



EXPERT ARTICLE

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Die casting – economical forming process since the Industrial Age

Daily life is not imaginable without die cast parts any more. The die casting technology was developed in the mid-19th century associated with the industrial printing of newspapers and books. From the 1890s, die casting became more and more interesting for other industries and has undergone a constant development since 1914.

Die casting is a casting procedure which is carried out in a die casting machine where liquid metal is injected into a mould under high pressure and at high speed, thereby taking on its contours and solidifying rapidly. After solidification, the machine opens the mould and ejects the casting. Die casting is one of the most economical forming processes. With a single mould, hundreds of thousands of castings can be produced in a consistent quality and with a high-quality surface at relatively low unit costs. The most commonly used metals for die casting are aluminium, zinc and magnesium together with their alloys.

From printing to die casting

The die casting technology emerged in the mid-19th century, in an era which was characterized by many interacting, known today as the Industrial Age. The publishing industry, which was also flourishing at that time, had an outstanding significance for the die casting technology. Important inventions provided the basis for being able to print newspapers and books quickly, flexibly, in large numbers and cost-effectively. It is worth mentioning a manually operated device in which an alloy of tin and lead could be cast into printing types (1838), the rotary printing press (1846) and finally the Linotype setting machine (1886) developed by the German-American Ottmar Mergenthaler (1854-1899). One of the main elements of this machine was an integrated die casting machine. It filled the casting moulds which were

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NürnbergMesse GmbH
Messezentrum
90471 Nürnberg
Germany
T +49 9 11 86 06-0
F +49 9 11 86 06-82 28
euroguss@nuernbergmesse.de
www.euroguss.de

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built up from printing type dies made of brass and looked like a line of text with liquid lead. After casting, the printing type dies were returned to the die magazine, and the cast lead lines were ejected. Thereafter an operator pieced the lead lines together and formed pages which were used as printing plates for sheetfed printing or as templates for the round printing forms needed for rotary printing processes.

For the first 30 years, die casting was used almost exclusively in the printing industry. Also Herman H. Doehler (1872-1964), a native of Nuremberg, Germany, who had lived in the USA since 1892, worked initially in this that industry. Inspired by the Linotype process, he reflected about the potential applications of die casting and the implementation of the resulting ideas. He founded the Doehler Die-Casting Company in 1908 which in the early 1940s was regarded as the world's largest manufacturer of die cast parts and existed until 1998. The "Herman H. Doehler Award", which is awarded by the North American Die Casting Association (NADCA), is a reminder of this die casting technology pioneer.

Also the first commercially available die casting machine which contained all the essential components of a modern die casting machine, was developed in the USA, namely by Joseph Soss, an entrepreneur, and Louis H. Morin who received the corresponding patent in the year 1925 (Fig. 1).

At the time, towards the end of the 19th and during the first decades of the 20th century, new types of products were constantly brought on the market and industrial production was growing rapidly.

Manufacturers recognized the advantages of the die casting technology which could be used to produce parts for typewriters, cash registers, watches, electrical appliances and other goods. Toy manufacturers also used die casting to produce toy cars and model cars as true as possible to the original. Last but not least, the emerging automotive industry became a major purchaser of die cast products.

Since the early 20th century, die casting technology has progressed at increasing speed. Initially mainly lead and tin, two metals with relatively low melting temperatures and good ductility, were processed by die casting. In the period around 1914 die casting of zinc and aluminium alloys started.



These materials are characterized by higher strengths. Copper and magnesium alloys were added in the 1930s. Magnesium, which having a specific gravity of 1.74 g/cm³ weighs one-third less than the light metal aluminium (2.75 g/cm³) and is increasingly used in the automotive sector today, experienced its first prime time as a die casting material in the period from 1946 to 1978: The engine and the gearbox of the VW beetle were made of this material. The development of die casting technology, however, did not stop at a level which once had been achieved. The machinery has been equipped with more sophisticated control technology and has become ever more powerful, for mould making, tool steels with improved properties have come on to the market, and the physical properties of the die cast alloys have been optimized so that today castings with very thin wall thicknesses and simultaneously high mechanical properties can be manufactured. Current key issue are automation, energy and raw material efficiency, complex moulds, hybrid components, process optimization, and digitization (Industry 4.0).

The trade fair EUROGUSS 2020

An insight into the state-of-the-art in pressure die casting and suggestions as to how die casting foundries can strengthen and expand their market position will be provided at the EUROGUSS 2018 –International Trade Fair for Die Casting: Technology, Processes, Products in Nuremberg, Germany, 14 – 16 January 2020.

Contact for press and media

Katja Spangler, Simon Kögel

T +49 911 86 06-89 02

F +49 911 86 06-13 89 02

simon.koegel@nuernbergmesse.de

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