Feb. 24, 1953 G. B. TENER 2,629,273

REPEATER FOR ROLLING MILLS

Filed June 18, 1949 2 SHEETS—SHEET 1

Fig. 1

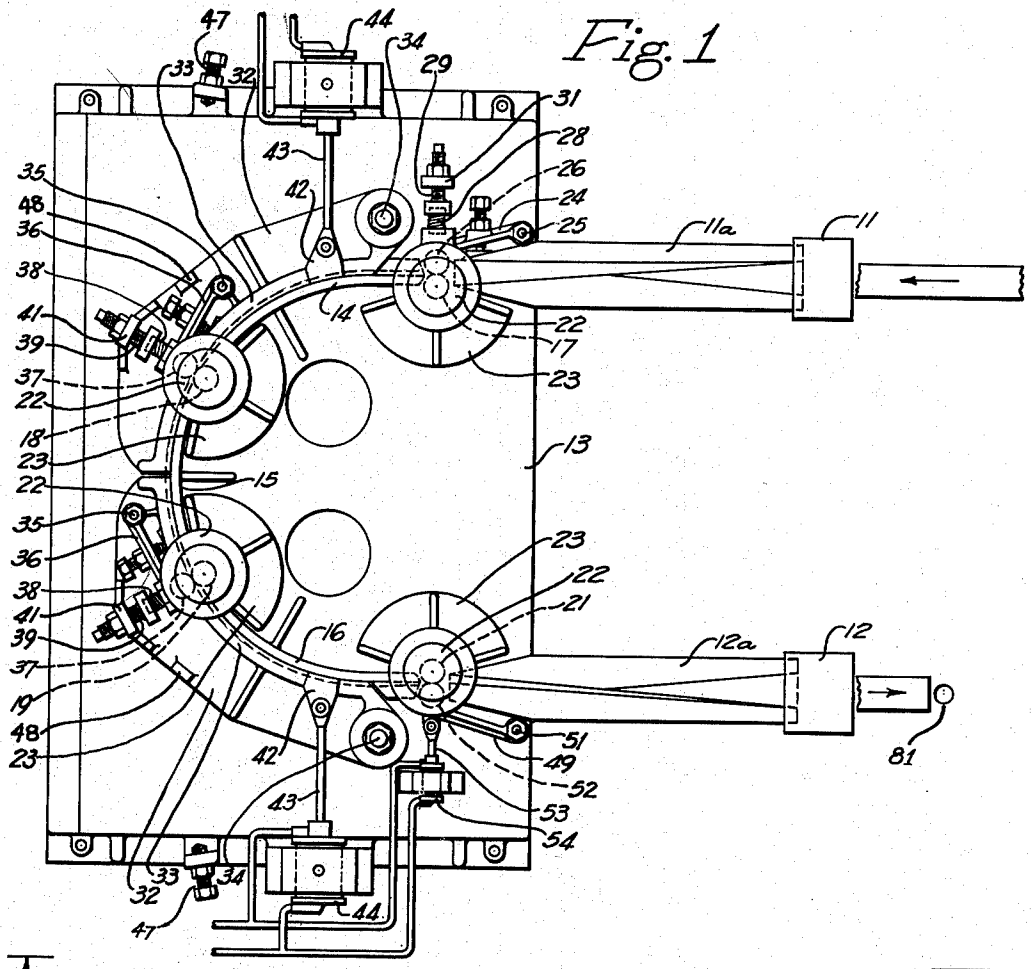
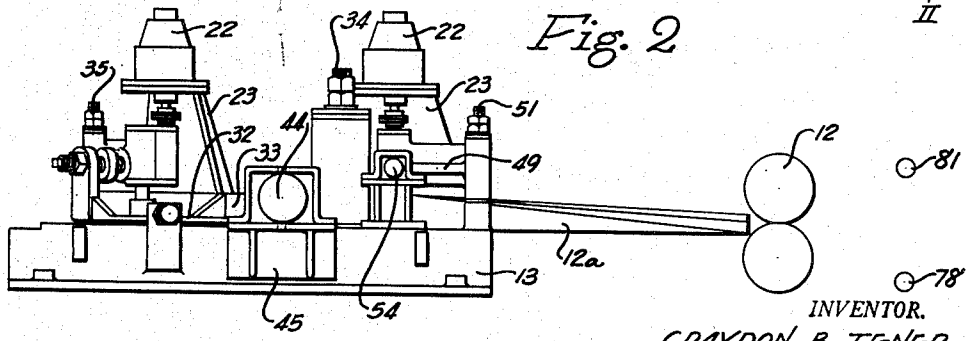


