My present invention relates to apparatus for making molds, and while not limited thereto, to apparatus particularly constructed and arranged to make sand molds for the production of cast-iron pipe, and has for an object the provision of such apparatus in which the sand used to form the molds is packed about the pattern by forcing the flask downwardly toward the pattern, thereby eliminating entirely any other form of packing of the sand, as for instance the usual hand tamping or jolting.

My invention contemplates the provision of apparatus of the character designated which will be effective to make both the cope and drag sections of the mold, and has for another object the provision of such apparatus in which an open bottom flask is placed over a pattern, filled with loose sand, and then is forced downwardly thereby to pack the sand in the flask about the pattern, together with means to strip the section of the mold thus formed by lowering the pattern.

Another object is to provide mold making apparatus comprising a table embodying plates in the nature of face or stripping plates, vertically movable pattern supporting mechanism, and a vertically movable open frame slidably mounted about the table and in effect forming an extension of the flask and disposed to support the flask in inverted position along its sides and ends, together with pressure cylinders for raising the flask extension and the flask to permit the same to be filled with loose sand preparatory to forcing the flask downwardly by other mechanism, thereby to pack the sand therein.

Another object is to provide improved mechanism for forming the pouring gates in the cope section of a sand mold which is particularly adapted for use in connection with my invention, and which is effective to form the pouring gate or gates during the packing of the mold.

A further object is to provide apparatus for making molds in which the sand in finished molds is packed uniformly throughout the depth thereof, and in which the molds are especially smooth and densely packed around the pattern, thus providing molds of high quality.

Apparatus embodying the features of my invention is illustrated in the accompanying drawings forming a part of this application in which:

Fig. 1 is an isometric fragmental view of one end of my improved apparatus with the flask in lowered position thereon, the patterns being removed;

Fig. 2 is a fragmental plan view with the flask removed;

Fig. 3 is a fragmental side elevational view partly in section with the flask and patterns in raised position ready to receive a charge of loose sand;

Fig. 4 is a longitudinal sectional view partly broken away showing the flask and pattern in raised position;

Fig. 5 is a sectional view taken generally along line V—V of Fig. 4;

Fig. 6 is a detail sectional view taken generally along line VI—VI of Fig. 4;

Fig. 7 is a detail sectional view taken along line VII—VII of Fig. 1;

Fig. 8 is a detail sectional view taken generally along line VIII—VIII of Fig. 2 and showing my improved mechanism for resiliantly supporting a pouring gate pin;

Fig. 9 is an isometric view of a form of flask ball suitable for use in lifting the particular kind of flask which I preferably employ with my improved apparatus; and

Fig. 10 is a diagrammatic view illustrating my improved apparatus in use.

Referring now to the drawings for a better understanding of my invention, the apparatus comprises a bed 10 forming the main supporting structure for the remainder of the apparatus. The bed comprises an elongated box like structure formed of longitudinally extending side channels 11 with the flanges thereof turned as shown more clearly in Fig. 4. The channels 11 are cross braced at the ends by means of channels 12 having the flanges thereof likewise inturned, and are cross braced intermediate their ends by other cross channels 13. The channels 11, 12 and 13 preferably are welded together to form an integral structure.

The bed 10 is supported at each end on rollers 14 journaled on pins 16, mounted in pairs of cross channels 17. Resting on the channels 17 and secured thereto are other cross channels 18, secured at their upper edges to the under side of the bed 10.

Secured to the tops of the cross channels 12 and 13 is a continuously extending centrally disposed bar 19 and continuously extending bars 21 mounted at the sides of the bed. Secured to the center bar 19 by any suitable means is a double sided pattern stripping plate 22, and secured to the bars 21 are single sided stripping plates 23.

As will be understood, the plates 22 and 23 are cut out along their edges to conform to the shape of patterns 24, for instance, a pair of pipe patterns having a bell end 26, and a spigot end 27.

The patterns thus fit snugly against the edges of
the plates 22 and 23, but are free to move downwardly with respect thereto from the position shown in Figs. 6 and 8 to the position shown in Fig. 9. The tops of the cross channels 21 and 22 are grooved out as indicated at 28, thereby to provide adequate room for lowering of the patterns in the manner and for the reasons later to be explained.

