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3 SHEETS—SHEET 1.

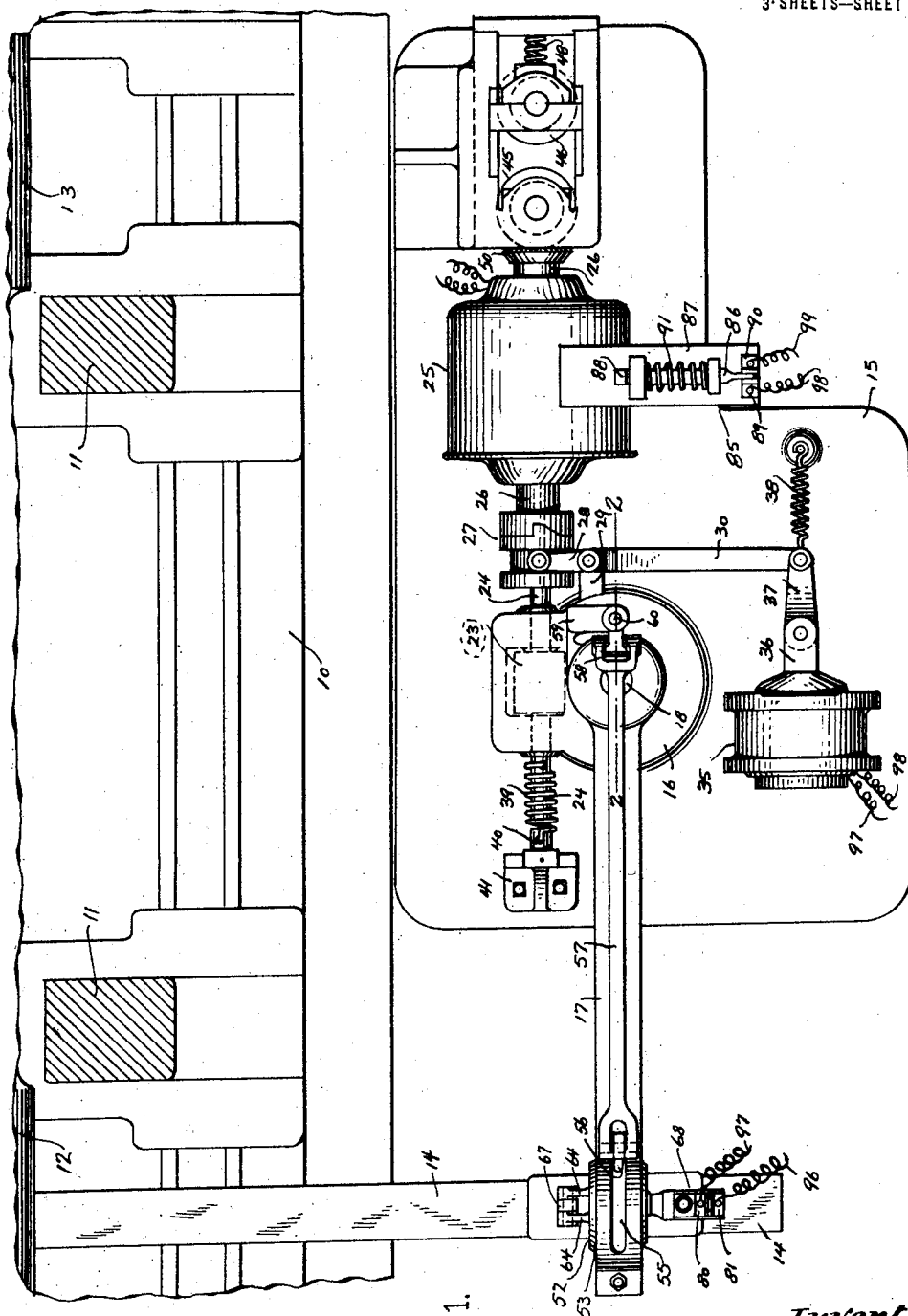


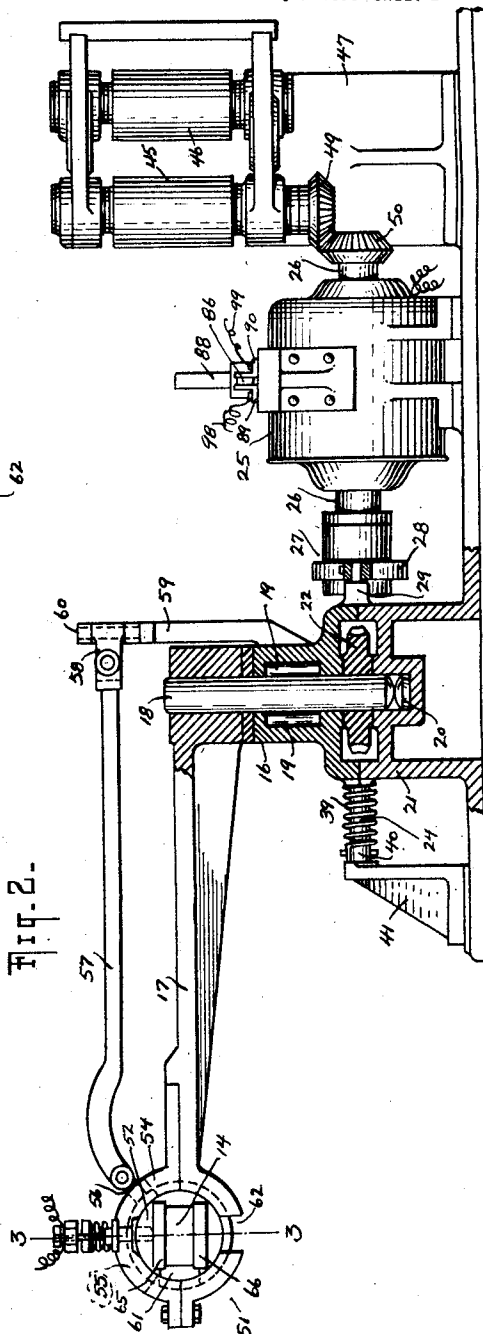
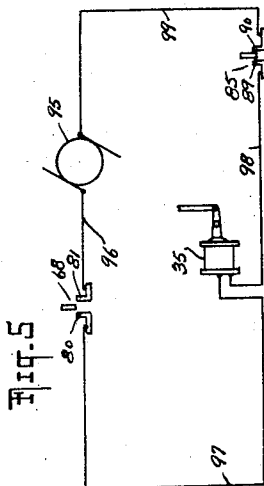
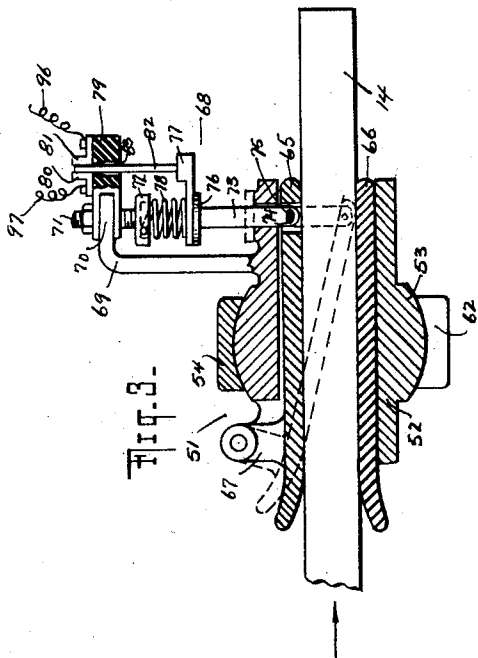
Fig. 1.

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3 SHEETS—SHEET 2.



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BAR REVERSER.

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3 SHEETS—SHEET 3.

Fig. 5.

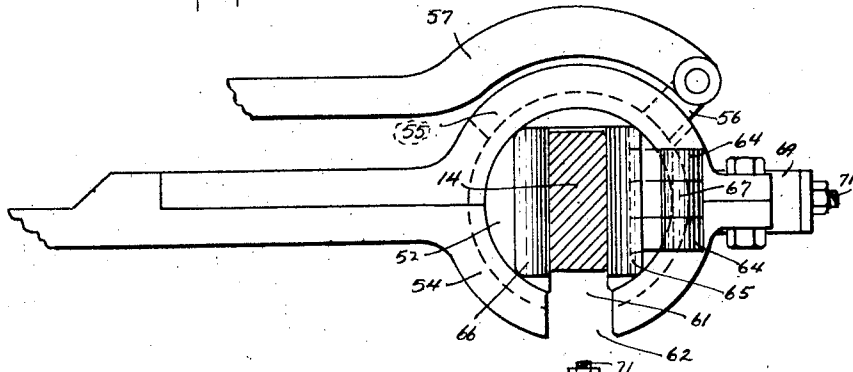


Fig. 7.