Fig. 2



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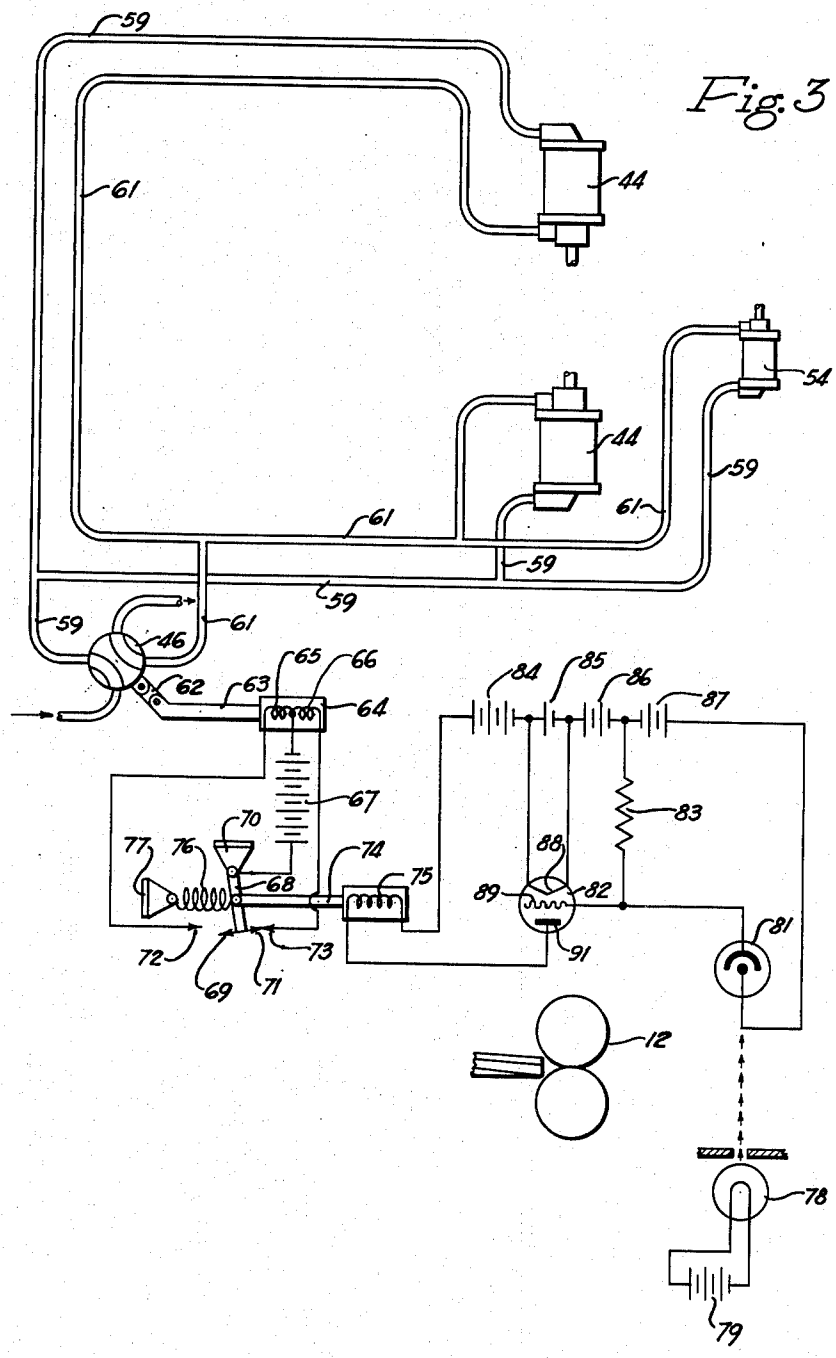
Filed June 18, 1949 2 SHEETS—SHEET 2

Fig. 3



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Patented Feb. 24, 1953

2,629,273

UNITED STATES PATENT OFFICE

2,629,273

REPEATER FOR ROLLING MILLS

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Application June 18, 1949, Serial No. 99,901

4 Claims. (Cl. 80—52)

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This invention relates to apparatus for handling metal strip and, in particular, to repeaters for rolling mills adapted especially to accommodate thin, wide, non-rigid strip metal for diverting the metal from one mill into another disposed out of alignment with respect thereto, and includes provision for permitting unrestricted movement of the excess metal which will gather between the mills due to variations in the draft thereof.