Mounted in bearings 29 secured to the sides of the channels 21 are a pair of cross shafts 31 and 32. Fixedly mounted on the shafts 31 and 32 are pairs of cams 33 and 34. Secured to the underside of each of the patterns 24 by means of bolts 35 are pads 37. The pads are disposed to engage the pads 37 as shown in the drawings, whereby upon rotation of the shafts 31 and 32 the patterns 24 are raised or lowered vertically.

In order that the shafts 31 and 32 may rotate precisely in unison, thereby to assure that the patterns move vertically throughout their length I provide on the shaft 31 an arm 39 having an integrally formed manually operable handle 41. Secured to the shaft 32 is an arm 42. Pivotedly connected at 43 and 44 to the arms 39 and 42 are the ends of a link 45. The link 45 carries a stop member 47 disposed to engage at its end 50 against the arm 42, thereby to limit counterclockwise movement of the shafts 31 and 32 as viewed in Figs. 3 and 4 of the drawings.

Slidably mounted against each side of the bed 18 are channels 48 and 49. The channels 48 and 49 are connected across the ends of the bed by means of cross bars 51. The bars are secured by bolts 52 which pass through lugs 53 welded to the channels 48 and 49, and nuts 54 therefor. As best shown in Figs. 4 and 6, the channels 11 are provided with aligned openings 66. Secured by welding to the inner sides of each of the channels 48 and 49 is one end of a pair of bars 57 which project through the openings 56. The bars overlap adjacent their centers as shown in Fig. 6, and have secured thereto by bolts 55 the cross head 59 of the piston rod 59 of an air cylinder or the like 51. As shown clearly in Fig. 4, there are two sets of the bars 57 and two of the cylinders 61. The cylinders are supported on cross members 62, in turn supported on depending bracets 63 secured to the channels 11 by bolts 64.

From the mechanism just described it will be apparent that when air is admitted through conduits 66 and 67 to the cylinders 61, the pistons 63 thereof move upwardly, thereby raising the channels 48 and 49, and the cross plates 51. The limits of travel of the channels 48 and 49 are adjustably determined by means of brackets 65 welded to the channels 11, each of which is drilled and tapped to receive a bolt 65a and a nut 65b. The bolt 65a passes slidably through an opening in the lower flange of the channels 48 and 49 to limit upward movement of the channels, while the lower flanges of the channels strike the studs 65b, to limit downward movement thereof.

Mounted on the end cross channels 12 of the bed 18 are plates 69. The plates are secured by bolts 71 which pass through horizontally elongated slots 72 in the plates 69. Outstanding from each of the plates 69 is a boss 73. The boss is drilled to accommodate a vertically disposed pin 74 having an upper tapered end 76. The pin is secured in the boss by means of a set screw 77. The purpose of these plates and pins will be explained later in connection with the functioning of the apparatus.

The particular type of flask which I prefer to employ with my improved apparatus is indicated generally by the numeral 78, and is of the usual trapezoidal shape in transverse section, and open at top and bottom. Likewise, the flask is preferably compartmented by the usual flanges 79, and is provided at each end with semicircular openings 81 having flanges 82 outstanding from the ends of the flask to strengthen the end thereof and to support cores for the well known purposes. The flask is disposed to be supported by the upper flange of the cross channels 48 and 49, and the cross bars 51 and in inverted position thereon as shown. On each end of the flasks I provide an outstanding boss 83, drilled to slidably pass over the pin 74, the tapered end 76 thereof aiding in inserting the pins in the openings when the flask is placed on the apparatus. Also, for the reason later to appear, I mount on top of the cross bar 30 semi-circular plates 84 adapted to fit up into the semi-circular openings 81 to prevent sand from spilling out of the flask during the filling and ramming thereof. The circular plates 84 have removed after the sand has been packed in the flask thus providing an opening for cores which are placed between two flasks placed together for pouring as is well known in the art. The flask are identical at both ends and therefore are reversible end for end on the apparatus. This construction of the flasks, together with the centering pins 74 and lugs 53, provides a unit in which cope and drag sections may be made and eliminates having to keep track of separate kinds of flasks in the plant.

