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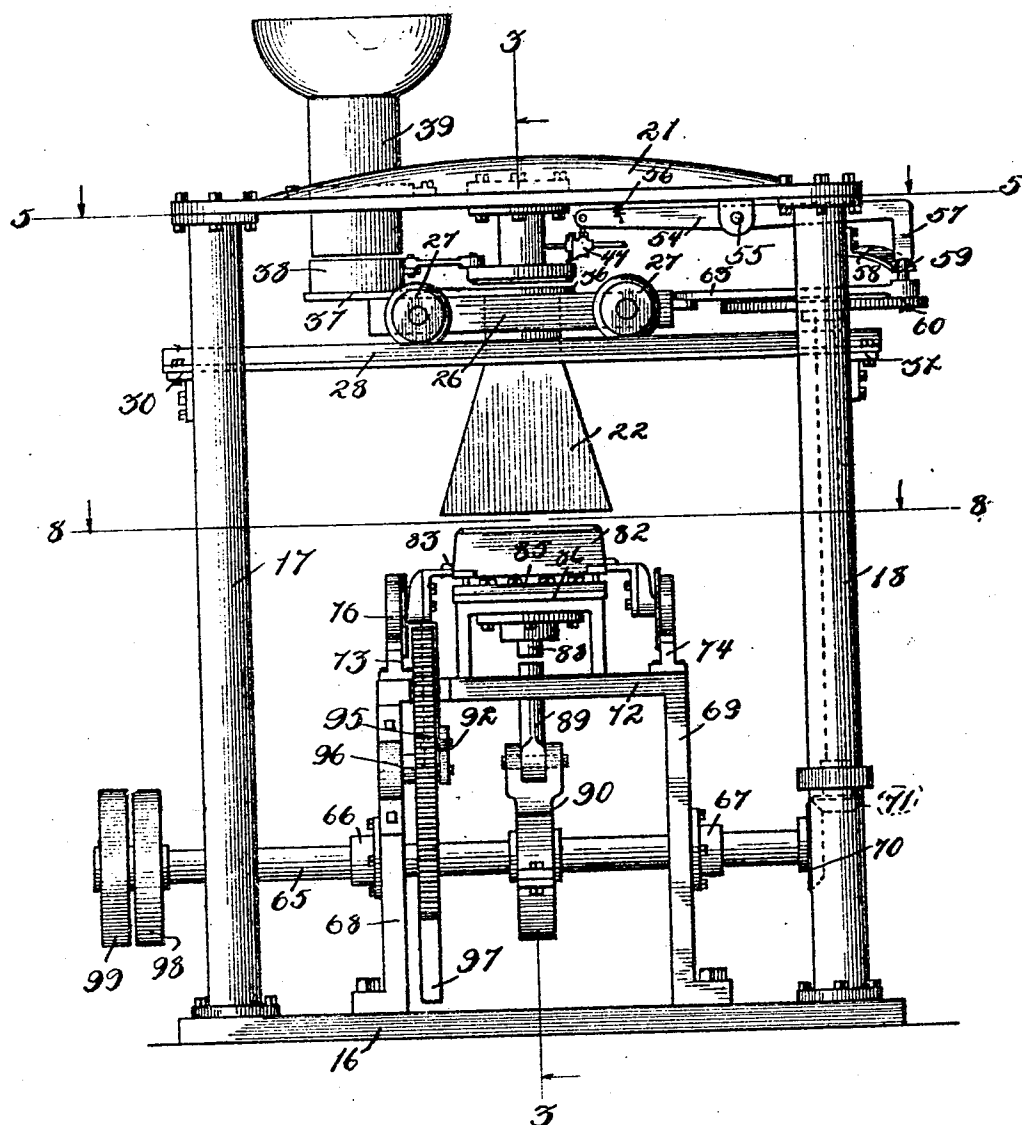
PATENTED DEC. 26, 1905.

A. M. & M. J. HEWLETT.
MOLDING APPARATUS.

APPLICATION FILED NOV. 9, 1903.

7 SHEETS—SHEET 1.

Fig. 1



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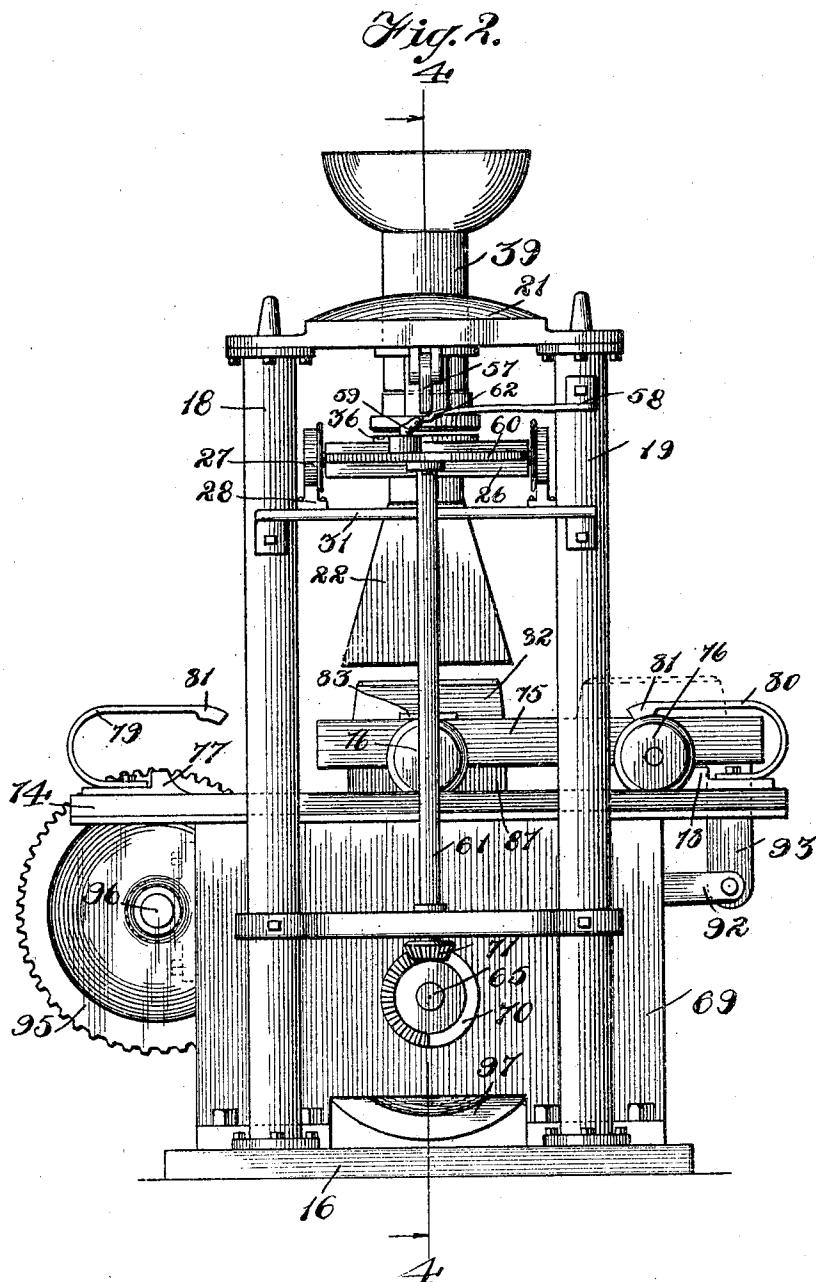
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7 SHEETS—SHEET 2.



