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Simons

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[54] **METHOD AND APPARATUS FOR CONVEYING A STRAND THROUGH A CONTINUOUS CASTING INSTALLATION**

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[30] **Foreign Application Priority Data**

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[58] **Field of Search** 164/49, 82, 250, 282; 198/41; 310/12

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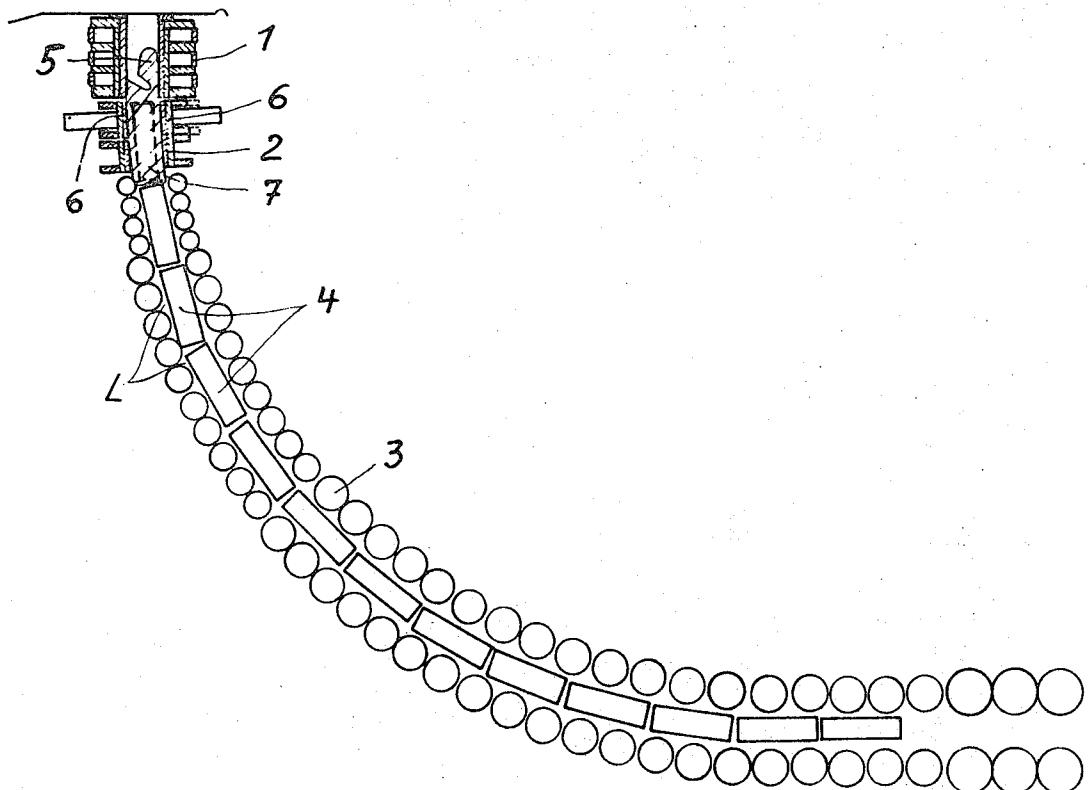
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[57] **ABSTRACT**

A method of, and apparatus for, conveying a strand through a strand guide mechanism of a continuous casting installation by means of electro-motor force, wherein linear electro-motor forces are generated parallel to the strand guide mechanism by induction currents, these linear electro-motor forces acting directly at the strand and determining the movement thereof. The apparatus of the invention contemplates arranging windings serving as the primary of a linear motor parallel to the strand guide mechanism, the secondary of the linear motor being constituted by the strand which is located in the strand guiding mechanism.

