
CAR

S T Y L I N G

1930 ————— 1983

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EUROPEAN CAR STYLING SINCE 1930

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INTRODUCTION

The time scale of this essay(1930 to the present), was decided because of the lack of styling in cars before this time. Bodywork was added to a chassis and it wasn't until the introduction of the integral structural body that cars were unified visually. American cars are not dealt with in detail because of the bewildering style changes from year to year, U.S. styling lacks the continuity of European styling. Japanese styling hasn't reached maturity yet because of it's short time span(it has been said that Japanese cars are such an amass of unrelated details, because the Japanese have so little space to stand back and look at them from a distance).

The scheme of chapters is intended to gradually make the reader more involved in cars; the first chapter shows changes in parts of cars and defines the elements in question.

The second chapter goes through the changes in chronological order and shows changes in contemporary designed objects.

The reader should now be involved enough to appreciate the technical advances which changed car styling. These are shown in the third chapter.

The fourth chapter views the shape of cars in a more abstract way, some of the comparisons in this chapter might seem a little unlikely but they are useful in helping us to see such familiar objects as cars with new eyes. I am indebted to Jan Meissner for parts of this chapter, his manuscript on car styling is in NCAD library.

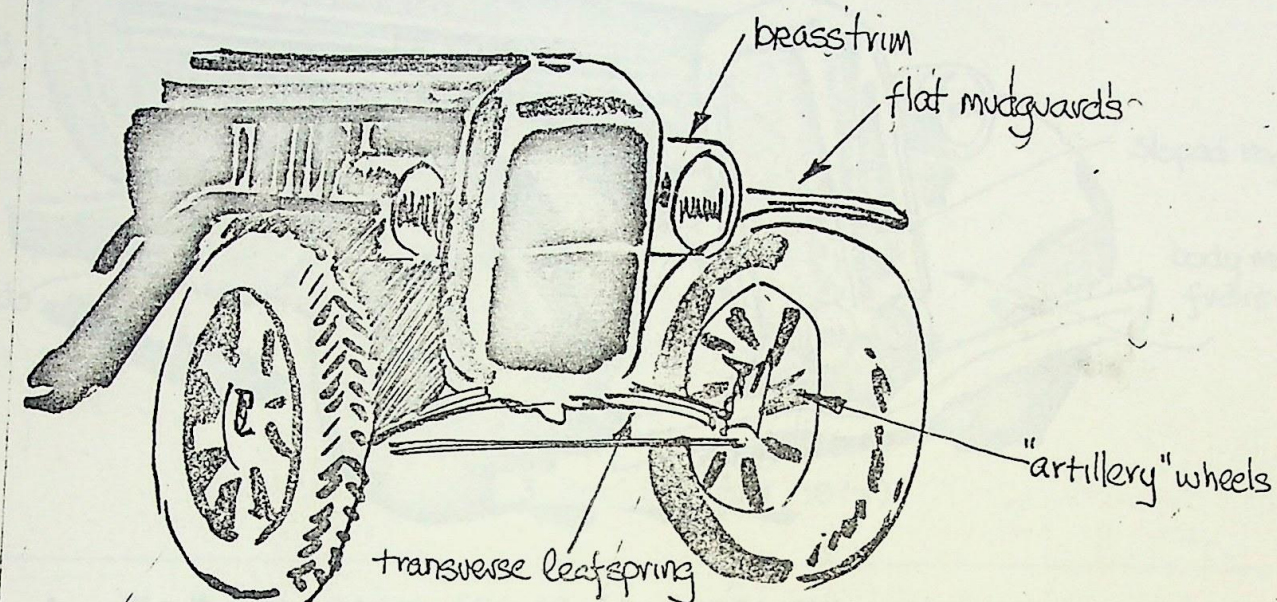
The final chapter extrapolates from the present to give a view of what future cars might look like.

Looking at car styling from an Industrial Designer's point of view is a worthwhile enterprise and something which hasn't been done often enough; most books and articles are written by total car enthusiasts and don't place cars in the context of the universe of design.

I would like to thank my tutor William Garner for his enthusiastic help with this work. I would like to thank my sisters Grace and Magser for their help with the typing(my mis-typing in this essay is to be found in parts which I typed myself).

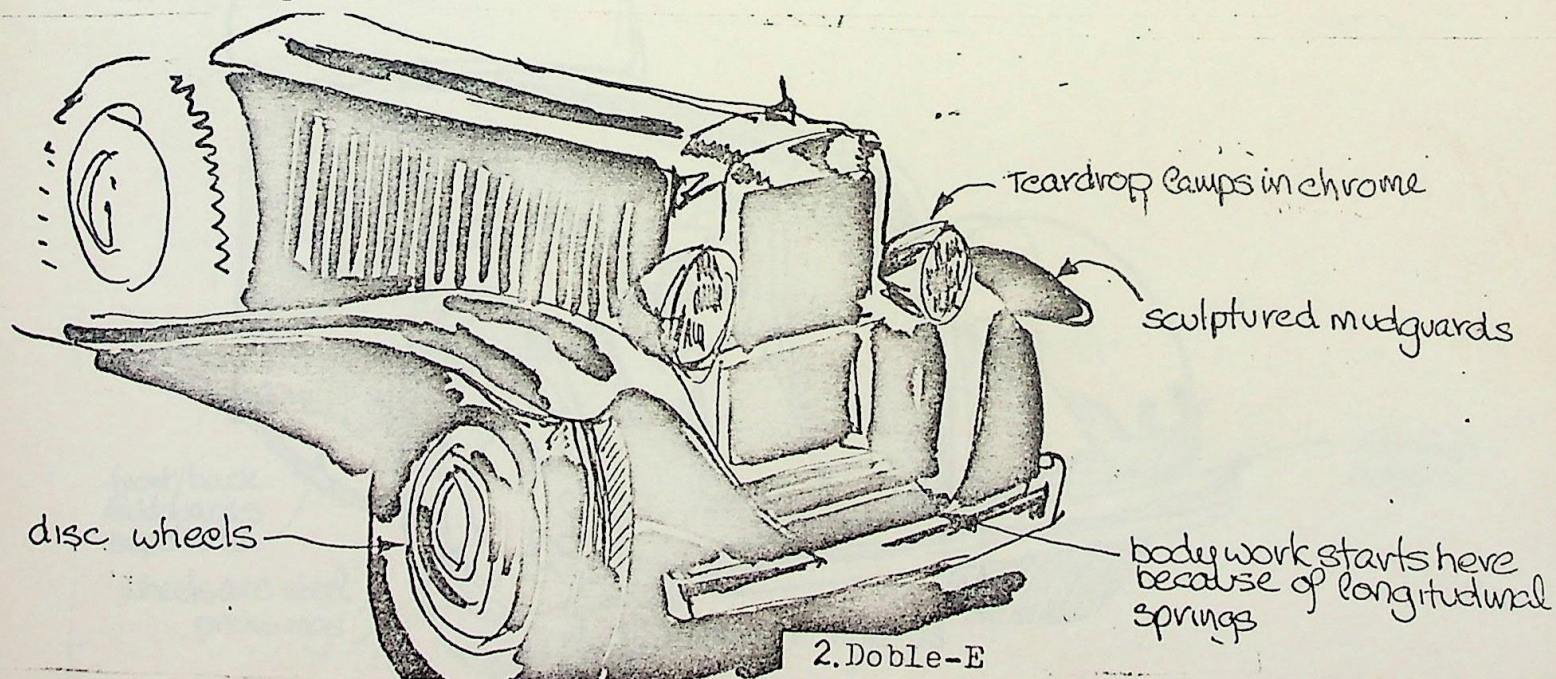
Chapter 1. The Changing Shape of Motor Bodies

1. Fig 1 shows a Citroen B2 of 1921 vintage. Its styling is very upright. In side view its radiator is placed directly above the front axle. The reason for this is that this is the end of the chassis and leaf springs (either longitudinal or transverse) had their centres attached here. All trim: radiator shell, lamps etc., were finished in brass as chrome plating had not yet come into use. Bumpers were optional and mudguards were likely to be made of thick flat steel.



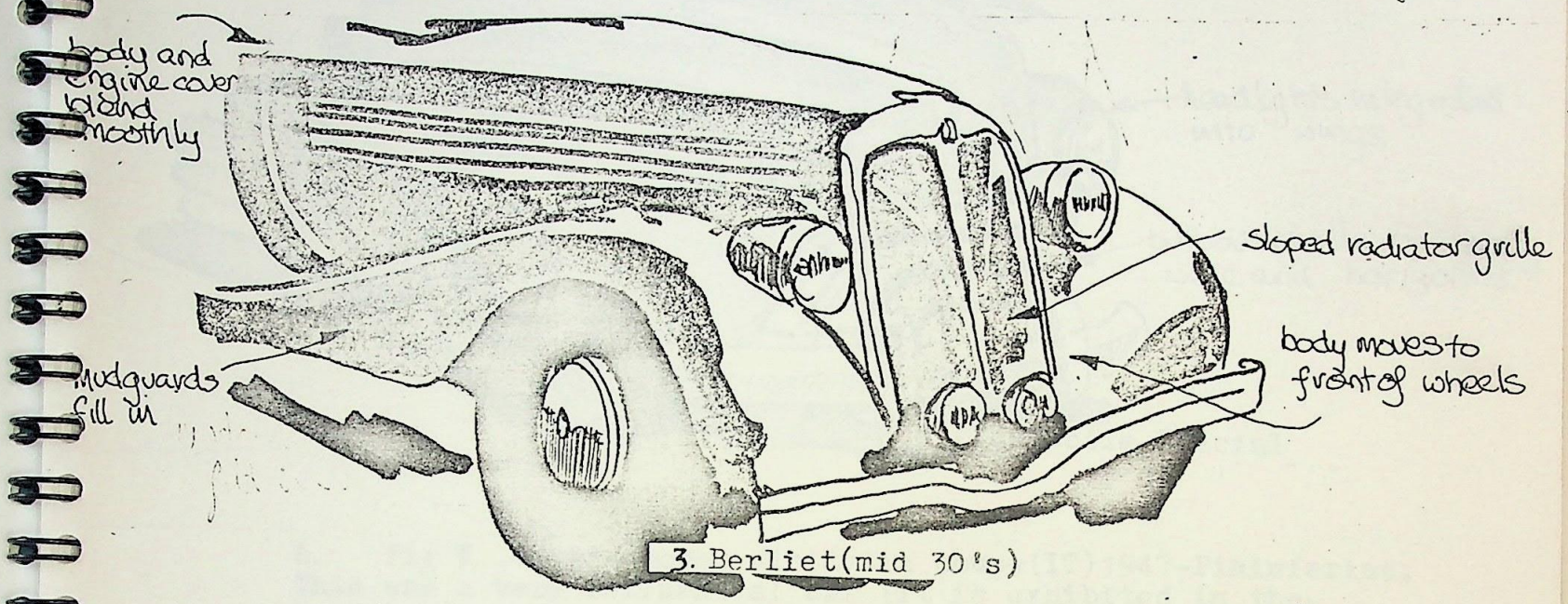
1. Citroen B2

2. Fig 2 shows a "Doble E" of 1932. This car shows the influence of aerodynamic thinking in the teardrop shape of the lamps. The mudguards do not envelop the wheels but are starting to achieve a more sculptured look; they start in the centre of the front, well in front of the radiator and sweep back from a peak in front of the tyres, like wings. They then run back in a smooth curve to become the running board.

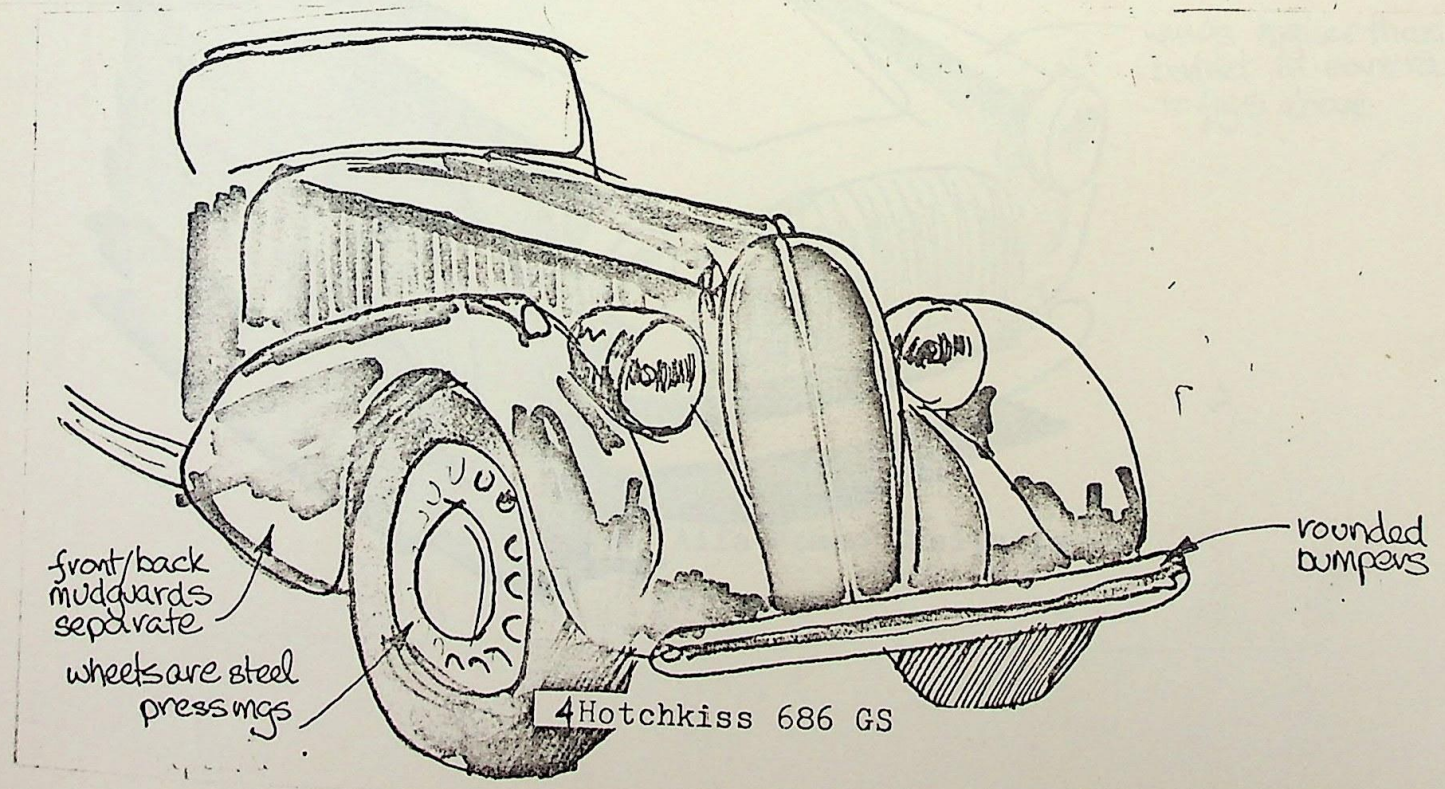


2. Doble-E

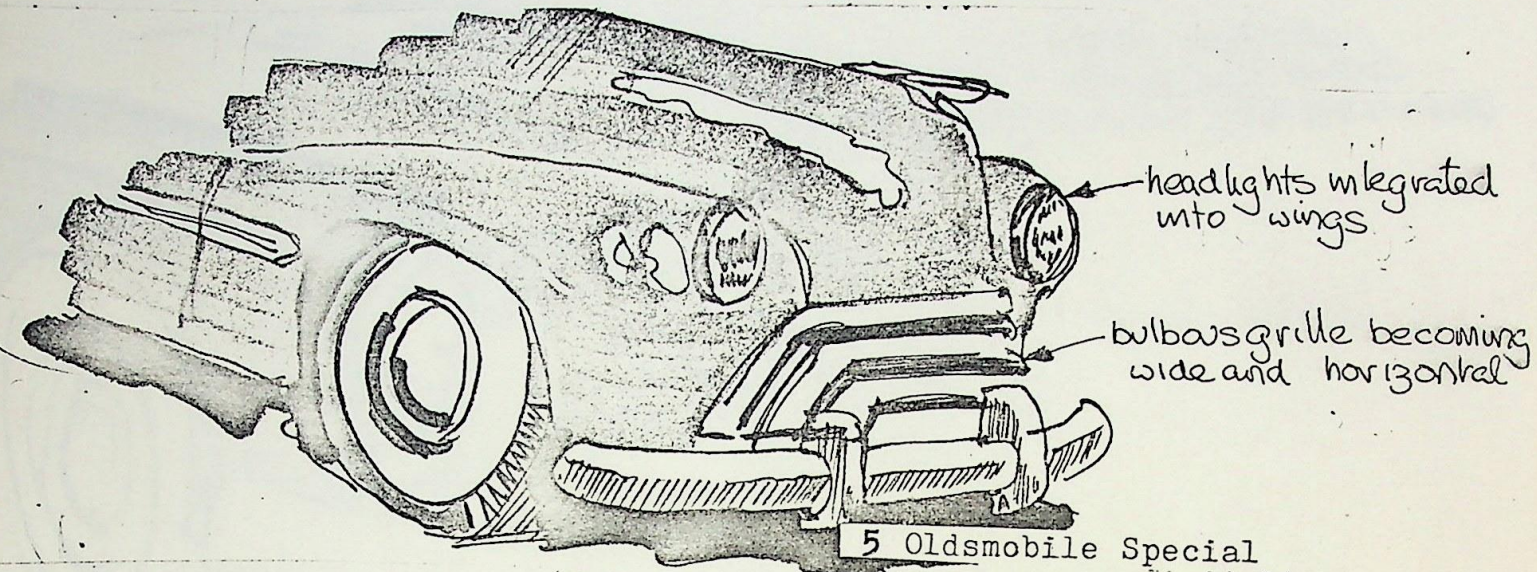
3. Fig. V.-a Berliet of the mid 1930's. This picture shows the radiator grille dis-associated from the radiator itself and swept up from a point well in front of the front axle. The headlights have acquired a more distinct "drop" shape and the bumpers while still made of flat metal, have become "V" shaped in the centre. The engine cover widens towards the rear to flow smoothly into the lines of the body. The mud guards at the sides enclose the wheels to a much greater degree. The style of body where the lines of the bonnet merged with those of the body, was known as the "torpedo body" style.



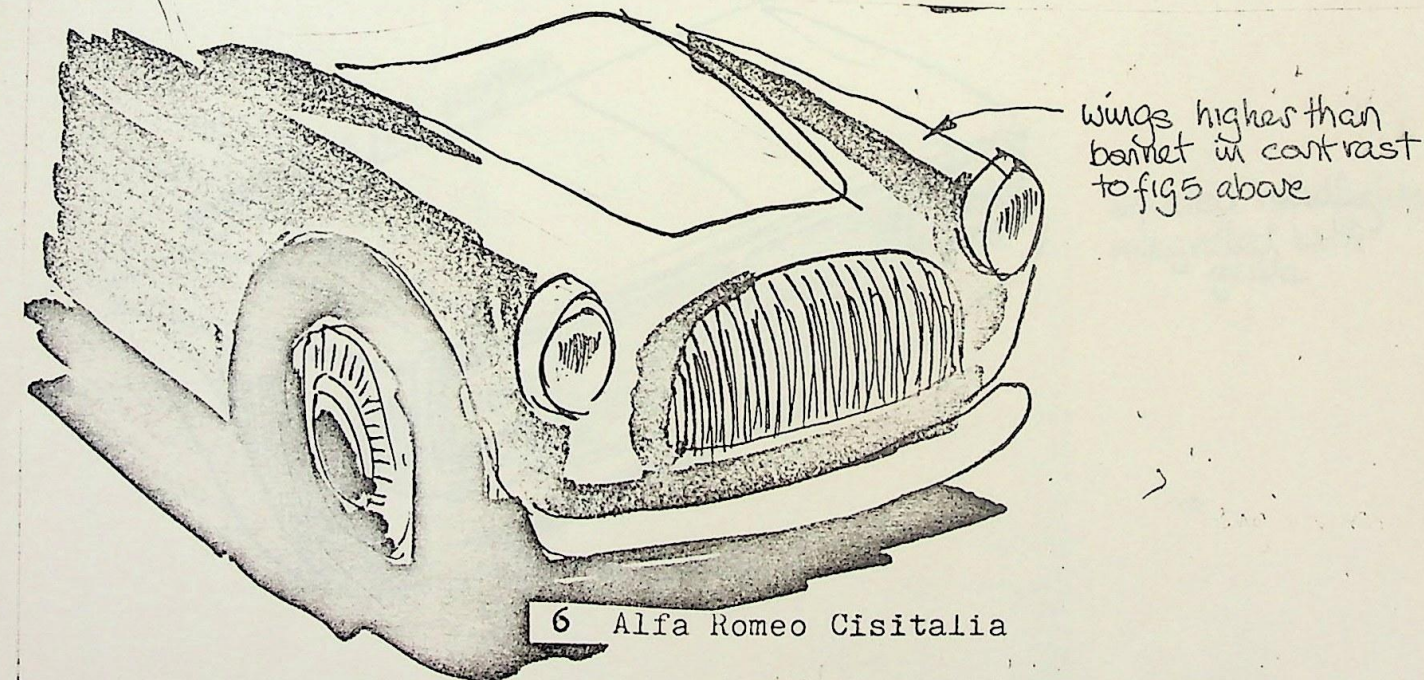
4. Fig. V.-Hotchkiss 686 GS (fr.) 1931. This shows the mudguards being separated from the car body and related to the wheels. Both the bumpers and the wheels, as well as the mudguards are now steel pressings. The grille has become more ornamental and less related to the radiator (the radiator is sitting straight and square a foot or so back from the grille). The long narrow engine cover, covers a long narrow straight eight cylinder engine.



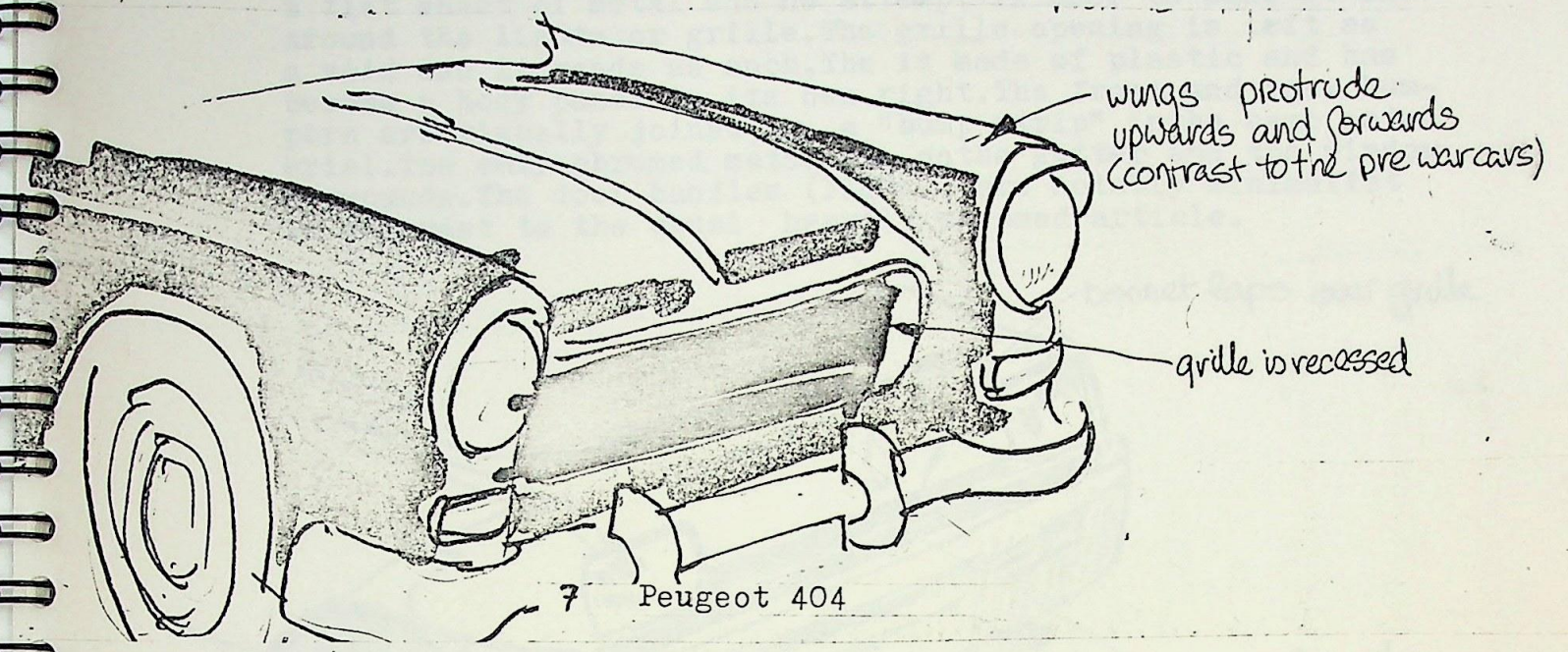
5. Fig 5.-Oldsmobile Special (U.S.), 1946, based on 1941 "Dynamic". The engine cover and wings blend with each other. The lights are integrated with the wings and the grille does not relate to the radiator at all. Chrome is starting to appear on the stylist's palette in large amounts and the tyres play a more sculptural role in the body. This type of "big fender" styling was influential in British styling in the decade after the war and remained current in American pick-up trucks until the sixties.



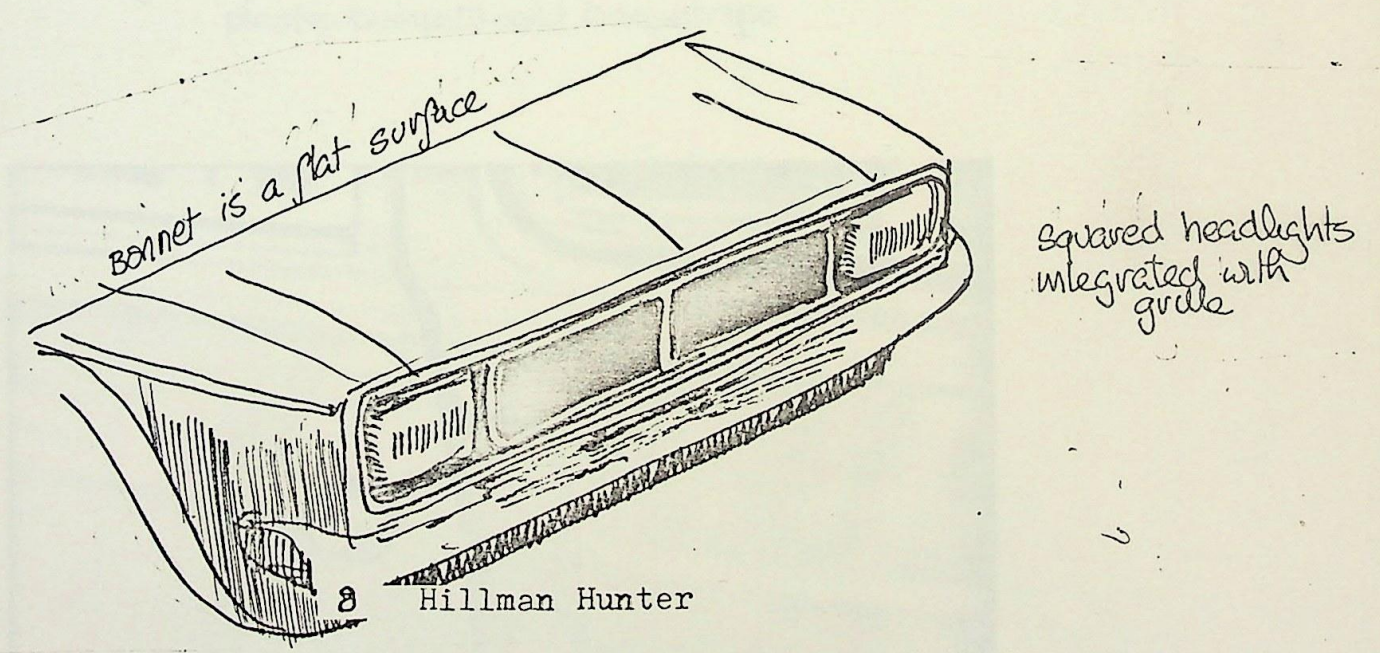
6. Fig 6.- Alfa Romeo Cisitalia coupe (IT) 1947-Pininfarina. This was a very influential car (it is exhibited in the Museum of Modern Art, NY, permanent design collection). It was the first "PONTON" body; that is it was the first body to have the wings and the engine cover blended together. The wings however rise proud of the bonnet, it will be noticed.



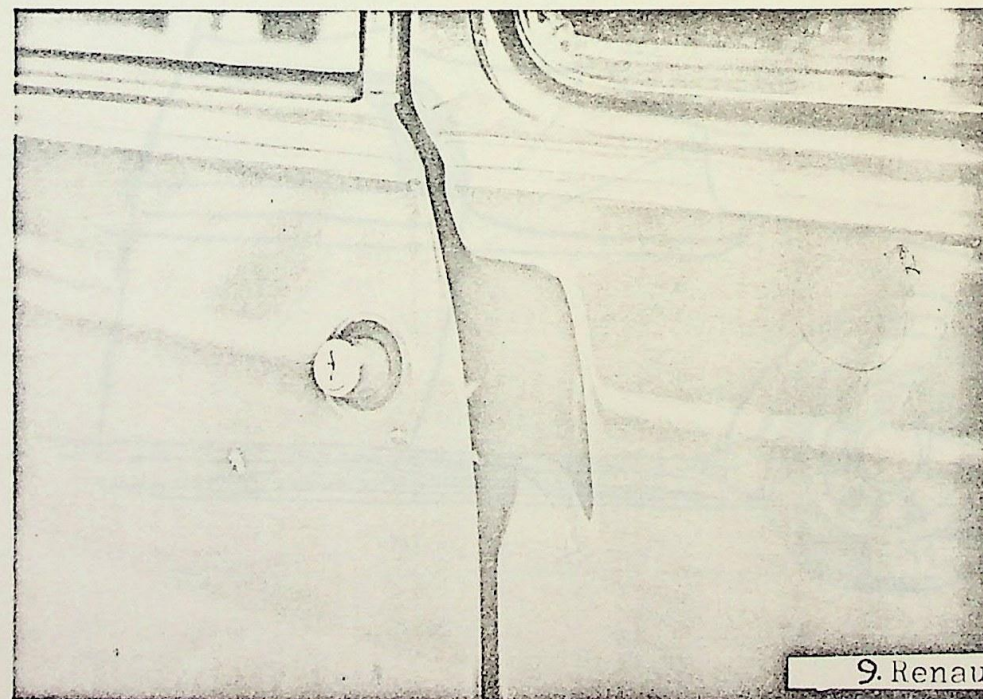
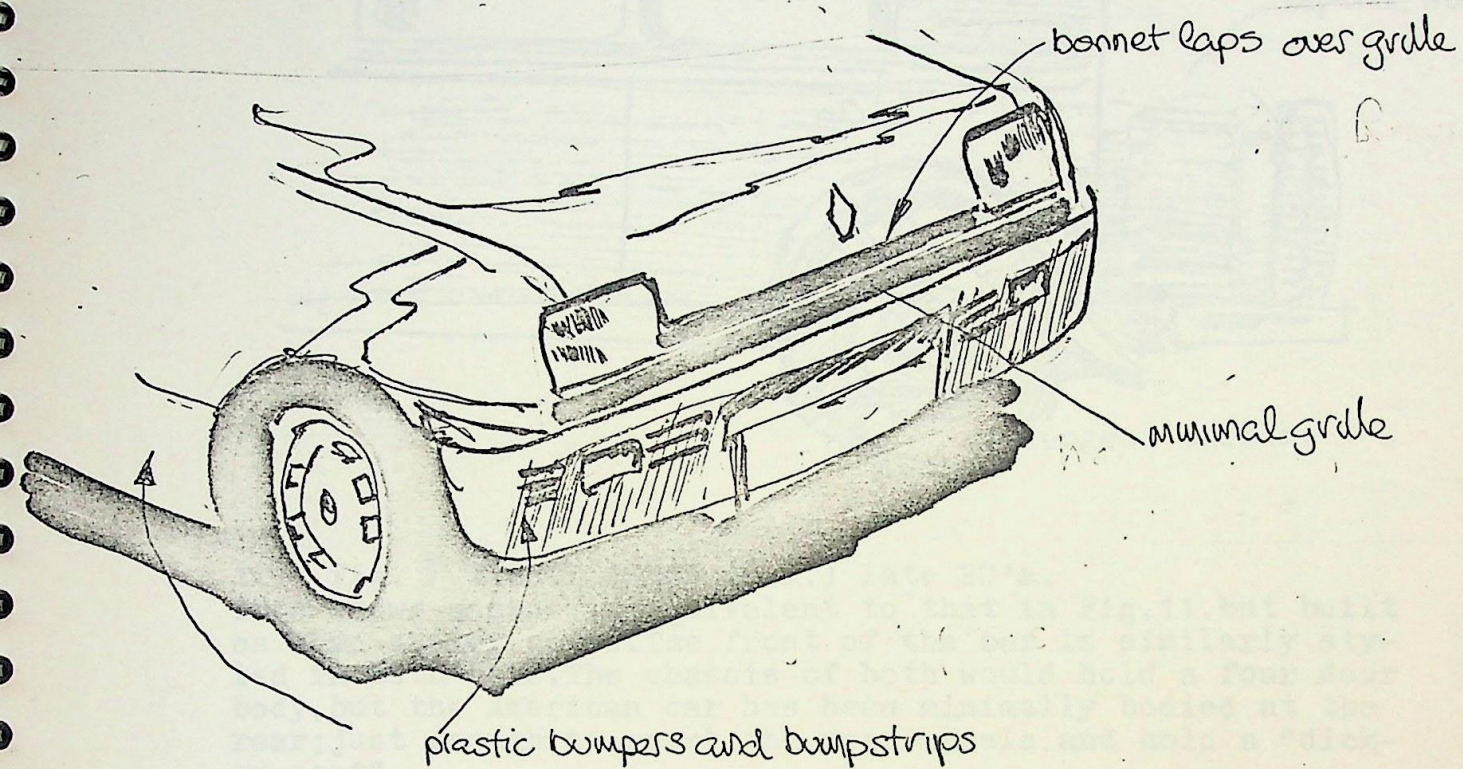
7. Fig 7. Peugeot 404 (A19). (FR.) 1956 Pininfarina. This car is very similar to the Morris Oxford-Austin Cambridge styled at the same time by the same man. This car shows the influence of the "peaked" look prevailing among American cars of the time. The wings at the front and rear rise over and dominate the bonnet and bootlid. The lines between front and rear are straight.



8. FIG 8 Hillman Hunter 1970 (G.B.). In this car the bonnet and boot lid are flat from side to side and almost flat from front to back. The lights and grille are integrated into one flat rectilinear panel. There is much less brightwork on this car than there would be on a similarly sized car of ten years earlier. The only brightwork on the grille consists of thin outlines picking out the black plastic.



9. Fig. 9. Renault 5(fr) This illustration shows some current styling features. The bonnet panel is turned down over the nose of the car. This is a derivation from the Ferrari Daytona 365 GTB ('72). The same feature is found in such current cars as the Rover SD1, Vauxhall Cavalier, and many U.S. coupes. In this way the bonnet is expressed frankly as formed from a flat sheet of metal and no attempt is made to make it flow around the lights or grille. The grille opening is left as a void and it reads as such. The grille is made of plastic and has become a body panel in its own right. The front and rear bumpers are visually joined by a "bump strip" in the same material. The only chromed metal is on the gutter and the window surrounds. The door handles (Fig. .) are notably minimalist in contrast to the usual heavily chromed article.

