Feb. 15, 1966 W. A. HUNTER ETAL 3,234,602

SELF-ALIGNING POURING CUP PATTERN AND SPRUE PUNCH ASSEMBLY

Filed Nov. 23, 1962 2 Sheets-Sheet 1

FIG. 1

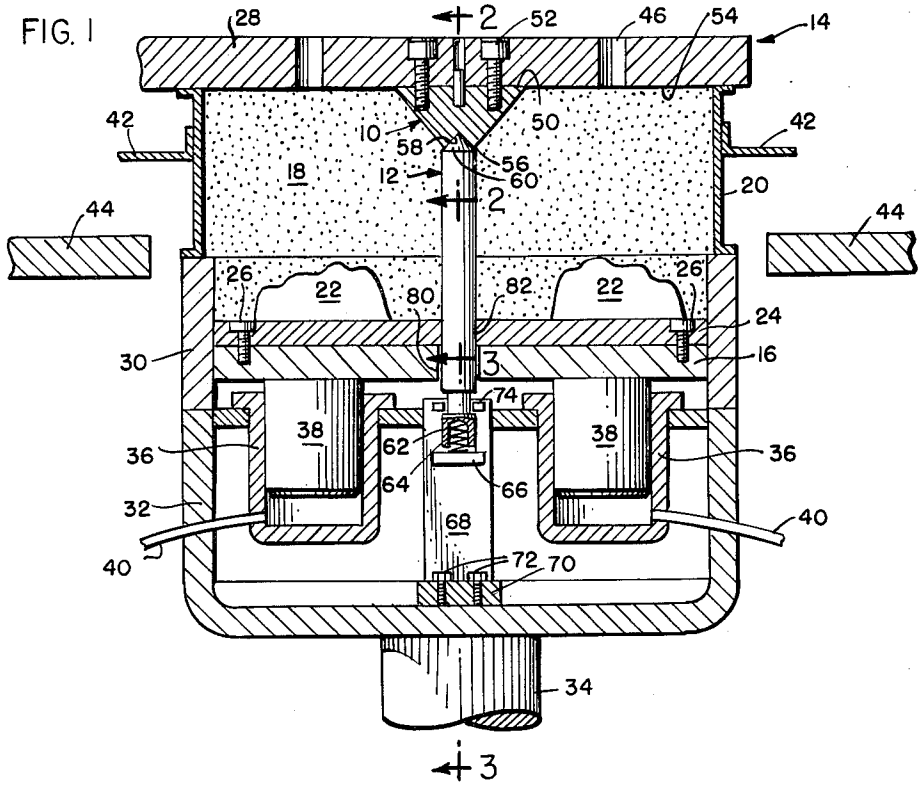


FIG. 2

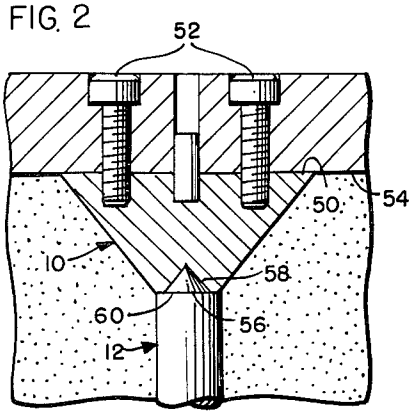
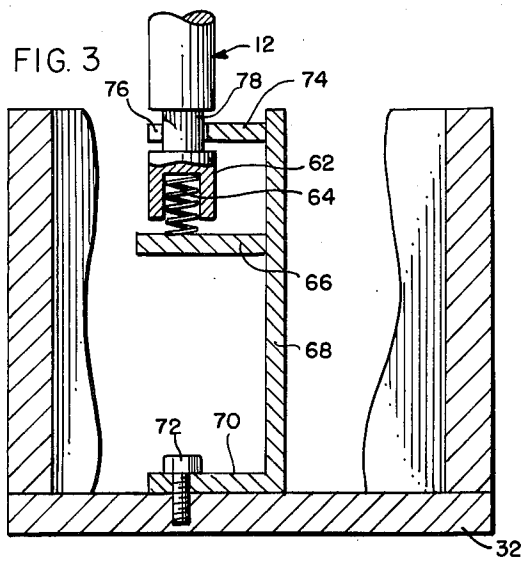


