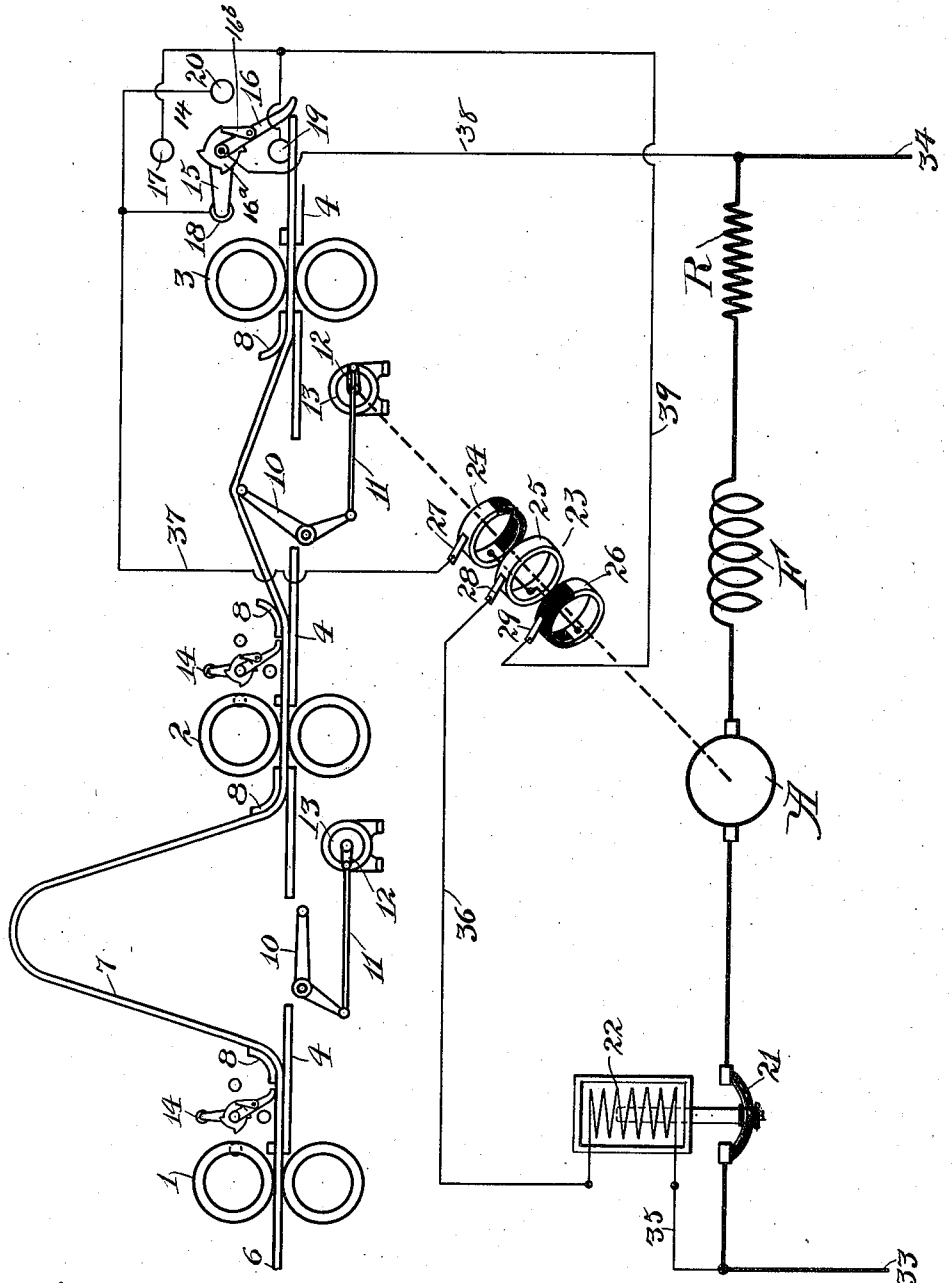
C. T. HENDERSON.

METAL ROLLING MACHINERY.

APPLICATION FILED AUG. 31, 1910.

