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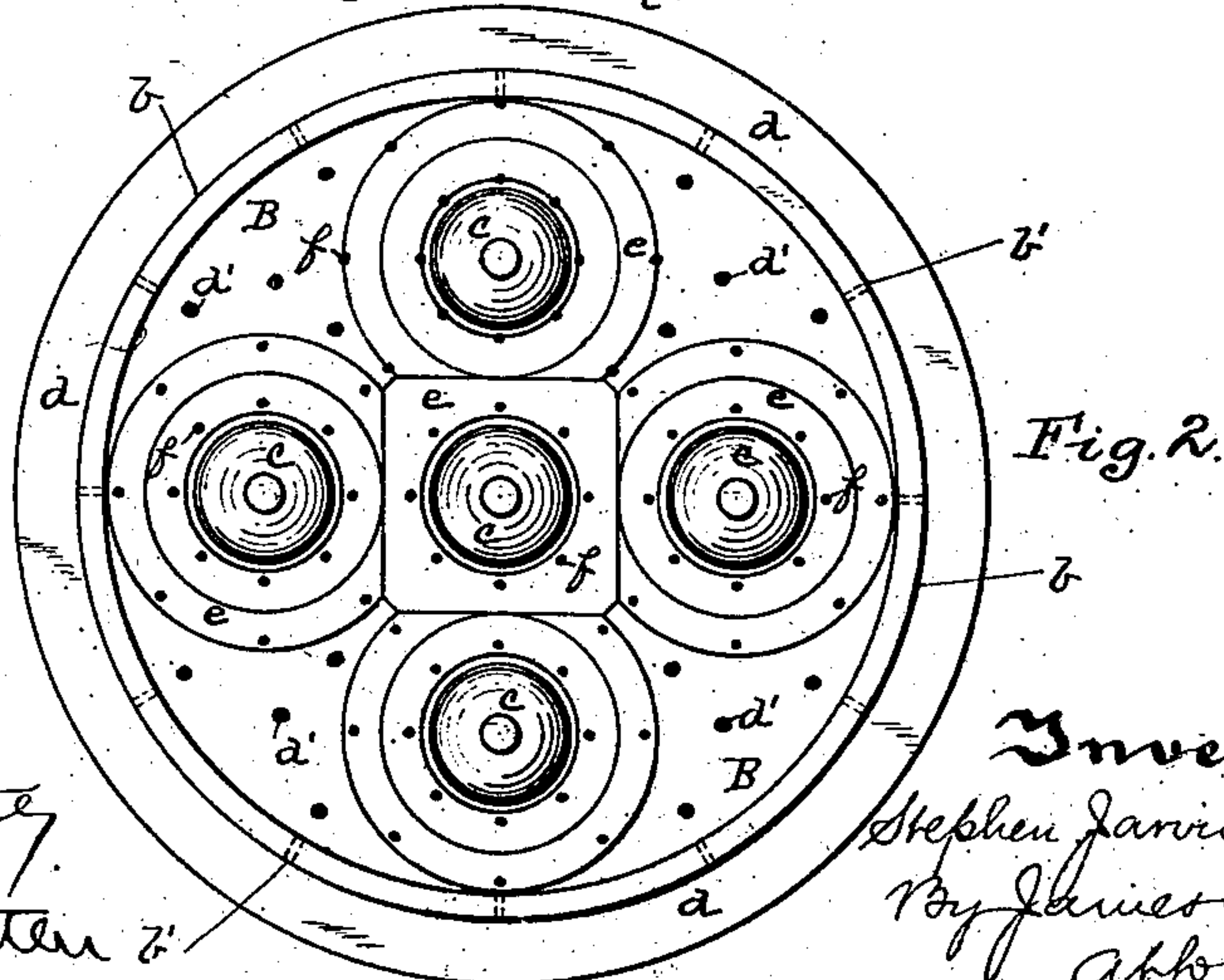
