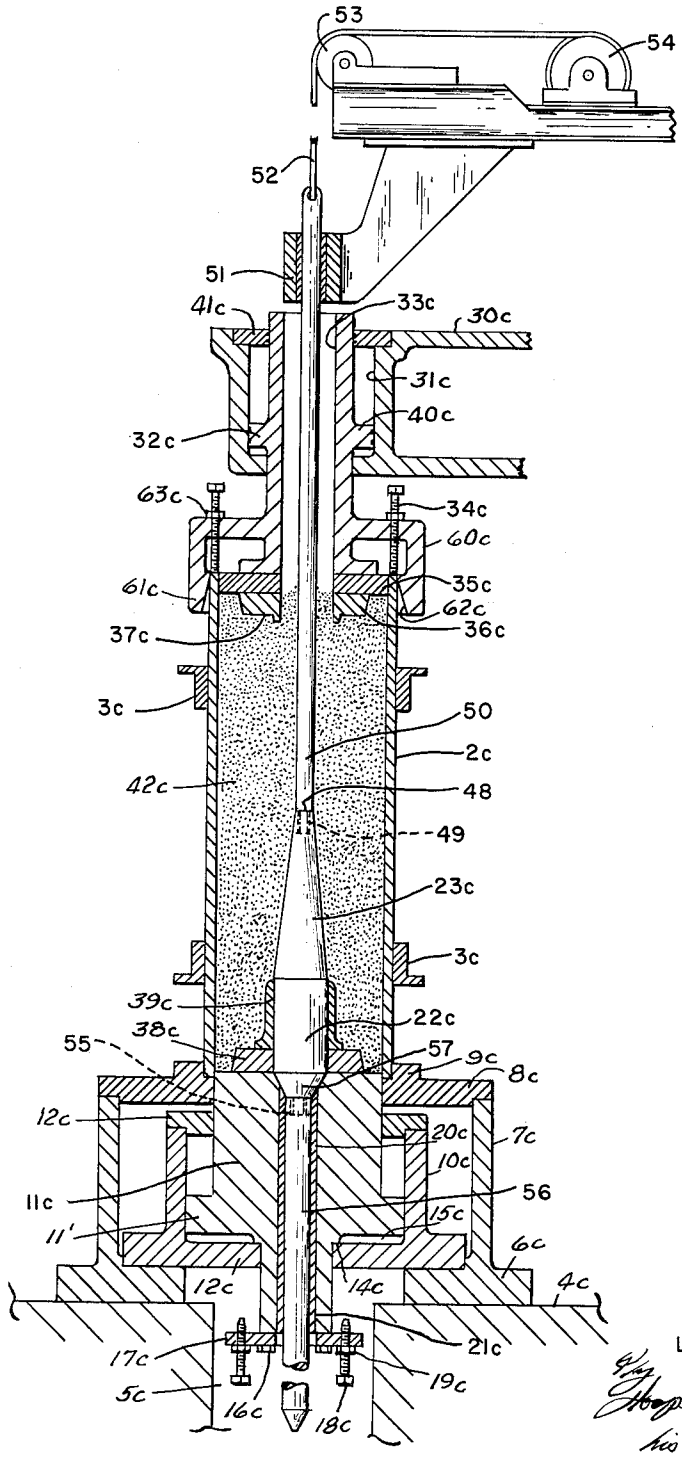
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APPARATUS FOR FORMING FOUNDRY MOLDS FOR CASTING PIPES

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APPARATUS FOR FORMING FOUNDRY MOLDS FOR CASTING PIPES

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Continuation of application Ser. No. 335,800, Jan. 6, 1964, which is a continuation of application Ser. No. 118,002, June 19, 1961. This application Mar. 22, 1965, Ser. No. 441,715

2 Claims. (Cl. 22—17)

This application is a continuation of my copending application Serial No. 335,800, filed January 6, 1964, now abandoned, which is in turn a continuation of my application Serial No. 118,002, filed June 19, 1961, now abandoned.

This invention relates to apparatus for forming foundry molds. It relates more particularly to apparatus for forming foundry molds adapted for the centrifugal casting of elongated hollow articles such as pipe.

My Patents Nos. 2,449,900 and 2,559,161 disclose a method and apparatus for forming molds for centrifugal casting and centrifugally casting elongated hollow articles in such molds. Those patents contemplate the formation of a mold and the centrifugal casting of an elongated hollow article therein at a single station, i.e., by the use of a duplex apparatus in which both the mold is formed and the centrifugal casting in the mold is carried out.

