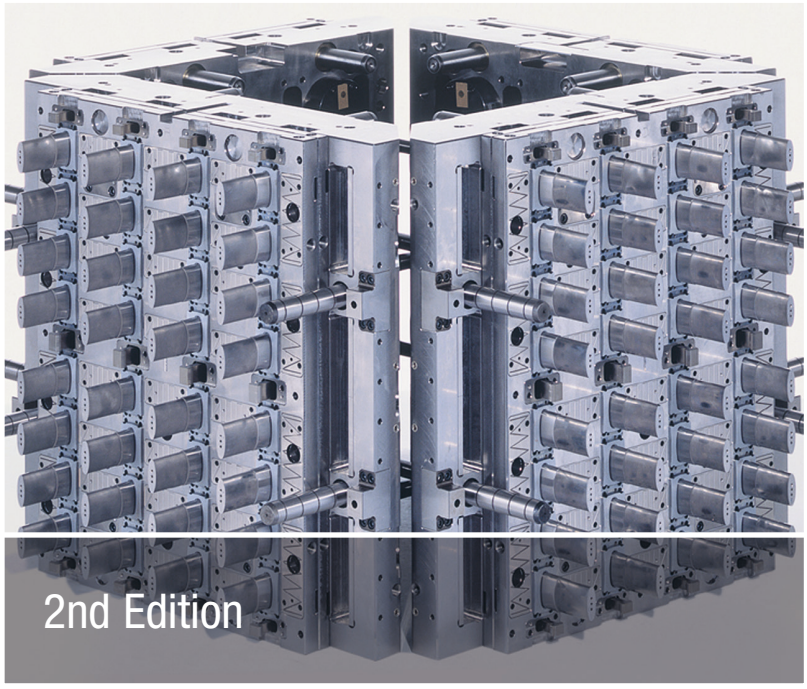
Harry Pruner
Wolfgang Nesch

Understanding Injection Molds



2nd Edition

HANSER

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Hanser Publishers, Munich

Hanser Publications, Cincinnati

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Distributed in the Americas by:
Hanser Publications
414 Walnut Street, Cincinnati, OH 45202 USA
Phone: (800) 950-8977
www.hanserpublications.com

Distributed in all other countries by:
Carl Hanser Verlag
Postfach 86 04 20, 81631 München, Germany
Fax: +49 (89) 98 48 09
www.hanser-fachbuch.de

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Library of Congress Control Number: 2020939510

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© Carl Hanser Verlag, Munich 2020
Editor: Dr. Mark Smith
Production Management: Jörg Strohbach
Coverconcept: Marc Müller-Bremer, www.rebranding.de, München
Coverdesign: Max Kostopoulos
Typesetting: Kösel Media GmbH, Krugzell
Printed and bound by Druckerei Hubert & Co GmbH und Co KG BuchPartner, Göttingen
Printed in Germany

ISBN: 978-1-56990-843-3
E-Book ISBN: 978-1-56990-844-0

How to Use the Book

The basis of the descriptions in this book are the thermoplastic molds. Divergent processes for thermoset or elastomer molds are explained at the end of the respective chapter.

In the subsequent table of contents, colored squares indicate whether the areas of thermoset and elastomers are identical, not identical, or not available at all for the thermoplastics. These markings are also continued in each section of the text, where the upper square represents the elastomers and the lower square represents the thermosets.

In the coloring of the principle figure, the following recurring colors were used:

red = Injection molded part
yellow = Second component in multi-component parts
orange = Explained component of one chapter

Elastomer or thermoset molds are identical
Elastomer or thermoset molds are not identical and are further described
Topic area for elastomer or thermoset molds is not available

Table of Contents

Preface

This textbook is specifically addressed for a beginner. The content provides the reader with a comprehensive and concise description of all the relevant components of an injection mold in a practical, easy to understand presentation. The chapters are designed so that they provide a complete basic knowledge of injection molds in chronological order as well as daily guidance and advice. The target group is not the designer, but the newcomers and processors in injection molding who can get a quick and comprehensive explanation of the variety of injection molds. In the foreground of the description are thermoplastic molds. In particular, the procedural aspects are highlighted in a compact form when explaining molds. Divergent processes for thermoset or elastomer molds are also described at the end of each chapter.

Particular emphasis is placed on a clear didactic structure of the book, so that the readers can capture all the essentials quickly. Deeper knowledge, as designers and professionals would require in production, can be found in other publications.

We are grateful for information from the users about optimizations of this textbook. At this point we would like to give a special thanks to the companies that supported us by providing expert information, constructive criticism, and pictures, as well as all employees of the Carl Hanser Publisher who were involved in the creation of this book.

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1 Basic Mold Design

1.1 Assemblies of an Injection Mold

The most important elements of an injection mold, along with the common technical terms, are given in the introduction to provide a basic understanding of the technology. An injection mold generally consists of two mold halves: a nozzle side and an ejector side. The cavity inserts, the sprue systems, the cores, the ejector elements, and the cooling system are located in the mold halves.

