United States Patent [19]

Taccone

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[45] **Jan. 9, 1973**

[54] **MOLDING MACHINE**

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[21] Appl. No.: **74,161**

Related U.S. Application Data

[63] Continuation of Ser. No. 687,750, Dec. 4, 1967, abandoned.

[52] **U.S. Cl.** **164/187**, 164/40, 164/212, 164/224

[51] **Int. Cl.**.....**B22c 15/08**

[58] **Field of Search**....164/15, 37, 40, 172, 173, 180, 164/181, 187, 188, 192, 195, 196, 205, 207, 209, 212, 213, 224; 25/120; 249/137

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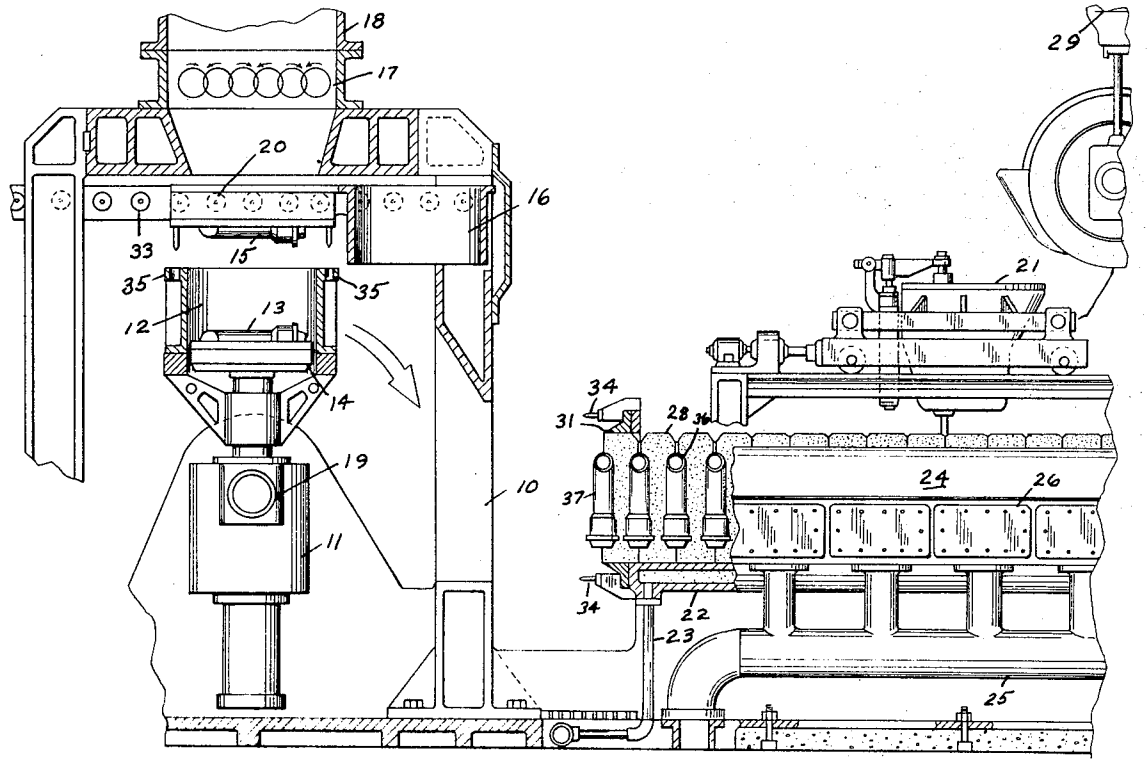
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[57] **ABSTRACT**

A molding machine for making sand molds includes means for vertically filling and squeezing a sand mold between pattern plates which enclose the ends of a molding flask. After mold formation the flask is tilted from the vertical to the horizontal for pushing the mold horizontally out of the flask onto a receiving conveyor for the metal pouring operation.

