

- [54] **STRIP JOINING APPARATUS FOR ROLLING MILLS AND THE LIKE**
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[56] **References Cited**

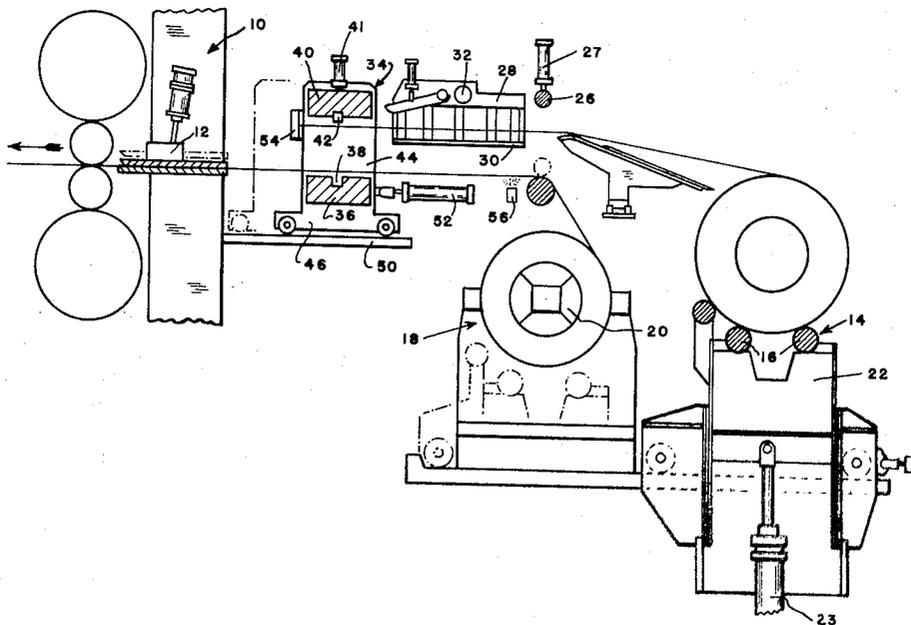
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[57] **ABSTRACT**

The disclosure pertains to a strip feeding device for a rolling mill adapted to roll joined coils of strip in a continuous and uninterrupted manner. It provides a flying stitcher or multi-spot welder arranged between a coil uncoiling means and the entry guide of the mill. A holding shelf arranged on the entry side of the stitcher or welder and above the mill passline supports the leading end of a second coil in the stitcher or welder when the stitcher or welder is in its retracted position. When the trailing end of the first coil is about to pass into the mill the supported leading end of the second coil is lowered to the trailing end of the first coil and while the stitcher or welder is advanced towards the mill at a speed substantially synchronous with the speed of the travelling end, the two strips are joined by the stitcher or spot welder. The joining operation is performed without interrupting the travel of the strip so that the mill can maintain its threading speed. After joining, the stitcher or welder and holding shelf can be repositioned to receive the leading end of the next coil.

