(No Model.) 2 Sheets—Sheet 1.

S. J. ADAMS.

METHOD OF AND APPARATUS FOR FORMING MOLDS.

No. 274,691. Patented Mar. 27, 1883.

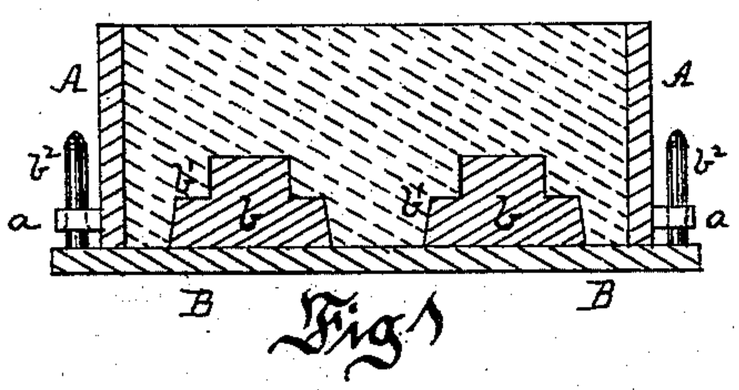

Fig 1

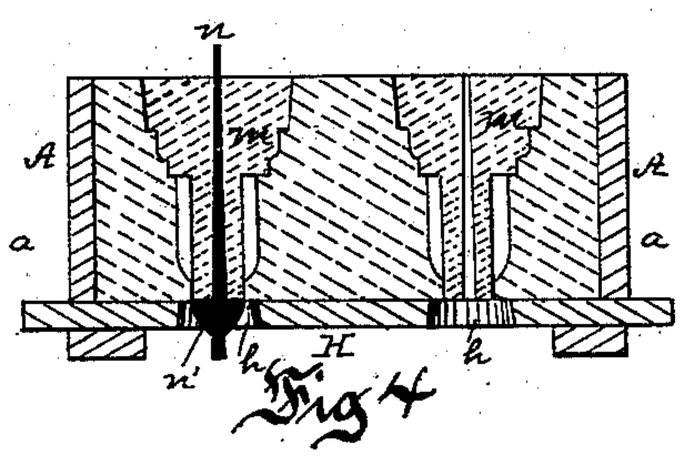

Fig 4

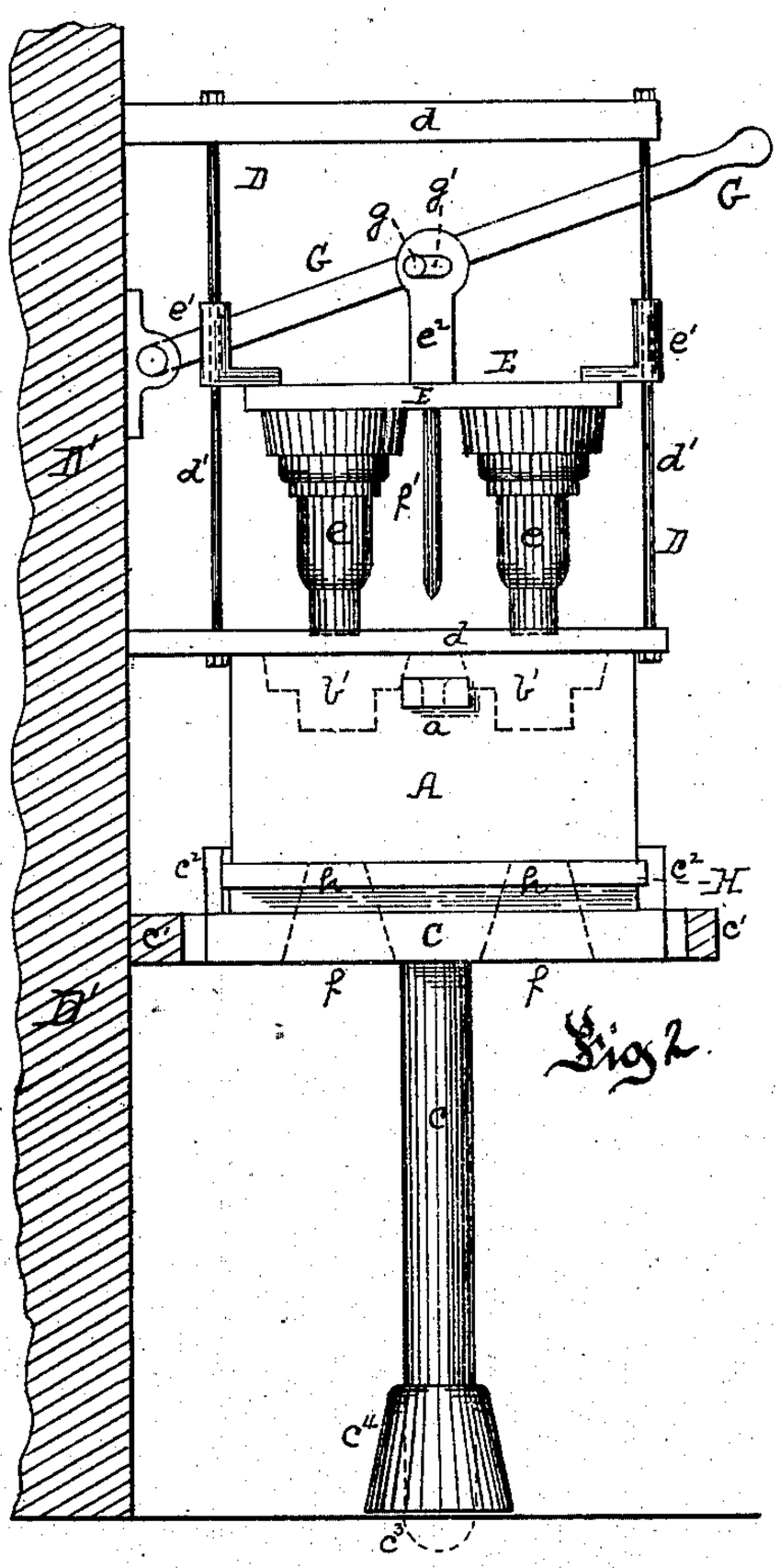

Fig 2.