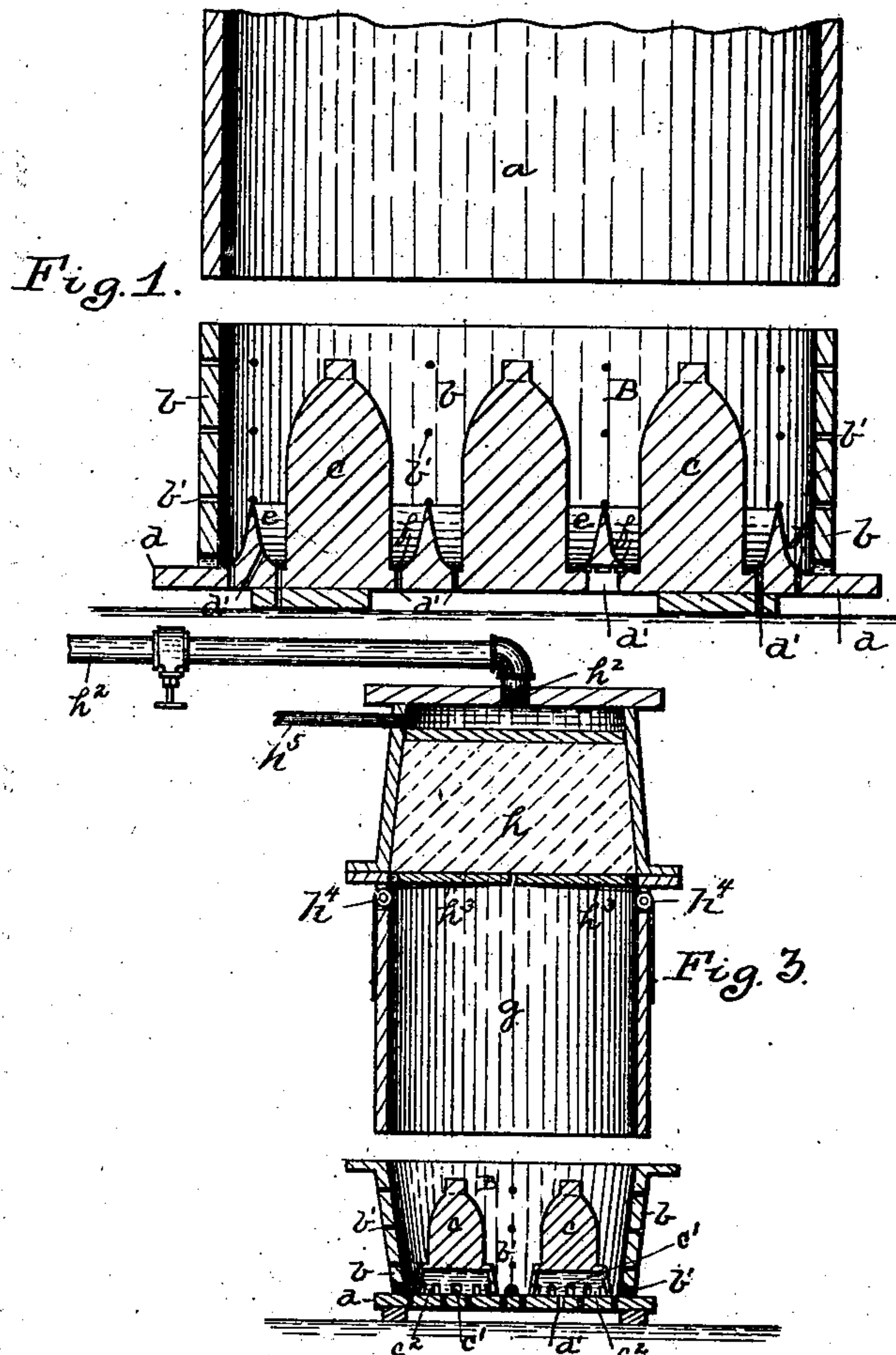
2 Sheets—Sheet 1.