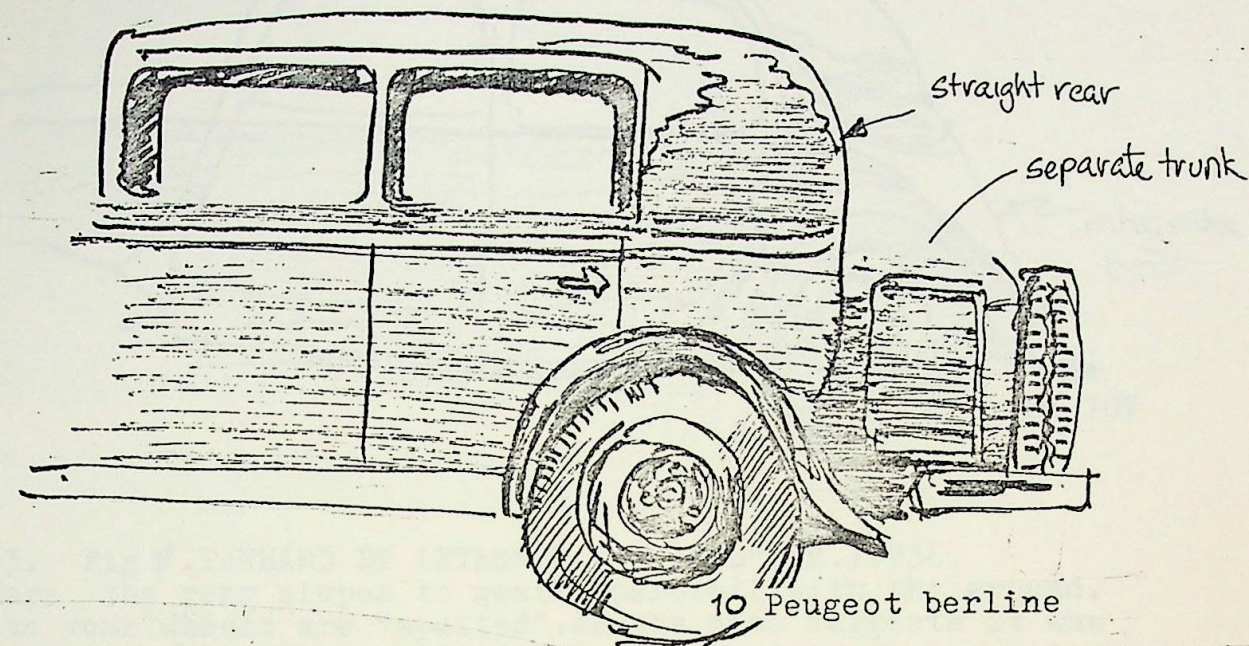


9. Renault 5

REARS.

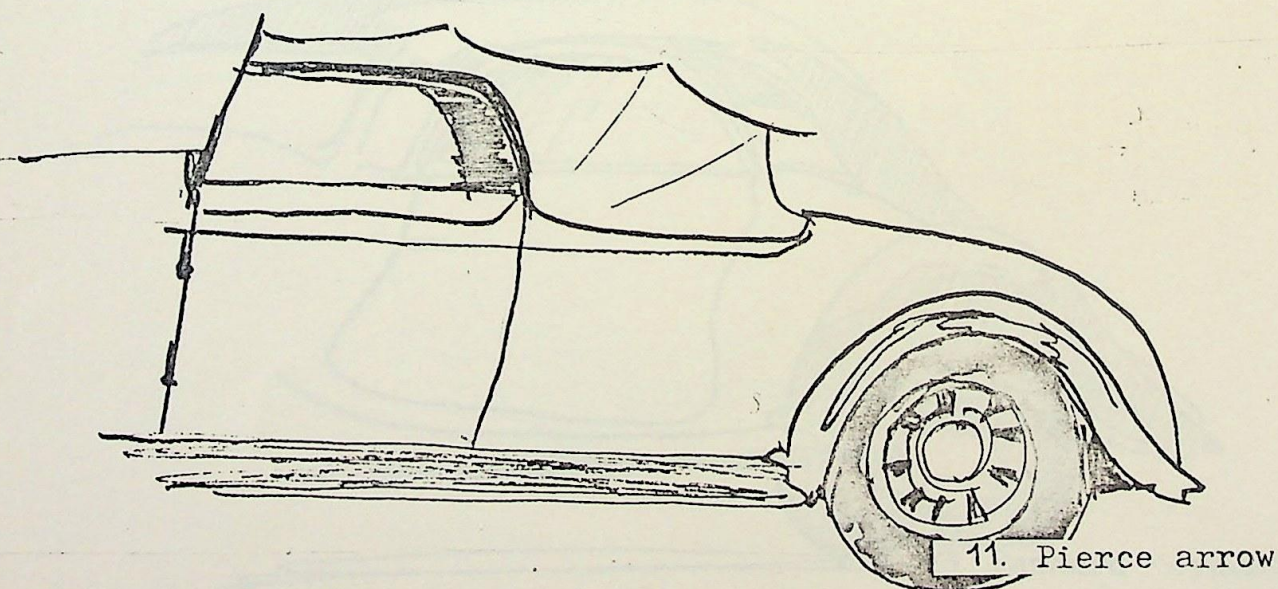
10. Fig. V. PEUGEOT Berline-(Fr.) early '30's.

This picture shows the rear coming down vertically in regulation fashion for the times. The back drops from the roof to a point just behind the rear wheels, where it tucks itself in. The trunk is literally that and the spare wheel is held between it and the rear bumper. This configuration owes much to coachbuilding tradition and little to a designer's skill.



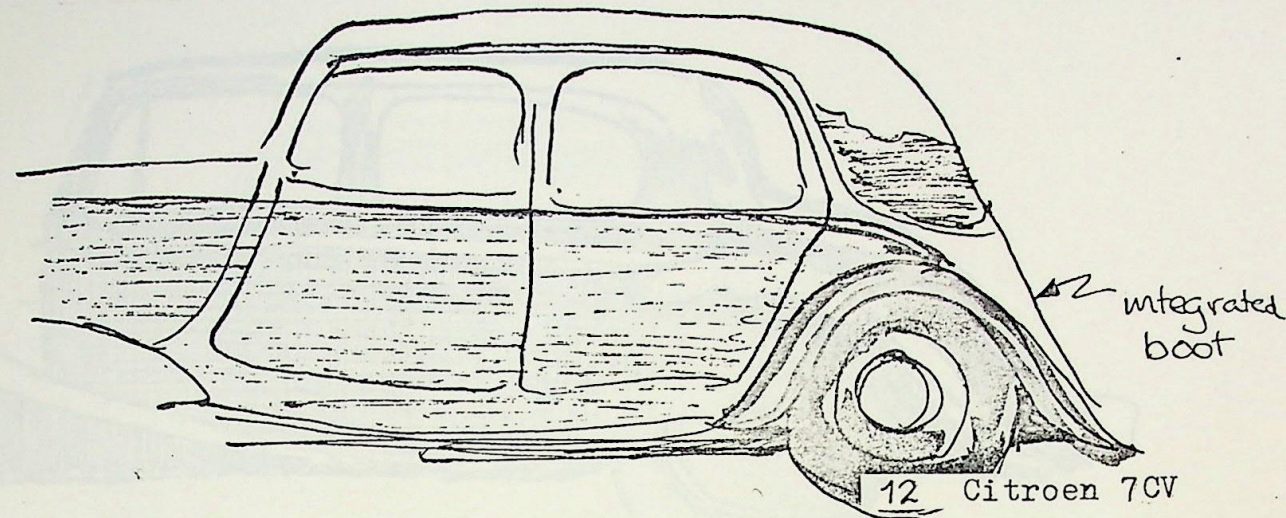
11. Fig. V. PIERCE ARROW (U.S.) late 20's.

This shows a chassis equivalent to that in Fig. 11, but built as a two-seater coupe. The front of the car is similarly styled in both cars. The chassis of both would hold a four-door body, but the American car has been minimally bodied at the rear; just enough to reach the rear wheels and hold a "dick-ey seat".



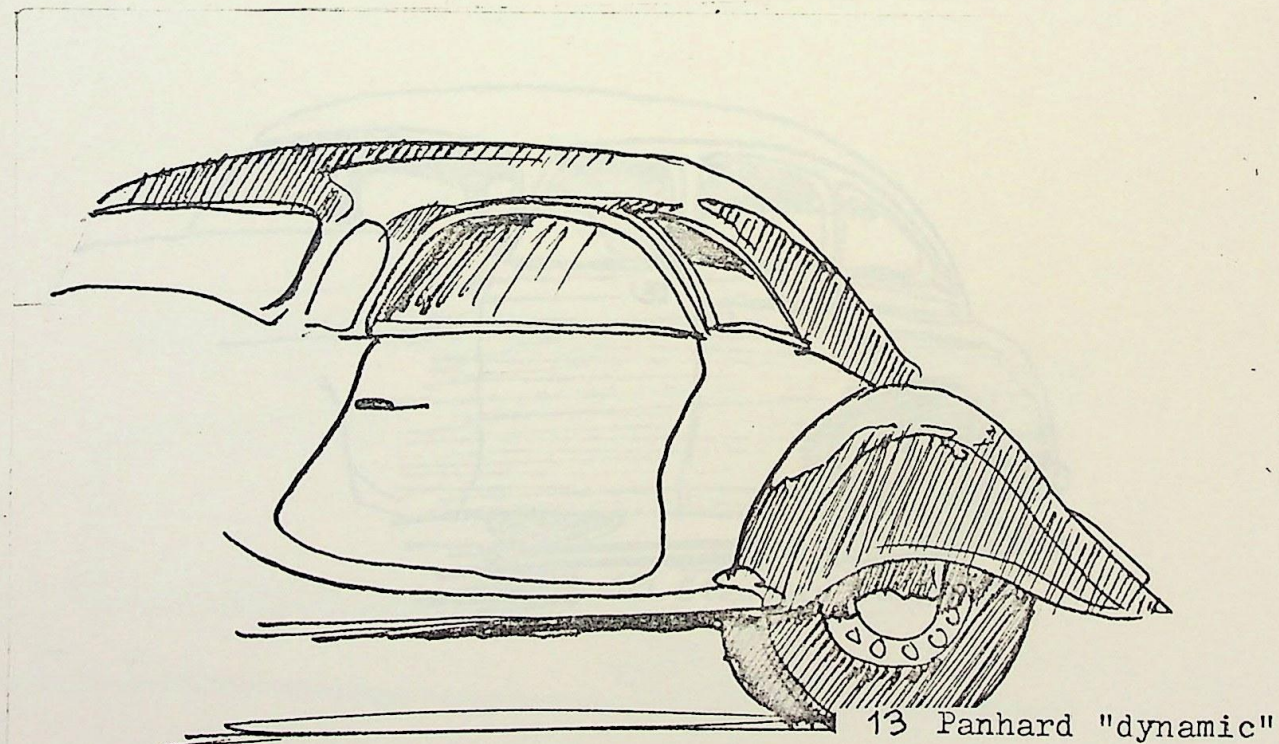
12. Fig. ▼ 7CV CITROEN 1935 (FR.)

Here the line of the windows is lowered to the top of the mudguards and the boot is integrated in the sloping rear. The rear wheels are farther back than previously because the adoption of torsion bar suspension on this car meant the elimination of the rearward leaf spring mounting points.

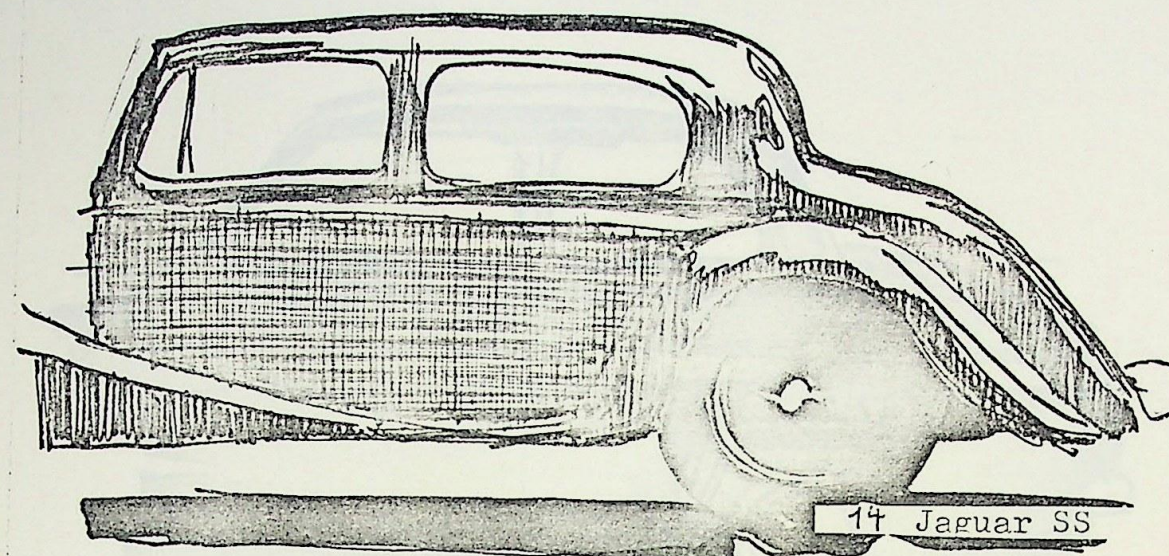


13. Fig ▼. PANHARD ET LEVASSOR "DYNAMIC" (FR.) 1936.

Here the rear slopes to nearly parallel with the ground. the rear wheels are "spatted". As the name suggests it was following the aerodynamic trends of the time; the rear tapers lingeringly in order not to create turbulence in the air behind the car. The detailing however is not in accord with this rational approach and the art- nouveau arcs of the windows and mudguards give a sense of acuteness and unease at odds with the smooth outline of the car. Compare with fig. 24 ►

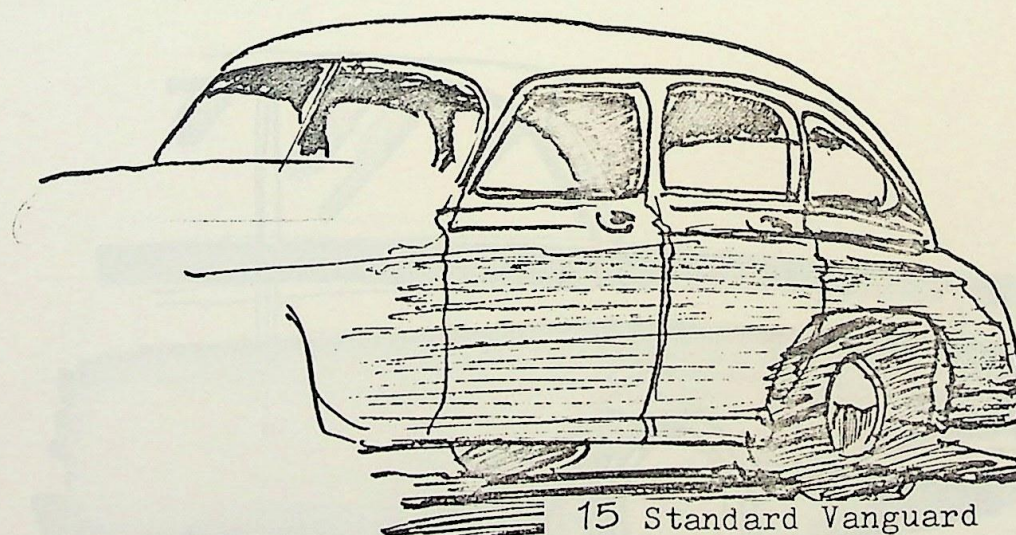


14. Fig. ▽ JAGUAR SS (G.B.) 1935. The boot of this car is expressed as separate from the passenger compartment but is blended smoothly with it. It has an eroded roundness about it but the tail looks too long and sharp to be safe in parking.

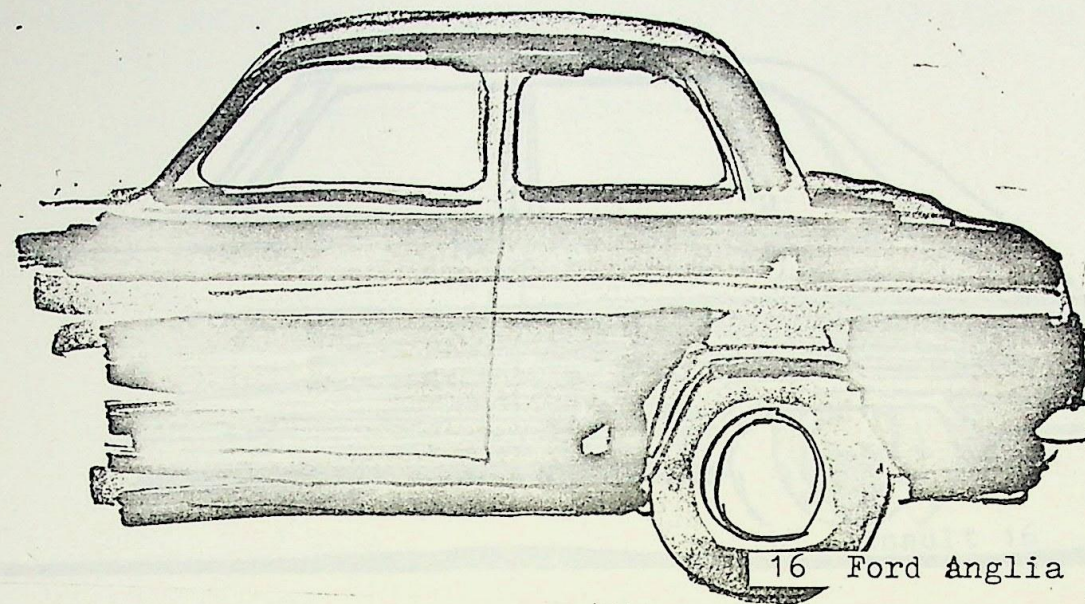


15. Fig. ▽ .STANDARD VANGUARD (G.B.) 1947.

This car does not have the eroded roundness of the previous one; instead it has the inflated roundness of the first unitary construction vehicles. In this form of construction the panels are structural so the deeper and more dished they are, the more resistant to torsion and resonance they are.

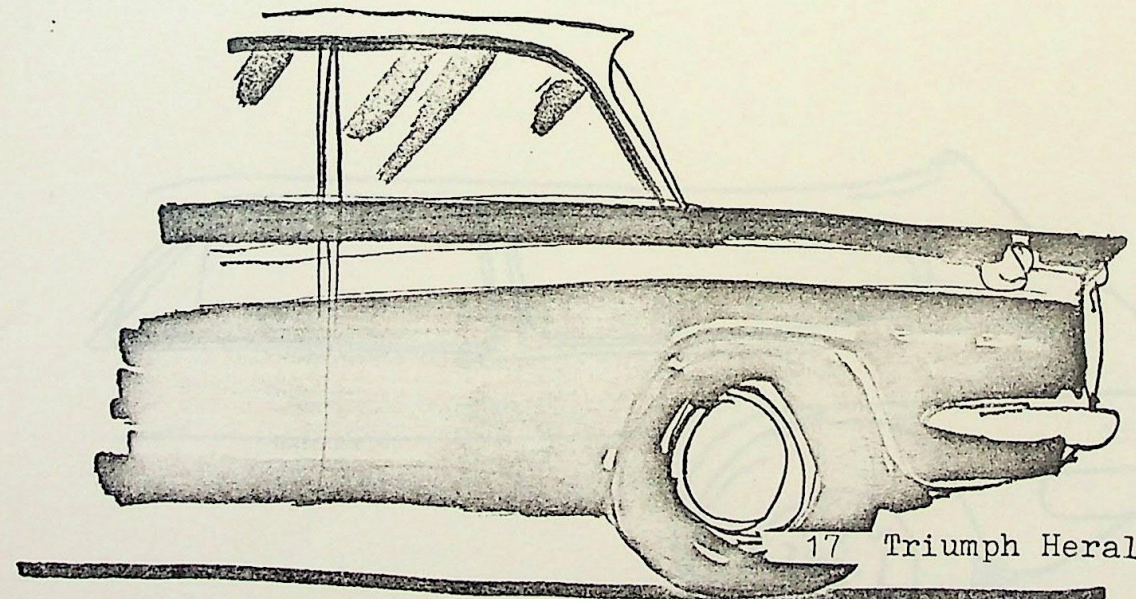


16. Fig. ▼ FORD ANGLIA 100E(G.B.)1953.
This is one of the first three box saloons. The boot is expressed as a box and so is the engine compartment. It is unlike the Cisitalia of fig. 6, which retains classic aerodynamic styling in its rear end.



16 Ford Anglia

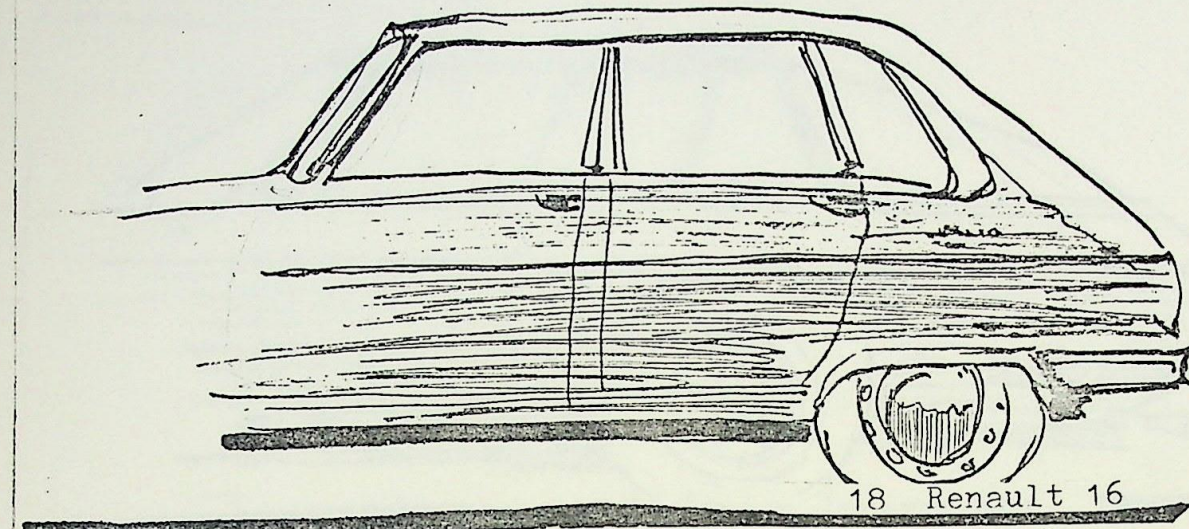
17. Fig. ▼ TRIUMPH HERALD (G.B.) 1959. Michelotti.
The three box saloon, but in the "peaked" mode. The roof has a very light look to it, unlike its contemporaries which either had the wraparound screens of the American "peaked" cars, or the reverse-raked windows of the FORD ANGLIA, CITROEN AMI, FORD CONSUL CAPRI. The sharp peak at the rear of the roof complements the peaks of front and rear wings.



17 Triumph Herald

18. Fig. ▽ RENAULT 16 (FR.) 1965.

A prototype of the hatchback style. A feature here is the concavity of the roof and hatch door: cars previously had either bulged or gone to a sharp lens shape, but avoided outright concavity. Rear wheel treatment is characteristically French in the negligible acknowledgement given to the rear wheels by the bodywork; see also CITROEN DS.

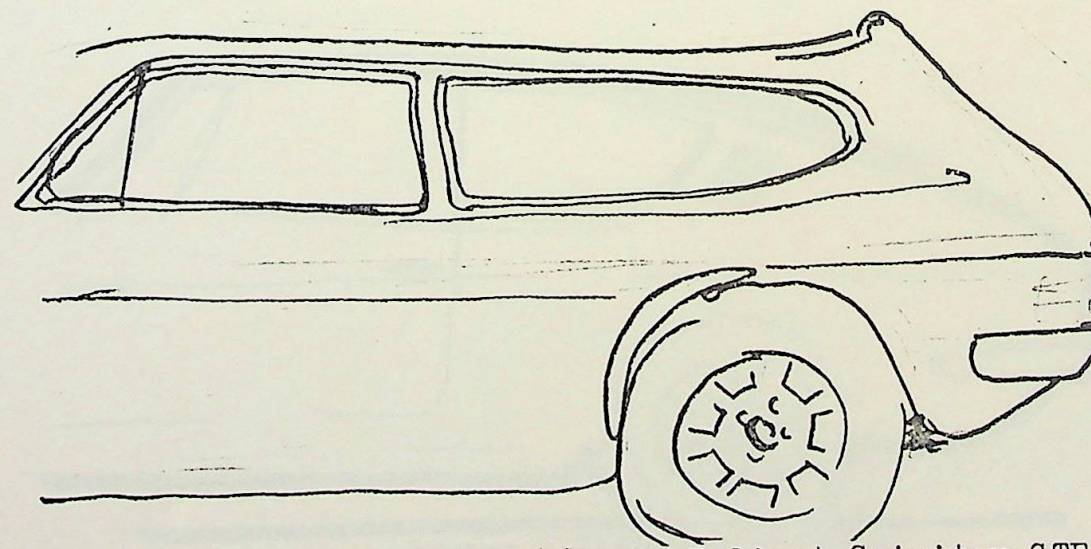


18 Renault 16

IN CONTRAST TO THE PROPHETIC RENAULT 16 HERE ARE THREE STYLES WHICH HAVE GONE OUT OF FASHION:

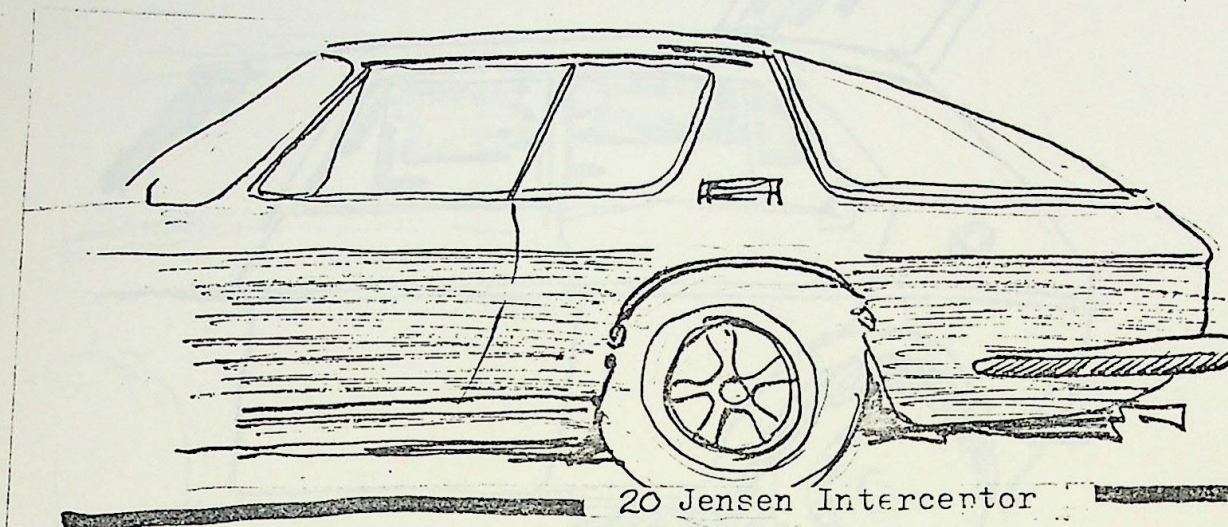
19. Fig. ▽. RELIANT SCIMITAR GTE (G.B.) 1967 OGLE DESIGN.

Here we have the gran turismo estate car style, which seems like a contradiction in terms. It had some success as a royal Corgi carrier, but apart from that it's only influence has been on the estate version of the BL Allegro, which also carries a hump on its back between roof and rear.



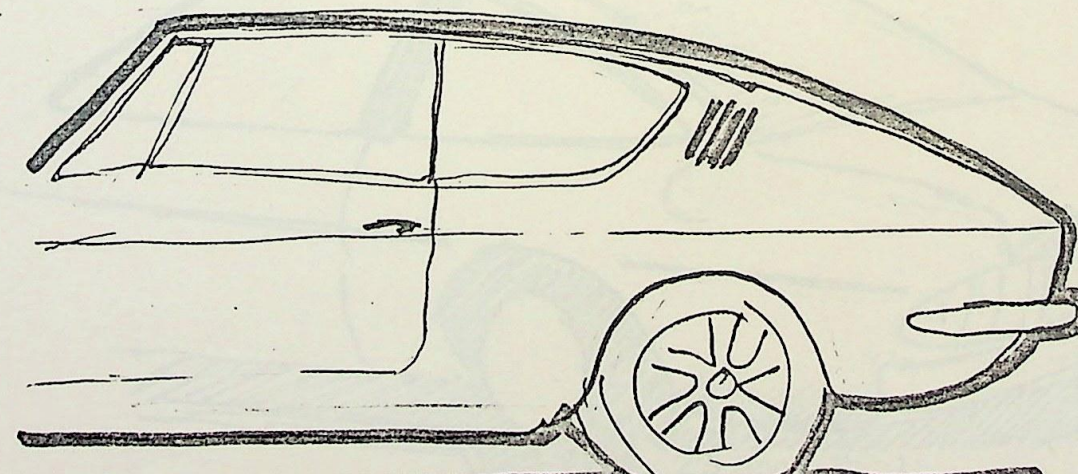
19 Reliant Scimitar GTE

20. Fig. V JENSEN INTERCEPTOR MK3 1966 (GB)-Vignale.
The notable feature of this car is its "glasshouse" roof at the rear. This feature probably owes something to the Plexiglass cockpit of American "dream" cars in the motor shows. It had disadvantages in the amount of ultra-violet rays it allowed onto back seat passengers and luggage. Compared to the flat windscreen one foot in front of a Renault 4 driver's face it is an impractical piece of glass. While it does continue the line from roof to back, it does appear to take away a lot of the metal supporting the rear of the car leaving only a narrow piece between wheelarch and window. The practise of using windows such as this has largely died out.



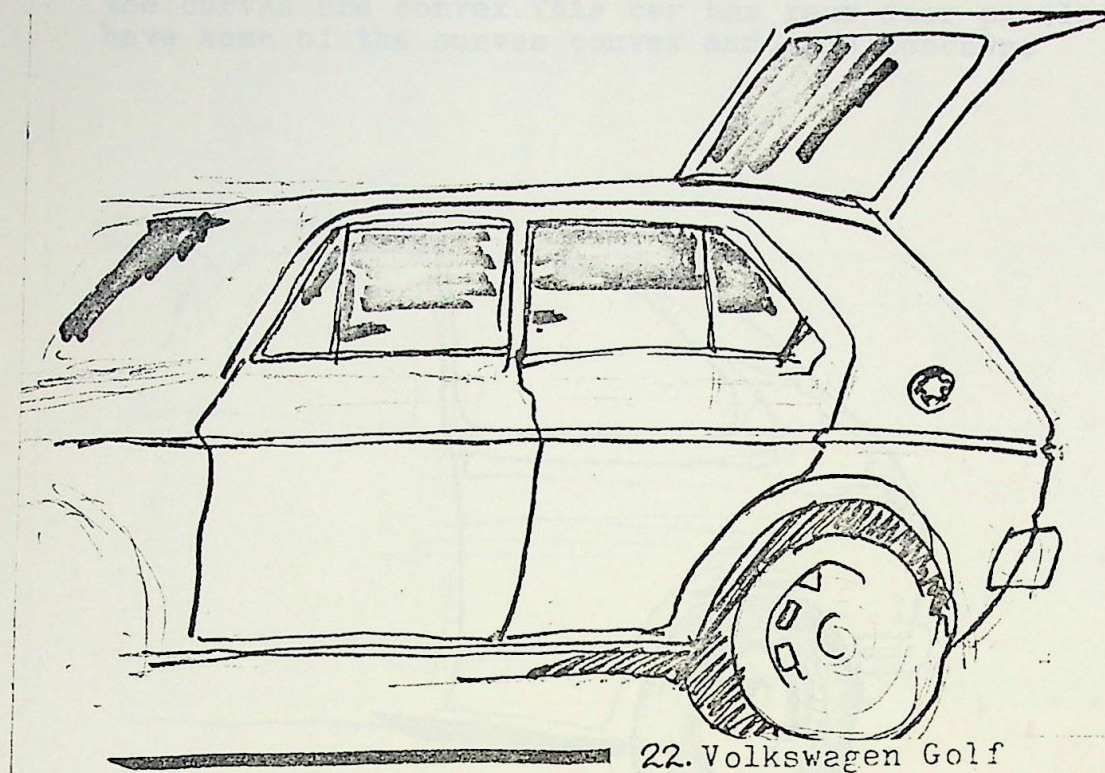
20 Jensen Interceptor

21. Fig. V AUDI 100 coupe 1970 (D).
-The fastback style-This style is characterised by the large triangle of roof pillar behind the rear window. Car customisers achieve the look by filling in the back windows of their cars. It looks very "butch" and reminiscent of MK 1 FORD Mustangs, but is derived from mid-engined sports cars where the engine is mounted above the rear axle and must be covered by bodywork. In a front engined car such as this the fastback has no function and causes poor rearward visibility as well.

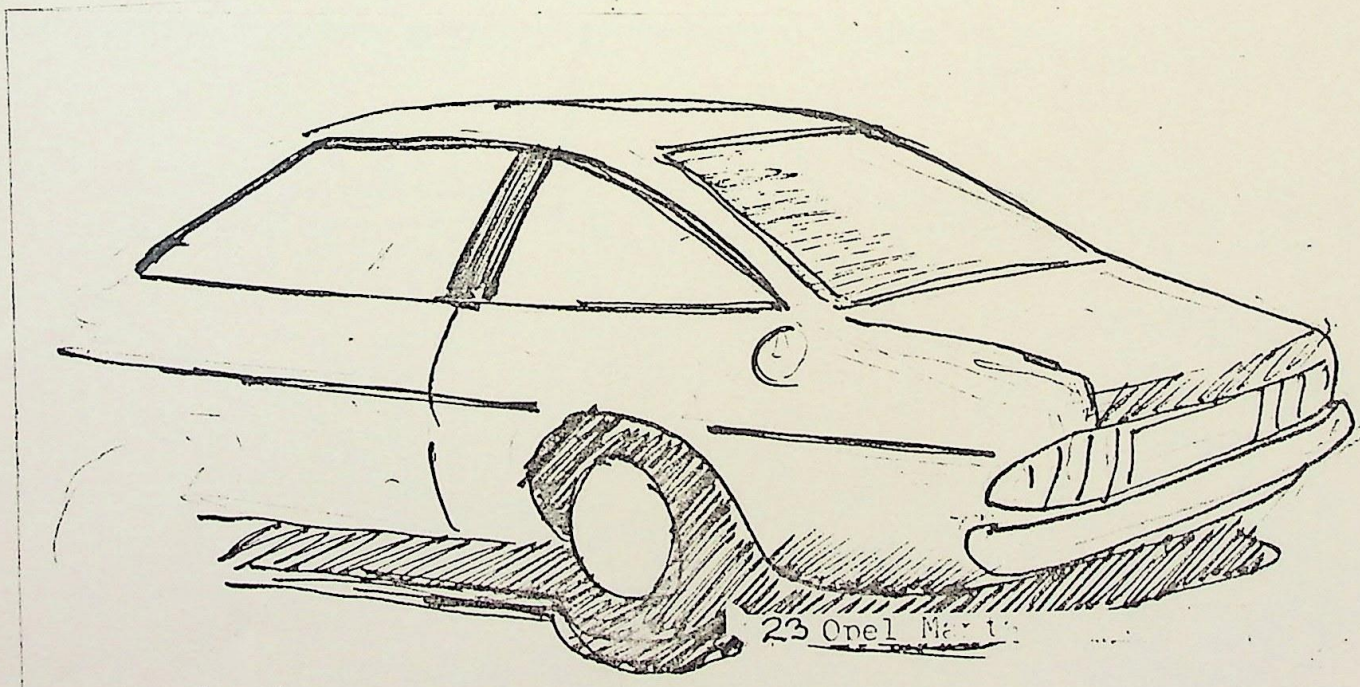


21. Audi 100 coupe

22. Fig. ▽. Volkswagen Golf (D) Guigario.
This is the style of present day hatchbacks: Renault 14, Ford Fiesta, Chrysler Alpine, Peugeot 104 etc. The rear door slopes down and then drops vertically to the bumper. The rear wheels are squarely at the corners in the mode of the Mini. The abrupt vertical cutoff shows the influence of the Kamm form; (see par 37.)