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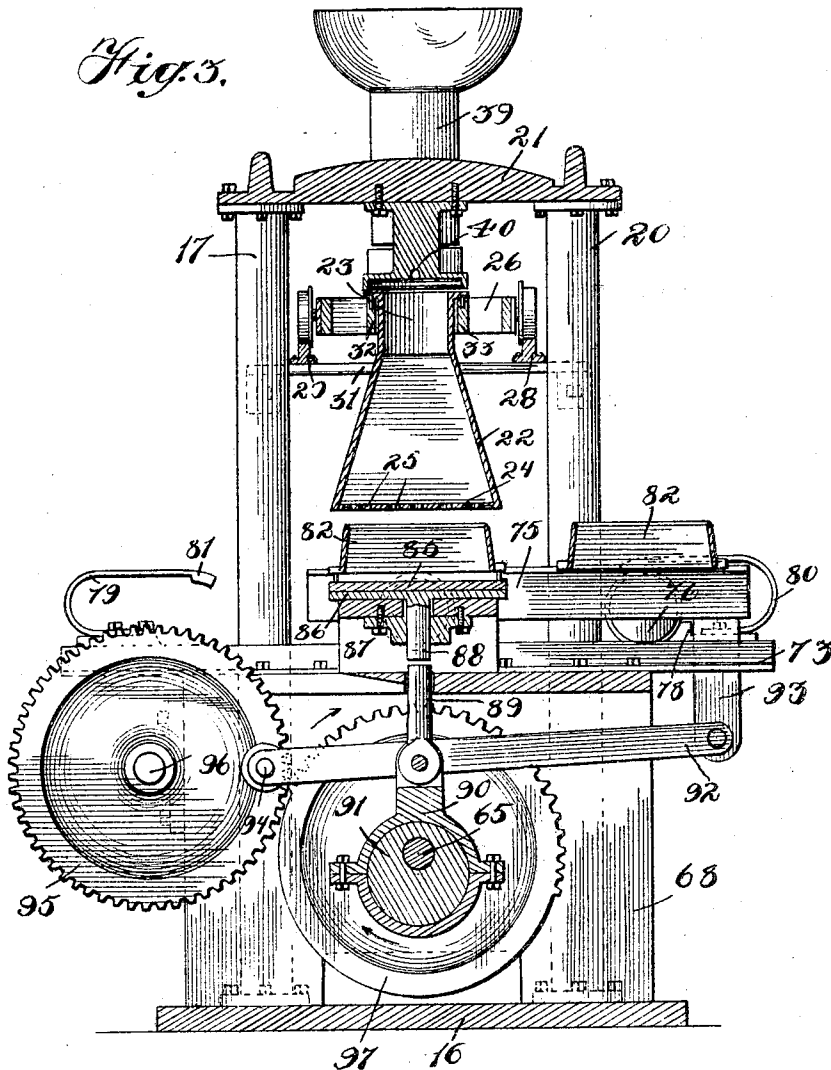
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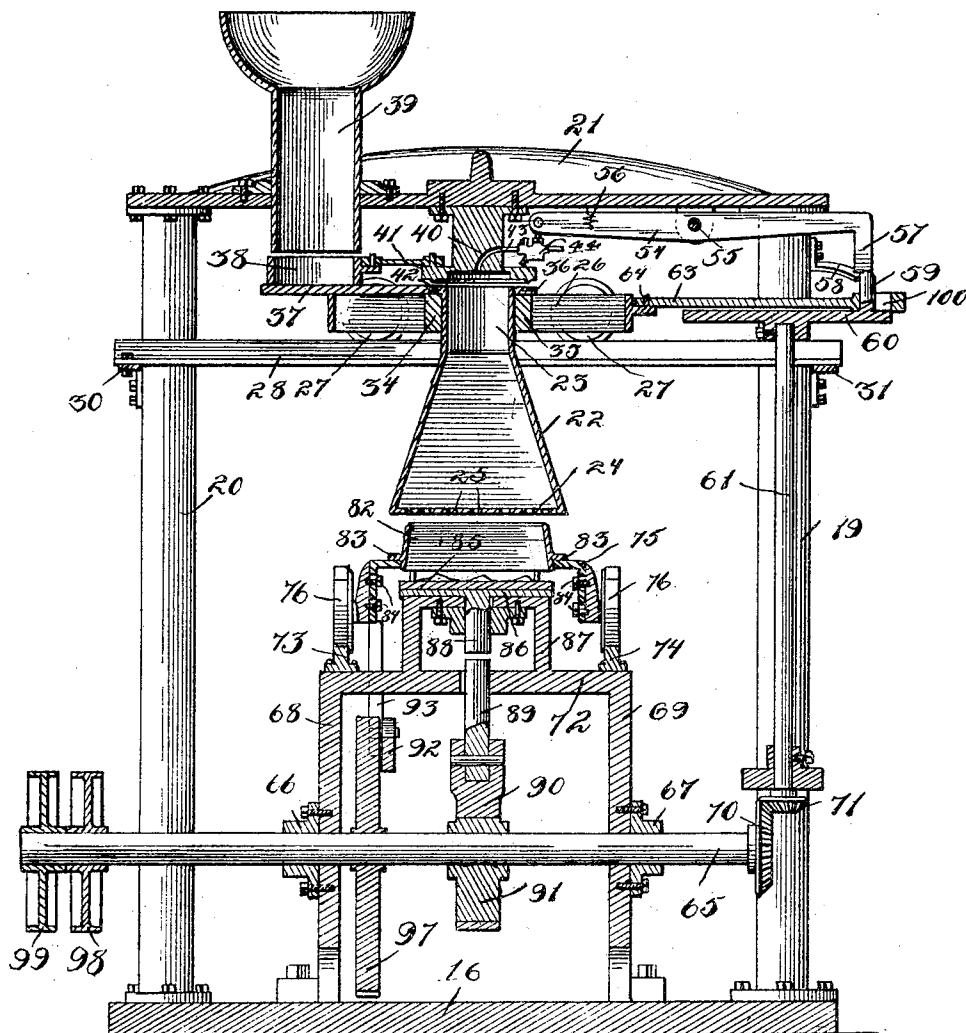
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7 SHEETS—SHEET 4.

