United States Patent

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[54] **METHOD FOR PRODUCING CASTINGS IN A PERMANENT MOLD**
2 Claims, 3 Drawing Figs.

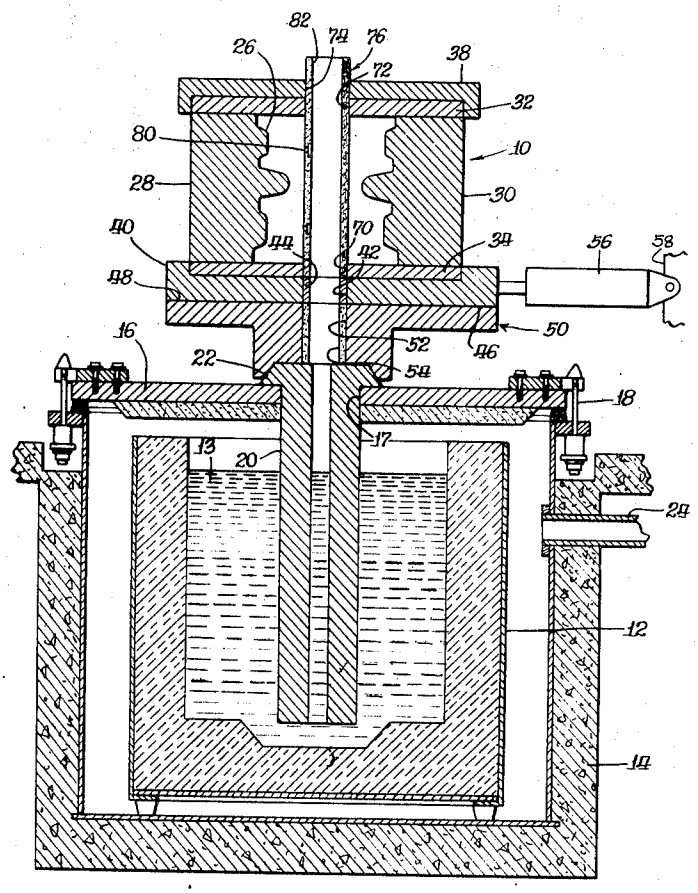
[52] **U.S. Cl.** **164/113,** 164/131
[51] **Int. Cl.** **B22d 15/00**
[50] **Field of Search** 164/61, 70, 113, 119, 127, 302, 303, 306, 356, 78, 133, 337, 363, 120, 122, 126, 128

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ABSTRACT: Hollow castings are produced in a permanent mold having a hollow refractory core disposed in the interior of the mold. The core has a number of small sprues through which the casting cavity of the mold is filled, and excess metal is retained within the core to feed shrinkage within the interior of the casting. After the surface of the casting has chilled, the mold is separated from the casting to prevent binding, but the core is retained therein until the casting has completely solidified. The core and solidified metal therein are then removed.