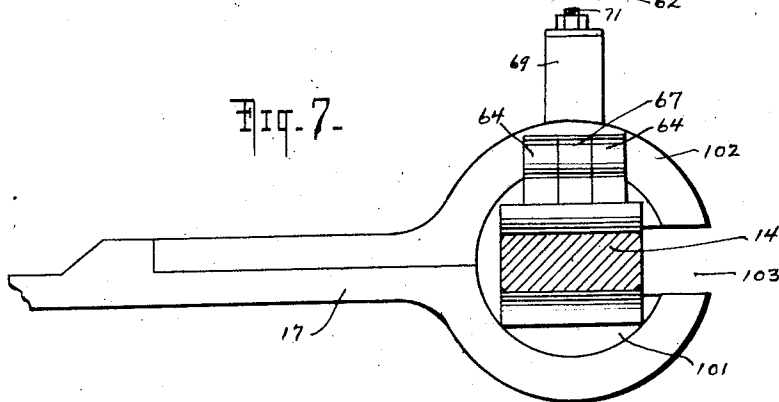
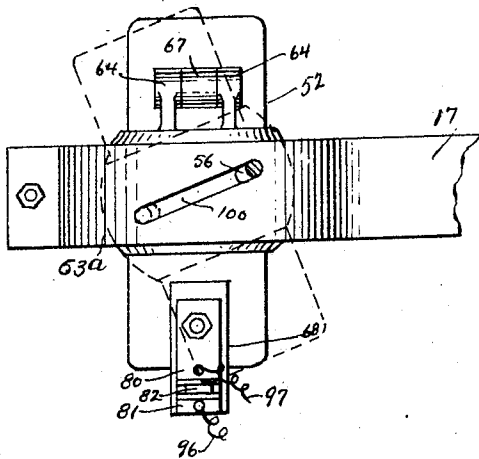


Fig. 6.



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UNITED STATES PATENT OFFICE.

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BAR REVERSER.

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Specification of Letters Patent.

Patented Feb. 7, 1922.

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To all whom it may concern:

Be it known that I, HARRY B. ROSE, a citizen of the United States of America, and a resident of the city of Buffalo, county of Erie and State of New York, have invented certain new and useful Improvements in Bar Reversers, of which the following is a full, clear, and exact description.

My invention relates generally to bar reversers and more particularly to devices for grasping the end of a bar coming from the pass rolls of a rolling mill and to turn the end around and direct it into another set of pass rolls.

It is well known that in the form of rolling mills where the rolls for successive passes are arranged with their axes in a substantially straight line, it is necessary that the end of the bar be reversed in its direction of travel in order that it may be successively passed through the various passes of the rolling mill. It is the present practice to have an operator stand between the pairs of rolls for each two successive passes, whose duty it is to grab the end of the bar as it is coming from the first set of pass rolls and by turning his body, to turn the end of the bar and direct it into the next successive pair of rolls. This operation is not only difficult, requiring considerable skill, but is fraught with a good deal of danger. It is also necessary during this turning or reversing motion to give the bar a turn axially through substantially 90° before it is passed into the second set of pass rolls. These two operations have to be performed between each set of passes.

The principal object of my invention, has been to provide a device which shall perform these two operations mechanically, and one which shall be automatic in its operation.

Another object has been to provide a device of this nature which shall be comparatively simple in its construction and operation, and one, therefore, which shall be durable and efficient.

The above objects and advantages have been accomplished by the device shown in the accompanying drawings, of which:

Fig. 1 is a plan view of my complete device, showing fragmentary portions of two successive passes of a rolling mill.

Fig. 2 is a front elevation of my device, showing a portion of it in section.

Fig. 3 is an enlarged, longitudinal, sectional view of the gripping means and is taken on line 3—3 of Fig. 2.

