

## The Road that Led to the Beetle

There is no denying that the Volkswagen Beetle had a great impact on the world, but was the Beetle a major advance in automobile design or just another step forward following a road started mostly in Central Europe in the early 1920s.

Ferdinand Porsche was Born in Maffersdorf in Northern Bohemia now part of Czech Republic, the son of a tinsmith. His first automobile designs were for Lohner of Vienna in 1899. He went on to design for Austro-Daimler 1906-23, Then Daimler-Motoren AG, later Daimler-Benz, in 1923 to 1929. Followed by Steyr, in Austria in 1929. Later in 1929 he set up his own design office in Stuttgart. Although he was actively involved in motorcar design for over fifty years, only one of his light car designs reached series production, that was the Volkswagen Beetle.

Precedent's time line.

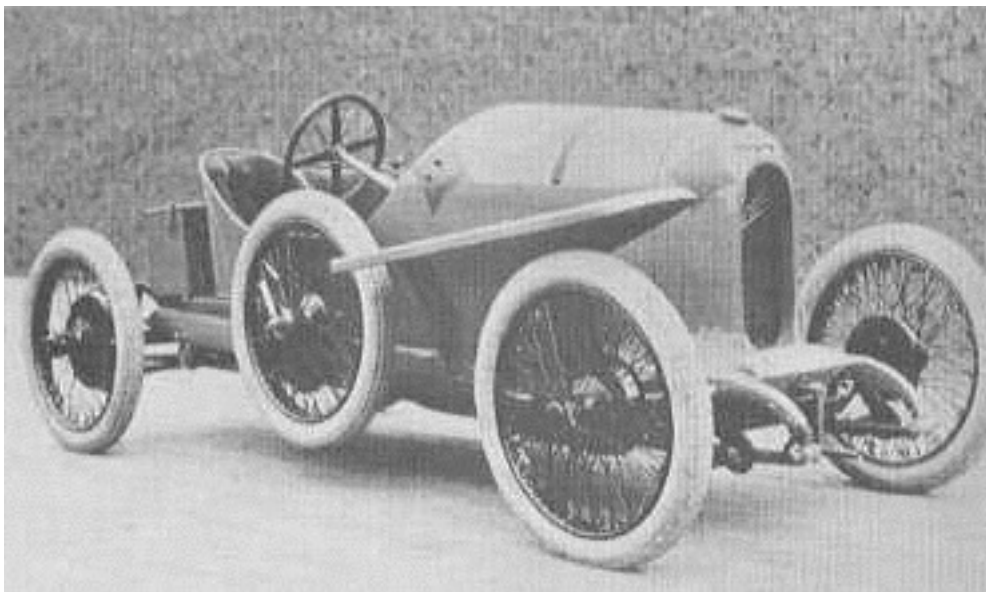
In the United States Franklin had been producing fan cooled air-cooled engines for automobiles since 1902, and continued production until 1934.

1921

General Motors began producing the so called "copper-cooled" models of Chevrolet, Olds, and Oakland between 1921 and 1923 but it was not a success and very few were made. The "copper-cooled" referred to the copper cooling fins on an air cooled inline four engine, not a good layout for fan cooling.

1922

While at Austro-Daimler in 1922, Ferdinand Porsche designed an 1100 cc sports car. Hoping that it would form the basis of a wider range of cars, but he was not supported by board of directors of Austro-Daimler. A handful of cars were produced and given the name Sascha in honour of Count Shascha Kolowrat who underwrote the venture. The Sascha proved very successful in motor sports events throughout Europe. Apart from the overhead camshaft four cylinder engine, the Sascha was of conventional design for the period with a channel section chassis frame, a beam front axle with half elliptic springs, a front mounted water cooled engine and gearbox with a propeller shaft to a live rear axle with quarter elliptic springs. A description that could describe the then new Austin Seven and many other contemporary cars.



