(No Model.) 2 Sheets—Sheet 1.

S. J. ADAMS.

SAND MOLDING APPARATUS.

No. 455,143. Patented June 30, 1891.

Fig. 1.

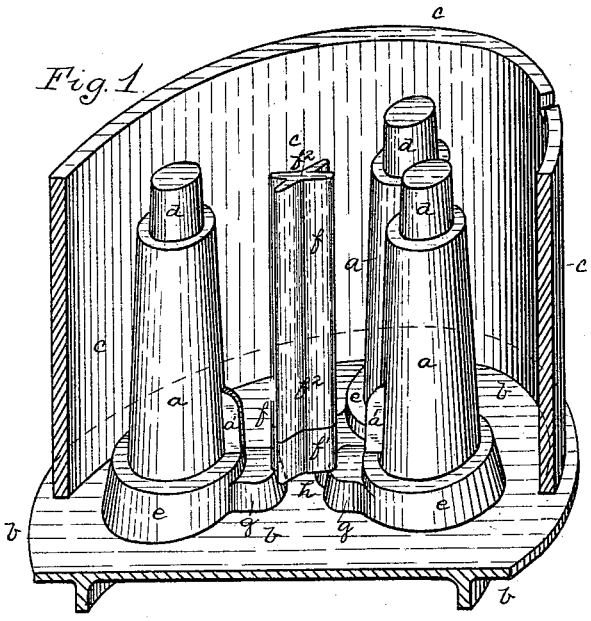


Fig. 3.

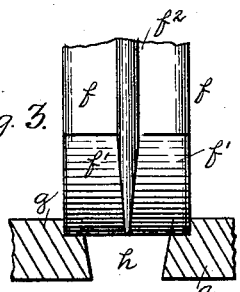


Fig. 4.

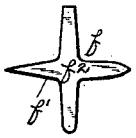
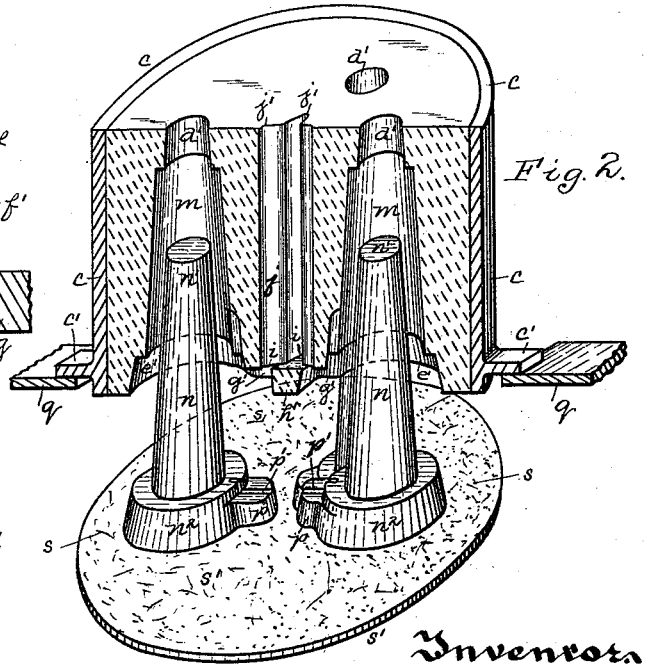


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

S. J. ADAMS.

SAND MOLDING APPARATUS.

No. 455,143. Patented June 30, 1891.

Fig. 5.

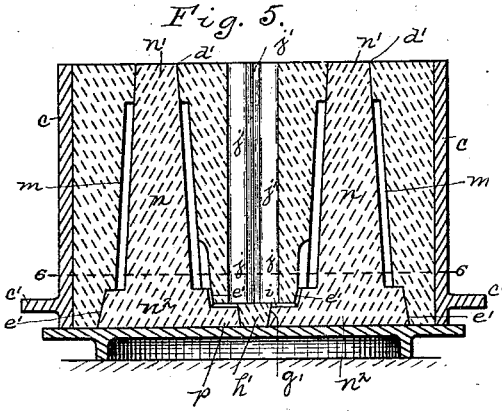


Fig. 7.

