697
SCIENTIFIC AMERICAN OFFPRINTS

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SCIENTIFIC AMERICAN
AUGUST 1977
VOL. 237 NO. 2 PP. 95-106

PUBLISHED BY **W. H. FREEMAN AND COMPANY** 660 MARKET STREET, SAN FRANCISCO, CALIFORNIA 94104

The History of the Airflow Car

As the first streamlined car, the Chrysler Airflow represented a milestone in automotive development. Although its sales were disappointing, it had a profound influence on automobile design

by Howard S. Irwin

The evolution of the automobile from the time of the "horseless carriage" to the present has proceeded in a series of steps that have been gradual and predictable, with the conspicuous exception of the Airflow, which was conceived by the automotive engineer Carl Breer and his associates and marketed by the Chrysler Corporation in the model years 1934 through 1937. The Chrysler Airflow and its sister car the DeSoto Airflow were utter failures in the showroom, but the impact of the design on the shape of the modern automobile has been profound.

The Airflow was Breer's attempt to achieve in automobile design what had been achieved in the same era by the DC-3 and the China Clipper in aircraft and by the Pullman Company's M-10,000 diesel locomotive and Henry Dreyfuss' steam-powered trains that ran as the 20th-Century Limited. In each case the designer's aim was to unify previously disparate design elements, not merely to please the eye by creating an illusion of forward motion but primarily to reduce the resistance of air to a speeding vehicle.

By 1927, when Breer and his associates started their experiments with streamlining, a number of milestones had been passed in the development of the automobile. One of them, the electric starter, made large motors with eight or more cylinders practical. With large motors the cars became heavier, and since weight conferred a gentler ride it came to be preferred in spite of its drawbacks in the form of higher operating cost and harder handling for the driver. Achieving the appearance of weight became a goal of design, epitomized by the first Chrysler designed by Breer. It was the 1924 model, featuring a low profile, balloon tires, thick wheel spokes, crowned fenders and rounded body angles. With the introduction of hydraulic brakes the speed potential of the Chrysler high-compression engine could be safely exploited. The form of the car, however, needed drastic revision. It had a boxlike configuration, and its various parts did not really form a harmonious whole. Moreover, the dynamics of its ride resembled the rocking of a hobbyhorse. It was to these problems that Breer addressed himself in 1927. The basic problem was to find the true form of least resistance and adapt it to the automobile.

Streamlining as a principle of design had its roots in hydrodynamics and aerodynamics. In the 19th century the Scottish physicist William J. M. Rankine determined that the motion of fluids has two forms: laminar flow and turbulent flow. Laminar flow can be visualized as a series of parallel layers in a moving fluid, each with its own velocity and direction without disturbance in its forward motion. Turbulent flow is characterized by eddies or vortexes and can be visualized as a tumbling of the fluid caused by a solid body. The turbulence creates a partial vacuum behind the body, which in turn causes drag and impedes the body's forward progress. When a body immersed in a flow does not cause turbulence, it is said to be streamlined.

In 1804 Sir George Cayley had proposed for the dirigible balloon "a form approaching to that of a very long spheroid." Examining natural forms, he took the measurements of the trout and the porpoise. He concluded that the spindle shape of these creatures would not only serve the dirigible well but also, if it were split lengthwise, produce two ideal ship hulls. Francis Wenham refined these early proposals in the wind tunnel. Ludwig Mach tested the laminar and turbulent airflow of different objects by means of silk threads, cigarette smoke and glowing particles of iron (recorded on a photographic plate). Étienne Jules Marey analyzed the aerodynamics of birds in flight.

In his classic treatise of 1917 on growth and form D'Arcy Wentworth Thompson employed the term "streamlining" to describe organic structures that offer the least resistance when they are in motion. To solve the problem of how such forms came into being he mathematically analyzed the shape of a bird's egg by applying the principle of least action, which states that a fluid medium tends to impress its "stream lines" on a deformable body until the body yields and offers a minimum of resistance. Similar examples are the contours of snowdrifts, sand dunes and lamp flames, which illustrate eddy curves that have been imposed by moving air facilitating its own flow. The same principle, Thompson concluded, must have come into play in the evolution of the body form of a fish or a bird.

Breer was one of the first "automobile nuts" and became one of the industry's outstanding engineers. In 1901, as a 17-year-old in his native California, he painstakingly built a steam-powered car. Following his graduation from Stanford University with a degree in engineering, he worked for several automobile manufacturers until 1921, when he organized a firm of consulting engineers with Fred M. Zeder and Owen R. Skelton. Two years later the firm transferred its activities to the Maxwell Motor Car Corporation, where Breer became executive engineer. In 1925, when Walter P. Chrysler bought out Maxwell, Breer was named director of research of the Chrysler Corporation, a position he held until his retirement in 1949.