19 Claims, 13 Drawing Figures



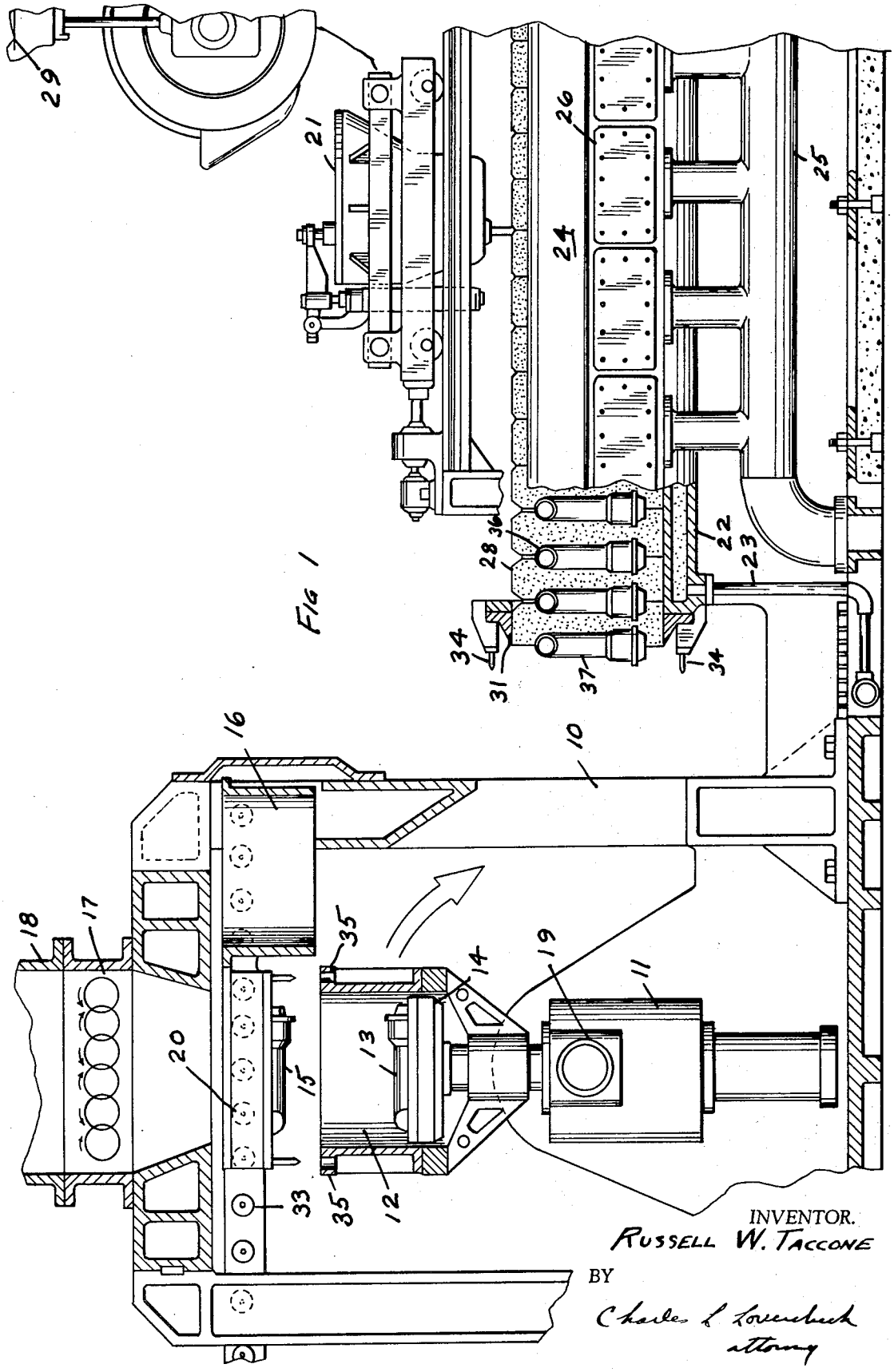


FIG 1

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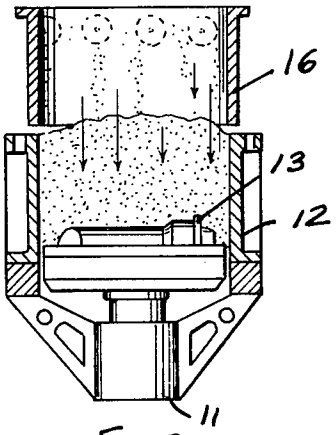


