

[54] **DEVICE FOR SUPPORTING A HORIZONTALLY POSITIONED STRAND IN A CONTINUOUS CASTING PLANT**

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[56] **References Cited**

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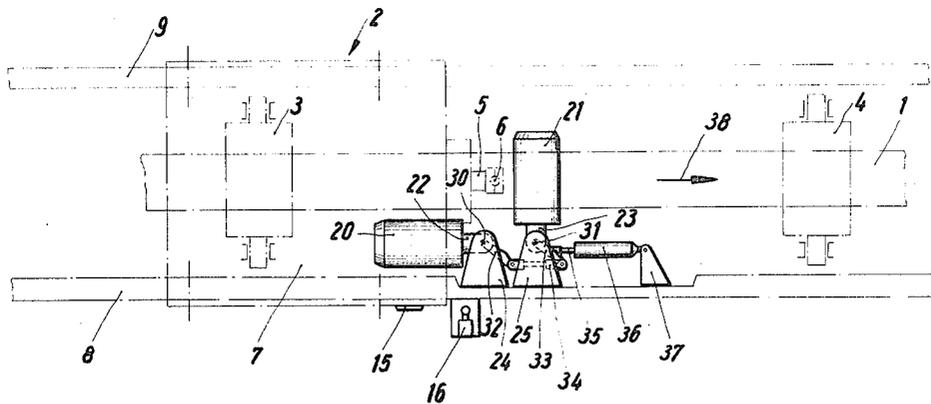
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[57] **ABSTRACT**

In a device for supporting a horizontally positioned strand in a continuous casting plant as it is flame-cut, a pair of supporting rolls is located in the region through which the strand passes as it is severed by a flame cutter. Each of the rolls can be pivoted between a support position disposed below the strand and another position spaced laterally from the strand. The rolls are interconnected so that their axles are disposed at right angles to one another. Due to their interconnection, as one roll is moved into the support position the other roll is moved out of the support position into another position. The supports for each roll can be located on the same side or on opposite sides of the strand.