FIG. 3



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SELF-ALIGNING POURING CUP PATTERN AND SPRUE PUNCH ASSEMBLY

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FIG. 4

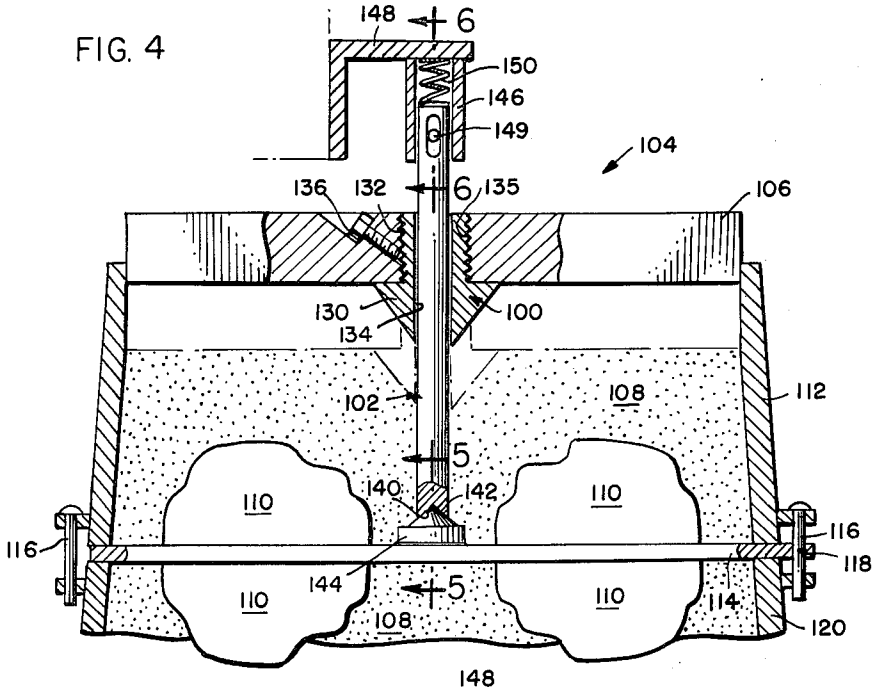


FIG. 5

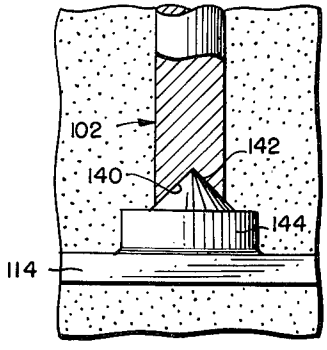
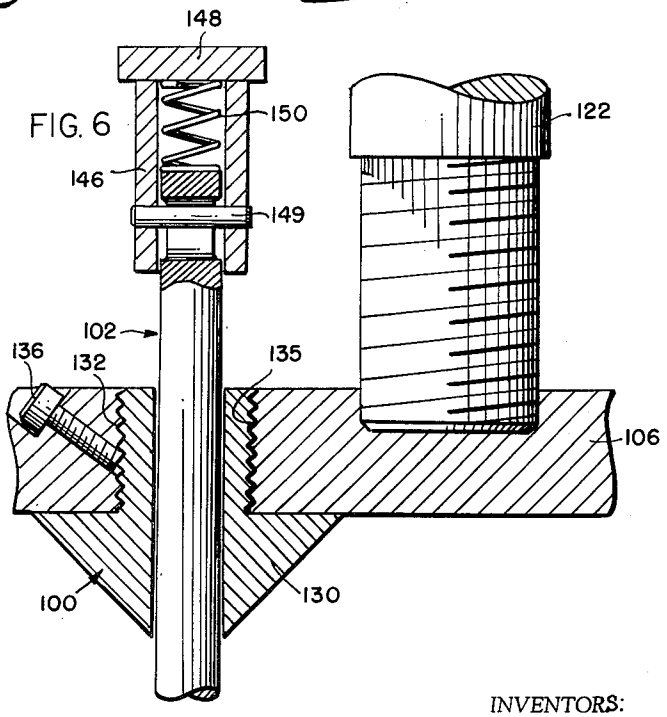