FIG 2

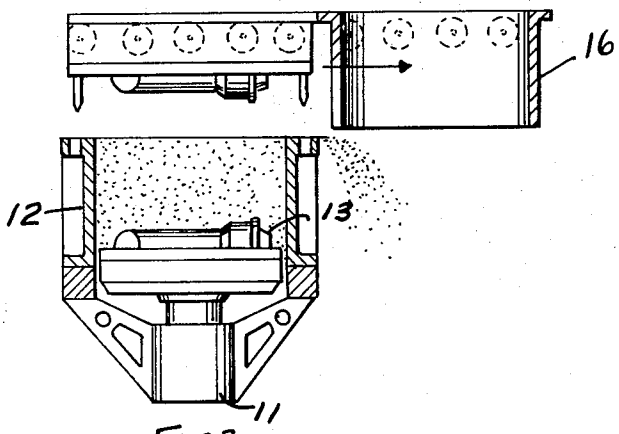


FIG 3

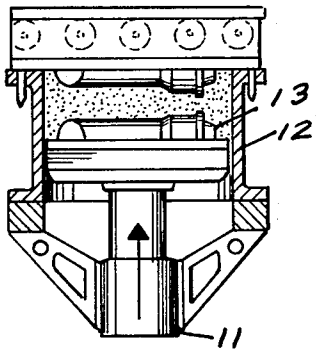


FIG 4

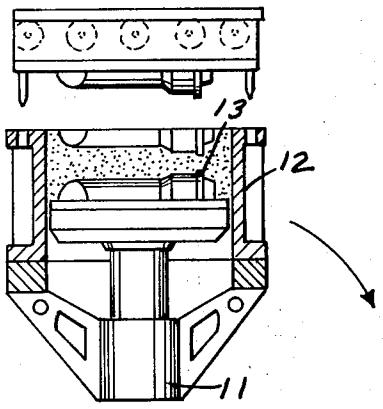


FIG 5

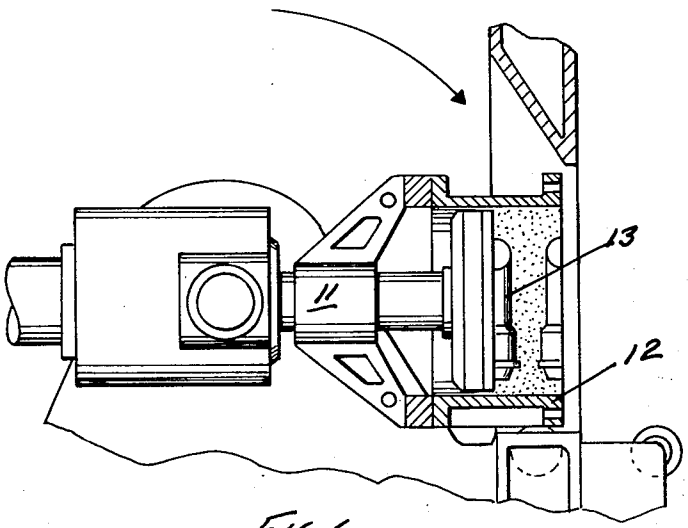
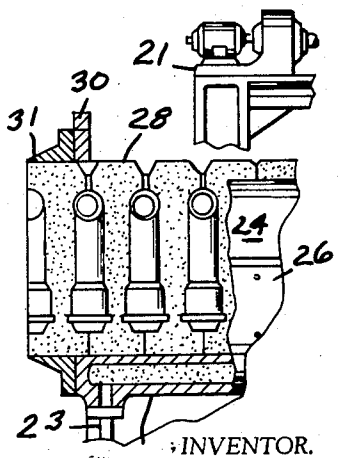


FIG 6



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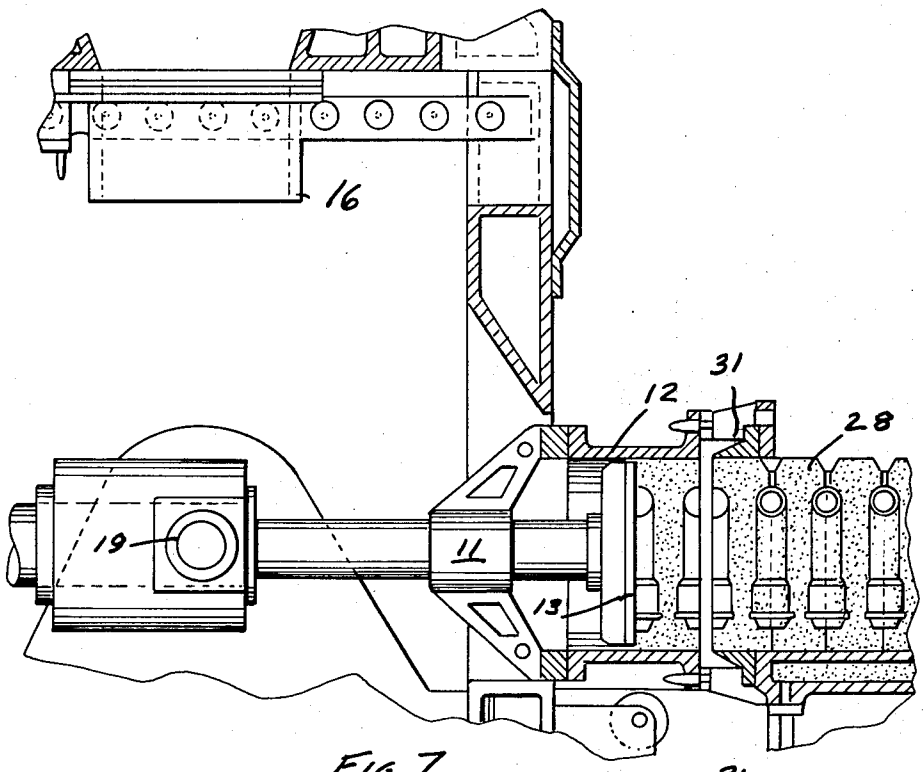