1,170,153. Patented Feb. 1, 1916.



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METAL-ROLLING MACHINERY.

1,170,153. Specification of Letters Patent. Patented Feb. 1, 1916.

Application filed August 31, 1910. Serial No. 579,850.

To all whom it may concern:

Be it known that I, CLARK T. HENDERSON, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Metal-Rolling Machinery, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to improvements in machines for rolling continuous bars or sheets of metal.

More particularly my invention pertains to automatic means for regulating or controlling the metal which is being worked upon as it passes through the rolls. In machines of this character, it is customary to pass the material through a series of rolls all, or a number thereof, working upon the material at the same time to gradually compress the same. Due to the elongation of the material during the rolling process, it obviously would be very difficult, if not impossible, to obtain such a fine speed adjustment of the various sets of rolls as to prevent buckling or crimping of the material, or else undue strain on the material between the successive rolls.

According to my invention, I propose to adjust the successive rolls for such relative speeds that the material will be fed out of each set of rolls faster than it will be taken up by the next succeeding set and to provide automatic means for causing the surplus material between each set of rolls to assume the form of a loop, which will obviate all danger of the same becoming crimped or buckled.

The objects and advantages of my invention will be best understood by reference to the accompanying drawing, which embodies my invention in one form.

In the drawing, I have schematically illustrated a rolling mill having three sets of rolls 1, 2 and 3, it being understood that the same might have more or less sets of rolls as desired. There are two rolls to each set, one being disposed above the other. The rolls may be driven from any suitable source of power and may be regulated to compress the material fed therethrough to any desired degree. It will be assumed that the material is fed into the rolls from the left and that the various sets are adjusted to gradually compress the material to different predetermined degrees as the same is fed therethrough. Between the various sets of rolls are arranged suitable tables or supports 4, upon which the material passes as it leaves the rolls. I have shown a sheet or bar 6, as having partially passed through the sets of rolls 1 and 2 and beginning to pass through the rolls 3. The portion of the bar or strip 6 between the rolls 1 and 2 has, through the medium of the mechanism which I shall hereinafter describe, been caused to form a loop 7, while the portion thereof, between the rolls 2 and 3, is passing through the initial stage of the loop formation. For reasons obvious to those skilled in the art, it is essential to prevent the bar or strip from bending at a sharp angle. Accordingly, I have provided suitably curved guide plates 8 on each side of each set of rolls to obviate the danger of the material bending at a sharp angle. The devices for causing the loop formation of the surplus material between the successive sets of rolls, each comprise a bell crank lever 10 connected by a pitman 11 to a crank 12 operated by a suitable electric motor 13. The free arm of the lever 10 is normally disposed in a horizontal position and is adapted when operated by the motor to project through the support 4 to engage and move upwardly the portion of the bar or strip between adjacent sets of rolls. The lever between the rolls 2 and 3 is illustrated as having been operated to thus press upwardly that portion of the bar or strip 6 between said rolls 2 and 3. It is only necessary to give the surplus material between the rolls a slight upward tendency after which it will of its own initiative form such a loop as that illustrated between rolls 1 and 2 without any further attention. On the other hand, if the loop formation was not started by extraneous means that portion of the bar or strip being fed out of one set of rolls and into the next succeeding sets would buckle or crimp, instead of forming a harmlessly curved loop such as the loop 7. With the arrangement as shown no fine speed adjustment of the rolls is required, for when a loop formation has been started, the size of the loop may be largely increased without endangering the bar or sheet being passed through the rolls. Accordingly, there need be no exact relation between the speeds of

adjacent rolls and the speed ratio of the various rolls need not be calculated on a fine mathematical basis.

