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MacPherson, Jr.

[11] **3,782,158**

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[54] **APPARATUS AND METHOD FOR ALIGNING ROLLER ENTRY GUIDES IN A ROLLING MILL**

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[21] Appl. No.: **297,251**

[52] **U.S. Cl.** **72/37**, 72/250, 33/286

[51] **Int. Cl.** **B21c 51/00**

[58] **Field of Search** 72/37, 250; 33/286

[56] **References Cited**

UNITED STATES PATENTS

3,640,109	2/1972	Ashton et al.	72/37
3,604,121	9/1971	Hull	33/286

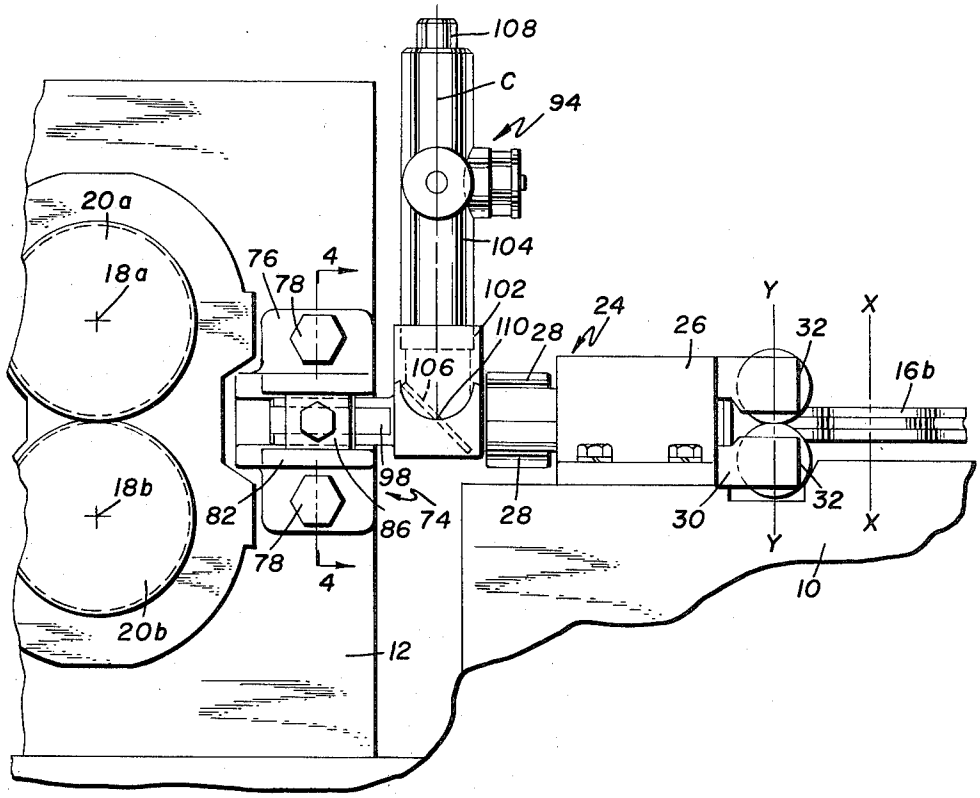
Primary Examiner—Milton S. Mehr

Attorney—C. Yardley Chittick et al.

[57] **ABSTRACT**

An optical device of the type which may be focused along an observed centerline is employed to accurately align roller entry guides in a rolling mill. The optical device is temporarily mounted at a location separate from and preceding that of the roller entry guide to be aligned, with its observed centerline coinciding with the center of the roll pass into which proudct is to be directed by the guide. By thereafter shifting the focus of the optical device to the guide rollers, the gap defined by the guide rollers can be centered with respect to the observed centerline of the optical device by laterally shifting the entire roller entry guide.