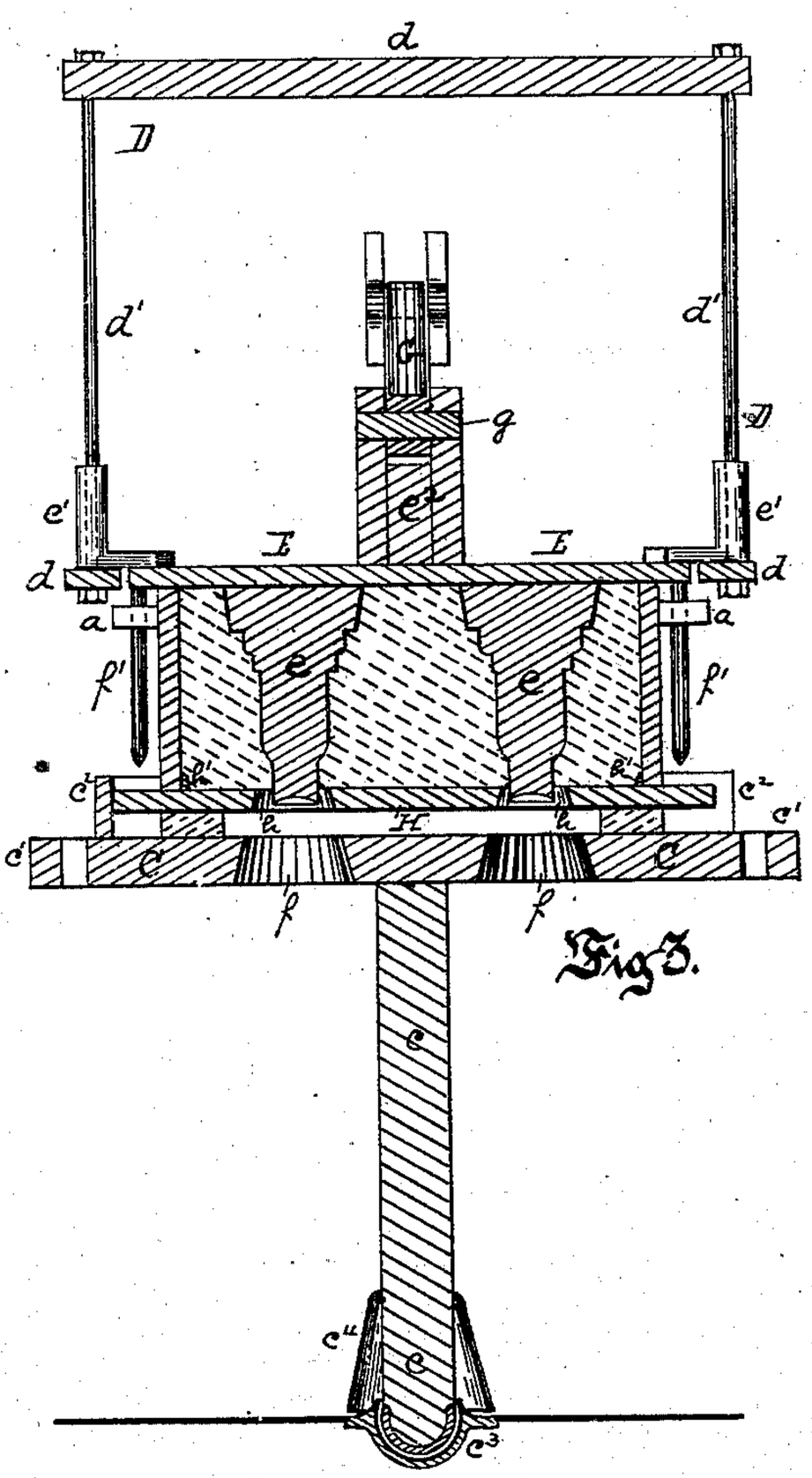

Fig 3.

Witnesses.
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(No Model.) 2 Sheets—Sheet 2.

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METHOD OF AND APPARATUS FOR FORMING MOLDS.

No. 274,691. Patented Mar. 27, 1883.

