PRACTICAL MECHANISM.

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SECOND SERIES—Number X.

PATTERN MAKING—THE FOUNDERY

It has been already remarked that the operations of the molder are, to a large extent, predetermined by the pattern maker; hence it becomes necessary that the latter shall have a knowledge of foundery work, otherwise he is likely to make the patterns very expensive and awkward to mold. In learning the trade, an apprentice is usually put to work and distinctly instructed as to the required form of his work without knowing anything of the reasons therefor. In this way he attains a practical knowledge of how different classes of patterns should be, or are, usually made; but it takes him years to become an expert mechanic, for the reason that, having learned by rote, he is incapable of meeting new conditions to the best advantage, until his experience has included both observations in the foundery and, in some cases, consultations with founderymen. Before entering, therefore, into the method of putting together different kinds of pattern work, it will be well to take a glance at the foundery, and examine the contrivances and the operations of the workmen, so that our operations in pattern work may be intelligently made from the beginning.

The floor of the foundery first demands our attention. It is composed of a layer of molding sand of sufficient depth to imbed patterns of the size usually cast in that foundery. For exceptionally large work, there is usually a place where the natural earth has been excavated to a greater depth; the cavity is filled with molding sand. This place is usually within easy reach of the crane (which commands almost every part of the floor) and the threshold of the melting furnace or cupola. We next observe the capacious oven for baking cores and drying molds for such special work as may require these operations; but the particular contrivance with which the patternmaker has now to concern himself is represented in Fig. 67. It is called a flask, and is composed of two or more parts (two only being shown in the engraving). The lower part is called the nowel, and the upper the cope. Each part is simply a strong rectangular frame of wood or iron. The sides, being continued past the rectangles, are roughly shaped for use as handles. The cope is provided with several crossbars, which embrace the pattern as it were, being roughly shaped like it in contour and approaching it in size, being about half an inch larger all round. These bars, by their adhesion, support the body of the sand in the cope, and in this they are frequently assisted by nails driven in nearly half way into them. When an intermediate part is used with the two parts shown in Fig. 67, the contrivance is called a three-part flask; with two intermediates it is called a four-part flask, and so on. As the cope is provided with crossbars, so also the intermediates, having to lift a ring of sand, are provided with wings; that is to say, as much crossbar as will extend from the sides to within about half an inch of the pattern. The parts are guided, in their position one to the other, by taper pins on one part fitting into eyes fixed to the other part, as shown in Fig. 67, in which the cope is shown with the side having the two pins exposed to view, while the opposite side of the nowel, having one eye, is visible. In many cases and for large work, the nowel is dispensed with, and the foundery floor is used in its stead, in which case the cope is guided to, and retained in, its place by stakes driven into the floor sand, as shown in Fig. 68, so that, when lifted to admit of the pattern being drawn from the mold, the cope may be returned again to its exact proper and former position. In Fig. 68, A represents the pattern whose impression in the floor sand, at M, forms part of the mold. B represents the cope; for the word cope is usually applied to the upper part of the mold as well as to that portion of the flask which contains it. The top print, C, of the pattern, has formed its impression in the cope at P. R is a round taper peg, which leaves a hole in the cope at *r*, through which hole the molten metal is poured. It also leaves an indentation at *r'*; and from this latter a gutter is made by the molder to communicate with the mold, M, as shown. The stakes referred to above are marked S. The dots, shown around the impression of the top pattern print, C, in the cope, are small holes made in the sand (after the molding is finished) by a piece of fine wire, and are for the purpose of giving vent to the air and gases which must escape when the metal is poured in.

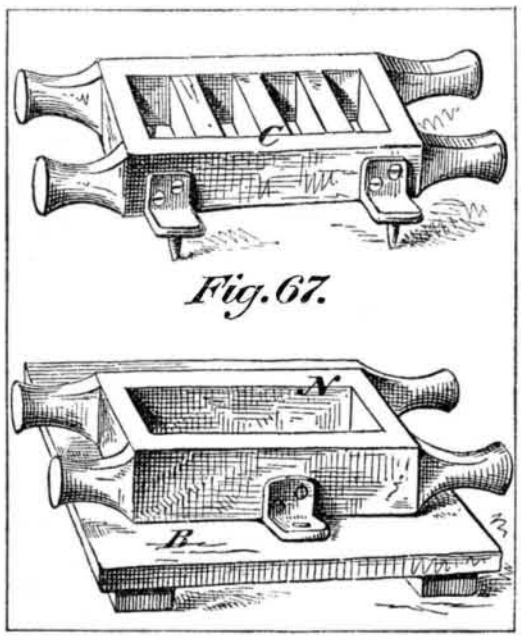

Fig. 67.

