H. R. GEER.

METAL ROLLING APPARATUS.

APPLICATION FILED MAY 31, 1913.

1,157,378.

Patented Oct. 19, 1915.

3 SHEETS—SHEET 1.

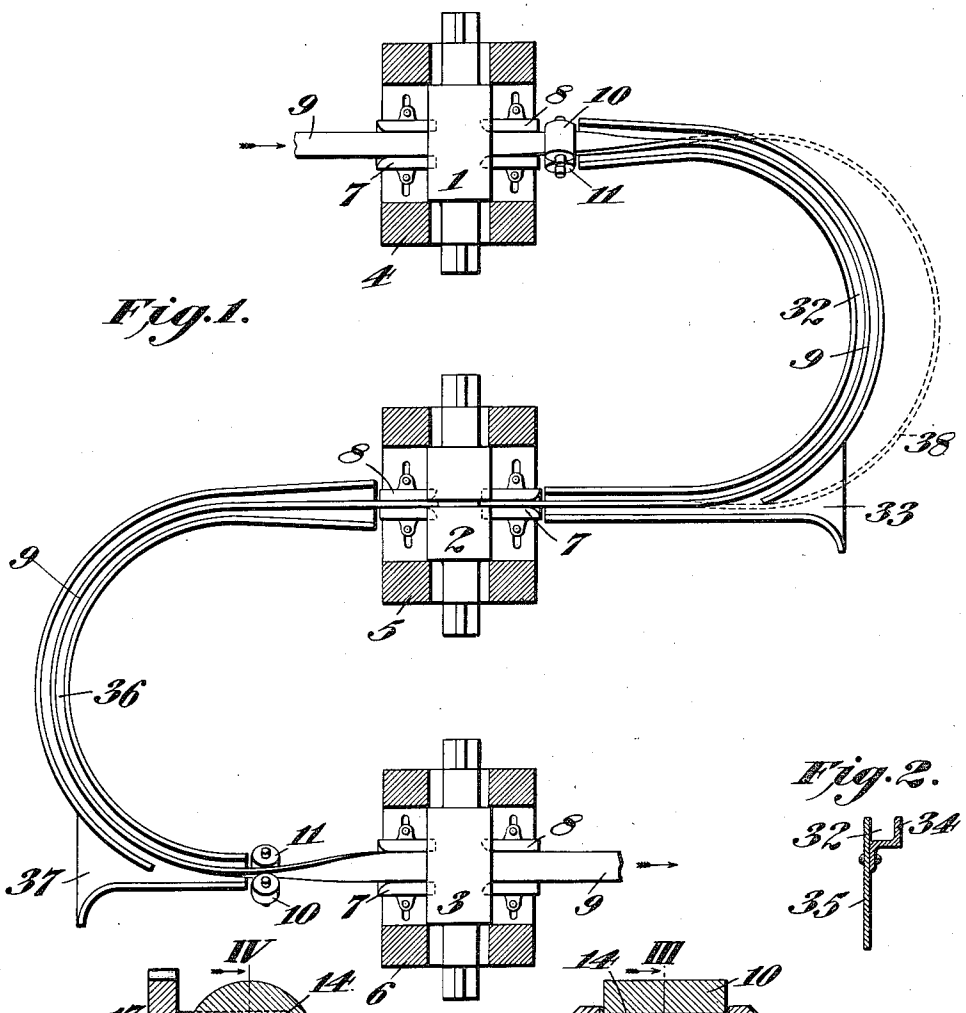


Fig. 1.

Fig. 2.

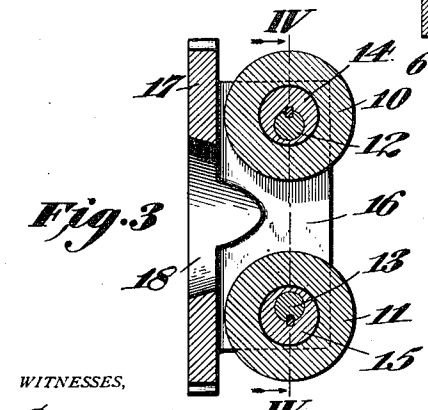


Fig. 3

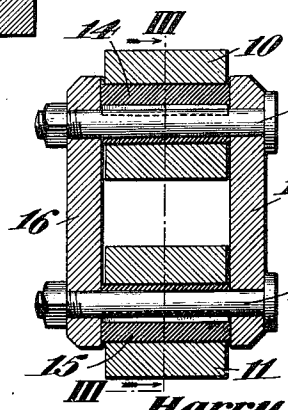


Fig. 4.