7 Claims, 7 Drawing Figures



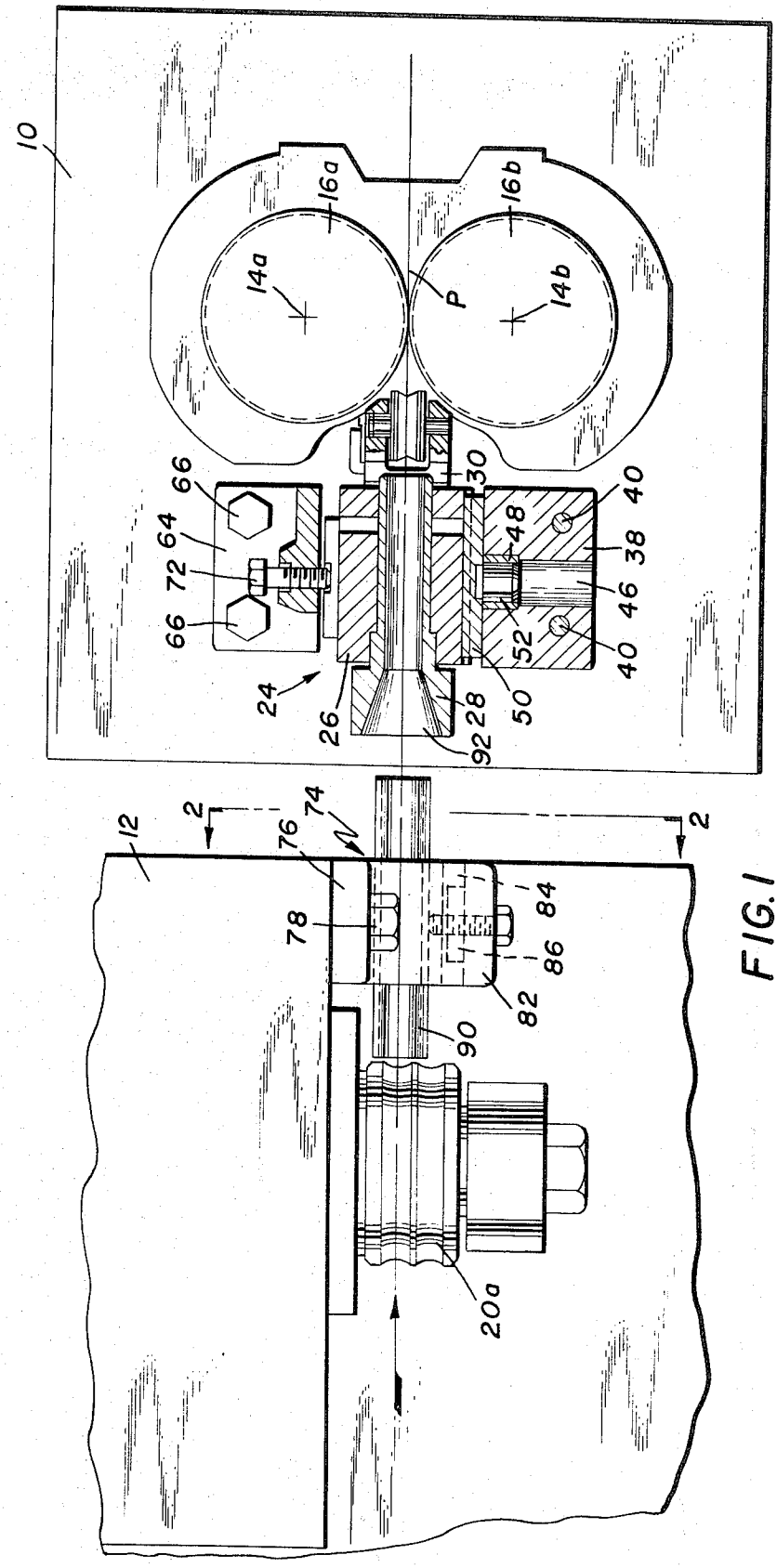

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FIG. 1

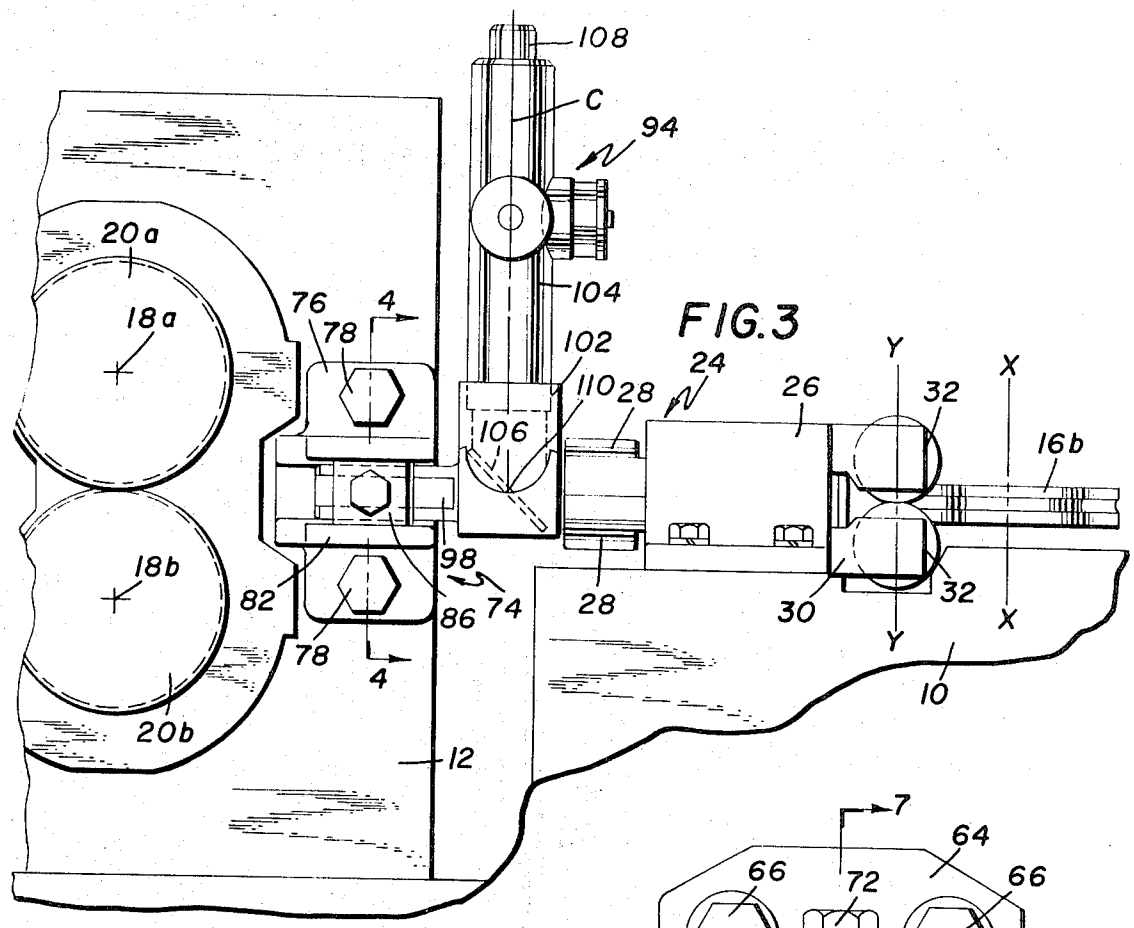

FIG. 3

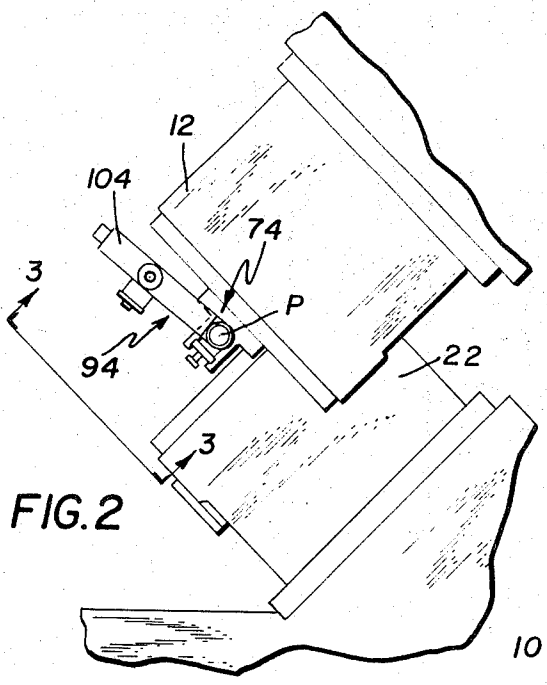

FIG. 2

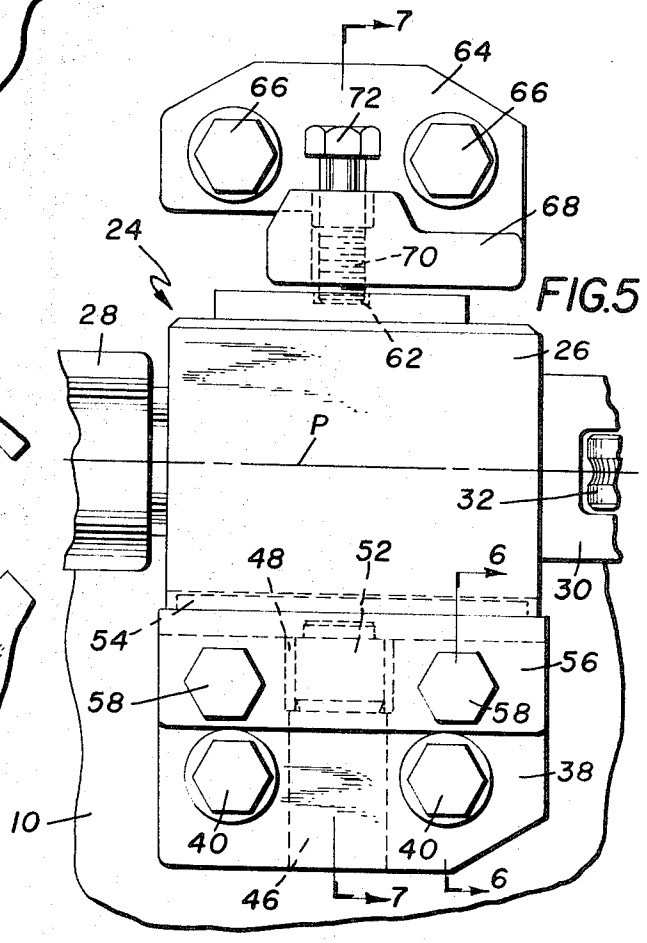

FIG. 5

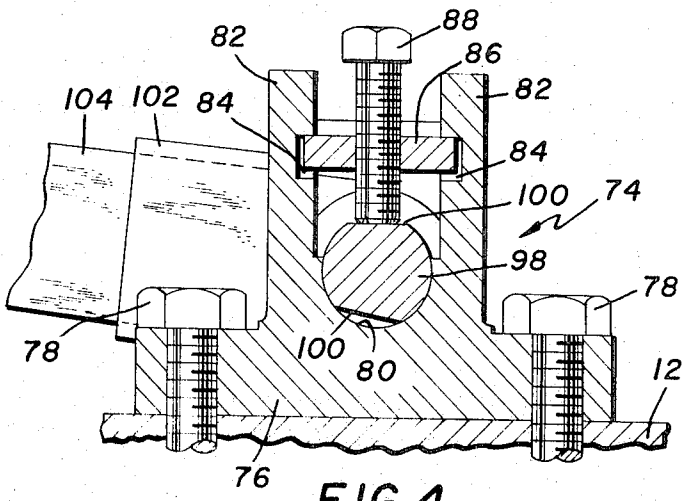

FIG. 4

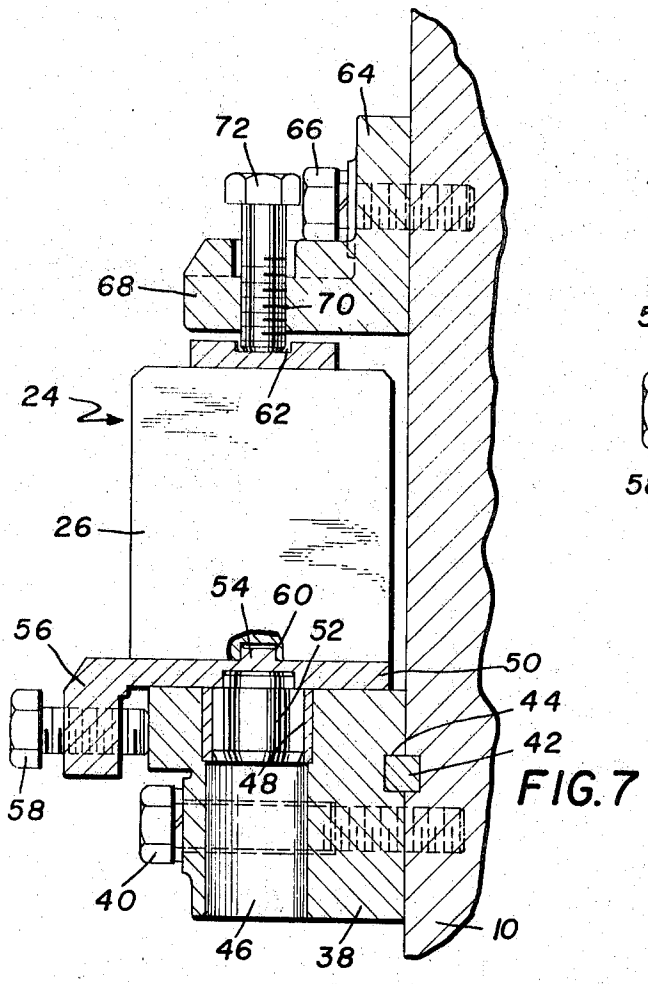

FIG. 7

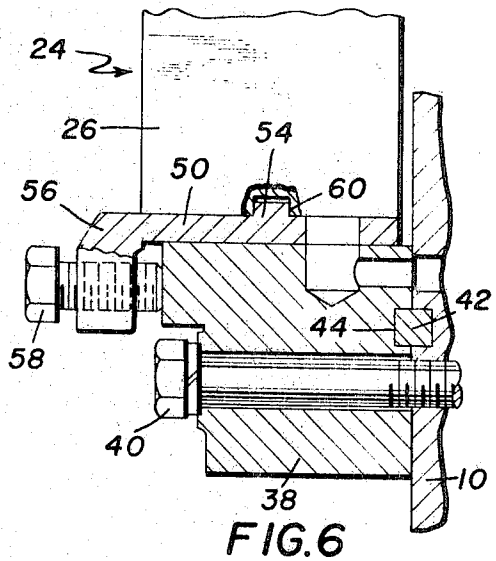

FIG. 6

APPARATUS AND METHOD FOR ALIGNING ROLLER ENTRY GUIDES IN A ROLLING MILL

DESCRIPTION OF THE INVENTION

This invention relates generally to rolling mills, and is concerned in particular with an improved apparatus and method for rapidly and accurately aligning roller entry guides. The accurate alignment of roller entry guides in a rolling mill is of extreme importance, particularly in the finishing section of