

Patterns and the Molding of Cast Iron Banks

Supplement No. 7: Match Molds*

Fritz Kokesh

"In making the mold for small castings...much time and labor may be saved by using a follow board that will form the joint; then, when the board is lifted off, parting sand can be sprinkled on and the joint is ready for the cope."

(Secrets of Green-Sand Casting)

A. INTRODUCTION

The article "Patterns and the Molding of Cast Iron Still Banks"¹ explained how the combination of a pattern tree² and match mold (see Figure 1) was used during mold making. It was explained that the match mold, which also was called a "follow board" or just plain "match," was a labor saving device³ that allowed Molders to complete molds much more rapidly. (The match mold never contacted molten metal; the latter point frequently is misunderstood.)

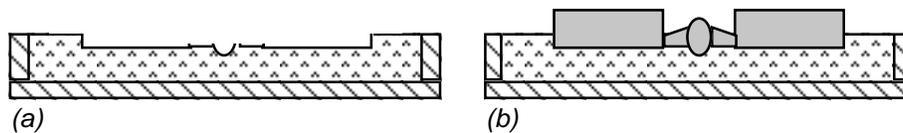


Figure 1. (a) Cross section of a match mold and (b) the match mold with its complementary pattern tree inserted.

The match molds used in the manufacture of cast iron still banks and toys usually were a "composition match," a type of match mold with an impression of the pattern tree in hardened sand composition within a wood frame and the impression was of the outer surface of the patterns. Such a composition match was made from each pattern tree, and that combination of match and pattern tree was kept together and used over and over during mold making.

The current article describes the process of making a composition match and the sand composition used to make it. Hopefully, it also offers additional insight into the purpose for and appreciation of the benefits of using a match mold. Three other types of match molds are discussed at the end of the article.

B. MAKING A COMPOSITION MATCH

It is easier to understand the process for making a composition match if it is presented in two stages: first the making of the drag half of a mold (see Figure 2), then the use of the drag to make the composition match.

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Part I: Making the Drag

You might recognize that the partial mold depicted in Figure 2 is identical to that created during mold making with a match mold; see Figure 4(a) of "Patterns and the Molding of Cast Iron Still Banks." So, to understand how a composition match was made one must begin by understanding how a green-sand mold was made *without* using a match mold.

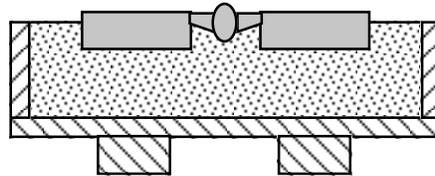


Figure 2. The drag half of a green-sand mold.

The process began with the pattern tree being placed on a wood follow board. If the pattern had a flat surface, the follow board was flat. An optional spacer was added to create the offset between the top edge of the flask and the parting line of the mold that can be seen in Figure 2. Alternatively, a series of wedges was used to create this offset.

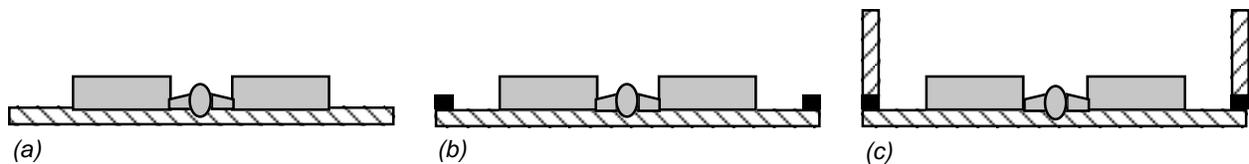


Figure 3. (a) The pattern tree placed cope-side down on the follow board. In (b) a spacer frame has been placed on the follow board, and in (c) the drag half of the flask has been added. (The central gate is shown penetrating the top surface of the follow board, but this was not necessarily the case and is ignored in the explanation.)

Parting was applied, and molding sand added and rammed in exactly the fashion used when a mold was being made for casting. Then a bottom board was placed atop the flask and the drag rolled over (turned upside down).

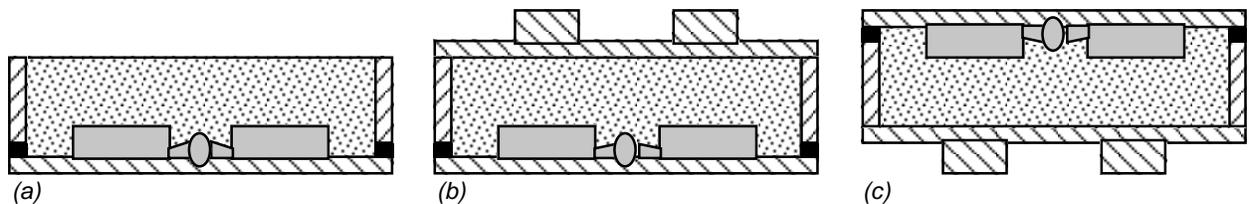


Figure 4. (a) The drag has been filled with molding sand, rammed and trimmed. In (b) a bottom board has been added, and in (c) the mold has been rolled over.