WITNESSES,

Elmer Seavey

Robert A. Bees

INVENTOR.

Harry R. Geer.

by Geo. E. Thackray

his ATTORNEY.

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3 SHEETS—SHEET 2.

Fig. 5.

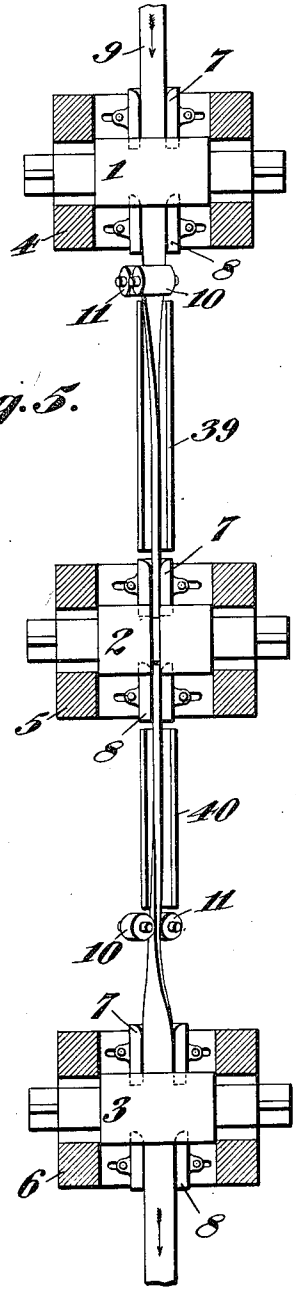


Fig. 6.

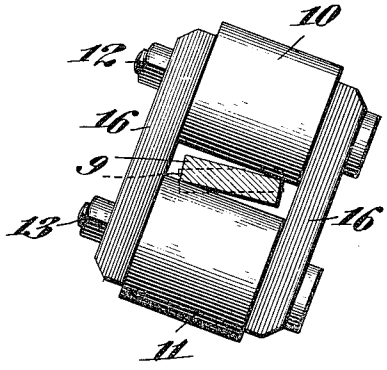
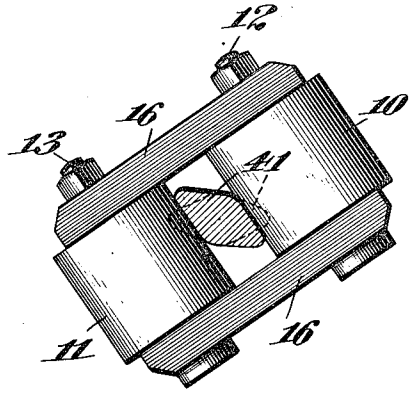


Fig. 7.



WITNESSES,

Elmer Seavey

Robert A. Bell

INVENTOR.

Harry R. Geer.

by Geo. E. Thackray

his ATTORNEY.

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3 SHEETS—SHEET 3.

Fig. 8.