9 Claims, 1 Drawing Figure



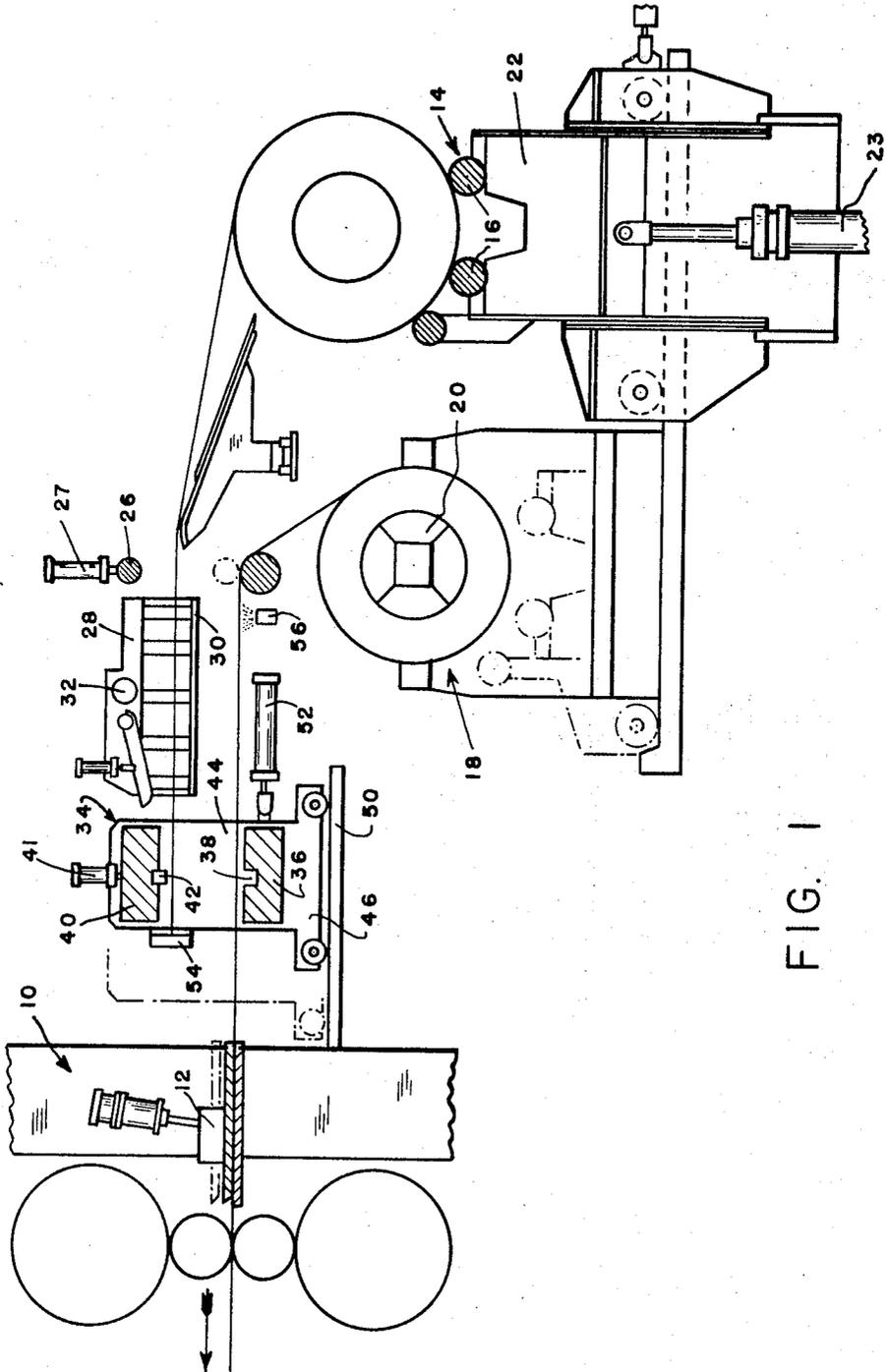


FIG. 1

STRIP JOINING APPARATUS FOR ROLLING MILLS AND THE LIKE

Much attention has recently been given to means and methods of operating tandem cold rolling mills so that they can roll joined coils of strip without interruption. The chief advantages of this endeavor are to increase the production rate of the mill as well as the percentage of on gauge strip. The arrangements employed and proposed to date, as to the entry end of steel rolling mills, have involved elaborate and costly strip storage facilities and high quality and costly flash welding equipment.

Most modern tandem cold mills employ high speed work roll gap adjusting mechanisms, such as hydraulic piston cylinder assemblies and controls, in which when considering such mills the present invention contemplates a strip joining arrangement that will permit, if desired, the mill to continuously operate during the joining of the coils and yet not require any storage facility to accomplish this.

While the present invention can be applied to many operations requiring joining of moving strips, which generally includes strip storage facilities, such as processing lines, etc., for the purpose of describing the invention it will be ascribed in conjunction with a rolling mill.

Another object of the present invention is to provide means for allowing a first fed coil to be transferred from a first uncoiling means to a second uncoiling means after its leading end is fed to the mill from said first uncoiling means, a stitcher or multi-spot welder arranged between the mill and said second uncoiling means, a carriage for said stitcher or welder for advancing it to and from the mill, said stitcher or spot welder having an opening through which the strip of the first coil is directed to pass, a holding shelf arranged to support the leading end of the second coil above, or below the passing strip of the first coil and in said opening of said stitcher or welder, means for permitting the supported leading end of the second strip to be lowered or raised into engagement with the trailing end of the first strip, and means for advancing the stitcher or spot welder at approximately the speed of the strip of the first coil and causing it to join the two strips without interrupting the operation of the rolling mill.

