(No Model.)

S. J. ADAMS.

METHOD OF AND APPARATUS FOR FORMING MOLDS FOR CASTINGS.

No. 257,991. Patented May 16, 1882.

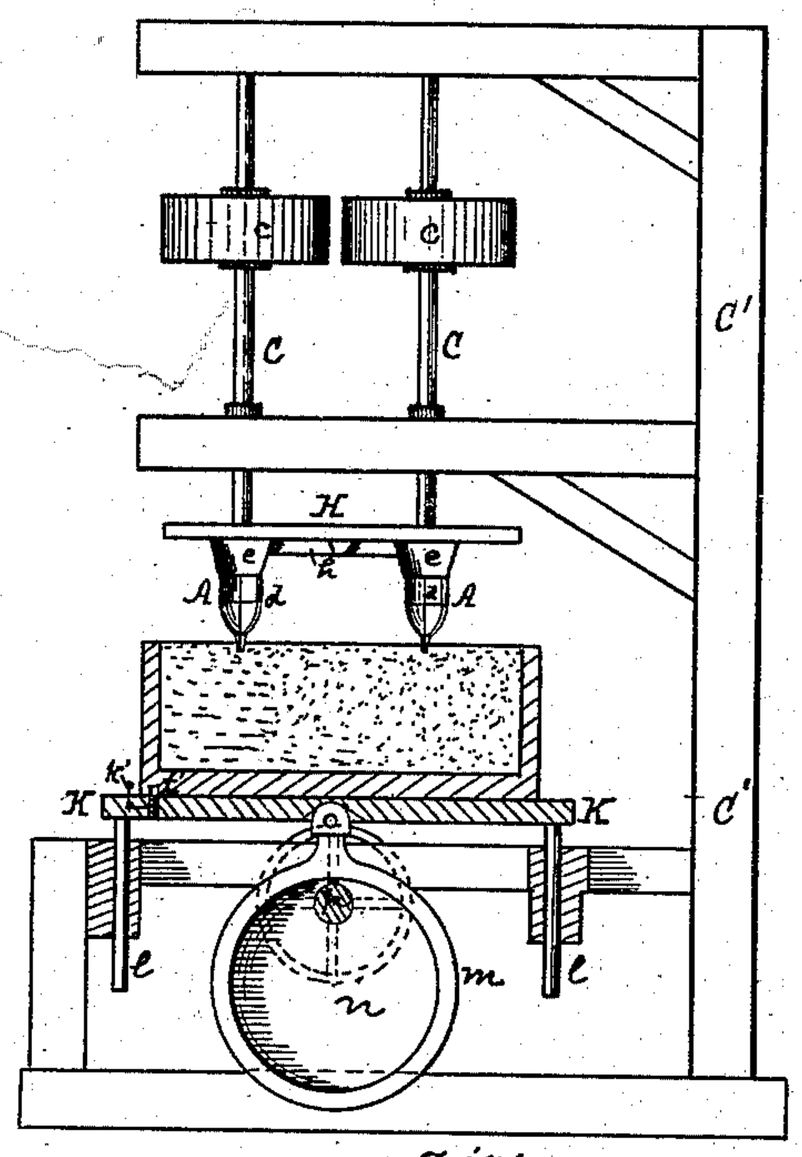


Fig. 1.

