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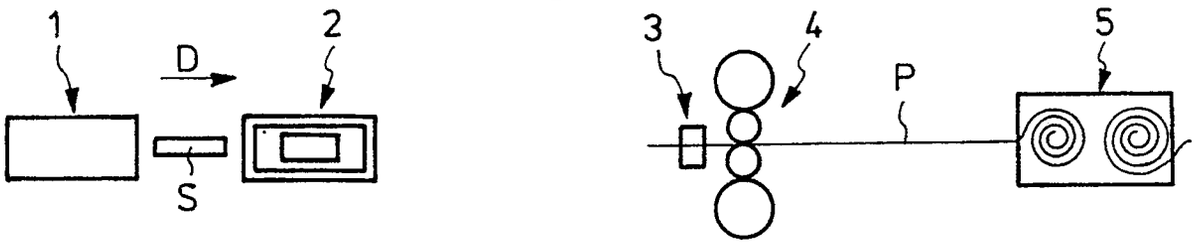
(54) Hot roughing mill installation.

(57) A hot roughing mill installation comprises one or two reversing roughing mills (4) through which a slab(s) of hot metal, in use, passes in a working direction (D). Upstream of the roughing mill(s) is a sizing press (2) which, in use, changes the width of the slab(s) after it has come out of a furnace (1) upstream of the sizing press (2). Downstream of the roughing mill(s) is a coil box (5) arranged to coil the roughed strip (P). Edgers (3), which form a thickened portion on each side of the slab(s), may be located immediately upstream and/or downstream of the or each roughing mill (4), and a rolling mill (6) may additionally be located between the sizing press (2) and the roughing mill(s).

Fig.1



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The present invention relates to a hot roughing mill installation. Known hot roughing mill installations are described for example in the Japanese Patent 1st Publication No. 53-26759 or the Japanese Patent 2nd Publication No. 61-3561. The former is directed to a large-scale production facility having a sizing press for achieving higher production efficiency and the latter to a medium-scale production facility having a coil box, i.e. a coiling device, for winding up the roughed metal strip to reduce the length of the roughing mill line.

The installation described in the former publication has a very long roughing mill line, whilst the latter installation does not achieve good production efficiency. There is at present no hot roughing mill installation which has both high production efficiency and a relatively short roughing mill line. The object of the present invention is therefore, amongst other things, to provide an installation with a short roughing mill line and which operates at a high production efficiency.

According to the present invention, a hot roughing mill installation which, in use, receives from a furnace a slab of hot metal which passes through the installation in a working direction, comprises a first reversing roughing mill and a sizing press upstream of the roughing mill and is characterised by a coil box downstream of the roughing mill which, in use, receives and coils a metal strip from the roughing mill.

The sizing press drafts the slab to a desired width before it passes through the roughing mill.

An edger is preferably included in the installation, immediately upstream of the roughing mill. The edger, in use, forms a thickened portion or "dog bone" on each side of the slab. This ensures that portions of reduced thickness, or "edge drops" are not created during' roughing in the roughing mill.

Another edger may be incorporated immediately downstream of the roughing mill.

It is possible for a second reversing roughing mill to be included in the installation, downstream of the first. In this case, further edgers may be incorporated immediately upstream and/or immediately downstream of the second roughing mill.

A rolling mill, which may be two-high, may be included in the installation, in order to flatten the thickened portions produced by the edger or edgers, should these portions be too pronounced.

The following description of four specific embodiments of the present invention is given by way of example only, with reference to the accompanying drawings in which:-

Figure 1 is a highly schematic side view of a first embodiment of hot roughing mill installation in accordance with the invention;

Figure 2 is a view similar to Figure 1 of a second embodiment;

Figure 3 is a view similar to Figures 1 and 2 of a third embodiment; and

Figure 4 is a view similar to Figures 1, 2 and 3 of a fourth embodiment.

Figure 1 shows a first embodiment of the present invention in which reference numeral 1 represents a furnace for heating a slab S; and 2, a sizing press for drafting, or reducing the width of, the slab S when it has been taken out from the furnace 1. Numeral 3 represents an edger for forming a "dog bone", or thickened portion, on each side of the slab S; and 4, a reversing mill for roughing the slab. Downstream of the roughing mill 4 is a coiling device, 5, specifically a coil box for winding up the roughed strip P. The sizing press 2, edger 3, roughing mill 4 and coil box 5 are arranged on the exit side of the furnace 1 in that order in the direction D of travel of the slab. The direction D is the working direction in which the slab moves; that is to say it is the direction in which the slab progresses through the installation, although it may in fact also have a reciprocating motion, and the direction of travel at any instant may not be the same as the working direction D. A mill (not shown) for finishing the metal strip P is arranged downstream of the coil box 5 with respect to the direction of travel D.

The slab S is heated in the furnace 1 to a predetermined temperature and is then taken out of the furnace 1 and drafted to a predetermined width in the sizing press 2. Then, the slab S is reverse rolled several times in the reversing roughing mill 4 and is thereby formed into a metal strip P with the desired thickness.

The strip P is then wound up into a coil in the coil box 5. The metal strip P is thereafter uncoiled to be sent to the finishing mill (not shown) for finishing.

It is possible that edge drops, or portions of reduced thickness, on each side of the slab S can be created during the reverse rolling process in the roughing mill 4. This is prevented, in an installation according to the invention, by initially drafting the slab S in the edger 3 to generate dog bones, or portions of increased thickness, on the sides of the slab. Accordingly, no edge drops may be observed on the metal strip P after roughing in an installation according to the present invention.

