May 30, 1933. W. H. CATTERALL 1,911,549

AUTOMATIC GUIDE ADJUSTER

Filed March 22, 1930

Fig. 1.

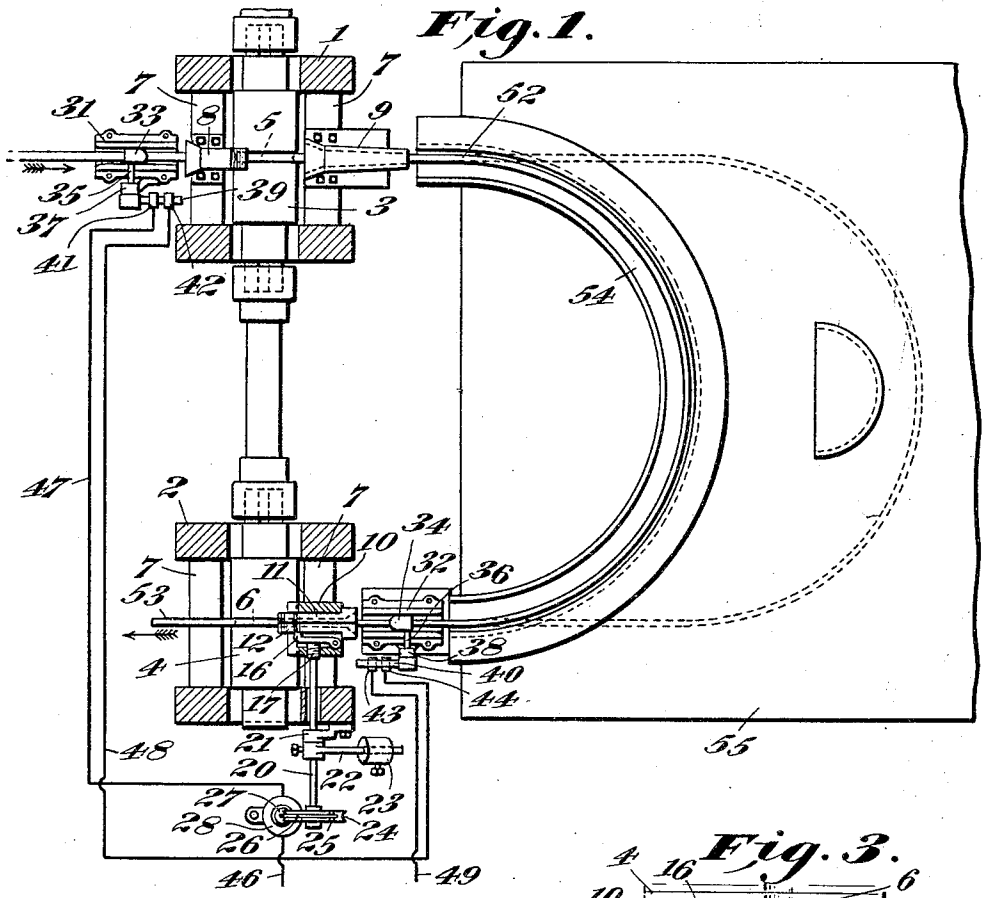


Fig. 2.

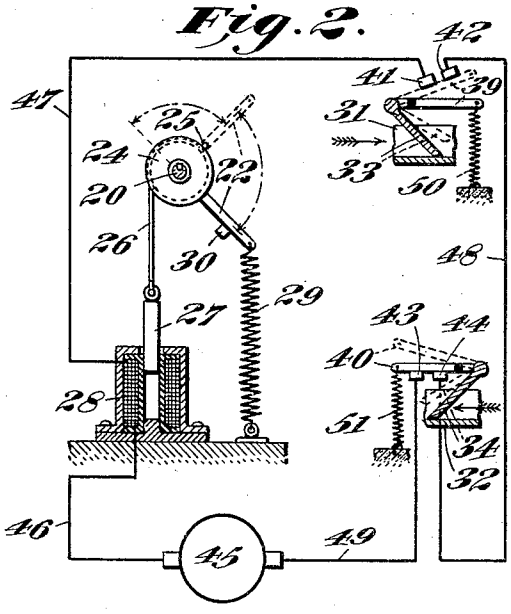
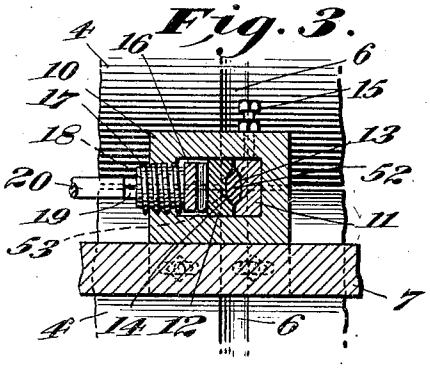