Fig. 4.



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Fig. 5.

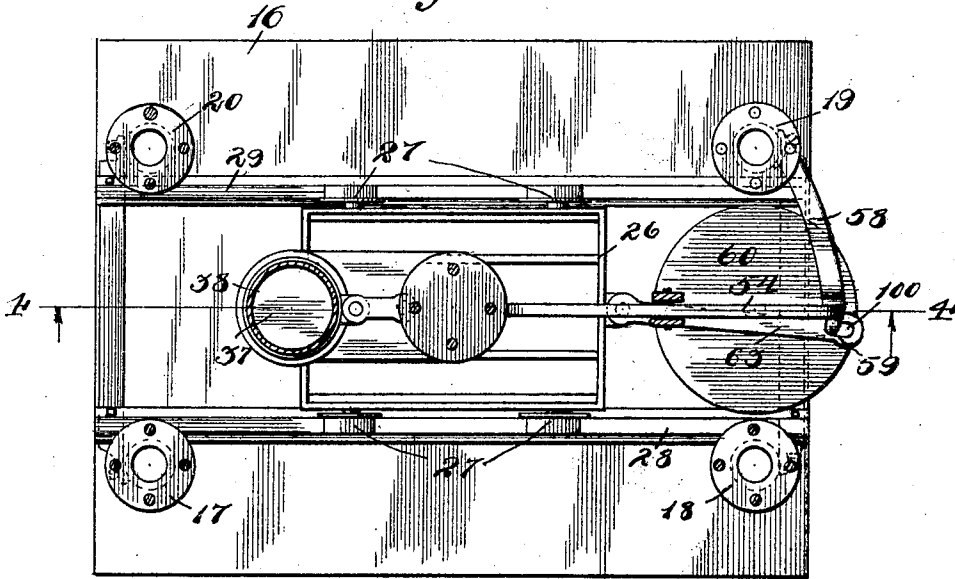
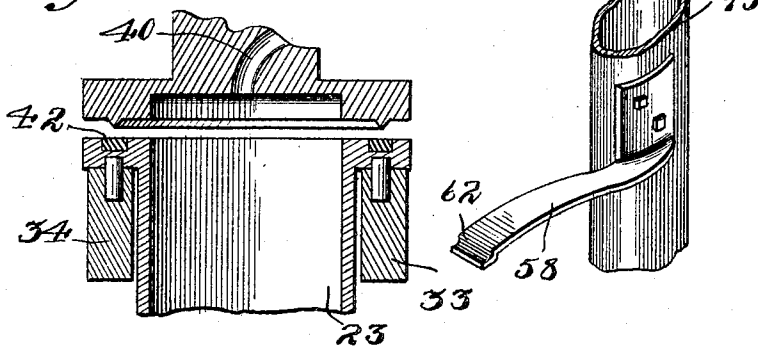


Fig. 7.

Fig. 6.



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Fig. 8.

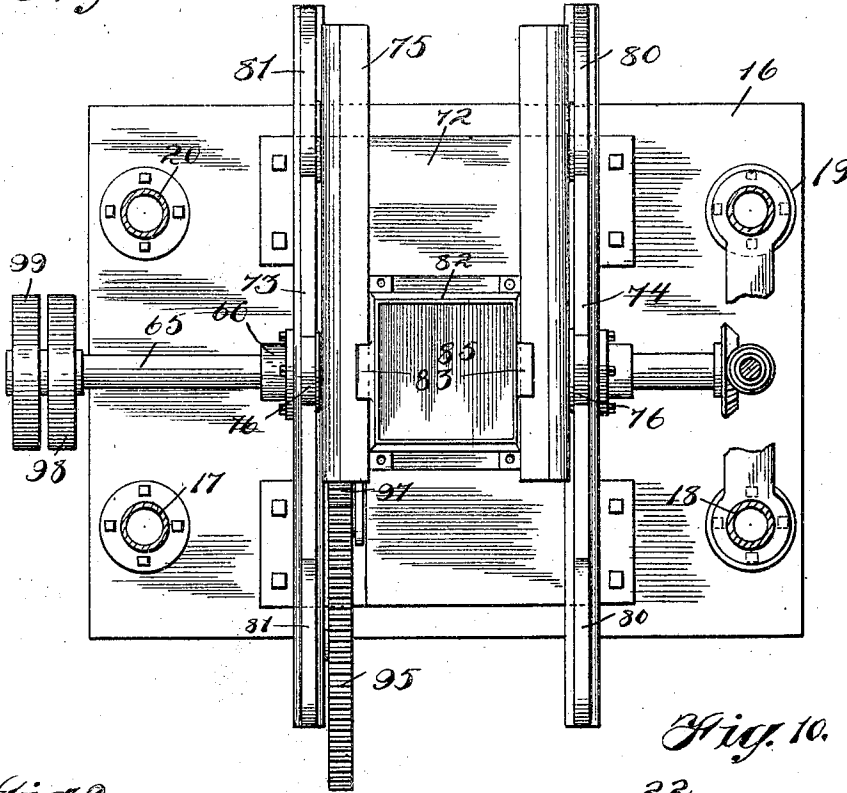


Fig. 9.

