May 9, 1967 H. LEMPER 3,318,368

ROLLER SPRAY APRON

Filed Sept. 9, 1964

Fig. 1.

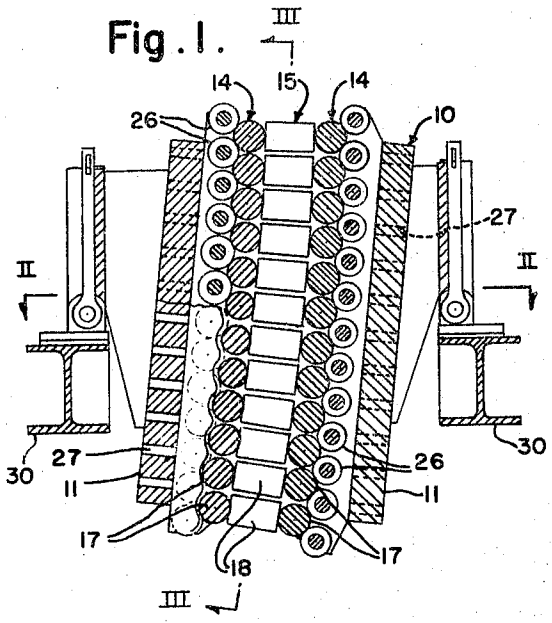


Fig. 2.

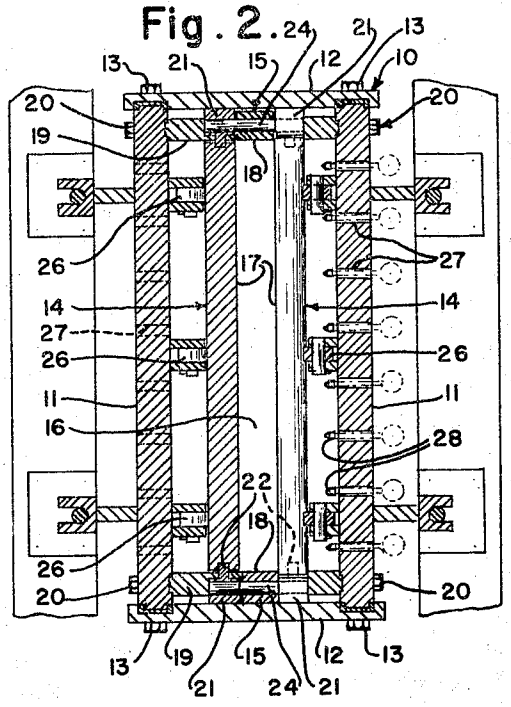


Fig. 4.

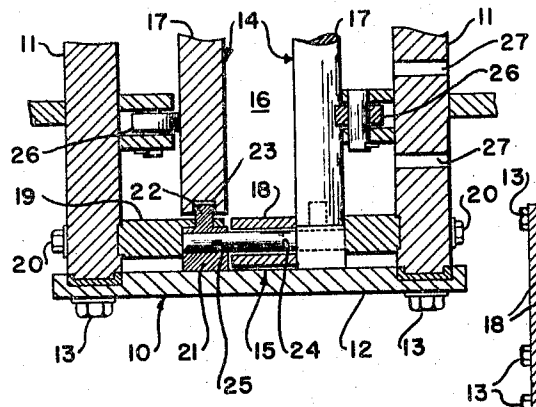
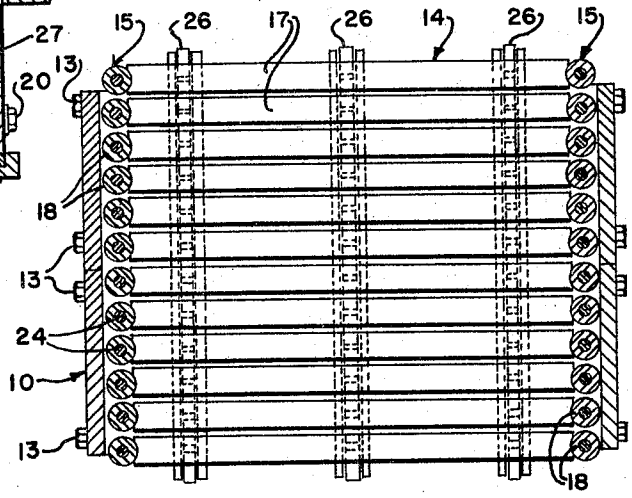


Fig. 3.



