Aug. 30, 1966 H. LEMPER 3,268,956

CONTINUOUS CASTING ADJUSTABLE ROLLER SPRAY APRON

Filed Feb. 19, 1964 2 Sheets-Sheet 1

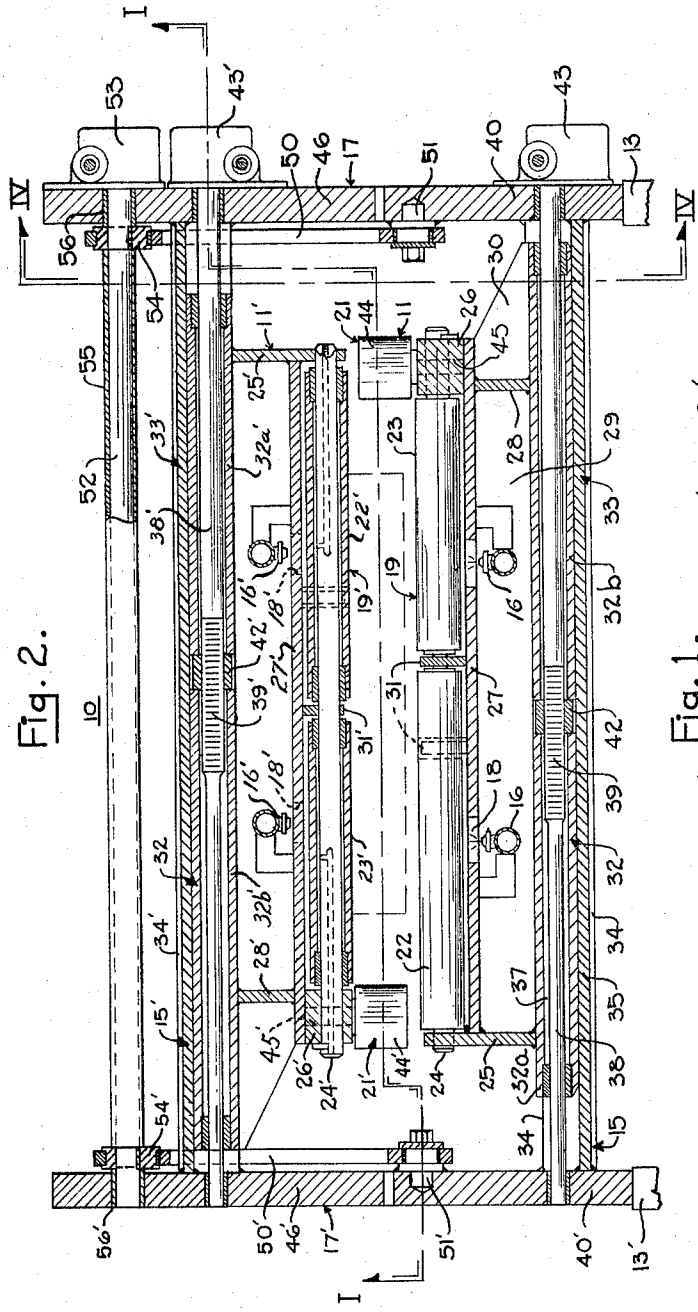


Fig. 2.

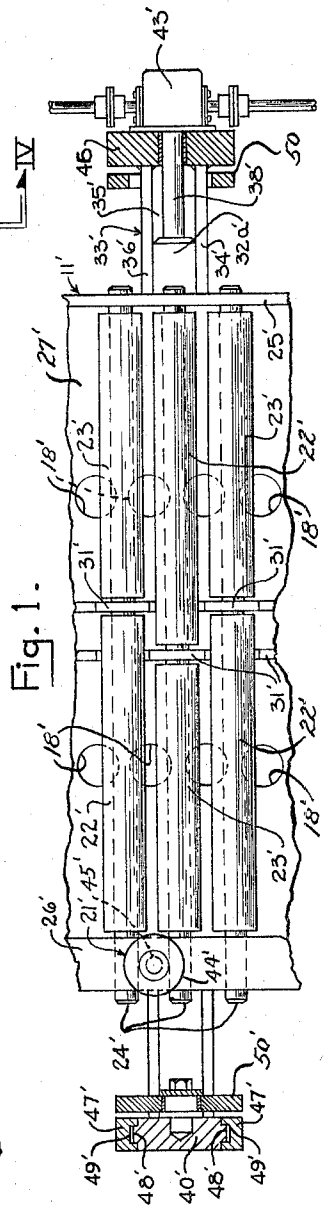


Fig. 1.