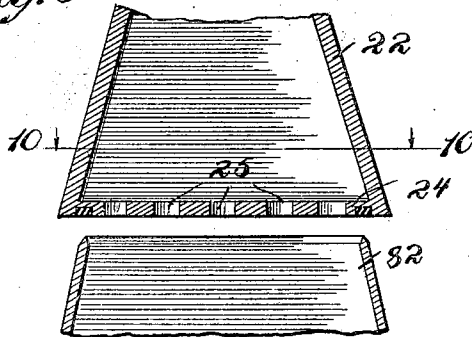
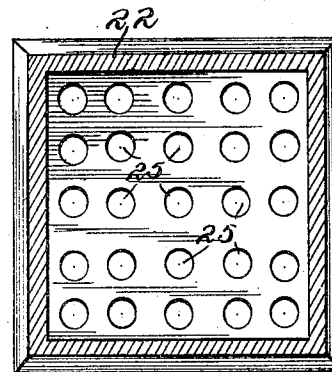


Fig. 10.



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Fig. 11.

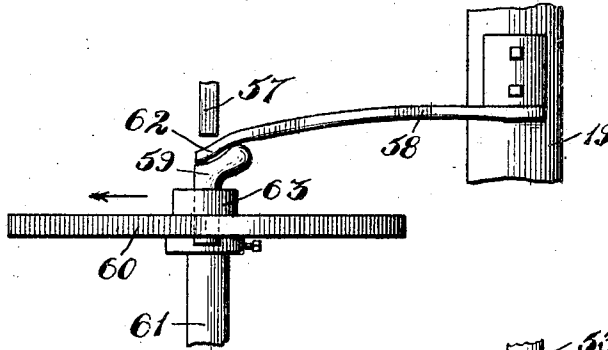


Fig. 12.

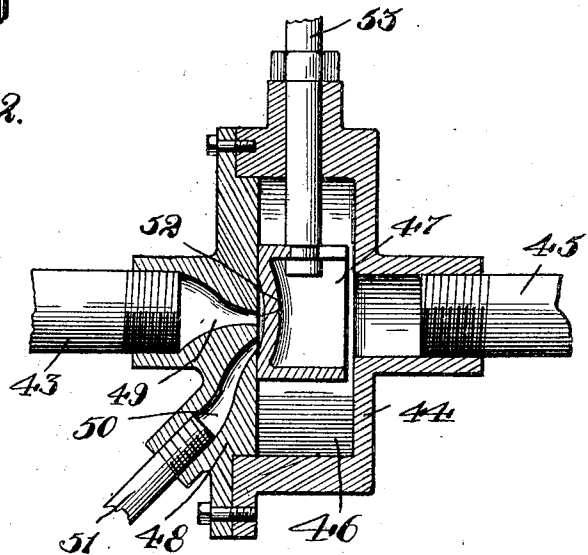


Fig. 13.

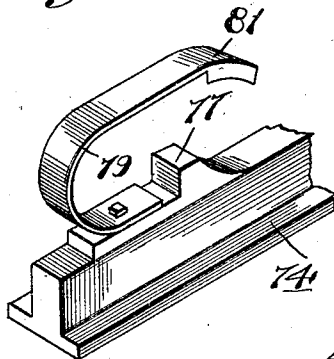


Fig. 15.

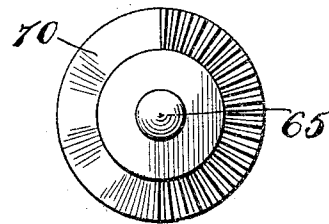
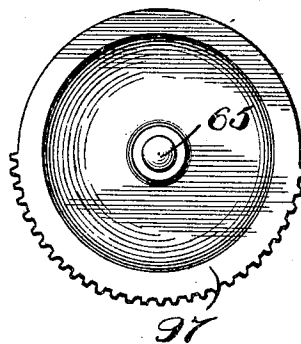


Fig. 14.



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UNITED STATES PATENT OFFICE.

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MOLDING APPARATUS.

No. 808,367.

Specification of Letters Patent.

Patented Dec. 26, 1905.

Application filed November 9, 1903. Serial No. 180,498.

To all whom it may concern:

Be it known that we, ALFRED M. HEWLETT and MADDRA J. HEWLETT, citizens of the United States, residing at Kewanee, in the county of Henry and State of Illinois, have invented certain new and useful Improvements in Molding Apparatus, of which the following is a specification, reference being had to the accompanying drawings.

Our invention relates to the molding of sand or analogous material for the formation of cores or in making molds, and has particularly to do with mechanism for utilizing compressed air to distribute and pack the sand in the mold or flask, which, generically, forms the subject-matter of our application, Serial No. 177,353, filed October 16, 1903. In our said application the generic invention is illustrated as embodied in a rotary machine; but, as therein explained, it may also be embodied in a reciprocating machine, and our present application has to do with the latter type of apparatus.

In the drawings of our present application we have illustrated a reciprocating machine as employed for the production of molds in flasks of the ordinary type; but it will be understood that it may be applied also to the production of cores.

Referring to the drawings, Figure 1 is an end elevation of our improved molding apparatus. Fig. 2 is a side elevation thereof. Fig. 3 is a vertical section on line 3 3 of Fig. 1. Fig. 4 is a vertical section on line 4 4 of Fig. 2. Fig. 5 is a horizontal section on line 5 5 of Fig. 1. Fig. 6 is an enlarged detail, being a partial vertical section of the compression-cylinder and air-cup. Fig. 7 is a perspective view illustrating part of the mechanism for operating the air-valve. Fig. 8 is a horizontal section on line 8 8 of Fig. 1. Fig. 9 is a detail, being a partial vertical section of the compression-cylinder and flask. Fig. 10 is a horizontal section on line 10 10 of Fig. 9. Fig. 11 is a detail illustrating part of the mechanism for operating the air-valve. Fig. 12 is a vertical section of the air-valve. Fig. 13 is a perspective view of one of the stops for reciprocating the carriage, and Figs. 14 and 15 are details illustrating the mutilated gears by which certain parts of the mechanism are operated.

Our improved machine has to do with the production of sand molds or cores by causing

compressed air to permeate the mass of sand and to enter the mold or flask, carrying the sand with it in individual particles or very minute masses into and throughout the different portions of the mold or flask, so that the sand is packed uniformly, the air escaping through the partings or connections of the mold or flask, which are tight enough to retain the sand, but not the air, the result being that the sand is packed just as solid in one part of the mold or flask as in another.