The method and apparatus of my above mentioned patents have proved highly successful and a large proportion of the cast iron soil pipe made in the United States and Canada is made on such apparatus by the use of such method. However the apparatus is relatively costly. Also, soil pipe is now in demand in ten foot lengths instead of the five foot lengths in which soil pipe was made substantially exclusively a few years ago. The building of an apparatus such as that disclosed in my above mentioned patents for the centrifugal casting of ten foot lengths of pipe would further greatly increase the cost of the apparatus.

I have devised a comparatively simple and inexpensive apparatus for forming foundry molds adapted for the centrifugal casting of elongated hollow articles. My apparatus is well adapted for the formation of long lengths of pipe, i.e., lengths of ten feet and longer. Also my apparatus is equally well adapted for the formation of molds for the centrifugal casting of soil pipe and pressure pipe. The apparatus may be rapidly and expeditiously adapted for the formation of molds for the centrifugal casting of elongated hollow articles of different lengths and diameters.

I form a mold out of finely divided mold forming material in a flask by apparatus quite different than that specifically disclosed in my above mentioned patents and I provide for removal of the mold to a separate station for casting instead of preforming the mold forming and casting steps at the same station. I preferably form the mold with the flask disposed generally upright rather than with its axis generally horizontal as in my above mentioned patents. The mold is formed and the finely divided mold forming material is compacted while the flask is stationary in contradistinction to the method of my above mentioned patents in which the flask is rotated while the mold is being formed and the mold forming material compacted. I find that by my present method I can form a mold of high and uniform quality which produces superior centrifugally cast pipe, either soil pipe or pressure pipe.

In forming a mold I fill the flask with finely divided mold forming material and form a cavity through the mold forming material and compact the mold forming material to the optimum extent for casting by forcing a former

through the mold forming material in the flask. The extent to which the mold forming material is compacted is determined at least partially by the relationship between the external transverse dimension of the former and the internal transverse dimension of the flask. Formers of different transverse dimension may be used with the same flask, provision being made for changing formers without necessarily changing flask size. However, changes in flask size may also be made easily and quickly.

Also, molds of different sizes may be made in the same flask with the mold forming material compacted to optimum extent by providing for removal from the flask during formation of the mold of some of the mold forming material initially introduced into the flask. Still further, additional compacting force may be exerted on the mold forming material in the flask at one or both ends of the incipient mold by auxiliary compacting means. Any tendency for the mold forming material at either end of the flask to be less tightly compacted than the mold forming material at the mid portion of the flask may thus be overcome.

I provide mold forming apparatus comprising a flask adapted to contain finely divided mold forming material, a hub pattern, means supporting the hub pattern inside an end of the flask, a former snugly fitting within the hub pattern, means attached to the upper end of the former for advancing the former out of the hub pattern and through the flask to compact finely divided mold forming material in the flask to form a mold, a guide rod connected with the former of smaller diameter than the former and extending therefrom in a direction away from the flask, and a guide also extending in the direction away from the flask in which the guide rod is snugly received to guide the former after the former has emerged from the hub pattern, the length of the guide rod being greater than the distance between the inner end of the hub pattern and the inner end of the guide so that as the former and guide rod are introduced into the flask from the opposite end of the flask for the beginning of a mold forming operation the guide rod enters the guide before the former enters the hub pattern and guides the former into the hub pattern. I preferably provide a member disposed in an end of the flask and movable axially of the flask which carries the hub pattern together with means for moving such member inwardly of the flask to compact finely divided mold forming material in the first mentioned end of the flask.

Other details, objeects and advantages of the invention will become apparent as the following description of a present preferred embodiment thereof proceeds.

In the accompanying drawing I have illustrated a present preferred embodiment of the invention, the figure being an axial cross-sectional view.

There is shown a flask designated generally by reference numeral 2*c* which is open both top and bottom, the flask shown being a plain hollow cylinder with spaced apart flanged steel tires 3*c* applied exteriorly thereto, the tires being employed in the handling and spinning of the flask in subsequent operations which are not here involved.

The foundry floor is designated by reference numeral 4*c*, having a pit 5*c* therein. Fastened to the floor 4*c* and spanning the pit 5*c* is a base designated generally by reference numeral 6*c* having upright supporting means 7*c* carrying at the top thereof a ring 8*c* having an annular upward projection 9*c* serving as positioning and centering means for the flask 2*c* which sets upon the ring 8*c* concentrically therewith as shown.

