Oct. 23, 1951 J. H. KEATING 2,572,037

METHOD FOR POURING CASTINGS

Filed Feb. 18, 1948 3 Sheets-Sheet 1

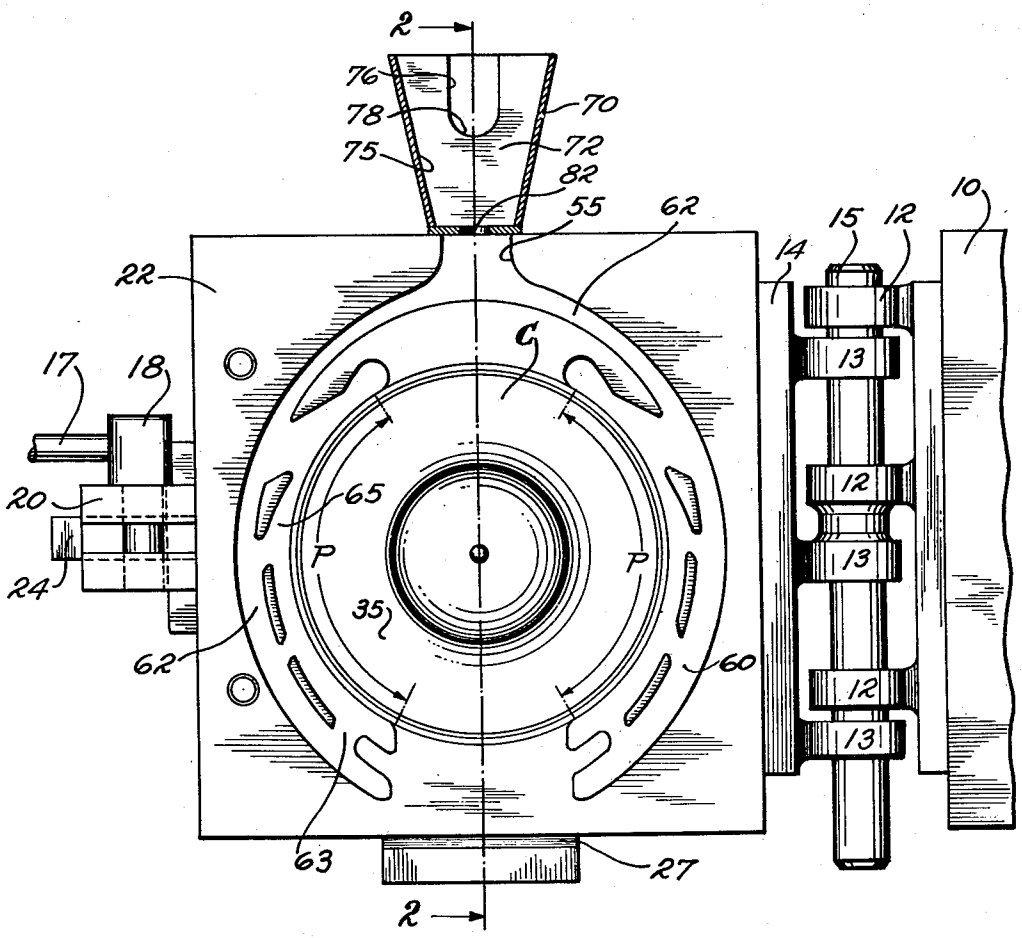


Fig. 1

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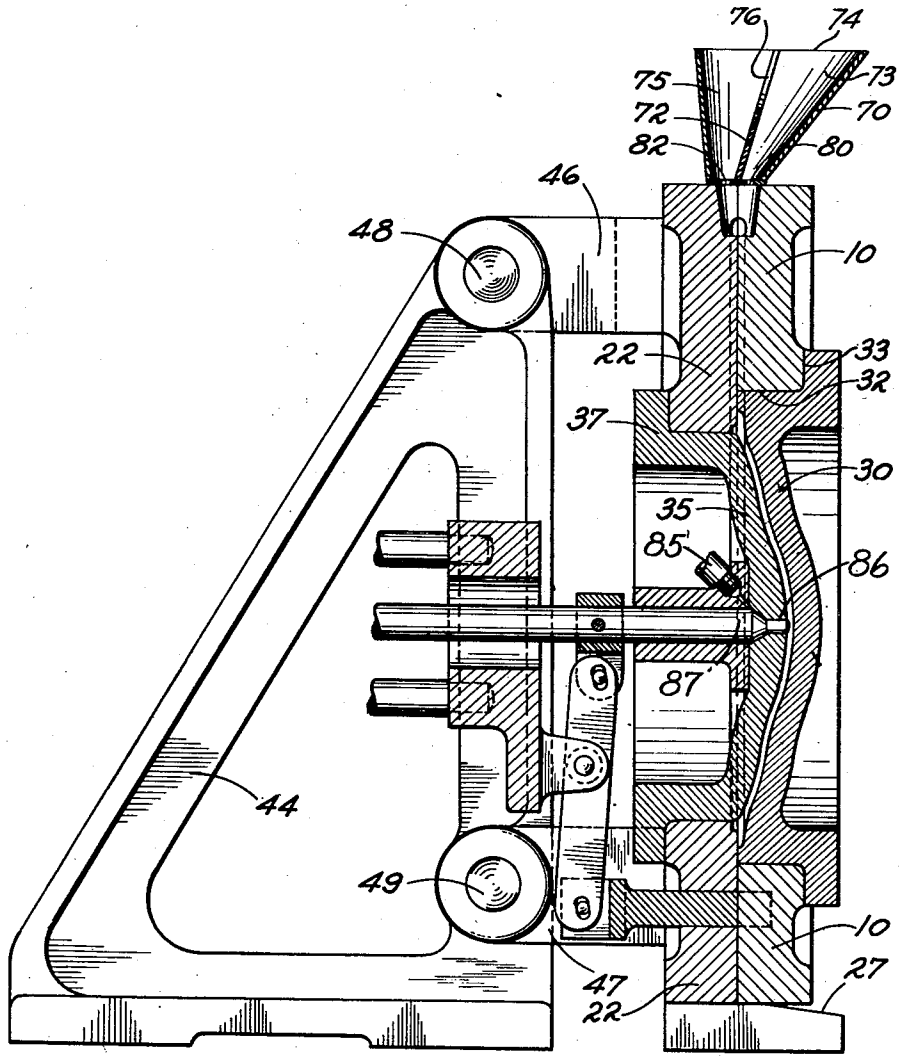


Fig. 2

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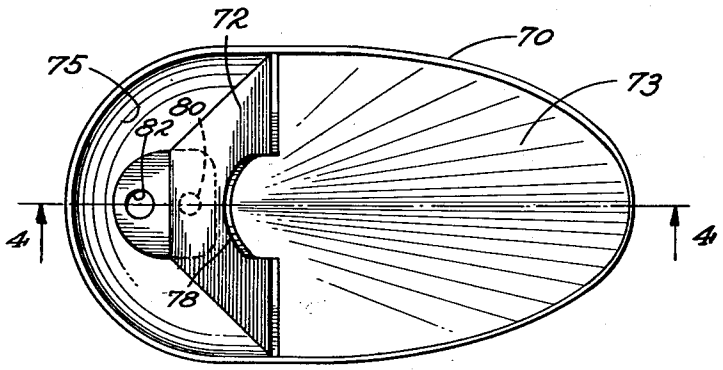


