

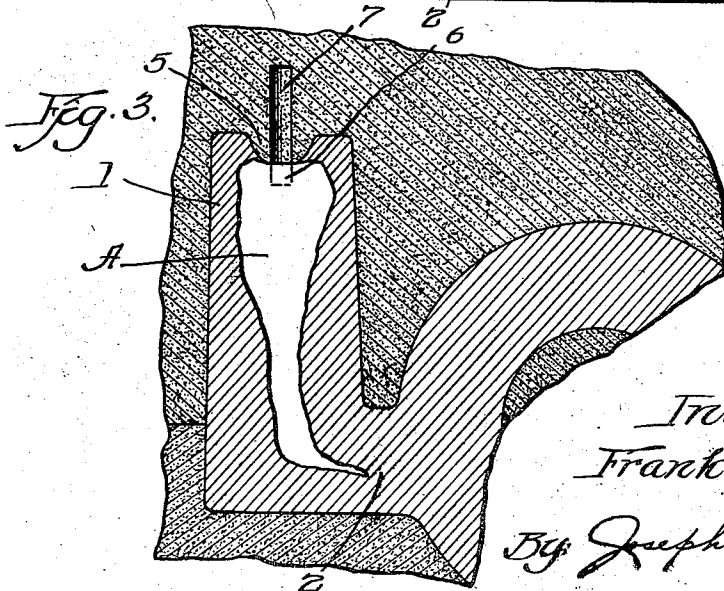
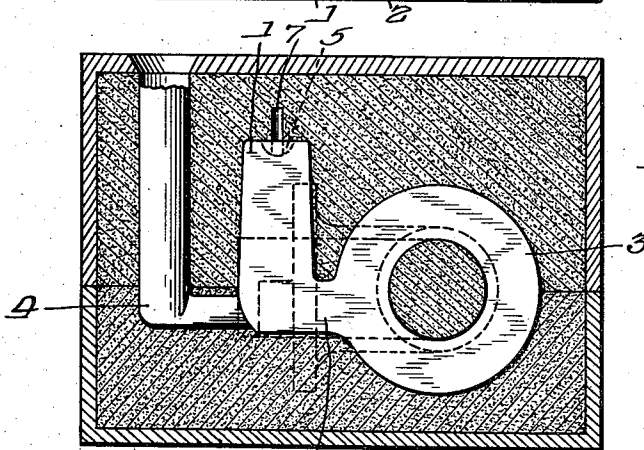
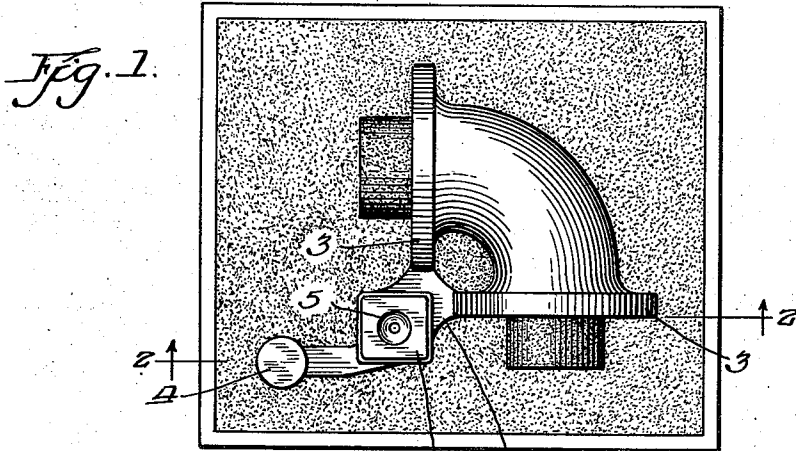
Sept. 8, 1942.

F. J. MACKETT, JR
MEANS FOR CASTING METALS

2,295,227

Filed Oct. 21, 1940

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 4.

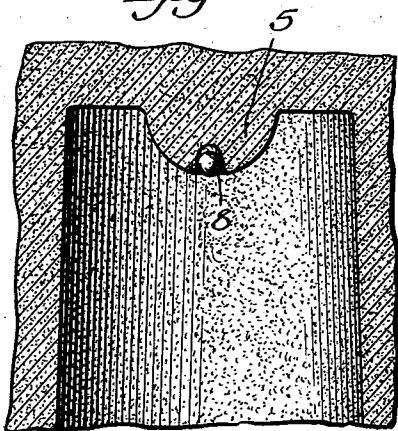


Fig. 5.

