments on the "dashboard" although it is far removed from the thing which stopped the mud thrown up by the horses' hoofs from landing in our laps.

Another obviously common-sensical or mechanical development which greatly affected external appearance concerned the mudguards. At first they were narrow strips of curved wood, metal or, on posh cars, patent leather stretched on iron frames, exactly like carriage guards. Even at 20 mph they were inadequate, and they soon grew larger and shaped to cover the wheels more completely; then they were fitted with valances, at least in front, but a lot of mud was still thrown on to the steps and body-panels. So some unnamed genius turned the little carriage steps into "platform steps" or running boards, connecting front and back mudguards and almost completely protecting the glossy body panels whilst making it much easier to get in and out of the car body *and* providing a splendid place to carry spare wheels, petrol tins, battery and toolboxes and the generator for acetylene-gas headlamps.

The running board, a purely utilitarian fitment, shows how difficult it is to combine good looks with utility. At first, there was a gap between running board and chassis through which the propeller shaft, brake rods and other mechanical odds and ends could be seen. This was rather unsightly and tidy-minded body designers filled the gap with a leather or, usually, sheet iron, valance. This hid the mechanical bits from view but also, alas, put them out of easy reach of oil can or

Underfloor engine again: The 1924 Trojan utility car was complete with a dummy bonnet and solid wheels and tyres





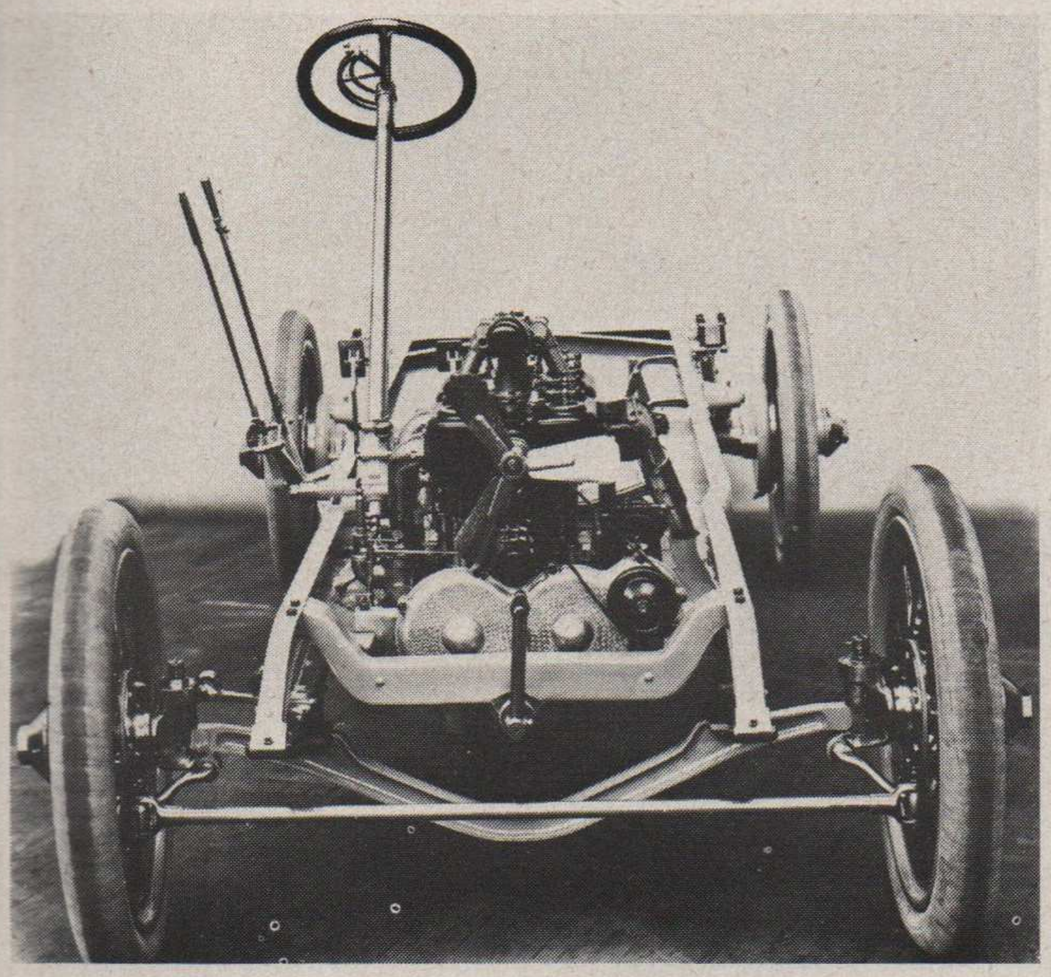
The original Silver Ghost of 1907, which gave its name to the Rolls-Royce 40/50 model, which stayed in production from 1906 to 1925

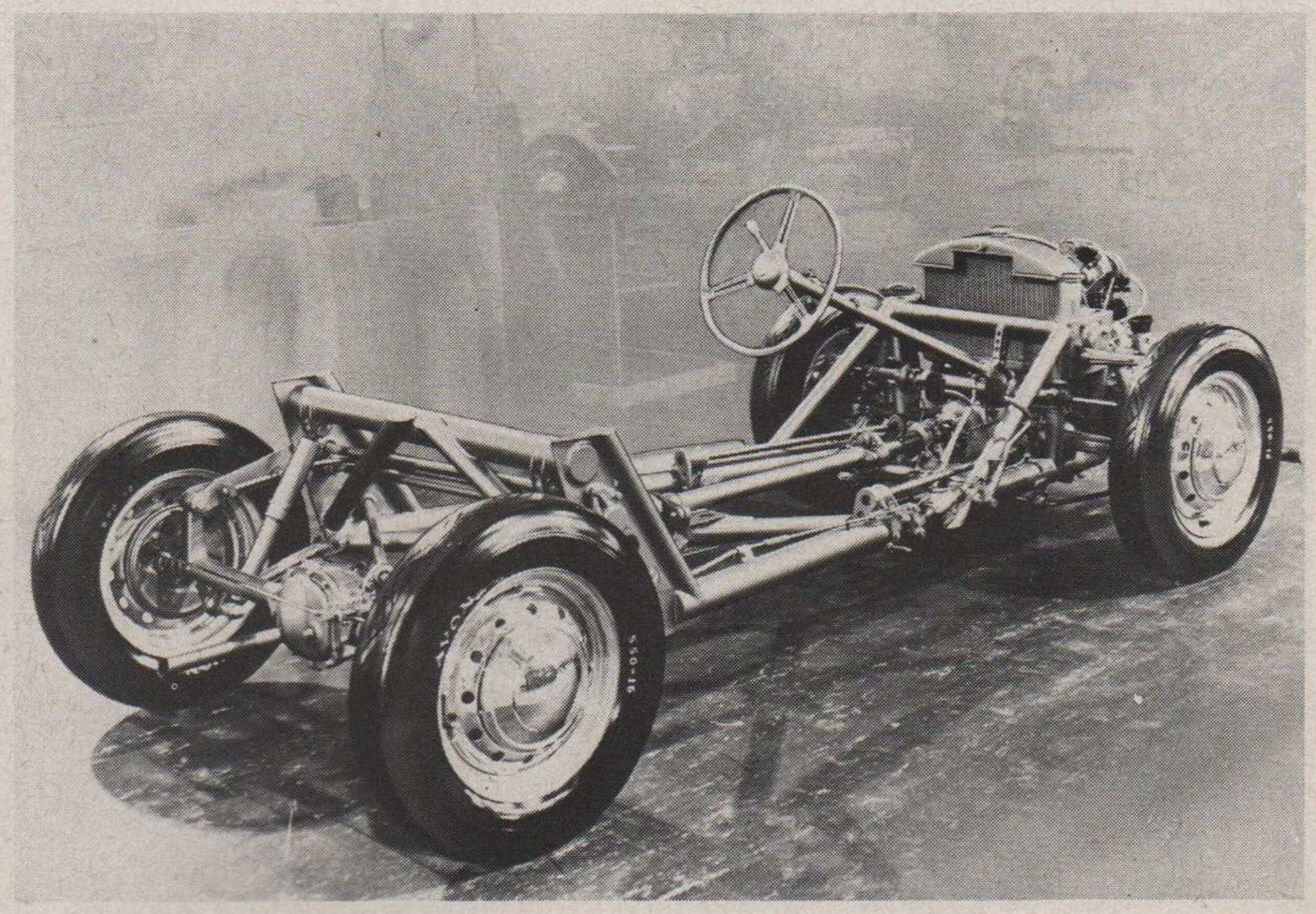
spanner. Some makers, it is true provided hand-holes or moveable plates in vital spots, but most did not and jobs which could once be done from the side of the car now meant lying on one's back beneath it. As wheels grew smaller even lying under the car became difficult, and a pit or hoist had to be used.

The mudguards, or "wings" themselves went through several metamorphoses, as they became larger and wider, hugged the wheels' curvature more closely, were flared then domed and then began to merge into the body panels, at first at the back of the car and then into the erstwhile bonnet as the modern enveloping body style emerged after the second world war. Whatever may be its merits aesthetically the enveloping body not only adds greatly to the rusting problem (which scarcely existed before the war), as the whole vulnerable underside of the car is subjected to the corrosive and abrasive spray thrown up by the small, fast-turning, fat wheels, but the effect on engine accessibility has also been disastrous. Disastrous to the point where, for example, the job of decarbonising, grinding valves and adjusting tappets on the two-cylinder, horizontally opposed, air-cooled Rover Eight of the early 1920s can easily be done in an hour, but the same work on a modern Daf 44, which has a basically similar engine, takes 10 hours. It is true that modern cars need less attention than their forbears but nine hours' extra labour on a simple job is a high price to pay for a sleek, enveloping shape. As the business has a direct bearing on insurance costs it is not one to be taken lightly.

No matter how we may clothe it and alter its external shape, the motor car is essentially a contrivance upon wheels to carry people. Despite recent attempts by British Leyland, following American examples, to prove otherwise wheels work best when they are circular, and people obstinately persist in being people-shaped—and people-sized; although the designers of some modern cars try to ignore this last inconvenient fact. Therefore the most sensible shape for a motor is that of a fairly tall rectangular box with a wheel at each corner, and if purely utilitarian-cum-mechanical considerations prevailed closed motor cars would not have altered much in shape since the late 1920s. To provide a less wind-resisting and uncompromising shape, whilst still taking care of the people, is a challenging task. The horseless carriage of the last century looks pretty ludicrous to us with its occupants perched "high and disposedly" atop those large spindly wheels, but how ludicrous it would appear to them to have to fold themselves like jackknives as a preliminary move towards sitting in a foetal posture with their backsides about 12 inches above

The simple and accessible layout of the 1909 Humber (below) in contrast with the 1949 ERA Javelin chassis (right)





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ground level in a little box like an eclair rolling on wheels like doughnuts. Compromise between these extremes has fortunately been achieved many times, and has produced the happiest marriages between function and appearance.

These happy marriages were solemnized quite early in the design of open touring cars, particularly the larger ones, as long as they *were* open; even the handsomest designs generally look top heavy when the hoods are raised. The emphasis on upward-sweeping lines or the voluptuous curvature of the "tulip phaeton" or "*Roi des Belges*" style gradually changed to a horizontal emphasis which culminated in the "flush sided" or "torpedo" tourer of about 1912 onwards. This meant giving up the practice of fixing the back seat on a higher level than the front one; unless the chassis was very long therefore the back seat passengers lost a bit of leg room as well as loosing their forward view.

Given the right proportions, and the correct placing of details, such as lamps, the torpedo tourer could look superb as well as being comfortable and practicable. With the wrong proportions on small cars, where the proportions naturally tended to be less happy, the effect was sadly apt to be that of a motorised bath tub.

To achieve similarly harmonious lines with closed coachwork was, at first, far more difficult. Because the engines were relatively feeble, closed cars before the 1914 war were usually given engines of between four and 14 litres' capacity. This meant that a closed car had to be large in all its dimensions and correspondingly expensive. The buyers therefore belonged to the "carriage gentry" class and they expected unobstructed, flat, floors, sufficient headroom to allow a tall man to get in or out without removing his top hat and really generous amounts of leg and elbow room. To meet these requirements on an Edwardian chassis, mounted above curved leaf springs and rolling on 35 to 40 inch diameter wheels meant that a formal closed car might stand as much as 9ft high. That many coachbuilders contrived to make these very lofty cars not only commanding but positively handsome in appearance is a great tribute to their skill. Nor did these lofty carriages handle as badly as their appearance suggests. I once owned a 1909 14h.p. Renault landaulet which stood 8ft 6in. high on a wheelbase of 8ft 9in., but up to its modest 40mph maximum pace it was light and pleasant to drive and showed no tendency to "lie on its door handles" on corners.

Mechanical means to reduce the excessive height without sacrificing

The "bullet nosed" Morris Oxford of 1913, with White and Oppe engine, grew up into Britain's best selling car of the 1920s

Mais quelle difference: *The lordly Hispano-Suiza (above) and the humble Jowett (left), both of 1930*

Below: The angular Essex four-light "coach" of 1924 still had wooden wheels with detachable rims. Right: France's answer to Detroit—1928 2½-litre Citroen, with pressed steel body

THE DEVELOPMENT OF THE PASSENGER CAR

interior head room were introduced quite early. The Lanchester underslung worm drive, which allowed for a much lower floor level than the usual bevel drive, or the outmoded side-chains, was copied by some others, and various forms of cranked or dropped chassis side members helped the process; whilst "underslinging", or fixing the axles below instead of above the leaf springs was also practised. These expedients improved the cars' road holding in time to match the improved performance rising from the lessened wind resistance and the constantly-rising power-to-weight ratio. The Rolls-Royce company's recommendations underline this point: before the first world war they stipulated that their guarantee would be void if the total laden weight of the complete 40/50 or "Silver Ghost" model exceeded 50 cwt or, in broad terms, they allowed one horse per hundredweight. Just before the second World War they set the weight limit for the Phantom III at 59 cwt, but the 12-cylinder engine developed at least 160 brake horsepower. Now, a car weighing a ton laden is thought very poorly provided if it has fewer than 65 bhp available.

All the mechanical expedients to reduce height were complemented, or even avoided, by forms of optical illusion. Many cars of the 'twenties were little or no lower in the vital measurement of ground to chassis than their Edwardian forbears; but they *looked* lower as the seats were put nearer the floor (often to the detriment of long-journey comfort), the radiator, bonnet, scuttle and body sides were raised and the windscreen made shorter. The effects are well illustrated in the pictures of the 1910 2-cylinder 8 hp Renault and the 1920 2-cylinder, 8 hp Rover. Both cars were

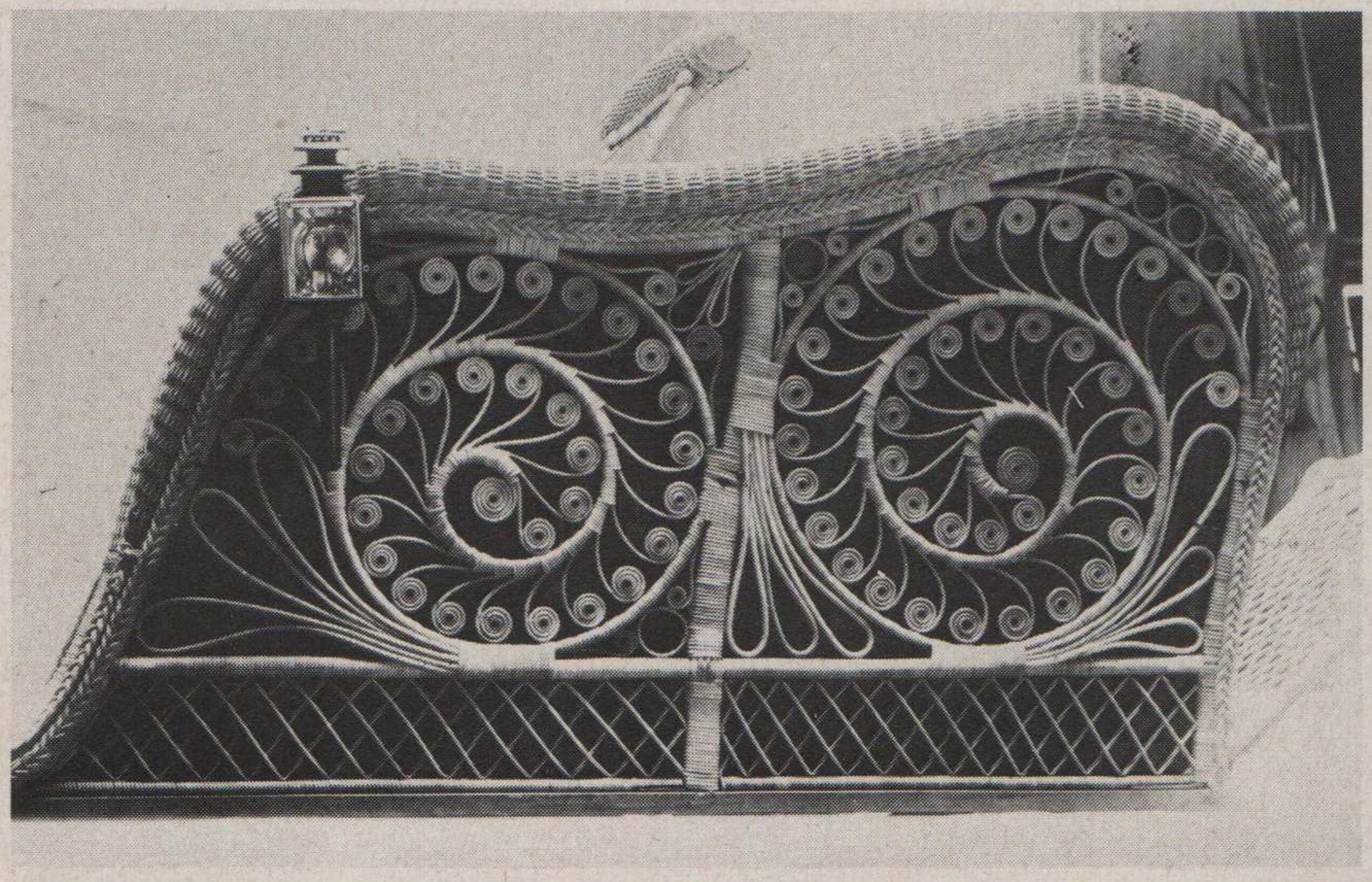
Extravaganzas: The delicate wicker-work panels on the 1897 Dunkley gas car, compared with the vulgar Frua-bodied Rolls-Royce Phantom VI seen at the 1973 Frankfurt Motor Show

The 1938 Triumph Dolomite, with the dickey seat blending well into the car's sleek lines

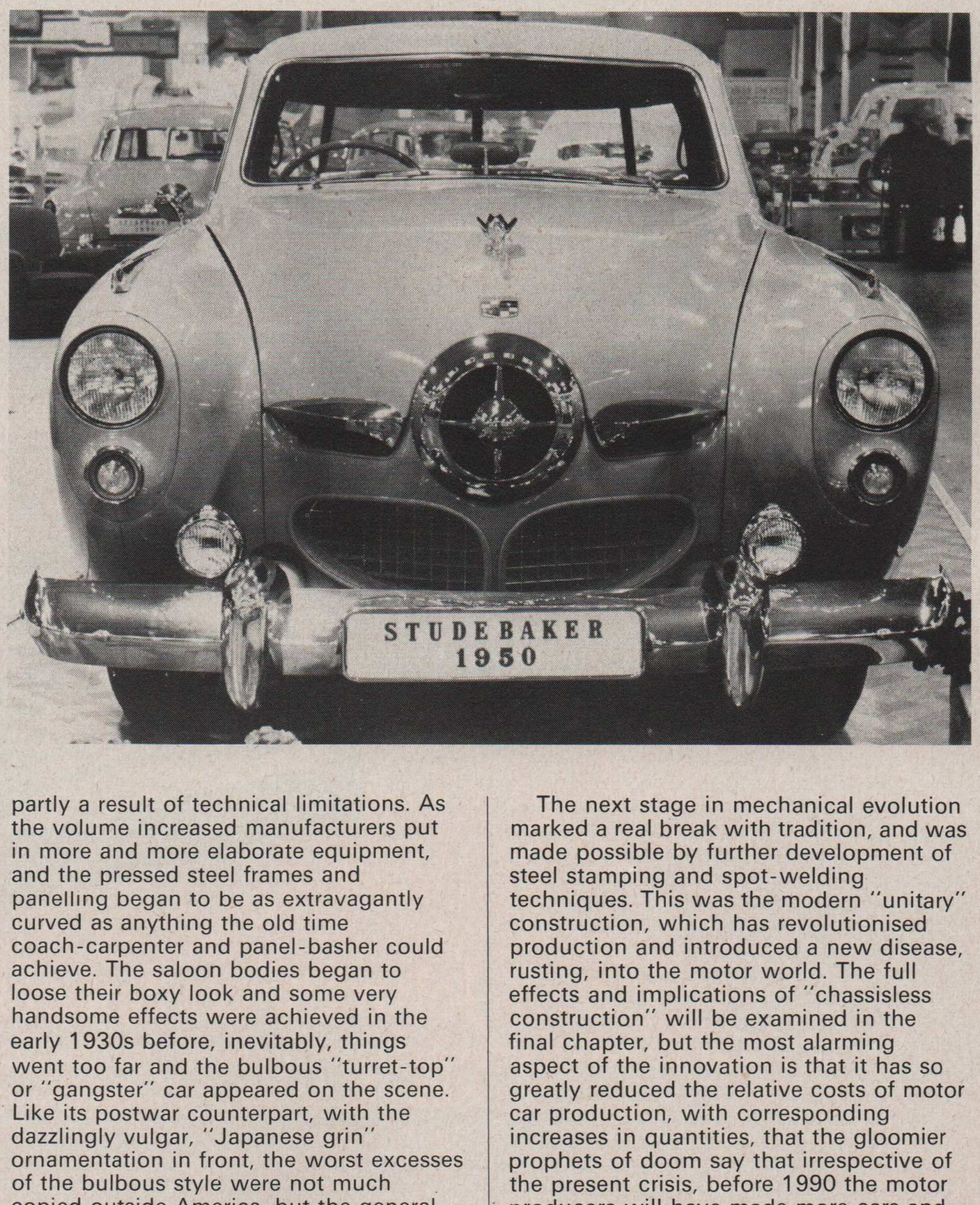
made for the same class of trade and the Renault's chassis line is actually nearer the ground than that of the Rover. The disadvantage of the Rover's styling, and it is fairly typical of the period, is that even though the seat is really too near the floor for comfort, occupants of even moderate height have to look over the windscreen rather than through it. This is acceptable in fine weather as the air stream is directed upwards, but once the rain starts and the hood is put up the forward view is alarmingly curtailed. Despite its laughable appearance and modest maximum pace of 35 mph the little Renault is really the more practicable machine.

Similar optical illusions were created with closed coachwork for the owner driver, particularly in the "sports saloon" category of the late 'twenties and early 'thirties. The scuttle, bonnet, radiator and body-sides were raised as high as possible, the seats placed as low as possible, with nasty cramped footwells either side of a shaft tunnel, the roof lowered to correspond and, very often, the bonnet made unnecessarily long. If done by a designer with a good eye cars in this manner could be wonderfully elegant, but the general effect on the occupants was claustrophobic and the driver, peering through a letterbox-slit windscreen along a high never-ending bonnet had to drive by inbuilt skill and guesswork as it was usually impossible to see the nearside front wing. Indeed, a popular accessory was a sort of little chromium plated stalk, carrying a red Bakelite knob, to fix to the wing to act as a width indicator. Not for the first or last time the usefulness of the motor car was sacrificed to stylistic whims.

By the middle 1920s the motor scene was changing fast and new types of closed car, designed for the owner driver, began to outnumber open tourers and 2-seaters. This new type of "saloon" or "sedan" bodywork did as much to extend motor usage as the electric starter. From the enthusiasts' point of view most of the new breed of small family saloons of 1925 to 1940 were uninspired and dull, as this was a period of fierce price cutting, when the individualistic motor firms were dying like flies, and the sort of top-gear flexibility the customers still wanted (in order to avoid gear changing, as "synchromesh" appeared only in the middle 'thirties) was given to the small-engined cars by making them low geared and consequently fussy. Nevertheless, 40 years later it is possible to see that even the most modest cars of this period are well made considering the prices, and they certainly gave the new middle class motoring public what it wanted.



Above: Without comment: The Mulliner-bodied Rolls-Royce and (right), the Studebaker, both from 1950



The technique of making all-steel bodywork was only slowly adopted, and nearly all the saloon bodies of the 1920s were still made with the traditional wooden frames and floors. At the lower end of the scale they were sometimes pretty shoddy and soon suffered from sagging doors and rattling joints. This led to the vogue for Weymann bodies with their patented flexibly-jointed, rattle-proof frames covered with fabric instead of metal. Their popularity was short-lived, as many of the cheaper cars were fitted with mock-Weymann bodies which soon grew very shabby and gave the real thing a bad name.

Pressed-steel body-framing ousted the traditional kind in the 1930s for all but the more expensive cars. Thus, a 1935 Austin Sixteen had a pressed steel body frame whilst the contemporary Daimler Light Fifteen, proudly advertised as having "coachbuilt" bodywork, had a rather inferior, cut-price wood-framed body which in practical terms was inferior to the cheaper product. Even the best coachbuilt "bespoke" bodies of the time were inferior beneath the skin to those of the Edwardian period. Labour was growing much more expensive and costs had to be cut somewhere. On the quantity-production side of the business more mechanization and new methods, particularly a much greater use of welding, counterbalanced rising labour costs. The use of proprietory components, which was as old as the industry, was also extended but just as the number of motor manufacturers dwindled so did the component industry become more monolithic. This restricted designers' scope for individuality, and played a big part in making cars less interesting.

Most of the early all-steel saloons were square and boxy, particularly in America where the passion for straight lines and plane surfaces found expression in the Essex "coach". This was partly a question of fashion, which was manifested on this side of the Atlantic by the razor-edge saloons and limousines which the leading Paris coachbuilders did to such perfection, and partly a result of technical limitations. As the volume increased manufacturers put in more and more elaborate equipment, and the pressed steel frames and panelling began to be as extravagantly curved as anything the old time coach-carpenter and panel-basher could achieve. The saloon bodies began to loose their boxy look and some very handsome effects were achieved in the early 1930s before, inevitably, things went too far and the bulbous "turret-top" or "gangster" car appeared on the scene. Like its postwar counterpart, with the dazzlingly vulgar, "Japanese grin" ornamentation in front, the worst excesses of the bulbous style were not much copied outside America, but the general effect was apparent in styling throughout the late 1940s and 1950s.

The next stage in mechanical evolution marked a real break with tradition, and was made possible by further development of steel stamping and spot-welding techniques. This was the modern "unitary" construction, which has revolutionised production and introduced a new disease, rusting, into the motor world. The full effects and implications of "chassisless construction" will be examined in the final chapter, but the most alarming aspect of the innovation is that it has so greatly reduced the relative costs of motor car production, with corresponding increases in quantities, that the gloomier prophets of doom say that irrespective of the present crisis, before 1990 the motor producers will have made more cars and trucks than the oil producers will be able to supply with fuel.

A party punch bowl
idea by Asprey

Three other party ideas
by John Player

John Player Special

Created and perfected to be the best Virginia cigarette in the world.
King-size luxury by John Player.

PS 161/LA

EVERY PACKET CARRIES A GOVERNMENT HEALTH WARNING

THE DEVELOPMENT OF THE PASSENGER CAR

In 1974 the fashionable shape for racing and sports cars is a mid-engined wedge. One could say that the wedge idea was not exactly new. This Vallée "Slipper" was built for the Tour de France in 1899

Part 2

Shape, Fashion and Style

By D. B. Tubbs

"QUITE inacceptable!" snapped the engineer. "Opening windows and roofs are an anachronism. They have no place in the aerodynamic air-conditioned vehicle of today. If people want sunshine and pollution they can go and lie on a beach. *My* cars are strictly functional—for go, not blow!"

Well, he's welcome to his private paradise. I would as soon ride a saloon horse as drive a non-opening car; but fresh air—or drag as our designer would call it—has been the ally, and the enemy, of motorists since motoring began. Some people have always wanted to take the air, others to be protected from it, in vehicles of fashionable shape. These shapes included Phaeton, Limousine, Torpedo, Skiff, Saloon, Landaulet, Coach, Berlinetta and, for want of a better name, Hermetic Wedge.

In the days of Queen Victoria (who died in January 1901) motor cars were mainly open, although saloon bodies had already been built by Daimler in this country and both Renault and Panhard in France. One Coventry Daimler model came complete with shelf in front for the driver to stand his beer on, and the Renault was shaped like a top-hat, an architectural rather than aerodynamic concept. The streamlined wedge shape, too, as understood by Sig. Giorgetto Giugiaro, took some years before crystallising out. Credit for the first wedge-shaped mid-engined sports car must probably go to a Monsieur Vallée for his Tour de France entries in 1899. Competition car designers were quite Drag-conscious in early times: the Rothschild body on Jenatzy's *Jamais Contente*, first car to break 60 mph and 100 kph, was shaped like a cigar; Amédée Bollée's racers were pointed at both ends like a whale-boat and the Paris-Madrid Mors had a very well-faired bonnet. Ordinary cars, on the other hand, were quite staid, being based on cycle or road vehicle (horse) practice. The important thing for most users seems to have been plenty of accommodation. Everyone wanted a ride on the new-fangled horseless carriages.

For a first look at motoring fashions our Time Machine should dock one fine day in the Bois de Boulogne during the Season of, say, 1902. By that time the Pioneers-O spirit had faded in France (though not in England) and cars had become quite commonplace. Everything worked in their favour. Fashionable Paris lay close to the Bois, where people went driving for pleasure,

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while all around that splendid piece of urban countryside clustered the workshops of those who made motorcars—at Ivry, Suresnes, Boulogne-sur-Seine, Billancourt, Courbevoie, Levallois-Perret. Help was always at hand, and with so many cars on view ideas spread quickly, especially as coachbuilders specializing in the car trade, such as Rothschild, Kellner, Belvallette and Henri Labourdette were clustered near the top of the Champs Elysées just outside the Bois.

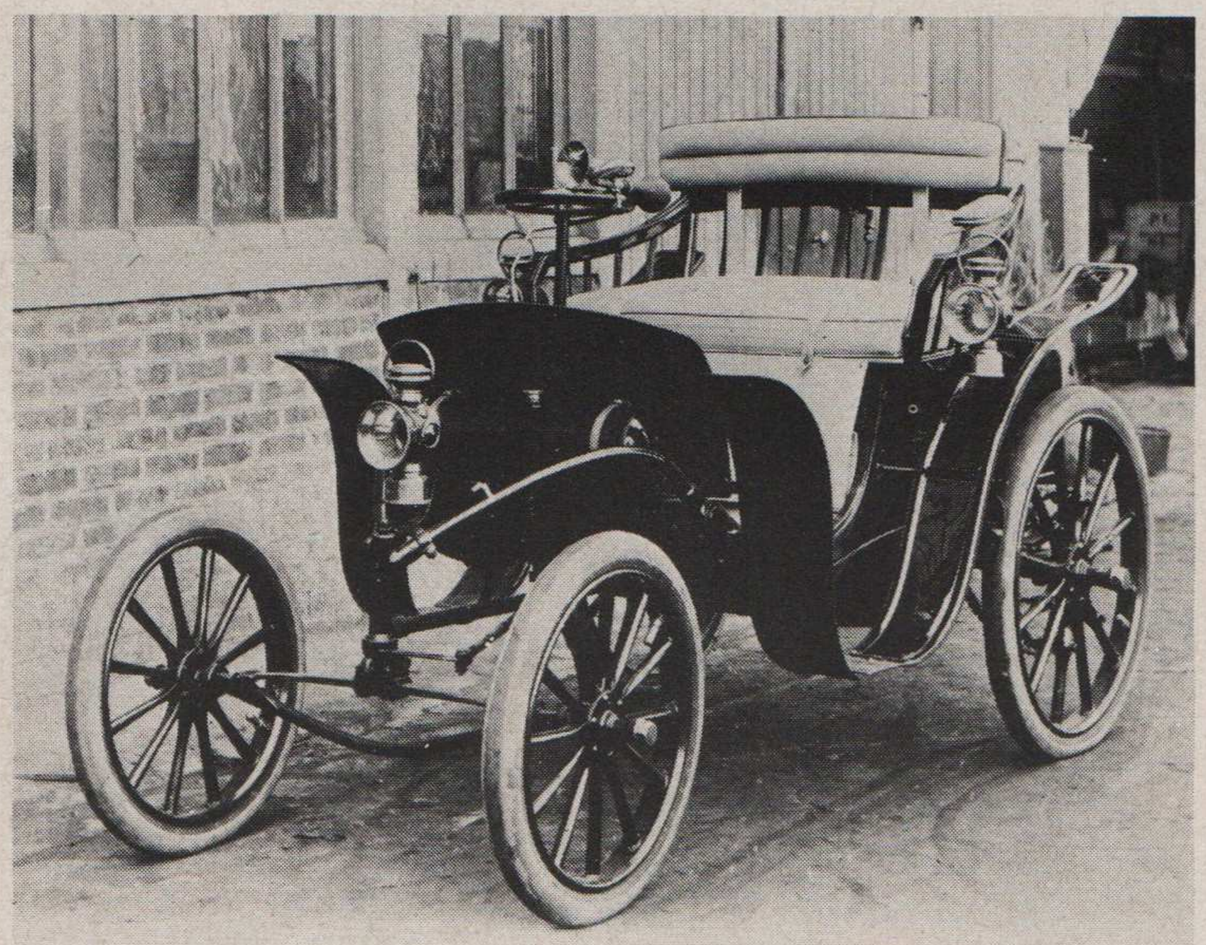
Small open cars carrying four persons seated either face to face or back to back were popular with beginners, and were built like a motorized Dog Cart, with engine aft or amidships, but with equal-sized pneumatic-tyred wheels. Weather protection was difficult, so they came out mainly in fine weather, sometimes with a canopy for shade—French equivalent of the "Surrey with a fringe on top" which Americans made a song about. The simplest closeable car was a Victoria, with a sort of pram hood. Benz made them in thousands both for export and for chuffing around spas dedicated to the wealthy Edwardian liver. Neater and nimbler than the Benz were little Victoria Phaetons made by Panhard and De Dion, with a bonnetted engine in front and often a "spider" or groom's seat behind. These cars were doorless and draughty, so it was not long before the front seat of a Phaeton was married to the rear quarters of a Governess Car or Tub Cart, to make the most popular Veteran body of all, the Tonneau. This had a central door at the back because wheelbases were too short to allow of a door in the side. Passengers were quite snug in a Tonneau, much more so than in a Siamese Phaeton, so-called because front and rear bench seats were identical in shape.

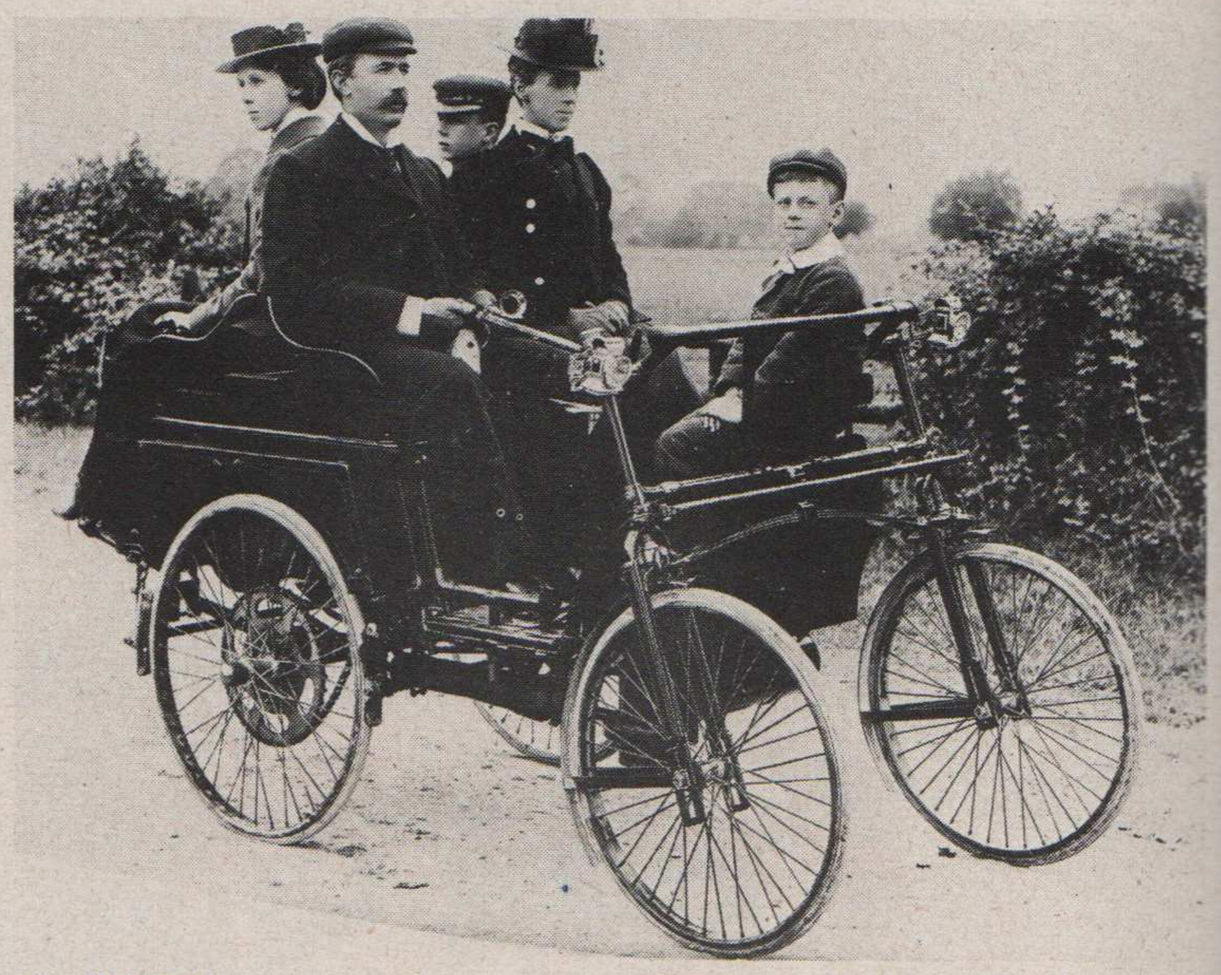
Probably the most influential open body was a Rothschild Tonneau built for King Leopold of the Belgians and named after him "Roi des Belges". Roi des Belges bodies had S-bends everywhere or, as coachbuilders would say "return sweeps". They were God's gift to the panel-beater and to the aluminium industry since the curvaceous panelling could be formed best in light-alloy, although it was not long before pressed-steel seats and panelling were being offered ready-made by the trade. As engine-power increased cars could be longer, with room for doors at the side. Tonneau bodies gave place to Double Phaetons, later known simply as "tourers", usually open in front but with side doors to the back. These were a great advance on early machines which had to be entered from the front by tipping the passenger's seat. Grand Touring cars came sometimes as *Triple* Phaetons, with an extra pair of armchairs amidships. The Kaiser liked this sort of body, and so did King Edward VII. For bad weather one could fit some sort of hard top, comprising a roof carried on corner standards, and a back panel-cum-quarters, often combined with windscreens front and rear, and side curtains. The French called this hard top a *Ballon*; the British called it a Limousine, and the story of closed cars in Britain is really the story of weather-proofing the open body. The Daimler "scuttle dash" discussed in Part I of this series, was a practical English device which the Continent was very slow to adopt. The French, too, were slow in fitting half-doors or full-doors to the driver's quarters.

