

Jan. 30, 1968

J. BARBE ETAL
APPARATUS FOR GUIDING A STRAND IN
A CONTINUOUS CASTING MACHINE

3,366,162

Filed Sept. 28, 1965

4 Sheets-Sheet 1

Fig. 1

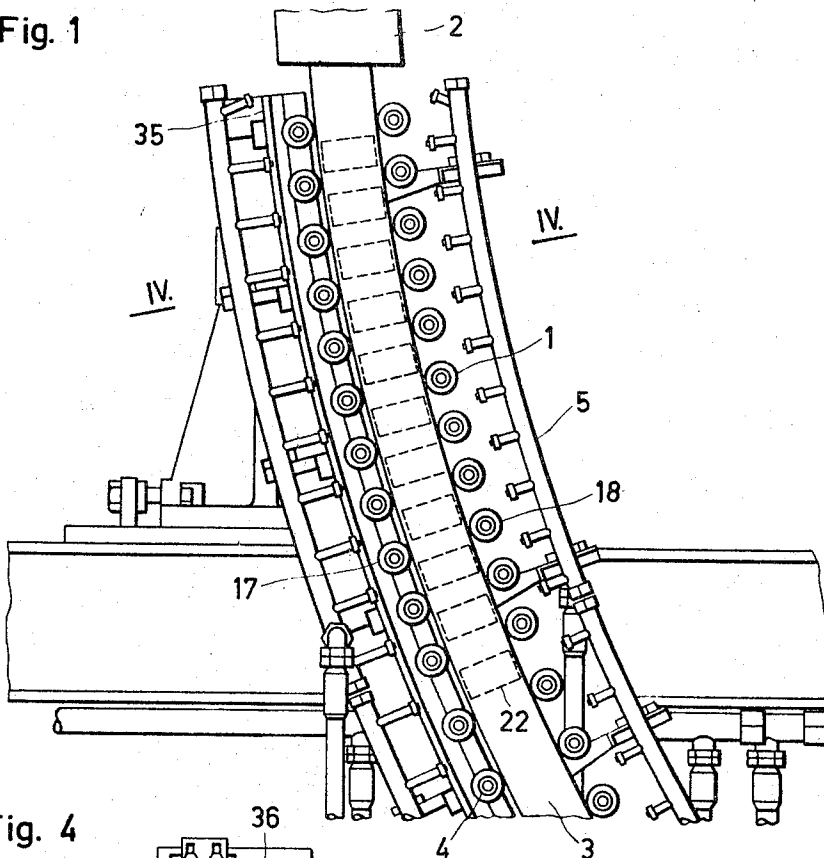
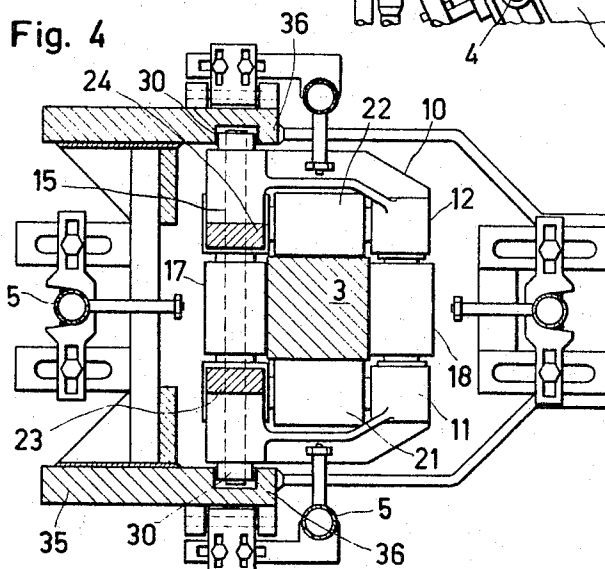