Now, the wood follow board was removed and set aside, and the spacer or wedges removed. The next step was to "cut down to the joint." This was the careful removal of the sand down to the parting line of the pattern. Slicks and trowels were used, examples of which are shown in Figure 6. Notice that Figure 5(c) is identical shown in Figure 2. So, the drag half of the mold now was complete.

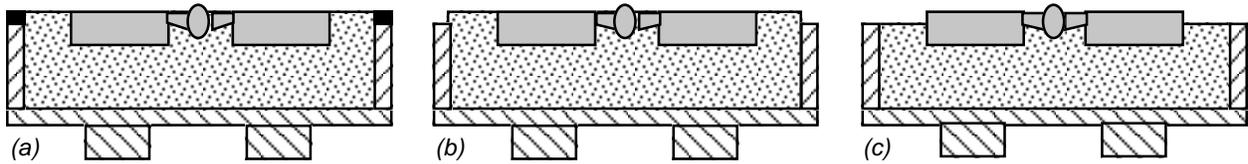


Figure 5. (a) The wood follow board has been removed, and in (b) the spacer frame also as been removed. In (c) the joint has been cut; molding sand has been removed down to the parting line of the mold.

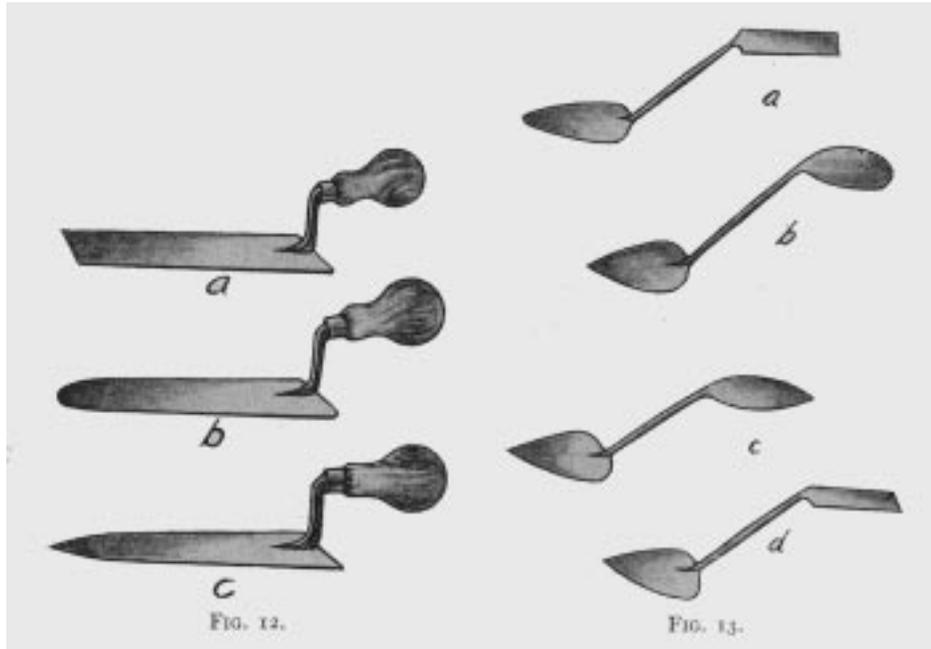


Figure 6. Examples of Molders' trowels and slicks from "A Text-Book of Elementary Foundry Practice."⁴

Part II: Making the Match

Once the drag had been made, the hard work was done (at least it seems that way to me). Now a frame was added that would become a permanent part of the composition match. The frame was filled and rammed with a sand composition (see below) that would harden to form a permanent and durable impression of the pattern. Nails projecting inside the frame helped hold the hardened sand composition in place. Then a bottom board was attached.

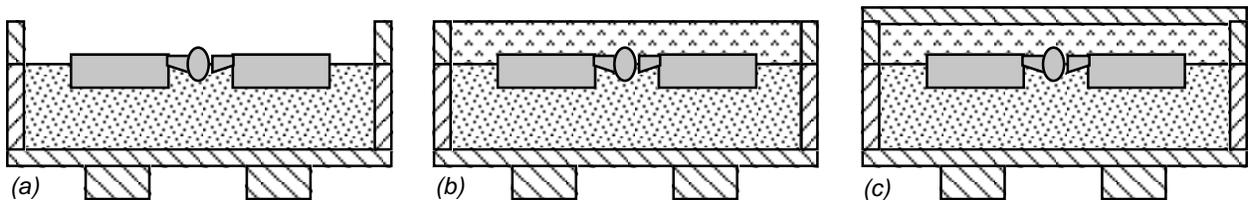


Figure 7. (a) The frame for the composition match has been added and in (b) the frame has been filled with the sand composition, rammed, and trimmed. In (c) a bottom board has been added and nailed or screwed to the frame.

The mold was rolled over, and the drag lifted off. Then the pattern tree was carefully removed. Minor repairs were made to the composition match, if necessary, and it was left undisturbed while the sand composition hardened.