France's great contribution was closed bodywork. Englishmen might view motoring as an Outdoor Pastime like riding to hounds or the cycling craze of the 1890's; the French were far less romantic. Automobiles quite simply spelt liberation from the tyranny of the horse. Engines did not fret nor catch cold. Therefore, because the car industry was based on Paris, and because the Bois was at hand for painless driving-lessons as well as promenades, fashionable Paris took motorcars to its bosom, using them delightedly in place of *voitures hippomobiles*. For fine-weather drives a Phaeton could be used, but for calling, shopping, theatre-going and so on, closed coachwork was essential, as it had been in horse-and-carriage days. Thus began a great Town Carriage tradition, the prototype of which was the *Coupé* or Brougham, so neat so smart and discreet.

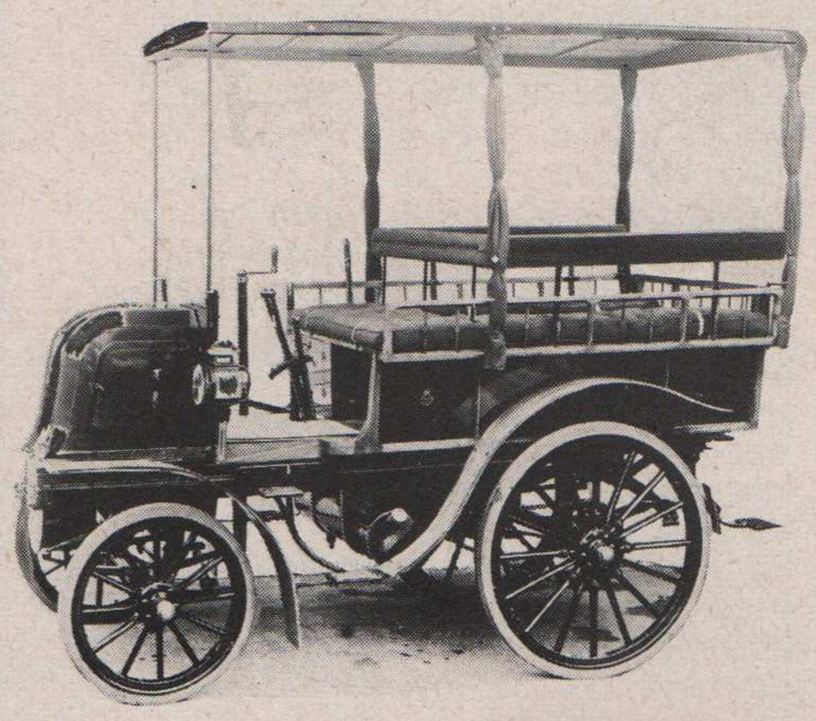
A *Coupé* had a seat for two inside, entered from a tall side door. The body had square "blind" (unglazed) quarters, a dropping window in each door and a pair of windows in front. Chauffeur and footman sat outside often on a backless seat railed like a coachman's box. A Double or Family Brougham had an extra bench with back to the driver contrived in a sort of bow window. When the latter was rounded the car became a D-fronted Brougham. This sort of body went well with both front- and mid-engined chassis.

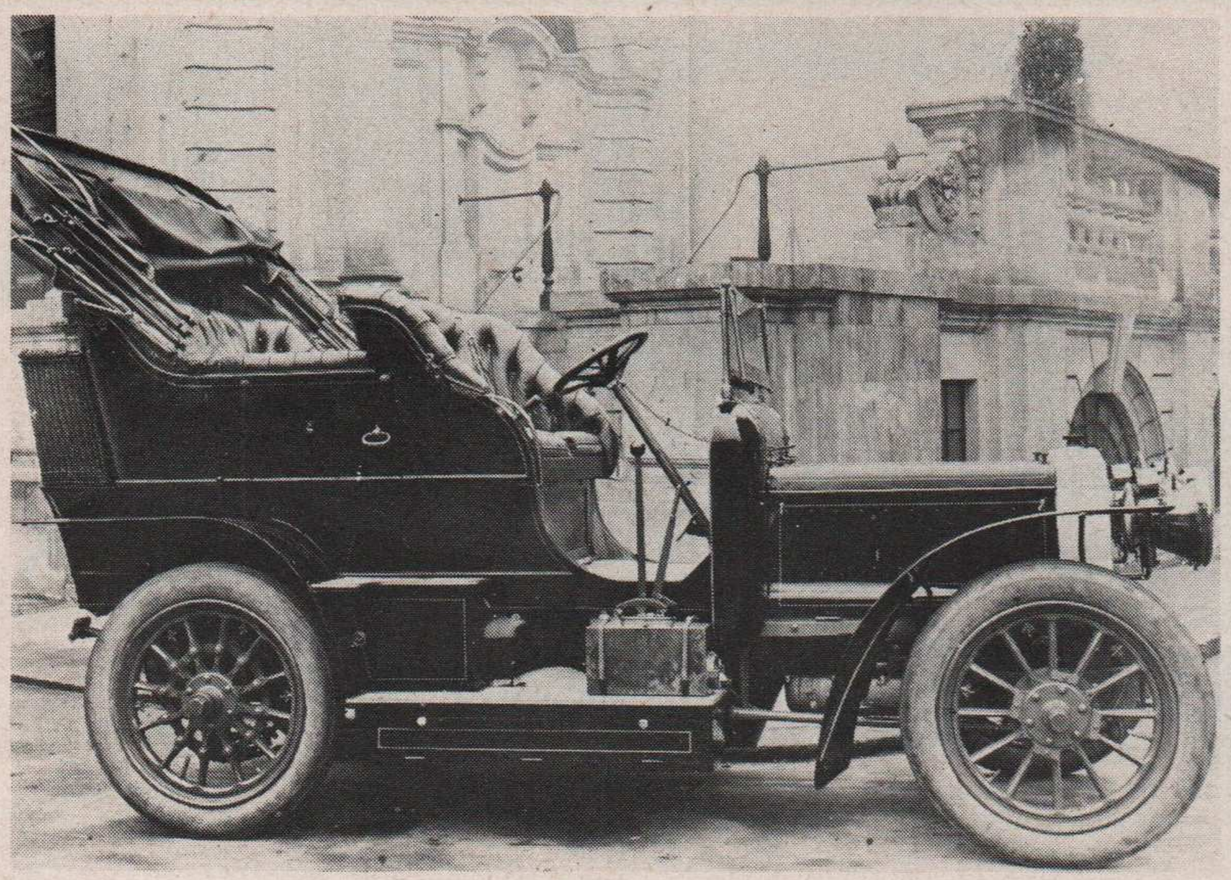
People with only one car found Landaulets very convenient, being snug as a Brougham when closed, but able to be opened as well. A Single Landaulet had the lines of a Single Brougham, but the blind quarters of the latter were replaced by an opening leather head. A Double Landaulet was fitted with cut hinge-pillars and a part of the roof opened with the Head. There was also the Three-Quarter Landaulet, whose distinguishing feature was a window interposed between the folding head and the door, which elements constituted the three "quarters". In France *Coupé* (Brougham) and Landaulet bodies were long popular for city use. They were the



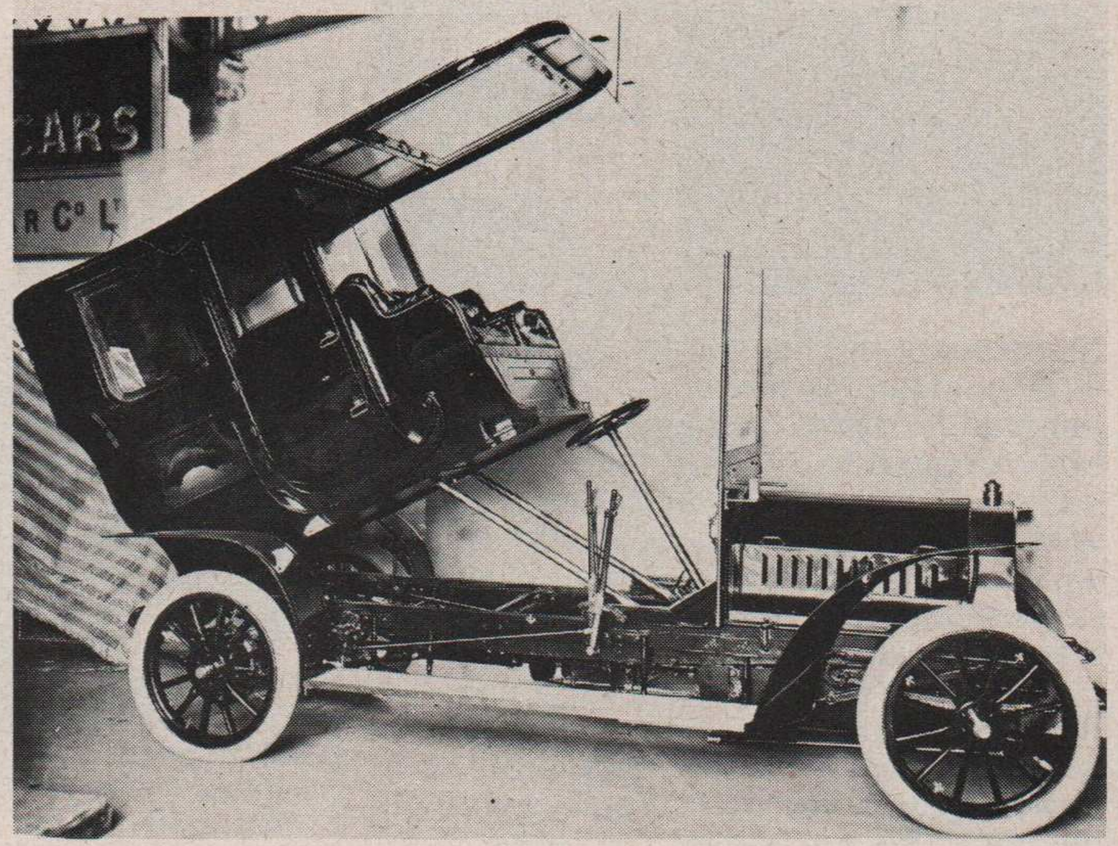


Above left: In early days the Panhard et Levassor company took the view (shared by many customers) that pleasure cars should depart as little as possible from horsedrawn carriage lines. Hence this Victoria of 1899 . . .
Above right: The cycle-trade origins of the early light car were never more obvious than in this photo of an 1899 Stephens.
Below: Inspired—and who shall call this exaggeration?—by the four-poster bed, the Duke of Westminster's 1899 Daimler possessed a canopy and side-curtains





The English Daimler company introduced their "hooded dash" in 1902 as a first tentative step towards uniting bonnet and body and, incidentally, providing a little weather-protection. By 1905, the date of this Double Phaeton, side-entrance bodies were demanded; the problem of accommodating side doors on a short, chain-drive chassis was solved by building high. The towering hood formed a useful dust-shield. Note the luggage platform and hamper behind



Coachbuilt bodies were complete in themselves and quite independent of the chassis. Sometimes, as in this picture, they could be raised, giving access to the running-gear. The owner of this Cupelle car has been rather crafty, for what appears to be a normal Limousine is in fact two bodies in one. The upperworks complete with roof, rounded quarters, bevelled-glass lights and retractable windscreen, can be removed, leaving a Roi des Belges touring body

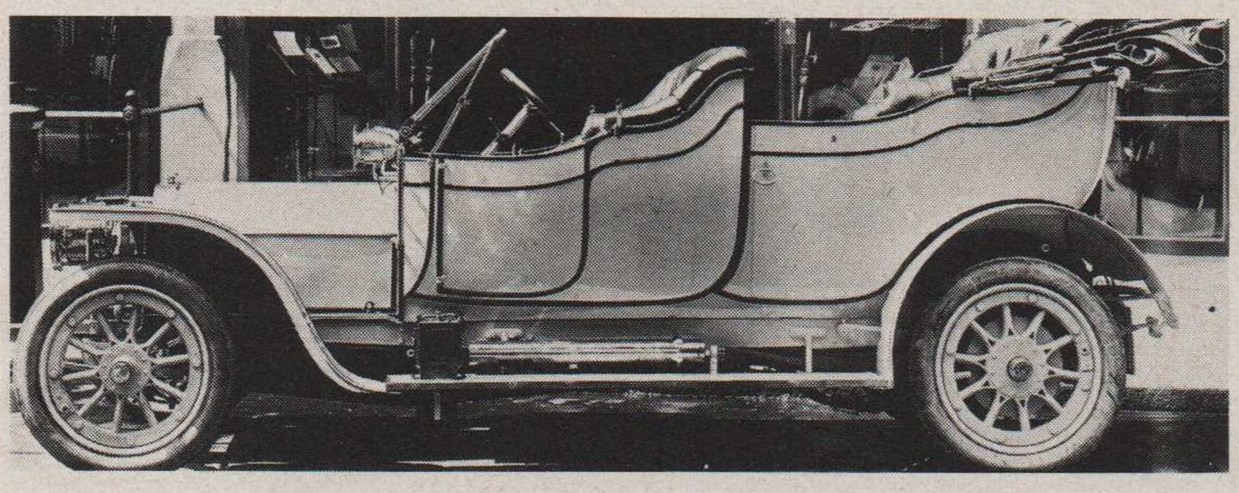
classic town cars, made for the most part with no covering above the chauffeur and often no windscreen, such things having been unknown in carriage days. As speeds rose screens were fitted and it then became possible to fit a canopy between windscreen and roof, sometimes retracting into the roofspace by means of a spring-roller mechanism. These open-fronted styles were known in England as "de Ville" bodies. Perhaps because of the English climate it was more usual to have a forward extension of the roof, and after the first few years the term "Limousine" was switched to describe a closed car with this extension and with seating for more than two behind, the extra passengers sitting on folding "occasional" seats.

Great ingenuity was shown by coachbuilders in devising forms of folding-head mechanisms. Soon they had evolved Landaulet-like bodies in which the whole superstructure folded away, making a completely open car. This style went by the name of Cabriolet during the Edwardian and early Vintage period. Landaulet and Cabriolet bodywork, although ingenious and convenient, tended to be overweight and was never for long free from rattles and draughts. Coachbuilders never stopped trying however, and were extremely proud of their convertible creations. During the 1920s as we shall see, they changed their approach, turning from "openable limousine" to "closeable tourer".

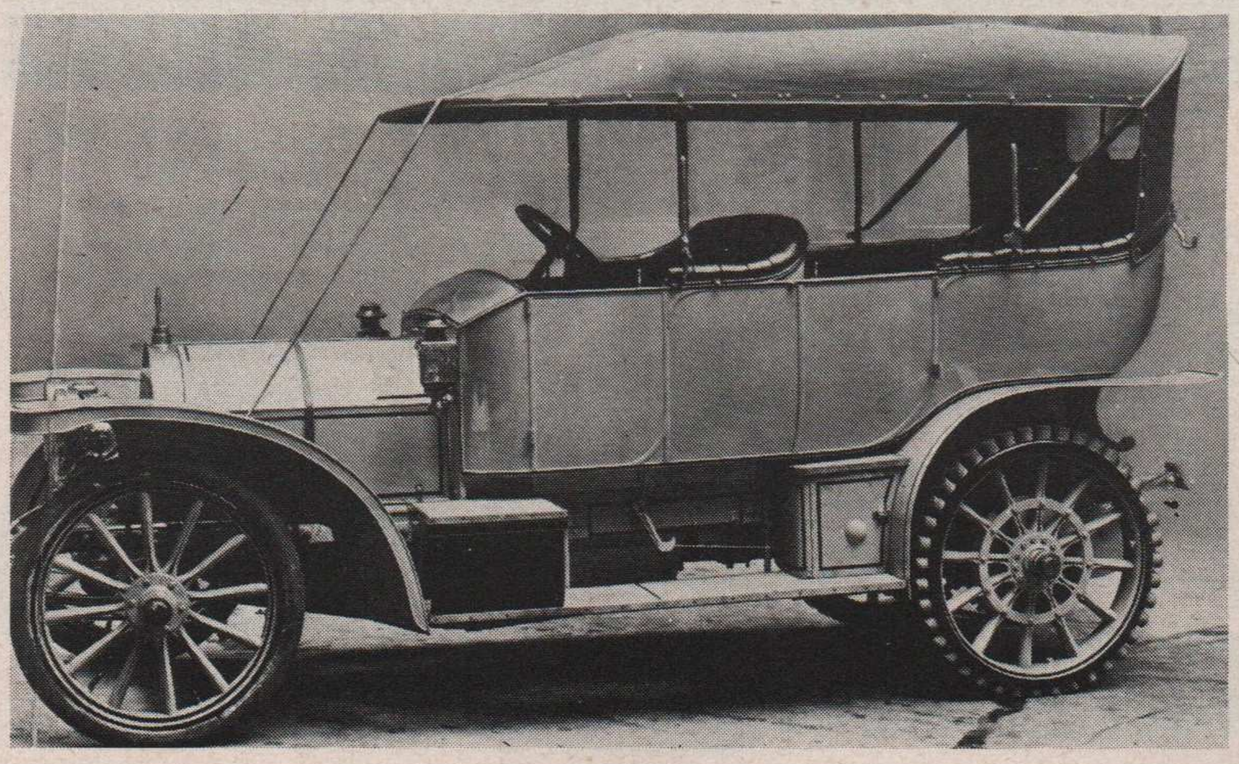
Closed bodywork remained pretty conventional during the first 10 years of the century, reproducing for the most part horsedrawn carriage styles adapted and enlarged as chassis grew longer and more powerful. There were even some that were modelled on Stage Coach and Drag, complete with seats on the roof and sleeping-accommodation like a nineteenth century Travelling Carriage. One of the few original styles was the "duplex" body, made in the shape of a Brougham built on to the front of a Limousine. The style came in about 1907, and oval windows were often fitted, since reduced glass-area meant reduced weight. In these cars the driver sat inside with the passengers, and it was quite normal in fact for the owner himself to drive, as he could never do in a Brougham, or Landaulet, the formality of which demanded a liveried chauffeur.

Although there were plenty of young *sportifs* in France who gloried in the open road and set town-to-town records undreamed of in belimited Britain, the main body of motorists saw no point in getting cold and wet. Then as now *conduite intérieure* was the thing: a glass-fronted box for the owner to drive from inside, dry, sheltered, unostentatious and private in his comings and goings. By 1902 *conduites* in Paris were challenging the open car. Over here despite the enthusiastic plugging of closed bodies by keen driving dealers like Charles Jarrott and Charles Friswell, the fresh-air lobby triumphed. Sir Max Pemberton, novelist and author of *The Amateur Motorist* summed the matter up in that excellent book:

> "The pleasures of motoring are the pleasures of the open air. An open motor-car enables you to see the country as you can never see it in a train, on a bicycle or afoot. The splendid exhilaration of speed in the open air has, above all else, established the motor-car in the affections of the people. If we are to lose this, if we are to box ourselves up in stuffy limousines, then, I say, we are better off in any train, even the meanest . . ."



Left: Back-seat passengers in this 1909 30h.p. Lancia sat high, to enjoy a good view of the scenery. The doors are of a sensible height but there is as yet no scuttle, the body adjoining the "dashboard" or engine bulkhead. Notice the adjustable screen and the irons beside the front armrests for the double-extension hood



Left: This Fiat, also made in 1909, is a complete contrast to the curly Lancia, having a flush-sided Torpedo body with scuttle dash. Here the double-extension hood is up, tethered by straps. No wind-screen is fitted

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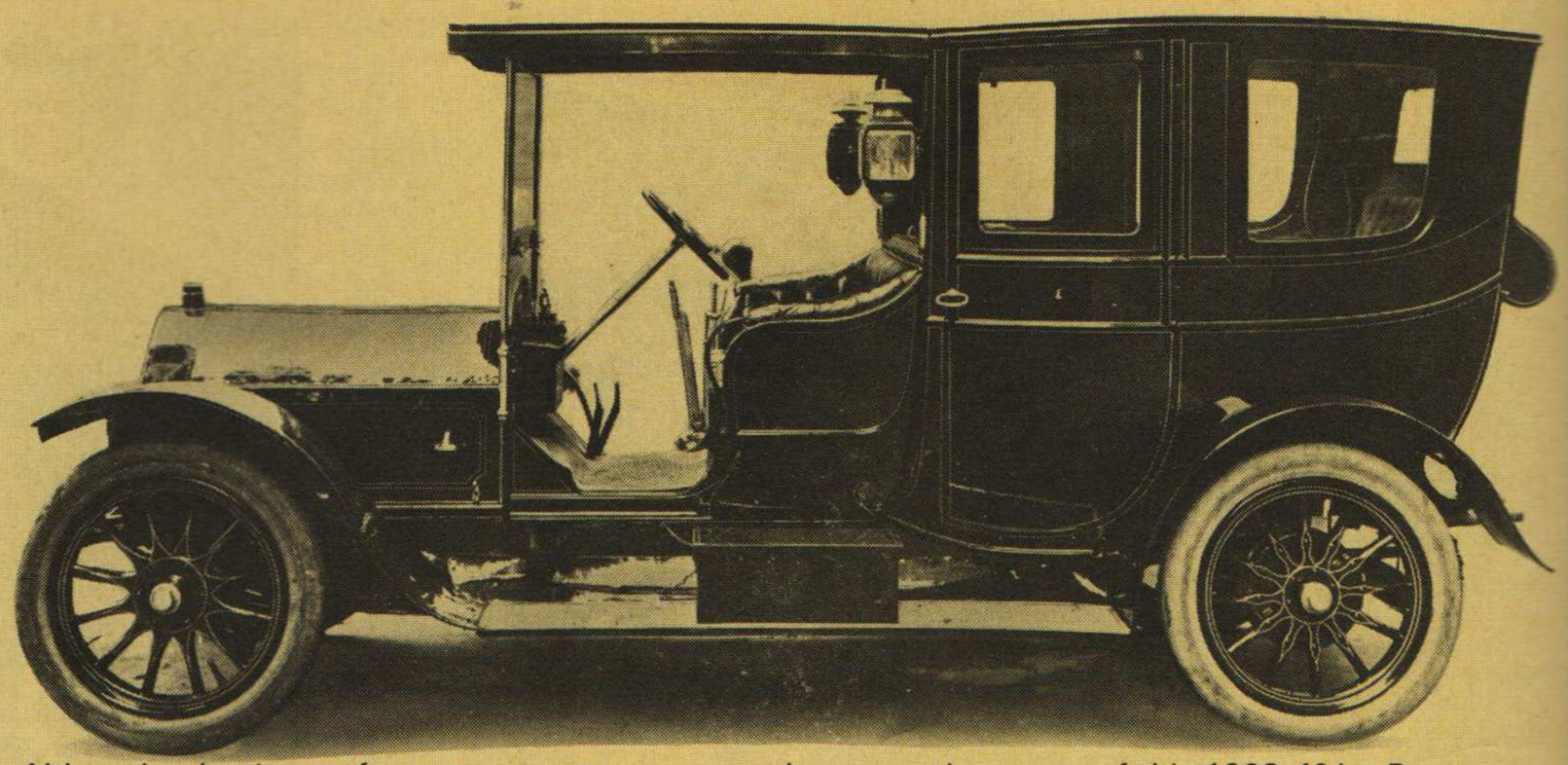
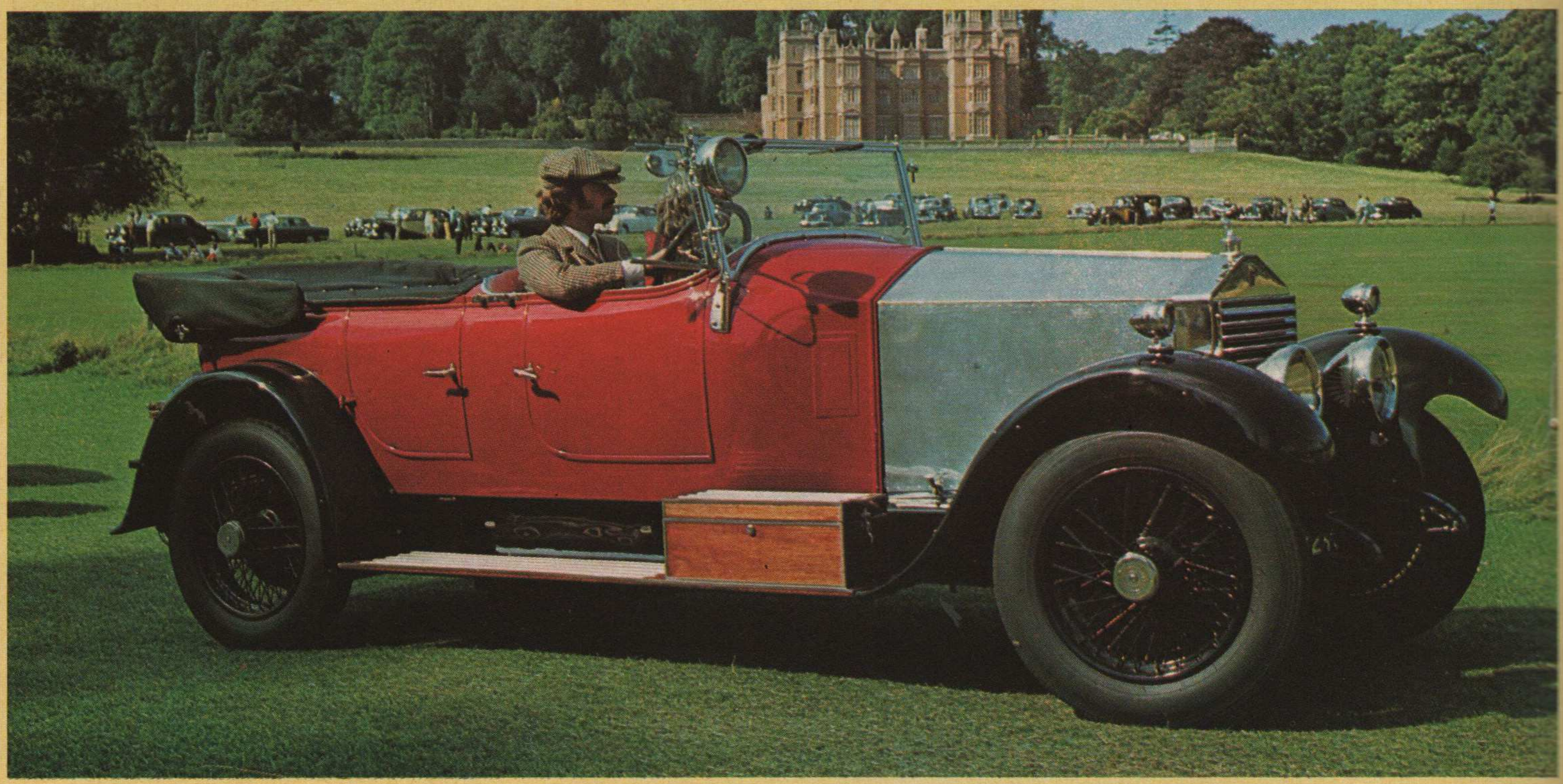


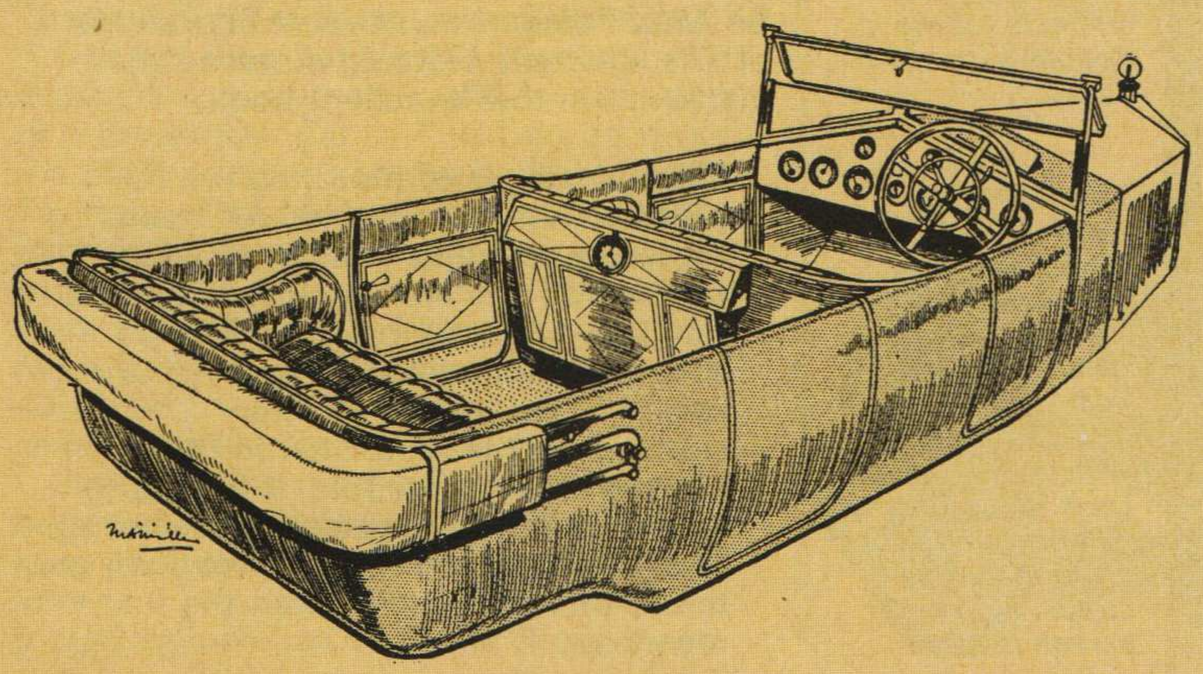
Although relenting so far as to mount a screen and canopy, the owner of this 1908 40hp Darracq limousine, has left his heart in the 18th century; he has even fitted a Sword Case, which is that little bulge behind

Motorists of the Pemberton persuasion, who included the majority of those who motored for sport, opted for an open body stripped to the bare essentials. They did without running-boards, hoods and windscreens—partly because of the wind-in-the-face mystique but mainly because all these objects were heavy and they wanted every horsepower to tell.

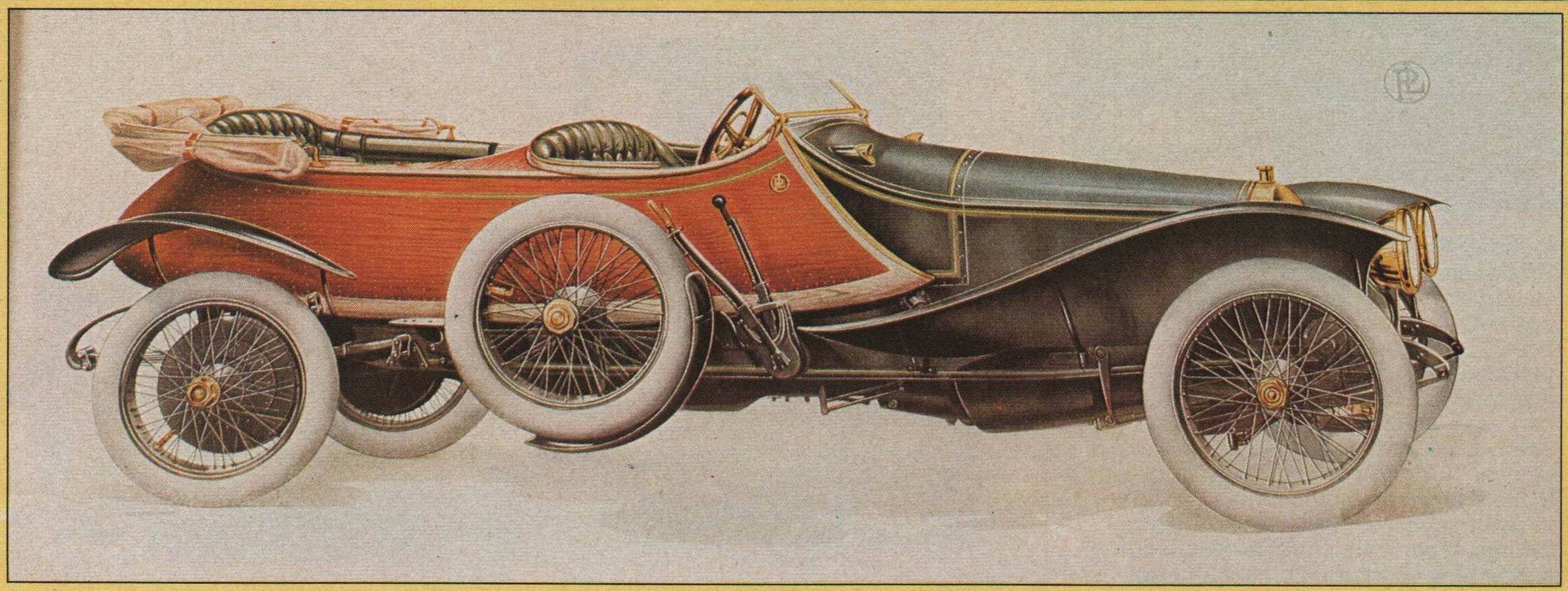
Sporting drivers played a large part therefore in the development of open bodywork, leaving closed cars to be looked after by the trade. Touring was popular ("We are touring the Lake District this summer"). Hence the scuttle dash, quickly followed by low halfdoors in front and taller doors for the back. Front doors grew upwards and scuttles were extended aft. The early Cape Cart hood sheltering the back alone reached forwards by means of a Double Extension, having a second set of hoodsticks which plugged into sockets on a level with the front seat squab. These at first were held down by straps and were independent of the screen.

Competition-work now played its hand. For the first RAC Tourist Trophy race the small Stoke-on-Trent firm of Rykneild built a car wth truly prophetic body, whose top ran parallel with the ground and whose sides were flush both vertically and fore-and-aft. No more was heard of Ryknield but the body was illustrated in *The Autocar*, and reappeared with alterations on the Arroll-Johnston car which ran second in the 1906 race. Further echoes were heard from Longbridge, and when Brooklands Motor Course opened in 1907 many people's thoughts turned to flush sides and narrow "wind-cheating" bodies. Flush-sided bodies were built of aluminium by Rothschilds for the Herkomer Trophy trials, and in 1908 the same coachbuilders almost stole the Paris Show with their "Racing Phaeton" Mercedes in which an extended scuttle, as long used on racing cars, was at last combined with a touring car's sides. The Torpedo body had arrived, complete with front doors whose tops reached the waist line. The stage was set for Jean Henri-Labourdette's beautiful carvel-built Skiff constructed in 1913 for the Chevalier René de Knyff and fully described in the designer's recently published memoirs. This lovely copper-riveted mahogany shell had no doors, so that passengers had to climb over the side. The Chevalier was unrepentant about this. He felt that ladies had for too long had things all their own way, remembering the great hats the size of bicycle wheels which had changed the whole silhouette of closed motors during 1907–8.