Fig. 3.



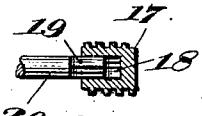


Fig. 4.

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UNITED STATES PATENT OFFICE

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AUTOMATIC GUIDE ADJUSTER

Application filed March 22, 1930. Serial No. 437,951.

My invention relates to rolling mill apparatus, and more particularly to that class of rolling mills known as continuous, in which a plurality of stands of rolls are employed for the successive reduction of a heated bar of metal.

In the continuous rolling of a bar in a mill of this type a heated billet is first fed from the furnace and then reduced by successive stages by feeding the bar through graduated roll passes of the several stands of rolls, each successive pass serving to reduce its cross sectional area and to extend and elongate the bar, the rolling process from start to finish being continuous. As a result, the method of rolling is greatly facilitated and the bar is not given a chance to cool, and a reheating thereof is not necessary.

Conductors and guides lead the bar from one roll pass to the next the bar being usually rotated about 90° between each pass.

The bar is usually adapted to pass loosely through all of the entry and delivery guides with the exception of the entry guide for the finishing roll pass which must be made adjustable to close as soon as the forward end of the bar enters the guide in order that the bar will be turned exactly 90° from the preceding roll pass to enter the finishing roll pass in the proper position. If for any reason the guide is not closed or properly adjusted the bar when it issues from the finishing roll pass will be deformed or have fins along the opposite edges and will have to be scrapped. Heretofore it has been the practice to employ a pair of cooperating guide plates having opposed longitudinal recesses in their adjacent faces adapted to constitute a guiding aperture for the rod or bar and to adjust one of the guide plates for the bar just before it enters the finishing roll pass by means of an adjustable screw adapted to bear against a movable guide plate and controlled manually by an operator by means of a rod and lever connection. This requires constant attention by the operator in order that the guide may be opened and closed at the proper time. As the bar when it reaches the finishing roll pass will be traveling at considerable speed, sometimes as great as several feet per second it very often happens that the operator will not act quick enough to close the guide in time before the end of the bar enters the finishing roll pass and several feet of the bar may have been rolled before the guide is finally closed, in which case all of said end which has passed through the finishing roll pass before the guide is closed will have fins formed thereon and will have to be cut off and discarded. It also sometimes occurs that the operator does not open the guide properly or wide enough for the forward end of the bar to enter at the desired time, in which case a cobble may be formed or injury to the mill may be the result.

One of the objects of my invention is to automatically adjust a movable guide plate used to direct a bar and hold it accurately in proper position to present the same to the circumferential grooves or other shaped passes of the rolls.

Another object of my invention relates to automatically controlling the opening and closing of the guide by means which is controlled by the bar being rolled, thereby eliminating manual labor.

A further object of my invention relates to electrical means for opening a guide and independent means for closing the guide which is controlled by the bar being rolled.

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

Figure 1 is a diagrammatic plan view showing two stands of a train of rolls, their guides and a curved repeater trough connecting the same and illustrating the application of my invention applied thereto;

Fig. 2 is a diagrammatic illustration of the electrical circuits and apparatus involved;

Fig. 3 is an enlarged detail showing a vertical transverse section through the guides, casing and rest bar therefor, the section being taken on the line of the adjusting screw for the movable guide, and;

Fig. 4 is a detail view of the adjusting

screw showing the manner of connecting the rod thereto.

For illustration I have described my invention as applied to the entering guide for a finishing roll pass of a continuous rolling mill, but I wish it understood that I do not limit its use to the entry guide of a finishing roll pass as it is equally applicable for use with any entry guide and may be used either singly or with a plurality of entry guides in the same mill if desired.