Fig. 4



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Fig. 2

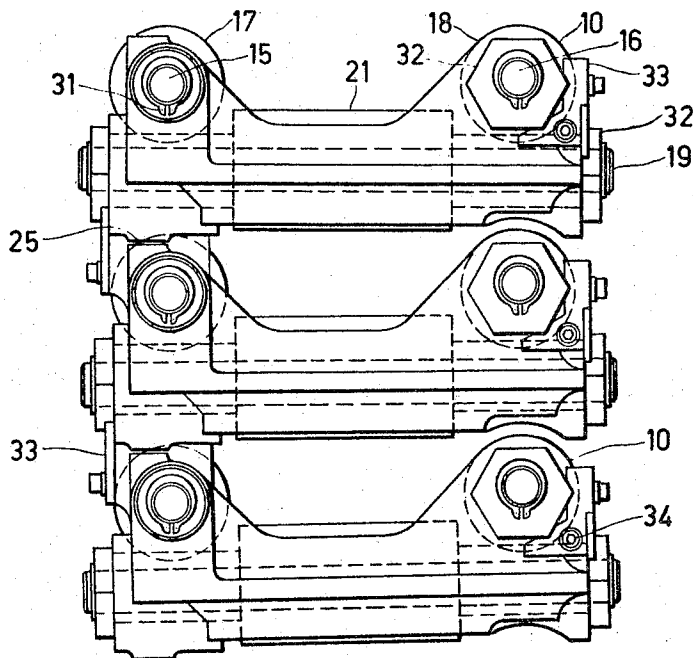
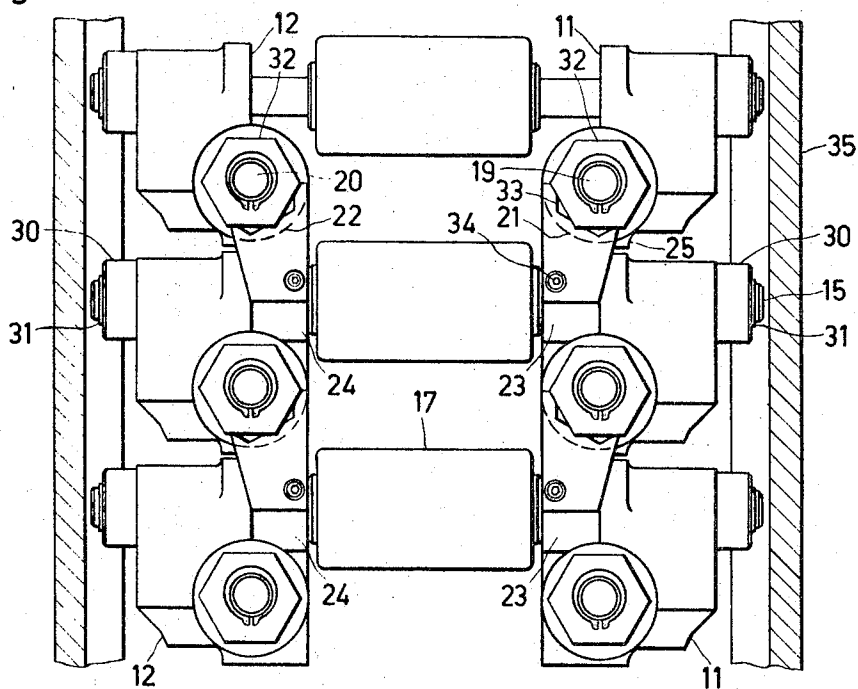


