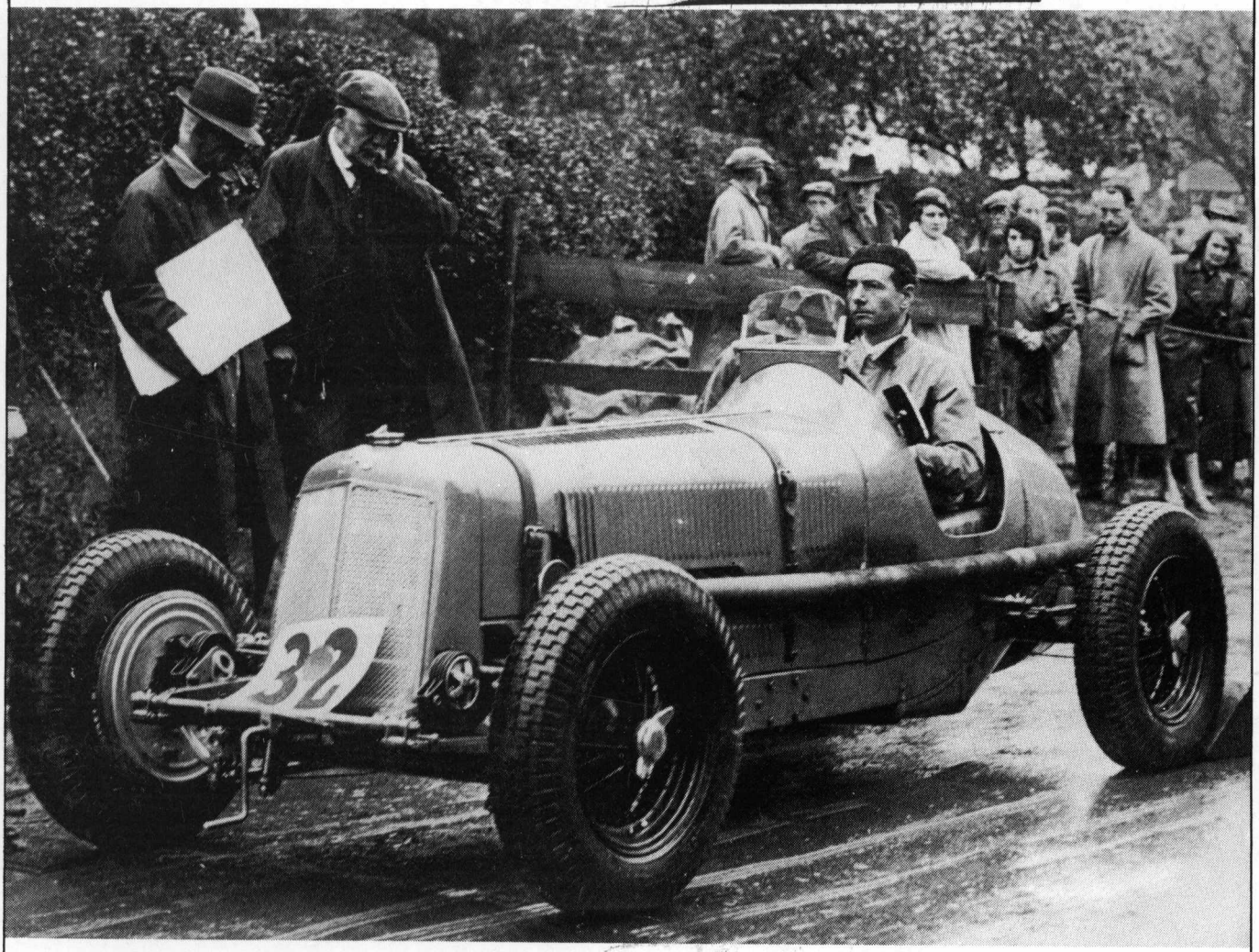
The Society of Automotive Historians

# AUTOMOTIVE HISTORY REVIEW

SPRING 1991 ISSUE NUMBER 26






A PUBLICATION OF THE SOCIETY OF AUTOMOTIVE HISTORIANS, INC.

# Editorial Comment

This issue of *Automotive History Review* exhibits the diversity of interests that we have come to expect in our Society. That is solely due to our members, who submit articles that are the fruits of research in each of their chosen fields. In these pages we leap from racing cars to electric vehicles, travel from the 1920s right through to the 1980s, and cover such allied topics as engineering history and America's highways. We are fortunate to have such a wide variety of topics presented to us, and to have contributors who write about them so well.

David Styles is no stranger to SAH members. His works have appeared in these pages before, and his books have won kudos from our Cugnot Committee. His specialty is Riley, but here he examines a particular era in the long career of Raymond Mays, an engineering genius whose experiments with Riley cars resulted in the creation of a legendary British racing marque, the ERA: English Racing Automobiles.

Those who bemoan the fact that we seldom cover modern history or non-traditional vehicles may commence a feast with page 9. Patrick Foster, a devoted researcher of lesser-known recent topics, presents a history of the Sebring-Vanguard CitiCar, an on-again, off-again venture, the fortunes of which have hinged on the fluctuating market for electric cars. With major manufacturers again looking seriously at this form of transport, perhaps Pat's subject will continue to have a present as well as a past.

Today, new highways are not seen as the answer to all transportation problems, but it's an indisputable fact that the grandaddy of American superhighways, the Pennsylvania Turnpike, became much more important and useful than even its supporters envisaged. Bob Hall describes the genesis and early days of the Turnpike, which celebrated its fiftieth anniversary last autumn. Bob's article begins on page 12.

Few people on earth have studied the lesser-known cars of the twenties more thoroughly than Keith Marvin. In this issue, Keith tells us of the Raleigh, on of the few cars to hail from New Jersey, and its short life. There's an element of mystery, too, in that the naming of the car's models became peculiar indeed.

Leslie R. Henry was one of the founders of the Society, but we have heard from him less frequently since his retirement from the Henry Ford Museum in 1977. Les gives us some sparkling insight into the engineering of one of America's favorite cars, the Model A Ford, and explains how some of Henry Ford's notorious anachronistic features had good basis in theory. Equally important were the advances made in component design for mass production by Harold Hicks and "Sheet Metal Joe" Galamb. If you like technological history and first-hand reminiscences, you'll love "Engineering the Model A" which begins on page 18.

Henry Ford may have felt that "history is more or less bunk," but he went to considerable lengths to leave some of it behind. Enjoy it and be glad.

*– Kit Foster*

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EDITOR
*Christopher G. Foster*

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**Front Cover:** *Raymond Mays on the starting line at the Shelsley Walsh hillclimb in ERA R1A. The Brooklands Society.*

**Back Cover:** *The Pennsylvania Turnpike, America's first superhighway, was just coming of age when this photo was taken. Pennsylvania Turnpike Commission.*

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# The Lincolnshire Giant-Killer

by David G. Styles

Raymond Mays is the name of a man who was to become a legend in his own time, driving such famous cars as the black Type 13 Bugatti "Black Bess," the famous red Vauxhall-Villiers supercharged sports car, the "White Riley" and, of course, the immortal ERAs — English Racing Automobiles.

This story begins at Eastgate House, in the small English town of Bourne, Lincolnshire, where Mays was born in 1899 and where he lived throughout his life. His father was a wool merchant, the proprietor of T.W. Mays and Company. During his early education at Oundle School, young Raymond took a keen interest in motor racing, so by the time he entered Cambridge University he was ready for his first drive, aboard a Hillman. He went on to drive an AC, the Bugatti "Black Bess," a Mercedes, the Vauxhall-Villiers and an Invicta before going on to the famous "White Riley" and then English Racing Automobiles.

As Mays' reputation grew, he teamed up with a man who was to become famous for his design work in the field of aero-engines, Amherst Villiers. They developed the Vauxhall-Villiers, the combination of a Vauxhall 30/98, much modified and lightened, and a Villiers-designed supercharger. The result was astounding, giving Mays many fastest-times-of-the-day at his favorite hill-climb venue, Shelsley Walsh, near Droitwich in Worcestershire. His first association with Humphrey Cook came as the result of an abortive attempt to develop a team of five-liter Invictas for international sports car racing. Some designs were prepared and parts made, one car being used as the development vehicle, but the project never reached completion. Humphrey Cook bought the Invicta from Mays, only to sell it within days, and gave him financial assistance to buy out Villiers' share of the Vauxhall-Villiers project.

A fine engineer named Peter Berthon was a good friend of Raymond Mays and had been closely associated with Mays' motoring projects for some time, including the Vauxhall-Villiers and the Invicta. But the next project they were to embark upon was to be their turning point. Raymond Mays and Berthon had to make a business trip to Coventry, shortly after writing off the Invicta development in the late winter of 1932-33, so they decided to call on Victor Riley, whom Raymond Mays knew.

*Percy Maclure's Riley wins the 1938 International Trophy, just ahead of Raymond Mays' ERA, the closest "International" finish ever. Quadrant Picture Library.*

Mays told how he was a keen supporter of the Riley marque, having owned many saloons as his road cars, and went on to tell of his ambitions to build a truly high-performance British car to compete in the Voiturette class and for hill-climbing, explaining that he particularly wanted to regain for Britain the Shelsley Walsh hill-climb record. Clearly, he captured the imagination of "VR" who, as a salesman, was a soft touch for a good sales pitch! Mays gave him one and walked out with the agreement that Riley would lend, on a long-term basis, one of the new racing Riley Six chassis, then in the final design stage. These were the cars which ultimately came into existence as the 1933 Tourist Trophy Sixes. Part of the deal was that Mays had the liberty to do whatever he wanted to the chassis to improve its performance potential. Riley also gave £300 in cash towards development costs and undertook to carry out initial engine modifications at Coventry.

To Mays and Berthon, this was tremendous news, and they recruited the aid of Murray Jamieson, a leading engineer specializing in the field of racing engine design and supercharging, who then worked for the Austin Motor Company in its racing department. Jamieson designed a 100mm vertically-mounted Roots-type supercharger for the Riley engine and a crankshaft capable of sustaining the power output to be demanded of it — 150 bhp was the target. In May of 1933, a young draftsman was recruited to complete the engine design work, while Peter Berthon dealt with the chassis development. That young draftsman was Aubrey Barratt, who had not long before completed his apprenticeship with the Daimler Company in Coventry.

Barratt wasn't used to the freedom he was given in this project, but his meticulous approach paid off. He started quite literally from the top and worked down, designing a new cylinder head first — the head which in fact became characteristic of the ERA engine. He progressed to the crankcase, which was to house the substantial crankshaft designed by Murray Jamieson, and concluded with an engine which retained the close identity demanded by Victor Riley as a condition of his support, whilst providing the powerful unit needed by Mays to achieve his hill-climbing goal. The measure of Barratt's, and Jamieson's, success was that, at

6,500 rpm, the engine produced 147 bhp at 12 psi boost — just 3 bhp short of target.

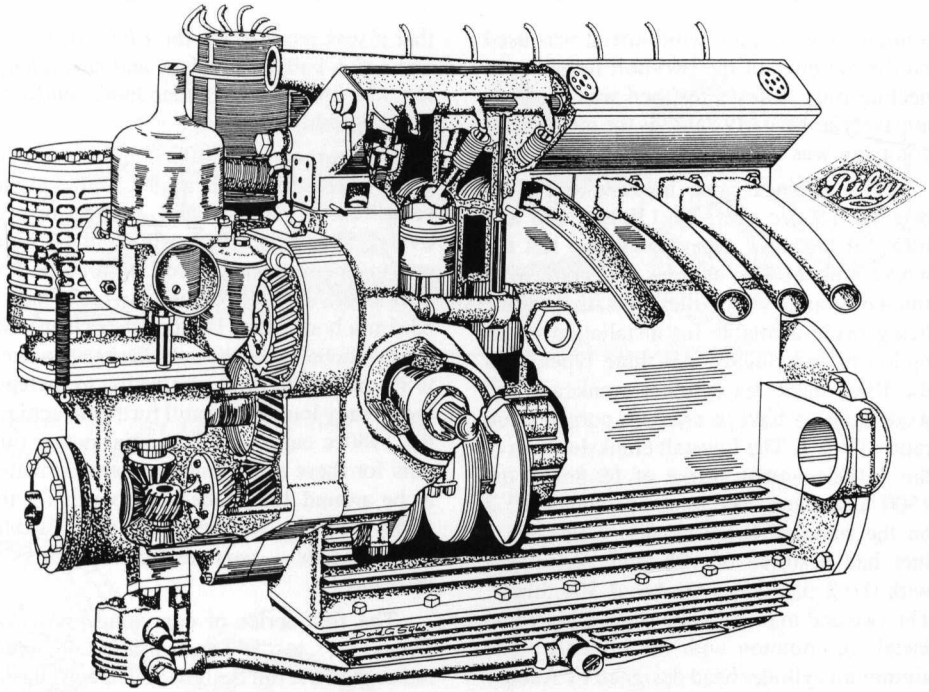
The "White Riley" made its competition debut at the Brooklands August Bank Holiday Meeting in 1933, but did nothing to distinguish itself. Next came the September 1933 Shelsley Walsh hill-climb, in which Mays was to redeem his promise to Victor Riley of recovering for Britain the unlimited record. Hans von Stück's three-year-old record was broken with a new time of 42.2 seconds, but just one hour later, Whitney Straight took his 2.9 litre Maserati up the hill in 41.8! At the Autumn BARC Brooklands Meeting, Mays drove the car in the Oxford and Cambridge Mountain Handicap Race, a motor-racing equivalent to the famous annual boat race. Raymond Mays shot through the field to win soundly for Cambridge, with a lead of 500 yards at the finish, as well as setting a new mountain circuit lap record of 74.68 miles per hour.

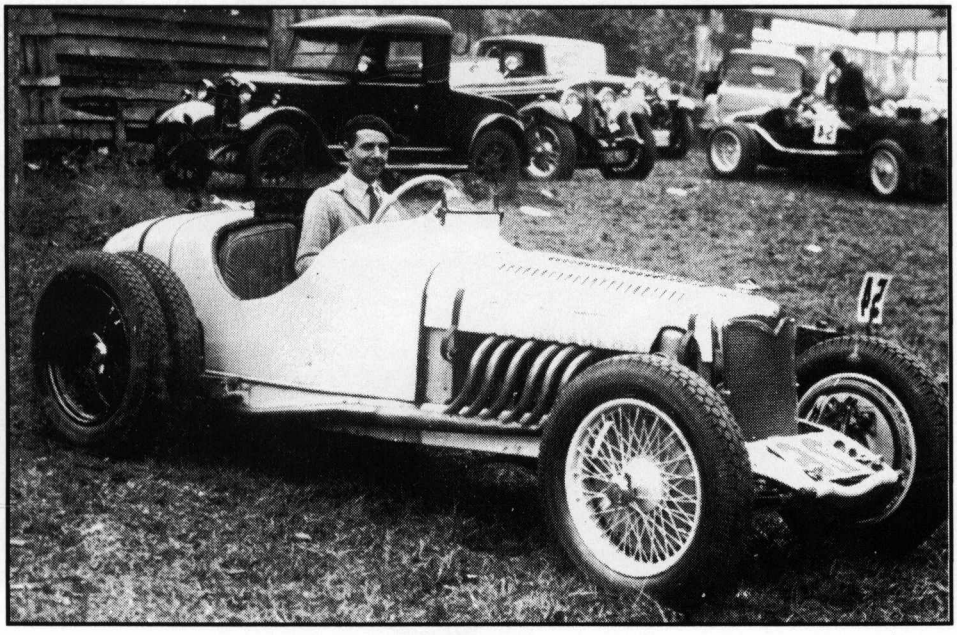
At this point, Humphrey Cook returned to the scene. Knowing Raymond Mays had spent just about everything he had and had earned on motor-sporting activities, and being attracted to the prospect of producing a team of highly successful single-seat cars which might compete in the voiturette class of racing, he offered financial assistance. The success so far of the "White Riley" had impressed Cook and he could see a great future for a line of cars developed from it. So Cook, Mays and Berthon discussed a partnership at great length. As a result, it was agreed to form a new company specifically to manufacture and field the new machines they were to produce, allowing that selected private individuals might buy cars for competition to run alongside the works machines, enjoying works support.