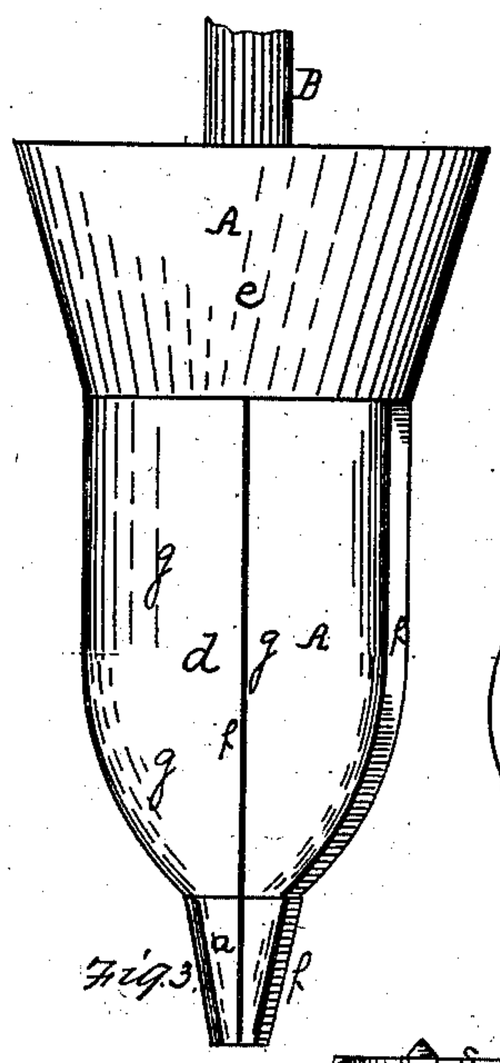


Fig. 3.

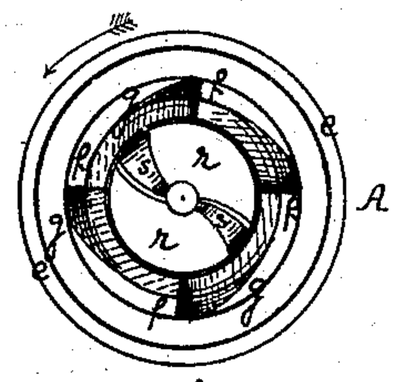
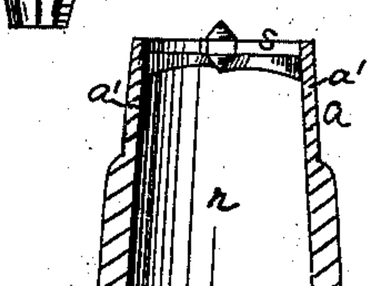


Fig. 5.



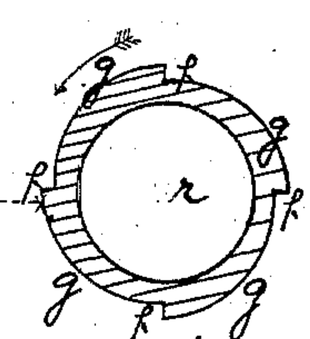


Fig. 6.