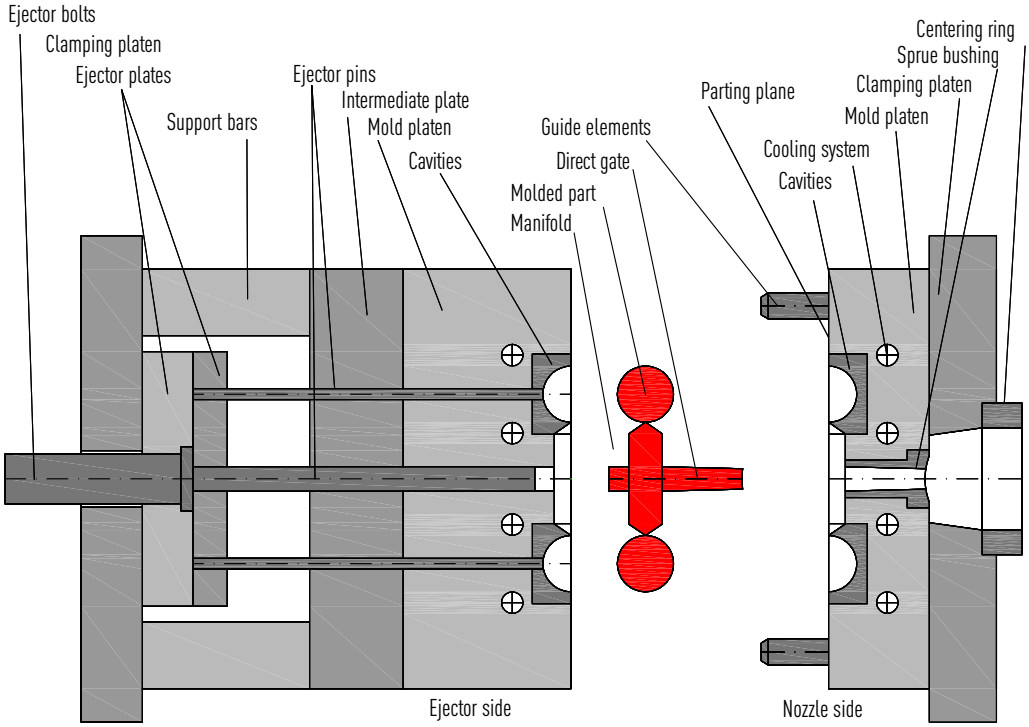

Figure 1.1 Principle of a two-platen mold

1.1.1 Phases of Design

It is important to start with a basic sketch of the mold to see which mold technology can be used. It is necessary to determine whether special functions are needed and if this concept is suitable for a fully automated production. Then the number of cavities should be evaluated, because this will affect the injection molding machine size and the dimensions of the mold. The next step is the determination of the plastic material. Is the plastic material easy-flowing, viscous, or reinforced? Does the mold need to be cooled or heated? Which sprue system is to be used?

With this knowledge, the design can begin. First, a parts drawing in 3D has to be made. Then a decision is made whether the filling simulation (mold flow analysis) is carried out for this part module. For a part that is exposed to mechanical stresses, a finite element analysis (FEA) and a simulation process may also be necessary.

The big advantage of this approach is that, except for the production of the prototypes, all functions are possible with computer-aided design (CAD) programs. Once this phase is completed, discussions with the customers for the detailed clarification of all points are recommended. This is followed by the release of the design. The mold and the individual components are then produced.

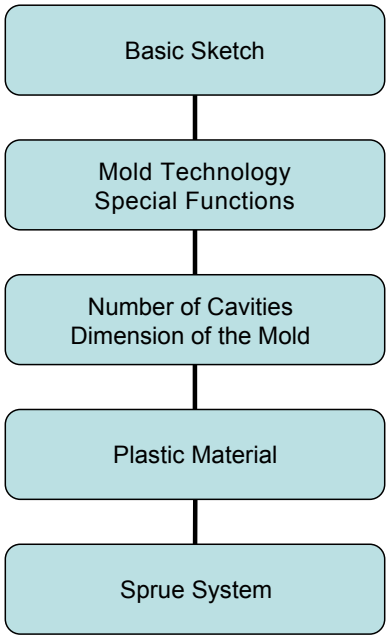

Table 1.1 Information Phase

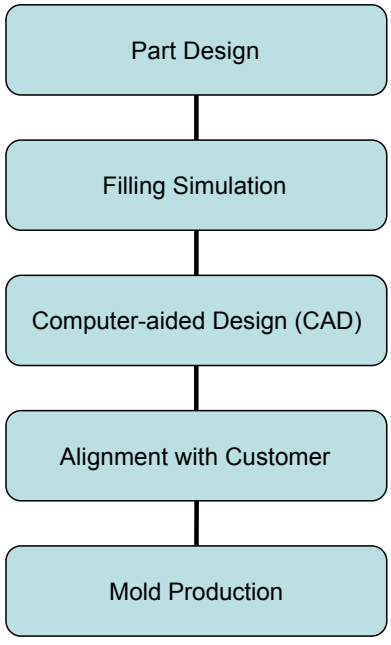

Table 1.2 Design Phase