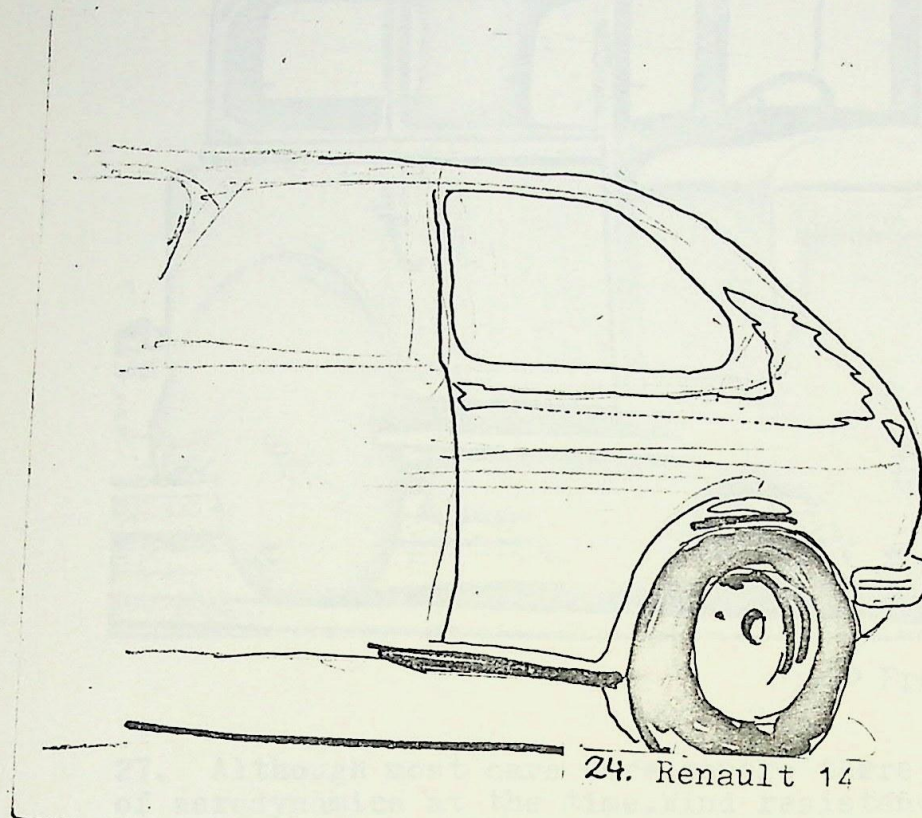


23. Fig. ▽. Opel Manta 1976 (D)
The acute angles contained within the arcs of the windows are styling features current in American cars. This is an indication of the influence of Vauxhall and Opel's U.S. parent; General Motors. This is also reminiscent of the Panhard Dynamic - fig. 13. ◀



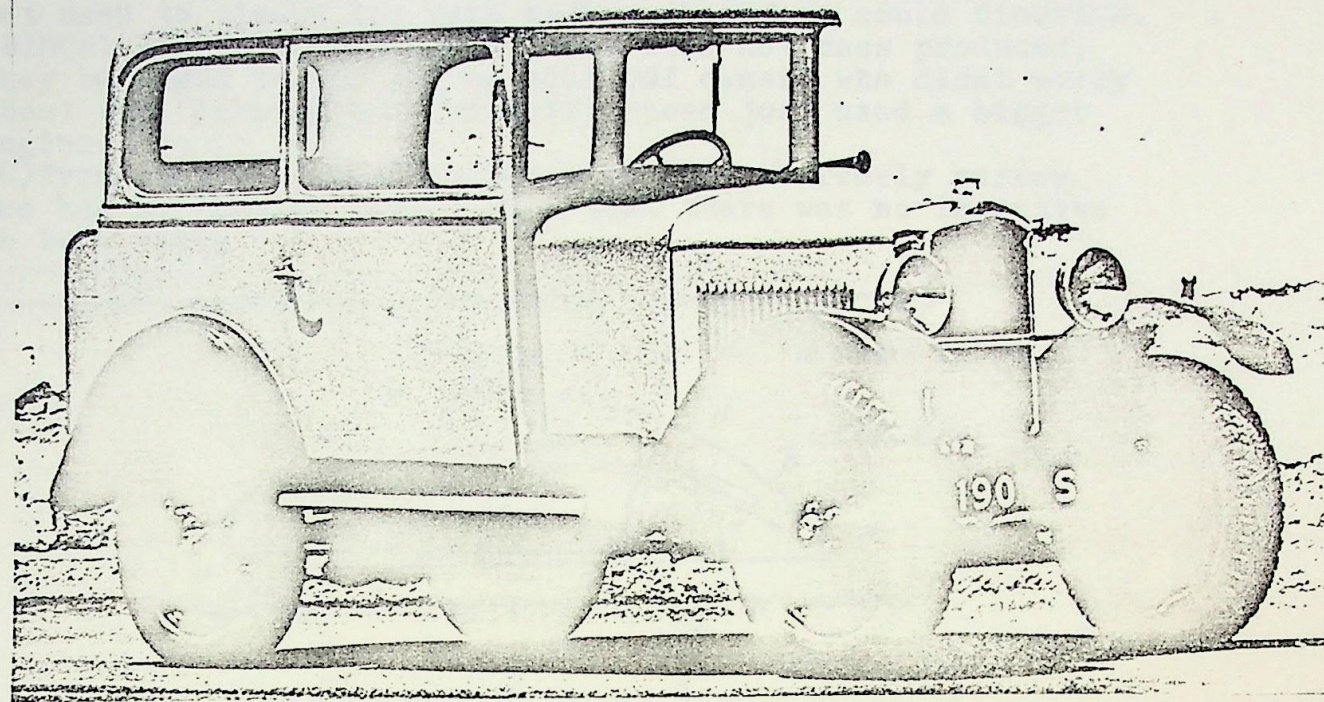
24. Fig. V Renault 14 (FR) 1977.

The slippery shape.-This car like the Ford Sierra has the very rounded shape which is just coming into vogue. This shape has been likened to a half used bar of soap. This particular car is very unusual in that it has panels with a double curvature. Most body panels are dish shaped; all the curves are convex. This car has rear door panels which have some of the curves convex and some concave.



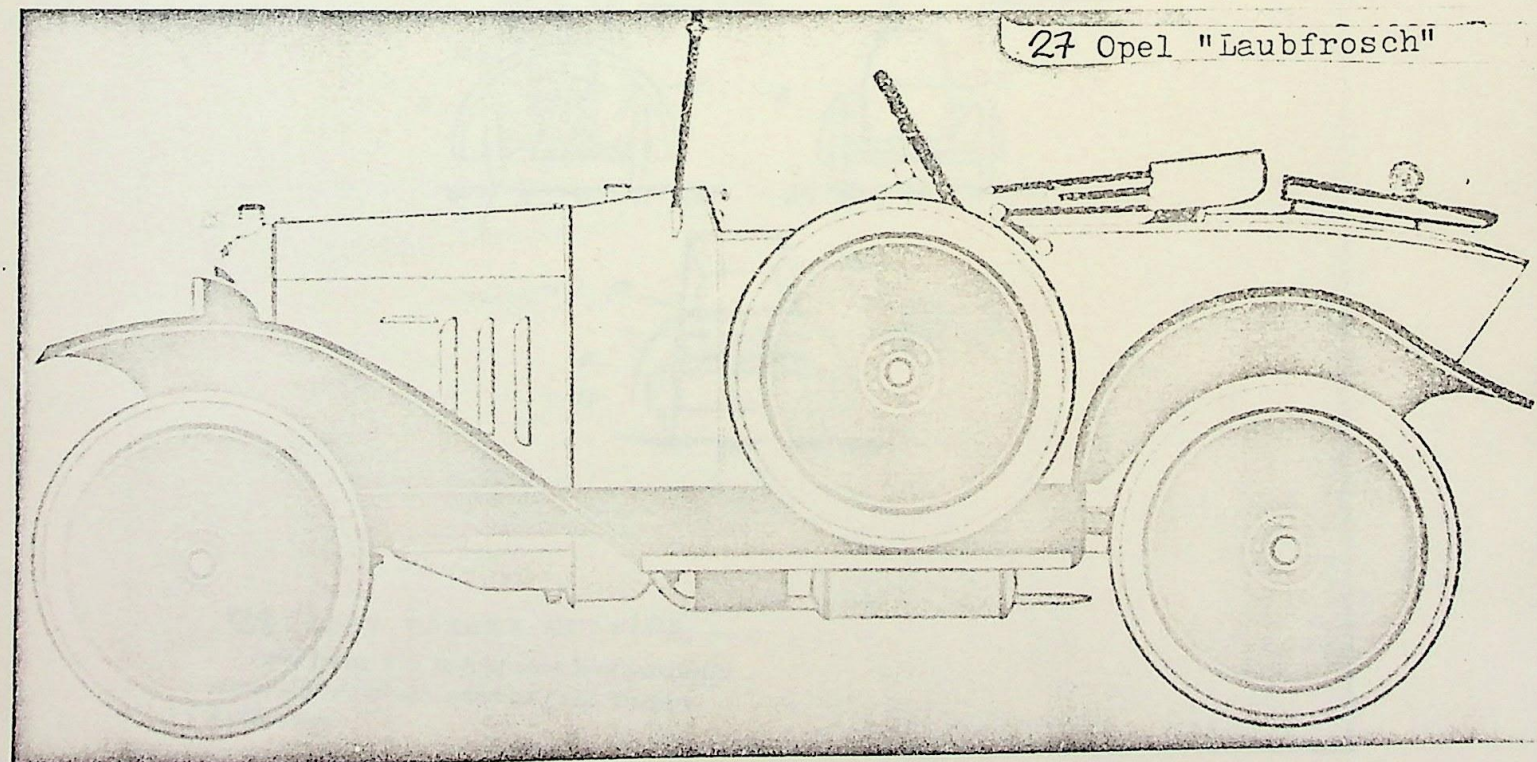
CHAPTER 2 STYLISTIC INFLUENCES

25. In 1920 Ford Model T's comprised 50% of world cars. They had upright bodies bolted onto ladder chassis and no conscious styling. Most other cars of the time were similar; upright radiator rising from the axle in front, vertical windscreen midway along the wheelbase and body dropping plumb behind the rear wheel. fig. 26.



25 Pre 1930's style

27. Although most cars were square there was an awareness of aerodynamics at the time. Wind resistance was obvious to cyclists and people in open cars, and forms were borrowed from other modes of transport to diminish this. Fig. 27 shows a skiff bodied Lancia inspired by rowing skiffs and schulls. Another nautical type is the "boat tail" style seen in fig. 28 but these adaptations were romantic rather than scientific.



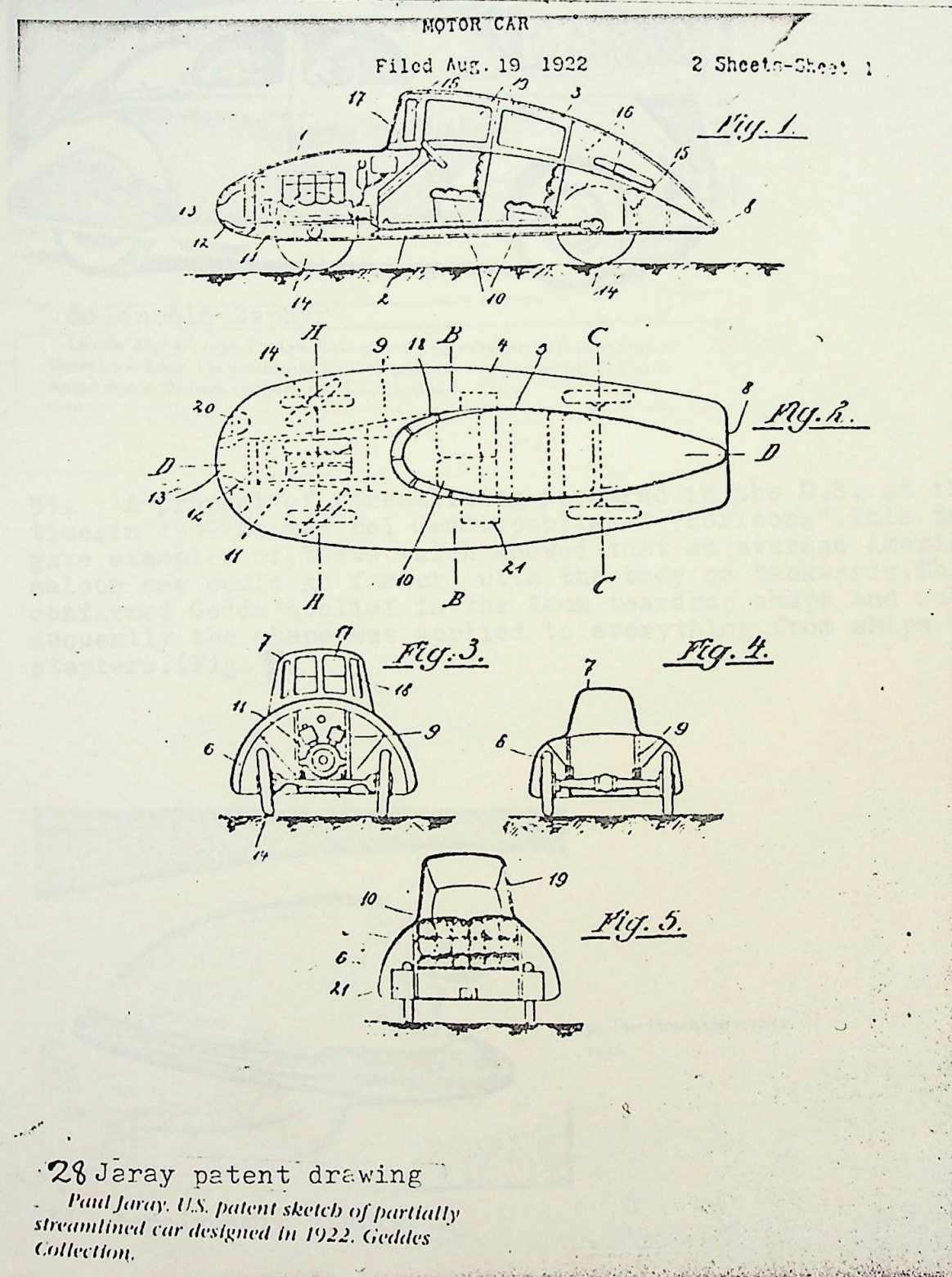
27 Opel "Laubfrosch"

28. Among the first to investigate wind resistance empirically was Paul Jaray; an engineer in the Zeppelin works who had access to a wind tunnel. His experiments resulted in a patent in 1922 (fig. ▼) for a form known as the "J" shape. The form consisted of half an elongated teardrop shape with a smaller half teardrop on top to hold the windows. A decade elapsed before Jaray's ideas were put into practise in Europe and the reasons were:-

(A) Most cars in the 20's were open topped and people had to get used to closed top cars before the Jform could flourish.

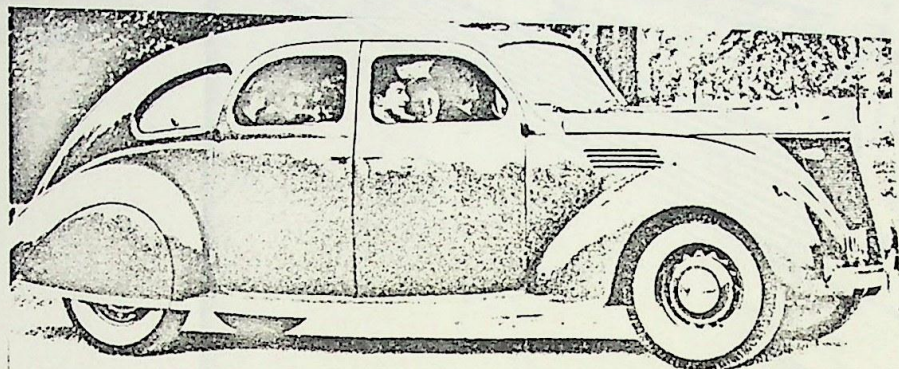
(B) Most European cars of the time were not mass produced, they belonged to wealthy or well off owners who didn't worry about fuel economy and for extra speed just used a bigger engine.

(C) Tyres especially on racing cars were extremely narrow and had so little frontal area that there was no incentive to body them.



29. U.S. -EUROPEAN COMPARISON.By 1923 Alfred P Sloan,head of General Motors had introduced the yearly styling change; the body pressing tools wore out so fresh ones were made. This however was used as a commercial weapon in the American market ,so introducing the equstion:-desire for cheapness *leads to standardisationVERSUS novelty which equals styling.In 1928 Harley Earl was head of the Art and Color DEPT. at G.M. and over the next three decades he brought a positively operatic spirit to American styling (at times a spirit of comic opera ,as we shall see.

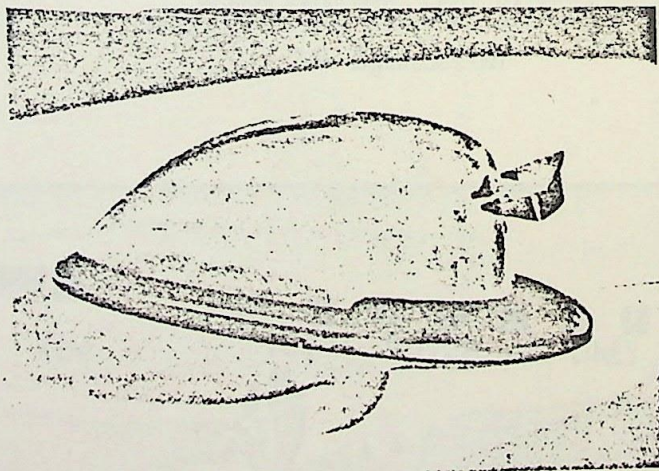
30. Henry Ford had reluctantly to acede to the desire for novelty inthe late 20'sand bring in a replacement for the Model T , but it was not until the 30's that the Lincoln Zephyr;his first full blooded piece of styling was produced (fig.▼).



30 Lincoln Zephyr

Lincoln 'Zephyr', 1936. The Lincoln company was a subsidiary of Ford and run by Henry's son Edsel. His enthusiasm for styling found freer expression in Lincoln designs than in the main company still dominated by his father

31. A prophet of streamlining appeared in the U.S. at this time;in 1932 Norman Bel Geddespublished "Horizons".This book gave examples of tests which showed that an average American saloon car could go faster with the body on backwards.This confirmed Gedde'sbelief in the Kamm teardrop shape and subsequently the shape was applied to everything from ships to staplers.(Fig.▼)



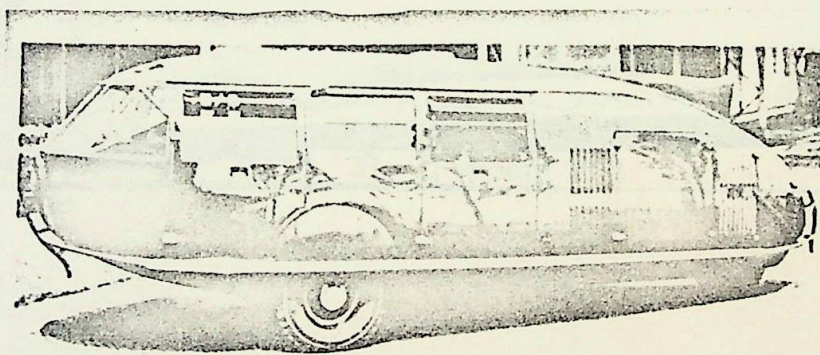
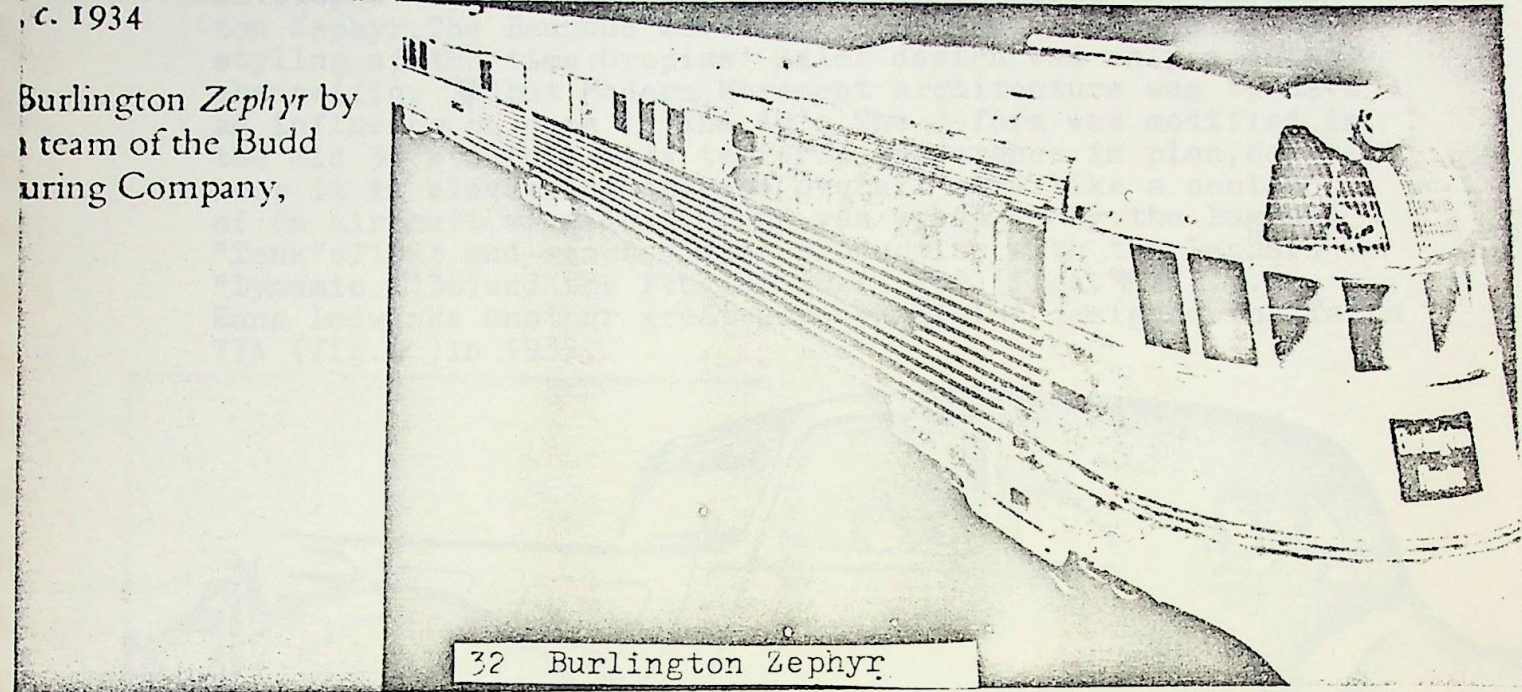
95-The Hotchkiss stapler, 1936

31 Aerodynamic stapler

32. In the U.S. in contrast to Europe aerodynamic effects were used for their evocative effect. Aerodynamic trains of the time had a strong emotional effect (Fig. V) and the similarity between this train; the Burlington Zephyr of 1934 and the bonnet treatment of the Lincoln Zephyr of 1936. (Fig. 30) is worth noting. Likewise Buckminster Fuller's Dymaxion car (FIG. V.) is imitative of a wingless D.C.2 plane (Fig. V) in the tilt of its nose and its triangular "undercarriage". The plane shape was very impractical for a car though, because a car has to keep a straight line in spite of crosswinds (unlike a plane) and this shape was very bad in crosswinds.

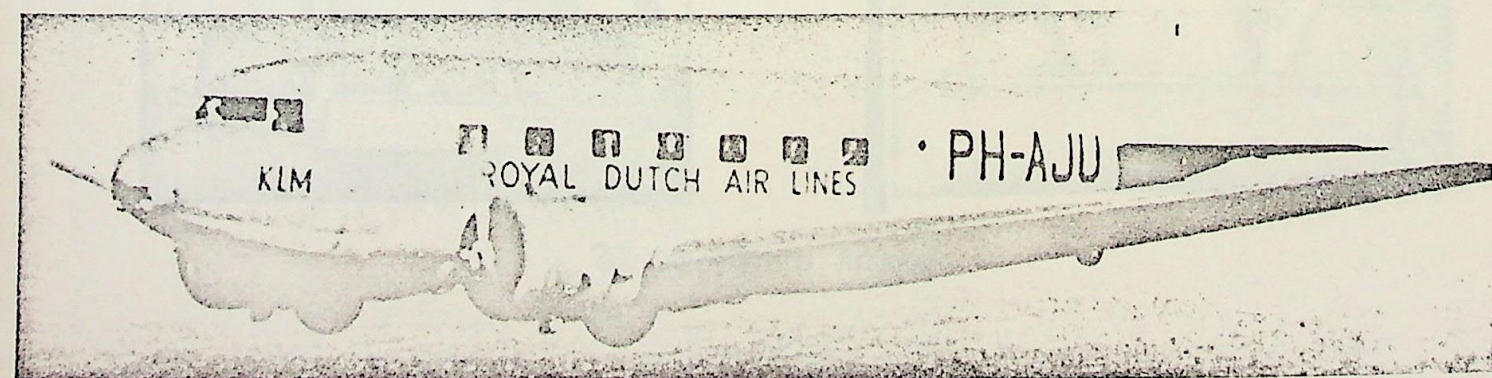
c. 1934

Burlington Zephyr by
a team of the Budd
Manufacturing Company,



Richard Buckminster Fuller. Dymaxion Cars One, Two and Three (TOP TO BOTTOM). 1933, 1934. (Courtesy R. Buckminster Fuller.)

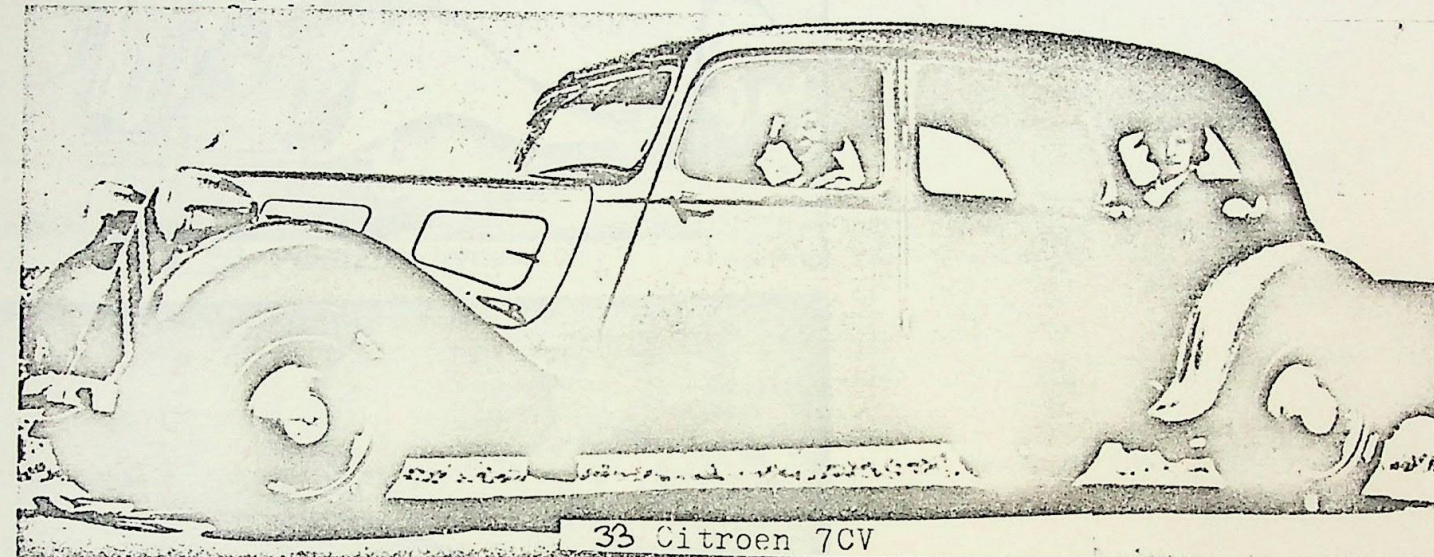
32 Dymaxion



32 DC 2 plane

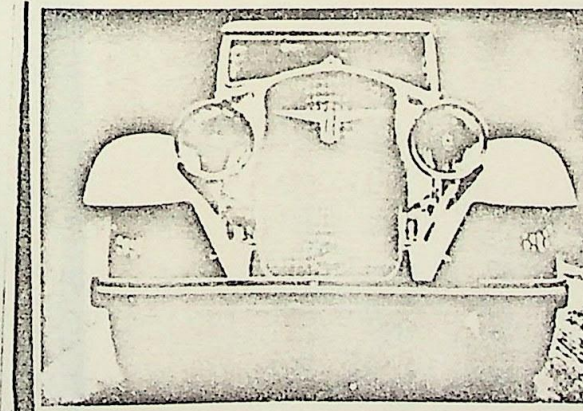
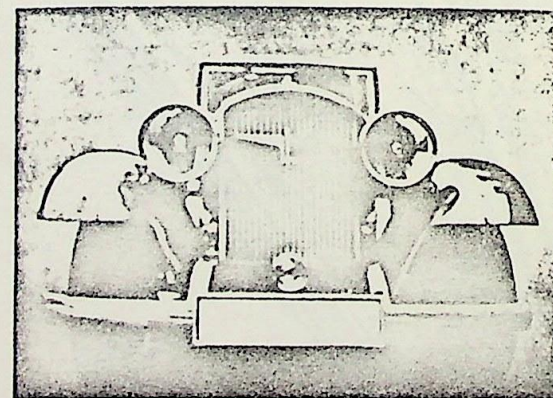
33. In Europe a more rigorous approach to aerodynamics and styling in general, was adopted. The reason for this is because the models tended to remain on the market for much longer e.g. Citroen 11CV, 1934-1957, superceded by DS, 1955-1975 (one major styling change in the lights), superceded by CX, 1975---. Compare this with three totally different reincarnations between 1955 and 1965.

34. In the 1930's the Jaray form began to have an influence. Teardrop shaped wings became the norm; (fig. ▼. Citroen Traction Avant). This car had front wheel drive, torsion bar suspension and the first all steel, volume-produced bodies, which were developed by the Budd Corporation, which built the Burlington Zephyr. The Bauhaus movement had no influence on car styling at the time: Gropius' Adler design was only a detail change (fig. ▼) but Modern Movement architecture was to have an influence on cars in the 60's. The J-form was modified in the mid 30's to lose its teardrop appearance in plan, but keep it in elevation, to become overall more like a section of an aircraft wing. This trend was presaged by the Bugatti "Tank" of 1923 and reached mass production with the Panhard "Dynamic" ('36) and the Peugeot 402 ('38) (figs. ▼▼.). Hans Ledwinka another great aerodynamicist designed the Tatra 77A (fig. ▼) in 1935.

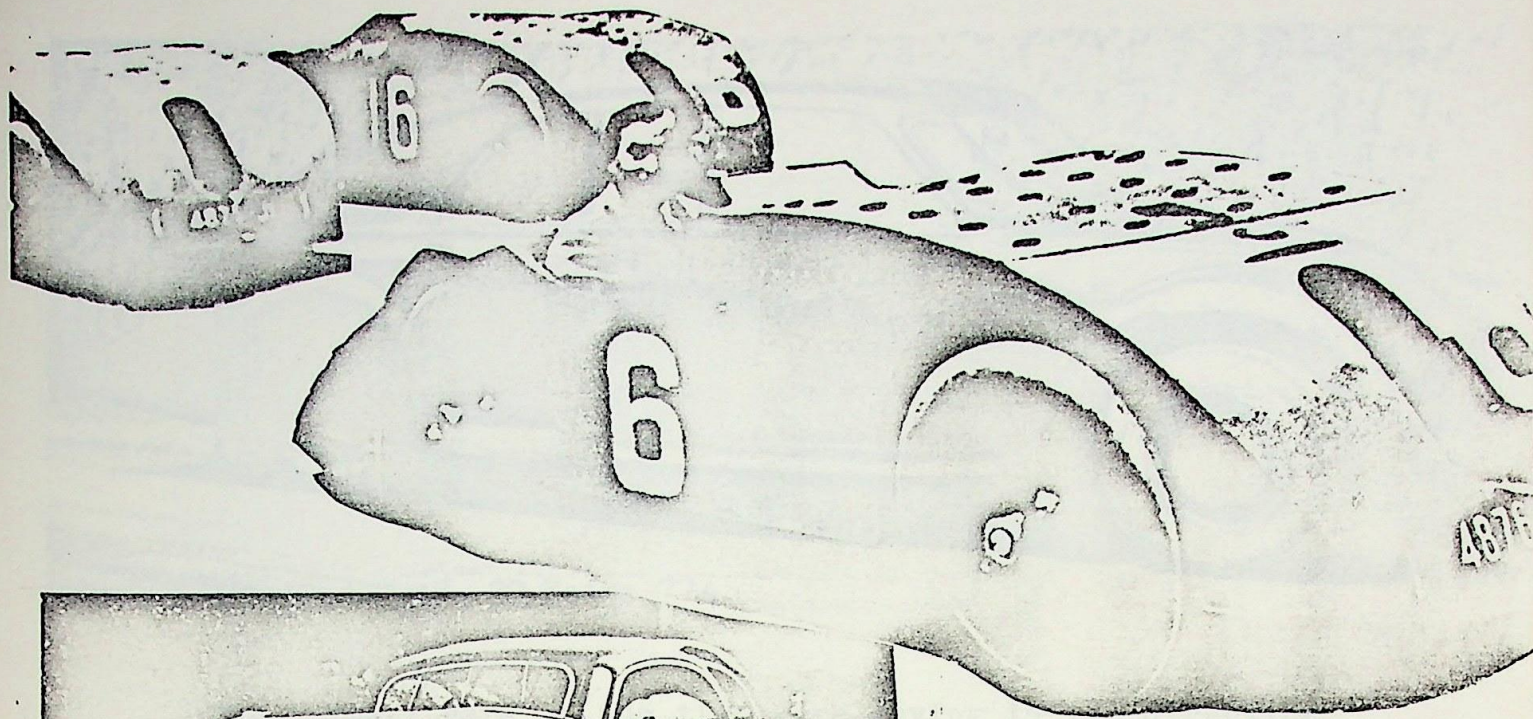


33 Citroen 7CV

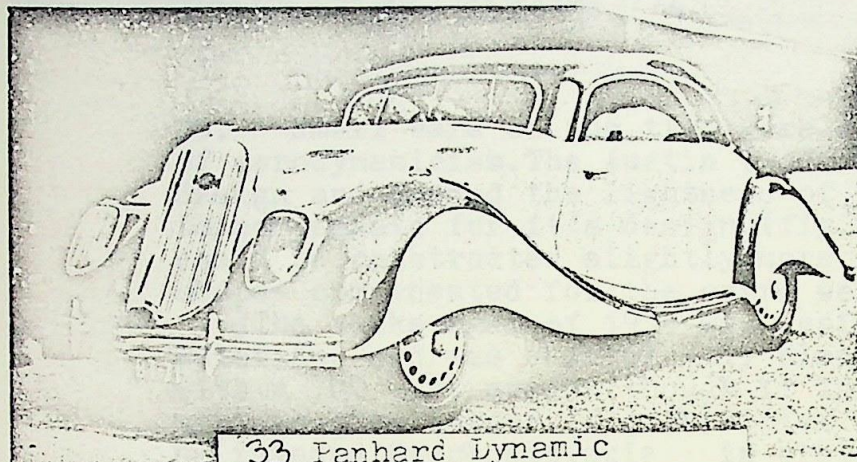
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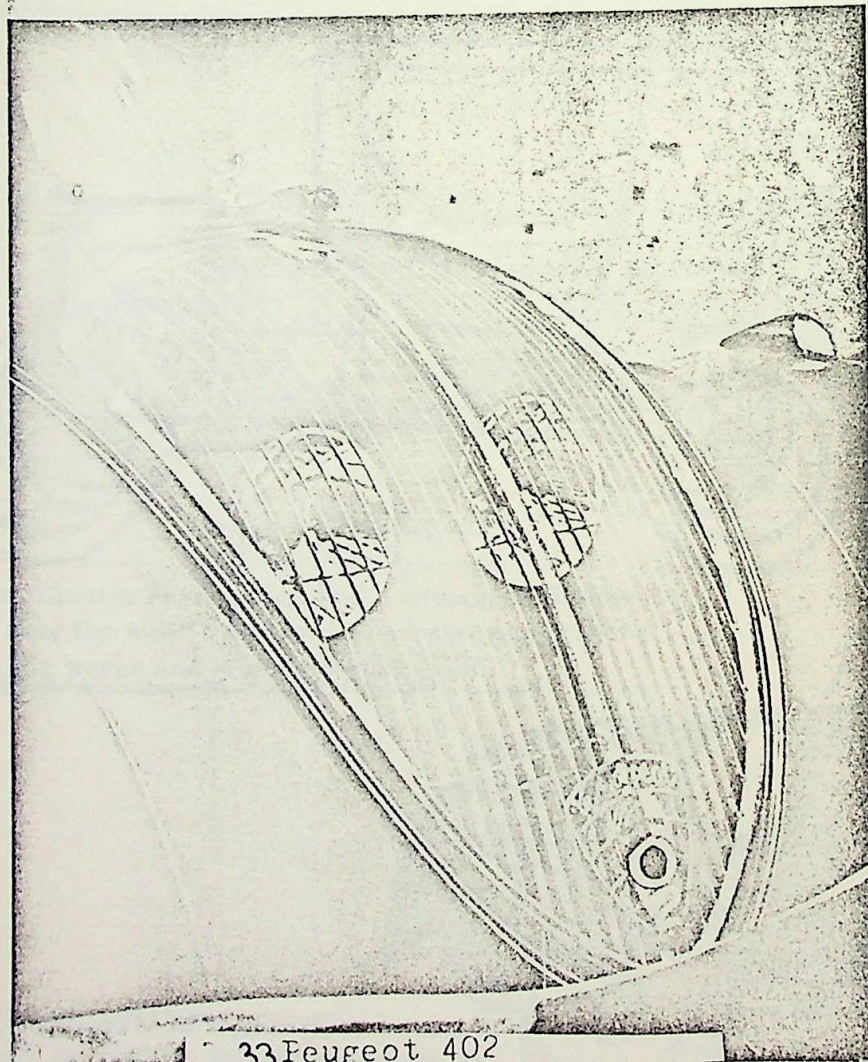
33 Gropius's Adler



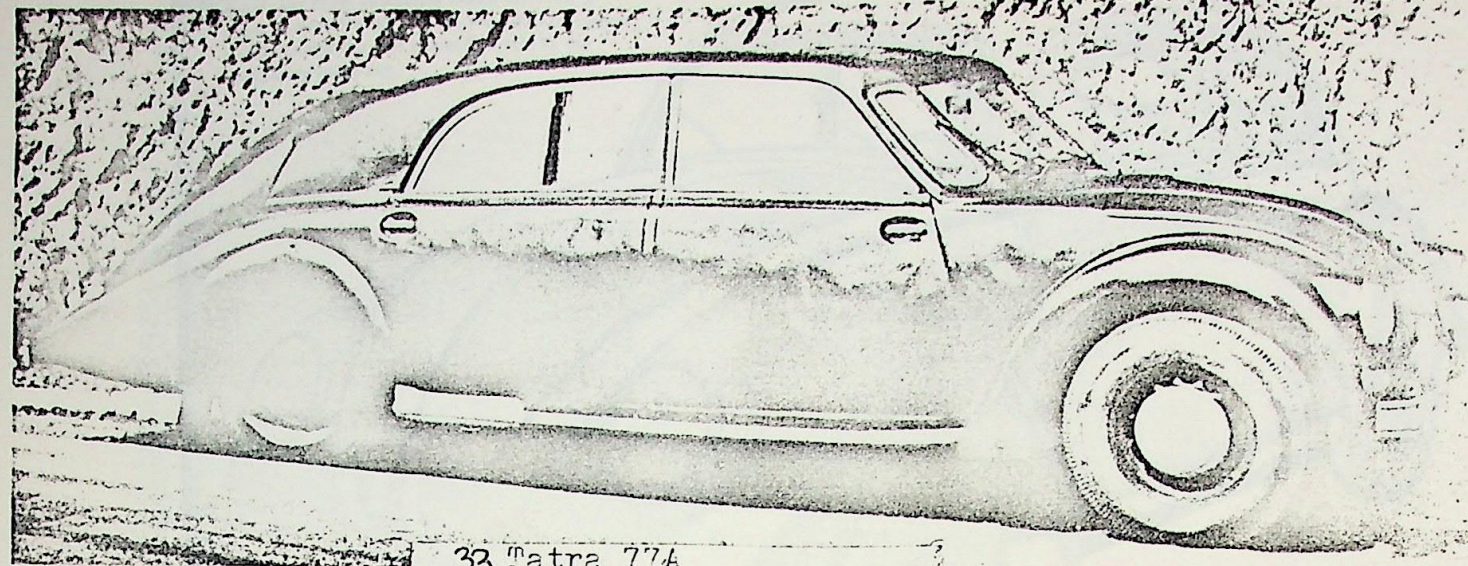
BUGATTI "TANK" RACING CARS.