Fig. 3



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Fig. 5

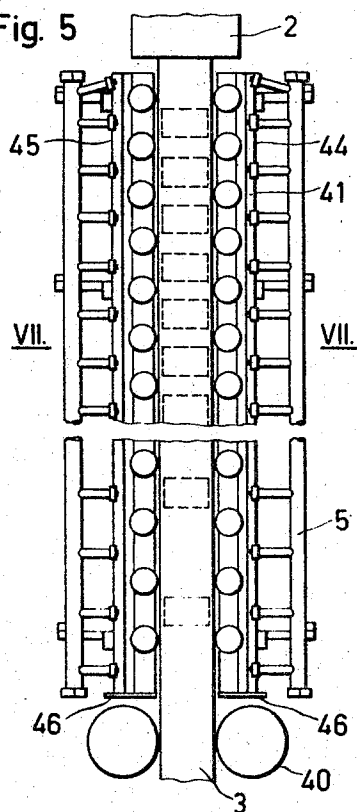


Fig. 6

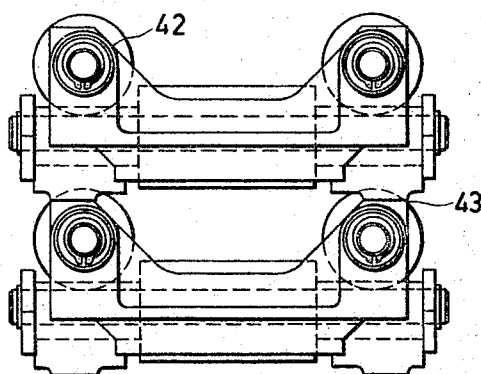
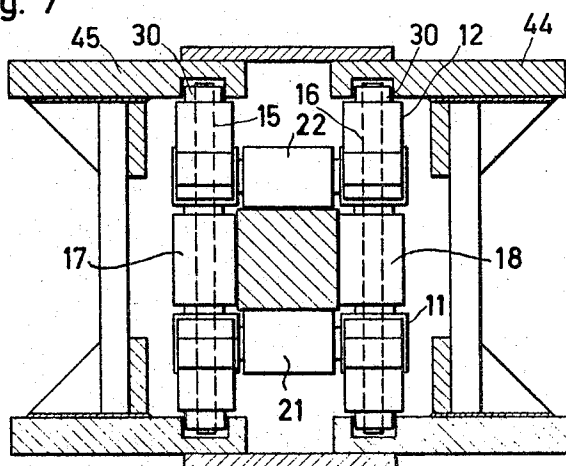


Fig. 7



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Fig. 8

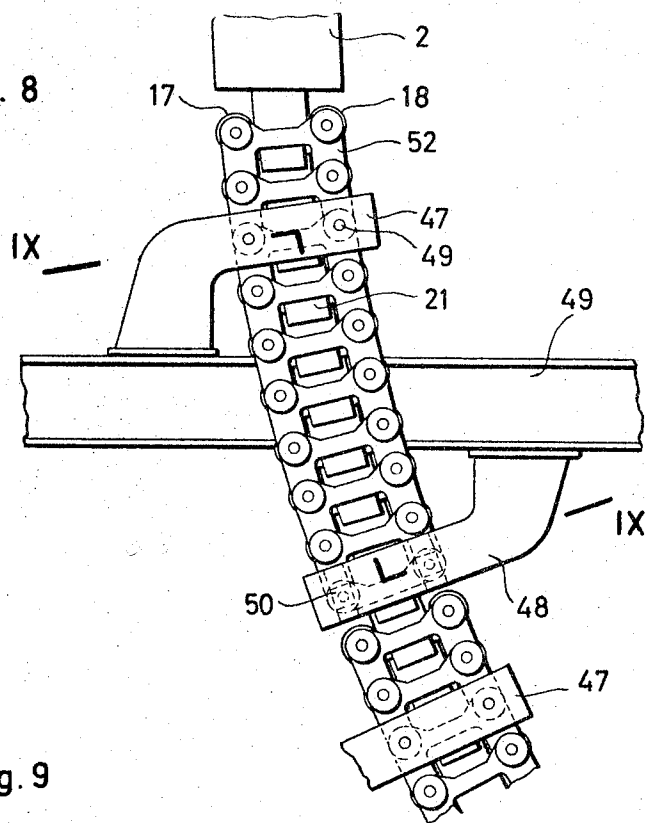
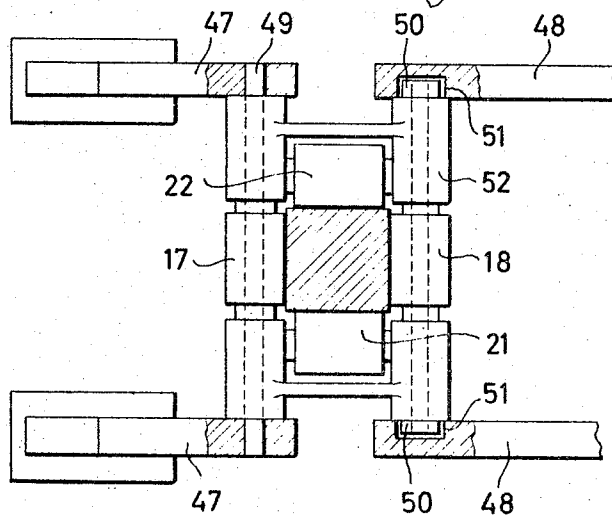


Fig. 9



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APPARATUS FOR GUIDING A STRAND IN A CONTINUOUS CASTING MACHINE

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6 Claims. (Cl. 164—282)

ABSTRACT OF THE DISCLOSURE

Strand guiding apparatus for a continuous casting machine comprising a succession of frames carrying pairs of strand guiding elements straddling the strand and engaging opposed surfaces of the strand, and guide rails straddling said strand which are engaged by said frames.

This invention relates to continuous casting and, more particularly, relates to an improved strand guidance arrangement for continuous casting plants.