Generally speaking, the machine which forms the subject-matter of our present application consists of a reciprocating carriage adapted to carry the mold or flask into and out of position to receive the charge of sand, a compression-cylinder of any suitable shape, the term "cylinder" being employed in a generic sense, adapted to contain the sand with which the mold or flask is to be charged, suitable mechanism for supplying compressed air to the compression-cylinder at the proper times, and operating mechanism for actuating the different parts of the mechanism.

Referring now to the drawings for a detailed description of the machine therein illustrated, 16 indicates the bed-plate of the machine, from which rise four columns 17 18 19 20, as illustrated in Fig. 5. Said columns support a top plate 21, which is rigidly secured thereto and serves to support certain parts of the machine, as will be hereinafter described.

22 indicates the compression-cylinder, which, as best shown in Fig. 4, is of the shape of an inverted funnel, its neck 23 being upmost. At its lower end the compression-cylinder 22 is provided with a perforated plate 24, having a number of perforations 25, through which the sand is discharged from said compression-cylinder. The perforations 25 are made small enough to retain the sand in the compression-cylinder except when it is forced out thereof by the action of the compressed air, as will be hereinafter described. The compression-cylinder 22 is supported by a wheeled truck 26, the wheels 27 of which run on rails 28 29, supported on cross-bars 30 31, secured to the columns 17 18 19 20, as shown in Fig. 4, the arrangement being such that the truck 26 may move backward and forward upon said rails, carrying the compression-cylinder 22 with it. In order to support the compression-cylinder so that it

will be free to move vertically to a slight extent, it is fitted between longitudinal bars 32 33 and cross-bars 34 35, as shown in Fig. 3, its upper end being provided with a flange 36, 5 which rests upon the upper surfaces of said bars.

37 indicates an imperforate plate, preferably formed integral with the flange 36 and extending laterally therefrom, as shown in 10 Fig. 4. The plate 37 extends under a sleeve 38, which forms an extension of a funnel 39, supported by the top plate 21 near one end thereof, as shown in Fig. 4. The funnel 39 forms a sand-receptacle from which sand is 15 supplied from time to time to the compression-cylinder 22, the arrangement being such that by moving the truck 26 to one end of the rails 28 29 the compression-cylinder may be brought under the sleeve 38, so as to register 20 therewith, and consequently permit the sand in the funnel 39 to enter the compression-cylinder. When the compression-cylinder is moved out from under the sleeve 38, the plate 37 closes said cylinder and prevents the 25 further escape of sand from the funnel 39. The object of making the sleeve 38 separate from the funnel 39 is to permit vertical movement of said sleeve independently of the funnel, which is necessary inasmuch as when the 30 compression-cylinder 22 is moved vertically the plate 37 moves with it, and consequently raises the sleeve 38.

The normal position of the compression-cylinder 22 is at the center of the machine, at 35 which time it registers with a compressed-air cap 40, secured to the under side of the top plate 21 and having a V-shaped tongue 41 on its under surface adapted to engage the flange 36 at the top of the compression-cylinder 22. 40 In order to form an air-tight connection between said parts, the flange 36 is provided with a rubber gasket 42, as shown in Fig. 4, so that when the compression-cylinder is raised into engagement with the tongue 41 45 said tongue is embedded in said gasket, thereby preventing the escape of air. The air-cap 40 is connected by a pipe 43 with a valve 44, as shown in Figs. 4 and 12. The valve 44 is connected by a supply-pipe 45 with any suitable 50 source of supply of compressed air. As shown in Fig. 12, the pipe 45 communicates directly with a valve-chamber 46, in which is mounted a slide-valve 47, which is adapted to bear against one side 48 of the valve-chamber in which are passages 49 50, respectively. 55 The passage 49 communicates with the pipe 43, while the passage 50 communicates with an exhaust-pipe 51, as shown in Fig. 12. The slide-valve 47 is provided with a concavity 60 52 in the surface next to the passages 49 50, and when said slide-valve is in its normal position it overlies the inner ends of both said passages, so that the pipe 43 is then in communication with the exhaust-pipe 51 and is 65 cut off from the valve-chamber 46. By mov-

ing the slide-valve 47 downward, however, the inner end of the passage 49 is uncovered, connecting it with the valve-chamber 46 and permitting compressed air therein to pass 70 through said passage 49 and pipe 43 to the air-cap 40. The exhaust-passage 50 remains closed by the slide-valve 47. Thus the air-cap 40 may be connected either with the compressed-air supply or with the exhaust by operating the slide-valve 47 and is normally 75 connected with the exhaust.

The slide-valve 47 is operated by means of a rod 53, which extends through the valve-casing and is connected with the inner end of an operating-lever 54. (Best shown in Fig. 80 4.) Said lever is mounted upon a pivot 55, secured to the top plate 21, as shown in Fig. 4, and its inner end is normally held in its uppermost position by a spring 56. The 85 outer end of the lever 54 is bent downward, as shown at 57 in Fig. 4, and overlies the outer end of a flexible bar 58, secured to the upper portion of the column 19, as shown in Figs. 4 and 11. Obviously by elevating the 90 outer end of the lever 54 the inner end thereof is depressed, and the valve 47 consequently moved downward in the valve-chamber 46 to admit compressed air to the air-cap 40. The lever 54 is so operated by means of a 95 pin 59, carried by a rotary disk 60, which is secured to the upper end of a shaft 61, mounted in any suitable bearing in the frame of the machine between the columns 18 19, that the pin 59 is adapted to rotate in a horizontal plane and to engage the under 100 surface of the bar 58. In order to cause the pin 59 to operate the lever 54 momentarily only, said pin and the bar 58 are so arranged with reference to each other that said pin engages only the free end of said bar, which is 105 bent downward at that point, as shown at 62 in Fig. 11, the remainder of said bar being placed high enough to clear the pin 59. By this construction when the disk 60 rotates at a certain period in its rotation the pin 59 will 110 engage the free end of the bar 58, elevating it into engagement with the depending arm 57 of the lever 54 and raising said arm so as to rock said lever and depress the slide-valve 47, thereby admitting compressed air to the 115 air-cap 40. As soon as the pin 59 passes beyond the bar 58 it returns to its former position, and the spring 56 raises the inner end of the lever 54, restoring the slide-valve 47 to its position over passages 49 50, thereby 120 connecting the air-cap 40 with the exhaust. The disk 60 by its rotation also operates to reciprocate the truck 26 by means of a connecting-rod 63, one end of which is connected with the pin 59, its other end being piv- 125 otally connected by a pin 64 with the adjacent end of the truck 26, as shown in Fig. 4.