The motors 13 for operating the levers 10 may be of any preferred type, either direct current or alternating current and may be controlled in any suitable manner. As illustrated, I have provided a switch 14 in front of each set of rolls for controlling the motor to the rear of the same set of rolls. In practice, this switch might assume various different forms. Referring to the switch at the extreme right which has been enlarged for clearness, the same comprises a pivoted contact arm 15 having an operating lever 16 adapted to operate the same through a suitable ratchet 16^a and pawl 16^b. The contact arm 15 is adapted to be moved over contacts 17, 18, 19 and 20 successively. The free end of the lever 16 normally projects into the path of the bar or sheet being fed through the rolls. Consequently, as the end of a new bar or sheet passes through a set of rolls, it will engage the lever 16 to move the contact member 15 from one contact button to the next succeeding button, the lever 16 returning to initial position when the bar or sheet leaves its corresponding set of rolls. As all of the motors 13 may be controlled in the same manner, it will be sufficient to describe the control of one of the same. I have accordingly, only shown a diagram of circuit connections between the switch 14 and the motor 13 to the extreme right of the machine. In this circuit arrangement I have shown the motor 13 as provided with an armature A and a series field winding F. As above set forth, however, any other preferred type of motor might be employed. In series with the motor, I have provided a resistance R for regulating the torque thereof as desired. This resistance should be so designed as to maintain the torque of the motor within such limits that it will not operate the lever 10 with sufficient force to stretch or injure the bar or sheet against which the same is forced. For controlling the continuity of the motor circuit I have provided a switch 21 having an operating winding 22. For a purpose hereinafter set forth, I have provided in circuit with the winding 22 of switch 21 a commutator 23 adapted to be operated by the motor. This commutator may be of any preferred type. As illustrated, it comprises three rings 24, 25 and 26, all electrically connected together and adapted to be engaged respectively by brushes 27, 28 and 29. The ring 25 is a continuous conducting member, while only one half of each of the rings 24 and 26 is of conducting material. The commutator is preferably arranged to make one half revolution to each complete revolution of the motor and the rings 24 and 26 are so arranged that they will be alternately brought into engagement with their respective contact brushes, each of the same disengaging its brush as the other comes into engagement with its brush. The brush 29 engaging the ring 26 is electrically connected to contacts 17 and 19 of switch 14, and brush 27 of ring 24 is connected to contacts 18 and 20. Current is supplied through the motor from main lines 33 and 34.

With the circuits established, as illustrated in the drawing, the motor 13 would be in operation and, therefore, in order that it may be clearly understood how these circuit connections were established, I shall assume, for the purpose of description, that the plate or bar 6 is just entering the rolls 3. Under such conditions, the lever 10 in the rear of said rolls 3 would be in horizontal position, the contact arm 15 would be on contact button 17 and the commutator would be in such a position that contact brush 29 would rest on the insulated portion of ring 26. Also, the winding of the switch 21 would be deënergized. As the bar or sheet 6 passes through the rolls 3, its extremity engages the lever 16 of switch 14, causing the same to move the contact arm 15 into engagement with contact button 18. Thereupon circuit is established from main line 33 by conductor 35 through winding 22 of switch 21 by conductor 36 to contact ring 25 of the commutator, thence to contact ring 24 and by conductor 37 to contact 18 of switch 14, thence through said switch 14 and by conductor 38 to main line 34. The switch 21 thereupon responds and closes the motor circuit through the resistance R. Thus the motor is started and upon 180 degrees rotation thereof, brings the lever 10 into the position illustrated. The lever has by this time entirely fulfilled its function, namely, the initial formation of the loop of the material being rolled, and it is therefore of no further service. Accordingly, the motor is arranged during the remaining 180 degrees of rotation to return the lever 10 to initial position. The commutator, being arranged to make one half revolution to one revolution of the motor, will upon 360 degrees movement of crank 12 bring the insulated portion of the ring 24 into engagement with the brush 27. This interrupts the circuit of the operating winding of switch 21, which thereupon drops out and disconnects the motor from circuit. The motor will thus be stopped and the lever 10 will remain in normal position. When, however, the motor comes to rest, the contact brush 29 of the commutator will be in engagement with conducting portion of ring 26. Accordingly, when a new bar or sheet is run through the rolls, the contact arm 15 of switch 14 will be moved onto contact button 19, the switch lever 16 having in the meantime been returned to normal position by gravity or