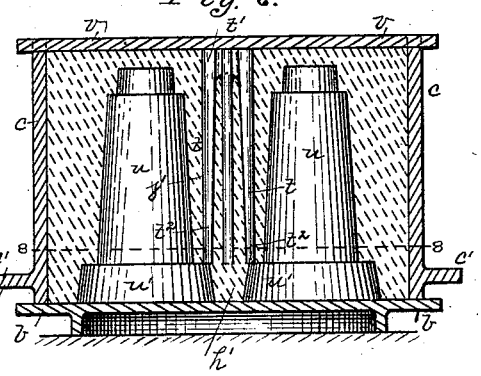


Fig. 6.

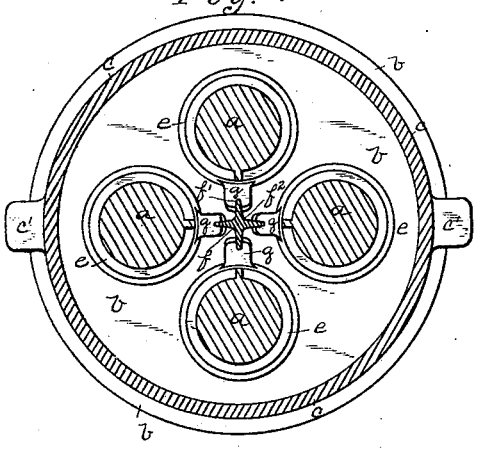
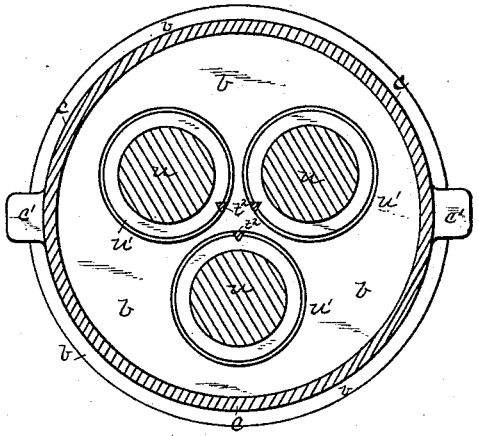


Fig. 8.



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UNITED STATES PATENT OFFICE.

STEPHEN JARVIS ADAMS, OF PITTSBURG, PENNSYLVANIA.

SAND-MOLDING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 455,143, dated June 30, 1891.

Application filed October 20, 1890. Serial No. 368,631. (No model.)

To all whom it may concern:

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

My invention relates to sand-molding apparatus and to the mold employed for forming wagon-boxes and other tubular articles in what are termed "vertical" or "one-part" molds—that is, where the molds are entirely inclosed within a single flask. The most common way of forming this class of molds where the metal flows into the bases of the mold-cavities, so that it will rise therein, is to employ a central gate, which passes down the center of the mold and extends entirely through the same, and thence flows by suitable runners into the mold-cavities. This construction requires the employment of a sand-bed, which can only be used to advantage where the cores enter the mold-cavities from the upper end thereof, while the simplest method of molding is where the cores enter through the other end of the mold, so that the base of the mold-cavity forms the larger end of the casting. Other means of closing the base of the runner have also been employed, such by special cores which fit within the same and when the heads of the main cores are at the lower end of the mold fit between the heads thereof, it being found necessary in such cases to have many joints around such core, and the metal being liable to escape through such joints, while at the same time the necessity of employing other cores for closing the end of the main vertical gate is objectionable, requiring time both to make the cores and to insert them in place.

The object of my invention is to provide a mold and molding apparatus in which these difficulties are overcome, and which may be employed in the ordinary course of molding, either by ramming or jarring of the sand to place, and requires no special cutting or forcing of side runners through to make the connection between the gate and the mold-cavities, and in which at the same time it is only necessary to employ single cores entering through the base of the mold in order to close that end thereof and to direct the molten metal from the main gate into the mold-cavities.

To this end my invention consists, generally stated, in a mold for forming these tubular castings, having a pouring-gate extending down from the top thereof, part of the lower end of said gate being closed by the body of sand forming the mold and part of the lower end of the gate being closed by the core or cores entering the mold cavity or cavities, it thus being possible to feed the metal down through the main gate and thence along the cores into the mold-cavities, while the cores themselves act to close the lower end of the mold and pouring-gate.

My invention also consists in the apparatus for forming such molds, in which the vertical gate extends down through and is supported on the base or lower end of the pattern or patterns, so permitting the packing of the sand under the gate-pattern in such way as to close that end of the gate except where communication is formed with the core or cores and thence with the mold-cavities.

