April 4, 1967 R. RICHARDS 3,311,955

DISPOSABLE MOLD MEMBER FOR CASTING MACHINE

Filed Jan. 6, 1965 2 Sheets-Sheet 1

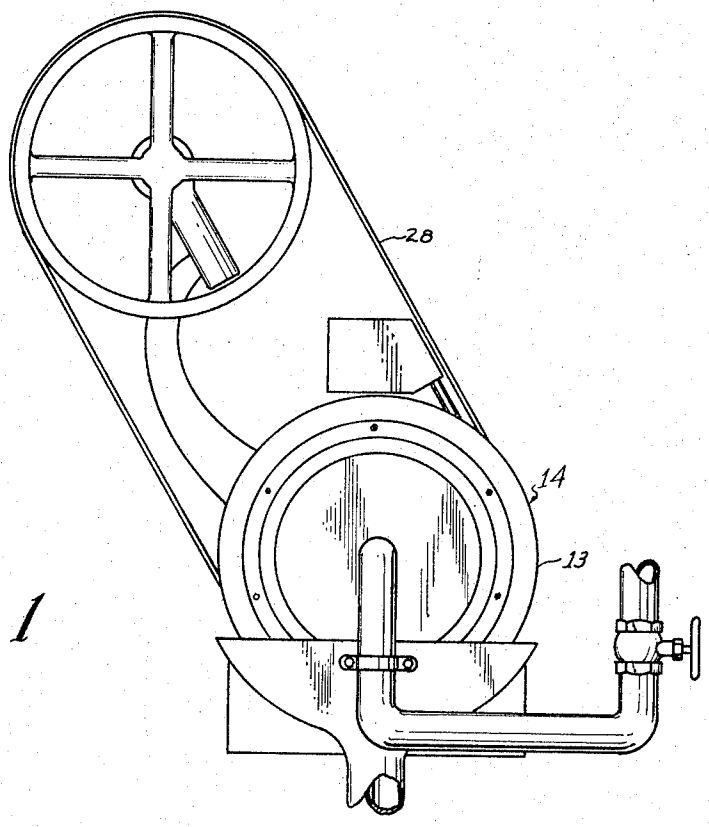

Fig 1

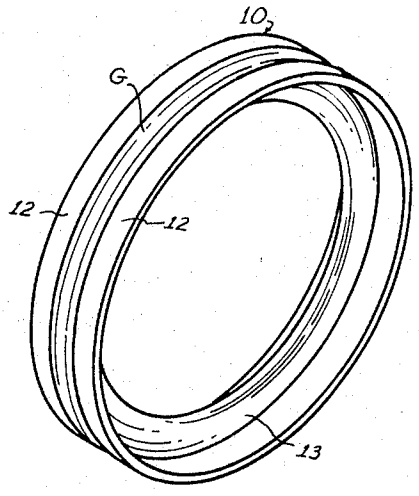

Fig 2

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DISPOSABLE MOLD MEMBER FOR CASTING MACHINE

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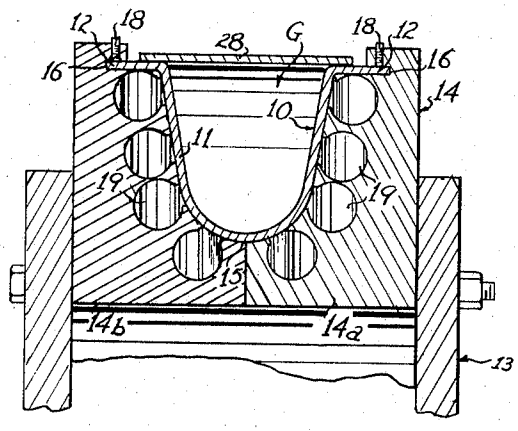
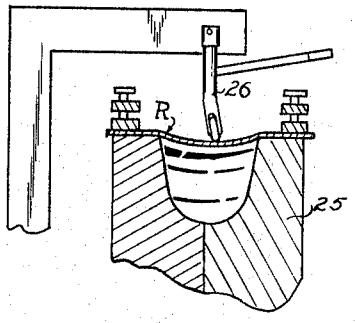