INVENTOR
Herbert Lemper
By Hoppe, Leonard & Buell
his attorneys

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Fig. 3.

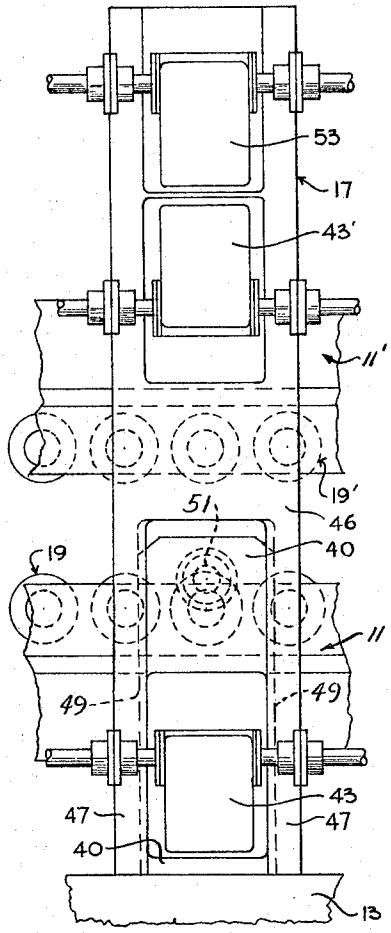
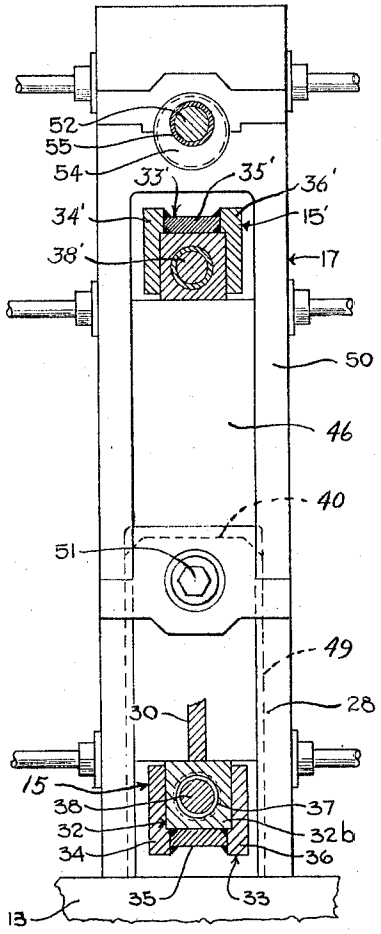


Fig. 4.



INVENTOR
Herbert Lemper
By Hoopes, Howard & Buell
his Attorneys

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CONTINUOUS CASTING ADJUSTABLE ROLLER SPRAY APRON

Herbert Lemper, Pittsburgh, Pa., assignor to Mesta Machine Company, a corporation of Pennsylvania

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4 Claims. (Cl. 22—57.2)

This invention relates broadly to roller spray aprons used in continuous casting machines and more particularly to a roller spray apron which is fully adjustable as to width and thickness of the continuously cast product so that a multitude of different sized slab cross sections are selectively available.