the mill where, depending on the tonnage rate of the mill and the size of the product being rolled, stock speeds can and frequency do exceed 10,000 fpm. If the roller entry guides are not aligned accurately, the stock will not be fed properly into the roll passes, and this in turn will adversely effect the quality of the product being rolled. Guide misalignment will also cause the guide rollers to wear at a greatly accelerated rate, thereby necessitating more frequent periods of non-productive mill down-time for guide replacement. Where the degree of guide misalignment is extremely pronounced, cobbles may result. Since the mill must of necessity be rendered inoperative while the guides are being changed, the speed with which guides can be placed in position and aligned is also an important consideration in minimizing non-productive mill downtime.

It is accordingly an object of the present invention to provide an improved apparatus and method for quickly and accurately aligning roller entry guides in a rolling mill. As will hereinafter be described in greater detail, the present invention involves the use of an optical device of the type which may be focused along an observed centerline. The optical device is adapted for rapid mounting at a temporary location preceding that of the guide to be aligned, with the observed centerline of the device coinciding with the center of the roll pass into which product is to be directed by the roller entry guide. When thus mounted, the optical device is initially focused on the work rolls, thereby providing a means of visually checking to determine that the observed centerline of the optical device is aligned with the center of the roll pass as viewed through the optical device. The focus of the optical device is then shifted along the observed centerline to the guide rollers, and the guide is then adjusted to bring the guide rollers into proper alignment. The positioning of the optical device at a location which is separate from and preferably in advance of the roller guide permits a final visual check to be made after the position of the guide has been fixed, thus insuring that everything is in order before the optical device is finally removed. This is to be contrasted to known prior art arrangements, for example that shown in U. S. Pat. No. 3,640,109, where the optical device and roller guide are interchangeably mounted at the same location, thus precluding a final visual check after the roller entry guide has been fixed in its operative position.