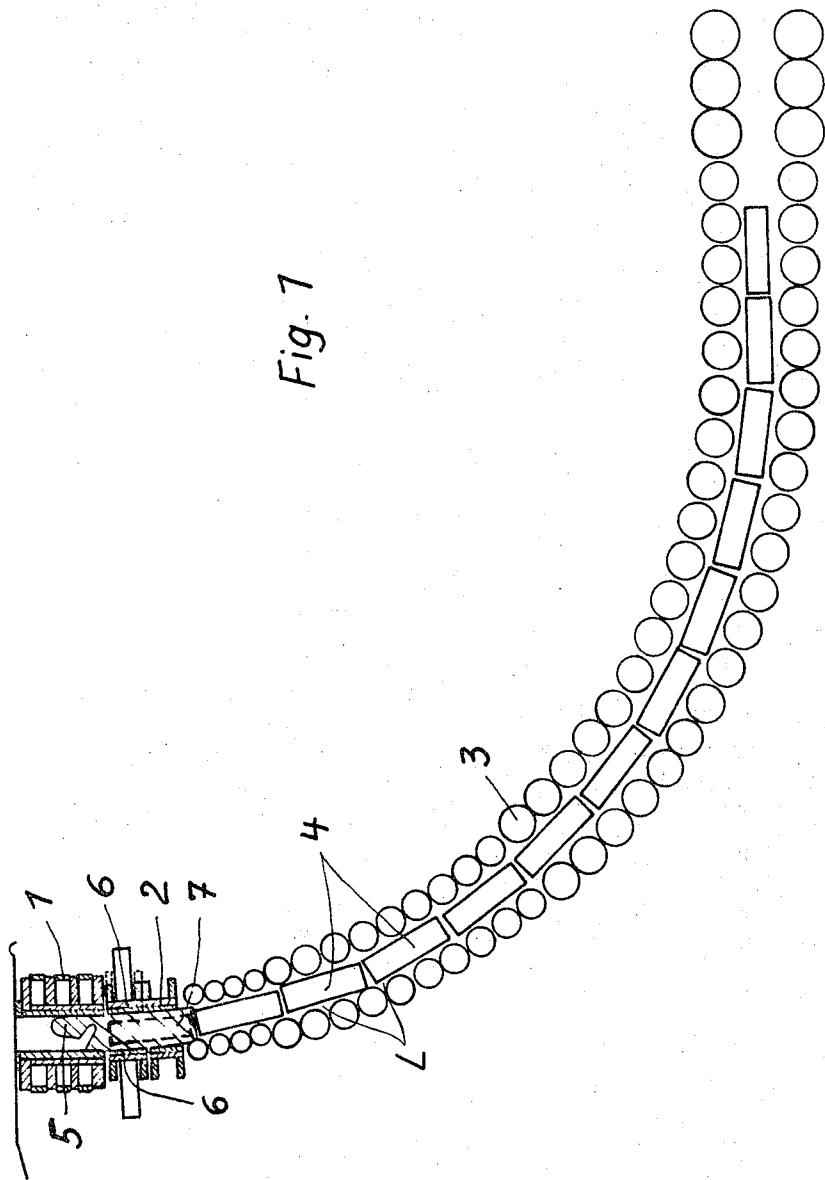
6 Claims, 4 Drawing Figures



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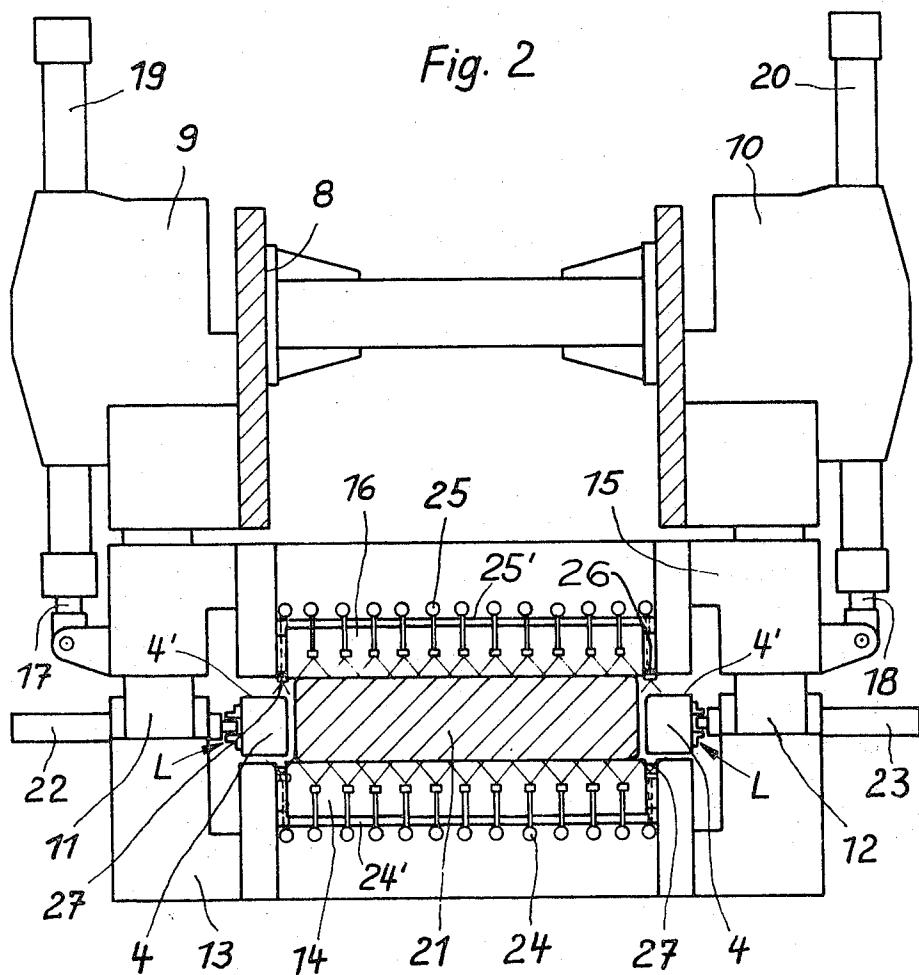
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Fig. 3