Above and left: In the early 1920s the Barrel-Sided Tourer was Britain's main contribution to motor body design. Sides were still low, dictated by the bonnet hinge line. Marquetry cabinetwork was often fitted even in open cars

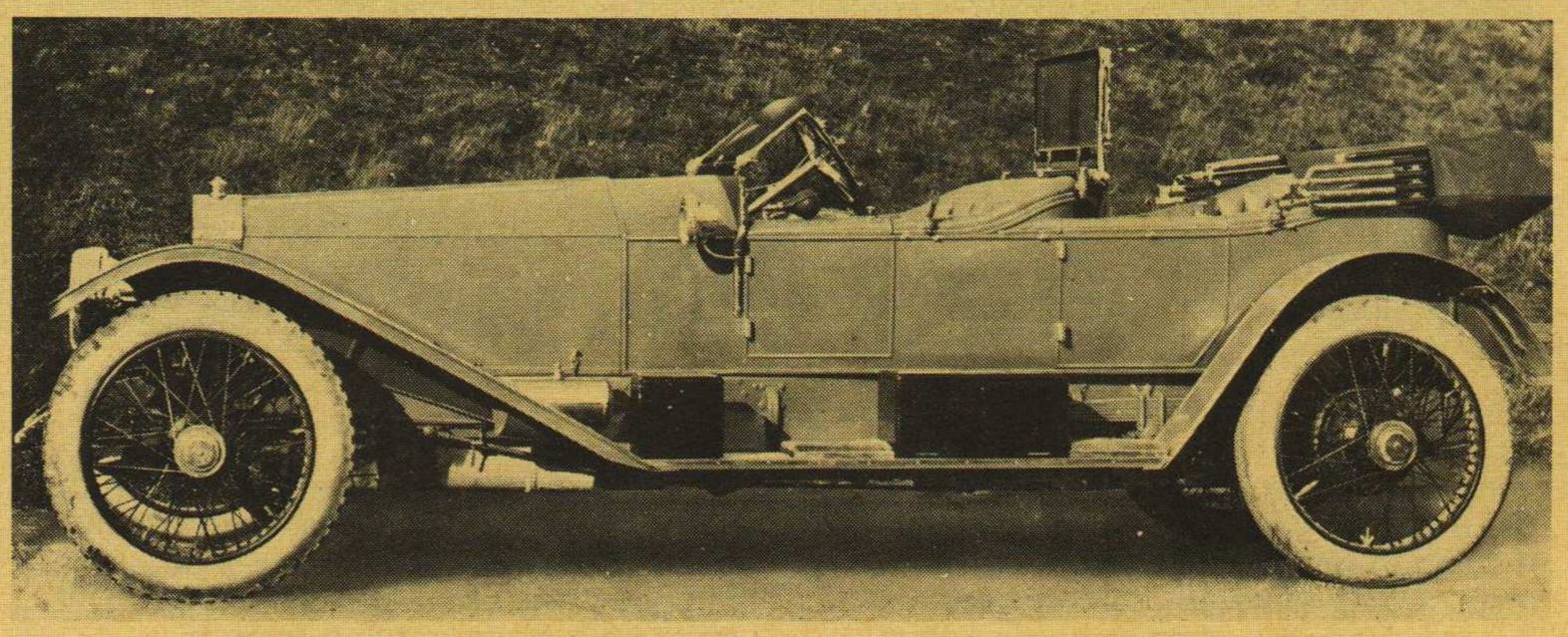


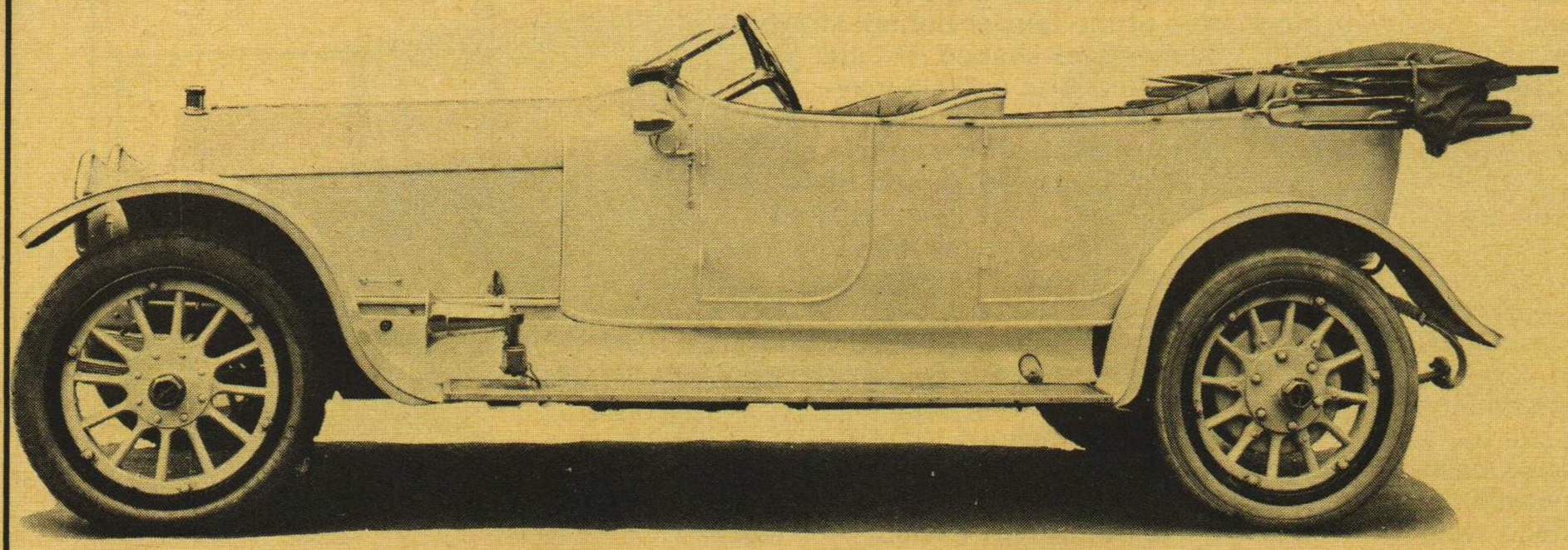
One of the "cleanest" pre-war designs was the famous Skiff designed for the Chevalier René de Knyff, of Panhards, by Jean Henri-Labourdette. No screen, no doors, no interior trim, the ash frame and copper-riveted triple-skinned mahogany hull telling their own story

Structurally the motor car body underwent its first change about 1900 when King Leopold's Panhard was built. Aluminium had been used in coachwork for some years before that by Rothschild et Fils, Kellner, Lamplugh, the English-born Paris coachbuilder, and H. J. Mulliner in England. The majority of cars however were built with panels of mahogany or birch steam-bent where necessary, blocked and canvassed and rabbeted into an ash frame. The voluptuous double curves of a Roi des Belges could not easily be formed in wood, and so panel-beaters were recruited into the industry, and the wooden frames were covered with aluminium sheet, joins being concealed beneath applied beads and mouldings. Single-curvature panels were still mainly of wood usually painted and varnished but sometimes done in clear varnish to show the figure of the walnut or mahogany. By 1910 virtuoso craftsmen were performing with the new oxy-acetylene welding-torch, making bodies of positively Easter Egg bulbosity, their joints neatly butt-welded. Within a couple of years wood panelling was out except for upper back panels of limousines and the like which could be easily formed from bent wood, and of course for special decorative effects.

When the Vintage Sports-Car Club led the way in conserving cars of the 1904–1918 period (i.e., those too young for the Brighton Run but historic nonetheless) they chose the name "Edwardian" for this class, and no-one has hit upon a better name. The more I look at the cars made during the reign of King Edward the Pacemaker the more closely do they become identified with that period. When he acceded in 1901 cars seemed suddenly to leave their pioneering stage. Tube ignition, quadrant gear-change, solid tyres and unequal wheels looked suddenly primitive; four-cylinder engines became commonplace. Cars ranged suddenly far and wide. The great motoring country-house party was on, under royal patronage, the King, his nephew the Kaiser, and the latter's brother, Prince Henry of Prussia, leading the revels.

Ceremonious motoring reached its peak in King Edward's reign, which corresponded with the *Belle Epoque* in France. During the Season Hyde Park and the Bois were thronged with fine motor carriages of the short-range type, which reached the height of curly splendour between 1906 and 1908 when "sidesweep" (the curvature of a body in plan) grew complex as panels seemed to overlap one another like the petals of a rose, and side elevations resembled a flight of steps. Height was considered no disadvantage, and was in fact actively encouraged because the owner and his lady liked to see over the heads of the crew in front. Several manufacturers, including Austin, Berliet, Brevetti Fiat and Itala produced chassis down-curved amidships, but clients objected that when bodies were lowered in this way they could see nothing but the backs of chauffeur and footman. Limousine bodywork tended to be ponderous, more suited to Savile Row tweeds than a Paris hat, but there was much elegance to be found in a Park Phaeton sailing majestically past the Serpentine with its





Above: This Silver Ghost is a 1913 model built when it was fashionable to sit out of, rather than in, one's motorcar. Sides are flush and the elbow line almost horizontal; the body lines blend into scuttle and tapered bonnet

Left: By 1913 American touring cars had already taken on the lean, clean Twenties look, with a metal valance between rocker and running-board. This a 40h.p. Oakland

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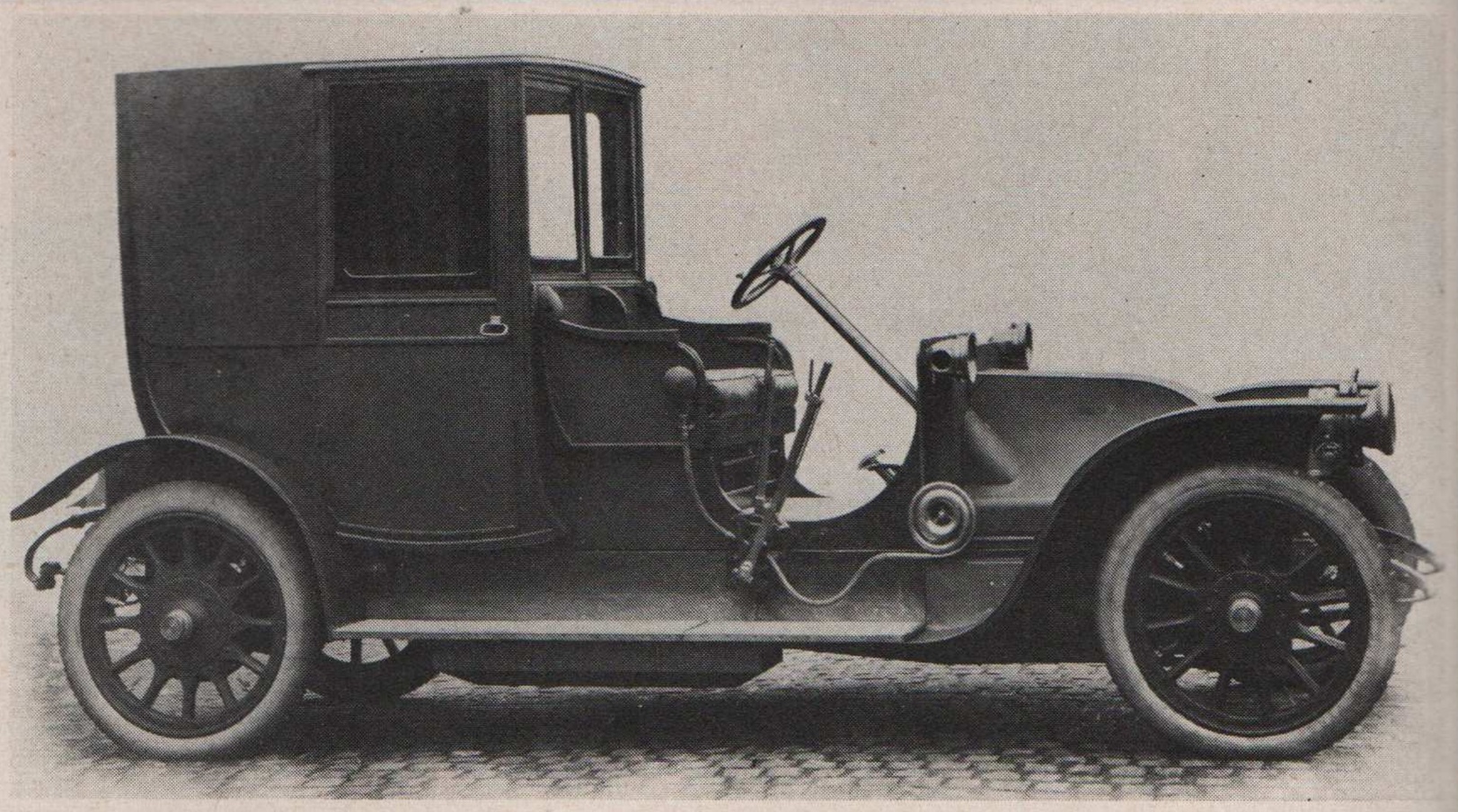
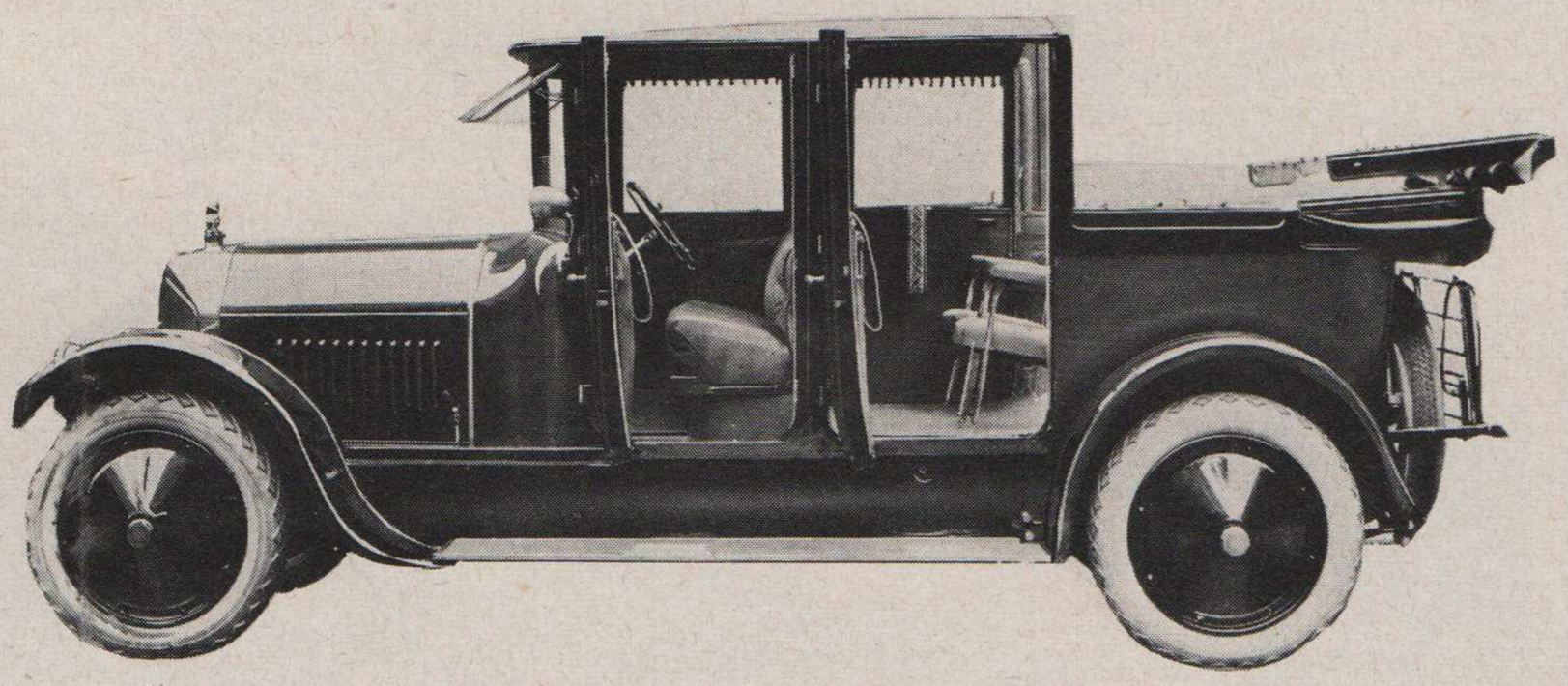
rounded Victoria head acting as parasol. Brougham town cars meanwhile kept classic simplicity alive, and preserved for posterity the "razor-edge" aesthetic, based on the assembly of subtly curved plane surfaces meeting one another at right angles. Closed cars for the most part were painted in dark, sombre colours, relieved sometimes by vertical stripes, "picking out" and canework, made either from actual wicker or done in paint squeezed from a sort of icing-syringe. Open cars could be painted in lighter and brighter colours, although some owners stuck to the family "stable colours" for all vehicles, and sporting drivers sometimes left their cars in "works grey" like experimental models on test, and laid on the top coats only when they sold the car.

When Benz, Opel and Austro-Daimler entered Torpedo-bodied cars for the Prince Henry Trials in 1910 there was great indignation amongst amateurs who still thought "Roi des Belges". The Continental entries, they mumbled, were nothing but racing freaks, with no proper mudguards and no beauty of line. As for that man Ferdinand Porsche, who not only drove but designed the



Above: Brougham or Coupé de Ville bodywork remained fashionable for 30 years, particularly in France. This example, evidently inspired by a Parisian designer's C.G.V. is in fact a 1908 20h.p. Ariel. It is a true Single Brougham, with seating for two inside

Below: In 1921, the date of this 25/30h.p. Crossley, and for some years to follow "the County" kept provincial coachbuilders busy with orders for Landaulet bodywork, ideal for gently taking the air. This example is by Maule and Son, of Stockton-on-Tees

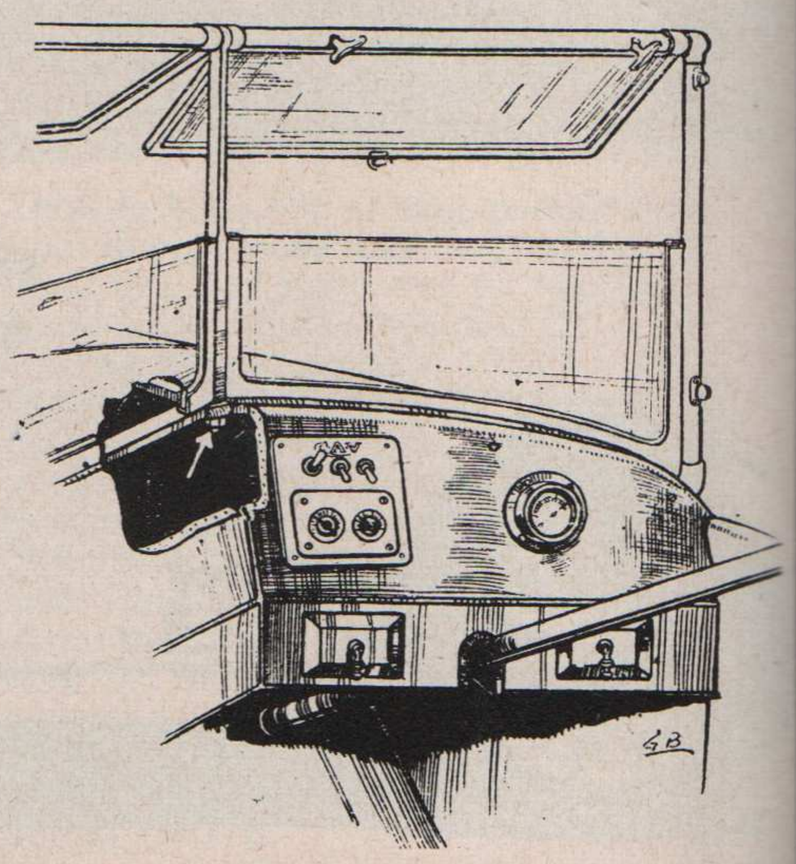


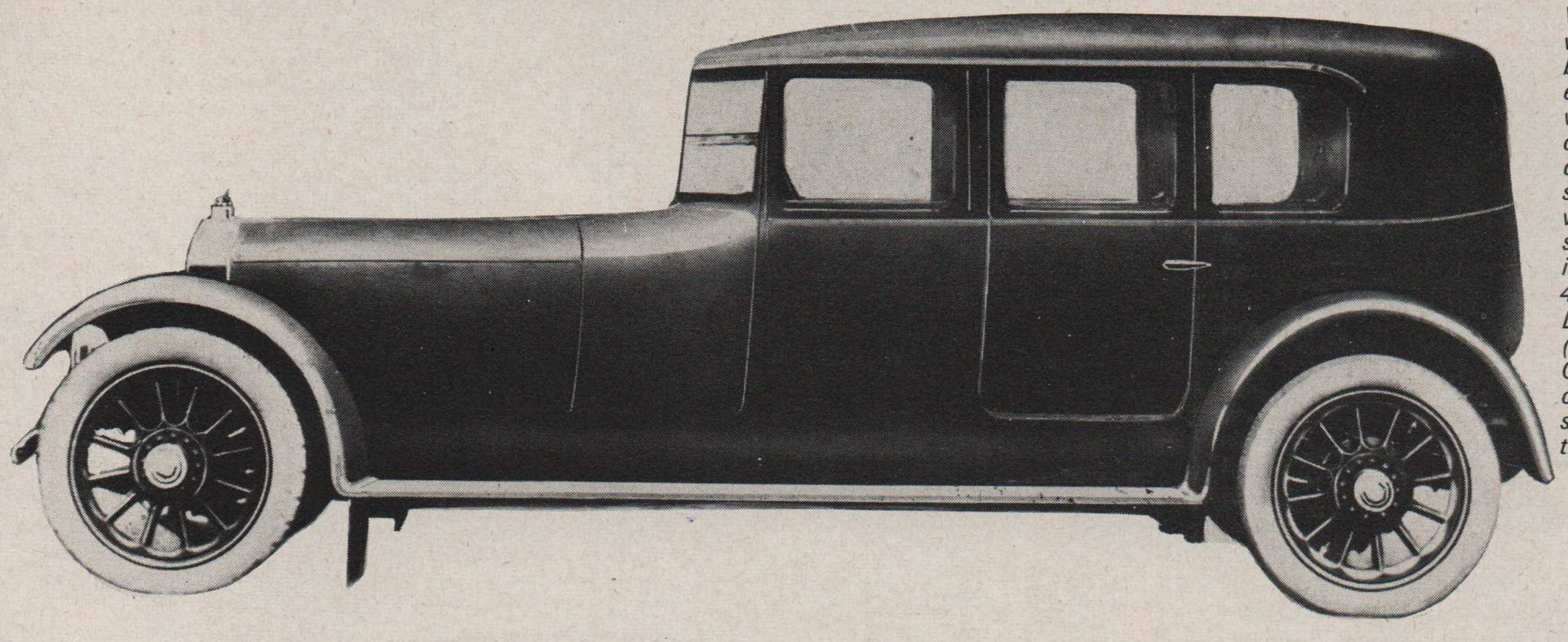
winning Austro-Daimler, he was nothing but a cad, since his car conformed to the regulation dimensions only in the one respect that mattered, being swept inwards from waistline to chassis thus narrowing the cross-section and reducing wind-resistance. This treatment continued to be popular with German and Austrian designers until the middle 1920s, and was often combined with a built-in tray for the hood.

The squeaks of protest did not last long. It was almost as though King Edward's death had closed the door on Edwardian motoring, for at any rate the more progressive machines of the 1910–1914 period were far more Vintage than Edwardian in outlook and presentation. Parisian town carriages might still be made without windscreen, scuttle-dash or canopy, but designers on the whole now realised that bonnet and bulkhead were no longer irrelevancies supplied with the chassis—which itself had been a mere building-plot for bodywork—but integral parts of a balanced design. This must have been rather a blow to proprietors of the fancier bonnet shapes (e.g., the diamond-shaped Iris and cylindrical Hotchkiss or Delaunay-Belleville) but the gap between bonnet and body was bridged in a couple of seasons. At first the scuttle and front door were built as part of the coachwork and the latter married to the manufacturer's old-fashioned wooden dashboard because the latter was too flimsy to take any strain; then gradually the scuttle arch and pillars became structural, and able to carry a door. From being separate the scuttle itself was inclined to meet the bonnet in various ways: convex curves were followed by awkward concave ones in 1911–13, but by 1914 when European drawing-offices closed "for the Duration" bonnets tapering to meet the scuttle (in elevation as well as plan) had become commonplace and a few even had the side hinges at a slant parallel with the general slope.

New-fangled front-end treatments spread to the formal car. Even Coupé de Ville bodies were made with waist-high doors in front, tapering scuttle, adjustable windscreen, and domed pressed-steel wings. The sound of hooves was receding. French coachbuilders produced *conduite intérieure* coachwork on every sort of chassis from tiny "doctor's coupé" two-seater to gigantic Travelling Carriage, since the French at that period were a fug-loving race. Almost all cars featured an opening windscreen for wet weather; a few had little pram-hoods rigged forwards above the screen, and optimists wiped their closed screens with half-potatoes to break the surface tension of the raindrops. In this country the "mobile greenhouse" did not sell so well; in fact coachbuilders collaborated with owners in planning formal windowless-fronted closed cars for the use of the owner driver. Enclosed-drive English bodies remained rare until the middle 1920s.

Tall, heavy opening windscreens before the days of wipers put a formidable strain on the scuttle. Vee screens, adjustable or two-piece, were popular in the early and middle 1920's





When bodies were high because everybody wore a hat, door-openings could seriously weaken the structure. That is why this 40h.p. Lanchester (the 1919 Olympia Show car) has a single door on the nearside

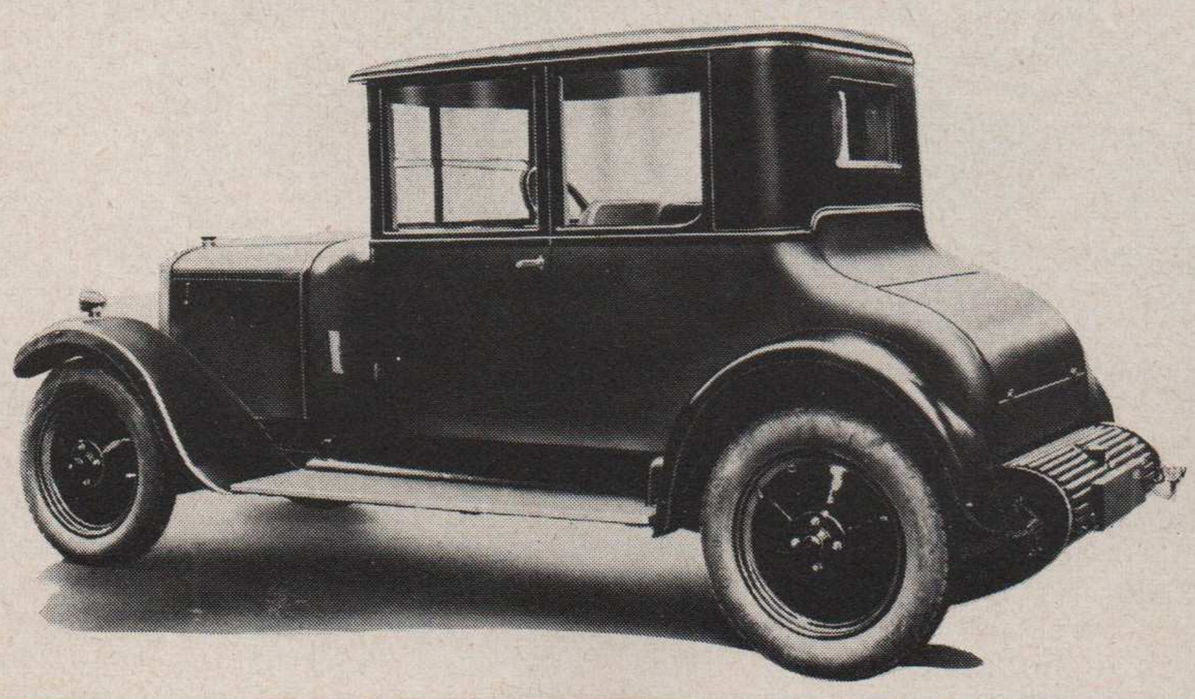
When car-building was resumed after the Armistic English designers pressed on with pre-war ideas. Domed "Easter egg" bodies seen at the Salon had rather impressed them, so that domed lids were prominent at the first post-war (1919) Olympia Show. Most of them, like the 1913–14 *carrosseries* which had sparked them off, were rather short on doors because motorcars were still very high and tall doors seriously weakened the structure. It was quite usual for these new "saloons" to have only one door a side, or perhaps only one door, placed either alongside the front passenger or amidships to serve front and back by means of tipping, swivelling or tramline seats and a central gangway. Marquetry ceilings and quarters were popular—although "fashionable" would be a better word, since they acted as sounding-boards. Post-war French closed cars were flatter-roofed. The Vintage open car, whose story had really begun about 1910 as we have seen, continued in the direction of its pre-war heading: radiators grew taller permitting a continuous horizontal line from front to back, or very nearly so, bonnets sloped less steeply and side hinges followed the same slope. At the same time the backrest of the front seats sank below the waistline, no longer standing above it as on all but the most advanced pre-war touring cars. The most exciting of these had been built for the Salon during the "nautical" craze of 1913, neat boatlike bodies with polished mahogany planking which encircled the entire hull and formed a neat bridge behind the front seat.

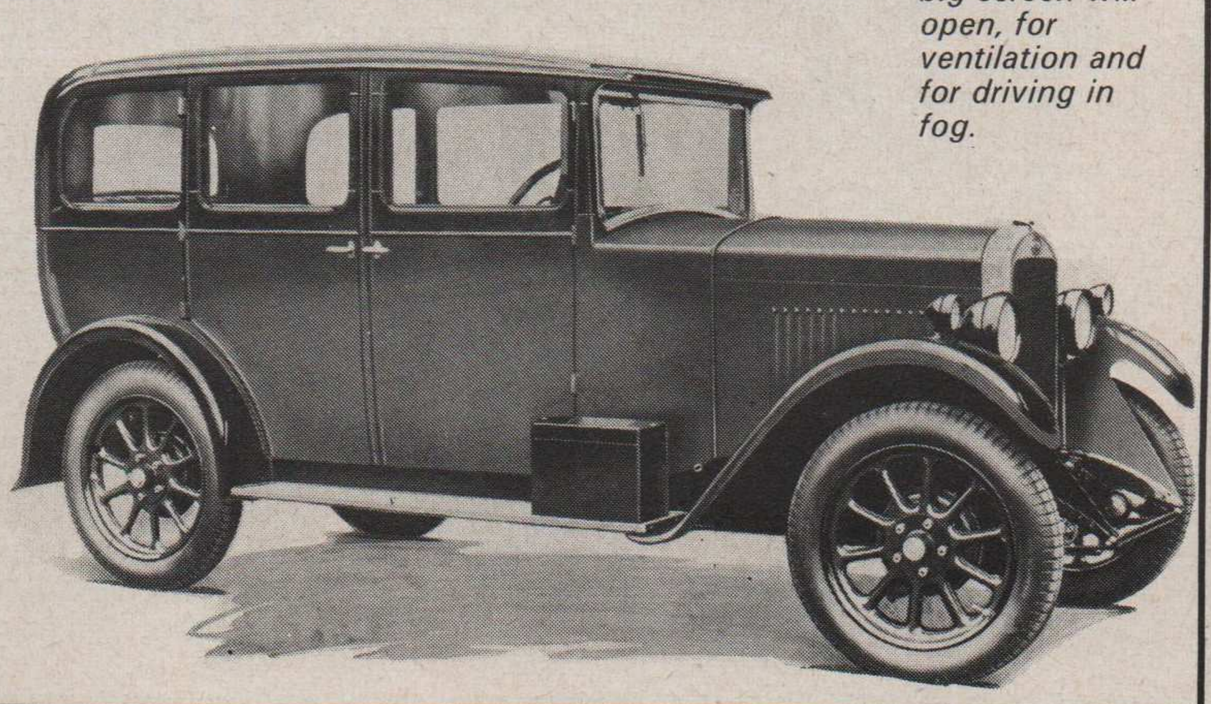
This nautical craze continued into Vintage times. Boat bodies—with more freeboard than a 1913 Skiff, it is true, but retaining the decking amidships—were made by the more sporting coachbuilders, including a smart maritime Silver Ghost built by Barker for

Above: By 1922 British "town car" bodies were usually provided with screen, scuttle and chauffeur's door, although many French ones were not. Here Barker and Co. attach the front of an open Touring Car to a classic Limousine de Ville on a Daimler 20h.p.

Below left: Coventry was sometimes guilty of hideous wheels, mudguards and running boards, which left the coachbuilder powerless. This 1925 "occasional four saloon coupé" is by Morgan and Co. of Leighton Buzzard on a 16h.p. BSA, BSA being the name for cut-price models in the Daimler range

Below: Built in 1928 this 9–28 h.p. Humber still had its radiator on the axle line. The big screen will open, for ventilation and for driving in fog.





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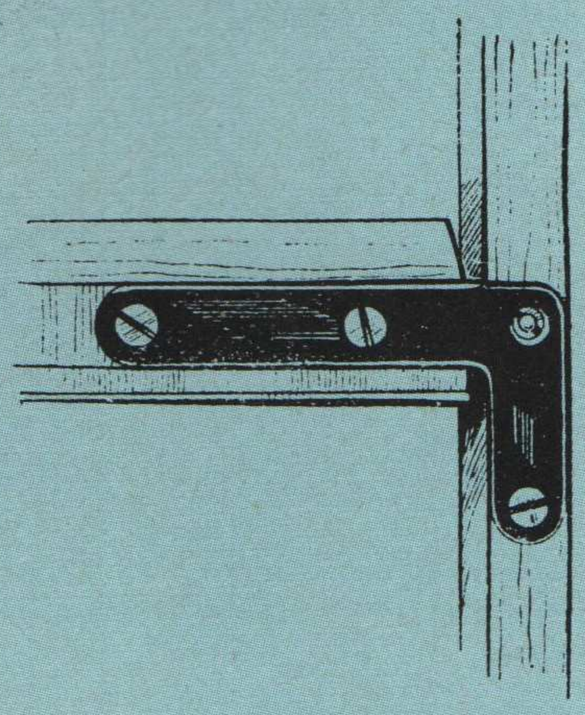
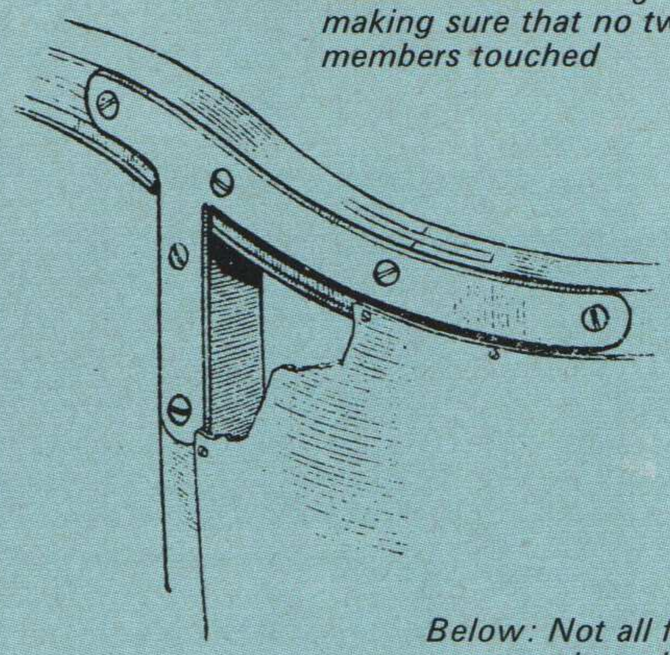
Queen Marie of Roumania. Cross-bracing amidships gave added strength, looked well and was a natural emplacement for a rear windscreen, which passengers now demanded on fast cars. This was the beginning of the Twin Cowl Phaeton style which bred so many handsome S and SJ Duesenbergs on either side of the 1929–31 Slump. All sorts of interesting arrangements were made so that people could climb easily into and out of the back: screens lifting up with the decking, sections pivoted to the doors, and so on. Side-wings to the screens (both front and back) could make an open touring car quite snug, and to make things more cosy still the Paris houses of Kellner and Labourdette built little cabins over the back seats. The latter called his product the Cab Skiff; Keller named his *le Scaphandre* (i.e. diving outfit), and very exciting they looked, although seats over the back axle cannot have been very comfortable. Cases are on record of girls refusing invitations to the back seat of a twin-cowl Hispano in favour of a two-seater DISS Delage, the boat-tailed roadster which springs immediately to British minds when boat-bodied two seaters are discussed. Closed

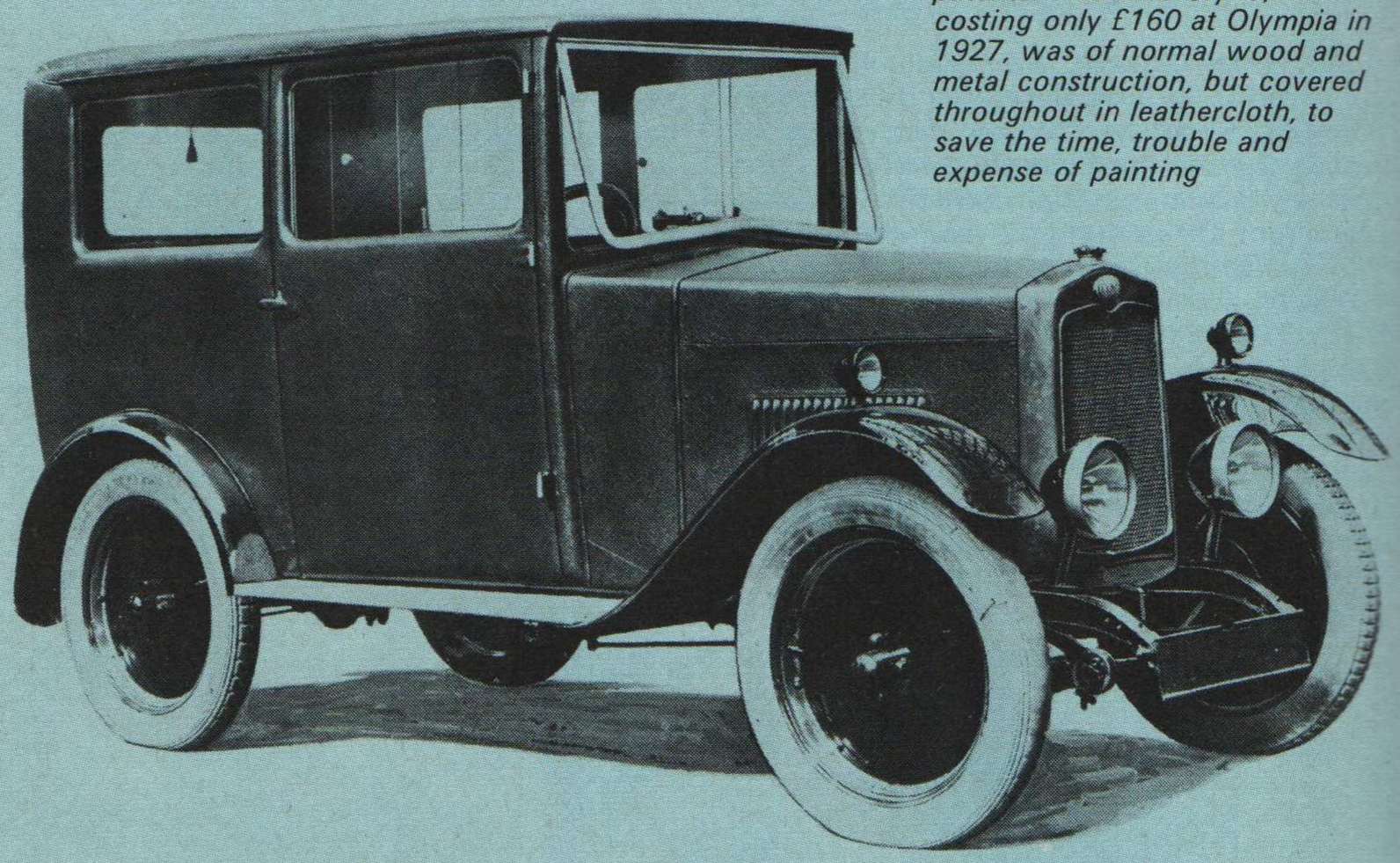
Popular in the 1920's was the dickey seat—a method used to enable a two-seater car to carry a third occupant without detracting too much from a sporting body style. The Americans had it too, only they called it a rumble seat. Our drawing shows a 1926 AC two-seater with dickey