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ROLLER SPRAY APRON

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This invention relates generally to continuous casting apparatus and more particularly to an improved roller spray apron therefor.

Generally speaking, roller spray aprons comprise a group of roller banks supported in a framework to form a channel of rectangular cross section bounded on all four sides by the roller banks to support and restrain the four sides of a continuous metal slab passing therethrough from a continuous casting mold while undergoing the cooling process of being sprayed with coolant. The metal slab emanating from the mold is extremely hot and in fact is mostly molten metal surrounded by a relatively thin skin of solidified metal as it leaves the mold. The roller banks in the roller spray aprons support and restrain or hold the slab together in this critically weakened state while coolant is sprayed on the slab to cool and thicken the skin of the slab until it can safely withstand the ferrostatic pressure of the gradually diminishing liquid core of the slab.

A continuing problem with roller spray aprons has been that the rollers in the roller banks, particularly the banks supporting the width of the slab, must be small enough in diameter to be able to place them closely enough together so that a sufficient number of support points for the thin skinned slab are present that a break in the skin, which would release the molten interior (called a break-out), will not occur. With the demand for larger and particularly wider (4 feet and more) slabs of the present day, these small diameter rollers must be of such length, that alone they do not have the strength to withstand the ferrostatic pressure of the liquid core of such slabs being cast and bend in the middle from it. Others have tried to overcome this by using shorter rollers assembled end to end to span the width of the slab. This provides the necessary strength to prevent bending by the rollers, but creates a new problem in that the bearing for these rollers that are located in the central zone of the metal slab are subjected to such greater heat than at the edges or narrow sides of the slab that it is, practically speaking, impossible to maintain proper lubrication of these bearings. In brief, the close proximity of these bearings to the hottest part of the slab affect the maintenance of their lubrication to the extent that the bearings soon burn up.

Still others have tried to solve the problem by employing back-up rolls, but although this too provided additional strength against bending, it created new problems in that it was virtually impossible and wholly impracticable to maintain accurate distances between the bearings of the work rollers and the bearings of the back-up rollers whereby the rollers were bent when assembled or had to bend to contact the back-up rollers.

I have invented a means that not only solves the necessary support problem but eliminates the lubricating problem as well and presents no new insurmountable alignment problem. I provide work rollers in the form of centerless rollers which do not have any bearings of their own, but which are supported by back-up rolls which take up all the forces from the slab. Because of the better location of the bearings of the back-up rolls away from the slab, one can maintain proper lubrication there and run them at reasonable temperatures. Further, because of the more favorable conditions for the bearings of the back-up rolls, sealed roller bearing type rolls can

be employed which minimize friction and maintenance.

More specifically, I provide roller banks for the wide sides of the metal slab comprising a multiplicity of closely spaced parallel centerless work rollers mounted within the roller spray apron adjacent to each of the wide sides of said metal slab and extending across the full width thereof at right angles to the centerline thereof, a multiplicity of spaced narrow-faced back-up rolls mounted on backer plates and disposed in rows with their axes between each of said centerless rollers on the side thereof away from said metal slab with each of said back-up rolls bearing against two adjacent centerless rollers in support thereof, there being at least two back-up rolls in each of said rows, and further providing roller banks disposed adjacent each of the narrow sides of the metal slab whereby the channel of rectangular cross-section is formed.

Although back-up rolls having bearings with lubricating means thereto may be used, I preferably provide sealed roller bearings for my back-up rolls.

I further provide that said backer plates have a plurality of spaced openings therethrough with spray nozzles extending therethrough adapted to spray coolant onto the metal slab, with said back-up rolls being spaced on said backer plate between said openings.

I also provide that the centerless rollers be supported at their ends between support members by pins carried by either the rollers or the support members engaged in corresponding oversized openings in the other of said centerless rollers or support members. This prevents the centerless rollers from leaving the saddle provided by the back-up rollers.

It will be understood that my centerless work rollers can extend entirely across the width of the slab as a single roller or can be more than one centerless roller aligned end to end in axial coincidence to bridge said width, with the back plates carrying supports for the ends of said centerless rollers disposed within said width.

From the foregoing, it should be clear that by providing centerless work rollers with back-up rolls, I not only provide sufficient support to the work-rollers to eliminate bending under the pressure of the slab but also eliminate the bearing lubrication problem and any bearing alignment problems by eliminating the need for bearings for the work rollers in the first instance.

Other details, objects and advantages of the invention will become apparent as the following description of a certain present preferred embodiment thereof proceeds.

