



Benz Patent Motor Car No. 1

1886: the Birth of the Automobile



Mercedes-Benz



The world's first motor vehicle was a three-wheeler.

“The motorized velocipede of Benz has almost one horsepower”
 In its edition of June 4, 1886, *Neue Badische Landeszeitung*
 (a newspaper for the Baden region in southwest Germany) wrote:

“It should be of great interest for friends of the velocipede sport to learn that great progress has been made in this field with a new invention by the local company Benz & Cie. This company ... currently manufactures a three-wheeled velocipede; the latter is driven by an engine the design of which is comparable to that of a gas engine. The engine, which has a cylinder width of nine centimeters and is mounted on springs above the axle between the two wheels at the rear, develops almost one horsepower despite its rather delicate appearance, and runs at 300 revolutions per minute. This means the vehicle can reach the speed of a normal passenger train. ... The entire vehicle is not much larger than an ordinary tricycle and makes a highly appealing and elegant impression. There is no doubt that this motorized velocipede will soon attract a large number of friends since it can be expected that it will prove to be extremely practical and useful for doctors, travelers, sportsmen and others.”

The writer of this article may have been a “friend of the velocipede sport” himself – committed, like so many others, to the popular sport of cycling at the time. However, he must also have been a farsighted person because he realized the opportunities inherent in the invention of a vehicle powered by a lightweight engine. On July 3, 1886, the same journalist wrote: “A velocipede powered by ligroin gas (gasoline), designed and built by Rheinische Gasmotorenfabrik Benz & Cie. and the subject of a report some weeks ago, was tested this morning on Ringstraße and the tests are said to have been satisfactory.”

Benz Patent Motor Car No. 1

With the stationary two-stroke gas engine he had developed in 1879/80, Karl Benz had earned so much money that from 1883, he was able to concentrate more intensively on realizing his dream: a motorized road-going vehicle. Right from the start, he had been thinking in terms of an engine being fully integrated in a chassis and quite consciously discarded the idea of the sort of motorized carriage Gottlieb Daimler built at the same time. Daimler had the vision of driving every conceivable vehicle and appliance with his high-speed engine.

The vehicle rattling along Mannheim’s Ringstraße on July 3, 1886 was the dream of an inventor, designer and passionate visionary come true: the Benz Patent Motor Car No. 1.

Ahead of his time

The engine

The heart of the vehicle was a single-cylinder four-stroke engine with a displacement of 0.954 liters – and it already had some of the major features that still rank among the basic elements of combustion engines today: a crankshaft with counterweights, electrical ignition and water cooling. According to Benz's measurements, it developed two-thirds of a horsepower at 250 revolutions per minute (measurements at Stuttgart Technical University at a later stage recorded as much as 0.9 hp at 400 rpm). Benz was

completely satisfied with the 250 revolutions of his first four-stroke engine – this speed was, after all, twice as high as that of his two-stroke gas engines. Other features worth mentioning in conjunction with the engine included its weight which, at around 100 kilograms, was very low by the standards of the time, as well as the cylinder with an open crankcase, an intake slide valve controlled via an eccentric rod, an exhaust poppet valve, operated via camshaft, rocker arm and push rod, and lubrication by means of drip oilers.



Benz designed a flywheel that was to be fitted horizontally in the chassis since he feared that the gyroscopic effect of a vertically mounted flywheel would adversely affect the vehicle's steerability and road-holding in tight corners.

For mixture preparation, Benz developed a surface carburetor which doubled as a reservoir for 1.5 liters of gasoline. The precise composition of the fuel/air mixture was adjusted by a sleeve-type slide control that covered the bores in the additional intake duct to a greater or lesser extent, thereby controlling power output. This slide control was fitted within easy reach underneath the driver's seat.

Benz had several goes at the ignition until he came up with a solution that was matched to the low output of contemporary batteries. He used a Ruhmkorff induction coil to transform the electricity to a higher voltage. The spark plug was his own design, too. Investigations at a later stage revealed that the material used for the spark plugs' electrodes was largely identical with that of commercially available spark plugs in the 1930s.

