Background information

An historical overview to mark the 150th anniversary of the birth of the braking pioneer and entrepreneur Georg Knorr

Georg Knorr (1859-1911) was one of the pioneers in the field of rail vehicle brakes. Without his inventions, which enabled the safe deceleration of trains that became faster and heavier as time went by, the dawn of the new era that the railways triggered in the second half of the 19th century would not have been possible. The progress of the fledgling railways was being held up by the urgent need to replace the hand-cranked brakes, operated on each carriage by a brakeman, by a continuous, automatic compressed-air braking system that could be operated by remote control from the locomotive cab.

The air brake

The advent of air brakes brought a system that features a control valve with an auxiliary air reservoir between the continuous main brake pipe and each brake cylinder at the wheel. When the brake is released, with the brake cylinder vented, the auxiliary reservoir takes a refill from the main brake pipe via the control valve, normally pressuring up to five bars. When the pressure in the main brake pipe falls during braking, compressed air from the auxiliary reservoir flows into the brake cylinder, pressing the pads against the wheel rim. This new system marked the advent of "information technology" in rail vehicles in the shape of the compressed air that was used not only to transmit energy but also as a means of conveying control signals. The delay in applying the brakes was only as long as it took for the signal to travel through the air in the form of a vibration – at the speed of sound. In addition, if the main pipe was damaged or broken, when a carriage was derailed for example, the brakes were applied automatically. This same principle still applies in modern-day trains.

Messrs Carpenter & Schulze

Georg Knorr, who was born in Ruda near Löbau in Western Prussia on 19 October 1859, as the son of a member of the land-owning gentry, joined Carpenter & Schulze in Berlin in 1884. One year earlier, the company had received a ten-year commission from Prussian State Railways to supply automatic braking systems for its passenger trains. In 1893, however, Knorr's employers were facing ruin: The railway authority had decided not to renew the ten-year contract and had opted instead for Westinghouse brakes. This effectively removed the raison d'être of the young company. Its founder, the American Jesse Carpenter, pulled out and returned to the United States. Georg Knorr, however, stood his ground with remarkable foresight. He could see that the railways were in the process of opening up a whole new dimension of mobility. He could sense that, far from just transforming people's private lives, they were about to revolutionize the manufacturing and trading sectors, as well. And he was convinced that these developments held immense opportunities for the products – the braking systems – manufactured by his company. So deciding to invest his personal fortune, he took over of the company and renamed it "Carpenter & Schulze, Proprietor G. Knorr". In his memoirs, he wrote of these early years: "In view of the unfavorable circumstances, the final decade of the last century was a very quiet time for my company." It was, he wrote, "the strongest growth phase for the Westinghouse brake." In the meantime, Westinghouse Air Brake Company had founded a subsidiary in Germany too, and had rapidly become an established player across Europe.

Determination

Georg Knorr restructured production operations at his factory and downscaled them substantially. Instead of building complete braking systems, Knorr turned his engineering skills to designing brake hose couplings and emergency brakes, and supplied the railway operating companies with spares and accessories. As the factory was still below capacity, he began production of pump machinery and gasoline engines. Ultimately, this approach enabled the company to master the crisis and its owner to finally make a decent living. At the same time, Knorr continued to apply his inventive talents to the development of a new control valve, the component at the heart of the air brake. On his initiative, Carpenter & Schulze had developed a new single-chamber rapid-action brake back in 1892, with a more simple design than that of the Westinghouse brake. Now Knorr took up this development and refined it. Initially, however, Prussian State Railways' response was that another change of braking system was out of the question. The breakthrough only came when Knorr designed a direct-release, single-chamber

rapid-action brake that combined several aspects of his earlier developments: Its simpler design guaranteed greater reliability with shorter stopping distances and, above all, a smoother braking process. Here, for the first time, was a brake that demonstrated in trials the ability to stop trains with 200 axles on the flat and 150 axles on gradients, safely and reliably. Moreover, from the outset, Knorr took steps to ensure that his new brake could be combined with its counterpart from Westinghouse in one and the same train. As a result, as the new century dawned, Prussian State Railways decided to adopt Knorr's rapid-action brake in its passenger trains. Around the same time, the question of continuous freight train brakes also appeared on the agenda, and in 1903, "Carpenter & Schulze, Proprietor G. Knorr" were commissioned to design an appropriate system.

New horizons

After years of persistent hard work, this opened up whole new horizons for Georg Knorr's company. Now Knorr's single-minded persistence and relentless pursuit of better designs, and the carefully maintained relations with Prussian State Railways would finally pay dividends. The new orders meant that the company had to relocate to larger premises in Boxhagen-Rummelsburg on the eastern edge of Berlin. Soon, though, even the new facilities were bursting at the seams and Knorr found himself in need of additional capital to fund further growth. So it was that, on 19 January 1905, Georg Knorr and the members of the board of the Berlin-based machine tool manufacturer Ludw. Loewe & Co. AG concluded a partnership agreement governing the establishment of a limited company, Knorr-Bremse GmbH. Four years ago, Knorr-Bremse celebrated the centenary of this founding act. Georg Knorr held almost one half of the share capital of 800,000 marks and was appointed sole Managing Director of the newly founded Knorr-Bremse GmbH. His new-found partners and his new financial footing meant that now Knorr was at liberty to pursue his innovations in a much larger setting.

Modern standards

Georg Knorr was well aware that the sustainable success of his safety-critical products depended on high standards of quality. Consequently, as early as 1905 he issued a set of rules, strictly regulating operating procedures at the factory. Machining tolerances for valves and cylinders were already down to between 0.02 and 0.03 millimeters. As one of very few companies at the time, from the outset Knorr-Bremse GmbH had its own Employees' Committee. Staff facilities included washrooms, baths and changing rooms, as well as a canteen. To the last, Georg Knorr's driving passion was development work and he was the originator of a whole series of additional innovations. However, Knorr would not live to see the advent of the company's innovative continuous train brake. In 1910 he was forced to withdraw from active management on ground of serious ill health and took up a seat on the Supervisory Board. In 1907 he had already handed over commercial management of Knorr-Bremse GmbH to Johannes Philipp Vielmetter. On April 15, 1911, Georg Knorr died of tuberculosis in Davos, Switzerland. He was just 51.

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