Sept. 9, 1952 I. ROSSI 2,609,574

APPARATUS FOR THE CONTINUOUS CASTING OF METAL RODS

Filed June 25, 1949 2 SHEETS—SHEET 1

FIG.1.

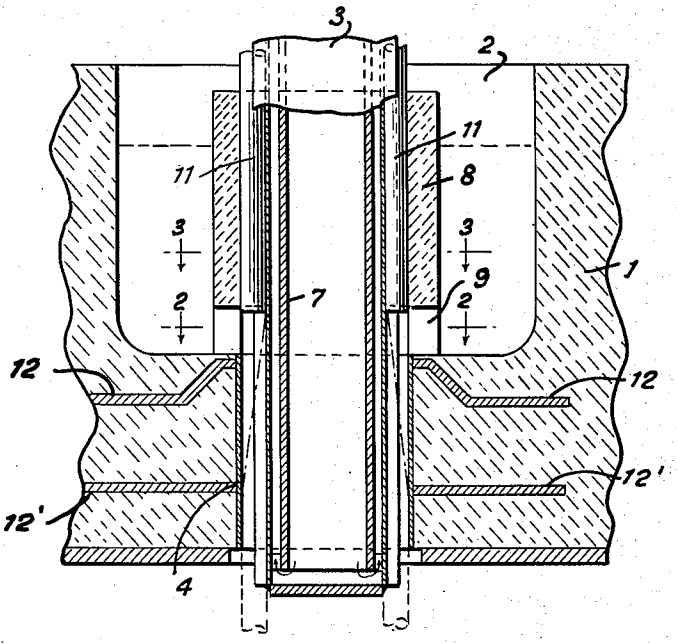


FIG.2.

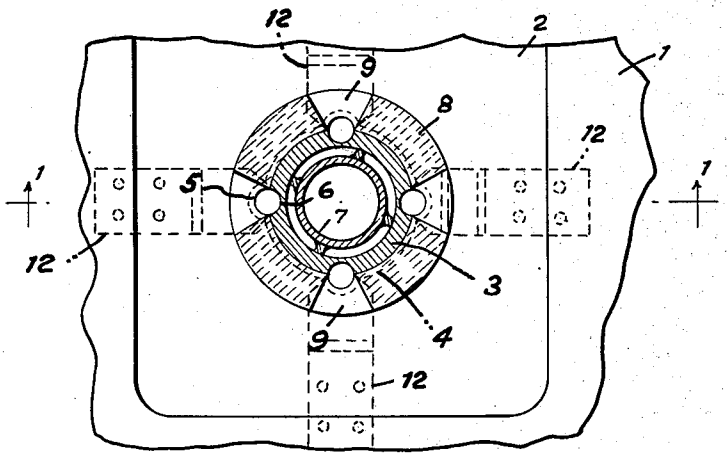
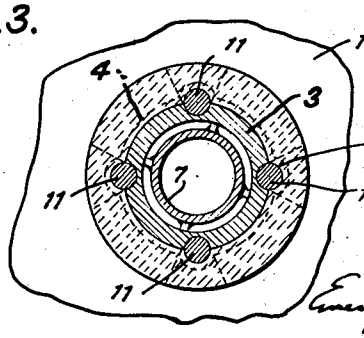


FIG.3.



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Filed June 25, 1949 2 SHEETS—SHEET 2

FIG.4.