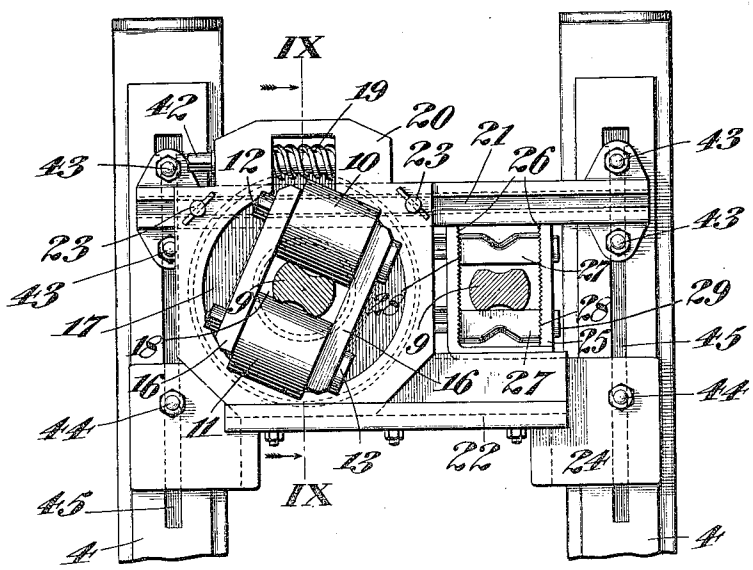
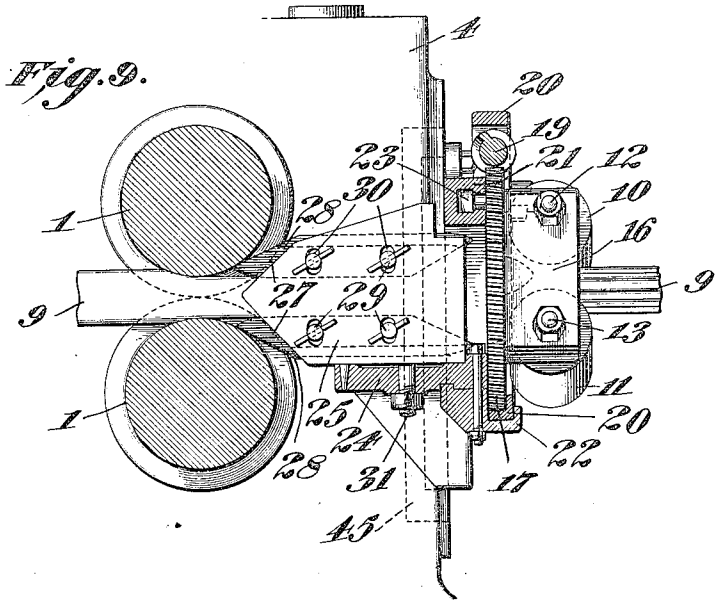


Fig. 9.



WITNESSES,

Elmer Seavey

Robert A. Bell

INVENTOR.

Harry R. Geer.

by Geo. E. Thackray

his ATTORNEY

UNITED STATES PATENT OFFICE.

HARRY R. GEER, OF JOHNSTOWN, PENNSYLVANIA.

METAL-ROLLING APPARATUS.

1,157,378. Specification of Letters Patent. Patented Oct. 19, 1915.

Application filed May 31, 1913. Serial No. 770,835.

To all whom it may concern:

Be it known that I, HARRY R. GEER, a citizen of the United States, residing at Johnstown, in the county of Cambria and State of Pennsylvania, have invented certain new and useful Improvements in Metal-Rolling Apparatus; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to rolling mill apparatus with particular reference to means for guiding bars or other sections of metal to and from the reducing and forming rolls of a rolling mill.

In order to simplify the description herein, I will refer to the piece which is to be guided by my apparatus, as a bar, although I wish it understood that my apparatus is equally adapted to handle blooms, billets, slabs, beams, channels, angles, T's, rails, flats, ovals, half-ovals, and in fact, any metal or material which is formed or operated upon by rolls, a few of the sections of which are illustrated in the drawings accompanying this specification.

My apparatus consists generally of a pair of rollers which are mounted on axes and adapted to be spaced apart at different distances, as may be desired, to accommodate bars of different sizes or sections, said rollers being also carried in a holder or frame capable of rotary adjustment or movement about an axis at an angle to, and preferably a right angle, the plane containing the axes of the rollers, said axis of rotation of the frame being also preferably located between the contiguous surfaces of said rollers.

My rollers are preferably carried on a swivel back-plate, whereby they may be rotatably adjusted and maintained at any desired angle with the delivering pass of a pair of reducing or forming rolls and thereby produce a suitable sweep or twist in the bar delivered from said rolls to make it, by its continued longitudinal movement, aline its cross section with that of the next pass in a succeeding stand of rolls, or the next pass in the same stand of rolls. This twisting action of my roller guide is usually arranged to turn or twist the bar about ninety degrees from one pass to the next, but it may also be adapted and arranged to twist the bar to any greater or lesser extent, as may be readily understood.

My apparatus is adapted for use in connection with what is known as a train of rolls, that is, a number of pairs of reducing rolls arranged with their axes approximately in line with each other, and it is also equally applicable to tandem mills in which the successive pairs of rolls are placed with their axes parallel to each other, one pair in front of the next pair, or it may also be used in connection with tandem continuous mills in which the axes of the rolls are substantially parallel, one in front of the other and at conparatively short distances apart, whereby the bar is simultaneously reduced in a number of pairs of rolls.