It also consists in the employment of a vertical gate of a winged or star shape—that is, a gate in which there is a longitudinal wing extending out sidewise to the core-head with which the gate communicates—such form of gate overcoming the pressure of the metal passing down through the same against the walls of the mold-cavity, since it reduces the surface between the gate and mold-cavity against which the direct pressure of the molten metal can act, while at the same time it directs such pressure against the side walls of the wings, which, as they are supported by the solid body of the mold, can properly sustain the pressure, even though the gate is made close to the mold-cavity.

It also consists in certain other improvements both in the mold and in the molding apparatus, as hereinafter more particularly set forth and claimed.

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—

Figure 1 is a sectional perspective view of the molding apparatus embodying my invention. Fig. 2 is a like sectional perspective

illustrating the mold formed and the method of introducing the cores into the same. Figs. 3 and 4 are detail views of the lower end of the gate-patterns. Fig. 5 is a view showing the completed mold. Fig. 6 is a cross-section on the line 6 6, Fig. 5. Fig. 7 is a view of a modification also embodying my invention, as will be hereinafter described; and Fig. 8 is a cross-section on the line 8 8, Fig. 7.

Like letters of reference indicate like parts in each figure.

I will describe my invention more particularly in connection with Figs. 1, 2, and 5, as it is the more clearly illustrated in said figures. The patterns *a* are secured to the pattern-plate *b* and extend up within the flask *c*, the patterns in said figures extending entirely through the flask. The patterns shown in said figures are for molding what are known as "wagon-boxes," the boxes shown simply as an illustration, having the feathers *a'* at one side thereof. In said drawings I have shown three of a group of four patterns, the one pattern being removed to more clearly illustrate the invention. The patterns have the upper or smaller core-prints *d* and the lower core-prints *e*, the said lower core-prints forming the seats for the heads of the cores, and in the pattern shown said prints being slightly larger than the mold-cavity, though these proportions as to the parts may of course be varied as desired. The heads *e*, as illustrated, extend out to the outer edge of the feathers *a'*, so as to entirely inclose the same. The heads may be made larger, however, so that the central gate-pattern *f* rests directly upon them, and in some cases this is considered desirable.

In the form of gate-patterns shown in Fig. 6 the pattern is shown as resting directly upon the heads of the main patterns. I prefer, however, to form the head-prints *e* with the side lips or projections *g*, which extend out toward the center of the group of patterns and on which the gate-pattern *f* rests, the employment of such lips or projections overcoming the necessity of employing large heads on the cores, such large heads being objectionable, as they require such a heavy body of sand in the head portion that they become cumbersome and are liable to break in handling or when inserted within the mold-cavity. It will be seen that the projections *g* of the head-patterns are not as great in height as said head-patterns, such construction being employed in order to provide for the feeding of the metal up into the base of the mold-cavity, as distinguished from feeding the metal in the side of the mold-cavity, as will occur where no groove or runner is employed in the core and such projection is of the same height as the head-pattern. It will be seen that between the several projections of the patterns there is a space *h*, which space extends below the gate-pattern *f*. This space is filled with the same body of sand as that forming the mold, and so partially closes the lower end of the gate formed by the pattern *f*, as hereinafter described, the remainder of the gate formed by said pattern being closed at its base, where it communicates with the mold-cavity by like projections or lips on the core-head, as hereinafter described.

The gate-pattern *f* is made of such shape that it can be easily withdrawn through the upper end of the mold, and in the form shown in Figs. 1, 2, and 5 is what may be termed a "star" or "winged" pattern—that is to say, instead of employing a circular gate-pattern and forming a circular gate thereby the pattern is star or wing shaped in cross-section, the number of wings corresponding to the number of patterns in the mold, and each one of these wings rests upon the projection *g* of one of the patterns, as clearly shown in Fig. 1. The reason for the employment of such a gate-pattern and the formation of such a gate is that the metal in passing down through such a gate acts with the same pressure upon all the walls of the gate, and in the ordinary circular gate, if it is made too close to the mold-cavity, the metal within the gate is liable to break into the mold-cavity, because the main pressure is against the circular face of the gate close to the mold-cavity. By the employment of the winged pattern such difficulty is overcome, as the pressure of the molten metal is outwardly against the side walls of the wings, and as the wings have practically no surface to press against at the end there is practically no pressure exerted by it toward the mold-cavity, the pressure of the metal in such case being against the side walls of the wings and said side walls being properly supported by the solid body of sand in the mold. At the same time it enables me to form a perfect pouring-gate, sufficient to carry all the metal to the mold-cavities without requiring such a great weight of metal, and it acts to feed the metal leading into the mold-cavity opposite where it is placed. The lower end of this winged gate-pattern *f* is shown in Figs. 3 and 4, in which the lower ends of the wings are formed tapering, as at *f'*, only the point end thereof resting on the head of the pattern or the projection extending out therefrom. The reason for this construction is that it is desirable to compact the sand in the space *h* under the gate-pattern as perfectly as possible, and by forming the lower end of the gate-pattern tapering it offers no obstruction whatever to the proper packing of the sand at that point, which otherwise would be spongy and wash into the mold-cavities.