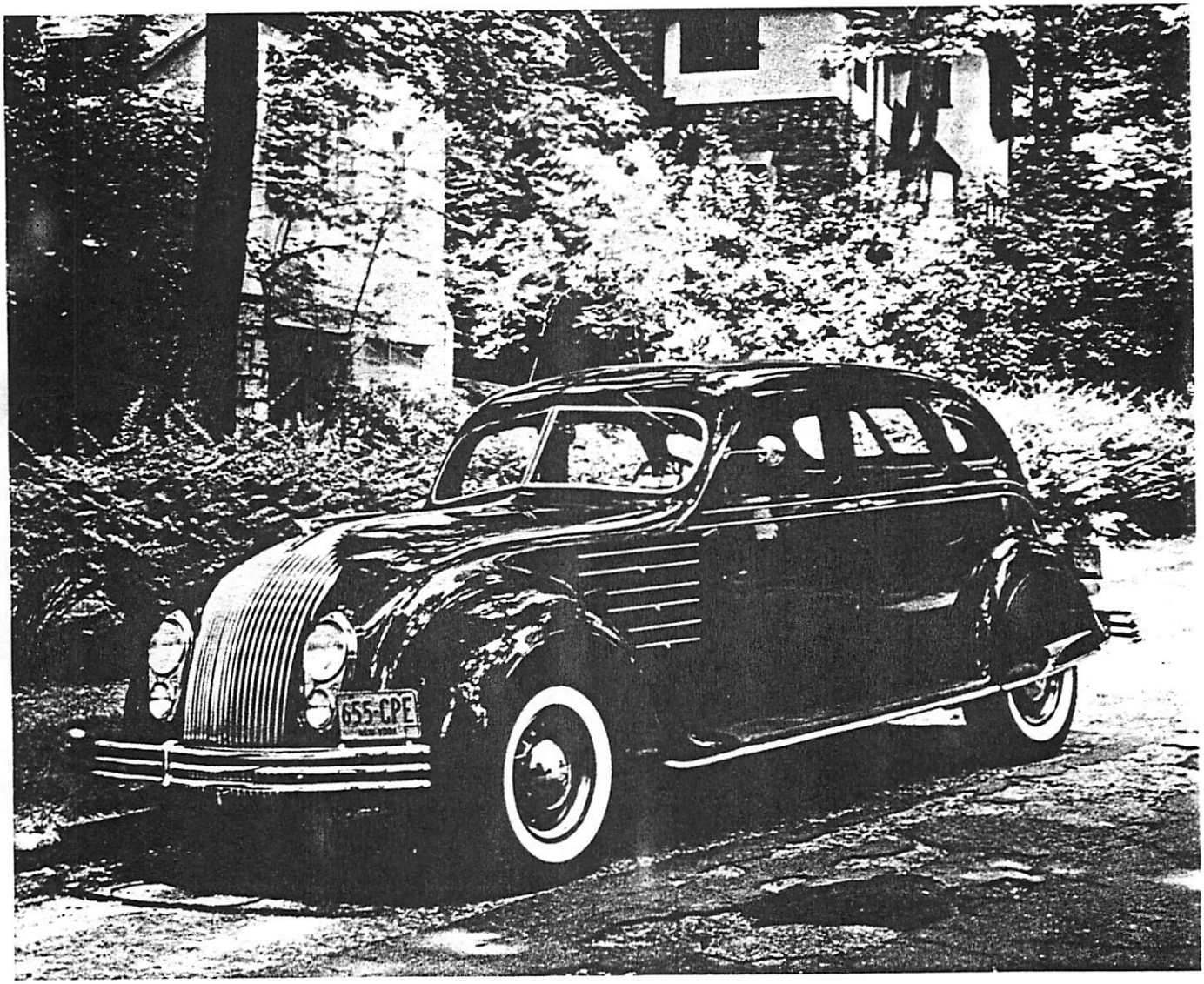
Breer saw everything in automobiles from the engineering point of view, but he remained alert to the basic role of the car as a servant of people. For example, in order to improve the way cars rode he had to consider the spring suspension, and so he first analyzed the gait at which the human body seemed most comfortable. He found that the least tiring stride was from 80 to 100 steps per minute, equivalent to a speed of from 2.5 to three miles per hour. Applying this finding to the design of the automobile suspension, Breer concluded that the up-and-down motion of a car's body should

be kept within the same range if maximum comfort was to be achieved for the passengers. The stiffly sprung bodies of the automobiles of the 1920's subjected passengers to much uncomfortable tossing and pitching (at different rates fore and aft). Breer determined that a main goal of engineering had to be the improvement of the ride. To accomplish that, however, it would be necessary to reproportion the weight borne by the front and rear wheels. A new body design was required.

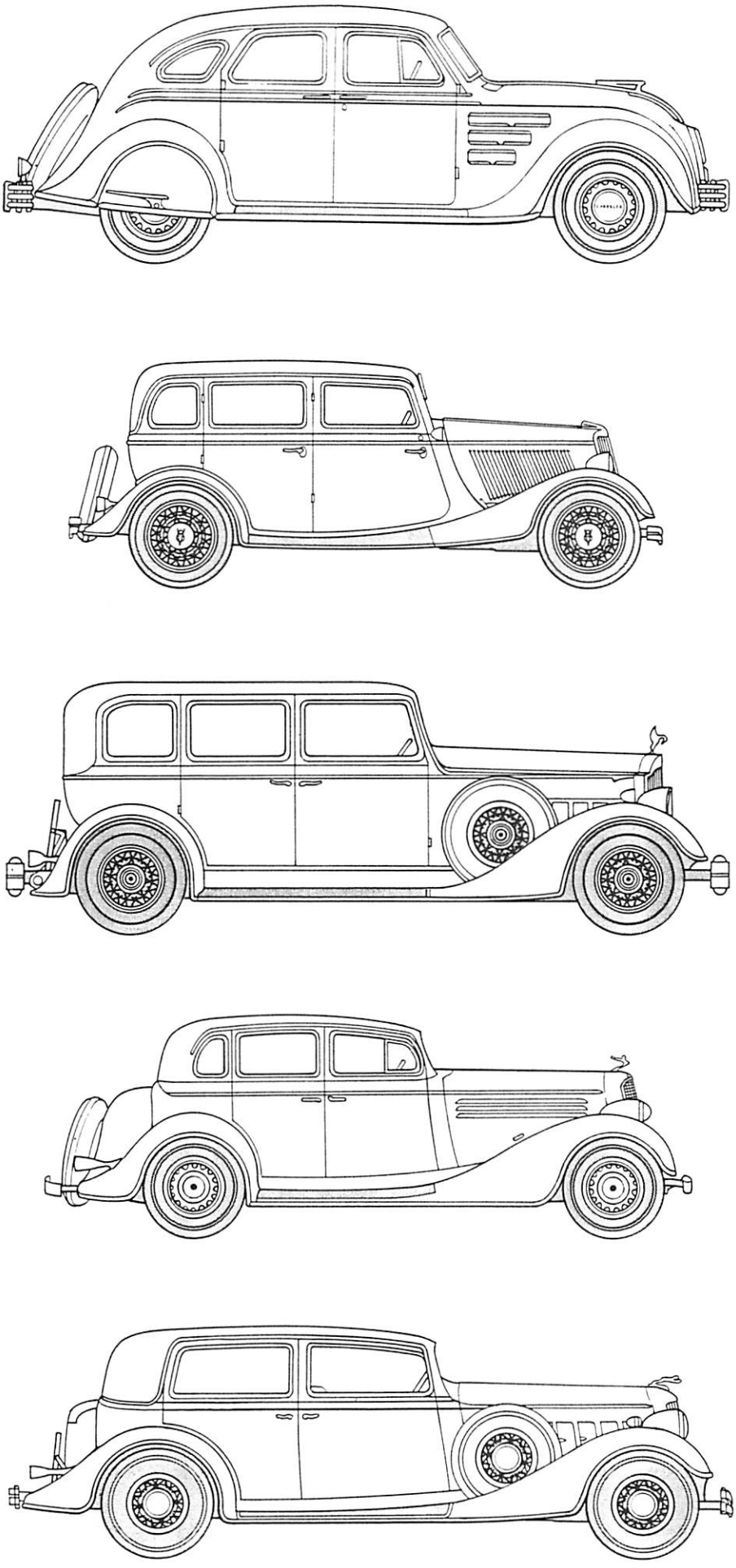
Breer's desire to create a new car was also influenced by new trends in industrial design, which embodied an increasing awareness of the fact that functional objects such as automobiles and refrigerators could also be attractive in appearance. The work of designers such as Norman Bel Geddes, Raymond Loewy, Russel Wright and many others found expression in objects as diverse as cameras and ocean liners. R. Buckminster Fuller carried the trend a step further with his "Dymaxion" concept, in which structural efficiency was emphasized and was brought to realization in the now well-known geodesic dome. Fuller's experimental three-wheeled Dymaxion automobile—light in weight, ovoid in shape, steered by the single rear wheel—markedly resembled the fuselage of an airplane.