These objects, as well as other novel features and advantages of the present invention, will be better appreciated when the following description of one embodiment thereof is read along with the accompanying drawing which is an elevational view, partly in section, of the present invention applied to the entry end of a tandem rolling mill.

The drawing illustrates in outline form the first stand 10 of a 4 high tandem cold rolling mill for rolling carbon steel. The mill includes the usual strip entry guide 12. To the extreme right of the drawing, coil uncoiling equipment is illustrated in the form of a coil rotating unit 14 having a pair of driven rolls 16. To the left, and more adjacent the mill, a coil uncoiler 18 is provided having opposed pair of driven coil supporting cones 20. Running between the units 14 and 18 is a coil elevator car 22 including a piston cylinder assembly 23 that is formed as part of the unit 14 and employed to support a partially uncoiled coil and transfer it from the coil receiving position of the rotating unit 14 to the uncoiler cones 20.

Above and to the left of the uncoiler 18 is a feeder pinch roll unit 26 having the upper surface of its lower roll in line with the mill passline and wherein its upper roll is vertically moveable from the illustrated phantom line position to the full line position of the drawing by a piston cylinder assembly 27.

To the left of the pinch roll unit 26 a horizontally arranged strip supporting shelf 28 is provided having opposed strip edge projecting hangars 30 which are horizontally retractable by piston cylinder assemblies 32. Adjacent the end of the shelf 28 there is arranged for horizontal movement to and from the mill in a direction parallel to the mill passline a flying stitcher 34. The construction and operation of the stitcher follows well known designs of available units for joining carbon steel ranging in width from 20 to 90 inches and thickness from 0.060 to 0.200 inches and having a stationary anvil 36 which includes a series of die openings 38, and an opposed moveable head 40, which includes an elongated die 42 for making a series of in line spaced apart interlocking perforations in two strips. The head 40 is quickly and forcibly lowered to effect a stapling or stitching by a piston cylinder assembly 41. In adapting the well known stitcher to carry out the present invention one is selected having a generous opening 44 between the anvil 36 and the head 40 when the head is in its retractable position as shown in the drawing. Stitcher 34 is mounted in a wheel mounted carriage 46 advanced over rails 50 by a rapid acting piston cylinder assembly 52. In the illustrated form of the invention, when the stand 10 is operating at the strip entry threading speed of 120 FPM, the piston cylinder assembly 52 will have a stroke of approximately 5 feet and accelerates the carriage 46 in the first foot or so of this distance to the speed of the strip.

Although a stitcher has been illustrated in the drawing, as noted before a multi-spot welder following the designs of well known available units may also be employed in its place. While a stitcher will perform the joining operation quicker than the spot welder, one second to two-thirds of a second, as compared with two to three seconds respectively, both are many times more rapid than a flash welding operation and many times less costly. In employing a stitcher with a single row of stitches, the total cycle time will be of the order of one second requiring less than a 6 foot travel of the carriage 46 with the speed of the stand 10 operating at 120 FPM entry speed.

In employing a spot welder, a single row of 30 welds for an 80 inch wide strip can be performed in three seconds requiring approximately 6 feet travel of the carriage 46. The short time cycle of the complete joining operation is not only contributed to by the joining means itself, but also, because the stitcher or spot welder eliminates any need of positioning and clamping the two strips for joining. In employing a stitcher or a spot welder, in most cases there will be, generally, no need to shear the trailing ends of the coils and only the leading end needs shearing to square these ends which can be done before the coils are brought to the mill.

Associated with the stitcher 34 is a stop 54 positioned to be engaged by a strip supported by the shelf 28 when the head 40 of the stitcher is raised so that the strip may pass through the opening 44. At the delivery side of the pinch roll unit 26 there is arranged a trailing end strip detector 56 which produces a control signal for enabling the sequential and timed related operations of

the piston cylinder assemblies 41 and 52 of the stitcher, the piston cylinder assemblies 32 of the shelf 28, and the piston cylinder assembly 27 of the pinch roll unit 26.

In briefly describing the operation of the present invention as illustrated in the accompanying drawing, let it be assumed that a coil is in the process of being uncoiled from the uncoiler 18 and that the tandem mill is operated at its optimum high production rate of an entry speed of 600 to 750 FPM. A second coil will be brought to the coil rotating rig 14 and its previously squared leading end will be uncoiled and fed under the raised upper roll of the pinch roll 26, over the hangars 30 of the shelf 28 and into the window 44 of the stitcher 34 until its leading end abuts against stop 54 of the stitcher.