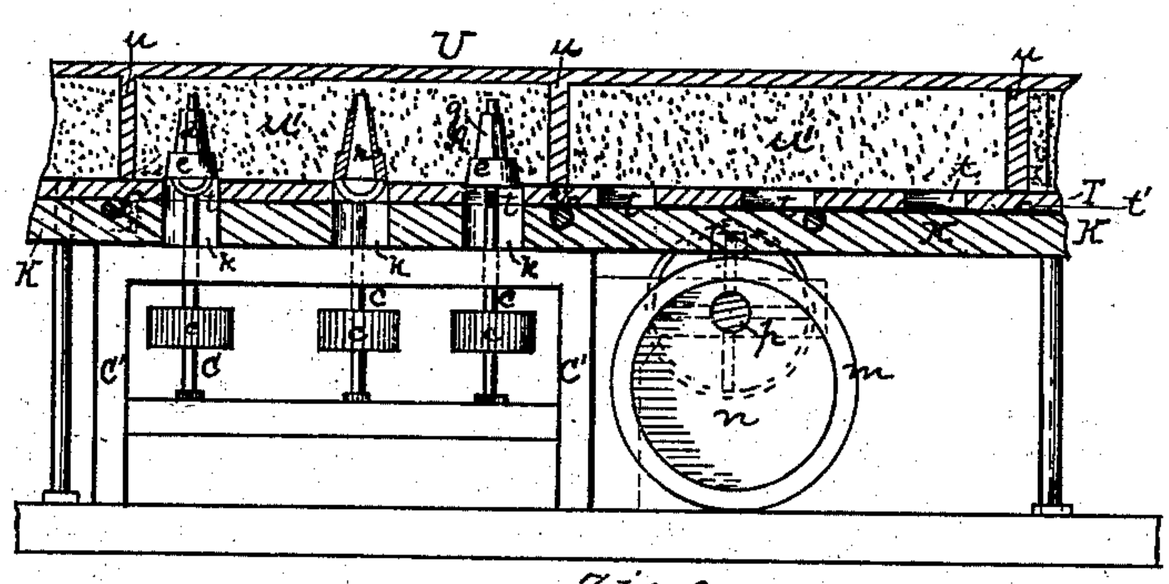


Fig. 2.

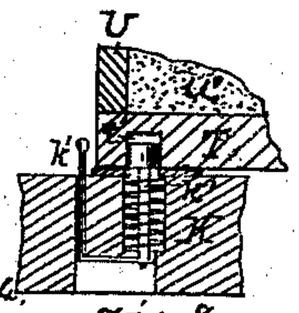


Fig. 8.

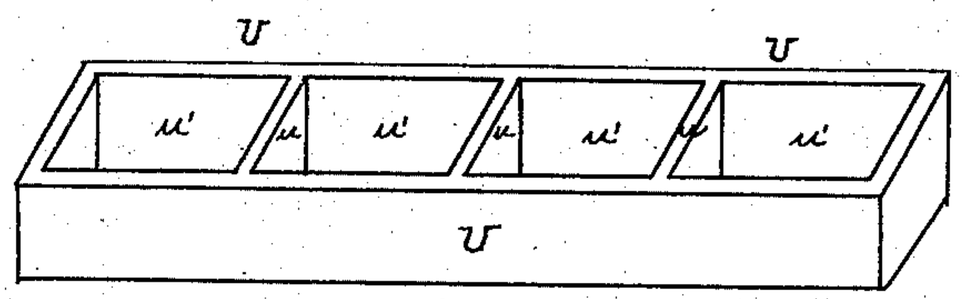


Fig. 7.

Witnesses
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UNITED STATES PATENT OFFICE.

S. JARVIS ADAMS, OF PITTSBURG, PENNSYLVANIA.

METHOD OF AND APPARATUS FOR FORMING MOLDS FOR CASTINGS.

SPECIFICATION forming part of Letters Patent No. 257,991, dated May 16, 1882.

Application filed June 8, 1881. (No model.)

To all whom it may concern:

Be it known that I, S. JARVIS ADAMS, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Method of Forming Molds for Castings; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 is an end view, partly in section, illustrating my invention where the patterns enter from above. Fig. 2 is a longitudinal section, illustrating the same where the patterns enter from below. Fig. 3 is a side view of the patterns when formed solid. Fig. 4 is a longitudinal section of the pattern when formed hollow. Fig. 5 is an end view, and Fig. 6 is a cross-section on the line *x x* of the hollow pattern, Fig. 4. Fig. 7 is a perspective view of my improved flask, and Fig. 8 is a detached view of the catch for holding the flask in place.

Like letters of reference indicate like parts in each.

My invention relates to the formation of molds in sand for making castings of iron, steel, or other metals, its object being to provide a rapid and effective method of forming cylindrical molds.

My invention consists, first, in forming cylindrical molds in a body of sand by at the same time rapidly rotating and gradually advancing a pressing-tool or pattern into the sand, so as to gradually press out the sand, compact the walls, and polish the sides of the mold, imparting to it a smooth finished surface; and, second, in certain improvements in the patterns and the apparatus employed in carrying out my improved method of forming molds.

To enable others skilled in the art to carry on my invention, I will describe the same more fully.