As described above, the sizing press 2 is used to width-draft the slab S so that the amount of width drafting of the slab S which may be carried out can be increased in comparison with an installation not including a sizing press. Therefore, the range of widths of slab which may be cast by a continuous casting machine upstream of the installation and fed to the furnace 1 may be large. The number of different types of slab which the

casting machine must produce is accordingly lowered, and as a result, the frequency with which the moulds on the casting machine must be changed is also reduced, resulting in an enhancement of the production efficiency.

Since the metal strip P, after roughing, is wound up in the coil box 5, the length of the production line from the roughing mill 4 to the finishing mill can be shortened, which leads to the installation being smaller than if the coil box were not included.

Figure 2 shows the second embodiment of the present invention in which a two-high rolling mill 6 is arranged between the sizing press 2 and the edger 3 so that, even if the thickened portions generated on each side of the slab S or metal strip P when it is drafted by the sizing press 2 or by the edger 3, are too big, they can be crushed by the two-high rolling mill 6.

Figure 3 shows a third embodiment of the present invention in which edgers 3 are arranged upstream and downstream of, i.e. in front of and behind the roughing mill 4 with respect to the working direction D. In this case, the sides of the metal strip P can be drafted by the edger 3 immediately prior to entering the roughing mill 4, regardless of the actual direction of travel of the strip P at that time.

Figure 4 shows a fourth embodiment of the present invention in which two reversing roughing mills 4, with edgers 3 in front of and behind each of them, are arranged between the sizing press 2 and the coil box 5. In this case, reverse rolling can be performed respectively by each of the roughing mills 4.

In a similar manner to the first embodiment, the second, third and fourth embodiments provide good production efficiency due to the inclusion of the sizing press 2 and the reversing roughing mill or mills 4, and a short roughing mill line due to the presence of the coil box 5.

It is to be understood that the present invention is not limited to the above-described embodiments and that various modifications may be made within the scope of the invention.

Claims

1. A hot roughing mill installation which, in use, receives from a furnace (1) a slab (S) of hot metal which passes through the installation in a working direction (D), the installation comprising a first reversing roughing mill (4) and a sizing press (2) upstream of the roughing mill (4), characterised by a coil box (5) downstream of the roughing mill (4) which, in use, receives and coils a metal strip (P) from the roughing mill (4).

2. An installation as claimed in Claim 1 characterised by an edger (3), which, in use, forms a thickened portion on each side of the slab, the edger (3) being located upstream of the first roughing mill (4).

3. An installation as claimed in Claim 2 characterised by a further edger (3) downstream of the first roughing mill (4).

4. An installation as claimed in any preceding claim characterised by a second roughing mill (4) located downstream of the first roughing mill (4).

5. An installation as claimed in Claim 4 characterised by an edger (3) immediately upstream of the second roughing mill (4).

6. An installation as claimed in Claim 5 characterised by a further edger (3) immediately downstream of the second roughing mill (4).

7. An installation as claimed in any of Claims 2 to 6 characterised by a rolling mill (6) located between the sizing press (2) and the roughing mill(s).

8. An installation as claimed in Claim 7 characterised in that the rolling mill (6) is two-high.

Fig.1

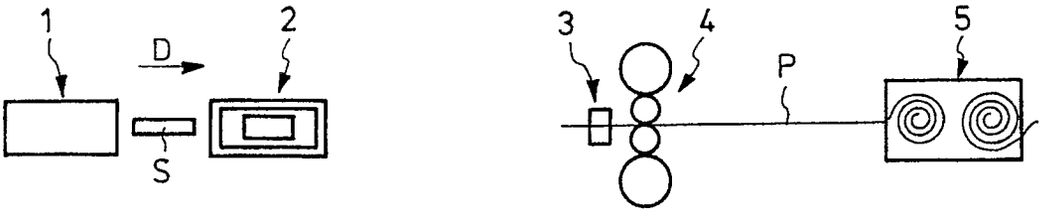

Fig.2

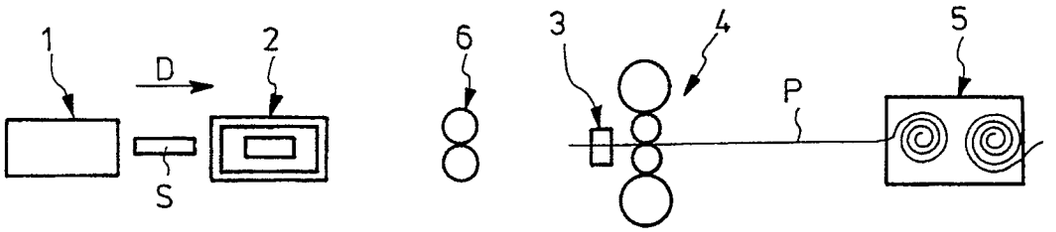

Fig.3

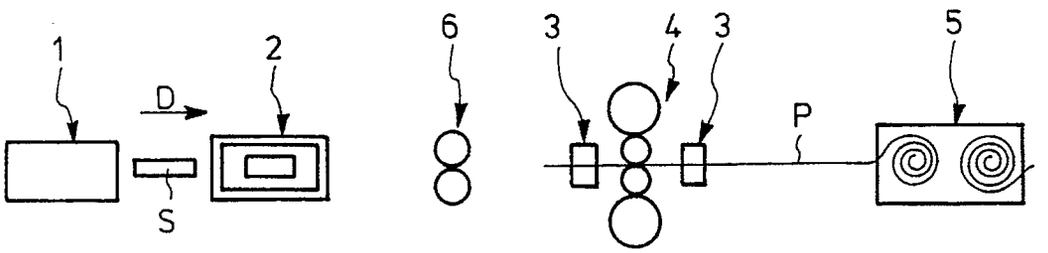

Fig.4