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CONTINUOUS ROLLING MILL

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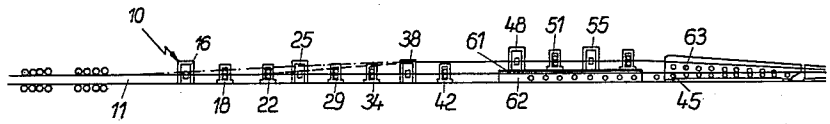
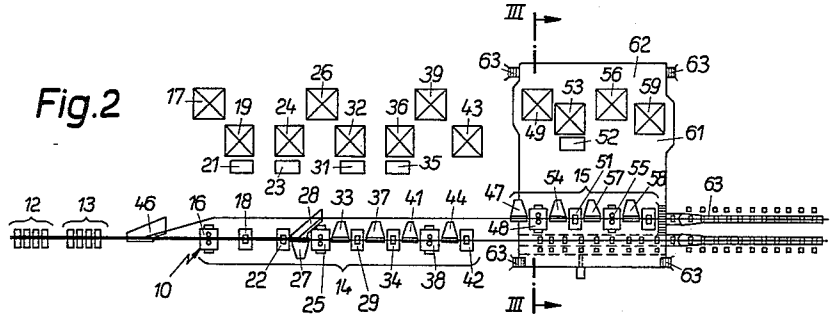


Fig. 1

Fig.2



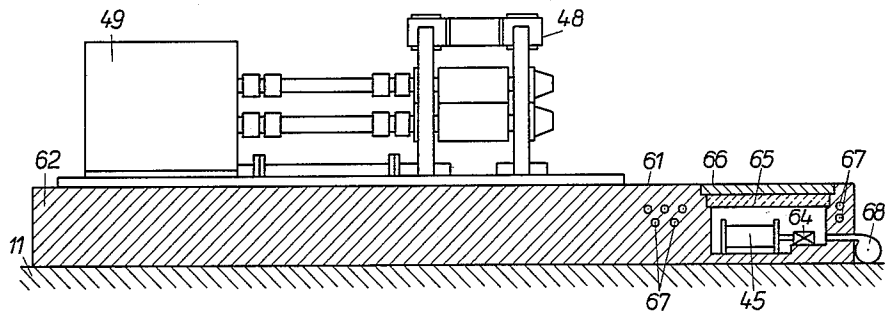


Fig.3

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CONTINUOUS ROLLING MILL

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This invention relates to a continuous rolling mill and more particularly to apparatus arranged to produce elongated metal strip or sections by the rolling method.

In the rolling of steel, it is advantageous to provide a mill which will produce either flat strip or sections alternately. This can be accomplished because the roughing and intermediate steps of rolling are generally the same for both products. However, the form of the rolls in the finishing stands and the speeds are, of course, different for the two products. In the past, such a dual-purpose mill has been difficult to operate effectively because of the long time required to change and adjust the finish rolls in converting from one product to the other. Also, it has previously not been possible to produce both flat strip and section material at the same time. These and other difficulties experienced with the prior art devices have been obviated in a novel manner by the present invention.

It is, therefore, an outstanding object of the invention to provide a continuous rolling mill which is capable of efficiently rolling either flat strip or sections.

Another object of this invention is the provision of a continuous rolling mill having two different sets of finishing trains, one for flat strip and the other for sections, in which the mill including one finishing train may be operated, while the rolls and guides in the other finishing train are being changed or adjusted.

A further object of the present invention is the provision of a continuous rolling mill in which the finishing stands of one type of product may be changed while product from another set of finishing stands continues to be produced.

It is another object of the instant invention to provide a platform for use in a dual-purpose rolling mill which permits the passage of hot product under the platform while operators in complete comfort make changes in the rolls and guides in a finishing stand mounted on the upper surface of the platform.

It is a further object of the invention to provide a continuous rolling mill for rolling either flat strip or angles in which all of the drives operate from one side of the mill.

A still further object of this invention is the provision of a continuous rolling mill having two parallel finishing passes which are relatively close together, so that the angle of deflection from the roughing and intermediate pass is very small.

It is a still further object of the present invention to provide a dual-purpose rolling mill in which the drives, control line connections, and the like are as short as possible and in which angles and flat strip may be produced at the same time.

With these and other objects in view, as will be apparent to those skilled in the art, the invention resides in the

combination of parts set forth in the specification and covered by the claims appended hereto.

The character of the invention, however, may be best understood by reference to one of its structural forms, as illustrated by the accompanying drawings in which:

FIG. 1 is a side elevational view of the continuous rolling mill embodying the principles of the present invention,

FIG. 2 is a plan view of the rolling mill, and

FIG. 3 is a sectional view of the mill taken on the line III—III of FIG. 2.

