

## **Rudolf Diesel – The Rational Inventor of a Heat Engine**

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Rudolf Diesel was born in 1858 (on the 18th of March) in Paris to Elise Diesel and her husband, Theodor, who was a well-read book binder. Diesel did well in school in France and was awarded a bronze medal by the ‘Société Pour L’Instruction Elémentaire’ in 1870. However, a war broke out between France and Prussia in the same year and Diesel’s parents were forced to leave France because of their German origins.

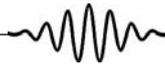
Money was in short supply and 12-year-old Rudolf was sent off to live with his aunt and uncle in Augsburg where his uncle was a mathematics teacher in a high school. Diesel started studying in the same school<sup>1</sup> which was quite an achievement in itself as all his schooling up to that point had been in French. By the time he was 14, Diesel decided he wanted to be an engineer so in his last year of schooling, he specialised as a “Mechaniker”. After this, he went to an industrial school (Industrieschule) for his vocational training and finished in 1875 at the top of his class.

Later that year Diesel joined the technical university in Munich (Technischen Hochschule München) where one of his professors was a young Carl von Linde who is famous for developing refrigeration and gas separation technologies. Diesel worked in Linde’s lab and by 1878 was very appalled by how inefficient the steam engine was when compared to the original Carnot heat engine. Steam engines back then typically achieved 1 or 2% efficiency which went up to 10% if they were very lucky (even today the best steam engines manage about 25% with all sorts of additions). Diesel was scandalised by the amount of energy being wasted and spent a lot of time at the university trying to logically come up with ways to get closer to the theoretical efficiency predicted by the Carnot cycle. He considered using coal directly in the engine as a fuel and went on to look at the possibilities of ammonia for the same purpose in 1884.

In the meanwhile, he came down with an attack of typhoid that prevented him from taking his final exams at university in 1879. These exams were held only once a year. So, once he recovered from the illness that year, Diesel spent six months working in the factory of the Sulzer Brothers Ltd. in Winterthur, Switzerland. In 1880, Diesel finished university with a grade in his final exams that was the best for his field since the founding of the university!

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<sup>1</sup> Formerly known as the “Augsburger Königlichen Kreis-Gewerbsschule”, now called the Holbein-Gymnasium Augsburg. They are very proud of Diesel and have a lot of information on their website [1].



In 1879, his professor, von Linde, had resigned to start a company called the *Gesellschaft für Lindes Eismaschinen Aktiengesellschaft* which translates to Linde's Ice Machine Company. Diesel joined this company after he graduated in 1880 and was made director by 1881.

Diesel's first patent while working with Linde was for a machine that produced crystal-clear ice! All the profits from this very successful invention went to Linde's company though, which made Diesel go back to his original quest for an efficient engine in his spare time. By 1890, Diesel had moved back to Germany, to the city of Berlin where he published his first book on the subject titled *Theorie und Konstruktion eines rationellen Wärmemotors zum Ersatz der Dampfmaschinen und der heute bekannten Verbrennungsmotoren* in 1893. This was translated into English in 1894 and is called "the theory and construction of a rational heat motor".

Based on this work and his patents, Maschinenfabrik Augsburg helped Diesel work on developing the yet-to-be-designed engine with financial backing from Krupp while the Sulzer Brothers bought the Swiss rights. This was very useful to Diesel as he wouldn't have had money for all the extensive testing and redesigning that the engine needed before it was finally ready to be manufactured nearly five years later (Diesel expected it to take only a few months!).

The engine was very successful and although Diesel was a multi-millionaire almost instantly, he continued to work on improving the engine right up to his tragic death by drowning in 1913. Since his engine developed such high pressures, he found it had many advantages over its competitors both in terms of efficiencies and flexibility with fuel. It became especially popular in the famous *Exposition Universelle* held in Paris in 1900 to celebrate the achievements of the previous century and encourage technologies that would define the future. Officials in the French government used a diesel engine running on groundnut oil to demonstrate distributed power generation in their colonies. Diesel was all for this idea but it didn't gain popularity until very recently. Diesel and everyone at the exhibition were absolutely right in predicting that this engine would be one of the most important technologies for the new century though!

Today, over 100 years of development by some of the best engineers have made the diesel engine a highly-refined, beautiful machine and the rising fossil fuel costs have brought it very sharply into focus as the technology that will define the present century as well!

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