Aug. 26, 1969 C. TILLERY 3,463,221

MODULAR SAND MOLD

Filed July 27, 1967 2 Sheets-Sheet 1

Fig. 1

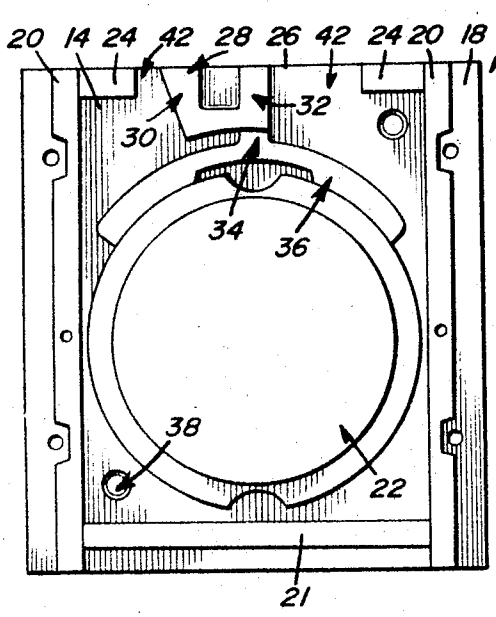


Fig. 2

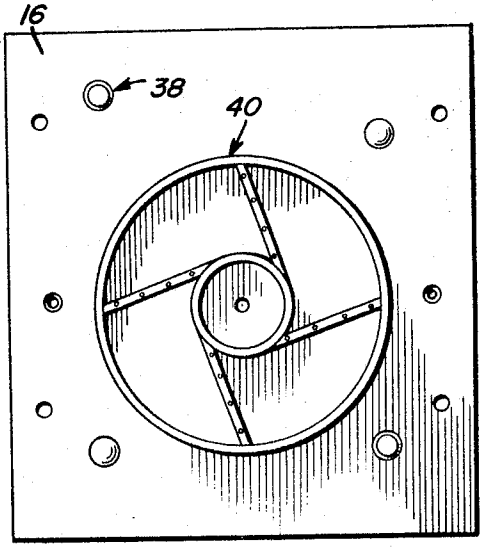


Fig. 3

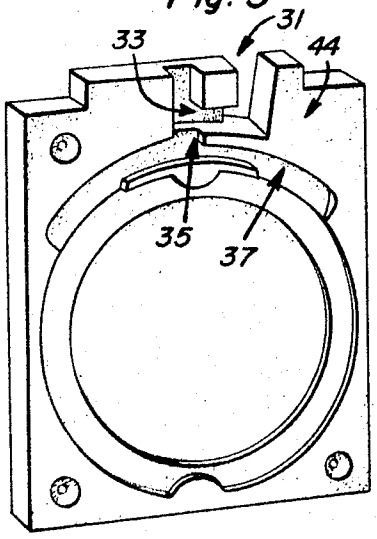
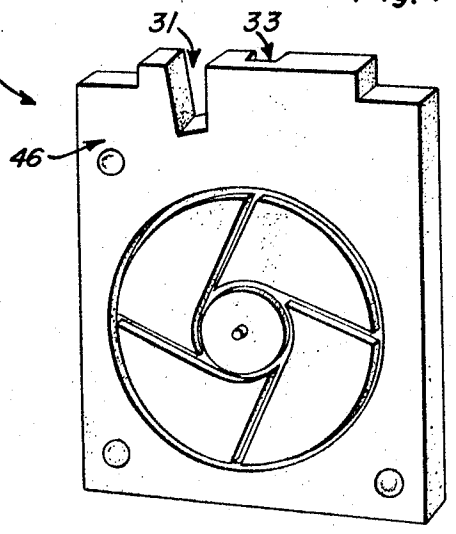


Fig. 4



Cloyd Tillery
INVENTOR.