My invention is illustrated in connection with the formation of molds for tube-welding balls, it being evident that it can be employed in the formation of many different styles of cylindrical molds, the pattern being formed to the proper shape in each case.

The pattern A is formed of metal or wood, as desired, being preferably made of steel, in which case it is turned and dressed to the proper shape, and then tempered to harden the outer surface, or cast of hard metal, in which case its surface is ground off, so as to give the proper size and a smooth finish. It is provided with the spindle B, by which it is mounted in suitable apparatus for rotating, it being secured on the perpendicular shaft C of the apparatus by means of a suitable coupling and rotated by suitable power-connections, as hereinafter set forth.

The pattern A is formed corresponding in shape to the article cast, there being the entering-point *a* to form the core-print and the pattern-body *d* the same shape as the article to be cast, and the head *e* to form the cope-print. The surface of the pattern A is preferably provided with a series of grooves, *f*, extending longitudinally across its face. These grooves are cut directly into the pattern on one side, and on the other side gradually curve from the bottom of the groove to the full surface of the pattern, thus forming a series of pressing-faces, *g*, around the pattern, which gradually increase in diameter and are therefore adapted to gradually press out the sand and form a compact finished mold. The width of these pressing-faces *g* will, of course, vary in the different sizes and shapes of the patterns, experience showing that from two to four pressing-faces around a pattern are usually sufficient. The pressing-faces can be arranged upon all the parts of the pattern intended to press into the sand, and this form of pattern is preferred, as the pressing-faces enable the pattern to press its way more rapidly into the sand, each separate face serving to press the sand aside. A well-finished mold may be formed, however, where the face of the pattern is plain, as shown on the head *e*, such a plain-face pattern pressing the sand forward and aside more slowly than that having the separate pressing-faces. The patterns are generally arranged in a nest of from four to twelve, according to their size, to expedite the formation of molds, each pattern forming its mold at the same time, so that the flask is rapidly filled with molds. Another important advantage gained by employing the patterns in nests is that as the sand is generally rather loose in the flask, the patterns, entering together, press the sand out to the side and pack it between them, thus forming molds packed firmly enough to sustain the weight of the molten

metal in casting. The pressing-patterns are generally formed so as to revolve below a stationary presser-plate, H, and on the lower surface of this plate are ridges *h*, by means of which the pouring-gates are formed above the mold, so that the mold is finished ready for cores at one operation.

The shafts C, carrying the different patterns in the nest, are mounted in the horizontal arms of the machine-frame C′, and are provided with pulleys *c*, around which a power-belt passes, and thus imparts a rotary motion to the patterns. As it is sometimes difficult to mount the patterns true and prevent any side motion in rotating, when the shafts have a longitudinal as well as rotary motion, I have arranged the patterns without any longitudinal motion, and mounted in proper relative position thereto a vertically-moving flask-table, K, by means of which the flasks filled with sand are raised up, so that the rotating patterns enter them and form the molds where, the patterns are mounted above the flasks, as shown in Fig. 1, or by which the flasks are lowered over the pattern where the patterns are mounted below the flasks, as shown in Fig. 2. The table K is provided with guide-rods *l* at either corner to insure an absolutely-vertical movement, and under the flask-table is arranged a cam-yoke, *m*, within which a cam, *n*, mounted on a power-shaft, *p*, works, this cam-yoke *m* being capable of such adjustment on the cam-*n* as to impart to the flask on the table the proper motion in forming the mold. Where the molds are formed from below the flask-table is formed with a series of openings, *k*, in proper position for the patterns to pass through them, and the cam mechanism is arranged above or below the flask-table, as considered most convenient. In this case a bottom board, T, is employed with the flask U, the bottom board having a series of circular openings, *t*, of such diameter that the largest part of the patterns will pass neatly through them to form the molds, this bottom board sustaining the sand in the flask and the sides of the openings *t* preventing the sides of the molds falling out when the patterns are operating in the sand. The cam-shaft *p* may either be operated by hand or by steam power, as desired, according to the weight of the flask and the pressure necessary in feeding it to the patterns.