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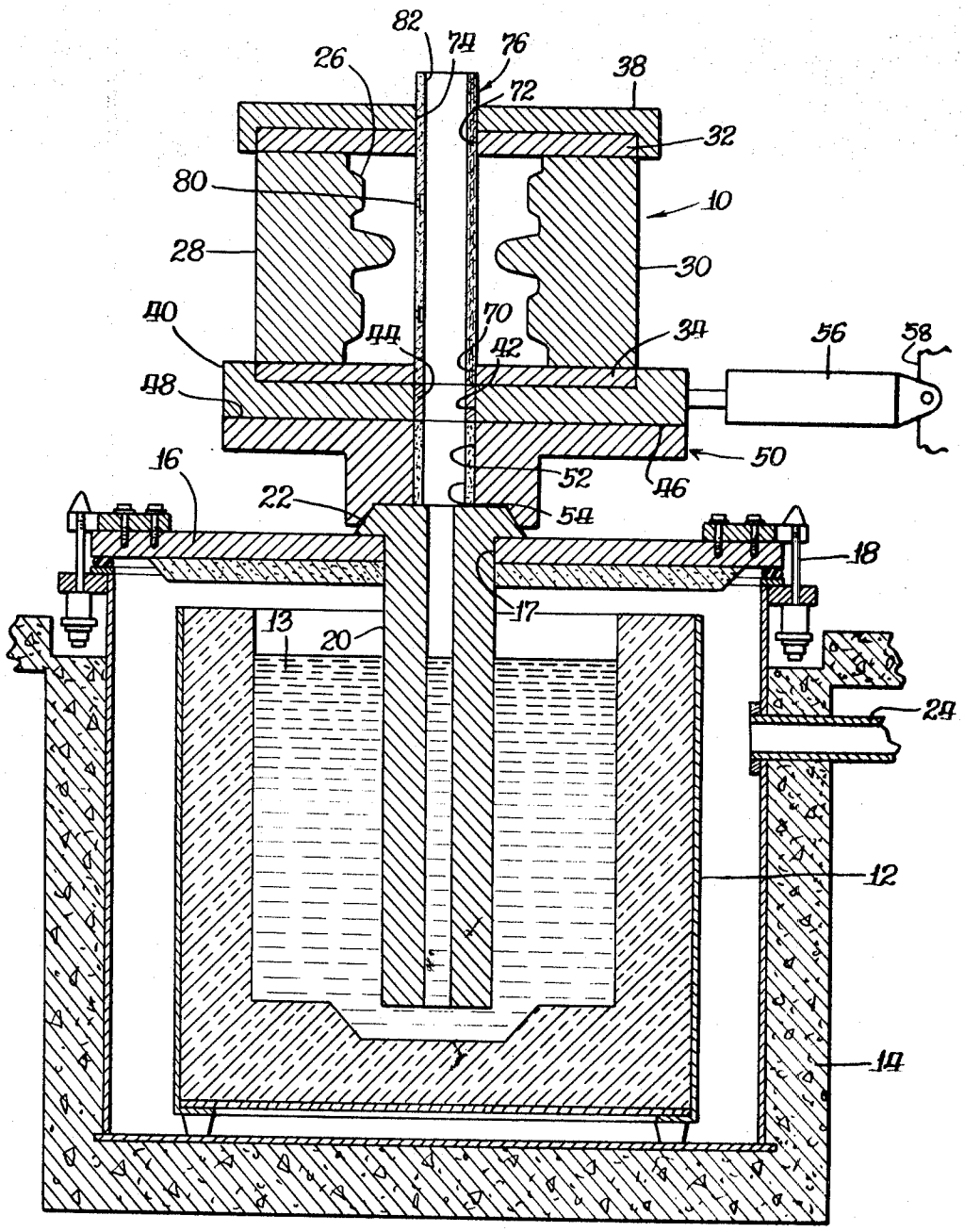


Fig. 1.

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Fig. 3.

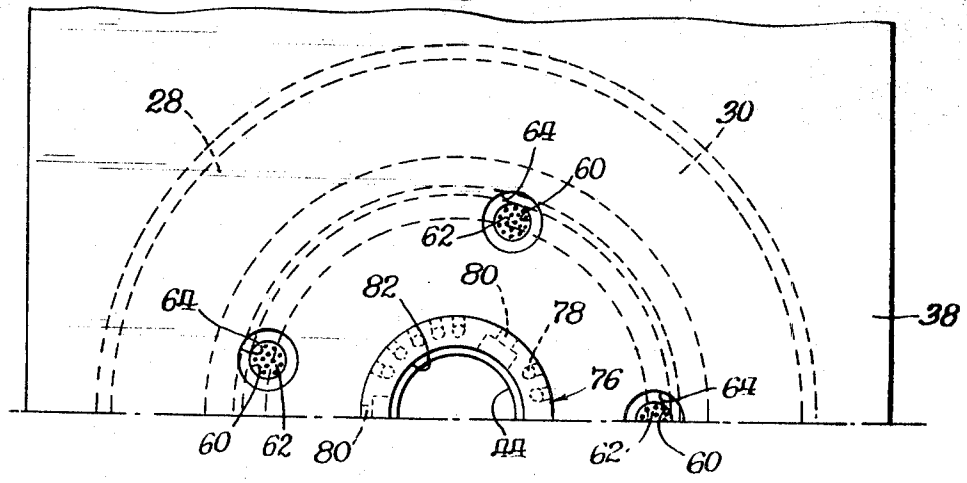
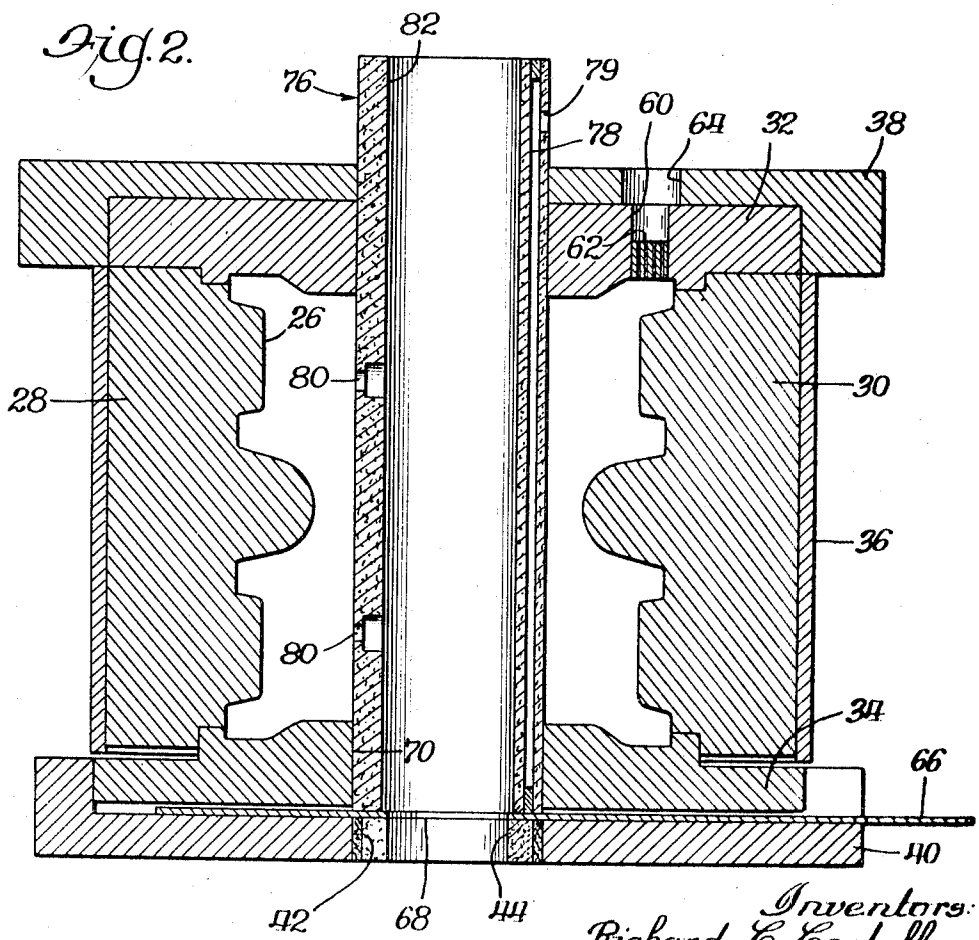


