ABSTRACT: Equipment for uncoiling and conditioning strip stock to be utilized in devices such as punch presses, shears, and stamping machines.
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1. STRIP STOCK HANDLING EQUIPMENT

BACKGROUND OF THE INVENTION

Strips of sheet stock are usually supplied from the mill in tightly wound coils wherein the metal has taken a permanent curvature in the coiling operation. In utilizing coiled strip stock, it is first unwound from the coil, and then passed through a flattening mechanism which usually comprises a series of rollers which successively reverse the flexure of the stock over a relatively short radius to reduce and ultimately eliminate the permanent set therein. Such straightened strip stock is then available for further processing by shears, presses, or the like, which utilize the lengths of the stock in step-by-step motion. The inertia of the coil, uncoiling mechanism, and the straight stock, requires relatively smooth withdrawal of the stock from the coil for passage through the straightener. In order to accommodate the continuous feed of stock from the straightener in the step-by-step consumption of the stock, prior practice has been to provide a loop of strip stock which is limited in its curvature to avoid the creation of any permanent set in the straightened stock. The usual practice has been to withdraw the strip from the uncoiling mechanism, pass it through a series of rollers constituting a straightener oriented to be essentially tangential to the periphery of the coil, and permit the loop to accumulate in line with the uncoiling mechanism and the straightener along a horizontal run. In order to reduce the required floor space of such an apparatus, it has been proposed that the uncoiling mechanism be placed immediately adjacent the mechanism which processes the strip stock and the intervening loop permitted to expand and contract to accommodate this paradox between the step-by-step consumption and the continuous feed of the strip in the region above the uncoiling mechanism.

In this type of arrangement, a straightener has been provided generally tangential to the outer surface of the coil and inclined upwardly and outwardly therefrom, so that the strip stock issues from the straightener along the direction of inclination and then is carried back upon itself and into a feed path beneath the uncoiling mechanism and into the consuming mechanism. In such an arrangement, the inclination of the straightener develops a cantilever support for the straightened strip stock of the loop extending above and around the uncoiling mechanism. This loop cannot be constrained in its radial dimension due to the variations necessary in the step-by-step take up of the loop during the operation of the mechanism consuming the strip stock. Therefore, only relatively heavy strip stock can be processed in such apparatus because the straightened strip stock is of insufficient length and elasticity to sustain the weight of the free material in the feed loop and the stock tends to collapse or buckle under its own weight, thereby stressing it beyond its elastic limit and introducing a permanent set which destroys or seriously impairs its utility.

The above arrangement have been improved by a mechanism sustaining a variable length loop of strip stock extending between the uncoiling mechanism and the utilization mechanism beneath the uncoiling mechanism. The stock is carried from the straightener over a series of supports and through a turn of essentially 180°, and then suspended on its own tension as a free loop between the supports at the end of that turn and the guide mechanism for introducing the stock into the utilization mechanism. This free loop suspension avoids any requirement for either columnar or cantilever type of self-sustaining action of the strip stock, and thus avoids certain of the disadvantages of the prior devices noted above. However, after the end of the strip stock passes through the straightener, the free end thereof becomes unmanageable and can impart injury to the attending operators and the associated machinery.

An object of the present invention is to improve strip stock handling equipment of the type discussed above wherein the free end of the strip stock is automatically controlled.

2. BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be completely understood by reading the following detailed description of an embodiment of the invention when considered in the light of the accompanying drawings, in which:

FIG. 1 is a side elevational view, partly in section, of a reel-type uncoiler and strip stock straightener, made in accordance with the invention;

FIG. 2 is an enlarged fragmentary side view of the drag brake mechanism of the invention;

FIG. 3 is an end view, partly in section, of the apparatus illustrated in FIG. 2; and

