Sept. 15, 1970 KARL-HEINZ GOLDE 3,528,486

DUMMY-BAR HANDLING MECHANISM

Filed May 7, 1968

FIG.2

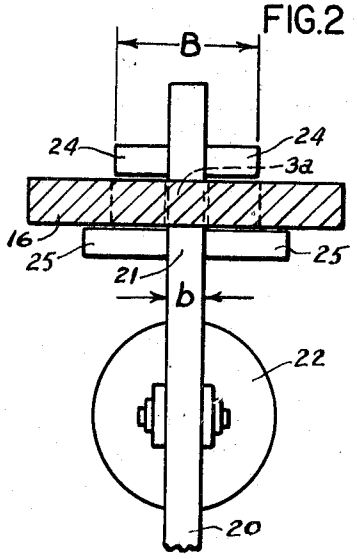


FIG.1

FIG.3

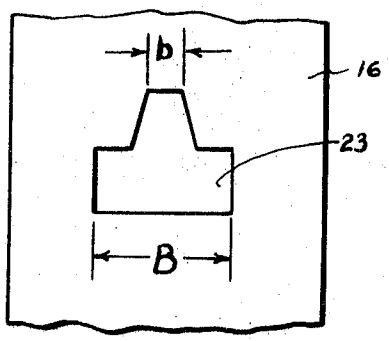


FIG.4

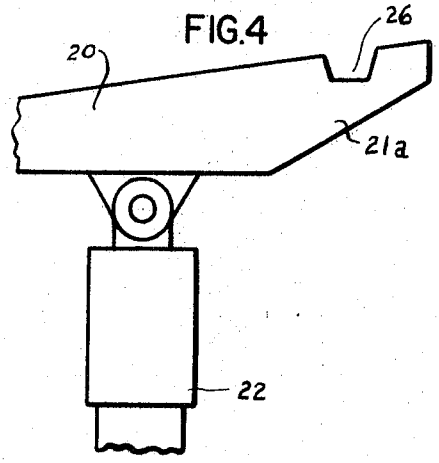
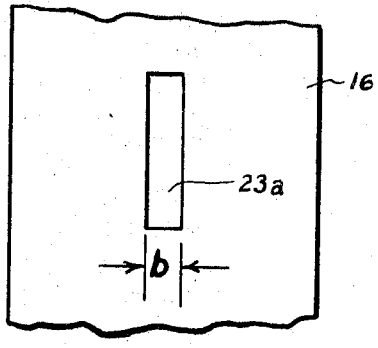


FIG.5



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DUMMY-BAR HANDLING MECHANISM

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ABSTRACT OF THE DISCLOSURE

Mechanism for handling a dummy-bar in continuous-casting apparatus wherein reversible withdrawal rolls for moving a dummy-bar, and a continuous casting following the dummy-bar, vertically downward from a mold includes a first carriage movable vertically to support and guide the lower end of a casting, or of a dummy-bar, down, and also to move the dummy-bar up to the withdrawal rolls which are reversibly driven to move the dummy-bar up to the mold preparatory to casting. A horizontally movable second carriage has a projecting tip which is adapted to be received in an aperture in the side of the dummy-bar for supporting the dummy-bar, in vertical alignment, on the carriage. The dummy-bar is moved up and down as necessary for placing it on or lifting off the tip in conjunction with the horizontal movement of the tip by the second carriage; when the dummy-bar is on the tip the second carriage moves it from a storage position, out of vertical alignment with the withdrawal rolls, into an operative position in line to be moved up to the withdrawal rolls by the first carriage.

The present invention is a mechanism for handling the dummy-bar in continuous-casting apparatus, to take the dummy-bar out of the way when it is not in use, and then to move it into position to be moved up to the mold for the start of casting. The mechanism is particularly adapted for use with continuous-casting apparatus in which the dummy-bar, and the casting following it, are moved vertically straight down from the mold by withdrawal rolls.