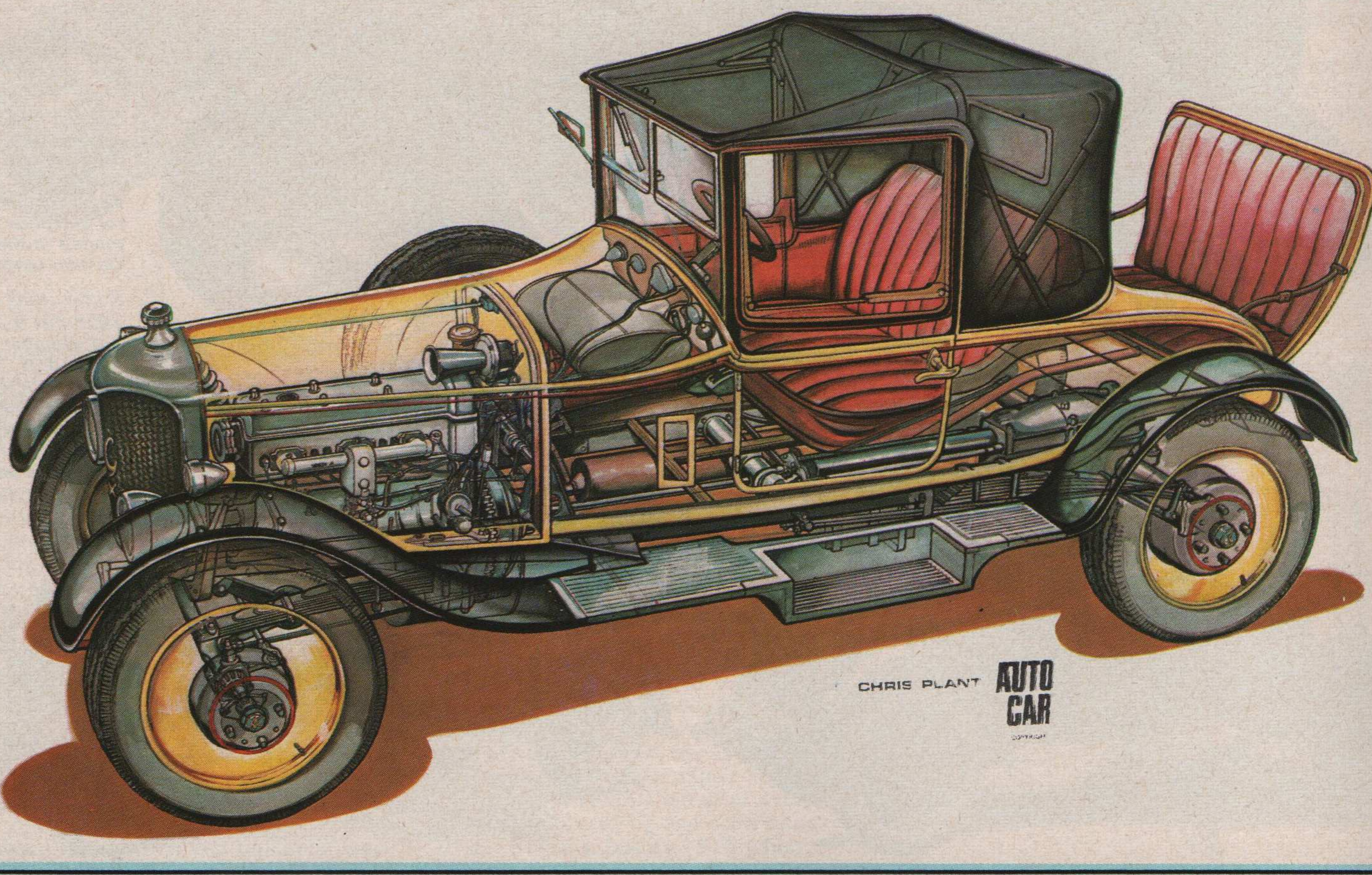




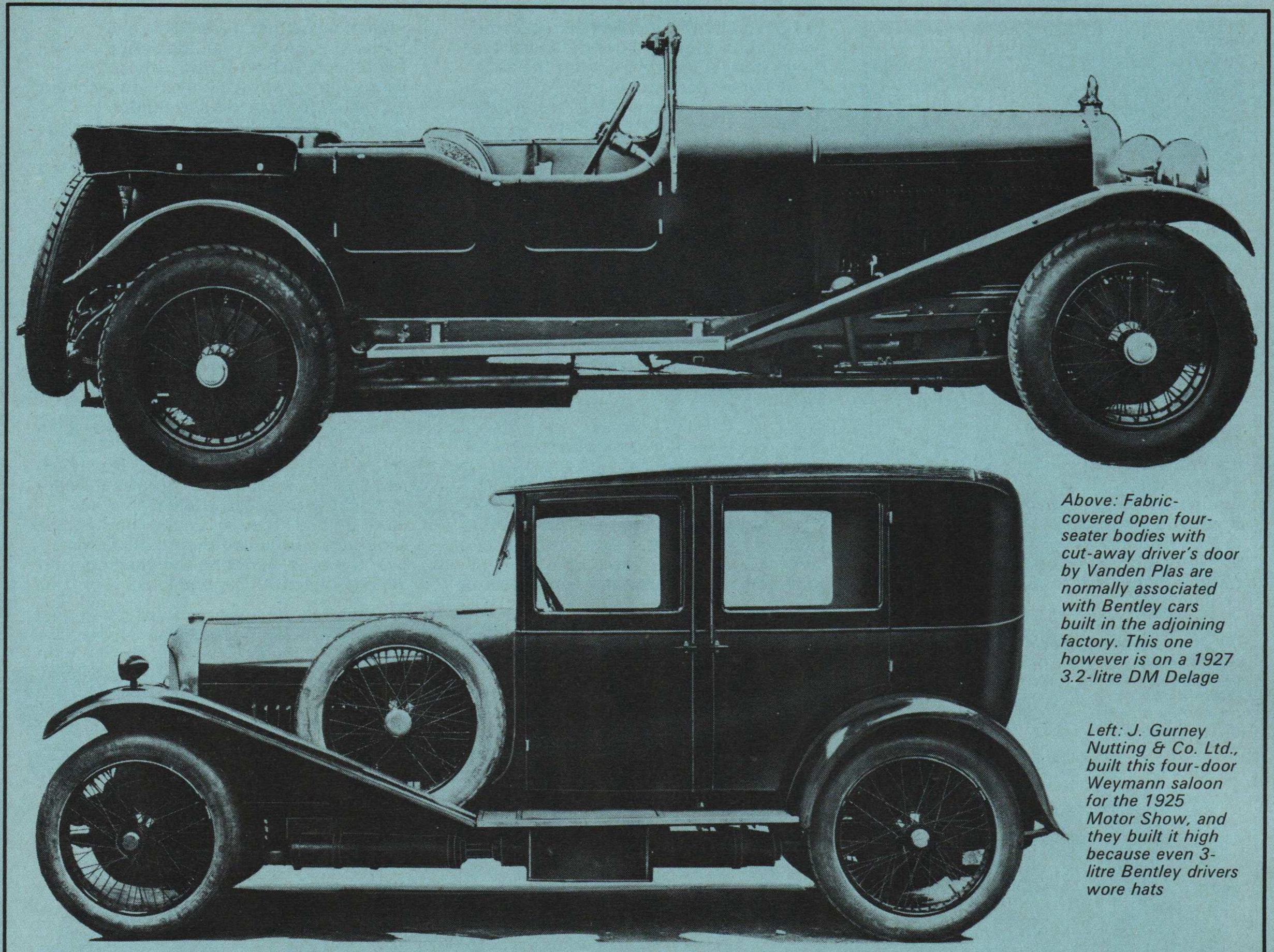
Below: Advantages claimed for genuine Weymann fabric bodies were lightness and silence. Freedom from rattles and drumming was secured by making sure that no two wood members touched

Below: Not all fabric bodies were made under Weymann patents. This little Clyno, costing only £160 at Olympia in 1927, was of normal wood and metal construction, but covered throughout in leathercloth, to save the time, trouble and expense of painting





CHRIS PLANT AUTO CAR



Above: Fabric-covered open four-seater bodies with cut-away driver's door by Vanden Plas are normally associated with Bentley cars built in the adjoining factory. This one however is on a 1927 3.2-litre DM Delage

Left: J. Gurney Nutting & Co. Ltd., built this four-door Weymann saloon for the 1925 Motor Show, and they built it high because even 3-litre Bentley drivers wore hats

two-seaters, too, occasionally adopted nautical trimmings, with round port-hole windows and upperworks like the conning-tower of a submarine. Swivelling spot-lights, very popular with *grands routiers* both before and after the Great War, gave them an urgent, businesslike look. Non-nautical two-seaters might have vertical knife-edge tail (Bugatti, Amilcar) or a disappearing dickey seat, enshrined in a boot whose sides filled out and grew higher with the years, losing the pinched look left over from Edwardian models.

The early 1920s were a time of "streamlining". Chenard et Walcker and Bugatti built "tank" bodies for the 1923 Grand Prix, and Voisin applied aircraft techniques with great effect. Lorraine-Dietrich and Bentley by contrast seem hardly more aerodynamic than Stephenson's *Rocket.* Voisin, the ex-aeroplane man, saved weight where he could, and concentrated it amidships to make his cars handle, and Weymann, also ex-aeroplane, used the lightest timber frames, in which no two wooden members joined, everything being done by thin metal plates or wire tensioners. Weymann bodies were covered not with metal or wood but with grained "leathercloth" fabric. They were light, quick to build, rattle-free; also they needed no painting, a great time-saver in paint-and-varnish days. The fabric phase lasted from 1923 until 1932 or so; it was killed by cheap imitations and the invention of cellulose spray painting which arrived from America in 1924. Car dealers did not like fabric bodies because they could not easily be given a quick "showroom shine".

Fabric bodies were one aesthetic revolution during the early Vintage years. Another was "balloon" low-pressure tyres, introduced widely for 1924 in the name of comfort and in the teeth of front-wheel "shimmy". Cars designed for narrow beaded-edge or straight-sided tyres looked terrible on Balloons, just as in the 1950s popular English cars looked suddenly bloated when placed on fashionably smaller rims. This however is to anticipate. When wheels were large and chassis high designers were tempted to make shallow bodies—especially open bodies—which the occupants sat out of rather than in. American tourers, especially, were dwarfed by their passengers from 1905 or so until the middle 1920s. Bad roads encouraged the use of big wheels, and Americans very much enjoyed the open-air life—never more so than when driving their classic sports cars, the Stutz Bearcat and Mercer Raceabout, the bodywork of which comprised a petrol tank, pair of bucket seats and that splendid folly, a monocle windshield clamped to the steering column.

Never has forward visibility been better, and never was it worse than during the late 1920s. Throughout the Vintage decade roof lines came ever lower. No Harvest Festival millinery, fewer top-hats for men. Wheels shrank as roads and tyres improved, and dropped chassis came in. All this meant lower build, but the laws of architectural proportion insisted that cars, like buildings, should be shallower above the waistline than below it. So, as roofs came down, waistlines rose "for the sake of the silhouette". Windows and screens dwindled to a mere slot. "No matter" cried the experts, "if a chap doesn't know how wide his cars is, he shouldn't be driving at all." So waists remained high, running-boards disappeared because there was nowhere to put them, doors extended downwards past the shut line and hid the chassis, or as far as a would-be-decorative louvred valance. Some hideous bodies resulted, and some that were tremendously smart. More important was the lesson they taught: that, once running-boards had gone, bodies could grow wider, encroaching on the wheel-arches and forshadowing the full-width, enveloping bodies of later times. It did not do the occupants much good, for no-one can sit comfortably on an unupholsterable hump. Two very influential fashions which have survived from the 1920s and 1930s are: the

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independently adjustable sliding seat, which replaced the Edwardian fixed seats and permanent cross rail; and propeller-shaft tunnels, which made life easier for designers but harder for passengers in the 1930s when wheels had grown smaller, bringing motorcars nearer the ground, but hypoid bevel gears had not yet come in to lower the propeller-shaft line.

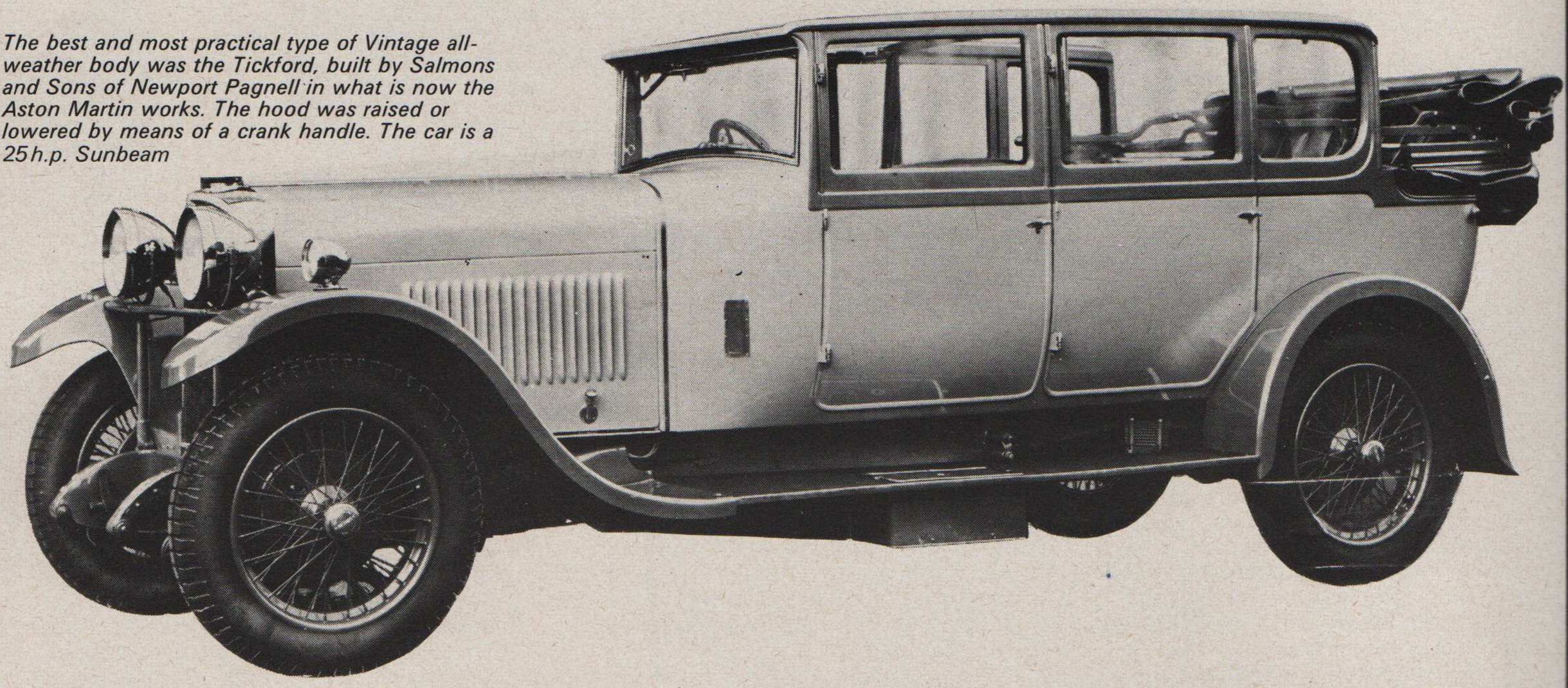
Closed bodywork comes, and indeed always has come, in "two-box" or "three-box" style, if we except some of the Primitives, which were "one-box". The two elements in a two-box are Bonnet and Body; a three-box has Bonnet, Body and Boot. The latter style is to be found at all periods since 1905; in fact if for Bonnet one substitutes Fore Boot, it dates back to the Mail Coach and beyond. When closed cars became practical for touring, after the Great War, it was natural to fit a trunk on the back. Trunks grew decorative, with lots of buckles and hardware. Then, during the middle and late 1920s Vuitton, Asprey and other makers of luxury luggage supplied shaped and fitted suitcases to simplify packing, which completely filled these now sham trunks. The next step, of course, was to house the trunk into the body framing and eventually to panel it to match the rest of the body. This was regretted by those, Ettore Bugatti's and Marc Birkigt's clients amongst others, who rather fancied a separate trunk covered in skewbald pony-skin or even ocelot.

The Age of the Haute Carrosserie was the Age of Biarritz, Deauville and La Baule. From 1920 until the Depression, cars, especially large open cars, were an essential fashion accessory. Art Déco designers undertook the interior, with black lacquer, metal stringing, coloured rep upholstery and even the new Rayon yarns before the latter sank to the level of "art silk". Outside, motorcars were sometimes painted in tartan patterns—of French clans that never knew the Hielans, of course—an idea originating I think, with Gabriel Voisin, whose body-shops turned out work every bit as smart as leading *carrossiers* like Binder, Belvallette, Labourdette, Kellner, Letourneur et Marchand, Chapron, Saoutchik and Million-Guiet.

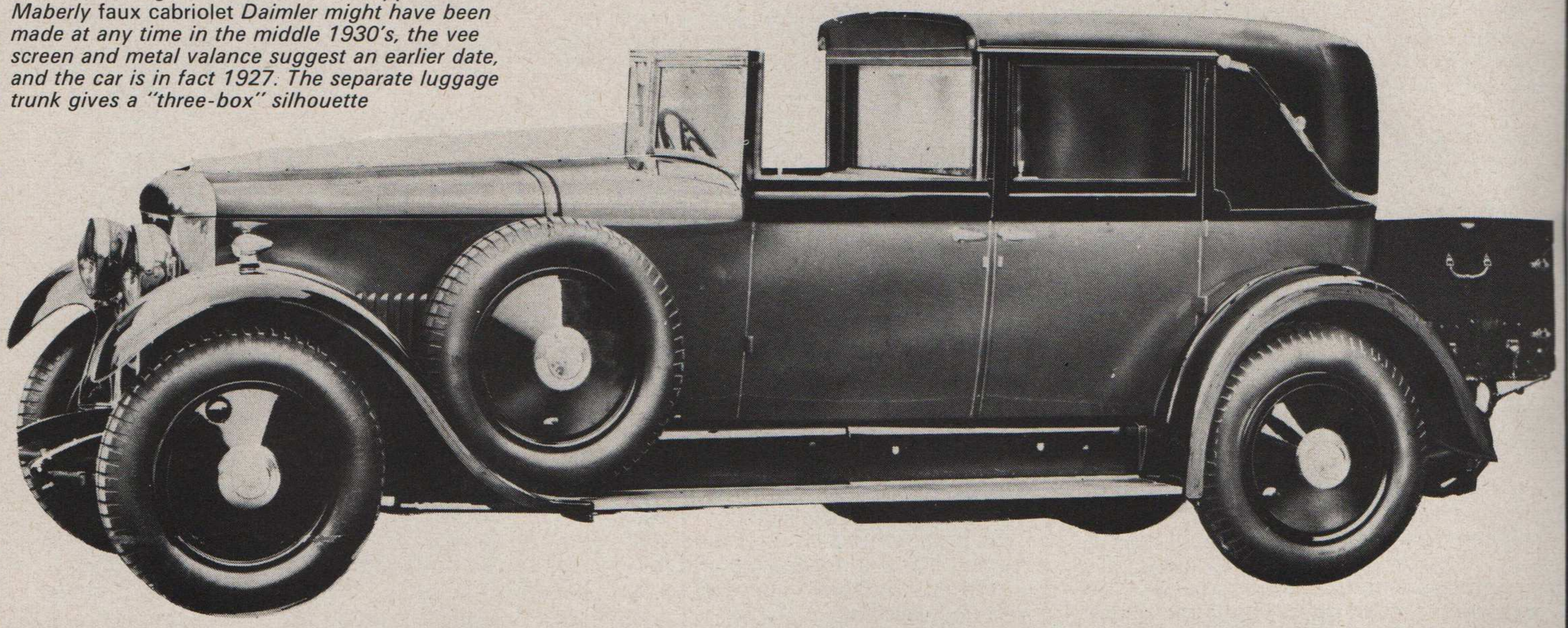
Alongside the products of these artists, and of their English opposite numbers (of whom Barker was the smartest and most inspired) stood squalid squads of cheap Saloons based upon American models, aping the all-steel Budd or Fisher body without the excuse of true mass production.

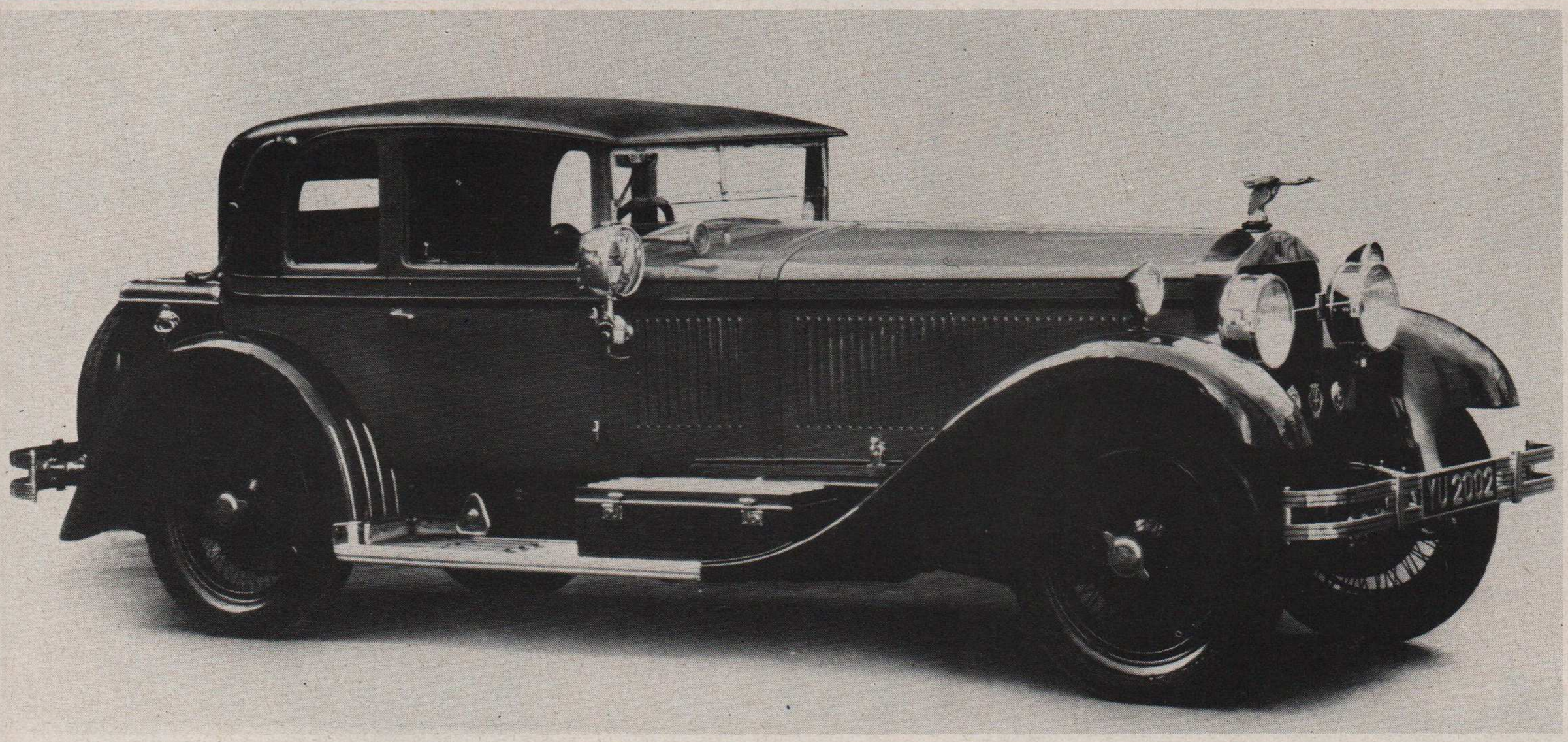
The story of US bodywork is one of growing rotundity. Cars of the early 1920s had been simple, flat-roofed and square. Sedans had two doors and six lights (side windows), a Coach had four lights and two doors. Nearly all had hickory-spoked artillery wheels with detachable rims. Gradually cars grew more domed. They shrugged their shoulders and pulled their roofs down over the eyes, adopting the characteristic armour-plated Al Capone look.

The best and most practical type of Vintage all-weather body was the Tickford, built by Salmons and Sons of Newport Pagnell in what is now the Aston Martin works. The hood was raised or lowered by means of a crank handle. The car is a 25 h.p. Sunbeam



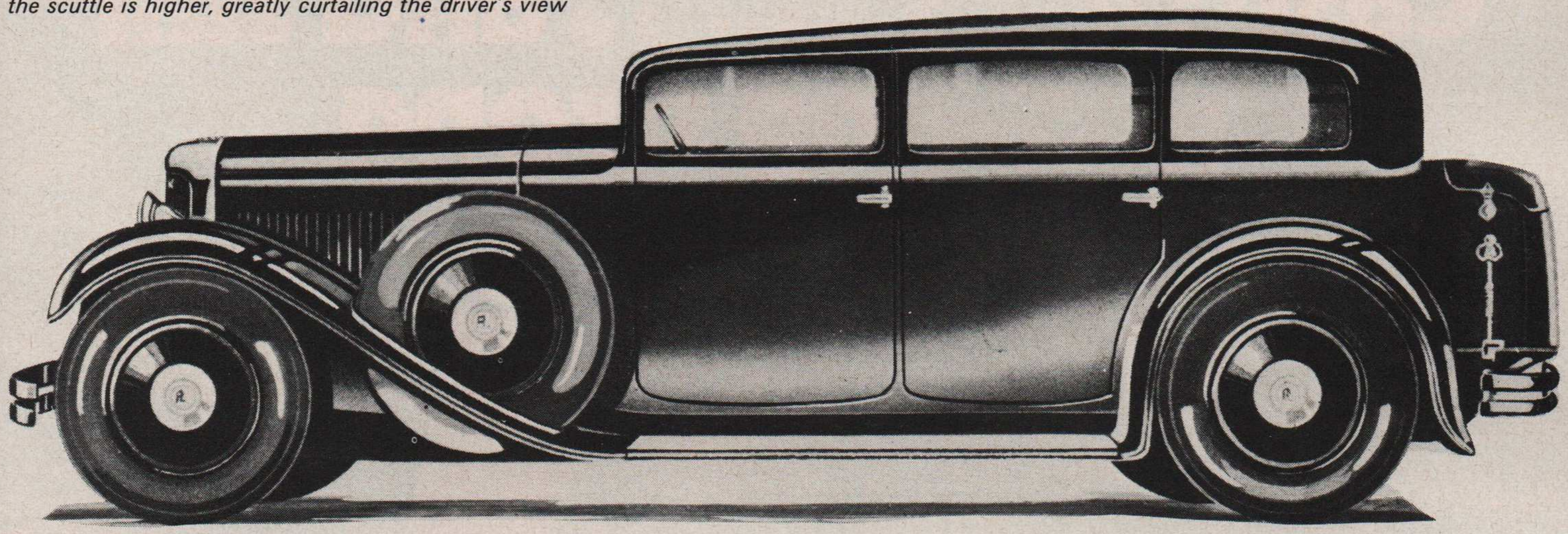
Below: Although the rest of this Thrupp and Maberly faux cabriolet *Daimler might have been made at any time in the middle 1930's, the vee screen and metal valance suggest an earlier date, and the car is in fact 1927. The separate luggage trunk gives a "three-box" silhouette*

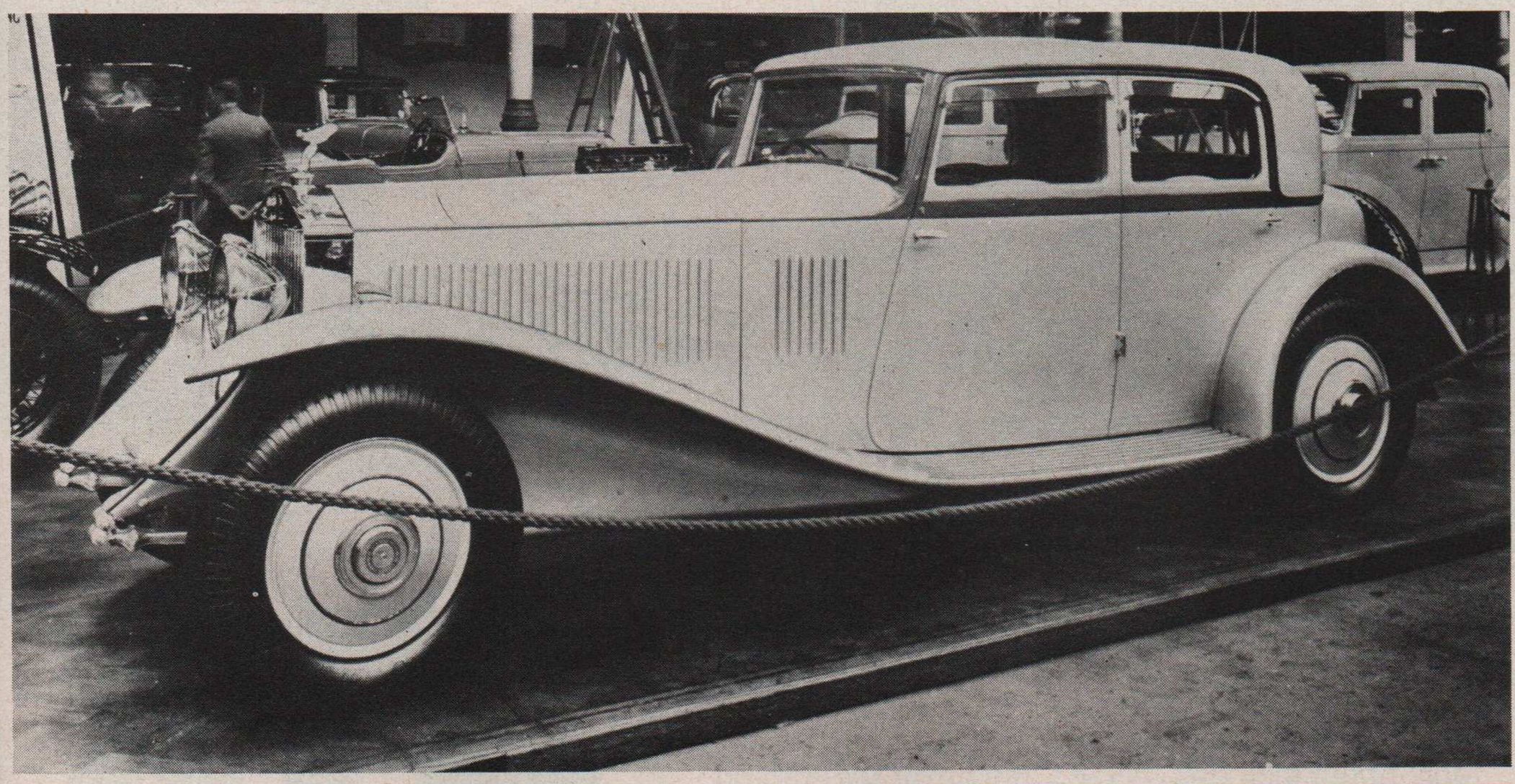




Above: In this Isotta-Fraschini the straight-eight engine has firm control over the styling. Everything is subservient to the long bonnet. It is interesting that although the elbow follows the bonnet hinge line, the scuttle is higher, greatly curtailing the driver's view

Below: The high scuttle and low roof fashionable in the years 1928–33 resulted in the worst outlook drivers have ever suffered. Windscreens shrank to a mere letter-box slot





Rolls-Royce cars tend to be rather high in the sill, the line being dictated by the manufacturers' radiator and bulkhead. In this Phantom II of 1931 the promise of the elegant flared Barker wings and crisp louvres is not maintained by the round body contours. Doors descend all the way to the running-board and are all hinged on the centre pillar. During the 1930's bodies grew gradually fatter, overlapping wheel arches and running-boards

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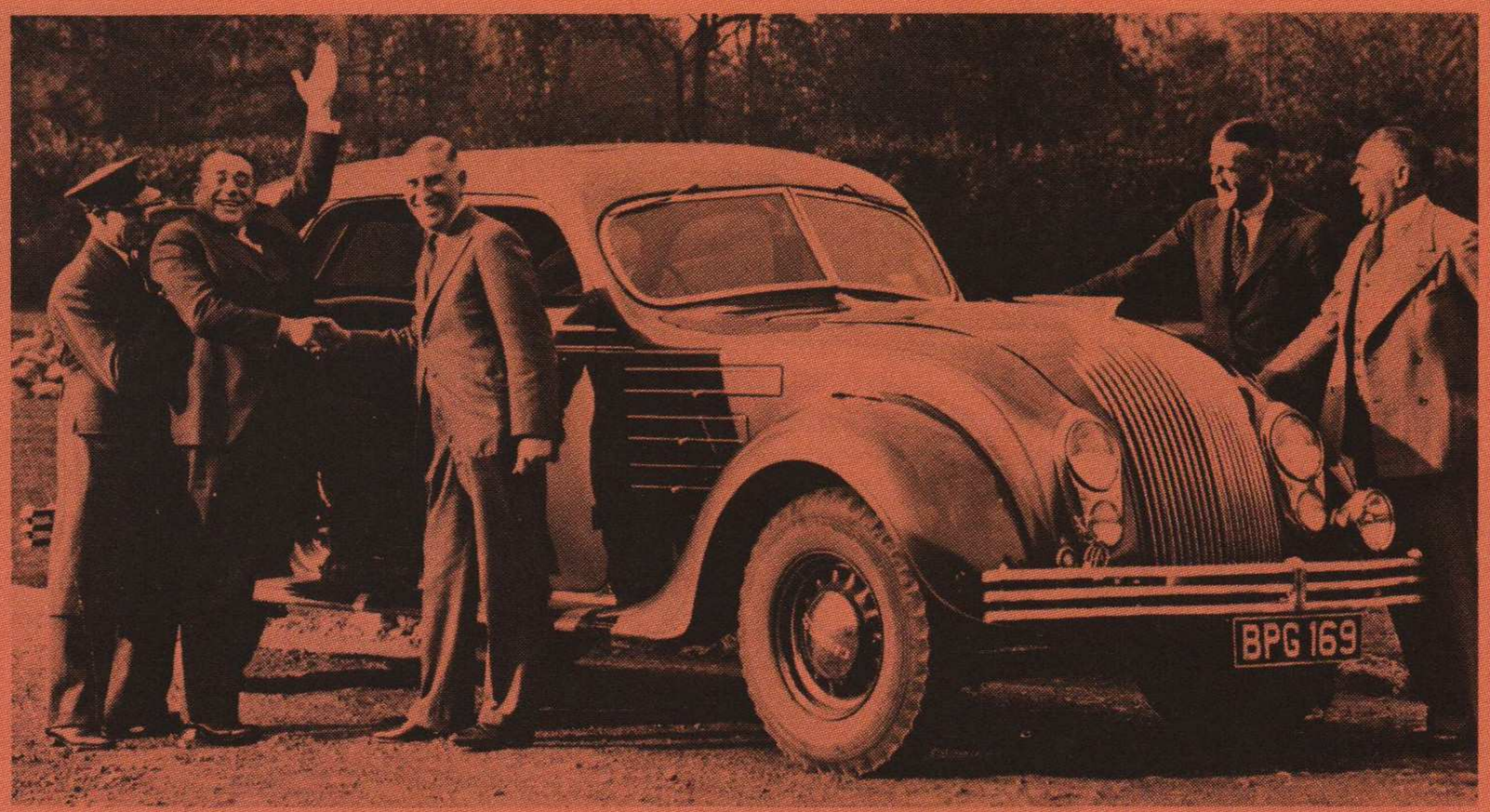
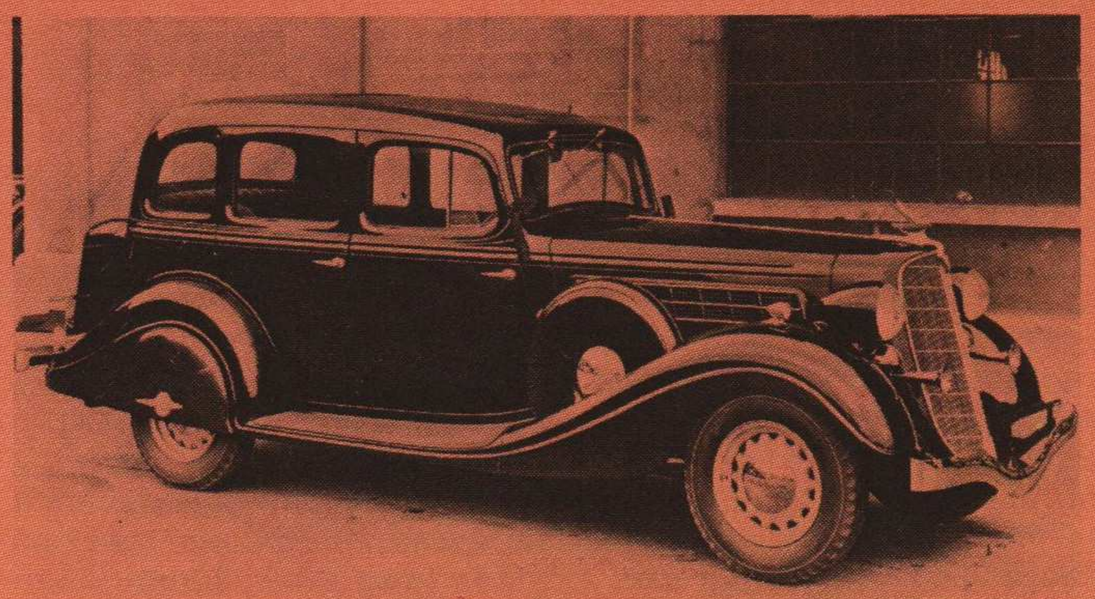
American tourers, horizontally waisted, with higher sides now and drum headlamps, were neater than most made in Europe, and their Sport Roadster bodies of the period 1926–30 on such chassis as La Salle, were as smart and exciting as anything made anywhere. Of Saloons (or Sedans) the fashion leader was Auburn, with bodies based upon the ellipse. Chromium plate replaced nickel from 1927 onwards; and because the process initially was expensive, dangerous and little understood, brightwork was drastically curtailed, lamps being painted and radiator shells reduced to a narrow ribbon. Unfortunately plating techniques were to improve. . . .

