PATTERNMAKING

A treatise on the construction and application of patterns, including the use of woodworking tools, the art of joinery, wood turning, and various methods of building patterns and core-boxes of different types.

by

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Excerpts:

Chapter I: Types of Patterns and Their Relation of Molding Problems.

"A PATTERN may be defined as a model of anything, so constructed that it may be used for forming a mold or impression in damp sand or other suitable material. This mold, when filled with molten metal or substances that solidify, forms a reproduction of the pattern and is known as a casting. The essential difference between a true model and a pattern — according to the general usage of these terms — is that, in making the former, the question of reproduction by casting is not a factor, while in making a pattern the principles of molding and the needs of the molder must be considered… Another point of difference between a model and a pattern is the contraction or shrinkage allowance placed on the pattern; this is an oversizing to compensate for the shrinkage of the metal in passing from a liquid state, and it differs widely from different metals." (p. 1)

Chapter VI: The Laying Out of Patterns.

"**Draft on Patterns.** — Draft is a tapering of all the vertical faces of a pattern to permit its removal from the sand without excessive rapping on the part of the molder. There is no rule fixing the amount of draft to give a pattern. A good plan is to give as much draft as possible without distorting the pattern. This draft may vary from 1/32 to 3/16 inch or may even be as much as 1/4 inch per foot of height. The draft always runs away from the pattern face; that is, the pattern face is the larger side of the pattern. If none of the faces is at right angles to the pattern face, then no draft will be required. Very small patterns and those of larger sizes to be used in molding machines are often made without draft." (p. 134)

"**Contraction or Shrinkage.** — Contraction or shrinkage allowance is the amount that a pattern is made over size to compensate for the contraction of the casting metal. The total amount that a casting will shrink depends largely upon its size and shape. If it is long and rather light, it will shrink more than a casting of the same weight but of more compact shape, even when cast in the same metal and under the same conditions. Cylinders and column-shaped castings will shrink more lengthwise than radially. They will shrink about 1/10 inch per foot lengthwise, while the radial shrinkage will be from 1/20 to 1/16 inch per foot.

A rule used by foundrymen producing columns for building purposes is to allow 1/8 inch per foot on the length and nothing in the diameter. A shrinkage of 1/10 inch per foot is considered the standard for machine castings, and although it is not the proper amount for all forms of castings, it averages up pretty well and does away with the confusion that would naturally follow the use of a number of shrinkages for different parts of a job or different forms of castings. Although there is no fixed rule governing this question, experience as shown that the amounts given in the accompanying table, "Shrinkage of Castings," are approximately correct." (p. 135)

Shrinkage of Castings

Usual Allowance for Each Foot in Length			
In large cylinders……..	3/32 inch	In zinc……...	5/16 inch
In small cylinders…….	1/16 inch	In lead……...	3/16 inch
In beams and girders……	1/16 inch	In tin…….	1/4 inch
In thick brass……	5/32 inch	In copper……...	3/16 inch
In thin brass……..	3/16 inch	In bismuth…….	5/32 inch
In cast-iron pipe……...	1/8 inch	In malleable iron……..	1/8 inch
In steel……	1/4 inch	In aluminum…….	1/5 inch

"**Finish Allowance.** — In addition to the shrinkage allowance, there is still another allowance to be made, and that is the finish or amount that will have to be added to certain parts of the casting to permit them to be finished or machined to the proper size. The amount varies widely, depending upon the size of the casting, the methods of machining it, and the degree of finish required. Castings to be finished from the rough on disk grinders require but little finish allowance. It is the practice in some shops on this class of work to let the molder's rapping allow for the finish. On small or medium-sized work that is to be finished in the lather, planer, or milling machine about 1/8 inch will be enough for the machining operations…" (p. 136)

Chapter XIV: Finishing Pattern Work.