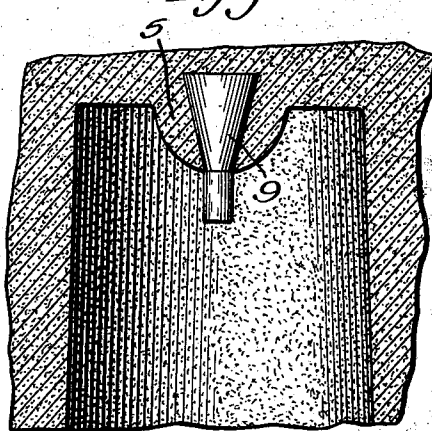


Fig. 6.

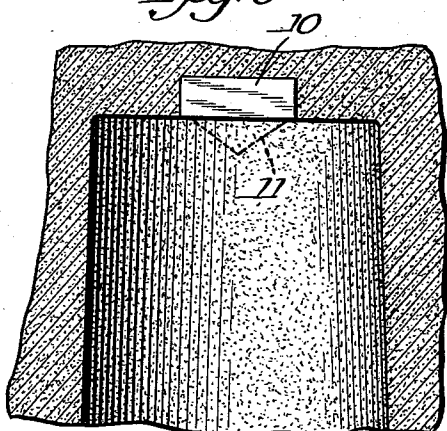


Fig. 7.

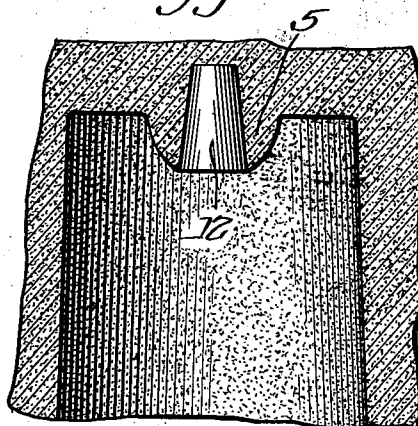


Fig. 8.

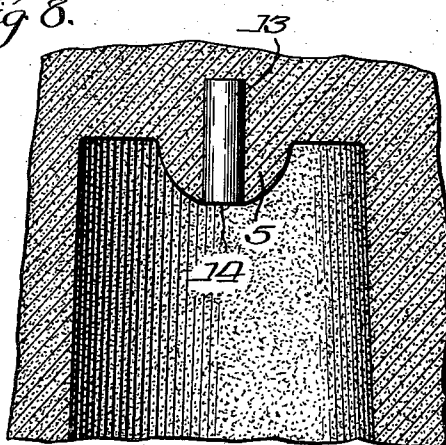


Fig. 9.

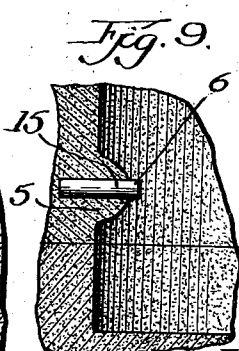
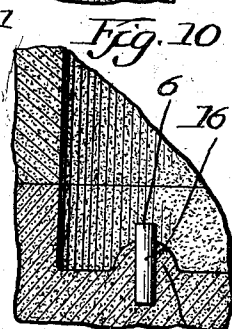


Fig. 10.



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UNITED STATES PATENT OFFICE

2,295,227

MEANS FOR CASTING METALS

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Application October 21, 1940, Serial No. 362,023

