(No Model.)

S. J. ADAMS.

ART OF PREPARING SAND MOLDS.

No. 386,951. Patented July 31, 1888.

Fig. 1.

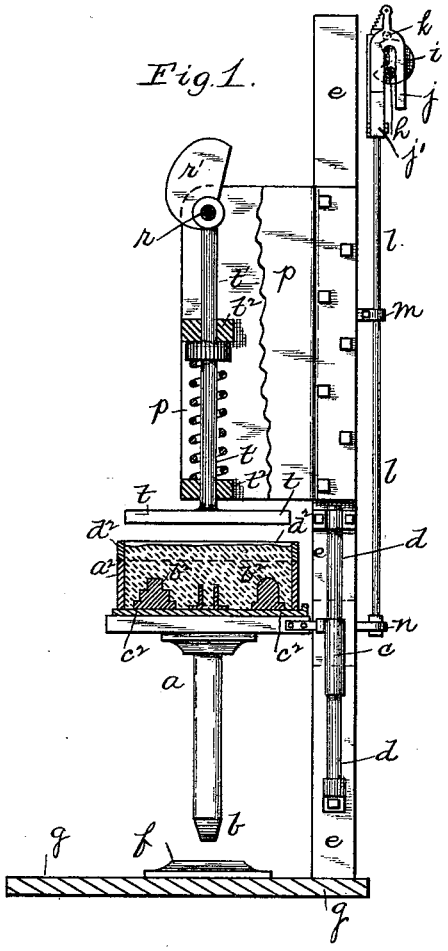


Fig. 2.

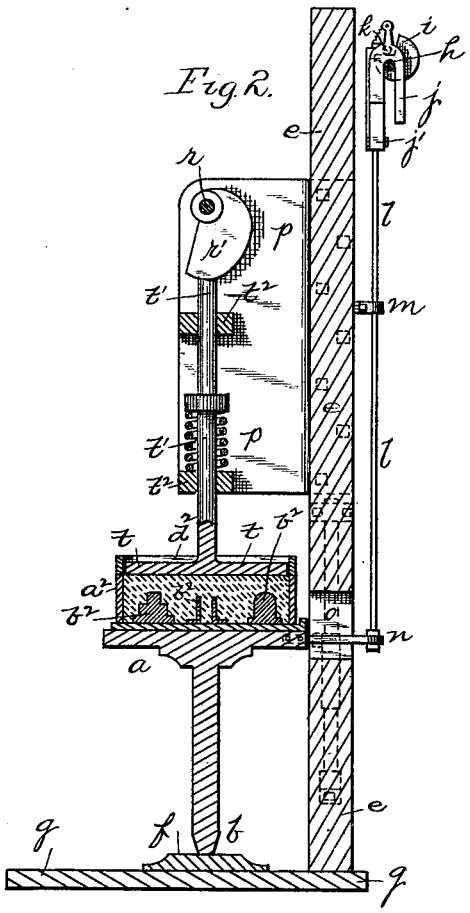


Fig. 4.

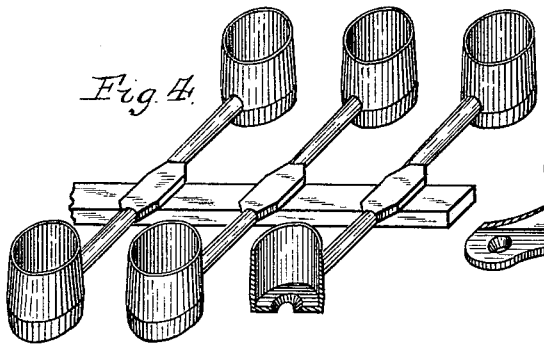
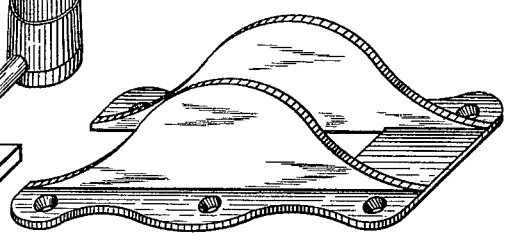


Fig. 3.



