Oct. 7, 1958 L. L. JOHNSTON 2,854,710

MOLDING APPARATUS

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Fig. 1.

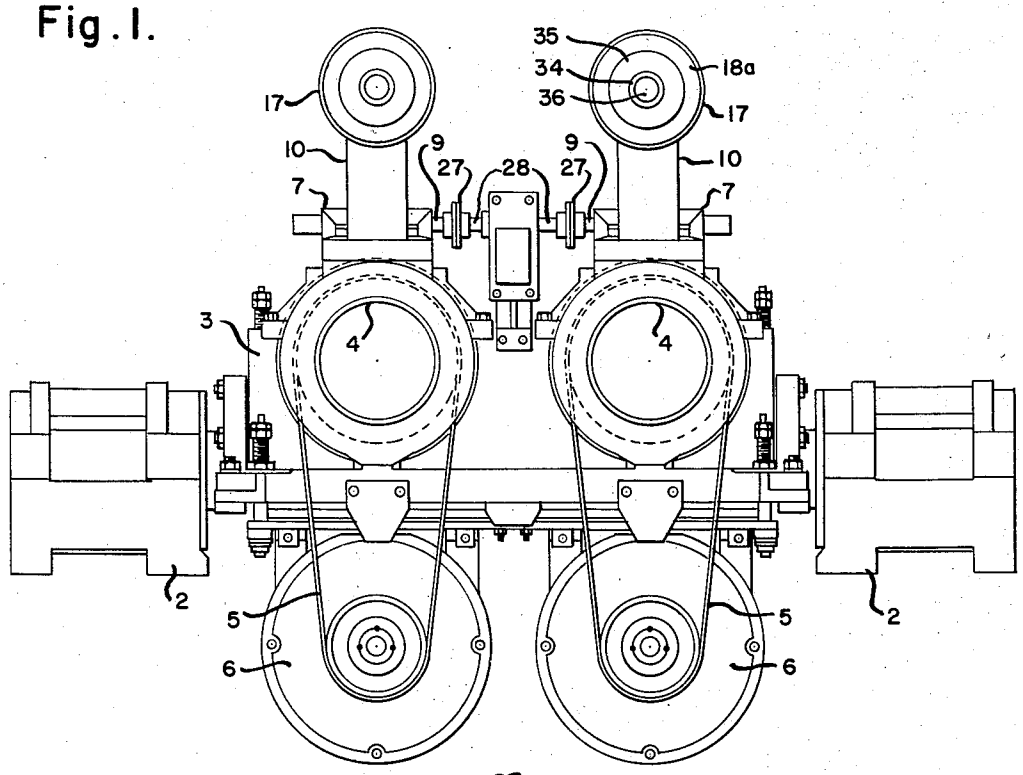


Fig. 4.

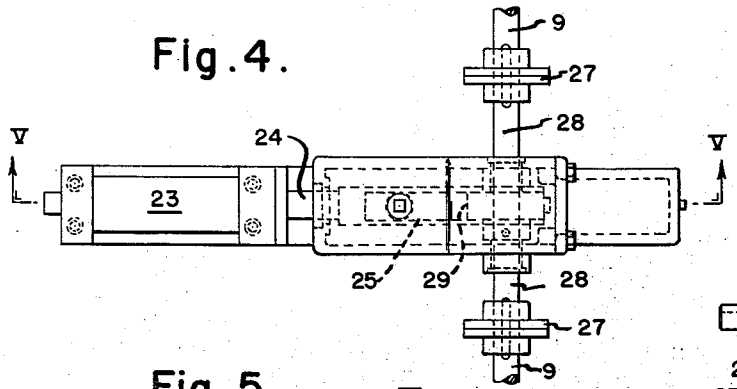


Fig. 5.

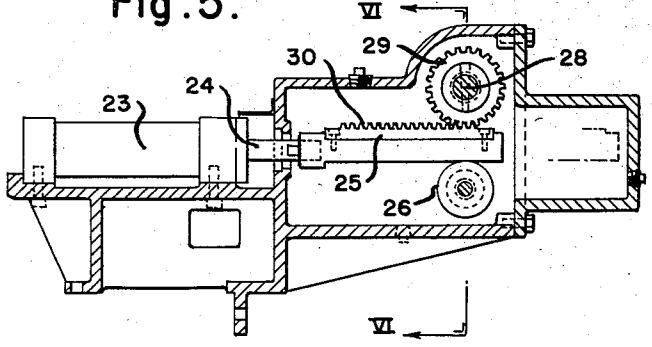
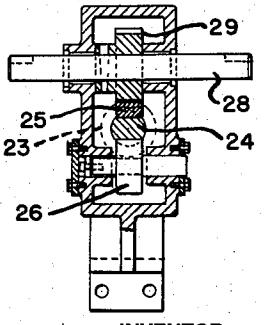


Fig. 6.