Referring now to the characters of reference on the drawing the numerals 1 and 2 indicate the last two stands of rolls of a continuous rod or bar mill each having a set of rolls 3 and 4 of the two high type. The set of rolls 3 having a reducing pass 5 formed therein while the set of rolls 4 have a finishing roll pass formed therein as at 6.

Rest bars 7 connect the side of the roll housings of each stand of rolls together. The entering and delivery guides 8 and 9 for the reducing pass 5 are mounted on the rest bars 7 at either side of the rolls. The entering guide for the finishing pass 6 is mounted in a hollow rectangular guide box 10 secured to a rest bar 7 for the stand of rolls 2, comprising stationary and movable guide blocks 11 and 12 each having a longitudinally grooved inner face 13 and 14 adapted to form a guiding aperture for the rod or bar. The stationary guide block 11 is secured within the hollow guide box 10 by means of one or more set bolts 15 while the movable guide block 12 is adapted to be moved laterally toward the stationary guide block by means of a pivoted lever 16 and screw 17 which is threaded into the side of the guide box 10. The screw 17 has a socket 18 formed therein for the reception of a squared end 19 of a shaft 20 which extends outwardly through the roll housing of the finishing roll stand 2, and journaled in a bearing 21. A lever 22 is mounted on the intermediate portion of the shaft 20 having an adjustable weight 23 mounted thereon, while the outer end of the shaft has a sheave 24 keyed thereto to which is attached as at 25 one end of a flexible strand 26 while the opposite end is attached to a reciprocating core 27 of a solenoid 28. The solenoid 28 with its connection to the sheave 24 is adapted to rock or rotate the shaft 20 and screw 17 in one direction a partial revolution to open the guide, while the weight 23 on lever 22 is adapted to rotate the shaft a partial revolution in the reverse direction.

In Fig. 2 I have shown a spring 29 attached to lever 22 for actuating the shaft 20 in one direction until it reaches a stop 30, instead of a weight as illustrated in Fig. 1. For illustration I have indicated in Fig. 2 the rotation of the shaft 20 by the solenoid and spring in either direction as 90°, but this amount of rotation may be varied by adjusting the parts if desired.

Troughs 31 and 32 are located before the entering guides for each roll pass each having a flag adapted to extend downwardly therein in an inclined direction as at 33 and 34. Short shafts 35 and 36 are journaled in bearings 37 and 38 formed on the side of the troughs and attached to the flags. The shafts each having a contact arm 39 and 40 mounted on their outer ends each adapted to form a switch and make contact with a pair of contacts 41 and 42, 43 and 44 respectively.

In Fig. 2 I have illustrated the wiring or circuit connections for the different parts as they appear in their normal positions in which 45 indicates a generator or source of power having a circuit connection 46 extending to the solenoid 28 and from the solenoid to the contact 41 by a connection 47, other circuit connections extend between contacts 42 and 44 as at 48 and between generator 45 and contact 43 as at 49. The contact arms 39 and 40 are raised into dotted position indicated, by the rod or bar engaging the flags as it passes through the troughs in the direction of the arrows and returned to their normal positions as indicated in full lines by means of the springs 50 and 51, or if desired the arms may be returned by gravity.

The roll pass 5 in stand 1 is adapted to form an oval bar 52 being rolled to the form more clearly indicated in Fig. 3, while the finishing pass 6 in rolls 4 of the stand 2 is made circular to form a round rod or bar when it issues from the pass as the finished product as at 53.

A curved repeater trough 54 extends between the delivery guide 9 and the trough 32 and is adapted to receive the bar after it issues from pass 5 and guide it in a curved direction to the finishing pass 6. The top of the repeater trough 54 is open to allow the rod or bar to be raised out of the repeater trough and to extend over a table 55 in case the rod is delivered from the reducing roll pass 5 faster than it is taken up by the finishing roll pass 6 thereby producing a loop or overfeed as indicated by dotted lines in Fig. 1.

The operation of my device is as follows: In Figs. 1 and 2 the flags 33 and 34 are arranged in a two stage contact which will open or close the circuit to the solenoid, causing the entering guide for the finishing roll pass to be opened by the solenoid and closed by a spring or weight.