Roller spray aprons are used in continuous casting machines to provide restraining forces to all sides of the continuously cast product and to avoid bulging and breakout while the product is being cooled and solidified by spraying. Heretofore roller spray aprons have been made in four individual sections to contain the four sides involved in a continuously cast product such as slabs, there being two wider roller bank sections for the width of the slab strip and the two narrower roller bank sections for the thickness of the slab strip. The four sections are arranged to form a rectangular passageway or channel through which the slab being cast passes and is contained thereby. It will be understood by those skilled in the art that the rectangular passageway must be the exact size of the slab being run to properly contain it and, therefore, the roller banks must be adjusted according to the size of the slab being cast. It will be further understood that when speaking of size in this specification, I am referring to the width and thickness of the slab being cast and not the length which, of course, for present purposes, is continuous. In order to adjust the roller banks to accommodate a different sized slab than that they were set up for, and also in compensating for mold and roller wear, it was heretofore the practice to have each roller bank capable of two-directional movements, i.e., the narrowside banks facing each other could individually be moved toward or away from each other, this being one-directional movement and also sideways toward or away from the plane of the broadside banks for a second directional movement; similarly, the broadside banks facing each other could individually be moved toward or away from each other and also sideways toward or away from the plane of the narrowside banks. Thus, it was necessary to provide four, two-directional movements for existing systems. I have devised a new roller spray apron utilizing a new roller bank device having infinite variable adjustment with at the most two, two-directional movements. The savings in equipment, parts and controls is immediately apparent, and the simplicity of my two-piece design as compared with the earlier four-piece design is particularly advantageous because it permits greater rigidity than heretofore possible which results in better containment of the slabs being cast and more precise compensation for mold and roller wear with less likelihood of breakout or bulging.

I provide an adjustable roller spray apron for use in continuous casting machines comprising at least a pair of roller bank means of L-shaped cross section disposed in opposing relationship with respect to each other to form a passageway or channel of rectangular cross section for slab casting, each roller bank means having a broadside roller bank and a narrowside roller bank disposed with respect to each other such that in cross section the broadside roller bank forms the long part of the L-shape and the narrowside roller bank forms the short part of the L-shape, at least one of said roller bank means having means operable to move it with respect to the opposing roller bank means in planes coincident with the planes of said broadside and narrowside roller banks such that the lineal dimensions of said rectangular cross section are selectively varied.

Preferably, each of said roller bank means has means operable to move it with respect to its opposing roller bank means in planes coincident with the planes of said broadside and narrowside roller banks.

In still another preferred embodiment of the invention, I provide that in each pair of roller bank means one of said pair has means operable to move it with respect to the opposing roller bank means in planes coincident with the planes of said broadside and narrowside roller banks and the other of said pair has means operable to move it with respect to the opposing roller bank means in a plane coincident with the plane of said broadside roller banks.

Preferably, the means operable to move the L-shaped roller bank means comprises threaded shaft members rotatably secured in supporting stand members, said roller bank means being movably disposed on and threadedly engaged with said shaft members with the plane of the broadside roller banks parallel to the shaft axes whereby when said shaft members are rotated at least one of said roller bank means moves along said shaft members in a plane coincident with the plane of the broadside roller banks, said supporting stand members being expandable and having means operable to expand and contract the length of said stand members whereby at least one of said roller bank means moves in a plane coincident with the plane of the narrowside roller banks.

I further provide as a new article of manufacture, a unitary device for use in continuous casting machines comprising a broadside roller bank of rollers arranged with parallel axes in a single plane and a narrowside roller bank of rollers arranged with parallel axes in a single plane, said roller banks being joined as a single device such that a cross section of said roller banks is L-shaped with the broadside roller bank forming the long part of the L-shape and the narrowside roller bank forming the short part of the L-shape.

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

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

FIGURE 1 is a fragmentary elevational view partly in section of my adjustable roller spray apron taken on the line I—I of FIGURE 2;

FIGURE 2 is a transverse cross-sectional view partly in elevation of my roller spray apron;

FIGURE 3 is a fragmentary side elevational view of my roller spray apron as viewed from the right of FIGURE 2; and

FIGURE 4 is a sectional view taken on the line IV—IV of FIGURE 2.