It will be seen that the several wings of the gate-pattern rest upon the projections *g* from the heads of the patterns, so that when the mold is formed a passage *i* will be formed at the base of the vertical pouring-gate *j*, which communicates with the core-seat *e'* of the mold, while below the pouring-gate *j*, formed by the pattern *f*, is the bed of sand, as at *h'*, which has filled the space *h* and

partially closes the lower end of the pouring-gate. It will also be seen that the pouring-gate j has the different wings j', into which the metal enters in descending to the mold-cavities and by pressing against the side walls of said wings is properly supported thereby, instead of acting to force its way through to the mold-cavities m, and that the cores n are formed of the proper shape for the mold-cavities, their upper prints n' being seated in the core-seats d', formed for them, while the heads n^2 of the cores enter the head-prints e' of the mold, so closing the same. Each core is also provided with a lip or projection p, corresponding to the seat g', formed by the projection g and extending out from the seat e' of the mold, said projections p entering the said seats and so enabling the core-heads to close all the openings in the base of the mold. At the same time the projections p form the base to the runner or passage between the pouring-gate j and the mold-cavity, this being accomplished either by a runner or groove, as at p', formed in the upper side of each projection p and in the edge of each core-head n^2, or by making said projection of less thickness than the depth of the seat g', leaving a space between the wall of said seat and the projection p, through which the metal may pass to the mold-cavity, or said projection fitting closely in said seat and a like groove being formed in the body of the mold, so as to lead to the mold-cavity. I prefer to employ this projection p of less height than the core-head, as shown, so that the metal may pass into the mold-cavity vertically instead of a side direction, so preventing the formation of side fins on the castings. When the cores are seated within the molds, it is evident that if the metal is poured down into the main gate j it will pass through the openings i into the runners p' and thence through said runners into the mold-cavity. In the mold as so constructed the base h' of the pouring-gate is formed of the same body of sand as the mold itself, so that the necessity of any core to close said base is overcome, while at the same time the passages from the base of the pouring-gate are closed by the core-heads or by their projections.

In the forming of these molds difficulty has been experienced in inserting the cores into the molds where any number of cores were formed on the same head, as it is sometimes found desirable, for the reason that it required great nicety of adjustment of the parts and the slightest wear or spreading of the parts would cause imperfect castings, the cores not being central, or lead to the breaking of the core or marring of the mold. It is, however, extremely desirable to form the cores in groups, according to the number of cores to be inserted within the mold, and to provide for the insertion of such cores without the handling of each separate core and without the necessity of turning the core over and at the same time to leave each core free to accommodate itself to the mold-cavity as it is introduced into the same, as in both the patterns, the flasks, and the core-boxes there is liability of slight movement, which might affect the relative position of core and mold-cavity. I have, it is believed, provided for the proper insertion of cores under these conditions, and this is particularly illustrated in connection with Fig. 2 of the drawings.

The mold can be formed in the ordinary way by ramming or jarring, pressing, or otherwise, and after it is formed the patterns can be lowered from the same while the mold is properly supported, such as upon the lugs q of a suitable lowering-table, the flask c having lugs c' resting on said lugs q. The cores n may be formed in a group of core-boxes or secured together, or a box containing a group of core-cavities, and the cores may be jarred or rammed to shape, and when completed all the cores for the one set of molds be withdrawn and inserted within the mold-cavities. It is necessary, however, in transferring the cores in this way that they shall be free to move over the surface of the supporting-board, so as to properly seat themselves within the mold-cavities, each core being independent of the other, and the friction between the core and the ordinary bottom board would be so great as to prevent any such movement of the core. In introducing the cores, however, I have overcome this difficulty by the employment of a sharp dry sand as a supporting-surface for the cores when resting on the bottom board s', the surface of said board being covered by the sharp dry sand, as at s. The board is thickly covered with this sand and the core-box placed upon the bottom board and the core-boxes properly rapped to free the cores. When the cores are lowered from the core-boxes and while thus supported on the sand or anti-friction surface of the bottom board, they may be placed under the mold, which is supported on the lowering-frame, above referred to, and then raised so that the cores will pass into the mold-cavities and fill the same. If, however, it is found that one or more of the cores is not brought to exactly the right position, on account of the anti-friction surface between the base of the core and the bottom board, the core will be easily moved by the tapering walls of the guiding seats or prints over such bottom board until brought to the proper position so that they can seat themselves within the mold, the bottom board being raised up until the cores are wedged to place. The mold is then lifted from the apparatus by said bottom board and carried out to the floor, ready for casting. Instead of placing the sand on the bottom board in case said bottom board is inverted upon the core-boxes, the surfaces of the finished cores may be sanded, which will insure the same result. Instead of the sand above referred to, plum-