BY Clarence A. O'Brien and Harvey B. Jacobson
Attorneys

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MODULAR SAND MOLD

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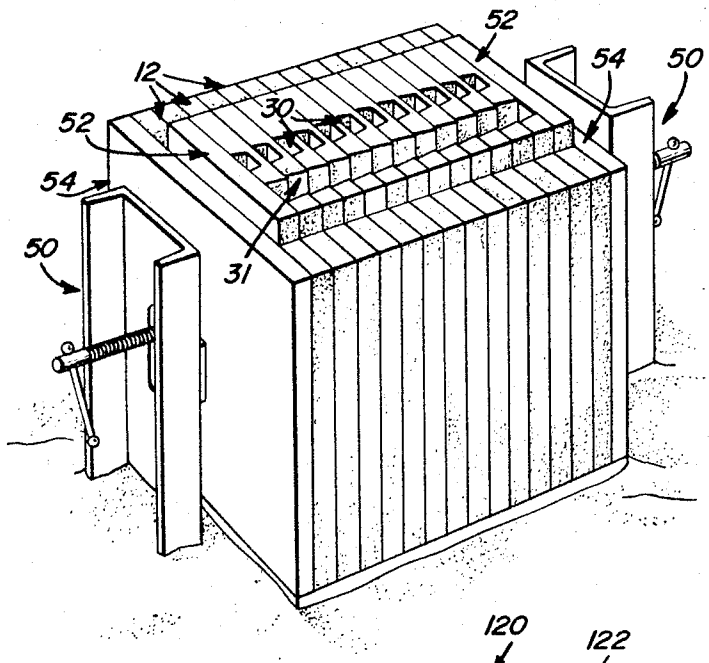


Fig. 5

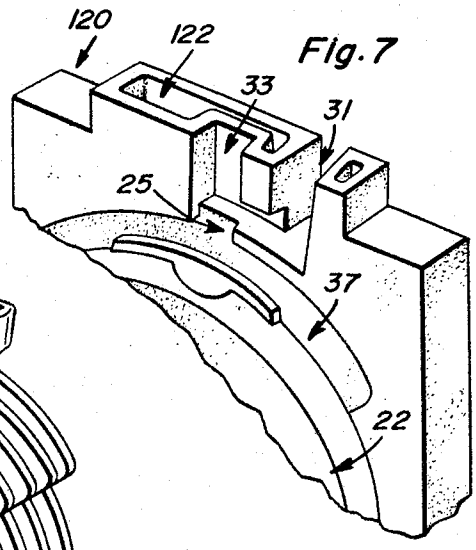
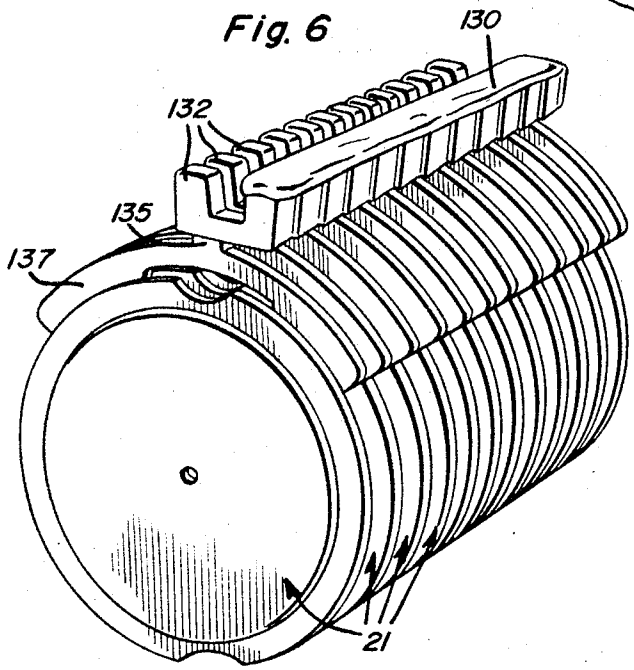


Fig. 7

Fig. 6



Cloyd Tillery
INVENTOR.

BY Clarence A. O'Brien and Harvey B. Jacobson
Attorneys

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3,463,221

MODULAR SAND MOLD

Cloyd Tillery, P.O. Drawer 1288,
Phenix City, Ala. 36867

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Int. Cl. B22c 9/02
U.S. Cl. 164—350 8 Claims

ABSTRACT OF THE DISCLOSURE

A modular sand mold adapted to be booked with a plurality of similar molds to simultaneously cast a plurality of metallic articles in generally vertically disposed mold cavities. Each mold is provided with an integral core and wherein one side of the mold is provided with a pattern relief for one surface of an article to be cast and the other side of the mold is provided with a pattern relief corresponding to the configuration of the other side of the article to be cast. Thus in booked relation a plurality of mold cavities formed are in close proximity whereby the articles cast therein will tend to retain heat for a significant period of time so as to render the articles cast relatively "self-annealing" whereby relatively low grade iron may be utilized to produce relatively ductile, malleable castings. A significant constructional feature of this invention comprises the configuration of the sprue, gate, runner and riser of the mold which facilitates the simultaneous casting of a plurality of generally vertically disposed articles of uniform quality by ensuring even, slag-free filling of the mold cavities.