Now it was time to get back to Victor Riley, which the newly-formed trio did. They presented the case to him that they wanted to continue the "White Riley" project and to develop it into a new single-seat racing voiturette to secure international racing victories for Britain. This could only enhance the Riley name if it succeeded; it could not harm the name if it failed and it did not conflict with any of the Riley Company's plans for its own racing program. So "VR" obliged again, this time providing support in the form of considerable manufacturing work, insisting only that the finished result must retain its family resemblance to the original Riley product.

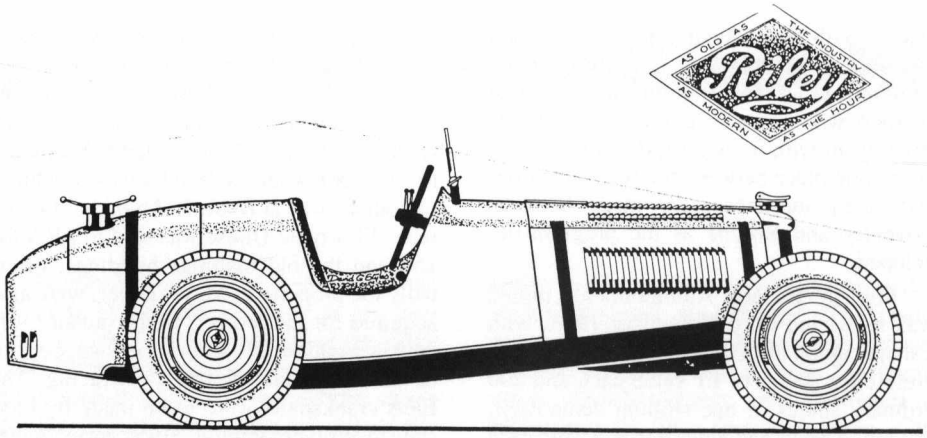
Riley's contribution to the success of ERA was substantial. The firm did a great deal of the engine manufacturing work, especially in the early stages while the Bourne workshop was being built, and throughout made all the cylinder blocks, installing and fitting the Laystall-made crankshafts, with their Hyatt roller center main bearings, and assembling what today would be described as short engines. So every time an ERA won a race or a hill-climb, a bit of Riley went with it. A great deal of co-operation took place between the two companies and many journeys were made between Coventry and Bourne as the program developed.

English Racing Automobiles Limited was registered on 6 November 1933, with a share capital of £10,000. There were 9,990 preference shares of £1 value each and 200 ordinary shares of one shilling value each. Raymond Mays and Peter Berthon were each to hold two-pounds-ten-shillings worth of one-shilling shares and Humphrey Cook retained the rest. This was to be the only written record of their business association, Cook preferring the rest of the arrangements to be by gentlemen's agreement. Mays had to find somewhere to build the cars, which, of course, was at Bourne. An orchard at the rear of Eastgate House was sold to ERA for £50 and the old maltings buildings, originally the property of Mays' father, were also acquired for the project. In the orchard was built a small works where the cars were to be assembled and prepared for racing. The ERA crankshafts were to be made by Laystall in Wolverhampton, Hyatt spring-roller bearings were used for the huge center main



*Above, cutaway view of the "White Riley engine. David Styles. Below, Raymond Mays with the "White Riley" at its first hill climb outing, Shelsley Walsh, September 1933. The Brooklands Society.*



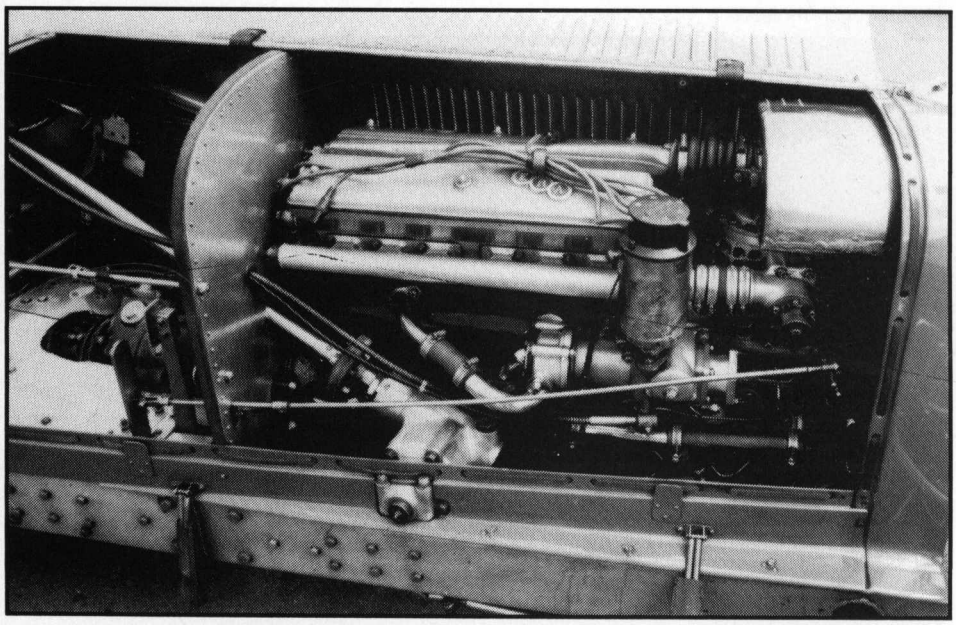

*The ERA's progenitor, the 1933 supercharged "White Riley." David Styles.*

journal, though plain white-metal was used on the big-ends of the two-bolt forged connecting rods. Riley's test-bed was used extensively in the early days, as the infant ERA company was establishing itself.

ERA engines came in three sizes: the original 1500cc unit, an 1100cc, and a 2 liter. Of the three types, only two left the works with 1100cc engines and none were fitted originally with 2-liter units, that engine being made available for installation at the option of individuals. All three types used the Riley-made six-cylinder crankcase and were built to have a uniform compression ratio of 7.5:1. The Laystall crankshafts gave the 1100cc unit a stroke of 69.8mm, the 1500 a stroke of 95.5mm (as against 95.2 on the standard Riley crank), whilst the 2 liter had a stroke of 106.5mm (compared with the 2 liter Riley stroke of 104.5mm). The two end main bearings were plain white metal, in common with the big-ends. The aluminum cylinder head designed by Aubrey Barratt for the White Riley was so successful that it was retained for the ERA, still using one-and-a-half inch valves and supercharging was provided by either Jamieson/Roots or Zoller blowers.

The bores of the 1100cc and 1500cc engines were identical at 57.5mm, giving capacities of 1088cc and 1488cc respectively. The 2 liter had a bore of 62.8mm and in this respect differed from the Riley-developed 2 liter engine, which had a 63.5mm bore. Peter Berthon was clearly not happy about taking the cylinder bore so close to its maximum limit, preferring to increase the already long stroke still further to achieve the 1980cc capacity. The initial power outputs for these three engines were estimated to be around 120 brake horsepower for the 1100, 170 bhp for the 1500, and 230 bhp for the 2 liter — very respectable figures in their day.

The first series of cars were known as Types "A" to "D" and differed in detail rather than overall design. Seventeen chassis were built, of the "A" and "B" types ("C" and "D" being conversions) and most of them are still in use in vintage and historic classes of competition, where they are still raced to win. The "A" and "B" types had semi-elliptic springs all around, Hartford friction shock absorbers, and were fitted with Girling mechanical rod type brakes, whereas the "C" and "D" types had Porsche-design trailing-link front suspension, semi-elliptic rear suspension de Ram type friction-hydraulic shock absorbers and Girling hydraulic brakes.



*The engine room of ERA R1A. David Styles.*

The ERA chassis frames were built by Thomson and Taylor who, it may be recalled, had developed the original Riley Nine Speed Model, so their experience was invaluable — not only from the point of view of having the ability to build chassis, but because of their knowledge of Riley ways and Riley people. The wheelbase chosen was eight feet, and the track was wider than Riley's standard, being four feet, four-and-one-half inches. Transmission passed clutch-less through an Armstrong Siddeley preselector gearbox via a torque tube to the the rear axle. The single-seat bodywork was of lightweight aluminum on metal framework.

The first three cars were were built for the 1934 season, to be driven by Raymond Mays, Prince zu Leiningen and Humphrey Cook. A fourth, with an 1100cc engine, was later added for P. G. Fairfield. The first B Type was built for R. J. B. Seaman and R2B was Prince Bira's first car, "Romulus," to be joined later by another B Type, R5B — "Remus" (which has been raced for so many years in VSCC events by the Hon. Patrick Lindsay with great credit). R14B was the last of this group to be built, in 1937, as a 1½ liter car and its predecessor was the third car bought by Prince Chula, R12B — "Hanuman" — for his cousin Bira's racing. This car was bought as a B Type, but immediately converted to C specification before going to work. However, Bira had a nasty incident in practice for the 1939 Coupé de la Commission Sportive, in which the car was very badly bent, so was later rebuilt as a B again.

R4D particularly merits mention here. Originally built as a B Type car, it was modified to become a C Type, after which it became the only D Type, which Raymond Mays retained in his own possession for some years after the company he formed was sold.

South Africa was the homeland of some highly successful racing "stars," one of whom was Patrick Fairfield. He was born in Liverpool, but his father, a fruit farmer, decided better fortunes lay in South Africa, and so emigrated there with his young family. Patrick returned to England in 1931 to enter Cambridge and find his fame and fortune in Britain. He met and became a good

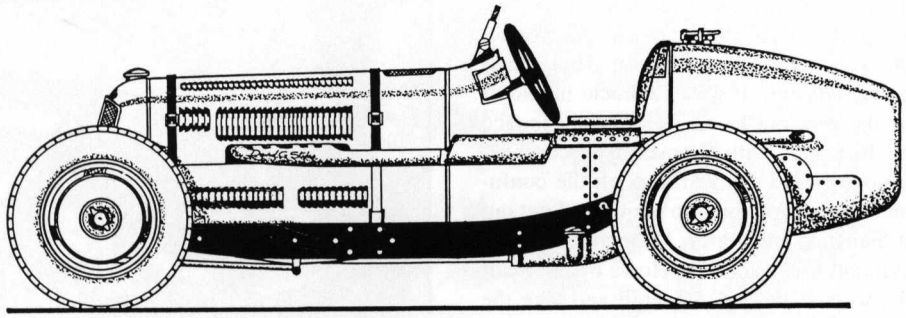
friend of Freddie Dixon in the process, with the result that he was ultimately invited to drive FWD's now rather long-in-the-tooth 1932 TT car in the 1934 BRDC 500 Miles Race. While he failed to finish, his performance was notable, for having spun on the fork hairpin in the appalling wet conditions of that race, he had worked his way up to second place before ending his race off the circuit.

Fairfield's "baptism" in British racing over, he went to see Raymond Mays and persuaded him to sell one of the new ERAs, in fact the first sold into private hands. Painted white, R4A was then piloted into sixth place in the 1935 British Empire Trophy Race, first in that year's Nuffield Trophy Race and first in the 1936 British Empire Trophy, to name but a few of his successes. He didn't forget his adoptive homeland either, winning the 1937 Grand Prix there aboard R4A. Sadly, however, at the age of only 29, he died as the result of a terrible accident at Le Mans in 1937, depriving motor racing in general, and the Riley-ERA world in particular, of a fine sportsman and superb driver.

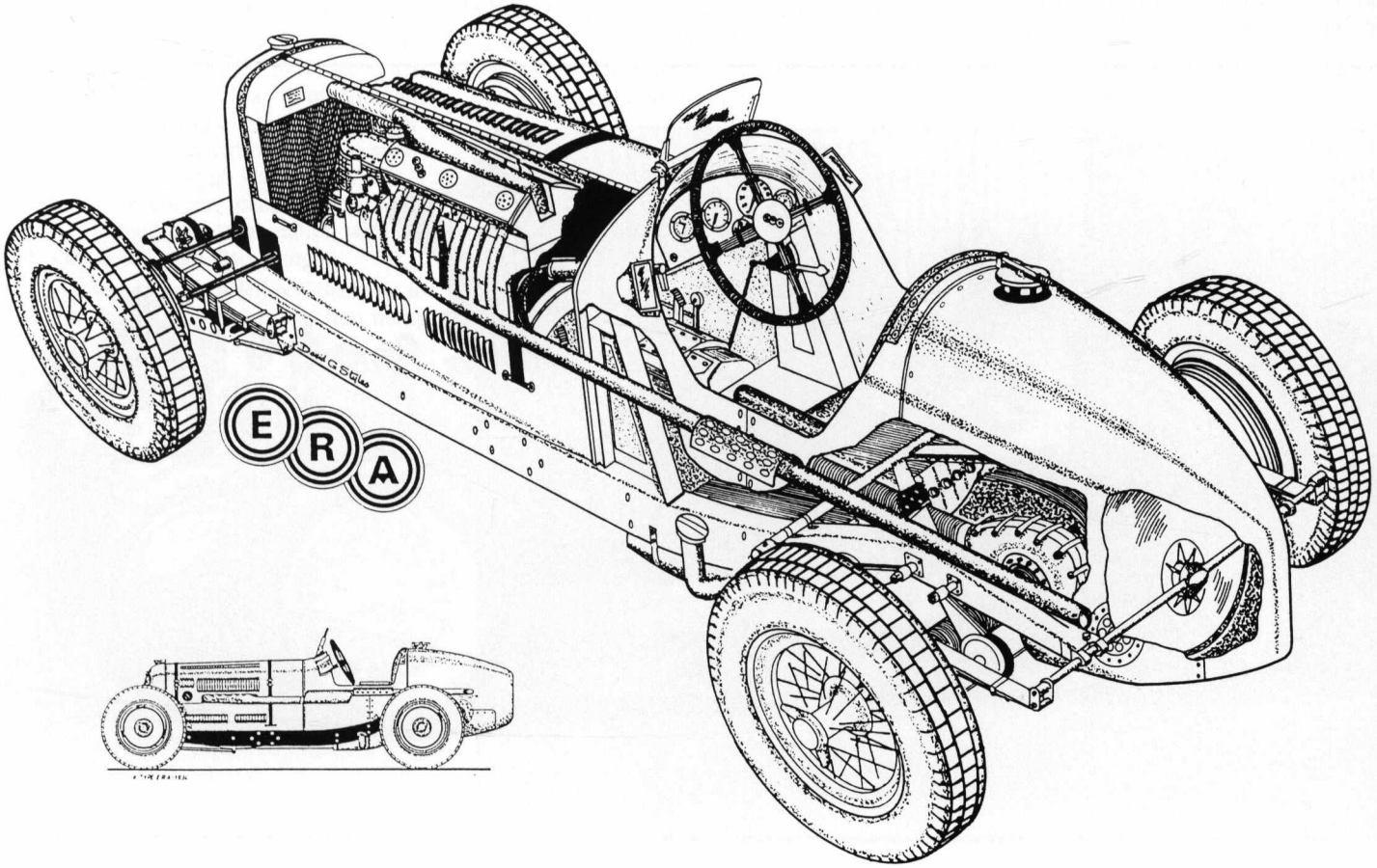
The Isle of Man had already achieved great fame by the 1930s as the venue for what may arguably be called the most exciting motorcycle race series in the world. The car races known as the Mannin Beg and the Mannin Moar, run in the streets of Douglas, were that island's answer to the Monaco Grand Prix, so far the most exciting "round-the-houses" grand prix event. Patrick Fairfield drove Freddie Dixon's Riley Nine (which he had driven himself in the 1932 Ulster TT) at the 1934 Mannin Beg and decided this new race was fun, and so returned in 1935 with his ERA, along with Raymond Mays, who drove R2A. Only two cars finished out of thirteen starters — Fairfield winning, followed by Freddie Dixon aboard his 2-litre Riley Six.

"B. Bira" was the name under which H.R.H. Prince Birabongse Bhanubandh of Thailand raced. Leaving his native Bangkok at 13 years of age, he went to Emsworth House Preparatory School and Eton before going on to study sculpture under the guidance of one of Britain's great masters, Charles Wheeler, RA. Such was the young prince's talent that he exhibited his work at the Royal Academy no less than five times in the years 1936-41 — and it was "Bira" who, fittingly, at the specific request of the British Racing Drivers' Club, sculpted a fine memorial to his fellow ERA driver, Pat Fairfield, after the latter's tragic death.

