END CORE DESIGN FOR USE AS A CLOSURE ON CENTRIFUGAL CASTING MOLDS

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This invention relates to apparatus for the centrifugal casting of metal, and in particular to a new end core design to be used on the rotating mold of the casting apparatus.

One method used today for making metal tubing or pipes is to centrifugally cast hollow cylindrical castings by pouring a molten metal into a mold rotating at high speeds. The inner and outer diameters of the so-formed castings are then machined to form smooth, flawless cylinders. Extruded machined pieces can then be passed through a reducing machine which will reduce the diameter of such pieces, thereby extending the length if desired.

In casting molten metal in a rotating mold, some means must be provided for preventing the molten metal from running out of the ends of the mold. For this purpose, an end core is generally secured to each end of the mold. However, the end cores presently being used today do not entirely nor satisfactorily prevent run out from the mold ends, and due to this run out of molten metal, the end portions of the casting are in many instances imperfect, requiring the ends of such castings to be cut off, or heavy grinding is required to eliminate the flaws. It is an object of this invention to provide a new end core design having configurations or irregularities formed on the surface of the end core which comes in contact with the molten metal, which will impel the molten metal radially outwardly into contact with the mold, which makes the molten metal spin with the mold, thus retarding or preventing run out from the mold ends.

Other objects and advantages will become apparent from the following description taken in conjunction with the accompanying drawings wherein:

FIGURE 1 is a side view of a centrifugal casting apparatus on which our new end core is utilized;
FIGURE 2 is a perspective view of our new end core which illustrates the embodiment of our invention as shown in FIGURE 1;
FIGURE 4 is a perspective of a second embodiment of an end core;
FIGURE 5 is a perspective of a third embodiment of an end core.

Looking now to FIGURE 1 of the drawings, numeral 10 designates a mold to be used for the centrifugal casting of hollow cylindrical metallic castings. This mold is rotated during the casting process by means of a motor 14, which rotates rollers or bearings 22 and 24 secured on shaft 20 by means of drum 16 and belt 18. Members 26 and 28 which are fixed or secured in any suitable manner support the rotating shaft 20. The other side of the rotating mold is similarly supported by rollers or bearings which are not shown.

The left and right ends of mold 10 contain flanges 36 and 38 respectively, and end cores 40 and 46 are removable, secured, for example by securing or retaining rings 42 and 48 which are bolted by means of bolts 44 and 50, to the flanges during the casting process to prevent the molten metal from being spun out of the ends of mold 10.

Molten metal which is melted in an electric induction furnace (not shown) is transferred from pouring ladle 30 into boot 32 and flows from boot 32 into the hollow interior of mold 10 by means of spout 34 to form the hollow metal casting 13. Gas burners 29 are used to heat the mold to a temperature of from 400—500° F. during the casting process. As illustrated in FIGURES 1 and 2, a thin layer of a suitable lining material 12, for example a mixture of diatomaceous earth containing a small percentage of bentonite clay as a binder, is formed on the inner surface of mold 10 to prevent the molten metal from coming in contact with and becoming fused to the mold 10. This lining material must completely cover the inner surface of mold 10 for if the molten metal were to come in contact with mold 10 even in a few small spots, the fusion formed thereby would be sufficient to prevent the later removal of the casting from the mold. After the casting has been allowed to cool and solidify, end core 40 is removed to permit the casting to be pulled out of the mold.

FIGURES 2 and 3 illustrate one embodiment of our new end core design, containing equally spaced protrusions 62 which extend radially outward from the central opening of the end core a predetermined distance. As the molten metal runs down the length of the mold 10 and comes into contact with the end core 40, a portion of such molten metal will tend to flow downwardly along the surface of end core 40 and eventually run out of the mold through central opening 60 illustrated in FIGURE 2. The molten metal which tends to run down along the surface of end core 40 comes into contact with equally spaced, radial protrusions 62 before reaching central opening 60, and such protrusions on the rotating end core 40 will throw the molten metal outwardly, acting in the same manner as a pump impeller thereby centrifugally pumping such molten metal radially outwardly into contact with the inner wall of the rotating mold, where it will again frictionally engage such wall and thus rotate or spin with the mold 10.

FIGURE 4 illustrates a second embodiment of our invention whereby the end core is provided with equally spaced indentations 70, which extend radially outward from the central opening. FIGURE 5 shows a third embodiment which utilizes equally spaced indentations 80 which extend outwardly at an angle to the central opening from the central opening of the end core. The indentations 70 and 80 formed in the end cores shown in FIGURES 4 and 5 perform in the same manner as the protrusions 62 of the FIGURE 3 embodiment, acting as a pump impeller to throw the molten metal outwardly as it runs down the surface of the end core.