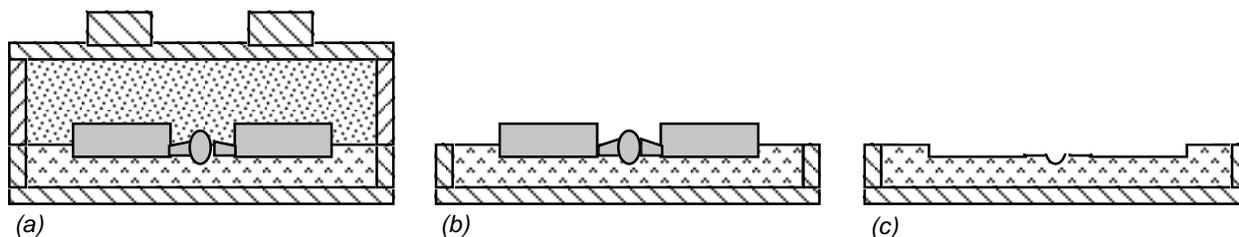


Figure 8. (a) The mold was rolled over and (b) the drag lifted off. (c) The finished composition match. After the sand composition has hardened the new composition match is ready for use. Note Figure 8(c) is identical to Figure 1(a).

C. SAND COMPOSITION

The following instructions for preparing the sand composition are quoted from *Secrets of Green-Sand Casting*.⁵ Note that "litharge" is lead monoxide.

"In place of ramming the frame (Figure 7(a)) with molding sand, a composition may be used that will become harder and last longer than the sand match. A composition often used is one made up of fine sand, boiled linseed oil, and litharge. The sand should be very dry. Add 1 part of litharge to about 20 parts of sand, mix thoroughly, and then sift the whole through a fine sieve. Temper this mixture with the oil to the same temper as sand intended for ordinary green-sand molding. The mixture is rammed, as one would ram a mold, to a degree of hardness equal to that generally required in copes. After the ramming has been done, the bottom board is screwed to the frame. The match and the drag on which is made are then rolled over together, the drag carefully lifted away, and the joint finally finished. Before these matches are dry, they are about as fragile as so much dry sand, and require the utmost care in handling, as well as in removing the pattern for the first time. When the match is dry its surface should be given a coating of shellac, which will prevent the sand from adhering to the surface. Before putting the match away, its edges and surface should be finished in the same matter as sand matches, using linseed oil instead of the molasses."

Additional instructions in the 1924 catalog⁶ of The S. Obermayer Co., a foundry supplier, noted that: *"When not in use, the patterns should be kept in the match to avoid shrinking. If properly made and handled, a match of this composition should last for years."*

D. OTHER TYPES OF FOLLOW BOARDS

The follow boards used in the manufacture of cast iron banks were generally the composition type described above. But, molders also used three other types of follow boards: wooden follow boards, plaster-of-Paris follow boards, and match boards or match plates.⁷

Generally speaking, a follow board is "a board shaped to the parting line of the mold."⁸ So, the simplest wooden follow board was just a flat board like that depicted in Figure 3(a). If the pattern

had an irregular surface, then the follow board had a complementary shape. Such wooden follow boards were made by the Pattern Maker.

Plaster-of-Paris matches could be made in much the same way as composition matches by substituting plaster for the sand composition. Plaster-of-Paris matches more perfectly fit the pattern or pattern tree and were very hard, which aided in ramming the molding sand. But this type of match also was relatively fragile and difficult to repair.

Simple match plates were made by attaching a pattern to a flat follow board. These "mounted patterns" or "match follow boards" served the purpose of both the composition match and the pattern tree, and were the forerunners of the "match plates" used in modern foundries. (Kenton began using match plates in about 1940.⁹)

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References

¹ Fritz Kokesh, "Patterns and the Molding of Cast Iron Banks, Seminar by Bill Robison," *Penny Bank Post*, April 2003, p.5.

² Fritz Kokesh, "Patterns and the Molding of Cast Iron Banks. Supplement No. 1, Working Patterns and Pattern Trees." privately published, 2003. Available at: www.toybanks.info .

³ Sometimes the match mold was more than just a labor saver. It was absolutely essential when a pattern didn't lie flat and the match mold kept it from moving during ramming.

⁴ William A. Richards, "A Text-Book of Elementary Foundry Practice," The MacMillan Company, New York, 1912, p. 17.

⁵ "Secrets of Green-Sand Casting," International Correspondence Schools, 1906. Reprinted by Lindsay Publications, Bradley, Illinois, 1983, Part 3, p. 9.

⁶ The S. Obermayer Co., "Manufacturers, Everything You Need in Your Foundry," General Catalog No. 51, undated, 1924 or later (on p. 13 is a Dec 2, 1924 patent date), p. 321.

⁷ "Secrets of Green-Sand Casting," p. 7.

⁸ Metal Technologies Group, Terms & Definitions, <http://www.metal-technologies.com/terms.asp> .

⁹ Robert Saylor, personal communication.