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[54] **ROLLER APRON FOR A CONTINUOUS CASTING INSTALLATION**

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[52] **U.S. Cl.** **72/251,** 164/282

[51] **Int. Cl.** **B21b 39/02**

[58] **Field of Search** ..... 164/282; 72/227, 160, 251; 173/35 R, 35 J

[56] **References Cited**

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[57] **ABSTRACT**

A roller apron for a continuous casting installation, especially equipped with withdrawal- and/or straightening rollers, wherein the rollers which follow in the direction of travel of the continuously cast strand are guided transversely with respect to the strand direction of travel. According to the invention, two rollers which follow in the direction of travel of the strand are pivotably connected through the agency of a support with a common adjustment drive and there are provided means for the automatic accommodation of the axial spacing of the hinge connection between the support and the rollers during their movement.

6 Claims, 4 Drawing Figures

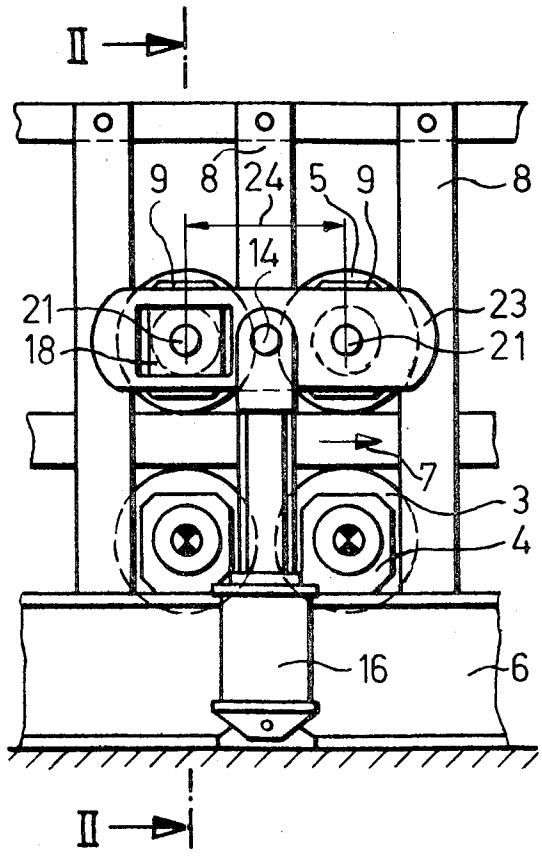


Fig. 1

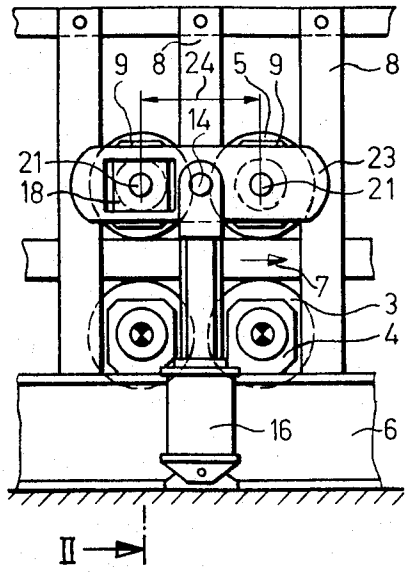


Fig. 2

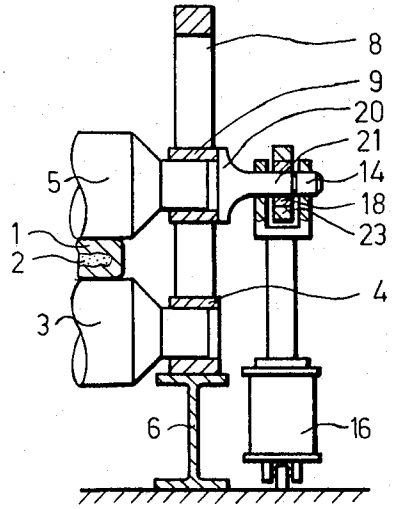


Fig. 3

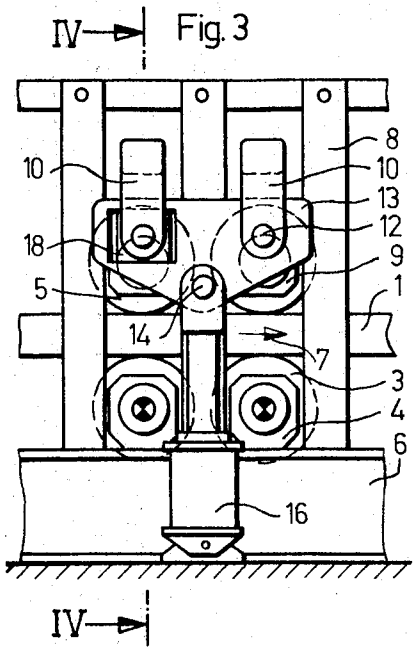
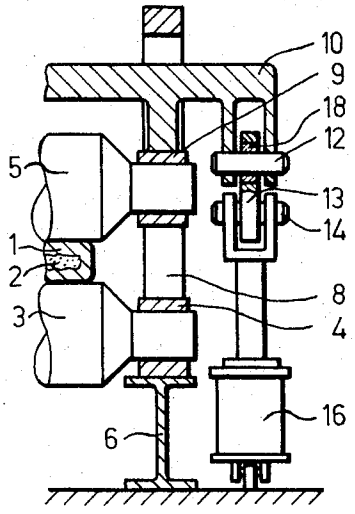


Fig. 4



ROLLER APRON FOR A CONTINUOUS CASTING INSTALLATION

BACKGROUND OF THE INVENTION

The present invention relates to a new and improved construction of roller apron or strand guide arrangement for a continuous casting installation, especially equipped with withdrawl-and/or straightening rollers, wherein the rollers which follow in the direction of travel of the continuously cast strand are guided transversely with respect to the direction of travel of the strand.

For the purpose of supporting and guiding the continuously cast strand, especially steel strands with a long liquid core, there are oftentimes employed hydraulically adjustably positionable or controllable rollers. Such rollers can be applied individually or grouped together in segments to the strand or against fixed stops.

With driven roller pairs it is conventional practice to adjustably arrange at least one roller of a roller pair in order to be able to convey strands of different thicknesses, but also to be able to convey a dummy bar which is thinner than the cast strand.

