The present invention relates to troughs for rolling mills, especially troughs of the character employed on continuous mills.

A purpose of the invention is to eliminate scratching and other damage to the bar being rolled.

A further purpose is to facilitate speed control on a continuous mill by permitting better observation of the bar on the trough.

A further purpose is to eliminate the need of a flap to guide the bar from stand to stand when a side loop is produced between mill stands.

A further purpose is to simplify the mechanism for removing the troughs to gain access to the mill guides, and avoid danger of rendering the mechanism inoperative by clogging with mill scale.

A further purpose is to provide guides means raised above the inclined rollers to assure supplemental guiding of the stock when conditions of rolling make such supplemental guiding desirable.

Further purposes appear in the specification and in the claims.

In the drawings I have chosen to illustrate only one of the numerous embodiments in which my invention may appear, selecting the form shown from the viewpoints of convenience in illustration, satisfactory operation and clear demonstration of the principles involved.

Figure 1 is a fragmentary top plan view of a continuous mill showing two mill troughs connecting three mill stands in accordance with the invention.

Figure 2 is a side elevation of the structure of Figure 1.

Figure 3 is an enlarged section through one of the troughs on the line 3--3 of Figure 1.

Figure 4 is an enlarged section on the line 4--4 of Figure 1, omitting all mechanism except for the support of an individual trough roller.

Figure 5 is an enlarged section on the line 5--5 of Figure 2.

Figure 6 is an enlarged section on the line 6--6 of Figure 3.

Describing in illustration but not in limitation and referring to the drawings:

The present invention is concerned particularly with continuous rolling mills of the character which are used to produce bars and shapes of steel and other structural metals, but is applicable also to rolling mills of other types.

In ordinary rolling mill practice, the troughs between roll stands are merely U-shaped solid cast iron guiding members. These troughs of the prior art are subject to a number of disadvantages from the standpoint of use particularly in continuous mills, but also applying to some extent in the case of ordinary non-continuous mills.

There is a tendency for the prior art troughs to scratch the bar during its travel. This is undesirable, particularly when rolling stainless steel and other materials on which a high finish is desired. Another difficulty encountered with the troughs of the prior art is that it is difficult for the speed control operator of the continuous mill to see the stock while it is in the trough, and therefore speed cannot be effectively controlled.

In many prior art installations, it is desired to form side loops of the bar between roll stands. In such cases, normal practice requires the use of a flat loop ing surface at one side of the trough, with an air or electrically operated flap to guide the bar from stand to stand. After the bar has entered the succeeding stand the flap is retracted.

In the conventional troughs it is normal practice to mount the structure solidly on the base. In some cases the whole trough is made horizontally retractable so that access can be attained to the mill guides. Structures of this horizontally retractable character require slidable bases which are complicated and expensive, and are subject to clogging by mill scale, so that often it is impossible to move the retractable mechanism.

In some cases the guiding obtained by conventional troughs may not be fully adequate to meet the requirements.

In accordance with the present invention, each trough consists of a series of rollers having their axes parallel and in a common plane and positioned side by side. The rollers turn with the bar, thus avoiding scratching of the bar.

The rollers also support the bar in a position such that it is visible to the speed control operator at all times, so that much more effective speed regulation of the mill can be obtained.

In the preferred embodiment, the rollers slope, and are flanged at their lower ends, the angle of the side of the flange toward the roller with respect to the axis of the roller being suitably greater than a right angle and preferably in the range between 140 and 100 degrees, and most desirably about 120°, the angle of the cylindrical roller axes to the horizontal being preferably between about 5 and 15 degrees and most desirably about 10 degrees. Under these conditions the trough acts as a side looping surface for the bar and there is no need for retractable side looping guides or flaps.

Also in the preferred embodiment of the invention, the trough rollers are made to swing up bodily about a longitudinal pivotal shaft positioned at the high side, so that they can readily be raised out of the way to clear the space between the mill stands for work on the guides.