As shown in Figs. 1 and 2 the contacts 41 and 42 are normally open, when the forward end of the oncoming bar or rod enters the trough 31 it engages the flag 33 and swings the arm 39 into engagement with contacts 41 and 42 thereby closing the circuit through the solenoid 28, the core 27 of which will be energized and drawn downward thereby rotating the sheave 24, shaft 20 and screw 17

a partial revolution in a counter clockwise direction whereby the pressure of the screw 17 on the pivoted lever 16 will be released allowing the guide plate 12 a limited lateral movement when engaged by the forward end of the bar or rod. After the bar or rod passes through the trough 31 it enters the entering guide 8, then into the reducing pass 5, thence into delivery guide 9, which has an inclined groove formed therein adapted to give the bar a 90° turn as it passes through the curved repeater 54 and enters the trough 32 where it engages flag 34, swinging the contact arm 40 out of engagement with the contacts 43 and 44 and opening the circuit deenergizing the core 27 of the solenoid 28, this allows the adjustable weight 23 on arm 22 or spring 29 to rotate the shaft 20 and screw 17 in a clockwise direction thereby laterally advancing the movable guide plate 12 toward the fixed guide plate 11 by the increased pressure of the end of the screw 17 on the pivoted arm 16 and closing the guide in such a manner that the bar or rod will enter the finishing pass 6 in the proper alignment, the bar having been turned substantially 90° after leaving pass 5. The weight 23 or spring 29 on arm 22 may be so adjusted as to allow time enough for the end of the oncoming bar to pass properly between the guide plates 11 and 12 before the guide is closed. The rod or bar is then fed through the finishing roll pass 6 and the then finished product is conveyed to a cooling bed to cool.

After the rear end of the bar 52 passes the flag 33 the contact arm 39 will return to its normal position out of engagement with the contacts 41 and 42. As the bar continues to advance and the rear end passes the flag 34 the contact arm will return to its normal position and engage the contacts 43 and 44.

The operation described above will then be repeated when the forward end of the next bar being rolled enters the trough 31.

Although I have illustrated in Figs. 1 and 2 the flag 33 as mounted to extend into the trough 31 so that the bar will engage the flag before it enters the roll pass 5 it will be readily understood that this flag may be placed after the pass on the other side of the rolls or in the curved repeater 54 or any place along the line of travel of the bar.

The space between the flags must not however be greater than the length of the bar being rolled and the forward end of the bar must engage the flag 34 and swing the contact arm 40 out of engagement with the contacts 43 and 44, to open the circuit at this point before the rear end of the bar passes flag 33 thereby swinging arm 39 out of engagement with contacts 41 and 42, otherwise if the rear end of the bar passes the flag 33 first and the circuit is opened at this point before the forward end of the bar engages the flag 34, the guide for the finishing pass will be closed before the proper time.

In my invention the operation of my device is entirely automatic, the motion of the operating mechanism is to be controlled by a flag or flags or the like placed in the path of the bar on its way to enter the roll passes alternately closing and opening an electric circuit at the proper instant, or the bar itself may engage two or more contact points thereby completing a circuit and thus becoming an electrical conductor for a part of the circuit.

Although I have described and illustrated my invention in considerable detail, I do not wish to be limited to the exact and specific details thereof as shown and described, but may use such modifications in, substitutions for, 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. In a guide for rolling mills, comprising a pair of rolls, a pass formed in the rolls for the reduction of a bar, housings for the rolls, rest bars connecting the housings together, a guide box secured to one of the rest bars, a fixed guide plate and a movable guide plate each having a grooved inner face mounted in the guide box, a screw adapted to be automatically rotated and controlled by the bar being rolled for opening and closing the guide, electrically operated means for rotating the screw in one direction and means independent of the electrically operated means for rotating the screw in the reverse direction.

2. In a guide for rolling mills, comprising a pair of rolls, a pass formed in the rolls for the reduction of a bar, housings for the rolls, rest bars connecting the housings together, a guide box secured to one of the rest bars, a fixed guide plate and a movable guide plate each having a grooved inner face mounted in the guide box, a screw threaded into the side of the guide box, a shaft connected to the screw, electrically operated means controlled by the bar being rolled adapted to rotate the shaft and screw when opening the guide, and means attached to the shaft and independent of the electrical means for rotating the shaft and screw in the reverse direction to that of the electrically operated means for closing the guide.