Fig. 2.



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METHOD FOR PRODUCING CASTINGS IN A PERMANENT MOLD

This invention relates to a method and apparatus for producing hollow castings and more particularly to a permanent mold having a separate refractory core and a method for its use.

The use of permanent and semipermanent molds is an expediency well known to those skilled in the art of foundry practices. Permanent molds, made up from a plurality of mating parts composed of rigid chill materials, such as graphite, cast iron, steel, or water cooled copper, have been used to produce cast structures of various simple shapes. Due to the rigidity of the mold structure, however, the casting of complex shapes has not been feasible because of possible binding up of mold parts and because the unyielding nature of the mold, which may contribute to faults, hot tears and other defects in the casting.

Accordingly, an object of the present invention is the provision of means for producing complex castings in a permanent mold, especially where the casting is to be formed with a hollow central area.

Other objects will become apparent from the following description and appended claims, taken in connection with the accompanying drawings wherein:

FIG. 1 is a vertical sectional view of a metal casting system that incorporates features of the presently described invention;

FIG. 2 is a vertical sectional view of the mold and core assembly of the present invention; and

FIG. 3 is a fragmentary plan view of the structure shown in FIG. 2.

Referring in greater detail to FIG. 1, the assembly shown comprises a mold, generally indicated at 10, which is filled with molten metal from the bottom thereof by means of a pressure casting apparatus. Such apparatus comprises a refractory lined ladle 12 containing molten metal 13 disposed in a pressure tank or pit 14, with a cover 16 releasably sealed on said pit by means of clamps 18. A refractory pouring tube 20 is centrally disposed within the ladle 12 and extends upward through an opening 17 in the cover where said tube terminates in a tapered annular head 22 supported upon said cover. A source of controlled pressurized pneumatic fluid (not shown) is connected to a line 24 leading into the pressure tank 14, such that the molten metal 13 in the ladle 12 may be pressurized and forced upward into the casting cavity 26 of the mold 10.

The mold 10, as best shown in FIGS. 1–3, comprises a pair of mating cheek sections 28 and 30, enclosed at the top and bottom thereof by respective cope and drag plates 32 and 34 to define the casting cavity 26. The cope and drag plates may be formed from two mating pieces, to facilitate disassembly, as will be hereinafter described. The mold parts are preferably composed of graphite, but other chill materials or combinations thereof may be employed, such as cast iron, steel or watercooled copper. The casting cavity 26 may be formed in any desired configuration to impart shape to the cast article; the configuration shown in the present instance is that for producing a track roller for track-laying vehicles, said roller having a cylindrical opening therethrough for eventual mounting on an axle or shaft.