FIG. 6



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SELF-ALIGNING POURING CUP PATTERN AND SPRUE PUNCH ASSEMBLY

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6 Claims. (Cl. 22—38)

The improved pouring cup pattern and sprue punch assembly comprising the present invention has been designed for use primarily in connection with sand casting operations and during that portion of the process wherein the sand is being compacted about the pattern. When so used, the invention is applicable to both mechanized or automatic foundry installations as well as conventional manual flask procedures. The invention is, however, capable of other uses and a pouring cup pattern and sprue punch assembly in accordance with the principles of the present invention may, with or without modification, be employed in connection with molding operations involving molds other than sand molds, for example, graphite, loam, and the like, whether the molds be formed of refractory or nonrefractory material and whether the molds be of the permanent or destructible type. Irrespective, however, of the particular use to which the present invention may be put, the essential features thereof are at all times preserved.

Heretofore, in sand molding operations, and particularly in present-day automatic molding machine operations, considerable difficulty has been encountered in effecting proper sprue punch placement within the flask cavity. By way of further explanation and example, it is pointed out that the cope section of a mold is invariably provided with a pouring basin or depression which communicates with at least one sprue passage in communication with and leading to the mold cavity. This depression functions in the manner of a funnel to conduct the poured molten metal to the sprue passages and from thence into the mold cavity. To form the depression and its associated sprue passages at the time of forming the cope section of the mold, cooperating pouring depression and sprue patterns are brought together within the flask at the time of flask-closure. These patterns move relatively to each other and in axial alignment during flask-closing operations. The pouring cup pattern is usually mounted on the blow plate above the flask and the sprue punch is, in most instances, mounted on and movable with the table of the molding machine so that as the table rises toward the blow plate, the sprue punch moves axially towards and finally into engagement with the pouring cup pattern. The particular difficulty which is involved in connection with this procedure resides in the fact that either a close tolerance in the height of the flask and the effective length of the sprue punch must be maintained or a lost-motion connection of some sort must be provided between the sprue punch and pouring cup pattern. In the matter of tolerances, excess flask height leads to a loosely-positioned sprue punch, while insufficient flask height leads either to the inability of the flask to close or to bending or other damage to the sprue punch or the pouring cup pattern. In the matter of a lost-motion connection, it has been the practice to provide in the pouring cup pattern a bottom opening which is slightly larger than the overall diameter of the sprue punch so that when the punch enters the opening in the pouring cup pattern, there will be an annular clearance between the punch and the rim of the opening to prevent binding of the parts. With such structures, upon separation of the parts and withdrawal of the sprue punch from the bottom opening in the pouring cup pattern, an appreciable amount of

sand in a fairly loose state will adhere to the sprue punch, as well as to the rim of the bottom opening in the pouring cup pattern, thus making it necessary to ream or otherwise remove surplus sand from the sprue openings in the flask. The removal of surplus sand from the sprue openings in a flask is a time-consuming operation, and where mechanized operations are concerned, complicated sprue reaming equipment including a reamer proper, a motor for rotating the reamer means for advancing and retracting the reamer into and out of the sprue passages, and various control mechanisms for such instrumentalities, has been devised.

The present invention is designed to overcome the above-noted limitations and disadvantages that are attendant upon the use of conventional pouring depression and sprue passage forming devices and, toward this end, it contemplates the provision of a novel combination of a pouring cup pattern and sprue punch assembly wherein the punch is floatingly mounted upon the table or other portion of the machine which moves relatively to the pouring cup pattern during flask assembly operations, the floating mounting including a yielding lost-motion connection between the punch and the table or other portion of the machine which supports it, the lost-motion take-up occurring in an axial direction with initial engagement and interlock between the pouring cup pattern and punch taking place well in advance of final flask-closing operations so that a lack of tolerance resulting in even an inordinate excess of flask height will not contribute to sprue punch looseness, while a lack of tolerance resulting in an inordinate lack of flask height will not cause binding of the sprue punch or prevent proper closing of the flask.

