April 28, 1953 J. T. DOUGHERTY 2,636,231

APPARATUS FOR AND METHOD OF MAKING SAND MOLDS MECHANICALLY

Filed June 5, 1950 2 SHEETS—SHEET 1

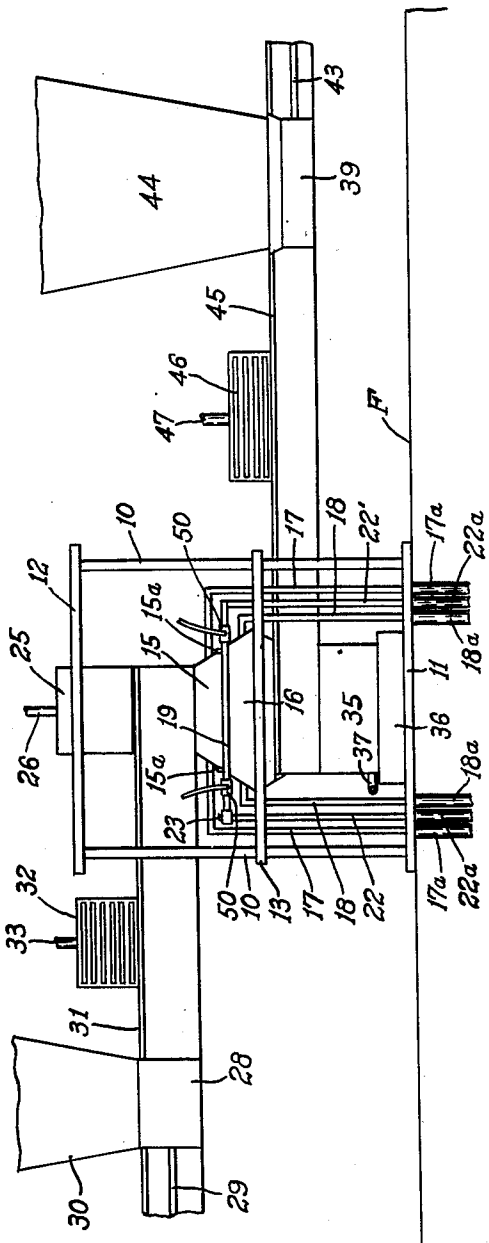


Fig. 1

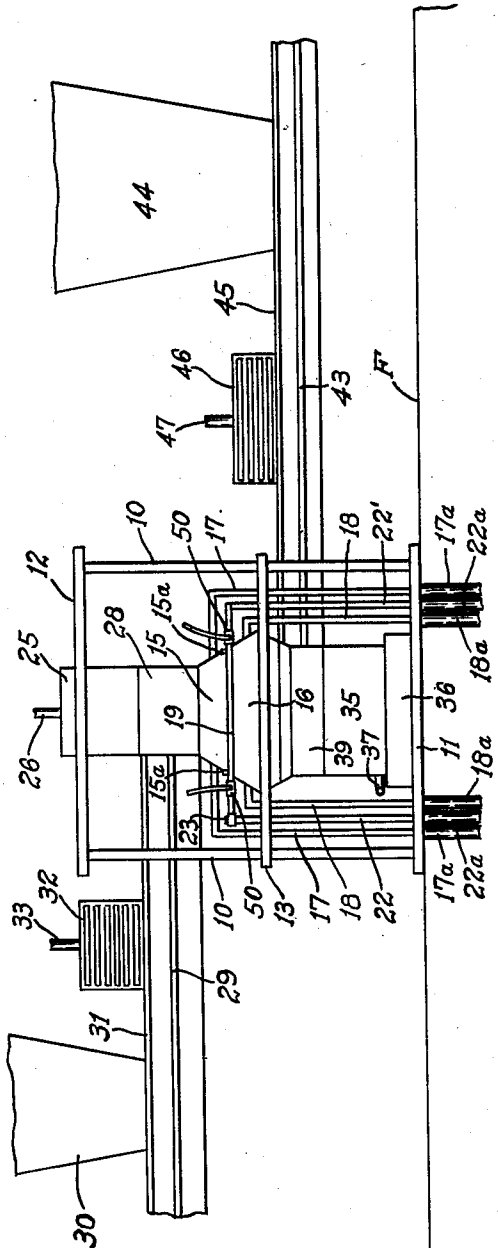


Fig. 2

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APPARATUS FOR AND METHOD OF MAKING SAND MOLDS MECHANICALLY

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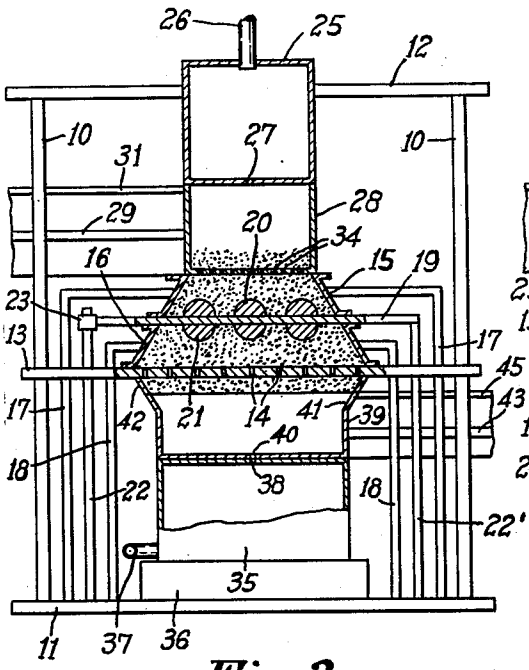


Fig. 3

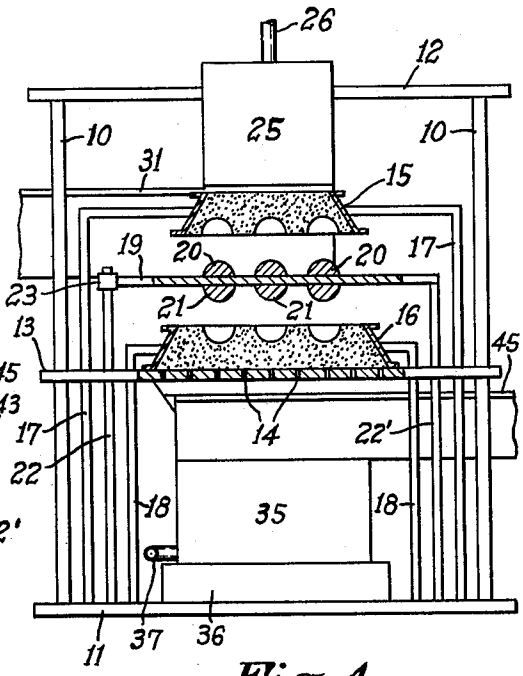


Fig. 4

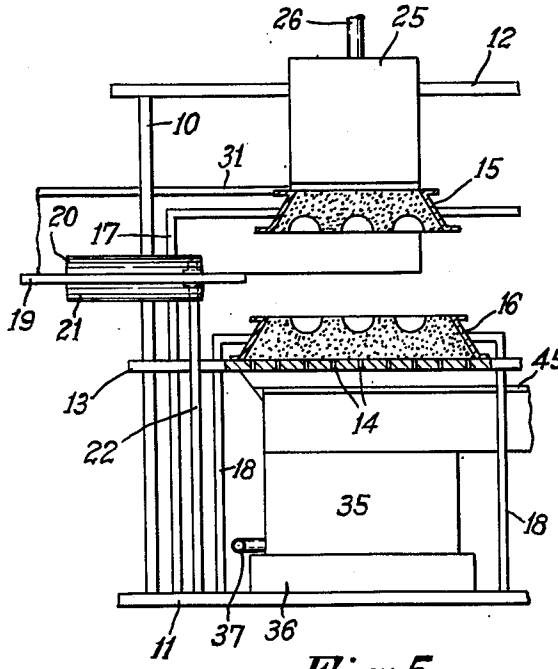


Fig. 5

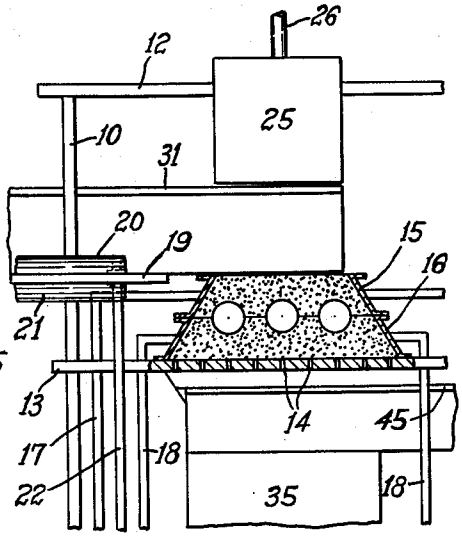


Fig. 6

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2,636,231

APPARATUS FOR AND METHOD OF MAKING SAND MOLDS MECHANICALLY

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11 Claims. (Cl. 22—25)

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The invention relates generally to a method of making sand molds for metal castings, and more particularly to a novel method whereby the complete sand mold is quickly made mechanically without manual operations other than the manipulation of a control device which co-ordinates the operation of the mechanical elements.