The size and number of protrusions or indentations utilized on the end core is not critical, so long as there are enough and they are of sufficient size to act as a pump impeller thereby causing the molten metal coming in contact therewith to be thrown outwardly against the inner wall of the mold, thus causing it to spin with the mold. The end core can be made of any suitable refractory material and by such standard methods as "shell molding," CO₂ process or the like which have proven satisfactory for such use. As illustrated in FIGURE 1, both the left and right end cores have central openings therein. It is necessary to provide a central opening in the left end core 46 to allows insertion of the pouring spout 34 into the interior of mold 10. The reason the central opening is provided in the right end core 40 is to permit the gases generated during the casting process to escape from the mold 10. It would be possible to omit the opening in right end core 40 shown in FIGURE 1, thereby forcing the gases to double back within the mold 10 and escape from the central opening in the end core position on the pouring or left end. But such gases would tend to carry some of the molten metal along with it out of the mold, and for this reason it is more desirable to provide a central opening in the end core at both ends.
The size of the central opening in the end core is not critical, although it must not be larger than the internal diameter of the casting being poured.

As mentioned earlier, the irregularities, either protrusions or indentations, formed on the end cores prevent the molten metal as it is being poured from running out of the ends of the mold. As an example of the effectiveness of these cores, the design shown in FIGURE 3 was used in making a casting with a 2%" internal diameter, and the central opening in the end core was also 2%". The molten metal spun out of the mold was found to be less than one pound. When castings having 2%" inner diameters were poured using a core with a smooth surface, having a central opening 2%" in diameter, as much as 20 pounds would spin or run out of the mold under similar casting conditions. When large amounts of molten metal run out the mold ends, the end portions of the casting are generally imperfect and require either heavy grinding or else a portion of the ends must be removed from the casting. It should be pointed out that the smaller the diameter of the mold, the thicker the casting wall, the more advantage there is in using our end core design. This is because there will be less centrifugal force tending to prevent the molten metal flowing towards the end core central opening.

The end core of our invention could be used in centrifugally casting materials other than metal, for example certain types of plastics where run out from the ends of the mold is a problem. Irregularities on the surface of the end core might also be of value even though there is no central opening in the end core. Such irregularities would still tend to cause the molten metal coming into contact therewith to be pumped or impelled radially outwardly against the inner mold wall, and thus they would prevent any metal from running down into the center of the mold near the mold end.

While we have shown and described the preferred embodiments of the invention it is to be understood that the invention is not limited thereto but may be otherwise variously embodied and practiced within the scope of the following claims.

What we claim is:

1. Apparatus to be used for centrifugal casting including a substantially horizontally positioned hollow cylindrical mold, said mold having a first pouring end and a second nonpouring end, means for rotating the mold, means for introducing a molten material into the mold through the first end, an end core secured to the second end, irregularities on the surface of the second end core which comes in contact with the molten material being cast, said irregularities being positioned such, and being of such configuration that they act as a pump impeller while the mold and end core are rotating to give the molten material which tends to run down the end core surfaces additional spin.

2. The apparatus set forth in claim 1, wherein said irregularities are protrusions on the surface.

3. The apparatus set forth in claim 1, wherein said irregularities are indentations on the surface.

4. Apparatus to be used for centrifugal casting including a substantially horizontally positioned hollow cylindrical mold, said mold having a first end and a second end, means for rotating the mold, means for introducing a molten material into the mold, which molten material will flow longitudinally in the mold, a first end core secured to the first end, a second end core secured to the second end, said first and second end cores each having means forming a central opening therein, said first and second end cores also having irregularities on the surface of each which comes in contact with the molten material being cast, the irregularities being positioned such, and being of such configuration that they act as pump impellers while the mold and end cores are rotating to give the molten material which tends to run down the end core surfaces additional spin.

5. The apparatus set forth in claim 4, wherein the irregularities are a plurality of protrusions on the end core surfaces which extend radially outwardly a distance from the central openings.

6. The apparatus set forth in claim 4, wherein the irregularities are a plurality of indentations on the end core surfaces which extend radially outwardly a distance from the central openings.

7. The apparatus set forth in claim 4, wherein the irregularities on the end core surfaces are a plurality of indentations which extend outwardly at an angle to radial lines from the central openings.

References Cited by the Examiner

UNITED STATES PATENTS

1,161,701 11/15 Le May — 22—65
1,944,461 1/34 Pike — 22—200.5
2,690,289 8/37 Fretz — 22—113.5
2,745,152 5/56 Johnson — 22—65
2,770,857 11/56 Boisso — 22—65

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