Referring now to the drawings and initially to FIGURE 2, I there illustrate my adjustable roller spray apron 10 having a pair of L-shaped roller banks designated generally by reference numerals 11 and 11' disposed in opposing relationship with respect to each other. A general description follows. The supporting structure is shown generally as support members 13 and 13' and it will be understood that there is general superstructure supporting the entire continuous casting machine or system that is not shown and that only a small portion of the length of the roller spray apron is being illustrated which is considered to be sufficient for the purposes of illustrating the present invention. The invention is here shown as for a fully horizontal continuous casting machine but it will be understood that it can just as well be incorporated with suitable support structure for vertical continuous casting machines and likewise for semi-

horizontal machines, commonly referred to as horizontal continuous casting machines, wherein the roller spray apron track is curved 90° from an initially vertical track into a final horizontal track.

Continuing with the general description, L-shaped roller bank means **11** and **11'** are carried on support carriers **15** and **15'**, respectively, which in turn are secured at their ends to support standards **17** and **17'** which are supported on support members **13** and **13'**, respectively. L-shaped roller bank means **11** and **11'** are identical images of each other which have been reversed to face each other so that they form a rectangular channel between them confined by roller banks **19**, **19'**, **21** and **21'** through which the continuous slab being cast passes and within which it is confined. Broadly speaking for a general understanding of the invention and without going into detail, standards **17** and **17'** are expandable lengthwise and then lengthened or shortened, respectively, raise and lower carrier **15'** by which means the distance between broadside roller banks **19** and **19'** may be varied to suit the thickness of the slab being cast.

Further, L-shaped roller bank means **11** and **11'** are movable transversely along their respective support carriers **15** and **15'** so that the distance between narrowside roller banks **21** and **21'** may be varied to suit the width of the slab being cast.

From this general description, it is clear that my roller spray apron can be adjusted readily to accommodate the width and thickness of various sized slabs being cast with only two two-directional movements instead of four as heretofore.

Continuing with a description of the invention in greater detail, L-shaped roller bank means **11** and **11'** are identical as are carrier channels **15** and **15'** and the means of moving the roller bank means on the carrier channels is the same for each also. Thus, I shall describe in detail the lower means **11–15** and it will be understood that the upper means **11'–15'** is an image of the same that has simply been turned around to face the lower means. Like parts in the upper means therefore carry the same reference numbers as their corresponding parts in the lower means with a prime added.

L-shaped roller bank means **11** comprises a broadside roller bank **19** and a narrowside roller bank **21**. Broadside roller bank **19** is made up of a number of long and short rollers **22** and **23**, respectively, supported in typical staggered arrangement on rods **24**, as best shown in FIGURE 1. As shown in FIGURE 2, the rollers are appropriately bushed for rotation on rods **24**. Rods **24**, in turn, are secured against rotation in suitable openings in plate **25** and block **26**, both of which extend the full length of the roller bank means. A backer plate **27** extends over approximately both the length and width of the roller bank means and is secured as by welding to plate **25** and another support plate **28** which like plate **25** runs the length of the roller bank means. As shown, block **26** is secured to backer plate **27** and so too are spray nozzles **16**, **16'** which spray coolant on the slab being cast to solidify it, through suitable apertures or openings **18**, **18'** in backer plate **27**. Nozzles **16**, **16'** and openings **18**, **18'** are spaced with respect to rollers such that the spray is directed between the roller rows. It will be understood that spray nozzles **16**, **16'** are shown diagrammatically and that there is appropriate plumbing connected thereto which is not shown. By way of further support, cross vertical plates **29** and gusset plates **30** are spaced along the length of the roller bank means to help support backer plate **27** to which they are joined. Backer plate **27** also carries pedestals **31** which centrally support rods **24**. Plates **25**, **28**, **29** and **30** are all secured to a block-shaped carrier bar **32** which is slidably disposed in a channel **33** made up of plates **34**, **35** and **36** as best shown in FIGURE 4, which are secured as by welding to posts **40** and **40'** of standards **17** and **17'**, respectively. Block bar **32** is divided into two sections **32***a* and **32***b* and has a bore opening **37** therethrough. A drive shaft **38** having a centrally disposed threaded portion **39** extends through opening **37** of block bar **32** and is secured in suitable openings in posts **40** and **40'** of standards **17** and **17'**, respectively. Said openings in posts **40** and **40'** being suitably bushed for the rotation of shaft **38** therein. A square nut **42** is disposed in channel **33** on threaded portion **39** of rod **38** and separates portions **32***a* and **32***b* of carrier bar **32**. As illustrated, nut **42** is of sufficient size to prevent its rotation or turning in channel **33**. Drive means **43** is geared to rotate shaft **38** in either direction.