3. In a guide for rolling mills, comprising a pair of rolls, a pass formed in the rolls for the reduction of a bar, housings for the rolls, rest bars connecting the housings together, a guide box secured to one of the rest bars, a fixed guide plate and a movable guide plate each having a grooved inner face mounted in the guide box, a screw threaded into the side of the guide box, a socket formed

in the screw, a shaft slidably secured in the socket, a sheave mounted on the shaft, a solenoid having a reciprocating core, a flexible connection between the sheave and the core of the solenoid, spaced flags adapted to be engaged by the bar being rolled, contact arms attached to and movable with the flags, contacts adapted to be engaged by the contact arm when the circuit is closed to energize the core of the solenoid and rotate the shaft and screw when opening the guide and means attached to the shaft and independent of the electrically operated means for rotating the shaft and screw in the reverse direction to close the guide.

4. In a guide for rolling mills, comprising a pair of rolls, a pass formed in the rolls for the reduction of a bar, housings for the rolls, rest bars connecting the housings together, a guide box secured to one of the rest bars, a fixed guide plate and a movable guide plate each having a grooved inner face mounted in the guide box, a screw threaded into the side of the guide box, a shaft slidably secured to the screw and rotatable therewith, a sheave mounted on the shaft, a solenoid having a reciprocating core, a flexible connection between the sheave and the core of the solenoid, a pair of spaced flags adapted to be engaged by the bar being rolled, a contact arm attached to each flag and movable with the flags, a pair of contacts adapted to be engaged by each contact arm when the circuit is closed to energize the core of the solenoid and rotate the shaft and screw when opening the guide, means for normally holding one pair of contacts open and the other pair of contacts closed, and means attached to the shaft and independent of the electrically operated means for rotating the shaft and screw in the reverse direction to close the guide.

5. In a guide for rolling mills, a guide box, a fixed guide plate and a movable guide plate mounted therein, a lever pivoted to the guide box and contacting with the movable guide plate, a rotatably mounted adjusting member engaging the pivoted lever, electrically operated means for automatically rotating the adjusting member in one direction to open the guide, and means independent of the electrically operating means for closing the guide.

6. In a guide for rolling mills, comprising a guide box, a fixed guide plate and a movable guide plate mounted therein, means for feeding a bar to be rolled between the guide plates, a screw threaded into the guide box adapted to control the adjustment of the movable guide plate, an electrical circuit, switches in spaced relation to each other in the circuit each adapted to be closed or opened by the passage of the bar, a solenoid in the electrical circuit for rotating the screw in one direction, and independent means for rotating the screw in the reverse direction.

7. In a guide for rolling mills, comprising a pair of rolls, a pass formed in the rolls for the reduction of a bar, housings for the rolls, rest bars connecting the housings together, a guide box secured to one of the rest bars, a fixed guide plate and a movable guide plate mounted within the guide box, a screw threaded into the guide box adapted to control the adjustment of the movable guide plate, a shaft having one end slidably engaging the screw and rotatable therewith, a sheave mounted on the shaft, an electrical circuit, switches in spaced relation to each other in the circuit each arranged to close or open by the passage of the bar, a solenoid in the electrical circuit, a reciprocating core for the solenoid having a flexible connection between the core and the sheave adapted when the circuit is closed to rotate the shaft and screw in one direction to allow the guide to open and a weighted lever mounted on the shaft for rotating the shaft and screw in the reverse direction to close the guide.