It was against this background that Breer began to think seriously about a new body design for the automobile. At that time the ungainly shape of the automobile represented little more than a series of unrelated compromises and had emerged essentially as a big box for people behind a little box for the motor. Breer, believing the speed potential of the high-compression engines developed by Chrysler could not be realized in the bodies then on the drawing boards, asked William Earnshaw, an outside engineer, to determine how seriously the boxy shape of contemporary automobile bodies impeded movement through the air. Earnshaw found that the resistance was high in the forward direction and less if the car went backward. Earnshaw then went to Orville Wright, who advised him to set up a small wind tunnel to test the resistance of differently shaped blocks of wood. Intrigued by the results, Walter Chrysler had a larger tunnel built so that Breer, Zeder and Skelton could carry the investigation further. Breer hoped to find a form that would employ the phenomenon of lift in reverse and thereby press the car more firmly against the road at high speeds.

The wind-tunnel tests continued into



CHRYSLER AIRFLOW of 1934 is owned by the author. The Airflow design was marketed by the Chrysler Corporation under the Chrysler and DeSoto lines in the model years 1934 through 1936 and as a Chrysler only in 1937. The streamlined shape of the car represented a distinct break with previous automobile designs, which had been basically boxlike. The author's Airflow, which is still roadworthy after 43 years, has the second of two grille designs offered in 1934. The modification was made in an effort to meet criticism of the original design, which had lighter, more numerous bars that were more curved. Original grille appears in top illustration on page 6.



1931. By then the Reo Royale of 1931 and the Graham Eight of 1932, each incorporating innovations in design, were being acclaimed. Breer, having found that the teardrop shape generated the least resistance, decided that it would be ideal for a new car. First he would have to rearrange the engine and the passengers within the form. He was disappointed to find that when any of the available engines were mounted at the rear of an experimental model, the car was tail-heavy and also handled poorly. Moreover, the long and vulnerable appendage at the rear would inevitably impede maneuvering. The teardrop would have to be modified.

After mocking up several trial models in wood the three engineers produced in December, 1932, a steel-bodied prototype that they named the Trifon Special. It was a sedan with a short, wide, rounded hood, buried headlights, a steeply sloping windshield and a gently undulating rear deck trailing off to the bumper. Walter Chrysler liked the car, but Breer was not yet satisfied.

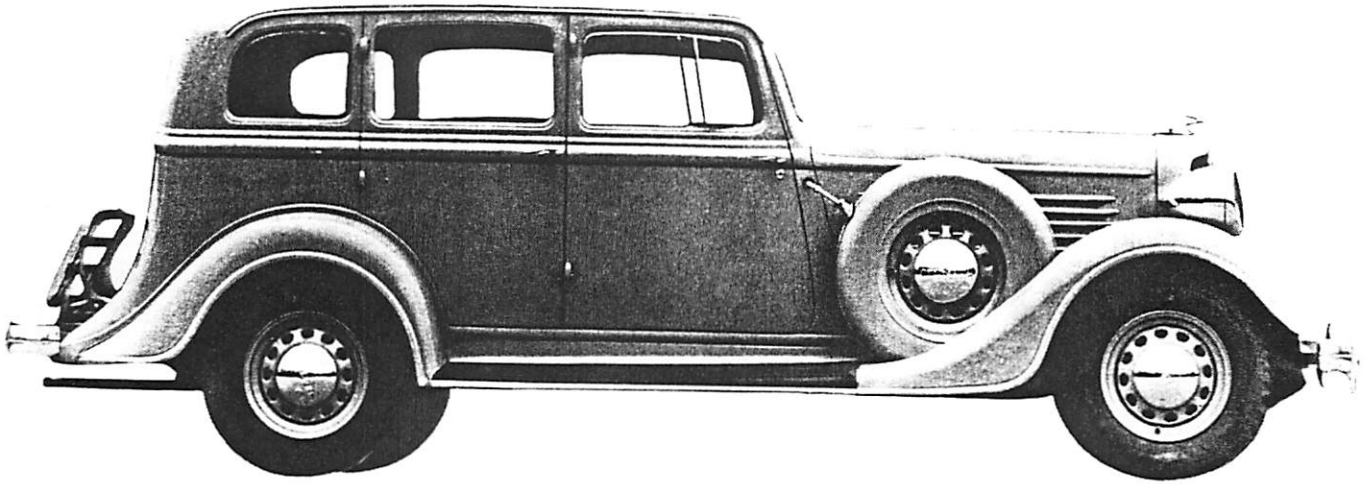
The Trifon's rounded hood was a problem, since it departed sharply from the distinctive long, tapered form, diverging gradually behind a highly stylized radiator shell, that imparted to the automobiles of the day so much of their visual character. Breer and his colleagues mocked up somewhat more conventional hood designs as late as May, 1933, but they finally decided that if the new design was to be faithful to the aerodynamic principles guiding their work, the rounded nose would have to be part of it.