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UNITED STATES PATENT OFFICE.

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ART OF PREPARING SAND MOLDS.

SPECIFICATION forming part of Letters Patent No. 386,951, dated July 31, 1888.

Application filed March 27, 1888. Serial No. 268,638. (No model.)

To all whom it may concern:

Be it known that I, S. JARVIS ADAMS, a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in the Art of Preparing Sand Molds; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to sand molding for casting, and more especially to mechanical methods of preparing the molds.

In the preparation of molds for casting it is the great aim of the foundryman to obtain a mold which is uniformly packed, so that the sand will be firmly and evenly distributed in and around all the parts of the pattern, especially at the vertical walls, crevices, and the lower and less prominent parts thereof. As the art of molding now exists, two mechanical methods of preparing molds are in general use—namely, compressing the sand in and around the patterns in the flask and jarring the sand into position in and around the pattern. With the ordinary forms of casting, in which the surface of the pattern employed is not very irregular, these methods can be very satisfactorily employed; but if the pattern is deep or irregular or has a number of sharp corners thereon both of the above methods have been found to be objectionable. Where the compressing of the sand in the mold is attempted, even with an adjustable or conforming compressor, it is found that in the upper part of the mold, where the pressure comes in contact with the sand and over the more prominent parts of the pattern, the sand is packed too hard, so that the mold does not properly vent itself or carry off the air displaced by the molten metal and the gases produced by the contact of the molten metal with the damp sand and facings of the mold, while at the same time the sand is not sufficiently compacted at the sharp corners, depressions, and irregularities of the pattern. These difficulties increase with the depth of the mold and render it impossible to obtain satisfactory molds in such cases. The jarring process, on the other hand, makes a mold which is the reverse of that obtained by compressing, as in jarring the sand packs first at the bottom of the mold around the pattern, and it is less compact at the top of the mold than at the bottom, and to obtain the proper degree of compactness at the pattern part of the mold the number of jars must be accurately determined and carried out, and with complicated and irregular patterns, and particularly with deep molds made by this process, when the proper degree of compactness is obtained in the lower part, the upper part of the mold is not sufficiently compact to adhere to the walls of the flask and the mold is likely to drop out in handling; or when the molten metal is poured into the sprue or feeder it will cut into the spongy sand at the top of the mold and wash it down into the mold-cavity below, destroying the casting. If, in order to avoid this sponginess in the upper part of the mold and obtain the proper degree of compactness at that part, the number or force of jars imparted to the flask is increased, the lower part of the mold will be found to be so compact as to either adhere to the pattern in the small depressions or corners, or so hard that it will not permit the escape of the air and gases, and will therefore form blow-holes.

In actual practice the only successful manner of making molds with complicated and irregular patterns has been to ram the sand in the mold by hand, which, to be successful, requires the greatest care and skill, and is a very slow operation. Even where the greatest care and skill are used in ramming, the molds are likely to be defective, as the molder is very liable to ram at the little delicate cavities and corners either too hard or not hard enough. If too hard, the sand will stick to the pattern, and the walls of the mold are broken on the withdrawal of the pattern therefrom, and a proper venting of the mold is not obtained, and if not hard enough molten metal will press out the sand and form irregularities in the casting. To illustrate these difficulties in molding by mechanical or hand methods, views of articles in which such difficulties are experienced are shown in the drawings, Figure 3 showing a pump-bracket which has two long vertical walls close to each other. In forming a mold for such bracket by pressing it is evident that the sand between these walls and on the outer surface thereof cannot be packed evenly, while the sand at the top of said walls