Present day foundry practice of making sand molds includes certain mechanical equipment such as vibrating and jolting devices for the pattern and means for supporting the flask sections during certain operations, but a number of manual operations are still required, such as shoveling and tamping or ramming sand into the flask sections, inverting certain flask sections and transferring the sections from one support to another.

These manual operations require skilled labor and extra time and expense, and moreover, the quality of the sand mold thus produced is always dependent to a large degree upon the care and skill exercised by the operator.

It is an object of the present invention to provide a novel method and apparatus for making a complete sand mold entirely by mechanical operations which are adapted to be performed automatically in proper sequence.

Another object is to provide a novel method for making sand molds of uniform and superior quality.

A further object is to provide a novel method of making sand molds which saves time, expense and labor, and requires a minimum amount of working space.

These and other objects are accomplished by the apparatus, method steps and combinations thereof comprising the present invention, a preferred embodiment of which is described in the specification and illustrated in the drawings as exemplifying the best known mode of carrying out the invention, the scope of the invention being defined in the appended claims forming part hereof.

In general terms, the novel apparatus for carrying out the method of the present invention preferably includes sand supply cylinders for the cope and drag sections of the flask movable laterally from a loading station into register with the assembled flask and with compressed air means for blowing the sand downwardly into the cope section and upwardly into the drag section simultaneously, the cope and drag sections and the pattern plate being independently movably supported so that the cope section and pattern plate can be raised and the pattern plate swung

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laterally from between the cope and drag sections, the supporting means being operable to then lower the cope section onto the drag section, and then to raise the cope and drag sections above the completed mold.

Referring to the drawings in which a preferred embodiment of the invention is illustrated by way of example;

Figure 1 is an elevational view showing somewhat diagrammatically one form of apparatus for carrying out the invention, with the sand supply cylinders in position to be loaded prior to making the mold;

Fig. 2 is a similar view with the sand supply cylinders in position for filling the mold flask;

Fig. 3 is an enlarged view partly in section with the flask sections and pattern in the assembled position of Fig. 2, after the sand is introduced from the cylinders into the flask;

Fig. 4 is a similar view showing the sand cylinders removed and the cope section and pattern plate raised and separated;

Fig. 5 is a fragmentary view similar to Fig. 4 showing the pattern plate removed from between the cope and drag sections; and

Fig. 6 is a view similar to Fig. 5 with the cope section lowered onto the drag section.

Similar numerals refer to similar parts throughout the several views of the drawings.

The apparatus preferably consists of an open rectangular frame having vertical posts or columns indicated at 10 mounted at their lower ends in a base plate 11 and supporting a top plate 12. Substantially midway between the base plate 11 and top plate 12 is a stationary supporting platform 13 which is carried on the posts 10 of the frame, and this platform is provided at its central section with a series of perforations 14 for a purpose to be described. The platform 13 is adapted to support the molding flask consisting of a cope section 15 and a drag section 16 which are preferably tapered inwardly upward as shown, and which may be of usual construction including cope sand holders indicated at 15a in Figs. 1 and 2.

The cope section is independently movably supported by means of a frame having vertical bars 17 which extend slidably through the platform 13 and base 11, and which may be vertically actuated by hydraulic cylinders 17a below the floor line F as indicated in Figs. 1 and 2. Similarly, the drag section of the flask 16 is independently movably supported by a frame having vertical bars 18 which extend slidably through the platform 13 and base plate 11 and into hydraulic

actuating cylinders 18a preferably below the floor line.