I prefer to form the surfaces of my rollers which contact with the bar to be guides, as straight line cylinders of uniform circular cross section, or what are known as flat rollers, regardless of the section of bar to be guided or turned, and these are adapted to operate on rectangular bars and also irregular sections such as diamonds, ovals, etc., as in such cases, bars of these sections are twisted by adjusting the rollers at a distance apart, such as to clear the minor axis of the section. I may also make the surfaces of my rollers with passes or grooves to fit or approximate the section of the bar to be guided.

I consider it essential that my roller guide construction should be readily demountable to facilitate the removal of a bar therefrom, which may have been improperly reduced or distorted in the rolls, such a bar being known as a "cobble."

By placing my twisting rollers near the delivery side of a roll pass, with the surfaces of said rollers at a slight angle to that of the axis of the cross section of the bar in said roll pass, and with their surfaces adjusted apart to correspond to and clear the axis of the cross section of the bar presented to the opening between them, the required work of twisting is easily accomplished, as its amount or angle of twist is small by reason of this arrangement, whereas the continuation of the longitudinal movement or the travel of said bar continues the twisting thereof until the required ninety degrees, or other angle of twist is accomplished by the time that the front end of the bar reaches the next pass of the reducing or forming rolls. I also prefer to mount my roller guide on a cross slide whereby it may be adjusted in opposite directions substantially parallel

to the axis of the reducing rolls, whereby my guide may be readily shifted laterally to accommodate any pass and any one of the several passes in a stand of rolls. I also prefer to arrange my roller guide so that its position can be adjusted vertically. These various adjustments make my apparatus generally adaptable for the purposes intended.

My apparatus may be employed in connection with repeaters of roll trains, in cases where it is desired to facilitate the passage of the bar around or through the repeaters, by twisting the bar so that the major axis of its cross section becomes vertical and therefore offers the least resistance to bending in an approximately horizontal plane, whereby it is easily looped from one pass to the next.

In some cases it is preferable that the bar should be in two or more reducing passes of the rolls at the same time, thereby accomplishing the work of reduction while the bar is hot and minimizing the travel of the same during the rolling process, and this is accomplished by having said roller twist guides and repeaters, if repeaters are used, near the reducing rolls.

Having thus given a general description of my invention, I will now, in order to make the same more clear, refer to the annexed three sheets of drawings forming part of this specification and in which like characters denote like parts.

Figure 1 is a diagrammatic plan view of my apparatus showing three stands of a train of rolls, their guides, curved repeaters connecting the same and my guide rollers, the arrows indicating the direction of travel of the bar. Fig. 2 is a vertical transverse section of the repeater trough showing the manner of construction. Fig. 3 is a vertical transverse sectional elevation of my adjustable roller guides and the bearings therefor, taken on a plane passing through said rollers at right angles to the axes thereof, this being on the line III—III of Fig. 4. This drawing shows one manner of eccentrically mounting my rollers, whereby they may be adjusted at different distances apart to accommodate different sections of bars. Fig. 4 is a longitudinal section taken on the line IV—IV of Fig. 3. Fig. 5 is a diagrammatic plan view of three sets or pairs of rolls of a continuous mill, the passes in which are in substantial alinement longitudinally of the bar, with straight guides and guide troughs; showing my roller guides applied thereto, the direction of the movement of the bar being indicated by the arrows. Fig. 6 is a front elevation of a pair of my guide rollers set at an inclination between the roll passes and showing in dotted lines the position of a flat bar entering between said rollers, and in full lines, the same bar as it leaves said rollers, having been given a slight twist as shown, the rollers in this case, contacting with the diagonally opposite surfaces of said bar. It will be seen from this figure that the angle of twist given may be comparatively slight, and by the continuation of the longitudinal movement of said bar, it is twisted as a helix or screw, so that by the time it reaches the next pass in the rolls, it will have been turned ninety degrees, or to any other angle desired, dependent on the amount of twist imparted to it by my roller guides and the length of its travel therefrom. Fig. 7 is a front elevation similar to Fig. 6, but showing my roller guides rotated to a greater amount and adapted to operate upon a diamond section, the position of same, when entering my roller guide, being shown in dotted lines, and upon leaving the same, being indicated by the full lines. It will thus be seen that the slight twist given to the bar, will increase after the fashion of a spiral or screw thread, so that by the time it reaches the next pass it will have been twisted ninety degrees, or more, or less, as may be desired, due to the angle of the adjustment of said rollers. Fig. 8 is a front elevation of the upper portions of a pair of rolling mill housings on which is mounted a cross slideway, to which is adjustably attached the swivel back-plate of my apparatus, provided with a worm and worm-wheel as shown; whereby my guiding rolls may be adjusted and rotated or turned as desired. Fig. 9 is a transverse sectional elevation taken on the line IX—IX of Fig. 8 and in this figure the reducing rolls and the slideway are shown in cross section, while my guides are shown in elevation.