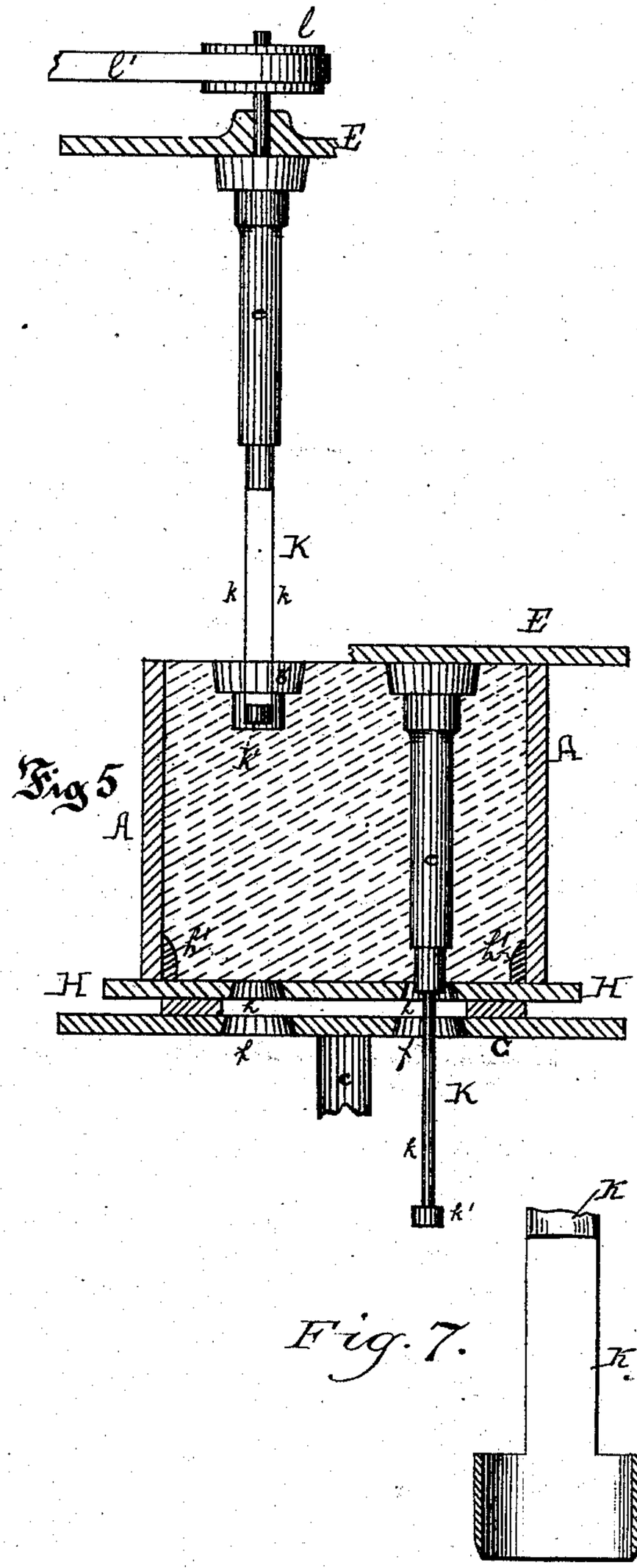

Fig 5

Fig. 7.