FIG 7

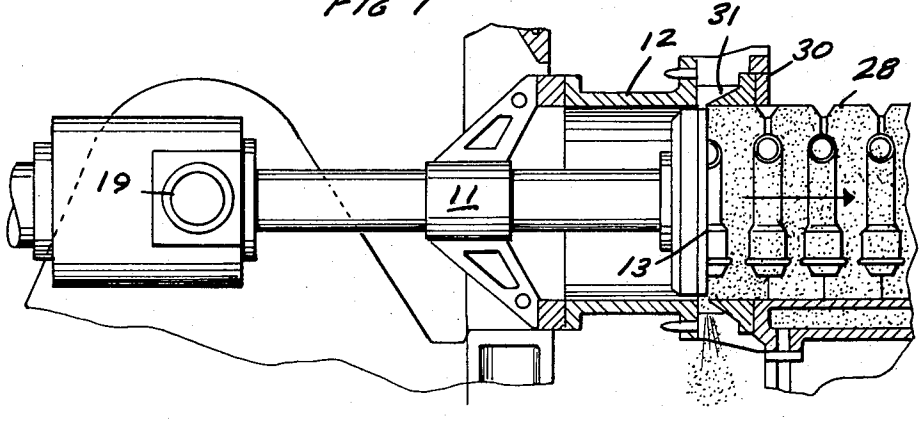


FIG 8

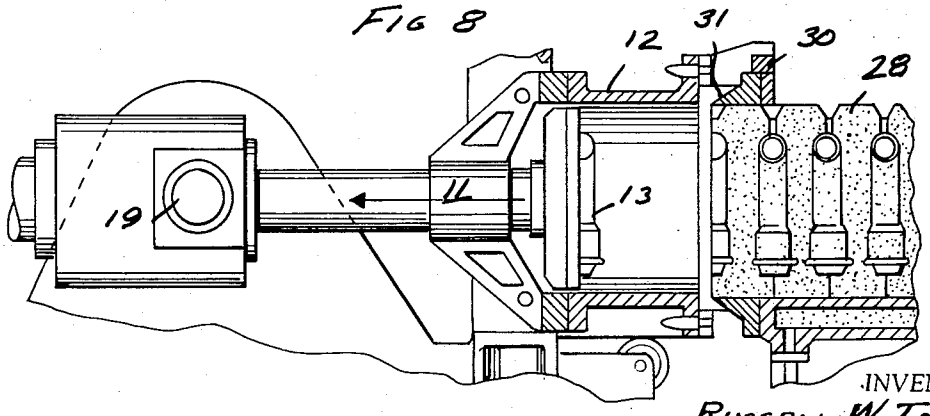


FIG. 9

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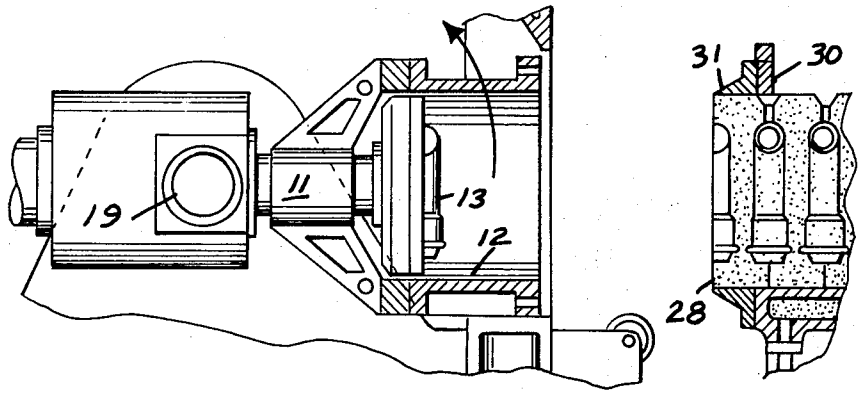


FIG 10

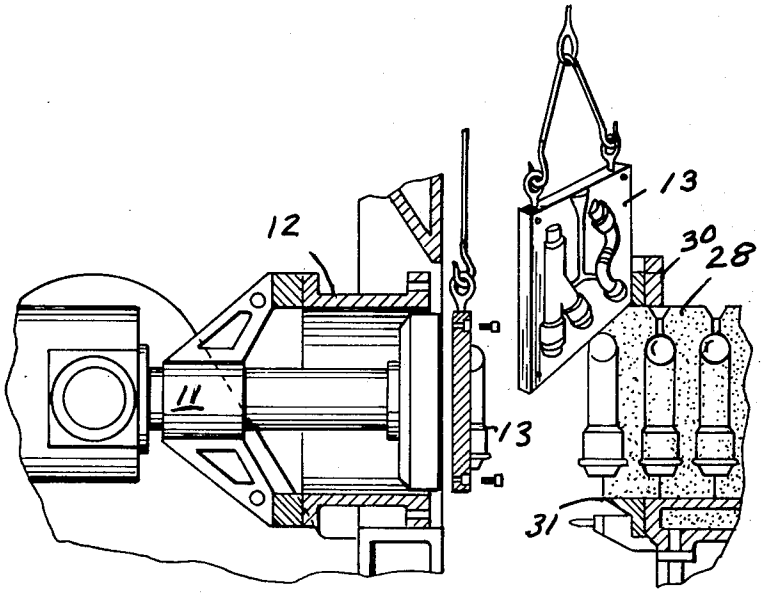


FIG. 11

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Fig. 12.