The function of the dummy-bar is to plug the bottom end of an open-ended continuous-casting mold for the start of casting. When sufficient metal has accumulated in the mold to start withdrawal of a continuous-casting the dummy-bar is drawn down out of the mold along the path for the casting, which is initially drawn out of the mold by the dummy-bar. The lead end of the casting is usually solidified around a projection on the end of the dummy bar to connect the two. At sometime after the dummy-bar has been withdrawn from the mold it is separated from the casting and stored for reuse.

In known apparatus the lower end of the dummy-bar—and subsequently the lower end of the casting, when the dummy-bar has been removed—is supported and guided by a vertically movable carriage. The dummy-bar has holes transversely through it and when it has been let down below the withdrawal rolls carrier rods are inserted through the holes. Then, after the dummy-bar has been disconnected from the casting and the vertically movable carriage continues its downward movement, the ends of the carrier rods come to rest on a horizontally movable carriage which transports the dummy-bar out of the path of the casting. For the start of casting the carriage supporting the dummy-bar on the carrier rods is moved forward until the dummy-bar is in vertical alignment with the withdrawal rolls. The vertically movable carriage is moved up to support the bottom end of the dummy-bar and lift it far enough for the carrier rods to be withdrawn. Then the vertically movable carrier is moved upward to

raise the upper end of the dummy-bar into the bite of the withdrawal rolls, which move it on up to the mold.

In this known apparatus the carrier rock must be thick enough to withstand the manner of loading—the weight of the dummy-bar being on the central portions of the rods which are supported at their ends. Consequently they are quite thick in comparison with the thickness of the dummy-bar, and the holes through the dummy-bar are correspondingly large, so that the carrier rods are quite bulky and the size of the holes required in the dummy-bar weaken it, and require making the dummy-bar of sufficient dimensions to accommodate the relatively large holes. In addition, due to the manner in which the carrier rods are put in place and removed, the carrier rods are handled manually. Due to the weight of the rods, however, auxiliary power means, such as winches or chain hoists, are ordinarily required, so that the whole procedure is difficult and time consuming, as well as dangerous for the workmen involved.

It is an object of the present invention to provide dummy-bar handling mechanism, which eliminates awkward and dangerous-to-handle carrier rods, and which consists of mechanically operating elements that eliminate time-consuming and dangerous manual operations, and which does not require the provision of relatively large holes through the dummy-bar.

In accordance with this invention mechanism for handling a dummy-bar includes a horizontally moving carriage that has a tip projecting from it to be received in an aperture in the dummy-bar. When the dummy-bar, supported by a vertically movable carriage, is in position with its aperture in line with the tip on the horizontally movable carriage, the latter carriage is moved forward to engage the tip in the aperture. The configurations of the tip and of the aperture are such that when the vertically movable carriage is lowered away from the dummy-bar, the dummy-bar hangs on the tip, in vertical alignment with the withdrawal rolls above. The horizontally movable carriage is then moved back to carry the dummy-bar out of the path of the casting continuing down from the withdrawal rolls. The dummy-bar on the tip is moved back into vertical alignment with the withdrawal rolls by moving the horizontal carriage forward again; the dummy-bar, being held in correct vertical alignment by the tip, is lifted up from the tip by upward movement of the vertically moving carriage. The tip is then retracted from the aperture in the dummy-bar by moving the horizontally moving carriage back so that the dummy-bar is free to be moved up to the withdrawal rolls by further upward movement of the vertically movable carriage.

Illustrative embodiments of the invention are described below with reference to the accompanying drawings in which:

FIG. 1 is a schematic side view of continuous-casting apparatus incorporating dummy-bar handling mechanism in accordance with the invention;

FIG. 2 is an enlarged view along the lines 2—2 of FIG. 1;

FIG. 3 is a front view of a portion of the dummy-bar illustrated in FIG. 2, showing the aperture therein;

FIG. 4 is an enlarged side view of an arm having an alternative form of tip, in accordance with the invention; and

FIG. 5 is a front view of a portion of a dummy-bar having an aperture adapted to receive and cooperate with the tip shown in FIG. 4.