is packed too hard and will not vent. In forming such an article by ramming, if the ramming-tool or the hand is pressed between these walls with too much force, it will pack the sand against the faces of the pattern, so that it will adhere and be withdrawn with the pattern, and if not pressed hard enough it will leave the walls of the mold spongy, so that the metal will force out the mold and form lumps or irregularities in the casting. In Fig. 4 is shown the pattern for making reflector-sockets, and in molding these the sand cannot be pressed mechanically into the cups or depressions to pack them evenly, and as it is necessary that the interior of these articles must be formed with substantially vertical walls the impracticability of forming the molds by mechanical compression becomes apparent. In molding such articles by hand the sand must be pressed into the cups by the finger, and as it is practically impossible to pack each cup evenly in this manner the reason why about one-third of these castings are imperfect can be well understood. Many other examples could be given. In forming molds by jarring the sand can be distributed evenly into these depressions and compacted properly in the lower part of the mold, so that a practically perfect outline of the pattern, no matter how irregular it may be, is obtained, and yet if the mold is jarred to pack the sand in the upper part of the mold to the proper compactness the lower part is so hard that it will either adhere to the pattern or will not vent properly, so that the molten metal will not lie against it, and blow-holes or irregularities are formed in the casting.

The object of my invention is to provide a method by which these deep or irregular molds may be made by mechanical means, and thus avoid the necessity of skillful hand-labor in their production, and at the same time obtain a greater uniformity in the molds made; and to these ends my invention consists, generally stated, in compacting the sand about the pattern by jarring until the lower part of the mold has obtained a desired degree of compactness, and then compressing the sand through the upper part of the flask to complete the same, it being found that by so doing an evenly and uniformly packed mold is obtained, as will be more fully hereinafter set forth.

To enable others skilled in the art to make and use my invention, I will describe the same more fully, referring to the accompanying drawings, in which—

Fig. 1 shows a side view, partly in section, of an apparatus adapted to carry out my invention, and Fig. 2 shows a central vertical section of the same, and Figs. 3 and 4 are views of articles in the molding of which the difficulties before referred to have been experienced.

Like letters refer to like parts in each.

In practicing my invention any suitable form of apparatus may be employed. I have shown, however, in the drawings a form of apparatus which has proved very satisfactory in practice. This consists of a jarring-table, *a*, for the support of the flask, as hereinafter explained, the table being provided with a base, *b*, adapted to strike against the jarring-block *f* to impart the jar to the table, and sleeves *c*, which are secured to each side of the table and travel or slide on guide-rods *d*, secured to the side of a standard, *e*, which extends up from the base *g*. This gives to the table a positive guidance in its vertical movement, and insures that the base *b* will strike evenly on the jarring-block *f*. To give the necessary lifting and dropping to the table *a*, a shaft, *h*, having a cam, *i*, thereon, is journaled in suitable bearings in the rear of the upper part of the standard *e*, and a U-shaped hook, *j*, having a lug, *k*, on its upper end, is passed over said shaft, so that the lug *k* will bear against the surface of the cam *i*, and to the end *j'* of said hook is attached a rod, *l*, which passes down through suitable guides, *m*, on the standard *e*, and is secured at its lower end to a heel, *n*, of the table *a*, which heel projects through a vertical slot, *o*, in the standard *e*. By this arrangement the rotation of the shaft *h* causes the hook *j* to be lifted by the cam *i* acting on the lug *k*, and thus raise the table *a*, and when the cam has passed its highest point the hook *j*, being no longer supported, allows the table *a* to drop and the base *b* to strike with the momentum due to the weight of the table and the flask against the jarring-block *f*, thoroughly jarring the contents of the flask resting on the table.

Projecting from the standard *e* above the table *a* are two wings or brackets, *p*, in which is journaled a shaft, *r*, which is connected to some suitable motor or power shaft, so that it can be turned when desired. Mounted on this shaft between the two wings *p p* is a cam, *r'*, which acts on the end of a vertical rod, *t'*, which rod passes through suitable guides, t^2, attached to the wings *p*, and carries at its lower end the presser or pressers *t*, employed in compressing the sand, as hereinafter explained.

