

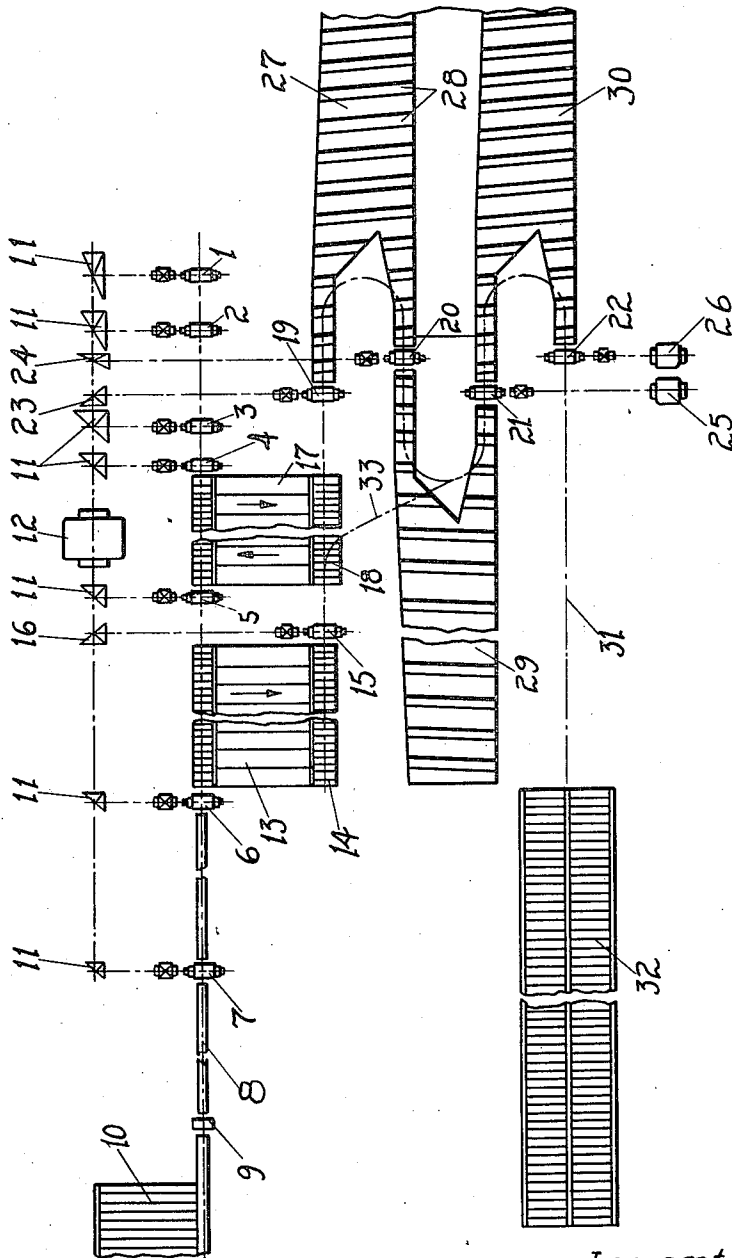
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ROLLING MILL

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ROLLING MILL

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The present invention relates to rolling mills. The invention resides in a novel disposition and arrangement of rolling mill apparatus, especially applicable to a general-purpose or jobbing mill, which is adapted to the rolling of a large variety of different sizes and sections; furthermore, the arrangement is such as to obtain the maximum of flexibility in the rolling operations, and a wide range of selection in the use of the various stands of rolls.

The above and other objects and advantages of the invention are fully set forth in the following detailed description thereof, reference being had in this connection to the accompanying drawing, whose single figure is a diagrammatic plan view of rolling mill apparatus arranged in accordance with the invention.