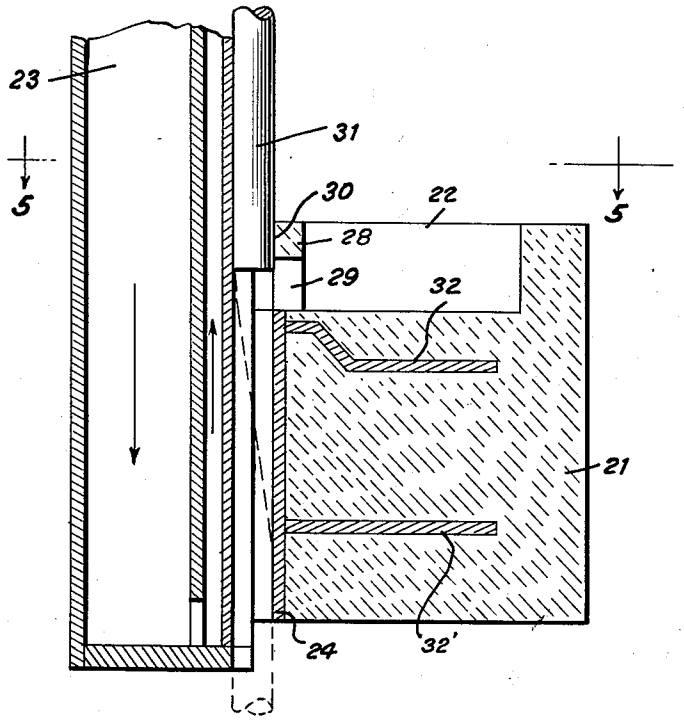
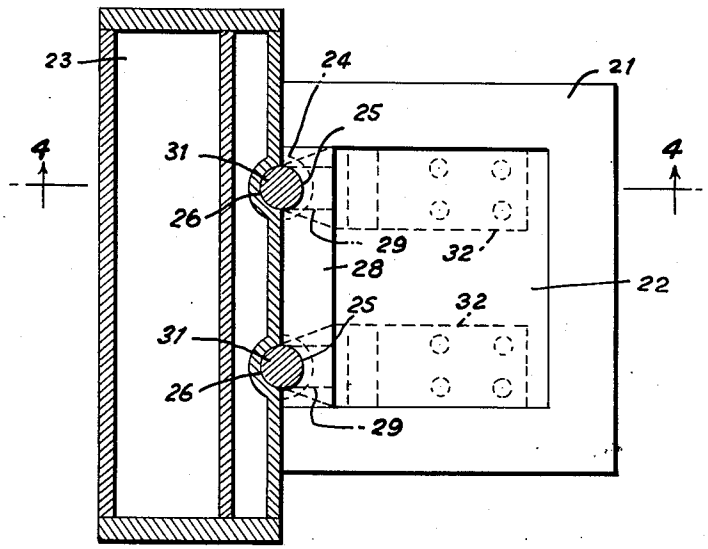


FIG.5.



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2,609,574

APPARATUS FOR THE CONTINUOUS CASTING OF METAL RODS

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Application June 25, 1949, Serial No. 101,324

9 Claims. (Cl. 22—57.2)

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This invention relates to apparatus for the continuous casting of metal rods, and pertains particularly to apparatus for the simultaneous casting of a plurality of such rods. As commonly understood in the art, the term rod is used to designate an elongated shape of relatively small cross sectional area, usually circular.

Rods are usually formed by hot rolling processes, and while it has previously been proposed to cast metal rods continuously, the methods and apparatus used heretofore have been inherently slow and expensive in operation. It is an object of the present invention to provide apparatus in which several rods may be cast simultaneously in a single operation, thereby reducing substantially the cost per unit.

Other objects and advantages of the invention will appear hereinafter.

A preferred embodiment of the invention selected for purposes of illustration is shown in the accompanying drawings, in which,

Figure 1 is a vertical section on the line 1—1 of Figure 2.

Figure 2 is a section on the line 2—2 of Figure 1.

Figure 3 is a section on the line 3—3 of Figure 1.

Figure 4 is a vertical section on the line 4—4 of Figure 5 of a modified form of apparatus.

Figure 5 is a section on the line 5—5 of Figure 4.

According to the present invention a plurality of rods are cast simultaneously against the surface of a water-cooled shell which cooperates with the opposed surface of a mold block, the surface of the shell and the opposed surface of the mold block having a plurality of pairs of opposed grooves formed therein which define a plurality of mold passages in which rods may be cast. In casting, all of the heat which is withdrawn from the molten metal to cause solidification thereof is withdrawn through the water cooled shell. The opposed surfaces of the mold block are maintained at a temperature such as to prevent any substantial withdrawal of heat therethrough. Hence, as the rods are formed, crystal growth proceeds outwardly from the chilled shell surfaces toward the opposed mold block surfaces which limit the crystal growth and smooth the rod surfaces on that side.