S. J. ADAMS.

METHOD OF AND APPARATUS FOR FORMING SAND MOLDS.

No. 587,031.

Patented July 27, 1897.



Witnesses:

J. M. Cooke

Robt. W. Lotter

Inventors

Stephen Jarvis Adams

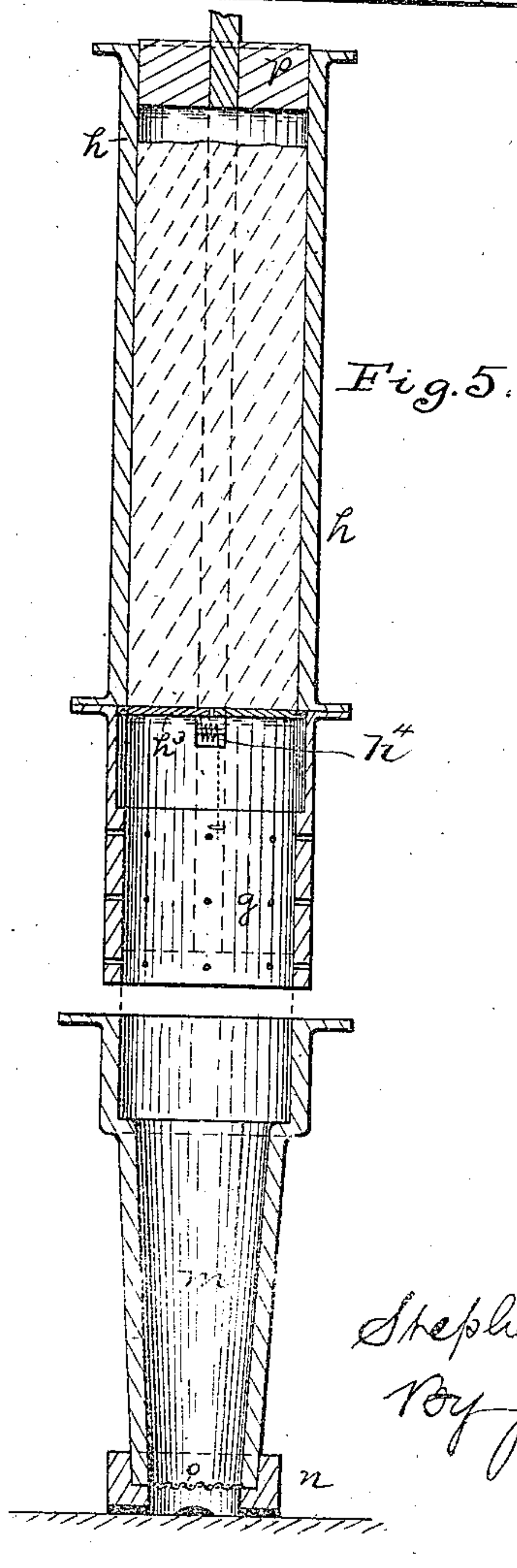
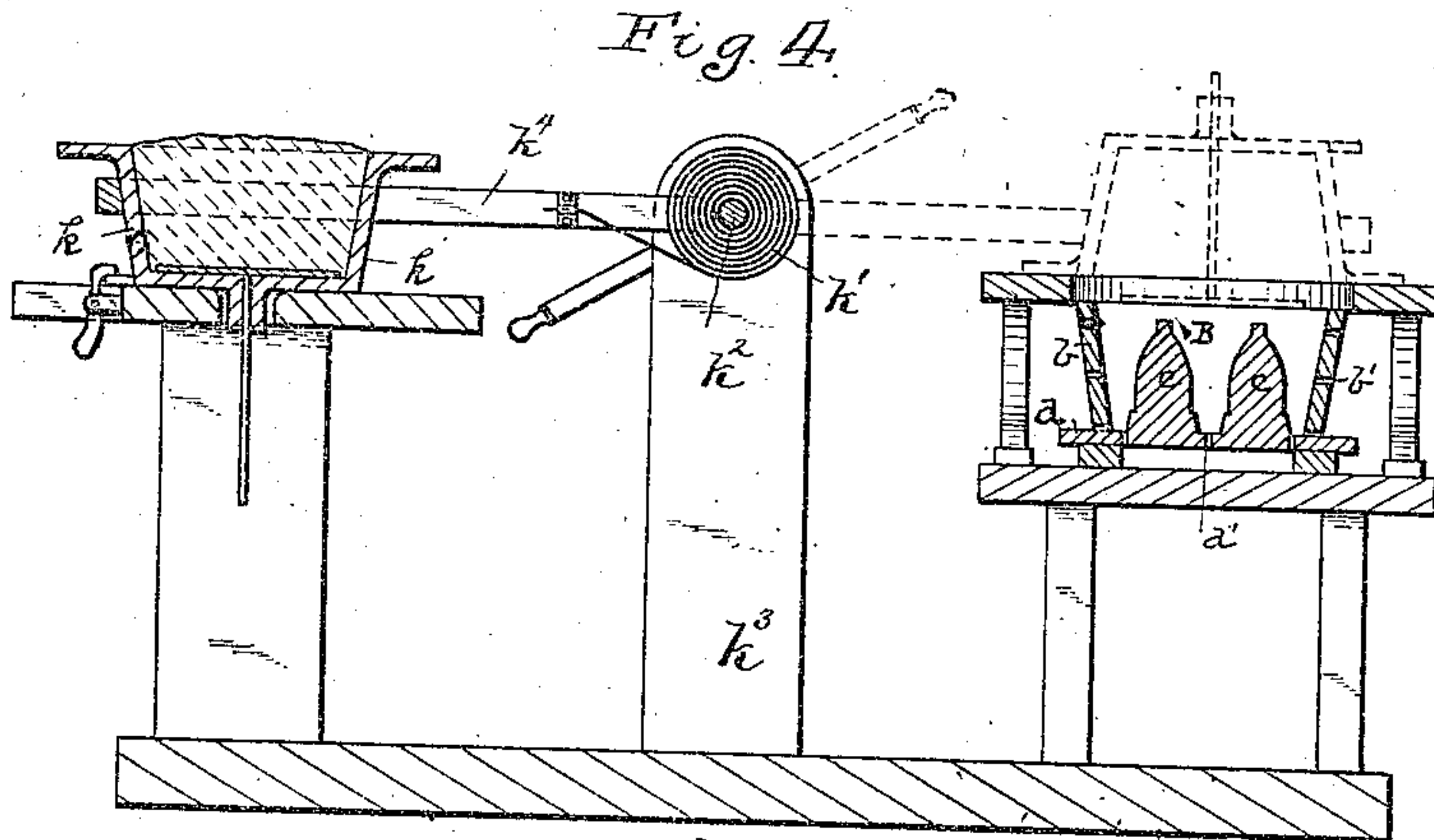
By James D. Hay