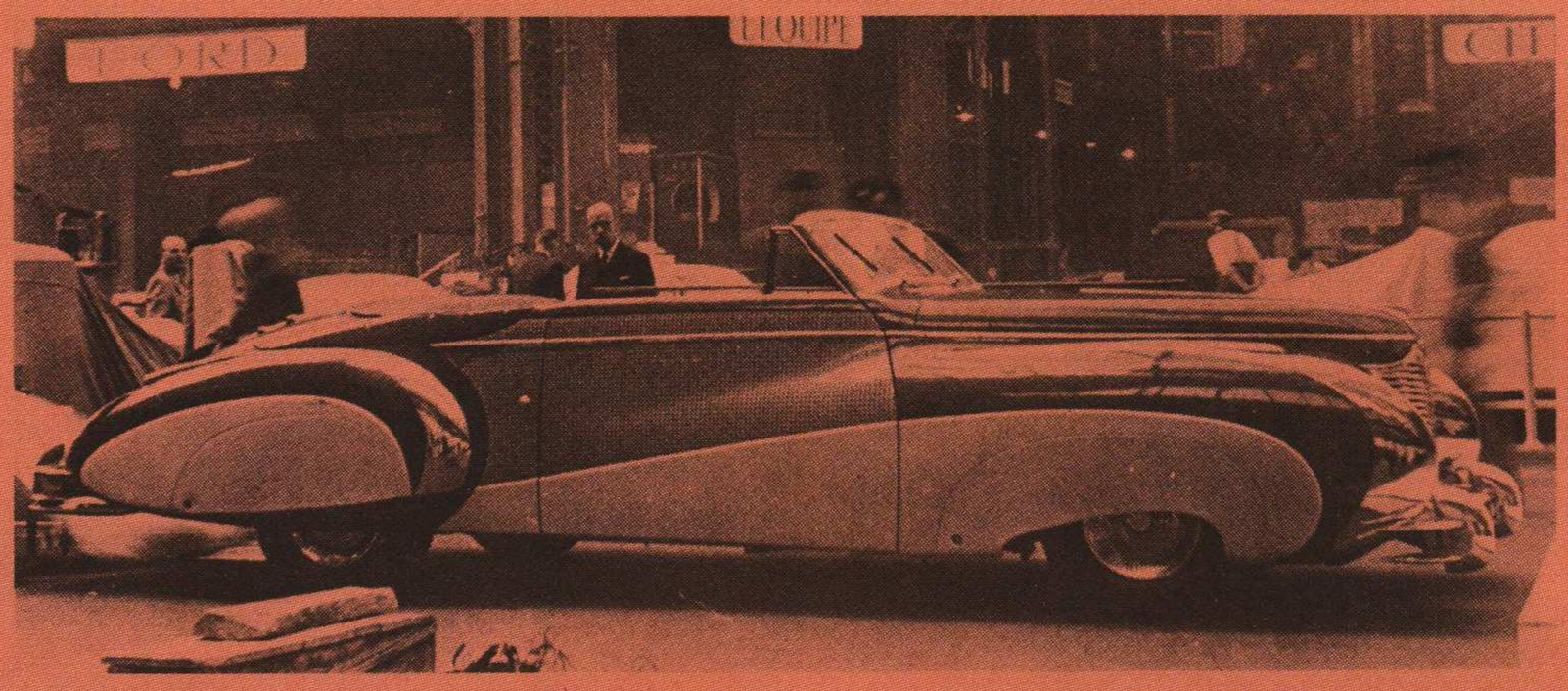
One feature of motoring 40 years ago was the almost universal listing of "sunshine" roofs. They cost as little as £5 on an ordinary English saloon and continued in production until manufacturers, resenting the complication to their production lines during a sellers' market, put out a propaganda campaign knocking them and withdrew the option. A great pity. Other forms of fresh-air motoring apart from roadster and touring car were the All-weather body (which was in effect a touring-car with winding glass windows) and sundry dual-purpose bodies, of which the most practical was the Tickford, made by Salmons in what is now the Aston Martin works at Newport Pagnell. Pillars and cantrails were fixed, saloon fashion, and the roof was raised or lowered by turning a handle.





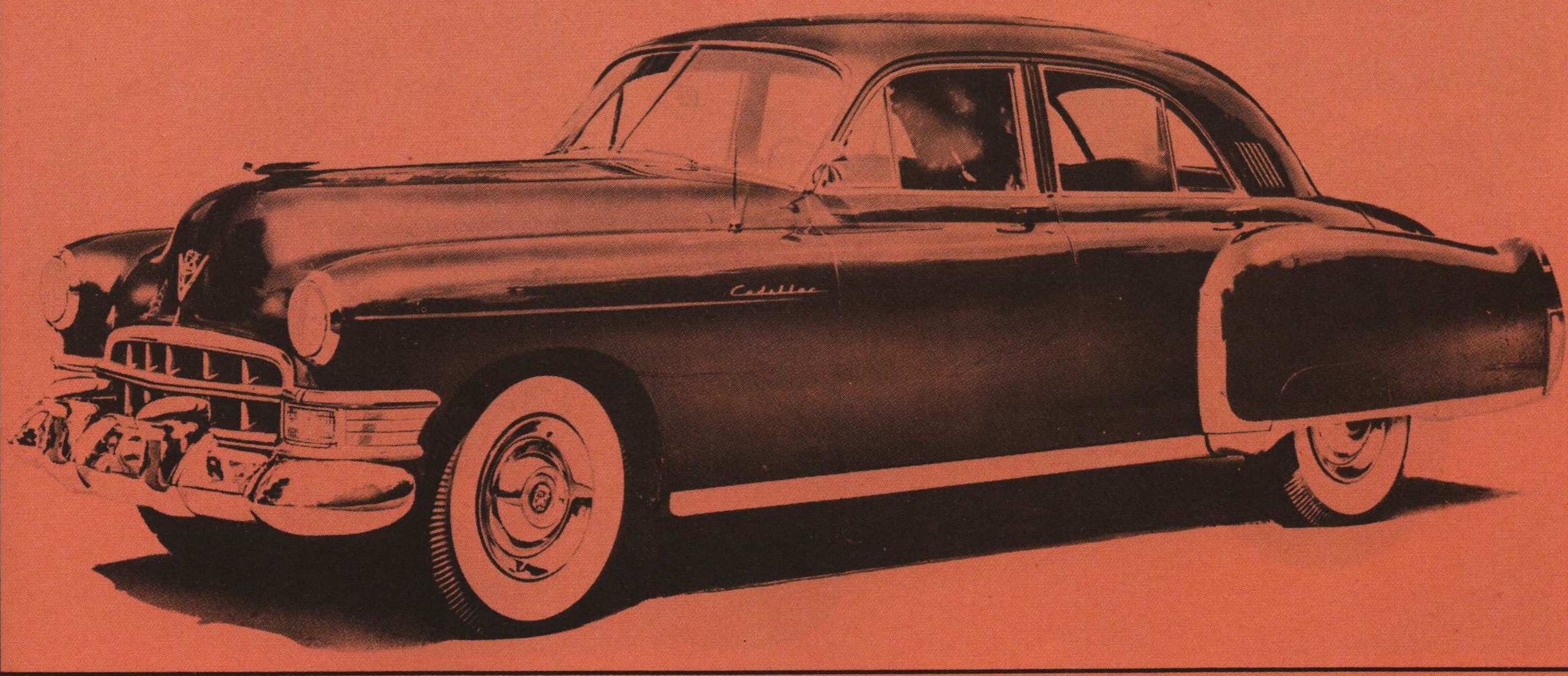
Above: There was perhaps more publicity than aerodynamics about the Airflow Chrysler of 1934; but many of its features became current American practice: wide bodywork, low "forehead", vee screen, blended bonnet and wings, recessed lamps

Hudson Terraplane, 1935. A splendid example of a "face lift". Remove the spats and wing-valances and replace the grille by a Vintage radiator and you are back in pre-Depression days



Right: Exhibiting this Cadillac convertible at the Paris Salon in 1949, Saoutchik make a play for the Vulgarest Car of All Time

Below: Strongly influenced by Pininfarina and Ghia, early post-war American cars had good clean contours, although ruined by too much brightwork and applied ornament. This is a 1949 Cadillac



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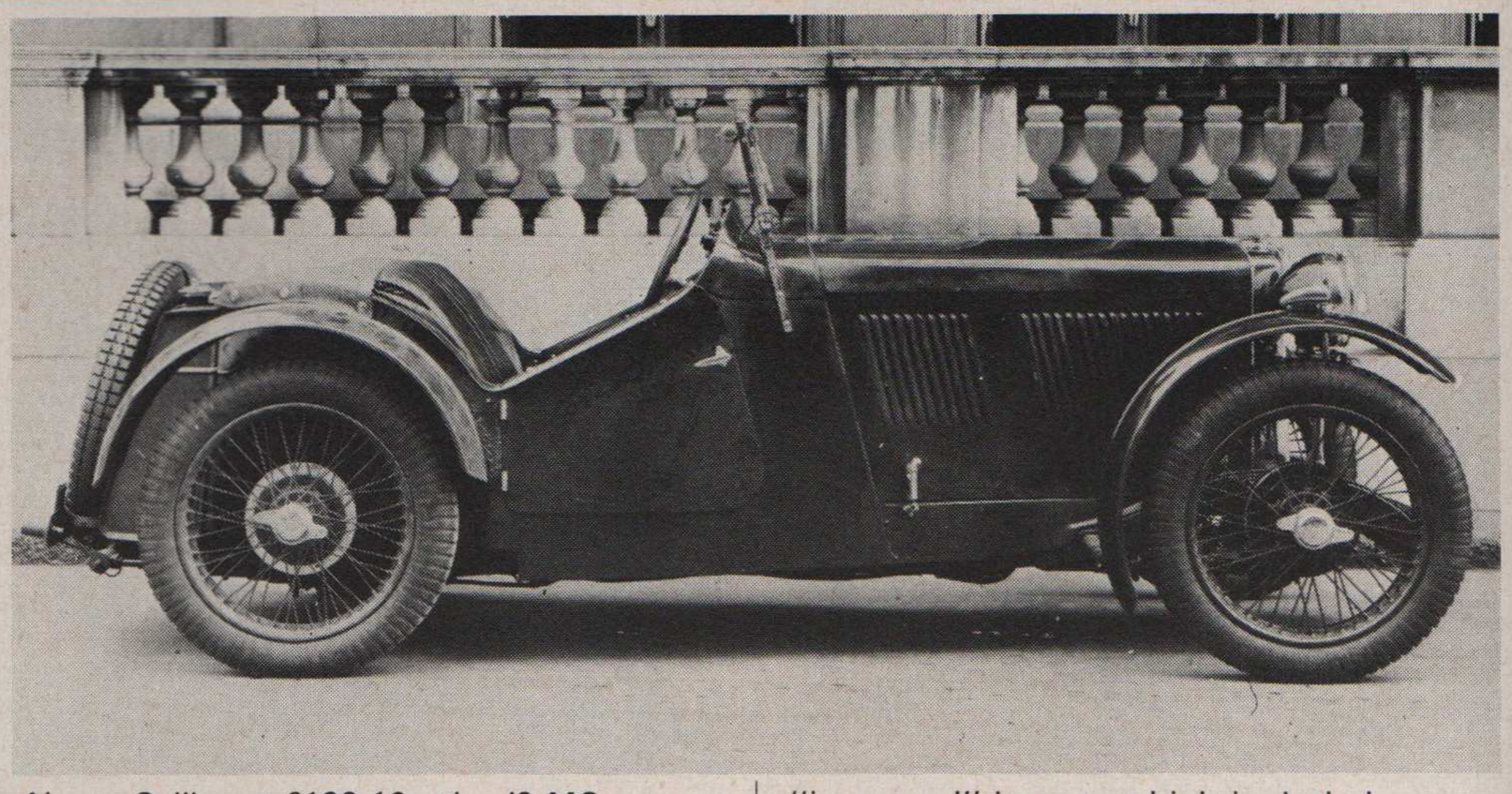


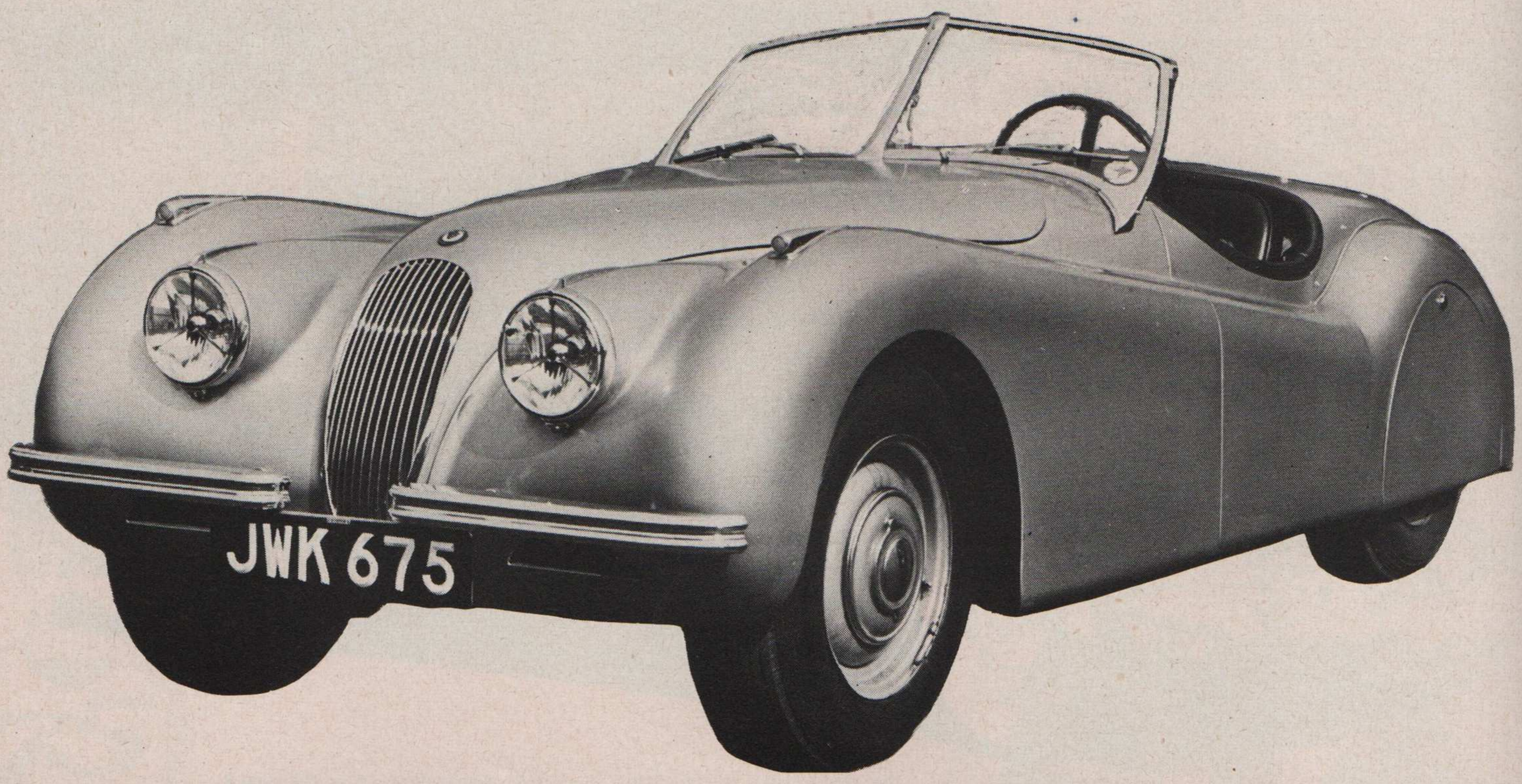
Above: Selling at £199 10s, the J2 MG Midget set a fashion in small sporting cars. Instead of a pointed or knife-edge tail à la *Bugatti, Cecil Kimber gave it a slab tank with the spare on the back, echoing the Tourist Trophy cars of 1921. This rearward concentration of weight was helpful in Reliability Trials. Other 1933 fashion notes are the cycle-type wings and flared instrument-panel "bosoms"*

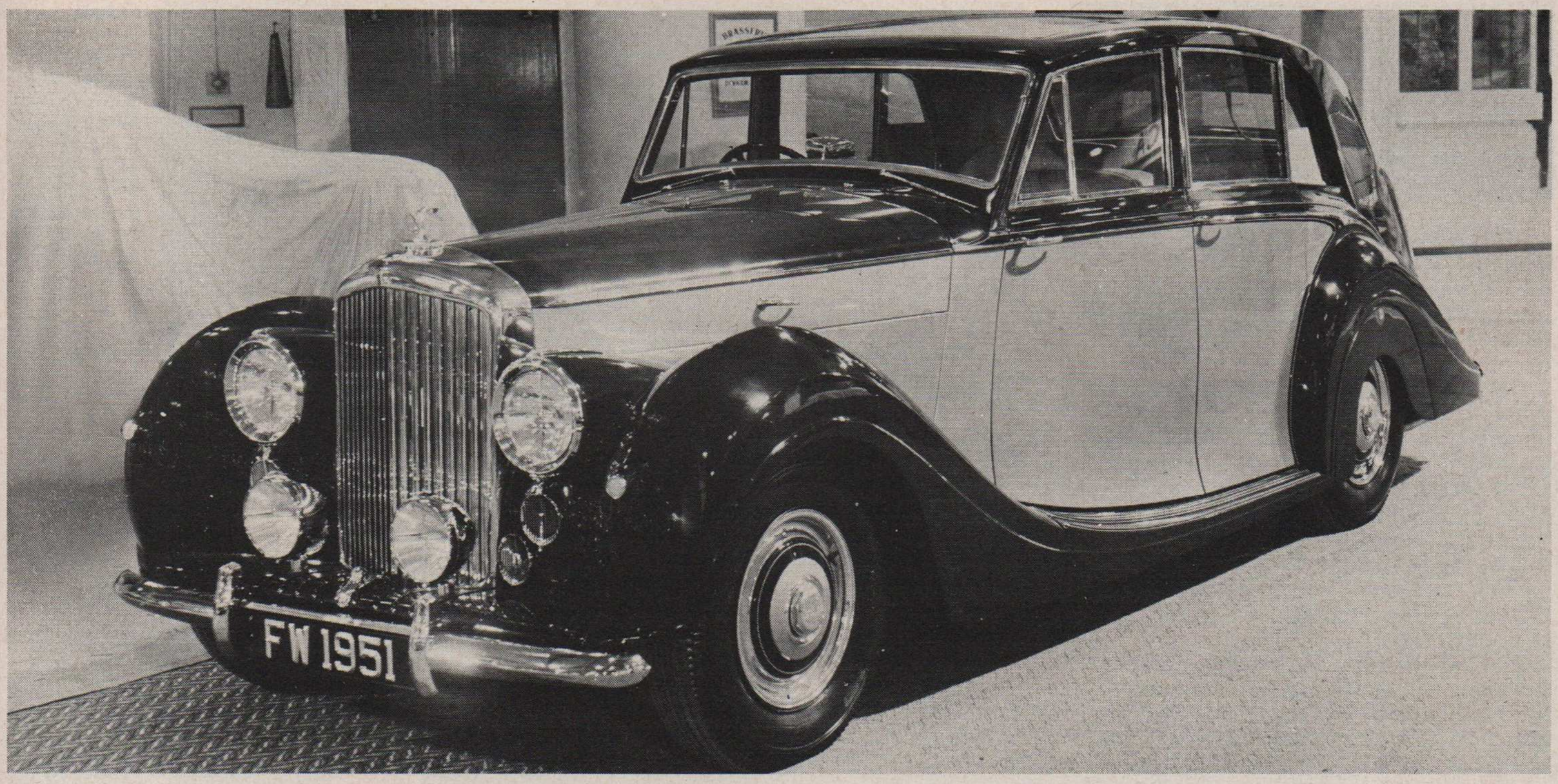
Sports cars meanwhile, grew closer to the ground and lost the *camion grand sport* image. Alfa Romeo, advancing with twin camshafts from where the side-valve OM left off, launched some of the most beautiful cars and engines ever seen. British small manufacturers like Lea Francis and Aston Martin did well with scant resources, and Cecil Kimber's Morris Garages at Oxford souped-up Morrises with great effect. The first MG (M type) Midget had a fabric-covered plywood body and a knife-edge tail; but its successor, the J2, harked back to 1922 TT Sunbeams, since the tail was simply a slab fuel tank with spare wheel on the back. The style was copied by Singer, HRG and others. J2s did well in trials, thanks to their low first and second gears, and racing derivatives waged continual war with competition Austins based loosely on the Seven. Why is it that bad cars inspire such fanatical loyalty? Reliable and cheap to run the Baby certainly was; also tunable. But unimproved Seven steering, suspension and brakes were dreadful and the clutch a standing—or rather leaping—joke. Aesthetically, however, all the Sevens except the ponderous late Ruby and Big Seven, had a certain cheeky charm, like their successor the Mini.

The qualities which had made the best Edwardians handle so beautifully—lightness, low unsprung weight, thin tyre-sections, high gears and "quick" steering—gradually declined during the 1920s. Fatter tyres meant lower steering-ratios, front-wheel brakes added to the unsprung weight, and new motorists demanded "top-gear performance", so that cars lost their long stride. More room was demanded, so that bodies moved forward on the chassis, placing more weight on the front, which meant gearing the steering down further. Appearance suffered, since the place, aesthetically, for a radiator is over the front axle, and the rangy, rakish look conferred by slim tyres was lost by 1925. With hindsight one would claim 1910–1925 as the "Vintage" period, and date "post-Vintage" cars from then. But it is too late now.

The Depression drove many firms out of business. Survivors pressed on with the "improved" layout, which included replacing the old heraldic radiator by a mere shroud or grille. The trend toward small wheels and fat tyres continued. Bodies spread sideways as well as forwards, but the bonnet and front wings retained their identities. There was an epidemic of "waterfall" or "bird-cage" grilles—which may have said "streamlining" to the cash customers, but which signally failed to bamboozle the wind. At the end of the 1930s the vertical emphasis changed to a horizontal one. The Lincoln Zephyr, for example, expanded the horn-outlets to form part of the main grille, which assumed the shape of a handlebar moustache beneath a Roman nose. Bonnets began to exert territorial demands on the neighbouring wing-space, and wings, in all manufacturing countries swelled steadily throughout the 1930s growing from a cycle-type strip (MG J2) and close-fitting "helmet" wings turning with the wheels (original SS 1) to the heavy ovoid boxes common in 1939, some of which, particularly in Italy and America, showed signs of invading the doors. The next step, scheduled for 1940 or 1941 had war not broken out, was obviously the acceptance of this takeover-bid.

In the sleek XK 120 Jaguar of 1949 front and rear wings merge, engulfing an oddly thick door. The screen is a vee, since curved glass was not yet widely available. General lines of the car are similar to those of the 1940 Mille Miglia BMW



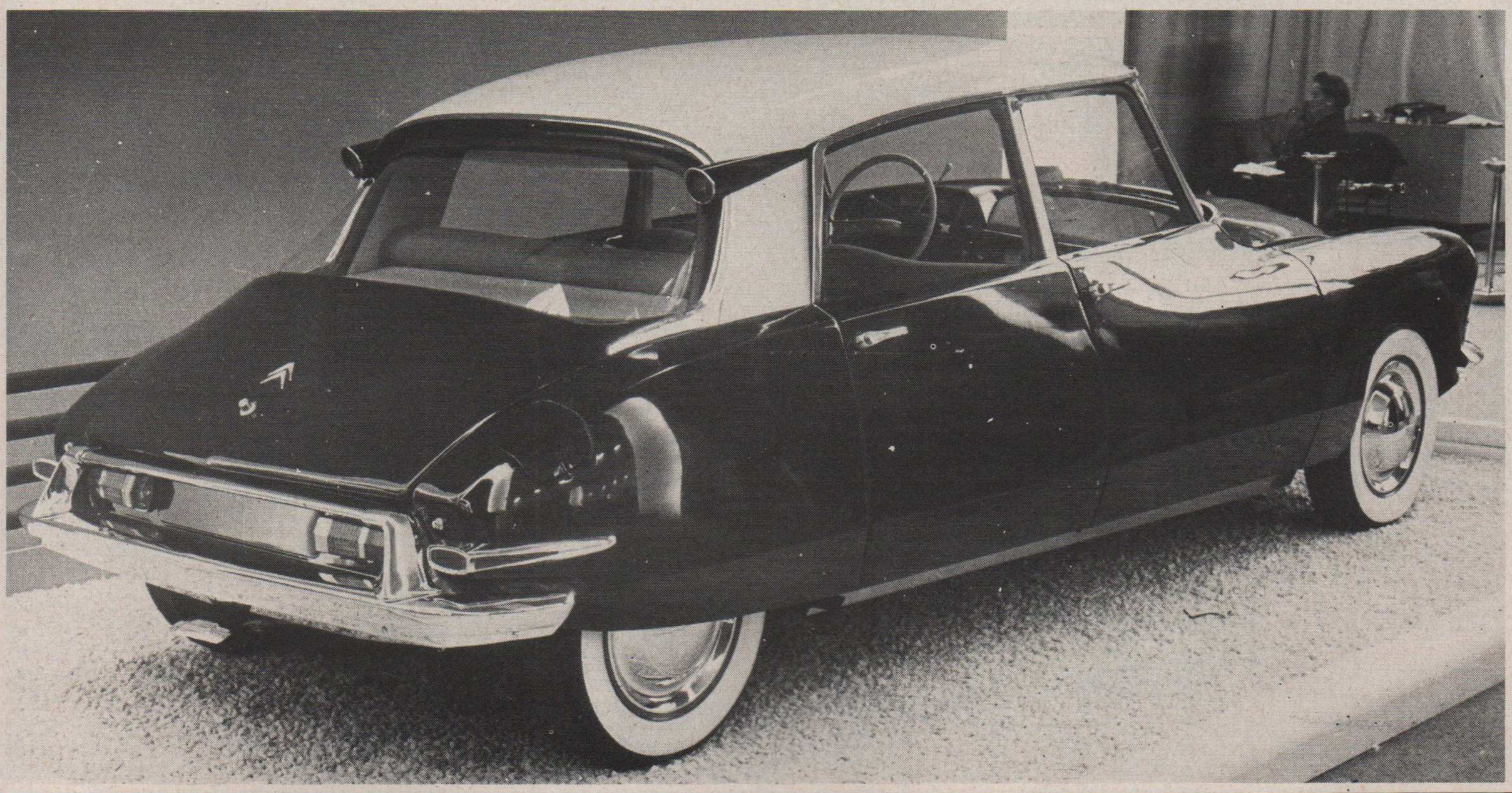


When it was designed almost 20 years ago the DS19 Citroen startled the stuffy by its sleek shape and the placing of its air-inlet. The car looks lower than it is because of the dihedral sides and the way in which turn-under and a change of colour "lose" much of the underworks

Early post-war Motor Shows brought out a number of re-hashes. Then, as new notions took hold, slab-sided designs appeared in which the body—but not the inhabited portion—ran the full width. Chassis-frames, where these survived the unitary principle, and box-section side-members made a broad sill. Horizontal grille designs based on the US "dollar grin" spread across the face of the world, and sports cars sought aerodynamics by turning through 90 degrees: no longer herrings, to use a fishy metaphor, but plaice, because fat tyres made so much wind-resistance that it paid to envelop the whole thing. Meanwhile the carriage trade had taken a nasty knock. Rolls-Royce policy-makers, reasoning correctly that post-war customers would not tolerate foot-wells as they had in Bentley cars heretofore, put a flat—indeed a convex—floor on top of the chassis, thus setting coachbuilders a difficult task. Some woeful designs resulted, made apparently from sealing-wax that had melted, running down from a central ridge to form thick spreading mudguards on either side of a narrow four-seater; a high chassis line dictated high sills, to the discomfort of all save tall men. Coach-builders learned to live with these chassis, and evolved some quite smart designs, especially by the use of razor-edge panelling.

Freestone and Webb strive unhappily to combine inflated curves with razor-edge panelling. The outward swelling doors give an effect of melting sealing-wax

Traditional skills in joinery, veneering, and upholstery were still practised in England, as they are to this day. So was the art of filling inequalities in the panelwork with lead. However it was no longer London, or even Paris, that governed the world of coachbuilding, but Turin and Milan. Here the artisan tradition lingered on. Designers with real flair, like Pinin Farina, Bertone, Savonuzzi (of Ghia), Vignale, Frua, Allemano and the rest, employed craftsmen who worked from a word or a



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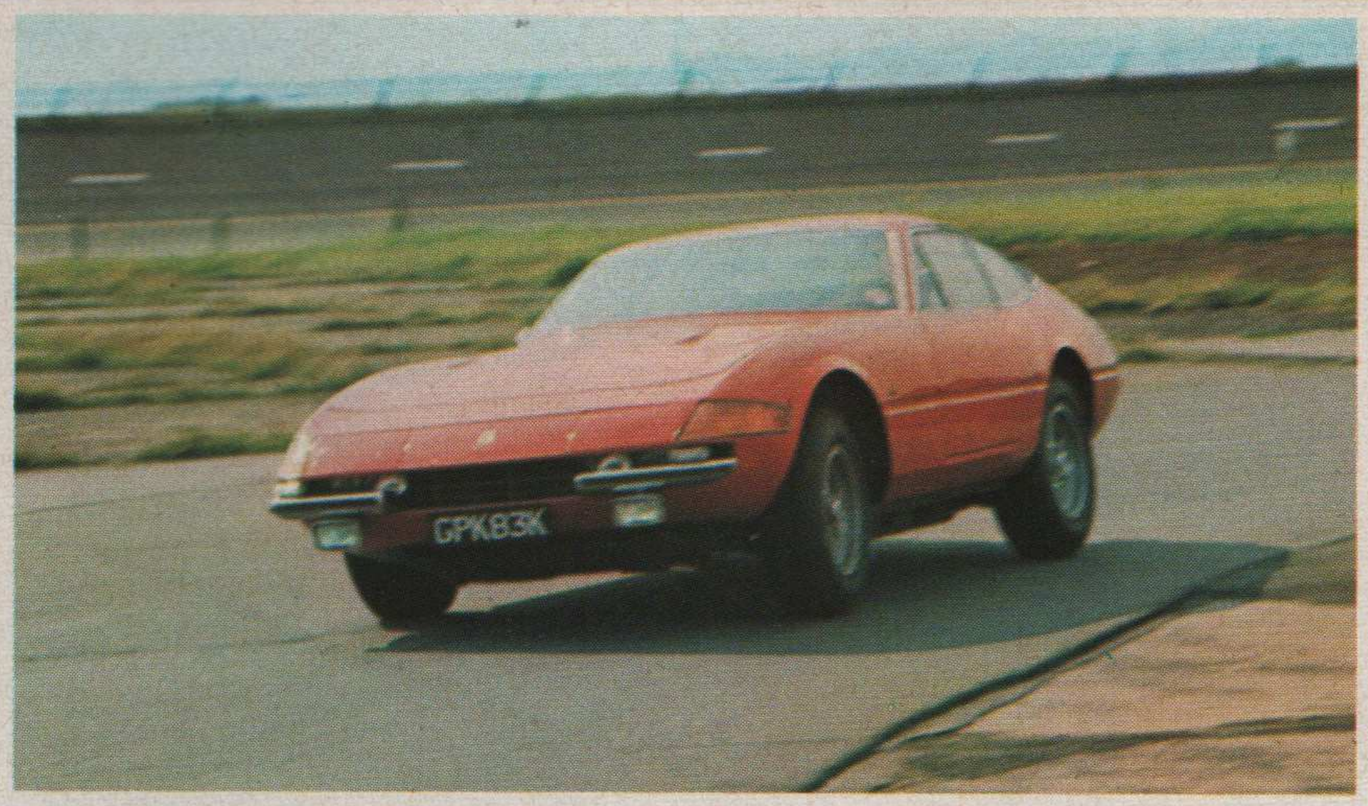
nod, creating or modifying shapes in a matter of minutes. Coachbuilders, meanwhile dissatisfied with the chassis offered them by manufacturers, or unable to build on chassis that did not exist, because all by now was welded-steel unitary construction, swiftly created whole cars, using manufacturers' engines, transmissions and running-gear. Coachbuilding during the 1940s and 1950s enjoyed an Indian summer in Turin, and at Milan in the workshops of Touring and Zagato, creating "this year's model" which smart customers queued up to buy. Manufacturers in the USA, France, Germany, England, Japan and, of course, Italy, hastened to engage Italian coachbuilding consultants, and the latter sometimes displayed a genius for international pastiche, producing exactly what every client required. For a brief while in the 1950s they even reformed the Americans' predilection for chrome; but the effort backfired, and Italian designs in turn became Americanate.

By this time, however, present tendencies were "on beam". Various expedients refined the slab sides.



Ferrari Daytona. Probably the last sporting high-performance design to have its engine in front driving the back wheels

Pressed mouldings, vestigial wing forms; and, because unitary construction saved weight, thinner steel was employed and engines gave greater power, glass areas were increased, with lightening effect on the silhouette. The DS Citroen, introduced in 1954—now almost 20 years old but still widely considered futuristic—showed what could be done by optical illusion. What the Italians call a dihedron—a junction of planes running the length of the bodywork—divided and lightened the side elevation; and at the same time a substantial amount of side area was "lost" by means of sharp turn-under and a change of colour. By these tricks Citroen made their low-built car appear much lower than it was. Their ideas, and their sharply raked screen and rear window have been widely copied both in the saloon-car world and by designers of sports and GT cars. Sloping tails are now out of fashion for high speed, and engines have retreated to the 'midships position current at the start of the century. Of this, no doubt, that great aerodynamicist and mid-engined car designer, Dr Fred Lanchester, would approve. Perhaps in some mechanical Valhalla he is discussing the truncated tails of high-speed hermetic wedge motorcars with that other great aerodynamicist, Professor Kamm.

Below: Back to the wedge depicted here by the Guigiaro designed Asso, based on an Audi, which was exhibited at last year's Frankfurt Motor Show. Inset: After almost three quarters of a century of experiment designers of sports and racing cars are currently agreed upon a wind-cutting wedge with its engine and transmission amidships as in the Lotus Europa. Thin-end honours, therefore, to M. Vallé and his 1899 "Slipper"

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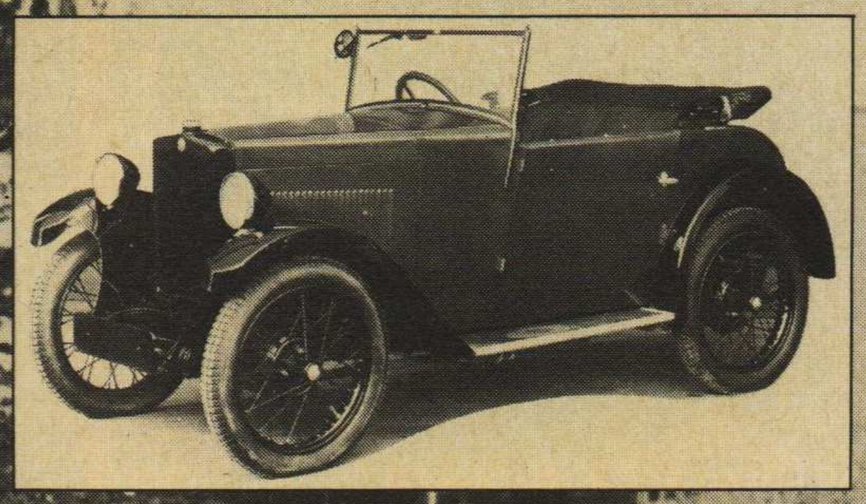

By 1939 the Morris Minor had become the Series E with rounded lines; gone was the boxy look of the 1930s Minor (inset)

Part 3

Present and Future Trends

By George Oliver

In terms of performance and quality of running the average car of 1939 was a good deal ahead of its counterpart of 10 years earlier. Its maximum, and comfortable cruising-speed capabilities, were some 10 mph higher; it was much more economical to operate overall; its bodywork was likely to be longer-lasting—and was certainly quieter after appreciable use, largely because of steady improvements in the methods of pressed-steel multiple production and in sound-damping techniques. Despite its greater complexity its first cost showed no significant change and its life expectation—in particular that of its engine—was a longer one; advances in the design of lubrication systems and a rise in the quality of oil itself, along with the introduction of superior bearing materials in the late 1930s, added appreciably to between-overhaul intervals.

The £125 Morris Minor saloon of 1929 was small, boxlike, bouncy and noisy; its 847 c.c. overhead-camshaft engine was lively and could take it close to 60 mph—but reliability was lacking and so, too, was effective engine life. The owner who exceeded 15,000 miles without having to rebore and pay attention to the main bearings was likely to boast about the fact.

By 1939 the Minor had grown up: now it was the Series E, costing around £130 and capable of a little more than 60 mph. But it was fuss-free at its maximum and cruised easily at 50 or more; engine life had risen to something like 25,000 miles and it had a useful synchromesh gearbox. The boxy look had gone: there was scarcely a straight line to be seen and its body was almost the full width of the car. The radiator and its false front were ahead of the front axle, flanked on either side by headlamps sunk into the wings. Forward mounting of the 918 c.c., side-valve engine increased body space and made possible the addition of a boot of reasonable capacity.

The Series E was ahead of its home contemporaries in appearance and superior to most in general refinement yet below its rather tank-like exterior all was normal, all "along the most approved lines", mechanically speaking.

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Ten years later there was a new Minor—at a price! In July of that year its basic cost was £299: with Purchase Tax added the home buyer lucky enough to lay hands on one at the time would have had to disgorge something like £380 (and by 1951 almost £200 more). But he got real value for his money; the MM Series Morris Minor was the most likeable, attractive and advanced small British car of its day—and, perhaps, the best looking of all small cars until the appearance of the Fiat 500 many years later.