In casting, the solidified rods are withdrawn continuously from the mold passages and a pool of molten metal is maintained in the mold block from which molten metal flows into the mold passages as the solidified rods are withdrawn.

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While casting is proceeding, the shell may be reciprocated in accordance with the teaching of Junghans Patent No. 2,135,183. That is, the shell which provides the cooling surface and which, therefore, corresponds to the chilled mold of the Junghans patent, would be reciprocated, moving downwardly with the rods at the same rate at which the rods are being withdrawn, and moving upwardly at a more rapid rate.

Referring to the drawings, one form of apparatus comprises a mold block 1 of any suitable refractory material, said block having a cavity 2 in its upper portion serving as a reservoir in which a pool of molten metal may be maintained, such molten metal being supplied continuously from a suitable holding furnace (not shown).

Extending downwardly through the mold block 1 is a vertical passage adapted to receive the water cooled shell 3 which extends through the passage and preferably projects a short distance below the bottom of the mold block. The interior surface of the mold block passage is preferably lined with a metal liner 4, and is provided with a plurality of spaced vertical grooves 5. The exterior surface of the shell is provided with an equal number of opposed and similarly spaced vertical grooves 6 which cooperate with the grooves 5 to form a plurality of vertical rod shaped mold passages in which rods may be cast.

The interior of the shell is filled with cooling water which may be circulated therein in any desired manner. Preferably the shell is provided with an interior tubular baffle 7 and is provided with suitable water supply connections so that the incoming cold water moves downwardly through the tubular baffle and moves upwardly through the narrow passage between the baffle and the shell as indicated by the arrows.

In order to prevent freezing of molten metal against the ungrooved portions of the walls of the water cooled shell 3 at levels above the floor of the cavity 2, the shell is surrounded by a protective baffle 8 of suitable refractory material which said baffle rests on the floor of the cavity 2. Said baffle, here in the form of a sleeve, is provided with channels 9, aligned with the mold passages, which permit the molten metal to flow into said passages. The said sleeve may also be provided with spaced grooves 10, opposed to the grooves 6 of the shell, and a series of rods 11, preferably of graphite, may be inserted in the passages formed by the grooves 6 and 10 to prevent the molten metal from entering the grooves 6 above the channels 9 and freezing therein. Said rods 11 may be adjustable vertically, if desired,

to limit the uppermost point of freezing of metal within the grooves 6.

It will be observed that the combination of the baffle 8 and the rods 11 prevents the molten metal in the cavity from contacting the chilled shell 3 at any point except within the grooves 6, and within the grooves 6 the extent of freezing may be controlled by adjusting the rods 11.

It will also be observed that in each mold passage, the only chilled surface is that provided by the grooves 6, the surfaces of the grooves 5 being kept hot by the pool of molten metal. In many cases, as when the refractory material used in the mold block is a highly non-conductive material such as zirconia, the heat insulation provided by the mold block itself may be sufficient to prevent appreciable withdrawal of heat through the grooves 5. It is always important, however, to keep the walls of the grooves 5 at a temperature sufficient to prevent appreciable withdrawal of heat therethrough, and means are provided to supply heat for this purpose whenever required. Thus, the liner 4, of suitable electrically resistant material, is provided with a series of electrical connections 12, 12' through which current may be supplied to the grooved portions 5 of the liner 4 so that they may be maintained at a temperature sufficient to prevent appreciable withdrawal of heat, i. e. at a temperature approximating the melting point of the metal being cast.

As a result, crystal growth proceeds from the chilled walls of the grooves 6 toward the walls of the grooves 5, and proceeds until the crystals engage the walls of grooves 5. The movement of the rods, as they are withdrawn continuously, causes the forming crystals to be smoothed by the walls of the groove 5 as final solidification takes place.