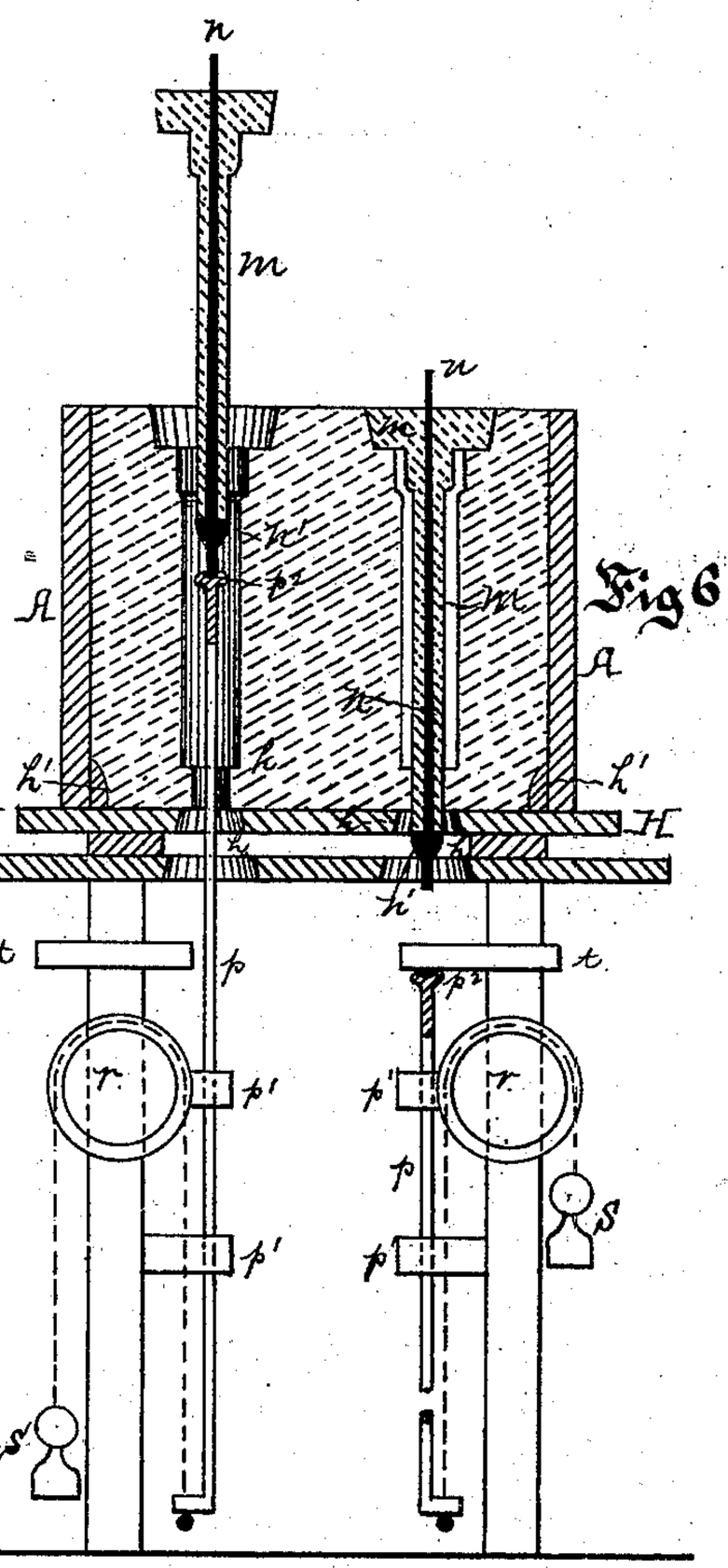

Fig 6

Witnesses
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UNITED STATES PATENT OFFICE.

S. JARVIS ADAMS, OF PITTSBURG, PENNSYLVANIA.

METHOD OF AND APPARATUS FOR FORMING MOLDS.

SPECIFICATION forming part of Letters Patent No. 274,691, dated March 27, 1883.

Application filed November 14, 1882. (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 Forming Molds; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to the formation of molds in sand for casting wagon-boxes, pipe-welding balls, and like tubular articles.

It consists, first, in forming tubular molds by first molding the cope-cavity and part of the mold, and then forming the remainder of the mold from the cope-cavity downward entirely through the mold material by displacing the mold material below the cope-cavity and discharging the surplus material through the bottom of the mold; second, in first compacting the mold material in the flask and then forming the mold from above through the mold material of the flask and discharging the mold material through openings in the bottom board below the flask; third, in certain improvements in the construction of the patterns, molding apparatus, and molding-table; and, fourth, in certain apparatus for guiding the cores into the tubular molds formed.

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

Figure 1 is a longitudinal section of a flask filled with the sand and patterns for forming the cope-prints therein. Fig. 2 is a side view of the molding table and apparatus, showing the same ready to form a mold. Fig. 3 is a longitudinal vertical section of the molding table and apparatus, showing the molds formed. Fig. 4 is a longitudinal vertical section of the flask with the molds formed therein and the cores inserted. Fig. 5 is a longitudinal vertical section of a flask, illustrating the formation of long tubular molds, and showing the patterns in full lines, one pattern before entering the sand and one after the mold is formed; and Fig. 6 is a longitudinal vertical section of a table and flask, illustrating the means for guiding the cores into the molds. Fig. 7 is a sectional view of skeleton cutter.

Like letters of reference indicate like parts in each.