Bira's racing career began in 1935 with a Riley Imp, graduating to a K3 MG Magnette. Neither of these cars brought him suc-



*Above, "B" type ERA, 1935-1937. David Styles. Below, cutaway view of "A" type ERA. David Styles.*

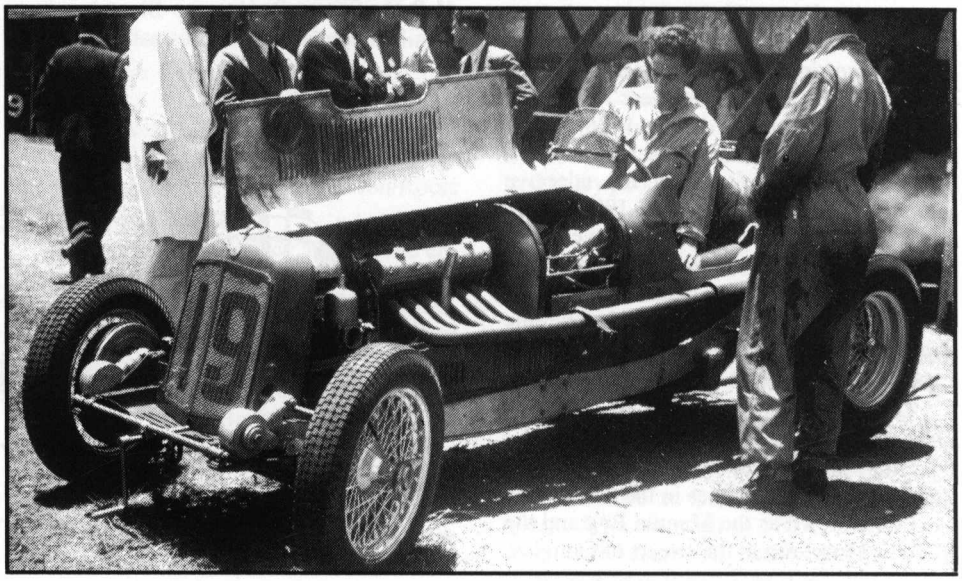


cess, but justified his cousin, Prince Chula Chakrabongse, who was also his racing manager and mentor, buying an example of the Riley's first cousin — an ERA — for his 21st birthday. That car, the first of three, and named "Romulus," was to bring its young driver greater success than he dreamed. He won many international successes with this and his two other ERAs ("Remus" and "Hanuman"), but his greatest single victory must be his win of the first and only Coupé du Prince Rainier, a light car race preceding the 1936 Monaco Grand Prix and run over 50 laps of the Grand Prix street circuit.

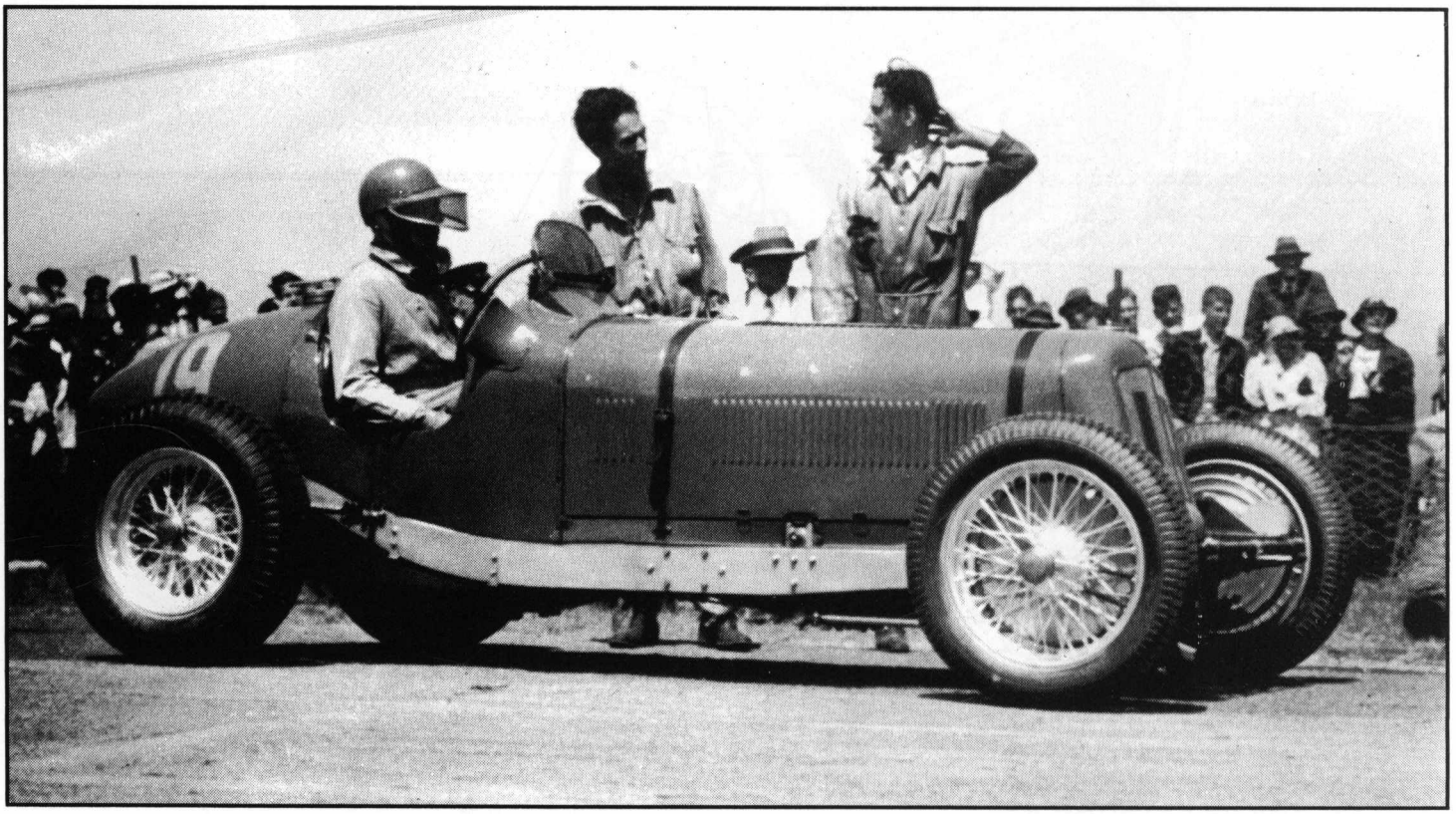
Just a couple of weeks before this event, Bira was driving "Romulus" in the British Empire Trophy Race at Donington Park, following closely behind another car, when a stone flew into his goggles, smashing glass into his left eye. It was a miracle he didn't lose the eye, but he made it to the Monaco start line and, with characteristic courage, the young Thai charged through the confusion of a multiple pile-up which had put out Pat Fairfield and three Maseratis, leaving Raymond Mays and Earl Howe by the roadside, to pass the last Maserati and take the checkered flag. Adding to that well-deserved victory, he went on to secure three British Racing Drivers' Club Gold Stars in a row — two with record points-scores (this was the British drivers' "championship" in those days). The names "Bira" and "ERA" had become inseparable.

By 1936, the Mannin Races had seen out their days, to be replaced by a new single race, run over a revised four-mile road course based upon part of the route of the motorcycle Tourist Trophy Races. This new event was named the RAC International Race and no less than ten ERAs were entered. Richard Seaman won that year with his ten year old Delage, followed into second place by Prince Bira and Cyril Paul with ERAs. The 1937 International was another story, however — an ERA benefit, with Bira, Mays and Fairfield coming home 1-2-3.

Back in Britain, Bob Gerard began racing Rileys in the 1930s and bought a white Sprite 2-seater, APM351, in 1937. In the same year, he bought the famous Riley TT Sprite, AVC20, then the last TT Sprite, CWK171, in 1938. Gerard was second in the 1500cc class of both the 1937 and 1938 RAC Tourist Trophy Races, aboard AVC20. "Graduating" to ERAs, he won many races before and after World War II. Affectionately known to his staff and many of the people with whom he did business as "Mister Bob," he owned Parr's of Leicester Limited,




*Above, the final touches are applied to Earl Howe's ERA R8B prior to the start of the 1937 South African Grand Prix. Courtesy of Michael Jones. Below, ready for the starter's flag. Courtesy of Michael Jones.*



a truck dealership which sold Dodge and ERF vehicles, and financed his motoring activities from that business.

Riley (Coventry) Limited had made quite an impact on the racing scene in 1936, and through its own direct efforts as well as by the support of private entrants, Riley cars won the French Coupé de la Commission Sportive, the RAC Tourist Trophy Race for the third time and the BRDC 500 Miles Race. However, because of their deteriorating financial position, which was not yet public, they decided not to run a works team for the 1937 season and reduced greatly their support to private entrants.

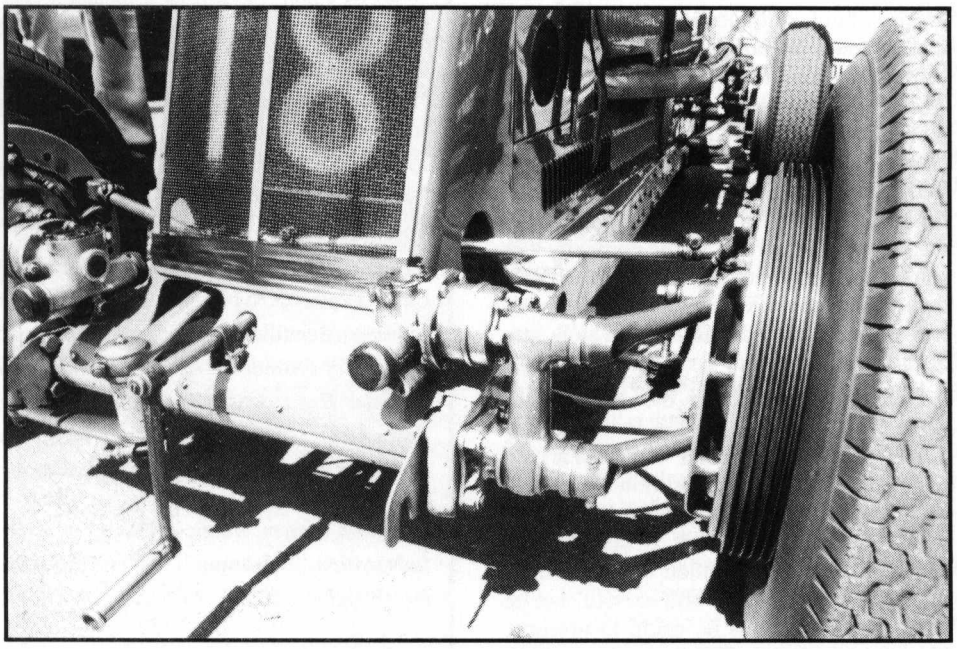
ERA had consolidated its reputation in 1936 too, endorsing Riley's basic engine design as well as the quality of the liaison between these two companies in the process. Among their major successes abroad, ERAs took the first three places in the Prince Rainier Cup Race (already referred to earlier); 3rd place in the Eifel Race at Nurburgring; 1st, 2nd and 3rd places in the Picardy Grand Prix; 1st in the Albi Grand Prix as well as 2nd and 3rd in the Berne Grand Prix. That was a pretty astonishing list of achievements, in which Riley played a major part.

Mays and Victor Riley had also launched a project to build a road-going ERA-Riley and to this end, the prototype Riley MPH went to Bourne for some months during the development of the project. However, it came to nothing as the potential cost of manufacture was clearly getting out of hand and Riley had the Sprite in prototype stage by the spring of 1935. They had realised that the MPH was a very expensive sports car now and if they were to stay in that market, then they had to build a less-expensive car. With the 1½ liter four-cylinder engine available now, the way to go was easy to see — make a new sports car, using the now well-tried MPH chassis in combination with the road-proven less-expensive engine.

The consequence of Riley's decision to withdraw from competition was that many private entrants either withdrew from racing or switched to other makes, selling off much of their racing machinery in the process. The Riley works sold off a great deal of racing stock to Percy Maclure, who was still very keen to continue on his own. He bought much of the Riley independent front suspension racing materials and certainly two chassis, one of which was the "White Riley." The engine from this car finished up in his own independent front suspension machine, which explains why the radiator on the Maclure Riley was located so far forward of the normal position — to accommodate the supercharger, now made reasonably easily detachable so that he could run with or without it.

So successful were the Types "A" to "D" ERAs that a new design was put in hand to compete in the 1½-liter Grand Prix formula, which was becoming very popular in Europe, to meet such opposition as the new-generation Alfa-Romeo, Maserati and Mercedes Benz cars. Despite Riley's decision to withdraw from competition, they did still give limited support to private entrants in terms of facilities, and this extended to ERA. The new car was the "E" Type, which also used the Riley Six engine as its basic power unit, though this was a very different car from its forebear, with a totally different chassis and Grand Prix bodywork. The engines were a little different from the earlier versions, having plain center main bearings, a bore of 63mm, a stroke of 80mm and a capacity of 1487cc. Four speed synchromesh gearboxes were used in the "E" types instead of preselector. By the time the "E" type was completed, the Riley company had been sold to Lord Nuffield.

ERAs had wrought havoc with their competition, and set a winning pattern that has continued unabated to the present day.



*Above, the Porsche trailing link front suspension of the "C" and "D" type ERAs. David Styles. Below, Percy Maclure alongside his ifs single seater, after fitting the "White Riley" engine and normal radiator. The Motor.*

In addition to that, two 1½-liter Grand Prix Delage chassis were fitted with ERA engines in later years, with the result that they were revitalised into very exciting machines. Of the three "E" types, two still exist. They were the last ERAs built under the original management, for Humphrey Cook felt that, having sunk £90,000 into the project and gained little support from the enthusiasts of motor racing, he could no longer afford to maintain ERA Limited.

An attempt was made to raise funds through the ERA Club, Cook having said that he would continue his support if £5,000 a year could be raised in cash from other sources. However, despite the large crowds which attended races in which ERAs took part (some 60,000 at the 1938 Donington Grand Prix), only 300 people joined the ERA Club, with the resultant shortfall in financial support causing Cook to decide to dispose of his interest. So the company was sold in 1939 and moved to Donington Park, then to Dunstable, where, after a brief post-war skirmish with the G-Type, it sank into obsurity.

Raymond Mays, on the other hand, came back to campaign the British motor industry after the Second World War and revive a great British tradition by setting up a new all-British all-racing car company, which was to be named British Racing Motors Limited (he couldn't use the ERA name, as that company still existed, but he came as near to it as he could to preserve his original ideals). BRMs were also built at Bourne, but the seemingly characteristic British apathy took its toll again and Mays was forced to find a new benefactor. This time, it was a man whose companies were closely involved in the motor industry — Alfred Owen, principal of the Owen Organisation.

Sir Alfred Owen maintained BRM through all of its frustrations and the bad times to a Grand Prix championship, secured by one of the most deserving of all Grand Prix champions — Graham Hill. So Raymond Mays lived to see his dream come true — a British world champion, in car and driver. He had come a long way from those early days of the "White Riley." Whilst Mays died in 1980, his cars live on and will do so for generations yet, perpetuating the memory of a man who did more than any other single individual to put Britain in the forefront of the world's motor racing scene — and for the best possible reasons: the good of motor racing and the good of Britain. The signal difference between Raymond Mays and the so-called moguls of modern Grand Prix theatre is that Mays' love of motor racing derived from his sense of sportsmanship, not avarice.

## DATA AND PRODUCTION SUMMARY OF ERA TYPES "A" TO "D" RACING SINGLE SEATERS

*MODEL:* ERA TYPES "A" TO "D" *YEARS PRODUCED:* 1934-37

### *CHASSIS*

Channel section mainframe arched over rear axle.

*Wheelbase:* 8'0" *Track:* Front – 4'4½" Rear – 4'4½"

*Type of Wheels:* 3.25" × 16" Dunlop centre lock wire with 5.25" × 16" tyres.

*Braking System:* A & B Types – Girling mechanical rod. C & D Types – Girling hydraulic. Wedge operated shoes on all types.

*Gearbox Type:* Armstrong Siddeley 4 speed preselector – no clutch.