After some 50 experimental designs had been tested tools and production were set to manufacture the Airflow for 1934. It was produced in five body sizes, for which an interesting array of interchangeable components were developed. The bodies were put on wheelbases ranging in length from 115.5 to 146.5 inches.

The smallest version, powered by a six-cylinder engine, was marketed under the DeSoto name. The other four were all Chryslers and had eight-cylinder engines. The largest model was an immense limousine that had a curved one-piece windshield. Both Chrysler and DeSoto offered the Airflow as a sedan with two or four doors and as a two-door coupé. The coupé was undoubtedly the purest expression of the Airflow design.

The Airflow was by far the most streamlined car to have been put on the

FIVE 1934 AUTOMOBILES are portrayed in side views to show the contrast between the Airflow and the standard designs of the time. From the top the cars are the Chrysler Airflow, the Ford, the Packard, the Buick and the Lincoln. All five cars are at the same scale.



CONVENTIONAL 1934 CHRYSLER was a six-cylinder model the Chrysler Corporation offered while it was also marketing the Airflow. Public response to the Airflow was so unfavorable that the company would not have been able to maintain its sales position if the conventional model had not sold well. The four Chrysler Airflow models of 1934 all had eight cylinders; the DeSoto Airflow had six.

market up to that time. It looked so utterly unconventional that a reviewer of the 1934 automobile show in New York reported that it took two or three days to become accustomed to it. Rarely had a major manufacturer brought forth a design so little bound by past traditions. The financial risk was tremendous, particularly since Chrysler's sales had slumped in the preceding two years.

The proportions of the Airflow differed from those of all the other automobiles then made. Passengers were moved 20 inches forward with respect to the rear axle, with the result that the engine was pushed out over the front axle and the radiator went even farther forward. The passengers were therefore seated nearer the middle of the car and so gained considerably in riding comfort. On the other hand, the same changes gave the car its nose-heavy appearance. Indeed, 55 percent of the Airflow's weight was borne by the front tires; most of the other cars had about 40 percent of their weight there. The shift in weight facilitated the improved riding characteristics that Breer sought by enabling him to put more nearly similar springs on the front and back. The shorter front springs had more leaves, and their flexing was limited to the 80 to 100 cycles per minute that Breer had determined to be the most comfortable for human beings. The Airflow's ride was in fact a great improvement, contrasting sharply with the rocking and pitching that was common in all but the heaviest cars of the day.

The passengers were not only shifted forward but also given more room laterally. The body and windshield of the Airflow were 10 inches wider than in the preceding Chrysler models. This result was achieved by spreading the body out over the fender wells, making it possible for the first time to carry a total of five or six passengers on the two seats.

One outstanding structural innovation of the Airflow was in the construction of its body shell. Instead of consisting of a series of separate steel panels attached to a light wood frame, which had been the general practice, the entire body except for the fenders, the doors and the hood was a single stressed-steel member that, in combination with the very light frame, had 40 times more torsional rigidity than the body of the preceding Chrysler model.

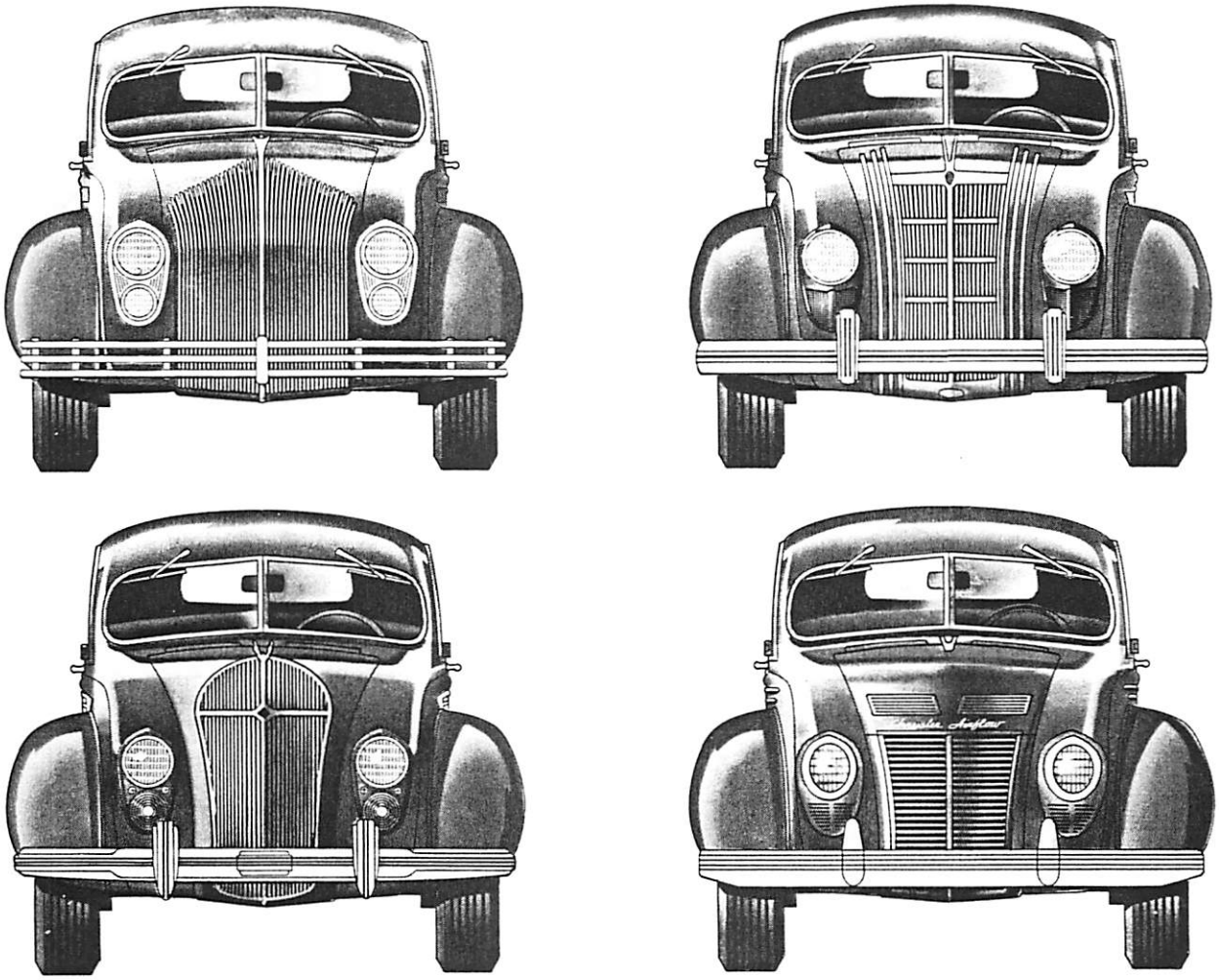
Overall the body of the Airflow resembled a section through the wing of an airplane: it was a parabolic curve rising from the front bumper and gently trailing off to the rear. The form was stepped to accommodate the sloping, divided windshield, which could be opened outward from the bottom. The headlights and front fenders were absorbed into the single rising curve of the front façade. A slight upturn and thinning of the trailing edges of the fenders reinforced the teardrop motif.

