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MOLYBDENUM SCREEN FOR MOLTEN NON-FERROUS METAL

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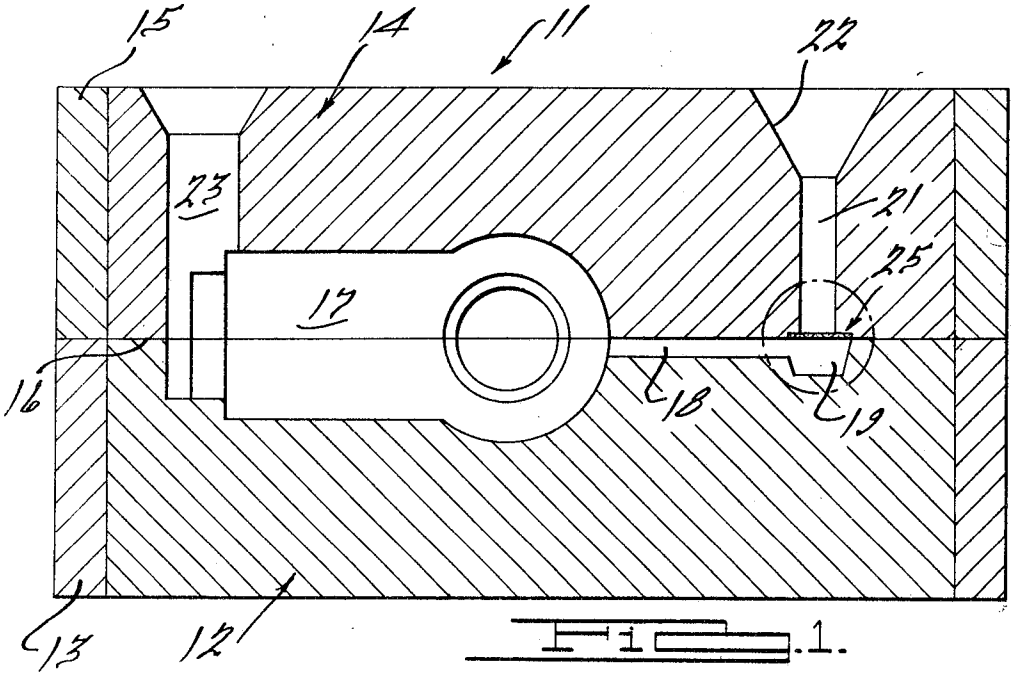


Fig. 1.

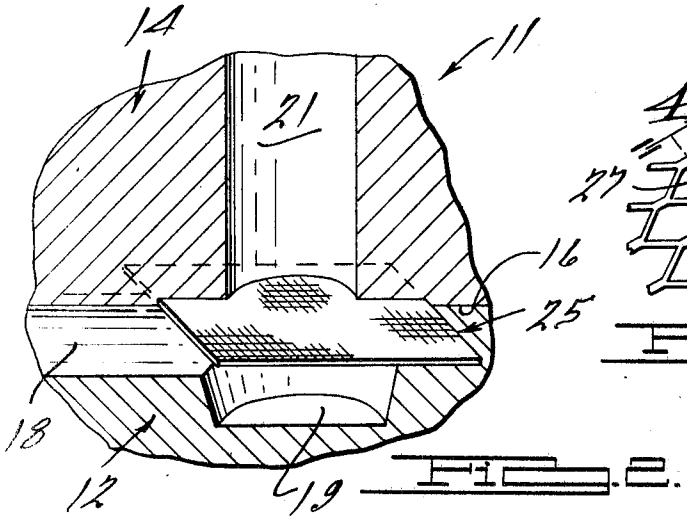


Fig. 2.

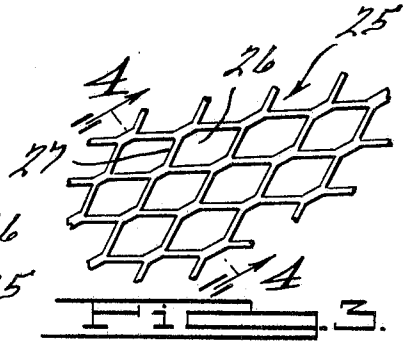


Fig. 3.

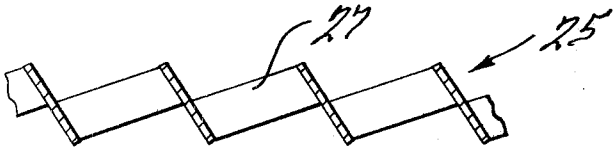


Fig. 4.

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MOLYBDENUM SCREEN FOR MOLTEN NON-FERROUS METAL

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ABSTRACT OF THE DISCLOSURE

This application discloses a sand mold comprised of a cope and drag ram packed with sand and defining a cavity having the shape of the object to be cast, a runner for delivering a molten non-ferrous metal to the cavity and a sprue into which metal is poured for delivery to one end of the runner. In order to separate slag and dross from the molten metal as it is poured without any significant decrease in the pouring rates, an expanded metal, molybdenum screen is positioned in the mold and extends across the sprue.