*Suspension:* A & B Types – semi-elliptic all around with Hartford friction shock absorbers. C & D Types – semi-elliptic rear springs and trailing-link type independent front suspension of Porsche patent design. Three cars (R2B, R4D and R14B) fitted with de Ram hydraulic/friction shock absorbers.

### *ENGINES*

*Type:* In-line six-cylinder based on Riley Six design.

*Bore:* 1100cc = 57.5mm. 1500cc = 57.5mm. 2 Liter = 62.8mm.

*Stroke:* 1100cc = 69.8mm. 1500cc = 95.5mm. 2 Liter = 106.5mm.

*Cubic Capacity:* 1100 = 1088cc 1500 = 1488cc 2 Liter = 1980cc

*Ignition:* Scintilla NV6 magneto with manual advance/retard.

*Number of Cylinders:* 6 *Firing Order:* 1, 5, 3, 6, 2, 4.

*Cylinder Head:* Cast alloy with hemispherical combustion chambers.

*Valve Gear:* 45 degree overhead with high camshafts and 1½" valves.

*Sizes and Types of Main Bearings:* Front = 2.000" plain; Center = 3.750" roller; Rear = 2.375" plain.

*Induction System:* Jamieson/Roots or Zoller superchargers.

*Lubrication:* Dry sump. *Cooling System:* Inlet camshaft driven pump.

*Dry Weight:* 1100 = 13½ cwt; 1500 = 14½ cwt; 2 Litre = 15½ cwt.

### *CARS BUILT*

*R1A* – Works 1500cc car - built 1934 - sold to Jean Trevoux.

*R2A* – Works 1100cc car - built 1934 - sold to N. S. Embiricos.

*R3A* – Works 1500cc car - built 1934 - sold to Luis Fontes.

*R4A* – 1100cc car - built for Pat Fairfield - later used by F. R. Gerard

*R1B* – 1500cc car - built for Richard Seaman.

*R2B* – 1500 cc car - "Romulus" - built 1935 for Prince Chula of Siam as 21st birthday present to his cousin, Prince Bira.

*R3B* – Works 1500cc car - written off in 1936 at Deauville.

*R4D* – Works 1500cc car - built 1936 - originally B Type, but converted to C Type, then later D Type, at Works - retained by Raymond Mays.

*R5B* – 1500cc car - "Remus" - bought by Prince Chula as 2nd car for Prince Bira in 1936.

*R6B* – 1500cc car - built in 1936 for Dr. J. D. Benjafield.

*R7B* – 1500cc car - built in 1936 and sold to Arthur Dobson.

*R8B* – 1500cc car - built in 1936 for Earl Howe.

*R9B* – 1500cc car - built for Dennis Scribbans.

*R10B* – 1500cc car - built in 1937 for Peter Whitehead, later converted to C Type.

*R11B* – 1500cc car - built in 1937 for Reggie Tongue.

*R12B* – Works 1500cc car - built 1937 - "Hanuman" - converted to C Type when purchased by Prince Chula.

*R14B* – 1500cc car - built in 1937 for Johnny Wakefield.

In addition to the above-listed cars, three E Type ERA chassis were laid down, GP1 - GP3. These still used the Riley-based engine, but with a bore and stroke of 63mm × 80 mm, giving an engine capacity of 1487cc. The crankshafts of these engines ran in plain main bearings and were connected to 4 speed synchromesh gearboxes. GP1 was built and raced in 1939, GP2 was finally assembled after World War Two, but GP3 was not completed.

# Sebring-Vanguard Citicar: The Dawn of a New Age

by Patrick R. Foster

"A New Dawning": that's how *Automotive News* captioned a photo that ran in its weekly trade paper in 1973. The photo was of a small, squarish electric car that obviously had not come out of a Detroit styling studio. It was angular and boxy, but it had a futuristic look about it. The car was the product of a new automobile company that was trying to open a market for electric powered cars: the Sebring-Vanguard Company. The new car was the CitiCar.

Despite its admittedly odd styling, the little car was a standout for several reasons. The first was simply availability. A number of other companies and individuals had been discussing production of electric cars, and many prototypes had been assembled, but no other companies were actually in series production with an electric. Yet here was Sebring-Vanguard with a factory-built, fully warranteed car that you could purchase from an authorized dealer, just as you would any Chevy or Ford. Amazing.

That is a point I stress to other historians who have not taken Sebring-Vanguard seriously. As a vehicle producer of historical significance, Sebring-Vanguard is as valid a company as any: a company that offered a road-worthy electric car, designed and built in its own factory and sold in large quantities. More than 4,000 cars were built during the lifespan of the company. That's more than Bricklin built in its short life as an automaker, and unlike Bricklin (or Delorean, for that matter), the company is still in production, albeit under a new company name and ownership.

Sebring-Vanguard, Inc. was registered as a Delaware corporation on May 14, 1973. Its stated purpose was to be engaged in the business of "designing, engineering, manufacturing and marketing electric vehicles." The company founder was Robert G. Beaumont, president and chairman of the board. Bob Beaumont had been a Chrysler-Plymouth dealer and had a financial stake in the Vanguard Vehicles company, a manufacturer of electric-powered golf carts. Bob was, in fact, the president of that company. Vanguard Vehicles had designed and built a series of electric cars based on its golf carts. These crude electrics had sold in very small numbers, but had generated a great deal of interest. Beaumont perceived a small market developing for electric cars, a market that he felt he was in a position to satisfy. He began to formulate the plans necessary for entering into full-scale production of his most advanced electric to date, the Vanguard Coupe, and found several investors willing to take a chance on the new venture.

Plans included setting up a new company, to be called Sebring-Vanguard, and obtaining a new plant for building the car. He settled on a large building at the Sebring, Florida airport, the site of the original 24 hour Sebring races. Between May 1973 and May 1974, the design was finalized, the plant set up for production, and contracts were signed with the various suppliers of parts for the new car, now dubbed "CitiCar."

Esb, Inc. was probably the largest supplier, as it provided the batteries. The electric motors came from General Electric, Bendix supplied the brakes and Dana the rear axle. Formall Plastics built the plastic bodies. The frame-rollcage assemblies were built in-house.

The basic design of the Citicar was simplicity itself, mostly because the fledgling automaker could not afford the expensive machinery needed for automated production. The chassis consisted of a hand-welded aluminum frame with built-in rollcage, onto which the motor, controller and axles were attached. The front suspension was rudimentary, with emphasis on the rude. It consisted of a solid front axle, leaf springs and tube shock absorbers. Ditto for the rear suspension. The batteries occupied a compartment under the seat. The body itself was attached by means of pop rivets, a method used to simplify assembly, but one that cheapened the overall look of the car and produced widespread criticism. Because of its planned limited production, the vehicle was designed for mostly simple hand assembly by unskilled workers. That helped get the car into production, but resulted in only fair quality.

Two models were offered that first year: the SV36, equipped with 6 six-volt deep cycle batteries, and the SV48 which had 8 batteries. The SV36 had a top speed of 28 mph, while the SV48 could do 38 mph. Range per charge was claimed to be 50 miles, but that was an optimum figure; the real range was closer to 35 miles per charge. These numbers don't seem like much today, but in 1974 they were as good as you could get. Other electric cars were touring auto shows, claiming higher top speed and longer ranges, but they were prototypes, not cars that anyone could buy. The CitiCar was al-


*The CitiCar in its second coming, as the General Engines Commuta-Car. Patrick Foster collection.*

ready a production model and available to the buying public.

Between the time of the company's incorporation and its forced shutdown of production in August of 1976, 2,153 CitiCars were built. The car had received enthusiastic reviews from the auto press, and initial sales were respectable. But in October of 1975, a little over a year after full scale production had begun, *Consumer Reports* magazine published an article that was highly critical of the CitiCar and rated it as "Unacceptable." *Consumer Reports* detailed the relatively poor performance of the car, along with criticism of its poor assembly. Sales soon nosedived. Sebring-Vanguard soon redesigned many of the problem areas, but in the process also redesigned the brake system. This was an unfortunate decision, as the redesigned brakes proved inferior to those of the original models. When *Consumer Reports* later tested the "improved" Citicar, the new front brake system fell apart. Sebring-Vanguard began to fall apart soon thereafter.

Production was halted on August 6, 1976. For the next year and a half, attempts were made to reorganize the company in the midst of a virtual cessation of sales. Dealers cancelled their franchise agreements as soon as their existing inventory of Citicars was sold out — sometimes sooner. The Sebring-Vanguard company soon found itself unable to meet its obligations, and entered into Chapter 11 bankruptcy on July 1, 1977. It continued to supply spare parts to the few dealers who had not bailed out.

On January 15, 1978 the company made a public offering statement. The plan was to raise new funds to resume production, this time with a product called the CitiVan, a long wheelbased version of the standard CitiCar. Sebring-Vanguard calculated that a minimum infusion of $250,000 in new cash could get it back in business. Two plans were contemplated. The first was to raise the minimum $250,000 needed to get the CitiVan into production. The second plan, requiring $1,500,000 of new capital, would fund the initial manufacture of an all-new electric car to be called the CitiCar II. Prototype frames for the new car were already fabricated. But these plans were all for nothing. The offering of promissory notes failed to attract enough investors. The Sebring-Vanguard company folded.

The story would end right there had there been no real market for electric vehicles. But in the mid-1970s, the public was enamored of the electric transportation concept. Thus, when the assets of Sebring-Vanguard were put on the auction block by the bankruptcy court, they found a buyer interested in putting the little electric car back into production. That buyer was General Engines Company of Sewell, New Jersey, a longtime builder of heavy equipment trailers and a builder of electric powered scooters. General Engines bought Sebring-Vanguard for $82,000 at the bankruptcy sale in May of 1978.

After a solid year of further redesign of the CitiCar, General Engines resumed its production on July 2, 1979. The new car, renamed the Comuta-Car, bore a strong resemblance to the old product, but featured a stronger frame, much better brakes, better fit and finish, and a new battery system with the batteries carried in trays outside the car, protected by the bumpers. A rear hatchback window was made standard equipment, along with a separate 12 volt battery to power accessories. The car was offered as a single model. The new division was named Commuter Vehicles.

The General Engines car was a vast improvement on the old Citicar, and sold well initially. Over 1,000 of the Comuta-Cars were built during the first 12 months of production. But then sales took a sharp downturn as gasoline prices stabilized and public interest in electric-powered vehicles waned. The company soon developed an electric-powered delivery van, with much improved performance. The van was tested by the U.S. Postal Service, which subsequently placed an order for 380 of the units. General Engines completed this order in 1981. Meanwhile, sales of the Comuta-Car continued to drop. Production ceased, this time for good, in 1985.

In 1988, General Engines sold its car-making subsidiary to a group of Florida investors, some of whom had been Sebring-Vanguard employees during its years of auto

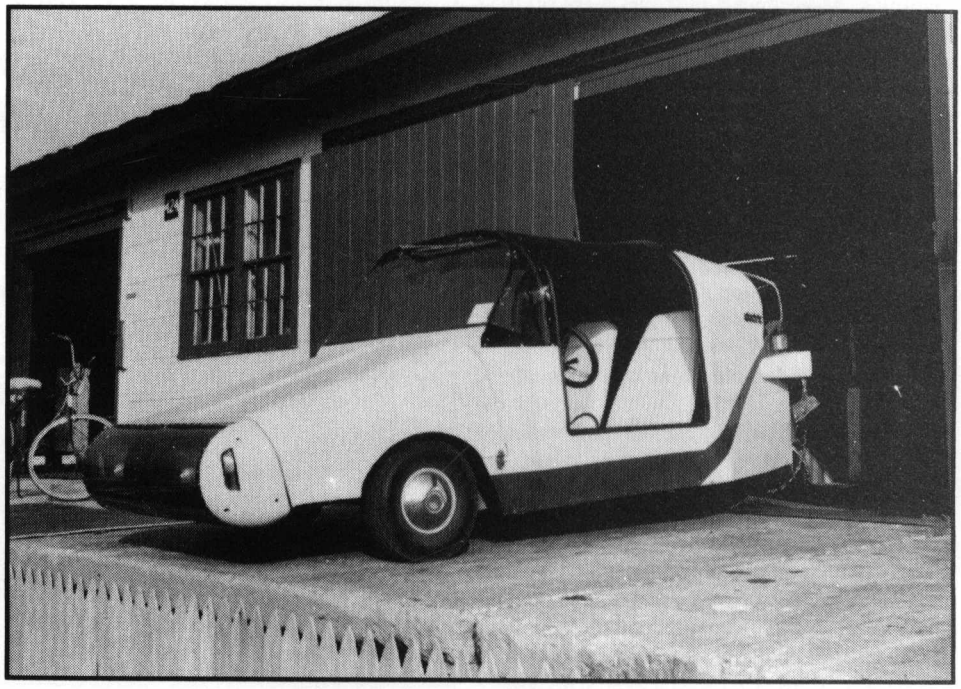

ELECTRIC VEHICLE NEWS/AUGUST 1978

*The Commuta-Car as advertised in* Electric Vehicle News, *August 1978. Patrick Foster Collection.*

production. The new investors changed the name of the company to Commuter Vehicles, a subsidiary of Sebring Auto Cycle, and began to design a new product.

The new 1990 product, a three-wheeled electric car, is called the Zzipper. Its top speed is 60 mph and its range is 50 miles with the standard battery pack, and up to 100 miles with an optional battery pack. Commuter Vehicles is still very much in business, and touts itself as the "World's Oldest and Largest Producer of Electric Cars." Production now runs at only 10-30 cars per year, as the market for electric vehicles has never regained the levels it enjoyed in the 1970s.

As mentioned at the beginning of this article, this is a licensed, valid producer of American cars, and a company with a history of ups and downs. Through sheer hard work, effort and perserverance, it has earned its place in automotive history.



***Engineering prototype of the 1990 Zzipper. A production prototype was test driven to 60 mph by the author in May 1990. Patrick Foster photo.***

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*August 1981 ad in* Electric Vehicle News *sought dealers for Commuter Vehicles, Inc., a division of General Engines Company. Patrick Foster Collection.*

# The Pennsylvania Turnpike: America's First Superhighway

by Bob Hall

October 1, 1990 marked a milestone in transportation history: the 50th anniversary of the Pennsylvania Turnpike, America's first "superhighway" and precursor of the Interstate Highway System.

Though ideas about such a project had been discussed almost from the time road building for automobiles began, the turnpike was actually designed during the Great Depression and constructed in the shadow of World War II, two events that figured prominently in its *raison d'être*.

There was irony involved as well, for the history of this boon to automotive travel began with a surveyed route "for a continuous railway from Harrisburg to Pittsburgh." This was in 1839, a full century before the Pennsylvania Turnpike opened to traffic.

Col. Charles L. Schlatter developed three different possibilities for rail routes across the mountainous terrain of the Keystone State. His "middle route" would become the Pennsylvania Railroad's main line, but his "southern route" became the object of much discussion and speculation for the next 44 years, for, though more expensive to construct, it provided a shorter path across the state.

In 1883, railroad magnate William H. Vanderbilt, backed by a syndicate of Wall Street and Pittsburgh financiers, decided to compete with the PRR; so construction began on what had become known as the South Penn route. Thousands of workmen swarmed into the mountains and valleys along the entire 209-mile line. In two years, 60 percent of the railroad had been completed at a cost of $10 million and 27 lives. Most of the fatalities had occurred during the construction of nine tunnels, which were about 70 percent completed when construction of the new route was abandoned.

The story of why the South Penn route never carried rail traffic across Pennsylvania is fascinating, but space doesn't permit our delving into the cut-throat business that was American railroad building and competition during the second half of the 19th century. In brief, super-financier J. P. Morgan persuaded Vanderbilt to end his ruthless rate war and to make peace with the PRR.

"And here, for the time being, and maybe forever, is buried the best route ever devised between the Ohio River and the Atlantic Ocean." That was a toast offered in memory of "Vanderbilt's Folly" by a disappointed engineer during a farewell dinner in September 1885. Little did he realize what lay in store for the abandoned South Penn Line.