Heretofore, in carrying out a repeating operation on thin, wide, strip metal it has been the practice, due to the lack of rigidity of the strip and to prevent buckling thereof through the use of known repeating means, manually to grip the end of the strip as it issues from the first mill and to carry it over and insert it into the second mill, permitting the excess metal to grow on a gathering or looping table adjacent to the mills. As is readily apparent such a procedure is highly unsatisfactory inasmuch as it involves considerable time and effort as well as a danger to the workmen.

It is one of the objects of this invention, therefore, to provide apparatus which is automatic in operation for expeditiously and economically diverting strip from one rolling mill into another, which is out of alignment relative thereto, for carrying out a continuous rolling operation.

Another object of this invention is to provide apparatus adapted to accommodate thin, wide, non-rigid metal strip for carrying out a repeating operation between two mills which are out of alignment relative to one another.

A further object of this invention is to provide apparatus which is adapted continuously to grip and support thin, wide, non-rigid metal strip for carrying out a repeating operation between two misaligned mills and which, on completion of the threading of the strip through the second mill, automatically releases and permits gathering of the metal which will accumulate between the two mills due to the difference in draft thereof.

Still another object of this invention is to provide an apparatus for supporting thin, wide, non-rigid metal strip during the interval required for directing the strip from one mill into and through another which is out of alignment therewith, to release the strip on completion of the threading operation and to return to its strip-gripping position as soon as a particular strip has passed through and beyond the second mill.

The apparatus provided in accordance with this invention comprises a strip handling device

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for use in carrying out a repeating operation between two mills and includes a guide for turning the strip into a vertical plane as it issues from the first mill, a plurality of pairs of pinch rolls, with normally closed guides therebetween, for positively gripping and urging the strip forward, and a second guide for returning the strip to a horizontal plane prior to entry thereof into a second mill. The normally closed strip guides are adapted to be opened for permitting the gathering, upon a suitable table, of the excess metal strip which will accumulate between the mills due to a difference in the drafts thereof. The opening of the guide takes place automatically when the leading end of the strip issues from the second mill and interrupts a control mechanism, preferably a photocell-solenoid operated valve arrangement, which causes a plurality of fluid actuated motors attached to the guides to operate and draw the movable portion thereof, together with the pinch rolls attached thereto, away from the stationary portion of the guide and the strip passing therebetween. So long as the beam of the light of the photocell arrangement is interrupted, the movable portion of the guides cannot return to their closed position, but as soon as the trailing end of the strip passes out of the second mill and beyond the beam of light, the control mechanism is again actuated and the guides returned to their closed positions, in readiness for accommodating the next strip which is introduced into the mills.

The aforementioned objects, as well as the various other novel features and advantages of this invention, will become apparent from the following description and accompanying drawings of which:

Figure 1 is a plan view of the preferred form of repeating apparatus shown in combination with two rolling mills;

Figure 2 is in elevation view taken at II—II of Figure 1, and

Figure 3 is a schematic diagram of the system of controls of the repeating apparatus shown in Figures 1 and 2.

With reference to Figures 1 and 2, the repeating apparatus shown in combination with two rolling mills 11 and 12, having twist guides 11*a* and 12*a* respectively associated therewith, includes a base 13 upon which are firmly affixed stationary guide elements 14, 15 and 16. At spaced intervals between the aforementioned guide elements and rotatably mounted within bearings attached to the base 13, there are vertical pinch rolls 17, 18, 19 and 21 driven by suit-

able electrical motors 22 supported on brackets 23 secured to the base 13.

At the entry end of the repeater assembly on a bracket 24, which is pivoted to the base 13 by means of a bolt 25, is rotatably mounted a pinch roll 26 which is constantly urged into engagement with the roll 17 by means of a compression spring 28 retained between the bracket 24 and a spring compression adjusting screw 29 threaded in a lug 31 affixed to the base 13.