FIG. 4 is a diagrammatic view of a hydraulic circuit suitable for energizing the apparatus illustrated in FIGS. 1, 2, and 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1 a reel-type uncoiler combined with a straightener in an arrangement whereby the variable length of the loop of the strip stock extends beneath the coil is shown. The coil 10 is sustained from an expandable arbor 12 upon which it is loaded by means of a cart 14 adapted to travel on associated rails 16. The outer end of the coil 10 is freed of the coil for threading through the apparatus by means of a peeler 18, and that stock is fed to pinch rolls 20 and thence to straightener rolls 22 wherein the offset of one set of rolls with respect to the other is controlled by means of a motorized straightener roll adjustment 24. The strip stock is then passed through pinch rolls 26 and into a casing 28 fashioned of side panels 30 and end panels 32. Stock is carried by means of a stock deflector 34 over a series of accurately arranged rollers 36 journaled to the casing 28, and arranged in an arc having a radius of curvature such that no permanent set is imposed the straightened stock.

Thus, the strip stock loop is suspended between the rollers 36 and a set of stock support rollers 38 and into antibackup rollers 40 and feeder pinch rollers 42. The stock support rollers 38, the antibackup rollers 40, and the feeder pinch rollers 42 cooperate to function as a feeder mechanism, generally indicated by reference numeral 43.

A threading chute 44 is pivoted at 45 to the frame supporting the straightener comprising legs 46 and 48 and side panels 50. The chute 44 functions as a threading chute and carries a series of guide rollers 52. The threading chute 44 carrying the guide rollers 52 is shown in phantom lines in two positions. This range of adjustment is afforded by adjustment of the position of the pivot 45 upon which the chute is mounted and by rotation of the chute 44 around the pivot 45. The pivoting action of the chute 44 is twofold; it facilitates threading the straightened strip stock by enabling the chute to be pivoted into alignment with the straightener stock support 54 which lead the stock into the antibackup rollers 40 and the pinch rollers 42, and also defines the size of the loop of stock which will be accommodated in the region between the rollers 26 and 40. The pivoting action of the chute 44 is provided by actuating a pressure fluid actuated cylinder 54 which is pivoted at 56 on the straightener support frame and has a piston rod 58 pivotally connected to the chute at 44 at 60, whereby retraction of the piston rod 58 into the cylinder 56, the chute rollers 52 define a path aligned with the rollers 38. When in threading position, the chute defines a path tangent to the phantom rollers 52' and the cylinder and piston rod appear as illustrated in phantom lines.

In order to guide the path of travel of the strip stock as it is introduced into the chute 44, there is provided spaced-apart rollers 36' having associated deflection plates 37 disposed therebetween, as illustrated in FIG. 2. Immediately adjacent the entrance to the chute 44, there is disposed a pair of laterally spaced-apart deflection plates 47 and 47' to assure a proper entrance of the strip stock into the chute 44.

The cart 14 is moved on the rails 16 into the region between the legs 46 and 48 of the straightener frame while the coil is maintained at a level such that its eye is in alignment with the arbor 12. Once the coil is suitably positioned on the arbor 12,
the arbor is expanded and the cart 14 is withdrawn from between the legs 46 and 48. The threading chute 44 is drawn into a position of alignment with the rollers 38 by retracting the piston rod 58 into the cylinder 54 so that the chute pivots about its support point 45. The peeled end of the stock is guided along the threading guide 62 through the straightening rollers 22 over the support rollers 36 to the threading chute rollers 52 in their displaced position, the stock support rollers 38, the threading guide 64, anti-backup rollers 40, and the pinch rollers 42. This advancement of the stock is achieved by rotating the arbor 12 and driving the straightening rollers by means of a motor 66 rotating a sprocket 68, driven through a suitable driven train (not shown) to a drive chain 70 which engages the drive sprockets 72, 74, and 76 for the straightening rollers 22.

It will be observed that no columnar or cantilever-type support of the strip stock loop is relied upon to support the loop, rather the straightener is oriented to issue the straightened strip stock along a perpendicular path which gradually turns upon itself as defined by the rollers 36 to a point from which the stock is suspended, thereby assuring that the stock sustains itself only under tension and therefore has no tendency to buckle or distort. This avoids any stresses which might develop a permanent set in the loop area.