Fig. 3

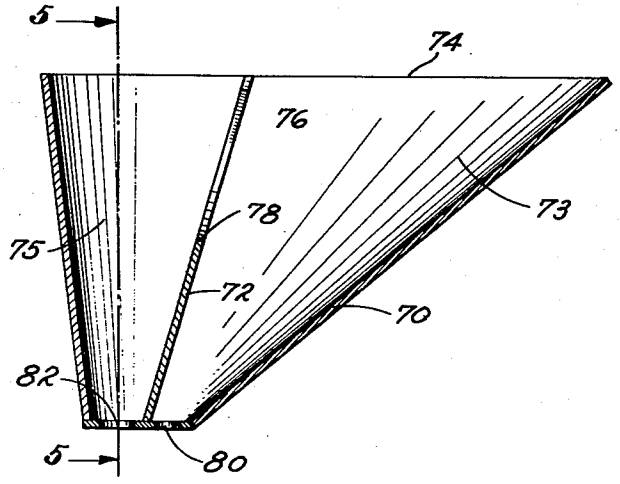


Fig. 4

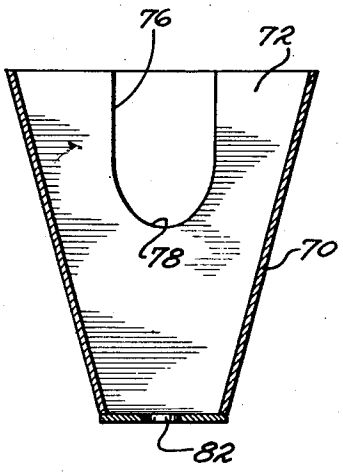


Fig. 5

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METHOD FOR POURING CASTINGS

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Application February 18, 1948, Serial No. 9,156