3 Claims. (Cl. 22-134)

Specifically, one of the more troublesome problems encountered in current foundry practice involves the necessity for effectively breaking the objectionable vacuum created in connection with the pouring operation and which tends particularly to form where blind risers are employed. It is quite common practice, especially in casting steels and certain ferrous alloys, to use blind risers for the purpose of providing a sufficient volumetric head to allow for the circulation of the molten metal thoroughly and completely within the mold. However, unless the volume of molten metal within the blind riser is maintained in a substantially molten condition and positive means are taken to destroy the usual resulting vacuum at least until such time as the metal within the mold proper has commenced to solidify and set, there will be an objectionable draw or pull by the riser portion of the solidifying metal upon the metal of the casting itself to the extent that a detrimental effect upon the metal structure of the latter results due to what is termed "shrinkage pull." In other words, the metal within the riser, due to the normal shrinkage which occurs during the solidification of the metal within the riser upon cooling and under the influence of the vacuum created actually draws or pulls the metal within the riser. This tends to prevent the complete circulation of the molten metal to fill the mold of the casting proper. Thus it will be apparent that if the metal within the riser solidifies upon cooling and thereby no longer possesses such flexibility as to enable it to be drawn normally into the mold proper as the latter requires it during the concurrent solidification of the metal within the mold, an objectionable shrinkage results which substantially negatives the advantage gained by the use of the riser.

Blind heads or risers have been common in foundry practice for a great number of years to serve as a head for the molten metal. Various means have been tried in an effort to break the objectionable vacuum which, without the application of my invention, otherwise occurs in the upper portion of the riser upon cooling of the molten metal. To my knowledge, no one previously has discovered the novel and convenient means effective for not only maintaining the metal in the blind riser in a molten condition for a period at least long enough to permit the mold to cool and solidify and to draw from the molten metal of the riser, but also provides positive means for venting (breaking the vacuum) at the inner portion of the riser metal by a direct

path created to the mold proper. Thus the metal within the riser, for as long a period as is required by the application of my invention, retains the necessary flexibility of molten metal to feed the casting proper during its solidification and normal shrinkage.

In greater detail, I have discovered that by means of a liquidizer preferably, but not necessarily associated with the top or upper portion of the riser, I am able to vent successfully such upper chamber portion of the riser thus breaking the vacuum which normally tends to occur within the riser. For example, I have found that such liquidizers as graphite, or carbons such as charcoal and coke, or wood, rope, sawdust, straw, paper or silicon, which are normally consumed without substantial chemical association with the molten metal and which melt at temperatures preferably lower than the metal being poured, may be used with excellent success.

While such liquidizer means are preferably used near the top of a riser, they may also be used at the lower portion or underside of the riser or upon any of the sides thereof, provided that in all such cases the liquidizers actually contact with the molten metal within the blind riser during the course of the pouring operation sufficiently deep within the riser metal to pass through the skin adjacent the mold surface forming the limits of the riser.

In further explanation of my invention, relying upon the relatively low temperature at which the combustion of the liquidizer occurs, it will be appreciated that the space occupied by the liquidizer when in the state before actual combustion has occurred subsequently serves upon its combustion to supplement the chamber formed by the riser. It also aids in eliminating the objectionable effects of the pipe or hollow chamber (see A in Fig. 3) if not properly formed within the riser upon the cooling of the casting.

To my knowledge, others in an effort to solve the problem referred to have resorted to the use of special gas permeable refractory means for the alleged purpose of allowing atmospheric pressure to be admitted to the upper chamber of the blind riser and to thereby supposedly use atmospheric pressure to force the molten metal into the mold print. However, my experience indicates that such theory is not tenable to the extent that all that is required, as previously explained, is the breaking of the vacuum within the chamber formed by the evacuation of the molten metal from the riser into the mold upon the normal cooling of the casting after being

poured. In contradistinction to the theory referred to, I have discovered that if a portion of the riser is preferably provided with an extended integral portion of the mold projecting into a hollow portion of the riser proper and such integral mold projection is provided with a liquidizer, say, for example, a small wood dowel rod, I am enabled to thus break the usual vacuum resultant from the metal cooling within the blind riser thereby causing the free flow of the molten metal uninterruptedly from the riser into the mold until the casting fed from the riser has been supplied with the necessary metal required by shrinkage during its normal cooling. In the latter case the wood dowel rod accomplishes a two-fold purpose; first, it vents the mold so as to render the latter more perforate in immediate proximity to the riser, and secondly, by the actual combustion of the wood dowel rod for at least an instant it supplements the normal high temperature of the molten metal so as to delay the formation of the chilled skin or layer of metal which otherwise forms on the surface of the riser. I prefer to allow for the mold extension containing the liquidizer to project sufficiently within the riser so as to be sure that it is well below the skin of solidified metal which normally forms, as above referred to. Because of the substantially complete disintegration of the liquidizer when the metal is poured and contacts with it, whether it be a wood dowel rod or a small piece of closely wound rope, or even welding Thermit or aluminum, the mold is thus rendered gas permeable to the extent that any vacuum tending to be created upon the solidification of the metal within the riser is promptly relieved.

