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(54) Method of feeding an ingot mold in a continuous casting system, and an ingot mold assembly for the implementation thereof.

(57) In a continuous casting system which can also yield very thin castings, the ingot mold (2) is fed sidewise by discharging molten steel into two wells (11,12) mounted laterally of the ingot mold (2) and opening into it.

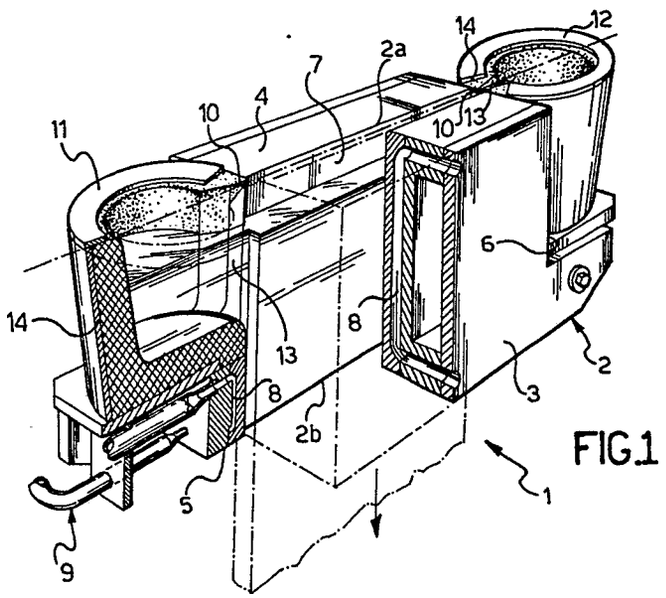

FIG.1

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This invention relates to a method of feeding an ingot mold in a continuous casting system.

As is known, in the sphere of continuous steel casting systems for the production of slabs, thin flat blooms, and the like, ingot mold feeding is a troublesome, if not downright critical, operation because the steel must be poured into a cavity which has a rectangular cross-sectional shape of small width.

According to Italian Patent 1187586, the ingot mold is fed by means of a plurality of discharge outlets overlying the ingot mold and being provided with respective nozzles of an appropriate size to fit partway into the ingot mold.

Feeding the ingot mold from such discharge outlets does not yield, however, very thin flat blooms. In fact, the minimum value for the mold width dimension on which the flat bloom thickness will depend is required to exceed the cross dimension of the nozzles, which nozzles must have, in turn, a sufficient steel discharge passage area to relieve a molten steel outflow of any proneness to blocking and suitable thickness to provide the necessary strength and resistance to wear.

To overcome this limitation, European Patent Application No. 87116456.2 proposes an ingot mold which has an inner portion, inclusive of the inlet, with oversize cross-section so as to accommodate one or more nozzles of standard size discharge outlets. Such changes in the mold inside outline result, however, in the onset of harmful stresses through the melt skin undergoing progressive solidification.

US Patent 4,719,961 provides for the ingot mold to be fed by discharging the molten steel into a funnel of refractory material which overlies the mold but is not inserted through the inlet thereof. While in this way, on the one side, it becomes possible to use ingot molds of much reduced width, on the other side, the funnel presence hinders the continuous lubrication of the inner walls of the ingot mold. Consequently, it is impossible to prevent the steel from adhering on said walls, thereby the solidified steel skin may be broken and the mold rate of wear increased. An additional major drawback is that the steel begins to solidify from the end section of the refractory funnel body, which results in quick deterioration thereof.

The problem that underlies this invention is to provide a method of feeding an ingot mold, to yield thin castings, which has such characteristics as to overcome the drawbacks noted herein above in connection with the prior art.

This problem is solved according to the invention by a method as indicated being characterized in that the ingot mold is fed sidewise.

The features and advantages of method according to the invention will become apparent from the following detailed description of a preferred embodiment thereof, given by way of example and not of limitation with reference to an ingot mold assembly shown schematically in perspective and in partial section in the accompanying drawing.

With reference to the above drawing, generally indicated at 1 is an ingot mold assembly according to the invention.

The assembly 1 comprises an ingot mold 2 of the vertical type having a rectangular cross-sectional shape wherein two opposed, parallel major sidewalls 3, 4 are held apart by two minor sidewalls 5, 6.

The ingot mold 2 is through-penetrated vertically by a passageway 7 having a rectangular cross-sectional shape and extending from a top inlet 2a to an outlet or discharge port 2b of the ingot mold.

