United States Patent

Bollig

[15] **3,661,199**

[45] **May 9, 1972**

[54] DUMMY BAR STORAGE APPARATUS

[72] Inventor: **Georg B. Bollig,** Buederich, Germany

[73] Assignee: **Schloemann Aktiengesellschaft,** Duesseldorf, Germany

[22] Filed: **Oct. 21, 1969**

[21] Appl. No.: **868,029**

[52] **U.S. Cl.** **164/274**

[51] **Int. Cl.** **B22d 11/08**

[58] **Field of Search** 164/82, 274, 282, 283, 120, 164/269

[56] **References Cited**

UNITED STATES PATENTS

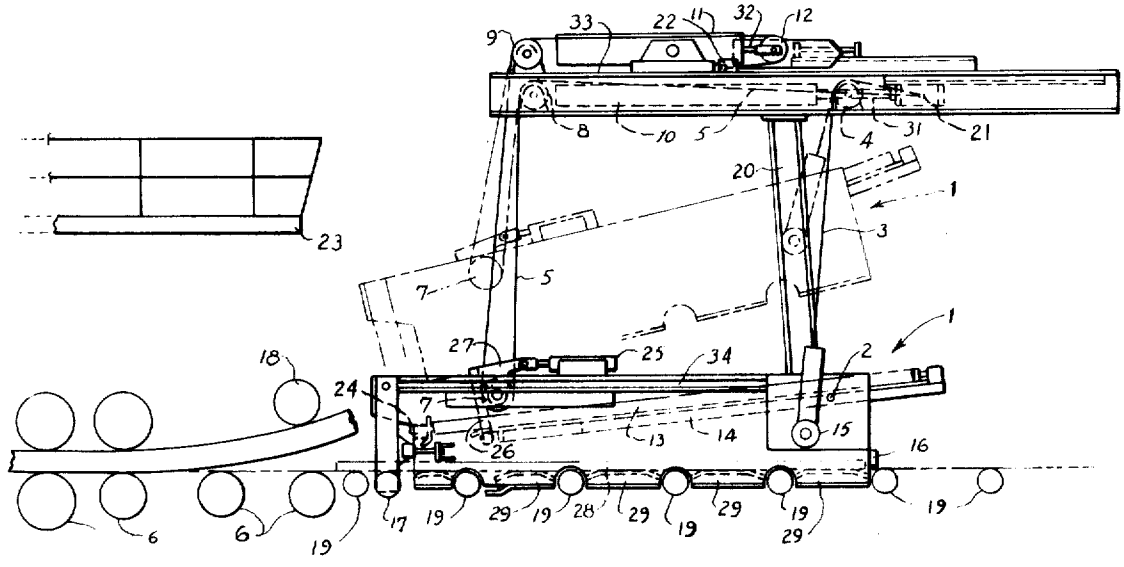
3,351,124	11/1967	Hess	164/274
3,464,482	9/1969	Greenberger	164/274
3,528,486	9/1970	Golde	164/274
3,461,951	8/1969	Szentaszloi	164/282
3,525,383	8/1970	Golde	164/282 X