Referring to said drawing, the preliminary reduction of the stock, as received from a heating furnace, not shown, is preferably effected in a roughing mill consisting as here shown of four stands of reducing rolls 1, 2, 3, 4, in tandem relation. Substantially in the line of delivery from said roughing train are arranged certain intermediate and finishing roll stands, here designated by the numerals 5, and 6, 7, respectively. These last three stands are spaced apart from each other and from the roughing train 1, 2, 3, 4 to provide for "open" rolling, that is, so that the full length of a piece of stock can be delivered from any of said roll stands before its first end is received in the succeeding stand of rolls. As shown, however, the roll stands 3 and 4 of the roughing train are arranged in juxtaposition for "continuous", as distinguished from "open" rolling. The several aligned stands of roughing, intermediate and finishing rolls, as above described, constitute for certain purposes a complete rolling mill, the product of which, as shown, may be delivered directly by the usual runout 8 to a flying shear 9 adapted to sever said product into predetermined lengths, prior to its delivery onto a cooling bed or other receiving device 10. Preferably, all of said aligned stands of rolls are driven through suitable gearing 11,

from a single motor or other prime mover 12.

According to the invention, I arrange between the intermediate roll stand 5 and the finishing roll stand 6 a broadside transfer mechanism 13 of any well-known construction, the latter adapted to intercept the rolled product when desired before its entrance to the finishing rolls 6 and to deliver it broadside to a longitudinal conveying mechanism 14 whose rollers in this case run in the opposite direction from the conveyor rollers that support the stock between the roll stands 5 and 6. Said conveying mechanism 14 delivers the stock to an offset stand of rolls 15 that is here shown as driven in a direction opposite to the previously described stands of rolls, preferably by suitable gearing 16 from the same motor or other prime mover 12. After undergoing reduction in the stand of rolls 15 the stock runs out on a second broadside transfer mechanism 17, the latter being operable when desired to return said stock to its original line of delivery, for repassage through the intermediate roll stand 5, and thence through the successive finishing stands 6 and 7 to the cooling bed 10. By this arrangement, two additional passes, over and above the number of passes provided by the aligned stands of rolls as first described, are obtained, namely, the pass between the stand of rolls 15, and the repassing through the stand of rolls 5. Thus, the rolling in this case is accomplished by a four-stand roughing mill, a three-stand intermediate mill, and a two-stand finishing mill, making nine stands in all. The above described diversion of the stock to the offset stand of rolls 15, and its ensuing repassage through the stand of rolls 5 can be repeated, in the rolling of a given product, as often as may be desired; each time it is done, the number of passes given to the stock is increased by two. Furthermore, these extra passes can be utilized, by the above described arrangement, without traversing the stock longitudinally through a greater distance than the minimum required for "open" rolling.

According to the invention, instead of returning the stock after passing through the

stand of rolls 15 to its original line of delivery, the broadside transfer mechanism 17 may be rendered inoperative, and in this case the said stock, as run out on conveyor rollers 18, is presented longitudinally to a single stand of rolls 19, which constitutes part of another finishing mill, here shown as a staggered duo mill consisting of four stands of separated rolls 19, 20, 21 and 22, of which the rolls 19 and 21 are operated in the same direction as the rolls 15, while the rolls 20 and 22 are operated in the same direction as the alined stands of rolls 1 to 7 inclusive. Preferably, the stands of rolls 19 and 20 are driven by suitable gearing 23 and 24 respectively from the same motor 12 which operates the previously described roll stands, while the stands of rolls 21 and 22 are preferably driven from the independent motors 25 and 26 respectively. In the operation of this staggered duo finishing train, the stock as delivered from the roll stand 19 is received on a Y-transfer conveying mechanism 27 of well known construction which provides the usual means, in the forming of of reversible skewed conveyor rollers 28, 28 for alining the stock with the next roll stand 20 of said finishing train, and for presenting thereto that end of the stock which last emerged from the rolls 19; a similar Y-transfer conveying mechanism 29 is interposed between the stands of rolls 20 and 21 of the finishing mill and a third Y-transfer conveying mechanism 30 is likewise interposed between the stands of rolls 21 and 22 of said finishing mill. From the rolls 22, a suitable runout 31 is adapted to deliver the stock to a cooling bed 32 of any desired construction. With this arrangement, utilizing the staggered duo finishing train 19, 20, 21 and 22, the rolling is accomplished by four stand roughing mill, a two-stand intermediate mill, and a four stand finishing mill making in all, a ten-stand combination. Furthermore, according to the invention, the broadside transfer mechanism 17 may, if desired, be operated in a direction opposite to that previously described, whereby it will intercept the stock as delivered by the roughing train 1, 2, 3, 4, and transfer it broadside to the conveyor rollers 18, the latter, as before, serving for delivery of said stock to the staggered duo finishing mill 19, 20, 21 and 22. This mode of operation cuts out from the passage of the stock, the two stands of rolls 5 and 15 and thereby constitutes an eight-stand arrangement, as distinguished from the ten-stand arrangement described immediately above. Thus, by the arrangement above described, assuming the alined stands of rolls to be seven in number as shown, I have provided for the stock's complete reduction either in a seven-stand mill (the alined stands 1 to 7 inclusive) or an eight-stand mill (the stands 1,