The provision of a pouring cup pattern and sprue punch assembly of this character being among the prinicpal objects of the invention, it is a further object to provide such an assembly wherein the pouring cup pattern and sprue punch are self-aligning, which is to say that, as the adjacent end of the punch moves into cooperating engagement with the pouring cup pattern, alignment between the punch and pouring cup pattern takes place automatically.

A still further object is to provide a pouring cup and sprue punch assembly of the character under consideration and wherein relative movement between the sprue punch and pouring cup pattern terminates substantially immediately upon initial engagement between the two parts, while at the same time, continuity of surface contour between the parts is effected, thus eliminating the presence of crevices, pockets or other voids at the juncture between the parts and into which sand particles might otherwise accumulate.

With these and other objects of the invention in view, which will not at this time be enumerated but which will become apparent subsequently, the invention consists of the novel construction, combination and arrangement of parts shown in the accompanying two sheets of drawings forming a part of this specification and in which:

FIG. 1 is a fragmentary sectional view, somewhat schematic in its representation, showing one form of the improved pouring cup pattern and sprue punch assembly operatively installed in the flask of an automatic molding machine for producing mold cope sections, the view being taken substantially centrally and longitudinally through the flask and showing the blow plate, flask and table closed upon one another and the flask filled with sand preparatory to the usual squeeze operation;

FIG. 2 is an enlarged sectional view taken on the line 2—2 of FIG. 1;

FIG. 3 is an enlarged sectional view taken on the line 3—3 of FIG. 1;

FIG. 4 is a fragmentary sectional view similar to FIG.

1 but showing another form of pouring cup pattern and sprue punch assembly operatively installed in a match plate forming machine;

FIG. 5 is an enlarged sectional view taken on the line 5—5 of FIG. 4; and

FIG. 6 is a sectional view taken on the line 6—6 of FIG. 4.

Referring now to the drawings in detail, and in particular to FIGS. 1 to 3, inclusive, a pouring cup pattern **10** and an associated sprue punch **12**, both constructed according to the principles of the present invention, have been shown as being embodied in a simplified form of molding machine, only the essential elements of which have been illustrated. The molding machine has been designated in its entirety by the reference numeral **14** and is designated for use in the making of the cope section of a mold.

The molding machine involves in its general organization a squeeze board **16**, the purpose of which is to compact molding sand **18** in a flask **20** containing a pattern **22**. The sand, when compacted about the pattern **22**, provides the cope section of a mold. The pattern **22** is supported upon a pattern plate **24** which is fastened as at **26** to the squeeze board **16**. The flask **20** is clamped against a blow plate **28** under the influence of the upward pressure of an upper table section or extension **30** which, in turn, is supported upon a lower or main table section **32**. The table section **32** is carried at the upper end of a vertically reciprocable ram **34**. It is generally of cup-shaped configuration, and within this section, squeeze cylinders **36** cooperate with squeeze rams **38** to elevate the squeeze board **16** immediately after the hereinafter mentioned blowing operation in order to compact the loose sand in the flask about the pattern **22** in the usual manner of molding machine operation. Fluid is supplied to the cylinders **36** through fluid lines **40**. The flask **20** is provided with lateral supports in the form of flanges **42** which are designed for cooperation with arresting stops or abutments **44** forming a part of the molding machine framework so that after the sand compacting operation has been completed and the ram **34**, the table sections **30** and **32**, and the flask **20** lowered bodily as a unit, the flask **20** will be arrested in its downward movement by the abutments **44** to the end that the formed cope section of the mold may be removed or stripped therefrom.

The arrangement of parts thus far described is purely conventional and no claim is made herein to any novelty associated with the same, the novelty of the present invention residing rather in the novel construction, combination and arrangement of the parts, including the pouring cup pattern **10** and the sprue punch **12**, and such parts will presently be described in detail.