Fig 3

Fig 4



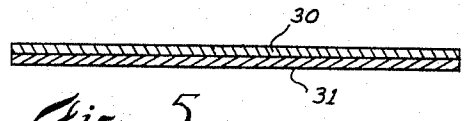


Fig 5

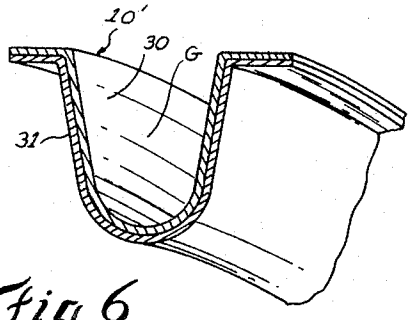


Fig 6

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3,311,955

DISPOSABLE MOLD MEMBER FOR CASTING MACHINE

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This invention relates generally to the casting of metal and more particularly to a removable mold portion that is designed to receive molten metal in a continuous casting process. The removable mold portion may be used to complete a casting ring that is mounted for use on a casting wheel employed in a continuous casting process.

It is well known in the art to cast metal in a groove defined in an annular casting ring, the casting ring forming the periphery of a circular casting wheel and having an endless belt mounted thereon to close the casting groove.

Since prior art casting rings have housed coolant channels within their groove defining walls and have had to support themselves as well as the metal poured into the groove of the casting ring, these casting rings have required the use of relatively thick side walls and bottoms.

In the prior art casting rings, after an extended period of use, the groove surface that contacted the molten metal deteriorated, causing the continuous metal bar cast within the groove to have a rough surface, thus producing a cast metal bar that was extremely hard to roll into rod in the subsequent rolling mill operation since the rough surfaces on the cast metal bar not only had an abrasive effect upon the rolls of the mill but also caused the rough surface of the metal bar to become lapped during rolling. Therefore, once the casting groove surface of prior art casting rings became pitted or otherwise deteriorated, the ring must either be thrown away or remachined. Whenever the casting ring was remachined, the casting groove was enlarged, therefore the metal bar subsequently cast therein was of enlarged cross-section. This produced problems in the subsequent rolling operation in that the rolling mill had to be adjusted to handle this larger cast bar, or the rolling mill would stall from overfilling. Practically, then, the only possible solution was to obsolete the entire casting ring that had a deteriorated metal receiving groove surface.

Since previous casting rings were relatively expensive to form by forging or casting, and relatively expensive to machine, prior art casting rings have caused the cost of the continuous casting of metal around a circular casting wheel to be extremely expensive.

The present invention overcomes these and other problems associated with prior art casting rings in that the portion of the casting ring defining the casting groove or cavity may be discarded without having to obsolete the entire casting ring. The apparatus of the present invention includes a casting ring having two portions; a support member or portion; and a mold portion seated in said support member, yet removable therefrom for replacement by a new mold portion. The mold portion which defines the casting groove is supported along its entire length by the support member, and therefore does not have to be self-supporting. This allows it to be relatively thin and easily manufacturable as well as allowing the utilization of selected metals that possess good heat resistant and thermal conductive properties; whereas the support member which forms the majority of the casting ring may be formed with coolant channels therein and manufactured from relatively inexpensive material. Since the support member does not have to be obsoleted when the removable mold portion becomes deteriorated, only the removable mold portion is discarded; and, since this is a small segment of the total casting ring, a low

cost of maintenance is achieved and an economical continuous casting operation is provided.

In summary, the removable mold portion may be made of materials having good heat resistance, heat transfer, strength and wear properties without entailing a prohibitive manufacturing cost, while the support member may now be fabricated from inexpensive material and by an inexpensive manufacturing operation.