"Art deco" themes appeared in much of the ornamentation, such as the three-tiered bumpers, the three horizontal hinged vents on each side of the hood and the parallel belt moldings along the body. Several unfamiliar materials were used inside the car: molded, washable roof panels; tubular-steel, chromium-plated seat frames and marbled rubber floor mats.

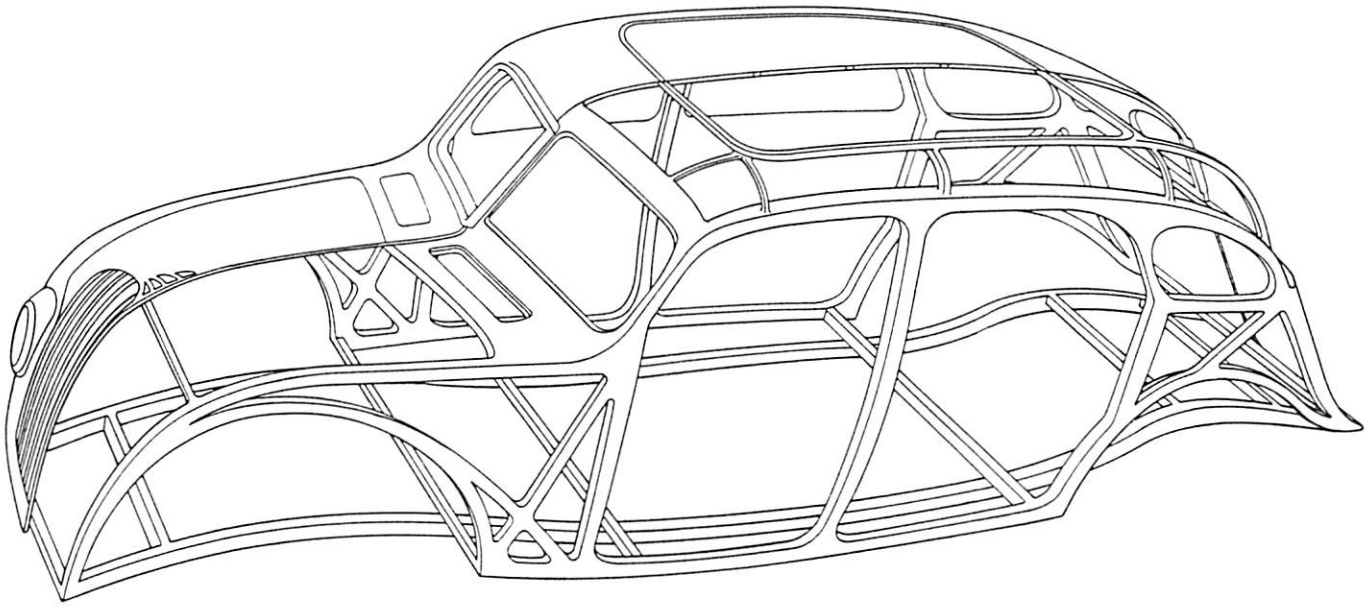
Did all of this result in a beautiful car? The sloping rear deck was widely admired, particularly in the coupé, which carried the spare tire inside so that nothing interrupted the clean sweep down the back. The raked *V* windshield and the full skirts of the rear fenders had met with approval on earlier cars. The broad, rounded front end, however, remained an unsolved problem. The stubby hood, with the headlights, radiator grille and fenders all blended into a massive cascade of metal, contrasted totally with the delicate, aquiline, prowlike grille, the free-standing headlights and the graceful outrigger front fenders of cars such as the widely acclaimed LaSalle. The Airflow evoked strong reactions; people either admired it intensely or detested it.

In the end the opinion of the detractors prevailed. Although the company had a good backlog of orders early in 1934, the summer sales figures told the disappointing truth: DeSoto's sales had slipped 47 percent below those of the previous year, and Chrysler's sales position (10th) was maintained only because the company simultaneously offered an array of conventional six-cylinder models. The round blandness of the Airflow's front end was described by critics variously as being bug-eyed, having a look of rhinocerine ungainliness and resembling a human face covered with a stocking. The car soon became the object of ridicule.