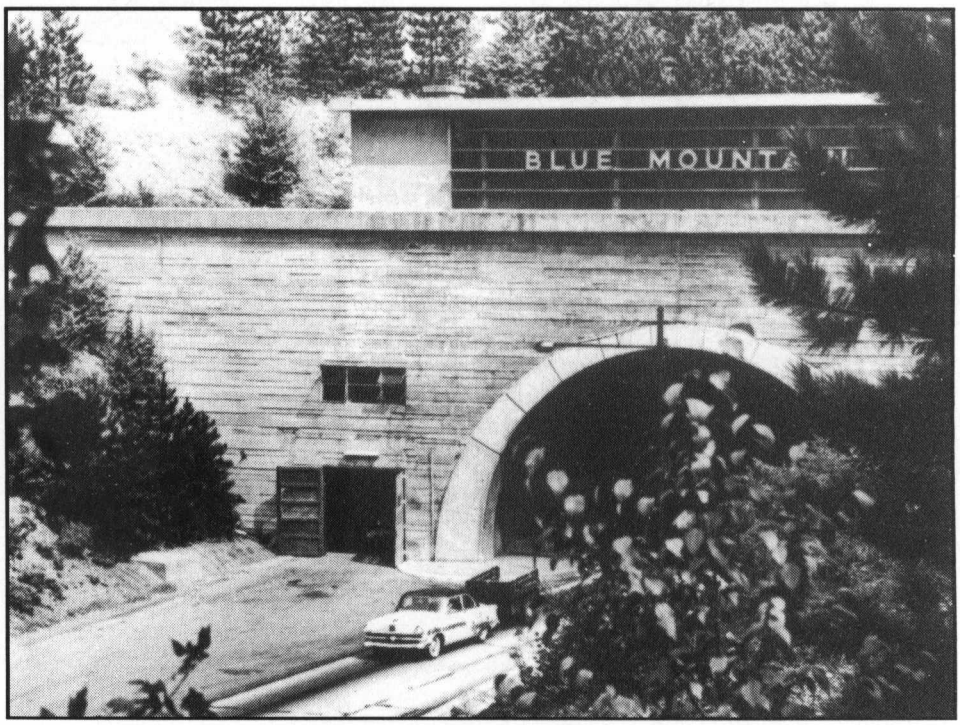
In 1908, a Somerset County man proposed its completion as a project to provide work for the unemployed. His enthusiastic support of the idea helped elect him to the Pennsylvania State Legislature, but most of the South Penn right-of-way still lay dormant. A small portion of it was utilized by the short line Pittsburgh, Westmoreland & Somerset Railroad just after the turn of the century, but it would be the automobile that would eventually make full use of the rail line that never was.

With the Great Depression of the 1930s devouring millions of jobs, the idea of an "all-weather highway" across Pennsylvania (as a public works project) began to be considered seriously. In 1935, the state's planning board and highway department, along with the Pennsylvania Motor Truck Association helped to convince the U.S. Works Progress Administration (WPA) to finance a survey of the South Penn route to see if an "express highway" could be built over it.

Throughout 1936, surveyors, geologists and engineers again checked for the best way across Pennsylvania's mountain ridges. They determined that the melancholy engineer's toast had been correct — the South Penn route could not be improved upon. The state legislature approved the establishment of the Pennsylvania Turnpike Commission in May, 1937, and authorized it to construct a 160-mile, four-lane, limited-access toll highway from U.S. Route 11 at Carlisle (10 miles west of Harrisburg) to Irwin (10 miles east of Pittsburgh) at U.S. Route 30, the Lincoln Highway.

The next hurdle was financing the project. The PTC's first contract was to remove water from the existing tunnels. Their second was for surveys to determine the toll road's potential income and its estimated cost. Although the resulting figures looked encouraging, the New York investment houses couldn't be convinced to finance a bond issue for the necessary $60 million; high finance practices had changed since the era of Vanderbilt and Morgan. This time the New Deal came to the rescue.

President Franklin D. Roosevelt thought that the turnpike would have strategic mili-

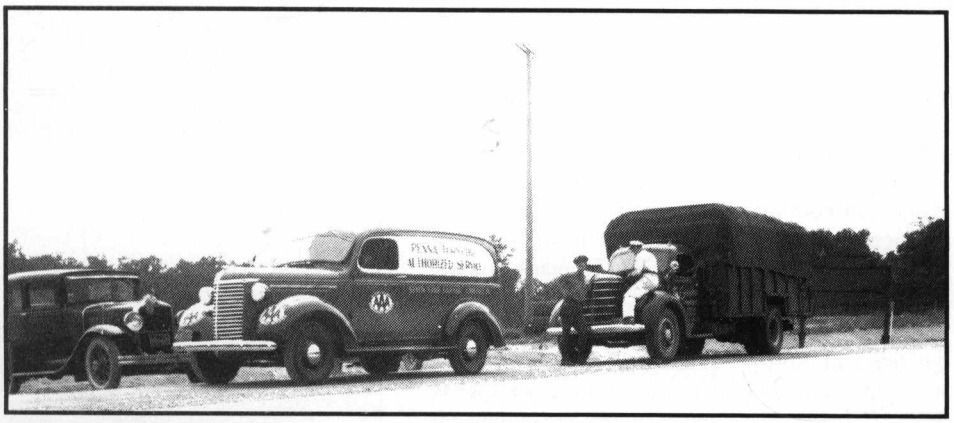



*The original Turnpike utilized seven two-lane tunnels in the western Pennsylvania mountains. This is the east portal of the easternmost Blue Hill tunnel in the mid-fifties. A parallel tunnel has since increased capacity to four lanes. Pennsylvania Turnpike Commission.*

tary value in the event of war, as well as creating thousands of jobs, so he arranged for the federal Reconstruction Finance Corporation to underwrite a $35 million bond issue, and for the WPA to provide an outright grant of $26 million. The funds were released to the PTC on October 26, 1938; construction began the next day, at a farm in Cumberland County. Over the next 22 months, 18,000 men worked on the turnpike for an average wage of 75 cents per hour; tunnel workers received 15 cents more. While men on relief received priority in the selection of common laborer, many skilled workers with experience on other large public works projects were also employed.

The Pennsylvania Turnpike was so constructed as to eliminate the sharp curves and steep grades (as much as nine percent) common on U.S. Routes 30 and 22. Maximum grade on the new Pennsylvania Turnpike was to be three percent — three feet of rise for every 100 linear feet of highway. Most of the roadway was placed on the southern and western exposures of the hills and mountains in order to obtain maximum available sunshine to aid in melting ice and snow — an important consideration in Pennsylvania.

The *Philadelphia Record* referred to the not-yet-under-construction turnpike as the "super-road" or the "tunnel highway" and published a map showing the nine South Penn tunnels. Actually, only six of the original tubes were used; a seventh, through Allegheny Mountain, had to be re-bored a short distance from the original shaft due to soft soil. Two others were bypassed by use of deep parallel cuts through the mountains a short distance from the old tubes. In later years, the one-lane-in-each-direction tunnels would prove to be major bottlenecks, and so were either replaced or enlarged. Of the 19 fatalities suffered during turnpike construction, 18 occurred in the tunnels.



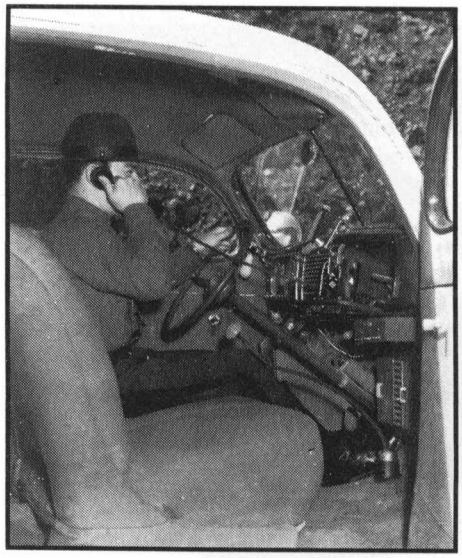
*Off-turnpike garages were engaged to provide "authorized service." This 1940 Cheverolet service truck came from the Seven Star Garage in Carlisle. Pennsylvania Turnpike Commission.*

One condition of the financing agreement with the federal government was that "the turnpike be substantially completed by June 29, 1940." This condition was met, but only by use of three daily seven-hour shifts (with the eighth hour for equipment maintenance) during the last few months of construction. The originally-planned July 4th dedication by President Roosevelt was delayed by opposition from the Republican members of the PTC, plus the fact that the last concrete wasn't poured until August 20. A Labor Day opening was also cancelled, and an October 1st opening date was finally decided upon.

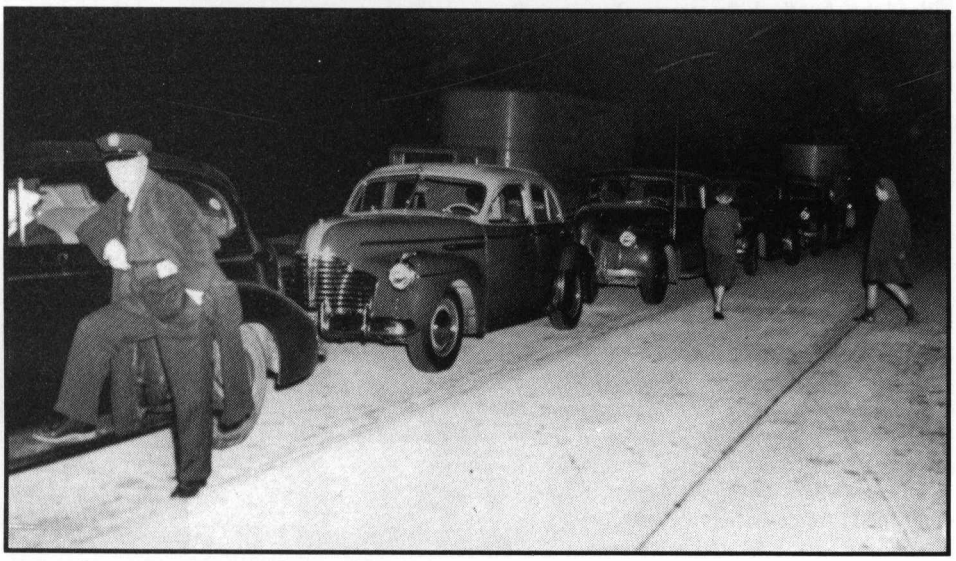
There was no opening ceremony, but drivers lined up at the tollbooths ten hours before the "World's Greatest Highway" (as almost all the national press were calling it) opened for traffic. The first Sunday the turnpike was open, 27,000 vehicles drove on it, although not without some interesting side-effects. People became confused by the cloverleaf interchanges (unknown to most drivers in 1940), they forgot to bring money for tolls, and several tollbooths ran out of tickets. Despite these initial snafus, the new road was accepted enthusiastically.

Some skeptics had predicted that the turnpike would never be successful. One of the most pessimistic was, surprisingly, another federal agency — the U.S. Bureau of Public Roads, later to become the Federal Highway Administration. It predicted that a mere 715 vehicles per day would opt to use the turnpike. Other consultants retained by the PTC estimated a daily average of 3,500 vehicles, or 1.3 million per year. Both figures proved to be far from accurate, as the "dream highway" carried 2.4 milion cars and trucks during its first 12 months of operation.

The Pennsylvania Turnpike had been expected to be unique, even before it welcomed its first vehicle. Indeed it was, but once in operation some problems became apparent arising from its unlimited-speed policy and the capabilities of the cars of the day (the turnpike had no speed limit throughout its first six months of operation.



*Early Turnpike police patrolled in radio-equipped Fords. Pennsylvania Turnpike Commission.*



*Drivers lined up awaiting the opening of the Turnpike at 12:01 AM, October 1, 1940. This queue is at Irwin, East of Pittsburgh. Some waited as long as ten hours. Pennsylvania Turnpike Commission.*

In an article entitled "The U.S. Highway System" in its June 1941 issue, *Fortune* magazine carried a two-thirds page aerial photo captioned "The Pennsylvania Turnpike is proof against every road hazard except a fool and his car." The authors added: "Straight sections like the one shown above above [sic] permit a hundred mile an hour pace without discomfort. But most cars cannot take advantage of the opportunity. As such it will represent the maximum in road construction for many years."

Indeed, the unrestricted speeds of those early months led to many overheated engines and blown-out tires. In April 1941 a speed limit of 70 mph was imposed on passenger cars, while truck speeds were set between 50 and 65 mph, depending on their size and weight. Within days of America's entry into World War II, a 35 mph fuel-saving limit was imposed. Once gasoline and tire rationing became facts of wartime life, turnpike use and revenues were drastically diminished, though trucks loaded with war materiel made excellent use of the new superhighway.

Once rationing ended and the victorious GI's returned home, use of the turnpike boomed and the pressure to expand the original 160-mile route increased. In 1949, traffic volume reached 3.8 million vehicles, almost triple the original estimate of a decade earlier. Enabling legislation for an eastern extension to Philadelphia had been passed on May 16, 1940, while the western extension to the Ohio line was authorized 13 months later on June 11, 1941.

The 100-mile "Philadelphia Extension" stretched only to Valley Forge, northeast of the city proper. Its construction took 26 months from groundbreaking to its completion in November, 1952. The relatively flat terrain of eastern Pennsylvania made for easy construction, requiring only one major project: the 4,526-foot-long bridge across the Susquehanna River, five miles south of Harrisburg.

The "Western Extension" to Ohio was only 67 miles long, but the hilly terrain of western Pennsylvania and the bridges over the Allegheny and Beaver Rivers made its construction more difficult. Despite this, its completion time was an identical 26 months, with the day after Christmas 1951 its "opening day." Another difference between the extensions was in the construction of the overpasses carrying local roads over the turnpike. Those in the Philadelphia extension were concrete, as in the original 160-mile section, but the western overpasses were of steel construction.

There were to be more extensions to the turnpike in succeeding years, while improvements along the original section, especially the widening or complete bypassing of tunnels, would continue to put the Pennsylvania Turnpike in the forefront of highway design and construction. But perhaps its greatest legacy is that of the prototype for the controlled limited-access highways that were to follow it. For as the federal government and the rest of the states saw the turnpike's success, it spurred them to create the Interstate Highway System so well utilized today.

*Original tollbooths had a characteristic hexagonal design. Pennsylvania Turnpike Commission.*


*C. C. Schleicher of Wilkinsburg, Pennsyylvania, was the first motorist to travel eastbound on the new Pittsburgh section, which opened at 12:01 AM on August 7, 1951. Pennsylvania Turnpike Commission.*

*". . . a hundred mile an hour pace without discomfort" extolled* Fortune *in 1940. Speed limits came quickly, however, in April 1941. Pennslyvania Turnpike Commission.*

# The Raleigh: Explorer or Princess?

by Keith Marvin

Of the approximately 500 makes of automobiles produced in North America during the 1920s, one of the most obscure was the Raleigh, an assembled car devoid of any perceptible imagination, either in its components or in its design. Its production was brief and limited. Its design heralded no mechanical or aesthetic breakthroughs. It lacked originality. Except for the attentions of a handful of persons in Cumberland County, New Jersey and in Berks County, Pennsylvania, where the cars were built (and presumably found buyers), it existed in a hazy sort of anonymity.

The Raleigh enjoyed a life span of two years. Before operations were moved to Reading, Pennsylvania, it comprised, with Kelsey and Mercer, New Jersey's entire automobile industry. Probably as many as 25 were produced; perhaps more. No definitive production figures have ever surfaced.

In the quest for information on obscure cars, every piece of documentation, even every assumption, is greatly appreciated and welcomed by the historian. In this regard, I would like to express my appreciation for the assistance in the preparation of this article provided by Dr. G. A. Nitshe, Jr. of Monroeville, New Jersey, and by Stanley K. Yost of Fort Myers, Florida. Dr. Nitshe, who observed the actual construction of a Raleigh car near his home in Bridgeton, New Jersey in 1921, has provided me with illustrative material (Dr. Nitshe is the author of an article on the make published in *The Horseless Carriage Gazette*). Mr. Yost, one of this country's outstanding automotive historians, helped fill in the missing links of the Raleigh scenario which would have otherwise been left to speculation. The word "scenario" is aptly used; the Raleigh story might be compared to a two-act play, as the scene shifts from one location to another.

The first act centered in Bridgeton, New Jersey, a city of some 20,000, county seat of Cumberland County in the southern part of the state. The chief character was Job Ralph *"Joe"* Sutterley, Jr., a native of Trenton.