Where large cylindrical molds are to be formed it is evident that a very strong power would be necessary to force the rotary pattern into the sand. To overcome this difficulty I have formed in the pattern a central passage, *r*, through which a portion of the sand may pass as the pattern enters the sand. This opening or passage extends axially through the end of the pattern, and its diameter will generally depend on the diameter of the core-point at the base of the mold, and where a large casting with thin walls and a large opening at the base is to be formed the core-point will be large, and the passage *r* may be almost as large as the core-point, the cylindrical walls *a′* of the entering part *a* being formed of thin sheet metal, and the rotary presser will have but a small portion of the sand to press aside in forming the mold. The central passage, *r*, increases slightly in diameter toward the back of the pattern, so that when the pattern enters the sand from below, the sand entering the passage and loosened by the rotation of the pattern may easily drop out of the pattern; or, if the pattern enters the sand from above, the sand may be retained in the passage until emptied by the operator. The pattern may also be provided with a wire or knife, *s*, at the entrance to the passage *r*, which cuts the sand loose and forces it into the passage on the rotation of the pattern, the knives also serving to sustain the sand in the passage where the pattern is operated from above.

Where a series of molds or a series of nests of molds are to be formed in a long flask, as the sand is only loosely packed, it is evident that the sand for each mold or nest of molds must be confined in order to compact it. To accomplish this I form the long flasks U with a series of transverse partitions, *u*, thus dividing it into separate compartments *u′* of proper size for the formation of one mold or a series of molds, the sand in each compartment being confined by itself, so that the lateral compression of the rotary patterns compacts it against the walls of the separate compartment. When the molds are formed in these long flasks from below, I employ a long bottom board, T, with a series of circular openings, *t*, under each compartment *u′*, so that the flask can be fed over the patterns and the molds formed from one end to the other. In order to bring the several compartments in proper relative position for the formation of molds in them, I form stop mechanism on the flask-table and the flask or bottom board carrying the flask. This stop mechanism on the flask-table may be formed of a bolt-hole, *t′*, at intervals in the flask or bottom board, and a spring-bolt, *k′*, on the flask-table catching in the bolt-holes *t′*, as shown, in which case the flask is pushed along after one operation until the next compartment is brought in place; or it may be formed of a gear and toothed bar having blank teeth or other suitable stop, by which it is fed along. In either case the flask-table is provided with rollers to facilitate the movement of the flasks.

The operation of forming molds by my improved method is as follows: The pressing-patterns are rotated at a speed of about two hundred revolutions per minute. Where the molds are formed from above the flask is filled with sand, preferably from a measuring-box, so that it contains the proper amount. It is then generally given a slight jar by the previously-patented jarring process, so as to settle it slightly and uniformly in the flask, though, as no sand is removed by the pattern and its action is to compact the sand, a tightly-packed flask is not desired. The flask is then placed on the flask-table K under the rotating patterns, and the table raised by the cam mechanism above de-

scribed until the rotary patterns enter the sand, the flask being then gradually raised until the mold is formed. As the pattern enters the sand its rotary motion has the effect to roll or press the grains or particles of sand to each side of it, rather than pressing them down, as is the case with a non-rotary pressing-pattern, though some longitudinal pressure is also exerted. It thus gradually presses out the sand and compacts it all around the pattern, the sand displaced forming a hard cake around the pattern of sufficient strength to sustain the weight of the molten metal in casting. The rotation of the pattern also imparts a smooth polished surface to the walls thus formed by it, so that the mold formed is firmly packed and perfect in cylindrical shape and surface finish.

Where a nest of patterns is employed, as above described, the sand is packed between the different patterns and against the flask-walls, and the whole flask is consequently tightly packed, though the sand might have been quite loose before the entrance of the patterns.