In connection with the foregoing description of the molding machine, it is pointed out that the disclosure made herein is somewhat schematic and many details of the machine have been omitted since such details have little, if any, bearing upon the construction and mode of operation of the pouring cup pattern **10** and the sprue punch **12**. For example, the conventional registration pins which normally are employed for aligning the flask **20** with the upper table section **30** or with the blow plate **28**, the blow instrumentalities by means of which sand is introduced into the flask through blow holes **46** in the blow plate, and numerous other details, essential or otherwise, have not been illustrated, these being well-known in the art.

Still referring to FIGS. 1 to 3, inclusive, the pouring cup pattern **10** may be regarded as constituting a part of the blow plate **28** and is generally of frusto-conical configuration. As shown in the drawings, the large base **50** of the pouring cup pattern is secured by fastening screws **52** to the bottom or underneath face **54** of the blow plate **28**. The pouring cup **10** may be formed of any suitable material as, for example, steel, and in the illustrated form thereof it is shown as being solid. The small base **56** of the pouring cup pattern is provided with a small conical socket **58**, the purpose of which will be made clear presently.

The sprue punch **12** is in the form of an elongated steel rod and has a pointed or conical upper end **60** (see FIG. 2) which is designed for mating engagement with the conical socket **58** when the punch and pouring cup pattern are brought into register and contact.

The lower end of the sprue punch **12** is formed with a cylindrical socket **62** which forms a seat for a spring **64**. The upper end of the spring **64** seats against the bottom wall of the socket **62** while the lower end of the spring seats on a horizontal flange **66** on a bracket **68**. The latter has a foot portion **70** which is secured by fastening screws **72** to the table **32**. A second horizontal flange **74** is bifurcated as at **76** and the bifurcated portion thereof extends into an annular groove **78** which is formed in the lower end region of the punch **12** and straddles the reduced section of the punch that results from the annular groove **78**. The weight of the sprue punch **12** is thus borne by the spring **64**, and the punch is capable of limited vertical shifting movements relatively to the bracket **68** within the limits afforded by the confining action of the annular groove **78**.

The sprue punch **12** extends vertically. It projects upwardly through respective openings **80** and **82** in the squeeze plate **16** and the pattern plate **24** and is slidable vertically in these openings in opposite directions during ram-raising and ram-lowering movements. The bracket **68** and the openings **80** and **82** are so disposed and are of such size that the upper end of the sprue punch **12** is maintained in approximate vertical register with the conical socket **58** in the small base **56** of the pouring cup pattern **10**.

In the operation of the pouring cup and sprue punch assembly of the present invention, upward movement of the table sections **30** and **32** for flask-closing operations in the usual manner of operation of a molding machine of the type under consideration will carry or move the bracket **68** upwardly, thus moving the sprue punch **12** upwardly under the influence of the spring **64** upon which it is supported. As soon as the pointed upper end **60** of the punch engages the wall of the conical socket **58** in the small base **56** of the pouring cup pattern **10**, the punch will, by a camming action against such wall, become aligned with the pouring cup pattern, alignment being completed when the pointed end of the punch seats squarely within the socket **58**. Thereafter, any further upward movement of the ram and table will serve to compress the spring **64**. The width of the annular groove **78** is such that freedom of floating movement of the punch with respect to the bracket **68** is available throughout a range of movement in excess of the difference between maximum and minimum tolerance discrepancies in the manufacture of the flask **20** so that an unduly high flask will establish no looseness in the sprue punch **12**, or an unduly low flask will create no binding of the punch.

In FIGS. 4 to 6, inclusive, a different form of the invention has been shown wherein a pouring cup pattern **100** and a sprue punch **102** cooperate to produce the necessary pouring depression and its associated sprue passage in the cope section of a mold which is undergoing formation in a match-plate mold-forming machine which has been designated in its entirety by the reference numeral **104**.

The machine **104** involves in its general organization a squeeze board **106**, the purpose of which is to compact the loose molding sand **108** about a cope pattern **110** which is contained within the cope section **112** of a flask. The pattern is supported on a match-plate **114** which bears upwardly against the flask section **112** during the sand-compacting operations. Conventional registration pins **116** for inter-engaging relationship with corresponding openings **118** at the corners of the flask section **112** serve to align the flask section with the match-plate, and

also with the lower movable drag section of the flask, a portion of which has been shown at **120**.