In continuous casting plants, liquid metal is poured into a mold which solidifies the periphery of the metal to define a strand. The strand issues from the mold in continuous manner and the solidified periphery encloses the still molten core as the strand issues from the mold. The strand is drawn from the mold by withdrawal rolls, guided by a strand guiding system positioned between mold and withdrawal rolls and further cooled by direct spraying with water.

This strand guiding system has the following two functions: When the strand leaves the mold with a solidified skin and a core of liquid metal, there is a danger of breakout of the liquid metal through the solidified skin. These breakouts can be avoided by guiding the strand below the mold, for example, by a plurality of rolls, spaced apart along the strand for support thereof. Also, the strand guiding system allows the further cooling of the partly solidified strand. For this purpose, the strand guiding system comprises water spraying systems, the function of which is to spray water directly on the surface of the strand.

In equipment known to the art, the strand guiding systems has been formed as a rigid assembly of the strand guiding system and the supporting rollers attached directly to the casting plant. These strand guiding systems which are known up to date have several drawbacks. They are expensive because they are bulky. Also, the holes for the roller housings have to be accurately drilled to maintain the correct position of the rollers. Liquid metal could flow through the elements during breakouts and damage these expensive parts. Furthermore, these strand guiding systems are not suited from the point of view of thermal expansions, because they form a rigid structure with the plant.

Moreover, it has been known to adjust strand guiding systems to various strand sections. Such strand guiding systems consist, for example, of two rows of rollers which guide the surfaces of the strand located opposite each other and are mounted on two supporting beams independent from each other. Their relative position can be adjusted by adjusting devices.

It is, therefore, an object of the present invention to provide an improved strand guiding system which is less expensive to construct and which provides operating advantages in ease of disassembly after a breakout and in flexibility to handling thermal expansion effects.

According to the present invention, the strand guiding system eliminates the above mentioned disadvantages, to which end it comprises a plurality of roller frames, each

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of said frames carrying the roller sets for strand guidance. Since the frames are identical, this arrangement allows a cheap mass production of the frames. The adjustment of the distances between the roller forming a roller pair can be made outside the strand guiding system, according to the strand section used, thus, reducing the time and increasing the accuracy of the adjustment.

A further object of the invention is to connect the frames with each other to simplify the setting up and dismantling operation of the strand guiding system. The frames are provided with guide lugs which are guided in guiding slots.

A further feature of the invention is that a guidance could be achieved if each frame is provided with guiding lugs. It would then be possible to guide only each second or third frame. The extreme would be that at least two frames of the row are provided with guide lugs, which are guided in guiding slots.

A still further object of the invention is that the frames forming a row can follow a predetermined curve, according to the continuous casting machine in question. This can, for example, be achieved by guiding the guiding lugs along a path with a predetermined curve. A further feature of the invention is that the strand guiding elements of two consecutive frames which guide the curved surface of the strand, can be connected so that the distance between these strand guiding elements parallel to the strand is longer at the outer curvature than at the inner curvature, according to the predetermined curve.

A yet further object of the invention is, that the frames can be designed as roller supports, whereby each roller support has two bearing pieces which are connected with each other with two shafts. Alternatively the frame can be designed in such a way, that more than two pairs of rollers can be mounted on one frame.

A further feature of the invention is that one of the shafts can function as a common joint of two consecutive roller supports which allows the roller supports mounted on this common shaft to swivel against each other, whereby the row of the roller supports forms a chain.

A still further feature of the invention is that the connecting shaft which is common to the two roller supports projects beyond the bearing pieces, and the two projecting parts of the shaft function as guide lugs which are guided in paths. This arrangement allows the use of the same guiding pieces which guide the roller supports. This means, of course, a saving in money and erection work.

Another feature of the invention is a setting device incorporated within the roller bearings which allows the adjustment perpendicularly to the strand surface of the distance between the roller shafts. Therefore, the adjustment of the whole strand guiding system can be made outside the plant.

Other features of the invention are explained below:

Further exemplified embodiments of the strand guiding system, according to the invention, are illustrated in the accompanying drawings wherein:

FIG. 1 is a broken away elevation view of a strand guiding system for a curved continuous casting plant;

FIG. 2 is a top view of a portion of the strand guiding system of FIG. 1 to clarify the arrangement of the roller supports;

FIG. 3 is a side elevation of FIG. 2;

FIG. 4 is a cross section view taken along lines IV—IV of FIG. 1;

FIG. 5 is a broken away elevation view of a strand guiding system for a vertical continuous casting plant;

FIG. 6 is a top view of a portion of the roller supports shown in FIG. 5;

FIG. 7 is a cross section view along lines VII—VII of FIG. 5;

FIG. 8 is an elevation view of a strand guiding system

of a curved continuous casting plant in which one of the roller supports in the row is rigidly connected with the structure of the plant and a further roller support is mounted floatably.