Referring now to the various characters of reference on the drawings;—the first set of reducing rolls is indicated as 1; the second set of reducing rolls is indicated as 2; the third set of reducing rolls is indicated as 3, while 4, 5 and 6 are the housings of the same respectively.

Although, for convenience of illustration, I have only shown my invention as applied to three sets of rolls, I wish it understood that it may be applied to one set or any number of sets of rolls containing one or more passes in each set, and said rolls may be two-high, three-high, or any other arrangement, as my invention is applicable to any style of rolls.

The entering guides for all the roll passes are numbered 7, while the delivery guides for the roll passes are indicated as 8, and the bar in process of rolling is indicated as 9. My upper twisting roller is indicated as 10, while 11 is my lower twisting roller acting in conjunction therewith.

12 is a clamping bolt for securing the upper twisting roller in position, 13 is the corresponding clamping bolt for the lower

twisting roller, 14 is a cylindrical bushing which may be made of some anti-friction metal and which is eccentrically bored as shown, and preferably longer than the roller, as clearly indicated in Fig. 4, while 15 is the corresponding bushing for the lower twisting roller. By loosening the clamping bolts 12 and 13 the bushings which are keyed to said bolt, as shown, may be turned by revolving said bolt, whereby the rollers are brought nearer together, or spaced farther apart, and they may be clamped and secured in rotative position as desired by then screwing up the nuts of the clamping bolts 12 and 13, thereby causing the frames 16 to securely bind the bushings in position, and this is facilitated by the fact that the bushings 14 and 15 are slightly longer than their respective rollers 10 and 11, as shown in Fig. 4.

As shown in Fig. 4 the rollers are spaced apart to their greatest extent. The supporting frames for the twisting rollers are indicated as 16, and these supporting frames are preferably formed integral with and project from a swivel back plate 17, which is supported in the rabbet of the mounting 20, as shown, so that it may be held stationary or be rotated about its axis when desired, being provided with a toothed outer edge comprising a worm-wheel as shown. This swivel back-plate is provided with an opening 18 of general funnel or tapering form through the central portion thereof forming a guide therein, while 19 is a worm mounted to mesh with the worm-wheel of the back-plate and thereby rotate the same, the shaft of said worm being provided with a squared end 42, to which a wrench or crank may be applied for this purpose. The mounting for the worm and swivel back-plate is indicated as 20, this being supported on an upper slideway 21 and further supported and held in position by a lower slideway or support 22, these slideways being provided with grooves therein, as shown. The upper slideway 21 and the lower slideway 22 and attachments are adjustably secured on the roll housings 4 by bolts 43 and 44 passing therethrough, the heads of said bolts being adjustably mounted in under-cut grooves 45 on the housings 4 as shown in Figs. 8 and 9. 23 are the retaining bolts for securing the mounting 20 to the upper slideway 21, these bolts having squared or T-shaped heads fitting in the groove of said slide-way, and being provided with keyways and keys as indicated particularly in Fig. 8. 24 is a transverse bracket bar or guide-rest adapted to support the fixed guides of the reducing rolls and it also carries the lower slideway 22, as clearly shown in Figs. 8 and 9. 25 indicate the side frames for the stationary delivery guides for the reducing rolls provided with saw-toothed inner surfaces 26 as indicated, while 27 are the upper and lower portions of the stationary delivery guides for the reducing rolls provided with corresponding saw-toothed ends, these guides being clamped between the guide-plates or side frames 25 and located in position therein as required, the serrations and bolts as shown aiding to this end; 29 are the retaining bolts for securing the stationary delivery guides of the reducing rolls in position; 30 indicate slotted holes in the guide frame, through which the bolts 29 are passed, as shown, and 31 is a bolt attaching the stationary delivery guides and frame to the guide-rest 24.