2, 3, 4, 19, 20, 21 and 22) or a nine-stand mill (the stands 1, 2, 3, 4, 5, 15, 5, 6 and 7) or a ten-stand mill (the stands 1, 2, 3, 4, 5, 15, 19, 20, 21 and 22). This selectivity as regards the total number of stands permits the efficient rolling of a great variety of sections; the alined stand mill arrangement, for example, is well suited for large angle, flat and round sections, while the other mill arrangements are well adapted for a great variety of smaller sections of angles, flats and rounds. In addition to the above described variations, and those provided by repeated diversions through the stands 5 and 15, the stock, upon emergence from stand 15 may, if desired, be passed, as shown by the broken line 33, directly to the third stand 21 of the staggered duo finishing mill, for finishing in the two stands 21 and 22 of said mill, without being subjected to reduction in the passes of the stands 19 and 20 thereof.

I claim,

1. In a rolling mill, the combination with a train of roughing rolls, of a finishing roll train, comprising a plurality of pairs of staggered roll stands, arranged at one side of and immediately adjacent to said roughing train, another finishing train comprising roll stands in tandem arrangement, disposed in substantial alinement with said roughing train and spaced apart therefrom, a series of intermediate roll stands common to both of said finishing trains, one of said intermediate stands being substantially alined with and interposed between said roughing train and said second-mentioned finishing train and means selectively operable in the passage of the stock from said roughing train to either of said finishing trains for making as many passes through said intermediate stands as may be required.

2. In a rolling mill, a series of stands of rolls in substantial alinement, comprising a plurality of stands of roughing rolls, a stand of intermediate rolls and a plurality of stands of finishing rolls, with provision for "open" rolling between the roughing and the intermediate stands, in combination with a group of additional finishing stands at one side of said substantially alined stands, means for broadsiding the stock as delivered by said intermediate roll stand, to aline it with the first stand of said additional finishing rolls, a second stand of intermediate rolls preceding said first stand of additional finishing rolls, means for passing the stock so broad sided repeatedly through the first and second stands of intermediate rolls, and means selectively operable to finish the stock so broadsided in said additional finishing rolls, or in the first-mentioned finishing rolls of said mill.

3. In a rolling mill, the combination with a train of alined roughing roll stands, of a stand of finishing rolls in substantial alinement with said roughing rolls and spaced

therefrom, an offset finishing roll train comprising a plurality of pairs of staggered roll stands, arranged at one side of and immediately adjacent to said roughing train, two
5 stands of intermediate rolls for operation on the stock between said roughing rolls and the first-mentioned and second-mentioned finishing roll stands, one of said intermediate
10 stands being alined with said roughing stands and the other being alined with the first stand of said offset finishing roll train, and means selectively operable to direct the stock delivered by the said second intermediate stand
15 either back to the first intermediate stand, or to the first finishing stand of said offset finishing train, or to an intermediate finishing stand of said offset finishing train.

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