It is known to the art to arrange at a support frame two rollers which follow one another in the direction of travel of the strand and to pivotably connect such with a common adjustment drive for both rollers. By pivoting the support frame, it is possible to accommodate the rollers to irregularities in the strand. Pivoting of the support frame is however additionally influenced by force moments acting upon the rollers parallel to the direction of travel of the strand, as for instance brought about by driving-and-bending forces. Due to these forces which act parallel to the direction of travel of the strand, there are transmitted to the support frame tilting moments which disturb uniform distribution of the adjustment force which for both rollers commonly acts transversely to the direction of travel of the strand, resulting in damage to the strand.

Furthermore, there is known to the art an arc- or curved-type plant wherein the roller pairs which follow one another in the direction of travel of the strand are held mutually independent of one another in each case between two supports which are arranged transverse to the direction of travel of the strand and secured to the machine frame. The bearings of the rollers situated closest to the center of curvature of the curved guide arrangement are connected with one another by transverse webs and each transverse web is equipped with two piston-cylinder units for generating the required adjustment or control force. Due to the multiplicity of piston-cylinder units required for this installation, this solution is quite expensive. Also, during each roller exchange the hydraulic hoses of the piston-cylinder units must be dismantled and again reconnected and the piston-cylinder units themselves must be disassembled and again reassembled during the exchange of the rollers.

SUMMARY OF THE INVENTION

Hence, it is a primary object of the present invention to provide an improved roller apron for a continuous casting installation which is not associated with the aforementioned drawbacks and limitations of the prior art constructions.

Another and more specific object of the present invention relates to a new and improved construction of roller apron which, on the one hand, requires less expenditure in equipment and on the other hand optimumly transmits the adjustment or application force which is associated with each roller to the strand, even with varying operating conditions.

Now in order to implement these and still further objects of the invention, which will become more readily apparent as the description proceeds, the invention contemplates the provision of two rollers which follow one another in the direction of travel of the strand and which are pivotably connected with a common adjustment drive through the agency of a support, and means are provided for the automatic accommodation of the axial spacing of the hinge connection between the support and the rollers during their movement transversely with respect to the direction of travel of the strand.