The mold portion is fabricated by a conventional process such as metal spinning. This allows the use of flat sheet material as the basic stock for the fabrication of the mold portion rather than requiring a relatively expensive casting or forging as is required in the fabrication of prior art casting rings. The sheet material from which the mold portion is fabricated may be a single layer of material or a multilayer material produced by bonding several layers of different metals of flat stock together before the desired groove has been formed for the mold. If a metal spinning process is used for fabricating the mold portion, the formed surfaces are smooth, and therefore require no futther machining. The use of a metal spinning process, then, serves to reduce the fabrication cost of the mold member.

The use of a multilayer material in the mold member allows the use of a first material having a high melting point to form the casting groove surface that contacts the molten metal, and a second material having a somewhat lower melting point but a higher thermal conductivity. The second material would be bonded to the inner surface of the first material, resulting in rapid transfer of the heat delivered to the first material by the molten metal to the coolant as well as providing sufficient strength to prevent rupturing of the mold portion.

These and other features and advantages of the present invention will become more apparent from the following details and description when taken in conjunction with the accompanying drawings wherein like characters of reference designate the same parts throughout, and in which:

FIG. 1 is an elevational view of a casting machine of the type wherein the invention may be embodied;

FIG. 2 is a perspective view of a removable mold portion constructed in accordance with the present invention;

FIG. 3 is a partial cross-sectional view of a casting wheel showing the removable mold portion in place within the support member portion of the casting ring;

FIG. 4 is a partial cross-sectional view of a portion of a conventional machine, such as a lathe, which can be used for manufacturing the removable mold portion;

FIG. 5 is a cross-sectional view of a multilayer strip of material before being formed into the removable mold portion; and,

FIG. 6 is a perspective view of a portion of a multilayer, removable mold portion.

The following specification discloses a specific embodiment of the invention; however, the invention is to be understood not to be limited to the specific details disclosed herein since it may be embodied in other equivalent forms.

Referring to FIG. 3, the invention is seen to comprise generally a removable mold portion 10 carried by an annular support member 14 and positioned in a conventional casting wheel 13. An endless metal belt 28 extends around the casting wheel so as to define a casting cavity in conjunction with the mold portion 10.

Referring more particularly to the replaceable mold portion 10, it is seen to be a thin, annular member defining a casting groove G by its outer peripheral surface. In cross-section the mold portion 10 is seen to be a U-shaped member having outwardly projecting lips 12 at the extending ends of side walls 11.

By reference to FIG. 6, a mold portion 10' is shown which has the same general configuration as the mold portion 10, but has a bonded multilayer cross-section. The layers of the cross-section may be bonded from sheets of the different metals that may be desired; however, practice has shown that a material having a high melting temperature as well as good strength characteristics such as copper-zirconium alloys should be used for the first layer 30 that forms the surface of the casting groove G which receives molten metal, whereas a material having a higher heat conductivity than the one mentioned above should be used for subsequent layers 31. This presents a hard, durable, non-deteriorating surface to the molten metal being cast without destroying the good heat transfer characteristics sought to be had by the mold portion.

For supporting the removable mold portion 10 which alone does not have sufficient structural strength to support adequately molten metal in the casting groove G, there is provided a split support member 14 which has a peripheral annular recess 15 therein, the recess 15 receiving the mold portion 10 and substantially conforming in shape to the shape of the peripheral groove G. The support member 14 is formed in mating sections 14*a* and 14*b* so that the support member 14 can be disassembled for replacing the mold portion 10. Since the mating sections 14*a* and 14*b* are complementary, i.e., mirror images of each other, they will be described in their mated position, it being understood that the sections 14*a* and 14*b* have corresponding parts. Just inwardly of the outer periphery of support member 14 and concentric therewith is an annular retaining slot 16 on either side thereof, which opens into the recess 15 and serves to receive the transverse, outwardly extending lips 12 of the mold portion 10. A plurality of set screws 18 is provided in the outer periphery of support member 14 extending into the slots 16 for retaining the lips 12 of the mold portion 10 in place.