In carrying out my improved process of making molds I place on the table *a* the flask a^2, which has the patterns *b* attached to the pattern-plate c^2 thereof or resting on the bottom board thereof. A shallow reservoir, d^2, is then generally placed on top of the flask and the flask and reservoir filled with sand. When the reservoir is employed, it is generally made of a depth to provide the proper quantity to fill the flask when the mold is completed. I may, however, dispense with the reservoir and employ a bottom board or presser fitting into the flask at the time the sand is pressed down into it or subsequent thereto. The table *a* is then raised and dropped to impart the desired number of jars to the flask and its contents, a sufficient number of jars being thus imparted to the contents of the flask to compact the

sand in the lower part of the flask around the pattern to a desired degree of density, the degree of density depending upon the depth of the mold, as in shallow molds the subsequent compressing operation affects to a considerable degree the sand in the lower part of the flask, while in deep molds the compressing operation affects the sand in the lower part but slightly, and the sand is therefore packed by jarring to nearly the density required in the finished mold. As, however, the sand in the upper part of the mold is not confined, at each jar it rebounds or vibrates, so that it remains in a spongy condition, as there is no weight or superimposed body to hold it down, this spongy condition extending down a considerable distance into the mold, so that it will not maintain the shape of the upper part of the pattern when it is withdrawn; or the sand is so spongy that it is liable to be washed away or be pressed back when the molten metal is poured into the cavity. If the number of jars imparted to the mold is increased to avoid this difficulty, the lower part of the mold becomes too compact, and as much danger from a defective casting is encountered as before. To remove the sponginess and lack of rigidity in the upper part of the mold and compact the sand in the mold to the proper degree of density I compress the sand downward through the upper part of the flask after it has been jarred the proper number of times to obtain the desired density in the lower part of the mold. In carrying this out with apparatus herein described the presser *t* is forced down by the cam *r'* into the sand in the reservoir d^2, the latter having a small amount of sand therein. This forces the sand of the reservoir down in the mold, compressing the sand in the upper part of the latter and packing it evenly into and around the upper part of the pattern, and further compacting the sand in the body and lower part of the mold more or less, according to the depth of the mold and the compacting of the sand by the jarring thereof, so that sharp rigid corners are formed by the pattern in the mold. As in jarring the sand it is caused to conform to the shape of the pattern, and yet the upper surface of the sand is substantially level, the ordinary flat-faced presser will impart an even pressure to all the sand in the upper part of the mold. The sand in the mold is thus given the proper density, all sponginess removed from the upper part of the mold, and the corners of the pattern filled, which results in a mold which has the right degree of density throughout, and a mold-cavity with rigid and sharply-defined walls, which insures a perfect and accurate casting. For the reasons before stated, with irregular patterns the jarring of the sand will not give a uniformly and properly packed mold, and if compressing is attempted it is found to be inapplicable; yet by my improvements the disadvantages and defects of both of these processes are overcome and a uniform perfect mold obtained without the intervention of skilled labor, which effects a very large saving in the cost of producing the mold.

In the making of long thin molds—such as a series of wagon-boxes in a flask, in which case patterns are generally set close together—my improved process avoids a very serious difficulty found in the present process of preparing these molds by jarring. In jarring the flask where a series of wagon-box patterns are attached to the bottom board or pattern plate, it has been necessary to employ a deep reservoir or body of sand to cause any compacting of the upper part of the mold, and this large body of sand will so pack as to arch over on the top of the patterns, and so form a hollow or spongy place in the mold, into which the molten metal enters or swells out during casting. By employing my process, however, as the sand in the upper part of the mold proper remains spongy, this arching of the sand does not occur, and the subsequent pressing of the sand compacts it properly around the upper part of the patterns, forming an evenly-packed mold.

In jarring the sand I prefer to jar the mold vertically, as described; but for this purpose a side or end jarring or vibrating may also be employed.

Having now described my invention, what I claim is—

The improvement in the art of preparing sand molds, which consists in jarring the sand into position around the pattern until the lower part of the mold has attained a desired degree of density, and then compressing the sand through the upper part of the flask to complete the same, substantially as and for the purpose set forth.

In testimony whereof I, the said S. JARVIS ADAMS, have hereunto set my hand.

S. JARVIS ADAMS.

Witnesses:

JAMES I. KAY,

J. N. COOKE.