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Fig. 2.

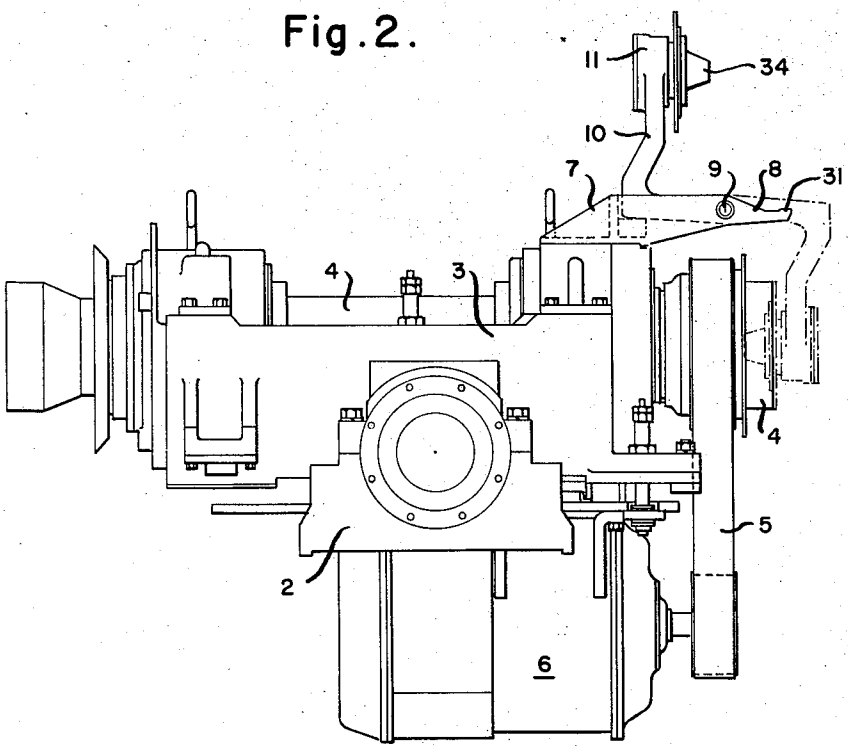
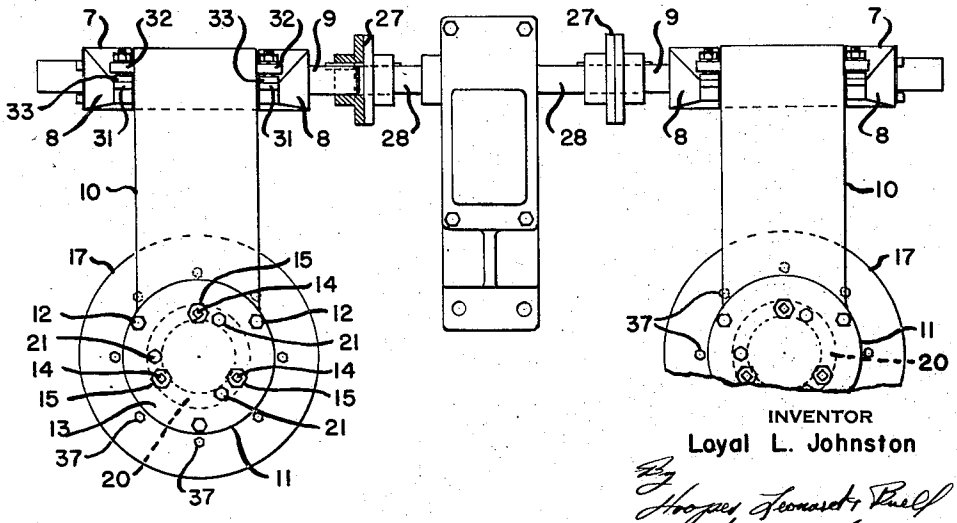


Fig. 3.



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MOLDING APPARATUS

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Fig. 7.