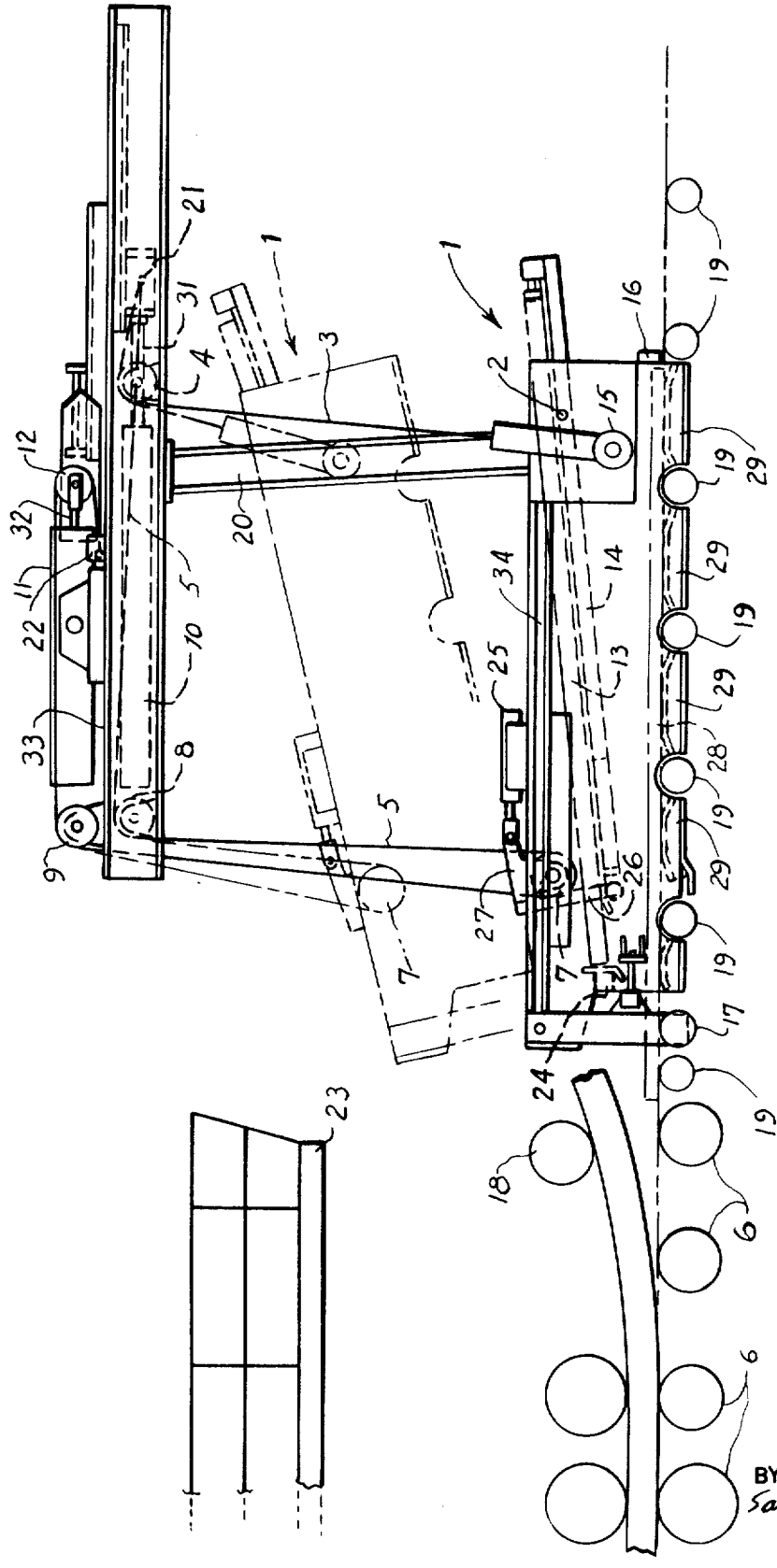
Primary Examiner—J. Spencer Overholser
Assistant Examiner—John S. Brown
Attorney—Sandoe, Hopgood & Calimafde

[57] **ABSTRACT**

In a continuous-casting machine the dummy bar storage apparatus comprises a frame movable into the path of a dummy bar and a rocker storage section pivoted at the rear, downstream end of said frame and adapted to receive thereon a dummy bar which has passed through a withdrawal roll unit for the cast strand. Hoisting means for lifting the frame is adapted to lift the rear end twice as much as the front end and includes means for independently lifting the front end. The hoisting means is thus operable for adjusting the angular position of the frame to the angular position of the dummy bar emerging from the withdrawal roll unit and also for lifting the front end of the frame for disconnecting the dummy bar from the cast strand.

6 Claims, 1 Drawing Figure





INVENTOR.
GEORG B. BOLLIG

BY
Sandoe, Hopgood & Calimafde

ATTORNEYS

DUMMY BAR STORAGE APPARATUS

The present invention relates to a dummy bar storage apparatus for continuous casting machines.

In continuous casting machines of the type under consideration molten steel is poured in one end of an open-ended chill mold wherein the periphery of the steel in the mold solidifies to form a strand which is withdrawn from the other end by a withdrawal roll unit downstream from the mold. In a usual arrangement the strand emerging from the mold in a generally vertical direction follows a curved apron and is then straightened into horizontal direction along a roller table. At the start of casting the exit end of the mold is temporarily plugged by a dummy bar until metal accumulates in the mold and begins to solidify to form a strand, the end of which is attached to the dummy bar by solidification of the metal in the bottom of the mold. The dummy bar, followed by the continuously forming strand is then withdrawn from the mold, disconnected from the strand and stored in dummy bar storage apparatus adjacent the path of the strand.