At each upper corner of the flask I provide a tapered pin 86 projecting outwardly of the ends of the flask. As shown in Fig. 9, I prefer to use a ball for lifting the flask which comprises rods 87 and 89 pivotedly connected to each other as at 88, a clevis 90 providing the pivot point. The rods slope downwardly as indicated and are provided with vertical portions 91 and 92. The vertical portions are inturnd to provide relatively short horizontal sections 93 and 94, and on these latter sections are pivotally mounted plates 95 and 97. Inwardly projecting from the plates are pairs of socket members 98 adapted to be slipped over the pins 85 when it is desired to remove a flask from the bed or to place one thereon as will later be explained.

At intervals along the center pattern strip 22 I provide round openings 99, which likewise pass through the bar 18. Secured to the underside of the bar 19 beneath each of the openings 99 is an internally threaded collar 101. Screwed into the collar and depending therefrom is a length of pipe 102, which may conveniently be closed at its lower end by means of a cap 103. Disposed in the pipe and with its lower end abutting the cap 103 is a coil spring 104. Contacting the upper end of the spring 104, and slideable within the pipe 102 is a washer 105. A pouring gate pin 107 having the usual conical head 108 is adapted to pass through each of the openings 99 and with its lower end fitting in the washer 106. The pin is thus resiliently supported for downward movement, and may be withdrawn by hand out of the opening 99 in the manner later to be explained.

Referring now more particularly to Fig. 10, I will now describe the additional apparatus which I employ in using the apparatus herefore described, and the method of using all of the apparatus for the production of molds.
I provide a track 109 embodying rails for supporting the rollers 14, thus to translatably support the entire apparatus heretofore described. Secured to one of the channels 11 of the bed 10, adjacent the longitudinal center thereof is a lug 110 to which is fastened the piston rod 111 of a horizontally disposed fluid pressure cylinder 112. Fluid may be admitted to either end of the cylinder 112 through conduits 113 and 114 by any suitable valve arrangement, and from any suitable source, not shown. Mounted above the track 109 is a sand hopper 116 having the usual dump valve 117 at its bottom and operating handle 118. The valve 117 and the bottom of the hopper 116 preferably are substantially the length of the flask 78 whereby upon opening the valve 117 sand is placed in measured quantity along the length of the flask.

Straddling the track 109 is a framework comprising vertical members 119, and horizontal members 121, together with suitable bracing members 122 and 123. Depending from the members 122 and 123 are a pair of fluid pressure cylinders 124 adapted to have fluid under pressure supplied thereto selectively through conduits 125 and 127. The piston rods 128 of the cylinders 124 carry an beam 139 with the flanges thereof disposed horizontally.

To the left of the mechanism just described as shown in Fig. 10 I provide an overhead track 131 carrying the usual roller mounted hook 132. The hook 132 is adapted to engage in the elevia 95 whereby the flask may be raised by engaging the sockets 96 over the pins 85.

To the left of the framework 119 and under the track 131 I provide a roller conveyor 133 on which the cope and drag sections formed by my improved apparatus may be placed for transportation to a pouring station in the manner now to be explained.

From the foregoing the method of using my improved apparatus may now be readily explained and understood. A flask 78 is inverted and placed with its top edges resting on the channels 48 and 49, and with the pins 76 passing through the openings in the flask. This position of the flask correctly with respect to the patterns 24, which as will be understood, are placed in the apparatus, and are held in raised positions through the medium of the cams 35 and 34 as determined by the position of the manually operated handle 41. Air or other fluid under pressure is admitted to the cylinders 61 through the conduits 66 and 67. It will be understood that flexible hose is used for connecting the conduits 66 and 67 to the control valves or to a source of supply of fluid under pressure. With a flask thus positioned, the cylinder 112 is actuated to position the open bottom of the flask 78 directly under the valve 117 of the sand hopper 116. By moving the lever 118 the flask is filled with loose sand while in raised position with respect to the pattern, it being remembered that the effect of admitting air to the cylinders 61 is to move the side channels 48 and 49, and consequently the flask upward. After sufficient sand fill the flask and space created by raising the channels 48 and 49 is delivered thereinto, fluid is admitted through the conduit 114 of cylinder 112, whereby the entire bed is pushed along the track and positioned beneath the beam 139 carried by the air cylinders 124. Pressure is now admitted through the conduit 126, and simultaneously released from the cylinders 61, thereby forcing the beam 139 into contact with the bottom of the flask 78. It will be noted that the beam 139 is of such size as to completely cover the open bottom of the flask. It will be apparent therefore that the beam, in pressing downwardly on the flask 78 confines the sand at the bottom of the flask. The sand is effectively confined otherwise by the upper inner edges of the channels 48 and 49, the cross bars 51, and the circular plates 84 carried thereby. The sand is thus packed or ramed in the flask about the patterns 24, the downward movement of the side channels 48 and 49 and consequently the flask being limited by means of the studs 69 previously described. At this point the handle 41 is moved to cause the cams 35 and 34 to rotate thus permitting the pads 87 and the patterns to be lowered from contact with the mold.