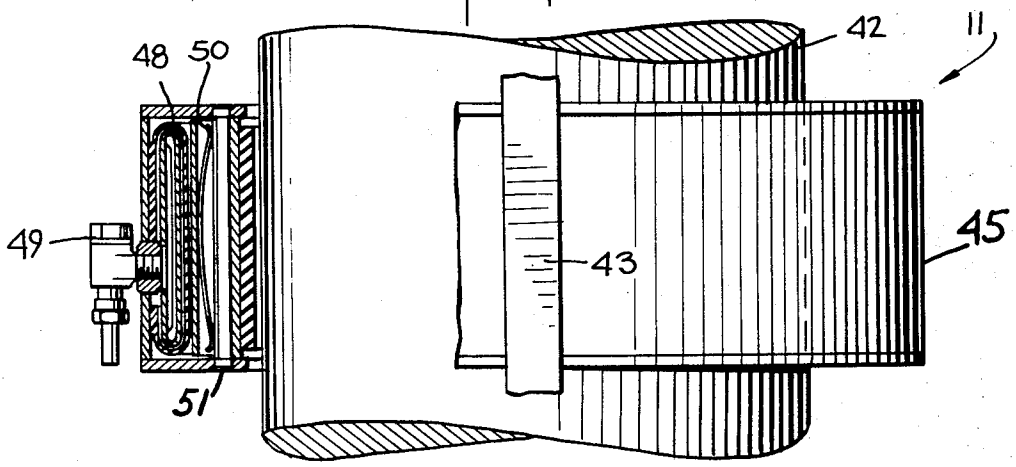
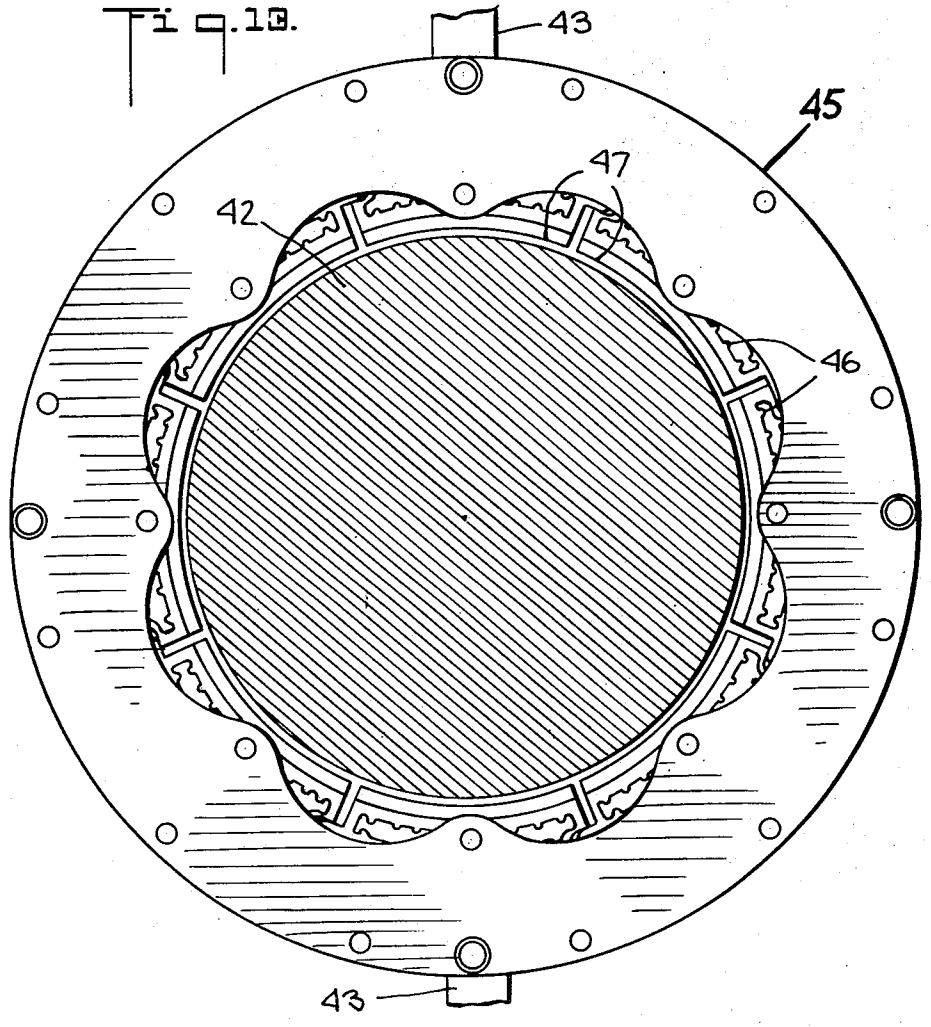


Fig. 13.



MOLDING MACHINE

This application is a continuation of Ser. No. 687,750 filed Dec. 4, 1967, now abandoned.

This invention relates to molding machines, and more particularly, to the type generally called flaskless molding.

BACKGROUND OF INVENTION

Green sand molding is generally done by filling flasks from the top and squeezing from the sides, top or bottom. An inherent disadvantage of such a machine is the small size of the mold that can be produced successfully, the top of the mold being somewhat softer than the middle and bottom sections.

The machine disclosed herein overcomes the foregoing difficulty by gravity filling from the top with well prepared sand, dropping it into a lower pattern, moving an upper pattern into position above the sand, and squeezing the mold from the bottom.

According to the present invention the flaskless molding machines include a molding station and a flask with top and bottom openings to receive top and bottom pattern plates. With this arrangement the flask is filled with sand by the use of propellor aerating devices which provide an improved packing of the sand in the flask. After filling the top pattern plate is brought into position and the mold is squeezed in the vertical direction. Thereafter the flask is titled so that the mold may be pushed in the horizontal direction out of the mold onto a receiving conveyor.

An arrangement is made in the present invention to position the flask together with the sand mold in mechanical alignment with the receiving conveyor so that the mold is precisely aligned with the next previously formed mold. Pushout occurs while the flask is in this position thereby supporting the mold during the critical moment when the force necessary for pushout is applied to the mold.

This machine also shaves off the outside of sand and sizes the mold.

One embodiment of the invention is a machine consisting of a main framework supporting a rotatable cradle on trunnions on which is mounted a squeeze cylinder or cylinder (linear actuator) with the lower pattern plate and molding chamber which must be of a suitable size and shape to accommodate the desired pattern. The cradle may be held with the squeeze cylinder in a vertical position by a tilting cylinder (linear actuator) pinned at one end to the main framework and at the other to the rotatable cradle, rocking trunnion, other tilting mechanism, rotary actuator, electric or hydraulic motor, and be rotatable to a horizontal position. Suitable stops and de-acceleration devices may be provided to limit and control the movement of the cradle.

The lower pattern plate and the molding chamber are mounted on the squeeze cylinder, the pattern plate being fixed firmly to the rod end and the molding chamber on a floating yoke with a clamping device, which allows it to be engaged or disengaged from the rod at will. The molding chamber has replaceable inside plates which serve to guide the pattern plate when it moves in relation to the molding chamber, and bushings which engage pins on the upper pattern plate or on the pouring tube when the molding chamber is in contact with these parts. The pattern plate must be a

fairly tight fit inside the molding chamber and should never disengage downward from it. Outside guide rods fixed to the molding chamber passing through bushings fixed to the rotatable cradle relieve the front bushings of the squeeze cylinder from unnecessary strain during the movement of the molding chamber and provide proper alignment for the molding chamber. The trunnions of the cradle are removable for ease of assembly and hollow to permit entry of the operating medium for the squeeze cylinder without the use of hoses. A high pressure rotating joint is provided in the line to allow for the movement of the trunnions.