Attorney

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UNITED STATES PATENT OFFICE.

STEPHEN JARVIS ADAMS, OF PITTSBURG, PENNSYLVANIA.

METHOD OF AND APPARATUS FOR FORMING SAND MOLDS.

SPECIFICATION forming part of Letters Patent No. 587,031, dated July 27, 1897.

Application filed November 23, 1891. Serial No. 412,857. (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 the Method of and Apparatus for Forming Sand Molds; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to an improvement in apparatus for forming sand molds, its object being to produce a mold in which the sand is closely compacted and free from spongy parts and small cavities or pockets, such as would lead to imperfections in the castings formed therein.

One of the processes of forming sand molds heretofore experimented with consists in carrying sand to a point elevated above the flask containing the patterns and allowing the sand to descend by the force of its own gravity into the flask below, the object of the process being to compact the sand densely all around the patterns by the velocity acquired during its descent. One serious obstacle is encountered in the practical operation of this process due to the air confined within the flask. When the sand is permitted to descend in bulk from a height above the flask into said flask, as there is no way of escape for the air within said flask except from the mouth or open upper end of the flask, the air acts as a cushion for the falling body of sand and its velocity or force is seriously impeded, and besides leaving spongy places in the channels where the air has escaped on its way out of the flask it also forms small pockets or air-cavities in the lower part of the mold around the base of the patterns by the air which could not escape. A casting formed in such a mold is necessarily liable to possess imperfections through the metal entering such cavities or pressing back the sand in such spongy places and so forming swells or enlargements thereon. The object of my invention is to obviate this difficulty in connection with the practice of this and similar methods of forming molds, and thereby produce a mold free from such imperfections.