Cooling the combustion engine posed a particular problem because unlike a stationary engine, a vehicle engine cannot simply be connected to a coolant pipe. Benz opted for a simple evaporator which proved to be quite effective and adequate for the low output levels reached at the

time. The engine was – and still is – started by courageous and vigorous turning of the flywheel. The fact that the gasoline filling in the carburetor did not permit longer distances to be covered, did – and does – not bother anyone driving the Benz Patent Motor Car. The ingenious propulsion system of this vehicle consumed as much as ten liters of gasoline – regarded as dangerous at the time – on 100 kilometers.

Chassis and bodywork

The frame was made of bent and welded steel tubing. Since the car was to have rear-wheel drive, i.e. to be pushed from behind, Karl Benz was faced with the problem of steering which had to differ from that of a pulled vehicle. Hence, the fifth-wheel steering customary on carriages had to be dispensed with – which is why Benz rather spontaneously decided in favor of a three-wheeler. The front wheel was suspended in an unsprung fork and steered by a toothed rack that was connected to a crank. (It was not before 1893 that Benz invented his double-pivot steering, one of the most important milestones in automotive design.)

Benz also manufactured the wire spoke wheels with solid rubber tires himself – only the rims were “outsourced”. As customary in vehicle construction at the time, the front wheel was running in a ball bearing, the rear wheels in tinplate bushings. The vehicle was driven with one chain each on the left and right-hand



sides, running from the countershaft to the rear wheels which in turn were attached to the frame by means of a rigid axle and fully elliptic springs.

The world's first automobile did not yet feature a transmission with two or more speeds, nor did it have a reverse gear. Instead, a single speed was made available on the countershaft in the form of a fixed drive disc with integrated differential; next to it an idle disc was fitted. Thanks to the idle disc, the flat belt between engine and countershaft was capable of doubling as a clutch. For starting off, the flat belt was simply moved from the idle to the fixed disc. Road speed was adjusted by means of the sleeve-type sliding control under the driver's seat.

The coolant reservoir was mounted on top of the engine. The vehicle was decelerated by means of a manually operated lever acting on the countershaft belt pulley – there was no foot-operated brake. The bench seat was mounted on elegantly curved springs directly on the frame, in front of the engine, and covered with perfectly finished and stitched leather, as befitting a thoroughbred roadster. Passengers were supported by low railings with leather upholstery at the back and sides.

The chains were a source of concern. In his memoirs, Karl Benz wrote: “The chains were highly inadequate; most of them were too soft and therefore elongated excessively, came off the gearwheels or broke in tests. Since there were no better ones, however, I had to make ends meet with the material that was at my disposal.”



The vision becomes reality

For reasons of secrecy, the first trials were staged in the factory yard in 1885 – and repeatedly ended in the factory wall. The first outing on normal roads – at night – lasted only a few minutes: the car broke down after just one hundred meters. Yet then, slowly but steadily, the distances covered became longer. In retrospect, Benz wrote: “I may well have reached a speed of 16 kilometers per hour with the car.”



“Every trial strengthened my confidence, but on every outing, I also became familiar with new hitches of the engine. On the other hand, every journey provided me with ideas for improvement so that I was able to apply for a patent for the car in January 1886 ...” When the first public trial was staged on July 3, 1886, as documented in the above newspaper article, Benz’s son Eugen ran alongside the car carrying a bottle of gasoline “to fill up the car should it run out of fuel.” This indicates the great fear people had at the time concerning the inflammability of gasoline in a vehicle.

German patent no. 37435 for the “vehicle propelled by a gas engine”

Karl Benz applied for a patent for his motorized vehicle on January 29, 1886. Patent no. 37435 became the birth certificate of the automobile. On March 25, 1886, a patent was applied for in France.

The patent specification was entitled “Vehicle propelled by a gas engine” and its first paragraph read as follows: “The construction concerned aims at operating predominantly lighter vehicles and smaller ships, such as are used for carrying between one and four persons. ... Power is generated by a small gas engine, no matter what design. The engine is fed with gas that is vaporized from ligroin or other suitable substances by means of an apparatus carried on the vehicle. The engine’s cylinder is kept at a constant temperature through the evaporation of

water.” The Benz Patent Motor Car No. 1 soon ended up in a corner of the factory because Benz built new models in rapid succession, all based on the experience he had gained. These versions were not fundamentally new but had more powerful engines and stronger chassis. Number 2 had a 1.5 hp engine, Number 3 boasted 2 hp. The latter had a power-to-weight ratio of just 42 kilograms per hp and with its 500 rpm, it was the first lightweight high-speed engine from Benz. From 1887 it was installed in an improved version of the three-wheeler which now had wooden spoke wheels, a small gasoline tank and a leather-covered, manually operated shoe brake that acted directly on the rear wheels.