As shown in Figure 1, there are two similar releasable pivotal guide portions adapted to be placed into or out of communication with the stationary movable guide portions affixed to the base 13. Each movable guide includes a bottom portion 32, having curved vertical side walls 33 integral therewith, pivotally mounted on the base 13 by means of bolts 34. Pivotally secured to each of the guide bottom portions 32 by means of a bolt 35 is a bracket 36 rotatably carrying at the free end thereof a pinch roll 37 which, by a compression spring 38, is urged into engagement with the driven pinch rolls. The spring 38 is confined between the bracket 36 and a compression adjusting screw 39 threaded in a lug 41 affixed to the guide bottom portion 32. Each of the movable guide portions is provided with an element 42 to which is secured at its outer end a piston rod 43 adapted to be positively actuated in either direction by the double acting cylinder 44 within which is confined the piston to which the rod 43 is attached. The cylinders 44 are secured to the base 13 by brackets 45 attached thereto and to the base. There are two adjustable stops 47 secured to the base 13 which are adapted to engage with bumper blocks 48, attached to the pivotal guide portions, when the guides are opened to their inactive positions. The two cylinders 44 are connected by pipes 59 and 61 through a four-way valve 46 to a source of fluid under pressure.

At the delivery end of the repeater, and to a bracket 49 pivoted by a bolt 51 to the base 13, is rotatably secured a pinch roll 52 urged into engagement with the pinch roll 21 by the piston rod 53 pivotally secured thereto and extending from a fluid motor 54 affixed to the base 13. Two additional pipes 59 and 61 supply the working fluid pressure from the source of supply to the motor 54.

Adjacent to the mill 12, at the delivery side thereof, and in line with the path of travel of the strip, there is a photocell 81 together with a light source 78 which, as shown more specifically in Figure 3, are adapted to influence an electrical circuit for operating, at desired intervals, the four-way valve 46 of the fluid system.

The four-way valve 46 is connected through pipes 59 and 61 to the branches relating to the various fluid motors of the system. Connected to the valve is a link 62 which, in turn, is connected to the end of the armature 63 positioned within a double acting solenoid 64 having coils 65 and 66 connected together at a common point to one terminal of a battery 67. The opposite terminal of the battery 67 is connected to a pivotal switching arm 68 having contacts 69 and 71 at the outer end thereof and pivoted on a bracket 70. The contacts 69 and 71 are adapted to close the circuit to either of the coils 65 and 66 by engaging with the terminals 72 or 73 thereof respectively. The pivotal switching arm 68 is connected to an armature 74 contained within a single solenoid 75. When the solenoid is energized, as shown in Figure 3, the switching arm will be drawn toward the right thereby energizing coil 66 which draws armature 63 to the right, opening the valve 46 to admit fluid under pressure to the pipe 59 and thence to the fluid motors 44 and 54 whereby the movable guide portions and the pinch rolls at the delivery side of the guides are closed. On de-energization of coil 75, the switching arm 68 is drawn into its opposite position by a spring 76 which is attached at one end to the switching arm and at the opposite end to a bracket 77.

The circuit for energizing and de-energizing solenoid 75 comprises a light source 78 to which a battery 79 is connected, a photocell 81, an amplifier tube 82, a resistance 83 and a plurality of batteries 84, 85, 86 and 87. As shown in the schematic drawing, Figure 3, the resistance 83 and the battery 87 form a circuit with the photocell 81. The filament 88 of the tube 82 is heated by means of a battery 85 and the grid 89 thereof is connected to the photo-sensitive plate of the photocell 81. One end of the solenoid 75 is connected to the plate 91 of the tube 82 and the other side to one of the terminals of the battery 84. The remaining battery terminal is connected to the filament 88 of the tube 82. So long as the beam of light from the source 78 passes uninterruptedly to the photo-sensitive plate of the photocell 81, ions will be emitted therefrom and cause current to flow from the battery 87 through the resistance 83. The resulting voltage drop in the resistance 83 overcomes the potential of the battery 86 so that the grid 89 of the tube 82 becomes positive, permitting current to flow from the battery 84 through the solenoid 75. The resulting magnetic flux which is set up by energized coil 75 causes the armature 74 to be drawn into the solenoid thus closing contacts 71 and 73 whereby solenoid 66 is energized. Immediately, movement of the armature 63 into the solenoid 64 is effected causing the valve 46 to be rotated to admit fluid from the source of supply to the various fluid motors for closing the movable guide portions and the pinch rolls 22. The guides and the pinch rolls will remain closed so long as the beam of light passing from the source 78 to photocell 81 remains uninterrupted. However, as soon as the leading end of the strip of material has passed from the mill 12 and into the beam of light, the tube 81 becomes inactive and the flow of current from the battery 87 through the resistance 83 ceases immediately. The loss of the voltage drop across the resistance 83 permits the battery 86 to impress a negative charge on the grid 89 in the amplifying tube 82. By reason of the negatively charged grid, the flow of current from the battery 84 through the solenoid 75 is interrupted, thus de-energizing the coil, permitting the armature 74 to be withdrawn from the solenoid by the action of the spring 76. The switching arm 68 thereby is drawn to the left thus to close contacts 69 and 72 and to energize the solenoid 65. The armature 63 is moved to the left, turning the valve 46 to cause the pipe 59 to be opened to the exhaust and the pipe 61 to receive fluid under pressure so that the fluid passes to the fluid motors 44 and 45 to open the movable guide portions and the pinch rolls 22. Since the movable guide portions remain in their most open positions during passage of the strip through the mill 12, excess metal which may accumulate between the mills by reason of the differences in draft thereof is permitted to gather on a table or the like so as not to interfere with the continuous operation of the mills. As soon

