

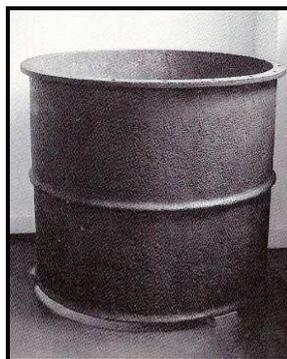
# FROM THE STEAM-‘DRAGON’ TO THE HIGH-SPEED-ICE: THE MODERNIZATION OF RAILWAYS FROM THE 19<sup>th</sup> CENTURY UP TO THE 1990s. ‘HENSCHEL’, KASSEL, EUROPEAN REGION OF HESSE, ONCE THE BIGGEST LOCOMOTIVE COMPANY OF EUROPE

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The historical perspective of the modernization of railways during the 19th and 20th centuries is one of the most interesting processes of the Industrial Revolution within modern human history. Especially the **modernization of locomotives** has been some important influences on the economic, political and social life of the European societies during the last two centuries. Therefore, one of the main enterprises to produce locomotives in Europe at that time, Henschel, was involved in some important improvements of this modernization process.

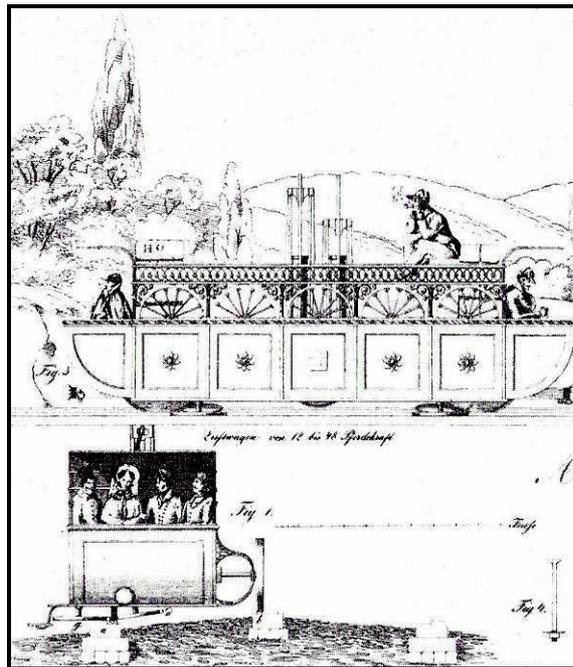
In 1785 the first actions of the Henschel-family started in Cassel, the capital of *Kurhessen-Cassel*, one of the smaller counties of the Holy Roman Empire of the German nation, nowadays Kassel in the European region of Hesse, with the moulding of bells and later on gun and cannon barrels, still being in service to the Landgraf Wilhelm IX. Already in 1706 the French refugee Denis Papin made his attempts with the worldwide first **steam-cylinder** for a high pressure steam pump in this county, which at that time, was know as a technological centre of science. Finally, in 1810 the Company ‘Gießerei und Maschinenfabrik Cassel’ was established by Georg Christian Carl Henschel.



**The oldest steam cylinder of the world Denis Papin worked with in Cassel, 1706**

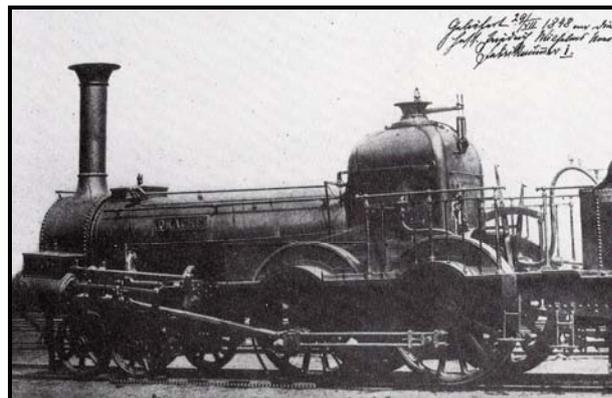
His son Carl Anton Henschel introduced the **era of railways** and founded a society for a railroad from Bremen, via Kassel to Frankfurt on the Main. In 1822 it was still envisaged with horse power, but it was never realized. Furthermore, he drafted several different railway-systems for mines or like in 1833 for example a **pneumatic railway**. Unfortunately, this single track should need too much energy. Henschel admitted later that the tensile force could be fifteen times higher with half of the speed of railways. Nevertheless, the foundation of the very successful railway production was made with such idealistic plans. In addition, he produced the first

steam boat in Hesse, which rested the only one there and was even sold, because it was judged not to be need at that time.