Referring to the drawings, it can be seen that the rolling mill, indicated generally by the reference numeral 10, is mounted on a floor 11 of a steel mill. The rolling mill consists of a roughing train 12, an intermediate train 13, a first finishing train 14, and a secondary finishing train 15. All of the roll stands, particularly those in the roughing train and the intermediate train, are shown very schematically and in improper spacing for the sake of simplicity. The first finishing train 14 consists of a vertical stand 16 driven by a motor 17 followed by a horizontal stand 18 driven by a motor 19 operating through a gear box 21. Following the stand 18 is another horizontal stand 22 driven through a gear box 23 by an electric motor 24. Next is mounted a vertical stand 25 driven by a motor 26. A horizontal loop repeater 27 is interposed between the stands 22 and 25 and a forward uphill repeater 28 is also so interposed and extends toward the drive side. Following the stand 25 is a horizontal stand 29 driven through a gear box 31 by an electric motor 32. A horizontal repeater 33 is mounted between the stands 25 and 29. Next in line is the horizontal stand 34 driven through a gear box 35 by a motor 36, there being a horizontal repeater 37 interposed between the stands 29 and 34. Next in line is mounted a vertical stand 38 driven by a motor 39, there being a horizontal repeater 41 interposed between the stands 34 and 38. The last stand in the finishing train 14 is a horizontal stand 42 driven by a motor 43 and preceded by a horizontal repeater 44. Suitable guides are interposed between the stands and at the entrance and exit of each stand in the usual manner.

Following the stand 42 and aligned with the roughing train 12, the intermediate train 13 and the finishing train 14, is a runout table 45 leading to a cooling bed (not shown). Interposed between the last stand of the intermediate train 13 and the stand 16 of the finishing train 14 is an upward forward repeater 46 similar in nature to the repeater 28. Both the repeater 28 and the repeater 46 terminate in a passline of the secondary finishing train 15 which begins with a horizontal repeater 47 which delivers stock into a vertical stand 48 driven by a motor 49. Following the stand 48 is a horizontal stand 51 driven through a gear box 52 by a motor 53. A horizontal repeater 54 is interposed between the stands 48 and 51. Next in line is a vertical stand 55 which is driven by a motor 56 and is preceded by a horizontal repeater 57. Following that stand is a horizontal final stand 58 driven by a motor 59. The stands, motors, gear boxes, and repeaters of the secondary finishing train 15 are all mounted on the upper surface 61 of a monolithic reinforced concrete platform 62, the said upper surface being a substantial distance above the surface of the floor 11.

The platform is generally rectangular and extends laterally across both of the roll passes including the main roll pass and the secondary roll pass and is provided with suitable stairways 63 for gaining access to the upper surface from the floor 11. Extending from the platform in line with the finishing train 15 is an inclined runout table 63 which inclines from a high end adjacent the platform to a low end on a level with the runout table 45 leading to the cooling bed.

Extending through the platform 62 in line wtih the main roll pass is a passage 64 having a bottom on a general level with the main pass line and carrying the runout table 45. Overlying the passage 64 and forming its roof is a slab 65 of insulating material and overlying this is a metal cover plate 66. Embedded in the material of the platform in the area close to the surface 61 and on either side of the passage 64 are pipes 67 carrying a cooling fluid, such as water. Also introduced into the center of the passage 64 is a fan 68 which introduces cooling air into the passage so that it flows in both directions to cool the platform and the surfaces of the passage. This protects the operators from the heat radiating from the roll stock passing over the runout table 45.