Fig. 4 is an enlarged view of the gripping means showing the position it occupies when the reverse arm 17 is in its reverse position.

Fig. 5 is a diagrammatical view showing the electric wiring and connections between the several parts of the device.

Figs. 6 and 7 show two modifications of the gripping means.

Referring now to the drawings and more particularly to Figs. 1 to 4 inclusive, 10 represents the rolling mill bed, 11 the mill housing, and 12 and 13 two successive pairs of pass rolls. 14 is a rolled bar, coming from the first set of pass rolls 12. My device is arranged along side of the rolling mill and in registering position with the passes of the pass rolls.

My device comprises a base 15 having a standard 16 which carries a reverse arm 17. The reverse arm is rigidly mounted upon a shaft 18, which is rotatably carried by the standard 16 and is preferably provided with roller bearings 19 and a step bearing 20. A gear housing 21 is formed at the base of the standard 16 and within it is mounted a worm gear 22 and an engaging worm 23. The worm gear 22 is rigidly attached to the shaft 18, whereby the reverse arm 17 is actuated. The worm 23 is mounted upon a shaft 24 which is suitably journaled in the gear housing 21.

An electric motor 25 is mounted upon the base 15 and furnishes the power for actuating the reverse arm 17. The shaft 26 of this motor is in line with the worm shaft 24, and these two shafts are connected together by a suitable clutch 27. A clutch-yoke 28 is engageable with the movable member of the clutch for throwing it into and out of engagement. This clutch yoke 28 is pivotally mounted upon an arm 29 carried by the gear housing 21 and is provided with an outwardly extending arm 30.

35 is a solenoid which is provided with a core 36. The core 36 is connected with the outer end of the clutch-yoke arm 30, preferably, by means of a link 37, so that when the solenoid is energized, the clutch members will be brought into engagement. A spring 38, having one end attached to the outer end of the arm 30 and its opposite end to the

base 15, is provided for retracting the arm 30 and throwing the clutch out of engagement when the solenoid is de-energized.

- On the opposite end of the worm shaft 24 is disposed a reversing spring 39. This spring has one of its ends secured to the shaft and its opposite end is rigidly secured to the projecting arm 40 of a standard 41, carried by the base. This spring is so designed that, when the worm shaft 24 is being rotated to move the arm from the position shown in Fig. 1 to its reverse position, this spring will be wound about the shaft 24 so that, when the clutch 27 disconnects the motor from the shaft 24, this spring will unwind and rotate the worm shaft 24 in the reverse direction, thereby moving the reverse arm 17 back to the position shown in Fig. 1.
- In some cases, owing to the size of the rolling mill housing, it is impractical to set my device close enough to the pass rolls to properly guide the advance end of the bar being rolled into the pass rolls. In such cases, in order to properly guide the advance end of the bar into the next successive pair of pass rolls, I provide pinch rolls 45 and 46. These rolls are mounted upon a suitable standard 47, and the roll 46 is mounted so as to be pressed toward the roll 45 by means of springs 48. The roll 45 is provided preferably with a bevel gear 49 at the lower end of its shaft and this gear meshes with a similar bevel gear 50 mounted upon one end of the motor shaft 26. The pinch roll 45 is kept continuously rotating by the motor 25, and the reverse arm 17 is operated when the worm shaft 24 is connected with the motor shaft 26.
- The reverse arm 17 is provided at its outer end with gripping means 51. These gripping means comprise a gripping head 52, having a central, spherical bearing portion 53. The bearing portion 53 is rotatably mounted within a housing 54, formed at the outer end of the arm 17. In the upper face of this housing 54 is provided a longitudinal slot 55 (see Fig. 1), and a turning pin 56, rigidly attached to the bearing portion 53 of the head 52, is slidably disposed within the slot 55. By means of the pin 56, the gripping head 52 may be turned through an angle of substantially 90°, so that if the bar comes from the first pair of pass rolls with its longest side in a horizontal position, it will be presented to the second set of pass rolls with the same side in a vertical position. A turning arm 57 is arranged above the reverse arm 17 and has its outer end pivotally connected with the pin 56. This end of the arm is curved slightly so as to conform with the circular shape of the housing 54 when the pin 56 has been moved to the position shown in Fig. 4. The inner end of the turning arm is pivotally