2 Claims. (Cl. 22—209)

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This invention relates to the art of casting molten material and more particularly to a method by which the molten material may be poured into the mold at varying and predetermined rates dependent upon the conditions under which the casting is accomplished.

In filling a mold, particularly a permanent mold, it is essential that the material, generally metal, be poured more slowly at the beginning than at the end. This is necessary so that the material may flow freely and have access to all of the spaces in the mold and gate in which air pockets might otherwise be formed and also to insure that the proper casting temperatures are maintained within the mold cavity so the cast article is homogeneous in its physical composition and does not include entrapped air bubbles or blow holes.

The invention is particularly useful in permanent mold casting of aluminum articles and in the example shown in the drawings a cast aluminum lid for a pan is illustrated although it will be apparent that the invention is applicable to casting various other forms of aluminum objects in permanent molds and also is useful in casting other materials in other types of molds.

Heretofore, it has been customary for a skilled workman to determine by a cut and try method just what pouring speeds and changes in pouring speeds were essential for casting an object of given shape. Once this pouring cycle was ascertained that workman then continued to pour that particular shape because his skill was needed to maintain the pouring cycle he determined. A workman with the ability to ascertain such pouring cycles is more highly skilled than a workman whose task may consist only in pouring metal into a casting gate without regard for the rate at which the mold is filled. More efficient production would be attained if the more skilled workman could be replaced by the less skilled workman once the necessary pouring rates of a given cycle are determined.

A general object of the present invention is to provide a method of casting by which the material is automatically poured into the mold at the different required rates of speed during the pouring cycle without regard for the skill of the workman involved. A further object of the invention is to provide a method by which a workman quickly fills a reservoir at the top of a mold and through suitable orifices in the reservoir the material thereafter is fed at the desired rate into the mold cavity without further attention from that workman. Still another object is to provide

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a pouring reservoir for use at the top of the mold that comprises two or more compartments from each of which the molten material is fed through orifices of different size into the mold cavity.

Other objects of the invention will become apparent from the following description and from the drawings in which a preferred embodiment is described and shown. The novel features of the invention are summarized in the claims.

In the drawings:

Figure 1 is a front elevation of a two part mold and reservoir embodying the present invention. with the mold shown in the open position; Figure 2 is a section through Figure 1 as indicated by the lines 2—2 thereon but showing the mold closed; Figure 3 is a plan view of one form of pouring reservoir used with the present invention; Figure 4 is a section through Figure 3 as indicated by the lines 4—4 thereon; and, Figure 5 is a section through Figure 4 as indicated by the lines 5—5 thereon. The form of construction of mold and reservoir herein illustrated and described is for purposes of example only and the method and apparatus described represents only one embodiment of the invention. It will be apparent to one skilled in the art that numerous modifications may be made within the scope of the present invention which is limited solely by the claims.

The mechanism herein illustrated in front elevation in Figure 1 comprises a two part mold with one part secured to a frame and the other hinged to it on a vertical axis so it may be closed to form a mold cavity and opened to remove a casting. The hinged portion is in the form of a door 10 provided with ears 12 that lie in vertical alignment with ears 13 on a stationary part 14 of the casting to form a hinge held by a pintle or pin 15 about which the cover may be swung between the open and closed positions. At the side of the mold opposite the hinge is a lever 17 pivotally supported at 18 in a bracket 20 secured to the stationary frame of the mold indicated generally at 22. The lever carries a gear tooth segment that engages a rack-toothed lock bar 24 slidable horizontally across a surface of the cover 10 to cam and lock the mold door in closed position. Accurate registration of the two parts of the mold is attained by provision of the slightly inclined cam surface 27 (Figure 2) carried by the main frame of the mold and adapted to support and guide the cover 10 into position.