bago or other suitable anti-friction substance to act between the cores and the bottom board may of course be employed.

In Fig. 7 I have illustrated another form of molding apparatus and mold illustrating my invention and which can well be employed and has practically the same advantages as that above described. Instead of employing the star-shaped gate-pattern with the solid central portion f^2 extending through the entire length thereof, this solid central portion is cut away for a large portion of its length, so forming a gate-pattern which can be withdrawn vertically from the mold in the same way as the gate-pattern f, and which will form vertical pouring-gates extending down to the heads of the patterns, producing, practically, the same result as the solid pattern f. This gate-pattern t has what might be termed a "solid head" t', from which extend downwardly the vertical arms or wings t^2, the lower ends of which rest upon the heads u' of the patterns u, which in said figure are illustrated as of greater sectional area than the heads e in the other figures, so dispensing with side projections g. The arms or wings t^2, as can be clearly understood, form separate pouring-gates extending down from a common head, so that instead of the metal flowing in a solid body down through the pouring-gate and through the wings j' thereof it simply enters the top of the pouring-gate and thence flows through what are the equivalents of the wings to the cores and thence along the cores to the mold-cavities.

For the purpose of preventing pressure against the mold-cavity, I prefer to form the arms t^2 of the pattern t V-shaped, so that the greatest pressure of the metal in flowing through the gate will not be in the direction of the mold-cavities. This is more particularly shown in Fig. 8. It will be seen that in such construction of mold the body of sand h', which closes the central part of the pouring-gate, extends up much higher than where the star-shaped gate, having the central body f^2, as described in the other figures, is employed. I have also shown in Fig. 7 a cross-bar v, extending from the top of the gate-pattern to the flask. This bar will serve to hold the pattern to place during the compacting of the mold. By my invention I am thus enabled to provide a mold which can be formed in the ordinary way of forming these molds—that is, by jarring or ramming—and in which the gate-pattern can be withdrawn through the upper part of the mold and the cores inserted through the lower part of the mold without the necessity of employing any separate core to close the lower end of the gate formed by the gate-patterns, while at the same time in the pouring of the mold the metal can flow down through the gate and be led into the mold-cavities at the base thereof, so as to rise therein and prevent the cutting of the mold and form a much more solid casting. The operation of forming the mold is therefore practically the same as the ordinary operation of forming such molds, while some of the particular difficulties therein are overcome. At the same time, on account of the shape of the vertical pouring-gate, practically no pressure is exerted by the metal entering the same against the side walls of the unfilled mold-cavities, and for that reason the gate can be placed much closer to the mold-cavities, as above described. At the same time I am enabled to form a mold and cores therefor without inverting the mold after it is formed, the action being simply to withdraw the gate-pattern in one direction and drop out the main patterns in the other direction, and I am also enabled to hold the cores in the exact position in which they pass from the core-box without inverting or otherwise handling them, and at the same time to enter the cores within the mold-cavities, so that each one is independent of the other and will naturally pass to its proper seat within the mold-cavity.

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

1. A mold for forming tubular castings, having a vertical pouring-gate extending down from the top thereof, part of the lower end of said gate being closed by the body of sand forming the mold and part of the lower end of the gate being closed by the head of the core entering the mold-cavity, substantially as and for the purposes set forth.

2. A mold for forming tubular castings, having a vertical pouring-gate extending down from the top thereof, part of the lower end of said gate being closed by the body of sand forming the mold and part of the lower end of said gate being closed by the head of the core entering the mold-cavity and having a runner extending from the lower end of the pouring-gate to the mold-cavity along the said head, substantially as and for the purposes set forth.