The operation of the invention will now be readily understood in view of the above description. The material to be rolled passes, first, through the roughing stands 12 where it receives its initial deformation and elongation, and then through the intermediate train 13 where its form is further changed. The final formation of the material takes place either in the finishing train 14 or the finishing train 15, depending upon the product which is desired. The finishing train 14 is intended to form flat strip material, while the finishing train 15 is intended to form angles and other material of irregular cross section known as "sections," including channels, I-beams, and the like. The mill may be operated in any one of several ways. First of all, a strip may be finished in the finishing train 14 and passed over the runout table 45 to the cooling beds, while no material goes through the finishing train 15. This would be the case if the next product to be rolled was an angle or the like and the workmen were occupied changing the rolls in the finishing train 15. Another method of operation, of course, would be that in which the material finished was finished by the finishing train 15 and passed over the runout table 63 to the cooling bed. At this time, the workmen could be changing rolls in the roll stand 14 or adjusting rolls in preparation for a new product to be rolled. The third possibility is that of rolling material in the finishing train 14 and the finishing train 15 at the same time. For this purpose two strands of material would be passed through the roughing train 12 and the intermediate train 13. One of the strands would continue on the main roll pass line through the finishing train 14, while the other would be shunted laterally either in the repeater 46 or the repeater 28 depending upon the product and then into the finishing train 15. The repeaters 46 and 28 are each provided in the usual manner with a switching means to cause the material being rolled to pass over into the finishing train 15 or to go straight ahead into the finishing train 14, depending upon the desired roll product. In some cases, before material is finished in the finishing train 15, it is desired to give it several more deformations and, for this purpose, the material would pass through the stands 16, 18, and 22 before being shunted laterally by the repeater 28 to pass it to the finishing train 15. While the operators are working on the stands 48, 51, 53, and 58 in the finishing train 15, they are moving around on the top of the platform 62. At the same time, the material being rolled in the finishing train 14 passes through the passage 64 on the surface of the runout table 45. The surface 61 of the platform is maintained at a comfortable temperature, first of all, because of the provision of the insulating slab 65 overlying the passage 64, and secondly, by the provision of cooling through the pipes 67 and the fan 68. The coolant in the pipes would be water from the regular water supply system and would be at ambient temperature which would be sufficiently cold to maintain the material of the platform at a comfortable temperature. In this way, it is possible for the operators to work on the finishing train 15 in comfort.

As can be seen from examination of the mill layout, all of the drives, irrespective of the location of the finishing stands involved, are on one side, which makes the side of the mills opposite the drives accessible from the main floor of the mill, for various purposes. Furthermore, the angle of deflection necessary to carry the rolled stock over into the secondary finishing train 15 is very small; this is important in the case of material which is to be formed in angles and other sections since its cross section is rather stiff at the time that it begins its distinctive deformation for ultimate formation into a section. This deflection angle is small because the secondary roll pass is quite close to the main roll pass, which relationship is possible only by permitting the material to pass over the drive spindles associated with the finishing train 14. The material is thus allowed to pass in a high position because of the high position of the finishing train 15 on the upper surface of the platform 62. Causing the material to pass a considerable distance over the tops of the spindles of the finishing train 14 permits these spindles and drives to be readily accessible, even while material is being passed to the finishing train 15. This is necessary since, while the finishing train 15 is being used, the finishing train 14 may not be in operation and, on the contrary, may be subject to repair and maintenance as well as to roll changes. In any case, it is quite necesasry to be able to have access to the spindles and particularly the point where the spindles are attached by couplings to the roll necks.

Another method of operating the apparatus which is beneficial is that of finishing angles in the finish train 14 and finishing strip in the finish train 15; this has the advantage that the flat strip is relatively easy to bend about its long dimension and can be deflected fairly easily into the secondary pass, while the sections (which presumably have a stiffer cross section) can continue in a straight line through the finishing train 14 over the runout table 45 to the cooling bed.

There are a number of other advantages obtained by mounting the finishing stand 15 at a high position. For instance, since it is thereby possible to arrange all the drives at one side, shorter electrical power leads and shorter control lines for the drives may be used. Furthermore, as has been stated above, the deflection angle for the secondary roll pass is maintained very small, so that, in the finish trains, sections and flat strip material can be rolled at the same time. By arranging the secondary roll train 15 closer to the cooling bed than the finish train 14, it is possible to have all the drives at one side so that it is not necessary for the roll stock of one finishing train to pass under the drives of the other finishing stand. With the present arrangement, it is, of course, not necessary to direct the stock emerging from the finish train 14 downwardly in order to avoid the operators working on the non-drive side of the finishing train 15. This has decided the advantage of permitting faster operation of the mills, since a constant level is used as the stock moves toward the cooling bed.

It is obvious that minor changes may be made in the form and construction of the invention without departing from the material spirit thereof. It is not, however, desired to confine the invention to the exact form herein shown and described, but it is desired to include all such as properly come within the scope claimed.

The invention having been thus described, what is claimed as new and described to secure by Letters Patent, is:

A continuous rolling mill, comprising

(*a*) roughing and intermediate trains mounted at floor level,

(*b*) a first finishing train mounted at floor level aligned with the intermediate train,

(*c*) a second finishing train parallel to and spaced from the first finishing train,

(*d*) a runout table aligned with the first finishing train,

(*e*) a platform mounted on the floor and having an upper surface located a substantial distance above the floor, the second finishing train being mounted on the said upper surface, the upper surface extending laterally over the said runout table, the platform being provided with a passage through which the runout table extends, and

(*f*) means for cooling the platform in the vicinity of the runout table so that the upper surface remains cool, despite the movement of hot rolled product on the table through the passage.

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