The present invention relates to a novel casting mold and more particularly to a modular mold adapted to be booked in series with a plurality of similar molds to permit the simultaneous casting of a plurality of articles in the mold cavities defined therebetween. More specifically, the present invention relates to a novel casting mold provided with improved sprue, gate, runner and riser means adapted to greatly facilitate the casting of slag-free articles.

It is an object of the present invention to provide a novel construction for a foundry mold which greatly facilitates the simultaneous casting of a plurality of articles.

Another object of the present invention is to provide a novel construction for a foundry mold wherein the mold is provided with a novel sprue, gate, runner and riser configuration wherein when clamped in booked relation a plurality of similar molds are characterized by interconnecting sprues whereby each mold cavity simultaneously, and equally, receives molten metal at a generally uniform pressure.

Still another object of the present invention is to provide an improved foundry mold, such as of phenolic or furan resin consolidated sand, wherein the novel construction of the sprue, gate, runner and riser cavities, and specifically the placement of the riser cavity, facilitates the simultaneous casting of relatively slag-free articles.

Still another object of the present invention is to provide an improved foundry mold adapted to permit the simultaneous casting of a plurality of generally vertically disposed articles in relatively close proximity so as to render the articles self-annealing whereby relatively low grade iron may be utilized to produce high grade castings.

Still another object of the present invention is to provide an improved foundry mold wherein the mold may be "shelled" to permit placement of a heat producing composition in the shelled portion of the mold to assist in annealing the articles cast therein.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is an elevational view of one half of an exemplary embodiment of a vacuum mold box suitable for forming an exemplary embodiment of a resin consolidated sand mold in accordance with the present invention;

FIGURE 2 is an elevational view of a mold box portion which cooperates with the mold box portion of FIGURE 1 to form a complete exemplary mold box;

FIGURE 3 is a perspective view of one side of a resin consolidated sand mold formed in the mold box of FIGURES 1 and 2;

FIGURE 4 is a perspective view of the reverse side of the mold of FIGURE 3;

FIGURE 5 is a perspective view of a plurality of molds, as illustrated in FIGURES 3 and 4, operatively clamped in booked relation;

FIGURE 6 is a perspective view of a plurality of disc-like castings produced by simultaneously pouring molten metal into the booked molds of FIGURE 5; and

FIGURE 7 is a fragmentary enlarged perspective view of a resin consolidated sand mold, similar to the mold illustrated in FIGURES 3 and 4, but which is shelled.

Referring now to the drawings in detail and FIGURES 1 and 2 in particular, it will be seen that the present invention contemplates the utilization of a two-part mold box indicated generally at **10** within which may be formed a mold, such as of phenolic or furan resin consolidated sand and the like. An exemplary embodiment of a sand mold formed in the mold box **10** is indicated generally at **12** as seen best in FIGURES 3 and 4. The mold box **10** comprises mating portions **14** and **16** preferably, although not necessarily, formed of cast iron to resist undue wear by virtue of the grinding action of the resin-sand mixture being introduced therein to form the sand mold **12**. The mold box **14** further includes a base plate **18** having upstanding peripheral side and bottom walls **20** and **21** respectively which define a cavity therebetween corresponding to the exterior dimensions of the mold **12**. In the exemplary embodiment shown, the body portion **18** is provided with a pattern relief indicated generally at **22** for the casting of a generally circular disc-like article. The top of the mold box portion **14** is partially closed by inwardly and upwardly projecting top portions **24** integral with the portion **18**. The pattern **22** for an article to be cast by a mold formed in the box **10** is in communication with the upper peripheral edge **26** of the mold box portion **14** by virtue of an upstanding pattern indicated generally at **28** which is integral with and upstands from the portion **18** and includes a sprue pattern portion **30**, a riser pattern portion **32**, a gate pattern portion **34** and a runner pattern portion **36**. The sprue pattern portion **30** extends upwardly from the base portion **18** a distance equivalent to the height of the peripheral elements **20**, **21** and **24**. However, the riser pattern portion **32**, gate pattern portion **34** and runner pattern portion **36** extend upwardly from the base portion **18** a distance less than the height of the peripheral elements **20**, **21** and **24**. The mold box portion **14** is preferably provided with one or more mold box vents such as indicated at **38** through which a vacuum may be drawn on the interior of the mold box to assist in accurately filling the mold box with a resin-sand mixture. From the foregoing it will be apparent that the pattern **22** comprises the pattern for one half of a disc-like article to be cast thereby. In addition, and as will become more apparent hereinafter, the pattern **22** in the

base portion **18** is so designed so as to facilitate casting an article with the article substantially on one side of the parting line so as to make it possible to form a relatively thin mold for reasons which will become apparent hereinafter.