as the strip has passed completely through the mill 12 and beyond the light source 78, the movable guide portions and the pinch rolls are again automatically closed to permit another repeating operation.

In accordance with the provisions of the patent statutes, I have explained the principle and operation of my invention and have illustrated and described what I consider to represent the best embodiment thereof. However, I desire to have it understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. Apparatus for repeating in a rolling operation relatively thin wide strip material comprising a twist guide for turning said strip into a plane substantially at right angles to that at which the strip enters said guide, a pair of pinch rolls adjacent to the end of said twist guide and having at least one driven roll, a retractible guide adjacent the delivery side of said pinch rolls, a pair of pinch rolls with at least one roll thereof driven and the remaining roll secured to said retractible guide for movement therewith, a second retractible guide, a pair of pinch rolls with one roll thereof driven and the remaining roll mounted upon said second retractible guide, means for withdrawing said retractible guides to their inoperable positions and for separating said last-mentioned pairs of pinch rolls, a pair of pinch rolls at the delivery end of said second retractible guide and having at least one driven roll, and a second twist guide at the delivery side of said last-mentioned pair of pinch rolls for receiving a strip passed thereto through said repeater for returning said strip to the original plane thereof.

2. Apparatus for repeating in a rolling operation relatively thin wide strip material comprising a base, a pair of twist guides mounted upon said base for turning strip material into a plane at substantially right angles to that in which the strip enters the guides, a plurality of vertically disposed convex stationary elements secured to said base and together forming substantially a continuous semi-circular wall between said twist guides, a pair of driven pinch rolls disposed between the ends of said wall and each of said twist guides, a pair of retractible concave elements pivotally mounted upon said base which in their active positions form with said stationary wall a restricted opening for passage therethrough of said strip, driven pinch rolls mounted upon said base and adjacent the inner ends of said convex elements forming said semi-circular wall, an idle adjustable pinch roll for each of said driven pinch rolls adjacent said retractible concave elements for engaging with and positively urging said strip through said restricted passage and means for retracting said concave elements into their inoperative positions thereby to free the strip from confinement between said concave and convex elements.

3. Apparatus for repeating in a rolling operation relatively thin wide strip material comprising a base, a pair of twist guides mounted upon said base for turning strip material passing therethrough into a plane at substantially right angles to that at which the strip enters the guides, a pair of pinch rolls having at least one driven roll adjacent to the delivery end of the twist guide through which the strip first passes, convex stationary elements secured to said base, a pair of retractible concave elements pivotally mounted upon said base which in their non-retracted positions form a restricted guide with said convex elements through which the strip material is passed, a plurality of pairs of pinch rolls spaced intermittently along the guides for engaging with and positively urging the strip between the concave and convex elements and retracting means operably engaged with said retractible concave elements for withdrawing them away from the convex elements and freeing the strip from confinement therebetween thus permitting an extended loop to form in the strip.

4. Apparatus for repeating in a rolling operation relatively thin wide strip material comprising a base, a pair of twist guides mounted upon said base for turning strip material passing therethrough into a plane at substantially right angles to that at which the strip enters the guides, a pair of pinch rolls having at least one driven roll adjacent to the delivery end of the twist guide through which the strip first passes, convex stationary elements secured to said base, a pair of retractible concave elements pivotally mounted upon said base which in their non-retracted positions form a restricted guide with said convex elements through which the strip material is passed, a plurality of pairs of pinch rolls spaced intermittently along the guides for engaging with and positively urging the strip between the concave and convex elements, retracting means operably engaged with said retractible concave elements for withdrawing them away from the convex elements to free the strip from confinement therebetween, and means responsive to movement of said strip for actuating said retracting means.

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