The shaft 61 is rotated to rotate the disk 60 and reciprocate the truck 26 by means of a shaft 65, mounted in suitable bearings 66 130

67, provided with supports 68 69, respectively, as shown in Fig. 4. The shaft 65 carries a mutilated beveled gear 70, which is adapted to mesh with a beveled pinion 71, mounted on the lower end of the shaft 61. As shown in Fig. 15, one-half the surface of the gear 70 is smooth, so that during half of each rotation of the shaft 65 the pinion 71 and shaft 61 remain stationary. The gear 70 is twice the diameter of the pinion 71, so that both the gear 70 and pinion 71 are operatively engaged during only one-half the period of rotation of the shaft 65. The shaft 61 is nevertheless given a complete rotation for each rotation of the shaft 65. The object of this construction will be hereinafter set forth.

72 indicates a table mounted on the supports 68 69 and preferably formed integral therewith. Said table is provided near its opposite edges with rails 73 74, extending at right angles to the rails 28 29, as shown in Fig. 4. 75 indicates a carriage mounted to travel upon said rails 73 74, said carriage having wheels 76, which run upon said rails, as shown in Fig. 4.

77 78 indicate stop-blocks near the opposite ends of the rails 73 74, as shown in Fig. 2, said blocks being adapted to engage the wheels of the carriage 75 to limit their further movement.

79 80 indicate spring-stops which are carried by the blocks 77 78, respectively, and are adapted to project over the wheels of the carriage 75 to engage the inner portions thereof and hold the carriage at one side of the machine or the other, as best shown in Fig. 2.

81 indicates shoes similar to brake-shoes, which are carried at the free ends of the spring-stops 79 80 and are adapted to engage the peripheries of the wheels 76 after the manner of brake-shoes. The carriage 75 is thus held firmly in either of its positions.

The carriage 75 is of such length that it is adapted to carry two flasks 82, as indicated by dotted lines in Fig. 2, and the stops 77 78 are placed such a distance apart that when the carriage is at either end of its track the flask near the opposite end will lie centrally of the machine and immediately under the compression-cylinder 22, as shown in Fig. 2. In this manner one flask or the other is always in operative position, and accordingly while one flask is being charged the other may be removed and a fresh one put in position on the carriage, thus economizing time. The flasks 82 are supported on the carriage 75 in the manner illustrated in Fig. 4, said flasks being provided with a projecting flange 83, placed a short distance from the lower edge of the flask which projects through a suitable opening in the carriage 75, the flange 83 resting upon the carriage. The flask is normally supported on the carriage a short distance

below the lower surface of the plate 24, so as not to interfere with the horizontal movement of the flask, and to accommodate flasks of different depths that part of the carriage which supports the flask may be made vertically adjustable, as by set-screws 84, connecting the intermediate part of the carriage adjustably with the wheeled portion thereof. Any other suitable arrangement, however, may be employed for the purpose.

85 indicates the pattern-plate which carries the patterns to be used in forming the molds in the flask 82. The pattern-plate 85 rests upon a head 86, which normally rests upon an upward extension 87 of the table 72, the object of the extension 87 being to support the head 86 a short distance below the lower edge of the flask 82. The head 86 is provided with a downwardly-projecting pin 88, which lies over the upper end of a plunger-rod 89, carried by an eccentric-strap 90, fitted on an eccentric 91, which is mounted on the shaft 65. By this construction when the shaft 65 is rotated the plunger-rod 89 is reciprocated, moving in a suitable bearing in the table 72, as shown in Fig. 4. When said plunger-rod rises, it engages the pin 88, raising the head 86 and pattern-plate 85 into engagement with the under surface of the flask 82. Farther upward movement of the head 86 raises the flask into engagement with the perforated plate 24 at the lower end of the compression-cylinder 22, raising said compression-cylinder also into engagement with the lower end of the air-cap 40, thereby making close connection between all said parts. The parts are so adjusted that such connection is completed immediately before compressed air is admitted to the compression-cylinder 22 by the operation of the valve 44. The admission of compressed air to the compression-cylinder 22 supplies sand to the flask 82 and packs it closely therein, as described in our former application above referred to. The air is then immediately shut off and the air-cap 40 connected with the exhaust, as described, thereby relieving the pressure in the compression-cylinder 22. The parts are then separated by the continued rotation of the shaft 65, which withdraws the plunger-rod 89, permitting the parts to descend by gravity to their former positions.

The carriage 75 is reciprocated by means of a connecting-rod 92, connected at one end to an arm 93, depending from said carriage, as shown in Fig. 3, and at the opposite end to a wrist-pin 94, carried by a gear-wheel 95, mounted on a stud 96, carried by one of the supports 68, as best shown in Fig. 1. The gear-wheel 95 is adapted to mesh with a mutilated gear 97, mounted on the shaft 65, as shown in Fig. 3. Somewhat more than one-half of said gear 95 is smooth, so that it meshes with the gear 97 during less than one-half of each rotation of the shaft 65, and as the gear

95 has twice as many teeth as the gear 97 it follows that the gear 95 is given half a revolution for each revolution of the shaft 65. The result is that by a partial rotation of the shaft 65 the carriage is moved from one of its positions to the other and then remains stationary until said shaft completes its rotation, when it is moved to the opposite position. The mutilated gear is so arranged with reference to the eccentric 91 that as soon as the teeth of said mutilated gear move out of engagement with the gear 95 and the carriage 75 consequently comes to rest the plunger-rod 89 begins its upward movement. Furthermore, the mutilated gear 70 is so adjusted with reference to the gear 97 that the movement of the truck 26 is coincident with that of the carriage 75, as obviously it is essential that the truck 26 and carriage 75 remain stationary at the same time.

98 99 indicate fast and loose pulleys on the shaft 65, by means of which said shaft may be stopped and started at pleasure.