The mold box portion **14** is closed by the cover portion **16** which in the embodiment illustrated is provided with an upstanding ring and vane core pattern indicated generally at **40**. The mold cover **16** may also be provided with mold box vents as the one indicated generally at **38** which may also assist in providing locator lugs to assist in aligning one sand mold with another when they are booked or nested together, as will be discussed hereinafter. With the cover portion **16** in place against the mold box portion **14**, wherein they are preferably doweled together, a suitable resin-sand mixture may be blown into the cavity formed therebetween through the openings indicated generally at **42** in the top of the mold box and as indicated previously the filling of the mold box may be facilitated by drawing a vacuum through the mold box vents **38** to ensure complete filling of the mold box cavity.

Upon opening of the mold box subsequent to filling the consolidated sand mold **12** produced will be seen to be provided with a sprue **31** extending completely from the front face **44** to the rear face **46** of the mold **12**. Integral with the sprue **31** is a riser indicated at **33** which communicates only with the face **44** of the mold **12**. In addition, a gate **35** is in communication with the riser **33** and a runner **37** which only communicates with the face **44** of the mold **12**. Thus, as will be appreciated from a simultaneous consideration of FIGURES 3 and 4, two molds **12** when clamped in cooperative relationship, i.e. booked, wherein the front face **44** of one is contiguous with the rear face **46** of another, the sprue **31** of one mold **12** will be in direct communication with the sprue **31** of another mold **12**. However, the riser **33**, gate **35** and runner **37** of each mold **12** will not be directly in communication with the respective sprue, gate and runner of an adjacent mold **12**.

Referring now to FIGURE 7 it will be seen that another embodiment of a mold indicated generally at **120** produced in accordance with the present invention is shelled as indicated at **122** wherein a portion of the resin-sand mixture is poured out by inverting the mold box before the resin-sand mixture blown into the mold box during make-up of the mold **120** has consolidated sufficiently. As indicated previously a mold such as the mold **120** would be shelled such as at **122** when it was found desirable to introduce a heat producing composition, such as Thermit, for example, which is the Metal & Thermit Corporation trademark for a mixture of iron oxide and finely divided aluminum, into the shelled portion **122** so as to assist in maintaining a casting within an annealing temperature range for a greater period of time than might otherwise be possible without the use of a heat producing composition within the shelled portion **122** of a mold.

Referring now to the utilization of the molds **12** and **120**, and referring particularly to FIGURE 5, it will be seen that a plurality of molds **12**, formed in the mold box **10** as discussed hereinabove, have been placed, and preferably clamped by clamping means **50** in a booked relation wherein the front face **44** and the rear face **46** of the several molds **12** are clamped in contiguous sealed relation with the sprue **31** upwardly disposed so as to form an interconnecting pouring basin common to all of the molds **12**. In addition, the molds **12** operatively positioned in the clamping means **50** are backed up with appropriate blind backing members **52** and **54** to provide an end wall for the interconnected sprues **31** and prevent a blow-out of the end molds in a series of molds **12** due to pressure therewithin. Although not shown, it will be understood that the interface between the back-up members **52** and **54** may be provided with a cavity corresponding to the configuration of an article being cast within the molds **12** whereby an article casting run may actually be placed between the back-up members **52** and **54** to assist in supporting the adjacent end molds **12**.