The main mold portion and the door or cover portion 10 provided between them a mold cavity

C into which the molten casting material is poured. In the embodiment of the invention illustrated this cavity is in the form of a round and slightly convex aluminum lid for a cooking utensil. Such a lid is only one of many objects that may be cast with the aid of the present invention which is primarily intended for use in making aluminum castings although it will be apparent that it may also be used where other materials are cast or molded.

The mold cavity C is bounded by a concave surface formed in a ring **30** positioned in a circular bore **32** of the cover **10**, and is provided with an annular shoulder **33** that abuts a shoulder in the cover. A convex mold surface complementary to the concave surface is formed on a member **35** flanged at **37** to provide a shoulder that bears against the main fixed frame **22**. The ring members **30** and **35** are secured to the cover **10** and frame **22** respectively. The frame **22** is supported on two cast triangular brackets **44** (Figure 2) by lugs **46** and **47** that are secured to the mold frame **22**, and to the brackets by pins **48** and **49**.

The mold cavity C is supplied with molten metal, in this case aluminum, through a gate **55** formed by recessing portions of the door **10** and stationary part **22** as best shown in Figure 2. As a part of the gate there is provided a skeleton shaped series of passages formed partially in the front portion **10** and partially in the stationary part **22** as indicated generally at **60** in Figure 1. The passages **60** include two opposite but otherwise similar circular passages **62** feeding through short passages **63** into inner circular passages **65** that in turn communicate directly with the circular mold cavity C. With this gate construction molten metal poured in at **55** flows down through passages **62** and inwardly through passages **63** to the innermost passages **65** and from them into the mold cavity. By this form of gate the mold cavity is filled simultaneously from opposite sides through two long thin arcuate passages P resulting in a uniform supply of metal to the cavity with simultaneous removal of entrapped air providing a uniformly homogeneous and dense cast article.

It has been found that even with complicated gate structures such as just described for the casting of pan lids, or similarly complicated gates for other objects, many castings are defective. They are defective because the molten metal is supplied at incorrect rates of feed to the gate opening **55** so that neither the gate nor the mold fill properly and uniformly. Although theoretically it would be possible to construct an accurate feeding mechanism for pouring metal to such molds at controlled rates the fact that many different shaped objects are cast at a low unit cost makes it necessary for economical operation to provide some simpler and less expensive means of accomplishing the desired result, in the present case with the use of semi-skilled labor. As indicated above it has been customary to employ a skilled workman who approximated the correct pouring rates and material for each form of casting and then proceeded manually to follow such pouring schedule as closely as he could in pouring all the castings of the run. The present invention enables a relatively unskilled workman to pour the castings of a run and frees the skilled workman to be available for other jobs that can carry a higher labor rate. Furthermore it decreases considerably the amount of time a workman needs to fill a particular mold and thus makes it possible for a workman to fill a considerably larger number of molds during the day than heretofore has been possible.

When casting objects of the kind contemplated herein within the limits of accuracy required a reservoir as illustrated in Figures 3, 4 and 5 is provided to meter the molten material that travels through the passages **62** and **65** into the mold cavity. Generally speaking, it is necessary to begin to supply the metal to the cavity at a rather slow rate of speed which rate is continued for a short interval of time after which the main part of molten material is supplied at a much greater rate of speed until the mold cavity and most of the gate are completely filled. In casting other types and shapes of objects it is frequently necessary to employ different metering cycles and it will be understood that the invention is in no sense to be limited to the two compartment reservoir shown herein. A greater number of compartments than two may be employed although there will always be more than one, i. e., a simple funnel.

The reservoir illustrated in the drawings comprises a generally conical steel outer shell **70** that is divided into two portions by a central steel partition **72** such that one compartment **73** has a very much larger top area **74** than its companion compartment **75**. The partition **72** does not entirely divide the two compartments but is slotted as indicated at **76** so that in effect the two compartments become one above the bottommost edge **78** of the slot. The molten metal is poured into the compartment **73** only, the large area of opening **74** making this easier and no metal enters the compartment **75** until the liquid level in compartment **73** has risen above the point **78**. At the bottom of compartment **73** is an orifice **80** discharging into the gate and a complementary orifice **82**, but of considerably greater area, is provided in the compartment **75**. The areas of these two orifices and the height of the slot in wall **72** are varied in each case properly to meter the amount of metal fed to the gate, the rate at which it is fed and the changes of rate during the pouring cycle. In some cases more than two compartments and orifices are provided better to control the pouring cycle.