As seen in FIG. 3, the support surface of the recess 15 that receives the mold portion 10 supports the mold portion 10 along its entire length and is formed with a plurality of annularly extending coolant channels 19 so that, when the replaceable mold portion 10 is carried within the recess 15, coolant flowing through the channels 19 passes adjacent the inner surface of the replaceable mold portion 10 to cool the mold portion 10 that is in contact with the molten metal. The channels 19 are connected to a central source of coolant in conventional manner, so that the rate of coolant flow through the channels 19 can be judiciously regulated. Therefore, the mold portion 10 is supported along its entire length, and is cooled along this length when it is seated in the recess 15 and coolant is flowing through the coolant channels 19.

Since the surfaces of the support member 14 are not required to have as smooth a finish as required by the mold portion 10, the support member 14 may be cast by some inexpensive casting process such as sand casting with the coolant channels 19 cast therein so as to reduce the fabrication cost. Moreover, since the support member 14 does not have to transfer heat, an inexpensive material may be used for the support member 14 even though it may have poor heat transfer properties, thereby further reducing the fabrication costs.

The assembly of the mold portion 10 and the support member 14 comprises what is generally called the casting ring of the casting wheel; therefore, the present invention allows the majority of the complicated parts of the casting ring to be retained which serves to reduce the cost of operation.

The mold portion 10 may be fabricated from a single length of thin, flat sheet metal cut to desired width and desired length, or from a plurality of lengths of flat sheets of different metals that are bonded together into a multilayer sheet. The ends of the single or multilayer sheet are then welded or otherwise joined together so as to form an endless ring R.

This ring R is then mounted on a form 25 that is rotatable by some known means, such as a lathe. The metal ring R and the form 25 are rotated, and a conventional spinning tool 26 is used to convert the transversely extending flat surface of the metal ring R into the desired configuration designed for the mold portion 10 defining the casting groove G. The mold portion 10 is then removed from the split form 25 and is ready for use without further machining.

It should be understood, however, that the original thin, flat stock may be produced in a variety of ways such as casting or forging before being formed into a ring and spun into desired shape.

It will be obvious to those skilled in the art that many variations may be made in the embodiments chosen for the purpose of illustrating the present invention without departing from the scope thereof as defined by the appended claims.

What is claimed as invention is:

1. In a casting machine wherein metal is cast in a peripheral groove around a rotating wheel enclosed by an endless belt, a removable mold portion for said casting wheel, said mold portion including a plurality of layers of different metals bonded together to form a single member, said mold portion being shaped to define said casting groove, means for supporting said mold portion on said wheel, and means for cooling said mold portion, said means for supporting said mold portion being cast with said cooling means cast integrally therein.

2. The casting machine of claim 1 in which said means for cooling said mold portion includes a plurality of annular channels in said means for supporting said mold portion.

3. The casting machine of claim 2 in which at least a portion of a side of each of said channels is formed by said mold portion.

4. In a casting machine for casting metal in a mold defined by the peripheral groove in a casting ring and by a belt which closes a length of said groove, said casting ring including an annular support member having a first section and a mating second section and having formed in its outer peripheral surface an annular recess which substantially conforms in shape to the shape of said peripheral groove; a mold portion positioned within said recess between said first section and said second section and shaped to form said peripheral groove, said mold portion being in contact with but separable from said support member and being of insufficient structural strength to support adequately the weight of a metal in said peripheral groove in the absence of said support member; and means for separating said first section from said second section so as to allow the removal of said mold portion from said support member.

5. The casting machine of claim 4 in which said mold portion includes a plurality of layers of metal bonded to each other.

6. The casting machine of claim 5 in which said layers of metal are of different metals.

7. The casting machine of claim 4 including means for cooling said mold portion.

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