The walls 3 to 6 of the ingot mold 2 are made of copper and plural passageways 8 are formed in their thickness for a cooling fluid to be supplied from a conduit 9, only partially shown. Said minor walls 5, 6 are each provided with a respective slit 10, 10a extending over a predetermined distance from the inlet 2a of the ingot mold 2.

Attached laterally to each minor wall 5, 6 is a respective well 11, 12 which is open at the top and provided with a vertical slit 13, 13a in register with the slit 10, 10a in the corresponding wall.

The wells 11 and 12 aremade of a refractory material enclosed and protected by a respective metal reinforcement 14, 14a and stand up to a lower height than that of the ingot mold 2, thereby their bottoms 11a, 12a locate at a higher level than the outlet or discharge port 2b of the ingot mold 2. The ingot mold 2 is fed by pouring molten steel into the wells 11 and 12 using any desired discharge device.

The steel will flow from the wells into the passageway 7 of the ingot mold 2 through the slits 13, 13a and 10, 10a of the wells 11 and 12 and of the walls 5 and 6, respectively.

With this arrangement, therefore, the ingot mold 2 will be fed sidewise from the wellS 11 and 12.

By feeding the ingot mold sidewise, adjustment can be made of the mold width, i.e. the distance between the major walls thereof, to the selected value independently of the size of the nozzles being used, which can therefore be the most appropriate ones. Thus, very thin flat blooms can be obtained having a smaller thickness than 30 mm.

In addition, the ingot mold can be easily lubricated from above with oils and powders over the inner walls to prevent the steel from clinging to them (skin breaking) and attenuate the wall wear.

Further, by pouring the molten steel into the side wells, the steel stream turbulence will be set-

tled therein before entering the ingot mold, while any variations in the line rate and/or molten steel flow rate can be accommodated.

Another advantage afforded by the invention is that impurities can be decanted prior to getting into the ingot mold.

Claims

1. A method of feeding an ingot mold in a continuous casting system, in particular for the production of slabs, thin flat blooms, and the like, characterized in that the ingot mold is fed sidewise.

2. An ingot mold assembly for continuous casting systems, in particular for the production of slabs, thin flat blooms, and the like, being of a type which comprises an ingot mold (2) having oppositely located major (3,4) and minor (5,6) sidewalls defining a passageway (7) extending from an inlet (2a) to an outlet port (2b) of the ingot mold (2), characterized in that it comprises a slit (10,10a) formed in at least one of the minor walls (5,6) and at least one well (11,12) attached laterally to said at least one wall (5,6) and provided with a side slit (13,13a) in communication with said passageway (7) through the slit (10,10a) in said at least one wall (5,6).

3. An ingot mold assembly according to Claim 2, characterized in that said well (11,12) has a lower height than said ingot mold (2), the bottom (11a,12a) of said well (11,12) being at a higher level than the outlet port (2b) of the ingot mold (2).