In contradistinction to the previous practices followed by others, it will be apparent I do not employ a physical path which exists within the riser and the mold throughout the metal pouring and setting operation, as for example, by the use of the gas permeable refractory means previously referred to. Instead, I have for my object the substantially complete combustion of the liquidizer so that by virtue of such combustion the metal within the riser is maintained in a molten condition for a longer period than heretofore and also that the mold is thereby rendered sufficiently permeable by the use of the chamber formerly occupied wholly by the liquidizer before its complete combustion to allow the vacuum which normally tends to be created upon the movement of the metal from the riser into the mold of the casting proper to be quickly and conveniently broken.

Thus, while my invention has a particular use with respect to blind risers, as above referred to, it may also be used in various other types of molds. For example, in such cases in which it may be necessary to maintain the metal within a prescribed portion of the mold proper in a plastic or molten condition for a longer period of time than in another, the method and arrangement may be conveniently pursued.

Other important advantages of my invention will become readily apparent upon proceeding with the specification in connection with the accompanying drawings, in which

Fig. 1 is a plan view of the lower portion or drag of the usual type of green sand mold with a pattern for a casting positioned within the mold and in which the pattern provides for a blind riser modified in a manner exemplifying my invention.

Fig. 2 is a vertical sectional view taken on the line 2—2 of Fig. 1.

Fig. 3 is an enlarged fragmentary sectional view in which the effect of the application of my invention is shown with relation to the riser action after the metal has been poured.

Figs. 4 to 10 inclusive show various modified applications of my invention.

Similar reference characters refer to like parts throughout the various views.

At the outset, it should be appreciated that the pattern in the mold shown in Figs. 1, 2 and 3, illustrating the use of the blind riser equipped with the feature of my invention, is entirely conventional and therefore may vary considerably, especially in the manner in which the riser is applied. In the illustrated embodiment, the distribution of the metal in the casting is so provided that a single reservoir may be used to provide the required head and thus the pattern in this case has been formed to provide the blind riser 1 which, as more clearly shown in Fig. 2, is completely encased within the surrounding sand comprising the mold. The blind riser connects with the lower part of the casting mold cavity 2 at the end which forms the flanges 3 of the elbow casting shown and at the opposite extension of its lower portion with the usual pouring gate 4. The latter passage extends, as indicated, to the top of the cope portion of the mold into which the molten metal is introduced from the pouring ladle (not shown) into the blind riser 1 and the casting cavity. Thus, by reference to Fig. 2, it will be apparent that after the metal has been poured into the mold, the usual cooling with its subsequent solidification of the metal therewithin takes place both as to casting and within the riser proper.

As distinguished from the conventional type of foundry practice employed with reference to ordinarily formed blind risers, attention is now specially directed to the departures therefrom which exemplify my invention and are more clearly shown in Figs. 2 and 3. It will be noted that the upper portion of the riser 1 is hollow and thereby provides a molding sand projection 5 which is integral with the mold and which extends into the upper part of the head 1, as more clearly shown in the enlarged view in Fig. 3. This sand projection, the shape of which may be hemispherical, as indicated, or any other suitable elongated form, is necessarily variable in its size and shape, depending largely upon the form and volume of the blind riser required for the individual casting.

During the process of making the mold, I have found it expedient to insert into the projection 5, as shown, a device which is termed by those skilled in the art as a "liquidizer" and which specifically may be nothing more than a conventional small wood dowel rod, in some instances as small as $\frac{1}{8}$ " or $\frac{3}{16}$ " in diameter and perhaps less than 1" long. The end of the dowel rod, as indicated at 6, is then allowed to project into the riser sufficiently so that when it is contacted by the molten metal being poured within the riser its combustion almost immediately produces the joint result previously described, namely, to raise the temperature of the molten metal adjacent the upper portion of the riser metal, thus offsetting the otherwise chilling effect of the molding sand. In addition, the space 7 is created, being formed as a result of the complete combustion of the wood dowel rod. Now it will be clear that the space 7 extending into the riser

metal through the projection 5 communicates with the inner portion of the riser to break any vacuum tending to form as the metal recedes into the casting proper during cooling. Since the projection 5 is relatively small in its surface exposed to the metal, it has been found that here there is little or no tendency for a chill skin to form, especially when its local temperature is raised by the combustion of the liquidizer. Therefore, the pipe A (Fig. 3) is "tapped" and allows for free flow of the hotter molten metal into the casting.