9 Claims, 2 Drawing Figures



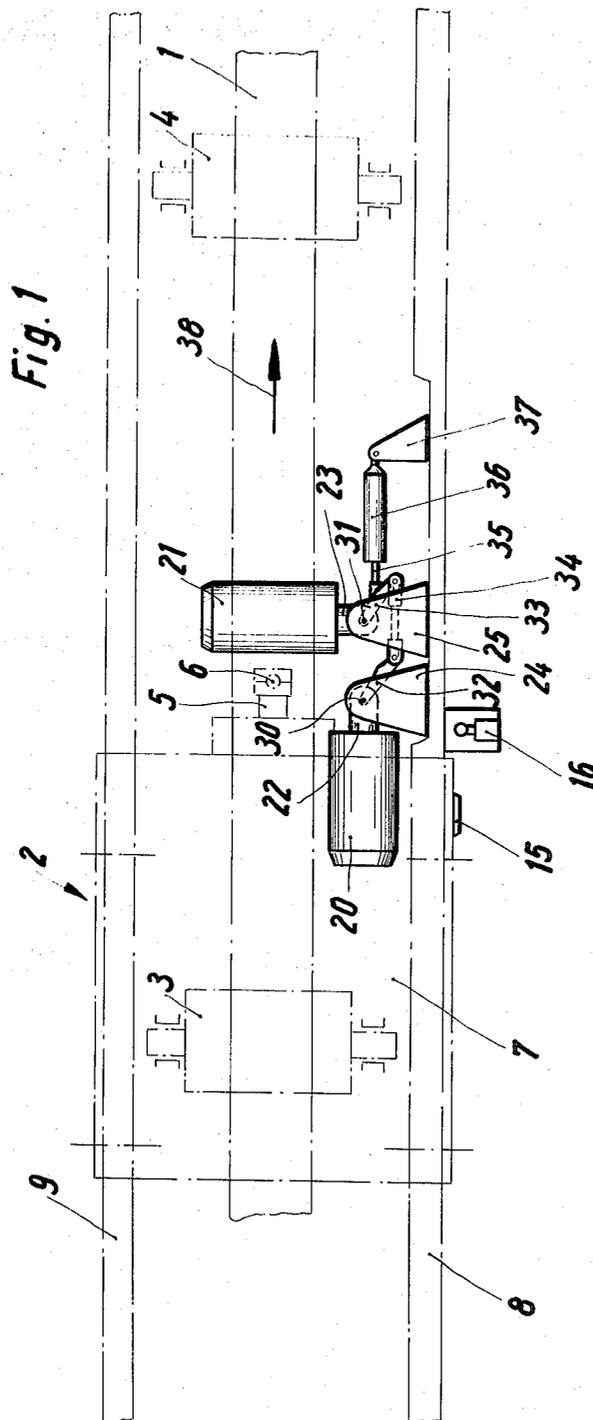
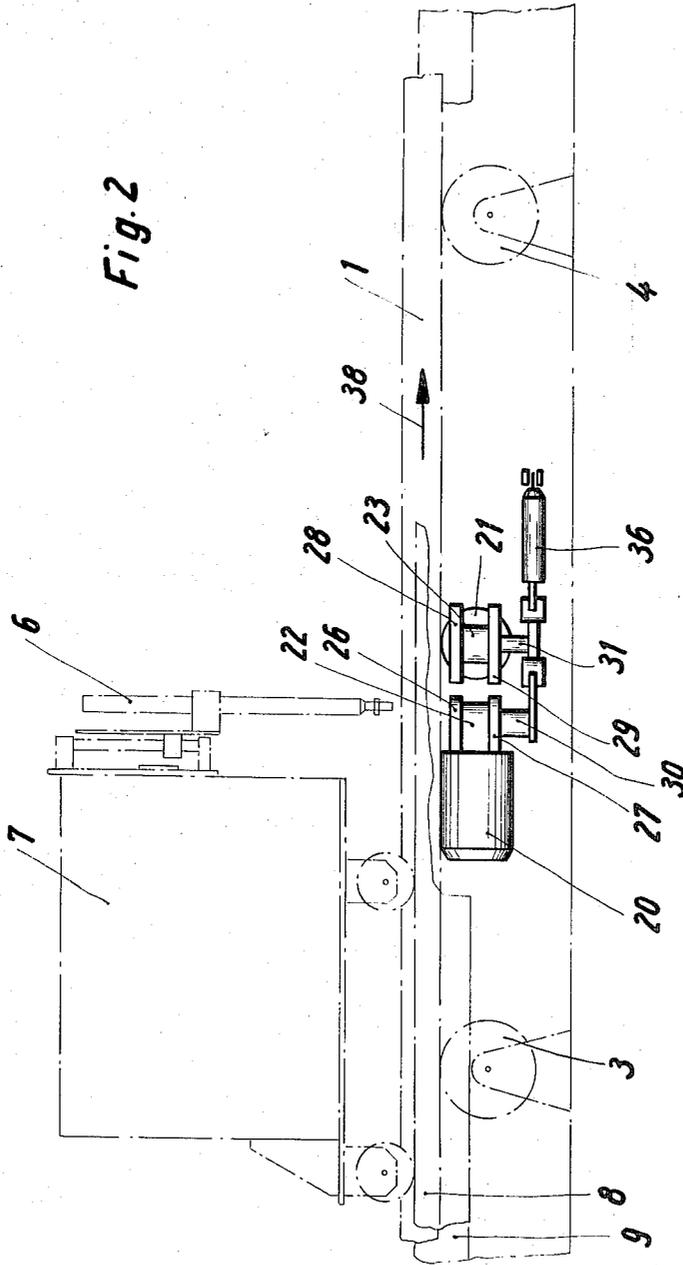


Fig. 2



DEVICE FOR SUPPORTING A HORIZONTALLY POSITIONED STRAND IN A CONTINUOUS CASTING PLANT

SUMMARY OF THE INVENTION

The present invention is directed to a device for supporting a horizontally positioned strand in a continuous casting plant as it is flame-cut and, more particularly, it concerns the arrangement of supporting rolls located in the region through which the strand passes as it is severed by a flame cutter.

Since the introduction of continuous casting systems in which the strand or casting runs horizontally from the mold, the problem has arisen of adequately supporting the strand in the region in which it is flame-cut without causing any damage to the support system from the flame cutter which moves synchronously with the strand. Further, the slag formed during the cutting operation has a tendency to foul the support equipment. In operation, difficulties have been experienced with known supports because they are exposed to the cutting flame as it emerges below the casting and also to slag formed as a result of the cutting operation. To overcome the difficulties experienced, special protection measures have been taken, for example, spray water granulation of the slag formed.