BACKGROUND OF THE INVENTION

This invention relates to the art of casting molten metal and more particularly to the casting of non-ferrous metals using sand molds.

In all casting techniques, it is essential that the amount of slag and other drosses present in the cast article be minimized, and various techniques have been employed to accomplish this result. Since these impurities are, for the most part, lighter than the metal being cast they will rise to the surface of the molten metal if it is poured slowly enough. Slow pouring rates, however, not only decrease production line efficiency but can cause poor castings. With slow pouring rates, the metal being cast might solidify before the mold is completely filled causing chills or voids in the finished casting. Another technique that has been used for permitting these lighter impurities to rise to the surface is the use of blind risers or multiple risers. These excess risers, however, result in a high loss of material or the necessity of subsequent reheats to reclaim this material.

Another technique that has been employed for removing slag and dross from a cast metal employs a perforate member through which the molten metal is poured. Such perforate members, however, must be formed from a material that is able to withstand the extremely high temperatures at which the molten metals are poured. Normally, ceramic screen have been employed for this purpose but ceramic screens have several disadvantages. The ceramics become brittle at the high pouring temperatures and can fracture and enter into the cast article along with the other impurities.

It is, therefore, a principal object of this invention to provide an improved screen through which a molten metal may be poured to remove impurities during a casting process.

It is another object of the invention to provide a screen for removing impurities from a cast object, which screen will not reduce the pouring rates.

It is another object of the invention to provide a screen for metal casting that will remove impurities without being attacked by the molten metal.

SUMMARY OF THE INVENTION

This invention is embodied in an expanded molybdenum screen particularly adapted for use in the casting of non-ferrous metals in a mold that defines a cavity that is adapted to receive a molten metal and having the form of the object to be cast. The molten metal enters the mold cavity through a passage that extends at least in part through the mold and is adapted to receive poured molten metal. The expanded molybdenum screen is positioned in the mold and extends across the passage.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a cross-sectional view taken through a sand mold embodying this invention.

FIGURE 2 is an enlarged, perspective view of the area encompassed by the circle in FIGURE 1.

FIGURE 3 is an enlarged top plan view of the screen embodying this invention and supported in the mold shown in FIGURES 1 and 2.

FIGURE 4 is a cross-sectional view taken along the line 4—4 of FIGURE 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring in detail to FIGURES 1 and 2, the reference numeral **11** indicates a sand mold for use in the casting of articles formed from non-ferrous metals. The mold **11** is comprised of a drag **12** formed from casting sand ram packed into a drag flask **13**. Supported above the drag **12** and drag flask **13** is a cope **14**, which is also formed from casting sand ram packed into a cope flask **15**. The cope **14** and drag **12** engage each other along a parting line indicated generally by the reference numeral **16**.

A cavity **17** is formed in the drag **12** and cope **14** in a known manner which cavity has the shape of the article to be cast. As is well known in casting techniques, one or more cores may be inserted into the cavity **17** if openings are desired in the finished casting. A runner **18** is formed in the drag **12** adjacent the parting line **16** and opening at one end into the cavity **17**. The other end of the runner **18** terminates in an enlarged cavity **19** which is adjacent to the lower end of a sprue **21** formed in the cope **14** and may be considered to be an extension thereof. The sprue **21** extends vertically through the cope **14** and terminates at its upper end in an enlarged pouring basin **22**. At the side of the cavity **17** opposite to the runner **18**, a riser **23** is formed which extends through a portion of the drag **12** and through the cope **14**. The riser **23** terminates in the upper surface of the cope **14**.

During casting the molten non-ferrous metal is poured into the pouring basin **22** from a ladle or the like at a temperature that will be considerably lower than the melting point of molybdenum. This molten metal passes down the sprue **21**, across the runner **18** and into the cavity **17**. Sufficient metal is poured to fill the riser **23** and insure that the complete volume of the casting **17** is filled. The metal thus poured contains slag or other drosses which might enter the cavity **17** and form impurities within the finished cast article. In order to exclude these impurities from the finished casting, an expanded molybdenum screen, indicated generally by the reference numeral **25**, is positioned within the mold **11** at the parting line **16** and extending across the sprue **21**.

Referring now in more detail to FIGURES 3 and 4, the molybdenum screen **25** is formed with a plurality of generally like size uniformly distributed polygonal openings **26** that are defined by unitary strands **27** of molybdenum. The strands **27** defining adjacent openings **26** are integrally connected to each other at the apexes of the polygonal openings, as clearly shown in FIGURE 3. This form of screen may be made by any conventional metal expanding technique.