In the drawings, A represents the flask in which the molds are formed, and which has cleats *a* at each end, through which the guide-rods of the plates carrying the patterns pass. The holes through these cleats are slightly flaring, so as to enable the guide-rods to enter them more easily.

B is a plate carrying the patterns *b* for molding the cope prints or cavities *b'* in the sand of the flask, and having the guide-pins b^2 at the center of the ends thereof adapted to enter the cleats *a* and hold the flask and plate in proper relative position. The flask A is placed over the plate B and the cope-cavities molded therein, either by pressing, ramming, or, as preferred by me, by jarring the sand to place, in the latter case, the flask and plate being placed on a jarring-table and given a sufficient number of jars, as described in patents previously granted to me, to compact the sand properly. As the patterns are to be subsequently pressed into the sand, it is not desirable that it be too closely compacted, and by jarring it to place I am enabled to pack it evenly and yet as loosely as desired.

C represents my improved molding-table, and D the molding-frame above the table, in which the plate E, carrying the patterns *e*, is mounted so as to slide vertically. The table C is mounted on a single standard, *c*, and moves within a surrounding frame, *c'*, extending out from the wall or standard D', supporting the molding-frame. The standard *c* is supported at the base in a ball and socket or like joint, c^3, so that it can have a movement therein, and the movement of the table C, attached to the standard, is limited by this frame *c'*, extending around it, so that the table is formed adjustable, and may conform itself and the flask A, supported on it, to the molding-patterns *e*, as hereinafter described. The table has lugs or ribs c^2 on its upper surface, by which the flask is guided to or held in its proper position on the table, these lugs being on two or more sides of the table, as desired, the lugs or ribs on two sides being generally considered sufficient. The table C has also openings *f*, extending through it in the same line with the patterns *e*, supported in the mold-