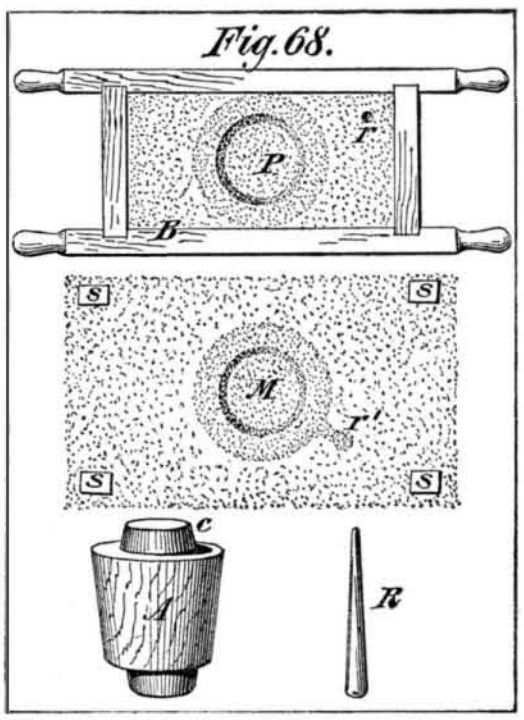

Fig. 68.

It will be seen that, when a mold is made in the flask we have described, it can perform no further duty until the casting has been made; for every mold, therefore, we require a flask, and hence the pile of these appliances we always see in a foundery. For light work, however, a comparatively modern and greatly improved device has come into general use. It is termed a snap flask, each part having a hinge at one corner and a latch at the diagonally opposite one; so that, after the mold is made, it can be detached from the perfected mold and can be used to make another. For the details of its construction and use, the reader is referred to page 111, Vol. XXVIII., since it is not our purpose to here discuss the merits of such contrivances. Sometimes, though rarely, it happens that a casting is required of such form that the patterns cannot be constructed so as to be molded with a flask of the ordinary kind. The flask requires to come to pieces and the mold to be parted sideways; this adds greatly to the labor of the molder, and the patternmaker should so construct the pattern as to avoid this whenever he can devise any means of so doing. Even when the pattern is molded in the floor, the mold is sometimes of necessity made to part on one or more of its sides, and these partings are termed drawbacks. An example of this class of work will be given hereafter.

By matching the operations of a molder, we shall observe that, in the case of a solid pattern, that is to say, a pattern not made in halves, he always endeavors to have as little of the pattern in the cope as possible, and in this respect the patternmaker should supplement his efforts. The reason is obvious: the cope has to be lifted while as yet there has been no opportunity to loosen the pattern in the mold. It is true that, in some cases, a bar is passed through the cope and driven into the pattern, and by rapping it the loosening is accomplished; but it is not well to have recourse to such an expedient, because, wherever the bar passes, the cope is damaged, and must be mended; and when a mold has to be mended, it is doubtful if the correct form, such as the pattern would have given it, will be left. Furthermore, it is all work in the dark; for the effect or extent of the rapping cannot be scrutinized, and it may therefore produce an undue distortion in one direction, while in another it may not have been effectual. Perhaps the bar may have descended at a place in the pattern where it is comparatively weak, from crossgrain of the wood or from some other cause. This measure is, therefore, on account of these difficulties, seldom resorted to; and it may be generally disregarded in the calculations of the pattern maker. The cope, then, being, as we may say, a dead lift, and with nothing to guide the operator in moving it, either horizontally or vertically, any part of the mold contained in it is much more liable to break down than is the other part of the mold. In extracting the pattern from the lower part of the mold, the eye lends to the molder great assistance. The pattern can be loosened in the sand before extraction, and is furthermore less cumbersome to handle than is the cope: all of which circumstances tend to preserve the lower part of the mold from damage during the extraction of the pattern. Rapping a pattern tends to alter the form of the mold from that calculated upon. A circle becomes slightly oval, a square becomes an oblong, and so on: and this cannot in most cases be avoided, because it is necessary to rap the pattern so as to enable the molder to extract the pattern without drawing out the sand with it; all that can be done in this direction is to rap the pattern as little as possible, and equally in all directions.

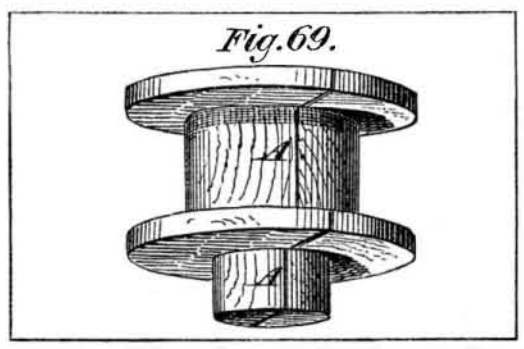

Fig. 69.

