

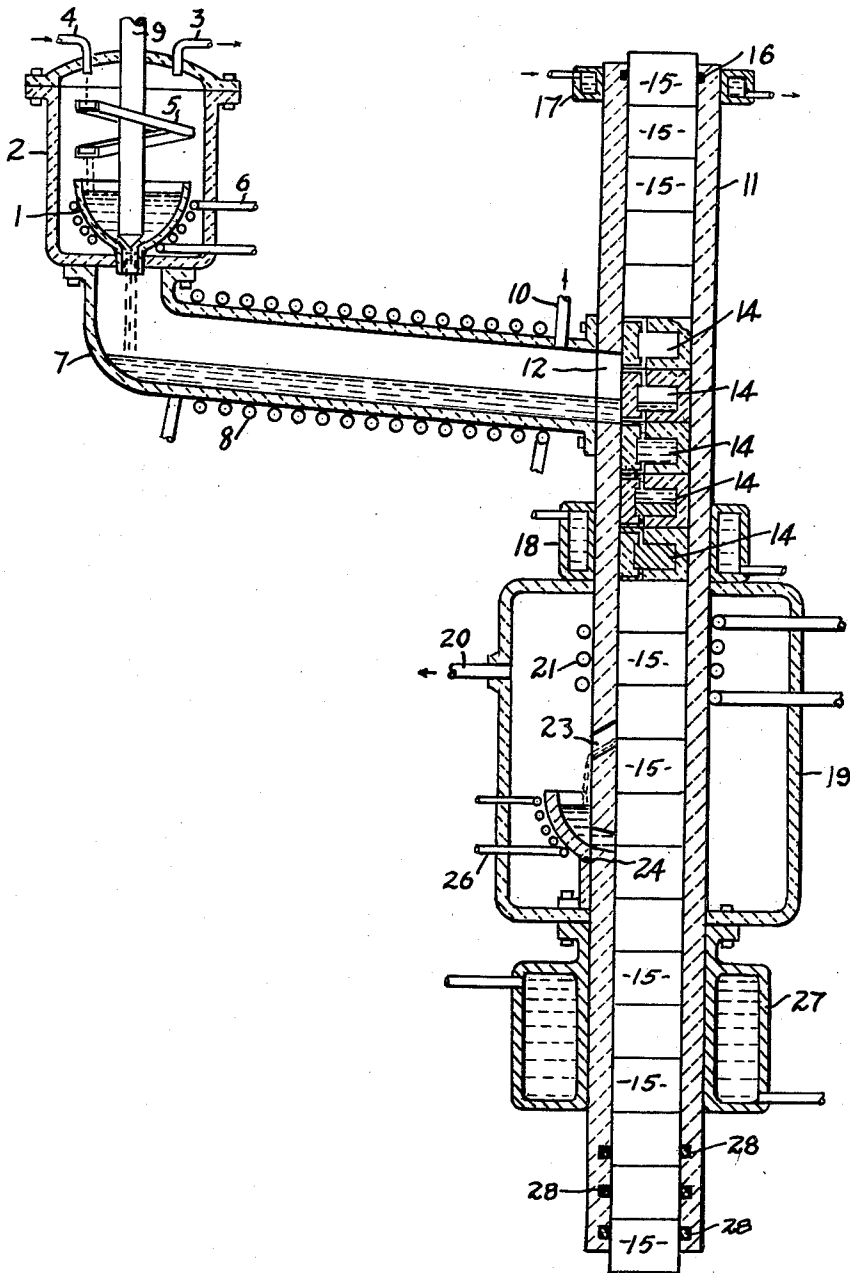
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CASTING APPARATUS

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CASTING APPARATUS

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4 Claims. (Cl. 22—57.2)

The present invention relates generally as indicated to a casting apparatus, and more particularly to a casting apparatus of the type disclosed in my copending application Serial No. 225,949, filed May 12, 1951, now Pat. No. 2,716,790, granted September 6, 1955, and wherein molds are adapted to be successively shoved downwardly through a guide tube past a casting zone whereat the molds are successively filled, and then through a chilling zone whereat the molds and metal therein is cooled to solidify the castings therein.

It is an object of this invention to provide a casting apparatus of the type indicated in which the casting and chilling operations are performed remote from the molten metal supply so that the operator is not required to be stationed close to the intense heat emanating from the molten metal supply crucible.

It is another object of this invention to provide a casting apparatus of the character indicated wherein molds are successively shoved downwardly through a guide, the guide being provided with a feed opening to which molten metal is fed from a remote source and which feed opening successively registers with openings leading into the successive mold cavities as the molds are successively shoved downwardly through the guide.

Another object of this invention is to provide a casting apparatus and, as well, a new method of casting wherein de-gassed metal is supplied into de-gassed or evacuated molds and is solidified therein followed by re-melting and draining of the solidified metal for further de-gassing, the re-melted and further de-gassed metal being flowed back into the emptied molds wherein it is finally solidified.

Other objects and advantages of the present invention will become apparent as the following description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawing setting forth in detail a certain illustrative embodiment of the invention, this being indicative, however, of but one of a few of the various ways in which the principle of the invention may be employed.

In said annexed drawing:

The single figure is a vertical cross-section view of the apparatus constituting the present invention.

Referring now more particularly to the drawing, there is provided at the upper lefthand side a molten metal supply container 1 which may be made of Al_2O_3 when the metal being cast is aluminum. Said container is supported in a housing 2 which is maintained under vacuum by the vacuum line connection 3. Molten metal is supplied into the container in particulate form as through the feed opening 4, whereby the metal is effectively de-gassed as it drops down toward the supply container 1.