"**Pattern Varnish or Shellac.** — Varnish used as a protective covering for patterns has for a base what is known as yellow or orange shellac. Shellac comes in thin, brown, flaking, irregularly shaped pieces. It is mixed or cut by placing a quantity of it in a glass

or earthenware jar and adding enough alcohol to cover it. The alcohol may be grain, denatured, or wood; any of these will do, but grain alcohol is the best. Wood and denatured are generally used on account of their lower cost. Black shellac is made by adding to orange shellac a good quality of lampblack that is free from grit. A good grade of finely dry-ground vermilion will make an excellent red shellac." (p. 313)

"**Varnish Pots and Brushes.** — Pots for holding clear or yellow shellac should be of glass or earthenware, as the chemical action set up by the use of a metal pot will darken the shellac; a metal pot may, however, be safely used for black or red shellac. Shellac pots should have tightly fitted covers to prevent excessive loss through evaporation.

Shellac that has become discolored may be cleared or cleaned by adding a small quantity of powdered oxalic acid, but care should be taken not to get this mixture into cuts or wounds, as oxalic acid is poisonous.

Shellac is best applied with the flat chisel-shaped brush made of badger or camel's hair. These brushes come in a number of widths, but for pattern work the 1-, 1 1/2- and 2-inch widths will be found most convenient. A leather- or rubber-bound brush should be used for clear shellac, as a metal binding will affect the shellac in the same manner as a metal pot. To keep the bristles straight the brushes should hand in the pot and not stand on the bottom." (p. 313)

"**Applying Pattern Varnish.** — Shellac varnish dries quickly and, if of good quality, is not easily affected by heat or moisture; it has the added advantage of being easy to cut through if alterations are called for after the pattern is finished. The first coat should be evenly applied and the varnish should not be too thin, as the moisture has a tendency to raise the grain of the wood, and if applied too thin will roughen the surface so that it may never be smoothed. The first coat should be given ample time to dry before the second is applied. There is no rule as to the amount of time to allow, but the more the better. Before applying the second coat, the surface of the pattern should be rubbed smooth with a piece of fine sandpaper held in the hand, and this should be done between each successive coat. Never use a block for sandpapering a varnished surface. The number of coats to apply will be governed by local practice, but for good work at least three coats should be given." (p. 313 – 314)

"**Casting Metal Indicated by Pattern Color.** — It is the practice in some shops to use a given color on patterns, as an indication of the metal it is to cast in. For example, all patterns to be cast in iron would be black, red would indicate steel, and yellow would mean brass or composition." (p. 314)

"**Finishing Metal Patterns.** — The surfaces of metal patterns should be filed smooth and all holes filled with solder or lead. There are several methods of finishing surfaces, the simplest of which is called the rusting process. All oil and grease must be removed by a steam bath or by scrubbing with hot soda water; this treatment is followed by several successive applications of a solution of water and sal-ammoniac, in order to obtain a well-rusted surface which is rubbed to a smooth finish with emery cloth. The final finish is given by heating the casting and rubbing bees wax on the surface while it is warm.

This is to prevent the damp sand from sticking to the pattern or causing it to rust." (p. 315 – 316)

"**Pattern Letters.** — Pattern letters are used for reproducing firm names, identification letters, or figures on castings… They are made of either brass or a soft alloy of tin and lead, and they may be procured in three styles, know as "Roman," "Sharp-faced Gothic," and "flat-faced Gothic." The sizes range in height from 1/8 inch to 4 inches. The brass pattern letters are used on metal patterns and the soft metal ones on wood, as they are easily bent to conform to curved surfaces.

Brass pattern letters are attached to metal patterns by sweating. The surface to be covered by the letters, and the back of the letters themselves, are tinned or given a thin coat of solder. This is done by heating the surfaces enough to melt the solder. A flux such as sal-ammoniac should be applied before the solder. The tinned surfaces are then reheated and the letters put in position. Soft metal letters are fastened to wood patterns by means of shellac, or shellac and small brads. Before an attempt is made to apply the letters to a pattern, their position must be decided upon and lines drawn as a guide for setting the letters. The letters should first be arranged dry for position and spacing, and the position of the first and last letter in each line marked. The letters are then placed face downward on a piece of board and shellacked, as is also the surface to which the letters are to be applied. When the shellac has become quite sticky, the letters should be reapplied and adjusted. A knife with a sharp-pointed blade will be found an excellent tool for this purpose." (p. 316)