33 Packard Dynamic

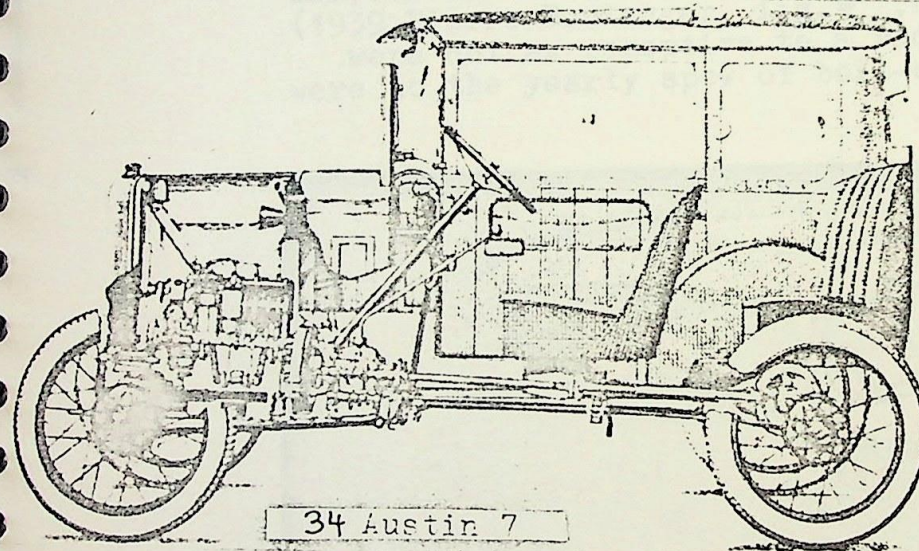


33 Peugeot 402



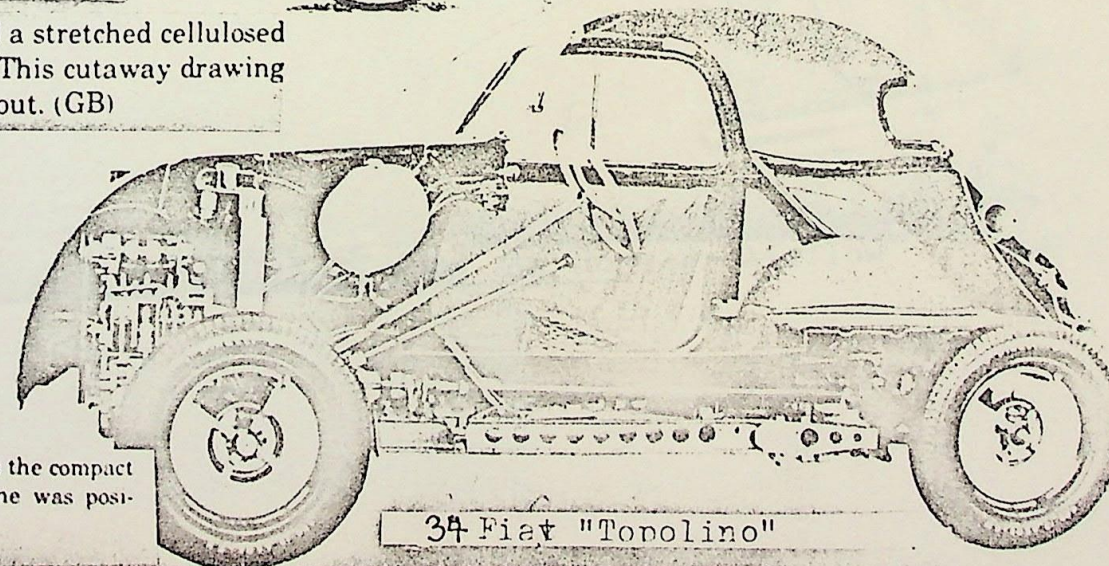
33 Tatra 77A

35. Small cars of the time were moving in the direction of aerodynamicism. The Austin 7 of the mid 20's was an upright design and needed the lightness of a fabric and wood body to compensate for its design. (fig. ▼). In the '30's cars could be constructed slightly more strongly and their sleeker shapes compensated for the extra weight (Fiat "topolino"-fig. ▼). The Volkswagen of 1936 was designed to utilise the new Autobahns and was sufficiently sleek at the time to be offered with a 700 c.c. engine, though it later grew taller and the engines grew larger. (fig. ▼) Hitler suppressed the Tatra when he invaded Czechoslovakia in order to favour the VW.



34 Austin 7

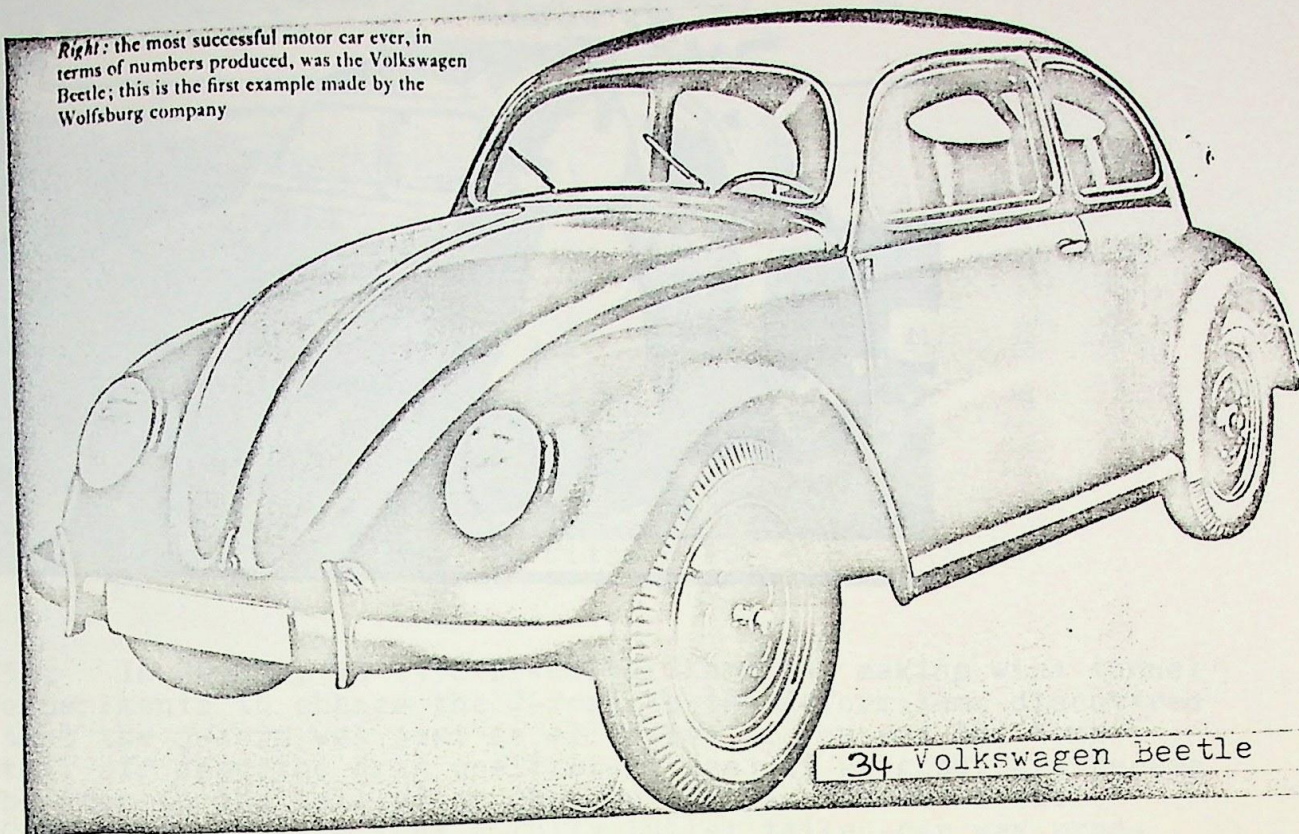
The first Austin Seven sedan had a stretched cellulose fabric over the wood framework. This cutaway drawing shows the works and seating layout. (GB)



34 Fiat "Topolino"

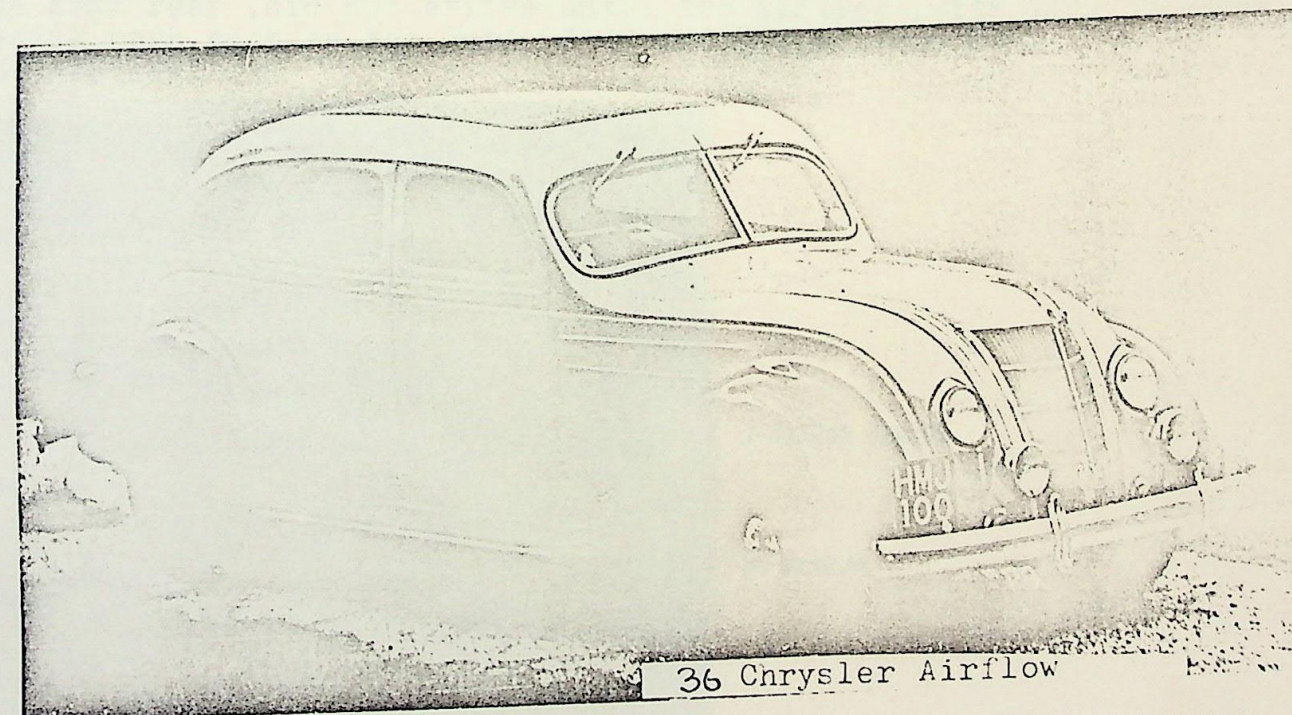
The cutaway picture of the Topolino shows the compact layout and, in particular, how the engine was positioned in front of the radiator. (I)

Right: the most successful motor car ever, in terms of numbers produced, was the Volkswagen Beetle; this is the first example made by the Wolfsburg company



34 Volkswagen beetle

36. Meanwhile in America a very influential aerodynamic shape was produced, this was the Chrysler Airflow (fig. ▼), designed by Carl Breer. This car had a full width body with no running board, it also had a bonnet which flowed smoothly from bumper to windscreen. It influenced many cars up to the war, for instance the Singer Airstream and the Citroen 2CV (1939, Pierre Boulanger fig. ▼), unfortunately the Americans were not as receptive to a radically new shape as they were to the yearly spew of bolt-on goodies from the stylists.



36 Chrysler Airflow



36 Citroën 2CV

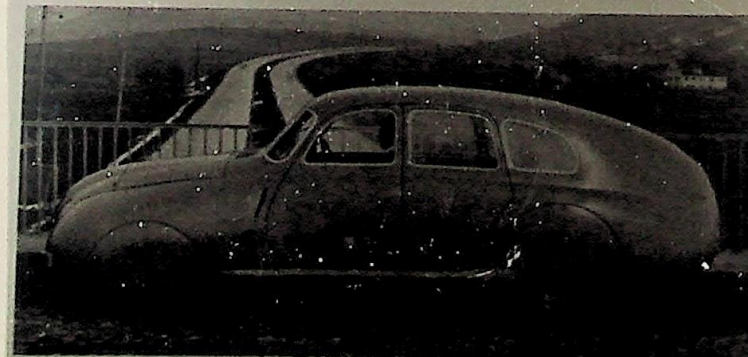
37. In Germany in 1938 DrWunibaldKamm was making wind tunnel experiments to change the J-form to the K-form. Kamm discovered that the j-form was just as effective if you cut the long tail off dead; the drag coefficient was just as good. Cars became blunter in the tail after that but it was not until the Citroën CX of 1975 that a fully bullet tailed car was produced. (see par 53)

The differences between the Jaray form and the Kamm form can be seen in (fig) below. The difference is in the tail; where the J form has a long tapering tail ending in a point in profile the K form has a more abbreviated and rounded one. Where the J form has a tapered tail in plan the K form has a blunter tail (this can be seen by comparing the plan in the Jaray patent drawings with the top view of the Cisitalia, which is an early Kamm back). A fully flattened vertical rear, which is the logical progression for the Kamm rear, did not arrive until the sixties with racing cars such as the Ford GT 40 and Pininfarina's BMC designs.



Wichtig für eine günstige Luftströmung: die Kühlluftführung. Hier an den vorderen Kotflügeln beim Adler, 1939.

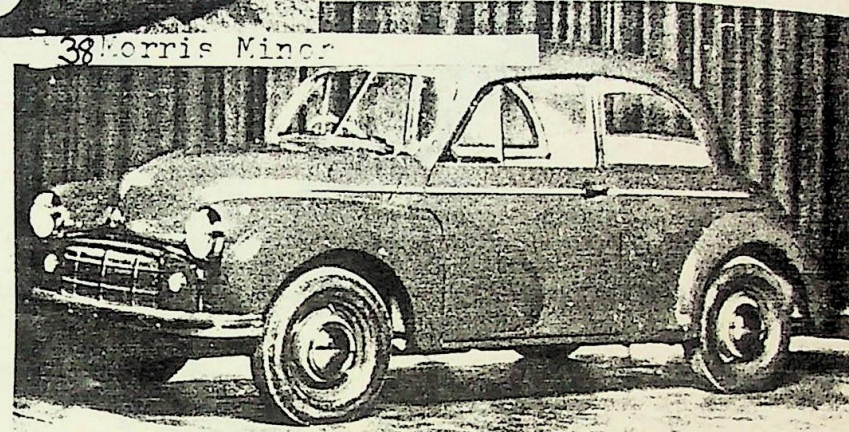
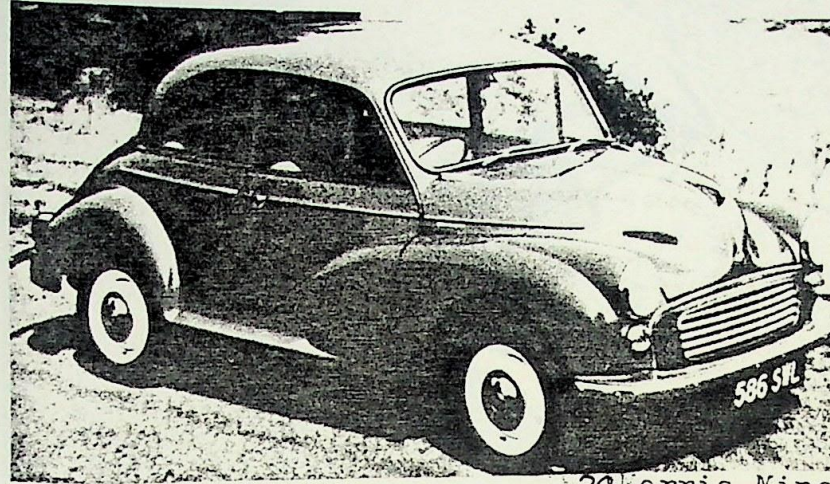
J-FORM ADLER



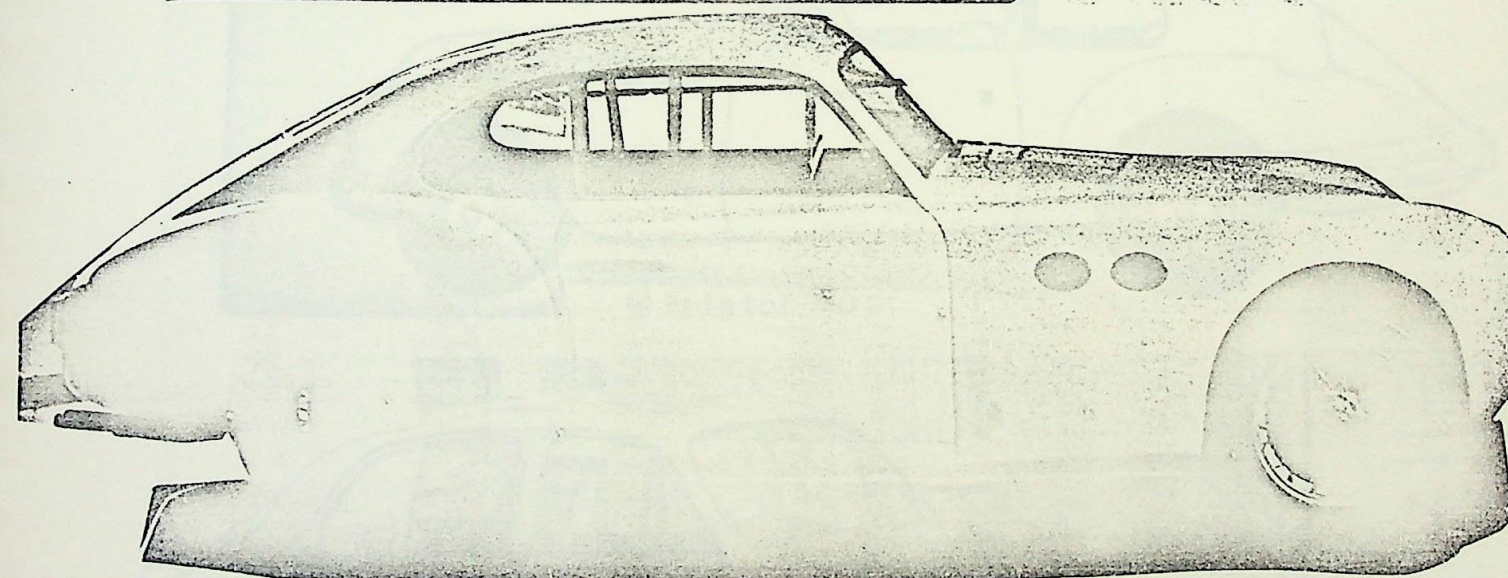
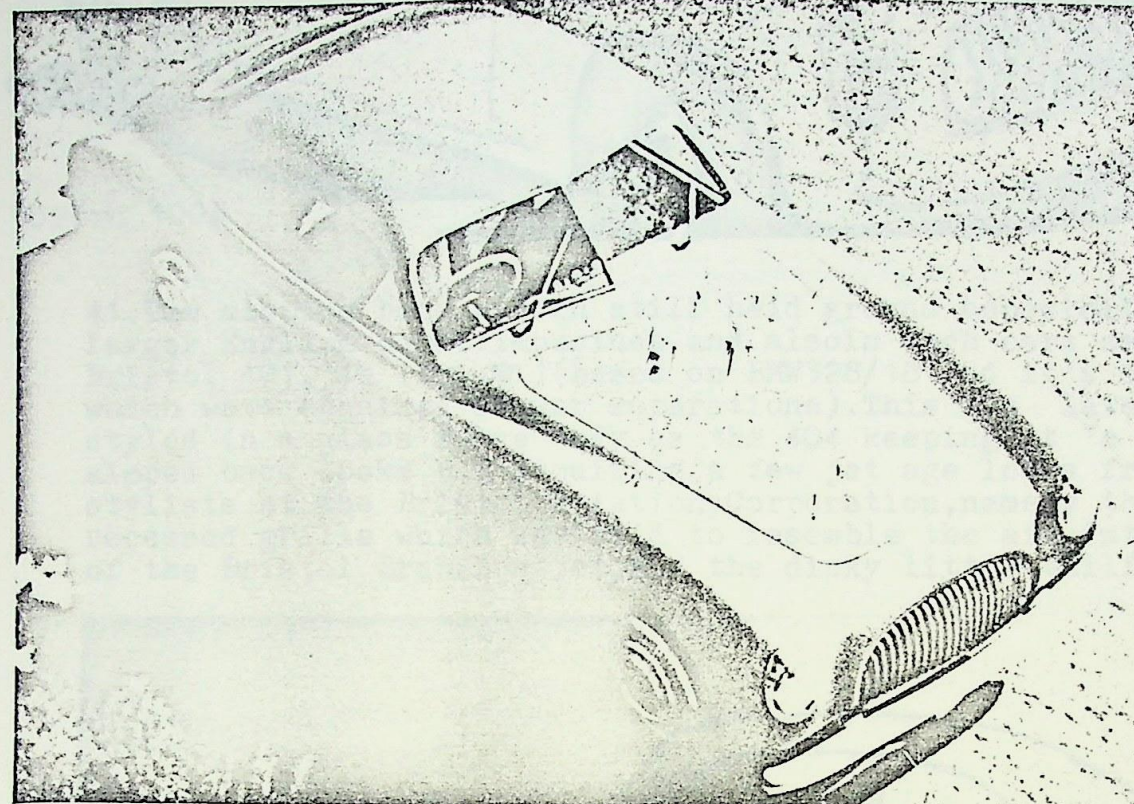
Berühmte Vorboten der Aerodynamik: die 1922 patentierte Jaray-Form oder, 1936, die sogen. »K-Form«.

K FORM

38. World War 2 stopped production in Europe (except for Sweden) in 1940 and in the U.S. in 1943 and post war styles didn't appear until 1947-48. In the new style the visual dominance moved from the engine cover to the wings; from the centre to the sides. The Morris Minor of 1948 (fig. ▼) summarises the changes. The headlights have moved outwards and become integrated with the wings, the wings become higher and higher until they overtop the engine cover. The grille has changed from being vertical to horizontal and all the body panels have become more rounded because of the influence of integral construction

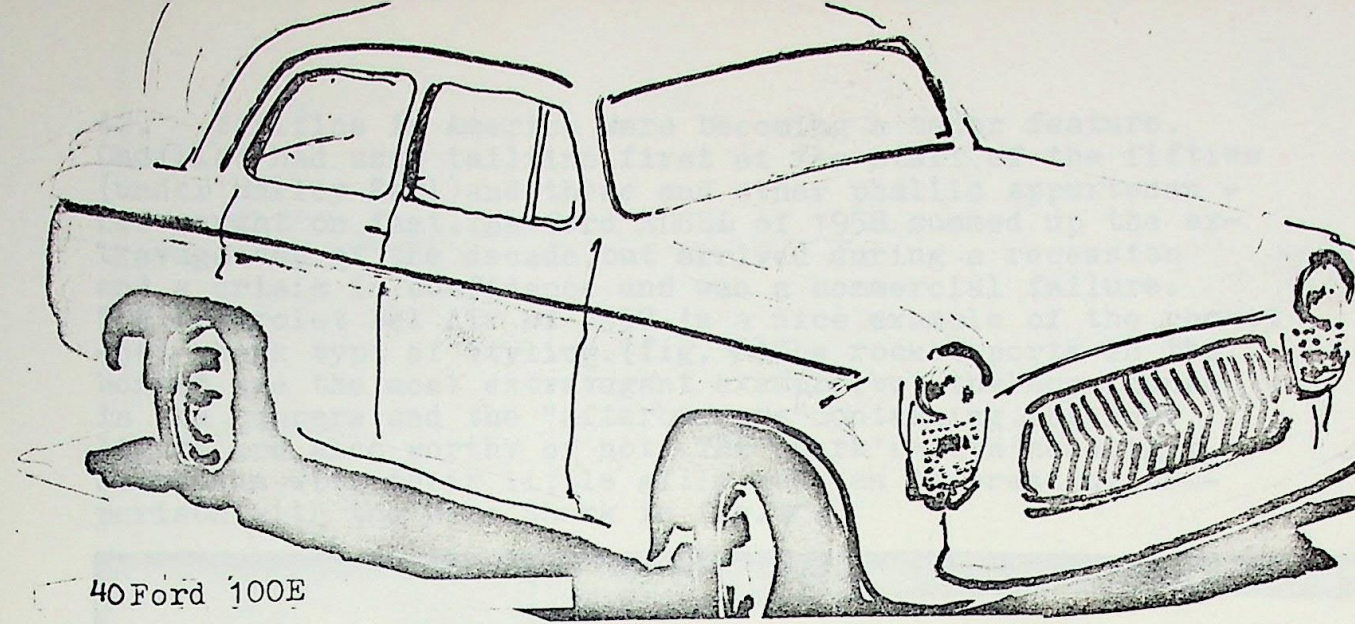


39. An influential car of 1947 is the Alfa Romeo Cisitalia coupe (fig. ▼▼ Pininfarina, see also Chap. 1). Here is a completely full width "pontoon" body. The front wings receive maximum emphasis by being higher than the engine cover for the first time. There is a form of the drop waist style referred to in ch. 1, but we can see in this car a movement towards the three box style of later years and away from the expression of wings as a separate visual entity.



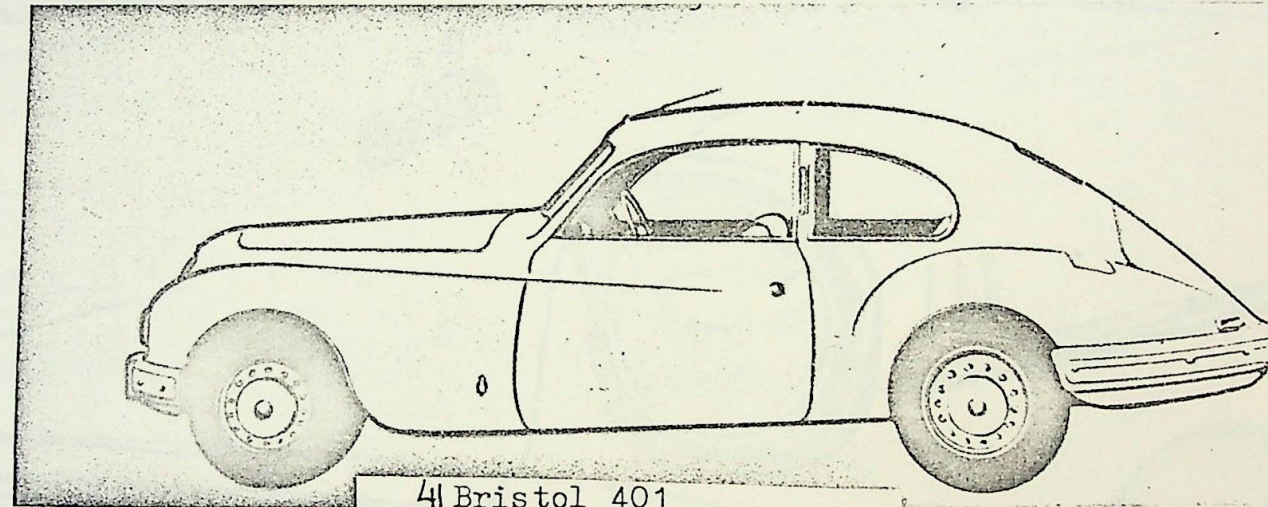
39 Alfa romeo Cisitalia

40. The three box saloon came in in 1952 when Ford in Britain introduced the Consul and the Zephyr to replace the "sit up and beg" Pilot they later, similarly replaced the Prefect with the 107E Anglia (fig. ▼). Three-box-saloons were to be the norm until the advent of the hatchback.

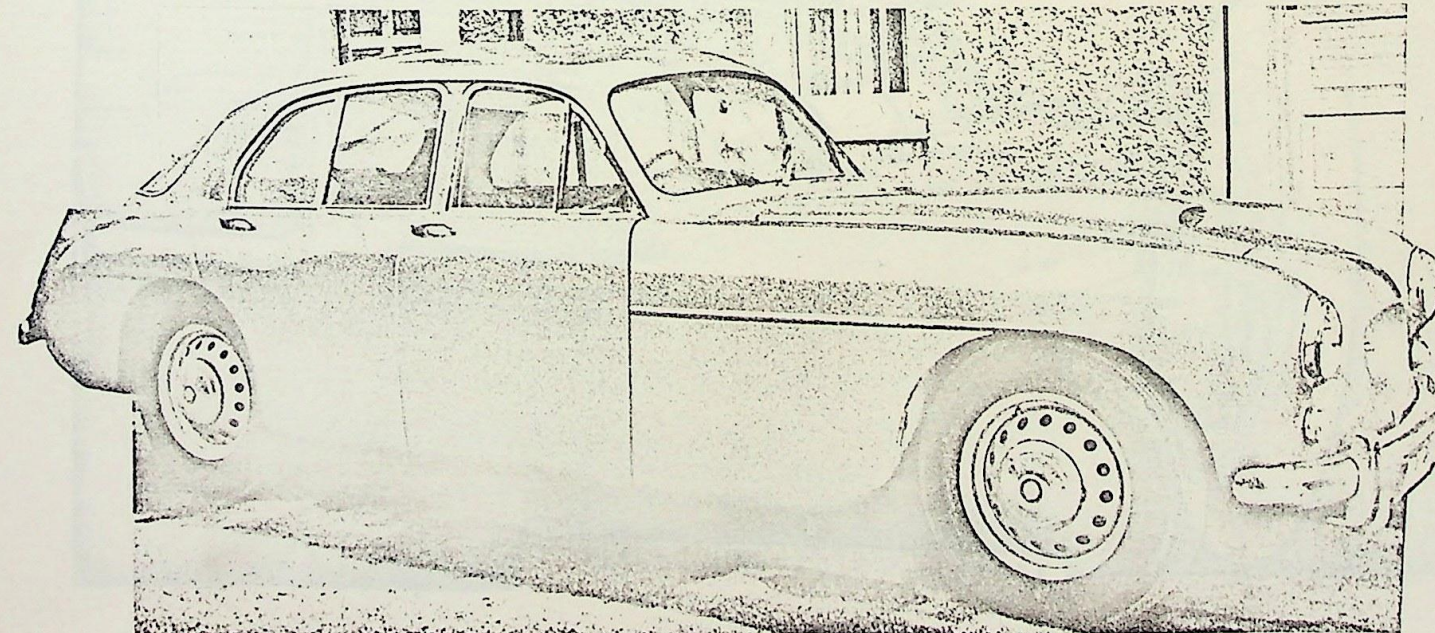


40 Ford 100E

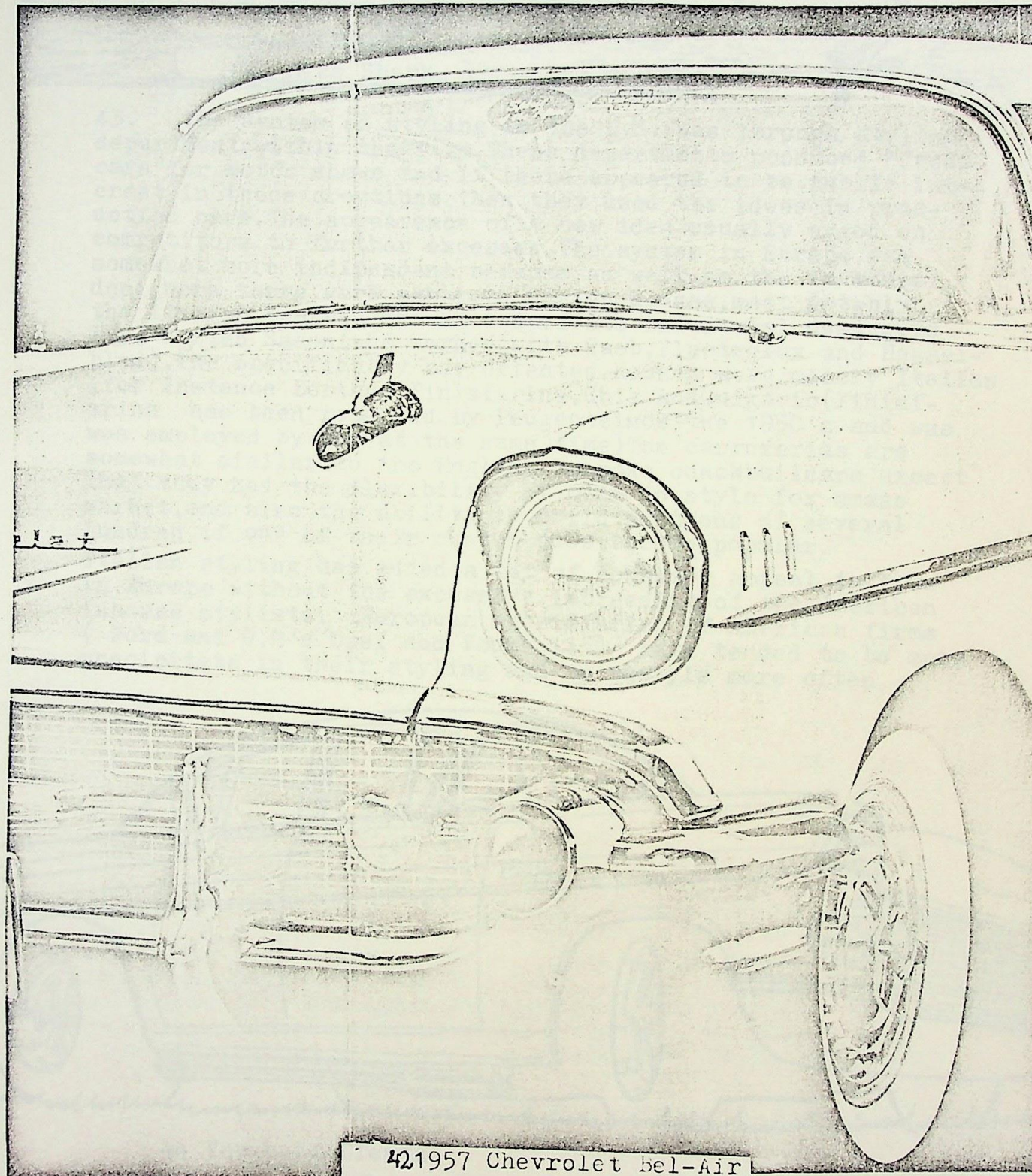
41. The sloping back saloon still held ground especially among larger English cars: limousines and also in such cars as the Bristol 401, '49 (fig. 41) (based on BMW 328/18 and its engine which were acquired as war reparations). This was later restyled in a glass fibre body as the 404 keeping its English sloped back looks but acquiring a few jet age looks from its stylists at the Bristol Aviation Corporation, namely the deeply recessed grille which was said to resemble the air intake of the Bristol Brabazon jet, and the dinky little tailfins.