A modified form of apparatus, embodying and utilizing the same principles is illustrated in Figures 4 and 5. In this form, the mold block 21 has a cavity 22 which is open at one side. The face of the mold block on that side is in abutting contact with a chilled surface of the water cooled shell 23, which said shell may be reciprocated in the manner previously described as casting proceeds. The face of the mold block is provided with spaced vertical grooves 25 and the shell is provided with an equal number of opposed and similarly spaced vertical grooves 26 which cooperate with the grooves 25 to form mold passages in which rods may be cast.

In the modified form the grooves 25 are lined with strips 24 having suitable electrical connections 32, 32' as previously described, in order that the said strips may be heated, if necessary, to prevent appreciable withdrawal of heat.

In the modified form, a protective baffle is also provided to prevent freezing of molten metal against the ungrooved portions of the chilled wall of the shell 23. Thus, the refractory baffle 28, resting on the floor of the cavity, extends across the cavity to form a dam which separates the chilled wall from contact with molten metal, but this baffle is provided with channels 29, aligned with the mold passages which permit molten metal to flow into the mold passages.

As before, the baffle may be provided with spaced grooves 30, opposed to the grooves 26, and graphite rods 31 may be inserted for the purposes previously described.

It will be understood that the invention may be variously modified and embodied within the scope of the subjoined claims.

I claim as my invention:

1. Apparatus for the continuous casting of metal rods, comprising, a mold block having a cavity therein forming a reservoir for molten metal, said mold block having a wall provided with a plurality of spaced grooves in its surface, a water cooled shell having a chilled wall in abutting contact with said mold block wall and extending above the floor of said cavity, said chilled wall being provided with a plurality of spaced grooves in its surface opposed to the grooves in the mold wall and forming therewith a plurality of mold passages communicating with said cavity, and a baffle extending upwardly from the floor of said cavity and in abutting contact with all portions of said chilled wall except the grooves thereof and separating such portions from contact with the molten metal in said cavity.

2. Apparatus for the continuous casting of metal rods, comprising, a mold block having a cavity therein forming a reservoir for molten metal, said mold block having a wall provided with a plurality of spaced grooves in its surface, a water cooled shell having a chilled wall in abutting contact with said mold block wall and extending above the floor of said cavity, said chilled wall being provided with a plurality of spaced grooves in its surface opposed to the grooves in the mold wall and forming therewith a plurality of mold passages communicating with said cavity, and a baffle in said cavity extending upwardly from the floor thereof in abutting contact with the chilled wall of said shell, said baffle being provided with slots aligned with said mold passages for permitting molten metal to flow into said mold passages, the remainder of the chilled wall of said shell being separated from the molten metal in said cavity by said baffle.

3. Apparatus for the continuous casting of metal rods, comprising, a mold block having a cavity therein forming a reservoir for molten metal, said mold block having a wall provided with a plurality of spaced grooves in its surface, a water cooled shell having a chilled wall in abutting contact with said mold block wall and extending above the floor of said cavity, said chilled wall being provided with a plurality of spaced grooves in its surface opposed to the grooves in the mold wall and forming therewith a plurality of mold passages communicating with said cavity, a baffle in said cavity extending upwardly from the floor thereof in abutting contact with the chilled wall of said shell, said baffle being provided with slots aligned with said mold passages for permitting molten metal to flow into said mold passages, the remainder of the chilled wall of said shell being separated from the molten metal in said cavity by said baffle, said baffle being provided with a plurality of spaced grooves opposed to the grooves in said chilled wall, and an adjustable rod in each of the passages formed by said grooves.