Mounted within the base 6*c* is a vertical cylinder 10*c* within which operates a piston 11*c*. The cylinder 10*c* has at its upper and lower extremities inwardly projecting rings 12*c* constituting in essence integral portions of

the cylinder and cooperating with reduced portions of the piston 11c as shown, the piston being sealed to the cylinder for vertical movement relative thereto. When in its lowermost position as shown in the drawing the piston 11c seats on the lower ring 12c of the cylinder 10c at 14c. Fluid under pressure may be admitted to the space below the body 11' of the piston 11c to raise the piston 11c in the cylinder 10c. Fastened to the lower extremity of the piston 11c by screws 16c is a ring 17c carrying set screws 18c equipped with lock nuts 19c which may be adjusted as desired and which limit upward movement of the piston 11c in the cylinder 10c by engagement with the bottom surface of the lower ring 12c of the cylinder.

The piston 11c has therethrough a vertical bore 20c within which is disposed a cylindrical bushing sleeve 21c which may be of bronze or other suitable material to serve as a guide bearing for the former 22c presently to be described.

There is provided a superstructure 30c comprising a cylinder 31c in which operates a piston 32c having therethrough an opening 33c and carrying at its lower portion a generally inverted cup-shaped centering member 60c having a downwardly projecting annular flange 61c internally tapered as shown at 62c. The internal diameter of the flange 61c above the taper 62c is such as to snugly and guidingly receive the upper end of the flask 2c, the taper 62c facilitating movement of the centering member 60c down over the upper end of the flask so as to center and position the flask. A circumferential series of set screws 34c are threaded through the centering member 60c and are adapted to be maintained in adjusted position by lock nuts 63c. Their lower ends are adapted to engage and seat atop the upper end surface of the flask as shown. The centering member 60c also carries a plate 35c adapted to enter the top of the flask 2c and a downward extension 36c below the plate 35c having a downwardly projecting annulus 37c constituting a pattern for shaping the mold for the casting of the spigot end of a pipe.

Mounted atop the piston 11c is a ring 38c carrying a hub pattern 39c.

At the beginning of a cycle the former 22c is in its lowermost position seated in the upper portion of the piston 11c at 57, the piston 11c is also in its lowermost position as shown and the piston 32c is in its uppermost position with the enlarged portion 40c thereof in engagement with the upper head 41c of the cylinder 31c. The flask 2c is positioned atop the base 6c and centered by the annular upward projection 9c as shown. Fluid under pressure is then admitted above the enlarged portion 40c of the piston 32c which lowers the piston until set screws 34c engage the top of the flask 2c, the plate 35c and the extension 36c therebelow entering the flask and the flange 61c embracing the upper end of the flask as shown. This positions the flask for formation of the mold. The setting of the set screws 34c determines the extent to which the plate 35c, extension 36c and annulus 37c enter the flask which of course determines the extent to which the finely divided mold forming material in the flask is compacted or in other words the hardness of the mold.

A measured quantity of finely divided mold forming material such as specially prepared foundry sand is then introduced downwardly through the opening 33c in the cylinder 32c to substantially fill the flask 2c, the former at that time being in the position shown. Alternatively the measured quantity of finely divided mold forming material may be introduced into the flask 2c, when the piston 32c is in its uppermost position so that direct access may be had to the flask to introduce the mold forming material directly into the upper end of the flask instead of through the opening 33c. Indeed, the superstructure 30c may, if found necessary or desired, be mounted for movement out of the way of the flask to facilitate setting the empty flask in place on the base and removing the flask with the formed and compacted mold of finely divided mold forming material therein and also to facilitate introduction of the mold forming material into the initially empty flask.

By means presently to be described the former 22c is moved upwardly through the finely divided mold forming material 42c in the flask 2c, the former forming a generally vertically elongated cavity in the mold forming material and compacting the mold forming material between the former and the inner wall of the flask. The diameter of the opening 33c in the piston 32c is such that when the former enters that opening it is guided thereby. When the former has moved up until the cylindrical portion thereof substantially reaches the annulus 37c upward movement of the former is stopped. When the former reaches that position the conical nose 23c thereof is disposed entirely within the opening 33c in the cylinder 32c and the cylindrical portion of the former below the conical nose completely closes the opening 33c so that the mold forming material in addition to having been laterally compressed by the former during formation of the cavity therein is completely enclosed within the flask 2c.