The operation of our improved machine is as follows: The desired patterns being put upon the pattern-plate 85, two flasks are fitted upon the carriage, one of said flasks overlying the pattern-plate, as illustrated in Figs. 2 and 4. The shaft 65 being in motion, the plunger-rod 89 will then rise into engagement with the pin 88, first lifting the pattern-plate into engagement with the flask, then lifting the flask and pattern-plate into engagement with the compression-cylinder, finally lifting the compression-cylinder into engagement with the air-cap 40. While this is taking place the gears 95 97 are out of operative engagement with each other, and the truck 26 also is stationary, since the mutilated gear 70 is out of engagement with the pinion 71, and consequently the shaft 61 is not in rotation. At this time the pin 59 occupies the position shown in Fig. 11, lying partially under the depressed outer end 62 of the bar 58, but in such position as not to raise said bar. As soon as the compression-cylinder 22 is moved closely up against the cap 40 the teeth of the mutilated gear 70 come into engagement with the pinion 71, starting the shaft 61 and moving the pin 59 to the left, as shown in Fig. 11, thereby momentarily lifting the outer end of the bar 58 and lever 54, and thereby opening the air-valve 44, admitting compressed air to the compression-cylinder 22. This movement of the pin 59 does not move the truck 26, however, for the reason that a little lost motion is allowed for between the connecting-rod 63 and the pin 59 by providing a slot 100 in the outer end of said connecting-rod, in which the pin 59 may move, as best shown in Fig. 4. As soon as the pin 59 passes beyond the end 62 of the bar 52 the lever 54 is restored to its former position by the spring 56 connecting the cap 40 with the exhaust, thereby relieving the compression-

cylinder from pressure. The plunger-rod begins to descend immediately upon the connection of the cap 40 with the exhaust, and the gears 95 97 are so timed with reference to each other that they come into operative engagement as soon as the pattern-plate moves out of engagement with the flask. Accordingly the carriage 75 is moved to one side by the action of the gear 95, while during the same interval the truck 26 is moved over to carry the compression-cylinder under the funnel 39 to receive a charge of sand and back again to operative position. While the molded flask is being removed the empty one is in position to be charged, so that no time is lost in the operation of the machine. Thus the several parts of the machine operate automatically to perform their respective functions, the only manual labor required being for the removal and insertion of molds or flasks.

It will be understood that the distances between the pattern-plate, the flask, the compression-cylinder, and the air-cap are exaggerated for the sake of showing the construction clearly. In practice very slight clearance is necessary.

Having thus described specifically the machine illustrated in the accompanying drawings, we wish it to be understood that our invention is not altogether restricted to such details of construction.

Except in so far as our claims specifically include details of construction, they are generic in character, being subsidiary only to the generic claims of our said application Serial No. 177,353.

That which we claim as our invention, and desire to secure by Letters Patent, is—

1. A sand-molding apparatus, comprising transversely-movable means for supporting the mold, fluid-pressure mechanism for carrying sand into the mold and packing it therein, and means for moving the mold vertically into operative relation to said fluid-pressure mechanism substantially as described.

2. A sand-molding apparatus, comprising transversely-movable means for supporting the mold, means above the mold for directing sand thereto, fluid-pressure mechanism for carrying the sand into the mold and packing it therein, and means for moving the mold vertically into operative relation with said fluid-pressure mechanism substantially as described.

3. A sand-molding apparatus, comprising means for supporting the mold, a compression-cylinder adapted to contain sand and to be brought into communication with the mold, reciprocating means for supporting said compression-cylinder, and fluid-pressure mechanism for packing sand from said compression-cylinder in the mold, said compression-cylinder being movable into and out of operative relation to said fluid-pressure mechanism substantially as described.

4. A sand-molding apparatus, comprising means for supporting the mold, a compression-cylinder above the mold adapted to contain sand and to be brought into communication with the mold, reciprocating means for supporting said compression-cylinder, and fluid-pressure mechanism for packing sand from said compression-cylinder in the mold, said compression-cylinder being movable into and out of operative relation to said fluid-pressure mechanism substantially as described.

5. A sand-molding apparatus, comprising reciprocating means for supporting the mold, a compression-cylinder adapted to contain sand and to be brought into communication with the mold, reciprocating means supporting said compression-cylinder, and fluid-pressure mechanism for carrying sand from said compression-cylinder into the mold, and packing it therein, said compression-cylinder being movable into and out of operative relation to said fluid-pressure mechanism substantially as described.

6. A sand-molding apparatus, comprising reciprocating means for supporting the mold, a compression-cylinder above the mold adapted to contain sand and to be brought into communication with the mold, reciprocating means supporting said compression-cylinder, and fluid-pressure mechanism for carrying sand from said compression-cylinder into the mold, and packing it therein, said compression-cylinder being movable into and out of operative relation to said fluid-pressure mechanism substantially as described.

7. A sand-molding apparatus, comprising means for supporting the mold, a longitudinally-movable compression-cylinder adapted to contain sand and to be brought into communication with the mold, and fluid-pressure mechanism for packing sand from said compression-cylinder in the mold, said compression-cylinder being movable into and out of operative relation to said fluid-pressure mechanism substantially as described.

8. A sand-molding apparatus, comprising means for supporting the mold, a longitudinally-movable compression-cylinder adapted to contain sand and to be brought into communication with the mold, an air-cap adapted to be engaged by said compression-cylinder, and means for supplying air under pressure to said compression-cylinder when it is in engagement with said air-cap, substantially as described.

9. A sand-molding apparatus, comprising means for supporting the mold, a longitudinally-movable compression-cylinder adapted to contain sand and to be brought into communication with the mold, an air-cap adapted to be engaged by said compression-cylinder, means for supplying air under pres-

sure to said compression-cylinder when it is in engagement with said air-cap, and means for relieving said compression-cylinder from pressure before said cylinder moves out of engagement with said air-cap, substantially as described.

10. A sand-molding apparatus comprising transversely-movable means for supporting the mold, means above the mold for directing sand thereto, means for moving the mold vertically into position to receive sand therefrom, fluid-pressure mechanism for supplying sand to the mold, and means for automatically actuating said fluid-pressure mechanism.

11. A sand-molding apparatus, comprising reciprocating means for supporting a plurality of molds, a compression-cylinder adapted to contain sand, means for moving the different molds into operative engagement with said compression-cylinder, fluid-pressure mechanism for packing sand from said compression-cylinder in said molds, and means for automatically actuating said mechanisms substantially as described.