There may be interposed between the feed opening 4 of the supply container 1 a helical trough 5 or the

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like along which the metal flows in thin layer form for further de-gassing, and finally drips from the lower end of the trough 5 into the container 1. Associated with the container 1 is a high frequency induction heating coil 6 which, in the case of the casting of aluminum, is operated at 400,000 cycles per second and 30 kva. to maintain the casting metal at a temperature of about 1250° F.

Secured under the housing 2 is a conduit 7 also made of Al_2O_3 in the case of casting of aluminum, and has associated therewith a high frequency coil 8 which also is operated at 400,000 cycles per second and 30 kva.

The flow of molten metal from the container 1 into the conduit 7 is regulated as by means of a vertically adjustable valve member 9 which preferably is adjusted so that the molten metal again drips in particulate form into the conduit 7 and thereby is still further de-gassed by reason of the evacuation of the conduit through the vacuum connection 10. Furthermore, the molten metal flows along the bottom of the conduit 7 as a relatively thin layer so that still further de-gassing is effected.

The other end of said conduit 7 is bolted or otherwise secured to one side of a mold guide member 11, said guide member being formed with an opening 12 through the wall thereof through which molten metal flows into the cavities 14 of the molds 15 which are adapted to be guided by and shoved downwardly through said guide member.

In the present case, the molds 15 are in the form of cylindrical blocks of fused Al_2O_3 , there preferably being sprues at the top and bottom of each mold so that the metal in one mold will be in communication with the metal in the molds therebeneath.

Accordingly, when the molds 15 are successively shoved downwardly through the guide member 11, the cavities 14 thereof will successively be filled with molten metal, and at the same time the cavities 14 thereof are previously evacuated by reason of the communication of the sprues thereof with the interior of the conduit 7.

The upper end of said mold guide member 11 is provided with a sealing ring 16 and a surrounding cooling unit 17.

A cooling unit 18 is disposed below the conduit 7 in surrounding relation to the guide member 11 so as to effect solidification of the metal in the molds 15 as the latter are moved downwardly through said guide member. Said cooling unit 18 in the case of casting of aluminum should preferably be arranged to cool the molds 15 and the metal therein to a temperature of approximately 600° F.

As a further feature of this invention, there is disposed below the cooling unit 18 and around the guide member 11 a vacuum chamber housing 19 in which a desired vacuum is maintained through the vacuum line connection 20.

Within said vacuum chamber housing 19 and surrounding the guide member 11 is a high frequency induction heating coil 21 which is effective to re-melt the metal in the molds 15 as the latter move through the high frequency heating field of the coil 21.

As the molds pass downwardly in register with the opening 23 in the wall of the guide member 11, the molten metal runs out and drops down into a receptacle 24 from where the molten metal still further de-gassed refills the molds 15 through the opening 25. There is also a high frequency heating coil associated with the receptacle 24 effective to maintain the metal at the proper temperature, namely, about 1250° F. in the case of aluminum.

As the refilled molds continue to be shoved downwardly, they pass through another cooling unit 27 ef-

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fective to re-solidify the metal therein, and finally the molds pass successive sealing rings 28.

As the molds 15 emerge from the lower end of the guide member 11, they and the metal casting therein may be at a temperature of approximately 600° F.

It is to be noted that, by reason of the conducting of the casting operations under vacuum, the air pressure acting on the upper and lower ends of the column of molds is effective to tend to hold the molds together in engagement.

It is to be noted further that the molds 15 in the casting zones are interconnected together so that there is a continuous molten shrink head of metal disposed above the progressively upwardly solidified castings, the solidified metal serving as a vacuum seal.

By reason of the provision of a plurality of vacuum chambers, the pressure in the housing 2 and in the conduit 7 need only be about 100 microns, whereas the vacuum in the lower chamber 19 may be as low as 5 microns.

Other modes of applying the principle of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims, or the equivalent of such, be employed.

I therefore particularly point out and distinctly claim as my invention:

1. The method of casting metal articles which comprises filling a mold cavity with molten metal, extracting heat from the metal to solidify same, re-melting the metal in the mold, draining the re-melted metal from the mold cavity and subjecting the drained metal and empty mold cavity to vacuum for de-gassing the metal and for evacuating gases from the mold cavity, re-filling the evacuated mold cavity with such de-gassed molten metal, and finally extracting heat from the metal in the cavity to solidify same to conform to the shape of the mold cavity.

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2. The method of claim 1 wherein the mold cavity is initially evacuated and filled with vacuum de-gassed molten metal whereby the successive re-melting, draining, re-filling and evacuating operations insure sound castings without entrapped gas.

3. Apparatus for casting articles comprising a mold having a cavity and a passage leading to such cavity, an upwardly extending mold guide through which said mold is adapted to be moved from one end to the other, said mold guide being formed with a molten metal feed opening which is adapted to register with such mold passage as the mold is moved through said guide, cooling means downwardly adjacent such feed opening effective to cool the mold and to solidify the metal therein, heating means downwardly adjacent said cooling means for re-melting the metal in said mold, means forming a vacuum chamber, said mold guide being provided with an upper opening through which the re-melted metal drains into the vacuum chamber and with a lower opening through which the re-melted and drained metal flows to re-fill said mold, a receptacle in said vacuum chamber to receive the drained metal and to contain same for refilling said mold, and cooling means below said vacuum chamber for solidifying the metal in the re-filled mold.

4. The apparatus of claim 3 wherein a series of molds are provided for successive shoving down through said mold guide.

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