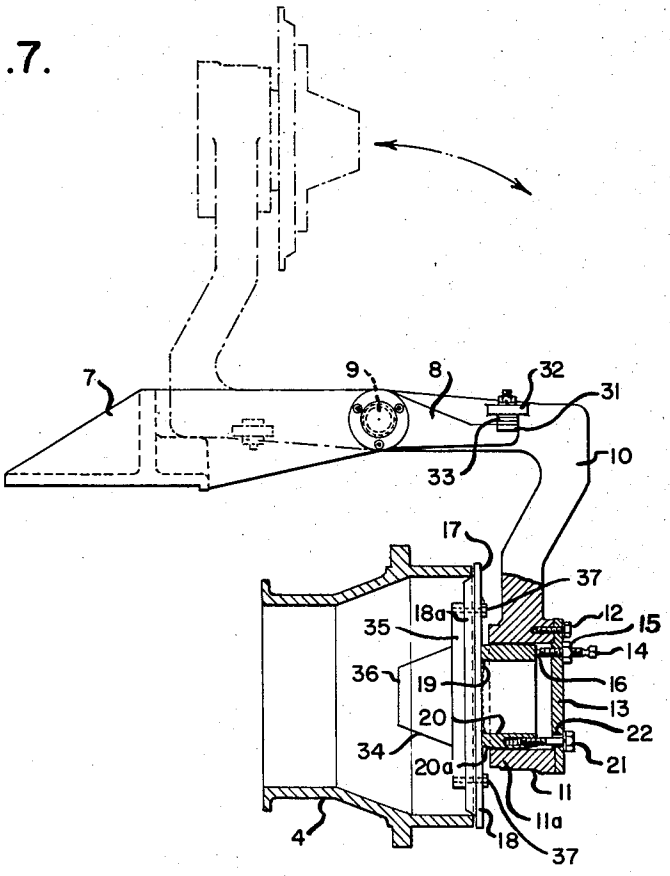
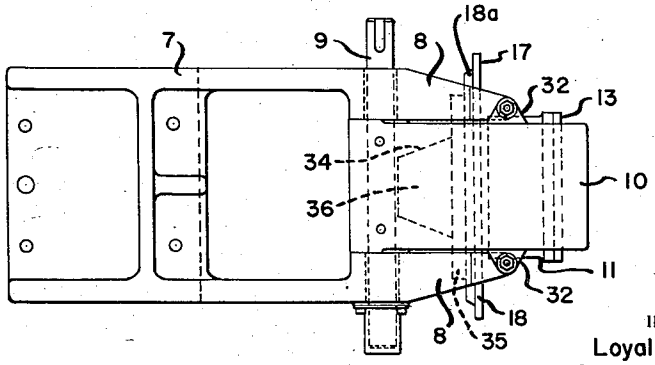


Fig. 8.



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United States Patent Office 2,854,710 Patented Oct. 7, 1958

2,854,710

MOLDING APPARATUS

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Application September 5, 1957, Serial No. 682,251

5 Claims. (Cl. 22—16)

This invention relates to molding apparatus and more particularly to molding apparatus comprising a flask adapted to receive finely divided mold forming material adapted to be compacted against the inner surface of the flask to form a mold. The invention has to do with the utilization of the flask itself as a measuring container determining the volume of uncompacted mold forming material introduced into the flask for formation of the mold so that when the mold forming material is compacted a mold of desired size is made.

The present invention may be applied to apparatus for forming molds for centrifugal castings of the type shown in my Patent No. 2,449,900. Such apparatus comprises either one flask or a plurality of flasks in battery; for example, I shall here refer to one flask. The flask is rotatably carried by a cradle which in turn is mounted for movement between a position in which the axis of the flask is generally upright and a position in which the axis of the flask is generally horizontal. The cradle carries means for rotating the flask. At the beginning of the cycle the flask is disposed in generally upright position and its lower end is closed by mold forming material retaining means whereupon finely divided mold forming material, such, for example, as sand, is introduced into the flask through the upper end thereof. Rotation of the flask is commenced and the flask is moved to generally horizontal position. The mold forming material retaining means is moved to inoperative position, a mandrel is introduced into the flask to compact the mold forming material, the mandrel is withdrawn and molten material, for example, iron, is then introduced into the mold and centrifugally cast to make, for example, a length of soil pipe. After the casting has solidified the flask is returned to its generally upright position and the casting is ejected therefrom whereupon the mold forming material retaining means is again disposed in its operative position to close the lower end of the flask and the cycle is repeated.