With this equipment there is achieved the result that notwithstanding the guiding of two rollers transversely with respect to the direction of travel of the strand and which rollers follow in the strand direction of travel, for generating the adjustment or application force there is required only one-half of the previously required piston-cylinder units. The adjustment or control force which acts conjointly for two rollers transversely to the direction of travel of the strand is divided in a balance-beam at both of the rollers by the articulated support, and the force components which act parallel to the direction of travel of the strand at the rollers due to strand irregularities, strand withdrawal- and-bending forces, are directly taken-up by the machine frame. These force components neither disturb the distribution of the force at the support nor the adjustment force of the rollers which are connected with the support.

If the bearings associated with one roller are connected with one another via a yoke, then it is advantageous to articulate the support at two yokes which follow one another in the direction of travel of the strand.

For the automatic accommodation of the axial spacing of the hinge or articulated connection between the support and the rollers or the support and the yokes and which axial spacing changes during pivoting of the support, different technical solutions are possible. For instance, the support can be constructed to be telescopically extensible. According to one feature of the invention, it is advantageous if the aforesaid accommodation means consists of a sliding block which is slidingly arranged in a support movable in the direction of travel of the strand.

With short rolls, such as for instance are conventional with bloom installations, it is satisfactory to provide a support connected at the roller center with the yokes for the application of the roller applying or adjustment force to both rollers. For wide strands, there should be applied to each bearing side a support. According to the invention, it is thus advantageous to articulate such supports laterally adjacent the roller bearings at the yokes and to connect the adjustment or control drive adjacent the strand guide at the foundation. Due to this arrangement it is possible during the assembly and disassembly of the rollers to avoid separation or disconnection of the hydraulic hoses from the piston-cylinder units and to eliminate the dismantling of the piston-cylinder units.

In the case of continuous casting installations for narrow slabs or for blooms, it can be advantageous to ar-

ticulate the support at the roller bearings. It is thus possible to simplify the construction of the roller apron.

The lower roller bearings are stationarily arranged at the machine frame or at a buffer with small deflection stroke as overload safety. The upper roller as a general rule is equipped with a large application or adjustment stroke. In order to realize a simple construction at the drive side it is of advantage if there are connected with the common adjustment drive at the top surface of the strand rollers which are devoid of a drive and at the bottom side of the strand there are arranged rollers which are supported at the machine frame and which are driven.

BRIEF DESCRIPTION OF THE DRAWING

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 drawing wherein:

FIG. 1 is a side view of a partially illustrated roller apron at the horizontal portion of a curved-type continuous casting installation;

FIG. 2 is a fragmentary sectional view taken substantially along the line II—II of FIG. 1;

FIG. 3 is a side view of another exemplary embodiment of roller apron; and

FIG. 4 is a fragmentary sectional view of the arrangement depicted in FIG. 3, taken substantially along the line IV—IV thereof.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Describing now the drawing, it is to be understood that only enough of the structure of the continuous casting installation or plant has been depicted in the drawing so as to enable those skilled in the art to fully understand the underlying concepts of this development. Now in the showing of FIGS. 1 and 2 a portion of a cast strand 1 having a still liquid core 2 is guided in a roller apron between lower rollers 3 and upper rollers 5. The lower rollers 3 are constructed as driven rollers in the exemplary embodiment under consideration, the drive having been omitted as a matter of convenience in illustration, particularly since any suitable conventional drive can be employed. These driven rollers 3 are equipped with bearings or supports 4 which bear against a machine frame or stand 6. Guide tracks 8 are secured at the machine frame 6 transversely with respect to the direction of travel, generally indicated by reference character 7, of the strand or casting 1 and between each bearing 4. The upper rollers 5 which are equipped with bearings or supports 9 are guided through such guide tracks or guides 8. The bearings 9 which are arranged to both sides of the rollers 5 of two such rollers which follow one another in the strand direction of travel 7 are hingedly connected by means of connection bolts 21 mounted at the bearing covers 20 and through the agency of a balance beam-like support or carrier 23. At an imaginary central axis parallel to the guide track 8 and between both of the connection bolts 21 the carrier or support 23 is hingedly connected through the agency of a connection bolt 14 with an adjustment or control drive 16. The adjustment or control drive 16, in the exemplary embodiment under discussion, is constituted by a piston-cylinder unit. However, it is also possible to use other or equivalent drives, such as for instance spindle drives and so forth. The adjustment or control force which is generated by the adjustment drive 16 is uniformly transmitted to both of the rollers 5 adjacent the support 23.