The pattern plate 19 is movable laterally into position between the cope and drag sections for forming the matrix of the mold, and is provided with raised pattern portions 20 and 21 in a usual manner. The pattern plate is independently supported on a frame having vertical bars 22 and 22' extending slidably through the platform 13 and base plate 11, and into hydraulic actuating cylinders 22a preferably below the floor line. Preferably the bar 22 has a swivel connection with the pattern plate 19, as indicated at 23, and the opposite side of the plate is slidably supported on the top of bar 22', so that the pattern plate may be swung laterally by piston and cylinder means or mechanical means (not shown) from the position shown in Fig. 4 to the positions shown in Figs. 5 and 6. It will be obvious that other ways of mounting and swinging the pattern plate laterally out from between the flask sections may be devised within the scope of the invention.

A compressed air cylinder 25 is supported on the top plate 12 in register with the open top of the cope section 15, and spaced above the same. A compressed air supply pipe 26 is provided at the top end of the cylinder 25 and an air outlet 27 is provided in its bottom wall. When the flask and pattern plate is assembled on the platform 13 as in Fig. 3, the bottom wall of the air cylinder 25 is spaced above the cope section a distance equal to the height of a sand cylinder 28 which is movable laterally from a loading station into register with the cope section as in Fig. 3.

The sand cylinder 28 may have attached thereto a piston rod 29 which is reciprocated by means of a piston and cylinder (not shown) in a usual fashion for moving the sand cylinder 28 from the position of Figs. 2 and 3 laterally to a loading position shown in Fig. 1 where the sand cylinder is positioned under a sand hopper 30. Means for guiding the sand cylinder 28 between the sand hopper 30 and the air cylinder 25 may include a suitable track indicated at 31. Between the hopper 30 and the air cylinder 25 is a vertically movable cleaning brush 32 which may be operated by a hydraulically or mechanically actuated rod 33 to move it downwardly and clean the sand cylinder when it is positioned under the brush.

The cope sand cylinder 28 is preferably provided in its bottom wall with a plurality of small discharge openings 34 through which the sand in the cylinder may be blown into the cope section of the flask. When the sand cylinder 28 is positioned as in Fig. 3 compressed air is introduced through the pipe 26 into the air cylinder 25 from which it passes through opening 27 and diffuses through the sand cylinder 28, which results in blowing the sand through the openings 34 into the cope section 15 of the mold, the air pressure being sufficient to compact the sand around the pattern portions 20 to form the pattern impressions or cavities in the sand.

A compressed air cylinder 35 is supported on a base 36 resting on the base plate 11 in register with the drag section 16 and spaced below the same. A compressed air supply pipe 37 communicates with the lower end of the cylinder 35, and an air outlet 38 is provided in its top wall. Between the top wall of the air cylinder 35 and the platform 13 is a laterally movable sand cylinder 39 having a hole 40 in its bottom wall adapted to register with the hole 38 in the air cylinder 35. The upper end of the sand cylinder 39 may have an outwardly flared flange 41 which registers with a similar flange 42 depending from the platform around the holes 14 therein.

The sand cylinder 39 may be reciprocated by a piston rod 43 similarly to the sand cylinder 28, from the position of Figs. 2 and 3 to the loading position shown in Fig. 1, where the sand cylinder is positioned under a sand hopper 44. Means for guiding the sand cylinder 39 between the sand hopper 44 and the air cylinder 35 preferably includes a suitable track indicated at 45, and between the hopper and the air cylinder is a vertically movable brush 46 operated by a rod 47 to move downwardly and clean the sand cylinder 39 when it is positioned under the brush, in a manner similar to the operation of brush 32.

The openings 14 in the platform permit the sand in cylinder 39 to be blown into the drag section 16 of the flask when the sand cylinder is in the position of Fig. 3 and compressed air from the cylinder 35 is discharged through the openings 38 and 40 into the sand cylinder.

Molding sand in proper condition is delivered into the sand hoppers 30 and 44 as needed by means of conveyers and the like in a usual and well known manner. Assuming that the flask sections and pattern plate are positioned in assembled relation on the platform 13 as shown in Figs. 2 and 3, the manner of making a sand mold in accordance with the present invention will now be described.

The sand cylinders 28 and 39 for the cope and drag are moved to the position of Fig. 1 where they are rapidly filled with sand from the hoppers, and the filling action may be aided by means of suitable agitators in the hoppers. The cylinders are then moved laterally inward toward the machine until they register with the cope and drag air cylinders 25 and 35, respectively, as in Figs. 2 and 3. The compressed air at suitable pressure is then introduced into the air cylinders 25 and 35 to blow the sand into the cope and drag sections in the manner indicated in Fig. 3. At this time the sand cylinders 28 and 39 are withdrawn laterally and stopped momentarily under the brushes 32 and 46 where they are cleaned for the next operation, and then they are returned to their loading positions under the hoppers as shown in Fig. 1.