4. Apparatus for the continuous casting of metal rods, comprising, a mold block having a cavity therein forming a reservoir for molten metal, said mold block having a wall provided with a plurality of spaced grooves in its surface, a water cooled shell having a chilled wall in abutting contact with said mold block wall and extending above the floor of said cavity, said chilled wall being provided with a plurality of spaced grooves in its surface opposed to the grooves in the mold wall and forming therewith a plurality of mold passages communicating with said cavity, a baffle extending upwardly from the floor of

said cavity and in abutting contact with all portions of said chilled wall except the grooves thereof and separating such portions from contact with the molten metal in said cavity, and a heating element mounted in said mold block and extending along said mold block grooves and adapted to heat the walls of said mold block grooves to prevent appreciable withdrawal of heat therethrough from the metal being cast.

5. Apparatus for the continuous casing of metal rods, comprising, a mold block having a cavity therein forming a reservoir for molten metal, said mold block having a wall provided with a plurality of spaced grooves in its surface, a water cooled shell having a chilled wall in abutting contact with said mold block wall and extending above the floor of said cavity, said chilled wall being provided with a plurality of spaced grooves in its surface opposed to the grooves in the mold wall and forming therewith a plurality of mold passages communicating with said cavity, and a heating element mounted in said mold block and extending along said mold block grooves and adapted to heat the walls of said mold block grooves to prevent appreciable withdrawal of heat therethrough from the metal being cast.

6. Apparatus for the continuous casting of metal rods, comprising, a mold block having a cavity therein forming a reservoir for molten metal and having a passage extending through said mold block from said cavity to the outside, a water-cooled shell extending into said passage, the wall of said passage being provided with a plurality of spaced grooves and the wall of said shell being provided with a plurality of opposed spaced grooves forming a plurality of mold passages, the wall of said shell being in contact with the wall of said passage except where interrupted by said grooves, and a baffle extending upwardly from the floor of said cavity and in abutting contact with all portions of the wall of said shell except the grooves thereof and separating such portions from contact with the molten metal in said cavity.

7. Apparatus for the continuous casting of metal rods, comprising, a mold block having a cavity therein forming a reservoir for molten metal and having a passage extending through said mold block from said cavity to the outside, a water-cooled shell extending through said passage, the wall of said passage being provided with a plurality of spaced grooves and the wall of said shell being provided with a plurality of opposed spaced grooves forming a plurality of mold passages, the wall of said shell being in contact with the wall of said passage except where interrupted by said grooves, and a protective sleeve surrounding said shell above the floor of said cavity, said sleeve being in abutting contact with the wall of said shell and provided with slots aligned with said mold passages for permitting molten metal to flow into said mold passages, the remainder of the wall of said shell being separated from the molten metal in said cavity by said sleeve.

8. Apparatus for the continuous casting of metal rods, comprising, a mold block having a cavity therein forming a reservoir for molten metal and having a passage extending through said mold block from said cavity to the outside, a water-cooled shell extending into said passage, the wall of said passage being provided with a plurality of spaced grooves and the wall of said shell being provided with a plurality of opposed spaced grooves forming a plurality of mold passages, the wall of said shell being in contact with the wall of said passage except where interrupted by said grooves, and a protective sleeve surrounding said shell above the floor of said cavity, said sleeve being in abutting contact with the wall of said shell and provided with slots aligned with said mold passages for permitting molten metal to flow into said mold passages, the remainder of the wall of said shell being separated from the molten metal in said cavity by said sleeve, the wall of said sleeve being provided with a plurality of spaced grooves opposed to the grooves of said shell, and an adjustable rod in each of the passages formed by said grooves.

9. Apparatus for the continuous casting of metal rods, comprising, a mold block having a cavity therein forming a reservoir for molten metal and having a passage extending through said mold block from said cavity to the outside, a water-cooled shell extending into said passage, the wall of said passage being provided with a plurality of spaced grooves and the wall of said shell being provided with a plurality of opposed spaced grooves forming a plurality of mold passages, the wall of said shell being in contact with the wall of said passage except where interrupted by said grooves, and a heating element mounted in said mold block and extending along said mold block grooves and adapted to heat the walls of said mold passages to a temperature sufficient to prevent appreciable withdrawal of heat therethrough from the metal being cast.

IRVING ROSSI.

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