ABSTRACT: In an apparatus for the continuous casting of metal strip, liquid metal solidifies between a casting belt carried on a pair of guide rolls and a casting roll spaced from one of said guide rolls, and a pair of casting rings engage opposite edges of the upper stretch of said casting belt to form a basin and to retain molten metal supplied to said basin.
TRAVELLING-BELT-TYPE APPARATUS FOR THE CONTINUOUS CASTING OF METAL STRIP

This invention concerns continuous casting apparatus in which liquid metal solidifies between moving endless cast strip to form a continuous metal strip.

A known apparatus comprises a rotating casting wheel in which the U-shaped cross section of the rim forms a channel on the inside of the wheel, thereby creating a trough in the lower part of the wheel into which liquid metal is poured. A casting roll located downstream of the trough limits the cross section of the channel to the desired cross section of the strip. The strip exits from the channel in the upper part of the wheel and is formed into a coil which is located inside the casting wheel which has only limited storage capacity. Frequent interruptions of the casting process are required, therefore, for removal of coils. Furthermore, cracks frequently develop in the strip when it is uncooled after it has cooled.

It is also known to remove the cast strip from the inside of the casting wheel by twisting it. However, the great stress to which the strip is subjected by this method limits its applicability to relatively narrow strips.

The above described difficulties are avoided in another known strip-casting apparatus in which the liquid metal is poured on the upper trough of an endless casting belt carried on and guided by guide rolls. The edges of the moving casting belt are bent upward by a lower support roll upstream of the metal pouring area. An upper casting roll limits the pouring area in casting direction and also controls the thickness of the cast strip. However, the belt is weakened by the repeated upward bending of the edges and it is also eroded by the direct impact of the metal which is poured into it, so that it wears out in a relatively short time. The lack of effective sealing of the edges of the casting belt on the rolls also causes difficulties.

An object of the present invention is to provide an apparatus for the continuous casting of metal strip utilizing an endless casting belt in which the cast strip can be discharged continuously from the apparatus without twisting it. Another object is the elimination of bending and reduction of erosion of the casting belt. A still further object is to form a basin in the casting belt and to seal the edges of the belt to retain molten metal supplied to the basin.

According to the present invention an endless casting belt is carried on a pair of spaced guide rolls, and a pair of rotatable casting rolls are supported on the ends of said guide rolls and engage the edges of the upper trough of the belt. The lower peripheral portions of the casting rolls cooperate with the casting belt to form a concave depression which provides a basin for the accumulation of a pool of molten metal which prevents direct impact of the liquid metal stream against the casting belt and also insures even distribution of the molten metal over the width of the belt. By using these casting rolls instead of a casting wheel the cast strip can be withdrawn from the apparatus in a straight line.

A casting roll is mounted opposite and above the downstream guide roll and is adjustable to control the thickness of the cast strip. The edges of the surface of the casting roll are each spaced from the opposed surfaces of the casting rings by a distance which is approximately equal to the thickness of the cast strip. Excess molten metal will therefore not be jammed between the casting roll and the guide roll but will escape sideways forming fins which can be removed later.

The casting rings are carried by the guide rolls with the edges of the casting belt located between them. Flanges on the casting rings are guided in grooves in the ends of the guide rolls and also in grooves in upper guide rolls. Coolants are conducted through the lower guide rolls and through the casting roll while the casting belt is sprayed cooled.

A preferred embodiment of the invention is shown in the drawings in which:

FIG. 1 is a side elevation of the casting apparatus, and FIG. 2 is a cross section of the casting apparatus along line 2-2 of FIG. 1.

Attached to the base 1 of the frame 2 are two spaced support plates 3 in which a pair of spaced parallel guide rolls 4 and 5 are journaled for supporting and guiding an endless casting belt 6. The belt is tightened by a roll 7 which is journaled at its ends in blocks 8 mounted to slide on the plates 3. The tightness of the belt may be adjusted by screws 9.

A pair of rotatable casting rings 10 and 11 are supported on the ends of the guide rolls 4 and 5, and the flanges 12 of the casting rings are guided in grooves 13 in the guide rolls. Two upper guide rolls 14 and 15 which are mounted on the frame 2 also have grooves which are engaged by flanges 12 to guide the upper portions of the casting rings 10 and 11. The outer periphery of each ring is in engagement with an edge of the belt 6 at and between the points of tangency between the ring and the rolls 4 and 5, thus forming a concave, curved depression which provides a basin in the upper trough of the belt between the rolls, and also forming a seal at each edge of the belt to retain molten metal in the basin when supplied thereto as heretofore described.

A casting roll 16 is located above and parallel to the guide roll 5 which is journaled at its ends in lever arms 19, 20 which are pivotally mounted on the frame 2 at pivot points 20'. The lever arms are adjustable by screws 17, 18 carried on the frame 2 and connected to arms 19, 20 to adjust the position of the casting roll 16. The motor 23 drives the guide roll 5 through gears 24 and 25 which in turn drives the casting roll 16 through gears 21 and 22.

The thickness of the cast strip is determined by the distance between the surface of the endless casting belt 6 and the opposed surface of the casting roll 16. The edges of the surfaces of the casting roll 16 are each spaced from the opposed surfaces of the casting rings 10, 11 by a distance which is approximately equal to the thickness of the cast strip.

Molten metal is supplied from a tundish 26 through a casting nozzle 27 into the basin which is formed by the lower peripheral portions of the casting rings 10, 11 the casting roll 16 and the belt 6, thereby forming a pool of molten metal which accumulates in the basin and prevents direct impact of the liquid metal stream on the belt. A strip of metal solidifies on the surface of the cooled belt and is adjusted to the desired thickness when it reaches the casting roll 16. The cast strip is conducted out of the casting apparatus by a guide 28. Fins which may be formed along the edges of the cast strip by metal which solidifies within the spaces between the edges of the surface of the casting roll 16 and the casting rings 10, 11 can be removed later.

We claim as our invention:

1. Apparatus for the continuous casting of metal strip comprising a pair of spaced, parallel guide rolls, an endless casting belt carried on and guided by said rolls, a casting roll mounted above one of said guide rolls parallel thereto and spaced therefrom, and a pair of spaced casting rings carried on said guide rolls and having peripheral portions engaging the edges of said belt along the upper trough thereof at and between the points of tangency between the rings and the guide rolls and forming a concave curved basin in the upper trough of the belt between said rolls and also forming a seal at each edge of the belt to retain molten metal in said basin.

2. The apparatus of claim 1 including upper guide rolls engaging the upper peripheral portions of said rings.

3. The apparatus of claim 2 in which said guide rolls are provided with grooves and said rolls are provided with peripheral flanges which engage said grooves.

4. The apparatus of claim 1, including a casting roll mounted above one of said guide rolls parallel thereto and spaced therefrom and adapted to control the thickness of the cast strip.

5. The apparatus of claim 4, including means for adjusting the spacing between said casting roll and the opposed guide roll.

6. The apparatus of claim 4 in which the edges of the surface of the casting roll are spaced from opposed surfaces of the respective rings by a distance approximately equal to the thickness of the cast strip.