8. In a guide for rolling mills, comprising a pair of rolls, a pass formed in the rolls for the reduction of a bar, housings for the rolls, rest bars connecting the housings together, a guide box secured to one of the rest bars, a fixed guide plate and a movable guide plate mounted within the guide box, a lever pivoted to the guide box and engaging the movable guide plate, a screw threaded into the guide box adapted to engage the pivoted lever and control the adjustment of the movable guide plate, a rectangular socket formed in the screw, a shaft having a squared end slidably engaging the socket and rotatable with the screw, a sheave mounted on the shaft, an electrical circuit, switches in spaced relation to each other in the circuit each arranged to close or open by the passage of the bar, a solenoid in the electrical circuit, a reciprocating core for the solenoid having a flexible connection between the core and the sheave adapted when the circuit is closed to rotate the shaft and screw in one direction to allow the guide to open, and a weighted lever mounted on the shaft for rotating the shaft and screw in the reverse direction thereby exerting pressure against the pivoted lever and movable guide plate to close the guide.

9. In a guide for rolling mills, comprising a fixed guide plate and a movable guide plate, means for feeding a bar between guide plates, a trough for conducting the bar to the guide, an electric circuit, a pair of spaced switches in series in the electric circuit, a flag for each switch extending into the trough across the path of the feed bar and adapted to control the opening and closing of the switches, means for allowing the guide to open when the circuit is closed, and independent means for closing the guide when the circuit is open.

10. In a rolling mill, comprising a plurality of stands of rolls, a pair of rolls in each stand, each pair of rolls having a pass formed therein for the consecutive reduction of a bar, troughs and guides for conducting the bar to the roll passes and giving the bar a partial axial rotation, a pair of spaced flags normally arranged across the path of the traveling bar being reduced and adapted to swing out of the path when engaged by the bar, an entering guide for one of the roll passes, a switch connected to each flag and movable therewith, an electrical circuit for connecting the switches, means for normally holding one of the switches open, means for holding the other switch closed, and means for controlling the opening and closing of the guide by the closing and opening of the switches.

11. In a guide for rolling mills, a pair of cooperating guide plates, means for feeding a bar between the guide plates, an electric circuit, a pair of switches in the circuit, means for normally holding the first switch open and the second switch closed, a flag attached to each switch arranged in the path of the traveling bar and movable therewith, means when the forward end of the traveling rod engages the flag attached to the first switch for closing the circuit and allowing the guide to open, and means when the forward end of the traveling rod engages the flag attached to the second switch for opening the circuit and closing the guide.

12. In a guide for rolling mills, a pair of rolls, a pass formed in the rolls for the reduction of a bar, a fixed guide box, a stationary guide plate and a laterally adjustable guide plate movably mounted within the fixed guide box, means for holding the laterally movable guide plate against longitudinal movement, electrically operated means in spaced relation with the guide for laterally adjusting the movable guide plate in one direction to open the guide before the bar enters the said guide, and means independent of the electrically operated means for laterally adjusting the movable guide in the reverse direction to close the guide before the bar being rolled enters the roll pass.

13. In a guide for rolling mills, a fixed guide box, a stationary guide plate and a laterally adjustable guide plate movably mounted within the fixed guide box, means for holding the laterally movable guide plate against longitudinal movement, a rotatably mounted adjusting member, electrically operated means for rotating the adjusting member for laterally adjusting the movable guide plate in one direction to open the guide, and resilient means for laterally adjusting the movable guide plate to close the guide.

14. In a guide for rolling mills, a fixed guide box, a stationary guide plate and a laterally adjustable guide plate movably mounted within the fixed guide box, means for holding the laterally movable guide plate against longitudinal movement, a lever pivoted to the fixed guide box and contacting with the movable guide plate, a rotatably mounted adjusting member for engaging the lever, electrically operated means for rotating the adjusting member in one direction to open the guide, and resilient means for rotating the adjusting member in the opposite direction to close the guide.

15. In a guide for rolling mills, a fixed guide box, guide plates mounted therein each provided with a grooved inner face adapted to form a guiding aperture for the bar, an electrically operated rotating means adapted to rotate in one direction to open the guide, and means independent of the electrically operating means adapted to rotate the rotating means in the reverse direction for closing the guide.

16. In a guide for rolling mills, a stationary guide box, a fixed guide plate and a movable guide plate mounted therein, a lever pivoted to the guide box and contacting with the movable guide plate, a rotatably mounted adjusting screw engaging the pivoted lever, electrically operated means for rotating the adjusting screw in one direction to open the guide, and a weighted lever means for rotating the screw in the opposite direction for closing the guide.