connected by means of a universal connector 58 to a turning standard 59 carried by the standard 16. This turning standard is arranged so as to have its pivot pin 60 arranged in a plane which is co-incident with the vertical plane passing centrally through the reverse arm 17 when it occupies the position shown in Fig. 1. The pin 60 is so positioned that it lies on the side of the shaft 18 which is opposite the gripping means 51, when it occupies the position shown in Figs. 1 and 2. It will be seen that as the reverse arm 17 is moved through substantially 180°, the distance between the pivot pin 60 of the turning arm 59 and the gripping means 51 will be decreased, thereby causing the turning arm 57 to move the pin 56 to turn the gripping head 52 within the housing 54. The distance between the pivot pin 60 and the axis of the shaft 18 is such that the gripping head 52 will be preferably rotated through substantially 90°. The gripping head 52 is provided with an opening 61 and the bearing 54 with an opening 62 through which the bar may be discharged from the gripping means. 65 and 66 are gripping jaws for the gripping means 51. The jaw 66 is rigidly attached within the head 52 by any suitable means; and the jaw 65 is provided with an outwardly projecting arm 67, which is pivotally attached to lugs 64 formed on the gripping head 52. These gripping jaws are spaced apart a distance equal to, preferably, the narrower side of the bar being rolled, and their outer ends are flared as shown in Fig. 3, so as to provide a suitable guide for the entrance of the advance end of the bar.

An electric circuit closing means 68 is carried by the gripping head 52 and is actuated by the movement of the movable gripping jaw 65. These means comprise an arm 69, carried by the gripping head 52 and provided with an outwardly extending bent portion 70. An adjusting screw 71 is carried by this bent portion 70 and has a washer 72 secured at its lower end. Arranged in line with the adjusting screw 71 is a rod 73 which has its lower end passing through a suitable bearing aperture in the gripping head 52 and is attached to the free end of the movable gripping jaw 65. The lower end of the rod 73 is preferably provided with a slot 74, as shown in Fig. 3, and it is connected to the movable jaw 65 by means of a pin 75. The slot 74 is provided for accommodating the longitudinal movement of the movable jaw 65 as it is oscillated on its pivot. The rod 73 is provided at its upper end with a washer 76 and a switch arm 77 of insulating material. A spring 78 is arranged between the washer 72 and the arm 77, whereby the rod 73 will be normally pressed away from the washer 72 and keep the movable jaw 65 in the dotted line position shown in Fig. 3 when there is no bar

within the gripping means. A switch base 79, of insulating material is carried by the portion 70 of the arm 69 and supports two switch contact members 80 and 81. The switch arm 77 carries a switch blade 82 which has its upper end disposed within a slot 83 formed in the base 79. The upper end of the blade 82 is engageable with the switch contact members 80 and 81 when the movable gripping jaw 65 is in the position shown in Fig. 3.

The adjusting screw 71 provides for altering the tension placed upon the spring 78 and the movable gripping jaw 65. The distance that the advance end of the bar will project beyond the farther end of the gripping head before contact is made between the switch members 80 and 81 may be governed by this means. The lighter the pressure of the spring 78, the less will be the frictional engagement between the gripping jaws 65 and 66 and the passing bar and, therefore, the projecting end of the bar will be greater than when the tension of the spring 78 is adjusted to increase the friction between the bar and the gripping jaws. The switch for closing the electric circuit of the device is provided so that the solenoid 35 may be energized, but it is necessary to provide some means for de-energizing the same when the reverse arm 17 has moved through its predetermined travel. A de-energizing switch 85 is, therefore, provided for this purpose. This switch comprises a switch bar 86, slidably carried by a base 87 of insulating material. The base 87 is supported preferably by the motor 25 and in the path of travel of the reverse arm 17. The switch bar 86 is provided with an upwardly projecting arm 88 which is engageable with the reverse arm 17. 89 and 90 are the contact members of the de-energizing switch which are engaged by the bar 86. A helical spring 91 is provided on the bar 86 for keeping it normally in engagement with the contact members 89 and 90, as shown in Fig. 1.