Sutterley was employed in 1920 by the Bauer Tractor Co., which also maintained an agency for Packard cars, in Bridgeton. Sutterley's imagination and ambitions, like those of so many men in similar positions, simply weren't geared to a permanent career as a car salesman. Approximately 200 different makes of automobile were then on the domestic market, and nearly every week the automotive press announced the formation of new companies and entirely new makes of cars. Being familiar with the industry, and interested in taking a larger part in it, Sutterley left the Bauer enterprise some time in early 1920 to establish Raleigh Motors, Inc. This new firm was headquartered in the former Rocap's Carriage Works, a three-story brick building at 44 Jefferson St., near the court house.

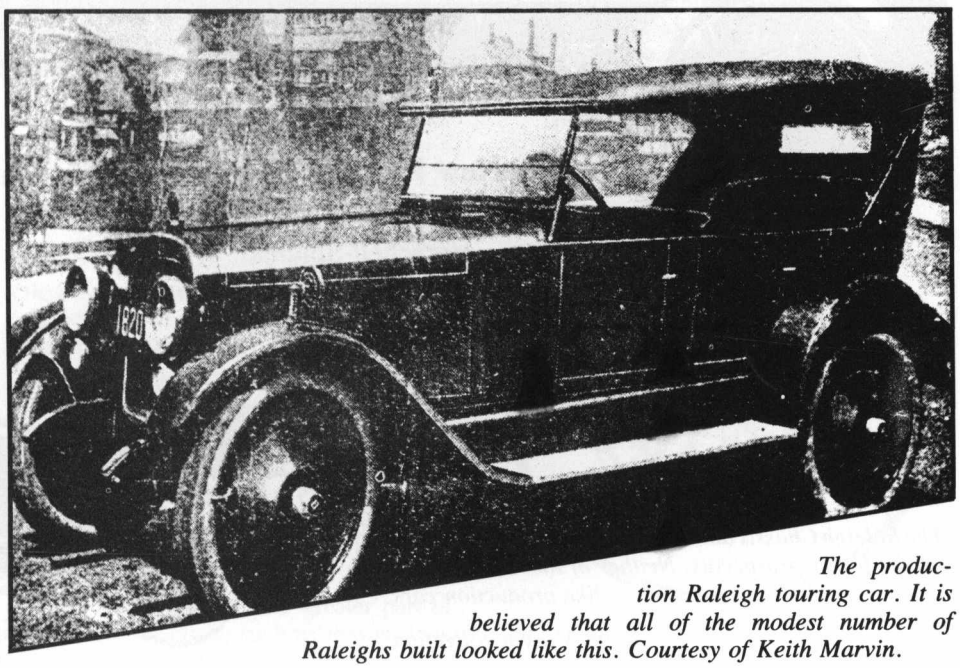
Exactly when he started the business isn't certain. What *is* certain is that by midsummer he had become the catalyst which would turn the city into an auto manufacturing center, albeit briefly. In those days, there were several ways in which to set up a motor car company on the proverbial shoestring. Nearly all of the smaller firms relied on an assortment of standard components, and simply put them together with a locally-built body, adding a distinctive radiator emblem and proclaiming the make. They were then marketed where and as they could be, in the hope of realizing enough profit to keep the operations going. Sutterly followed this practice, but in his case even the body was purchased (more on this later).

Whether any Raleigh cars were completed before the end of 1920 is doubtful. However, the December 29, 1920 issue of *Motor World* carried a full-page ad illustrating a wire-wheeled chassis, proclaiming it a "New Standardized Six" with a price of $2050. The fine print explained that "standardized" simply meant that the car was a happy blend of proven components bought from the leaders of their respective fields. No double-talk here; the Raleigh was to be an assembled car, pure and simple, and proud of it!

At about the same time, a prospectus for the Raleigh was published at the job press of the *Elmer Times*, in the nearby town of Elmer. This prospectus was headed with a portrait of Sir Walter Raleigh and provided specifications of the new car, along with a Jordanesque bit of patter.

It seems that Joe Sutterley was an admirer of Raleigh and had decided to name his car in honor of the sixteenth century navigator. Explorers and navigators have ever appealed to the imagination, and as with other similarly-named cars (Cadillac, Balboa, LaSalle, Standish, and Marquette, to name a few), the hero figure was played to the hilt.

If the great Ned Jordan didn't have his finger in the pie, it must have been an ardent disciple who attempted to describe the new car. "Beauty and Brawn are One," caroled the blurb. "It is as if the Velvety Smooth, High Strung Pride of the Racing Stables had been Miraculously Endowed with the Heavy Bone, Sinew and Constitution of the Draft




*The production Raleigh touring car. It is believed that all of the modest number of Raleighs built looked like this. Courtesy of Keith Marvin.*

Horse." After that, the Raleigh's slogan was something of a letdown: "The Car You Will be Proud to Own."

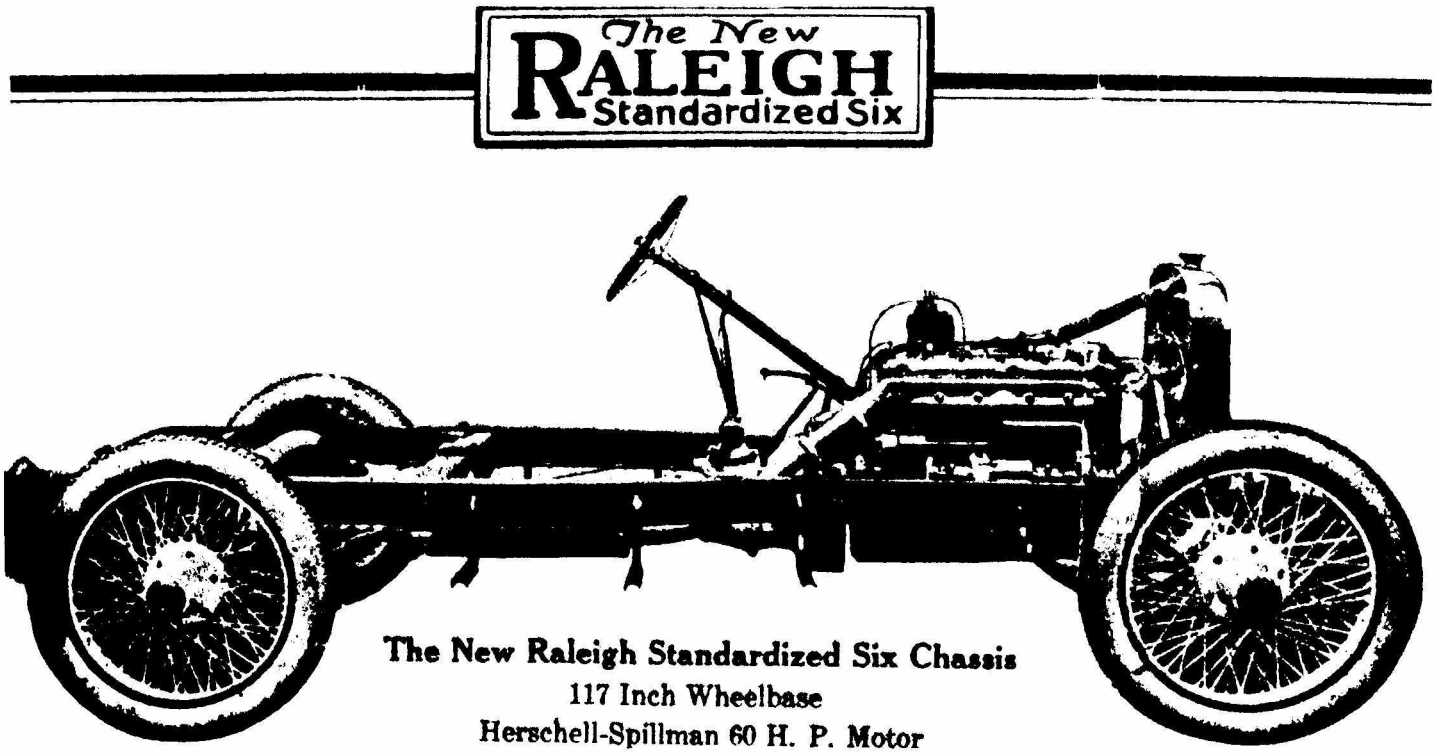
The prospectus included the picture of the wire-wheeled chassis, plus one of a fully-completed touring car — a largish appearing machine sporting wooden artillery wheels and two rear-mounted spare tires. Subsequent cars emanating from the Raleigh works were mostly, if not all, disc-wheeled jobs. The hood louvres shown in the catalogue photo were different from subsequent cars. I consider it not only possible, but probable, that both the stripped chassis and touring car depicted were built elsewhere and brought in for promotional use, a practice not uncommon at that time for newly announced makes.

Specifications included the following: The chassis was 117 inches and a Herschell-Spillman "11000" six cylinder L-head engine was used. This power plant had a bore and stroke of 3¼ × 5 inches, with a displacement of 248.9 cubic inches and developing 60 bhp at 2200 rpm. Other vital statistics included Spacke axles, Hotchkiss drive, Westinghouse lighting and starting, Bosch magneto ignition, a Stromberg LB-2 carburetor, Stewart vacuum system, Gemmer steering, a Johnson beveled plate glass window on the open models, and Kellogg tire pump. Wheels weren't listed among the specifications, but judging from existing illustrative evidence it would appear that the buyer had several options. Tires were 33 × 4 cords, and provision was made for an "extra tire and rim," which again makes the two rear-mounted spares shown on the touring car in the brochure seem inconsistent, if not downright suspicious. Bodies were to be built by the American Body Company of Buffalo, New York, which also built open bodies for Henry Leland's recently-introduced Lincoln.

By early 1921, news of the Raleigh was beginning to appear in a number of national automotive magazines, occasionally accompanied by an illustration of a chassis or touring car. Unlike the catalogue, this car sported Harvey disc wheels and the tire size had been changed to 32 × 4.5. Designated the Model "A-6-60," the car had undergone another change — the price.

Recession was on the land, and the handwriting was on the wall, particularly for automoile manufacturers. Although there were no crystal balls sharp enough to tell the tale early that year, statistics by year-end 1921 would show automobile production down by some 387,499 units compared with 1920. A number of companies would fold before the 1922 model year. Many others who managed to hang on would be mortally wounded by the recession and quickly start their downward plunge into oblivion.

What to do? Raleigh was forced to do exactly what every other car builder was doing: increase the price of its product. Prices on the Raleigh skyrocketed to $2750 for the touring car and the roadster, $3600 for the coupe and $3700 for the sedan. Weight was given only for the touring





*The Raleigh Chassis and Special Touring Car, as shown in the firm's prospectus. Neither of these looks much like production cars.*

*Keith Marvin collection.*

model: 2950 pounds. It is doubtful that there were ever any Raleighs produced *except* the five-passenger touring cars.

Production was slow in Bridgeton, and presumably very few cars were produced at the Jefferson Avenue facility. In his recollections, Dr. Nitshe recalls seeing one under construction there in 1921 while he was on a Saturday afternoon walk with his grandfather. He remembers the car as being blue. This is the only information on the Raleigh color scheme that I have found.

Sutterley's application for a trademark, filed in September, 1920, was formally registered with the United States Patent Office on May 17, 1921. It displayed the insignia he had been using on the radiators and hubcaps of the cars, depicting a knight on horseback. The design was probably derived from the emblem then carried on ReVere cars. An odd slant here was the spelling of Sutterley's name as "Sutterly" on the trademark application. This misspelling persisted throughout the Raleigh works' duration, and even later in various news items and announcements.

That same May also brought an announcement of a proposed four-cylinder companion car, to be offered as a $2050 touring model, a coupe, and a sedan. It may have appeared as a prototype, perhaps not. After the initial announcement, no further mention of this car was forthcoming from Bridgeton. A proposed seven-passenger touring car on the larger chassis was also projected, but never got off the drawing board.

Business must have been bad at the Raleigh works, even if the cars were only put together on a one-at-a-time basis, as prices were reduced by $500 per car in June. A close look at 1921 statistics for other makes reveal that such price reductions were commonplace throughout the industry during that troublesome year.

Despite the recession and the unpleasantness surrounding it, Sutterley was apparently entertaining grander dreams, for he seems to have decided on an expansion of facilities at this time. The factory in Bridgeton, if you could call it that, wasn't adequate for the production increase he envisioned. In August it was announced that a new factory was under construction on land that had been purchased in Buffalo, New York for that purpose. What actually happened in Buffalo is unclear, but in September what appeared to be ideal manufacturing facilities became available in Reading, Pennsylvania. Thus begins Act II of our play.

Whether the Buffalo backing proved to be inadequate, whether the erection of a new factory there was simply too much of an undertaking, or whether Job Sutterley was simply in over his head isn't clear. What we do know is that J. W. Kline's old brass works building at 426 North 2nd Street in Reading was up for grabs, and operations were immediately transferred there as the Buffalo plans ground to a halt.

How active the Reading operation was, we don't know. In his article, "The Automobile Industry in Reading," published in *The Historical Review of Berks County* for April, 1939, Byron A. Yazakas states that Raleigh Motors, Inc. operated there with J. S. Sutterley as president and J. B. Huhn as secretary-treasurer. He further states that "This small concern set up frames for the assembling of autos but went out of business after about six months."

There is little reason to doubt the accuracy of this statement. The Raleigh activity, such as it was, probably existed from about mid-1921 until the early part of the following year. The latter-day existence of the enterprise is cloudy indeed. Even tiny news items concerning the make after December, 1921 were few and far between. There seems to have been no planning whatsoever towards the timely placement of material where it could get to the reading public and possibly do some good. Raleigh was certainly still making cars at the beginning of 1922, yet its name did not appear in the January Show Number of *Motor*. *Motor* was prone to print just about anything sent in, and therefore served as the ideal medium for free advertising. Yet Raleigh was conspicuous by its absence. The name did apear in the Branham *Automobile Reference Books* of the period, indicating that Sutterley was in contact with at least one segment of the automobile world.

If Raleigh shifted its operations from Bridgeton to Reading in September, 1921, we may assume that it was building cars by October — after all, the operation was a small one. If October marked the date of the first Pennsylvania activities, the firm would have folded its tent around the following April, according to Mr. Vazakas' research. The failure of the make occurred without a murmer. One minute it was there, the next minute it was gone. It was as simple as that.

If the serial numbers listed by Raleigh in Branham's *Automobile Reference Book* reflect actual cars produced, they add up to a grand total of only 11 cars. This is the closest figure I have been able to track down, although it should not be regarded as an official production statistic. Branham lists 1921 serial numbers as "100 and up," and those for 1922 as "100 to 110." This implies that the same numbering system was used throughout the company's existence, and that "110" was the cutoff figure. They may never have reached it.

Stan Yost feels that the greater part of Raleigh's production, such as it was, took place in Reading, rather than Bridgeton. In a letter to this writer, he sums it up thus:

"In an area like that, you could put together a large number of units without ever selling one out of the two- or three-county section. This we know from experience with countless marques across the country. The publications that I have list the car along with all of the well known makes and show it as a touring car consistently."

Job Sutterley, who died a number of years ago, remained in the automobile business. Around 1928 or 1929, his name cropped up in a newspaper clipping which was preserved in a scrapbook put together at that time. The source of this clipping isn't listed, but the item itself poses a minor question:

"J. R. Satterley [sic] Jr., has taken the Graham-Paige dealership in Englewood, N.J., and is undertaking a wide and thorough coverage of his territory. Satterley [sic] goes well back in his automotive experience, having been the builder of the 'Raleigh Princess Pat' line. His experience covers all phases of selling."

Aside from the consistent misspelling of his name, the item which intrigues me is the reference to the "Princess Pat" line. What, for Pete's sake, was *that?* It didn't show up in promotional literature and, as far as I can tell, it never appeared in any of the car's press releases. "Princess Pat" was a name attached to a prestige unit of the Canadian Army during World War I, and was also the name of an operetta by composer Victor Herbert in 1915. I wonder if Sutterley was impressed by the regiment or by the lilting strains of Herbert's attractive opus. If anyone could attach the name of his hero, such as Sir Walter Raleigh, to grace the radiator of a motor car, surely a designation such as the "Princess" could fall into the pattern. And even if it didn't happen during the days of the car's manufacture, it could still be mentioned later on.

That's what I'd like to believe.