ing-frames to permit the escape of sand pressed out of the flask, as hereinafter described, and at the base of the standard *c* is a leather, tin, or like apron, c^4, which prevents the entrance of sand into the ball-and-socket joint c^3, when its falls through these openings. The frame D is formed of arms *d*, extending out horizontally from the wall or upright standards D′, and having perpendicular guide-rods *d′*, extending between these arms, and on which the sleeves or sockets *c′*, secured to the plate E, are mounted. These sleeves or sockets guide the movement of the pattern-plates and patterns. Motion is imparted to the pattern-plate and patterns by means of the lever G, which is hinged or pivoted to the upright D′, and extends across the plate E, and has a pivot or coupling pin, *g*, fitting within the upright bar e^2, extending up from the plate, so that the patterns may be drawn down or raised by means of this lever G. The pin *g* may either fit into an elongated seat or slot, *g′*, in the bar e^2, in order to allow its movement as the pattern-plate is raised or lowered, as shown, or the bar *e* may be pivoted both to the lever G and the pattern-plate, and thus accommodate itself to the movement of the lever. The pattern-plate E has guide-rods *f′*, which fit into the cleats *a* of the flask A, and thus draw the flask into the proper relative position with the patterns and hold it during the formation of the molds. The guide-rods *f′* are pointed to enable them to enter the cleats *a* more readily. After the cope cavities *b′* are formed in the flask A, as above described, the bottom board, H, is placed on the flask, and the flask is inverted, and the plate B, carrying the patterns *b*, is withdrawn in the usual manner. The bottom board, H, is provided with lugs or projections *h′*, for holding it in proper relative position with the flask, two or more of these projections being employed, as desired. The projections may also be formed on the flask instead of the bottom boards, if desired. Extending through the bottom boards in vertical line with the patterns *e* are holes *h*, these holes *h* corresponding in number to the number of patterns employed, and in size approximately to the diameter of the lower portions of the patterns, so that the base of the patterns may pass into or through these holes after the plate B is removed from the flask. The flask resting on the bottom board is placed on the molding-table C, the edge of the flask or its bottom board resting against the guide lugs or ribs c^2 and bringing the flask in proper position, so that the cope-cavities *b′* and openings *h* in the bottom board, and the openings *f* in the table, are all in vertical line with the patterns *e*. In case the flask is not in proper relative position with the pattern *e*, the guide-bars *f′*, entering the cleats *a*, draw the flask and table over into the proper line with the patterns, the adjustable table conforming itself and allowing the flask to be drawn into proper line. The patterns are then pressed down into the sand of the flask by means of the lever G, and are finally pressed through the flask, their bases entering the holes *h* in the bottom board, and expelling the surplus sand through these holes. The action of the patterns is to press aside part of the sand and so further compact the mold, while the surplus sand is expelled from the flask, as above described, and an evenly-packed mold is therefore formed. As it is desired that the sand be partially compacted in the flask before the finished patterns are formed therein, the advantage of molding the cope-cavities *b′* therein will be seen, as too great pressure would be required to press the large heads of the patterns into the partially-compacted sand, and the sand itself would be packed too tightly.

Instead of pressing the pattern by direct pressure into the sand, it may be rotated while entering the sand, as described in Letters Patent No. 257,991, granted me the 16th day of May, 1882; or the pattern may be arranged to cut out the sand, as described in Letters Patent granted to me the 17th day of December, 1880. In the latter case the sand in the flask will of course be more tightly compacted before the mold is formed therein.

When using a rotating cutter pattern or in forming large molds, or molds which are long and narrow—such as pipe-boxes—I generally employ a skeleton frame or cutter at the base of the pattern, as shown in Fig. 5, this skeleton frame or cutter entering the sand before the pattern proper, and forming a hole extending entirely through the flask, so that the pattern may enter more easily, and the sand cut or pressed out by it can pass out of the hole formed by the skeleton frame below the pattern. Where the pattern is pressed into the sand by direct pressure this skeleton frame K is formed of two flat arms, *k*, and a flat ring, *k′*, supported at their base, the skeleton cutter being first pressed into the sand and forming a hole through the flask, and the sand removed by it entering the frame and falling out of it as soon as the frame passes below the flask through the holes *h* in the bottom board, H, and *f* in the molding-table, and leaving free spaces for any sand loosened by the pattern to fall out at the bottom of the flask. Where the pattern is rotated the ring *k′* at the base of the skeleton cutter is not required, and the flat arms will cut loose the sand, which will then fall out at the base of the mold, and any sand cut or pressed out by the rotary pattern can fall out through the bottom of the flask.