Referring to FIGS. 1, 2 and 3, of the drawings, in the subject continuous casting apparatus, a continuous-casting **10**, formed by an open-end mold **11**, is moved vertically straight down from the mold by withdrawal rolls **12**. The bottom end of the casting **10** is supported and

guided by a first carriage **13** which is movable vertically on a vertical track **14**, by conventional means, such as a driven chain hoist (not shown) having a reversible drive. Auxiliary vertical guides, illustrated by vertical guide **15**, are adjacent the path of the casting **10** to assist in guiding the casting—and a dummy-bar **16**, described below—in a vertical direction.

The dummy bar **16**, for use in starting a casting operation, is elongated and has removable head portion **16***a*, which is adapted to fit in and plug the bottom end of the mold **11**. At the start of casting the dummy-bar **16** is in vertical position through the withdrawal rolls **12** with its head portion **16***a* in the bottom end of the mold. When there is sufficient metal in the mold for the continuous casting to start, the dummy-bar **16** is drawn down from the mold by the withdrawal rolls **12**, the bottom end of the dummy-bar being supported and guided downward by the first carriage **13**.

FIG. 1 shows a casting **10** moving in a vertical line down from the mold, while the dummy bar **16** is supported off to the left, out of the path of the casting **10** on a second carriage **17**.

The second carriage **17** is movable, by a power driven cylinder **18**, on a track **19** in a horizontal direction to intersect the path of a dummy-bar which is moving in a vertical alignment with the withdrawal rolls **12** (i.e. the path of movement illustrated by the casting **10** in FIG. 1). An arm **20**, pivotally supported on the second carriage **17** at one end, has a tip **21** at its other end adapted to support the dummy-bar **16** in vertical alignment. A spring, or shock-absorbing device, **22** is mounted on the second carriage and connected to the arm **20** for resiliently supporting the arm in a predetermined position.

As best seen in FIGS. 2 and 3, for supporting the dummy-bar **16** on the tip **21**, the tip **21** is received through an aperture **23** which is transversely through the dummy-bar. The height of the aperture **23** is greater than the vertical thickness of the tip **21** and the width *b* of the upper portion of the aperture corresponds to the lateral thickness, or width, *b* of the tip **21**. Thus, with the tip **21** in the upper portion of the aperture the walls of the aperture provide support which assists in maintaining the dummy-bar in vertical alignment when it is on the tip.

Two pairs of studs, **24** and **25**, are attached on the tip **21** with the studs of each pair in line projecting out from opposite sides of the tip, and the two pairs spaced apart a distance approximating the thickness of the dummy-bar through the aperture **23**. The lower portion of the aperture **23**, having a width B, is wider than the top portion. The distance between the outer ends of the pair of studs **24** at the forward end of the tip **21** is approximately equal to, or slightly less than, the width B of the lower portion of the aperture so as to fit through. The distance between the ends of the rearward studs **25** is greater than the width B. Thus, when the tip **21** is received through the aperture, and moved up to the upper portion thereof, the thickness of the dummy-bar is embraced by the two pairs of studs **24** and **25**, which hold the dummy-bar firmly in position on the tip **21**.

FIGS. 4 and 5 illustrate alternative cooperating configurations of a tip **21***a* of an arm **20** and an aperture **23***a* in a dummy-bar **16** for supporting the dummy-bar. In this instance the aperture **23***a* is a vertical slot having a uniform width *b* corresponding to the width of the tip **21***a*, and the tip **21***a* has an upwardly facing notch, or hook, **26** for embracing the upper edge of the slot **23***a*. The width of the upper portion of the notch (from front to back) corresponds approximately to the thickness of the dummy-bar through the aperture **23***a* so that the dummy-bar is firmly held in position by the notch.

To prepare the continuous-casting apparatus for operation, the second carriage **17**, having a dummy-bar **16** supported on its tip **21**, is moved forward (to the right from the position shown in FIG. 1) until the dummy-bar is in vertical alignment with the withdrawal rolls **12**, the vertical auxiliary guides **15** being swung out of the way. The first carriage **13** is brought up to the lower end of the dummy-bar and moved up a little further to lift the dummy-bar enough for the tip **21** to be withdrawn from the aperture **23** by moving the second carriage **17** back (to the left). The first carriage **13** is then moved on up to engage the upper end of the withdrawal rolls **12** which are operated to move the dummy-bar the rest of the way up to the mold **10**.