The relationship of the elements of the apparatus illustrated in FIG. 1 specifically reduces the floor space consumed in a shop where a takeup loop of stock is required. The apparatus is able to accommodate coils of strip stock weighing up to 30,000 pounds and a width up to 50 inches. The coil 10 may have outside diameters from 36 inches to 72 inches and be suitably accommodated in an area 174 feet high and 16 feet long.

Controls are provided for the drives for the feeder 43 and the straightener 24 to insure that the dependent loop of the strip stock remains within limits. Limit switches are typically actuated by an operating arm 78 having a roller 80 at its distal end which follows the inner surface of the strip stock forming the loop. At one extreme, the loop might be shortened to draw it against the underside of the coil 10 or its adjacent structures indicating that a greater feed rate from the rollers 26, or a slower consumption rate at the feeder 24 should be employed. A switch (not shown) actuated by rotation of a shaft 82 attached to the upper end of the arm 78 can effect such alterations. Conversely, an oversize loop, which results when the straightener 24 issues stock too fast for its consumption at the feeder 43, can be sensed from the shaft 82 by another switch operated by shaft rotation in the opposite direction to some predetermined limit.

It will be appreciated that after the last layer and the end of the coil the straightener 24, the dangling loop will become free and basically out of control. Such situation can be dangerous to operating personnel, as well as to adjacent machinery. To mitigate against the otherwise deleterious effects of a loose end of the strip stock, a drag brake mechanism 90, clearly illustrated in FIGS. 2 and 3, is employed. The drag brake mechanism 90 is positioned on suitable framework approximately intermediate the output end of an array of support rollers 36 and the input end of the threading chute 44. The drag brake mechanism 90 includes a power driven roller 92 suitably journalled in a stationary support framework by spaced-apart bearings 94 and 96. Shaft 98 of the roller 92 extends outwardly of the supporting framework and is drivingly coupled to a drive motor 100. Suitable operation of the system has been conducted by having the drive motor 100 a hydraulically actuated reversible motor, although it will be understood that equally satisfactory results could be achieved by the employment of an electrically actuated reversible motor.

Cooperating with the driven roller 92, there is a pinch roller 103 mounted for movement toward and away therefrom. The opposite end of the roller 103 is rotatably mounted on a hub 104 and the associated drive roller 102. The drive roller 102 is pivotally mounted on the stationary framework, as at 106; while the opposite end is pivotally connected, as at 108, to the piston rod 110 of a hydraulically actuated cylinder 112. The opposite end of the cylinder 112 is pivotally connected to the stationary framework, as at 114.

In operation, the end of the coil 10 is sensed by a photocell detection circuit 116 located in the region of the output of the straightener 24. The photocell detection circuit 116 detects light energy emitted from a light source 117 provided with any suitable collimating lens arrangement. Upon sensing the end of the coil 10, the circuit 116 energizes a solenoid actuated valve 118, shown in FIG. 4, moving the same to the right to thereby direct pressure fluid to flow from a source 120, through a line 122, a control valve 124, a line 126, and thence into the cylinder 112 to force the piston rod 110 and the associated bellcrank from the position illustrated in full lines to that illustrated in FIG. 2 in phantom wherein the pinch roll 102 is urged against the drive roll 92. Thereby, the strip stock is firmly gripped between the pinch roll 102 and the drive roll 92 to effect a dragging action on the end portion of the strip stock. The motor 100 which controls or drives the roll 92 is controlled by a loop control limit switch actuated by the operating arm 78. As the feeder 43 pulls the loop of strip stock, the loop is made smaller, thereby causing a limit switch to be actuated by the arm 78 to electrically actuate a solenoid valve 128, moving the same to the right in such a fashion to permit pressure fluid from the source 120 to flow to the reversible hydraulic motor 100 through the control valve 130, a line 132, and then through a line 134, a control valve 136, the valve 128, and finally, into a reservoir for the pressure fluid. When the motor 100 is thus energized, the power roll 92 is caused to rotate, thereby moving the strip stock toward the feeder 43.

As the loop of the strip stock reaches an excessive position, the control arm 78 energizes a microswitch which effectively electrically centers the solenoid actuated valve 128, stopping the flow of pressure fluids through the associated circuitry to effectively stop the motor 100.