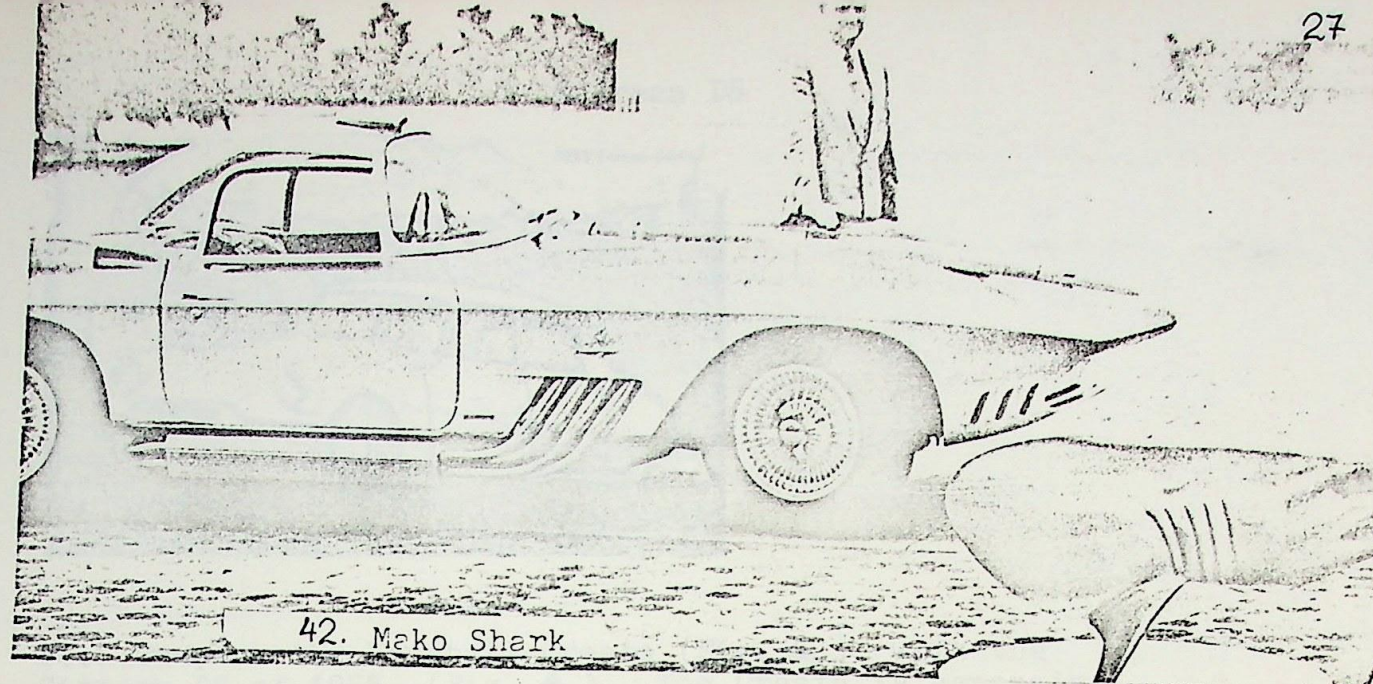
41 Bristol 401



42. Tailfins in America were becoming a major feature. Cadillac had used tailfins first at the start of the fifties (under Harley Earl) and these and other phallic appurtenances caught on fast. The Ford EDSEL of 1958 summed up the extravagances of the decade, but arrived during a recession and a crisis in confidence and was a commercial failure. The Chevrolet Bel Air of 1957 is a nice example of the rocket-jet-shark type of styling. (fig. ▼) The rocket ports in the bonnet are the most extravagant example, but the nose cones in the bumpers and the "afterburners" containing the rear lights are also worthy of note. The shark's mouth headlight surrounds with their little gills make an interesting comparison with the Mako Shark in fig. ▼.



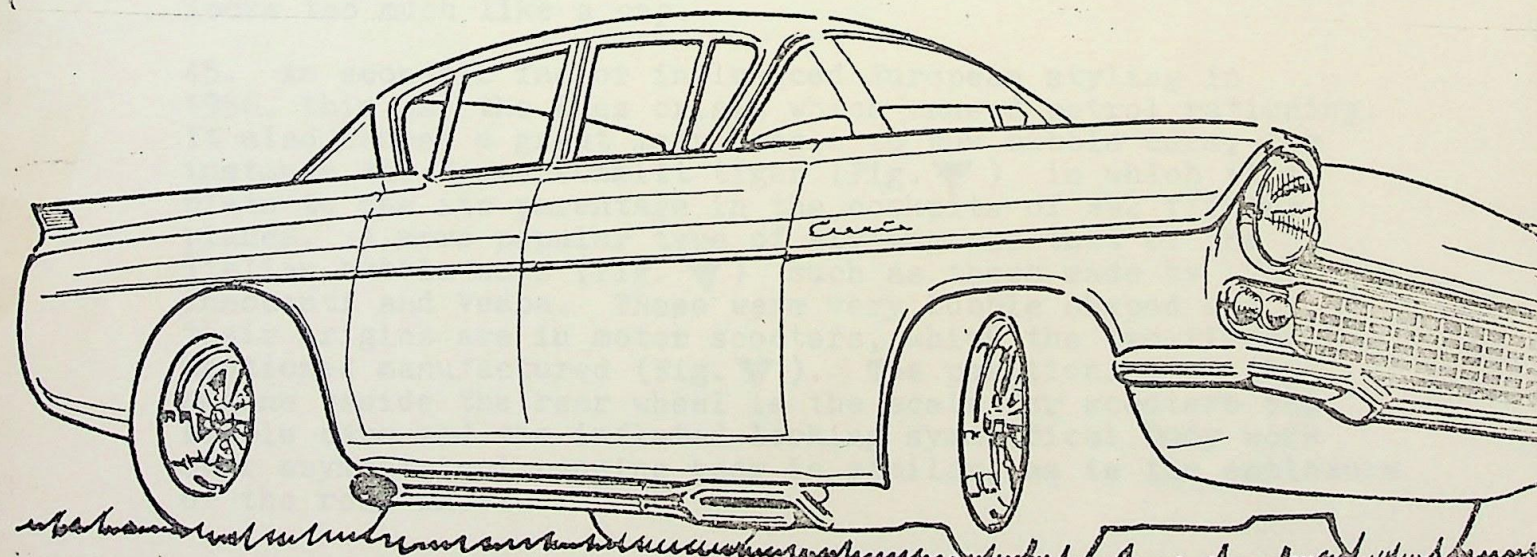
421957 Chevrolet Bel-Air



42. Mako Shark

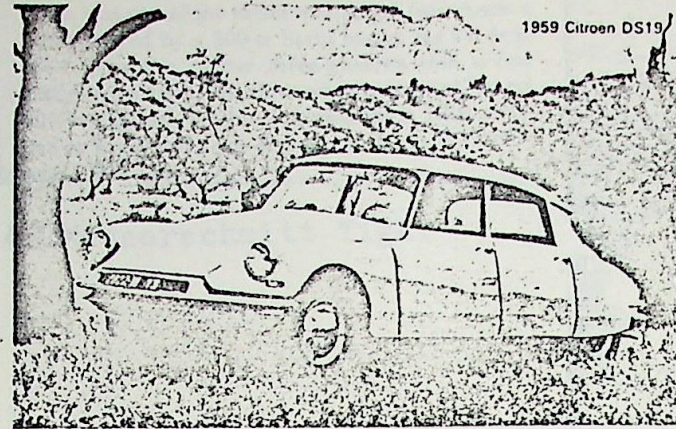
43. The system of styling in the U.S. was through styling departments within the firm. These departments produced "dream cars" for motor shows and if there appeared to be public interest in these creations then they used the ideas in production cars. The appearance of a new idea usually egged on competitors to further excesses. The system in Europe was somewhat more independent because as well as the in-house designers there were separate design houses, most notably the Italian "carrozzerias" and private industrial designers like Sixten Sason (who worked with Saab, Electrolux and Hasselblad). The specifically car-oriented houses were mostly Italian, for instance Bertone, Pininfarina, Ghia and Guigario (Pininfarina has been retained by Peugeot since the 1950's and was employed by BMC at the same time). The carrozzerias are somewhat similar to the English bespoke coachbuilders except that they had the flexibility of mind to style for a mass market, and also the ability to build editions of several hundred if one of their custom jobs became popular.

Italian styling has added a lot of consumer appeal to cars in Europe without the excessive inbreeding of the American in-house stylists. European subsidiaries of American firms (Ford and G.M.'s Opel and Vauxhall) have tended to be more precipitate in their styling and to restyle more often.



44. Vauxhall Cresta

Citroen DS



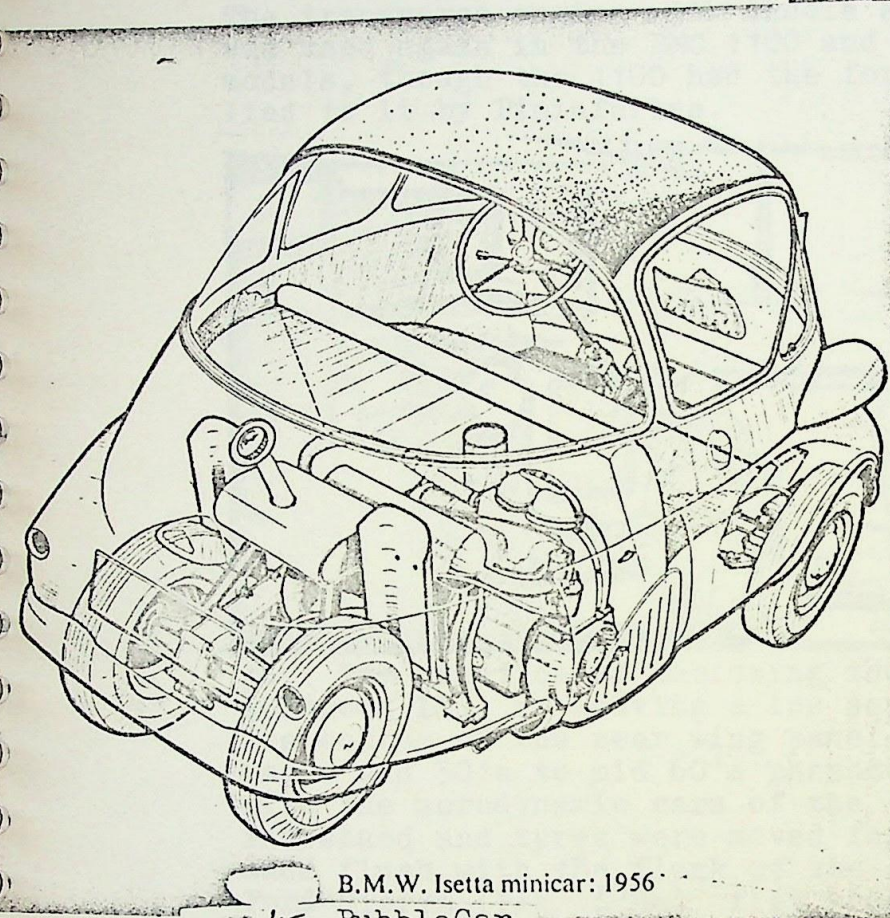
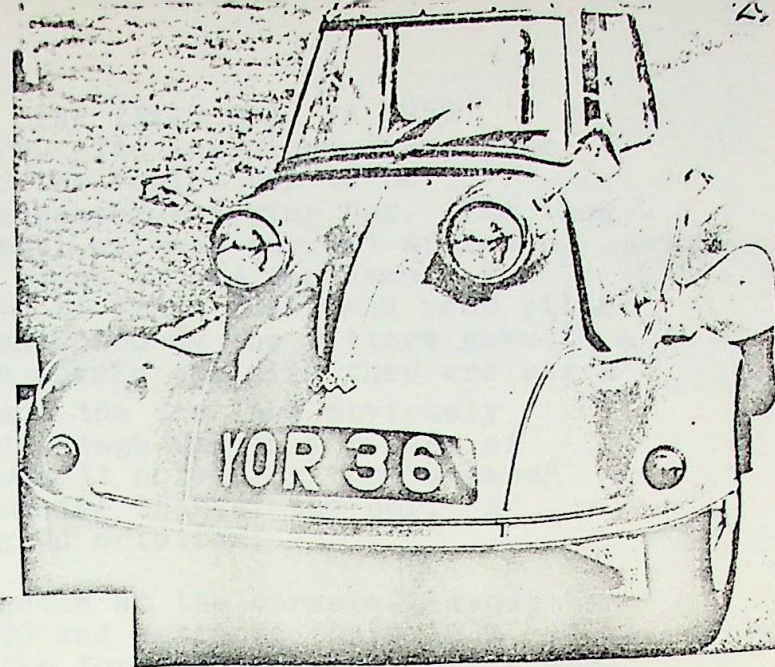
44. Compare the Vauxhall Cresta (Fig. ▲) with the Citroen DS of 1955 (Fig. ▲). The Cresta is aggressive with the peaks over front and rear lights and front and rear wraparound glass. The DS by contrast is a smooth lens shape in profile. It was restyled later to put the headlights under glass which was flush with the panels and to change the bugle shaped indicators on the rear of the roof. The smoothness of the DS was not merely a superficial styling ploy as there was an underpan covering the chassis members, exhaust and underbody which is not readily visible. The streamlining of the DS is much more relaxed and less energetic than the Cresta and yet it has much more the look of a projectile.

It is interesting to examine the glass in the 2 cars : wraparound screen as in the Cresta were a product of developments in the early fifties. Looking at the illustration and imagining away the glass we are left with a very awkward shaped roof (like two rear halves of an Anglia stuck together) which caused in their turn a very awkward shaped front door and any advantage in forward vision must have been negated by decreased sideways vision. The DS windows are treated as body panels with the same kind of curves as the body. The styling fails with the roof which does not have smooth transition with the rest of the car except at the front. The roof (a separable fibreglass item) looks too much like a cap.

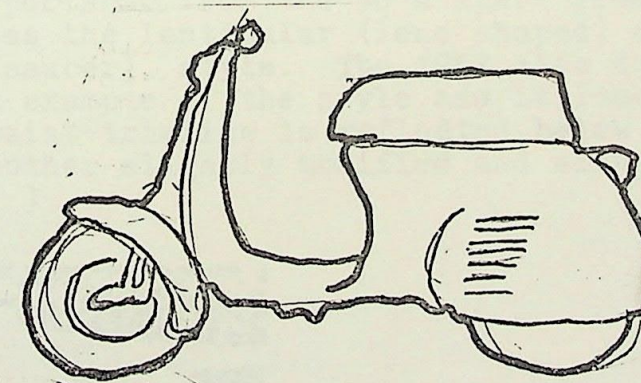
45. An economic factor influenced European styling in 1956, this was the Suez crisis which caused petrol rationing. It also caused a great many people to buy bubble cars, for instance the Messerschmitt tiger (Fig. ▼) in which it is plain to see its parentage in the cockpits of WW2 fighter planes. A more popular type of styling was that of the Italian bubble cars (Fig. ▼) such as those made by Innocenti and Vespa. These were very bubble shaped and their origins are in motor scooters, which the two firms mentioned manufactured (Fig. ▼). The positioning of the engine beside the rear wheel is the scale for scooters and bubble cars and the inflated looking symmetrical body work over asymmetrical running gear is similar, as is the enclosure of the rear wheel.

Looking for all the world like the purposeful cockpit of its World War II namesake—the ME 109 fighter—the Messerschmitt Tiger, produced between 1958 and 1960, was one of the better minicars. A four-wheeler, it was powered by a 500-cc Sachs engine and was developed from the earlier three-wheelers built to Fend design from 1953. The three-wheelers, using 175-cc and 200-cc engines (the latter introduced in 1955), continued to be made in one of the aircraft company's works until 1962. (D)

45. Messerschmitt Tiger



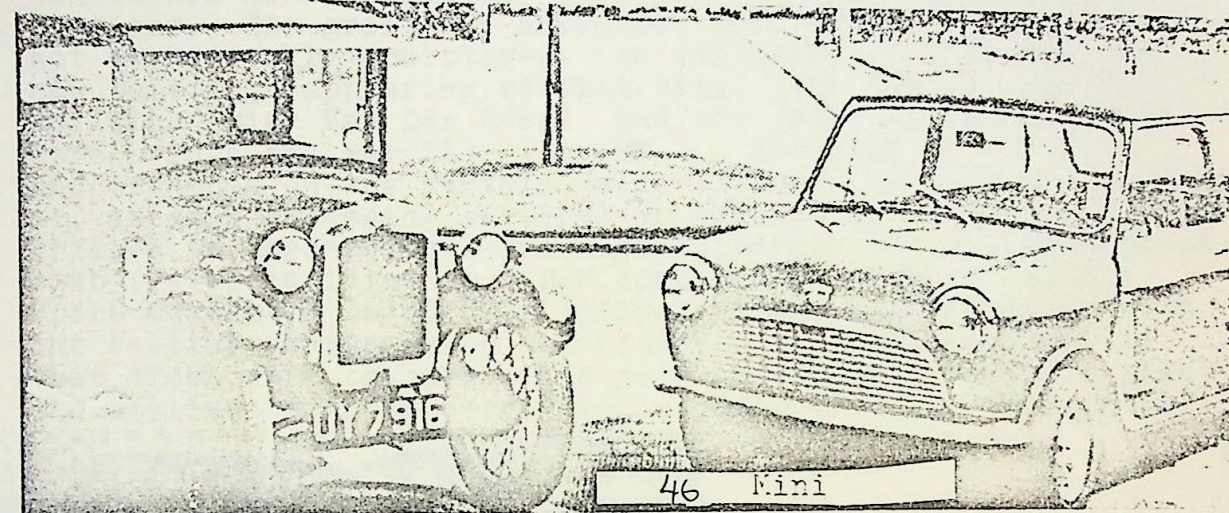
B.M.W. Isetta minicar: 1956
45. BubbleCar



45. Scooter

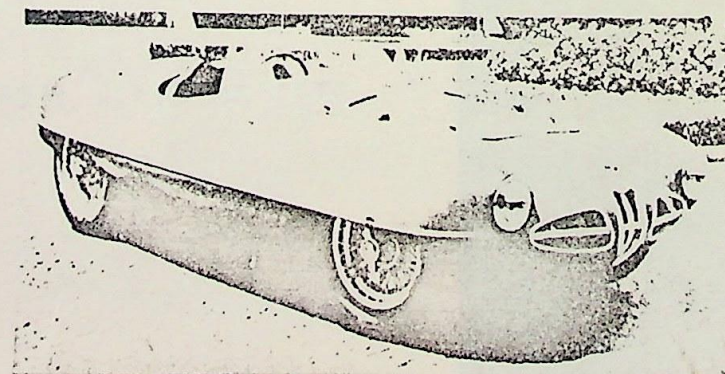
46. The introduction of the mini (Fig. ▼) in 1959 brought the end to bubble cars. Its ingenious transverse engine/gearbox design enabled the engine box to be proportioned neatly to the passenger-carrying box. The lack of overhang caused by the "wheel at each corner" approach (as used in the Citroen DS) added to its neatness. The line of front pillar to centre of front wheel and rear pillar to centre of rear wheel, accentuated by the gutters gave it a very stable look. Making the wheels the size they are was a bold move by Issagonis and made the car less obviously small. The mini's main disadvantage was in its lack of load bearing capacity which wasn't solved by the "estate" and van versions which spoiled the look of the car. A hatchback could have been a good solution.

The transverse engine with wheels at the corners, layout was used again in the BMC 1100 and again in their 1800 models, though the 1100 had the fore and aft peak style applied to it by Pininfarina.

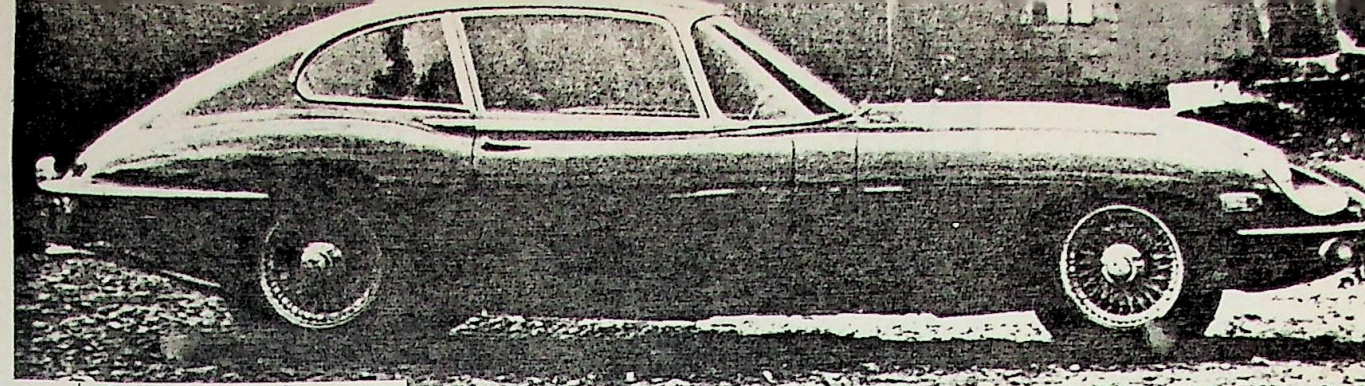


46. The practice of enclosing the rear wheels in bodywork (Citroen DS) or leaving a low square gap in the return at the bottom of the rear wing panel for the wheel (R. 16) was a mid 50's to mid 60's phenomenon and had its origins with the aerodynamic cars of the 30's. As tyre widths increased and tyres were moved farther out the wheels were made flush with the flank of the car as in the case of the Ford Sierra (Fig 55▶) flat wheel trims gave the side of the car a smooth surface.

47. Another style of sportscar from the 50's apart from the dip waisted style was the lenticular (lens shaped) or disco volante (flying saucer) style. The 1952 Alfa Romeo is (Fig. ▼) a perfect example of the style and it looks as if the body above the waist trimline is reflected below it. The E-Type Jaguar is another slightly modified and elongated version of it. (Fig. ▼)



47 Alfa Romeo "Disco VOLANTE"

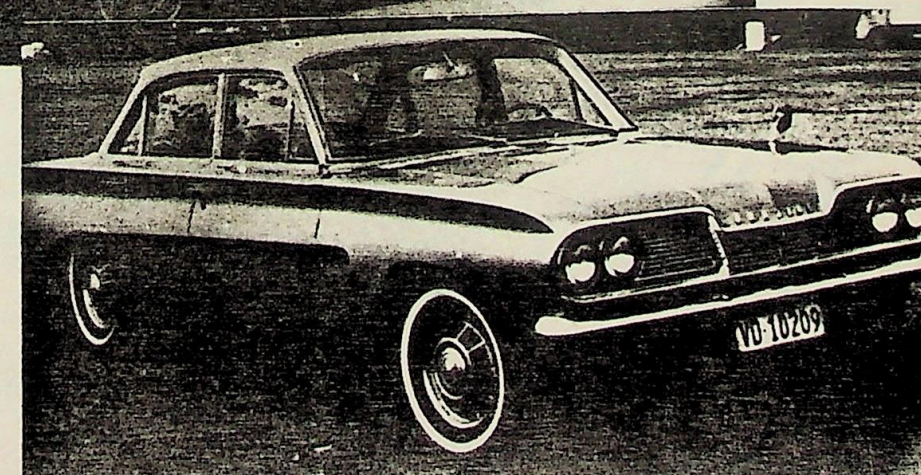


47 E-type Jaguar

Another ageless Jaguar design, the immortal "E" type originally derived from the "C" and "D" type racing cars is shown here in 2 plus 2 Series Two guise in 1969, employing the 4.2-liter version of the famous overhead

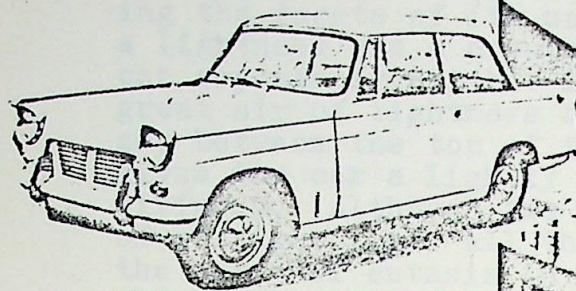
twin-cam engine. Customers for the 2 plus 2 also had the option of automatic transmission—an innovation missing from Jaguar's sporting range since the demise of the XK 150 in 1960. (GB)

48. Leaving the 50's behind the Americans had abandoned tail fins and had cars which were tending towards a series of flat planes ((Fig. ▼.) Rambler Ambassador '60 Chevrolet Bel-Air 62 Pontiac Tempest 62) the change is striking between the 62 Bel-Air and the earlier example shown. Boot and bonnet are nearly flat and fore and aft lines are completely straight. The grille is a regular grid and bright-work is not emphatically sculptured. An influence in this was the new buildings appearing at that time, like the Seagram Building (Mies Van Der Rohe) and the Lever Building (Skidmore Owings and Merrill) (Fig. ▼). The grid of mullions and transoms on the curtain walls of these buildings (unemphatic, neither stressing vertical or horizontal) influenced the grilles on these cars. The impressiveness of large unadorned slab (Lever building or I.B.M computer or slab in "2001 a space odyssey") must have influenced American stylists with the feeling of impassive technology. A further analogy is that these cars compared with pre-war American cars are like the styling of an art deco radio compared with a transistor.



48 60's American cars

48 Lever Building
Lever House, New York
City. Skidmore, Owings
& Merrill, 1952. Exterior.

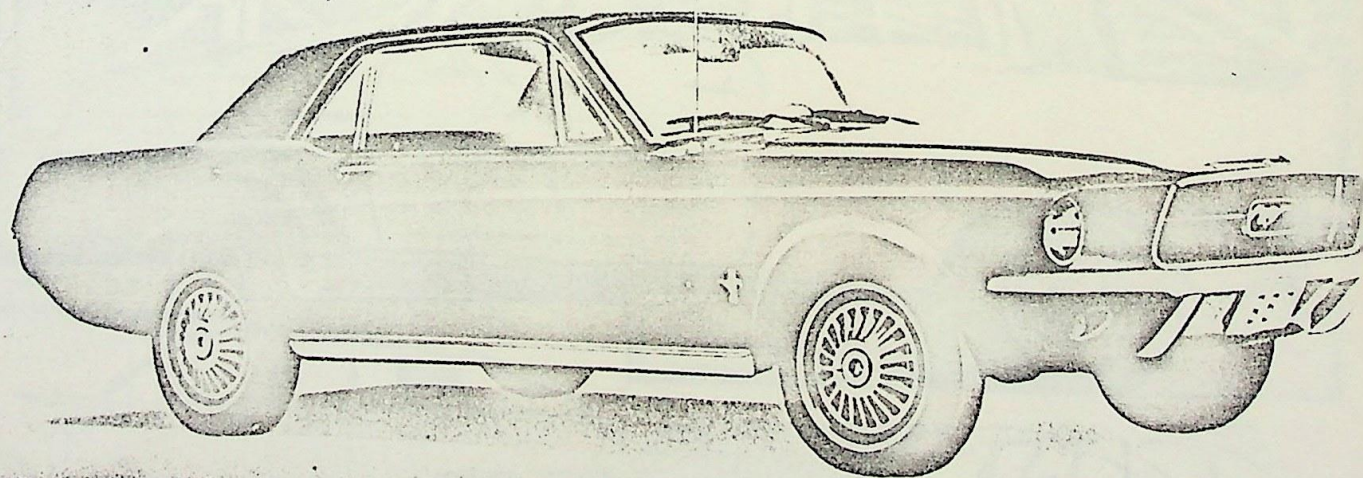


49 Triumph Herald

49. While American cars were moving towards slab styling the European stylists were applying a modified form of the earlier U.S. style. The Triumph Herald of 1959 styled by Michelotti (Fig. ▲) had fins at the rear and peaked headlamps but the grille was restrained and the bumper blended with the bodywork. The Anglia (1960) with the reverse rake back window shared this type of styling and had a wide grinning grille as well.

The MK1 Cortina of 1961 was styled in the new American mode and the MK2 model completed the transition to a squared off car, the grille notably being flat and more a product of the graphic artist, in its flat use of light and dark, than of the sculptor as in the 1955 Bel-Air (Fig 42 ◀).

50. The MK3 Cortina, when it came, was again influenced from America but with styling derived from the Mustang of 1964 (Fig. ▼) which brought back the curved waistline. This new style unlike the earlier drooping waistline beneath the windows, accentuated the uplift on the rear wing panel. The fastback version of the Mustang (Fig.) is very reminiscent of the 60's and many makers styled a fastback onto their coupe's (see chapter 1), but the functionless triangle of body work above the rear wheel and the steep rear window gave such poor visibility that the style is not very prevalent any longer.

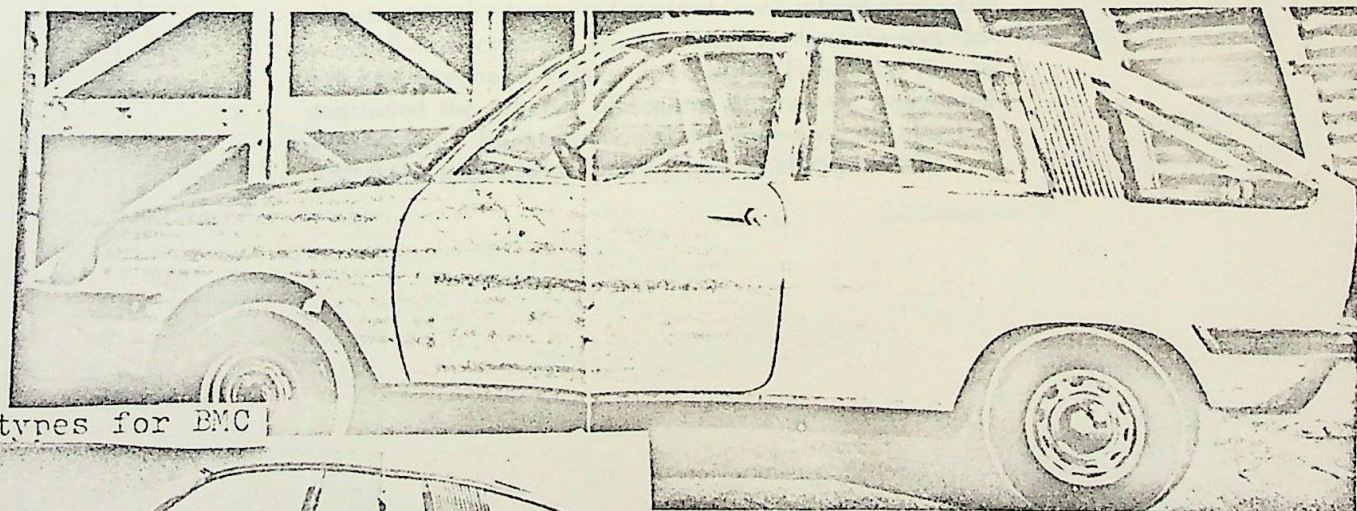


50 Ford Mustang
2 Ford Mustang Hardtop, 1967.

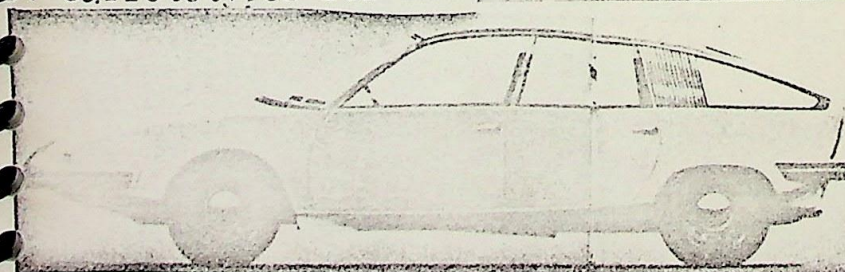
51. The slab styling remains today the usual way of dealing with a box saloon; Mercedes, Audi, Volvo, Ford Granada, Hillman Hunter) but it was never better used than in the Pininfarina Fiat 130 (Fig. 86) which with the light defining the facets of its usually metallic silver bodywork has a lightness and a crystalline look. The proportions of the car especially notable in the grille and lights give it a great air of lightness and repose for such a large car. The gap between the top of the wheels and the wheel arches gives the car a lightly sprung look which adds to its airiness. Although the car has the look of being composed of straight lines all the panels have a subtle curve (like the curve of entasis in a classical column) which prevents the panels looking like the body plates of a tank.

52. Meanwhile back in the 60's another present day form was born with the 1965 Renault 16 (Fig. 87). The hatchback is a style difficult to define but readily distinguishable from either a fastback or an estate car: all 3 slope from the horizontal roof to a vertical panel; but to me a hatchback has a sloped part at an angle of 30-45 degrees whereas an estate car is more perpendicular and a fastback is more horizontal. The R.16 is definitely hatchback; a 4 side-door car with an angled rear door, in all the models in the range. Cars existed at that time which look as if they should be hatchbacks (Austin A40, Morris 1100) but they had a conventional boot. Nowadays if such cars were being made they would undoubtedly be hatchbacks whether they were large cars (like Renault 30, Saab 99) medium sized (like Opel Manta) or especially small cars (VW Passat, VW Golf, Ford Fiesta, Peugeot 104, Renault 5, Fiat Ritmo)

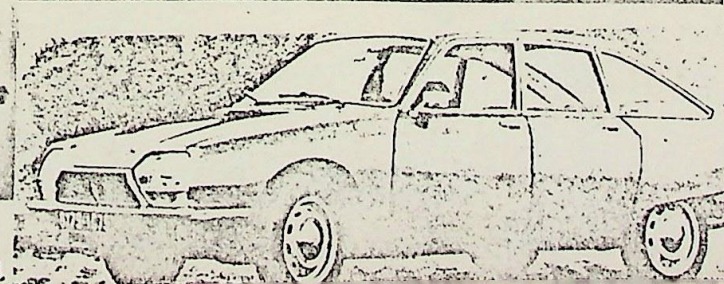
53. Design prototypes which were rejected for production were Pininfarina's 1967 designs for BMC for the Austin 1100 and 1800 (Fig. 88 top and bottom respectively). They were very similar with their lens shaped noses and smooth flow up to low pitched windscreens and the Kamm back, which is cut off as if by a knife. BMC management liked the designs but were disinclined to change the existing model.