In Fig. 5, where I show a diagram of the electric connections of my device, 95 represents any suitable source of electric energy which has one of its terminals connected with the electric circuit closing means 68 by means of a lead 96. The means 68 is also connected with the solenoid 35 by means of the lead 97. The solenoid is connected with the de-energizing switch 85 by means of a lead 98. A lead 99 connects the other side of the de-energizing switch with the other terminal of the source of electric energy. It will be seen that the de-energizing switch is a normally closed switch and that the electric circuit closing means 68 are normally open. The electric contact means 68 are closed by the bar as it passes in between the jaw of the gripping means and this completes the circuit just above described, whereby the solenoid will be energized and the reverse arm 17 operated. When the reverse arm has reached the predetermined limit of its travel it will strike the de-energizing switch and open this circuit, thus de-energizing the solenoid and allowing the parts to return to the positions shown in Figs. 1 and 2.

When the advance end of the bar being rolled has been turned around and directed toward the pinch rolls, it is, of course, necessary that the end be nearly in line with the opening between the pinch rolls. This, of course, will depend not only upon the relative position of the pinch rolls with respect to the gripping head 52, but also upon the distance that the end of the bar projects beyond the end of the gripping jaws 65 and 66. If the bar passes through the jaws beyond a distance at which the end thereof will register with the pinch rolls, it is desirable to move the end of the bar inwardly, in this case, so as to properly meet the pinch rolls. In the modified form shown in Fig. 6, this is accomplished by providing a cam-shaped or angularly-arranged slot 100 in the housing 63^a instead of the slot 55 shown in the other figures of the drawing. As hereinbefore described, the bearing for the gripping head is spherical so that the axis of the gripping head may be conveniently altered during the rotation of the reverse arm 17. It will be seen that as the pin 56 of the gripping head 52 is moved along the slot 100, the axis of the gripping head 52 will be moved to the dotted line position in a counter-clockwise direction as viewed in Fig. 6, thus moving the forward end of the bar inwardly so that it will be properly directed between the pinch rolls. The amount of motion of the gripping head will, of course, be governed by the shape and angular disposition of the slot 100. The more acute this angle is with the side face of the reverse arm 17, the less will be the amount of motion of the gripping head 52.

In some instances, it may not be necessary to rotate the bar on its axis during the reversal of its direction of travel, and in such cases the reverse arm 17 will be provided with a gripping head like that shown in Fig. 7. In this figure the gripping head 101 is rigidly secured within the bearing 102, and the bearing is provided through its horizontal axis with a slot 103 for the discharge of the bar.

From the foregoing, it will be clear that when the bar comes from the first pair of rolls 12 of the mill and is projected into the gripping means and between the jaws 65 and 66 thereof, it will cause the movable jaw 65 to move from the dotted line position shown in Fig. 3 to the full line position of this figure. When in the last mentioned position, the switch of the electric circuit

closing means 68 will be closed by the upward movement of the switch blade 82 which is controlled by the movement of the rod 73. The electrical circuit will then be completed through the leads and apparatus, shown in Fig. 5, and the solenoid 35 will be energized. This will operate the arm 30 of the clutch-yoke 28 and force the clutch 27 into engagement, thereby connecting the worm shaft 24 with the constantly rotating motor shaft 26. When the parts are so connected, the reverse arm 17 will be moved in a counter-clockwise direction, as viewed in Fig. 1, carrying with it the advance end of the rolled bar. When the reverse arm 17 has reached its predetermined limit of travel, and the forward end of the bar has been grasped by the pinch rolls 45 and 46, or the next set of pass rolls, the de-energizing switch 85 will be opened by the engagement of the reverse arm 17 with the projecting arm 88 of this switch, and the circuit shown in Fig. 5 will thus be broken and the solenoid 35 thereby de-energized. This will allow the spring 38 to retract the arm 30 of the clutch-yoke, which will disengage the clutch 27. As previously described, the spring 39 will be wound up when the worm shaft 24 has been operated; and when the clutch 27 is disengaged, this spring 39 will unwind itself, and, as it does so, it will rotate the worm shaft 24 in a reverse direction and cause the reverse arm 17 to be moved back to its initial position (shown in Figs. 1 and 2).