**Pneumatic railway, publication of Henschel, 1833**

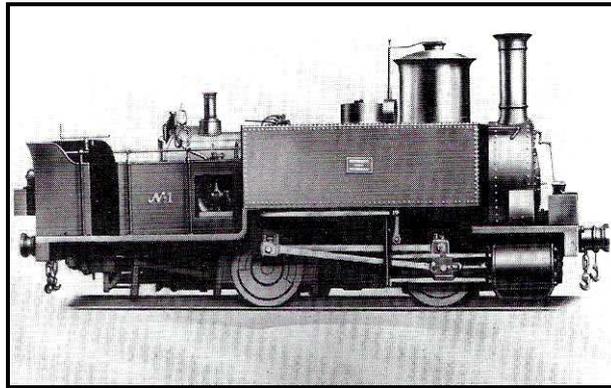
Nevertheless, in 1837 the now called ‘Henschel & Sohn’ moved to a new-established bigger factory location and constructed between 1845 and 1848 the first Henschel **steam locomotive ‘Drache’** (dragon) for the new founded *Friedrich-Wilhelm-Nordbahn* in Hesse. To create a link between the Thuringian and the Westphalian railway lines the operator ordered at the beginning four American and four English locomotives, before the local company Henschel get an order, which, later, was followed by three other ones of the same locomotive type and the new production was established.



**First steam locomotive of Henschel ‘Drache’, 1848**

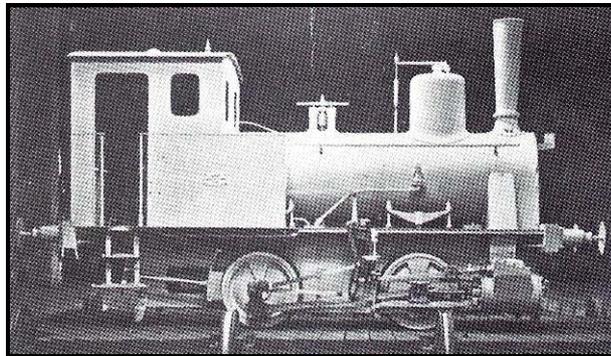
Several technical amendments for orders of different German railways, like the first German locomotive, model 14, for the Nurnberg-Fürth railway in 1852, and the first six export locomotives in 1858 enabled the company to produce in total fifty locomotives up to 1861. In the same year Henschel introduced the first **industrial railway** on the European continent and up to 1865 100 locomotives were produced. But in 1864 the occupation of Kurhessen-Cassel by, and later the integration to, Prussia were related to some disadvantages for Henschel, because they were treated as a foreign company by the Prussian railway administration. With the

industrial exposition *Allgemeine Industrieausstellung* of 1870 in Kassel the situation changed for Henschel. In addition, related to the economic boom of the *Gründerjahre*, more and more locomotives were ordered.