Before the trailing end of the first coil being uncoiled by the uncoiler 18 is unwound, the speed of the mill will be lowered to a threading speed, for example, an entry speed of 120 FPM for stand 10. As the trailing end passes above the detector 56, the detector will produce a signal, delayed if required, to allow the proper overlap of the two strips when joined. This signal will operate the piston cylinder assemblies 32 to allow the leading end of the second coil to be lowered onto the trailing end of the first coil and piston cylinder assembly 52 accelerates the carriage 46 to strip speed, and then operates piston cylinder assembly 41 to allow the head 40 to effect the stitching operation. Once the stitching has been performed, the piston cylinder assembly 41 will be quickly retracted before the full forward travel of the carriage 46 has been used, the piston cylinder assembly 27 will be operated to lower the upper roll of the pinch roll 26 along with the rolls 16 of the coil rotating rig 14 being rotated to commence the uncoiling of the second coil at the speed of the mill, and the entry guide and the work rolls of the mill 10 along with the remaining stands will be opened sequentially to allow the overlapped joint to pass through the rolls without being rolled.

After a certain number of wraps have been unwound from the second coil while supported by the rotating rig 14, the coil will be transferred to the uncoiler 18 by the car 22 where the piston cylinder assembly 23 will position the coil to align its opening with the cones 20 for support thereby, after which the car will be returned to the coil receiving position for receiving the next coil.

In accordance with the provisions of the patent statutes, I have explained the principles and operations of my invention and have illustrated and described what I consider to represent the best embodiment thereof.

I claim:

1. In an arrangement for continually feeding joined coils of strip to a processing apparatus,

means for uncoiling a first coil to the apparatus in a given path of travel providing a trailing strip end,

means for uncoiling a second coil to the apparatus providing a leading strip end in said path of travel after the first coil has been uncoiled,

means for joining the leading and trailing ends of said coils and arranged between said two uncoiler means and said apparatus,

said joining means having strip contacting members which cooperate to effect a joining of the leading and trailing ends of said coils,

means for advancing said strip contacting members in the direction of said path of travel and towards said apparatus and at a speed substantially equal to the speed of the strip of the first coil, and

means for causing said members to join said leading and trailing ends while at said speed.

2. In an arrangement for continually feeding joined coils of strip material to a rolling mill,

means for uncoiling a first coil to the mill in a given path of travel providing a trailing strip end,

means for uncoiling at least a portion of a second coil providing a leading strip end to the mill after the first coil has been uncoiled,

said two uncoiling means being co-planar with said path of travel,

means for rapidly joining the leading and trailing ends of said coils, and arranged between said two uncoiling means and said mill,

a carriage for said joining means arranged to move parallel to said path of strip travel,

means for advancing said carriage in the direction of said mill and at a speed substantially equal to the speed of the strip of the first coil, and

means for causing said joining means to join said leading and trailing ends while at said speed.

3. In an arrangement according to claim 2, wherein said means for uncoiling said first coil comprises a member protrudable into the center of a coil for supporting the coil during its uncoiling,

said means for uncoiling said second coil comprising a pair of coil supporting rolls arranged on the side of said member opposite said mill, and

means for transferring a partially uncoiled coil from said coil supporting rolls to said member for its complete uncoiling thereby.

4. In an arrangement according to claim 3 including a holding shelf for said leading end of strip uncoiled by said coil supporting rolls and arranged above said path of travel,

means for disengaging the strip from said shelf to allow the strip to come into said path of travel and above a strip being uncoiled from said member.

5. In an arrangement according to claim 4, wherein said strip joining means includes a moveable head,

means for moving said head above said path of travel and to a position generally in line with said holding shelf to create an opening for the passage into said joining means of the leading end of a strip supported by said holding shelf.

6. In an arrangement according to claim 5 including a stop means arranged to control the extent of the passage of said leading end through said opening.

7. In an arrangement according to claim 6 including separate actuating means for operating said shelf, carriage, and head to effect a lowering of said leading end by said shelf, an advancement of said carriage towards said mill, and a joining of said trailing and leading ends, respectively, and

detecting means associated with said member to detect the trailing end of said first coil and produce a signal for actuating said separate actuating means.

8. In an arrangement according to claim 2, wherein said rapid joining means comprises a stitcher.

9. In an arrangement according to claim 2, wherein said rapid joining means comprises a spot welder.

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