From the foregoing, it should be clear that by rotating shaft **38**, nut **42** and consequently carrier bar **32** and roller bank means **11** are caused to travel along shaft **38** in channel **33**, and that the roller bank means thus may be adjusted transversely in either direction according to the direction of rotation of shaft **38** by drive means **43**, and further, that the same is true for roller bank means **11'** with respect to shaft **38'** and drive means **43'**. It should also be understood that the support and carrier means described above with respect to the roller bank means is duplicated or even multiplied according to the length and size and weight of the roller bank means and is spaced along the length of the roller bank means accordingly as dictated by operational needs. Preferably where there are two or more carriers involved with roller bank means **11** the drive means **43** for each carrier **15** thereof are geared together so that all drive shafts **38** are driven at the same speed and in the same direction. This, of course, also applies accordingly to drive means **43'** of roller bank means **11'**.

Continuing with the detailed description, L-shaped roller bank means **11** has a narrowside roller bank **21** which comprises rollers **44** disposed on and suitably bushed for rotation on shafts **45** disposed in and secured against rotation in block **26**. As shown in FIGURE 1, rollers **44** and **44'** are spaced along block **26** at longer intervals than the spacing of rollers **22–23**. Note also that rollers **44** and **44'** are spaced between adjacent rollers **22–23** and **22'–23'**, respectively, to accommodate the placing of shaft **45** in block **26**, which might otherwise intersect the ends of rods **24** disposed therein also. Thus, the broadside roller banks **19** and **19'** form the long part of the L-shape of the respective roller bank means, and the narrowside roller banks **21** and **21'** form the short part of the L-shape of the respective roller bank means.

The foregoing description also demonstrates the rigidity offered by the unique L-shape of the roller bank means **11** and **11'**, the advantages of which have already been noted.

Proceeding with further detailed description of the invention; as earlier mentioned, standards **17** and **17'** are expandable to vary the size of the rectangular channel formed by the roller banks for slab thickness. Standards **17** and **17'** are identical too and the following description of standard **17** applies as well to standard **17'** with like parts having like reference numerals with a prime.

Standard **17** comprises a lower plate earlier designated as post **40** and an upper support plate **46**. Upper plates **46**, **46'** carry the upper carrier channel **33'** and shaft **38'** like lower plates or posts **40** and **40'** carry the lower carrier channel **33** and shaft **38**. As best shown in FIGURE 3, upper plates **46** and **46'** have extensions or legs **47** and **47'** which straddle posts **40** and **40'**, respectively, and are keyed thereto such as by the guides or runners **48'** of post **40'** (see FIGURE 1) being slidably disposed in channels **49'** of legs **47'**. From the foregoing, it is clear that legs **47**, **47'** and consequently upper support plates **46**, **46'**, can be raised and lowered with respect to posts **40**, **40'** along the track formed by channels **49**, **49'** to vary the lengths of standards **17**, **17'**.

Although there are obviously numerous ways of raising and lowering the upper support plates **46** and **46'**, I

provide drive arms **50**, **50'** secured at one end by stub shafts **51**, **51'** secured in posts **40**, **40'**, the opening in drive arms **50**, **50'** receiving stub shafts **51**, **51'** being suitably bushed for rotary movement therebetween, and secured at the other end to a drive shaft **52** which extends between and is secured in upper plates **46** and **46'**. The openings in upper plates **46** and **46'** receiving the ends of drive shaft **52** have bushings **56**, **56'** for rotation of drive shaft **52** therein, and a drive means **53** is disposed on plate **46** to rotate shaft **52** in either direction. As best shown in FIGURES 2 and 4, shaft **52** passes eccentrically through bearings **54**, **54'** which are disposed in drive arms **50**, **50'**, respectively.