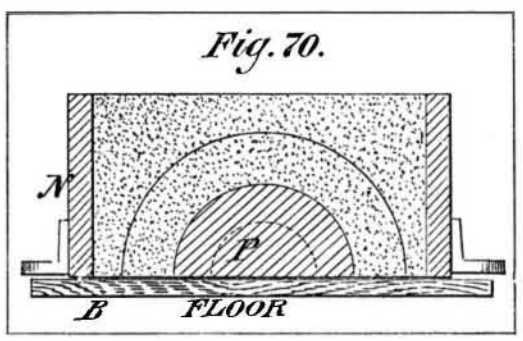

Fig. 70.

When a flask nowel is used, the labor involved in making a parting of the mold is facilitated. Fig. 67 shows a board cope and nowel for an ordinary straight parting; but it is evident that the parts of the flask may be made to show a crooked, a curved, or irregular line at the joint, if it is required, in which case the bed board must be made of similar conformation. The process of molding with a flask independently of using the floor, instead of a flask nowel, is illustrated in Figs. 70 and 71. If it be required to mold the pattern illustrated in Fig. 69, which is made in halves, the joint being denoted by the line, A A, one of the halves is taken and laid with its flat face upon the molding board, B, shown in Fig. 70. The nowel, N, is then placed upon the board, so that the half of the pattern will be in about the middle of the flask nowel. Sand is then rammed tightly in the nowel; and when the latter is filled with the sand, it is turned upside down, showing the flat face of the half pattern, the rest of the half pattern being imbedded in the sand. The other half of the pattern is then placed upon the one in the sand, its proper position being determined and regulated by pegs fitting into holes, provided in the first part, to receive them. The next operation is to put on the cope, as shown in Fig. 71, the taper pins being fast to the cope lugs shown on the sides, fitting into holes provided in the nowel lugs, similarly shown, serving to hold the cope in position and prevent it from moving. The cope is then filled with sand, lightly rammed, the taper pin, R, Fig. 68, being inserted to leave in the mold the hole, R, Fig. 71, through which to pour the melted metal. The cope is now lifted vertically; and as the pattern is made in halves, the top half lifts with the sand in the cope. In some cases a screw is fixed into the top half of the pattern, the head of the screw projecting into the cope: the object being to insure that the top half of the pattern shall lift with the cope. The next procedure is to extract the two halves of the patterns from the molds, and perform any trimming or repairing that the mold may require, after which the cope is again placed upon the nowel, and the mold is complete, ready to have the metal poured in.

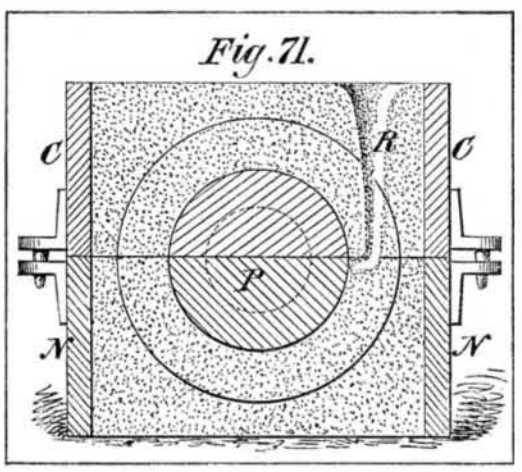

Fig. 71.

Simian Sagacity.

The sagacious monkey, who, according to the time-honored story, used the reluctant paw of a cat to withdraw hot chestnuts from the fire, is outdone by the performance of another member of his tribe, which is recounted by a French resident of South Africa, in a letter to *Les Mondes*. The writer is the possessor of a large coffee plantation, and his crops have suffered severely from the ravages of a large species of baboon, which greedily devours the fruit of a small tree which grows among the bushes. The best safeguards against the depredations are the wasps which make their nests in the lower part of these trees, for, of the fierce attack and painful stings of these insects, the baboons have a wholesome fear. One morning, a hideous chorus of yells and howls was heard from a portion of the plantation where the wasps had most thickly congregated, and where the fruit trees consequently were heavily laden. On searching for the cause, the writer saw from afar a venerable and ancient baboon busily engaged in throwing infant monkeys at the trees. These living projectiles thus knocked down the nests and of course were objects of the keen attentions of the infuriate occupants. Meanwhile the baboon quietly made his way to the upper branches, gorged himself, and then added insult to injury to the badly stung monkeys by pelting them with the rinds and pits of his repast.

THERE is no royal road to learning; its acquisition without study is like the acquisition of wealth without labor. It is as necessary for the mechanic to study out his problem, when it comes to him to be studied, as it is for him to finish his task by his handicraft.