In the accompanying drawings, I have shown a certain present preferred embodiment of the invention in which:

FIGURE 1 is a longitudinal cross section of a representative portion of my new roller spray apron;

FIGURE 2 is a transverse cross-sectional view taken along the line II—II of FIGURE 1;

FIGURE 3 is a vertical cross-sectional view taken along the line III—III of FIGURE 1; and

FIGURE 4 is an enlarged fragmentary view of the lower portion of FIGURE 2.

Referring now to the drawings and initially to FIGURE 2, I there illustrate a roller spray apron **10** embodying my invention. The framework of roller spray apron **10** comprises backer plates **11** and side support plates **12** arranged in a four-sided figure of rectangular cross-section and fastened together as by threaded bolts **13**.

As there illustrated, the aforesaid framework carries opposing wide roller banks **14** and opposing narrow roller banks **15** which form a channel **16** of rectangular cross section through which the newly cast metal slab (not shown) passes for spray cooling. Roller banks **14** support the wide sides of the metal slab and roller banks **15**

support the narrow sides of the metal slab and thus together they support and restrain the four sides of the continuous metal slab passing through channel **16**.

As shown in FIGURES 1 and 3, roller banks **14** and **15** are made up of a multiplicity of closely spaced parallel work rollers **17** and **18** respectively. Referring again to FIGURE 2, I there illustrate how each of the rollers are supported. As there shown, I provide support blocks **19** fastened to backer plates **11** as by threaded bolts **20**. Blocks **19** locate and support pin blocks **21** each of which have a pin portion **22** extending through an opening in a corresponding support block **19**. Rollers **17** carry holes **23** in the ends thereof into which pin portion **22** extends and it should be particularly noted that holes **23** are oversized or substantially larger than pin portions **22**. Thus each roller **17** is a centerless roller that is simply located or held in place in roller banks **14** by pins disposed in oversized holes in its ends. Each roller **18** is mounted for rotation on a pin **24** which is supported at its ends disposed in openings **25** in pin blocks **21**. Each roller **18** is suitably bushed for rotation on pin **24** and suitable fittings for lubrication of same (not shown) are also provided. The lubrication of the bearing bushing of roller **18** does not present any problem because rollers **18** are located along the narrow side of the slab where the heat is not as intense, and, of course, centerless rollers **17** have no bearings so that there is no lubrication problem there.

I further provide a plurality of narrow-faced backup rolls **26** secured to backer plates **11**. Back-up rolls **26** are spaced in rows along the length of centerless rollers **17** with their axes disposed between centerless rollers **17** on the side thereof away from the slab channel so that each back-up roller **26** bears against two neighboring centerless rollers **17**, as is most clearly shown in FIGURE 1. The number of back-up rolls **26** depends primarily upon the length of centerless rollers **17** which, of course, depends upon the desired width of the slab being cast. At least two back-up rolls **26** spaced therealong are needed though, and in FIGURE 2 I have illustrated three back-up rolls **26** spaced in each row, which is preferred when the width of the slab is over three feet. It will be understood from the foregoing that back-up rolls **26** take up all the forces exerted against the centerless work rollers **17** by the slab in channel **16**, and that because of the loose fit of pin supports **22** in the oversized openings **23** in the ends of centerless work rollers **17**, work rollers **17** are able to hunt sufficiently to properly seat in the saddles provided by back-up rolls **26** whereby they are sufficiently supported to eliminate any bending by the forces from the slab and since no bearings are needed for centerless rollers **17**, no lubrication or bearing alignment problems can develop either.

In addition, I have found that the location of back-up rolls **26** is sufficiently removed from the intense heat of the motor slab that sealed roller bearings can be used which eliminates the fittings otherwise needed for lubricating back-up rolls **26** and provides a better situation with regard to reducing friction at these bearings.

Although for the present embodiment I have shown centerless rollers **17** as extending entirely across the width of the slab, it will be understood that where even wider slabs are contemplated that it may be more convenient or economical to provide shorter centerless rollers end to end in axial coincidence to span this width. In such case it is easily understandable that a loose fitting support means like that described earlier for the ends of the centerless rollers **17** can be readily provided for the ends of centerless rollers disposed within the width of the slab by securing such means on backer plates **11**, with additional back-up rolls to support the greater number of work rollers.

It will also be understood that the support of pin portions **22** disposed in oversized holes **23** in the ends of rollers **17** could be reversed without ill effect by instead having the ends of rollers **17** reduced to form the pin portions that would engage in oversized holes in the support members.