other suitable means. This establishes a circuit through the operating winding of switch 21, as already traced to ring 25 of the commutator, thence to ring 26 and by conductor 39 to contact button 19 of switch 14, thence through said switch 14 to main line 34, as already traced. The motor will then be again set in operation, moving the lever 10 into the position illustrated and then returning it to normal position. When the motor has thus made another complete revolution, the insulated portion of the ring 26 will engage the contact brush 29 of the commutator, thus again deënergizing the switch 21 and interrupting the motor circuit. It will thus be seen that the commutator alternately connects alternate buttons of the switch 14 in circuit with the operating winding of switch 21, thus making it possible to start the motor automatically upon successive operations of the switch 14 and at the same time insure stopping of the motor after the same has made one complete revolution. Of course, the switch 14 and the remainder of the controller may be modified in accordance with the type of motor employed.

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

1. The combination with a plurality of sets of metal rolls, one set feeding the material issuing therefrom to a second set faster than it enters the latter, of a device operable to bow the material between said two sets of rolls, and means for automatically operating said device after the material enters said second set of rolls.

2. The combination with a plurality of sets of metal rolls, one set feeding the metal issuing therefrom to a second set faster than it enters the latter, of a device operable to bow the material passing between said two sets of rolls, and means operating automatically after the material enters said second set of rolls to operate said device and immediately restore the same to initial position.

3. The combination with a plurality of sets of metal rolls, one set feeding the material issuing therefrom to a second set faster than it enters the latter, of a device adapted to be projected against the material passing between said sets of rolls, a member operated by the material issuing from said second set of rolls, and automatic means operating upon said movement of said member to operate said device and thereafter return the same to initial position independently of the passage of the material rolled.

4. The combination with a plurality of sets of metal rolls, one set feeding the material issuing therefrom to a second set, of a device operable to bear against the material passing between said two sets of rolls, a member operable by the material issuing from said second set of rolls, and automatic means operating upon said movement of said member to operate said device and restore the same to initial position, said means being unaffected by the return movement of said member.

5. The combination with a plurality of sets of metal rolls, one set feeding the material issuing to another set faster than it enters the latter, of a device operable to bear against and bow the material passing between said two sets of rolls, an electric motor for operating said device and restoring the same to initial position, and automatic controlling means for said motor including a switch operated by the material issuing from said second mentioned set of rolls and an automatic limit switch.

6. The combination with a plurality of sets of metal rolls, one set feeding the material issuing therefrom to another set, of a device operable to bear against the material passing between said two sets of rolls, an electric motor operable in a single direction to operate said device and restore the same to normal position, and automatic means for starting said motor after the material enters said second mentioned set of rolls, and for stopping said motor after a predetermined degree of operation thereof.

7. The combination with a plurality of sets of metal rolls, one set feeding the material issuing therefrom to a second set faster than it enters the latter, of a device operable to bear against the material passing between said two sets of rolls, an electric motor operable in a single direction to operate said device and restore the same to initial position, a starting switch for said motor operated by the material issuing from said second set of rolls, and a stopping device for said motor operated thereby and in synchronism therewith.

8. A device for directing the course of a moving body or portion thereof comprising a member operable to bear against the moving body, an electric motor, and an operative connection between said member and said motor whereby the former is operated and restored to initial position by operation of the latter in a single direction.

9. The combination with a device operable to direct the course of a moving body or portion thereof, of an electric motor, an operative connection between said device and said motor whereby the latter upon operation in a single direction will operate said device and restore the same to initial position, a starting switch for said motor adapted to be operated by the moving body and a stopping device for said motor operated thereby and in synchronism therewith.

10. The combination with a device operable to direct the course of a moving body or

portion thereof, of an electric motor, an operative connection between said device and said motor whereby the latter upon operation in a single direction will operate said device and restore the same to initial position, a starting switch for said motor adapted to be operated by the moving body and a stopping device for said motor operated thereby and in synchronism therewith, said stopping device being effective only after operation of said motor to restore said first mentioned device to initial position.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

CLARK T. HENDERSON.

Witnesses:
FRANK H. HUBBARD,
M. S. PETERSON.