It is important that the proper amount of uncompacted mold forming material be introduced into the flask to form when compacted to the proper degree a mold of desired size. The problem of how most efficiently and rapidly to measure the mold forming material has existed for many years and has not been satisfactorily solved prior to the present invention. At one time the mold forming material was measured before being introduced into the flask. The procedure was very uneconomical, requiring both additional apparatus and additional labor. The quantity of uncompacted mold forming material required to form the mold will usually approximately fill the flask but the flask cannot be relied upon as a measuring container for the mold forming material because the volume of the flask and the volume of the uncompacted mold forming material required to form a mold of desired size when compacted to the proper degree vary with such factors as the size of the enlargement or enlargements at one or both ends of the flask for the formation

of a bell or bells on the pipe being cast, the length of the casting, whether the casting is to be of standard or other wall thickness, etc.

I proposed in my Patent No. 2,598,554 a solution to the problem involving the selection of a flask whose internal diameter bears a particular relationship to the internal diameter of the mold to be formed. However, such selection of a flask is not always practicable. Under certain conditions the mold forming material may be compacted to a greater or less extent than might be considered normal; also, the number and size of the enlargement or enlargements or at one or both ends of the flask introduce a further complication.

I have finally discovered a very simple but highly effective way of utilizing the flask itself to measure the mold forming material to be used in forming a mold in the flask. I provide means at the end of the flask opposite the end through which the mold forming material is introduced displacing a predetermined part of the volume of the flask so that the volume of the mold forming material which is introduced into the flask is determined by the remainder of the volume of the flask whereby to assure the presence in the flask of the proper volume of uncompacted mold forming material to form when compacted a mold of desired size. Such volume displacing means may be of various sizes and shapes depending upon the particular flask being used and the particular specifications as to degree of compacting the mold forming material, etc.

The displacing means is preferably carried by the closure means for the end of the flask opposite the end through which the mold forming material is introduced. I preferably provide means for moving the closure means into and out of a position in which the closure means and the displacing means carried thereby are operative with respect to the flask, the end of the flask at which such means are disposed being open when the closure means and the displacing means carried thereby are moved out of said position. Normally the flask will have a radial enlargement at at least the end thereof at which the closure means and the displacing means are disposed and the displacing means when operative will be disposed at least partially within the radial enlargement.

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

In the accompanying drawings I have shown a present preferred embodiment of the invention in which:

Figure 1 is an end elevational view of molding apparatus, the mold forming material retaining and displacing means being shown in inoperative position;

Figure 2 is a side elevational view of the molding apparatus shown in Figure 1 the mold forming material retaining and displacing means being shown in inoperative position in solid lines and in operative position in chain lines;

Figure 3 is a fragmentary elevational view, partly in vertical cross section and to enlarged scale, of a portion of the apparatus shown in Figure 1 but with the mold forming material retaining and displacing means swung to their downward or operative positions, the mounting means, cradle and flasks being omitted for clarity;

Figure 4 is a fragmentary top plan view showing a portion of the mechanism shown in Figure 3;

Figure 5 is a vertical cross-sectional view taken on the line V—V of Figure 4;

Figure 6 is a vertical cross-sectional view taken on the line VI—VI of Figure 5;

Figure 7 is a fragmentary elevational view to enlarged scale and with a portion in vertical cross section of part of the apparatus shown in Figure 2, the mold forming

material retaining and displacing means being shown in operative position in solid lines and in inoperative position in chain lines; and

Figure 7 is a plan view of the apparatus shown in Figure 7 but for clarity omitting the showing of the flask end.

The apparatus shown is of the general type of that of my Patent No. 2,449,900. I provide mounting means designated generally by reference numeral **2** in which is mounted a cradle **3** for movement between generally upright position and generally horizontal position as disclosed in my said patent. In the drawings the cradle **3** is shown in generally horizontal position. Rotatably mounted on the cradle **3** are two parallel flasks **4** each driven through a belt **5** by a motor **6** also carried by the cradle. Parts of the apparatus not necessary to the functioning of the invention are not shown.