Referring again to FIGURE 2, I further show that backer plates **11** have a plurality of spaced openings **27** therein through which spray nozzles **28** extend to spray coolant on the slab passing down channel **16**. Back-up rolls **26** should be spaced or located on backer plates **11** between openings **27** so as to minimize or preclude any interference with the spray coming from nozzles **28**.

Referring to FIGURE 1, my roller spray apron is supported on beams **30** by appropriate means and as shown in this instance is being supported in a generally vertical altitude for use in a vertical type continuous casting machine. It will be understood, however, that the same may be employed with equal value and advantage in the so-called horizontal or semi-horizontal continuous casting machines; for which I have shown and described a present preferred embodiment of the invention, it is to be distinctly understood that the invention is not limited thereto, but may be otherwise variously embodied within the scope of the following claims.

I claim:

1. In a roller spray apron for continuous casting machines having roller banks disposed so as to form a channel of rectangular cross section to support and restrain the four sides of a continuous metal slab emanating from a continuous casting mold, the improvement of providing roller banks for the wide sides of said metal slab comprising a multiplicity of closely spaced parallel centerless work rollers mounted within the roller spray apron adjacent to each of the wide sides of said metal slab and extending across the full width thereof at right angles to the centerline thereof, a multiplicity of spaced narrow-faced back-up rolls mounted on backer plates and disposed in rows with their axes between each of said centerless rollers on the side thereof away from said metal slab with each of said back-up rolls bearing against two adjacent centerless rollers in support thereof, there being at least two back-up rolls in each of said rows, and further providing roller banks disposed adjacent each of the narrow sides of the metal slab whereby said rectangular channel is formed.

2. The improvement in a roller spray apron for continuous casting machines as in claim **1** wherein said back-up rolls are sealed roller bearings.

3. The improvement in a roller spray apron for continuous casting machines as in claim **1** wherein said centerless rollers are supported at their ends between support members by pins carried by one of said centerless rollers and support members engaged in corresponding oversized holes disposed in the other of said centerless rollers and support members.

4. The improvement in a roller spray apron for continuous casting machines as in claim **1** wherein each of said centerless rollers extend only partway across the width of said metal slab and more than one centerless rollers are disposed end to end in axial coincidence to bridge said width, said backer plates carrying supports for the ends of said centerless rollers disposed within said width.

5. In a roller spray apron for continuous casting machines having roller banks disposed so as to form a channel of rectangular cross section to support and restrain the four sides of a continuous metal slab emanating from a continuous casting mold, the improvement of providing roller banks for the wide sides of said metal slab comprising a multiplicity of closely spaced parallel centerless work rollers mounted within the roller spray apron adjacent to each of the wide sides of said metal slab and extending across the full width thereof at right angles to the centerline thereof, a multiplicity of spaced narrow-faced back-up rolls mounted on backer plates and disposed in rows with their axes between each of said centerless rollers on the side thereof away from said

metal slab with each of said back-up rolls bearing against two adjacent centerless rollers in support thereof, there being at least two back-up rolls in each of said rows, means for lubricating the bearings of said back-up rolls, said backer plates having a plurality of spaced openings therethrough with spray nozzles extending therethrough adapted to spray coolant onto said metal slab, said back-up rolls being disposed on said backer plate between said openings, and further providing roller banks disposed adjacent each of the narrow sides of the metal slab whereby said rectangular channel is formed.

6. In a roller spray apron for continuous casting machines having roller banks disposed so as to form a channel of rectangular cross section to support and restrain the four sides of a continuous metal slab emanating from a continuous casting mold, the improvement of providing roller banks for the wide sides of said metal slab comprising a multiplicity of closely spaced parallel centerless work rollers mounted within the roller spray apron adjacent to each of the wide sides of said metal slab and extending across the full width thereof at right angles to the centerline thereof, said centerless rollers being supported at their ends between support members having pins engaged in corresponding oversized holes in the ends of said centerless rollers, a multiplicity of spaced narrow-faced sealed back-up roller bearings mounted on backer plates and disposed in rows with their axes between each of said centerless rollers on the side thereof away from said metal slab with each of said back-up

roller bearings bearing against two adjacent centerless rollers in support thereof, there being at least two back-up roller bearings spaced along each of said rows, said backer plates having a plurality of spaced openings therethrough with spray nozzles extending therethrough adapted to spray coolant onto said metal slab, said back-up roller bearings being disposed between said openings on said backer plate, and further providing roller banks disposed adjacent each of the narrow sides of the metal slab whereby said rectangular channel is formed.

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