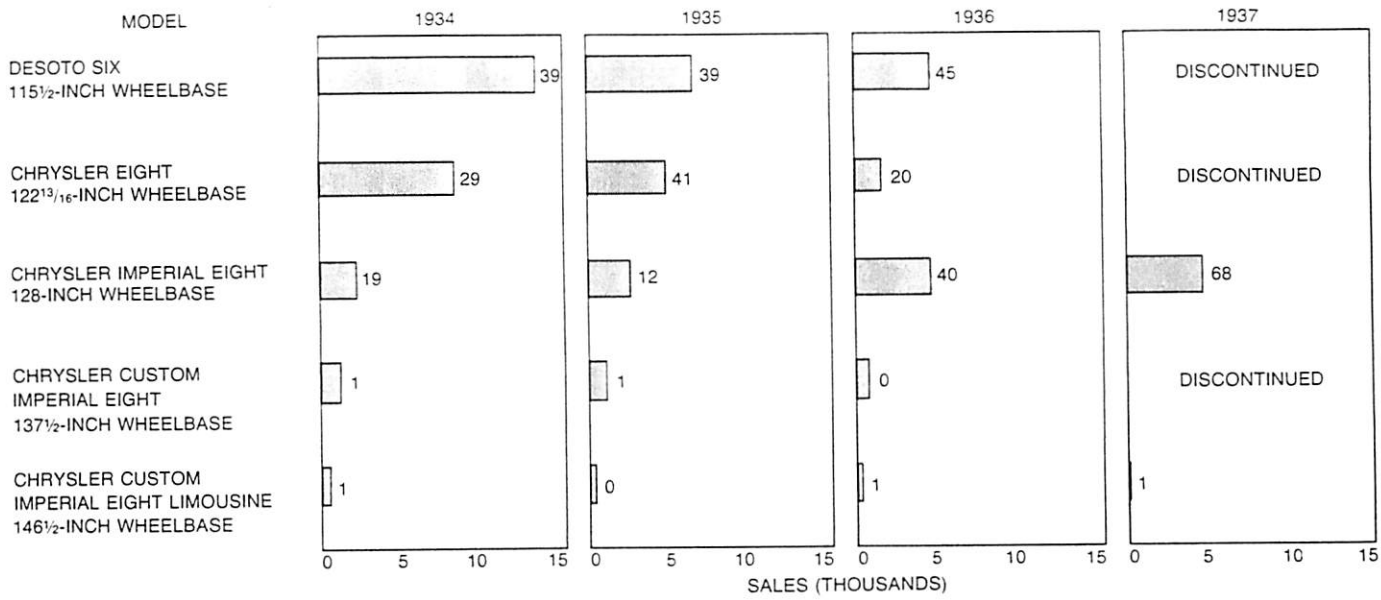
Nothing could be done to alter the basic shape of the Airflow. Walter Chrysler was not, however, ready to abandon it. Stylists were rushed in, first to strengthen the face of the 1934 Chrysler Airflow by replacing the curious compound-curve waterfall grille with fewer, straighter, stronger bars and then for the three succeeding model years to graft on a more conventional prowlike radiator grille and to simplify other front-end ornamentation. The rakish tilt of the steering wheel was reduced, the headlights were toned down, the anachronistic freestanding taillights were drawn into the fenders and broad bumpers replaced the easily damaged three-tiered ones. A bustle trunk mounted on the sedans brought the spare tire inside. Wool broadcloth and cut pile replaced



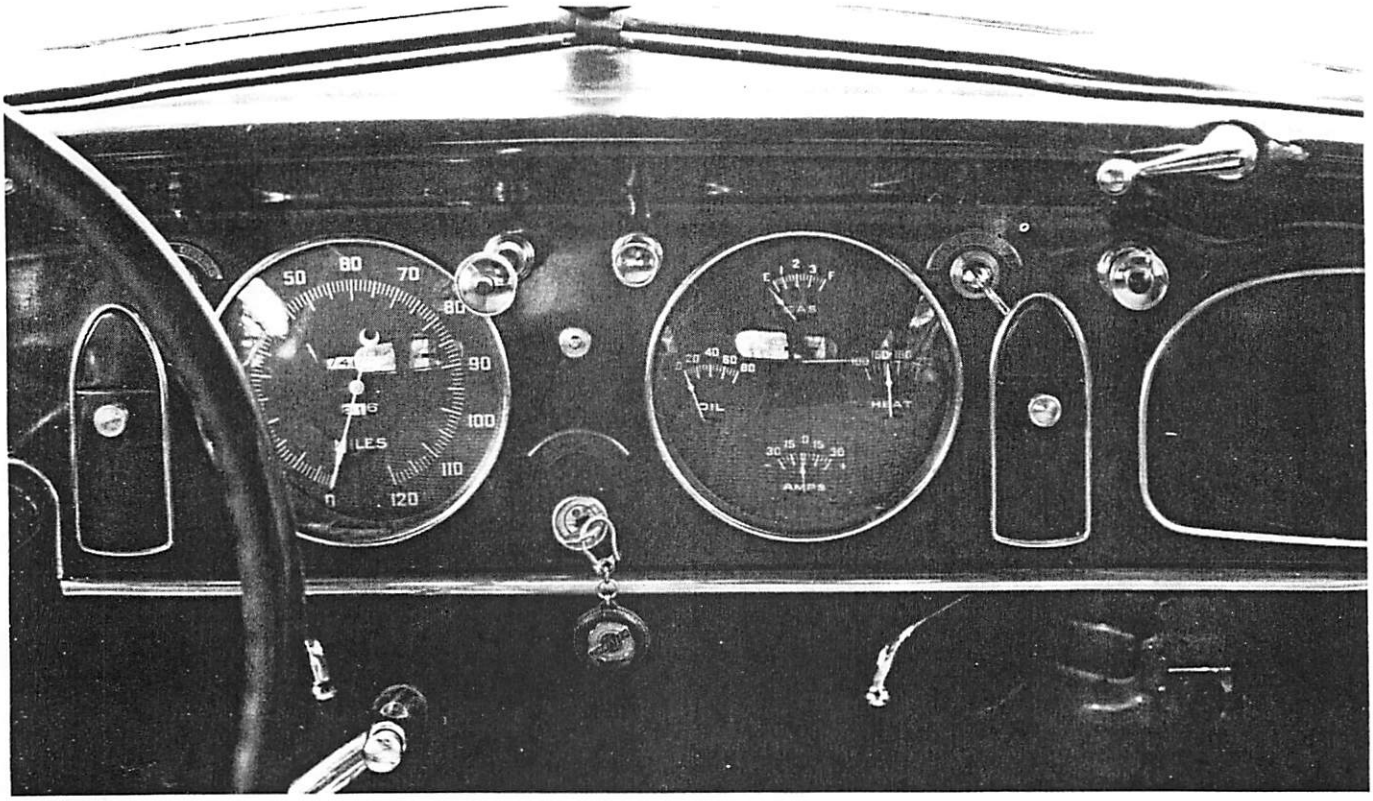
MODIFICATION OF GRILLE was the chief means whereby the Chrysler Corporation tried to make its Airflow car more acceptable to the public. The heavy-looking rounded front of the car was a focus of criticism from the outset. Here one sees at the top left the original grille design of 1934, which was modified during the year, and, reading from left to right, the grille designs of 1935, 1936 and 1937.