The cradle **3** carries atop each of the flasks **4** adjacent an end thereof a bracket designated generally by reference numeral **7**, the two brackets being disposed side by side but spaced apart. Each bracket has opposed arms **8** spaced apart and reaching toward the end of the flask. Journaled in the arms **8** of each of the brackets **7** is a shaft **9**. Fixed to each shaft **9** is a generally L-shaped arm **10**. Each arm **10** is fixed to the corresponding shaft **9** at one end of the arm and when the arm is in operative position it projects toward the end of the flask and downwardly to a position intersecting the axis of the flask as shown in Figure 7. The free extremity of each arm **10** is formed as a carrier **11**. While in the form shown the carrier **11** is integral with the arm it may be separately made and applied to the arm. Each carrier **11** has a generally cylindrical portion **11***a* as shown in Figure 7 and when the arm carrying it is down it is positioned at an end of the corresponding flask but somewhat spaced from the flask. When each arm **10** is up (see chain lines in Figure 7) the corresponding carrier **11** is disposed at a position relatively remote from the end of the flask and alongside but substantially spaced from the flask.

Bolted to each carrier **11** by bolts **12** is a plate **13**. Threaded through the plate **13** are three positioning screws **14** each provided with a lock nut **15** and adapted to be adjustably positioned so that their extremities **16** serve as stops or positioning members to precisely determine the position of a mold forming material retainer designated generally by reference numeral **17** and comprising a plate-like portion **18** welded as shown at **19** to a generally cylindrical portion **20** telescoping within the carrier **11**. The outside of the generally cylindrical portion **20** is somewhat convexly formed or curved as shown at **20***a* to permit relative angular adjustment between the retainer and the carrier. Three bolts **21** pass through openings **22** in the plate **13** and are threaded into the cylindrical portion **20** of the mold forming material retainer **17**, the screws **14** and **21** being cooperatively operable to move the retainer **17** relatively to the carrier **11** in a direction which when the carrier is in position at an end of the flask is generally parallel to the axis of the flask to a selected one of a plurality of positions to substantially close the end of the flask. When the retainer **17** is in operative position the face of the portion **18** thereof opposed to the end of the flask just clears the end of the flask by a very small fraction of an inch, perhaps one-sixteenth of an inch, to permit turning of the flask while the retainer does not turn, yet preventing the mold forming material in the flask from walling out. To prevent substantial leakage of mold forming material while filling the flask and tilting it to generally horizontal position I preferably provide a projection **18***a* on the retainer which is of circular shape and of very slightly smaller external diameter than the internal diameter of the extremity of the flask which substantially fills the end of the flask and projects into the end of the flask. The projection **18***a*, may, for example, be a one-half inch thick circular plate whose external diameter is one-eighth inch less than the internal diameter of the extremity of the flask, providing a circumferential clearance between the projection **18***a* and the inside of the flask of one-sixteenth inch.

Intermediate the upper portions of the flasks the cradle carries a cylinder **23** arranged with its axis generally parallel to the axes of the flasks in which operates a piston with which is connected a piston rod **24** carrying at its outer end a toothed rack **25**. The teth **30** of the rack **25** point upwardly, the rack being supported upon a supporting and guiding roller **26** for back and forth movement as the piston is operated in the cylinder **23** by fluid under pressure controlled by suitable valves as well known to those skilled in the art.

It has been explained above that the two shafts **9** are coaxial. Operatively interposed between the shafts **9** and connected with each thereof by a flexible coupling **27** is a shaft **28** to which is fixed a pinion **29** in mesh with the teeth **30** of the rack **25**. Thus movement of the piston in the cylinder **23** causes movement of the rack, which movement through the pinion **29** turns the shaft **28**, which shaft through the flexible couplings **27** turns the shafts **9** to pivotally move the arms **10**, carriers **11** and retainers **17** between operative and inoperative positions.

The ends of the arms **8** have upwardly facing positioning faces **31** and the arms **10** carry lateral projections **32** having positioning stops **33** adjustably mounted thereon and adapted to come to rest upon the faces **31** when the retainers **17** are in operative position. Thus the retainers can be quickly shifted between accurately disposed operative positions substantially closing the ends of the flasks and inoperative positions remote from the ends of the flasks permitting discharge of the castings therefrom or permitting introduction of the mandrels for compacting the mold forming material.

The projection **18***a* of each retainer **17** carries at its outer face displacing means designated generally by reference numeral **34** shown as being of generally hat shape, including a base portion **35** and a projecting portion **36** which in the form shown is of generally frusto-conical shape. The particular size and shape of the displacing means may vary widely depending upon the volume to be displaced, the size and shape of the radial enlargement if any at the end of the flask, the degree of compacting of the mold forming material specified and other factors. However, the displacing means **34** displaces a predetermined part of the volume of the flask so that the volume of the mold forming material which is introduced into the flask is determined by the remainder of the volume of the flask whereby to assure the presence in the flask of the proper volume of uncompacted mold forming material to form when compacted a mold of desired size.