Austro-Daimler Sascha

## The Road that Led to the Beetle



Tatra T11 chassis

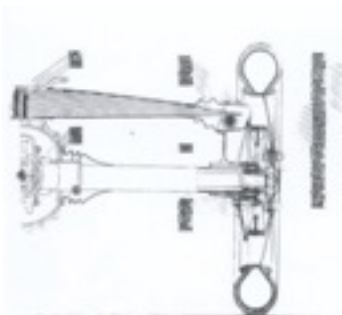
1923

While working at Steyr Hans Ledwinka had been creating the design of a small car in his own time. His design had been rejected by the Steyr, management, but he was able to develop and produce this design after he left Steyr in 1923 to work for Tatra. Designated the Tatra T11 it made the name of Tatra well known throughout Europe. The T11 was the first of his designs using a backbone chassis, a fan cooled horizontally opposed engine and a jointless independent rear axle. The engine in this design was an overhead valve 1056cc twin, mounted in unit with the gearbox on the front of the chassis. The front beam axle being attached to the engine. This was the first of a line of light car design's to a similar pattern that were produced until 1948. The T11 was produced from 1923 to 1927, and replaced by the T12 with a similar specification. The T12 was produced from 1926 to 1936. In 1931 the T54, with a 1465cc air-cooled flat four engine was introduced. It was made until 1936. Also in 1931 the T57 a 1155cc air-cooled flat four was introduced, and through the T57A, T57B and T57K versions remained in production until 1948. The later models having a 1256cc engine. A total of thirty-eight and half thousand of these small Tatra's were made between 1923 and 1948.

Hans Ledwinka 1878-1967, was born in Austria when it was part of the Austro-Hungarian empire. By 1906 he worked for Nesseldorfer, a car manufacturer in Moravia a province of Austria. After the break up of the Austro-Hungarian empire, Moravia became part of the new state of the Czechoslovak republic. Ledwinka left Nesseldorfer to join Steyr another Austrian company in 1917. The Nesseldorfer company changed its name to Tatra 1923.

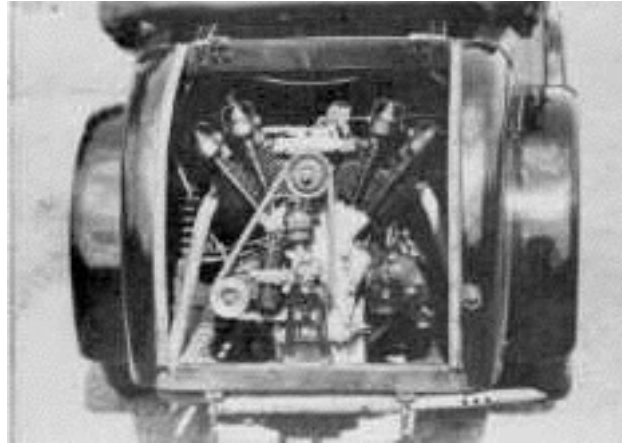
The jointless rear axle used by Tatra consisted of a final drive unit attached to the rear of the tubular backbone chassis that had the drive shaft enclosed within it. The final drive unit had two crown wheels and pinions each driving a shaft to a rear wheel. The crown wheels could rotate around its pinion allowing its shaft to swing. This may seem over complicated but is still in use on Tatra truck today. It was necessary to do something like this to provide a reliable flexible drive arrangement as flexible drive joints at that time were not up to the job.

The flexible coupling commonly in use at the time was the fabric coupling it had a limited degree of deflection and working life and was not suitable for use with swing axles. The availability of better flexible couplings of the Hardy Spicer type made it possible to develop a reliable swing axle transmission. The combination of the rear mounted engine with swing axle transmission proved to be the simplest way to remove the engine and the transmission from the passenger space and lower the overall height of the car.



Tatra T11 Axle

## The Road that Led to the Beetle



Rover Scarab

1928

From 1928 onwards, the idea of a people's car with a rear mounted air-cooled engine, all independent springing and a backbone frame was promoted in Germany by an engineer and journalist Josef Ganz in the auto magazine Motor-Kritik.

1929

In 1929 Colonel Frank Searle the managing director of the Rover Co Ltd of England decided that the company needed a small car to widen its range. He set Maurice Wilks and Robert Boyle, both to become key figures at Rover, to design and produce a prototype of a small rear engined car at his home Braunston Hall near Rugby in a similar way that Herbert Austin had done with the Austin Seven earlier in the decade. The outcome of their work the Rover 7 HP or Scarab was unlike any previous Rover design with a Rover Patented engine, transmission and rear suspension layout. The rear mounted O.H.V fan-cooled 60 degree "V" twin engine was of 839 cc. The ladder frame chassis was of advanced design with coil spring sliding pillar front suspension and coil spring swing axles at the rear with a pivoting support member giving zero roll stiffness. The four-seat tourer body was a simple affair of wood framing clad with steel sheet of compact dimensions, the car being designed down to a price of £85. Unfortunately the engine proved to be rough, noisy and prone to overheating. With the departure of Colonel Frank Searle from Rover in 1931 the Scarab didn't go into production as it was considered too radical and at the same time too Spartan by the Rover management.