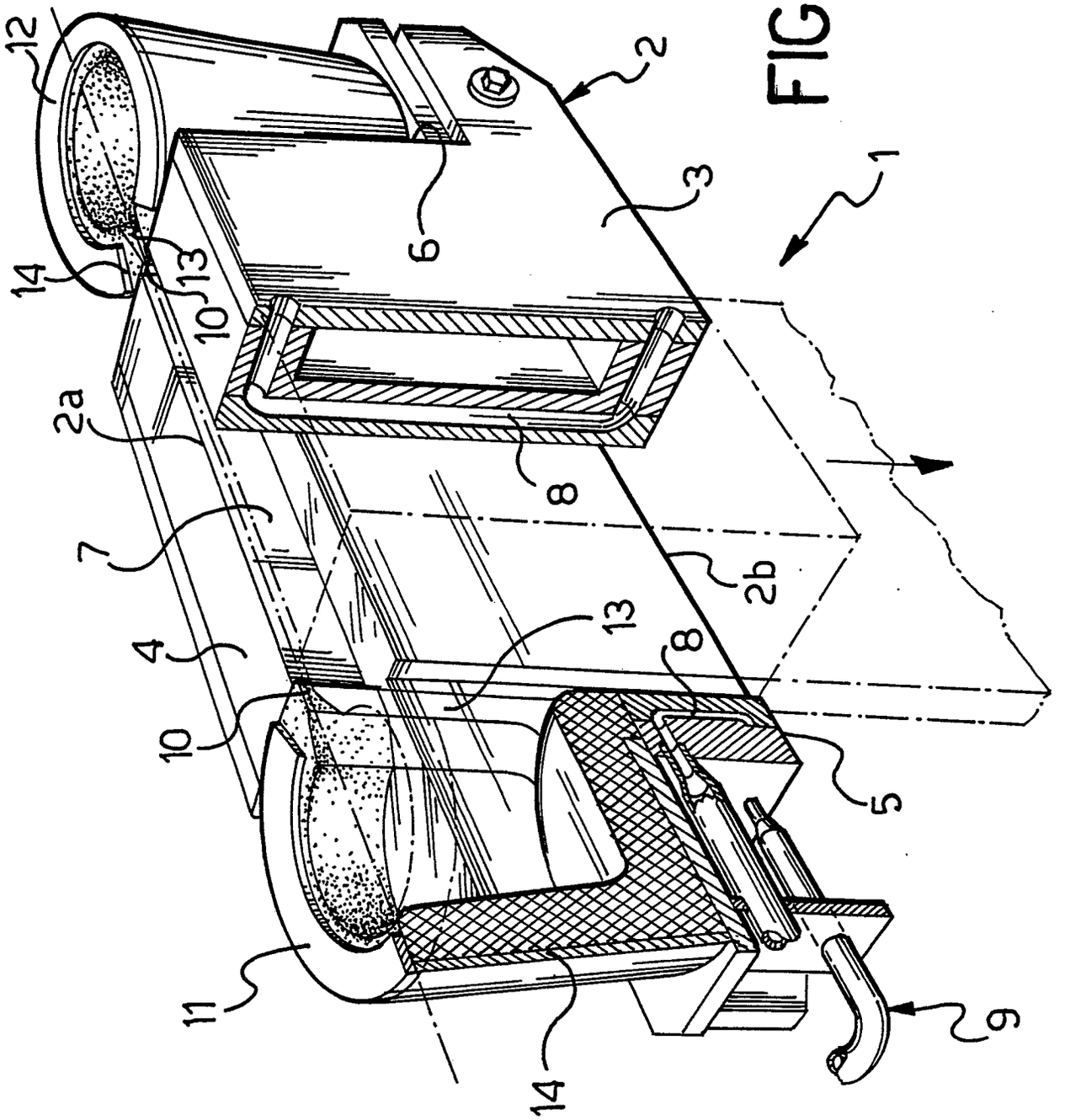

FIG.1

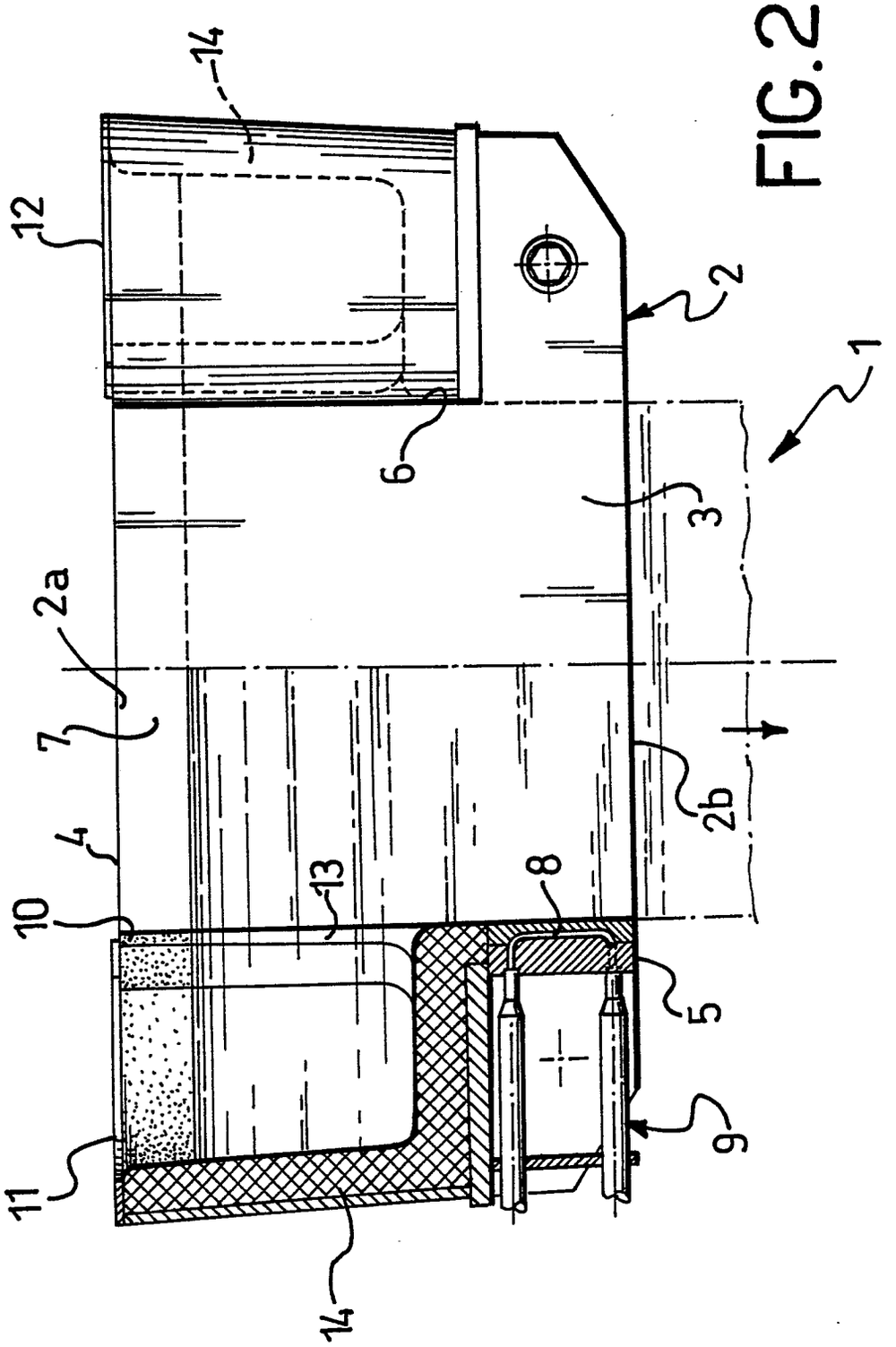