In a preferred embodiment of the invention, a screen **25** was formed from a low carbon molybdenum sheet rolled from an arc cast ingot and expanded in a conventional manner. It is to be understood that certain alloying elements such as titanium, zirconium, columbium and tungsten may be added to the molybdenum as long as the metal retains sufficient ductility to be expanded.

Molybdenum sheets made by rolling sintered powders also may be expanded as long as they have adequate ductility.

The size of the openings in the screen **25** and the ratio of the area of the openings with respect to the remaining strand area may be varied to suit particular requirements in a given application. This is also true with respect to the particular shape of the openings. The illustrated embodiment has a generally diamond shaped opening **26** and good results have been obtained with the use of such openings wherein the long dimension of the diamond was about 0.187 inch and the short dimension of the openings was in the range of about 0.048 inch to about 0.071 inch. In this embodiment there were approximately 170 such openings per square inch of screen material and the thickness of the strands **27** in the plane of FIGURE 3 was in the range of about 0.007 inch to about 0.035 inch. The thickness of the original material before expansion was in the range of about 0.002 inch to about 0.015 inch. It is to be understood that these dimensions represent only one range of examples that has proven satisfactory and that variations from this range may be made to suit a particular application. Due to the thinness of the screen **24**, the screen **24** may be positioned in the mold without providing a special cavity for the screen **24**. The thinness of the screen **24** will cause only very minor and insignificant displacement of the sand of the mold when the cope **14** is positioned upon the drag **12**.

The use of the molybdenum screen as described herein has particular advantage in the casting of non-ferrous metals. It is believed that the expanded molybdenum screen can be used in the casting of any non-ferrous metal in which the molybdenum of the screen has a relatively low solubility at the casting temperature. Good results have been obtained to date in the casting of commercial grades of aluminum, which contain small amounts of silicon and other alloying materials, aluminum alloys, the Babbitt metals, lead, zinc, cobalt based hard facing alloys, copper and copper base alloys. The pouring temperatures of the aforenoted metals and their alloys are considerably lower than the melting point of the molybdenum and molybdenum is not wetted by these metals and their alloys, this characteristic being particularly true of copper and the copper base alloys.

Molybdenum, however, had not previously been used in such applications, since another of its known characteristics is the catastrophic oxidation it undergoes in air at temperatures at or above 1400° F. The resulting molybdenum oxide would vaporize at normal casting temperatures of most non-ferrous metals. It has been found, however, that the molten metal apparently shields the screen from oxygen and hence these deleterious effects do not occur. The use of expanded molybdenum also provides considerable advantage in this application. The high ratio of open mesh area to strand area provides for high flow rates with low flow resistance which means that hotter metal is delivered to the mold cavity. In addition, the hotter metal has greater fluidity and smaller runners can be used with a reduction in the amount of scrappage or amount of metal to be remelted. The expanded molybdenum screen further streamlines the flow of metal and reduces the tendency for swirling and turbulence. Hence,

the more laminar metal flow stream is less likely to dislodge sand particles into the metal being cast further reducing the amount of impurities present in the finished, cast article. Conventional screens formed from interwoven wires have a number of voids in addition to the flow openings. Woven screens cause capillary action to occur when the molten metal is poured, thus reducing the pouring rates.

In the described embodiment the expanded molybdenum screen has been described and illustrated as being positioned within a sand mold extending across the sprue passage at the parting line between the cope and the drag. It should be readily apparent that the use of an expanded molybdenum screen to remove slag and other drosses from molten non-ferrous metals may be used in connection with other types of casting techniques, such as those using a permanent mold. In these embodiments the expanded molybdenum screen also may be positioned within the mold. As an alternative arrangement, the expanded molybdenum screen may be positioned across the upper face of the sprue passage or interposed in another conduit that is employed to deliver the molten metal to the mold. This latter embodiment has been used successfully in the casting of the Babbitt metals.

While it will be apparent that the preferred embodiments of the invention disclosed are well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. In a mold for casting non-ferrous metals, the mold defining a cavity adapted to receive a non-ferrous molten metal and having the form of the object to be cast, the non-ferrous metal being poured at a temperature substantially less than the melting point of molybdenum, a passage extending at least in part through the mold, said passage having an opening for receiving poured molten metal, said passage terminating at said cavity for conducting the poured molten metal to said cavity for the introduction of molten metal to said cavity from said passage, the improvement comprising an expanded metal molybdenum screen extending across said passage for separating slag and other impurities from the molten metal as it is poured through said passage.

2. The improvement as set forth in claim **1** wherein the expanded metal molybdenum screen is an integral member having a plurality of substantially like sized, uniformly distributed openings defined by molybdenum strands integrally connected to each other, said openings forming substantially the sole voids in said screen.

3. The improvement as set forth in claim **2** wherein the openings are generally polygonal in shape.

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