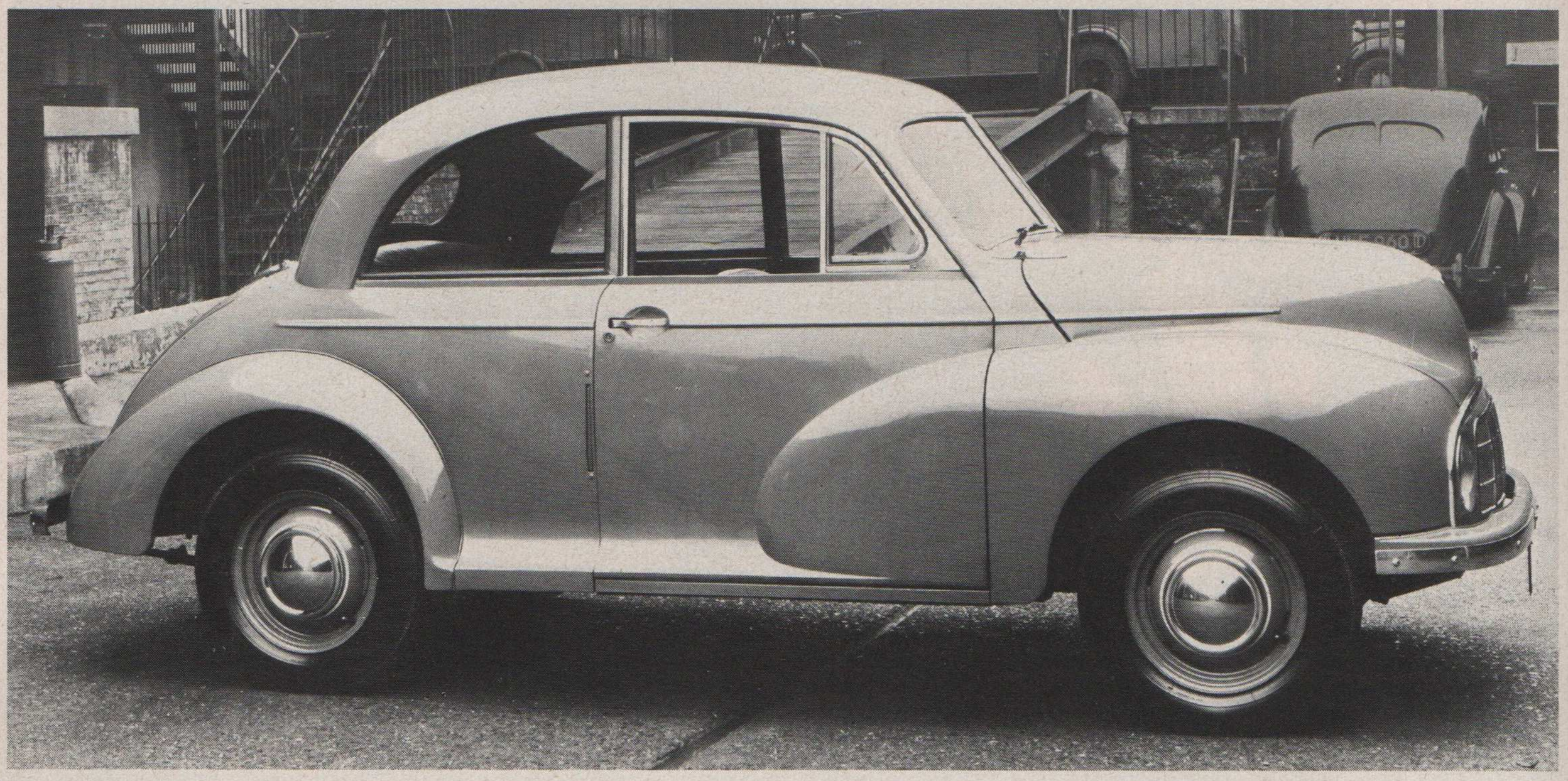
Through no fault of its designer—Alec Issigonis—the engine first used (the 918 c.c. side-valve unit from the Series E) was out of step with the rest of the car and it was not until the early 1950s, when a suitable combination of lively ohv engine and effective gearbox was fitted that its full potential was realized.

The Minor was intended primarily for the family motorist and satisfied with distinction his needs for adequate performance, operational economy, reliability, durability (during its long production run engine life was more than doubled, for example) and ample load-carrying capacity. But it was not simply a family hack; it had the kind of handling qualities previously associated only with the better sort of Continental car or specialist British product, its steering combining lightness with great precision of control and its suspension (torsion bars at the front, long half-elliptics at the rear) providing at one and the same time a high standard of comfort and very good roadholding.

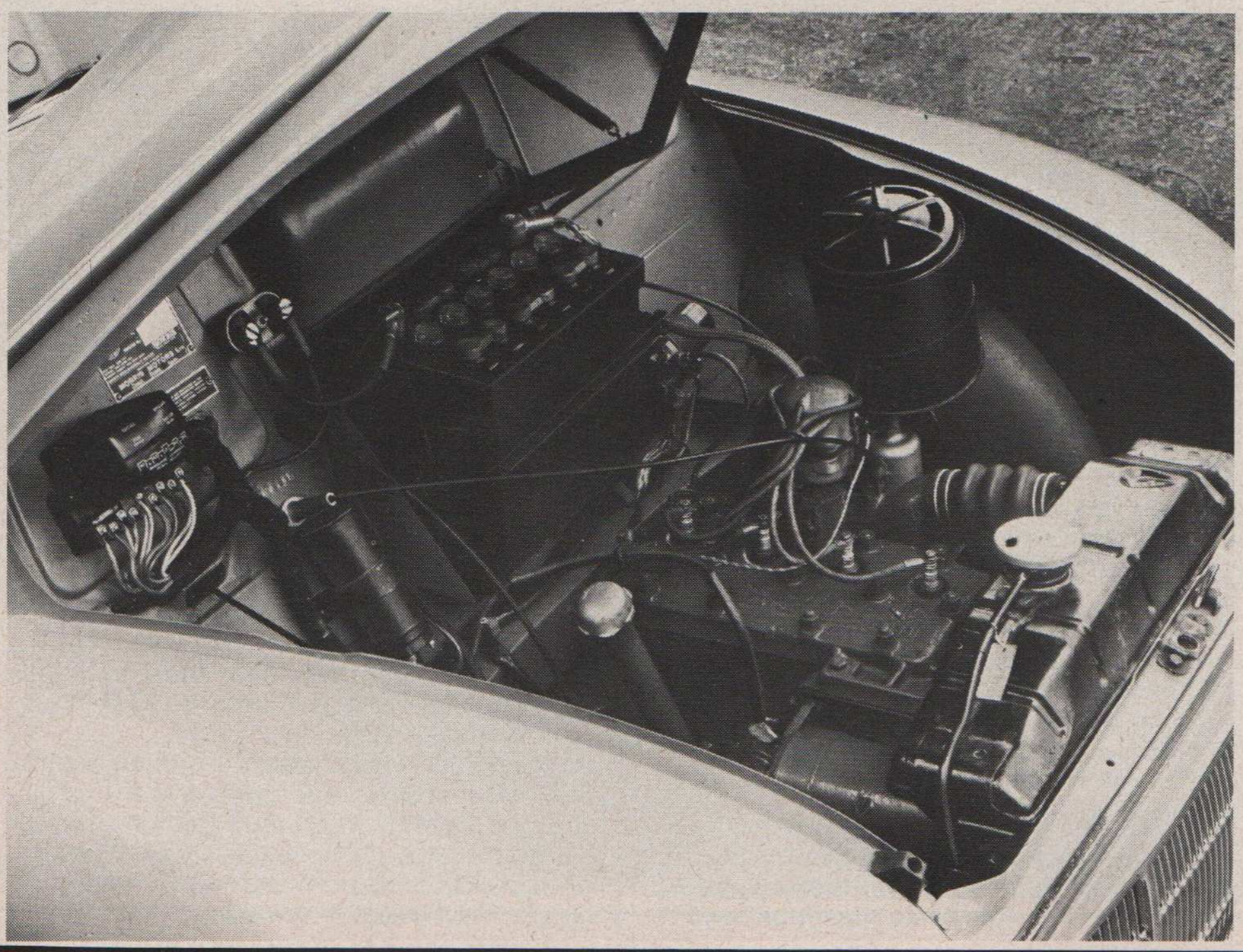
Such qualities had not been conspicuous, to say the least, in many pre-war British cars, small or large. Some early schemes of independent front-wheel suspension had not been satisfactory, theoretical advantages seldom coming up to expectation, practically speaking. The post-war Minor was the first wholly successful mass-produced small car with ifs to prove to the British motorist that a properly designed layout could provide significant gains in ride and road-worthiness.

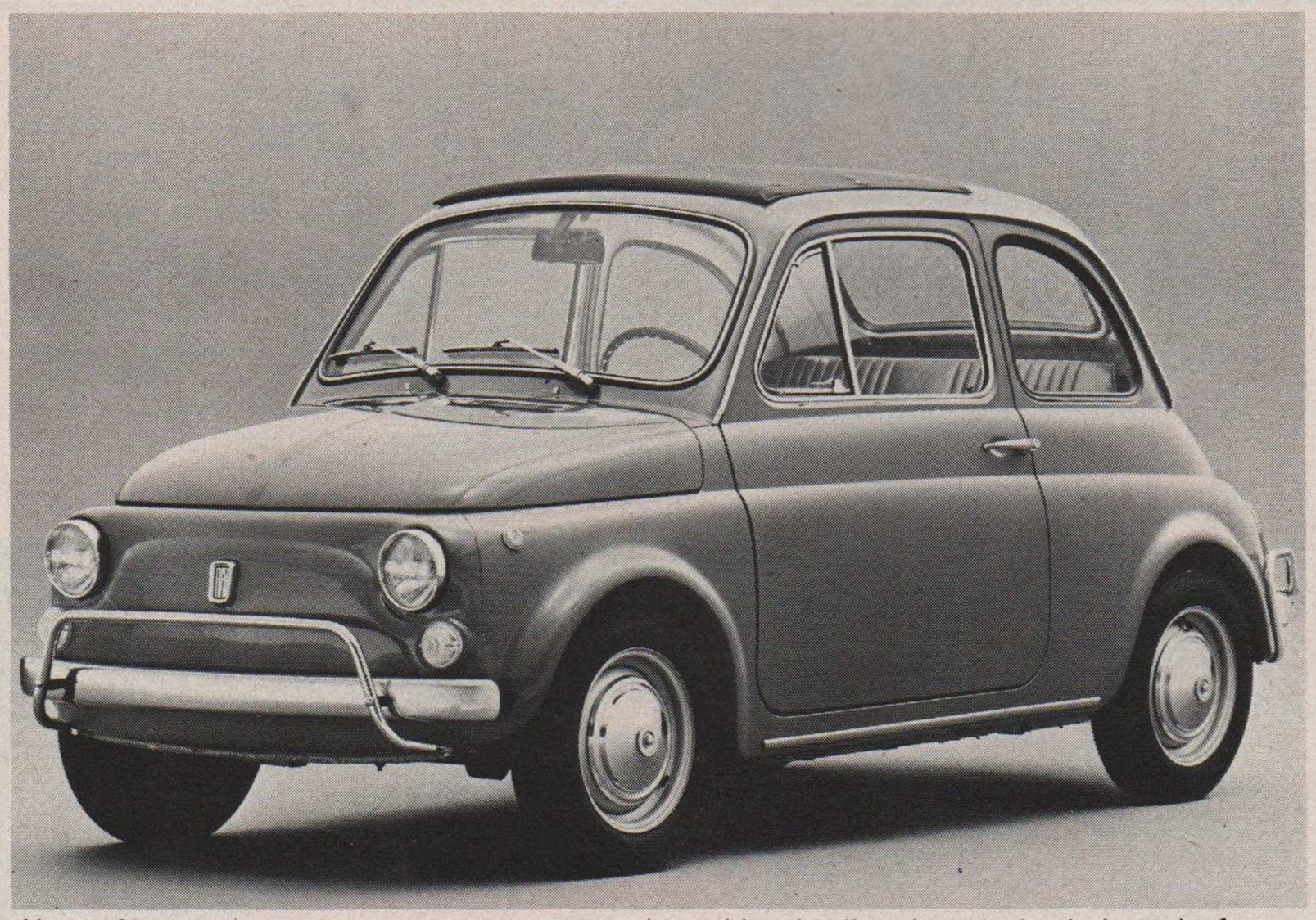
It was also the first small British car of unitary construction to be built in really large numbers—though not, of course, the first of this type to made here, or elsewhere. Vauxhall Motors, for example, had invested £1,000,000 in plant and tooling for the production of the new Ten that was introduced in 1937 and three years earlier another, far more technically intriguing example of integral construction, the first of the front-wheel-drive Citroens, began a production life that was to exceed 20 years and was to establish its makers and designers as pace-setters for the world motor industry.

Integral construction—as Dr Fred Lanchester was well aware even before this century began—is the most effective way of producing a really rigid structure of reasonable weight. Its inherent stiffness is essential if high standards of steering, suspension and roadworthiness are to be realized in normal production



Above: The post-War Morris Minor had a completely new body with rounded curves and headlamps recessed in the wings. This basic shape was to stay with the Minor until it finally went out of production in December 1970. Below: Original versions of the Minor in 1948 used a 918c.c. side valve engine which looked almost lost under the bonnet





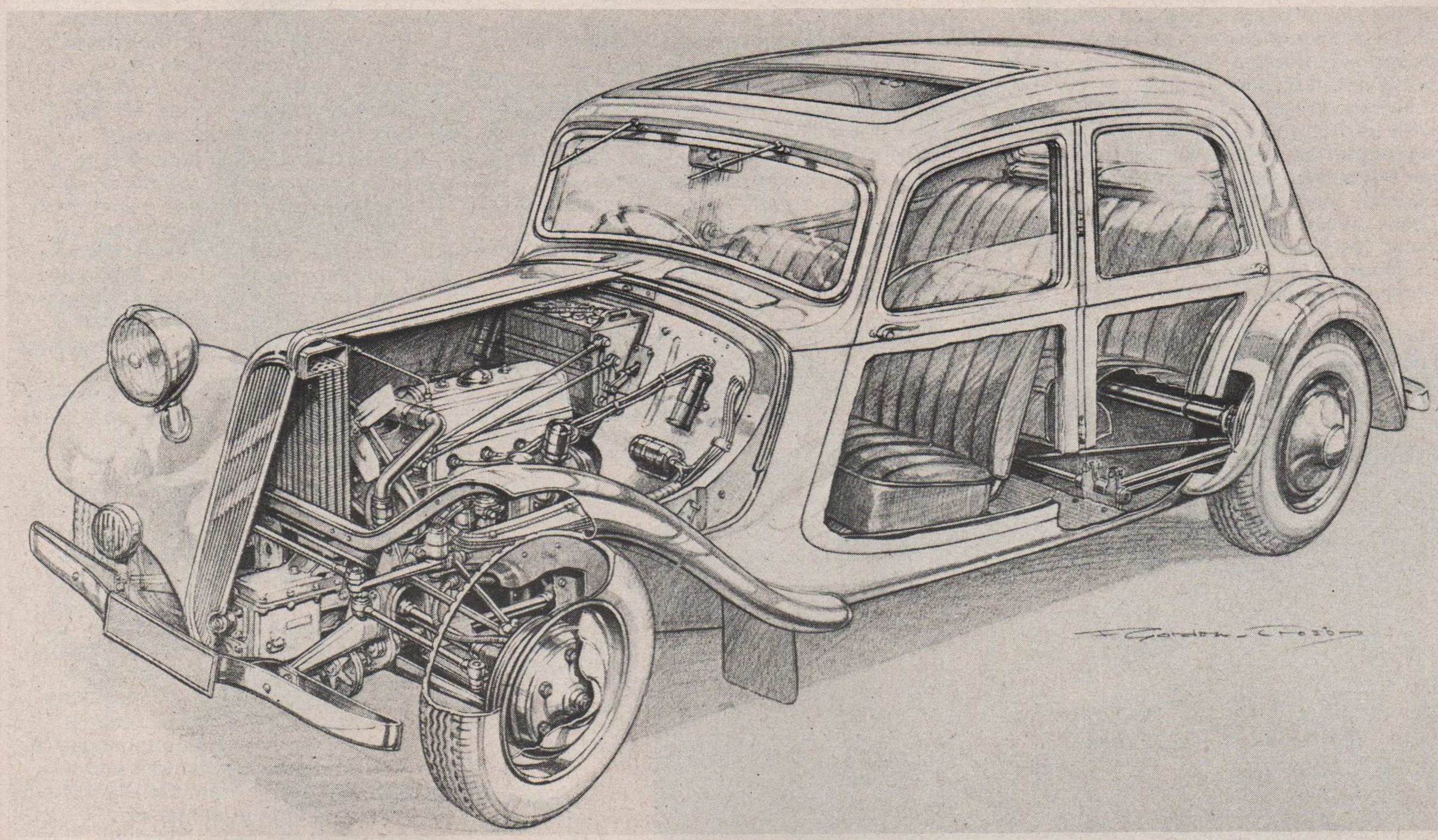
Above: Since its announcement in 1957 the Fiat 500 has had a firm following among small car buyers. This is the 500L, the final stage in the model's development. Top right: Spartan interior of the 1959 500, note the rear-hinged doors. Right: Successor to the 500, the Fiat 126, still with rear-mounted air-cooled engine

cars—a fundamental fact of automobile design overlooked by Ettore Bugatti, whose cars managed to excel in these respects nevertheless . . . perhaps it would be as well to explain this away by thinking of Bugattis not so much as cars as mechanical miracles of a rather special kind.

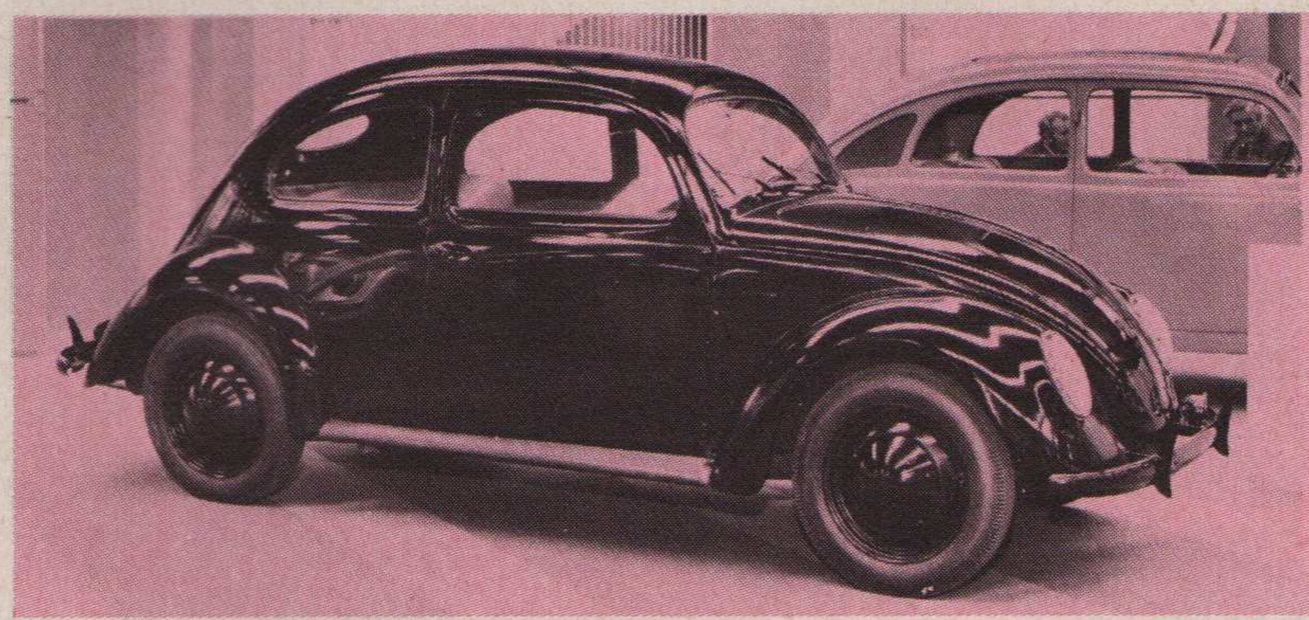
It is also an excellent method for making bodies that retain their rattle-free qualities over considerable distances and periods of time, a fact that not even the most diehard Vintage or Veteran car enthusiast dare contradict. But in saying so the writer is fully aware of the folly of making dogmatic statements of such a kind, for the successful exploitation of this form of construction involves the use of large areas of light-gauge steel, much of it extremely vulnerable to physical stresses fed in from the car itself in motion (not for nothing was the phrase "stressed-skin construction" created . . .), and from attack, mainly from below, by water, mud, grit and stones and, in times of snow, from lethal quantities of salt and other harmful chemicals.

Its vulnerability in this respect is a major disadvantage of the system, the other being the impossibility of making any significant shape changes once a manufacturer has committed his share-holders' money in the enormous amounts necessary for tooling-up and for assembly-plant design and construction. Only detail alterations are possible; ferrous surgery of a major kind is out of the question and except in the United States, where use of the "perimeter frame" as base—or "building-plot", as D. B. Tubbs has so effectively described the motor car chassis—enables extensive annual alterations to be carried out still, long production runs are now the norm.

Below: Citroen's Light 12 of 1934 featured front-wheel drive with an in-line engine



THE DEVELOPMENT OF THE PASSENGER CAR



Left: The original pre-War production version of the Volkswagen Beetle has changed little in outward appearance by the time this 1970 1500 Beetle (below) came on the scene

These often extend from decade to decade, the Volkswagen Beetle being the outstanding post-war example (though it should be said that it is not quite so "chassis-less" as most of its contemporaries, past and present).

At one time tuberculosis, or consumption, was seldom referred to out loud in so-called polite society, along with such things as drains, dry-rot and the Trojan motor-car. Until comparatively recently the subject of corrosion in the structure of the car tended to be treated with similar reticence. It is not so easy, however, to hide away the vehicle visibly affected by this particular kind of metallurgical decay, and so widespread is the problem now that the opening of highly specialized sanatoria occurs on an ever-increasing scale. That this should be necessary at all is a truly disgraceful state of affairs and one for which the motor manufacturer must take his full share of responsibility.

It is not confined to the cheapest—or, indeed, to any particular class or kind of car, this fact being ruefully recognised by owners of many post-war Bentley and Rolls-Royce cars, the pressed-steel bodies of which show only too clearly that they have nothing like the life potential of the sturdy chassis supporting them. It is ironical in a way that the current cars from Crewe—the first from there to feature integral construction—appear to be totally free from troubles of this type.

The position is so uncertain overall that one takes with the largest available dose of salt claims of extensive and *effective* anti-corrosion measures carried out during manufacture. That they are carried out is not in dispute so much as the fact that they do not seem to be completed with anything like sufficient care or thoroughness. In consequence the new car buyer has no real guarantee of a decently long rust-free life from his costly investment—unless, of course, his purse and his motoring needs permit purchase of an alloy—or fibreglass-bodied machine.

Some cars—or some models of certain makes of car, at any rate—appear to be little affected by the problem; try to find a rusty London taxi, for example.

The experts tell us that it is perfectly possible to provide substantially improved protection at the manufacturing stage for something like £40 a car—but we are told also that the average motorist is not prepared to add this extra amount to what is already a large investment for him. Has he been asked—has any maker offered a special long-life model with extra protection instead of spot-lamps, speed stripes, cigar lighters and the like?

One specialist concern now offer to treat a new car (or one not more than three months old) in such a way that freedom from rusting for a period of five years, or 100,000 miles, is guaranteed. For the average family car the cost is about £40. Why should this be necessary, however? Should not the manufacturer be able to turn out his product with a similar guarantee?

Perhaps the motorist himself is to blame to some extent; "still deceived with ornament"; concerned mainly with externals and, in the more affluent societies, able to change cars before metal rot intrudes too much. The fact remains, however, that the life expectation of the average modern car is related almost entirely to the corrosion resistance of its under-structure.

No longer is engine life a determining factor; nowadays it is a substandard unit that will not reach 50,000 miles without major attention and the days of the back-lane rebore (with new pistons and gudgeon-pins thrown in it was possible to recondition an Austin Seven engine for a pound or two in the early 1930s) and the blue smoke trail are long past. The reliability of a properly maintained modern car is the more remarkable because of its incredible complexity—so many things to go wrong and so few actually doing so, statistically speaking.

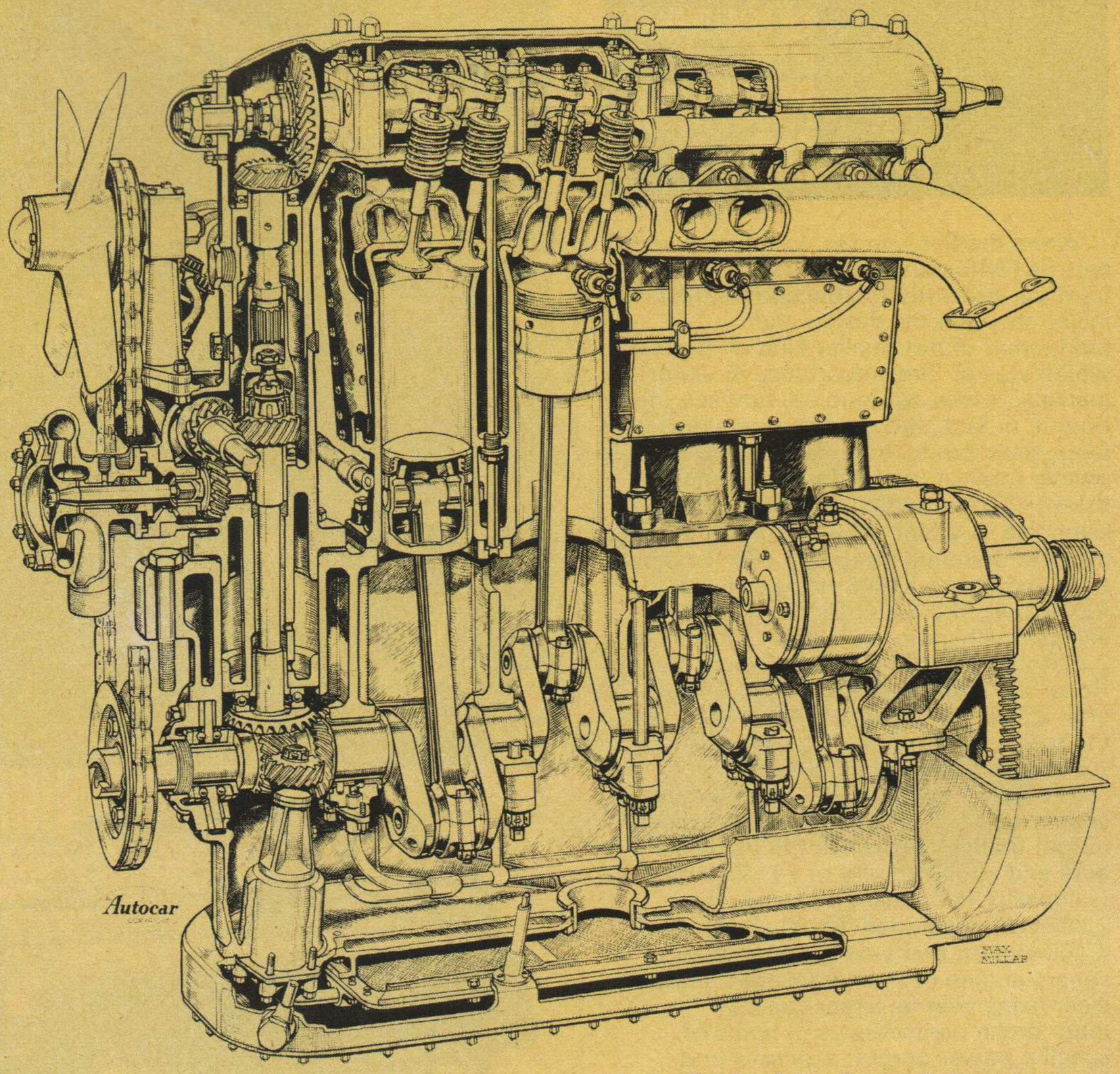
The basic principles of the internal-combustion engine have not changed in any way since the last century and in spite of competition from the Wankel type (at present of little quantitative importance in any case) it is quite

One of the biggest problems of the mass produced cars of the post-War period has been rust, and current cars are still plagued by it. Though not completely solving the problem, processes like Ziebart which treat internal and underbody surfaces prone to rusting, bring the rust-free car a step nearer

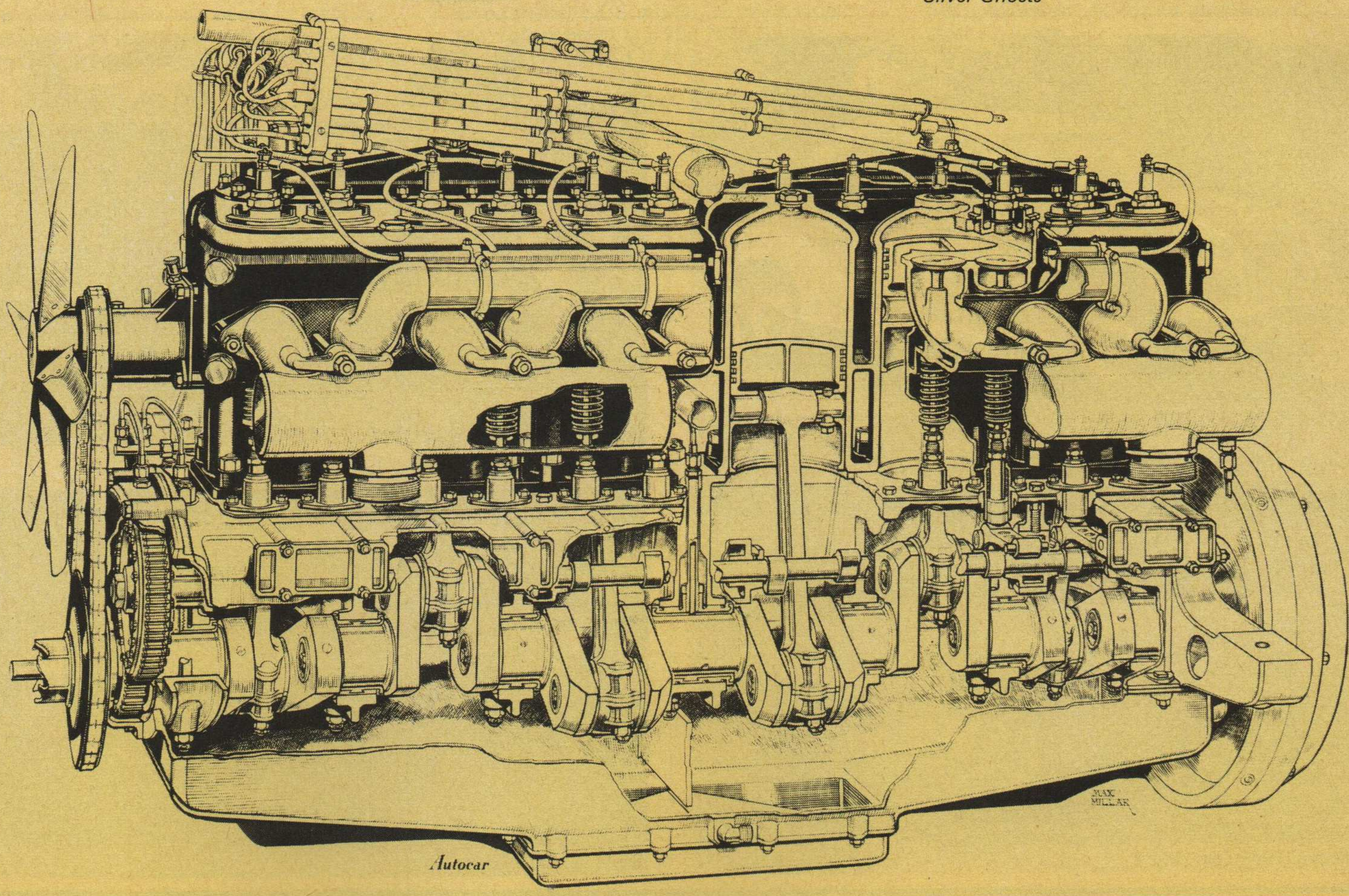
certain that there will be no radical change for many, many years to come. Standards of efficiency, reliability and durability have risen sharply—fortunately with a corresponding improvement in such vital elements as steering, roadholding and stopping power.

Until 1946 engine design in this country had been hampered by a horse-power tax based on the RAC Formula, the latter dating from a time when it provided a reasonable basis for comparison between one size of engine and another. It encouraged the development of narrow bore, long stroke units, the pistons of which had to travel at uncomfortably high speeds with consequent restrictions on safe cruising rates and engine life (unless the highest standards of design, materials and construction were reached). A classic example was the 3-litre Bentley of the 1920s, the engine of which had a bore of $3\frac{3}{16}$ in., a stroke of 6 in., a capacity of 2,996 c.c. and an RAC rating of 15.9 h.p. It produced much power and was notably reliable—but it was far from typical.

The Formula discouraged development of the short-stroke engine in this country for over 40 years, early and exceptional examples of the type being the Lanchester twin of 1901 ($5\frac{1}{4}$ in. bore and $5\frac{11}{16}$ in. stroke) and the 40/50 Rolls-Royce six of 1906–09 ($4\frac{1}{2}$ in. bore and $4\frac{1}{2}$ in. stroke). What these engines and others "square" or almost square, dimensionally speaking, provided was a low piston speed/high resistance-to-wear factor characteristic of the type—and, because it is now universal, of the majority of engines built during the past 10 years and more.



Above: Bentley 3-litre four-cylinder engine of the 1920s
Below: Short stroke Rolls-Royce 40/50 h.p. six-cylinder engine fitted to early Silver Ghosts



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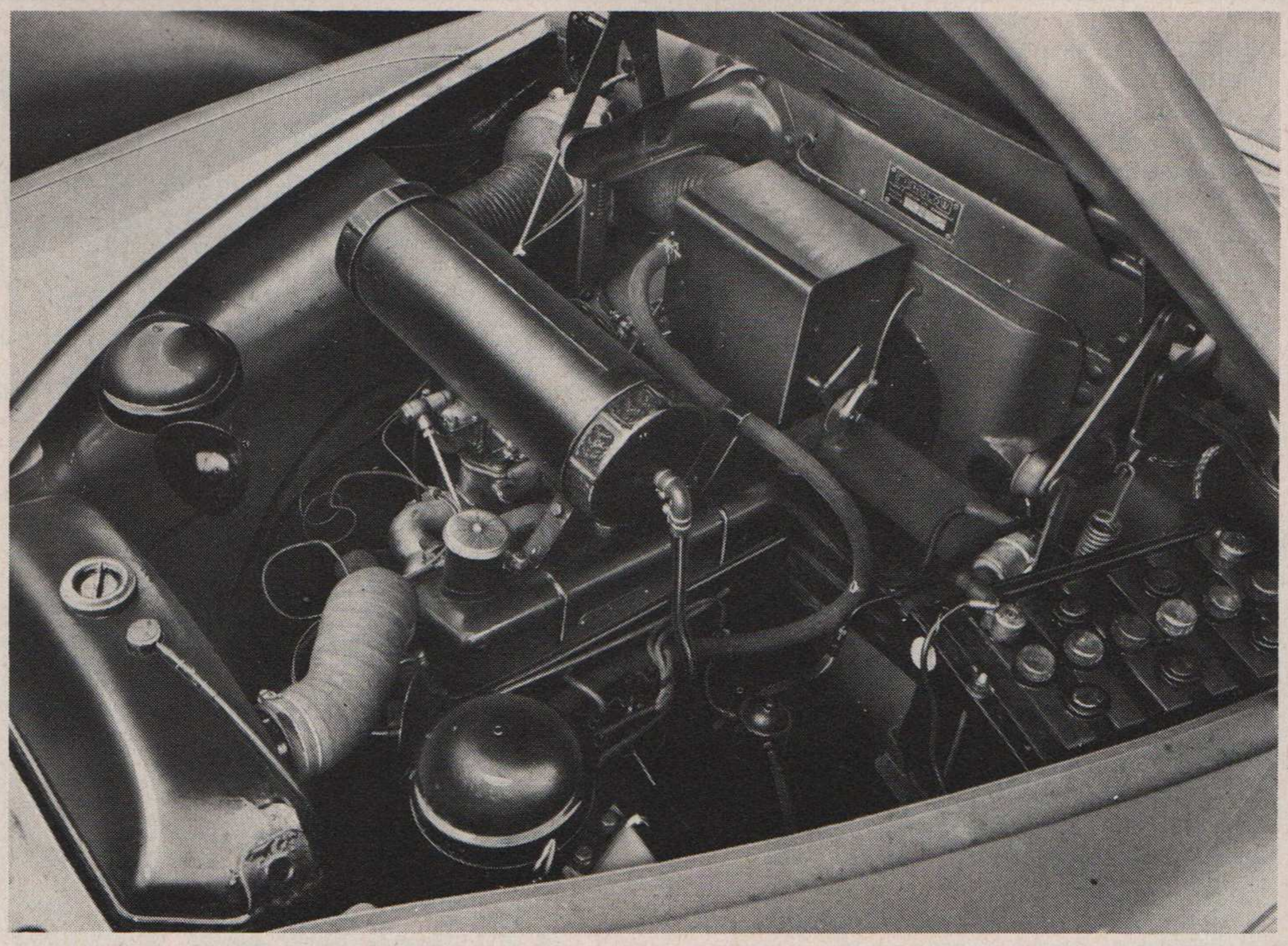
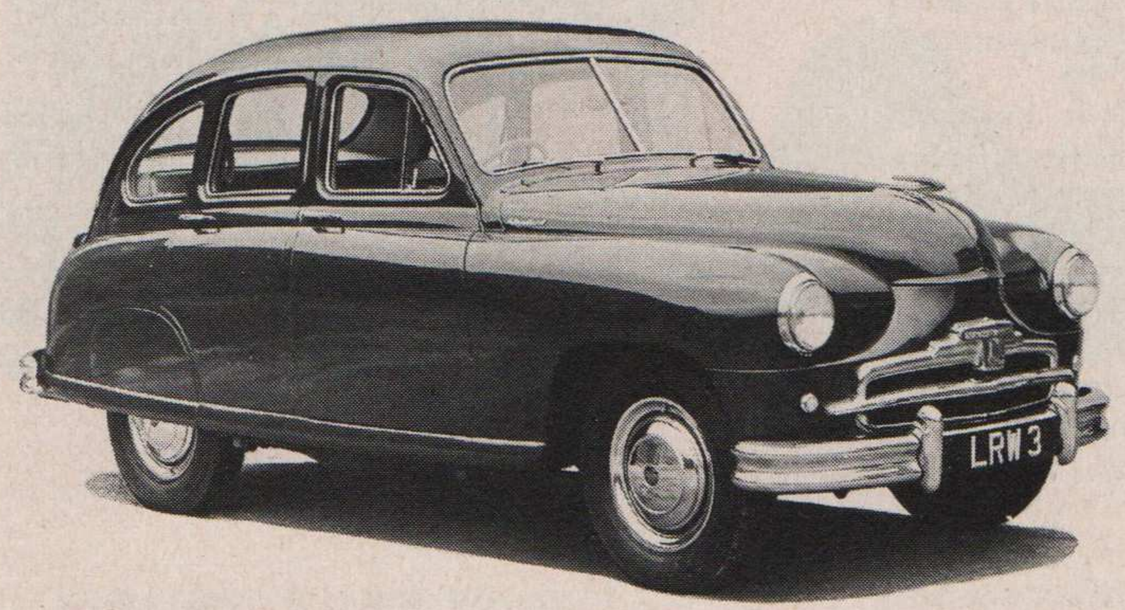
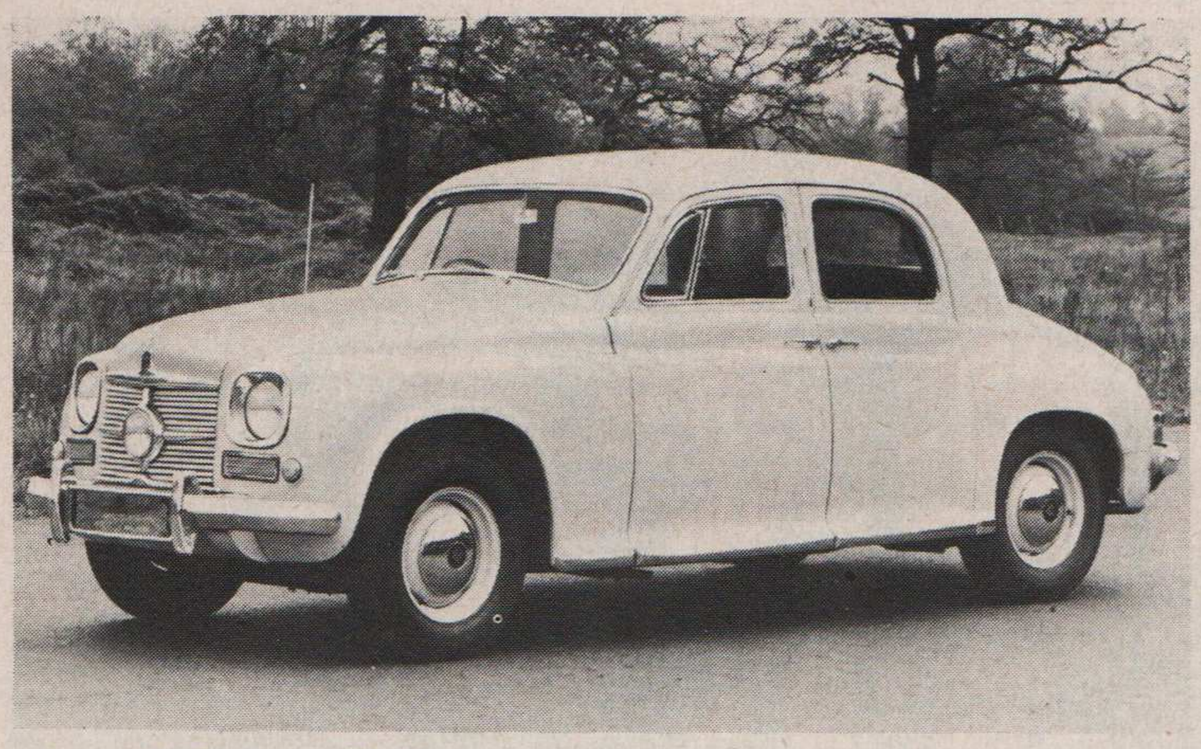
When the flat-rate tax was introduced here in 1946 manufacturers were freed from the necessity to concentrate their major effort on the design and production of the smaller kind of engine, which was of little importance in export markets. It was not ignored, however; far from it, in fact, and the type continues in large-scale production. But there was greater interest than before in engines in the $1\frac{1}{2}$–$2\frac{1}{2}$-litre range, outstanding early examples of which included the four-cylinder Standard Vanguard (85×92 mm bore and stroke: 2,088 c.c.: 68 bhp at 4,000 rpm), the Vauxhall Velox, an exceptionally quiet six (69.5×100 mm: 2,275 c.c.: 54.75 bhp at 3,300 rpm), the Rover 75, another silent six (65.2×105 mm: 2,103 c.c.: 75 bhp at 4,200 rpm) and the four-cylinder Riley $1\frac{1}{2}$ (69×100 mm: 1,496 c.c.: 55 bhp at 4,500 rpm).