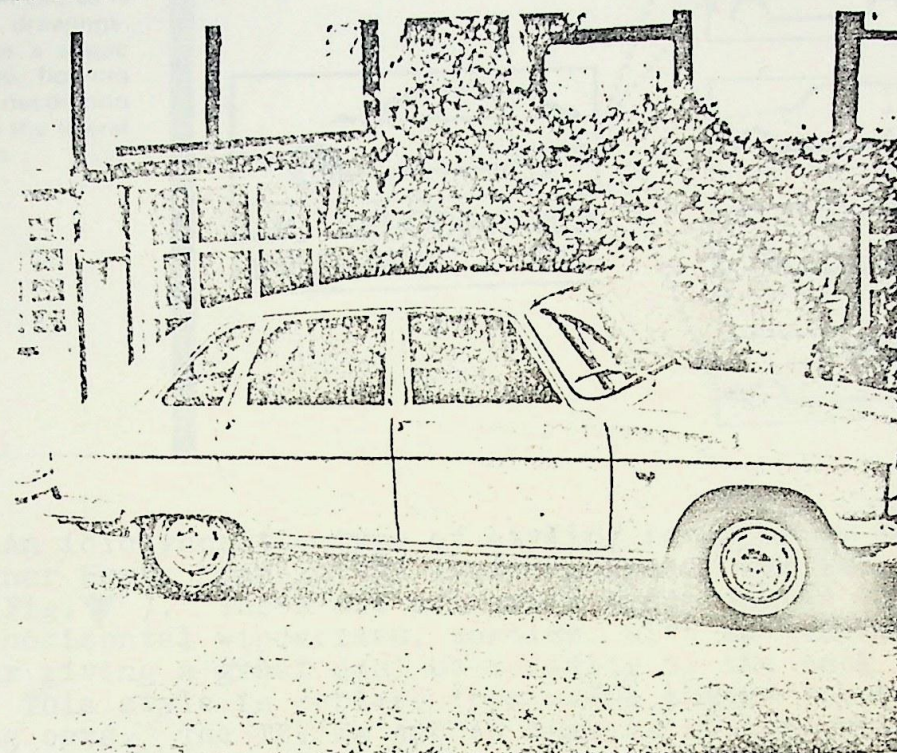


53. Prototypes for BMC



Citroën GS

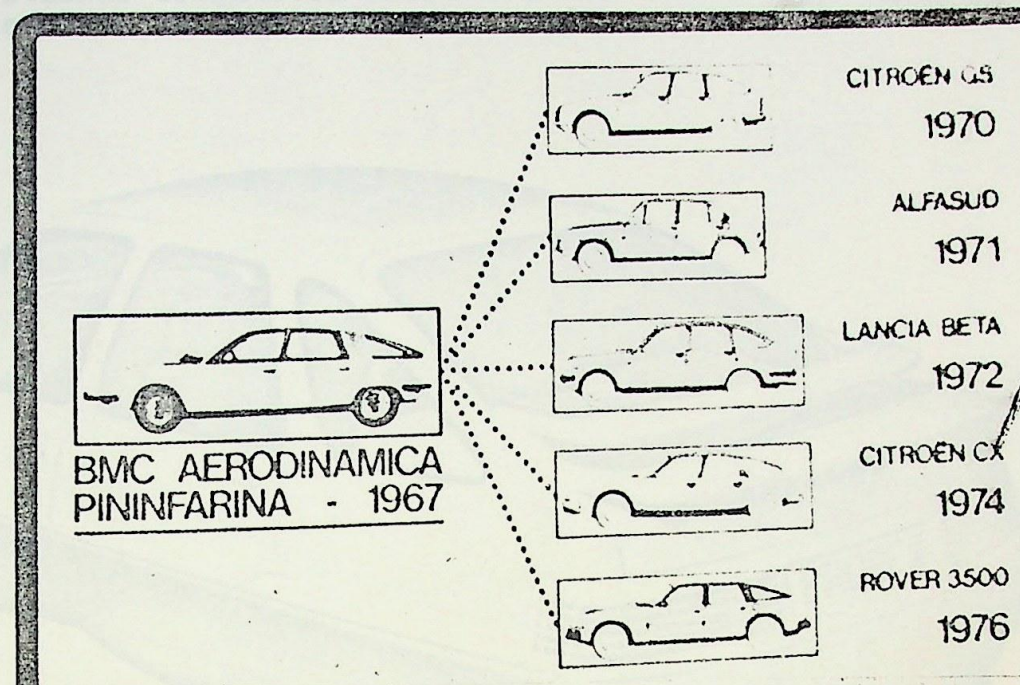




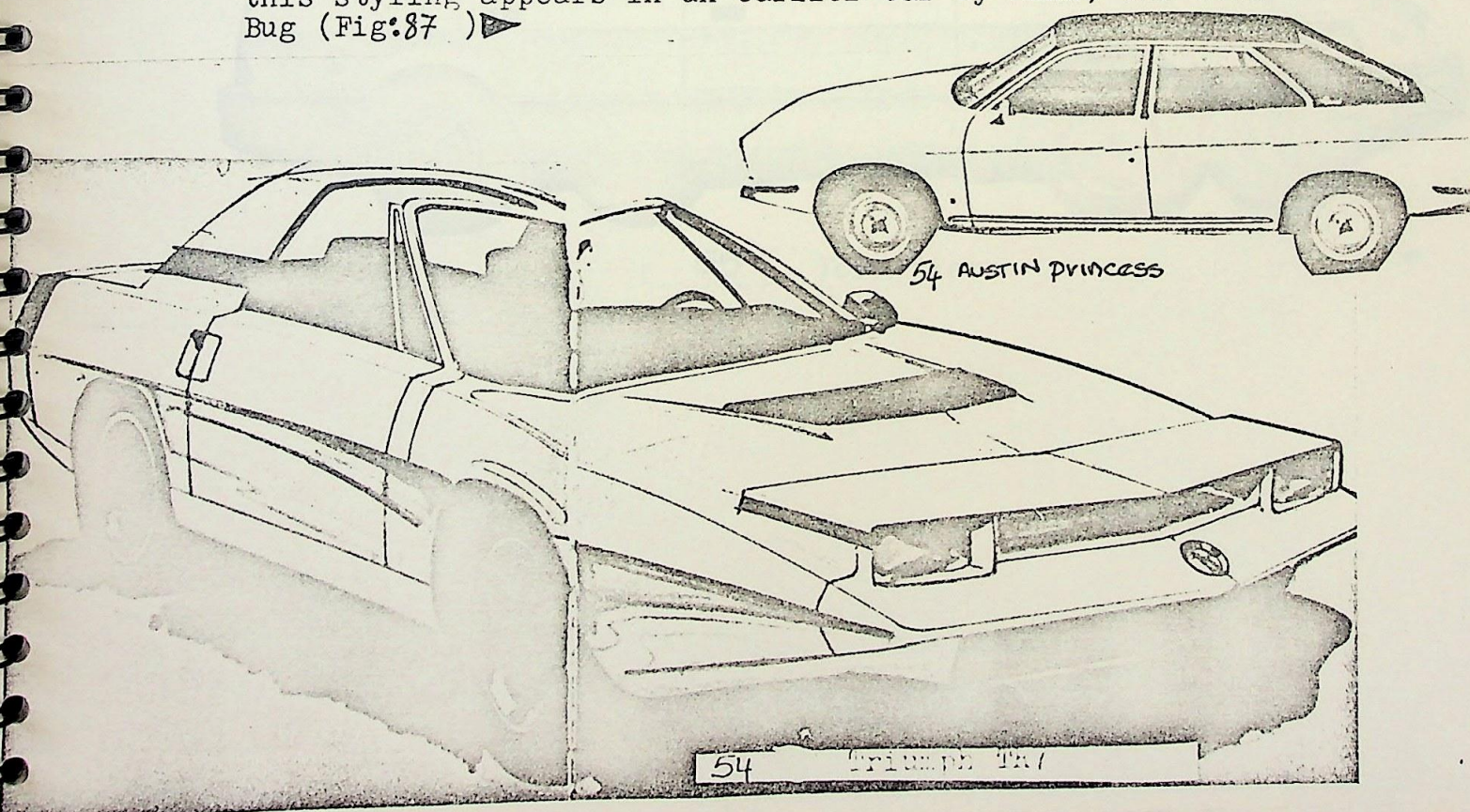
52. Voted the "Car of the Year" when it was introduced in 1965, the Renault 16 bristled with innovations. A full four-door sedan, but with large rear-opening door on shooting brake lines, it featured front-wheel drive and a 1,470-cc, 4-cylinder engine, with removable wet liners and overhead valves. Like other Renaults, the 16 continued the practice of sealing the coolant, pioneered by the firm. Suspension was independent all around, and front disk brakes were fitted as standard. (F)

Citroen however used the designs for their GS of 1970 and the DS replacement: the CX of 1974 (Fig.). The line sweeping from front pillar to front of door is more abrupt and less graceful in the Citroens though. Other derivatives of the same shape are shown in the illustration.

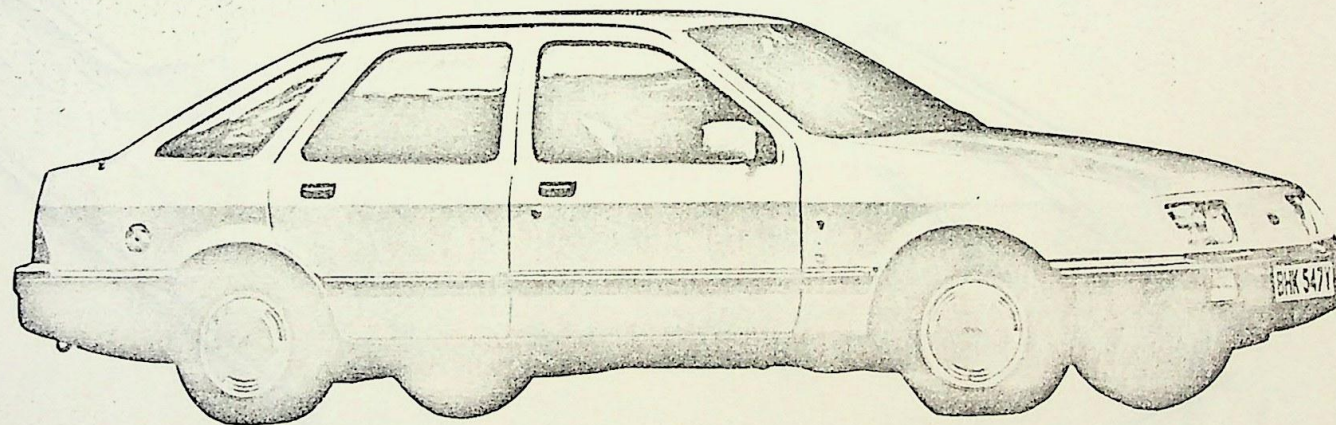
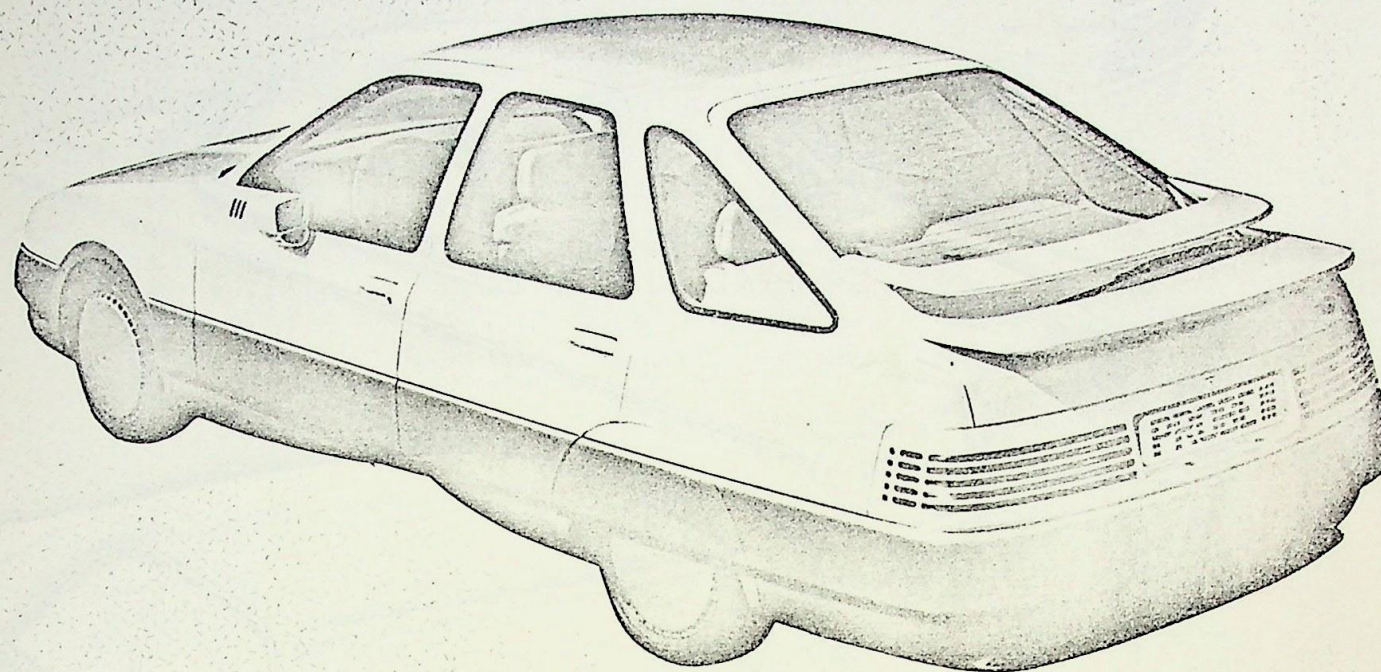
53 Aerodynamic BMC 1800
 balloons The different aerodynamic balloons of Pininfarina, introduced from 1967 on with the BMC 1800 (left) and the 1968 BMC 1100 (above), follow a very consistent and realistic line and purpose which certainly have had a very definite influence on the evolution of the medium-sized European car, as is shown by the comparative drawings. The volume is considered as a single block, carefully shaped into flowing surfaces, without any use of decoration except for the plated grills on the lateral pillars, justified for ventilation.



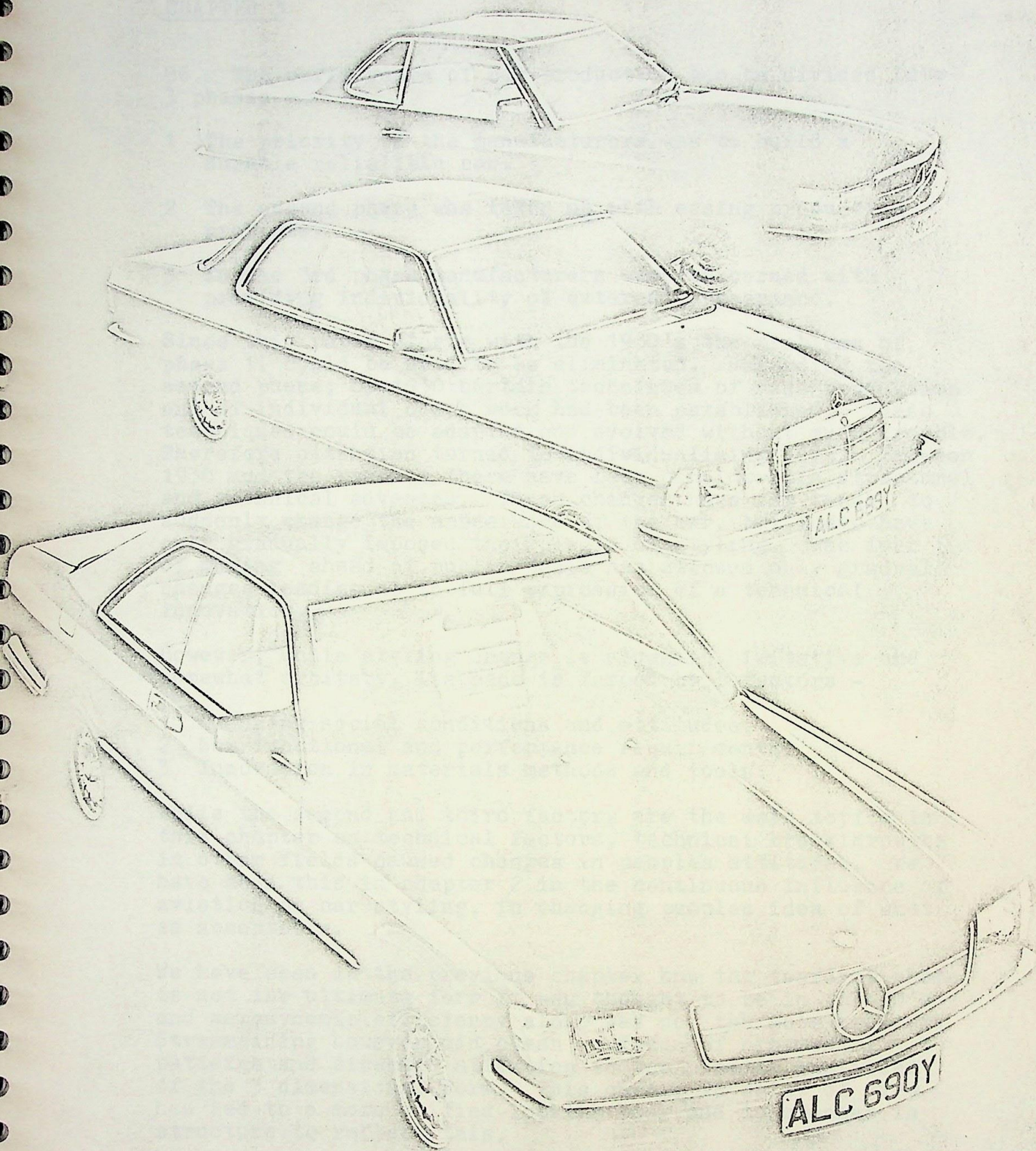
54. An idiosyncratic type of styling is shown by the British designer Harry Mann in the Austin Princess and the Triumph TR7 (Fig.). These are extremely wedge shaped with a very horizontal windscreen, combined with an overheavy rear pillar giving a great deal of solidity to the back of the car. This style is derived from wedge shaped Formula one racing cars. The TR7 is odd in that it appears higher off the ground than the large saloon. A caricature version of this styling appears in an earlier car by Mann; the Bond Bug (Fig. 87).



55. A trend in styling at present is to take a square car and round off the corners as can be seen from the Mercedes illustration. Compare the centre car with the bottom one. (Fig. ▼) (See chap 1). It is epitomised in the Ford Sierra and the (Fig. ▼) Probe on which it is based. A feature of the Sierra is the absence of brightwork, chrome bumpers being replaced by plastic or rubber ones. The windows also lack the traditional brightwork surrounds and this helps the top of the doors to blend with the roof.



55 Ford Sierra



CHAPTER 3

56. The early years of car production can be divided into 3 phases -

- 1 The priority of the manufacturers was to build a durable reliable car.
- 2 The second phase was taken up with easing production problems.
- 3 In the 3rd phase manufacturers were concerned with providing individuality of external appearance.

Since this paper starts with the 1930's the problems of phase 1. could be said to be eliminated. Regarding the second phase; by 1930 certain techniques of mass production and of individual coach work had been established. These techniques could be adapted and evolved without much trouble. Therefore attention turned to individualising cars. Between 1930 and the present there have been considerable structural and technical advances. These changes have not tended to suddenly change the appearance of the car, but these have only gradually imposed their logic on styling. The fear of moving ahead of public taste has allowed only gradual changes leading up to full expression of a technical innovation.

However, while styling change is sluggish, imitative and somewhat arbitrary, its pace is forced by 3 factors -

- 1 Changing social conditions and attitudes.
- 2 New functional and performance requirements.
- 3 Innovation in materials methods and tools.

While the second and third factors are the main topics in this chapter on technical factors, technical breakthroughs in other fields caused changes in peoples attitudes. We have seen this in chapter 2 in the continuous influence of aviation on car styling, in changing peoples idea of what is acceptable.

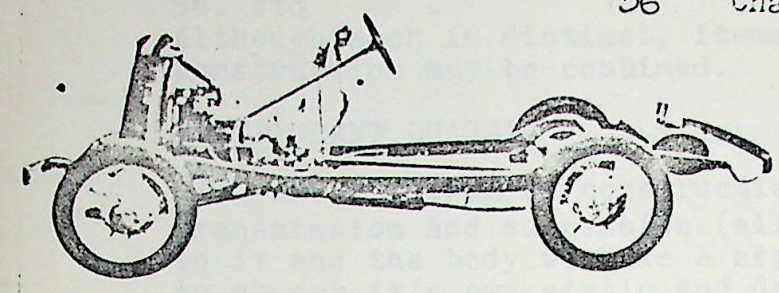
We have seen in the previous chapter how the teardrop shape is not the ultimate form it was thought to be in the 30's and aerodynamic efficiency alone was not the sole arbiter. Streamlining however did clean surfaces of ornamental patterns and directed attention to the plastic qualities of the 3 dimensional form. This change in point of view has led to a more unified looking body and to changes in structure to reflect this.

There are 3 structures applicable to cars

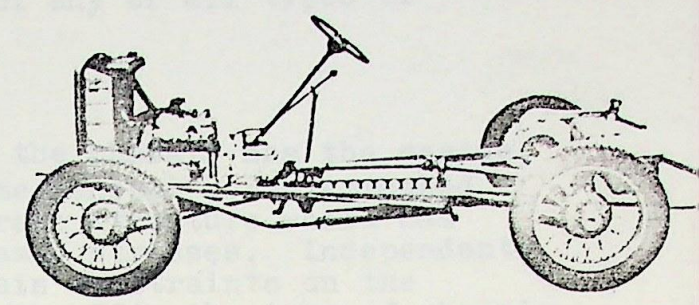
- 1 Independent chassis and body (Fig ▼)
- 2 Space frame construction (Fig ▼)
- 3 Monocoque construction (Fig ▼)

The last two are referred to as unitary construction.

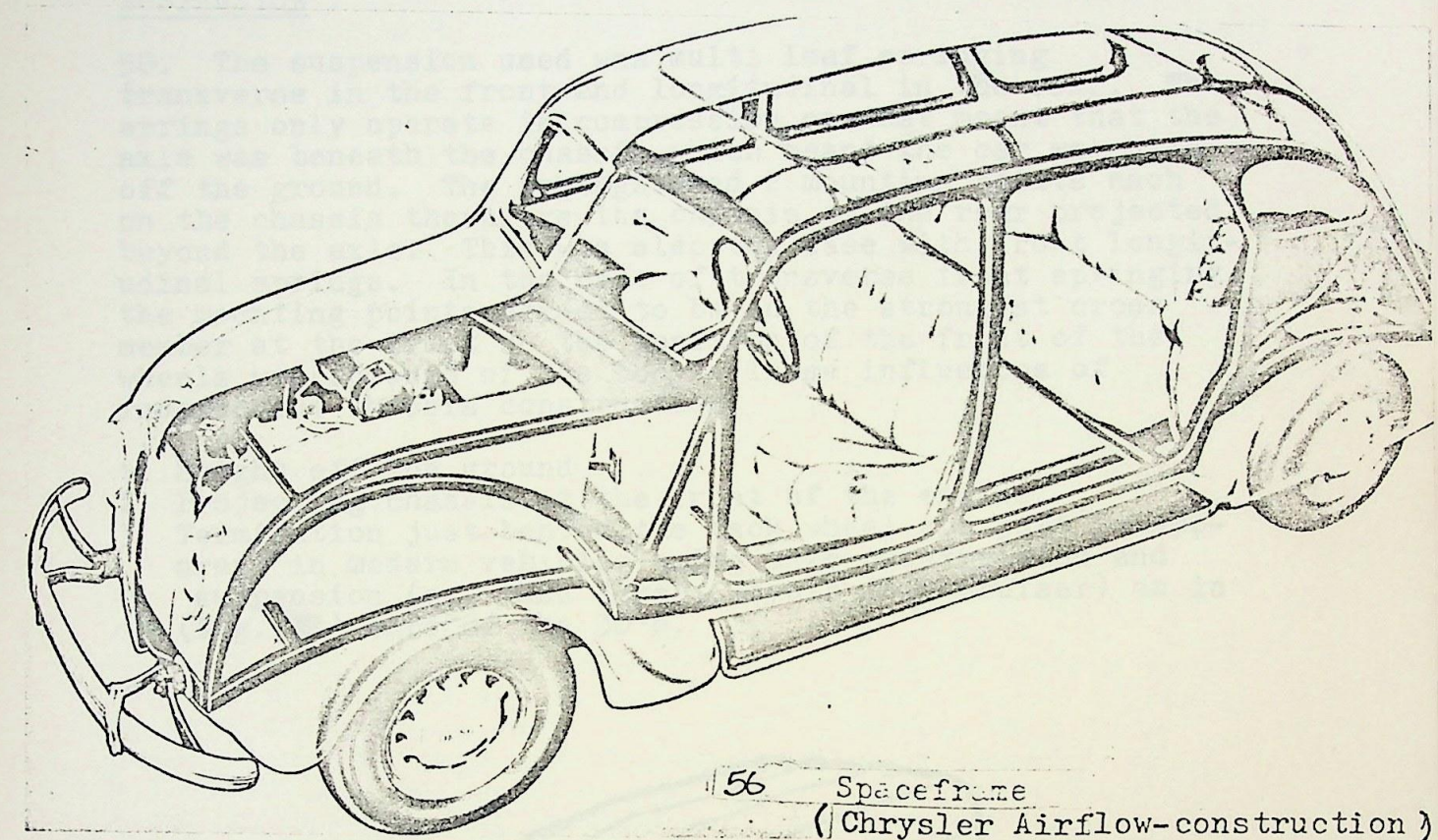
56 Chassis



Ford chassis: 1937



Austin chassis: 1935



56 Spaceframe
(Chrysler Airflow-construction)

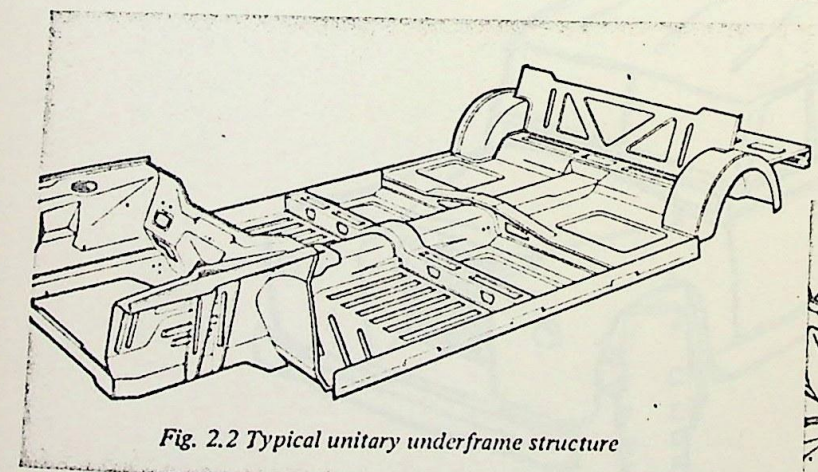
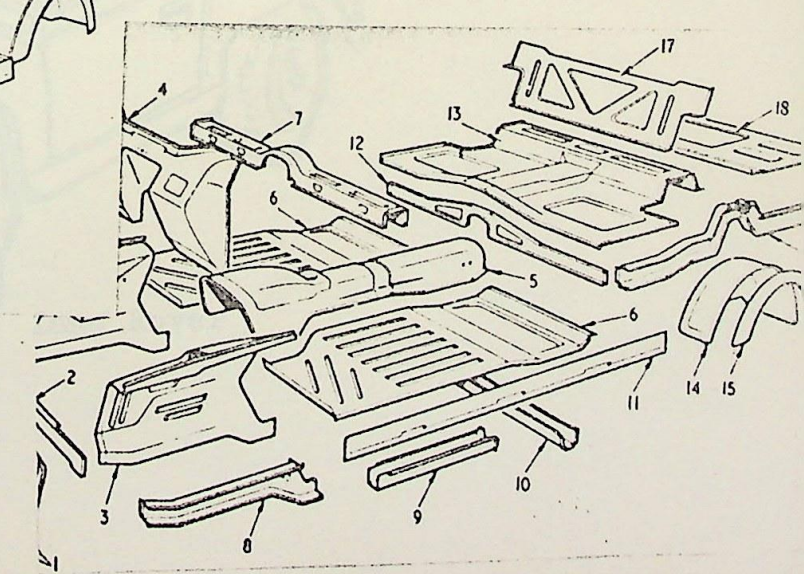


Fig. 2.2 Typical unitary underframe structure

56 Monocoque



56. ctd

Although each is distinct, items of any or all types of construction may be combined.

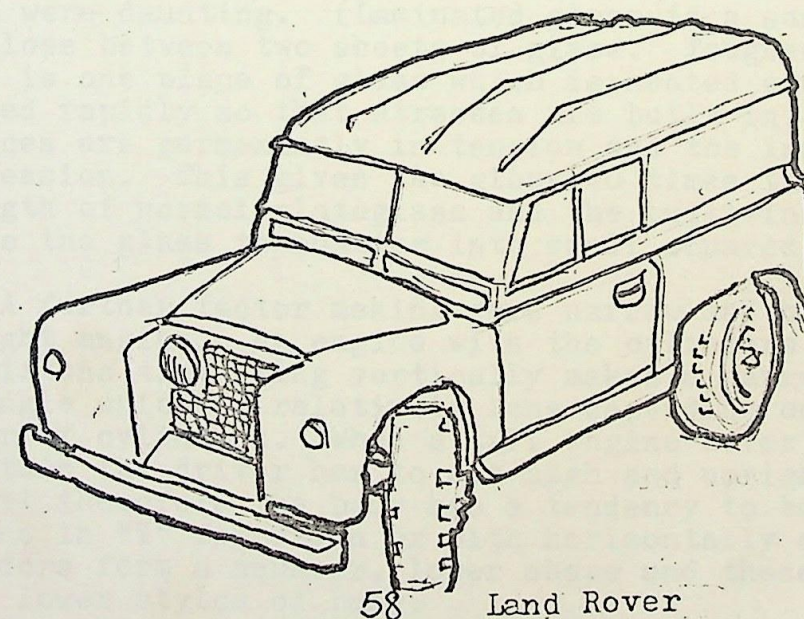
INDEPENDENT CHASSIS

57. In this form of construction the chassis has the engine, transmission and suspension (all mechanical parts) attached to it and the body work is a separate structure which has to absorb it's own static and dynamic stresses. Independent chassis construction imposes certain constraints on the body which covers it. In cars of the 30's the type of chassis and suspension dictated the form of the car.

SUSPENSION

58. The suspension used was multi leaf springing transverse in the front and longitudinal in the rear. The springs only operate in compression so that meant that the axle was beneath the chassis which meant the car was high off the ground. The springs need 2 mounting points each on the chassis therefore the chassis at the rear projected beyond the axle. This was also the case with front longitudinal springs. In the case of transverse front springing the mounting points needed to be on the strongest cross member at the front so the position of the front of the wheels was forward of the body. These influences of independent chassis construction.

- 1 Height off the ground
- 2 Projecting chassis at the front of the engine
- 3 Termination just behind the back wheel are just as apparent in modern vehicles using this construction and suspension (eg. Land Rover, Toyota Land Cruiser) as in (Fig. ▼) cars of the 30's.



58

Land Rover

59. Looking at a plan of a separate chassis it becomes apparent that to build the body work outboard of the longitudinal chassis rail, cantilevered outriggers are needed adding to construction costs and lessening stability. This is why bodies until the 40's were not usually built to the full width of the wheels, separate mudguards and a running board provided the extra width.

60. Until the mid 30's it was normal for the chassis rail to be expressed in side view as a sill between the running board and the body above. This sill is more apparent on larger cars with longer wheelbases and deeper chassis members and adds to the impression of height.

61. As the body only had to support it's own weight the simple traditional coachbuilding methods could be used. This meant a wood frame with unstressed panels attached to it. The body work therefore was an advanced piece of joinery and it is easier to join pieces of wood at right angles the bodies were square and upright.

As chassis can only have a limited depth they lack rigidity on their own they therefore twist on rough roads or when cornering. The body above twists along with the chassis and the answer to this was to have separate body panels loosely joined together. The alternative would be a heavy rigid body which would (a) strain the mounting points and (b) need a heavy roof (to make a rigid box) and be topheavy.

62. Wood framed bodies were the norm and braced frames with fabric covering were very common. These fabric covered bodies were called Weymann bodies after a man who designed aeroplanes in the same manner during WW1 and who transferred the technology to cars.

63. Before 1930 90 per-cent of cars were open topped and fabric roofed. The reason for this is that the weight of the glass and its height off the ground led to instability. Another reason is that laminated safety glass was not in general use before then and the hazards of sharp slivers of glass as well as spears of broken wood in a crash were daunting. (Laminated glass is a sandwich of cellulose between two sheets of glass. Toughened safety glass is one piece of glass which is heated and air chilled rapidly so that stresses are built in, the outer surfaces are permanently in tension and the inside is in compression. This gives the glass 10 times the impact strength of normal plateglass and the built-in stress causes the glass to shatter into small squared pieces)

64. A further factor making cars narrow and high was the straight engine. An engine with the cylinders in line and the pistons travelling vertically makes a narrow upright rectangle which is relatively long depending on the number of cylinders. When a tall engine cover is placed over this the driver has to sit high and upright to see over it therefore the body has a tendency to be tall. Engines in "V" formation or with horizontally opposed cylinders form a squarer, lower shape and these influenced wider lower styles of body.

65. The last two forms of construction are known as unitary construction. One single unit absorbs the stresses of the load in motion. Space frame construction can be seen in (Fig. 56A) Chrysler airflow. This is a system of tubing or pressed channels which are more or less triangulated because as in a bicycle frame this is the most rigid arrangement possible. Unlike chassis construction this method militates against open topped cars. If we look at the Airflow picture we see that if the roof were to be taken off the strength of the car would be drastically reduced. If a car is made with a triangulated frame the front and back naturally slope so this was the form naturally taken by early space frame cars.

A ladder chassis (1) can easily be made up by a skilled person but a spaceframe has more complex forces in it and is much more difficult to make up. Although most modern racing cars are made using a space frame lattice of small tubing, it's large scale use in production cars is small. A remnant of space frame construction are the stiffening built into structural panel constructed cars, eg. diagonal bracing ribs on the underside of bonnet/bootlid. Pure spaceframe construction does not lend itself to mass production because the strength is dependent on a large number of accurate joints, which are time consuming and labour intensive to make.

66. Monocoque construction consists of a structural shell. It is not a technique suitable for craft/ small workshop production. To make a large deep metal pressing like a motor body panel needs a very large machine and forces in the order of hundreds of tonnes. Monocoque construction was not practicable until the motor industry had sufficient resources to invest in large machinery and until techniques for welding thin metal panels had been perfected; Rolls constructed only chassis, engines and mechanical parts for their cars until after the second world war and only produced their first unit constructed car, the Silver Shadow in 1965.

67. The Citroen "Traction Avant" of 1934 was a very advanced car for it's time. It was the first mass produced front wheel drive car. It had torsion bar suspension which enabled the rear wheels to be placed right at the back and it had a unitary construction body designed by the Budd Steel Body company of the U.S. The car had a low slung flat welded floor because of the front wheel drive. The "traction" was so mechanically advanced that it bankrupted Citroen and the firm was bought by Michelin.

The floorpan was what is known as a "pant body-pan", that is a deep floor pan roughly shaped like a pant and playing a major part in the structure of the vehicle. The pant is apparent in the way the sills curve under to the floor. This type of pant construction was used later in the Citroen 2CV and in the Volkswagen Beetle. The way in which the floorpan of a Beetle can be removed and mated with a fibreglass body to make a beach buggy demonstrates the structural role of the pant floor pan.