Rover Scarab



## The Road that Led to the Beetle



Ardie Ganz

1930.

Ardie a German motorcycle manufacturer produced an experimental car with a forked backbone frame the to a Josef Ganz design, the Ardie Ganz.

1931.

Adler a German manufacturer produced another Ganz prototype. Josef Ganz was a consultant engineer at Daimler-Benz and BMW where he was involved in the development of the first models with independent wheel suspension: the highly successful Mercedes-Benz 170 and BMW AM1 .

Josef

The first prototype of the Tatra Type V570 designed by Erich Ledwinka, the son of Tatra's chief engineer Hans Ledwinka was produced. Although this prototype had a body of conventional form, the inspiration for the rear engined Tatra came from the idea of taking full advantage of the streamlined forms proposed by the aerodynamicist Paul Jarey. By locating the engine in the long tail, a low hood or bonnet line could be achieved. It had a platform chassis and the air-cooled flat twin engine of 845cc; gearbox and final drive was located at its rear.

Tatra V570



## The Road that Led to the Beetle



Zundapp Volksauto

Dr Ferdinand Porsche set the engineers in his design bureau on project number 12 at the end of September, the design of an economy car. He didn't have a commission for the car, but this was something he wanted to do for some time. By December 1931 the design for a small car was sufficiently advanced for Porsche to look for a possible manufacturer. The main features of the design were, independent suspension on all four wheels using trailing arms at the front and swing axles at the rear, with Porsche patent torsion-bar springs. A three cylinder air-cooled radial engine that was complete with the gearbox and final drive located at the rear of the chassis.

Dr Neumayer head of Zundapp, a German motorcycle company was looking for a small car design to produce and the Porsche project No 12 proved of interest. The result was the Zundapp Volksauto project. The major change from the original project was the engine. A one litre capacity five cylinder water-cooled radial engine was fitted. Three prototypes were produced in 1932 and extensively tested but the project didn't continue due to financial and business factors. 1932.

Skoda produced the 932 prototype, it had a backbone chassis with an air-cooled flat four engine at the rear. Skoda didn't develop the design but produced the 420, a front-engined car that had some of the features that were innovative at the time, namely a backbone chassis with swing axle rear suspension.

Skoda 932



## The Road that Led to the Beetle



Standard Superior

BMW produced their first original design the 3/20 with a backbone chassis and a 788cc over head valve, pressure lubricated engine that was otherwise similar to the Austin engine and independent swing axle rear suspension. A few thousand of these were produced by 1934.

The first prototype of the Tatra Type 77 was running, it was a large car with a streamlined body. The three litre air-cooled OHV V8 engine at the rear of a platform chassis drove the rear wheels via Tatra type swing axles, A double wishbone type of front suspension was fitted and transverse leaf springs were used at front and rear.

1933.

Tatra produced a second Type V570 prototype with an aerodynamic body, the project was not continued as the Tatra board decided that the streamlined rear engine concept was to be reserved for limited production high cost cars concentrating on the type 77 that was put into production in 1933. The Type 77 and the Type 77A with a 3380cc engine, were in production until 1938 and 249 examples were made. The existing Type 57 would continue to fill the roll of their economy car, which it did until 1948.

The first of Josef Ganz designs to go in production, the Superior was made by Standard Fahrzeugfabrik. It had a rear mounted two stroke engine. Some internet references claim that Ganz managed to persuade director Wilhelm Kissel and technical director Hans Nibel of Daimler-Benz to develop new rear-engined models under his supervision. Others claim an input from Ferdinand Porsche but I am not able to confirm either of them.

Mercedes-Benz produced three rear engine cars in the middle of the nineteen thirties, the 130H, 150H and the 170H, "H" stood for Heckmotor. The former had a 1308cc side valve engine located behind the rear axle and produced 26hp. The 130H designed by Hans Nibel had a backbone chassis with independent front suspension by transverse leaf springs and swing axles at the rear. The 150h had a 1500cc engine producing 55hp that was located in front of the rear axle. Ten thousand of these models were produced between 1933 and 1938.

