Harold Ipsen – a pioneer in the field of modern heat treatment

by **Markus Reinhold**

Some events in American history are still present today, more than 100 years later. In January 1915, the world-famous Rock Mountain National Park in Colorado was founded and in December of the same year Frank Sinatra was born. Between those two events, Harold Ipsen (**Fig. 1**) was born on 21 May. It was clear at an early age that Harold Ipsen would become an engineer and inventor rather than being a great artist. As sung by Frank Sinatra in "My Way", our inventor went his own way – influencing the life of millions of people as well.

Ipsen's success resulted from the fact that the metalworking industry was experiencing its heyday in the USA – technologically advanced, custom-designed industrial kilns were therefore in great demand. In addition, the heat treatment in the plants designed by Harold Ipsen resulted in surprisingly bare components, an innovation, for example, that was reported by the newspaper Rockford Morning Star. By using an oxygen-free protective gas – which had not been done before in the industry – Harold Ipsen achieved results never seen before, thus emerging as a pioneer in the industry.

TECHNOLOGICAL KNOW-HOW COMBINED WITH ENTREPRENEURIAL VISION

Harold Ipsen's spirit of invention and his technological talent were not only remarkable, he also had a strong entrepreneurial flair. Upon recognizing this great opportunity, he gave up heat treatment and concentrated on plant construction starting in 1948. By enabling customers to cost-effectively produce bare, evenly tempered components, he made a small revolution on the market and secured access to a multi-million business in the U.S., as well as Europe. In the following years, the company continued to grow, and in 1953, Ipsenlab in Canada became the first location outside the United States. In 1957, Ipsen chanced the leap across the pond and founded Ipsen Industrie GmbH in Kleve, Germany. A special milestone in this period was also a research project for NASA, which involved the production of more stable metal foams.

Fig. 1: Harold Ipsen

The son of Danish immigrants, however, was far from resting on his laurels. Rather, he devoted himself to the expansion of his plant offerings, and thus strengthened his position as a technology leader even further. In this context, Ipsen's groundwork for the convective heating of components in a chamber kiln using a muffle is still interesting today (**Fig. 2**). Experts are still divided on whether the additional gas supply by means of a gas-deflecting muffle, which shields the inner charge chamber from the furnace wall in physical and radiation terms, actually offers advantages for the process and the component. For Ipsen, however, the case was clear: measurements with thermocouples showed that when using convection-assisted heating, the inner charge temperature increases faster with a muffle than without, whereby the outside temperature of the charge remains virtually unaffected. For the subsequent carburizing or carbonitriding process with stationary temperature distribution, Ipsen found, as expected, no difference with or without a muffle. For us, the question here is whether it is the component distortions, rather than the muffle manufacturing process itself, that should be in the foreground of a sophisticated discussion.

CATERING TO DEMANDS FOR MASS PRODUCTION

With a view to ever-increasing industrialization and the accompanying demands of mass production, Harold Ipsen also demonstrated an insightful vision. He developed a solution in which components, preheated by inert gas in a central transport chamber, are fed from a preheating furnace module into a kiln module after heat treatment. These components then undergo quenching in a separate oil or gas module before being placed in a washing unit. This groundbreaking solution, registered under license number 3.212.765 in 1965, allowed for quasi-continued operation without quality losses during the transition from one operating step to another.

Harold Ipsen had already patented a new oil bath for particularly efficient quenching as early as 1958 under patent number 2.854.013. One of its innovative features was the sophisticated arrangement of flow deflectors in the floor, which allowed for more targeted and uniform circulation of the oil across all component surfaces. As a result, the heat transfer between the oil and the component was more uniform and efficient; the heat transfer coefficient increased due to a lower boundary layer thickness of the oil film; and at the same time, the hot oil was better transpor-

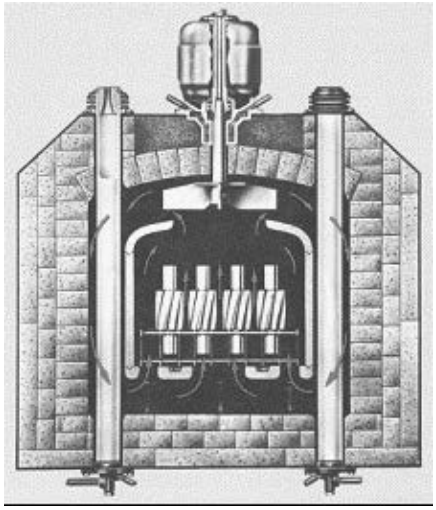

Fig. 2: Batch furnaces with muffle

ted into the colder part in the surrounding area. This also reduced the required oil bath volume, which in turn reduced investment and operating costs. This technology, known as SuperQuench, still makes Ipsen the only worldwide provider of complex quenching solutions. Several other patents followed, including one in 1961 for washing systems (2.972.352) and one in 1965 for quench baths with a parts transporting conveyor (3.164.656).

IPSEN STARTS CONSTRUCTING VACUUM INSTALLATIONS

Ipsen's clientèle was broadly diversified at that time. At the end of the 1950s, it included manufacturers of automobiles, washing machines and typewriters, as well as the aircraft industry. In the following decade, Harold Ipsen expanded his performance portfolio by developing and manufacturing vacuum furnaces needed for various applications in the field of military technology, as well as in the rocket and spacecraft construction (**Fig. 3**). Here, too, the entrepreneur proved lucky as he could expect sales of over € 9 million in 1965.

The fact that not every invention by Harold Ipsen had resounding success was easy to survive. Today, some of his patents might make you chuckle – such as the motor-driven propane and air gas mixing unit (dated 1960, Patent No. 2.961.005) – yet they demonstrate Harold Ipsen's boundless creativity and unfailing drive.

HIS LEGACY CONTINUES TO THIS DAY

Harold Ipsen was not only a gifted engineer and entrepreneur, but also an enthusiastic hobby pilot. This passion, though, proved to be fatal for him. His co-pilot was not on board, and Harold Ipsen, who was not an aviation professional, was unable to control the unequal thrust ratio. The machine ended up crashing to the ground, killing the 49-year-old inventor. His legacy, however, lived on. With more than 30 patents to his credit, Harold Ipsen's innovations continue to influence our

Fig. 3: One of the first vacuum furnaces

everyday life in ways that often go unnoticed. Whether it is automotive parts, turbine blades or tools, almost all of the world's leading manufacturers use the technology and heat treatment solutions developed by Harold Ipsen and his company, Ipsen International, which now employs 900-plus people. While nearly 70 years have passed since Harold Ipsen founded the company, it still embodies his creative and innovative spirit, as well as his enthusiasm for heat treatment and improving the world around us.

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