Referring now to Fig. 1, 32 indicates the first curved repeater trough which is adapted to receive a bar from one pass of the rolls and guide it in a curved direction to the second pass; 33 being a straight portion of said repeater leading to the second pass.

As shown in Fig. 2, 34 indicates one side of the repeater trough shown as of Z-bar construction, while 35 is the other side formed of plate construction, although said trough may be made as an integral casting or otherwise. 36 is the second repeater trough leading from the second pass of the rolls to the third pass, and 37 is the corresponding straight portion leading to the said third pass.

As indicated in dotted lines in Fig. 1, 38 represents the position of a looped bar after the end has been guided from the first pass to the second pass, and after the excess material delivered from the first pass has overflowed or escaped from the trough. The trough, as shown in Fig. 2, is made comparatively shallow, but of sufficient depth to guide the material from the first to the second pass, but sufficiently shallow so that, as the excess material is delivered from the first to the second pass it can escape over the top of the outside trough and assume the position shown in dotted lines as 38. This construction compensates for any excess of bar material which is delivered from the first to the second pass and prevents buckling or distortion of the bar in the repeater after the function of said repeater has been performed, viz.:—to deliver the end of the bar from one pass to the next and to aid it to enter therein.

As shown in Fig. 5,—39 is a straight trough leading from the first set of rolls to the second set, and 40 is a corresponding straight trough leading from the second set to the third set.

As indicated in Fig. 7,—41 is a diamond-shaped bar adapted to be operated upon by my roller guides.

The operation of my apparatus is as follows:—The reducing rolls of the rolling mill are set and lined in the usual way and

fitted with entering and delivery guides conforming approximately to the sections to be rolled and the roll passes which they serve. My twisting roller guide is set and adjusted between the proper roll passes, the angle of the contact surfaces of my roller guides with respect to the corresponding surfaces of the bar to be guided and twisted, being carefully adjusted beforehand, by turning the worm 19 by means of the squared shaft 42 until the swivel back-plate is revolved to such an extent as to set the contact surfaces of my rollers at the desired angle. The bar is then entered into the first reducing pass of the rolls and then successively into other passes, until it reaches the point where the edging or twisting has to be given to it, in order that its edge or other surfaces not previously acted upon can then be operated on by the reducing rolls. The bar is then delivered between my twisting guide rollers, whereupon its diagonally opposite surfaces contact with the cylindrical surfaces of the rollers, thus putting a twist in the bar which, as the bar continues its longitudinal motion, causes it to assume a position with the axis of its cross section at an angle of ninety degrees, or other angle, as desired, to that of the corresponding axis of its cross section, as it issues from the roll pass. The bar is then in position to enter into the next roll pass in which the reducing action, or rolling action is applied to other surfaces than those previously operated upon. I prefer to arrange my roller guides near to the delivery pass of the rolls and farther from the next pass which the bar is to enter, thus accomplishing the required amount of twist with a comparatively slight angular adjustment of my rollers. I also wish it understood that in case the setting of my roller guide is not exactly right to accomplish the exact amount of twist required for proper position for delivery of the bar to the next roll pass, it may be angularly adjusted backward or forward by turning the swivel back-plate in either direction until the adjustment is correct.

In Fig. 6 the manner in which a rectangular bar contacts with my roller guides is clearly shown, the original position of the bar 9 being shown in dotted lines, and in the twisted position it is shown by full lines, and this is similarly shown with respect to a diamond-shaped bar 41 in Fig. 7.

As heretofore explained, I may use curved repeater troughs or straight troughs between the roll passes to guide the bars from one roll pass to the next, and by means of my roller guides no manual operations are necessary in entering the piece from one pass to the next, whereby the operation of the rolling mill is continuous and automatic.

In cases where friction between the bar and the guides is immaterial, I may make my rollers fixed—that is, non-rotative about their own axes, or, I may form the guide surfaces of curved metal pieces, not rollers, the rotative adjustment around the longitudinal axis of the bar being, however, preserved. In this case my twist guide will form a sliding contact with the bar to be guided, instead of a rolling contact, thus somewhat increasing the friction and wear of the contact surfaces, but at the same time conducing to simplicity in that the use of roller bearings and the consequent wear and maintenance of the same is avoided. I consider, however, that my roller guide is well adapted for the larger sizes of bars, while my non-roller guide may be used in connection with the smaller sizes of bars.