To these ends my invention consists, generally stated, in setting a bulk of sand in motion and causing it to enter the receiving-

cavity in bulk, and at the same time providing free escape of air from such cavity to permit the sand to pack evenly and solidly therein.

It also consists in applying pressure to a body of sand contained in a holder, so as to project it into the flask.

It also consists in combining means for setting a bulk of sand in motion and guiding it to the flask with a flask having openings leading from its sand-receiving cavity, so that air may have free escape and the sand be properly compacted.

It further consists in arranging within the flask a projection having an inclined face which surrounds part or all of the pattern and which is adapted upon the descent of the sand to direct the sand against the body of the pattern, so as to pack the sand closely against the pattern.

It also consists in other improvements, as 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—

Figure 1 illustrates a flask containing patterns, showing the lower end of the chute arranged to direct the sand into the same. Fig. 2 is a plan view of the flask. Fig. 3 is a sectional view of the flask, showing an improved method of projecting the sand into the flask; and Fig. 4 is a like view showing another means of discharging the sand in bulk into the flask, the means illustrated in the latter view forming the subject of another application of even date herewith, Serial No. 412,860; and Fig. 5 is a view of a core-box, illustrating the application of the invention to the same.

Like letters of reference indicate like parts in each view.

In practicing my invention where the bulk or body of sand receives its velocity by dropping through the chute the lower end of such chute is shown at *a*, such chute acting to direct the sand into the flask, the sand being dropped the proper distance to give the necessary velocity for packing within the flask. Such chute forms a good illustration of the manner of feeding the sand in bulk, such as by dropping or gravity, but the sand may be fed

in bulk with the necessary force to compact it in any suitable way, one of which is included in this application. The flask *b* is located directly under the chute *a*, said flask
 5 containing the patterns *c*, which, for the purpose of illustration, are patterns for pipe-balls. The patterns *c* rest upon the base-plate *d* and may be secured to the same or may be loose or separable therefrom, being simply guided
 10 to place by suitable seats and projections, if necessary. Leading from the sand-receiving cavity *B*, which is surrounded by the flask *b* and has for its base the pattern-plate and into which the patterns themselves extend,
 15 are suitable openings for the escape of air from such cavities, these openings being formed either in the flask, the base-plate, or in the patterns, which in such cases are hollow. Several examples of these escape openings
 20 or outlets are illustrated, the base-plate *d* being provided with openings *d'*, while the walls of the flask *b* are provided with the openings *b'*, which openings are illustrated as formed adjacent to the base-plate *d*, which is
 25 the preferable position for the same, though the openings may extend toward the upper end of the flask, and like openings *c'* are shown at the bases of the patterns. For some purposes the patterns may be supported on
 30 pins *c''*, resting on or entering seats in the pattern-plate, and the air permitted to escape between the base of the pattern and the pattern-plate. It will be understood that the object of such construction is to provide free
 35 escape of the air from the sand-receiving cavity when a bulk or body of sand sufficient to fill the same enters with the velocity necessary to compact the mold, and that while it is essential that there should be these open-
 40 ings at or near the base of such sand-receiving cavity these openings may extend as far above the base as it is found desirable. It will be noticed that the flasks are formed inwardly, tapering toward the base, and in form-
 45 ing molds where the sand in bulk enters the flask this is of considerable importance, as such tapering walls force or direct the sand against the patterns projecting into the sand-receiving cavity and materially assist in pack-
 50 ing the sand against the patterns. For this same purpose I also prefer in some molds to employ the internal guide pieces or rings *e*, projecting into the said receiving-cavity, rings such as illustrated in the drawings be-
 55 ing generally employed with tubular or circular patterns, though for some patterns of other shapes sectional pieces extending up from the base-plate could of course be employed. These conical rings or guide-pieces
 60 extend up from the base-plate within the flask to a suitable height and have their faces inclined from the top ridge or apex thereof toward the patterns, so as to direct the sand in its descent against the bodies of the patterns
 65 and cause a more perfect compacting thereof in the particular place where it is desired to compact the sand firmly. Air-openings may

also be formed at the base of such projected pieces.