Contemporary cars such as Ford Escort or Cortina have monocoque construction in which all the body panels play a structural role, this means that quite minor accident damage to one panel could deform the whole car into an insurance "write off".

68. Another aspect of fully unitary monocoque construction is that it makes model variants such as coupe or open top difficult unless they are planned for at the very start. The converse of this principle is seen in the Triumph Herald for instance. This car was a composite construction and was a much more adaptable base to repair or to alter. The passenger compartment of the Herald was built on a structural body pan with the transmission hump in the centre lending strength and the front and rear bulkheads built on to the floor pan and also playing a part in the structure. This centre section had rail chassis built on at the front and rear which supported the engine and suspension. The non structural bodywork was light and open to change (The entire front; bumper, lights, wings, grille etc hinged forward to reveal the engine) This non structural element of the body work was exploited to the full with the very light looking roof given to the car, the opportunities for easily installing a larger engine and the large numbers of permutations of the car. The variants included; the standard car, the coupe (with its fluted rear pillars), an open topped version, an estate car, a restyled bonnet and larger engine in the Vitesse and finally the basic structure was used for the Triumph Spitfire and its variants.

69. Although the structure of a car is capable of being given strong expression (Land Rover, Land Cruiser, vintage cars). Stylists shy away from expressing the structure and try to convey strength and suppleness through ornament such as the plastic strip going round the Renault 5 at wheel height. Stylists tend to produce the same car body whether they are designing it in structural steel or fibreglass (example Morris 1100's for export to underdeveloped countries had fibreglass panels), and it is the style rather than the structure which counts to the customer. A custom car enthusiast can make a "Ford Popular" from a chassis made by Jago Ltd, a body from Fibreglass Applications, a Vauxhall Viva front suspension/steering, a Jaguar independent rear suspension and a Rover V8 engine; containing no Ford parts at all!

We can see that the public is torn between

- 1 Fascination with futuristic styles (Lamborghini Lotus et.al)
- 2 Respect for the traditional panoply of classic limousines and
- 3 An affection for the "tin lizzie" style of car (2CV, Morris Minor) which they learned to drive in. The manufacturers are pleased to cater for these tastes but to the detriment of expression of the car as a whole, structural as well as non structural.

NON STRUCTURAL TECHNICAL ADVANCES

70. In the previous section we have seen how shape and disposition of engine, constructional technique and type of suspension affected the look of the car. In this part of the chapter we will examine the effects of

- 1 chrome painting
- 2 paint
- 3 tyres
- 4 plastic additions
- 5 the styling of cars

CHROME

71. Chrome plating was first applied to cars in the U.S. in the mid 1920's. It was first used on Cadillac models but by the end of it's production run in 1927 the Model T had a chromed radiator shell instead of the previous copper item. As appreciation grew of the look of chrome and it's ease of maintenance, it's use became widespread.

Copper or brass items (radiator shells, lights) on cars had to be formed from sheet and this led to parts having relatively sharp angles and flat planes. The difference with chrome plating was that it could be added to a casting or a pressing composed of a more rounded shape. While brass and copper have dull reflections (especially if not cleaned frequently), and a dark colour which gives them a look of solidity. Soft chrome (as the finish is called) gives a mirror like reflection and echo's the colour of the sky and surroundings. Chrome also gives an intense reflection of the sun. These factors give chrome an airy neutrality if used in spiky staccato forms (50's American cars) the chrome reflects a lot of both high-lights and shadows giving a heavy look to the car.

72. REACTION AGAINST CHROME

In recent years there has been a reaction to brightwork trims around windows, lights and grilles. The reaction has taken the form of - expressing the edges of panels around lights (Renault 5) and either expressing the part of the door around the windows as a continued panel from the lower part of the door - or trying to visually remove the doorpillars altogether by using matt black rubber or metal (Opel Manta 2 door). Du Pont introduced "Black Chrome" in 1975 and matt black is the fashion colour for photographic equipment at present.

73. PAINT

"Let them have any colour they want as long as it's black" is a well known saying of Henry Ford's. Other manufacturers of mass produced cars, as well as the maker of the model T, must have felt the same way. Paint at the time was slow drying oil paint which had to be left for a long while to dry, between coats. The black pigment was the most opaque and so needed fewer coats to paint a car.

The introduction in 1924 by DuPont of cellulose based quick drying paint meant that other colours than black could be used economically, so cars became more colourful from that point on.

74. METALLIC PAINT

This was first available on British cars in 1934. The effects of metallic paint are discussed in Chap 2 on the Fiat 130. The metallic effect is gained by including ground metal particles in the paint.

75. COLOURS

Some colours have been associated with particular cars. For instance the 1922 Opel Laubfrosch (Tree Toad) was a peculiar shade of green. The Citroen 5CV type C 1922 was known as the Citron Citroen because its manufacturers used up thousands of gallons of war reparations paint on the cars. In the same way we think always of 1928 4½ litre Bentleys in stiff-upper-lip British racing green and of "E" type Jaguars in a particularly inflamed shade of red.

In recent years there has been a return to dark colours and to black; most new Saabs seem to be black. Mercedes had a bout of two tone cars during the 60's and 70's (chocolate and light tan was a favourite) but the new models are appearing more often in sober dirt resistant black.

76. TYRES AND WHEELS

TYPES OF WHEEL

Before the 1930's the "artillery" cast metal wheel with it's heavy spokes was the norm for larger cars and it gives them a rather agricultural look in retrospect. The heavy pattern of the spokes does not give a smooth transition between car and ground. Light cars in contrast had a spindly look because of their light narrow spoked wheels reminiscent of motorcycles.

During the 30's deep drawn pressed metal wheels became common along with metal pressings for other parts of the car.

Roads in Europe were bad at the time so wheels had to be tall to surmount bumps. When Hitler started his autobahn programme in 1934 a direct result was that his people's car could have lower wheels and a more low slung appearance overall.

Wheels and tyres were narrow before the war and were placed well inboard which meant they were deeply shadowed. This meant that they didn't relate well to the bodywork. To solve this chrome hubcaps were used to brighten the dark space and rear wheel spats were used extensively.

After the war tyres became wider and squatter especially on the bulging American cars immediately after the war. The wide body work over hung the tyres even more so white sidewalls were added to give the wheels some presence in their wheelwells. (Fig. 4)

After a period of lurking under low square cut wheel arches in the 50's and 60's, tyres and wheels moved outboard to sit in circular concentric wheelarches as is the present mode.

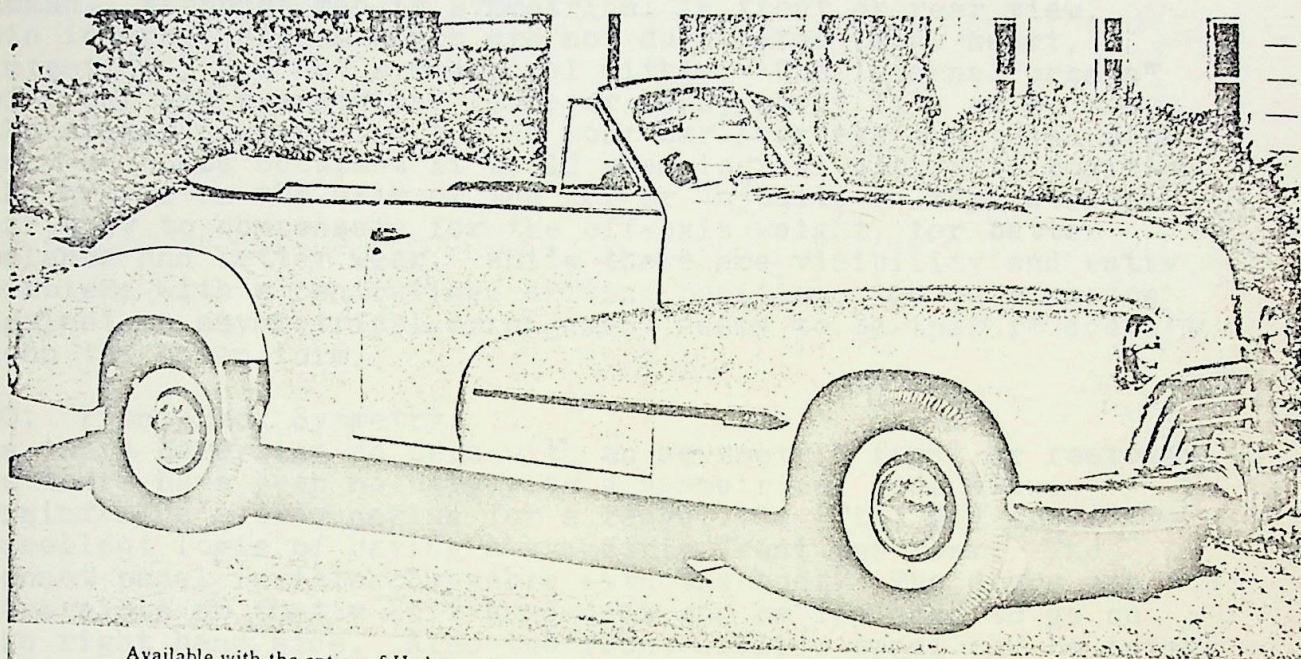
77. PLASTIC ADDITIONS

ctd

77.

Plastics haven't yet been developed to play a structural role (except for fibreglass) in cars. Their good impact absorbing properties have been utilised in bump strips on the sides of cars (Renault 5). Plastic covered bumpers (Volvo, TR7) and integral cellular "crash zones" in fibreglass cars like Chevrolet Corvette and Maserati Bora.

The large rubber bumpers on the TR7 and on Volvos are a result of U.S. federal regulations. Another federal regulation only repealed in 1977 forbade the use of anything but round headlamps. This is why Mercedes in American T.V. films have a very odd look about them.



Available with the option of Hydramatic transmission, the 3,903-cc, 6-cylinder Oldsmobile Special shown in 1946 was basically the 1941 "Dynamic" and continued in production through the 1947 model year. For 1948 it

received the "Futuramic" styling treatment, and by 1949, when the 4.9-liter "Rocket" was introduced, the old six had only two more years to run. (USA)

76

Whitewall tyres

CHAP (4)


The Morphology of the Motor Car.




78. Cars have the same relationship to drivers as clothes or suits of armour. They are past the stage of veteran cars which are huts on wheels and fit the occupant closely. People's view of cars reflects this and raises some interesting general anthropomorphic points. I am not going to deal with the particular point of likeness in the front of cars to the human face. Instead I think the factors of symmetry and convexity in cars, related to the humans who use them, are of interest. Both the symmetry and convexity anticipate the presence of man.

79. Symmetry - Bilateral.

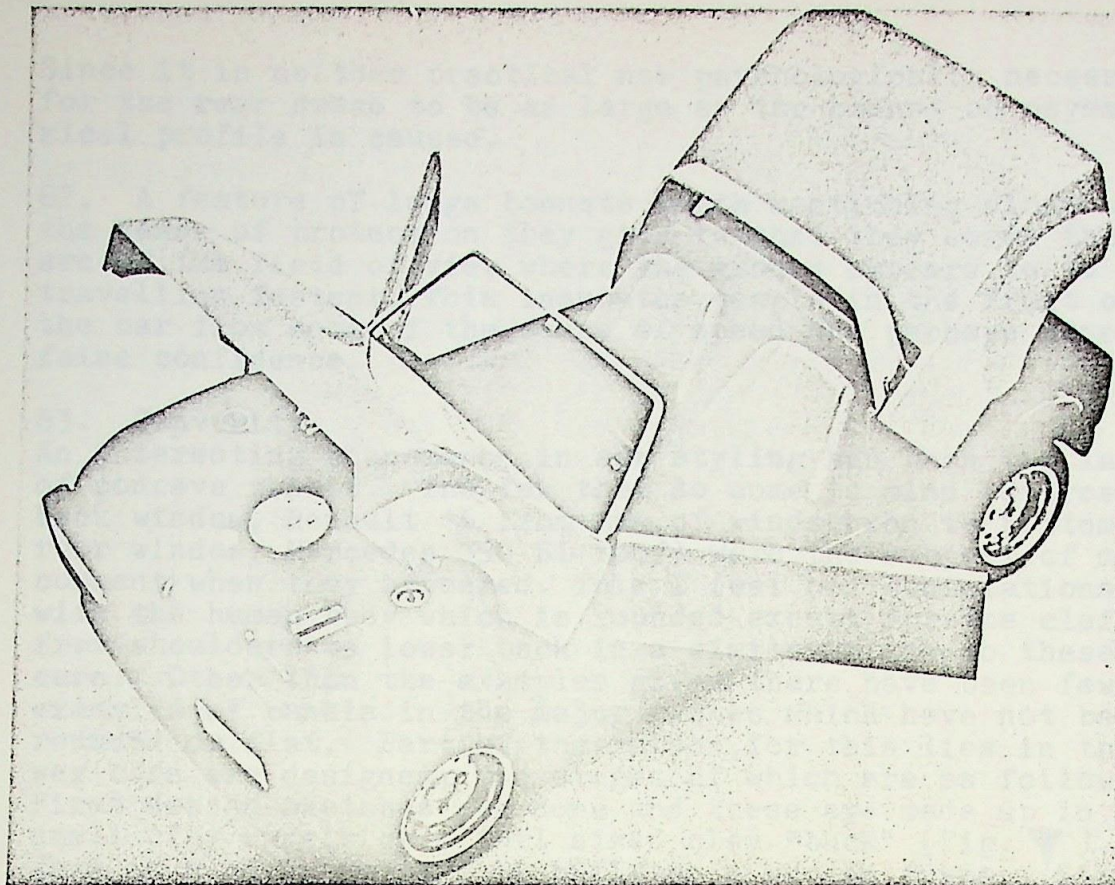
The bilaterally symmetrical outer form reflects that of the human. Although man is symmetrical in front or rear view, his internal organs which are not duplicated (e.g. heart, intestine) are not symmetrical within. The internal "organs" of a car are symmetrical (more or less) about its axis, but the driver however isn't. As most car journeys are taken with only a single occupant it would seem logical either to position the driver on the axis of the car or to build an asymmetrical car body to compensate for the off-axis weight, for better balance and better wear. While there are visibility and entry problems with a centralised driving position, the only reason against an asymmetrical arrangement seems to be that it doesn't echo the human form.

80. Front/Back Symmetry.

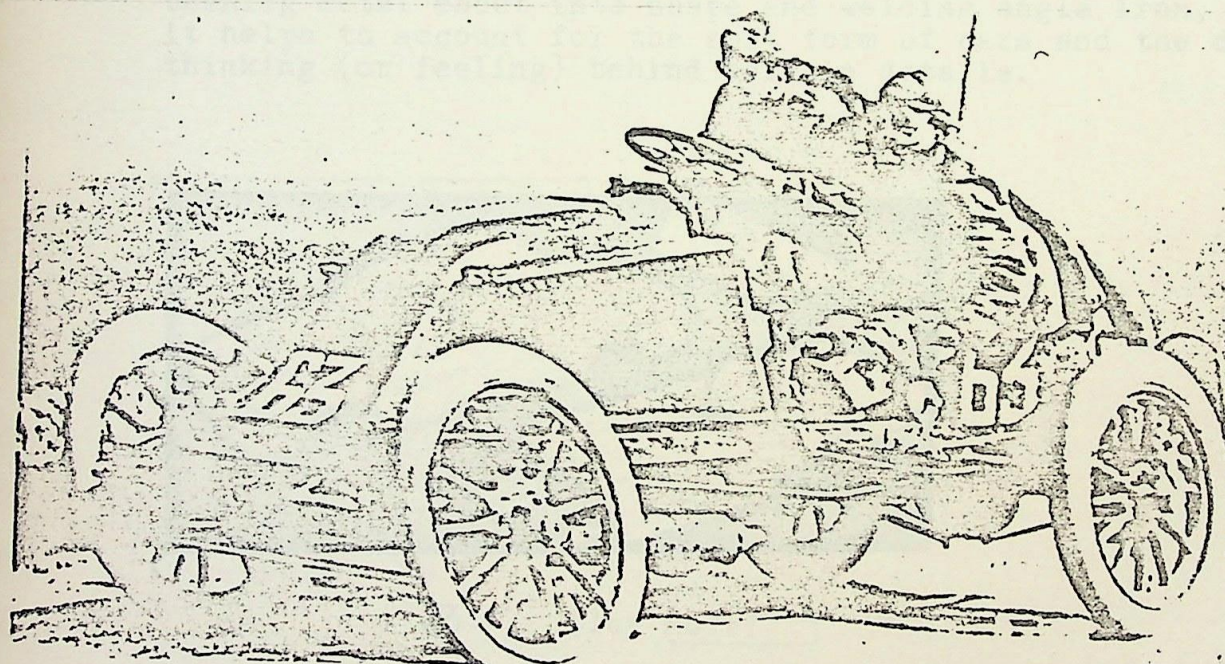
As there have been no cars with an asymmetric front or rearview, so there have been no cars with a symmetrical side view. Pininfarina's body design for a Peugeot 104 (fig. ) shows the excellent logic of having a symmetric front and rear. The bonnet panel is interchangeable with the boot. The doors are reversible so that a left hand door can be rehinged to go on the right hand side. Also the front offside panel can be interchanged with the rear nearside one. This excellent logic has never been put into practice because it looks too static. Cars have grown up at the same time as photography and films. The characteristics of these media have given artists and cartoonists some of their vocabulary.

(Fig. ) shows some of these characteristics: 1. The wheels and body distorted forward by the focal plane shutter of the camera (the wheels would have been distorted in the opposite direction if the direction of shutter travel had been different). 2. The speed blur on the spokes and the dust trail which would have become a speed blur if the rate of camera panning had been faster. This cartoon view of motion was applied to cars to make them look faster even when motionless. It became unexciting to have a car sitting squarely on its wheels, it had to sit, harelike, back on its haunches as the Citroen DS does (Fig. 44)  or appear to bull its way forward and not for nothing was the baby fiat of the 1930's called the "Topolino" (Mickey Mouse) (Fig. 34) .

81. Another reason for lack of symmetrical profiles in cars is because the nose and tail reflect people's "space bubbles"; that is the space around a person inside which, the presence of strangers makes him feel uncomfortable. The bonnet of a car fulfils the same function as an executive desk in keeping people at bay.



80 Pininfarina Peugeot 104



Marcel Renault at speed in the 6.3-liter, 30-hp Renault during the 1903 Paris-Madrid race. Several cars went out of control (speeds were up to 85 mph on the rough roads of the French countryside) during the early

stages, killing drivers, mechanics, and spectators. The race was stopped after the first leg, but not before Marcel Renault had run off the road and been fatally injured. (F)

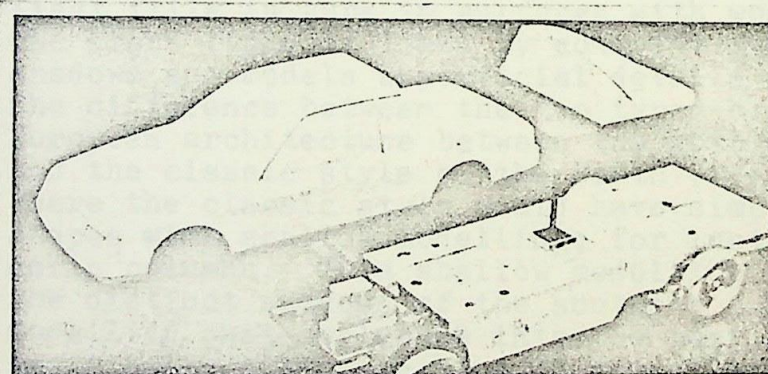
80 Early car photograph

Since it is neither practical nor psychologically necessary for the rear space to be as large as the bonnet an asymmetrical profile is caused.

82. A feature of large bonnets worth mentioning along with the sense of protection they give is that they cover that arc of the field of view where the ground appears to be travelling fastest. This insulates people in the front of the car from some of the sense of speed and perhaps gives false confidence.

83. Convexity.

An interesting phenomenon in car styling has been the lack of concave panels. The few that do come to mind (Citroen CX back window, Renault 16 from top of windscreen to bottom of rear window, Mercedes 350 SL roof) were the subject of much comment when they appeared. This I feel has connotations with the human body which is rounded except for the cleft from shoulders to lower back in a similar place to these cars. Other than the examples given there have been few examples of panels in the major planes which have not been rounded or flat. Part of the reason for this lies in the way cars are designed, the stages of which are as follows. First design sketches are done and these are made up in small clay models or a full sized clay "buck" (Fig. ▼). This is a covering of clay built on a wooden frame. Since the clay is only of limited thickness it is easier to add more clay for a rounded form than to cut into the wood for a concave form. The dimensions of the clay model are plotted by a manual to a computer controlled bridge and production drawings are done from this plot. This viewpoint shows us the designer sculpting the car in the soft clay rather than bashing metal sheet into shape and welding angle iron, and it helps to account for the soft form of cars and the design thinking (or feeling) behind certain details.



83. Clay model



Die Form wurde aus hartbarem plastischen Werkstoff modelliert.

84. "Divergent" Shapes and "Enclosed" Shapes.

Among these convex we can use two classifications - divergent and enclosed shapes. The divergent is epitomised by American and European cars of the "tail-fin" era

. The lines of these cars are all headed toward some point outside the car. All the lines are busy and unresolved and the car looks as if it is "shedding vectors in all directions". The enclosed shape is epitomised by the ISETTA Bubble car of the same period (Fig. 45A). Every line on this car curves around to meet another and the whole gives an air of passiveness and enclosure. It is significant that both come from the same year and that the American one looks fast, pushy, self confident and ready to shove off for the blue infinity of the stratosphere, The car from Germany - which was recovering from war and a fuel shortage - looks passive, womblike, finite but with a certain neatness and perkiness. There are other differences between the cars. The "divergent" car looks complicated and is full of technological references whereas the bubble car looks positively non mechanical, neat and easy to clean.

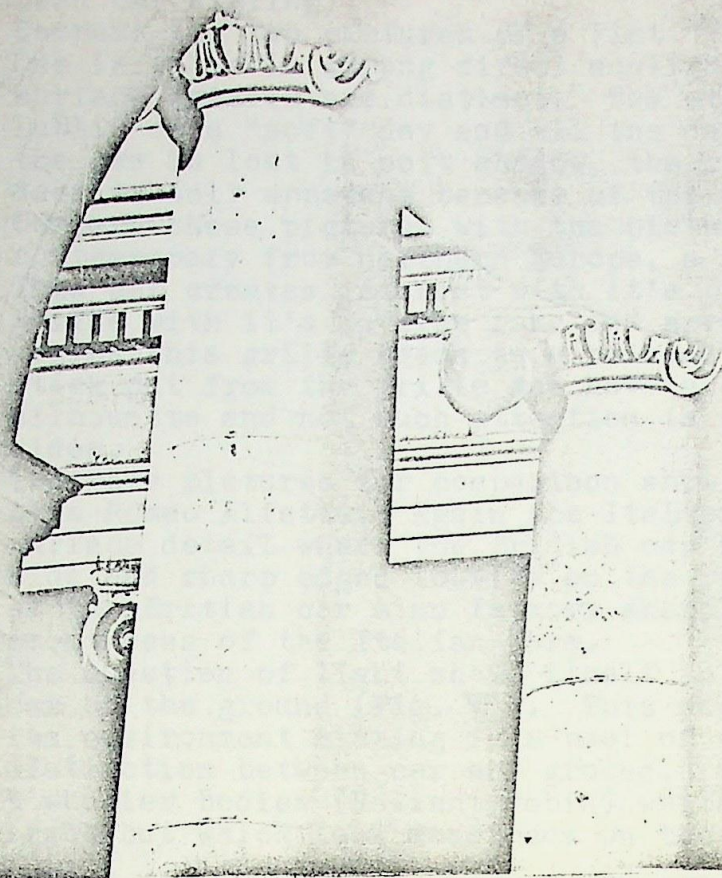
This classification works fairly well for dividing the brash from the sober, in styling, with lines resolved in curves or right angles going into one classification and unresolved lines into the other.

85. Relationship with Environment.

An important factor in styling of cars is the relationship to the environment where they are designed. There may be some elements of national characteristics in this (the art nouveau elements in the 2CV Citroen are well documented) but since there has been such a cross fertilisation of designers since the 1950's it would be hard to investigate national characteristics fully.

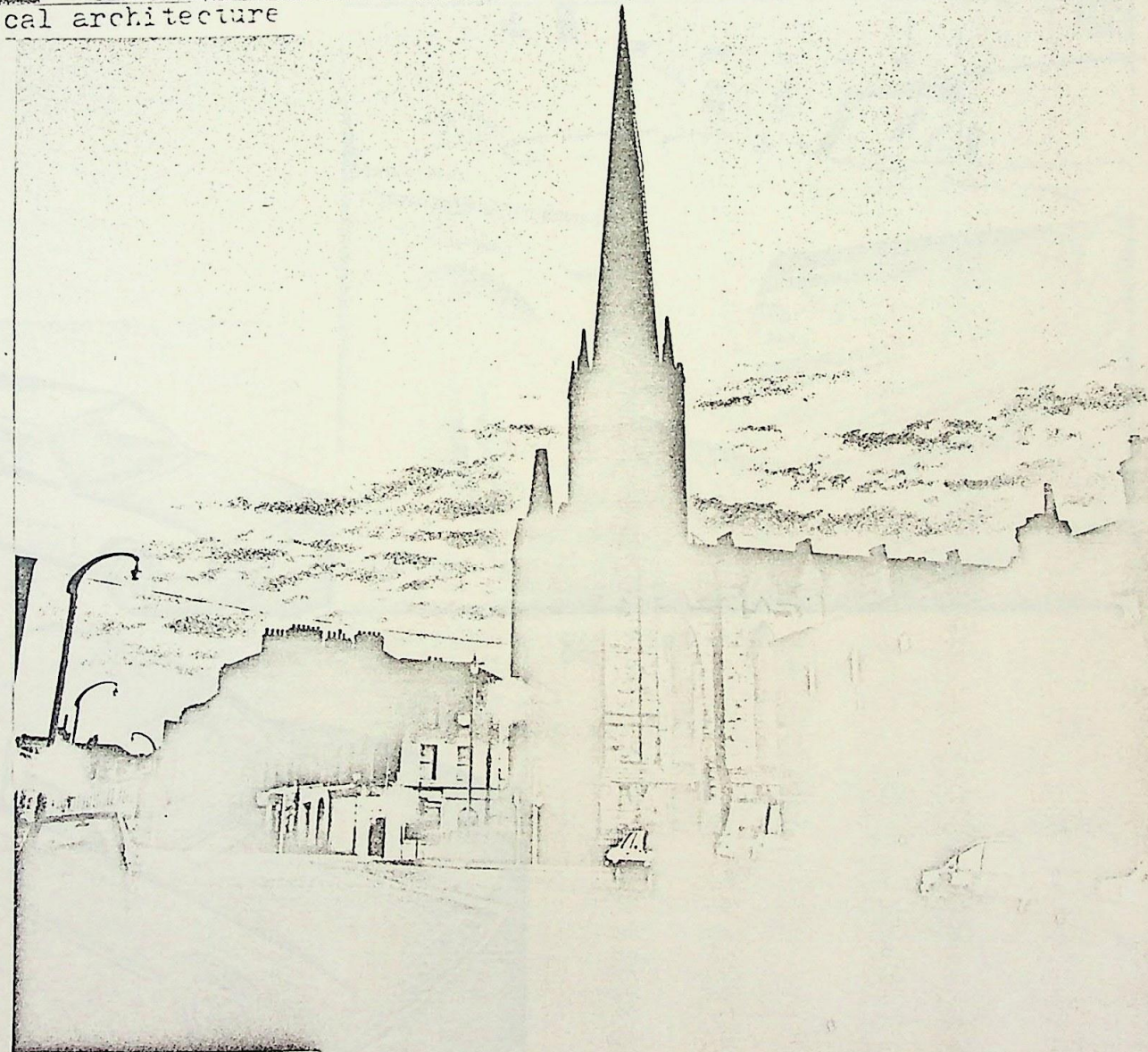
86. Northern Versus Southern.

A useful comparison, though, is between cars from Northern and Southern Europe. The misty diffuse light of northern Europe throws indistinct shadows without hard edges. This light fills in gaps in surfaces with wooly shadow. The light found in Italy by contrast is direct, casts distinct shadows and models superficial details well. The difference between the two types of light is apparent in European architecture between the gothic style of the North and the classic style of the South (Fig. ▼, Fig. ▼). Where the classic style could have simple geometric block shapes with shallow modelling; for instance the fluting in doric columns. This shallow modelling was given substance by the distinct shadows of the southern sun. In the North the modelling just coalesces into the hazy shadows and the gothic style gains attention by a different expedient; that of an interesting profile. The spiky pinnacles of the gothic style create interest in their profile against the sky when the surface details are lost.



86

Classical architecture



86

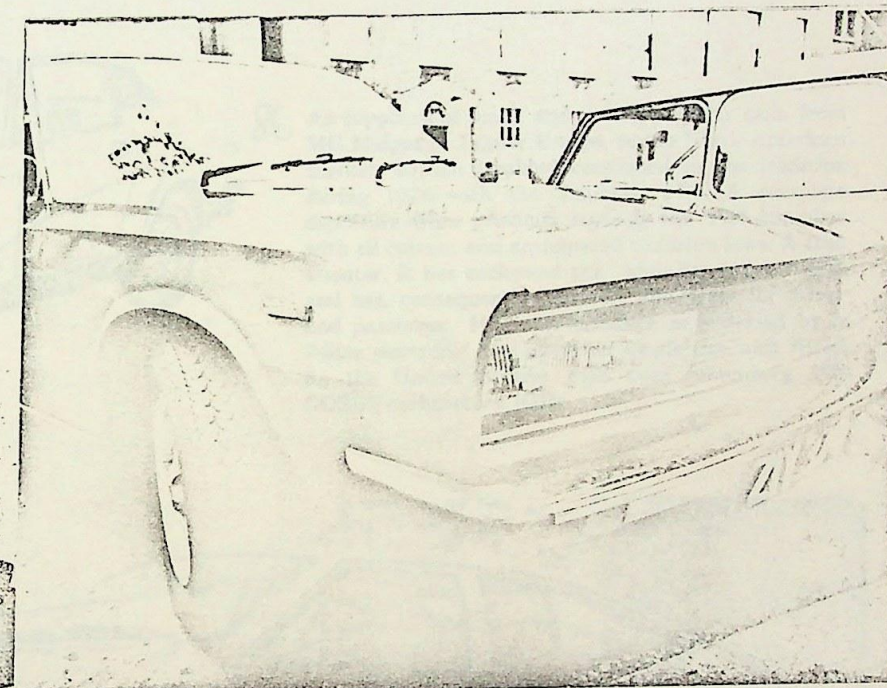
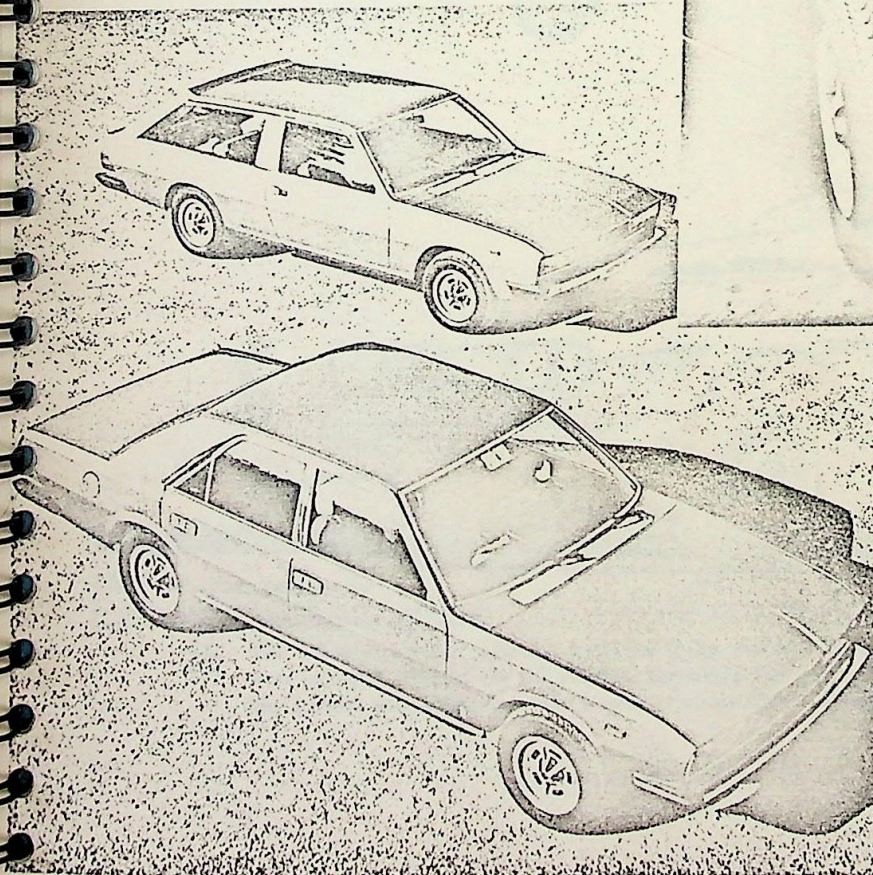
Gothic Architecture

There is similar use of light in northern and southern European car styling.

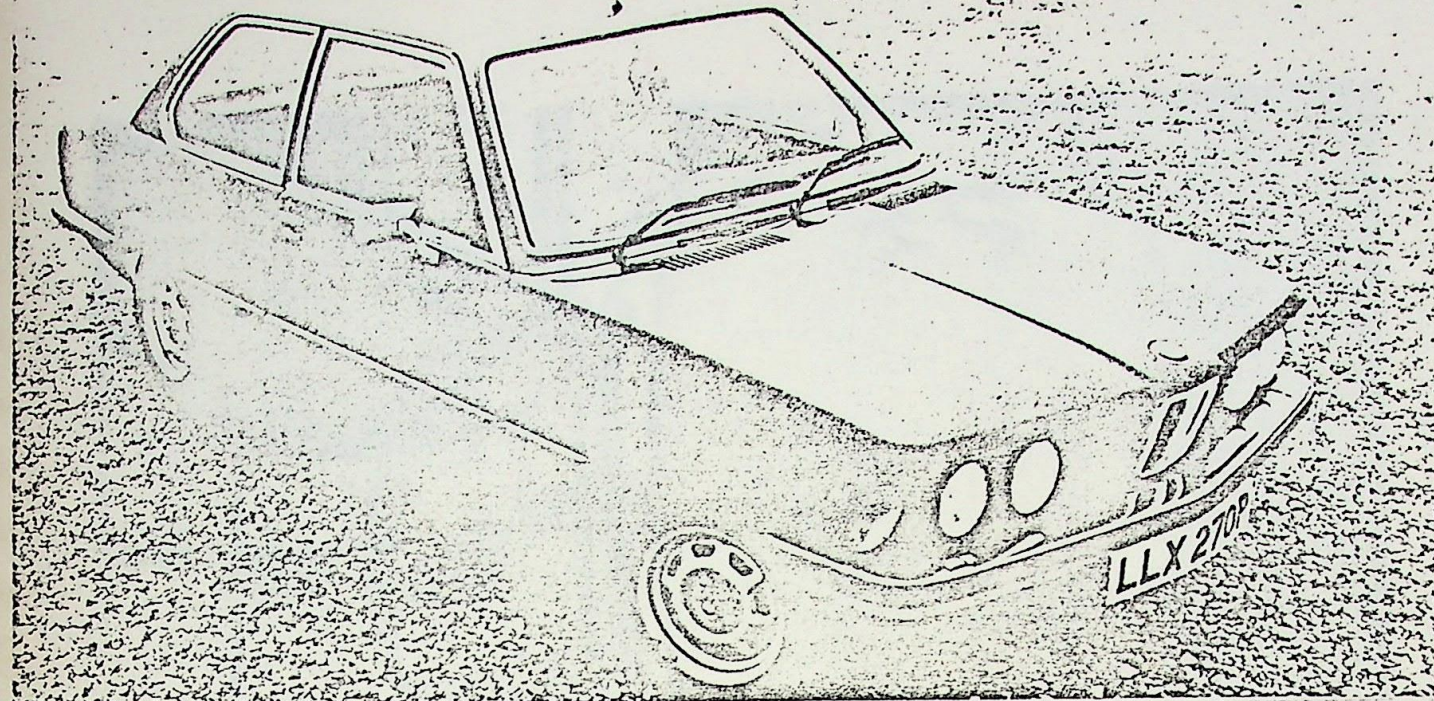
Compare the two pictures of a Fiat 130 (Fig. ▼, Fig. ▼'). One is taken in strong direct sunlight and all the shallow surface details are distinct. The other picture is taken in Dublin on a "soft" day and all the detailing on the side of the car is lost in soft shadow, the line of the bottom of the door is only apparent because of the bright work trimline. Compare these pictures with the picture of a comparable contemporary from northern Europe, a BMW 320 (Fig. ▼'). This car creates interest with its profile especially the grille with its reverse rake and arrow shape. Seen from most angles this grille reads as a pointed shape - the lights stick out from the grille and have a cylindrical shape in silhouette and not much attention is paid to modelling the sides.