Further, another problem experienced has been with the maintenance of the tracks which support the rollers for the strand and the flame-cutting machine. Since the tracks are positioned below the cutting machine, they are also fouled by slag causing disturbances in operation and increased cost of maintenance.

Where the support track is equipped with only one or two supporting rolls, the distances between the supports cannot be divided optimally. On the entrance side into the cutting zone there is initially a small support distance between the last roll of the roll train and the support members of the track, however, a large distance exists to the support members at the exit side. As the flame cutter moves to the exit end of the cutting zone, the situation with respect to the support distances is reversed. If there is an early termination of the cutting operation, the insufficiently supported strand may bend before it reaches the exit roll train. Other difficulties result when moving the so-called starting chains and when removing left-over sections at the end of the casting operation.

If the flame-cutting machine is coupled with the strand support arrangement, special measures are required to introduce the starting chain into the continuous casting system along with the flame-cutting machine or, respectively, the removal of the trailing end of the strand in a simple manner, as the support equipment moves back and forth with the flame-cutting machine. The back and forth movement of the cutting machine, which may be clamped to the continuous casting, might displace the cut pieces of the strand out of position due to friction. This displacement action is especially noticeable when severing relatively small sections from the end of the strand for achieving a desired length of the end section of the strand.

The costs of the equipment for supporting the strand are, in certain cases, relatively high such as when considerable energy is needed to push up on the sagging strand or when the mechanical instrumentation is too costly. Factors involved in such costs are the dimen-

sions of the casting or strand, the casting rate, the cutting speed, and the length to be cut from the strand.

Therefore, it is a primary object of the present invention to provide an improvement of the known devices for supporting the strand in a continuous casting operation and also to simplify the construction of the support arrangement for increasing operational safety and for reducing maintenance costs.

In accordance with the present invention, a set of supporting rolls are positioned below a horizontally extending strand in a continuous casting operation with the rolls arranged to be displaced from a support position beneath the strand to another position spaced laterally from the strand. Preferably, each set of supporting rolls consists of a pair of rolls which alternately provide the support of the strand in the cutting zone and the position of the rolls is controlled by the flame-cutting machine. In the preferable arrangement of the strand support, one roll is in a supporting position below the strand with its axle extending transversely of the strand, while the other roll is positioned laterally from the strand with its axis extending parallel to the direction of movement of the strand. As the cutting operation proceeds, the roll in the support position is pivoted outwardly until its axle extends parallel to the direction of movement of the strand and the other roll is pivoted inwardly until it is in the supporting position below the strand. As the flame-cutter is moved forwardly in the direction of movement of the strand, the supporting roll is pivoted outwardly so that it is displaced out of the cutting zone and is not exposed to the deleterious effect of the cutting operation. Further, the strand is continuously supported since the other roll previously in the non-supporting position is pivoted inwardly behind the flame cutter and provides the necessary support within the cutting zone. As the cutting operation proceeds, and the pair of supporting rolls are alternatively being pivoted in and pivoted out of the supporting position, the flame cutter is located between the two rolls. The lateral friction force component on the strand which takes place as the supporting roll is pivoted out of the supporting position is compensated by a corresponding friction force component as the other roll is pivoted into the supporting position with the result that there is no lateral displacement of the strand.

The device embodying the present invention has the advantage that its construction is simple and it is inexpensive to make. Further, the maintenance costs on the device are low, since the rolls are positioned to avoid the harmful effect of the cutting flame and the fouling by slag, which occurs at the location of the cut, does not take place because of the pivoting of the rolls. As a result, the device can be operated very safely.

In one arrangement of the invention, both rolls of the supporting roll set can be arranged on one side of the casting or, as an alternative, the rolls can be positioned on opposite sides of the strand. The axles carrying the supporting rolls can be pivotally mounted in bearing pedestals located laterally outwardly from the strand. The bearing pedestals can be formed of a vertically spaced pair of horizontally arranged support plates which are positioned above and below the roll axle with a vertically extending pin positioned between the support plates and providing the pivotal mounting for the axles. A lever is secured to each of the support rolls, such as to the pin, for pivoting the rolls between the dif-

ferent operating positions. The levers for the supporting rolls are interconnected by means of a link so that the axles of the rolls are maintained at right angles to one another. One of the levers is connected to a piston drive device for effecting the pivotal displacement of the rolls. The drive device may consist of a cylinder secured on a bearing pedestal with a piston—piston rod extending from the cylinder to one of the levers. As the flame cutter moves along with the strand a cam can be provided for actuating a limit switch which pivots the supporting rolls into the desired positions.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there is illustrated and described a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