Fluid under pressure is admitted to the space 15c below the body 11' of the piston 11c to raise the piston in the cylinder 10c. This causes upward movement into the flask of the ring 38c carrying the hub pattern 39c and additionally compresses the mold forming material 42c. This completes formation of the mold of finely divided mold forming material 42c in the flask 2c, the mold having at its upper end a depression formed by the annulus 37c for formation of a spigot on one end of the pipe to be centrifugally cast in the mold and the hub pattern 39c forming an enlarged cavity at the opposite end of the mold in which the pipe hub is cast. The ring 38c forms in the lower end of the mold a seat for the core used in formation of the hub when the pipe is cast. The operation of the piston 11c is independent of the operation of the drum 54 wherefore the piston 11c may be operated as above described when the former is at a selectable zone of its travel through the flask.

The former 22c may be replaced with a former of different transverse dimension. Also the piston 32c may be replaced by a similar piston having an opening therethrough of smaller diameter than the opening 33c or a sleeve may be inserted into the opening 33c of the piston 32c whose internal diameter is such as to snugly receive the cylindrical portion of the smaller former.

After the mold has been formed the parts are moved back to the positions which they occupied at the commencement of the cycle, freeing the flask and mold for removal to a casting station. After removal of the flask with the finished mold therein an empty flask is set in place and the cycle is repeated.

The drawing shows a former 22c operable in the flask 2c and having a conical nose 23c which, however, does not extend to a point but terminates in a flat face 48. Threaded thereinto at 49 is a stem 50 which extends upwardly through the opening 33c in the piston 32c and through a guide 51 where it is connected with a cable 52 which passes over a sheave 53 to a drum 54 upon which the cable is adapted to be wound up and from which it may be payed out.

Connected with the bottom of the former 22c at 55 is a guide stem 56 which operates in the bushing sleeve 21c in the piston 11c. Thus the former 22c is guided both by the bushing sleeve 21c and through the stem 50 by the guide 51, and operative movement of the former is effected through the cable 52. The pit 5c need be only deep and wide enough to receive the guide stem 56. Upward movement of the former 22c is brought about by winding up the cable 52 on the drum 54, and when the drum 54 is turned in the counter-clockwise direction viewing the drawing the former 22c moves downwardly by gravity to its lowermost position as shown. Downward movement of the former 22c into the hub pattern 39c is limited by the seating of the former in the upper portion of the piston 11c at 57.

The stem 50 may be replaced by a stem of different

transverse dimension if desired. The stem displaces a predetermined volume in the flask 2*c* when the elements of the apparatus are positioned as shown in the drawing, thus limiting the quantity of mold forming material which may be introduced into the flask. By substituting a stem of different transverse dimension the quantity of mold forming material which the flask will receive is altered with the result that the extent to which the mold is compacted in operation of the apparatus shown in the drawing may be controlled. In other words, the removable and replaceable stem **50** provides a control factor.

Features of the apparatus herein disclosed are claimed in my Patent No. 3,165,794.

While I have illustrated and described a present preferred embodiment of the invention it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied with the scope of the following claims.

I claim:

1. Mold forming apparatus comprising a flask adapted to contain finely divided mold forming material, a hub pattern, means supporting the hub pattern inside an end of the flask, a former snugly fitting within the hub pattern, means attached to the upper end of the former for advancing the former out of the hub pattern and through the flask to compact finely divided mold forming material in the flask to form a mold, a guide rod connected with the former of smaller diameter than the former and extending therefrom in a direction away from the flask, and a guide also extending in the direction away from the flask in which the guide rod is snugly received to guide the former after the former has emerged from the hub pattern, the length of the guide rod being greater than the distance between the inner end of the hub pattern and the inner end of the guide so that as the former and guide rod are introduced into the flask from the opposite end of the flask for the beginning of a mold forming operation the guide rod enters the guide before the former enters the hub pattern and guides the former into the hub pattern.

2. Mold forming apparatus comprising a flask adapted to contain finely divided mold forming material, a member disposed in an end of the flask and movable axially of the flask, a hub pattern carried by said member, a former snugly fitting within the hub pattern, means for advancing the former out of the hub pattern and through the flask to compact finely divided mold forming material in the flask to form a mold, a guide rod connected with the former of smaller diameter than the former and extending therefrom in a direction away from the flask, a guide also extending in the direction away from the flask in which the guide rod is snugly received to guide the former after the former has emerged from the hub pattern, the length of the guide rod being greater than the distance between the inner end of the hub pattern and the inner end of the guide so that as the former and guide rod are introduced into the flask from the opposite end of the flask for the beginning of a mold forming operation the guide rod enters the guide before the former enters the hub pattern and guides the former into the hub pattern, and means for moving said member inwardly of the flask to compact finely divided mold forming material in the first mentioned end of the flask.

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