By 1888 Karl Benz had been granted another four German patents, among them a patent for a fire-proof carburetor.



On January 29, 1886, Karl Benz was granted the German patent no. 37435 on his motorized vehicle. This patent marks the beginning of automobilism. It describes the first functional unit of an engine with a chassis – the Karl Benz Patent Motor Car.

Karl Benz and the dream of his life

Karl Friedrich Michael Benz was born in Karlsruhe on November 25, 1844 and went to primary school, grammar school and polytechnic in his home town. The son of an engine driver, it was not surprising that he soon developed an interest in engines, especially in gas engines which were already fairly widely used at the time.

From an early age, he occupied himself with ideas for the design of more efficient gas engines and a vehicle “that runs under its own steam, like a locomotive, but not on rails but quite simply on normal roads.”

After his engineering studies and from 1864, Benz worked as a draftsman and designer for several companies in Karlsruhe, Mannheim and Pforzheim. During these years, he developed into a meticulously working man who set great store by precision and attention to detail.

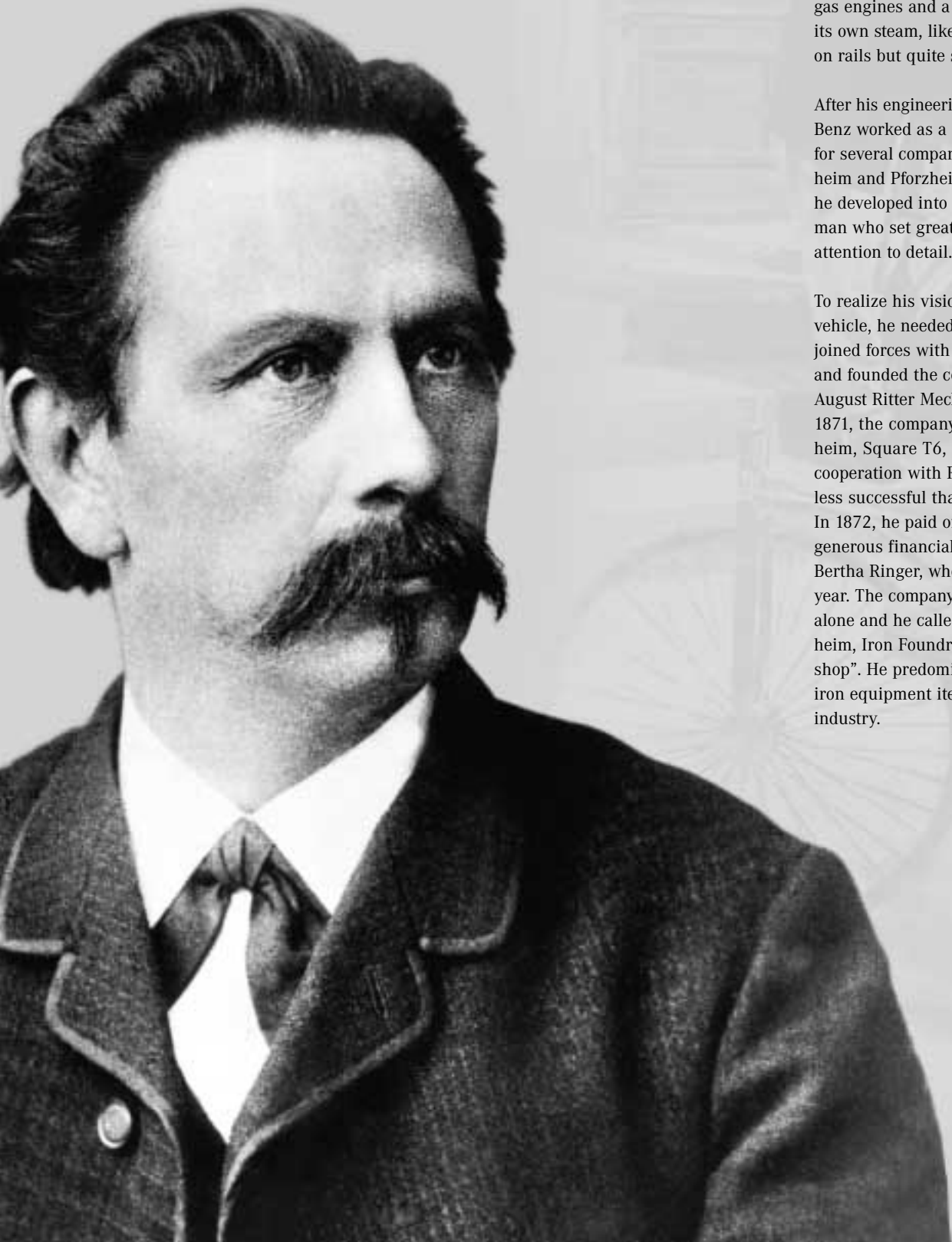
To realize his vision of a self-propelled vehicle, he needed money, and so he joined forces with a partner, August Ritter, and founded the company “Karl Benz and August Ritter Mechanical Workshops” in 1871, the company’s address being Mannheim, Square T6, number 11. However, cooperation with Ritter turned out to be less successful than he had hoped for. In 1872, he paid off his partner with the generous financial support of his fiancée, Bertha Ringer, whom he married the same year. The company now belonged to Benz alone and he called it “Karl Benz, Mannheim, Iron Foundry and Mechanical Workshop”. He predominantly manufactured iron equipment items for the construction industry.