The present invention also makes it possible to raise supplemental guides above the inclined rollers to obtain further guiding when required.

Considering now the drawings in detail, I illustrate a continuous rolling mill having vertical mill stands 20 (only one of which is shown) and horizontal mill stands 21 (only two of which are shown), separated by troughs 22 which form the subject matter of the present invention. The troughs differ in the number of trough rollers to suit the distance between the roll stands, but are otherwise desirably the same. Each trough includes a base 23 which rests on the foundation of the mill and which includes a column support 24 which extends up at one side of the trough, suitably the high side, and a lateral bracket 25 which provides the anchorage for the operating mechanism.

At the top of the column support 24 there is a series of longitudinal bearings 26 which journal a shaft 27 extending longitudinally in the direction of stock travel and desirably consisting of bearing portions 28 and connecting portions 30 which are suitably joined as by welding at 31.

The connecting portions 30 are cross drilled at 32 to receive the shank ends 33 of roller shafts 34 which extend out with their centers in a common axis plane for
all of the rollers of a given trough, with the centers in side by side parallel relation. The roller shafts 34 are suitably mounted to the longitudinal shaft portions 30 by welding at 35.

Each of the shafts 34 has a cylindrical trough roller 36 journalled thereon, the trough rollers desirably comprising an inboard head 37 which engages the outside of an antifriction bearing 38, suitably a ball bearing, secured on the inside on the shaft, an outboard head 40 which engages the outside of an antifriction bearing 41, suitably a ball bearing, secured at the inside to the shaft, and a tubular portion 42 welded at 43 to the inboard head and at 44 to the outboard head.

The inboard head has an oil seal at 45 on the shaft at one end, and a threaded closure 46 carrying an oil seal 47 on the shaft at the other end. The outboard head has an oil seal 48 on the shaft at one end and a bearing locking closure 59 threaded in the head 40 at the other end. A nut 51 secures the inner race of the bearing 41 on the shaft 34.

In operative position, the outboard ends of the trough rollers are lower than the inboard ends, the trough rollers desirably being disposed at an angle of between 5 and 15 degrees to the horizontal, preferably about 10 degrees. The outboard ends of the rollers at their periphery at 52 are of the diameter of the tube 42 and at the outboard ends the rollers have radially extending flanges 53 whose sides 54 toward the rollers make an obtuse angle preferably between 100 and 140 degrees and preferably about 120 degrees with respect to the axis of the rollers. This produces a component of motion of the bar being rolled up along the roller, while the downward inclination of the roller tends to make the bar travel at the lowest point and the effect is to carry the bar 55 (Figure 3) at the low point.

A position along its length, the shaft 27 carries a stop dog 58 (Figure 3) which in normal operating position of the rollers engages an adjustable stop 60 held on the top of the frame. Thus the desired angle of the rollers can be adjusted.

At intervals between the positions of the inclined rollers, the longitudinal shaft 27 carries rotatably positioned thereon guide arms 61 (the guide arms swing around the shaft) which in retracted position remain below the level of the rollers and carry outboard guide portions 62 and 63. An inboard longitudinal guide 64 is also provided on the guide arms 61.

The portion 62 continuously connects the various guide arms 61 beyond the ends of the rollers as best seen in Figure 3.

A double acting fluid operated cylinder 65 is supported on a housing 66 and the housing intermediate the ends of the cylinder is pivoted on trunnions 67 at the back of each bracket 25. The cylinder has a piston and rod combination 68 which interconnects by a threaded adjustment block 70 to a rod extension 71 which is threaded into a clevis 72 pivotally connected at 73 to rearward portions 74 on the guide arms 61 which pivot on shaft 27. Beneath the clevis there is a latch 75 pivoted on the frame at 76 and having a resilient buffer 77 which is normally positioned in the path of the clevis and which limits the forward movement of the piston to raise the guiding side guard elements to the position shown in dot-dash lines at the left in Figure 3.