As hereinbefore stated, the pinch roll 45 is being constantly rotated by the motor 25, and as soon as the end of the bar engages with these rolls, it is immediately drawn in between them and directed toward the next successive set of pass rolls 13 of the mill.

As the reverse arm 17 is being moved through its predetermined travel, it will be clear that the turning arm 57 will move the pin 56 through the slot 55 of the gripping head bearing 54, and thus rotate the gripping head 52, whereby the bar will be axially rotated through an angle of substantially 90° (see Fig. 4), before it is presented to the pinch rolls and the next successive set of pass rolls.

It will be clear that when the gripping head 52 has been rotated to the position shown in Fig. 4, the narrower side of the bar 14 will be in line with the opening 61 of the gripping head 52 and the opening 62 of the bearing 54, in which position it will be free to drop out from between the gripping jaws 65 and 66. As the forward end of the bar is being carried around by the reverse arm 17, it will be clear that the portion of the bar between the gripping means and the set of rolls from which the bar is coming will sag considerably, so that when the reverse arm has reached the limit of its

travel and the gripping jaws 65 and 66 are in the position shown in Fig. 4, the weight of the sagging portion of the bar will tend to draw the bar out from between the jaws and thereby release the reverse arm 17. When the bar is thus released, the clutch 27 has already been disengaged and the arm is being urged to its initial position by the spring 39, which moves it to its initial position just as soon as it is released by the discharge of the bar from its gripping means.

In the drawings, I have shown a jaw clutch, but I do not limit myself to this form of clutch, for, if desired, I may use a magnetic clutch with attached braking means. While I have shown the use of electrical means for controlling the starting and stopping of the reverse arm 17, it is obvious that any suitable and mechanical equivalent of these means may be employed with equal efficiency. Furthermore, the gripping head 52 may be rotated through an angle greater or less than 90° if so desired. These and other modifications of the details herein shown and described may be made without departing from the spirit of my invention or the scope of the appended claims, and I do not, therefore, wish to be limited to the exact embodiment herein shown and described, the form described being merely a preferred embodiment thereof.

Having thus described my invention what I claim is:

1. The combination with a pair of pass rolls, of a bar reverser comprising a pivotally mounted reverse arm, and means carried by the arm for gripping, and moving with, a bar as it is coming from the pass rolls whereby the arm will be moved and the original entering end of the bar will always be the advance end.

2. The combination with a pair of pass rolls, of a bar reverser comprising a pivotally mounted reverse arm having its outer end engageable and movable with the advance end of a bar as it is coming from the pass rolls, and means for operating the reverse arm, whereby the original entering end of the bar will always be the advance end.

3. The combination with a pair of pass rolls, of a bar reverser comprising a pivotally mounted reverse arm having its outer end engageable and movable with the advance end of a bar as it is coming from the pass rolls, gripping means carried at the outer end of the arm, and means for operating the reverse arm, whereby the path of travel of the bar will be changed.

4. The combination with a pair of pass rolls, of a bar reverser comprising a pivotally mounted reverse arm having its outer end engageable and movable with the advance end of a bar as it is coming from the pass rolls, means for rotating the arm so that the original entering end of the bar

will always be the advance end, and means for stopping the movement of the arm.

5. The combination with a pair of pass rolls, of a bar reverser comprising a pivotally mounted reverse arm, means carried by the arm for gripping, and moving with, a bar as it is coming from the pass rolls, and means for rotating the bar axially.

6. The combination with a pair of pass rolls, of a bar reverser comprising a pivotally mounted reverse arm having its outer end engageable and movable with the advance end of a bar as it is coming from the pass rolls, means for rotating the bar axially, and means for operating the reverse arm.

7. The combination with a pair of pass rolls, of a bar reverser comprising a pivotally mounted reverse arm, rotatably mounted means carried at the outer end of the arm for gripping and moving with a bar as it is coming from the pass rolls, a pivotally mounted turning arm arranged adjacent the reverse arm, and a connection between the turning arm and the gripping means whereby the bar will be rotated axially as its path of travel is being changed.

8. The combination with a pair of pass rolls, of a bar reverser comprising a pivotally mounted reverse arm, rotatably mounted gripping means carried at the outer end of the arm and movable with a bar as it is coming from the pass rolls, a pivotally mounted turning arm arranged adjacent the reverse arm, a connection between the turning arm and the gripping means, the pivot of the turning arm being eccentrically arranged with respect to the pivot of the reverse arm, whereby, when the reverse arm is rotated, the turning arm will move relatively therewith and rotate the gripping means.