3. A mold for forming tubular castings, having a series of mold-cavities, a central pouring-gate having part of the base thereof closed by the main body of sand forming the mold, and cores entering the mold-cavities, each core closing a part of the central pouring-gate, substantially as and for the purposes set forth.

4. A mold for forming tubular castings, having a series of vertical mold-cavities extending up within the same and having a vertical central pouring-gate star-shaped in cross-section and extending down from the top of the mold, the number of wings thereof corresponding to the number of mold-cavities, and runners leading from said wings to the vertical mold-cavities, substantially as and for the purposes set forth.

5. A mold for forming tubular castings, having a series of vertical mold-cavities extending up therein and having a vertical central pouring-gate star-shaped in cross-section and extending down from the top of the mold, the number of wings thereof corresponding

to the number of molds to be formed, and cores entering said vertical mold-cavities and closing the lower ends of said molds, the wings of said pouring-gate communicating with runners to direct the metal into the bases of the mold-cavities, substantially as and for the purposes set forth.

6. A mold for tubular castings, having a central pouring-gate the walls of which next to the mold-cavity are formed V-shaped in cross-section, so as to relieve the walls of the mold-cavities from the pressure of the metal passing into the gate, substantially as and for the purposes set forth.

7. A mold for forming tubular castings, having a pouring-gate extending down from the top thereof, part of the lower end of said gate being closed by the body of sand forming the mold, and having a core provided with a side lip or projection extending out from the head thereof, said lip or projection extending under and closing part of the said central pouring-gate, substantially as and for the purposes set forth.

8. A mold for forming tubular articles, having a pouring-gate extending down from the top thereof, part of the lower end of said gate being closed by the body of sand forming the mold, and having a core provided with a lip or projection extending out from the head thereof and closing the part of the lower end of the pouring-gate, said lip being of less height than the head of the core which forms the base of the mold-cavity, substantially as and for the purposes set forth.

9. A mold for forming tubular castings, having a central pouring-gate extending down from the top thereof, part of the lower end of said gate being closed by the body of sand forming the mold, and having a core provided with a side lip or projection extending out from the head thereof and closing the part of the lower end of the pouring-gate, said lip being of less height than the head of the core which forms the base of the mold-cavity, and said projection having a runner-groove in the upper face thereof, substantially as and for the purposes set forth.

10. A mold for forming tubular castings, having a series of mold-cavities, a central star-shaped main pouring-gate extending down from the top thereof, part of the lower end of said gate being closed by the main body of sand forming the mold, and cores provided with side lips or projections extending out under the wings of said central pouring-gate, substantially as and for the purposes set forth.

11. In molding apparatus, the combination of the patterns having a space between the heads thereof, into which the sand can enter, and a gate-pattern extending down from the top of the flask and resting on said heads and above said space, substantially as and for the purposes set forth.

12. In molding apparatus, the combination of the patterns having a space between the heads thereof, into which the sand can enter, and a gate-pattern extending down from the top of the mold above said space, the lower end of said gate-pattern being tapering to permit the packing of the sand in said space, substantially as and for the purposes set forth.

13. In molding apparatus, the combination of patterns having a space between the heads thereof, into which the sand can enter, said heads being provided with the seats or depressions in the upper face thereof, and a gate-pattern extending down from the top of the flask and having its lower edge entering said seats in the heads, substantially as and for the purposes set forth.

14. In molding apparatus, the combination of patterns provided with lips or projections at the sides of the heads thereof and having a space between said side lips or projections, and a gate-pattern extending down from the top of the flask and resting upon the side lips or projections of the pattern-heads, substantially as and for the purposes set forth.

15. In molding apparatus, the combination of patterns having a space between the heads thereof, into which the sand can enter, and a star-shaped or winged central gate-pattern extending down from the top of the flask and having its wings resting on said pattern-heads and above said space, substantially as and for the purposes set forth.

16. In molding apparatus, the combination of the flask, a series of patterns having a space between the heads thereof, into which the sand can enter, a pattern extending down from the top of the flask and resting on said heads and above said space, and a supporting-bar extending to the upper end of said gate-pattern to hold the same rigid, substantially as and for the purposes set forth.

17. The herein-described method of directing cores into mold-cavities in forming molds for tubular castings, consisting in supporting the cores upon a sanded or anti-friction bottom board and passing the cores while so supported into the mold-cavities, so that they may adapt themselves to said mold-cavities over such anti-friction surface, substantially as and for the purposes set forth.

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

STEPHEN JARVIS ADAMS.

Witnesses:
JAMES I. KAY,
J. N. COOKE.