In its receiving position, the subject dummy bar storage apparatus of the prior art, which includes a rocker support section pivoted at one end, is only capable of forming a certain angle with respect to the roller table plane. The strand, to which the dummy bar is still attached, has a tendency, particularly in continuous casting machines having curved aprons, to leave the withdrawal roll unit and move toward the dummy bar storage apparatus in an upwardly curved condition. This tendency is largely a function of the cross section of the strand, its grade, and particularly its temperature. A very hot strand, for example, will tend to leave the withdrawal roll unit at a relatively small angle relative to the roller table plane while a comparatively cold strand will form a larger angle. Since the frame of the dummy bar storage apparatus, which supports the dummy bar moving into it, forms a constant angle with the roller table plane, a kink will form at the connection point between the dummy bar and the strand. Disconnection is then considerably more difficult since clamping forces, in addition to the normal adhesive forces, must then be overcome in the joint between the dummy bar and the strand. As a result, damage to the head end of the strand or breakdowns can occur.

It is a principal object of the present invention to provide an improved dummy bar storage apparatus of the type described above in which the above-described drawbacks are eliminated. Specifically, the frame of the dummy bar storage apparatus of this invention is adapted to form at all times a precise tangential position with respect to the curvature of the strand emerging from the withdrawal roll unit, so that clamping forces are avoided and will not interfere during disconnection.

In accordance with the invention, this is accomplished by making the frame of the storage apparatus vertically adjustable at both ends by hoisting means which is operable to bring the frame of the storage apparatus into any desired angular position. For this purpose, in accordance with the invention, the hoisting means is adapted for raising the rear end exactly twice as much as the front end and includes means for independently hoisting the front end. Thus, when the strand has passed the withdrawal rolls, the hoisting means can be operated to bring the frame of the storage apparatus into a precise tangential position with respect to the curve of the strand.

The means for independently hoisting the front end enables the frame of the storage apparatus to be lined up accurately with the dummy bar and is utilized for the disconnection of the dummy bar from the strand when the frame of the storage apparatus has been brought into the required tangential position. After the dummy bar has been deposited on the frame of the storage apparatus, the hoisting means may be operated to lift the dummy bar up to a position in which it is accessible for set-up work, inspection, repairs, etc.

The frame of the dummy bar storage apparatus of this invention is also adapted to enable a plurality of dummy bar sections to be deposited on it in a stacked manner.

In order to guide the dummy bar dependably into the frame of the storage apparatus and, moreover, to provide it with a support for the disconnecting operation, the frame of the storage apparatus is advantageously provided with a rear movable stop connected with a disconnecting roller which is adapted for supporting the dummy bar at the front portion of the frame of the storage apparatus. Initially, this disconnecting roller is positioned fairly close to the withdrawal rolls, and is pushed back towards the rear once the dummy bar has reached a rear movable stop inside the frame of the storage apparatus.

An upper withdrawal roll which is adjacent to the frame of the storage apparatus is adapted to be raised in conformance with the upward curve of the head end of the emerging strand.

The invention will now be described in detail with reference to the accompanying drawing, which is a side view of an illustrative embodiment of the apparatus of the present invention.

The entire storage apparatus arrangement is disposed downstream of a withdrawal roll unit **6**, whose last, upper, movable roll **18** is shown in open position. The withdrawal roll unit is followed by the roller table comprising the rolls **19**.

The frame **1** is adapted to be vertically positioned by means of a guide roller **15**, which forms the point of support and which runs on a guide track **20** at the rear, or downstream end of the apparatus. The shaft of the guide roller **15** has a rear cable **3** attached to it and a front cable **5** passes around a pulley **7** which is journaled in the front end of the frame. In the position shown, a rocker support section **14** which is pivoted at **2** near the rear end of the frame has received thereon a dummy bar section **13** and has been raised by means of a cylinder **25**, a lever **27** and a lifting rod **26** into the position shown inside the frame **1**; the dummy bar section **13** is secured against slipping forward by a stop **24**. A further dummy bar section **28**, travelling across the roller table rolls **19** and frame skid plates **29**, is shown moving into the frame **1**.

As soon as the joint between dummy bar and strand (not shown) reaches the vicinity of the rear roll **18** of the withdrawal roll unit **6**, the strand, which has a more or less pronounced upward curvature, depending on its temperature, will lift the dummy bar section off the roller table **19**. At that instant, the frame **1** will be raised by its hoisting mechanism, described later, so far that the skid plates **29**, which then form a rest for the dummy bar, are tangential to the curvature of the emerging strand. The dummy bar is thus able to slide further into the frame without kinking the joint with the strand.