After the start of casting, when the dummy-bar **16** has been withdrawn from the mold **10** and is below the withdrawal rolls **12** with its lower end supported on the first carriage **13**, the first carriage **13** is operated to lower the dummy-bar to a point at which the aperture **23** is in horizontal alignment with the tip **21**. The second carriage **17** is moved forward to insert the tip **21** through the aperture **23**. The first carriage **13** is lowered to let the dummy-bar down firmly on the tip and is lowered enough further to leave the lower end of the dummy-bar free to move horizontally. Then the second carriage is moved back (to the left) to remove the dummy-bar from the path of the casting **10** and to support the dummy-bar in position ready to be moved forward again after the casting run is finished and the casting **10** is out of the way.

What is claimed is:

1. Mechanism for handling a dummy-bar in continuous-casting apparatus wherein reversibly driven withdrawal rolls are adapted for engaging a dummy-bar, and a casting following the dummy-bar, and moving them vertically downward, and alternatively for engaging a dummy-bar and moving it upward into position for plugging the mold of the apparatus, said mechanism comprising: a vertically movable first carriage in line below the withdrawal rolls for receiving and guiding the lower ends, respectively and alternatively, of a dummy-bar and a casting in vertical alignment with the withdrawal rolls, a horizontally movable second carriage, said dummy-bar having a transverse aperture opening through at least one side thereof, a horizontally projecting tip on said second carriage adapted to be received in said aperture for supporting the dummy-bar in a predetermined vertical position, said second carriage being mounted for movement in a horizontal plane for inserting its tip into, and retracting the tip from said aperture when the lower end of the dummy-bar is supported on the first carriage and the upper end of the dummy-bar is below the withdrawal rolls, whereby the first carirage is adapted to support the dummy-bar in vertical position for the second carriage to be moved to insert said tip in said aperture so that the dummy-bar is supported on the second carriage when the first carriage is thereafter moved further downward, whereby the second carriage is adapted to move the dummy-bar supported thereon in a horizontal direction into and out of vertical alignment with the withdrawal rolls, and whereby, when the dummy-bar is supported on the second carriage in vertical alignment with the withdrawal rolls, the first carriage is adapted to engage the lower end of the dummy-bar to move the dummy-bar up sufficiently for the second carriage to be moved to retract said tip from said aperture, after which the dummy-bar is in line and free to be moved up to the withdrawal rolls by subsequent upward movement of the first carriage.

2. The mechanism of claim **1** in which said tip on the second carriage is at an end of an arm pivotally mounted on the second carriage for movement of the tip up and down in a vertical plane, with spring means connected to the arm for resiliently supporting the tip in a predetermined vertical position.

3. The mechanism of claim **1** in which the lateral thickness of the tip and the width of at least the upper portion of the aperture in which the tip is received correspond so that sides of the tip adjacent opposite walls of the aperture provide lateral support for the dummy-bar.

4. The mechanism of claim **1** in which the aperture opens through opposite sides of the dummy-bar, and the

tip is adapted to extend therethrough, said aperture having a height greater than the vertical thickness of the tip, the width of the aperture being greater at its lower portion than at its upper portion, said tip having two pairs of projections from opposite sides thereof, the projections of each pair being in line at right angles from opposite sides of the tip, and the two pairs being spaced apart in an amount corresponding to the thickness through the aperture in a horizontal line along the tip with the distance between the ends of he first pair of projections at the outer end of the tip being less than the width of the lower portion of the aperture but greater than the width of the upper portion, whereby the first pair of projections pass through the lower portion of the aperture and the two pairs embrace the dummy-bar between them when the tip is received through the aperture and is in the upper portion of the aperture.

5. The mechanism of claim 1 in which the aperture opens through opposite sides of the dummy-bar and the tip has an upwardly facing hook portion adapted to embrace the upper edge of the aperture when the tip is received in the aperture and the dummy-bar is unsupported by the first carriage.

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