The present invention further includes an improved means for mounting and adjusting the position of the roller entry guide in relation to the observed centerline of the optical device. To this end, the roller entry guide is mounted on a base plate which is in turn pivotally mounted on the roll housing which rotatably supports the work rolls between which the product is to be directed by the roller entry guide. The guide is held on the base by means of a single retaining bolt which is in axial alignment with the pivotal axis of the base plate.

Pivotal adjustment of the base plate is accomplished by means of a pair of adjusting bolts which also serve to fix the base plate relative to the roll housing during the rolling operation.

These and other objects, advantages and novel features of the present invention will become more apparent as the description proceeds with the aid of the accompanying drawings, wherein;

FIG. 1 is a view in side elevation showing a pair of roll housings in a typical mill installation with which the present invention may be employed. The roll housings each support pairs of overhung work rolls, with the rotational axis of one pair of work rolls being arranged at a 90° angle in relation to the rotational axes of the other pair of work rolls. The roller delivery guide and portions of its support means have been shown in cross-section to better illustrate certain features thereof;

FIG. 2 is a view on a reduced scale taken along lines 2—2 of FIG. 1, showing an optical device in accordance with the present invention mounted in place of the delivery guide on the roll housing immediately preceding the roll housing supporting the roller entry guide;

FIG. 3 is a view on an enlarged scale taken along line 3—3 of FIG. 2;

FIG. 4 is a sectional view on an enlarged scale taken along lines 4—4 of FIG. 3;

FIG. 5 is an enlarged side elevational view of the roller entry guide; and,

FIGS. 6 and 7 are sectional views taken along lines 6—6 and 7—7 respectively of FIG. 5.

Referring now to the drawings wherein like numbers designate like parts throughout the several views, and with initial reference to FIGS. 1 and 3, there is shown a pair of roll housings 10 and 12. Roll housing 10 supports a pair of rotatably driven roll shafts 14*a* and 14*b* onto which are mounted overhung grooved work rolls 16*a* and 16*b*. Roll housing 12 likewise supports rotatably driven roll shafts 18*a* and 18*b* onto which are mounted work rolls 10*a* and 10*b*. The roll housings 10 and 12 are arranged such that the rotational axes of the work rolls 14*a* and 14*b* and their respective roll shafts are disposed at a 90° angle in relation to the preceding set of work rolls 18*a* and 18*b* and their respective roll shafts. Still another roll housing 22 is partially shown in FIG. 2 at a location preceding that of the roll housing 12.

A roller entry guide which is generally indicated at 24 is employed to guide the product being rolled into the roll pass defined by the grooved work rolls 14*a* and 14*b*. The roller entry guide is of a generally conventional design in that it includes an exterior box-like housing 26 which contains a pair of stationary entry guide inserts 28 and laterally spaced pivotally adjustable elements 30 having guide rollers 32 rotatably mounted on the ends thereof.

Referring now additionally to FIGS. 5 to 7, it will be seen that the roller entry guide 24 is mounted on the roll housing 10 in the following manner: a lower bracket member 38 is secured to the housing 10 by any convenient means, for example bolts 40. A key 42 may be positioned on the housing 10 to act in conjunction with a keyway 44 on the lower bracket member 38 to insure that the latter is precisely positioned.

The lower bracket member is drilled as at 46 to receive a bushing 48. A base plate 50 is pivotally mounted on the lower bracket member 38 by means of

a depending pin 52 which is received in the housing 48. The base plate 50 is provided on its upper surface with a key 54, and is additionally provided with a laterally extending portion 56 having a pair of threaded holes therein which accommodate adjusting bolts 58. The bolts 58 are located on either side of the pivotal axis of the base plate, and serve both as a means of pivotally adjusting the base plate in relation to the lower bracket member 38, and also as a means of holding the base plate in position once it has been adjusted. Base plate 50 provides the bottom support for the roller entry guide 24. The roller entry guide housing 26 has a longitudinal groove 60 along its lower surface which receives and cooperates with the key 54 in holding the roller entry guide in proper lateral alignment on the base plate. The housing 26 is further provided with a circular depression in its upper surface which is aligned vertically with the lower groove 60. An upper bracket member 64 is spaced vertically above the lower bracket member 38 and is fixed to the roll housing 10 by any convenient means again for example by retaining bolts 66. Bracket member 64 has a laterally extending portion 68 which is drilled and tapped as at 70 to accommodate a single retaining bolt 72. Bolt 72 is aligned axially with the pivotal axis of base plate 50 (as defined by the axis of pin 52), and when tightened, its lower end engages the base of depression 62 and thus exerts a downward force which fixes the roller entry guide 24 on the base plate 56.