FIG. 1 is a plan view of a supporting device in accordance with the present invention; and

FIG. 2 is a side view of the device shown in FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

In FIG. 1, a strand 1 in a continuous casting plant carries a flame cutting machine 2 between two fixed supporting rolls 3,4. At the forward end of the flame-cutting machine, a rotary mount 5 supports a flame cutter 6 from a carriage 7 which is movably supported on rails 8,9 located on and extending along the opposite sides of the strand 1. By means of a clamping device, not shown, the carriage 7 is moved along by the strand during the cutting operation. Along one side of the carriage 7, as shown in FIG. 1, a cam 15 is positioned which cooperates with a limit switch 16, mounted on the rail 8.

Positioned below the strand and between the fixed rolls 3 and 4 is a set or pair of supporting rolls 20, 21 which are rotatably mounted, by means of ball bearings, on axles 22, 23, respectively. Secured to the rail 8 and extending inwardly toward the strand, but spaced from the strand, are two bearing pedestals 24,25. Each of the bearing pedestals consists of a pair of horizontally arranged, vertically spaced support plates 26, 27 and 28, 29, respectively, and vertically positioned pivot pins 30, 31 extend between the support plates for pivotally mounting the axles 22, 23. Each of the pivot pins has a lever 32, 33 attached to it, and the levers are interconnected by means of a link 34. The lever 33 is articulated to a piston rod 35 positioned within and extendable from one end of a control cylinder 36, the other end of which is secured to a bearing pedestal 37. Though not shown in the drawing, the limit switch 16 is in communication with the control cylinder for effecting a pivoting action of the rolls 20,21. The bearing pedestal 37 is secured to and also extends inwardly from the rail 8.

The levers 32, 33 and the link 34 are arranged so that the axles 22, 23 of the rolls 20, 21 are disposed at right angles to one another when the rolls are pivoted between a support position below the strand and another or non-supporting position located laterally outwardly from the side of the strand. When the control cylinder 36 is actuated, as the cutting machine 2 moves in the

direction of the arrow 38. That is the direction of movement of the strand, the roll 21 is pivoted out of the support position, shown in FIG. 1 and the roll 20 is pivoted into the support position. As the rolls pivot, they are maintained 90° apart by the arrangement of the levers 32, 33 and the link 34. Further, since the friction force components of the rolls operate in opposite directions to one another, they compensate each other and the casting is not displaced laterally out of its path of movement. Though not shown, a return device restores the carriage 7 of the cutting machine back to its starting position after a cut has been made so that another cut can be made.

The operation of the support rolls 20, 21 set forth above, is as follows: when the continuous casting or strand 1 reaches a desired length, with reference to the position of the flame cutter 6 in the starting position of the cutting machine 2, the synchronized movement between the cutting machine 2 and the strand 1 is achieved by clamping machine 2 to the strand or by other suitable means. In this starting position the support roll 21 is spaced forwardly in the direction of the arrow 38 from the flame cutter 6 and supports the strand 1, that is its axle extends transversely of the direction of movement of the strand. At the same time, the other roll 20 of the pair of support rolls is positioned with its axle 22 extending perpendicularly to the axle 23 of support roll 21 so that it is located laterally outwardly from the path of movement of the strand, note FIG. 1. As a result of this displaced position of the roll 20, it cannot be damaged or soiled by the flame cutter 6 or by slag which results from the cutting operation. When the movement of the strand 1 and the cutting machine 2 has proceeded to the point where the flame cutter 6 is positioned before the roll 21 in its supporting position, the cam 15 on machine 2 actuates the electric limit switch 16 positioned on the rail 8 of the support track. Though not shown in the drawing, the limit switch 16 actuates the control cylinder 36 and by means of a suitable hydraulic control, not shown, the cylinder is supplied with a flow of pressurized fluid driving its piston-piston rod 35 which is articulated to the lever 33. As the lever 33 is pivoted by the piston rod 35, the link 34 transmits a corresponding pivoting action to the pivot support for the other roll 20. As a consequence the roll 21 pivots forwardly, in the direction of the arrow 38, out of the path of the flame cutter 6 and out of the support position below the strand 1 into a non-supporting position spaced laterally outwardly from the strand. Conversely, the other roll is swung or pivoted inwardly into the supporting position below the strand and rearwardly of the flame cutter 6. With the correlated movements of the support rolls 20, 21 adequate support for the strand is provided in the cutting zone or region and the support rolls are positioned so that they are not disadvantageously affected by the cutting operation.