FIG. 9 is a cross section view taken along lines IX—IX of FIG. 8.

FIG. 1 illustrates a part of the strand guiding system 1 for a curved continuous casting plant, adjacent to an oscillating mold 2. In the strand guiding system, the strand 3 is guidedly supported and is cooled from the mold 2 to processing equipment (not shown). In this particular example, the strand guiding elements are shown as rollers. These elements could also be designed as cooled sliding elements, i.e., cooling plates. A water spray cooling arrangement 5 is provided in conventional manner.

FIGS. 2-4 show details of portions of FIG. 1 to enlarged scale and reference will be made to FIGS. 1-4. In the figures, there is shown the frames 10 carrying the guiding rollers of the strand guiding system 1. Each frame 10 consists of the bearing blocks 11 and 12, which are connected by the two shafts 15, 16. The rotating guiding rollers 17, 18 are mounted on these shafts 15, 16 respectively. Further, shafts 19, 20 are mounted perpendicularly to the shafts 15, 16. The rotating guiding rollers 21, 22 are mounted on shafts 19, 20. The rollers 17, 18 and the rollers 21, 22 form a pair of rollers. These pairs of rollers have the function of guiding the strand. Each of the bearing blocks 11 has a coupling strap 23 and each of the bearing blocks 12 has a coupling strap 24. Each of these straps is provided with a bore, which is in line with the bore accommodating the shaft 15 of the adjacent roller support. Therefore, the shaft 15 connects and is common with the adjacent roller supports. When connecting two roller supports 10 with this common shaft 15, a swivelling action of the adjacent roller supports can be achieved. The faces 25 on the roller supports 10 limit the swivelling angle. By arranging a plurality of such roller supports in the above mentioned manner, a row of roller supports is produced, thereby forming a chain.

The connecting shafts 15 which are the common joints of the roller support 10 project beyond each of the bearing blocks 11, 12. These projecting portions of the connecting shaft 15 are designed as bearings for the rollers 30, which are held by locking rings 31. The bearing blocks 11, 12 and the rollers 17, 18 mounted on the shafts 15, 16 are also held in position by locking rings 31. The rollers 30 are designed as guide lugs for the roller supports. The examples in the accompanying drawings on FIGS. 1-7 show guide lugs which are formed by shafts 15 and rollers 30. As an alternative, these guide lugs could be fastened on the bearing blocks 11, 12 as separate parts.

It is known to guide the strand accurately between pairs of guiding rollers to avoid bulging out of the strand which has a liquid core. According to the invention, setting devices allow the adjustment perpendicularly to the strand surface of the distance between the roller shafts within certain limits. These setting devices consist of eccentric bushings 32 which are provided with hexagonal heads. These bushings function as bearings for shafts 16, 19, 20. The locating plates 33 fastened on the bearing blocks 11, 12 by screws 34 hold the eccentric bushings together with the guiding rollers in the set position.

In FIG. 4, there is more clearly shown a guiding rail 35 which guides the rollers 30 along a predetermined path. The rail 35 guides each roller frame 10 and, thus, the chain formed by the plurality of roller frames. The guiding rail 35 which is arcuate in the example shown, serves as support for the cooling spray equipment 5. The details of the cooling spray equipment is not described in detail as such is well known to the art. The guiding rail 35 as shown in FIG. 1 is rigidly connected with the structure of the plant by fasteners which are not shown on the drawings.

The first roller frame 10 of the following chain is positioned adjacent to the mold 2 and is rigidly connected with the guiding piece 35 by screws not shown on the

drawing. The remaining frames are coupled to the first frame and the chain is, thus, allowed to expand when heated without being stressed too highly.

The described chain fits into any desired curve of the strand guiding by means of rollers 30, because of the swivelling action of the chain members. Should the strand for example be additionally bent or straightened in the strand guiding system, the swivelling action allows the roller supports 10 to adapt themselves on the inner and outer curvature of the strand.