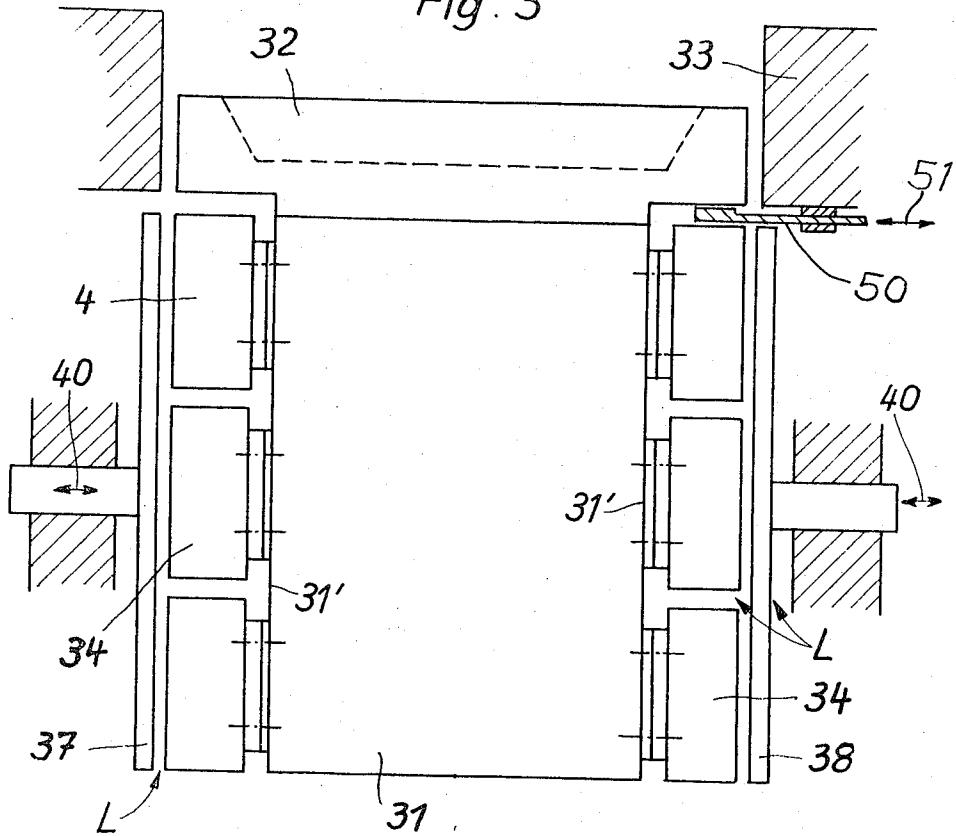
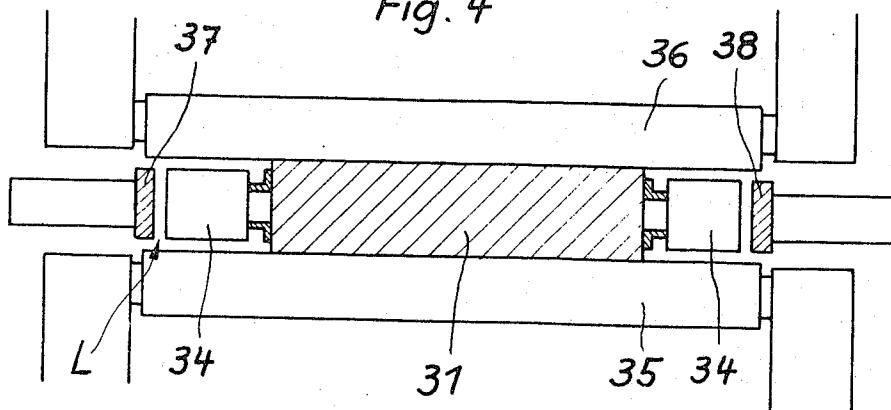