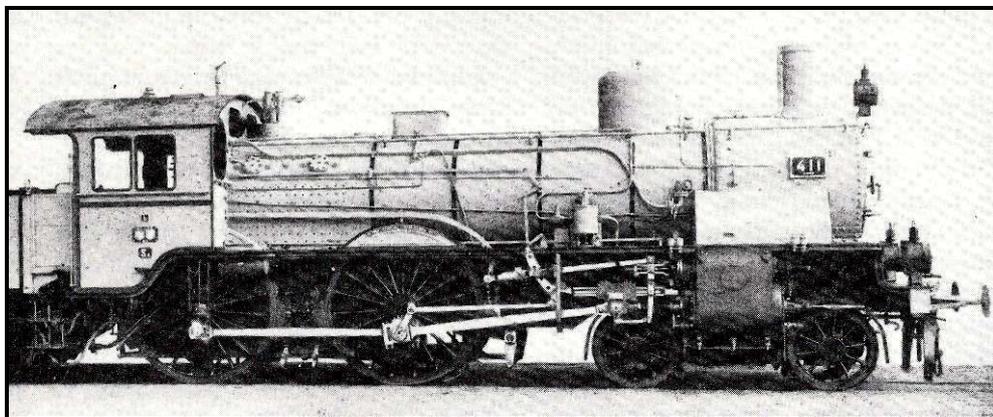


**First industrial locomotive, Henschel, 1861**

At this time, in 1876, Henschel introduced, with the prototype 'Bonifatius', the first locomotive produced with **standardized parts** (*Regeln* - rules; after the internal rules of the Henschel plants). Until 1900, they enlarged this programme of groups of parts, produced in stock, which enables them an output of 100 different types of locomotives on the bases of the same parts. With this unique method of industrialized mass-production, times before Ford or Taylor, Henschel could produce faster and more flexible and became the biggest producer of locomotives in the Second German Reich. In 1899 the 5,000<sup>th</sup> and in 1910 the 10,000<sup>th</sup> locomotive was constructed. Impressive for the time is also, that a woman, Sophie Henschel, after the dead of her husband Carl Anton Oscar Henschel in 1894, directed the company up to 1912.



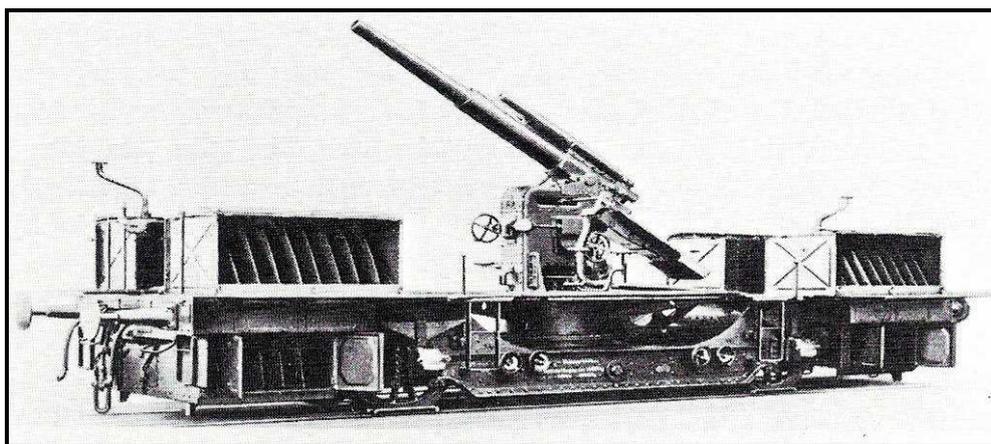
**First locomotive with standardized parts, Henschel 'Bonifatius', 1876**



**Hot-steam locomotive, Henschel, 1907**

Furthermore, some complex rail technologies were invented. In the 1890s, one of the main technical innovations in the improvement of the performance of steam engines was the introduction of the **hot-steam**

**locomotives** (*Heißdampf-Überhitzer-Prinzip*). It was achieved by the engineer Wilhelm Schmidt in Cassel and the first locomotive of this type was produced by Henschel in 1897. The supremacy of the new technology has been that impressive, that for example in 1909 two third of the Prussian locomotive were ordered of the new type. Even though, some other technologies were introduced at the beginning of the 20th century, most of them rested prototypes. The beginning war accelerated the production, while it limited the complexity of the engines and the number of different models within the Reich. Beneath the unified war types of locomotives, *Einheits* – or *Kriegsvarianten*, military relevant versions were more and more demanded. Only marginally involved in the production of war goods, Henschel still tried to get some of these orders and proposed new products like the air defence artillery wagon.



**Artillery for air defence, Henschel prototype, 1918**

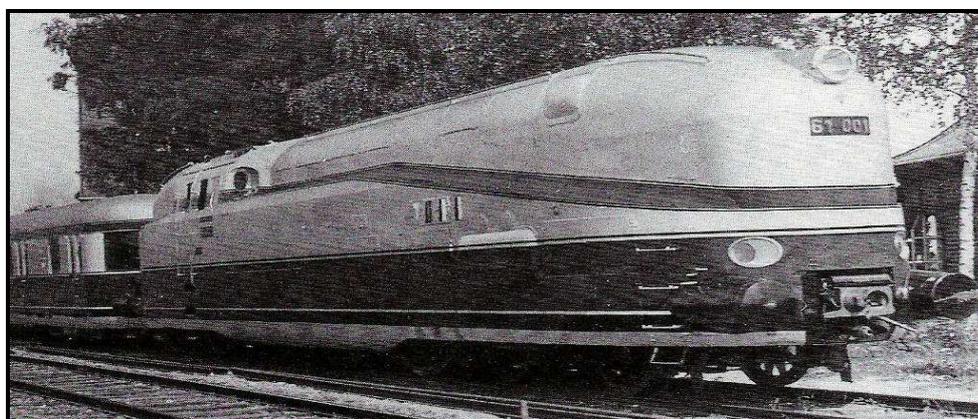
After the First World War the commands of locomotives by the new founded nationwide German Railways ('Deutsche Reichsbahn - DR', and for some years also 'DRG -DR Gesellschaft') were nearly stopped, due to the consequences of the Treaty of Versailles. But although the de-facto blockade of the French, British and North American markets for German products resulted in some bankrupts in the railway sector, Henschel had achieved such a worldwide reputation, that it was still able to export and in 1923 the 20,000<sup>th</sup> engine was produced. Nevertheless the economic crises at the end of the 1920s urged some fusions of German engine producers and Henschel bought companies like Hanomag to get more market shares of the regulated market. In addition, Henschel started to produce steam lorries, steam trams and steamrollers, but also **buses** and **lorries** and as well as **aircrafts** at the beginning of the 1930s.