In light of the above, it will be understood that once the roller guide 24 has been mounted on the base plate 56 and locked in place by tightening bolt 72, its position relative to the roll housing 10 may be thereafter be pivotally adjusted by adjusting the bolts 58. This may be accomplished without first having to loosen retaining bolt 72.

The roll housing 12 is provided on its delivery side with a bracket assembly generally indicated at 74. The bracket assembly is comprised of a base 76 which is fixed to the housing 12 by any convenient means, for example bolts 78. The base 76 is provided with a centrally located semi-circular depression 80 which is straddled on either side by upstanding ears 82. The oppositely disposed faces of the ears 82 are grooved as at 84 to receive the edges of an intermediate plate 86. The plate 86 is drilled and tapped to threadably receive a single retaining bolt 88.

With reference to FIG. 1, it will be understood that during the rolling operation, bracket assembly 74 supports a tubular delivery guide 90, the purpose of which is to direct stock emerging from between work rolls 20a and 20b to the enlarged receiving end 92 of the roller entry guide 24. The stock then proceeds between the stationary guide inserts 28 and then passes between the guide rollers 32 before entering the roller pass defined by the work rolls 14*a* and 14*b*.

When the roller guide 24 becomes worn and requires changing during an interval of mill down time, the following takes place: the retaining bolt 72 is loosened to free the worn guide and the latter is then removed from the base plate 50. An identical replacement roller guide 24, which has previously had the gap between its guide rollers 32 set, is then reinserted on the base plate and locked in place by tightening bolt 72. Thereafter, it becomes necessary to center the gap defined by the guide rollers 32 with the center of the roll pass defined by the work rolls 16*a* and 16*b*. This is accomplished by first removing the preceding delivery guide 90 from the bracket assembly 74. An optical alignment device, which is generally indicated at 94 in FIGS. 2 and 3, is then temporarily inserted in the bracket assembly 74 in place of the delivery guide 90.

The optical alignment device includes an adapter 96 which has a laterally extending stub shaft 98 suitably dimensioned to be inserted between the ears 82 of the bracket assembly 74. As is best shown in FIG. 4, the stub shaft 98 is substantially cylindrical and is provided with flats 100, one of which is engaged by the end of the retaining bolt 88 to lock the adapter 96 in place.

The adapter 96 is further provided with a tubular collar 102 into which is inserted an alignment telescope 104 of known construction, for example model K-122 manufactured by the Kollomorgen Corporation of Northhampton, Massachusetts. The base portion of the adapter contains a reflector 106 which is disposed at an angle relative to the mill pass line "P." The telescope 94 is of the type which permits the position of a center "C" to be observed through an eyepiece 108 from a location lateral of the mill pass line P. The telescope 104 is capable of being focused along the observed centerline C.

By mounting the adapter 96 in place of the delivery guide 90, the observed centerline C of the telescope 104 intersects with the mill pass line P on the surface of the reflector 106 at a point indicated in FIG. 3 at 110. Thus, as viewed through the eyepiece 108, the observed centerline C coincides with the mill pass line P.

To insure that the optical alignment device 94 is precisely positioned in relation to the mill pass line, the telescope is initially focused on the work rolls 16*a* and 16*b* at a plane indicated schematically in FIG. 3 by the line "X—X." The position of the observed centerline C is thus checked in relation to the center of the roll pass defined by rolls 16*a* and 16*b*.

Once this has been accomplished, the focus of telescope 104 is shifted to the guide rollers 32 and to a plane again indicated schematically in FIG. 3 by the line "Y—Y". If the gap defined by the guide rollers 32 is not centered in relation to the observed centerline C, the roller entry guide 24 is pivotally adjusted on base plate 50 by making appropriate adjustments to the bolts 58. Once this has been accomplished, and the technician is satisfied that the gap defined by the guide rollers 32 is properly centered in relation to the roll pass defined by rolls 14*a* and 14*b*, then the optical alignment device 94 is removed from the bracket 74 and the delivery guide 90 replaced.