Fig. 4



METHOD AND APPARATUS FOR CONVEYING A STRAND THROUGH A CONTINUOUS CASTING INSTALLATION

BACKGROUND OF THE INVENTION

The present invention relates to a new and improved method of, and apparatus for, conveying a strand through a strand guide mechanism or roller apron of a continuous casting installation by means of electro-motor force. In the context of this disclosure the term "strand" is used in its broadest sense to encompass not only a cast strand but also a dummy bar.

With prior art constructions of continuous casting installations the dummy bars and the cast strands are guided by rollers. For the purpose of conveying such strands, i.e. the dummy bars and the cast strand, a number of the rollers are driven in an electro-motor fashion, wherein the drive force is transmitted by friction from the surface of the rollers to the surface of the strand. Due to the frictional drive the thin shell or skin of the strand is subjected to additional loads, intensifying the possibility of forming fissures or cracks at the strand shell. For supporting the continuously cast strand directly beneath the mold there are provided thin rollers owing to the necessary small support spacing. These rollers cannot be driven. Also when employing plates in the first secondary cooling zone a drive is not possible at this region. The dummy bar must be considerably longer than the first guide section since the next following strand guide mechanism there must be in engagement a number of driven rollers.

SUMMARY OF THE INVENTION

It is a primary object of the present invention to provide an improved method of, and apparatus for, conveying a strand through a continuous casting installation in an extremely novel, efficient and reliable fashion.

A further object of the present invention relates to a new and improved method of, and apparatus for, conveying a strand through the strand guide mechanism of a continuous casting installation by electro-motor force.

Yet a further object of the invention aims at the provision of a novel method of, and apparatus for, conveying strands through the strand guide mechanism while subjecting the strand shell or skin to lesser load.

Another object of the invention relates to a novel method of, and apparatus for, conveying strands through a continuous casting installation in a manner permitting the use of shorter dummy bars.

Now in order to implement these and still further objects of the invention, which will become more readily apparent as the description proceeds, the method aspects of this development contemplate generating linear electro-motor forces parallel to the strand guide mechanism by induction currents, the linear electro-motor forces acting directly at the strand and determining strand movement.

By virtue of this technique of conveying or feeding the strand there is dispensed with loading of the strand shell or skin by the line of attack or engagement of driven rollers, since the drive forces are transmitted in a field-like fashion to the strand. As indicated above the term "strand" as employed herein encompasses a cast- or hot strand as well as the dummy bar.

The apparatus for the performance of the method aspects of this development comprises arranging as the primary of a linear motor windings parallel to the strand guide mechanism, the secondary of the linear motor being constituted by the strand located in the strand guide mechanism. The windings are preferably associated with the side surfaces of the strand, and such windings can be adjusted in accordance with the momentary strand width. The first motor windings can be directly arranged following the mold. The motor windings are preferably encapsulated and provided with a cooling mechanism so that they do not become damaged by heat.

Movement of the strand is governed by electro-motor forces, the magnitude and direction of which can be regulated. In the event of conveying a dummy bar it can be necessary to generate forces which act opposite to the direction of travel of the strand in order to brake the dummy bar which moves, due to the action of its gravitational force, through the strand guide mechanism.

According to a modified construction of continuous casting installation for the performance of the method of this invention the motor windings are arranged at the dummy bar and rails which extend parallel to the strand guide mechanism constitute the secondary of the linear motor. Also in this case there can be used a very short dummy bar. Fewer windings are necessary and such are not subjected to the heat of the cast strand.

For the purpose of fixing the dummy bar head or stopping and withdrawing head in the mold at the start of casting and for bridging longer standstill times after sealing of the dummy bar head it is possible to provide directly beneath the mold a holding mechanism for the dummy bar.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and objects other than those set forth above, will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings wherein:

FIG. 1 schematically illustrates a continuous casting installation incorporating linear motor windings arranged between the guide rolls of the strand guide mechanism;

FIG. 2 illustrates a guide segment of the strand guide mechanism viewed in the direction of the strand;

FIG. 3 schematically illustrates a dummy bar equipped with linear motor windings; and

FIG. 4 is a cross-sectional view of the arrangement of FIG. 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Describing now the drawings, and considering initially the showing of FIG. 1 there is depicted a continuous casting installation or plant having a continuous casting mold 1 for the production for instance of slabs.