While these brushing and loading operations are being performed, the usual vibrators 50 attached to the pattern plate 19 are operated and then the vertical bars 17 and 22 are raised in unison to lift the pattern and cope slightly above the drag, and with the vibrators still operating the cope is then raised above the pattern to the position shown in Fig. 4. At this time the pattern plate 19 is swung laterally out from between the cope and drag sections in the manner shown in Fig. 5, whereupon the bars 17 are lowered to position the cope on the drag as shown in Fig. 6, and the cope sand holders are withdrawn. Then the bars 17 and 18 are raised in unison to draw the cope and drag sections from the mold and leave the sand mold on the platform 13.

The completed mold may be pushed laterally off the main stationary platform onto a flat metal plate or bottom board, and thence transferred by a conveyer to the pouring or casting department. Next, the drag flask section is lowered, the pattern swung into place between the cope and drag sections and the pattern and cope sections lowered onto the drag in the assembled position of Fig. 3, and the sequence of operations is repeated to make another complete mold.

By means of this novel method and apparatus, all of the method steps or operations necessary to make a complete mold are performed mechanically, using the term "mechanically" in a broad sense as including hydraulic or other pressure fluid operated devices and also electrically operated devices, which are all well known and which per se form no part of the present invention. By performing each of the operations in proper sequence and at proper time intervals and by maintaining the air pressure for blowing the sand uniform, the sand molds produced will be of uniformly high quality without requiring skilled labor in ramming and otherwise preparing the mold, as is the case in present practice.

Moreover, all of the mechanical operations and actuating devices therefor may be co-ordinated so as to be performed automatically, in any one of several well known ways, as for example by means of a timing device including a drum driven at a predetermined constant speed and having fingers or projections actuating at proper time intervals electrical switches controlling the various mechanical devices for performing the several operations in sequence.

In the foregoing description, certain terms have been used for brevity, clearness and understanding, but no unnecessary limitations are to be implied therefrom beyond the requirements of the prior art, because such words are used for descriptive purposes herein and are intended to be broadly construed.

Moreover, the embodiment of the improved construction illustrated and described herein is by way of example, and the scope of the present invention is not limited to the exact details of construction.

Having now described the invention, the construction, the operation and use of a preferred embodiment thereof, and the advantageous new and useful results obtained thereby; the new and useful methods and constructions, and reasonable mechanical equivalents thereof obvious to those skilled in the art, are set forth in the appended claims.

I claim:

1. The method of forming sand molds mechanically which consists in independently supporting a pattern plate and cope and drag flask sections in assembled relation, moving sand supply means laterally into register with sand loading means, then moving said sand supply means laterally to register with said cope and drag sections, simultaneously introducing sand under pressure from said supply means into said cope and drag sections, removing said supply means laterally, raising the cope section and pattern plate in assembled relation, raising the cope section above said pattern plate, laterally removing said pattern plate, then lowering the cope section onto the drag section, and then raising the cope and drag sections in assembled relation above the completed sand mold.

2. The method of forming sand molds mechanically which consists in independently movably supporting a pattern plate and cope and drag flask sections in assembled relation, moving sand supply means laterally into register with sand loading means, then moving said sand supply means laterally to register with said cope and drag sections, simultaneously blowing sand under pressure from said supply means into said assembled cope and drag sections, removing said sand supply means, raising and separating the cope section and pattern plate above the drag section, laterally removing said pattern plate, then lowering the cope section onto the drag section, and then raising the cope and drag sections in unison above the completed sand mold.

3. The method of forming sand molds mechanically which consists in independently movably supporting a pattern plate and cope and drag flask sections in assembled relation, moving sand supply means laterally into register with sand loading means, then moving said sand supply means laterally to register with the top of the cope section and with the bottom of the drag section, simultaneously blowing sand under pressure from said supply means vertically into said assembled cope and drag sections, laterally removing said supply means, raising and separating the cope section and pattern plate above the drag section, laterally removing said pattern plate, then lowering the cope section onto the drag section, and then raising the cope and drag sections in unison above the completed sand mold.