**First electric locomotive of Henschel, 1905**

Related to the railway sector, diesel and electric traction became more and more important at that time. In 1905 Henschel constructed the first **electric locomotive**, equipped with technology of Siemens-Schuckardt. The first diesel-engines were built at the beginning of the 20<sup>th</sup> century and up to the war, in 1914, Adolf Klose developed in Württemberg the Diesel-Klose-Sulzer locomotive without a clutch or a gear. At Henschel, in 1910 the first locomotive with a carburettor-engine was built. And in 1923 the co-founded company for oil-engines (*Öllokomotiv-Gesellschaft mbH*) started a new area of locomotive development. But while a 300 hp **diesel engine** was designed, problems with the liquid-gear on such a high power level let the engineers follow another path. Therefore, after the innovations of the Maschinenfabrik Esslingen and Prof. Georg Lomonossow up to 1912 and other diesel-electric engine in the 1920s, the first **gasoline-electric locomotive** was created at Henschel in 1931. This evolution led under the Third Reich to the draft of a three-meter-gauge, diesel-electric locomotive with a high-speed of 250 km/h, ordered for a trans-continental railway line in 1942, which was never realized.

But in the 1920<sup>th</sup> and 1930<sup>th</sup> the success of the steam engines was not yet terminated. Several amendments were achieved and new developments could be realized. Based on the hot-steam engines, Henschel developed in cooperation with Schmidt the next evolution, the **high-pressure locomotives**. Another innovation was forwarded by the foundation of the Association for coal-dust-heaters (*Studiengesellschaft für Kohlenstaubfeuerung auf Lokomotiven*) in 1924. Under the leadership of Henschel the first **coal-dust-locomotive** were delivered to the DRG in 1928. While the first versions were still heated with brown coal, later ones were established for hard coal. In 1927 the conversion of a classic steam engine brought the next innovation, the **condensation-tender technology**. Therefore, the wasted water was cooled down and reused. Once, this technology enabled to travel on longer distances without water refill and twice, the need for combustion could be reduced. Finally, the condensation-tenders were used worldwide in extensive areas like in South Africa, Argentine, Russia and Iraq, while Henschel achieved to reuse 95% of the water. The fourth important innovation was the **streamlined locomotive** 61001, still as a steam engine, in competition to the ‘Flying Hamburger’, *Fliegender Hamburger*, already a diesel-electric railcar. The locomotive was combined with streamlined wagons of the Wegmann plants, also situated in Kassel. Consequently, the train reached a high travel speed of 100 km/h and was used between Dresden and Berlin.



Streamline steam locomotive, 61001, Henschel, 1935

These streamlined locomotives were very well seen during the Third Reich. Therefore, several drafts were created and a last impressive locomotive was presented in 1941. Powered by several small steam-motors for each of the four driving axles, it was called consequently **steam-motor locomotive** (*Dampfmotorlokomotive*). The V19

worked, after initial problems of coordinating the different axles, quite well and reached a high-speed of 175 km/h with very small track wheels of only 1,250 mm. Only one exemplar was built and it was captured by the US troops and the new Western German Railways refused to buy it back in 1950s, so it was scrapped in 1952. Finally, the last steam locomotives, after the famous, well performed 66002 of 1955, left the Henschel plants in Kassel in 1961.