Ten years later, in 1960, the Vanguard engine was still in production, its size and output unchanged, while the Velox, its bore and stroke altered to 79×76 mm and its capacity fractionally reduced, to 2,262 c.c., developed 76 bhp (net) at 4,400 rpm. In that year the new over-square engine of the Ford Anglia showed clear gains over its larger capacity long-stroke predecessors in terms of specific power output, economy and flexibility. Its bore and stroke were 80.96 and 48.41 mm respectively, its capacity 996.6 c.c. and its bhp 39 (net) at 5,000 rpm.



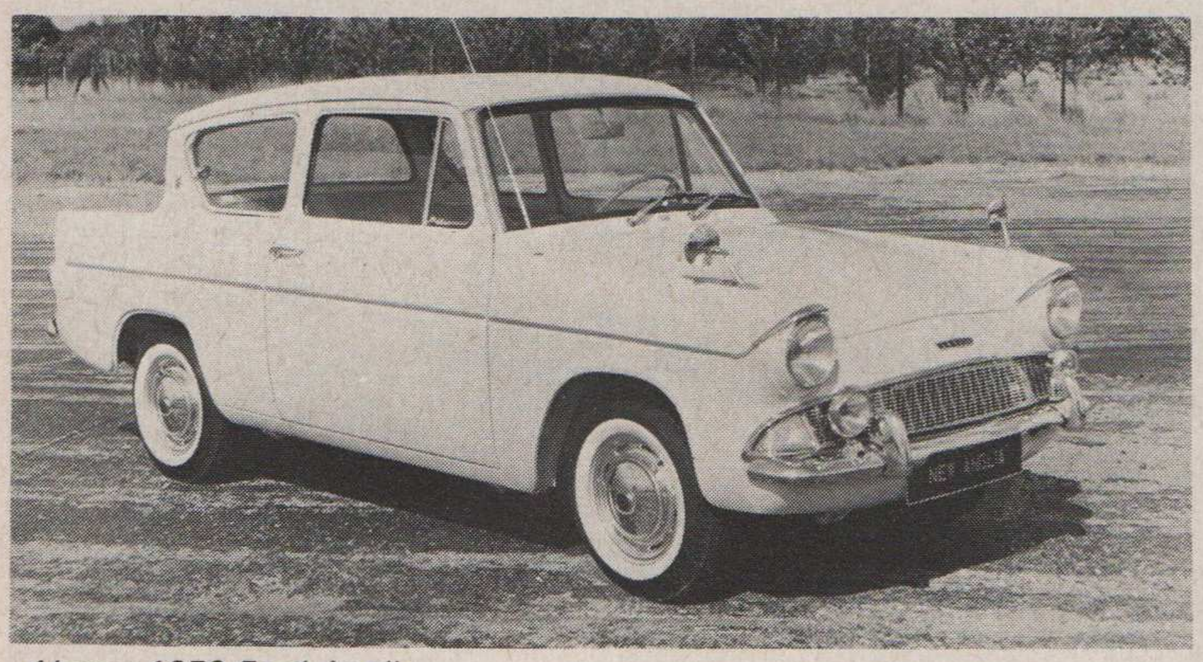


Above: The four-cylinder 2-litre Standard Vanguard engine was one of a number of outstanding post-War engines. Left: The Vanguard's body style with its rounded back was distinctive too

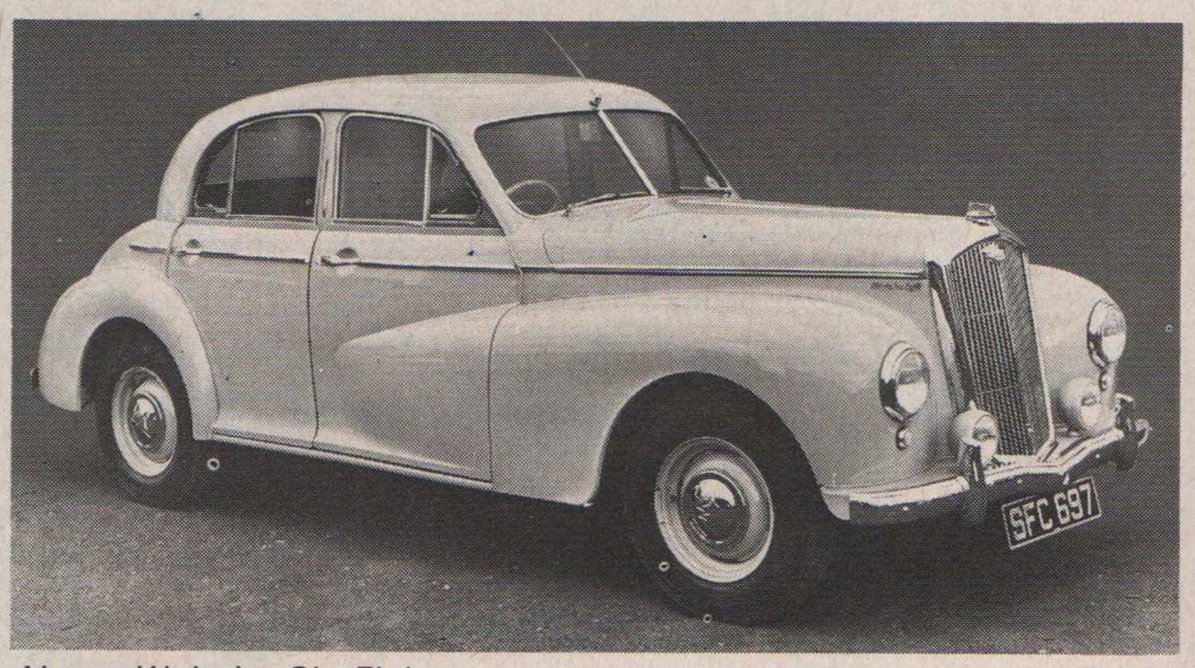


Above: 1950 Rover 75 P4

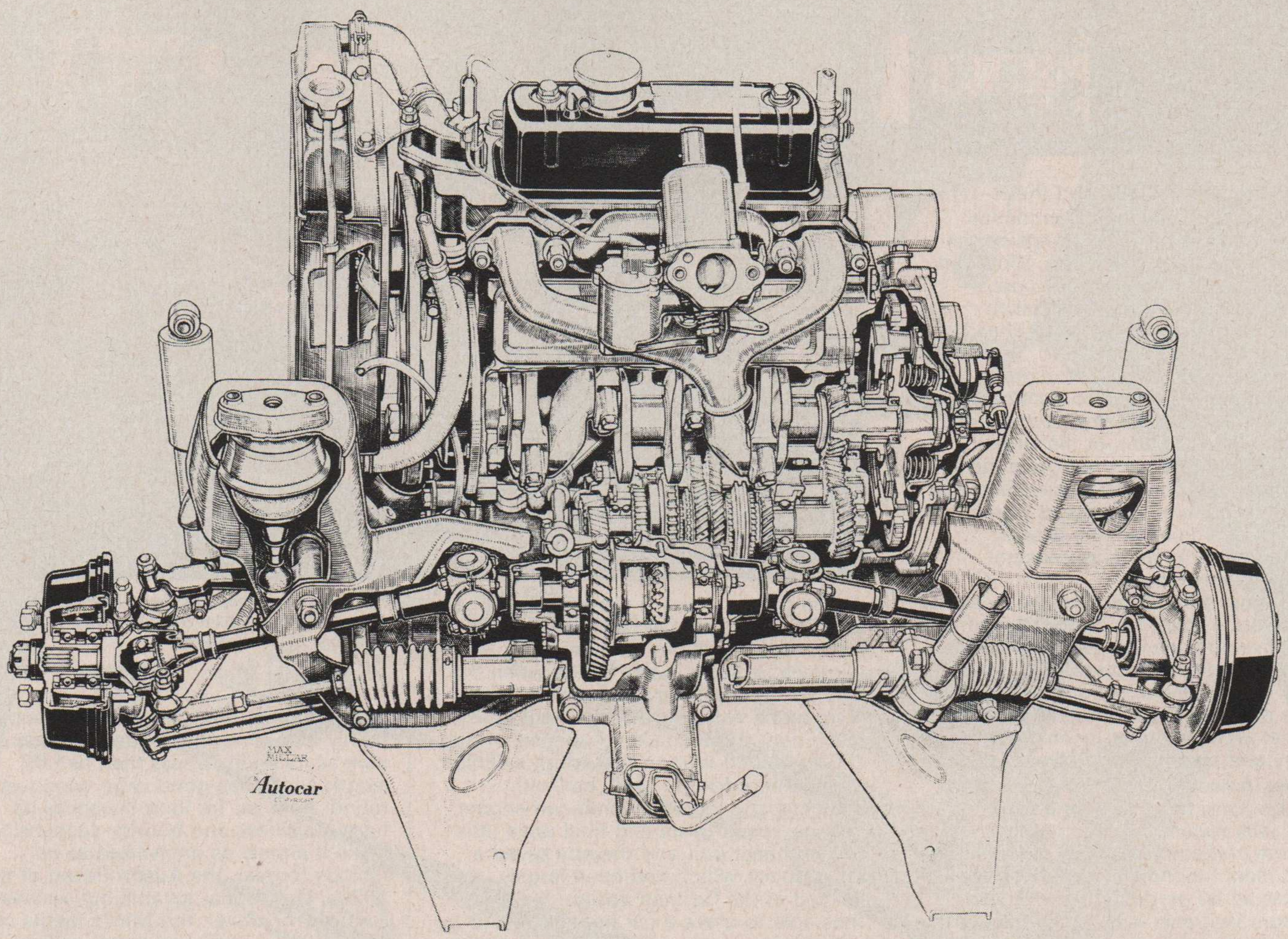
Above: 1952 Riley $2\frac{1}{2}$-litre



Above: 1959 Ford Anglia

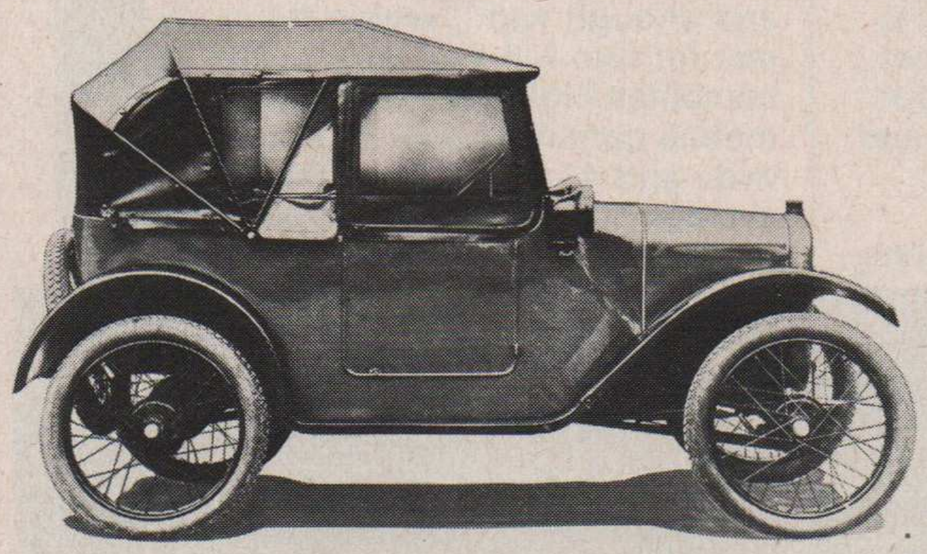


Above: Wolseley Six-Eighty



Even more efficient was the 848 c.c. engine of the Mini-Minor introduced in the previous year—an event at least as important in motoring history as the earlier introductions of the Model T Ford, the first Austin Seven, the *traction avant* Citroen in 1934 and the same maker's DS model 21 years later, the Volkswagen and the MM Series Minor. The Mini's bore and stroke were 62.94 × 68.26 mm and at 5,500 rpm, 34 bhp (net) was developed. It is still in full production, its output unchanged after 14 years.

Nor has there been much alteration to the basic design of the Mini itself. At the time of its introduction the general tendency was for British cars to swell in size without, however, adding greatly—if at all—to the room available within. The good proportions and generally fine lines of many early post-war models were lost during the 1950s as fashions changed very much for the worse under transatlantic influences. Such English classics as the Riley $1\frac{1}{2}$- and $2\frac{1}{2}$-litre models of 1945–1954, the Morris Minor and Oxford of 1948–1953, the Wolseley 4/44 and 6/80 saloons of the same



Above: Original Mini 850 engine and transmission.
Below left: Original Austin Seven (Mini) of 1959 was a new concept in small car design and a worthy successor to the 1922 Austin Seven (left)
Below left: Current Mini Clubman with squared-up front

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period, the MG Midget, and the R-Type Bentley in H. J. Mulliner Continental form can take their place alongside the best produced anywhere else. What this means in practice is that they rank immediately behind the best Italian designs of the period and well ahead of the rest.

From the early 1960s, of course, Italian influences began to dominate motor-car appearance design in Europe and, to a lesser extent, in the United States. Almost nothing but good came out of this, the principal consequence of which has been a widespread rise in world standards of vehicle design. Italian superiority remains constant, seemingly inevitable.

The most difficult task for the designer is to create a small car of really good and distinctive appearance. Issigonis was almost completely successful with his Minor (especially in its early form) and at a later date the Fiat Company, with its 500, set an example of incomparable quality and charm. From a practical point of view, however, the Mini excels, and must be considered to be more universally successful than its tiny Turinese contemporary. It is certainly one of the most functionally satisfying road vehicles so far produced.

Before Issigonis revived the idea in the 1950s, transverse engines, that is with the crankshaft parallel to the axles, had been used by many manufacturers. Indeed, as stated in Part One transverse engines were once commoner than longitudinal ones, and amongst notable British examples were the early Wolseley's designed by Herbert Austin, one of which is illustrated, and that most redoubtable of Scottish makes, the Arrol-Johnston.

A classic of the 1950s was the Bentley R-Type Continental with streamlined, lightweight body by H. J. Mulliner

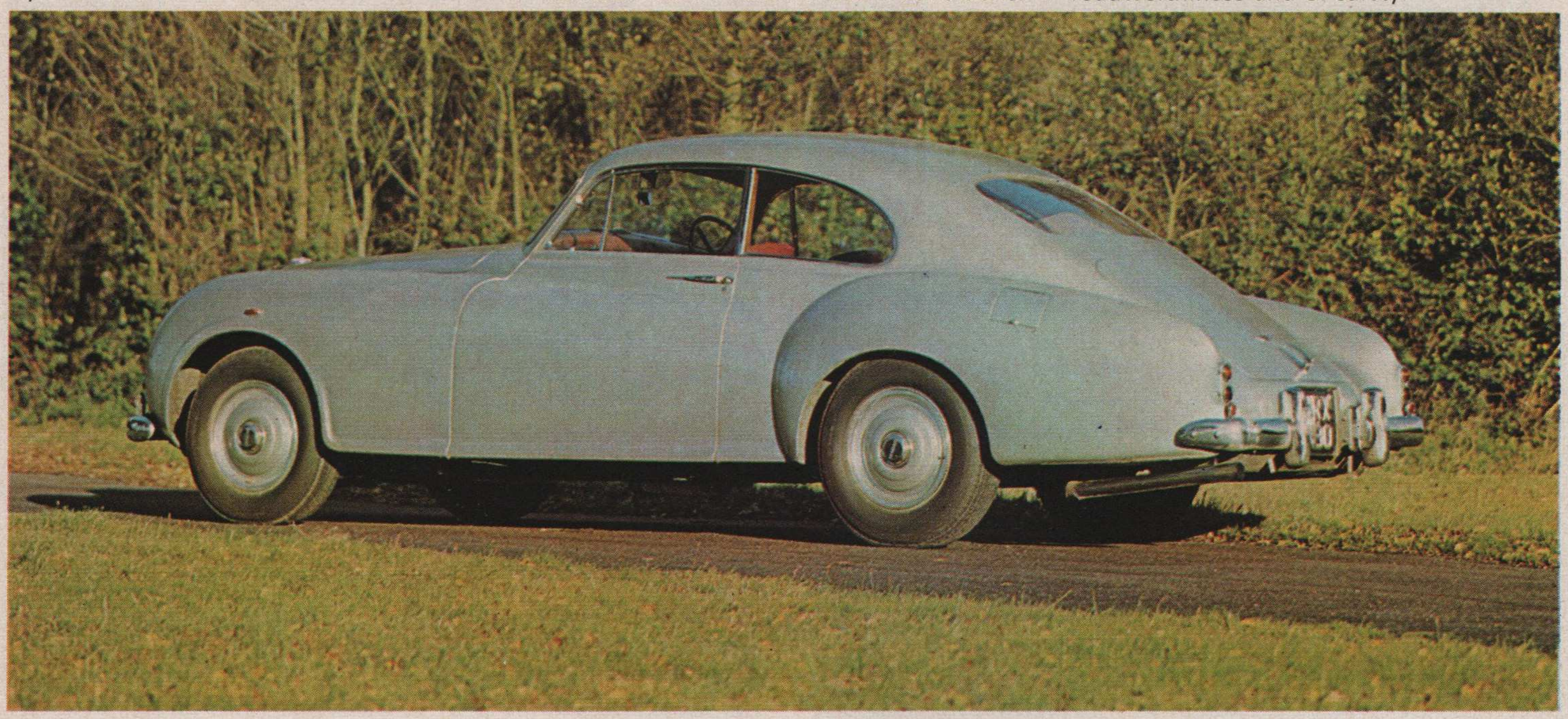
The combination of transverse engine and front wheel drive had also been tried, but it only came into its own on a commercial scale in the 1930s when the very successful 2-stroke German DKW's were made with this arrangement of machinery. The excellent handling of the DKW inspired Issigonis to adopt a similar arrangement for the Mini, but with characteristic logic he combined engine, change-speed gears and final drive into one compact unit and thereby saved a lot of space which had been largely wasted in the German design. He was thus able to make a car only 10 feet long with three-quarters of its length available to the occupants and their belongings.

Like the celebrated police box in the television serial, *Dr Who*, the Mini is much larger inside than seems possible from the outside. There is space for four adults, provided they are not above average height and are supple enough to get in and out—processes which are not too easy for the elderly or rheumatic, but for the majority there is little difficulty and the inside seems surprisingly spacious. The Mini also has enough power to maintain station under modern conditions.

Transverse engines had been used by many manufacturers before the Mini, one example was this 1902 Wolseley

As a town car it is almost ideal; nimble, highly manoeuvrable, extremely easy to park as its width is less than half its length and it has good large windows all round. As a car for long distances its fussy noisiness and bouncy suspension make it almost as uncivilised as its famous forbear, the Austin Seven of the 1920s. Unlike that lovable but wayward creation, however, the Mini's merits of "roadability" and consequent safety outweigh its shortcomings.

Its small-diameter wheels are out of proportion to some extent but they are absolutely essential, practically speaking, their very smallness allowing sufficient movement at the front end for steering and enough width within the body at the rear for two full-size adults. The Mini combines high load-carrying capacity in a mobile container only 10ft long, $4\frac{3}{4}$ft wide and $4\frac{1}{2}$ft high with far-above-average standards of control, of roadworthiness and of safety.



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The latter always have been singularly important and desirable features of the motor-car, though not always as notable or as widespread as they now are. The enormous increase in the number of vehicles in constant use, their speed potential and the statistically daunting possibility of collision or other kinds of accident have concentrated more and more intensive investigation into the gigantic problems involved, and into practical methods of raising standards all round.

The inherently safe motor-car is a help, naturally—but it is not by any means the complete answer. Safe handling, predictable behaviour at all times and instant response may be taken for granted in the majority of cases nowadays; "Undertakers' friends" no longer swell the accident and casualty statistics in the way they once did; and the incidence of mechanical failure as a contributory cause is quite *remarkably* low. For some time past designers have been concerned more intimately with improving the resistance-to-mishap factor: with providing maximum protection to driver and passengers in situations of catastrophe by anticipation on the drawing-board at the planning stages. The inherent strength of the pressed-steel structure as a whole is positively used; so, too, is its localized "crumple factor". In other words this latter feature is deliberately exploited as a large-scale shock-absorber at times of collision by dissipating much of its initial force.

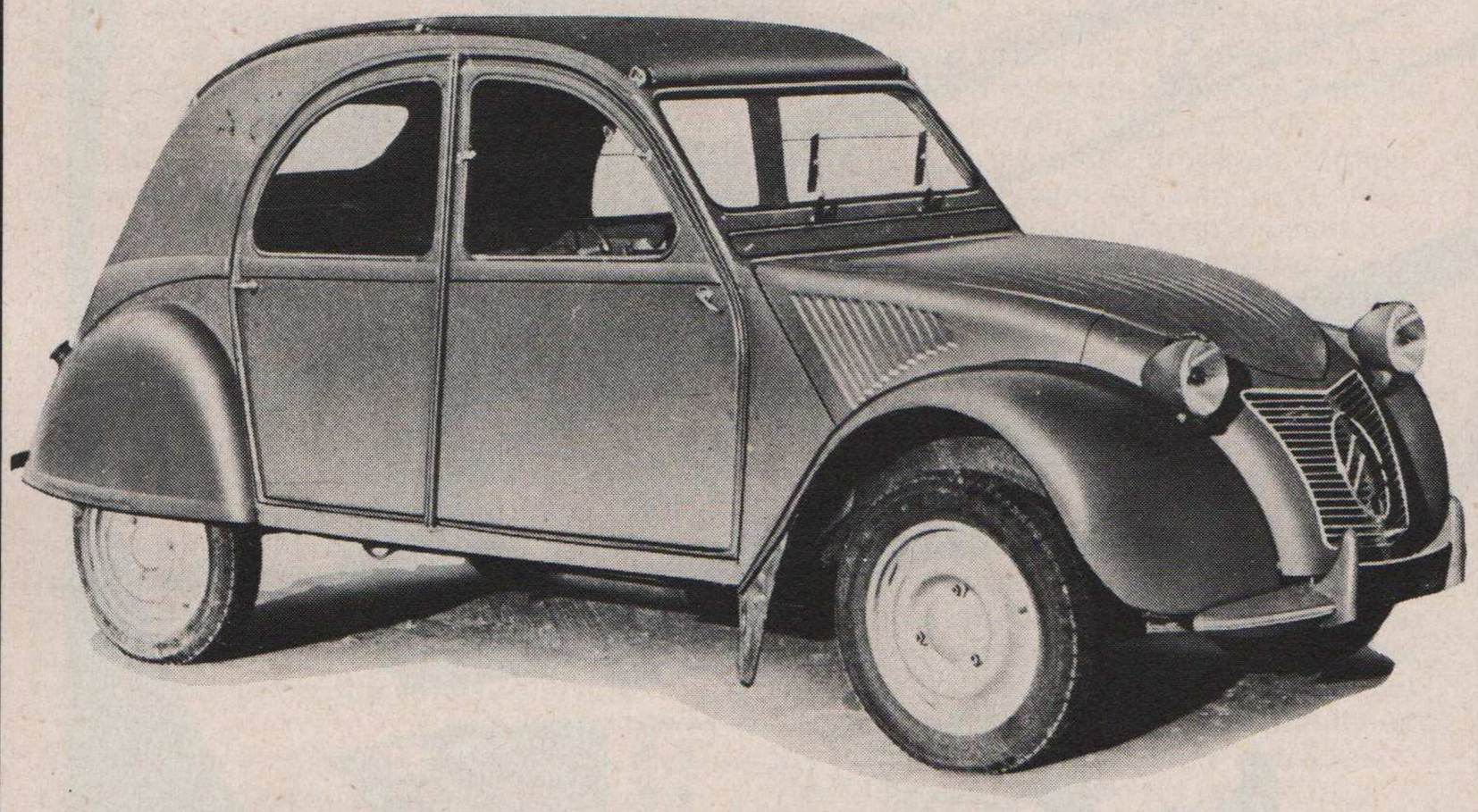
Apart from the structure itself (upon which tremendous amounts of effort, experiment and finance have been, are, and will be expended) increasing attention is being given to making safe its interior by elimination as far as practically possible of potential hazards—controls likely to cause injury on sudden impact, steering wheels and columns sited in lethally dangerous ways, windscreen and window glass of unsuitable type and so on.

At a time when cars from other countries tend to attract favourable attention almost as a matter of course (and not without good reason, more often than not) it is as well to recall the examples of the post-war Minor and Mini—cars designed primarily with the aim to providing enjoyable, economical and *safe* transport. It has taken the rest of the world quite a long time to catch up.

Not that any attempt is being made to hold up these excellent and highly individual models as the only good things of their kind; with the range of automotive design skills and genius available there are numerous solutions to the problems of designing and making small cars—and medium-size and large ones as well. The 2 cv Citroen is a case in point: a highly original form of transport dating back more than 30 years in conception and not actually put into production until 1949; breaking most of the generally accepted rules and yet getting away with it.

When it was first shown in public, at the 1949 Paris Salon, it aroused rage; controversy; incredulity; violent argument. On the face of things it did seem highly unlikely that a vehicle more than 12 ft long, almost 5 ft wide and over 5 ft high—and powered by an engine of 375 c.c.—could move four adults at any speed or for any reasonable length of time. In our 1953 Road Test this journal pointed out "With a two-cylinder air-cooled engine driving the front wheels, the Citroen is the simplest and most economical instrument yet devised for moving four people and their luggage from place to place with acceptable standards of comfort and weather protection . . . as functional as a bicycle or a lawn mower . . . and it seems to serve as they do, with the minimum of skilled attention."

Here indeed was a totally different approach to economy car design; concentration on the essentials only, with apparent disregard for appearance, performance and for the provision of certain amenities taken for granted by the average motorist.



Simple and economical, the Citroen 2CV introduced in 1949

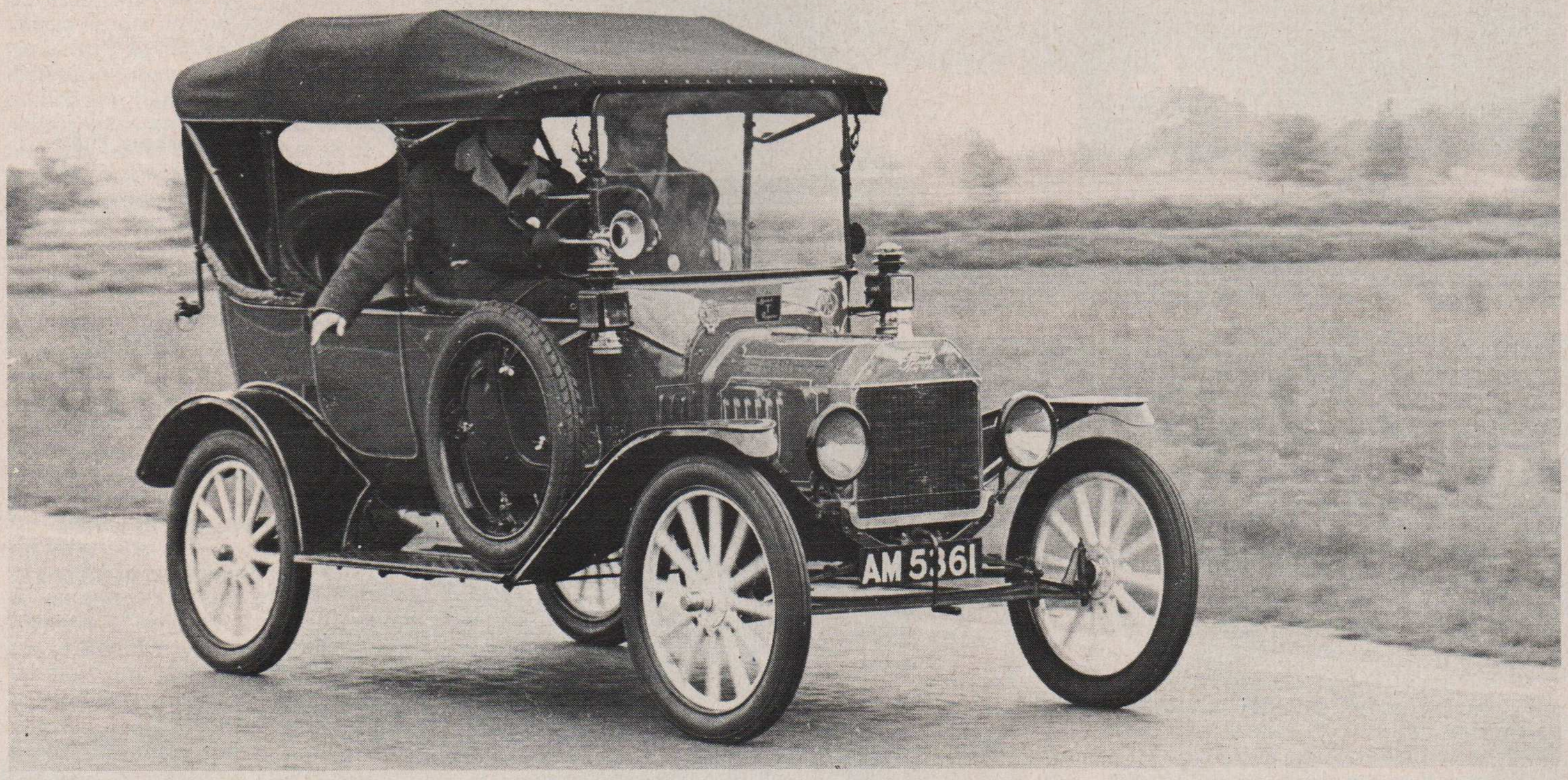
But the 2 cv of the time, was not intended for the average motorist, whatever or whoever he might be. Its designers' aim was to produce a car acceptable to those previously unable to contemplate purchase and maintenance of a conventional motor-car for financial reasons, and this they managed to do with overwhelming success. Similar ideals lay behind Leslie Hounsfield's ingenious but uncouth Trojan, and were embodied in his brilliant slogan—"Can You Afford to Walk?"

Good appearance was not a feature of the 2 cv to begin with but at no time in its long production life has this been a serious disadvantage as a selling factor. In this respect there are obvious parallels with the Model T Ford, the appearance of which was scarcely its outstanding feature. Nevertheless it was only towards the end of its production, after 17 years or so, that the better appearance of its rivals seriously affected demand; by the late 1920s the American consumer was generally willing to believe that the better-looking car (or 'fridge or whatever) was much more desirable than its less externally handsome contemporary. The fact that it might be less good in all other matters of importance, mechanically and practically speaking, has not seemed to matter overmuch since then.

It is possible that the apparent lack of concern for the outward show was a cloak for commercial cunning. Fashions change swiftly enough, even in motorcar appearance, and the cost of catching up has never been low where large-scale production is concerned. Perhaps the separation of such classics from normal standards of automobile aesthetics was their surest guarantee of an exceptionally long selling life; the Model T was in continuous production for something like 19 years, and the 2 cv has been in steady demand since 1949. If anything its appearance has deteriorated since then. . . .

Attention should be drawn at this point to two highly significant features of the 2 cv—its lack of need for frequent and thorough servicing and the capacity of its tiny engine to withstand prolonged use at full throttle. What was at one time a weekly ritual involving attention to dozens of oiling points and to the making of essential adjustments has been largely eliminated on cars of the last two decades. One or two makers had made some attempt between the wars to extend the intervals (Bentley Motors, for example, featured oil reservoirs in the steering connections of certain models that made replenishment a quarterly rather than a weekly chore) and in America, in the 1920s and 1930s, and here throughout the 1930s and, to some extent, in early post-war years, one-shot, automatic chassis lubrication looked after a tiresome and messy service operation for the owners of certain makes.

For a great many different reasons the trend to reduce servicing to the absolute minimum has spread enormously in the past decade or so. On balance an excellent thing—but the more interested kind of motorist has found that regular and quite frequent servicing meant that he had an up-to-date idea of the general mechanical and structural wellbeing of his car, whether he did it himself or not. The underside in particular was under constant surveillance and with its



In production for 19 years, the Ford Model T

growing vulnerability to attack any breaches of its ferrous defences could be spotted early.

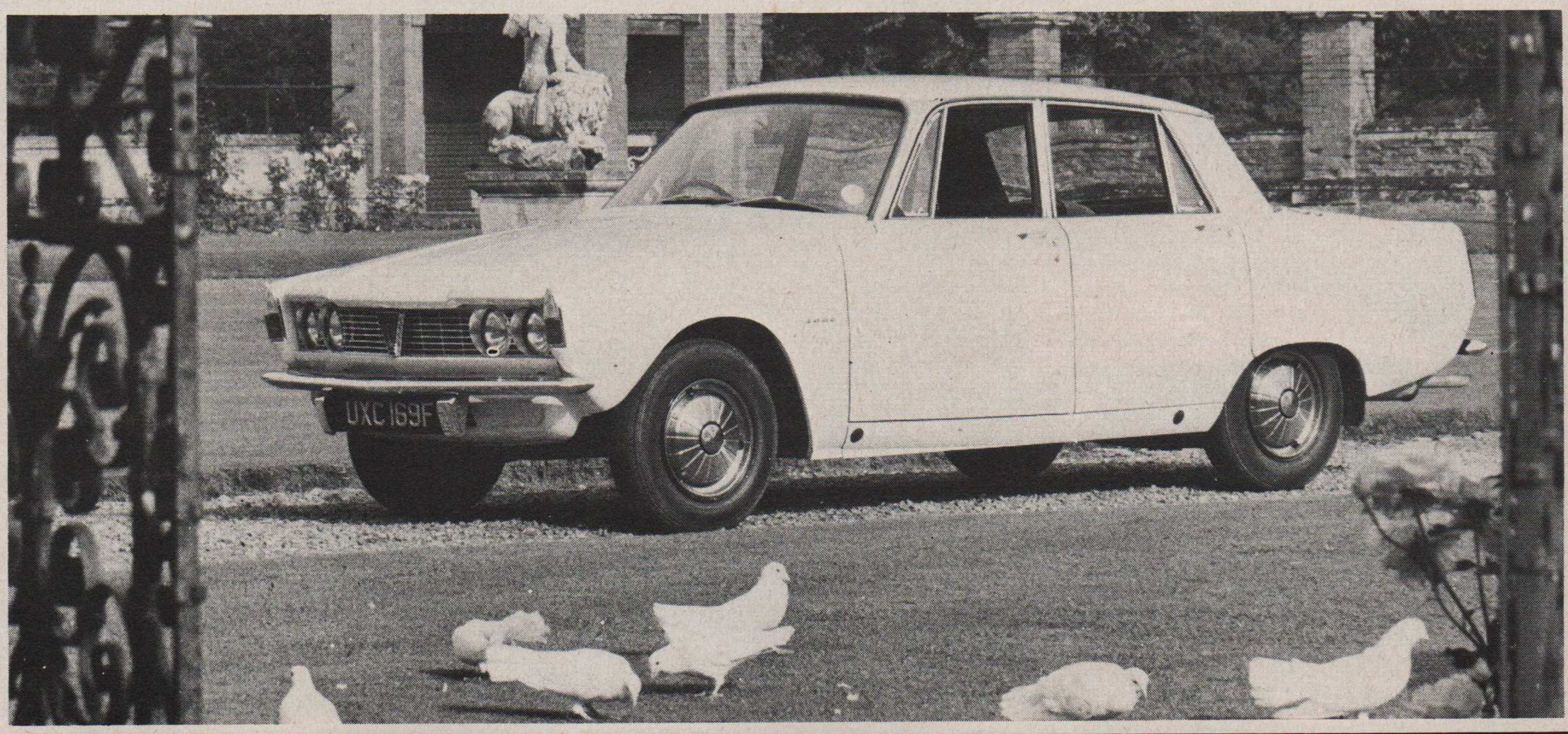
Something has already been said about the greatly extended life expectation of the modern engine and about its ability to withstand continuous use at high speed. Before the war the typical family car could exceed 60 mph (but not by much) and cruise at anything from 45 to 60 mph. On the whole its steering and suspension and its brakes were adequate for the traffic and road conditions prevailing here.