In order that on the one hand the rollers 5 can shift or displace transversely with respect to the direction of strand travel 7, for instance during bulging-out of the strand 1, and on the other hand can support themselves at the guides 8 in accordance with the direction of the force components which act parallel to the direction of strand travel 7, there is provided a device or means for the automatic accommodation of the spacing or axial distance 24 between the connection bolts 21. This device consists of a sliding block 18 mounted at the support or carrier 23 and movable parallel to the direction of strand travel 7. Furthermore, by virtue of the adjustment of the spacing 24 it is possible to additionally compensate for play between the bearings 9 and the guides 8. Notwithstanding the play, the bearings 9 of each roller 5 can bear at the preceding or subsequent guide 8 with regard to the direction of strand travel 7 depending upon the force components which act upon the rollers 5. With a play of for instance 1 mm. between each bearing 9 and its associated guide 8 it is possible for the effective length lever arm of the support 23 for the transmission of the adjustment or control force to vary by 1 mm. With a distance of for instance 225 mm. between the connection bolt 14 and the connection bolts 21 there thus however only results a change in the effective lever length of about 0.5 percent, so that the balance beam-like distribution of the control force at both of the rollers 5 is practically not influenced.

Now in FIGS. 3 and 4 there is illustrated another exemplary embodiment of roller apron for a continuous casting installation for slabs, wherein all of the same components have here also been conveniently designated by the same reference characters as have been used in the embodiment of FIGS. 1 and 2. The difference of this construction from that of the preceding described embodiment resides in the fact that the bearings 9 associated with each roller 5 are connected with one another via a yoke 10. The yokes 10 of both of the rollers 5 which follow in the direction of strand travel 7 are thus hingedly connected at both sides via connection bolts 12 with a support or carrier 13. When using yokes 10 it is possible to orient the support or carrier 13 at different locations. The lateral arrangement of the support 13 adjacent the roller bearings 9 renders it possible to also support the adjustment or control drive 16 at both sides adjacent the strand guide at the foundation.

In place of twofold mounted rollers 5 it would also be possible to support at the yoke 10 also divided or interrupted rollers with three and more bearing locations.

It is readily possible to employ this strand guide arrangement or roller apron also in curved portions of a continuous casting installation devoid of driven rollers.

This strand guide arrangement or roller apron is particularly suitably within withdrawal- and/or straightening machines because the withdrawal- and straightening forces continuously impact the rollers with force components which act parallel to the direction of strand travel.

Finally, it is here mentioned that instead of the lower rollers 3 it is however also possible to drive the upper rollers 5 or also simultaneously both the lower rollers 3 and upper rollers 5.

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. A roller apron for a continuous casting installation, especially equipped with withdrawal- and/or straightening rollers, wherein each of the rollers which follow in the direction of travel of a strand are guided transversely with respect to the strand direction of travel, the improvement comprising a common adjustment drive, support means including means providing a hinge connection for hingedly connecting two rollers which follow in the strand direction of travel with said common adjustment drive, and means for the automatic accommodation of the axial spacing of the hinge connection between said support means and rollers during their movement transversely with respect to the direction of travel of the strand.

2. The roller apron as defined in claim **1,** wherein said accommodation means comprises a slide block slidably arranged in the support means and movable in the direction of travel of the strand.

3. The roller apron as defined in claim **1,** further including bearings provided for each roller, the bearings associated with each roller being connected with one another via a yoke, and wherein the support means is hingedly connected at two yokes which follow one another in the direction of travel of the strand.

4. The roller apron as defined in claim **3,** wherein each of the support means is hingedly connected laterally adjacent the roller bearing at the yokes.

5. The roller apron as defined in claim **1,** further including bearings provided for each roller, and means for hingedly connecting the support means with the roller bearings.

6. The roller apron as defined in claim **1,** further including a machine frame, and wherein said rollers are located for engagement with the top surface of the strand, said top surface rollers being connected with the common adjustment drive, and rollers arranged at the underside of the strand and supported at the machine frame.

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