Above the molding chamber allowing clearance for the pattern character is a movable carriage, underneath which, on a hinged mounting, is supported the upper pattern plate with pins to match the bushings in the molding chamber the movable carriage defines a pattern shuttle for moving the upper pattern plate into position over the molding chamber. Part of the movable carriage is a sand chute which exactly corresponds in its interior dimensions to the interior dimensions of the molding chamber. The movable carriage may be provided with stops and deacceleration devices and be capable of having the upper pattern in alignment above the lower pattern in one position and the sand chute in alignment with the molding chamber in its opposite position.

The movable carriage is operated by a cylinder trunnion mounted to the main framework of the machine and pinned for flexibility to the carriage.

A cover at the front of the machine protects the operator from accidently stepping into the path of the moving mold chamber when the cradle is being rotated. A pouring channel tube is provided to be in line with the molding chamber in the horizontal position and keyed directly to the molding machine. A space for the operator to set cores if needed is provided between the front cover and the pouring channel tube.

It is, accordingly, an object of the invention to provide an improved molding machine.

Another object of the invention is to provide a molding machine that is simple in construction, economical to manufacture, and simple and efficient to use.

Another object of the invention is to provide a molding machine wherein the flasks are filled with sand and compressed in a vertical position, then swung to a horizontal position, and the mold is forced from the flask into a tunnel to form mold cavities with other molds for pouring.

Another object of the invention is to provide an improved flaskless molding machine.

Another object of the invention is to provide a molding machine that applies a vacuum to molds in an improved manner.

With the above and other objects in view, the present invention consists of the combination and arrangement of parts hereinafter more fully described, illustrated in the accompanying drawings and more particularly pointed out in the appended claims, it being understood that changes may be made in the form, size, proportions, and minor details of construction without departing from the spirit or sacrificing any of the advantages of the invention.

In the drawings:

FIG. 1 is a longitudinal cross sectional view of the machine according to the invention; and

FIGS. 2 through 11 are partial cross sectional views of the machine showing the flasks swung to various positions during several sequences of the molding and pouring cycles.

FIG. 12 is a side elevation view partially in section of a clamping device,

FIG. 13 is a plan view thereof.

Now with more particular reference to the drawings, the machine shown has a frame 10 that supports the molding mechanism adjacent the pouring section. The frame has a hydraulic cylinder 41 rockably supported on the frame with a pattern plate on the upper end of its piston rod and the flask 12 supported on the frame, so that the piston rod will reciprocate the pattern plate 14 inside the flask 12. The flask 12 may be of the type familiar to those skilled in the molding art a movable carriage 20 mounted on the roller conveyor 33 defines a shuttle for moving the pattern plate 15 mounted on pattern plate support 15*a* pattern and for moving the sand chute 16 into position over the molding chamber 12. An upper pattern plate 15a with pattern 15 is supported on movable carriage 20 to roll into position over the flask for molding or to roll to the left out of molding position and bring the sand chute 16 which is fixed to the pattern plate into position under the high speed sand propeller unit 17. When the chute is in position over the flask, sand can be dispensed from suitable batching equipment 18 into the flask on top of the pattern 13, as shown in FIG. 2. After the flask has been filled with sand, the roller conveyor carries the sand chute to the right, as shown in FIG. 3, and brings the pattern 15 over the flask. As the flask is raised by cylinder 41, the locating pins shown fit into the locating holes in the flask, and as the piston rod of cylinder 41 continues to rise, it brings the pattern plate 14 upward to compress the sand between the patterns 13 and 15, as shown in FIG. 4. When the sand has been compressed to the desired density, the piston rod of cylinder 41 retracts and lowers the flask from the pattern plate to the position shown in FIG. 5.

The rockover unit 19 will swing the flask 12 and pattern plate 14 and associated equipment into horizontal position in alignment with the tunnel on top of table 22, as shown in FIG. 6. Table 22 is a water cooled table. Water is supplied through a pipe 23 for cooling the table. The locating pins 34 are received in the holes 35 when the flask is forced toward the tunnel by the cylinder 41.

The molds 28 are formed in the flask and are extruded from the flask into the tunnel shown in FIGS. 7 and 8. The cavities 36 may have cores 37 set in them by a suitable operator.

The piston of cylinder 41 then retracts to the position shown in FIG. 9, and as the cylinder further retracts the flask is withdrawn to the position shown in FIG. 10. A pattern may be changed by suitable equipment as shown in FIG. 11.

The pouring and cooling channel 24 receives the molds 28 as they are extruded from the flask 12, and this pouring and cooling channel is slightly smaller than the inside of the flask so that the sharp edges 31 on the trim frame 30 clean the edges of the sand molds and allow them to fit snugly inside the pouring and cooling chamber.

The ladle 21 is supported above the pouring and cooling chamber and from it molten metal may be poured in a well known manner.

A vacuum line 25 is provided below the flasks and this exerts a vacuum on the flask and draws all air out from the pores in the sand to provide a smoother casting job.

The cooling chamber has cleanout plates 26 that may be removed to inspect the magnets inside the cooling chamber and a metal transfer ladle of a suitable type indicated at 27 and familiar to those skilled in the art is supported on track 29. The pouring and cooling channel 24 may be considered to have an opening 32 at its forward end.