After the lower flanges of the channels 48 and 49 have contacted the studs, thus indicating that the flask is fully ramed, pressure is admitted to conduit 127, raising the plates of the cylinders 124 and consequently the beam 139. Pressure is again admitted to the conduit 114 of the cylinder 112, moving the entire roller mounted bed leftward from beneath the cylinders 124, and thence under the overhead beam 151. The ball is now engaged with the roller mounted hook 132, cocked over the pins 86, and the flask is lifted from the apparatus and placed on the conveyor 133. If the flask is to be turned upright, the pivotal mounting of the plates 96 carrying the sockets permits a workman to readily accomplish this.

It is to be noted that in making a cope portion of the mold, the pouring gate pins 107, resting on the springs 104 are forced downwardly by the beam 139 during the raming of the sand. Consequently, when the beam is again raised, the springs 104 move their associated pins upwardly whereby a workman may readily remove the pins 107 by hand. It will be appreciated that the spring in association with the pin permits the same to move downwardly with the flask without interfering in any way with the raming of the sand in the flask.

From the foregoing it will be apparent that I have devised an improved apparatus for making molds which is effective to pack the sand therein without the necessity of hand or jar raming the same. Raising the channels 48 and 45 and the plates 51 above the level of the stripper plates in effect provides an extension for the inverted flask, providing a space sufficient to accommodate the required amount of loose sand for forming a tightly packed mold. It is to be noted particularly that the edges of the sides of the flask at all times are in contact with the top flanges of the channels 48 and 49 during the filling of the flask with sand, whereby no sand gets between these members. Further, it is to be noted that the wear due to raising and lowering the channels 48 and 49 and the end bars 51 is negligible as I have found in actual practice that a movement of approximately only one and one quarter inches is necessary to pack the sand to the degree required when making the usual small sizes of soil pipe and the like. The slots 72 in the plates 68 permit of lateral adjustment of the pins 76, thus to accurately position the flask with respect to the remainder of the apparatus.

While I have shown an air cylinder 112 for effecting movement of the bed along the track 109, it will be apparent to those skilled in the
art that other forms of motive power may be provided. For instance, in some installations it would be preferable to employ a fluid or air motor to drive one or more of the rollers 14 along the track 18, and in others it would be more desirable to provide an electric motor for this purpose. It is also to be noted that with my improved arrangement the empty flasks may be returned to a point adjacent the roller conveyor 13, there to be picked up by means of the ball, and placed on the apparatus prior to returning the same under the sand hopper 116. I have found that my improved apparatus lends itself admirably to the mass production of pipe, and it will be apparent that through its use large plant areas may be saved for other purposes.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications, without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claim.

What I claim is:

In apparatus for making sand molds in open bottom flasks, a pattern table embodying a bed formed of side and end plates secured together, a pattern stripping plate on the top of said bed, means mounted in said plates and supporting a pattern for vertical movement relative to the stripping plate, a secondary frame formed of plates slidably surrounding and contacting the sides and ends of said bed and disposed to support the flask in inverted position relative to the top of said table and pattern, a pair of vertically disposed fluid pressure cylinders embodying pistons and piston rods supported from the side plates and disposed beneath the bed, there being aligned pairs of openings in the side plates forming the bed, inwardly extending members secured to the side plates of said secondary frame and passing through said openings, means to secure said inwardly extending members to the piston rods of their associated pressure cylinders, means to admit fluid under pressure concentrically to the cylinders thereby to raise the secondary frame with its upper edges projecting above the top of the stripping plate, means to fill the flask and projecting portion of the secondary frame with loose sand, a temporary closure for the bottom of the flask, and means operatively connected with said closure for forcing the secondary frame and the flask downwardly into mold forming relation with the pattern thereby to pack the sand.

DURRO E. WOOD.

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