9. The combination with a pair of pass rolls, of a bar reverser comprising a reverse arm having its outer end engageable with the advance end of a bar as it comes from the pass rolls, means for pivotally mounting the reverse arm, motive power means for operating the arm, and means, controlled by the moving bar, for connecting the motive power means with the arm, whereby the arm is rotated and the path of travel of the bar is changed.

10. The combination with a pair of pass rolls, of a bar reverser comprising a reverse arm having its outer end engageable with the advance end of a bar as it comes from the pass rolls, means for pivotally mounting the reverse arm, gear means connected with the arm, a motor, a clutch connecting the motor and the gear means, and means, controlled by the moving bar, for engaging the clutch.

11. The combination with a pair of pass rolls, of a bar reverser comprising a reverse arm having its outer end engageable with the advance end of a bar as it comes from

the pass rolls, means for pivotally mounting the reverse arm, gear means connected with the arm, a motor, a clutch connecting the motor and the gear means, means controlled by the moving bar, for engaging the clutch, and means, controlled by the movement of the arm for disengaging the clutch, whereby the arm may be returned to its initial position.

12. The combination with a pair of pass rolls, of a bar reverser comprising a reverse arm having its outer end engageable with the advance end of a bar as it comes from the pass rolls, means for pivotally mounting the reverse arm, gear means connected with the arm, a motor, a clutch connecting the motor and the gear means, means, controlled by the moving bar, for engaging the clutch, means, controlled by the movement of the arm, for disengaging the clutch, and means for returning the arm to its initial position.

13. The combination with a pair of pass rolls, of a bar reverser comprising a pivotally mounted reverse arm having its outer end engageable with the advance end of a bar as it comes from the pass rolls, means for rotating the arm to change the path of travel of the bar, and gripping means at the outer end of the arm, comprising a gripping head and gripping jaws carried by the head, and means governed by the jaws for causing the arm to be operated.

14. The combination with a pair of pass rolls, of a bar reverser comprising a pivotally mounted reverse arm having its outer end engageable with the advance end of a bar as it comes from the pass rolls, means for rotating the arm to change the path of travel of the bar, and gripping means at the outer end of the arm, comprising a gripping head rotatably mounted in the outer end of the arm and gripping jaws carried by the head, means governed by the jaws for causing the arm to be rotated, and turning means adjacent the arm and connected with the gripping head, whereby the gripping head will be rotated axially.

15. The combination with a pair of pass rolls, of a bar reverser comprising a pivotally mounted reverse arm having its outer end engageable with the advance end of a moving bar as it comes from the pass rolls, gripping means at the outer end of the arm, motive power means for the arm, and electric means actuated by the advance end of the bar for causing the power means to be connected to the arm.

16. The combination with a pair of pass rolls, of a bar reverser comprising a pivotally mounted reverse arm, a constantly rotating source of power, a clutch for connecting the source of power to the arm, means for engaging the clutch to operate the arm, means for returning the arm to its initial position, said means being made ac-

tive by the forward movement of the arm and released by the arm at a predetermined point, and means for disengaging the clutch.

17. The combination with a pair of pass
5 rolls, of a bar reverser comprising a pivotally mounted reverse arm, a constantly rotating source of power, a clutch for connecting the source of power to the arm, means for engaging the clutch to operate
10 the arm, a spring for returning the arm to its initial position, said spring being wound up as the arm is moved through its predetermined travel, and means for disengaging the clutch.

15 18. The combination with a pair of pass rolls, of a bar reverser comprising a piv-

otally mounted reverse arm having its outer end engageable with the advance end of a bar as it comes from the pass rolls, a constantly rotating source of power, a clutch 20 for connecting the source of power to the arm, a solenoid for controlling the operation of the clutch, a source of electric energy, a switch, controlled by the advance end of the bar, for causing the solenoid to be energized, and a de-energizing switch for opening the circuit through the solenoid, and means for disengaging the clutch. 25

In testimony whereof, I have hereunto signed my name.

HARRY B. ROSE.