In Fig. 5 the pattern *e* is journaled in the pattern-plate, and power is applied to the pattern to rotate it by means of pulley *l* and belt *l′*. Only one such pattern is illustrated in the drawings, the connections for a nest of such patterns being easily arranged by a skilled mechanic.

Where the mold formed is shallow, as in pipe-balls, the cores can be placed therein by hand, as shown in Fig. 4, the cores *m* being preferably formed around a core-rod, *n*, having

a button, n', with tapering base, and the tapering base guiding the core to place, as described in an application made by me of even date herewith. The core-rod can then be removed as described in that application, leaving the core in the mold.

Where a long mold is formed in a deep flask of sand, as shown in Figs. 5 and 6, it is desirable to have a means for guiding the core m into the flask, and, as the mold is open at both ends, I am therefore enabled to use guiding apparatus below the flask, and extending up through the opening at the base of the mold to guide the core to place. This is illustrated in Fig. 6 of the drawings, in which p represents the guiding-rod sliding in bearings p', extending out below the table, and having the cord passed over the wheel r, and the weight s attached at the other end. The guide-rod has a cup-shaped seat, p^2, at the top, and is raised by means of the weight up through the hole h in the bottom board, H, and through the mold formed, the end of the core-rod is placed in this seat p^2, and the core lowered by means of this rod centrally of the mold into its proper place. Any suitable means of mounting this guide-rod or balancing it may be employed. The guide-rod is held below the table by means of a stop, t, which passes over the top of the guide-rod when it is not in use.

Molds are formed by my improved method and apparatus in the following manner: The flask A is placed over the plate B, the guide-pins b^2 entering the cleats a and holding the plate and flask in proper relative position. The plate and flask are then placed upon a jarring-table, and the sand jarred into the flask and the cope-cavities b', formed in the sand, the sand being compacted as much as required for the formation of the molds. The bottom board, H, is then placed on top of the flask, being held in proper position by the lugs or projections h'. The flask is inverted, and the plate B withdrawn. The flask, resting on the bottom board, H, is then placed on the molding-table C, being guided into proper position by the lugs or ribs c^2. The plate E, carrying the patterns e, is then drawn down by lever G, and the guide-rods f' enter the cleats a and draw and hold the flask and molding-table in proper line with the patterns, the flask and table being brought into register with the patterns on account of the adjustability of the table. As the patterns enter the sand their bases press the sand below them downward, and the sides of the patterns press out the sand, so that part of the sand is pressed through the holes h in the bottom board and f in the molding-table, and the sand in the flask conforms itself to the shape of the patterns, the molds being thus formed in the flask. If the patterns are provided with skeleton cutters K, the cutters enter the sand and pass through the flask ahead of the patterns, forming an opening entirely through the flask for the escape of the sand. Where rotary cutting patterns are employed the sand loosened or removed by them passes through this opening and falls through the bottom board. The patterns are then withdrawn from the flask, leaving the molds formed. The cores are then placed in the flask, as above described, and the mold is ready for casting. Where long tubular molds are formed the flask is placed on another table, having the guiding apparatus mounted below it, as shown in Fig. 6. The guide-rod p is raised through the base of the mold, and the end of the core-rod placed in the seat p^2 and the cores lowered into the mold, as above described.