The disclosure of the match-plate mold-forming machaine **104**, like the disclosure of the molding machine **14** previously described, is a schematic one, and furthermore, only such portions of the machine **104** as bear a relation to the pouring cup pattern and sprue pin assembly of FIGS. 4 to 6, inclusive, have been illustrated. It will be understood, for example, that the plunger **122**, which has been shown in FIG. 6 as being applied to the squeeze plate **106**, constitutes the movable element of a press assembly (not shown) whereby the squeeze board and its associated devices may be moved downwardly for compacting the sand **108** within the flask section **112** while at the same time creating the impression of the pouring cup pattern in the cope section of the mold, and also for stripping the cope section of the mold from the flask and from the sprue punch **102**, as will be described in greater detail hereafter.

The pouring cup **100** is in the form of a sleeve having an enlarged conical head portion **130** and a reduced coaxial threaded shank portion **132**. An axial bore **134** extends through the pouring cup pattern **100** and is designed for loose reception therethrough of the sprue punch **102**. The shank portion **132** is threadedly received within an opening **135** provided on the squeeze board **106**. Fastening screws **136** may be provided for holding the pouring cup pattern **100** in position on the squeeze board **106** with the enlarged head portion **130** underlying the latter and fitting closely thereagainst. The pouring cup pattern **100** preferably is formed of steel.

The sprue punch **102** is in the form of an elongated steel rod, the lower end of which is provided with a small conical socket **140** (see FIG. 5) which is designed for seating engagement with an upstanding conical protruberance **142** on a raised boss **144** on the match plate **114**. The upper end of the sprue punch **102** projects into an inverted cup **146** which is carried on an attachment bracket **148**. The latter forms a stationary part of the machine framework and is permanently attached to the bracket by a pin and slot connection **149** between the punch and the cup. The pin and slot connection **149** permits limited axial shifting movement of the sprue punch relatively to the cup. A spring **150** is interposed between the upper end of the sprue punch and the bottom wall of the cup **146** and serves normally to urge the punch downwardly to the limit of its motion as permitted by the pin and slot connection **149**. The punch **102** projects loosely through the axial bore **134** in the pouring cup pattern **100** and is thus slidable through the pouring cup pattern. The lower end of the sprue punch is thus at all times maintained in axial alignment with the boss **144** and in axial register with the conical protuberance **142** thereon.

The operation of the pouring cup pattern and sprue punch assembly of FIGS. 4 to 6, inclusive, is similar to the operation of the pouring cup pattern and sprue punch assembly of FIGS. 1 to 3, inclusive, rising of the lower flask section **120** and the match-plate **114** bodily in unison taking place in the usual manner of operation of the machine to effect closing of the two flask sections **120** and **112** upon each other. As the match-plate approaches the limit of its upward movement, the small conical protuberance **142** enters the mating conical socket **140**, and when the two conical surfaces are in full mating engagement, the sprue punch **102** becomes accurately positioned and aligned within the fixed flask section **112**. Flask and sprue pin tolerance of a fairly wide nature are compensated for by the yielding action of the spring **150** which, in any event, becomes compressed so as accurately to position the sprue punch **102**.

After the blow operation which fills the flask sections **112** and **120** with loose sand, the squeeze board is forced downwardly under the influence of the plunger **122** and assumes an intermediate position such as has been shown in dotted lines in FIG. 4, thus compacting the sand in the fixed flask section **112** about the pattern **110**. A similar compacting operation takes place in the lower flask section **120** under the influence of a lower squeeze board (not shown). After these sand compacting operations are completed, the two flask sections are parted to enable the patterns to be removed. Finally, the two flask sections are again brought together and the ram **122** moves further downwardly, while at the same time, the upper and lower flask sections **112** and **120** move downwardly bodily as a unit. During the downward movements of the squeeze board **106**, both initially for sand-compacting operations, and finally, for mold-ejecting operations, the sleeve-like pouring cup pattern **100** slides axially along the sprue punch **102**, the latter remaining suspended by the pin and slot connection **149** from the fixed bracket **148**. Upon initial compacting of the sand, the pouring cup pattern **100** creates the desired pouring basin within the cope section of the mold, while the sprue punch **102** creates the intercommunicating sprue passage.