In light of the above, it will now be appreciated by those skilled in the art that the present invention offers advantages not heretofore available with known prior art alignment devices. For example, by temporarily mounting the optical alignment device 94 at a location separate from and preceding that of the roller entry guide being adjusted, the said location preferably although not necessarily being that normally occupied by the delivery guide on the preceding roll housing, a technician can adjust the pivotal base plate 50 and then finally check the accuracy of his adjustments before removing the optical alignment device. This insures accuracy of alignment, and precludes any possibility of an intervening error after the base plate has been set. The ease with which the base plate 50 is pivoted and simultaneously locked in place by the adjusting bolts 58 is also advantageous. Thus, this arrangement permits the

roller entry guide **24** to be replaced and optically adjusted in a rapid and efficient manner with a minimum loss of valuable production time, and without the possibility of any intervening error after a final visual check has been made through the alignment telescope **104.**

It is my intention to cover all changes and modifications of the embodiment herein chosen for purposes of disclosure which do not depart from the spirit and scope of the invention as set forth in the following claims:

What I claim is:

1. In a rolling mill having a roll housing supporting a pair of work rolls which are grooved to define a roll pass, and a roller entry guide having guide rollers for guiding the product being rolled into said roll pass, apparatus for operatively positioning and setting the roller entry guide comprising: a first support means for mounting the roller entry guide at a location along the mill pass line preceding said work rolls, and optical device for observing the position of a centerline, a second support means for temporarily mounting said optical device at another location along the mill pass line, the location of said optical device when thus mounted being such that the observed centerline coincides with the center of said roll pass as viewed through said optical device, means for adjusting said optical device to permit alternate focusing on the work rolls and the guide rollers of the roller entry guide, and adjustment means associated with said first support means for adjusting the position of said roller entry guide to center the gap defined by said guide rollers relative to said observed centerline.

2. The apparatus as claimed in claim **1** wherein said roller entry guide is mounted by said first support means on one housing, and wherein said optical device is mounted by said second support means on the delivery side of another roll housing which precedes the roll housing on which the roller entry guide is mounted.

3. The apparatus as claimed in claim **2** wherein said other housing is provided on the delivery side thereof with tubular delivery guide means, and wherein said second support means is positioned temporarily in place of said tubular delivery guide means during alignment of said roller entry guide.

4. The apparatus as claimed in claim **1** wherein said optical device is mounted by said second support means in a manner permitting the observed centerline to be viewed from a position laterally adjacent to the mill pass line.

5. The apparatus as claimed in claim **1** wherein said adjustment means is operable to pivotally adjust the roller entry guide about an axis which extends transversally to the mill pass line.

6. In a rolling mill which includes two roll housings, one of which precedes the other, and each of which supports a pair of work rolls which are grooved to define roll passes aligned with the mill pass line, a delivery guide for receiving product emerging from the roll pass of the preceding housing, and a roller entry guide for guiding the product from said delivery guide into the roll pass of the subsequent roll housing, an apparatus for operatively positioning the roller entry guide, said apparatus comprising: a first support means for mounting the roller entry guide on said subsequent roll housing, an optical device for observing the position of a centerline, a second support means for mounting said optical device on said preceding roll housing, said second support means being adapted to receive said optical device in place of said delivery guide, the location of said optical device when thus received by said second support means being such that the observed centerline coincides with the mill pass line and the center of the roll pass defined by the work rolls of said subsequent housing, the said optical device being adjustable to permit focusing along the observed centerline, and means associated with said first support, means for pivotally adjusting the position of said roller entry guide to center the gap defined by said guide rollers relative to said observed centerline.

7. In a rolling mill having a roll housing supporting a pair of work rolls which are grooved to define a roll pass, and a roller entry guide preceding said roll pass and having guide rollers for guiding the product being rolled into said roll pass, a method of centering said roller entry guide in relation to said roll pass comprising the steps of: mounting an optical device on a support which is separate from both said roll housing and said delivery guide, said optical device having an adjustable focal length and being adapted to enable the position of a centerline to be observed, the position of said optical device on said support being such that the observed centerline coincides with the center of said roll pass; focusing said optical device on the guide rollers of said roller entry guide; and, pivotally adjusting the roller entry guide to center the gap defined by said guide rollers relative to the observed centerline.

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