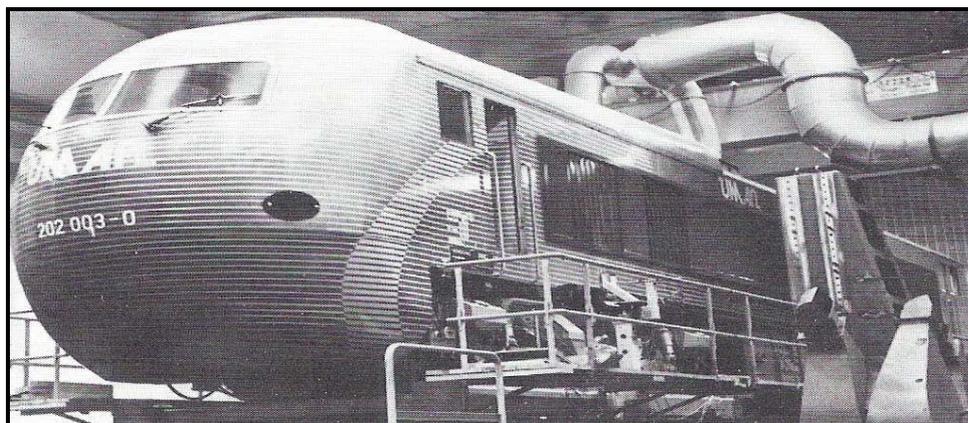
**Last new model of a steam locomotive, 62002, Henschel, 1955**

At the end of the Second World War, even though 80% of the fabrication plants in Kassel were destroyed, the first repaired locomotive left Henschel already on May 12<sup>th</sup> 1945, under the control of the American army. But from a long term perspective more difficult for the company was the separation of the three production lines: locomotives, lorries and aircrafts. Consequently a diversification to balance the economic cycles of the different transport sectors was enabled. In addition, the concentration on the production of and research about steam engines during the past decades became a problem with the upcoming diesel and electric engines. Henschel, now in international terms a medium sized company, got funding problems for the new technologies. Therefore, it started in 1954 some licence productions, for example of electric engines with General Electric - GE, or took over the production of diesel locomotives of the engine producer (*Maschinenfabrik Esslingen*) in 1961. And finally after several different reorganizations and the integration in other conglomerates like Rheinstahl, later Thyssen, the cooperation with Asia Brown Boveri - ABB resulted in new high tech rail innovations under the new name ABB-Henschel AG from 1982 on.



**High-speed electric locomotive, Henschel-Siemens, 1973**

In 1961 the now called Federal German Railways of the FRG (“Deutsche Bundesbahn”) demanded the creation of an **electric high-speed locomotive** for about 200 km/h. Henschel designed in cooperation with Siemens some prototypes, which resulted in the top engine of the Western German railways for nearly two decades, the so called locomotive-line 103 (p.58), with a high-speed up to 250 km/h. In addition, Henschel created in cooperation with BBC the extraordinary innovation of a **diesel-electric engine with three-phase current**. This locomotive, the locomotive-line 202, was presented in 1973. In addition, in 1980, Henschel rebuilt the experimental diesel-electric locomotive 202 003-0 with new bogies for theoretically 350 km/h and a streamlined front. The bogies of the *ICE-V* were derived from this concept. Therefore, these two products became from 1985 on the basis for the new high speed trains, Inter City Experimental, later Inter City Express - ICE, which up to nowadays have become a great success in Central Europe, *Mitteleuropa*.



**Three-phase current high-speed locomotive, Henschel-BBC, 1983**

In 1990s the classical rail-track technology, represented by TGV, Shinkansen and ICE, is the state of the art. And in 1996 unfortunately the name of Henschel, symbol of the production of more than 33,000 locomotives, found its execution with the take over by the Daimler Benz AG, like before the production of Hanomag-Henschel lorries in the 1970s, despite other announcements to keep the name up. As ADtranz, Henschel was sold to Bombardier and the productions plants with the maglev technology to Thyssen. But the engineers and workers of Henschel, the so called *Henschelaner*, stayed the driving or from nowadays nearly flying force to the most innovative technologies. They also introduced the electro-magnetic track, which became the core of the guided magnetic roadway. Actually used for the **maglev trains**, Henschel started the first testing line for the *Transrapid* already in 1974. Its maximum speed is about 500 km/h and, since the beginning of the new millennium in 2001, the ‘trains’ for the first commercial maglev train line in China are produced in Kassel, the heart of Europe.



**First test track for electro-magnetic Transrapid, Henschel, Kassel, 1980s**