17. In a guide for rolling mills, a stationary guide box, a fixed guide plate and a laterally movable guide plate mounted therein, means for holding the laterally movable guide plate against longitudinal movement, a lever pivoted to the guide box, an adjusting screw threaded into the guide box and engaging the lever, a socket formed in the adjusting screw, a shaft slidably keyed to the adjusting screw, electrically operated means for rotating the shaft and adjusting screw in one direction, and mechanical means for rotating the shaft and adjusting the screw in the reverse direction.

18. In a guide for rolling mills, a stationary guide box, a fixed guide plate and a laterally movable guide plate mounted therein, means for holding the laterally movable guide plate against longitudinal movement, a lever pivoted to the guide box, an adjusting screw threaded into the guide box and engaging the lever, a rectangular socket formed in the adjusting screw, a shaft having a squared end slidably engaging the socket, a sheave mounted on the shaft, a solenoid, a connection between the solenoid and the sheave, electrical means for energizing the solenoid to rotate the shaft in one direction, a weighted lever mounted on the shaft adapted to rotate the shaft in the reverse direction.

19. In a guide for rolling mills, comprising a pair of rolls provided with a pass for the reduction of a bar, housings for the rolls,

rest bars for connecting the housings together, a stationary guide box secured to one of the rest bars, a fixed guide plate and a laterally movable guide plate each having a grooved inner face mounted in the guide box, means for holding the laterally movable guide plate against longitudinal movement, a lever pivoted to the guide box and contacting with the movable guide plate, a rotatably mounted adjusting member for engaging the lever, electrically operated means controlled by the bar being rolled for automatically rotating the adjusting member in one direction to open the guide, and means independent of the electrically operating means for closing the guide.

20. In a guide for rolling mills, comprising a pair of rolls provided with a pass for the reduction of a bar, housings for the rolls, rest bars for connecting the housings together, a stationary guide box secured to one of the rest bars, a fixed guide plate and a laterally movable guide plate each having a grooved inner face mounted in the guide box, means for holding the laterally movable guide plate against longitudinal movement, a lever pivoted to the guide box and contacting with the movable guide plate, an adjusting screw threaded into the stationary guide box and engaging the lever, a rectangular socket formed in the adjusting screw, a shaft having a squared end slidably engaging the socket, a sheave mounted on the shaft, electrically operated means controlled by the passage of the bar being rolled for automatically rotating the shaft in one direction, and means independent of the electrically operating means for rotating the shaft in the reverse direction.

21. In a guide for rolling mills, comprising a pair of rolls provided with a pass for the reduction of a bar, housings for the rolls, rest bars for connecting the housings together, a stationary guide box secured to one of the rest bars, a fixed guide plate and a laterally movable guide plate each having a grooved inner face mounted in the guide box, means for holding the laterally movable guide plate against longitudinal movement, a lever pivoted to the guide box and contacting with the movable guide plate, an adjusting screw threaded into the stationary guide box and engaging the lever, a shaft having its end slidably keyed to the adjusting screw, an electric circuit provided with switches in series adapted to be opened and closed by the passage of the bar, a solenoid in the circuit controlled by the switches, a connection with the shaft adapted to rotate the shaft in one direcion to open the guide, and a weighted lever mounted on the shaft adapted to rotate the shaft in the reverse direction.

22. In a guide for rolling mills, comprising a pair of rolls provided with a pass for the reduction of a bar, housings for the rolls, rest bars for connecting the housings together, a stationary guide box secured to one of the rest bars, a fixed guide plate and a laterally movable guide plate each having a grooved inner face mounted in the guide box, means for holding the laterally movable guide plate against longitudinal movement, an electrical circuit having a plurality of switches in spaced relation to each other in the circuit adapted to be closed or opened by the passage of the bar to control the actuating means for opening the guide, and resilient means for closing the guide.

23. In a guide for rolling mills comprising a pair of rolls, a pass formed in the rolls for the reduction of a bar, a guide mounted adjacent to the roll pass, electrically operated means for opening the guide before the bar enters the said guide, and means independent of the electrically operated means for automatically closing the guide before the forward end of the bar enters the roll pass.

In testimony whereof I hereunto affix my signature.

WILLIAM H. CATTERALL.