In practicing my invention with the appa- 70
 ratus above described the operation is practically as follows: The flask *b* is arranged directly under the chute *a* and the sand which is held in bulk at the upper end of the chute
 75 is allowed to descend through the same, the sand dropping a sufficient length to acquire the necessary velocity to pack firmly within the flask where the bulk or body of sand enters the same.

Instead of permitting the sand simply to 80
 drop through the chute or guidway *a* I in some cases employ simply a short guideway *g*, as more particularly illustrated in Fig. 3, above which is the sand-holder *h*, which is filled with sand, the upper part of said sand- 85
 holder being closed, and I apply pressure in any suitable way to the body of sand to project it into the flask. For this purpose I may either through a pipe *h''* introduce air under considerable pressure or I may through such 90
 pipe introduce a mixture of gas and air, which may be exploded by a jet entering the space above the sand through pipe *h''*, and so generate sufficient force to impel the sand through the guidway into the flask. In such 95
 cases the doors *h'''*, closing the lower ends of the sand-holder *h*, are hinged and are provided with springs *h''''* of sufficient force to hold the doors closed when the bulk of sand rests upon them, but are yielding when the 100
 pressure is brought upon the sand, so as to be forced out of the way and permit the bulk of sand to be projected into the flask below the same.

Where the sand is projected in bulk from 105
 the holder, the result is practically the same, a body of sand sufficient to fill and pack the flask being set in motion by the pressure created above it, such as by the air-pressure or by the explosion of the gas above the same, 110
 and so ejected from the holder into the flask. In either such case a bulk or body of sand sufficient to fill the flask and be compacted therein enters the cavity of the flask with sufficient force to compact itself within the 115
 flask and around the patterns, and when it enters the same the air which is contained within the sand-receiving cavity finds free escape therefrom through the several escape-
 120 openings leading from such cavity, either through the flask-walls, the base-plate, or patterns, so that all liability of the formation of air-pockets on account of the confining of air within the flask or the formation of soft spots is overcome, practically all resistance to the 125
 bulk or body of sand being removed, and it can therefore compact itself by its velocity firmly within the sand-receiving cavity and around the patterns. During this action the sand which strikes the inclined rings or in- 130
 135 clined faces *e* will be directed thereby against the patterns and the proper compacting of the sand at such points will be obtained. At the same time the inclined walls of the flask

will act in the same way as the inclined faces to direct the sand against the several patterns and assist in the compacting of the sand around the patterns. After the air has been expelled through the several openings some of the sand may protrude through the same, either through the bottom plate or through the openings in the patterns, and in such case, when the plate is removed, the sand may be smoothed off, or, if desired, the plate may be arranged to have a sliding movement, so as to smooth off such protuberances. The patterns may also be arranged to be turned slightly in the mold-cavities so formed and smooth off any roughness from protuberances arising from such cause.

In Fig. 4 I have illustrated a different manner of projecting the bulk of sand into the flask, this forming the subject-matter of a separate application of even date herewith, Serial No. 412,860. In such case the sand is filled within a suitable holder or reservoir *k*, which in the drawings illustrated has a swinging motion to impart the necessary velocity to the sand, the reservoir being arranged to swing in a circular course and to be brought above the flask, so that the sand contained within the reservoir may be projected therefrom directly into the flask. The motion is imparted to the reservoir *k* by means of the coiled spring *k'*, surrounding the shaft *k²* on the standard *k³* and connected to the swinging arm *k⁴*, carrying the reservoir. This is shown simply to illustrate another method of imparting motion to the sand, and in such case the air has the same free escape from the flask as that above described.