This position acts as a safety guide in case the slope of the rollers 36 does not provide sufficient guidance for the bar 55. This additional guiding from the side guard elements 62 and 63 may be desirable in starting up the mill when the first few bars may be delivered poorly due to misalignment of guides, crossing of roll passes and the like which might cause excessive deformation at the front end of the bar so that the bar would run up the surface of the inclined roller and not enter the entry guide for the next mill. Once proper delivery of bars has been secured, the operator can retract the guide arms 61 to the full line position of Figure 3 and lower the side guard elements 62 and 63 to their inoperative position.

During the movement of the clevis to engage the buffer 77, the rollers 36 remain lowered, as shown in Figure 5.

If it is desired to raise the rollers to their inoperative position, a dog 78 which normally holds the latch 75 up is released by the side by manipulation through handle 80. The dog slides on guides 81. When the dog is removed, the latch drops and on actuation of the cylinder 65, the clevis is pushed forward until abutment 82 on the guide arms 61 engages arm 83 extending out in its path from the shaft 27, as shown in Figure 3. Further advance of the clevis then carries both the guide arms 61 and the rollers 36 up to the extreme dot-and-dash position indicated at the top of Figure 3.

In normal operation, when the trough is in operative position, the bar is guided by the trough rollers so that a minimum of scratching or damage to the bar occurs. The speed control operator can see the bar readily on the trough and can regulate the speed accurately.

In case a side loop forms, the sloping position of the roller axes and the slope of the side of the roller flange adjoining the roller, provide a combination trough and side guiding surface which does not require the use of any side loop guides.

The slope of the cylindrical portion of the rollers urges the bar toward the lower end of the rollers and the flange keeps the bar from falling off the lower end. The bar is thus carried on the mill center line and the front end of the bar is kept in alignment with the mill center line so that it will enter the next roll stand at the proper position. The uniform sloping cylindrical surface of the rollers, on the other hand, assures an easy outlet for a side loop should a side loop form between the stands because one stand feeds material faster than the succeeding stand takes it away.

If the operator anticipates poor delivery of a bar, for example at the beginning of mill operation, he may advance the clevis to engage the buffer 77, and thus positively raise side guards above the trough, but as soon as normal operation has been restored these side guards will preferably be lowered to inoperative position.

When it is desired to clear the space between the roll stands for working on the guards or otherwise, it is merely necessary to remove the dogs 78 and allow the latches 75 to swing out of the path of the clevises. When hydraulic fluid is then applied to the cylinders in the proper direction the shafts 27 swing and raise the trough rollers out of the way as indicated at the top of Figure 3.

There is little danger that mill scale or other foreign matter will clog the mechanism as there are no exposed rails or sliding guides on which the base must move.

In view of my invention and disclosure variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art, to obtain all or part of the benefits of my invention without copying the structure shown, and I, therefore, claim all such insofar as they fall within the reasonable spirit and scope of my claims.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a rolling mill trough, a plurality of rollers pivotally mounted side by side on parallel axes in a common plane, the roller axes being transverse to the direction of progression of the stock, the roller axes in one position being inclined downwardly toward one end, flanges on the rollers in line at the one end, side guards adjoining one end of the rollers and power-operated means for raising the side guides above the rollers.

2. In a rolling mill trough, a plurality of rollers pivotally mounted side by side on parallel axes in a common plane, the roller axes being transverse to the direc-
tion of progression of the stock, the roller axes in one position being inclined downwardly toward one end, flanges on the rollers in line at the one end, guide arms pivotally mounted and extending out between the rollers, side guard means on the guide arms and having a position beneath the rollers and a position above the rollers and adjoining the ends thereof, and power-operated means for raising the arms and the side guard means to a position above the rollers, and means interconnecting the rollers with the arms for swinging the rollers upward on further advance of the arms.

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