Referring now to FIGURE 6, and the plurality of integrally cast plates **21** illustrated therein, it will be appreciated that when molten metal is poured into the interconnecting sprues **31** of the booked molds **12**, seen in FIGURE 5, slag still present in the molten material in the pouring ladle, which has been inadvertently missed during removal of the slag therefrom, upon entering the sprue **31** and proceeding toward the gate **25** will be free to rise within the riser **33** rather than being carried down through the gate **25**, runner **37** and thence into the patterned cavity defining the mold cavity for the article **21**. From the foregoing it will thus be apparent that a novel mold produced in accordance with the invention, when placed in the booked relation shown in FIGURE 5, facilitates uniformly pouring a cluster of the molds by virtue of the interconnecting sprues **31**. In addition, it will be appreciated by those skilled in the art that this greatly expedites pouring and consequently reduces the cost of pour-off in addition to making it much easier to pour. Furthermore it will be appreciated that each casting is subjected to substantially the same pressure unlike vertical stack pouring of a plurality of articles through one common sprue, wherein the bottom molds are subjected to more pressure than the top molds and swelling and burst-outs occur regardless of the fact that back-up materials such as steel shot and sand may be utilized.

When utilizing molds produced in accordance with the invention castings, in a cluster of castings, can be made as close as ¼" apart so as to keep the castings red hot for an hour or longer depending upon the thickness of the article. This generally renders the articles self-annealing. In addition, as will be apparent from a consideration of the mold **120** of FIGURE 7, the annealing time can be lengthened by the addition of carbonaceous material such as coke, sea-coal, or the like to the shelled area **122** whereby under the influence of the temperature of the molten metal entering the mold cavity the carbonaceous material will ignite whereby the castings will take a significantly longer period of time to cool thereby greatly facilitating self-annealing of the articles being cast. Conversely, if desired, the shelled portion **122** of a mold such as the mold **120** may be left empty, such as when a high permeability sand is used for formation of the mold **120** so as to permit venting of gases through the shelled portion **122** if desired. From the foregoing it will be readily apparent that foundry molds produced in accordance with the present invention are highly desirable for the multiple casting of a plurality of articles particularly wherein it is desirable or necessary to anneal the articles.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. A modular foundry mold element comprising a body portion having article defining pattern means formed on both sides thereof, one of said article defining pattern means being a pattern for one side of an article to be cast, said other article defining pattern means being a pattern for the other side of an article to be cast, said body portion being provided with a normally upwardly disposed sprue means, said sprue means extending between and communicating with said sides of said mold element whereby when a plurality of said modular mold elements are secured in contiguous relation adjacent sprue means are directly interconnected in series relation, a riser means in communication with one side of said mold element and including portions extending laterally and vertically

from said sprue means in communication therewith, a gate means in communication with said same one side of said mold element as said riser and in communication therewith, and a runner means in communication with said same one side of said mold element as said riser means, said runner means communicating said gate means with one of said pattern defining means.

2. The mold element of claim 1 wherein said gate means is in direct communication with said laterally extending portion of said riser means at a point laterally spaced from said sprue means.

3. The mold element of claim 2 wherein said vertically extending portion of said riser means and said gate means are normally in generally vertical alignment.

4. The mold element of claim 1 wherein said mold element is shelled by being provided with an internal cavity in communication with the top edge of said element, said internal cavity being noncommunicating with said sprue, riser, gate, runner and pattern defining means.

5. A multiple foundry mold comprising in combination a plurality of booked modular foundry mold elements each comprising a body portion having article defining pattern means formed on both sides thereof, one of said article defining pattern means being a pattern for one side of an article to be cast, said other article defining pattern means being a pattern for the other side of an article to be cast, means for releasably securing said mold elements in contiguous relation, said body portion being provided with a normally upwardly disposed sprue means, said sprue means extending between and communicating with said sides of said mold element whereby adjacent sprue means are directly interconnected in series relation, backing members providing opposed end walls for said interconnected sprue means, a riser means in communication

with one side of said mold element and including portions extending laterally and vertically from said sprue means in communication therewith, a gate means in communication with said same one side of said mold element as said riser and in communication therewith, and a runner means in communication with said same one side of said mold element as said riser means, said runner means communicating said gate means with one of said pattern defining means.

6. The combination of claim 5 wherein said gate means is in direct communication with said laterally extending portion of said riser means at a point laterally spaced from said sprue means.

7. The combination of claim 6 wherein said vertically extending portion of said riser means and said gate means are normally in generally vertical alignment.

8. The combination of claim 5 wherein said mold element is shelled by being provided with an internal cavity in communication with the top edge of said element, said internal cavity being noncommunicating with said sprue, riser, gate, runner and pattern defining means.

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J. SPENCER OVERHOLSER, Primary Examiner

ROBERT D. BALDWIN, Assistant Examiner

U.S. Cl. X.R.

164—359