Bertha Benz’s secret long-distance trip

In the early morning of a day in August 1888, Karl Benz’ committed and courageous wife Bertha, accompanied by their sons Eugen (15) and Richard (14), set out on the first long-distance trip in automotive history, without her husband knowing. Her intention was to make her husband’s invention known beyond Mannheim and to demonstrate that his vehicle was not just suitable for traveling short distances. The journey took her from Mannheim via Weinheim, Heidelberg, Wiesloch and Durlach to Pforzheim, where Bertha was born – and road connections between towns weren’t as straight at the time as they are today!

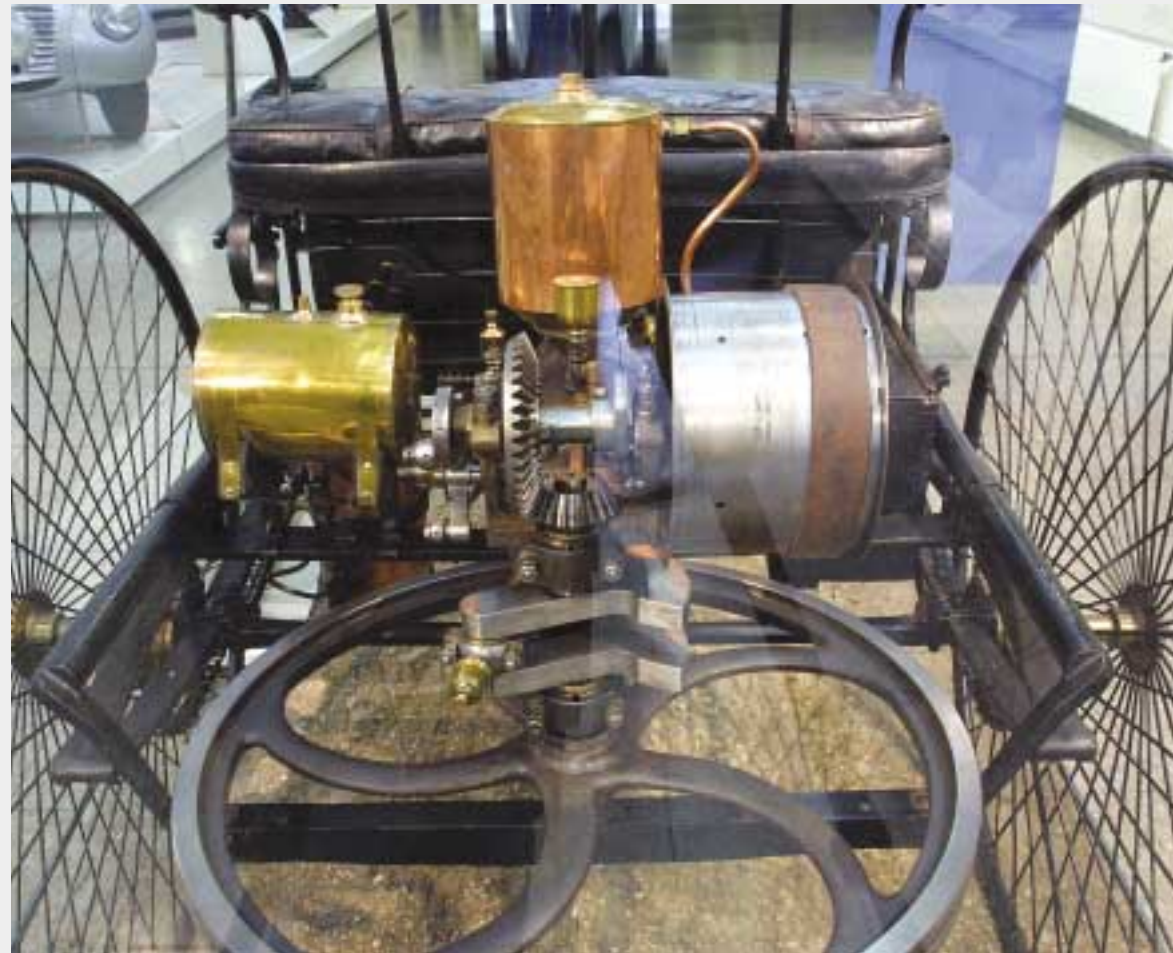
On her journey, Bertha cleaned a clogged carburetor with a hat pin and insulated a bare wire with her garter. On uphill gradients, her sons had to climb down and push the car time and again because engine power was not always sufficient. The car lacked a transmission or at least another gear. The heavily strained shoe brake had to be lined with new leather several times, and the supply of valuable ligroin had to be replenished at the chemist’s in Wiesloch. The world’s first woman at the wheel and her sons arrived in Pforzheim in the evening, covered with dust but safe and sound and with a wealth of newly gained experience.