The operation of this machine begins with the squeeze cylinder in the upright position and the sand chute lines up between the mold chamber and the opening in the crown. The mold chamber is then filled with the molding medium through the opening in the crown. The carriage is moved to align the upper and lower patterns. Any overfill of the mold chamber is struck off and pressure is applied to the squeeze cylinder moving the mold chamber and the lower pattern plate up until the mold chamber contacts the upper pattern plate and engages the pins and bushings. The mold chamber continues up closing the clearance between the pattern carriage and the crown. The mold chamber stops, the locking device either slipping or disengaged, while the lower pattern continues up, squeezing the mold. The squeeze cylinder decompresses while the locking device engages. The squeeze cylinder retracts slowly, stripping the mold, still with molding chamber, from the upper pattern, the molding chamber and the lower pattern maintaining the same positions relative to each other that they had when the squeeze cylinder decompressed and stops with the mold chamber and mold clear of the upper pattern.

The tilt cylinder is actuated to rotate the cradle bringing the molding chamber and mold to the horizontal position. The squeeze cylinder is extended, carrying the molding chamber, into contact with the pouring channel and aligning on the pins and bushings. The locking device slips or is disengaged and the squeeze cylinder continues to push the completed mold into the pouring channel. The carriage can begin to move to the starting position at any time while the molding chamber is in the horizontal position. The squeeze cylinder must retract, stripping the mold from the lower pattern. The locking device must engage to present the face of the pattern outside the front cover for inspection, service, or changing. The locking device disengages while the squeeze cylinder continues to retract bringing molding chamber and pattern to their original position. The cradle rotates to the vertical position and the cycle may be started again.

The molding chamber 12 is mounted on the cylinder rod 42 by means of a floating yoke 43 and a clamping or locking device 11 which allows the molding chamber to be engaged or disengaged from the rod at will. If desired, the locking device 11 may be adapted to slip when the molding chamber engages the pattern carriage 20 and the pouring channel 24. Disengagement or slippage of the locking device allows for the cylinder 41 to squeeze the sand mold against the upper pattern plate and for push out of the mold onto the pouring channel. A locking device of this kind is well-known and is manufactured by Fawick Corporation, Cleveland, Ohio. Fawick Corporation illustrates a typical locking device in Bulletin No. 500–A, pages 24 and 25.

The locking device is illustrated in FIGS. 12 and 13 of the drawing and comprises an outer doughnut shaped frame 45 having a plurality of brake shoe segments 46 which collectively define a cylindrical interior surface 47 for engaging the cylinder rod 42 to be braked. Each shoe segment 46 is mounted for movement radially inwardly and outwardly of the frame, and is urged radially outwardly by spring member 50 which bears against fixed rod 51. An annular pneumatically actuated tube 48 when inflated is effective to move the shoe segments 46 radially inwardly to bear against piston rod to cause locking action to occur. A suitable fitting 49 provides for inlet and exhaust of air from the pneumatic tube 48. The locking action may be ended by releasing air from the pneumatic tube in which case springs 50 urge the shoes radially outward within the outer frame 45. Alternately, the locking action may be overcome by causing the piston rod 42 to slip through the locking device, that is, overcome the friction force of the shoe segments.

Cores can be set in the last mold in the pouring channel during the molding cycle. An electric eye or other safety device can prevent the molding chamber from extending while the operator is in the core setting area.

The foregoing specification sets forth the invention in its preferred practical forms but the structure shown is capable of modification within a range of equivalents without departing from the invention which is to be understood is broadly novel as is commensurate with the appended claims.

What is claimed is:

1. A molding machine comprising a machine frame,
a flask and means supporting said flask relative to said machine frame,
a pattern shuttle,
sand loading means,
means supporting said pattern shuttle on said machine frame,
an upper pattern supported on said pattern shuttle,
a lower pattern plate,
a lower pattern supported on said pattern plate,
means connected to said lower pattern plate to move said pattern plate through said flask and to position said pattern plate normally to close the lower end of said flask,
a generally horizontally disposed table,
means for exerting a vertical compression force on sand in said flask whereby said sand is compressed into a mold between said upper pattern and said lower pattern,
and means for swinging said lower pattern plate and said flask to bring one edge of said sand into general alignment with said table,
and means to force said mold from said flask onto said horizontal table.

2. The machine recited in claim 1 wherein
said flask support and said lower pattern plate are carried on the piston rod of a hydraulic cylinder,
and said hydraulic cylinder being swingably supported on said machine to swing said flask from a vertical molding position tc a horizontal position on said table.

3. The machine recited in claim 1 wherein
said table is adapted to receive a plurality of said molds,
said molds being forced onto said table in engagement with each other with a cavity formed by said patterns between each two said molds,
and means is provided to pour molten metal into said cavities while in said mold.

4. The machine recited in claim 3 wherein vacuum means is connected to said table to remove air from said molds.

5. The machine recited in claim 3 wherein
said table forms one side of an open channel,
and said molds are forced from said flask into said channel.

6. The machine recited in claim 5 wherein
a frame is provided around the open end of said channel,
and said frame has a cutting edge around it for sizing said molds so they fit snugly into said channel.

7. A molding machine comprising a machine frame,
a lower pattern plate,
an upper pattern plate,
means to support a flask between said upper pattern plate and said lower pattern plate,
means to move said lower pattern plate and said upper pattern plate relative to each other in a generally vertical direction for causing compression of the sand in said flask,
means to separate said flask from said upper pattern plate,
a generally horizontally disposed support for molds disposed on said machine,
means to swing said flask and said lower pattern plate from a generally vertical orientation to a generally horizontal orientation position adjacent said support,
means to engage said pattern plate and to force said mold out of said flask and onto said support means,
and means to pour molten metal into said mold while said mold is on said support means.