Mercedes 130h



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NSU prototype

The next manufacturer that Porsche was able to interest in his design was another German motorcycle company. The next version of the design the NSU Volksauto was a complete redesign, the engine was again changed this time to an air-cooled flat four of 1500cc giving the car a maximum speed of 72 mph. Three prototypes were produced in 1933 but again business factors unconnected with the cars design caused the project to be dropped.

The Hansa was one of the range of car produced by the Borgward group. The 1100 was typical of German thinking in 1934, with all round independent suspension, using transverse half elliptic leaf springs at the front and swing axles at the rear with torsion bars. Also a tubular backbone frame and a water-cooled inline four cylinder engine with overhead valve-gear. This advanced specification was completed by hydraulic brakes. It did not have a high performance, but was said to handle well.

1934.

The idea of creating a small car of advanced design for the people of Germany seem to be doomed, until Porsche submitted a proposal on the development of such a car to the Transport department of the German government, this was in January. Ferdinand Porsche finally found someone interested in his ideas that could find the money and had the power to see them into production. This was Adolf Hitler the new German Chancellor. After Porsche had written a memorandum outlining his proposals, he was given a contract to proceed; This led to a lot of hard work by the Porsche bureau, before the car then called the KdF Wagen and known to us as the Volkswagen was a reality. The car was similar to the NSU Volksauto but slightly smaller.

1936.

The Tatra Type 87 was similar in concept to the Type 77 but was a completely new design, with an all-steel body whereas the Type 77's body was made of steel over a wood frame. A redesigned front suspension and a new single overhead camshaft V8 air-cooled engine of 2968cc. It was lighter and smaller in overall size than the Type 77 and was in production from 1936 until 1950 with a few small breaks due to the onset of war and then peace, in which time 3023 examples were produced.

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Volkswagen prototype

The first Volkswagen's, the three Series 3 prototypes were completed in 1936, after many engine variations had been explored, the design was as the car was eventually produced with a 995cc flat four engine.

1937.

Thirty prototype Volkswagen cars were completed, the series 30, and used for extensive road testing.

The Tatra Type 97 was designed and developed about the same time as the Type 87. The by then classic Tatra form was followed, this time with a 1749cc single overhead camshaft flat four air-cooled engine that produced 40ps, in the rear of a streamlined five seat body. The front suspension with two transverse leaf springs and the rear with Tatra pattern swing axles were similar to the Type 87. With a weight of 1150 kg and a wheelbase of 2600 mm, it was not a small or inexpensive car but complimented the Tatra range and was in production in 1937.

1938.

Another sixty prototype Volkswagens, the series 60, were completed for more testing. The Volkswagen was developed and ready for production.

1939.

Production of the Volkswagen started at the purpose built factory at Wolfsburg. But only two hundred and ten examples were made before the factory went over to war production.

Five hundred and ten examples were produced of the Tatra Type 97 by 1939 when the production ceased. A myth has grown up over the years, that production of the Type 97 was discontinued by orders of the German government, because it paralleled the Volkswagen. If you look at the basic similarities in the design this could seem possible, but if you compare the specifications in more detail the idea is unlikely. The Volkswagen only had a one litre capacity engine producing 25bhp, and it weighed 730 kg it was an economy car, and designed to be produced at a rock bottom price. If you compare this to the Type 97's details you can see they were totally different cars. Another factor than emphasised the difference between the two cars was the possible market. The total annual production of the Tatra factory in a year spread through seven different models was similar to the planned daily production of the Volkswagen. An indicator of their possible potential can be gained by studying the post war successors of both cars. As car production ceased all over Europe with some exceptions and turned over to production of war materials, this may have been a bigger factor in its demise.



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Tatra 97

### Conclusion.

I believe the unique thing about the Beetle was having the support of a head of state with unlimited powers, a state of the art design that was thoroughly developed before being produced, in a purpose built factory equipped with all the latest plant and tooling sufficient to produce a million cars a year for a ready market. Six years of war that interrupted production could have been the end of it, but another set of unique circumstances after the war allowed to project to succeed eventually.