By traveling 180 kilometers from Mannheim to Pforzheim and back again, Bertha Benz had demonstrated the motor vehicle’s practicality to the whole world. Without her daring and that of her sons – and the crucial stimuli her trip provided – the rise of Benz & Cie., Mannheim, to become the world’s largest automotive producer at a later stage, wouldn’t have been conceivable.





Twenty years after its maiden journey – the maiden journey of the first holistically designed motor vehicle – the Benz Patent Motor Car No. 1 was rediscovered in a distant corner of Benz's automotive factory, scrupulously restored and, on the occasion of its 20th anniversary, donated to the Deutsche Museum (German Museum) in Munich.



Technical data of the Benz Patent Motor Car No. 1

Engine:

Water-cooled single-cylinder four-stroke engine with a large flywheel installed horizontally in the rear of the car.

Bore x stroke:

90 x 150 mm

Displacement:

954 cc

Output:

0.90 hp at 400 rpm

Design features:

Horizontally installed single-cylinder engine with horizontal flywheel; gas exchange through a sliding intake valve, controlled by an eccentric rod; vertically mounted exhaust valve, controlled by camshaft, rocker arm and push rod; mixture preparation by a Benz surface carburetor, evaporation cooling (thermosyphon); lubrication by means of drip oil dispensers and grease cup; electrical high-voltage buzzer ignition; starting by turning of the flywheel.

Chassis:

Tubular steel frame; front wheel suspended in an unsprung steering fork; rear wheels suspended from a rigid axle with fully elliptic spring; rack-and-pinion steering, steering crank in the center of the car; no foot-operated brake – manually operated brake acting on the countershaft belt pulley; three wire spoke wheels with a diameter of 730 mm at the front and 1125 mm at the rear, all three wheels with solid rubber tires.

Power transmission:

One flat belt from the engine to the countershaft with idle and fixed discs and integrated differential, one chain from the countershaft to each of the rear wheels

Gearshift:

Movement of belt between idle and fixed disc.

Top speed:

16 km/h

Consumption:

approx. 10 liters/100 km

Dimensions and weight:

Wheelbase:

1450 mm

Track width:

1190 mm

Length:

2700 mm

Width:

1400 mm

Height:

1450 mm

Unladen weight:

265 kg