From what has been said previously, it is clear that other means than those just described may be used; as for example, in Fig. 4, I have found that a small piece of the element silicon 8 is satisfactory since it similarly produces a hot spot at this point, i. e. projection 5, upon being consumed and therefore forms a chamber for breaking the vacuum in the manner described in connection with the wood dowel rod.

In another modification as in Fig. 5, I have found that the dowel rod or other liquidizer may be made in a tapered form, as at 9, so as to maintain it more securely within the mold and prevent its being accidentally dislodged when the pattern for the casting is being withdrawn from the mold.

Similarly, in Fig. 6, I have found that a liquidizer 10 may be placed upon the flat upper surface of the riser and held frictionally within the sand of the mold proper. This method will also aid in venting and breaking the vacuum, and in some cases, in order to provide for the metal striking the sand first before it strikes the liquidizer directly, I may use a wedging means composed of sand, as indicated in dotted lines at 11, formed within the mold proper.

As to the modified form shown in Fig. 7, the liquidizer may take the form of an oppositely tapered section 12 in such instances in which it is deemed desirable to provide greater exposed surface of the liquidizer to the molten metal. Further, in view of the direction of the taper of the liquidizer, it is more easily insertable into the mold projection 5, even after the mold has been completed without it.

In Fig. 8, instead of having the dowel rod extend downwardly beyond the projection 5, it may be made cylindrical, as at 13, and extend flush, as at 14, with the innermost portion of the projection 5.

Previously, mention has been made that the liquidizer and mold projection need not necessarily be placed at the top of the riser, because equally good results are obtainable for the purpose intended if they are positioned with the liquidizer 15 shown at the side of the riser in Fig. 9

or as shown in Fig. 10, with the liquidizer 16 at the bottom of the riser.

From the numerous modifications illustrated it is therefore apparent that the application of my invention may assume numerous forms and I desire therefore to be limited only to the extent prescribed by the appended claims.

I claim:

1. Combined means for supplying molten metal to a blind riser in a mold having a casting cavity, projecting means integral with the mold formed by depressing a surface portion of the riser and including a combustible insert within said integral projecting portion for jointly maintaining the molten metal within the riser in liquid form and also breaking a vacuum therewithin, said combustible insert being in direct communication with the molten metal of the said riser so that upon its combustion a supplemental closed chamber is provided for the said riser at its depressed surface portion.

2. A metal casting mold comprising a blind riser cavity and a casting cavity, a wall of said blind riser cavity having an integral inwardly extending raised portion adapted to communicate with the interior liquid portion of the metal in the said riser when cooling, an insert positioned in the said raised portion of said riser cavity wall, the said insert being composed of a material adapted to liberate gas upon the application of heat thereto, whereby upon introduction of molten metal to the interior of said riser cavity gas is liberated by the said insert into the liquid interior portion of the said riser thereby preventing the formation of a vacuum therein through a loss of metal by shrinkage into the casting cavity.

3. A metal casting mold of porous material comprising a blind riser cavity and a casting cavity, a wall of said blind riser cavity having an integral inwardly extending raised portion adapted to communicate with the interior liquid portion of the metal in said riser when cooling, an insert embedded in said raised portion of said riser cavity wall disintegrable with the evolution of gas at the temperature of molten metal, whereby upon such disintegration of the said insert a hollow chamber is formed in the said riser cavity wall which is in direct communication with the said liquid portion of the metal in said riser, the said chamber providing for improved passage of atmospheric air through the porous walls of the mold, the latter being effective in supplementing said evolution of gas in minimizing any tendency to form a vacuum in said riser due to the normal shrinkage of metal from the riser cavity into the casting cavity.

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