As already mentioned before, it is known that the first section of the strand guiding system can be damaged by breakouts of the liquid steel. It is, therefore, advantageous to install the strand guiding system in at least two sections, so that only the first short section must be changed after the occurrence of a breakout. In this first section of the strand guiding system guiding flaps 36 of the guiding rail 35 which guide the rollers 30 can be designed so as to be removable after the breakout has occurred.

This allows a quick change of the damaged roller supports, thus, reducing the down time of the continuous casting plant to a minimum.

FIGS. 5, 6 and 7 show a further embodiment of the strand guiding system, particularly useful in a vertical continuous casting plant.

FIG. 5 shows the strand 3 issuing from the mold 2 and withdrawn by withdrawal rolls 40, guided in a straight strand guiding 41 and further cooled therein. The difference between the roller frames 10 described above and the roller frames 42 shown in FIG. 6 is, that the roller frames 42 are not connected together with a common shaft. They are, instead, guided on both sides and have four faces 43 which act as a support for each consecutive roller support 42.

Each roller frame 42 accommodates four rollers 30 which are guided in guide rails 44, 45 as shown in FIG. 7. The bottom roller frame 42 rests on plates 46 which close the slot in the guide rail 44, 45. The other roller supports are piled upon each other. Instead of positioning the bearing blocks 11, 12 on the shafts 15, 16, they could be connected with ribs which are not shown, whereby the frame consists of a single piece.

The roller frames 42 can be guided without guide rails 44, 45 by positioning means, i.e. pins, on faces 43 shown in FIG. 6. These positioning means are not shown on the accompanying drawings. By piling the frames upon each other, a row is formed following a predetermined path according to the strand guiding used. The lateral positioning of the row is achieved by supports spaced at certain intervals.

FIGS. 8 and 9 show an arrangement of a strand guiding system consisting of a row of frames 52, whereby the distances between two rolls parallel to the strand are longer at the outer curvature than at the inner curvature according to the predetermined curve. It is also possible to arrange this strand guiding in several sections whereby one frame 52 is rigidly connected with the structure 49 of the plant by support 47 and shaft 49. Another frame 52 is held with support 48 in the correct position to the strand axis, whereby any movement in direction of the strand is taken up by floating lugs 50 in slots 51.

This invention may be variously modified and embodied within the scope of the subjoined claims.

What is claimed is:

1. Apparatus for guiding a strand in a continuous casting machine in which liquid metal is poured into a cooled mold to form a strand which is withdrawn continuously therefrom by withdrawal rolls, comprising strand guiding means positioned between said mold and said withdrawal rolls, said strand guiding means comprising a plurality of frames, at least one pair of strand guiding elements carried by each of said frames, said strand guiding elements being positioned astraddle said strand in guiding relationship thereto, and guide rails positioned astraddle said frame plurality, at least two of

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said frames being provided with projecting guide lugs engaging said guide rails in guiding relationship.

2. Apparatus in accordance with claim 1 in which each of said frames is pivotally coupled to the immediately adjacent frame.

3. Apparatus in accordance with claim 1 in which each of said frames comprises a pair of bearing blocks, a pair of shafts coupling said bearing blocks, each of said shafts carrying a roller thereon, and with said rollers positioned astraddle said strand and engaging opposed surfaces of said strand in guiding relationship.

4. Apparatus in accordance with claim 3 in which said bearing blocks carry a second pair of shafts arranged perpendicular to said first pair of shafts, each of said second pair of shafts carrying a roller thereon, and with said last named rollers positioned astraddle said strand and engaging opposed surfaces of said strand in guiding relationship.

5. Apparatus for guiding a strand in a continuous casting machine in which liquid metal is poured into a curved cooled mold to form a curved strand which is withdrawn continuously therefrom by withdrawal rolls, comprising strand guiding means positioned between said mold and said withdrawal rolls, said strand guiding means comprising a succession of frames, at least one pair of strand guiding rolls carried by each of said frames, said strand guiding rolls being positioned astraddle said strand in guiding relationship thereto, said successive frames being pivotally connected to one another by a shaft carrying one of said rolls which engages one surface of said strand,

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the portions of said frames carrying the other of said rolls which engages the opposite surface of said strand being unconnected and free to move toward or away from one another, curved guide rails positioned astraddle said frame plurality, and means carried by said frames for engaging said curved guide rails to hold said frames in a predetermined curve conforming to the curvature of the strand.

6. Apparatus in accordance with claim 5 in which the means for engaging said curved guide rails are the shafts which pivotally connect the successive frames.

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