Where the stationary presser H is employed, after the rotary patterns have entered the sand, it follows in and forms the pouring-gates, serving also to still further pack the sand, and, as the patterns are carried farther into the sand, to insure a dense firm mold.

In addition to the stationary ridges to form the pouring-gates, a large presser to form a seat for the cope, or separate stationary pressers for each pattern to form the cope prints for each mold, may be employed, the pouring-gates being formed by ridges between the stationary patterns.

After the formation of the molds as above described, they are lowered by the cam mechanism and the flask removed; or, if a long flask divided into separate compartments *u'*, as above described, is employed, it is fed along until the stop mechanism again engages, and the operation is repeated until the several compartments of the flask are filled with molds, the sand being packed in the separate compartments. The only further operation necessary is to place the cores in the molds, when they are ready for casting.

The operation is substantially the same where the molds are formed from below, the sand being placed in the flask, which is inverted on the bottom board, T, and fed over the rotary presser-patterns, and as the flask-table is lowered the patterns pass into the flask through the circular openings *t* and press out the sand to form the molds, the edges of the circular openings sustaining the sand of the flask, so that it is not displaced by the rapid rotation of the pattern during the operation of forming the mold. Where long flasks are employed the flask is then fed along until the stop mechanism again engages in the bottom board, bringing the next compartment over the patterns, and the next set of circular openings *t* in proper position over the patterns, and the flask-table is lowered, so that the patterns enter this compartment through the circular openings, and the operation is repeated.

Where rotary presser-patterns are employed for forming molds of large diameter and they are provided with the central passage, *r*, passing axially through the entering end for the reception of part of the sand, the operation is the same as above described, except that part of the sand passes into the central passage, *r*, so that the pattern is not required to press out the entire mass, and consequently it enters the sand much more rapidly. If these patterns enter from below, the sand removed through the central passage may be carried off by a deflector-plate under the patterns; or, if they enter from above, the sand may be removed by a worm, blast, or other suitable means. These rotary presser-patterns with central passages for removing part of the sand may also be employed to advantage in forming small as well as large molds.

Instead of the cam or eccentric shown for the operation of the flask-table, levers and similar devices may also be employed.

No claim is made herein for the long flask divided into separate compartments, except in combination with other devices, as a separate application for Letters Patent will be made therefor.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The herein-described method of forming cylindrical molds in a body of sand, consisting in at the same time rapidly rotating and gradually advancing a pattern into the body of sand, so as to compact and smooth the walls of the mold, substantially as and for the purposes set forth.

2. A rotary pressing tool or pattern for forming molds in sand, provided with a series of pressing-faces on its periphery, adapted to gradually press out the sand, substantially as set forth.

3. A rotary pressing tool or pattern for forming molds in sand, having a hollow passage extending axially through the entering end for the escape of sand, substantially as set forth.

4. A rotary pressing tool or pattern for forming molds in sand, provided with a central passage for the escape or removal of part of the sand, and a wire or knife across the mouth of the passage, substantially as and for the purposes set forth.

5. In combination with a rotary pattern for forming molds in sand, a vertically-moving flask-table adapted to advance the flask to the rotary pattern and withdraw it therefrom after the formation of the mold, substantially as set forth.

6. The combination of the rotary patterns A, vertically-moving flask-table K, guide-rods *l*, and cam or eccentric for imparting motion to the flask-table, substantially as and for the purposes set forth.

7. The combination of the rotary patterns A, flask-table K, long flask U, divided into separate compartments, and stop mechanism for holding the flask in proper relative position to the patterns, substantially as set forth.

8. The combination of the long flask U, divided into separate compartments, and the bottom board, T, provided with the circular openings *t* under each compartment, substantially as and for the purposes set forth.

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

S. JARVIS ADAMS.

Witnesses:

H. B. BRUNOT,

JAMES I. KAY.