After the mold 1 there is arranged a plate guide mechanism 2 and thereafter there is arranged an arcuate-shaped roller apron 3 which runs-out in essentially horizontal direction, as shown. At the region of the narrow sides of the strand there are arranged linear motor windings 4. In order to be able to fixedly hold a dummy bar head or stopping- and withdrawing head 5 in the mold 1 at the start of casting two oppositely situated

holding members 6 of the plate guide mechanism 2 can be displaced towards the short dummy bar 7. The dummy bar 7 and the cast strand form the secondary of the linear motor, generally indicated by reference character L. They are moved through the guides 2 and 3 with the desired speed by the generated induction currents.

The guide segment depicted in FIG. 2 illustrates further details of the strand guide mechanism. At a frame 8 there are laterally attached the brackets 9 and 10 in which there are anchored the columns 11 and 12 respectively. At the columns 11 and 12 there is secured a lower segment member 13 at which there are mounted guide rollers 14. At the columns 11 and 12 there is also guided or mounted an upper segment member 15, at which there are likewise mounted guide rollers of rolls 16. Connected with the upper segment member 15 are the piston rods 17 and 18 of the setting or adjustment cylinder units 19 and 20 secured to the brackets 9 and 10 respectively.

Associated with side surfaces of a strand 21 which is guided at the strand guide mechanism are the linear motor windings 4 of the linear motor means L and these windings can be adjusted by pressurized cylinders 22, 23 at the required spacing determined by stops with respect to the strand 21. At the segment members 13 and 15 there is arranged a respective water cooling system 24, 25, at the infeed lines 24', 25' of which there are also connected spray nozzles 26, 27 for cooling the windings 4, which may be suitably encapsulated as generally indicated by reference character 4'.

In FIGS. 3 and 4 there is illustrated a different embodiment of the invention in which a dummy bar 31 possesses a narrower construction than the associated dummy bar head 32 for closing a mold 33. In order to be able to fixedly hold the dummy bar head 32 in the mold 33 at the start of casting there are provided two oppositely situated holding members 50, only one of which has been conveniently shown at the right-hand side of FIG. 3, and which can be displaced towards and away from the dummy bar 31 as indicated by the double-headed arrow 51. At the sides 31' of the dummy bar 31 which are offset with respect to the dummy bar head 32 there are here arranged the linear motor windings 34 which extend approximately up to the region of the dummy bar head 32. The windings 34 are transported together with the dummy bar 31 between the strand guide rollers 35, 36. Here as the secondary there

are associated with the linear motor windings 34 and the rails 37, 38 in the strand guide mechanism and these rails can be adjusted in any suitable manner with respect to the required spacing with regard to such windings 34, as generally indicated by the double-headed arrows 40 of FIG. 3.

While there is shown and described present preferred embodiments of the invention, it is to be distinctly understood that the invention is not limited thereto, but may be otherwise variously embodied and practiced within the scope of the following claims. ACCORDINGLY,

What is claimed is:

1. In a continuous casting installation having a continuous casting mold and curved strand guide means, an apparatus for conveying a strand through the strand guide means by means of electro-motor force, said apparatus comprising linear motor means incorporating as the primary side windings extending substantially in the direction of the strand guide means, the strand located in the strand guide means forming the secondary side of the linear motor means, said windings being positioned in operable association with the narrow sides of the strand, and means for adjusting the windings in accordance with the momentary strand width.

2. The apparatus as defined in claim 1, wherein said windings include a first motor winding arranged directly after the continuous casting mold.

3. The apparatus as defined in claim 2, wherein the windings are encapsulated and provided with cooling means.

4. The apparatus as defined in claim 1, further including holding means for a dummy bar arranged directly after the continuous casting mold.

5. In a continuous casting installation for casting a strand by means of a continuous casting mold and equipped with strand guide means, an apparatus for conveying a strand through the strand guide means of the continuous casting installation by electro-motor force, said apparatus comprising windings provided at a dummy bar and constituting the primary side of linear motor means and rail means extending substantially parallel to the strand guide means and defining the secondary side of the linear motor means.

6. The apparatus as defined in claim 5, further including holding means for a dummy bar arranged directly after the continuous casting mold.

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