4. The method of forming sand molds mechanically which consists in independently movably supporting a pattern plate and cope and drag flask sections in assembled relation, moving sand supply means laterally into register with sand loading means, then moving said sand supply means laterally to register with said cope and drag sections, simultaneously blowing sand under pressure from said supply means into said assembled cope and drag sections, removing said sand supply means, raising and separating the cope section and pattern plate above the drag section, laterally removing said pattern plate, then lowering the cope section onto the drag section.

5. Apparatus for forming sand molds mechanically including a platform, a pattern plate and cope and drag flask sections arranged to be supported in assembled relation on said platform, means independently supporting said pattern plate and cope and drag sections for vertical movement power means for independently moving said supporting means vertically, power means for swinging said pattern plate laterally relative to said cope and drag sections, sand cylinders movable laterally into and out of register with said cope and drag sections, power means for moving said cylinders, and means for blowing sand from said cylinders simultaneously into said cope and drag sections.

6. Apparatus for forming sand molds mechanically including a platform, a pattern plate and cope and drag flask sections arranged to be supported in assembled relation on said platform, means independently supporting said pattern plate and cope and drag sections for vertical movement, power means for independently moving said supporting means vertically, power means for swinging said pattern plate laterally relative to said cope and drag sections, sand cylinders movable laterally into and out of register with said cope and drag sections, power means for moving said cylinders, gravity means for loading said sand cylinders when out of register, and means for blowing sand from said cylinders simultaneously into said cope and drag sections when said cylinders are in register with said sections.

7. Apparatus for forming sand molds mechanically including a platform, a pattern plate and cope and drag flask sections arranged to be supported in assembled relation on said platform, means independently supporting said pattern plate and cope and drag sections for vertical movement, power means for independently moving said supporting means vertically, power means

for swinging said pattern plate laterally relative to said cope and drag sections, sand cylinders movable laterally into and out of register with said cope and drag sections, and means for blowing sand under pressure from said cylinders simultaneously into said cope and drag sections for compacting the sand against opposite surfaces of said pattern plate.

8. Apparatus for forming sand molds mechanically including a perforated platform, a pattern plate and cope and drag flask sections arranged to be supported in assembled relation on said platform, means independently supporting said pattern plate and cope and drag sections for vertical movement, power means for independently moving said supporting means vertically, power means for moving said pattern plate on its support from between said cope and drag sections, a cope sand container movable laterally into and out of register with the top of said cope section and having a perforated bottom wall, a drag sand container movable below said platform laterally into and out of register with the bottom of said drag section, power means for moving said containers, and means for blowing sand under pressure from said containers simultaneously into said cope and drag sections.

9. Apparatus for forming sand molds mechanically including a platform, a pattern plate and cope and drag flask sections arranged to be supported in assembled relation on said platform, frames independently supporting said pattern plate and cope and drag sections for vertical movement, power means for independently moving said frames vertically, means swivelling the pattern plate upon the corresponding frame, power means for swinging the pattern plate laterally relative to the cope and drag sections, sand cylinders movable laterally into and out of register with the cope and drag sections, power means for moving said sand cylinders, and means for blowing sand from said cylinders into the cope and drag sections.

10. Apparatus for forming sand molds mechanically including a platform, a pattern plate and cope and drag flask sections arranged to be supported in assembled relation on said platform,

frames independently supporting said pattern plate and cope and drag sections for vertical movement, power means for independently moving said frames vertically, means swivelling the pattern plate upon the corresponding frame, power means for swinging the pattern plate laterally relative to the cope and drag sections, sand cylinders movable laterally into and out of register with the cope and drag sections, power means for moving said sand cylinders, means for loading said sand cylinders when out of register, and means for blowing sand from said cylinders into the cope and drag sections when said cylinders are in register with said sections.

11. Apparatus for forming sand molds mechanically including a platform, a pattern plate and cope and drag flask sections arranged to be supported in assembled relation on said platform, frames independently supporting said pattern plate and cope and drag sections for vertical movement, power means for independently moving said frames vertically, means swivelling the pattern plate upon the corresponding frame, power means for swinging the pattern plate laterally relative to the cope and drag sections, sand hoppers spaced laterally from the cope and drag sections, sand cylinders movable laterally into and out of register with the cope and drag sections and with the hoppers, and means for blowing sand from said cylinders into the cope and drag sections when the cylinders are in register with said sections.

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