12. A sand-molding apparatus, comprising means for supporting the mold, a compression-cylinder above the mold, an air-cap above said compression-cylinder, means for moving said mold into engagement with said compression-cylinder and said compression-cylinder into engagement with said air-cap, and means for admitting compressed air to said air-cap, substantially as described.

13. A sand-molding apparatus, comprising means for supporting the mold, a compression-cylinder above the mold, an air-cap above said compression-cylinder, means for moving said mold into engagement with said compression-cylinder and said compression-cylinder into engagement with said air-cap, and valve mechanism for momentarily admitting compressed air to said air-cap and thereafter exhausting it therefrom while said mold, compression-cylinder and air-cap are in operative engagement with one another, substantially as described.

14. A sand-molding apparatus, comprising a compression-cylinder, a reciprocating carriage below said compression-cylinder, a plurality of molds carried by said carriage and adapted to be operatively connected with said compression-cylinder, means for supplying compressed air to said compression-cylinder, mechanism for intermittently reciprocating said carriage, valve mechanism controlling the admission of compressed air to said compression-cylinder, and means operating said valve mechanism to admit compressed air to said compression-cylinder when one of the molds is in operative engagement therewith, substantially as described.

15. A sand-molding apparatus, comprising a compression-cylinder, a reciprocating carriage below said compression-cylinder, a plu-

5 rality of molds carried by said carriage and adapted to be operatively connected with said compression-cylinder, means for supplying compressed air to said compression-cylinder, mechanism for intermittently reciprocating said carriage, valve mechanism controlling the admission of compressed air to said compression-cylinder, and means operating said valve mechanism to admit compressed air to said compression-cylinder and for exhausting it therefrom when one of the molds is in operative engagement therewith, substantially as described.

15 16. A sand-molding apparatus, comprising means for supporting the mold, a compression-cylinder above the mold and adapted to operatively engage the mold for supplying sand thereto, a reciprocating truck supporting said compression-cylinder, means for supplying sand to said compression-cylinder, means for intermittently reciprocating said truck to move said compression-cylinder from its operative position into position to receive sand from said sand-supplying means, means for admitting compressed air to said compression-cylinder when it is in operative engagement with said mold, and means for automatically actuating said mechanisms substantially as described.

30 17. A sand-molding apparatus, comprising a compression-cylinder adapted to contain sand, a pattern-support below said compression-cylinder, a carriage movable over said pattern-support, said carriage being adapted to support a flask, means for moving said pattern-support into engagement with said flask and said flask into engagement with said compression-cylinder, and means for admitting compressed air to said compression-cylinder, substantially as described.

40 18. A sand-molding apparatus, comprising a compression-cylinder, an air-cap adapted to be engaged by said compression-cylinder, a carriage movable under said compression-cylinder, a flask mounted on said carriage, a pattern-support below said flask, means for moving said pattern-support into engagement with said flask, said flask into engagement with said compression-cylinder, and said compression-cylinder into engagement with said air-cap, and means for admitting compressed air to said air-cap, substantially as described.

55 19. A sand-molding apparatus, comprising a compression-cylinder adapted to contain sand, a plurality of molds, means for moving said molds into operative engagement with said compression-cylinder, fluid-pressure mechanism for packing sand from said compression-cylinder in said molds, and means for automatically actuating said mechanisms substantially as described.

60 20. A sand-molding apparatus, comprising a compression-cylinder, a reciprocating truck by which said compression-cylinder is supported,

a reciprocating carriage, a plurality of molds carried by said carriage, means for moving said truck and carriage to bring said compression-cylinder and one or the other of said molds into position to operatively engage one another, means for operatively connecting said molds with said compression-cylinder, means for supplying compressed air to said compression-cylinder, and means for automatically actuating said moving parts substantially as described.

21. A sand-molding apparatus, comprising a compression-cylinder, means for supporting a pattern, means between said compression-cylinder and said pattern-support for supporting a flask, means for moving said parts into operative relation with one another, means for supplying compressed air to said compression-cylinder, and means for automatically actuating said moving parts substantially as described.

22. A sand-molding apparatus, comprising a compression-cylinder, a reciprocating truck supporting said compression-cylinder, a reciprocating carriage adapted to support two molds, and mechanism effecting a complete reciprocation of said truck and simultaneously moving said carriage in one direction only, substantially as described.

23. A sand-molding apparatus, comprising a carriage adapted to support two molds, a track for said carriage, stops adapted to stop the carriage so as to hold one or the other of said molds in operative position, a compression-cylinder adapted to supply sand to the mold that is in operative position, and fluid-pressure mechanism movable into and out of operative relation to said compression-cylinder for packing sand from said compression-cylinder in said molds, substantially as described.

24. A sand-molding apparatus, comprising a carriage adapted to support two molds, a track for said carriage, stops adapted to stop the carriage so as to hold one or the other of said molds in operative position, a compression-cylinder adapted to supply sand to the mold that is in operative position, means for moving said molds into close contact with said compression-cylinder, fluid-pressure mechanism for packing sand from said compression-cylinder in said molds, and means for automatically actuating said moving parts substantially as described.

25. In a sand-molding apparatus, the combination of a carriage adapted to support a plurality of molds, means for reciprocating said carriage to move the different molds into position to receive a charge of sand, means for supplying the different molds with sand when in operative position, and means for automatically actuating said moving parts substantially as described.

26. A sand-molding apparatus comprising transversely-movable means for supporting

the mold, means for supporting sand in position to be supplied to the mold, means for operatively connecting the mold with said sand-supporting means, fluid-pressure mechanism for supplying sand to the mold and packing it therein, mechanism for automatically bringing said mold and sand-supporting means into operative relation, and mechanism for automatically actuating said fluid-pressure mechanism to supply sand to the mold when in operative position.

27. A sand-molding apparatus comprising transversely-movable means for supporting a plurality of molds, means for supporting sand in position to be supplied to the molds, means for operatively connecting the several molds with said sand-supporting means, fluid-pressure mechanism for supplying sand to the molds and packing it therein, mechanism for automatically bringing said molds and

sand-supporting means into operative relation, and mechanism for automatically actuating said fluid-pressure mechanism to supply sand to the several molds when they are respectively in operative position.

28. A sand-molding apparatus, comprising transversely-movable means for supporting a plurality of molds, a compression-cylinder adapted to supply sand to said molds, means for moving said compression-cylinder into and out of operative position, fluid-pressure mechanism for filling the molds, and means for automatically operating said parts, substantially as described.

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