The hoisting mechanism comprises the aforesaid cables **3** and **5**, a lifting cylinder **10** and the pulleys **4**, **7**, **8** and **9**. The cables **3** and **5** are both attached at one end to a carriage **21**, which is fastened to the piston rod **31** of cylinder **10**. The rear cable **3** runs from the carriage **21** over the fixed pulley **4** to its point of attachment to the shaft of guide roller **15** of the frame **1** while the front cable **5** passes from the carriage **21** over the fixed pulley **8**, around the idler pulley **7** which is mounted on the frame **1**, over the fixed pulley **9**, and around the pulley **12**, which is connected with the piston rod **32** of the lifting cylinder **11**, to a plate **22** on a member **33**. As the lifting cylinder **10** moves, its stroke is transmitted in its full magnitude by the rear cable **3** to its point of attachment to the shaft of guide roller **15** of the frame **1** while by reason of the idler pulley **7** said stroke is transmitted only at half of its magnitude through cable **5** to the shaft of pulley **7**, which is mounted on the front, upstream end of the frame **1**. The rear, downstream end of the frame is thus raised twice as high as the front end when the lifting cylinder **10** is actuated. In addition, the front end is raised and lowered by operation of the lifting cylinder **11** so that the inclined position of the frame can be adjusted to correspond to the incline of the strand emerging from the withdrawal unit. As previously mentioned, the more the strand is curved the higher and steeper the joint between strand and dummy bar will be as it leaves the withdrawal unit.

As the dummy bar **28** enters the frame, it is supported by the disconnecting roller **17**, which is connected through a element **34** with the rear strand stop **16** so that the roller **17** and stop **16** may be shifted rearward when the dummy bar reaches the stop.

For disconnecting the dummy bar from the strand, the lifting cylinder 11 is actuated to cause the cable 5 to raise the front end of the frame 1 and bring about the disconnection.

By operating the lifting cylinders 10 and 11, the front end of the frame 1 may be raised up to a working platform 23 from which the storage apparatus and a dummy bar thereon can be prepared for use in a subsequent casting run.

I claim:

1. Dummy bar storage apparatus for a continuous casting machine wherein at the beginning of a casting run a dummy bar connected to the head end of the cast strand is withdrawn from the mold followed by the casting, and a frame is movable into the path of a dummy bar withdrawn from the mold, said frame being adapted to receive and support a dummy bar therein, said apparatus comprising a rocker support section carried on the frame and being pivoted near one end for tilting the other end into and out of the path of a dummy bar from the mold in one position of the frame for receiving a dummy bar thereon, and hoisting means for raising and lowering the frame including means for moving the rear, downstream end of the frame in the same direction but by a greater amount than the front, upstream end, said hoisting means also including independently operable means for additionally raising and lowering said front end for adjusting the angular position of the frame relative to a dummy bar and for raising said front end for disconnecting a dummy bar in the frame from a cast strand.

2. The storage apparatus of claim 1 in which said hoisting means includes a first cable connected for lifting the rear of the frame and a second cable connected for lifting the front of the frame, one end of each cable being connected to first means for moving both cables longitudinally to alternatively lift and lower the frame, said second cable passing around a pulley arranged in a manner such that the pulling of the cables by said first cable moving means causes the front end of the frame to be lifted less than the rear end, and the other end of the second cable being connected to second cable moving means for moving the second cable to alternatively lift and lower the front end of the frame independently of the lifting and lowering of the frame by the first cable moving means.

3. The apparatus of claim 2 in which said first cable has one end attached to said first cable moving means and passes over a pulley and then down with its other end attached to the frame, and in which said second cable has one end attached to said first cable moving means and passes successively over a pulley, down and around another pulley that is mounted on the frame, and then up and over still another pulley with its other end attached to said second cable moving means, whereby operation only of the first cable moving means causes the rear end of the frame to rise and lower twice as far as the front end.

4. The apparatus of claim 1 which includes power means carried on the frame and connected for lowering and raising said other end of the rocker support section respectively into and out of the path of a dummy bar from the mold in said one position of the frame.

5. The apparatus of claim 1 which includes a stop at the rear end thereof in position to be engaged by one end of a dummy bar received on the frame, and a roller at the front end of the frame in position for supporting the other end of said dummy bar when said one end of the dummy bar engages the stop, said support roller and said stop being mounted on the frame for the movement longitudinally thereof and being connected together for movement in the same direction at the same time.

6. The apparatus of claim 1 in which said frame is adapted to receive and support thereon in stacked relation a plurality of sections of a sectioned dummy bar of which the sections are adapted to be separated from each other.

* * * * *