8. The machine recited in claim 7 wherein
said generally horizontally disposed support is a part of a channel and means is provided on said channel to remove sand from the outside edge of said mold to cause said mold to fit into said channel,

9. The machine recited in claim 7 wherein said flask is fixed to a hydraulic cylinder,
and said lower pattern plate is fixed to a piston rod in said cylinder.

10. The machine recited in claim 7 wherein
means to exert a vacuum on said molds is provided on said machine.

11. The machine recited in claim 7 wherein
said upper pattern plate has an upper pattern on it,
and said lower pattern plate has a lower pattern on it,
and said pattern plates each form cavities in said mold,
one of each of the said cavities made by said upper pattern and one of the cavities made by lower pattern each being disposed beside each other providing a space to receive molten metal.

12. The machine recited in claim 7 wherein
said means to swing said lower pattern plate comprises a cylinder swingably supported on said machine,
said flask being attached to said cylinder,
a piston rod on said cylinder,

said lower pattern plate being attached to said piston rod whereby said piston rod may push said lower pattern plate through said flask to compress sand therein and to force said mold therefrom.

13. A molding machine comprising:
a machine frame,
a first pattern plate supported on said machine frame,
a cradle rotatably mounted on said frame for movement from a generally vertical orientation to a generally horizontal orientation,
an open-ended flask mounted on the cradle for rotatable movement with the cradle,
a second pattern plate mounted on said cradle being adapted to close one end of the flask and being further adapted for movement in a linear direction through the interior of said flask,
means for placing sand in the flask,
means for moving the flask in a generally vertical direction toward the first pattern plate,
means for moving the second pattern plate toward the first pattern plate so that the flask and the second pattern plate travel together toward the first pattern plate,
means for exerting a compression force on sand in said flask whereby said sand is compressed into a mold between the first pattern plate and the second pattern plate,
means for moving the flask and the sand mold together with the second pattern plate away from the first pattern plate in a generally vertical direction so that the first pattern plate is disengaged from the sand mold,
means for rotatably moving the cradle from a generally vertical orientation to a generally horizontal orientation,
a generally horizontally disposed table,
means for moving the second pattern plate through the flask to push the sand mold out of the flask onto the horizontally disposed table, and for withdrawing the second pattern plate away from the sand mold.

14. A molding machine as defined in claim 13 which further includes means for moving the flask together with the sand mold and the lower pattern plate in a generally horizontal direction toward the horizontally disposed table.

15. A molding machine comprising:
a machine frame,
a first pattern plate mounted on said machine frame,
a cradle rotatably mounted on said frame for movement from a generally vertical orientation to a generally horizontal orientation,
an open-ended flask mounted on the cradle for rotatable movement with the cradle,
a second pattern plate mounted on said cradle being adapted to close one end of the flask and being further adapted for movement in a linear direction through the interior of said flask,
means for locking the second pattern plate in position at said one end of the flask,
means for placing sand in the flask,
means for moving the flask together with the second pattern plate toward the first pattern plate,
means for further moving the second pattern plate in the flask toward the first pattern plate to squeeze sand in the flask thereby to form a sand mold,
means for locking the second pattern plate relative to the flask after formation of the sand mold,
means for moving the flask and the sand mold together with the second pattern plate away from the first pattern plate in a vertical direction,
means for rotatably moving the cradle from a generally vertical orientation to a generally horizontal orientation,
a generally horizontally disposed table,
means for moving the flask together with the sand mold and the lower pattern plate in a generally horizontal direction toward the horizontally disposed table,
and means for moving the second pattern plate through the flask to push the sand mold out of the flask onto the horizontally disposed table.

16. The molding machine according to claim 15 in which the means for locking the second pattern plate is adapted to slip.

17. The molding machine according to claim 15 in which the means for locking the second pattern plate is adapted to be released.

18. A molding machine comprising a machine frame,
a flask and means supporting said flask relative to said machine frame,
an upper pattern supported on said machine frame in a position above said flask,
a pattern plate,
a lower pattern supported on said pattern plate,
means connected to said pattern plate to move said pattern plate through said flask and to support said pattern plate normally to close the lower end of said flask,
a generally horizontally disposed table,
means for exerting a compression force on sand in said flask whereby said sand is compressed into a mold between said upper pattern and said lower pattern,
means for locking the lower pattern plate with respect to said flask and mold,
means for separating the mold from the upper pattern,
and means for swinging said pattern plate and said flask to bring one edge of said mold into general alignment with said table,
means for releasing the locking condition of the lower patten plate with respect to said flask and said mold,
and means to force said mold from said flask onto said horizontal table.

19. A molding machine comprising a machine frame,
a flask and a rod supporting said flask relative to said machine frame,
an upper pattern supported on said machine frame in a position above said flask,
a pattern plate,
a lower pattern supported on said pattern plate,
said rod connected to said pattern plate to move said pattern plate through said flask and to support said pattern plate normally to close the lower end of said flask,
a generally horizontally disposed table,
power means for exerting a compression force on sand in said flask through said rod whereby said sand is compressed into a mold between said upper pattern and said lower pattern,

a locking device to engage and lock said rod relative to said flask and said lower pattern,
means for withdrawing the flask in said locked condition from said upper pattern,
and means for swinging said pattern plate and said flask in said locked relationship to bring one edge of said mold into general alignment with said table,
means for releasing said locking devices,
and means to force said mold from said flask onto said horizontal table.

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