Bearings **54**, **54'** are keyed to shaft **52** so that they rotate with shaft **52**, and the openings in drive arms **50**, **51'**, in which bearings **54**, **54'** are disposed, are suitably bushed for rotation of bearings **54**, **54'** therein. Between bearings **54**, **54'**, drive shaft **52** is encased in a tubular spacer **55** to keep said bearings properly located on shaft **52** with the bushings **56**, **56'** extending to such bearings to assist in this purpose also. From the above description, it is clear that by rotating shaft **52**, drive arms **50**, **50'** are vertically moved and since posts **40**, **40'** are stationary, upper plates **46**, **46'** are caused to move up or down in channels **49**, **49'** with respect to posts **40**, **40'** to lengthen or shorten standards **17**, **17'**. In this manner roller bank means **11'** may be adjusted vertically with respect to roller bank means **11** to vary the size of the rectangular channel formed by roller banks **19**, **19'**, **21**, **21'** with regard to slab thickness by a single two-directional movement.

As earlier described with respect to the transverse drive means for slab width, if the length of the roller bank means requires two or more drive means for adjusting for slab thickness, said drive means should be geared together or otherwise synchronized to drive the two or more shafts **52** in unison.

From all of the foregoing description, it is shown that I have invented a device wherein it is possible to adjust a roller spray apron for slab width and thickness with simply two two-directional movements and having a rigidity that permits precise adjustments for mold and roller wear.

It is obvious too that it is not necessary that both carriers **15** and **15'** be transversely adjustable and that the adjustability of one alone would suffice to accommodate many various slab widths and, similarly, that either or both of the upper and lower portions of standards **17**, **17'**, could be arranged for movement to adjust to various slab thicknesses. I have shown a preferred embodiment of the invention wherein both carriers **15** and **15'** are transversely adjustable and only the upper portions of standards **17**, **17'** are adjustable because of the suitability of this arrangement for fully horizontal continuous casting machines.

While 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. An adjustable roller spray apron for use in continuous casting machines comprising at least a pair of roller bank means of L-shaped cross section disposed in opposing relationship wth respect to each other to form a channel of rectangular cross section therebetween, each roller bank means having a broadside roller bank and a narrowside roller bank disposed with respect to each other such that in cross section the broadside roller bank forms the long part of the L-shape and the narrowside roller bank forms the short part of the L-shape, at least one of said roller bank means having means operable to move it with respect to the opposing roller bank means in planes coincident with the planes of said broadside and narrowside roller banks such that the lineal dimensions of said rectangular cross section are selectively varied.

2. An adjustable roller spray apron for use in continuous casting machines as claimed in claim **1** wherein each of said roller bank means has means operable to move it with respect to its opposing roller bank means in planes coincident with the planes of said broadside and narrowside roller banks.

3. An adjustable roller spray apron for use in continuous casting machines as claimed in claim **1** wherein in each pair of roller bank means one of said pair has means operable to move it with respect to the opposing roller bank means in planes coincident with the planes of said broadside and narrowside roller banks and the other of said pair has means operable to move it with respect to the opposing roller bank means in a plane coincident with the plane of said broadside roller banks.

4. An adjustable roller spray apron for use in continuous casting machines as claimed in claim **1** wherein said means operable to move said L-shaped roller bank means comprises threaded shaft members rotatably secured in supporting stand members, said roller bank means being movably disposed on and threadedly engaging said shaft members with the plane of the broadside roller banks parallel to the shaft axes whereby when said shaft members are rotated at least one of said roller bank means moves along said shaft members in a plane coincident with the plane of the broadside roller banks, said supporting stand members being expandable and having means operable to expand and contract the length of said stand members whereby at least one of said roller bank means moves in a plane coincident with the plane of the narrowside roller banks.

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J. SPENCER OVERHOLSER, *Primary Examiner.*

R. S. ANNEAR, *Assistant Examiner.*