By my invention I am enabled to rapidly and at small expense form evenly-packed and perfect tubular molds. By the formation of the cope cavity, or cope-cavity and part of the mold, first, I overcome the objections to these long pressing-patterns of compacting the upper part of the mold more than is desired, and enable them to enter the sand more easily, so that these long patterns may be formed by hand, other power having been heretofore found necessary to press these patterns into the sand in forming the mold. By forming the mold entirely through the flask I remove the sand from the flask at the base of the mold and overcome the necessity of lifting it out and removing it from the patterns before another molding operation. I am also enabled to form a more perfectly packed mold, as the surplus sand is removed from the mold, instead of being pressed out into the walls by the entering patterns. I am also enabled to place the cores into the molds more accurately, and to employ guiding apparatus for that purpose, as well as to do away with the large number of core-rods usually employed to support the cores into the molds, as the core-rod can be removed from each core at the base of the mold through the opening in the bottom board after the core is placed in the mold, as described in the application of even date herewith, referred to above. The guiding apparatus, as it passes up through the molds and guides the cores centrally to place therein, prevents the marring or injuring of the walls or the bottom of the molds, and enables me to form perfect castings where the end of the casting is required to be formed square, as in wagon-boxes, it being heretofore impossible, as a business, to direct these long cores to place without injury to the molds in these parts.

If desired, a pattern or rod not having the exact shape of the mold to be made may be first pressed through the sand of the flask and discharge the sand through the holes in the bottom board, and the patterns be pressed into the hole or cavity which is formed to finish the mold; and this is also included in my invention.

No claim is made herein for the serrated or roughened core-venting rod or for the mold open at both ends and core having a supporting or venting rod adapted to be removed through the base of the mold, that being made

the subject of an application of even date herewith.

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

1. The method herein described of forming molds, consisting in first molding the cope-cavity and part of the mold in the mold material and then forming the remainder of the mold from the cope-cavity downward entirely through the mold material below the cope-cavity, and discharging the surplus material through the bottom of the mold.

2. The method herein described of forming molds, consisting in first compacting the mold material in the flask and then forming the mold from above through the mold material of the flask and discharging the mold material through the bottom of the mold, substantially as set forth.

3. The combination of a vertically-moving pattern, a flask containing mold material, and a bottom board having an opening of approximately the same diameter as the base of the pattern, whereby said pattern is adapted to enter the mold material from above and discharge the mold material through the opening in the bottom board, substantially as described.

4. In combination with a flask containing sand, a bottom board having an opening therein, and a pattern adapted to enter the sand from above and form a mold, and a skeleton cutter at the base of the pattern adapted to pass through the sand and the opening in the bottom board, substantially as and for the purposes set forth.

5. In combination with the frame supporting a pattern, the pattern adapted to enter the flask and form molds, and an adjustable table supporting the flask and secured to a standard mounted in a movable joint, whereby the flask may be brought into register with the pattern, substantially as set forth.

6. In combination with a frame supporting a pattern or patterns mounted so as to move vertically therein, an adjustable table supporting a flask and secured to a standard mounted in a movable joint, and guide apparatus to hold the pattern and flask in proper relative position, substantially as set forth.

7. In combination with the molding-frame D, the plate E, mounted therein and carrying the patterns *e* and guide-bars *f'*, and the flask A, having the cleats *a*, substantially as and for the purposes set forth.

8. In combination with the molding-table C, having the opening *f*, bottom board, H, having the opening *h*, of approximately the same diameter as the base of the pattern, and flask A, the patterns adapted to enter the flask from above and discharge the surplus sand through said openings, substantially as and for the purposes set forth.

9. The molding-table C, having the standard *c*, supported at the base in a movable joint, substantially as and for the purposes set forth.

10. The adjustable molding-table C, in combination with the surrounding frame *c'*, substantially as and for the purposes set forth.

11. The molding-table C, secured to the standard *c*, supported at the base in a movable joint, and having lugs or ribs *c'* to guide the flask to the proper position thereon, substantially as set forth.

12. The adjustable molding-table C, having the standard *c*, supported at the base in a movable joint, and provided with the apron c^4, substantially as and for the purposes set forth.

13. The pattern *e*, having the skeleton frame K, formed of the arms *k* and ring *k'*, substantially as and for the purposes set forth.

14. In combination with a mold extending entirely through the sand, guide apparatus adapted to enter the mold from below and guide the core to place therein, substantially as set forth.

15. The guide apparatus mounted below the table and having the vertically-moving guiding-rod *p*, provided with the seat p^2 at the top, 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:

JAMES I. KAY,

F. G. KAY.