The structural dimensions of the support roll arrangement, in particular the positions of the pivot points for each roll relative to one another and to the casting, are arranged so that as the rolls are pivoted into and out of the supporting position, respectively, the roll 20 moves under the strand to the extent that the roll 21 is moved outwardly from its support position under the strand. Accordingly, the casting is supported at all times. Due to the pivoting action of the two support rolls, the sliding force which is produced by the

lateral friction force component as roll 20 pivots into the support position, and which force tends to displace the casting laterally from its position, is cancelled by a counter force produced by roll 21 as it pivots from the support position.

During the return of the cutting machine 2 to its starting position after the completion of a cut, the same pivoting movements take place, triggered by the limit switch, but in a reverse sequence, that is the roll 21 is pivoted back into the support position and the roll 20 is returned to its laterally outwardly located non-supporting position.

If the cutting machine must traverse a greater distance in severing the casting, it is possible to install two, three or more of the pairs of support rolls instead of the single pair as illustrated in the drawing.

The invention is not limited to the example described above and shown in the drawing. There are many diverse possibilities for the construction and arrangement of the support rolls within the scope of the invention. For example, the support rolls 20, 21 need not be positioned next to one another on the same side of the casting, but they may be positioned on opposite sides of the casting.

While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. Device for supporting a horizontally positioned strand in a continuous casting plant during the flame-cutting of the strand, including a flame cutter and means for supporting said strand as it is moved through the zone in which the flame-cutting takes place, wherein the improvement comprises that said supporting means comprise a pair of support rolls, a separate horizontally positioned axle for mounting each of said support rolls, means for pivoting each of said axles through a horizontal plane about a vertical axis located laterally outwardly from the path of the strand for displacing each said support roll between a supporting position and another position located laterally outwardly from the supporting range of the strand, the vertical pivot axes of said axles located in closely spaced apart vertical planes extending transversely of the strand so that the supporting positions of said support rolls are in side-by-side relationship, means for cooperatively interconnecting said axles for moving one of said support rolls into the supporting position and simultaneously moving the other said support roll into the another position as the flame cutter moves in the direction of movement of the strand so that as one support roll is

moved out of the path of said flame cutter the other said support roll is moved into position below said strand rearwardly of said flame cutter.

2. Device, as set forth in claim 1, wherein each of said pair of support rolls in the support position project inwardly below the strand from the same side of the strand.

3. Device, as set forth in claim 1, wherein each of said support rolls in said pair of support rolls extends inwardly below the strand into its supporting position from an opposite side of the strand.

4. Device, as set forth in claim 1, wherein each said support roll of said pair of support rolls comprises a bearing pedestal positioned laterally outwardly from the strand.

5. Device, as set forth in claim 1, wherein each said bearing pedestal comprises a pair of vertically spaced horizontally positioned support plates, a vertically positioned pivot pin extending between said support plates and forming the vertical axis for one of said axles for pivotally mounting said axle so that it can pivotally move its said support roll in a horizontal plane.

6. Device, as set forth in claim 5, wherein said means for cooperatively interconnecting said axles comprises a separate lever secured to each said pivot pin for pivoting the associated said support roll between its supporting position and the another position, and a link interconnecting said levers connected to each of said pivot pins so that as one of said support rolls is pivoted into its supporting position the other one of said pair of said support rolls is pivoted into its another position.

7. Device, as set forth in claim 6, wherein a piston cylinder drive associated with said pair of support rolls and articulated to one of said levers for displacing said support rolls one into the supporting position and the other into the another position.

8. Device, as set forth in claim 7, wherein said piston cylinder drive consists of a bearing pedestal, a cylinder secured to said bearing pedestal, and a piston—piston rod movably displaceably mounted in said cylinder and connected to one of said levers.

9. Device, as set forth in claim 7, wherein said support means includes a pair of laterally spaced rails each extending along and in the direction of an opposite side of the strand, a carriage for supporting and movably displacing said flame cutter mounted on said rails, a cam positioned on said flame cutter, a limit switch positioned on one of said rails and arranged to be actuated by said cam, and said limit switch associated with said piston cylinder drive for actuating the pivotal movement of said pair of support rolls.

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