FIG.2

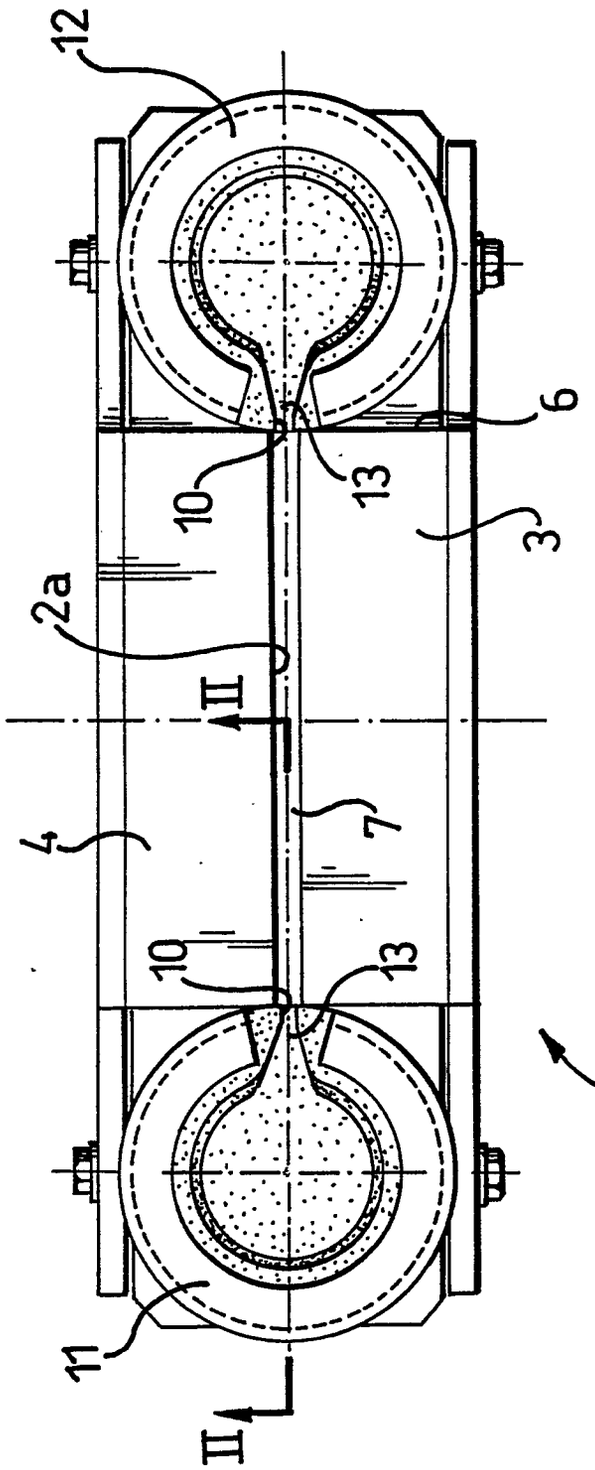

FIG.3