An outer steel jacket 36 (FIG. 2) is provided around the cheek sections, and the respective cope and drag plates 32 and 34 are secured in steel flanged retainers 38 and 40, respectively. As shown in FIGS. 1 or 2, the drag retainer 40 has an opening 42 therethrough lined with a refractory annulus 44, the lower flat surface 46 of said retainer being slidably supported upon the upper flat surface 48 of a base 50 having a similar opening 52 and refractory liner 54, said base being adapted to fit over and rest on the tapered annular head 22 of the pouring tube 20. When assembled, as seen in FIG. 1, the bore of the pouring tube is in communicative alignment with the opening 52 in the base 50 and the opening 42 in the drag retainer 40. A hydraulic cylinder 56 (FIG. 1) is connected between an independent support 58 and the drag retainer 40, which allows said retainer to be moved horizontally on the base 50 to seal off and retain molten metal in the mold after the filling thereof. The cope plate 32 includes a plurality of openings 60 (FIGS. 2 and 3) each containing a graphite vent plug 62 having a plurality of small passages therethrough, which allows the escape of hot gasses from the mold during the filling operation but chills and prevents leakage of molten metal after filling of the mold. Corresponding openings 64 are provided in the cope retainer 38.

FIG. 2 shows an alternative arrangement for sealing off flow of molten metal from the mold, wherein a slide cutoff 66 having an opening 68 is positioned between the drag plate 34 and drag retainer 40 and may be moved horizontally to a closed position.

Means are provided in the interior of the mold cavity to allow filling of the cavity and feeding of metal to the casting during solidification. For this purpose, as best shown in FIGS. 2 and 3, aligned circular openings are provided in the drag plate 34, the cope plate 32, and the cope retainer 38 at 70, 72 and 74, respectively. A refractory tube 76 is disposed in openings 70, 72 and 74 throughout the full height of the casting cavity 26 and extends upward beyond the top of the cope retainer 38. The tube is preferably composed of a refractory sand bonded with an organic binder, which allows loss of rigidity during solid state contraction of the casting. Circumferentially spaced vertical vent passages 78 (FIGS. 2 and 3), communicating with the atmosphere at 79, are provided in the tube 76 to allow egress of gas evolved in the decomposition of the organic binder.

A plurality of sprues or openings generally indicated at 80, in the side of the tube 76 provide communication between the bore 82 of the tube and the casting cavity 26. Preferably, such openings are tapered from the bore 82 of the tube 76 to the casting cavity 26. As shown in FIG. 2, such openings may comprise an opening from the bore of the tube communicating with a relatively small coaxial opening from the outer surface of the tube. The number and spacing of the openings 80 are such that the casting cavity may be filled without undue turbulence and that shrinkage of the casting may be adequately fed.

In operation, molten metal is introduced into the cavity 26 through the sprues 80 of the tube 76 until the cavity is completely filled and the tube is filled to a level above the cope surface, thereby furnishing feed metal for the casting. Pouring is then terminated by activating the hydraulic cylinder 56 and sliding the mold over on the base, as shown in FIG. 1, or by moving the slide cutoff 66 illustrated in FIG. 2 to a closed position.

After the outer surface of the casting has chilled, the mold parts are separated from the casting and removed, while the refractory tube 76 is retained. The metal in the tube 76 remains molten because of the surrounding envelope of molten steel in the casting, which allows a ferrostatic head to be maintained to feed the casting through the sprues 80. It may thus be seen that the sprues 80 are preferably located at or near the last portion of the casting to solidify.

It will also be understood that the mold 10 may also be filled from the top by any suitable means, such as a bottom pour ladle. For this purpose, a steel plug is placed in the opening 42 of the drag retainer 40, and molten metal is introduced at the open top of the tube 76.

After the casting has completely solidified, the remaining metal in the core is attached to the casting only in the area of the sprues 80, and the core may be removed with a hydraulic punch on a press, thereby resulting in a casting with a hollow core.

Having thus described the invention, what is claimed is:

1. In a method for producing ferrous castings in a rigid chill mold having a casting cavity, the steps of introducing molten metal into said casting cavity through a hollow refractory core disposed in said cavity and having restricted sprues therein communicating with said casting cavity, filling said casting

cavity through said sprues, establishing a ferrostatic head of molten metal in said core above said casting cavity to feed shrinkage in said casting through said sprues during solidification, separating and removing the mold from said casting when the outer surface thereof is chilled and the interior thereof is at least partially molten, allowing said casting to solidify, and removing said core and any metal solidified therein from said casting.

2. In a method for producing ferrous castings in a rigid chill mold having a casting cavity, the steps of introducing molten metal into said casting cavity through a plurality of restricted passages in an insulated core disposed within said casting cavity, filling said core and the entire casting cavity through said restricted passages, allowing said casting to solidify against the chilled surfaces of said mold away from said core while maintaining the metal in said core in molten state, separating and removing the mold from said casting, and feeding the shrinkage of the solidifying casting through said restricted passages from said core.

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