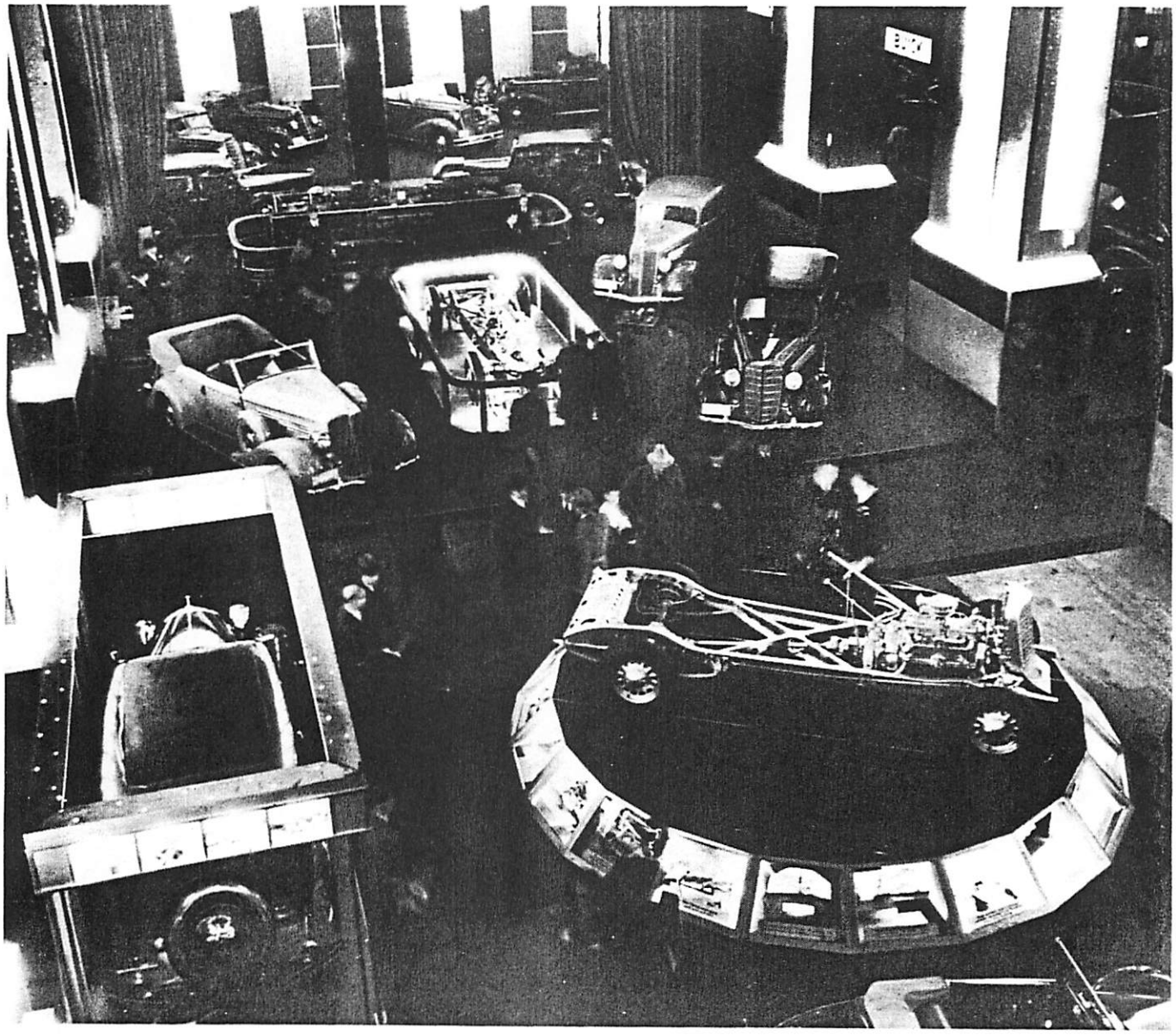
BODY FRAME OF AIRFLOW incorporated several innovations. It was light and made of steel, whereas in most cars up to that time it had been made of wood. The body attached to the Airflow frame was, except for the fenders, doors and hood, a single piece of stressed steel, whereas other cars had separate steel panels attached to the wood frame. The Airflow body had uncommonly high torsional rigidity.



SALES AND SURVIVAL of the Chrysler and DeSoto Airflows are charted. For each model year the bars show the number of cars manufactured, and the numeral at the end of each bar shows how many are still in running condition according to the Airflow Club of America.