The displacing means **34** may be fastened to the retainer in any suitable way, as, for example, by bolts **37** shown in Figure 7. Thus one displacing means may easily be removed and replaced by other displacing means of a different displacing capacity and/or shape. The mechanism allows the completely formed mold to actually be shifted in or out with relation to the flask.

While I have shown 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 within the scope of the following claims.

I claim:

1. Molding apparatus comprising a flask adapted to receive finely divided mold forming material, means for rotating the flask to centrifugally compact the mold forming material against the inner surface of the flask to at least partially form in the flask a mold of the mold forming material, the flask itself serving as a measuring container determining the volume of uncompacted mold forming material introduced into the flask through an end thereof for formation of the mold, closure means blocking egress of mold forming material through the opposite end

of the flask and means at said opposite end of the flask displacing a predetermined part of the volume of the flask so that the volume of the mold forming material which is introduced into the first mentioned end of the flask is determined by the remainder of the volume of the flask whereby to assure the presence in the flask of the proper volume of uncompacted mold forming material to form when compacted a mold of desired size.

2. Molding apparatus comprising a flask adapted to receive finely divided mold forming material, means for rotating the flask to centrifugally compact the mold forming material against the inner surface of the flask to at least partially form in the flask a mold of the mold forming material, means for moving the flask between a position in which its axis is generally vertical and a position in which its axis is generally horizontal, the flask itself when in the first mentioned position serving as a measuring container determining the volume of uncompacted mold forming material introduced into the flask through the upper end thereof for formation of the mold, closure means blocking egress of mold forming material through the opposite end of the flask and means at said opposite end of the flask displacing a predetermined part of the volume of the flask so that the volume of the mold forming material which is introduced into the first mentioned end of the flask is determined by the remainder of the volume of the flask whereby to assure the presence in the flask of the proper volume of uncompacted mold forming material to form when compacted a mold of desired size.

3. Molding apparatus comprising a flask adapted to receive finely divided mold forming material, means for rotating the flask to centrifugally compact the mold forming material against the inner surface of the flask to at least partially form in the flask a mold of the mold forming material, the flask itself serving as a measuring container determining the volume of uncompacted mold forming material introduced into the flask through an end thereof for formation of the mold, closure means blocking egress of mold forming material through the opposite end of the flask and means carried by the closure means displacing a predetermined part of the volume of the flask so that the volume of the mold forming material which is introduced into the first mentioned end of the flask is determined by the remainder of the volume of the flask whereby to assure the presence in the flask of the proper volume of uncompacted mold forming material to form when compacted a mold of desired size.

4. Molding apparatus comprising a flask adapted to receive finely divided mold forming material, means for rotating the flask to centrifugally compact the mold forming material against the inner surface of the flask to at least partially form in the flask a mold of the mold forming material, the flask itself serving as a measuring container determining the volume of uncompacted mold forming material introduced into the flask through an end thereof for formation of the mold, closure means blocking egress of mold forming material through the opposite end of the flask, means carried by the closure means displacing a predetermined part of the volume of the flask so that the volume of the mold forming material which is introduced into the first mentioned end of the flask is determined by the remainder of the volume of the flask whereby to assure the presence in the flask of the proper volume of uncompacted mold forming material to form when compacted a mold of desired size and means for moving the closure means into and out of a position in which the closure means and the means carried thereby are operative with respect to the flask, the second mentioned end of the flask being open when the closure means and the means carried thereby are moved out of said position.

5. Molding apparatus comprising a flask adapted to receive finely divided mold forming material, means for rotating the flask to centrifugally compact the mold forming material against the inner surface of the flask to at least partially form in the flask a mold of the mold forming material, the flask itself serving as a measuring container determining the volume of uncompacted mold forming material introduced into the flask through an end thereof for formation of the mold, the flask having a radial enlargement at at least the opposite end thereof, closure means blocking egress of mold forming material through said opposite end of the flask and means disposed at least partially within the radial enlargement at said opposite end of the flask displacing a predetermined part of the volume of the flask so that the volume of the mold forming material which is introduced into the first mentioned end of the flask is determined by the remainder of the volume of the flask whereby to assure the presence in the flask of the proper volume of uncompacted mold forming material to form when compacted a mold of desired size.

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