On the Continent, in spite of surface conditions generally inferior to those in Britain, opportunities for fast driving over long distances were widespread and were taken, suspension systems specially evolved to cope having been commonplace for years. In North America also faster motoring was possible; and although individual States imposed speed limits outside towns and cities, steady cruising at about 60 mph was an accepted feature of cross-country or cross-continent driving. The big American car was particularly well suited to home driving conditions in any case, its easy and quiet running engine and soft suspension making light of journeys far longer than anything possible in Britain, and often over routes of widely differing surfaces and kinds of climate.

As the networks of motorways began to spread in Europe during the late 1950s and after, and as increasing prosperity at all levels in society made car travel abroad more and more common, British cars had to acquire the high cruising-speed capability and long-distance stamina already characteristic of their French, German and Italian contemporaries.

They also had to have suspension of sufficient quality to cope with these higher speeds and although the highest standards were established in the first place by Citroen, with their DS-series cars, and by some other Continental manufacturers subsequently, these were to be approached in the course of time by others. The Rover 2000 was one of the most successful British challenges, still in full production and with suspension design unchanged after 10 years, and while it has been surpassed in

Still largely unchanged in appearance, the Rover 2000 was introduced in 1963 and was years ahead of its time in many respects



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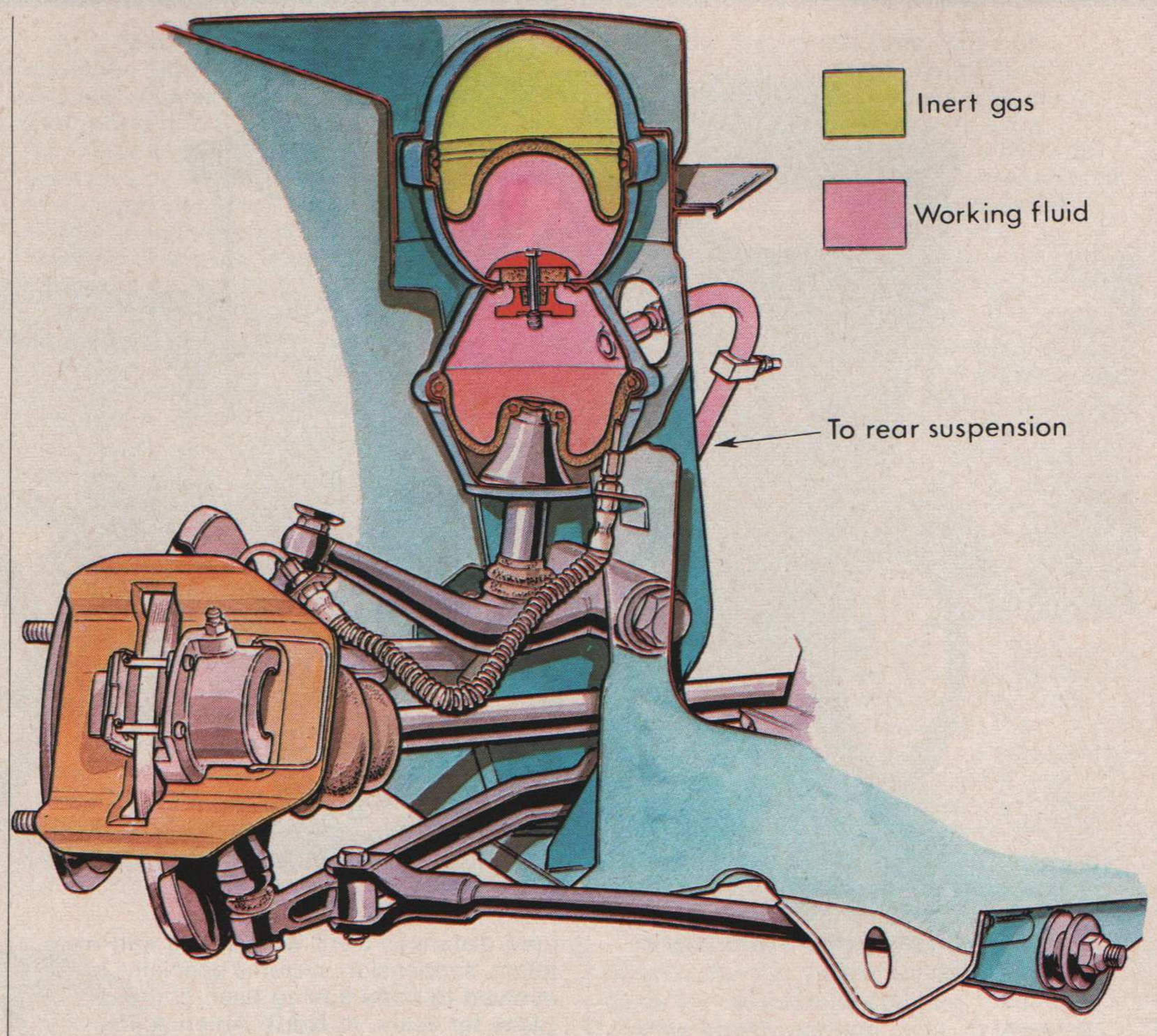
all-round excellence by more recent designs the original Hydrolastic system of the Morris/Austin/MG/Riley/Wolseley 1100 and 1300 range was ahead of its time in 1962. In 1973, in up-dated Hydragas form, it features on the Allegro range recently introduced.

Faster cars must have better stopping power and here again important advances have been made, the fade-free characteristics, the power and the consistency of behaviour of the disc-brake having been exploited to the full. Drums have not disappeared—yet; on grounds of cost and expedience their place in the specification of the cheaper kind of car is likely to be sustained for a long time. Increasing use has been made of servo assistance—once found only on costly cars which combined high speed with great weight—and hydraulic actuation has taken over almost completely from the rival mechanical-linkage systems.

What makes the modern car go faster than its forebears is its engine, of course; already we have touched briefly upon the general use of the short-stroke unit which, however fast it may revolve, seldom takes its pistons above the safe normal limit of speed of 2,500 ft per min. The present unit may be simple in design and execution, with two or four cylinders only, modest cubic capacity and sufficient bhp. The same engine can be tuned to produce a great deal more power with maintained reliability and no important reduction in economy. Or it can be complex; four-, six-, eight-cylindered—perhaps more; fitted with one or more carburettors—or fuel injection; enormously rigid, enormously powerful in relation to its capacity and yet seldom *nerveux*, seldom temperamental in the old-fashioned way. A recognized classic is



Left: Hydrolastic suspension was first used on Austin/Morris 1100 in 1962 and is still used on current Austin 1100/1300 models

Above: A development of Hydrolastic suspension using an inert gas as the springing medium and retaining the fluid interconnection between front and rear to provide a good ride is called Hydragas

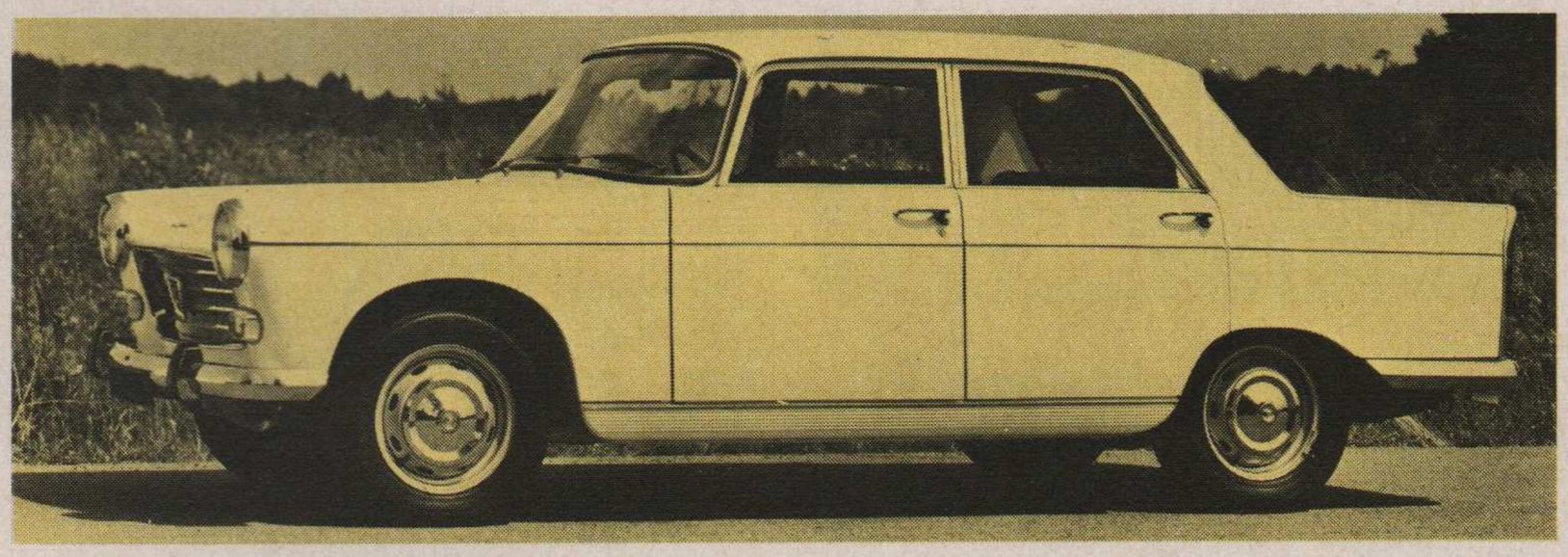
Below: The new Austin Allegro range introduced in May 1973 uses Hydragas suspension. Shown here is the 1300 de luxe, there are also 1100,1500 and 1750 versions

the post-war Jaguar engine which, in 3½-litre form, was first used in the XK120 sports model and in smaller or larger capacities has served with enormous distinction ever since in road cars combining high performance with great smoothness and quietness of running and has taken racing versions of the road cars to victory in an impressive list of races. A properly maintained engine of this make and type can cover 100,000 miles without more than routine attention to plugs, contact-breaker points, tappets and oil changes.

It might be foolish to think that further improvements in the engine room are unnecessary; even the best could be better and progress does not stop. In terms of power output, economy of operation, reliability and general smoothness the present state of affairs is undoubtedly good. But there is room for a fair degree of improvement in quietness of running—or, at least, in the effectiveness of methods of keeping the noise from the driver and occupants of the car. In the majority of medium- and large-sized cars the problem is not too serious, road and wind noises often effectively masking it. But among small cars—and almost without exception—there is much scope for improvement still.

One hopes that this particular matter will have an increasing amount of attention devoted to it in the future, along with significant reductions in levels of a road-transmitted sound. Certain makers have established impressive standards—Rover from the late 1940s, for example, and Peugeot in the past decade with their splendid 404, a 1½-litre car with the internal calm of a car of at least three times the engine capacity and three or four times the price. And, of course, the XJ Jaguars.

One would welcome a Mini or car of similar size capable of transporting its occupants in a greater state of grace than is presently common; in an atmosphere of quietness and general refinement comparable, say, to that of the 404. Among small cars the Renault 5 might be such a car if the amount of mechanical noise could be made acceptable over extended periods of time and distance.



Top: The Peugeot 404 established an enviable reputation for quietness in a 1½-litre saloon in the 1960s

Above: Jaguar and Daimler versions of the the XJ6 and XJ12 have built up a substantial following from those who want outstanding roadholding and performance in a luxury saloon

Below: A 1970s approach to small car design has produced the Renault 5TL with 956 c.c. engine driving the front wheels, a lift-up rear door and a fold-down rear seat

With more and more talk of fuel shortages before the end of the century—and no sign as yet of a practical alternative—one wonders about the possibility of official restrictions on engine capacity and fuel consumption in years to come. If the mammoths of Detroit were reduced to a more discreet size over a comparatively short period of time; if their large and not especially efficient engines were halved in capacity and given more to do a very considerable saving in petrol would surely follow. Easy to suggest—probably utterly impossible to implement. Yet the capacity limit of 2.8 litres common in Continental countries deters all but the well-off from investing in costly, large-engined cars. . . .

Nowadays many cars in the 1½-litre class have as much performance as a 3-litre of 10 years ago and 100 mph, 2-litre models are numerous. The reliable, smooth and unfussed production of any reasonable amount of power can be taken for granted, almost, and so long as the internal-combustion engine continues in its present form future developments would appear to centre on such factors as improved low-speed torque (is there really no substitute for litres?), even quieter and smoother running, lowered fuel consumption and as complete a reduction in the amount of harmful emissions as possible without stifling the engine entirely.

One cannot imagine that the larger type of high-performance car will disappear in the foreseeable future unless there is a really drastic, properly enforced limit on speed on public roads outside Britain and the United States. The number of perfectly tractable cars

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Citroen's elegant looking SM model must rank among the most complicated of modern cars from a service viewpoint

capable of 140 mph or more has risen in the past few years, in spite of prices ranging from over £3,000 to £10,000 or more—and now there is rumour of a new Rolls-Royce to cost £20,000 or so. Anything seems possible in motoring, which is why forecasting future trends is so hazardous an undertaking. Is it too much to hope for a continuous programme of improvement to those incidental (but often vital) items that cause trouble—like door locks and window winders, instruments that fail, or fail to tell enough; electrical equipment that lacks reliability and so on? Is it too much to hope for further improvements in anti-corrosion measures?

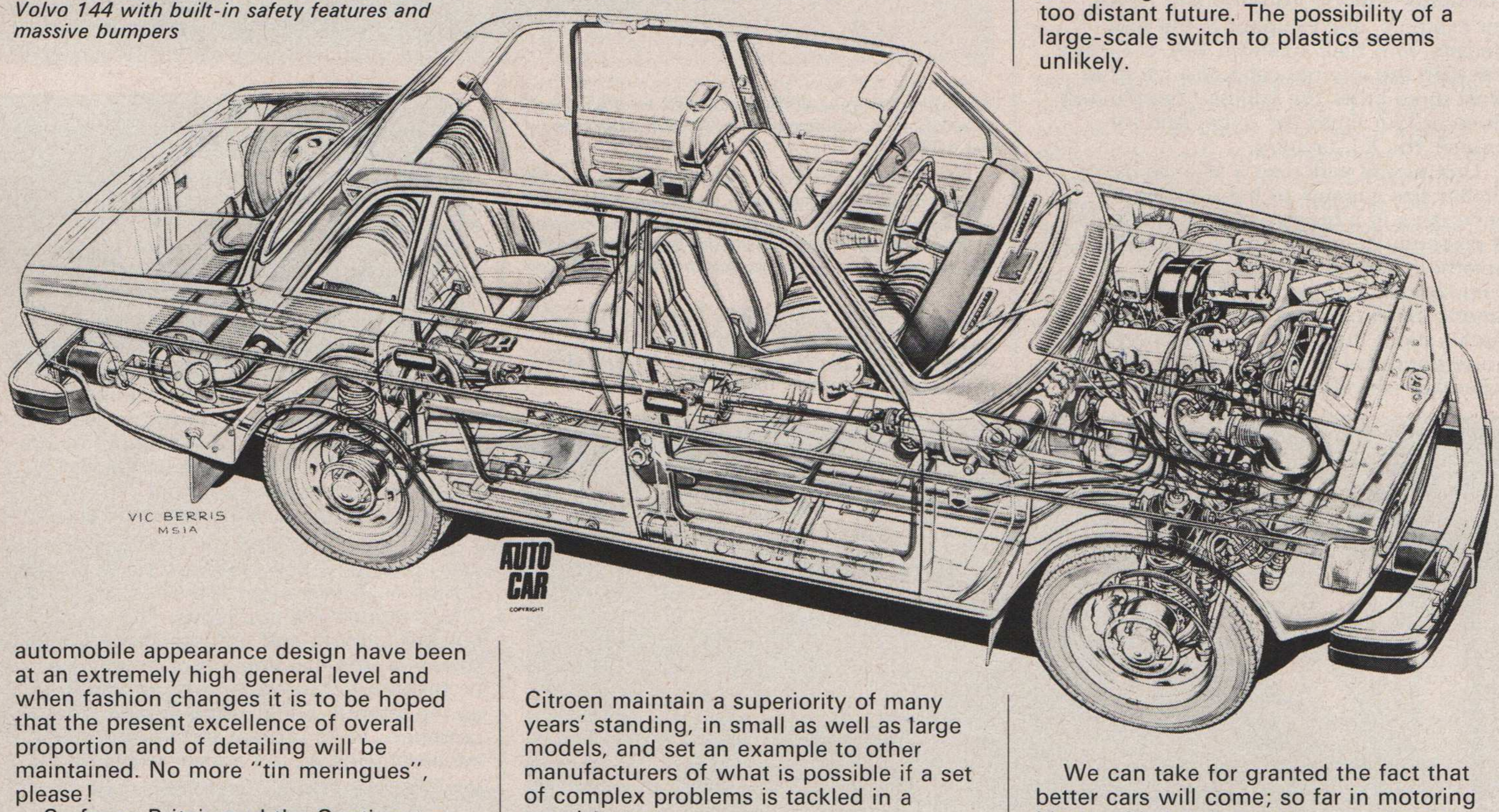
It is highly unlikely that the universal all-enveloping body will make way for earlier types, the practical advantages of the former as regards carrying capacity making it too useful for any fundamental changes to be made. Shapes will alter, inevitably, but not drastically or dramatically in spite of the precedent established as long ago as 1955 by Citroen. For some time past standards of automobile appearance design have been at an extremely high general level and when fashion changes it is to be hoped that the present excellence of overall proportion and of detailing will be maintained. No more "tin meringues", please!

So far as Britain and the Continent are concerned it looks as if manual gearboxes will be around for many years to come, despite the advantages of the automatic in respect of reduced wear and tear on car and driver. One would like to see further improvements in the actual quality of manual gear shifting itself; more changes as light, as swift and as precise as those enjoyed by owners of recent Fords or the MG Magnette of the late 1950s.

Some improvement is still possible in the operational efficiency of the automatic, no doubt, standards of quietness and smoothness of changing speed in the best present-day examples are so high that further improvement is scarcely possible. Its additional cost is almost certainly the reason for the continued resistance to widespread use of the automatic gearbox on this side of the Atlantic—and how first cost can come down to an acceptable level is a problem as yet unsolved. Production would have to rise by an enormous amount before any reasonable chance of reductions would be possible—which is the problem.

A continuing improvement in systems of suspension may be expected; there is still room for it in many cases though the general standard now is high.

Future car design is going the way of this 1974 Volvo 144 with built-in safety features and massive bumpers



Citroen maintain a superiority of many years' standing, in small as well as large models, and set an example to other manufacturers of what is possible if a set of complex problems is tackled in a creative way.

Steering wheels, one hopes, will remain round—and where they are; directional control by any other means (by levers or bars, for example) may come in time but will have to overcome massive customer opposition. Any further increase in the use of power steering depends greatly on design requirements; changes in tyre design or an increase in the amount of weight carried by the front wheels, for example, might lead to unacceptable levels of effort at the wheel, in which case discreet hydraulic help would be given. It is unlikely that this would affect any car below 1½-litres' capacity, however.

What else? Cheaper cars? Rust-free cars? Better cars? Even more reliable cars?

Actual reductions in price one cannot expect; the wonder is that the present-day car can be sold as cheaply, relatively speaking, as it is. Here more and more intensive applications of automation at the manufacturing and assembly stages have held down increases with greater effect than is generally realized. Perhaps even more machine-making and less man-involvement is possible—but against the potential savings of automation must be set its first cost, maintenance and regular updating.

Rust-free cars will elude us as long as steel is used—but a guaranteed minimum corrosion-free life of five years would be something to look forward to in the not too distant future. The possibility of a large-scale switch to plastics seems unlikely.

We can take for granted the fact that better cars will come; so far in motoring history this has been so . . . engines at the front, engines at the rear, engines in the middle or wherever; powered by petrol, by steam, by electricity, by solar energy; large or small or in between; mostly closed (because authority frowns on anything open, especially on wheels) and so hung about with safety systems that movement may be almost impossible. Driver and passengers crash-hatted; strapped in by law; speechless; immobile. It might just happen. . . .

Postscript

By Anthony Bird

FROM time to time eulogistic reports appear about alternatives to the conventional reciprocating internal-combustion engine. Taken at face value any one of these alternatives promises less weight, less noise, less pollution, less complication, less of everything indeed except performance which is to be wonderfully enhanced, and the ordinary reader may well wonder why the "nasty explosion engine", as it was often called in the last century, is still with us. The accounts of the alternatives tend to gloss over the drawbacks, and one obstacle is common to all: the investment both in manufacturing and servicing "conventional" vehicles is so prodigious that a general change of direction has become prodigiously difficult.

Disregarding the ever-active lunatic fringe of invention, the alternatives most usually discussed are the Wankel, or rotary internal combustion engine, steam, electricity and the Stirling engine which is all too often misleadingly spelled as sterling.

The Stirling engine, indeed, is none other than our old friend the hot-air engine made very much hotter, in both senses, than when the Rev. Patrick Stirling invented it in 1818. It has all the necessary virtues of simplicity, quietness and steady-state combustion which makes it easy to keep the exhaust fumes clean. It has the only vice of abysmally poor specific efficiency, because air is such an abysmally bad medium for carrying heat. Therefore, in an attempt to make the Stirling engine equal the specific efficiency of petrol or diesel engines a different medium must be used. Hydrogen is the best alternative, but a hot-hydrogen engine presents great difficulties as the gas is not only dangerously flammable, but is the worst of all gases to keep where it is wanted. In other words, making seals for piston rods, displacers and other parts which will safely restrain hydrogen gas at pressures up to 2,000 psi is almost impossible except under laboratory conditions; but it is only by working at very high pressures that the Stirling engine could compete.

Electricity seems to hold all the aces; the first road vehicle ever to exceed 60 mph was Jenatzy's battery-electric car, *La Jamais Contente*, and the world's first fleet of motor cabs was put on the road by the London Electric Cab Company in 1897. An electric motor can be almost silent, totally vibrationless, absolutely pollution-free, very easily controlled and able to offer a wide torque range. Why then did the battery electric car become extinct long ago, and why have all attempts to revive it failed? The simple answer is that conventional lead-acid batteries are little better than they were 100 years ago, and the battery able to drive a small electric car of, say, seven nominal horsepower for 50 miles at a maximum speed of 40 mph weighs some 10 times as much as the filled petrol tank of a comparably sized conventional car, able to travel 200 miles or more on its contents at speeds up to 100 mph.

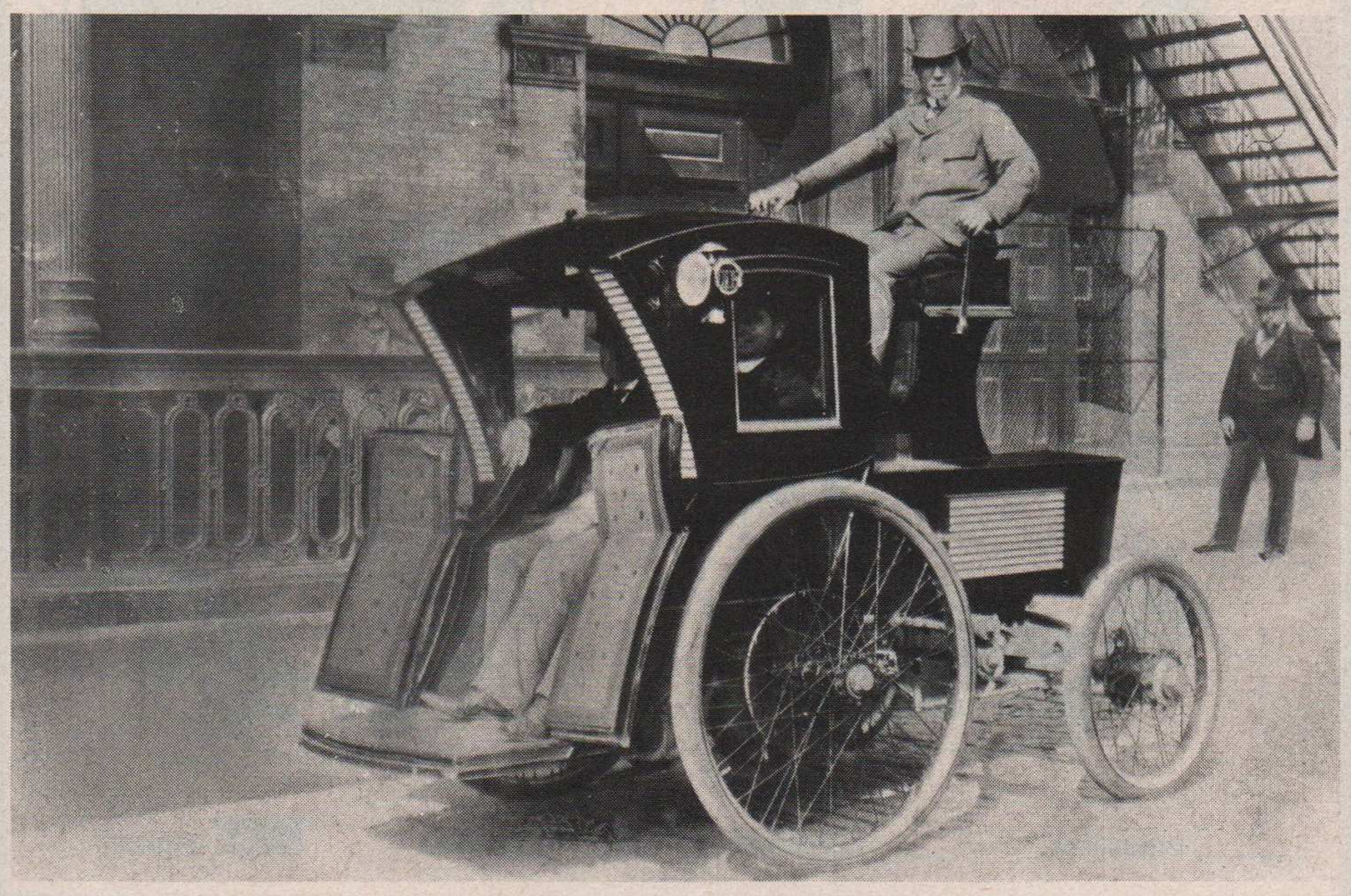
Alternatives to conventional batteries now available or in prospect tend to be very expensive or to require very rare materials; or the use of very dangerous or toxic liquids; or to generate very high internal pressures or temperatures; or to combine two or more of these drawbacks. Nevertheless, there could be good commercial prospects for small electric town cars, using conventional batteries, if the present emphasis on performance could be transformed into equally enthusiastic regard for cleanliness and silence. Advocates of electric traction extol the low "fuel costs" by comparison with petrol or diesel oil, but they overlook one fundamental fact. If electric vehicles became plentiful no government could resist taxing their fuel, probably by means of a sealed mileage recorder, so that no advantage would remain. This was foreshadowed more than 140 years ago when Faraday showed his embryonic electric motor to Sir Robert Peel. On being asked what use it would be he replied: "I don't know Sir, yet—but I do know government will find some way of taxing it."

Similar arguments apply, and are similarly overlooked, to the steam car's ability to burn low-grade fuel. The enthusiasm for steam cars has never vanished and has been considerably reinforced in recent years. Between 1897 and 1931 approximately 180 different companies offered steam cars for sale to the public. This is a formidable total even if one allows for the fact that many companies folded up after selling perhaps fewer than a dozen cars, and a number did no more than impoverish their shareholders and publish some optimistic publicity.

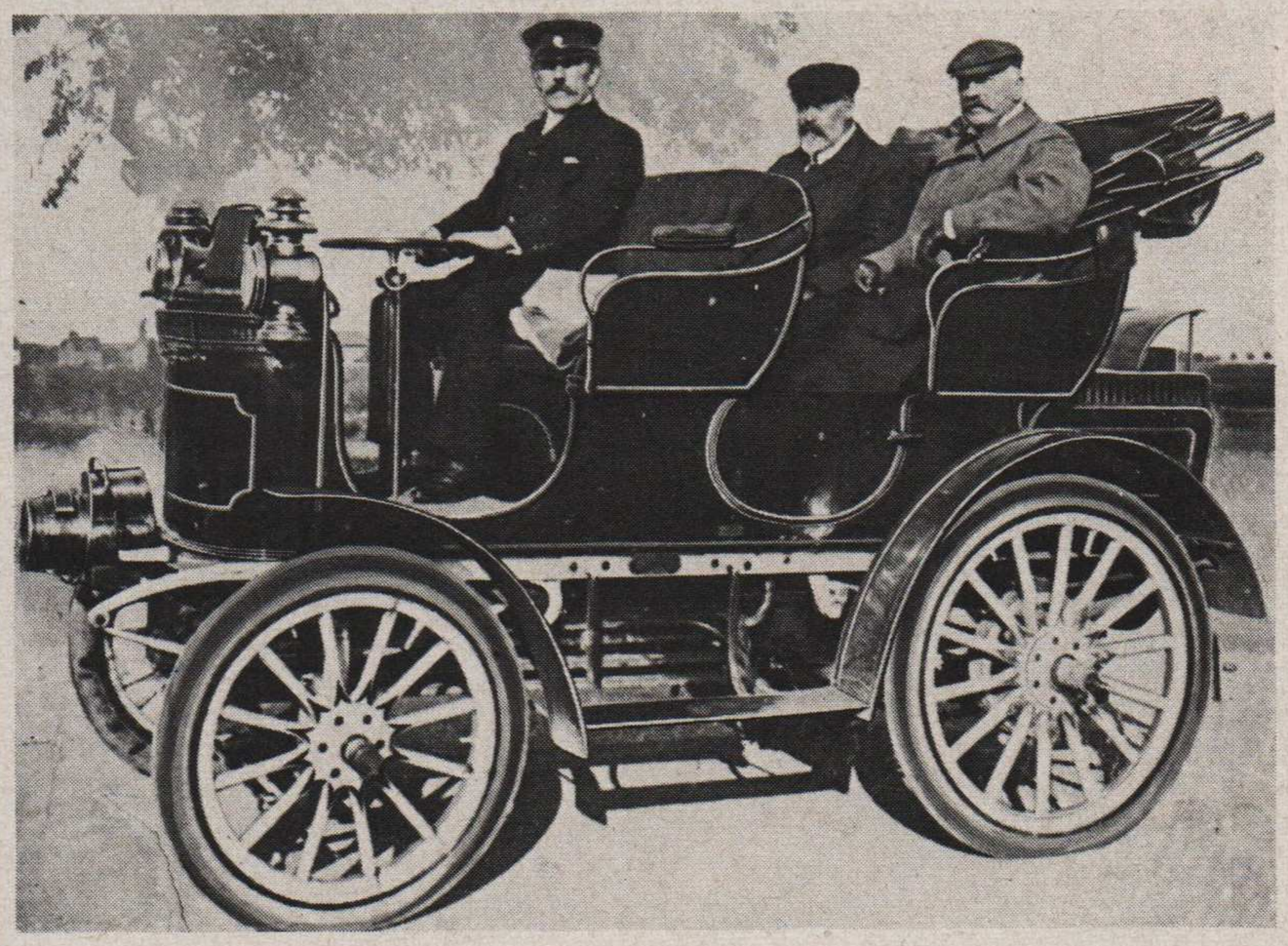
A conventional reciprocating steam engine can be very quiet, tolerably vibration-free and have such a "flat" power curve that it may start a car from rest and accelerate it smoothly and swiftly to maximum speed without the intervention of a clutch and change-speed mechanism. This seems ideal: so what went wrong, and why did those 180 companies vanish? Steam enthusiasts say

Left: Jenatzy's electric car of 1899, La Jamais Contente

Below: Electrically-powered cabs were to be seen in London and New York in the 1890s



THE DEVELOPMENT OF THE PASSENGER CAR



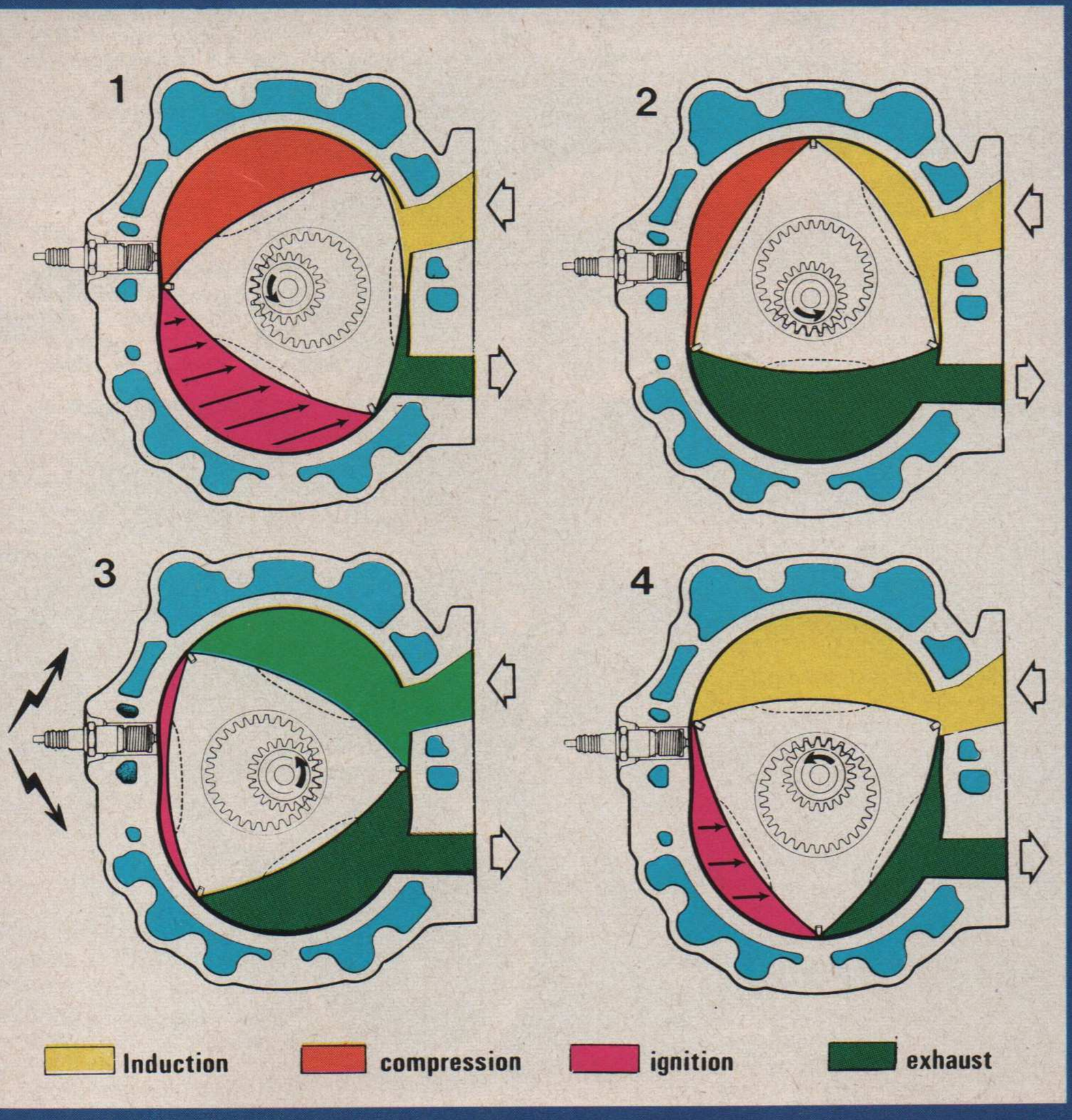
The Prince of Wales takes a drive in his Serpollet steam car in the year 1900

it was because of unfair discrimination, particularly by the oil companies. This argument will not stand for a moment, as all the steam cars put on the market since 1895 have burnt petroleum, either as petrol, kerosene or furnace oil, and burnt it, moreover, in greater quantity than conventional cars of comparable performance.

Unfortunately, the wonderful flexibility of the steam engine has never been matched by corresponding flexibility of the burner-boiler-condenser system. Much of the simplicity of the engine has been counterbalanced by nightmarish complexity of heat-sensing and boiler control devices which, ingenious though they are, still do not equal the flexibility of the theoretically inflexible petrol engine. Nor has it yet been possible to make a steam engine, burner, boiler, condenser, assembly, with the necessary ancilliaries of fuel and water pumps, tanks, etc, as light and compact as the engine, radiator, petrol tank and gear-box of the conventional car. The greatest snag lies in the fact that poor though the thermal efficiency of a petrol engine is, that of a steam engine is worse. Narrowing the gap by raising the pressure of the steam also, of course, raises the temperature, whereupon lubrication and sealing problems begin to obtrude. The gap is still considerable, and recent tests with an experimental steam 'bus in California showed that it consumed fuel at the rate of just under 0.74 mpg against 4.5 mpg for a diesel 'bus. This also undermines the clean exhaust claims for the steam car's burner, as there is no point in halving the offensiveness of exhaust gases if you throw out five times as much of them.

Rather the same problem applies to the most promising of the alternatives, the Wankel. Everybody who has driven a Wankel-engined car speaks highly of its smooth, vibrationless, quiet behaviour. Early troubles with rapid wear of rotor seals and consequent unreliability seem to have been overcome, and the Wankel barometer ought to be at Set Fair. There are clouds though, and they take the shape of a heavy fuel bill. As the world begins to wake up to the realisation that oil supplies are not inexhaustible the Wankel's relative greed becomes more serious. Nor does it seem a readily curable weakness, as fuel economy is very closely linked with the proper shaping of the combustion chamber; but the one thing you cannot do with a Wankel is to design its combusion chambers so that they burn fuel economically, for the simple reason that they constantly change their shapes as the rotor revolves.

It seems certain that there will be more and more Wankel-engined cars on the roads during the next 10 years, but that they will ultimately dominate the scene is much less certain. The "nasty explosion engine" of the 1890's, which was once described as "barking like a dog and stinking like a cat", with its clumsy trunk pistons moving to and fro, improbably sucking in an "inflammable smell" from a sort of glorified scent spray, to be set on fire by an implausible electric spark, whereupon nine tenths of the resultant heat is immediately thrown into the atmosphere via the radiator and exhaust pipe, seems likely to be going about its business for some time yet. □



Left: The introduction of the Wankel rotary engine in a production car in the 1960s seemed to offer great promise as an alternative to the piston engine. Now Comotor have developed a twin-rotor Wankel which is to power a version of the advanced Citroen GS. This engine works on the four-stroke cycle. The air/petrol mixture moves in through the inlet port and the rotor then shuts off the inlet and begins to compress the mixture. The spark produced by the sparking plug causes combustion of the petrol gas mixture when compression is greatest and expansion causes the rotor to rotate and provides the driving power. The rotor then clears the exhaust port allowing evacuation of the burnt gasses