*Job Sutterly's trademark for the Raleigh.*

# Engineering the Model A

by Leslie R. Henry

*Leslie R. Henry, a founder member of SAH, is probably best known for his years as curator and consultant at the Henry Ford Museum. He has written several books on Ford automobiles, many of which were devoted to his particular interest and the subject of this article, the Model A Ford. This article was first delivered as a talk at a meeting of the Detroit Chapter of the Society of Automotive Engineers in 1961. It has since appeared in* Antique Automobile, *magazine of the Antique Automobile Club of America, and appears here in a form updated by the author. It was researched by the author in the Ford Archives, and the quotations are taken directly from transcripts in the Archives' oral history files.*

*– Editor*

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Certainly the Model A was a man's car in what was the beginning of a woman's market. By all precepts of the modern market researcher, the Model A should have been a miserable failure in its first year; instead, it became a monument to Henry Ford's intuition. Austere in style, masterful in design, economical to maintain, dependable in operation, the Model A sprang into immediate leadership and acceptance by a nation already glutted by motor cars. It outsold, outperformed, and ultimately outlasted all competitors, and in its four brief years of production, 1928-1931, it earned a reputation as enviable as that of the Rolls-Royce.

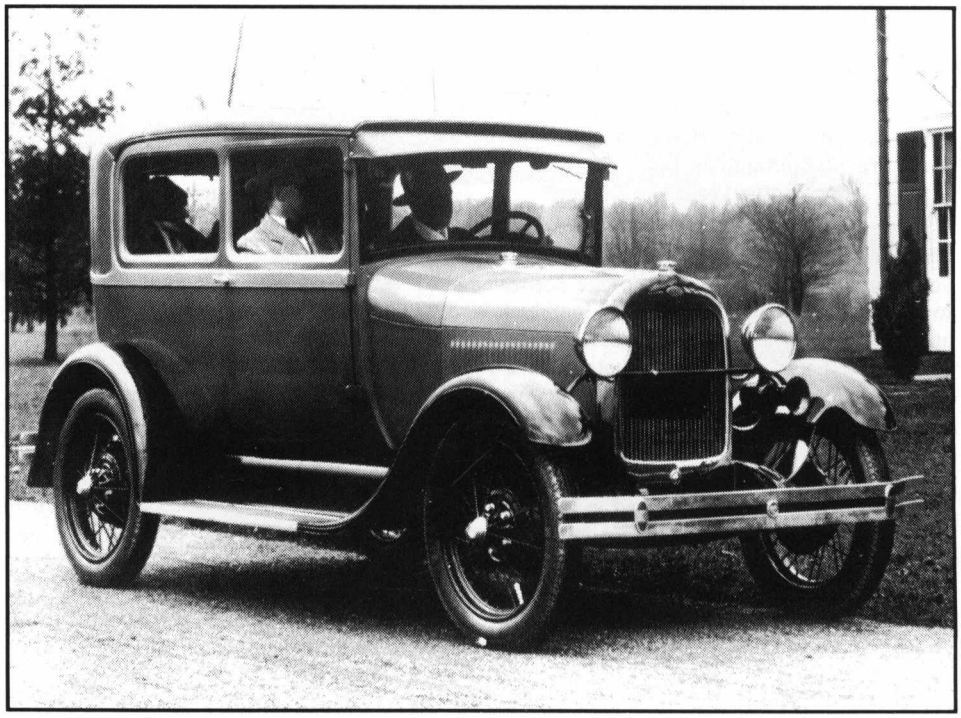
While the Model A itself appeared almost overnight, the decision for it came painfully slowly and at great cost. The wonder of it is that the Model A Ford ever came into being at all. It was born of necessity, a child of adversity. It was forced upon Henry Ford, who was not mentally set for it, and his organization, which was not physically prepared for it, but fortunately the past was a prologue for Model A. It was the undeliberated sum of all that had gone before in the Ford Motor Company. And being distinctly Ford in background and in features, it was patently the kind of car that could have been built successfully nowhere else. Not the result of long directed planning, for Ford engineering was not then set up to operate on long range projects, the Model A actually sprang into being in less than a year through the integration and compromise of the latent ideas of Edsel Ford, Henry Ford, and a small group of engineers steeped in the Ford way.

Once Henry Ford had made his decision for Model A, the work of its creation went forward at a furious, but often interrupted, pace. There was naturally a great deal of confusion in the Ford Motor Company, and in the Ford Engineering Department in particular, when Henry Ford suddenly ordered work started on an entirely new car. This condition was not lessened any by the continued decimation of Ford personnel at that time. Then, too, Henry Ford was making so many assignments, reassignments, and divisions of authority within the company that progress in designing the car was further hampered. Only he knew from day to day what was being accomplished with the new car, and perchance even he knew not.

Although the car was at first neither Henry Ford's idea nor his ideal, he was quick to adopt it as *his* Model A Ford. Certainly it was never entirely his as was Model T, for while he actually *approved* Model A, he had *dictated* all of Model T. Thus, for Henry Ford, the designing of the Model A was a combination of his approvals, dictates, rejections, concessions, and compromises. But with all its delays, Model A was created with remarkable speed. So fast, in fact, that many of its parts went directly from the drawing board into production, and in the later stages of its birth, some of the plant layout and some of the new special machine tools were designed simultaneously with the specific parts of the car each was to accommodate.

Since the long period for decision extended almost to the end of 1926, it left no time in 1927 for extensive experimenting, thorough developing, or exhaustive testing such as usually attends the birth of a completely new and successful car. The Model A had to be exactly right the first time, and it was.

The need for a new transmission in any new Ford car was basic, and this issue was forced by Edsel Ford months before Henry Ford ever conceded to a successor of any kind for the Model T. That a new transmission was the first of Henry Ford's many, many compromises between his ideal car and the final product is well attested by his close associate, Charles Sorensen, who said, "The Model T planetary was the elder Ford's idea for the future car. He called the shifting gear a crunch gear. He said the transmission would never stand up because the gears would clash when changing speeds." This was a paradoxical statement for Henry Ford, who was even then building the Lincoln car



*The 1928 Ford Model A Tudor Sedan. From the collections of the Henry Ford Museum and Greenfield Village.*

with a sliding gear transmission which stood up very well. As a matter of fact, it was a scaled down version of the Lincoln transmission that went into Model A. This and so many other Lincoln features finally were incorporated in the Model A Ford that it became known as the "Baby Lincoln."

Lawrence Sheldrick, who was assigned to engine design late in 1926, recalls that "we followed the Model T only in the respect that it was to be a four-cylinder L-head engine of the same general type, but with a number of improvements. Specifications just grew from this start. For example, the new crankshaft was the same length as Model T but was made much stronger and had larger journals." This, too, was a compromise, for Henry Ford would not permit Edsel Ford and Lawrence Sheldrick to make the journals as large as they wished. Henry said, "No, I want those journals small so that the crankshaft will be limber enough to follow the bearings in the block."

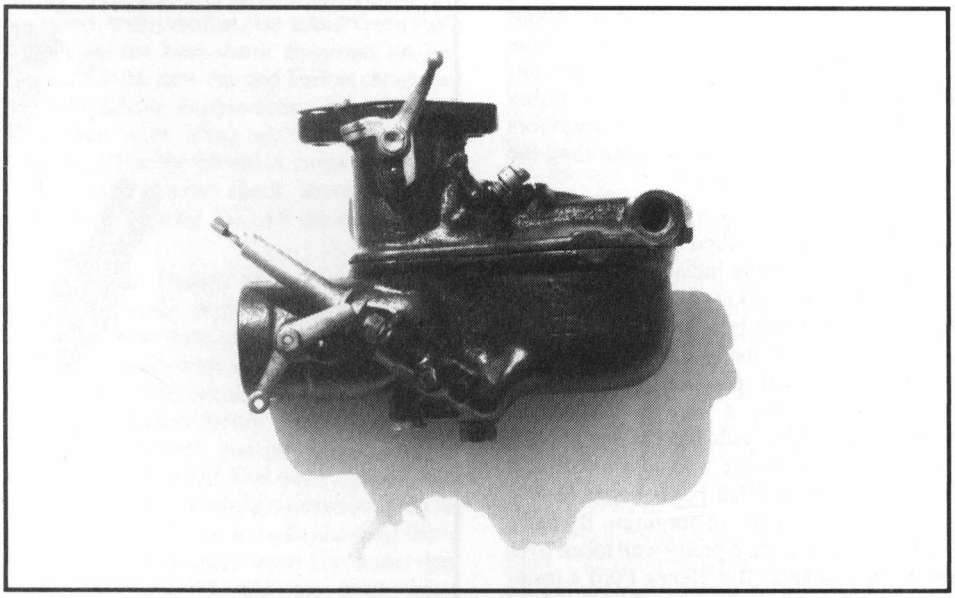
It was characteristic of Henry Ford that he should concentrate on an improved power plant for the new car and he took a personal interest in the engine work. According to Sheldrick, "Mr. Ford wanted full-size sketches of the engine, vertically, in front of him. We used a cloth blackboard, which could be rolled up, and different colored chalk for drawing the various parts. He found the usual intricate drawings with sectional views, one upon the other, a little difficult to follow."

Harold Hicks, who had earlier distinguished himself by work on the World War I Liberty aircraft engines, played a very important part in the engine development of the Model A. Hicks says, "I was called down to the north end of the big room of the old dynamometer section of the Ford engineering laboratory. There were Sorensen, Martin, and Edsel Ford. They showed me an engine that was running on the block and Sorensen said, "Well, Hicks, we've got here an engine which is 203 cubic inches — Model T was 176 — but it is only developing 22 horsepower — Model T developed 20. If we should give you charge of this development, how much could you increase the horsepower?"

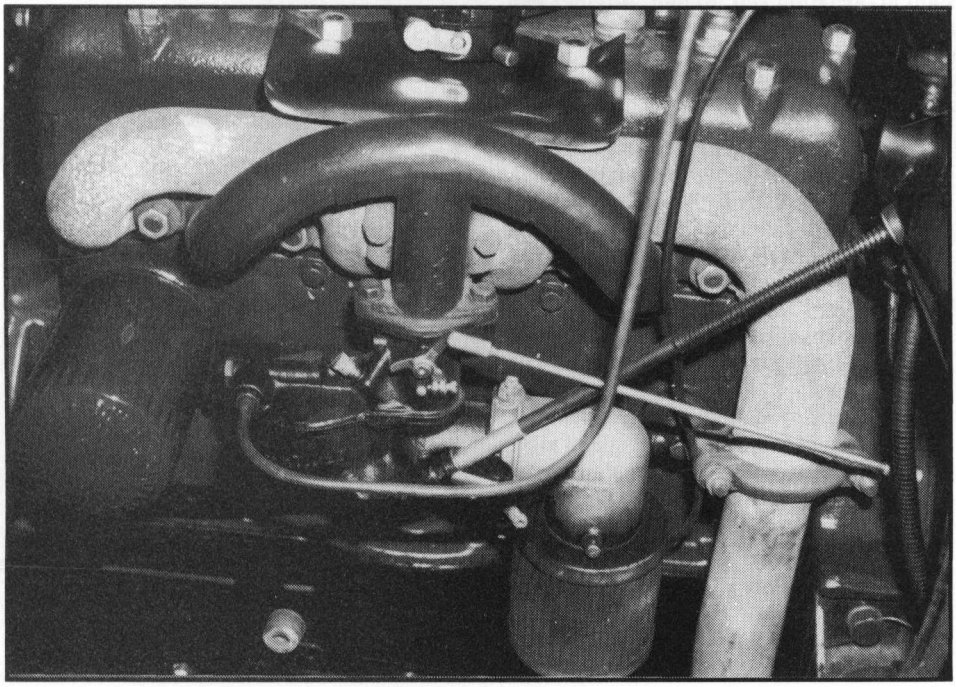
Hicks recalled, "I took out my slide rule, did a few calculations and said 'I think I can get you 40 hp'" Hicks was given the job. He asked for two months in which to complete the work but Sorensen gave him one. Hicks stated, "We got out first a Y-type manifold in only seven days using certain principles I had obtained from Col. Hall way back in World War I Liberty engine days. This gave us 30 hp right off. But there was more to do." He found there were insufficient water passages around the exhaust valve ports and had them opened up. He and Edsel Ford both believed the valves themselves were too small in diameter. These were enlarged and the hp went up to 34.

Hicks realized that the original vaporizer-type manifold and carburetor, designed by Holley, did not give sufficient range for a 40 hp engine of that size. Therefore, he went to his friend, Howard Manwaring at Zenith Carburetor Company for a test carburator and then, only three weeks after he had started the job, Hicks had the engine developing the promised 40 hp.

Since Henry Ford was at that time laid up in Fairlane recovering from an automobile accident, he did not witness the engine test nor see the Zenith carburetor on the job. Joe Galamb, another of Model A's creators, added this sidelight on the matter of the carburetor: Holley had a terrific "in" at Ford Motor Company as a bosom friend of Henry Ford. Hicks knew this and cleverly needled Sorensen each time he came down to watch the dynamometer tests by saying, "Of course we're developing 40 hp but you'll never use the Zenith carburetor." Finally Sorensen said, "Why in the hell do you keep telling me we won't use the Zenith carburetor? By God, we're going to. You get the Zenith Company in." Because of Sorensen, Henry Ford accepted the Zenith carburetor, but not without first giving it his personal touch. Hicks says, "I remember we had too many bolts holding it together. Henry Ford said to me 'Cut those bolts down,' so I had Zenith get out a new design and I felt quite proud that they had reduced the number of bolts from 14 to 2. Then Mr.



*Above, the one-bolt Zenith carburetor. Below, the carburetor fitted to Hicks's final manifold. The oil filter, obviously, is a modern adaptation. Jim Schild photos.*



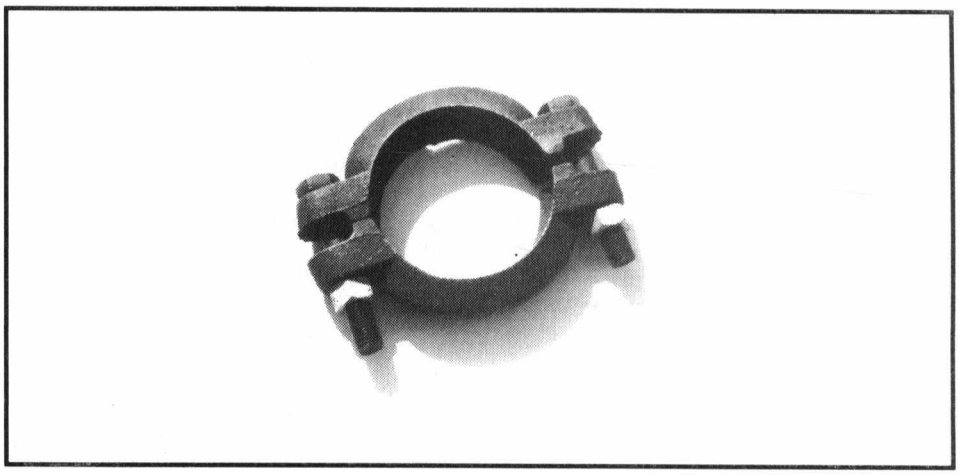
Ford looked at it and said, 'Two's too many — make it just one bolt.' So the Model A carburetor came out with a single bolt down through it."