The strip stock is automatically controlled in the above fashion until the end of the strip stock material passes through the cooperating rolls 92 and 108, at which point, the end of the strip stock drops a small distance safely into the chute 44 on the rollers 52. At this point, the feeder 43 has the entire control of the relatively small amount of strip stock remaining in the system.

Upon introducing a new coil into the machine described herein above, the operator employs the regular features of the machine in peeling the strip stock from the coil 10, straightening the coil, and threading the deformed strip stock through the balance of the machine. Once the strip stock has entered the chute 44, the operator may "jog" the strip into the rolls of the feeder 43 by manually operating the reversible hydraulically actuated motor 100. This is accomplished by initially energizing the solenoid actuated valve 128 in such a fashion to drive the valve to the left, allowing the pressure fluid to flow through the line 132 into the motor 100, and back through the line 134 to effect forward operation of the mechanism 90; and then energizing the solenoid actuated valve 128 to the left, causing the pressure fluid to enter through the line 134 into the motor 100, and back through the line 132, effecting a reverse rotation of the motor 100 and the associated drive roller 92. By intermittently causing the motor 100 to effect rotation of the drive roller 92 in one direction and then in a reverse direction, the leading end of the strip stock may be readily threaded into the feeder 43 in an expeditious manner. It will be appreciated that, during the threading operation, suitable means are provided to override the photocell detection circuit 116 to actuate the cylinders 112 to effect a pinching action between the pinch roll 102 and the drive roll 92. Further, it will be appreciated that the control valve 130 and the control valve unit 136 may be operated to control the speed of rotation of the hydraulic motor 100. More specifically, the control valve 130 is operative to maintain the desired pressure within the system, but to reduce the volume of flow of pressure fluid therethrough.
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While the features of this invention have been illustrated in this specific embodiment, it will be appreciated that many modifications are available within the spirit and the scope of this invention. Accordingly, the above description is to be read as illustrative, and not in a limiting sense.

We claim:

1. In apparatus for handling strip stock having a leading end and a trailing end from a strip stock uncoiler to a strip stock receiving means wherein the strip stock is fed from a means for sustaining a coil of strip stock for rotation about a horizontal axis through a strip stock straightener having an upwardly extending path which is substantially tangential to the coil sustaining means and at a greater vertical height than the coil support means to a support means for supporting the strip stock and defining an arcuate path for the straightened strip stock extending from the straightener upwardly, passing over the uncoiler and turning downwardly and having a radius sufficient to avoid developing a set in the stock to the stock receiving means positioned under the means for sustaining the coil of strip stock, the support means for supporting the strip stock having an inlet end adjacent the straightener and an exit end, the improvement comprising: a pair of cooperating braking roll means for automatically controlling the movement of the strip stock disposed between the exit end of the means for supporting the strip stock and the strip stock receiving means whereby the movement of the trailing end of the strip stock is controlled as it passes over the support means.

2. The invention defined in claim 1 wherein said braking roll means for automatically controlling the movement of the strip stock includes means for automatically sensing the trailing end of the strip stock.

3. The invention defined in claim 2 wherein said sensing means includes a photocell detection means.

4. The invention defined in claim 2 wherein at least one of said roll means is coupled to a prime mover.

5. The invention defined in claim 4 wherein said prime mover is a hydraulically actuated motor.

6. The invention defined in claim 4 wherein said prime mover is reversible.

7. The invention defined in claim 4 wherein means are provided to move said roll means toward and away from engagement with one another.

8. The combination according to claim 1 including a photocell detection means for sensing the end of the strip stock following its release from the straightener, a pair of rotatably mounted rollers adjacent the end of said support means from which said stock is issued and located on opposite sides of the stock path from said support means, a bellcrank mounting for one of said rollers providing pivotal movement of said roller toward and away from said other roller of said pair, and means responsive to said detection means when the end of said stock is sensed to actuate said bellcrank mounting to move said crank mounted roller toward said other roller of said pair whereby the end of said stock released from said straightener is restrained in its travel on said support means.