SYMMETRICAL DASHBOARD of the Chrysler Airflow was photographed in the author's 1934 model. The instrument panel at the left incorporates the speedometer and two odometers (the lower one reading up to 99.9 miles for the measurement of trips). In the panel at the right are, clockwise from the top, gauges for fuel, engine temperature, amperage and oil pressure. The handle at the upper right serves to open and close the right half of the windshield from the bottom; similar handle for the left half is barely visible in the picture.



NEW YORK AUTOMOBILE SHOW of 1934 provided the occasion for the public introduction of the Airflow line. This photograph, made from a balcony overlooking the displays of the Ford Motor Company and the General Motors Corporation, indicates how sharply the Airflows differed from the other cars offered in 1934. The two cars in the foreground are Lincolns; behind them is a group of Buicks.

the rubber mats, molded roof panels and chromium-plated tubing inside.

Notwithstanding these and other largely cosmetic changes, the sales of the Airflow diminished year by year. After years of work and millions of dollars spent it was a bitter disappointment in the salesroom, much to the dismay of Breer, Zeder and Skelton and particularly Walter Chrysler. Although the company lost money only in 1934, it was embarrassed and frustrated by its magnificent failure.

The fate of the Airflow dampened the enthusiasm of the advocates of streamlining. The Reo and the Graham a few years earlier had been striking at first look, but neither of them had flouted earlier standards of beauty. The Airflow, however, not only jumped ahead of its predecessors but also incorporated such an array of novel features that the buying public was turned away rather than attracted. In effect the Airflow posed a question: Is honest functional design in an automobile beautiful, even when it breaks completely with tradition? The answer in the summer of 1934 was emphatically no.

All the same the impact of the Airflow on design was soon evident, although the evolution of the design was more successfully accomplished by other manufacturers. Certainly the Lincoln Zephyr, introduced in 1936, was Ford's answer to the Airflow. In basic body engineering the two designs had much in common: a short hood, a sweeping tail, passenger seating in the middle. The Zephyr's shell was even wider than the Airflow's, and its unitized body trusswork was even further developed. It also had a graceful appearance. Its hood was flat, behind a *V*-shaped, prowlike grille, and it was flanked by distinct fenders, each one carrying a partly buried headlight, all relieving the heaviness disliked in the Airflow. In spite of its unexciting engine, drive train and suspension the Zephyr, unlike the Airflow, was widely praised in the automotive press. Even so, its sales too were slow at first.

Ironically, just seven years after the debacle of the first Airflows the General Motors Corporation introduced its "fastback" design, with a profile almost

identical with that of the Airflow coupé except for a vertical grille and a long, flat hood. The design was marketed through all the company's automobile divisions until well into the 1950's and was strong in sales.

Equally ironic is the great success of the Volkswagen "Beetle." Its designer, Ferdinand Porsche, was so impressed by the engineering logic reflected in the Airflow that he immediately began work on a scaled-down version that would incorporate the rear-engine feature Breer had abandoned. The car came on the market in 1936 and before long was widely bought in many countries.

Thus one cannot call the Airflow a failure even though it sold poorly. In it Breer introduced a number of important technical innovations, gave high priority to the comfort of the passengers and conditioned the public to accept the streamlining principles that were to be evident in all automobiles by the end of the decade.

I recently bought a 1934 Chrysler Airflow sedan, the third Airflow I have owned. My daughter's first remark on seeing it was, "It looks like a big Beetle!" Friends and colleagues regard it as an antique curiosity and a shrewd investment, but only the most perceptive see in it the milestone of automotive history it represents.

After 43 years and undetermined but undoubtedly high mileage the body remains free of rattles, bearing silent testimony to the soundness of one of Breer's engineering tenets. Although the profile of the body was low for the 1930's, it is 68.5 inches high, so that one has to step up by means of the running board to get into the car. Seating is high by today's standards, but visibility is limited, partly by the modest amount of glass in the car (particularly in the rear) and partly by the thick pillars associated with the doors and the windshield.

The 112-horsepower, straight-eight, flat-head, side-valve engine is very quiet, as is the transmission. Acceleration is modest by today's standards, but fuel consumption (from 18 to 22 miles per gallon with an overdrive at high speeds) is respectable for a car that weighs 3,900 pounds. The unassisted drum brakes are balanced and positive in action but require heavy foot pressure. Some larger Airflow models had vacuum boosters to relieve this problem.

The ride is best described as heavy but nimble. Steering is manageable as long as the car is moving, but without any hydraulic assistance it is heavy for parking. Cornering is remarkably well controlled for such a softly sprung car, and excessive leaning is avoided by a rear-suspension stabilizer bar (moved to the front suspension in later models).

Because of the six-volt electrical system the cranking done by the starter is slower than today's cars provide with 12-volt systems, and the feeble bulb-and-reflector lights become exceedingly dim when at low engine speeds they are not assisted by the generator. The lighting was never satisfactory in the Airflows, even when they were new. Separate gauges for amperage, oil pressure, water temperature and fuel are welcome, but their location in a circular cluster on the right side of the symmetrical dashboard is distracting. The grille and the hood top open as a rear-hinged unit but offer only limited access to the long engine, which is mounted high over the front axle. Lateral access to the engine, which is required to adjust the valve tappets, requires removal of the right front wheel and the detachable inner body panel.

Today the Airflow has largely passed from the public consciousness. Several hundred of the cars survive (perhaps 1,000 or more if badly deteriorated ones are counted), many of them restored, pampered and registered on the rolls of the Airflow Club of America, a doughty band of devotees whose activities did much to create the current interest in the preservation and restoration of old automobiles. What is important about the Airflow is that the clamor it caused in 1934 pushed the automobile manufacturers into making a start toward adopting new principles of engineering and design. Once that process had begun there was no turning back.

The Author

HOWARD S. IRWIN is president of the New York Botanical Garden and the Cary Arboretum. He joined the Botanical Garden in 1960, after receiving his Ph.D. in botany from the University of Texas. The Airflow car has been a lifelong avocation of his, both as a hobby and as a source of enlightenment about the automobile's role "as a servile object and as an expression of our culture." He owned his first Airflow as a teenager and recently acquired a third.

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