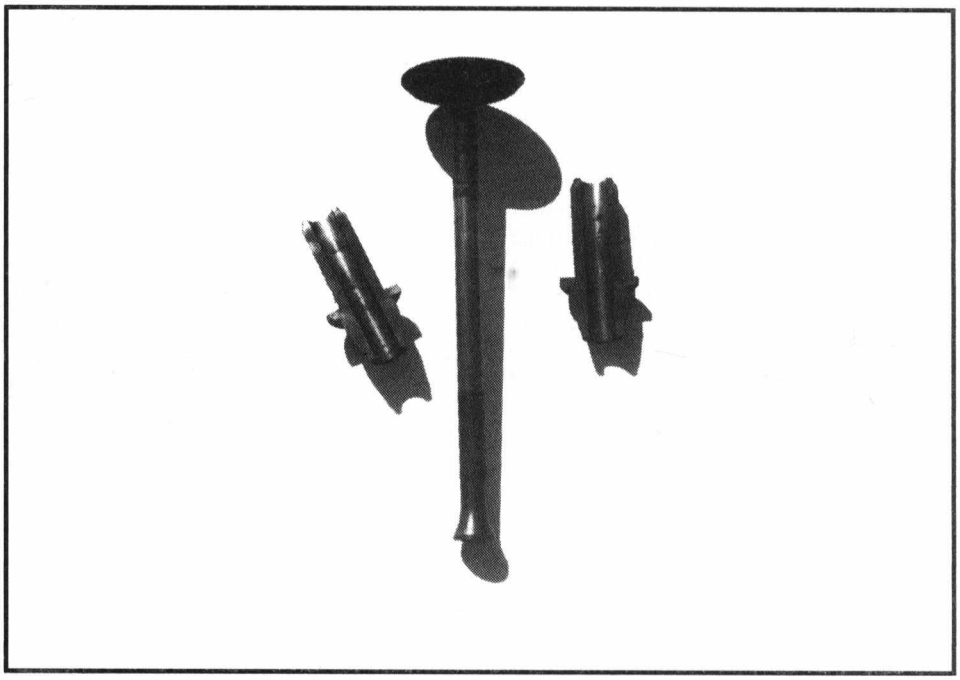
Hicks' choice of carburetor was vindicated in the final test he ran for Henry Ford on July 28, 1927 with the carburetors of Holley, Stromberg and Kingston all competing unsuccessfully with Zenith. Hicks' original Y-type manifold never went into production because he had to put a certain amount of heat on it to make it function correctly. His final manifold was more successful because of this heat operation.

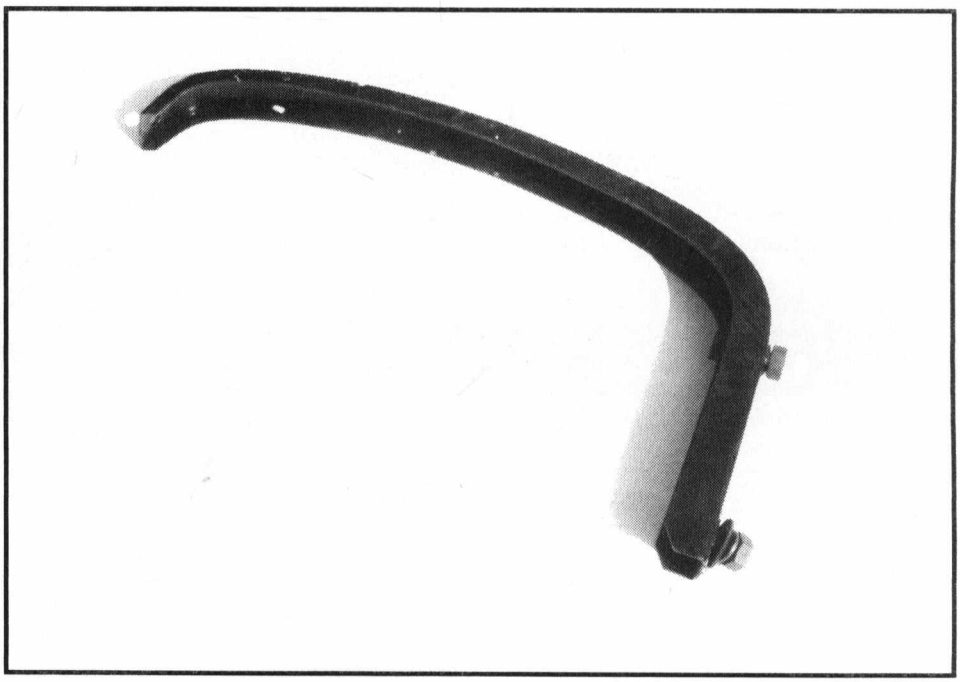
The characteristic Model A tapered muffler welded into a single unit with exhaust and tailpipe was Hicks' design to which Henry Ford added his own personal touch in the form of a V-shaped forged clamp to hold the exhaust pipe to the manifold. About this, Harold Hicks said, "At this time throughout the Model A development, Henry Ford went forging crazy. Everything had to be a forging; even on the carburetors there were little forgings for controlling the throttle and choke valves."

Even "Sheet Metal Joe" Galamb, as he was affectionately called by Henry Ford, complained about the indiscriminate use of forgings for the brackets to support fenders, lamps, and running boards. He knew those brackets could be made just as strong and much cheaper with pressed sheet metal. It took Galamb nearly a year to demonstrate to Mr. Ford that he could have strong pressed steel brackets and save $30 on the cost of a Model A. Late in 1928 Fords began to lose some of their expensive forgings. By early 1929 pressed steel had pretty well taken over the body brackets. But Henry Ford's insistence then on many forgings was based on two things: he had just put a large forging shop in operation and, to him, forgings had always meant quality. Here was his chance to put his new shop to work and to put quality into his new car at the same time. He counted not the high cost of forgings — then.

Henry Ford contributed other of his own ideas to the Model A engine design, which, however, often added to expense in time, money, and difficulty of manufacture. His insistence on a mushroom foot on the engine valve stems, for example, was good from the standpoint of reducing stem end wear and thus enabled the Ford valves to last the life of the engine without adjustment. The mushroom valves were more expensive and more difficult to manufacture than conventional valves and, in addition, required more expensive split guide bushings in order to be assembled in the engine.







*Top to bottom: Henry's personal forging — the exhaust pipe clamp, the mushroom-stemmed valve with split guide, Goe Galamb's pressed steel fender bracket. Jim Schild photos.*

Lawrence Sheldrick recalled also that the original crankshaft had thick discs or cheeks between the throws, a machining extravagance that Mr. Ford explained he wanted because sometime he might want to put on counter-weights and then every car in the field could have them added. Others of Henry Ford's peculiar ideas involved the connecting rods. At first he wanted forged X-section rods, then welded tubular section rods in the early Model A engines. But neither of these was as satisfactory as the conventional I-sectional rod, which he soon had to approve for all subsequent production.

Harold Hicks indirectly made one more contribution to the Model A because of an automobile accident. He was road testing one of the experimental cars when an old truck pulled right out in front of him. In the resulting crash, Hicks and a passenger were thrown through the windshield and were badly injured and severely cut. Henry Ford and Edsel both looked at the wreck and decided, then and there, to put laminated safety glass in the windshield of the Model A. This was another Ford first, as was their method of making the glass in a continuous strip, rather than in small batches.

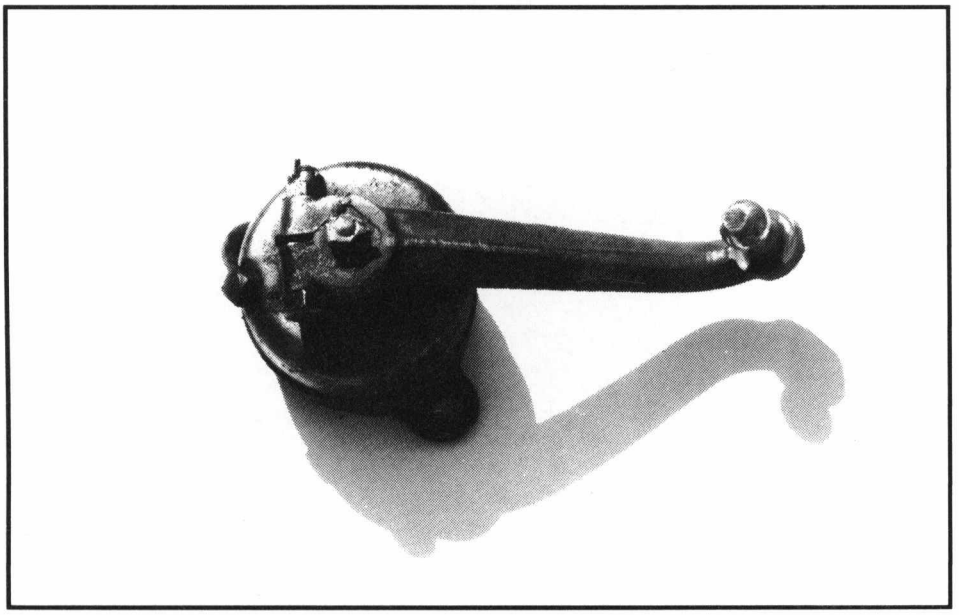
The cowl-mounted gravity fuel tank, while not Henry Ford's original idea, was his adoption. It was extremely simple, and simplicity appealed to him. Furthermore, Henry Ford did not like the vacuum tank system, and having no faith in the fuel pumps then on the market, he would have none of these things on his new car. It remained only for Edsel then to give the tank uniqueness by designing it as an actual and visible part of the body cowl on the Model A.

Gene Farkas, who was in charge of developing the suspension, the all-welded wire wheels, the axles, and the new 4-wheel brakes, progressed admirably with all but the brakes; here he was handicapped by some of Ford's ideas that were either illegal or impractical. Since Henry Ford would have nothing to do with any of the 4-wheel designs already on the market, Farkas had to design a new system that would not be a complicated mechanism nor a patent infringement. His first design included a cam-operated, wedge-adjusted brake shoe linked directly to the foot pedal bar. But Henry Ford demanded an equalizer bar and linkage, and Farkas and Sheldrick, the chief engineer, had to take time to install an equalizer bar in a test chassis and demonstrate to Mr. Ford that it made the car skid. They were then allowed to go back to the solid cross-shaft system. Farkas had an easier time with his other assignments. His job was to improve the suspension for the Model A. This had to include Henry Ford's two transverse springs, mounted across the frame, rather than the conventional four lateral springs placed along the frame. Many people believed that the two transverse springs must necessarily give a harder ride than four lateral springs, but Henry Ford believed otherwise. So no Ford car since 1908 had any lateral springs until after his death in 1947. Regardless of what was generally *believed,* Henry Ford *knew* that tranverse suspension made the springs carry their own weight and so relieved the axles of that unsprung weight; then lighter axles and bearings could be used to advantage and lightness with strength was the Model A's biggest advantage over its competitors.

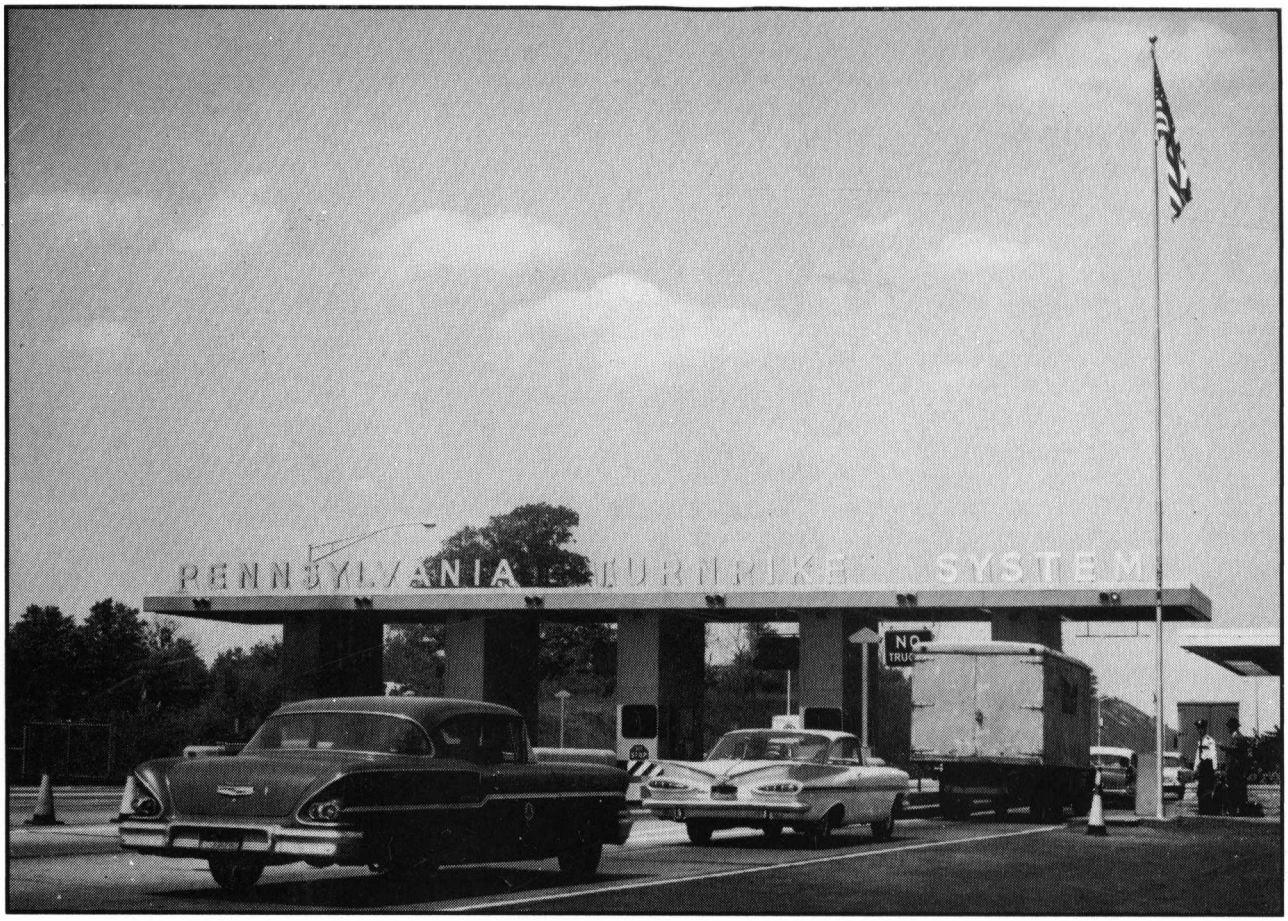
The new suspension, while a great improvement over that of the Model T, did not satisfy Mr. Ford; he may have laughed along with his customers when they joked that the passengers were the Model T shock absorbers, but he wanted no such jokes about the Model A, which was to be a masterpiece of economy with comfort. He asked Gene Farkas to get the best shock absorbers on the market for the new car and Farkas chose the same Houdaille double-acting shock absorbers they were using on the high-priced Lincoln. Thus the Model A came to pioneer expensive hydraulic shock absorbers on a low-priced popular car. All the others soon followed.

Although Harold Hicks' injuries had taken him away from the Model A work during the last days of its creation, he kept in close contact with it through Henry Ford and others. Hicks recounted later, "The new Model A pleased Henry Ford very much. He told me, 'Well, you go out and drive a Model A wide open. The other fellows will stick with you for a while; pretty soon they'll get tired and you just go right ahead of them all.' At that time there were few autos that could go above 75 miles per hour, most around 70. The Model A was right out there competing with them. Up to 30 m.p.h. the A could skin the pants off anything that was on the road. Lionel Woolson, chief engineer at Packard, called me one day and asked, 'Hicks, what are you fellas out there trying to do? You really made us just look silly below 30 because we can't catch those Model A's.'" Henry Ford had long been the world leader with his 4-cylinder Model T; he now knew that he was again leading with his 4-cylinder Model A. "There is no excuse for a 6-cylinder car," he used to say. "It has all the engineering difficulties of an 8 and none of its advantages, and furthermore, I will not build a 6-cylinder car for then I would simply be following the industry, not leading it."

Actually Henry Ford built "the new car" better than he realized. There are no other 63-year old cars still in existence in so great a number as the Model A. Of the original 5 million built, it is estimated by some authorities that 900,000 still remain and in use. Part of this longevity is due to the durability resulting from what we might call an "over-engineering" of many of the parts. For example, the wheel bearings, the clutch throw-out bearing, the clutch discs and the universal joints remained standard from 1928 through 1948 for all Fords and Mercurys. These parts were strong enough in the Model A to serve later in cars having twice the weight and three times the horsepower of the Model A Ford. This is, indeed, a tribute to Henry Ford and his engineering staff at that time. And how large was that staff? How did it compare with today's engineering department, with thousands of employees and covering dozens of acres of ground with buildings? Well, only 34 engineers made up the Ford Engineering Department, which occupied a small section of the building just behind the Henry Ford Museum on Oakwood Boulevard. From this small group came one of the world's greatest motor cars.



*Houdaille shock absorbers were a hand-me-down from Lincoln. Jim Schild photo.*

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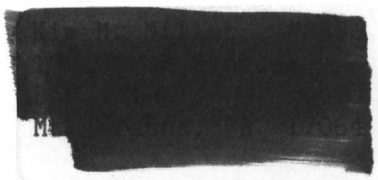

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