In Fig. 5 I have illustrated the application of the invention to the making of cores. It is of course desirable that the outer walls of the core-box *m* shall be solid or imperforate, so as to form perfect outer walls to the core, and to provide for the escape of air I form perforations *o* in the base-plate *n*, closing the lower end of the core-box, and for such purpose I may form rather large openings, covering the same with wire-gauze, so as to prevent the escape of sand. In said Fig. 5 I have illustrated a piston *p* for projecting the sand from the sand-holder and generating the necessary force to cause the sand to enter and pack within the cavity of the core-box.

By my invention I am enabled to overcome the particular difficulty in forming perfect molds by causing a bulk or body of sand to enter the flask with sufficient velocity to pack itself therein by providing a free and perfect escape for the air contained within the sand-receiving cavity, so that it is practicable to form merchantable molds by such method. It will be understood that I do not confine myself to any particular location for the air-outlets, as they may be arranged in many different ways, the main feature being to provide the full and free escape of air from the flask when a body of sand sufficient to fill the same enters the sand-receiving cavity.

No specific claim is made in this application to the mechanism illustrated in Fig. 4 of the drawings further than the general claims of this application cover the same, as the mechanism shown in that figure forms the subject-matter of a separate application of even date herewith, Serial No. 412,860.

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

1. The herein-described method of forming sand molds, consisting in setting a bulk or body of sand sufficient to fill the flask in motion, and causing it after motion is imparted to it to enter the sand-receiving cavity with sufficient velocity to pack therein, and at the same time providing free escape of the air from such cavity to permit the sand to pack evenly and solidly therein, substantially as set forth.

2. The herein-described method of forming sand molds, consisting in positively moving a bulk or body of sand contained within a holder by applying pressure thereto, and so projecting the body or bulk of sand first from such holder and then into the flask, substantially as and for the purposes set forth.

3. The herein-described method of forming sand molds, consisting in positively moving a body or bulk of sand by applying pressure thereto at a point away from the empty flask, and guiding it in its course to the flask and so projecting the body or bulk of sand into the flask, substantially as set forth.

4. The combination of a sand-holder for holding a body or bulk of sand, means for applying pressure to and projecting the body of sand in bulk from the holder, and a flask in line with but out of contact with the holder having perforations at or near the base thereof, substantially as set forth.

5. The combination of a sand-holder for holding a body or bulk of sand, means for projecting the body of sand in bulk from the sand-holder, a flask in line with the holder, and a guideway between the holder and flask, but out of contact with the flask, substantially as set forth.

6. The combination of a sand-holder for holding a body or bulk of sand, means for projecting the body of sand in bulk from the sand-holder, a flask in line with the holder having perforations at or near the base thereof, and a guideway between the holder and flask, but out of contact with the flask, substantially as set forth.

7. In apparatus for forming sand molds, the combination with a flask, of a sand-holder away from but in line with the flask, said sand-holder having an inclosed space above the sand to receive fluid under pressure to project the sand from the holder, substantially as and for the purposes set forth.

8. In apparatus for forming sand molds, the combination with a flask having a pattern extending up into the same, of a projection extending up within the flask, and provided with a face or faces inclined toward the pat-

tern, to direct the sand fed to the flask against the pattern, substantially as and for the purposes set forth.

9. In apparatus for forming sand molds, 5 the combination with a flask having inwardly-inclined walls, of patterns extending up within the same, and projections extending up within the flask provided with faces inclined toward the patterns, said inclined 10 flask walls and faces acting to direct the sand fed to the flask against the patterns, substantially as and for the purposes set forth.

10. In apparatus for forming sand molds, the combination of a flask, a sand-holder for 15 holding a body or bulk of sand away from but in line with said flask, and a base-plate

closing the lower end of said flask and having air-escape openings extending through said plate, substantially as set forth.

11. In apparatus for forming sand molds, 20 a flask having a base-plate closing the lower end thereof, and a pattern extending up within the flask, and having openings in the hollow base of the pattern and escape-outlets therefrom, substantially as and for the pur- 25 poses 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.