With a reservoir of the particular dimensions and construction illustrated herein the following pouring cycle takes place: As metal is first rapidly poured by a hand ladle into the compartment **73** it first passes out of the orifice **80** into the gate opening **55**. Since the metal is poured at a much faster rate than the orifice can accommodate it the liquid level rises until the point **78** is reached after which it overflows into the compartment **75** and thereafter also passes out through the orifice **82** into the gate opening **55** to supplement the metal passing through the orifice **80**. This dual supply of metal to the mold then continues as the ladler pours the balance of the required volume of metal into the compartment **73** and until the liquid level drops below the level **78** and the compartment **75** by virtue of its enlarged orifice **82** and general volume becomes empty. From this time on to the end of the cycle metal passes only through the orifice **80** into the mold.

Thus a small amount of metal passes first through the orifice **80** at one rate after which a much larger quantity passes through both orifices **80** and **82** at an increased rate and finally a small quantity of metal passes only through the orifice **80** at the end of the pouring cycle.

The relative volumes of the two compartments 70 and 75 and the relative area of the orifices 80 and 82 are dependent upon the particular casting conditions required for a given mold cavity C and will be varied to meet different conditions. As stated above, under certain conditions more than two compartments may be required and a somewhat different gate construction than that described may be employed to produce the desired results. Accordingly it is not intended to limit the invention or the practice thereof to any particular reservoir construction except as a multi-compartmented reservoir with separate orifices in each and communication between the compartments permits proper metering of the molten material into the mold. The reservoir may be permanently secured to one or the other edges of the mold or it may be so constructed that it is merely set in place and easily removed entirely therefrom.

After the casting has solidified the lock bar 24 is withdrawn by the lever 17 and the cover 10 is swung around the pin 15 to open the mold and separate the convex and concave faces that form the mold cavity after which the casting is removed. Frequently the casting sticks to the convex face of the mold and to expedite its removal, fluid, preferably compressed air, is admitted at an elevated pressure between the casting and the convex mold surface to spread out between the two and free the casting. This compressed air is admitted from a source 85 through a passage or opening 86 upon retraction of a plunger 87 connected to a piston mounted within an air cylinder and actuated in a known manner as disclosed in copending application Serial No. 681,302, now Patent 2,497,098, issued February 14, 1950 in the name of Gottlieb E. Schmid and assigned to my assignee. The passage 85 communicates with the center point of the mold cavity because this permits equal distribution of fluid pressure over the surfaces and also because any slight irregularity in the casting due to deposit of material adjacent the opening is concealed when the knob is secured to the lid.

From the foregoing description it will be evident that I have provided an improved method and apparatus for simply and economically casting molten objects in such fashion that the molten material is supplied to the mold at varying rates in accordance with the requirements of the casting cycle. The invention is simple to make and use and produces results that are far superior to those heretofore obtained by ladling in the customary fashion and at the same time is sufficiently inexpensive to be adapted to the casting of objects in either small lots or under conditions where a low unit price is essential.

I claim:

1. The method of introducing molten metal into a mold having a gate having a pouring opening adapted to receive molten metal and providing a passage leading to the mold cavity, comprising the steps of disposing a pouring box over said opening, said pouring box having a plurality of orifices adapted to discharge into said opening, filling said pouring box with molten metal, discharging molten metal through one of said orifices while said pouring box is being filled and until the metal reaches a predetermined level in said pouring box, thereafter discharging molten metal through a plurality of orifices until said pouring box is filled, and continuing to discharge molten metal through a plurality of orifices until said pouring box is substantially empty.

2. The method of introducing molten metal into a mold having a gate having a pouring opening adapted to receive molten metal and providing a passage leading to the mold cavity, comprising the steps of disposing a pouring box over said opening, said pouring box having at least two compartments separated by an upwardly extending partition within the box, said partition providing an overflow passage between said compartments, each compartment having an orifice adapted to discharge into said opening, filling one compartment of said box with molten metal and discharging molten metal through the orifice thereof while said compartment is being filled, continuing to pour molten metal into said one compartment at a greater rate than the discharge therefrom through said orifice and overflowing molten metal into the other compartment of said box and discharging molten metal from the orifice of said other compartment, continuing to pour molten metal into said first compartment until the volume of metal required by the mold has been poured and continuing to discharge molten metal through said orifices until said compartments are respectively emptied.

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