FOUNDRY PRACTICE: A TREATISE ON MOULDING AND CASTING IN THEIR VARIOUS DETAILS

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Foundry Practice: A Treatise on Moulding and Casting in Their Various Details by James M. Tate & Melvin O. Stone

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BY

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AND

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INTRODUCTION

In administering the work in foundry practice at the University of Minnesota, the want of a good text book has been a serious disadvantage. The work of the shop and that of the class room should be correlated—shop work should be studied and discussed in the class room, and examples illustrating the various principles underlying good practice should be worked out in the shop.

While there have been some excellent books written upon the subject of foundry practice, yet, as a rule, these have been written with the needs of the experienced molder in view rather than those of the beginner. For this reason it is a difficult matter to teach the subject so that the student will acquire an intelligent understanding of its various details. The nomenclature and shop phraseology are not sufficiently elementary for the average beginner to grasp the statement presented, and much time is frequently spent in explaining an author's meaning.

The present little treatise has been written with a full knowledge of the problems involved and with the object of lessening some of the difficulties which arise in teaching the subject. The authors are both men of wide experience in foundry practice and its correlated subjects. Mr. Tate is an experienced pattern maker, who has been in charge of the pattern shop at the University of Minnesota for the past fifteen years, and during a part of this time he has also had charge of the work in the foundry. Mr. Stone is a graduate of the University, who has given especial attention to foundry work, both from the standpoint of the chemist and from that of the molder.

In presenting this work on foundry practice, the authors realize that it is not a complete treatise on the subject. The aim has been to produce a book in which the principles of foundry practice are set forth concisely and clearly; with the needs of the engineering student in view rather than those of the practical foundryman. To this end numerous examples are given representative of the different kinds of molding, and it is believed that the simple methods used in illustrating and describing the various operations involved and the reasons therefor will give the student a ready knowledge of the details of molding which will go far to supplement the practical work of the foundry, which, in a college course, must necessarily be limited.

While the treatment is thus somewhat brief, the subject matter as here presented is intended to cover all ordinary work in foundry practice including both brass and iron casting.

A glossary of foundry terms has been added, as it has been found that to obtain the greatest value from a work of this character, the reader must become familiar with names and expressions used by foundrymen, for even if it were possible to eliminate shop expressions, it would be undesirable to do so.

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University of Minnesota.

Minneapolis, Minnesota,
September, 1904.

The authors wish to acknowledge their indebtness to Mr. E. A. Johnson, Instructor in Foundry Practice at the University of Minnesota, and also to other foundrymen for information and suggestions received in the preparation of their work.

FOUNDRY PRACTICE

CHAPTER I

A **sand** suitable for **molding** must be open to allow the escape of gases and must be able to hold a given form to withstand pressure and wash of the metal. Such a sand has a percentage of clay or binding material which will hold the mass together firmly when dampened and compressed. If the percentage of clay becomes too great, the sand is too close when compressed, so the gases cannot pass off; then the metal will not lie quietly against the face of the sand.

The molding sands used in different parts of the country vary greatly in their composition. Those high in clay must be used with as little **water** as possible and must not be compressed or rammed much as the mold must give free escape for gases through the sand. The coarse sands very low in clay may. require much water and hard ramming in order to form a satisfactory mold. The tempering and ramming of the sand must be largely gauged by the nature of the sand the molder has at hand.

Tempering the sand means the mixing and wetting of the sand ready for making a mold. It is otherwise known as **cutting over the sand.**

The sand should be mixed evenly and to a dampness such that it will stick together when squeezed in the hand, but not so wet as to show moisture or dampen the hand. The sand pile should be opened out so that there will be no holes in which the water will accumulate. The water should then be thrown over the sand in thin sheets by swinging the pail with the bottom slightly ahead of the top. In this manner the water is distributed evenly and does not cause mud in spots. If the sand is wet excessively in spots as by throwing the water on the pile in a body, it requires much more shovelling to obtain an even temper, hence loss of time. The sand should then be shovelled over in order to mix thoroughly. The shovelling should be done so as to scatter the sand when casting it from the shovel. This is accomplished by giving the handle of the shovel a twist just as the sand is leaving it. When wishing to throw the sand to a distant point, it should be allowed to leave the shovel in a solid mass, but this does not mix it evenly. In mixing, a space should always be kept between the pile from which the sand is taken and the one to which it is thrown. If this is not observed some of the sand will not be thoroughly mixed. After the sand has been shovelled over once it seldom is found to be mixed thoroughly, which makes it preferable to cut it over from two to three times. All the water necessary for the proper tempering should be put on before shovelling over the sand the last time. When trying to find whether the sand needs more water or not the hand should be forced into the pile to get some sand from the interior from which to determine its temper. This should be done at several points. When only a little more water is necessary it should be sprinkled on by throwing the water from the pail with the hand.

The molder or helper should learn to shovel either right- or left-handed, so as to be able to take either side of the heap when working with an assistant.

The **riddle** is the sieve used for sifting the sand. Its meshes range from 2 to the inch to 16 or 32 per inch. They are numbered according to the number of meshes per inch, as a No. 2 riddle means one having ½ in. meshes, a No. 4 has ¼ in. meshes, a No. 16 has $^1/_{16}$ in. meshes, etc. In some places the riddles having the mesh finer than ⅛ in. are called sieves.

In **riddling sand** by hand, the riddle should be held loosely in the hand and carried by the fingers so that the palm of the hand will strike the rim as it is cast from side to side. Hitting the rim of the riddle in this way jars loose the sand that sticks to the riddle, keeps the meshes open better, and allows the sand to pass through more freely. By practice in holding the riddle in this manner, a rocking swing may be obtained which jars the riddle at each turn and carries but very little weight on the fingers. It is often found of advantage, especially in fine riddles, to put some irons in with the sand, as gaggers, etc. These irons scrape the wires clean and add to the jarring of the riddle.

When not in use, the riddle should always be hung up on a nail or placed on the sand heap with the screen up. If left with the screen resting on the sand, the meshes become clogged, thus hindering the passage of the sand through the screen.

There are many forms of mechanical sand sifters. The two representative forms of pneumatic sifters are shown in Figs. 93 and 96, while the belt-driven sifters are shown in Figs. 98 and 99.

Facing sand is placed next to the pattern in making a mold in order that the sand will **peel** or part from the casting freely and leave a smooth surface. Facing sand contains a percentage of sea coal and usually new sand, dependent upon the kind of work for which it is to be used.

The percentage of sea coal varies greatly, depending upon the thickness of metal and type of casting. The limits are 1 part of sea coal to 2 parts of sand, and 1 part of sea coal to 16 to 20 parts of sand. The limiting proportions are very seldom used. The usual proportions are from 1 to 6, to 1 to 14 of sand, depending on the thickness of the metal. When the metal is thinner than ½ in. no facing is necessary. Better and smoother castings are obtained in this case by using heap sand riddled through a fine riddle onto the pattern. For metal between ½ in. and 1 in. the proportion should be about 1 part of sea coal to 12 or 14 parts of sand; between 1 in. and 2 in., 1 part of sea coal to 8 or 10 parts of sand; above 2 in., 1 part of sea coal to 6 or 8 parts of sand.

The sand used in the facing may also vary in its proportion of new and old sand. This is dependent upon the sand used. The most general proportion is 1 part of new sand to from 3 to 5 parts of old sand. Greater percentages of new sand may be used on heavy work. The limiting case is a facing made of entirely new sand for the cope of very heavy work.

It is not always the thickness of the casting that regulates the strength of the facing sand. There are many other things to be considered: (1) whether the