Two more pictures for comparison show the Triumph TR7 and the (Fig. ▼) Alfa Romeo Alfetta. Again the Italian car has finely modelled surface detail where the British car has a deep curve in the side and sharp edged louvres on the rear pillars. The profile of the British car also is more sharply cut compared to the smoothness of the Italian form.

The question of light shows itself in the shadow cast by the car on the ground (Fig. ▼). This shows a British car in (JAQUAR) its environment sitting in a pool of shadow which blurs the distinction between car and ground. This is useful for British 3 wheeler bodies (Reliant Robin) which look normal in diffuse light but which look monstrous on the continent.

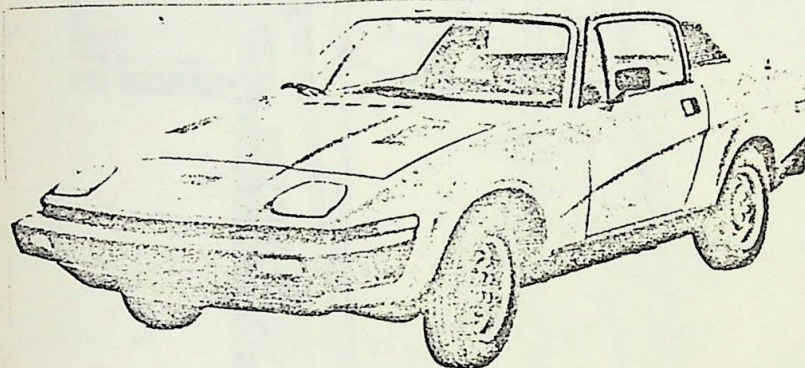


86 Fiat 130

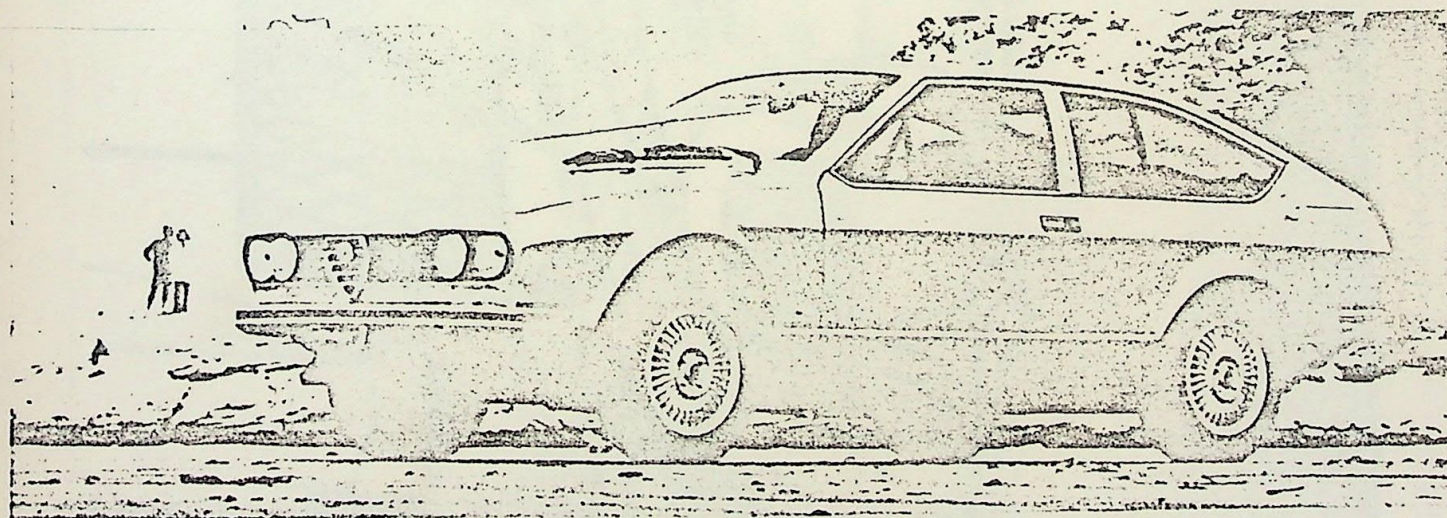


One of the BMW's "3" series range, the 320 is an 109-mph 2-liter, two-door sedan that accelerates from 0 to 60 mph in a creditable 10.2 seconds. Now available as the 320i with a gas-injection engine, a top speed of 113 mph is possible. (D)

86 BMW 320

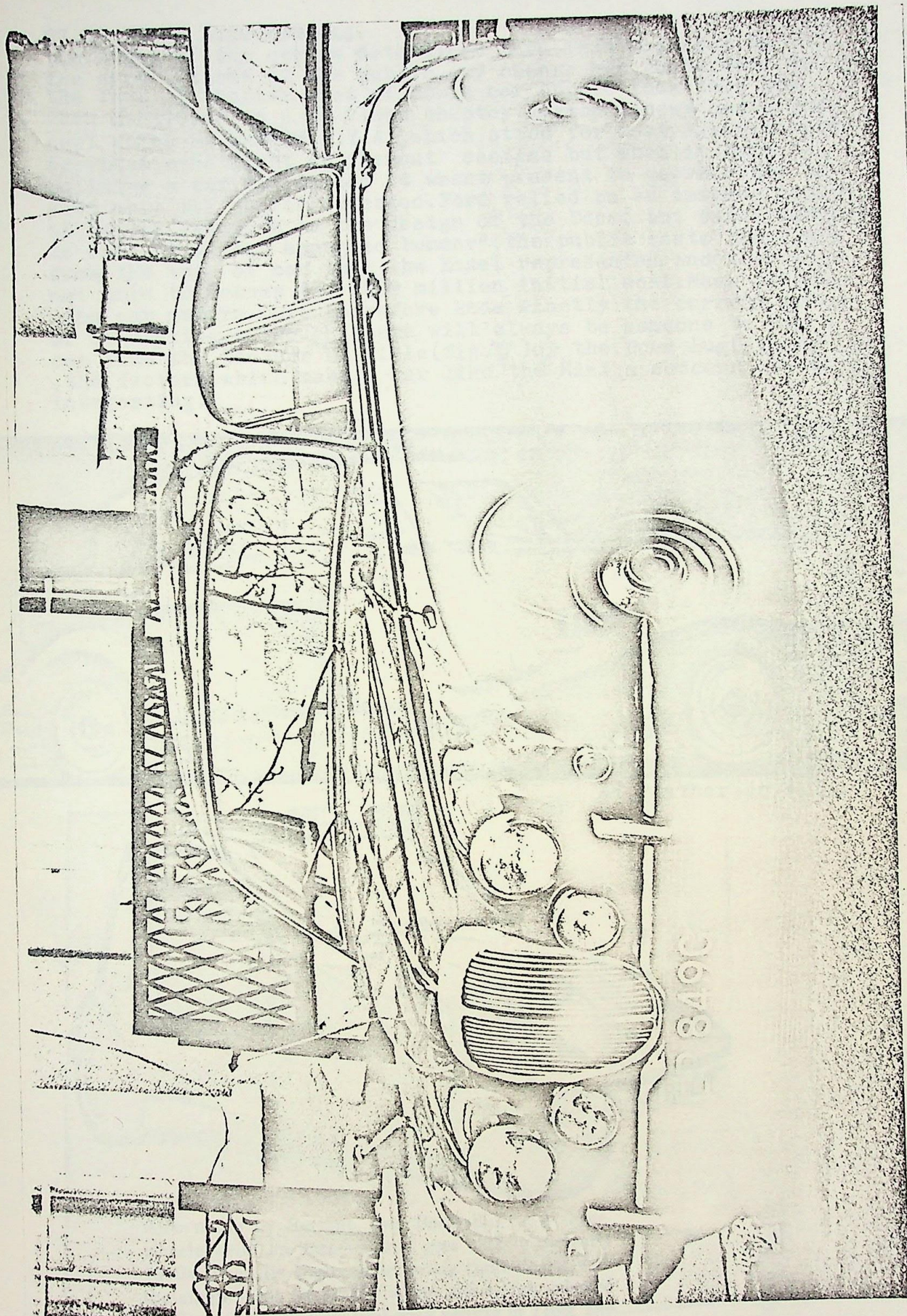


86 As suppliers of small and medium sports cars, from MG Midget to Jaguar E-type, to the North American market, British Leyland continued in the tradition during 1976 with the Triumph TR7. A complete departure from previous styling, the TR7 complies with all current and anticipated emission laws. A true 2-seater, it has eschewed the "shoe-horn" 2+2 form and has, consequently, comfort and space for driver and passenger. High performance is provided by a 2-liter electronic fuel-injection single ohc unit fitted (in the United States) with twin Stromberg 175 CDSEV carburetors. (GB)



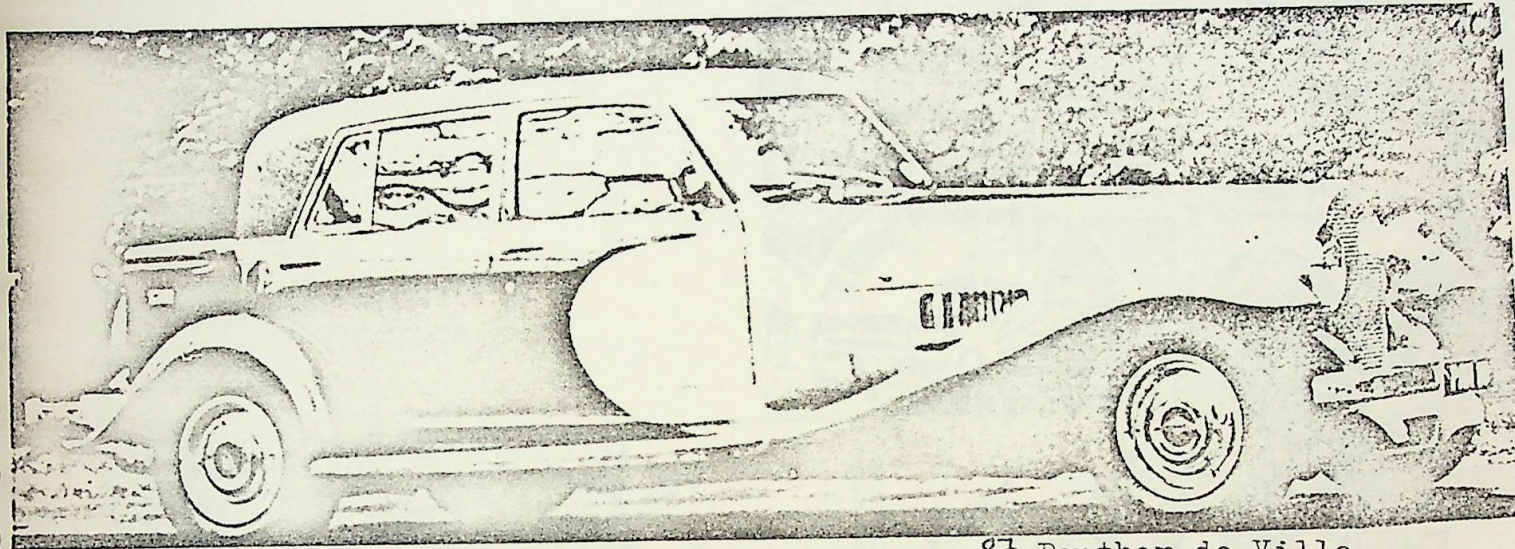
86 The 1.6- and 1.8-liter Alfettas from the Milan stable were joined in 1975 by the GT version. Housing a 118-bhp 1.8 unit with a rear-mounted 5-speed transmission,

it is a handsome small car with distinct sporting tendencies. This Alfa Romeo product is in the classic tradition of the brand. (I)

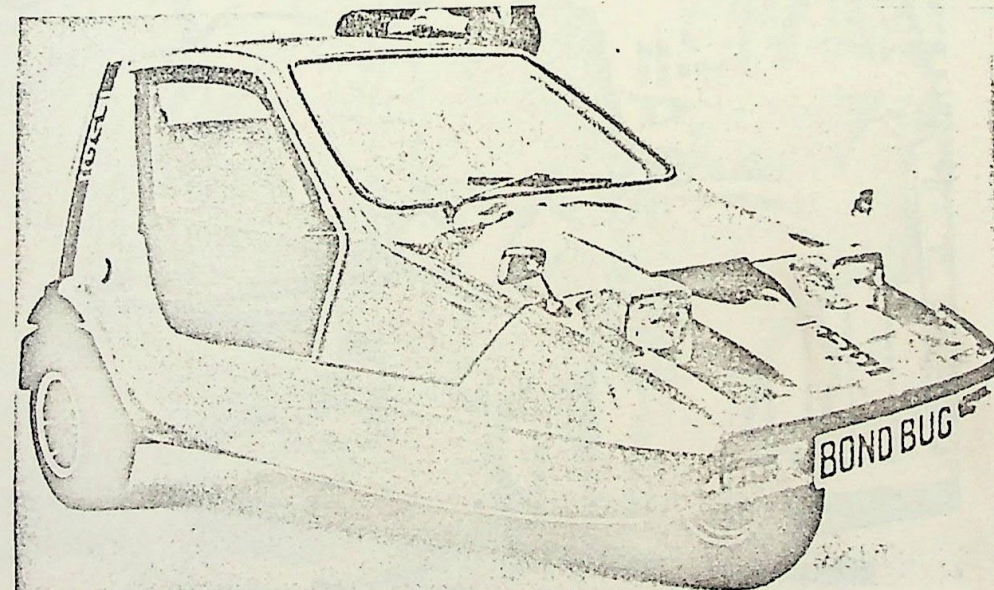


87. People's Expectations.

The shape of the car is determined more than anything by the expectations of the public. Any change has to be made in the face of people's idea of how a car should look; this has been mentioned in a previous chapter. Raymond Loewy had a precept which he named M.A.Y.A., which stood for most advanced yet acceptable; he might do far-out designs but when it came to building a car he decided it wasn't prudent to go very far beyond what the public expected. Ford relied on an immense amount of market research in the design of the Edsel but still managed to make it a "star spangled bumper"; the public taste had swung from the type of car that the Edsel represented and they were not able to recoup the \$259 million initial cost. Mass production car makers must therefore know exactly the current grammar of styling. Although there will always be someone to buy a car like the Panther De Ville (fig. ▼) or the Bond Bug (fig. ▼), the factors which make a car like the Mini a success are more interesting.



87 Panther de Ville

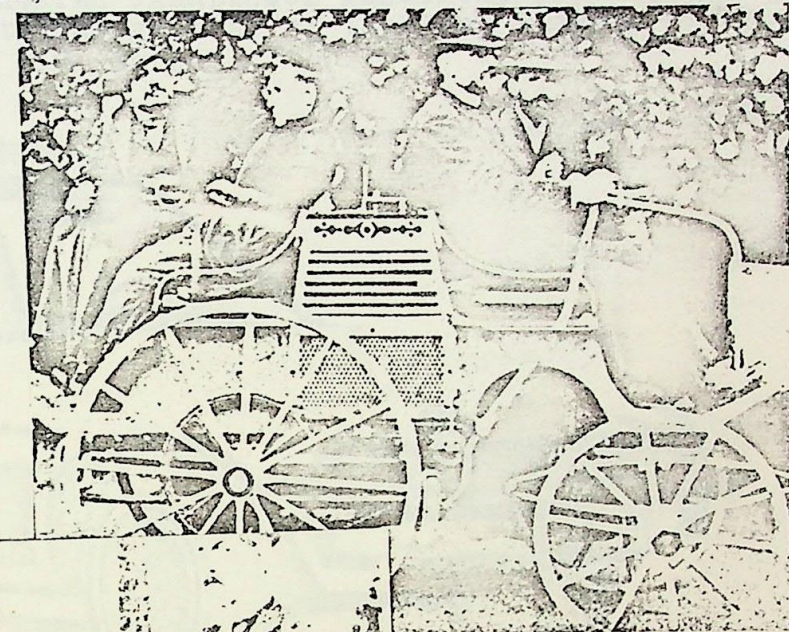


Also made by Reliant, this Bond Bug is a three-wheeler with an ancestry that goes back to the early 1950s, when its tiny engine swung right or left with the single front (steerable) wheel, the system adopted by Cugnot on the very first road vehicle in 1769! The

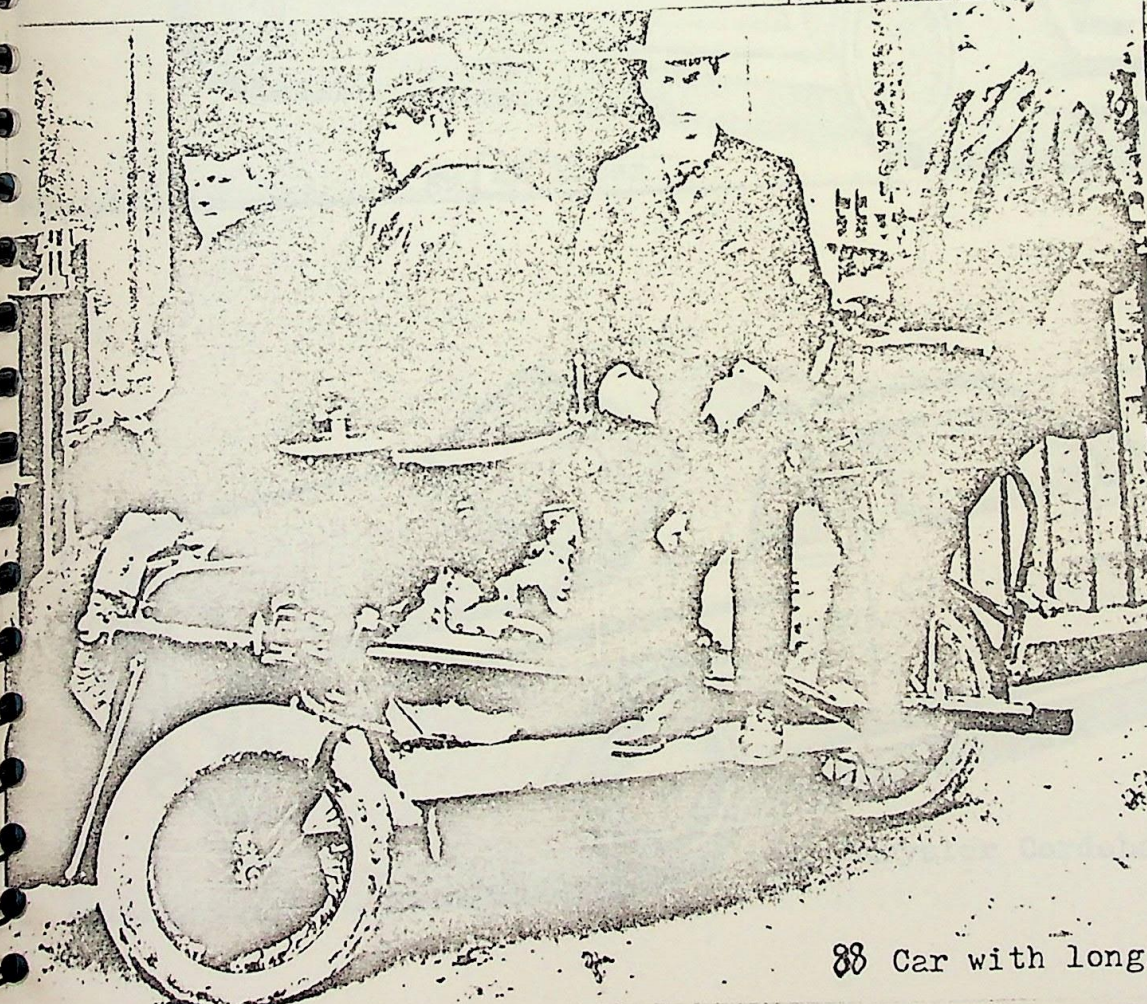
87 Bond Bug

88. Vintage Cars.

It is instructive to study car designs from the 19th. century when the shape of the car had'nt fossilised or crystallised to the standard shape we have come to expect. The Panhard and Levassor of 1890 (fig. ▼) a mid engine car with back to back seating; this has the advantages of putting the engine in the position of greatest stability, and of saving space. This pattern was used in the design of the German "janus" minicar in the mid 50's. It seems a better solution for mid engine sports cars than the cramped "2+2" formula, and certainly safer for child passengers. It is probably lack of acceptance for the somewhat unsociable seating position which scuppered this idea but if people can accept the idea of sitting backwards in trains and jet planes then it can't be a very deep seated objection. Fig. ▼ shows another possible configuration: longitudinal seating. This solution has been used for the third row of seats in the Peugeot 504 estate car and in the back of four-wheel-drive vehicles, again one wonders why this configuration hasn't been used more widely.



88 1890 Panhard

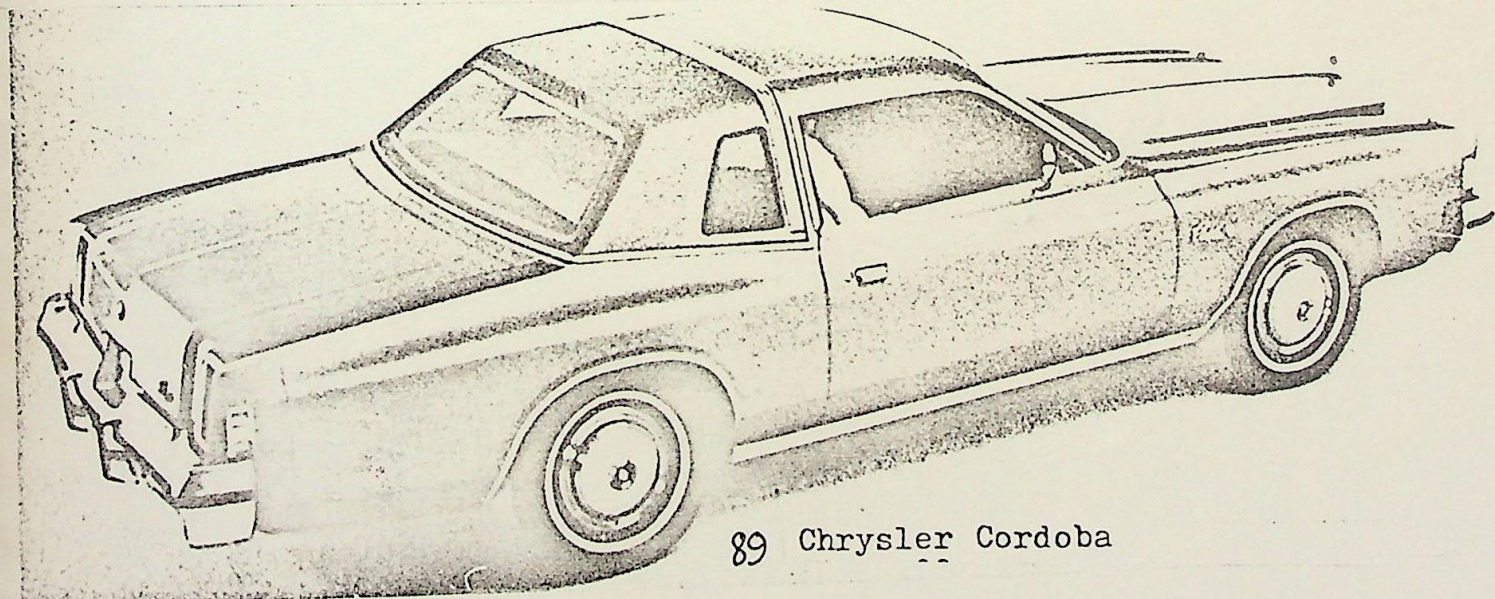
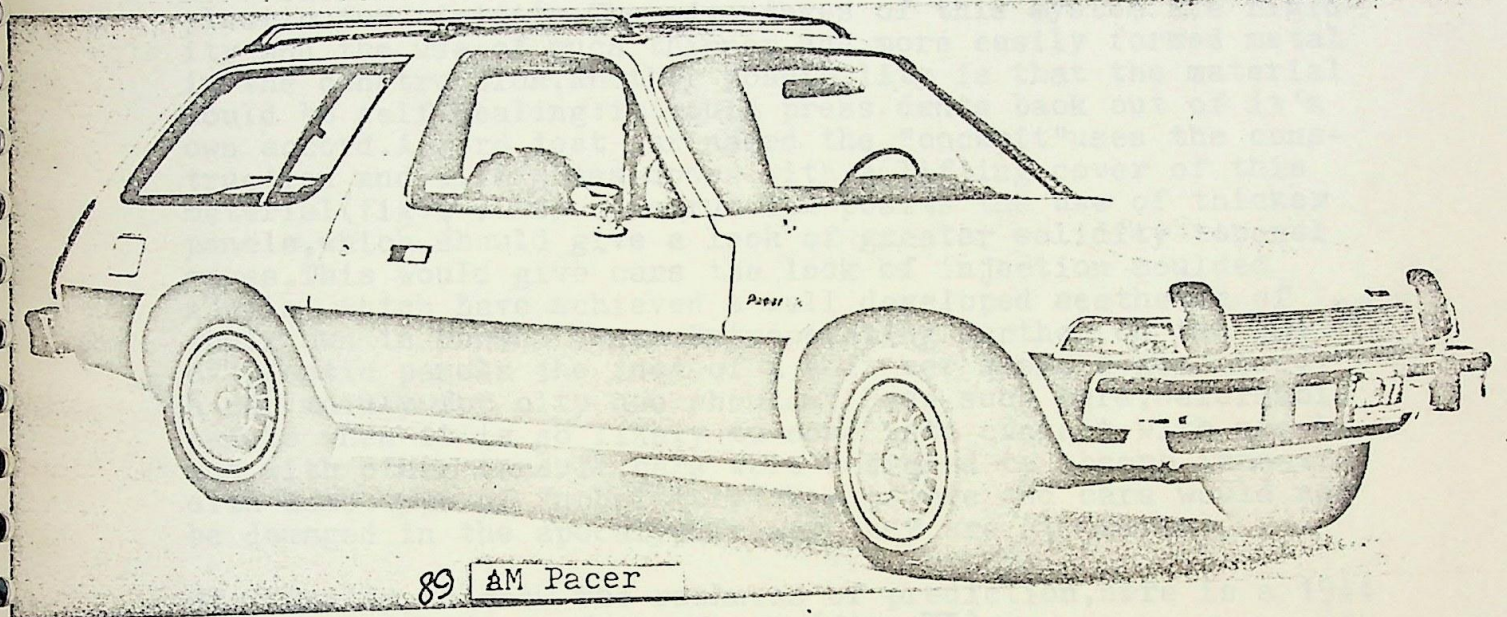


88 Car with longitudinal seating

89. Other Variants.

Some possible variations have been introduced but never fully explored by being used in several different cars. One of these is the central driving position as used in the Panhard Dynamic (see chap. 1). Another good idea is the under body streamlining panel used on the Citroen D.S. It was a plastic cover over the protruding exhaust and transmission which had a beneficial effect on speed and fuel consumption. It was not much use as a visual sales ploy however and so was pushed aside in favour of more visible manifestations of the aerodynamic. In view of the damage done by salting roads in the winter it is strange that underpans haven't made a comeback.

Another idea which could be usefully copied is embodied in the American Motors Pacer. This innovation is that the door on the passenger's side is four inches longer than that on the driver's side, this enables much easier access to the rear seat. Apart from this example there have been far fewer examples of practical innovation from the U.S. than from, for example, France. The U.S. makers usually come up with something meretricious like the "opera windows" and "T-bar roof" of (fig. 89) which apes the styling of 1920's limousines. An example of genuinely functional styling (the asymmetrical grilles of the Fiat Ritmo) were made symmetrical for the U.S. market.



90. Response to Fuel Shortage.

Previous response to expensive petrol has come in the form of small cars using engines comparable to those used in large motor bikes but with rounded dumpy bodies. If a 350cc motorbike has such mystique and a 500cc car has so little that it is faintly ridiculous then it seems obvious that future "micro-cars" should adopt some motorbike features and see if they are appealing.

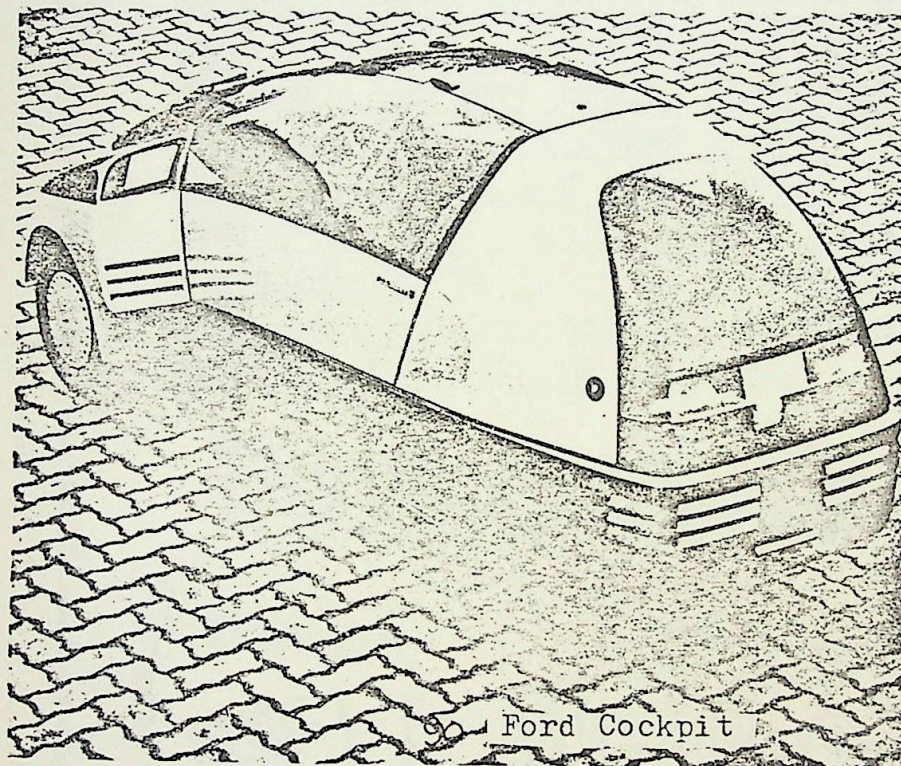
91. Present Developments.

Here are two examples of developments which could have a large impact on future styling. One of these is used in this year's Audi 100; (fig. ▼); flush fitted glass in the windows. This has the function of reducing wind noise and drag, but it also has the effect of treating the windows as panels in the same way as the body panels. This gets rid of the clutter of gutters and side window surrounds, and gives a much cleaner look to the car. The other development, which is still experimental is the use plastic sandwich panel construction. The sandwich consists of ; a strong material forming the skin (metal for instance) and another skin on the inside, the core is foamed plastic for rigidity. The advantages of this system are rigidity and the use of much thinner and more easily formed metal in the construction. Another possibility is that the material could be self healing: it could press dents back out of it's own accord. A Ford test car named the "cockpit" uses the construction and eliminates doors with a lifting cover of this material (fig. ▼). This construction posits the use of thicker panels, which should give a look of greater solidity to panel edges. This would give cars the look of injection moulded shells, which have achieved a well developed aesthetic of their own in recent years. Extrapolating further on the use of plastic panels the idea of a soft car seems a good one; a car mainly for city use shouldnt have such hard, deformable panels when it is so likely to come into contact with people and with other cars. If cars were designed to absorb impact eith some type of "upholstery" then people and cars would not be damaged in the apocalyptic way they are at present.

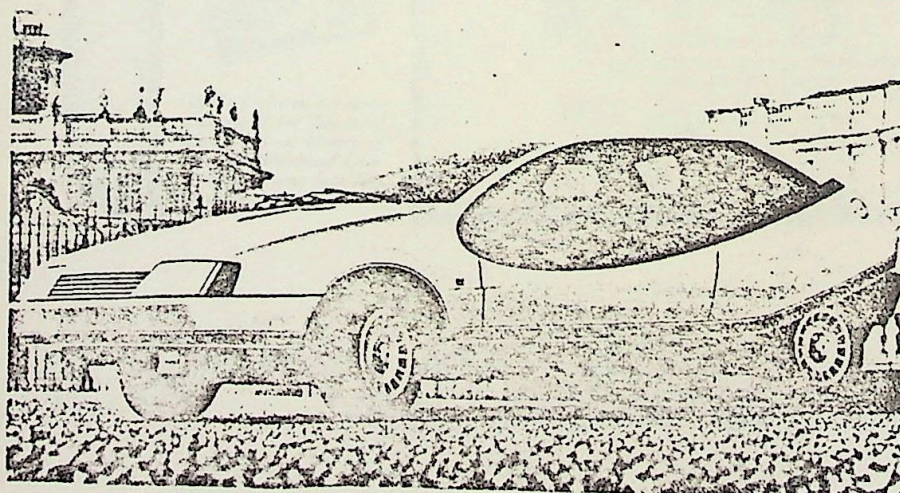
92. Finally, to show the rashness of prediction, here is a 1944 version of the car of the future (fig. ▼).



90 Audi 100



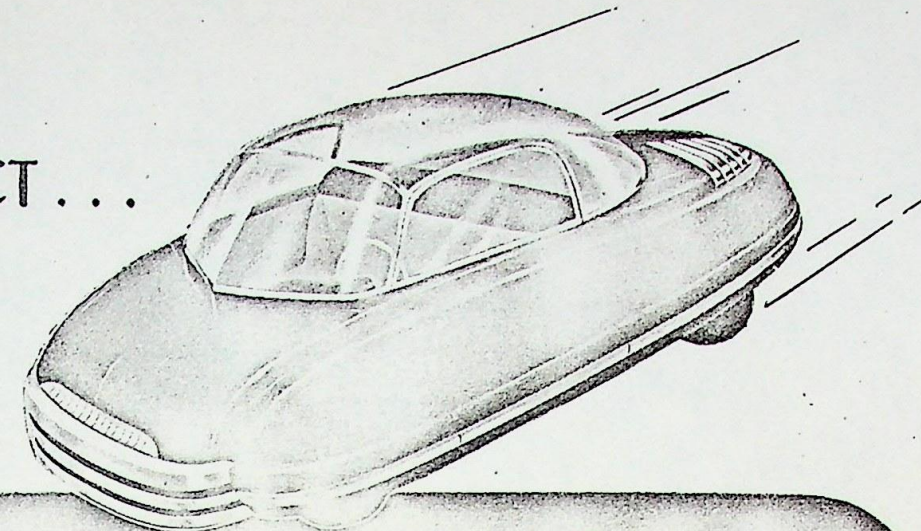
90 Ford Cockpit



90

Design exercises at Ford, such as the Cockpit top and the Megastar II have made good use of the light weight and styling freedom offered by plastics body panels

I PREDICT . . .

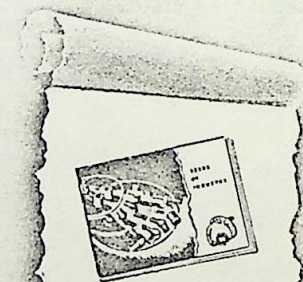


by George W. Walker

Industrial Designer of Detroit

"The car you will own in what engineers call the *post war* period will take greater advantage of streamlining for beauty and efficiency. Running boards will disappear, permitting wider bodies and more seating room. There will be foam rubber upholstery, soundproofing, opaque colored plastic panels and plexiglass windshields and tops that will provide greater visibility and safety. The small car sketched here is designed with the engine in the rear and enclosed running gear, permitting an extremely short turning radius. The car your War Bonds will buy will be fully air conditioned, making window ventilation unnecessary and eliminating the present day annoyance of draughts, rain and dust."

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