The invention is not to be limited to the exact arrangement of parts shown in the accompanying drawings or described in this specification as various changes in the details of construction may be resorted to without departing from the spirit or scope of the invention. Therefore, only insofar as the invention has particularly been pointed out in the accompanying claims is the same to be limited.

Having thus described the invention what we claim as new and desire to secure by Letters Patent is:

1. In a molding machine of the character described, in combination, an open-ended flask section adapted to receive a charge of loose sand for subsequent compacting thereof about a pattern within the flask section, a first sand-compacting member seated upon and closing one open end of the flask section, a second sand-compacting member movable toward and away from said first sand-compacting member for compacting the loose sand within the flask section against the first sand-compacting member, there being an opening in said second sand-compacting member, a fixed abutment adjacent to said second sand-compacting member and exteriorly of the flask section, said first sand-compacting member including a pouring cup pattern for creating a pouring depression in the sand during compacting of the latter, a fixed length sprue punch extending between said fixed abutment and said first sand-compacting member and projecting into the flask section slidably through said opening in the second sand-compacting member, said sprue punch being in cooperating engagement with said pouring cup pattern for creating a sprue passage in the sand in communication with the pouring depression during compacting of the sand, means on said pouring cup pattern establishing a seat for the adjacent end of the sprue punch, and a compression spring interposed between the other end of said sprue punch and said fixed abutment to compensate for manufacturing tolerances in the length of the sprue punch and the axial extent of the flask section.

2. In a molding machine of the character described, an open-ended flask section for receiving a charge of loose sand for subsequent compacting thereof within the flask section about a pattern, first and second sand-compacting members, respectively, coaxial with the flask section and mounted for relative movement toward and away from each other in an axial direction for compacting a charge of loose sand within the flask section, means for effecting relative movement between the first sand-compacting member and the flask section to bring said first sand-compacting member into seating engagement with one open end of the flask section to effectively close said one open end of the flask section, means for moving the second sand-compacting member toward and away from said first sand-compacting member when so seated for sand-compacting and sand-releasing purposes, a pouring cup pattern secured to one of said sand-compacting mem-

bers for creating a pouring depression in the charge of sand within the flask section during the compacting operation, one of said sand-compacting members being provided with an opening therethrough, an abutment exteriorly of the flask section and adjacent to said one sand-compacting member, a sprue punch coaxial with the flask section, projecting loosely slidably through the opening and having one end thereof disposed in close proximity to the fixed abutment, a compression spring interposed between said one end of the punch and the fixed abutment, and cooperating centering means on said first sand-compacting member and the other end of the punch and movable into cooperating relationship when said first sand-compacting member becomes seated upon said one open end of the flask section to center said other end of the punch on the first sand-compacting member and to place the punch under compression between the centering means and said spring.

3. In a molding machine of the character described, in combination, an open-ended flask section for receiving a charge of loose sand for subsequent compacting thereof about a pattern within the flask section, an imperforate plate designed for seating engagement with one open end of the flask, a squeeze board movable toward and away from the plate for compacting a charge of sand within the flask section, there being an opening through said squeeze board, an abutment exteriorly of the flask section on the side of the squeeze board remote from the plate, a pouring cup pattern secured to the squeeze board and having an axial bore therethrough in register with said opening, a sprue punch interposed between said abutment and the plate and projecting slidably through said opening and bore, and a spring interposed between one end of the punch and the abutment for yieldingly urging the punch against said plate.

4. In a molding machine of the character described, the combination set forth in claim 3 and including, additionally, cooperating centering means on the plate and adjacent end of the punch.

5. In a molding machine of the character described, the combination set forth in claim 1 and including, additionally, means establishing a lost motion connection between said fixed abutment and the sprue punch whereby the sprue punch and abutment are connected together against separation.

6. In a molding machine of the character described, the combination set forth in claim 2 and including, additionally, means establishing a lost motion connection between said fixed abutment and the sprue punch whereby the abutment and sprue punch are connected together against separation.

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