Although I have shown and described my improvements in considerable detail, I do not wish to be limited to the exact and specific details shown and described, but may use such substitutions, modifications or equivalents thereof, as are embraced within the scope of my invention, or as pointed out in the claims.

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

1. A rolling mill guide comprising a pair of rollers revolubly mounted and spaced apart and means for rotatably adjusting said rollers about an axis at an angle to the axes of said rollers and means for laterally adjusting said rollers.

2. A rolling mill guide comprising a pair of rollers revolubly mounted and spaced apart, means for regulating the space between the contiguous surfaces of said rollers, and means for rotatably adjusting the same about an axis at an angle to the axes of said rollers and means for laterally adjusting said rollers.

3. A rolling mill apparatus comprising a pair of rollers provided with means for regulating the space between the adjoining surfaces thereof, and means for rotatably adjusting said guides about a line substantially at right angles to the plane of the axes of said rollers at a point midway between the planes of the ends of the said rollers and midway between the said axes, and means for laterally adjusting said rollers.

4. A rolling mill guide comprising a pair of annular rollers mounted on cylindrical bushings, bores in said bushings eccentric with the cylindrical surfaces thereof, a frame adapted to rigidly support the ends of said bushings and a bolt or pin passing through said bore and frame and secured to said bushing whereby said rollers may be spaced apart as desired, the said frame be-

ing rotatable about an axis at an angle to the axes of said rollers and laterally adjustable.

5. A rolling mill guide comprising a frame rotatable in a vertical plane, a pair of annular rollers loosely mounted on cylindrical bushings, said bushings being each provided with an axle secured thereto eccentric with its axis, and means for adjustably or rigidly securing the bushings to said frame, whereby the rollers may be spaced apart, as desired.

6. A rolling mill guide comprising a swivel back-plate, means for supporting the same, whereby it may be rotatably adjusted about its axis as desired, a frame projecting from said back-plate, a pair of rollers laterally adjustable and spaced part by eccentric adjustment and revolubly mounted in the said frame.

7. A rolling guide comprising supporting members adapted for vertical adjustment, a laterally adjustable mounting carried by said supports having a circular opening therethrough, a swivel back-plate supported on said mounting opposite the circular opening aforesaid, means for rotatably adjusting said swivel back-plate, a frame carried by said back-plate, a pair of rollers mounted in said frame and adapted to be spaced apart, as desired.

8. A rolling mill guide comprising supporting members adapted for vertical adjustment, a mounting carried by said supports adapted for lateral adjustment thereon, an opening through said mounting, a swivel back-plate supported on said mounting opposite the opening aforesaid, a worm-wheel forming part of said swivel back-plate, a worm revolubly supported in the mounting and meshing with the worm-wheel aforesaid, a supporting frame carried by said back-plate projecting therefrom through the said opening, and a pair of rollers revolubly mounted in said frame and adapted to be spaced apart, as desired.

9. A rolling mill guide comprising supporting members adapted for vertical adjustment, a mounting carried by said supports adapted for lateral adjustment thereon, an opening through said mounting, a swivel back-plate supported on said mounting opposite the opening aforesaid, a worm-wheel forming part of said swivel back-plate, a worm revolubly supported in the mounting and meshing with the worm-wheel aforesaid, a supporting frame carried by said back-plate projecting therefrom through the said opening, a pair of annular rollers mounted on cylindrical bushings, said bushings being each provided with an axle secured thereto eccentric with its axis, and means for adjustably securing the bushings to said frame, whereby the rollers may be spaced apart and inclined, as desired.

10. The combination with a rolling mill of a guide adjacent to one of the delivery passes thereof, said guide comprising a pair of rollers revolubly mounted and spaced apart by eccentric bushings, means for rotatably adjusting said rollers about a line substantially at right angles to the plane of the axes of said rollers at a point midway between the planes of the ends of the said rollers and midway between the said axes, and a guide trough leading therefrom to the next pass of the rolling mill.

In testimony whereof I hereto affix my signature in the presence of two witnesses.

HARRY R. GEER.

Witnesses:
ELMER SEAVEY,
R. A. BEE.