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APPARATUS FOR UNCOILING SHEET METAL

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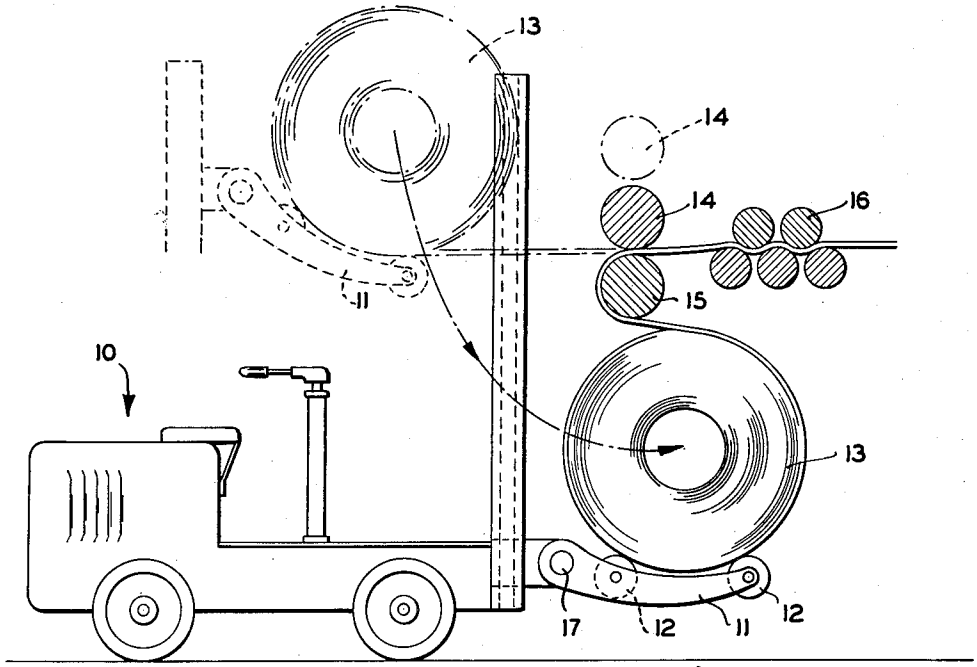


Fig 1

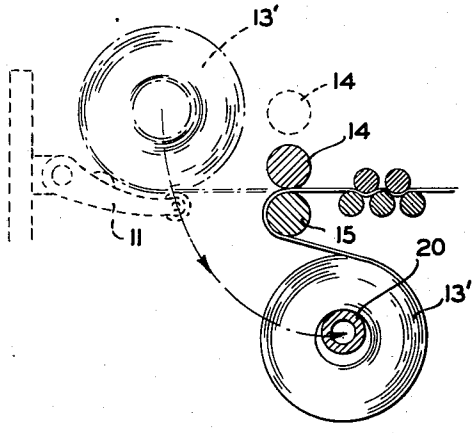


Fig 2

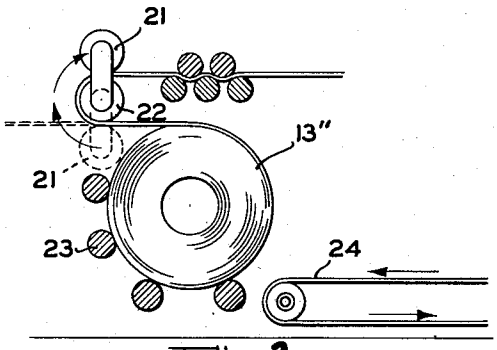


Fig 3

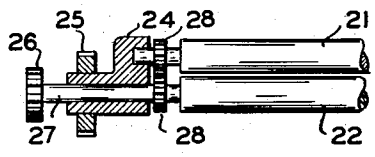


Fig 4

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APPARATUS FOR UNCOILING SHEET METAL

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1 Claim. (Cl. 153—54)

This invention relates to the art of uncoiling metal strip and more particularly to the solution of the problem of uncoiling metal strip without the formation therein of "coil breaks" while requiring only apparatus of a simple inexpensive design.

It is well known in the metal working art that in uncoiling metal strip which attains a rigid preset curvature in the coil such as hot rolled strip and silicon steel, for example, that it is quite difficult to pull off the strip in a straight line for feeding to a roller leveler, shear, or press, for example, without creating minute transverse fissures or breaks in the metal due to the pronounced tendency of the metal to retain its original curvature and the resultant periodic violent buckles or reverse bends which stress the metal beyond its elastic limit thus forming the breaks. To avoid this, it has been heretofore proposed to cold work and thus stress relieve the metal at the precise point of its emission from the coil or to rigidly confine transversely the metal of the strip at a point spaced outwardly of the coil but along the natural curvature of the strip and within the lengths of the natural arcs which would otherwise occur in the strip. These various methods entail operational and control difficulties but, of more importance, require complicated and costly machines which are beyond the economic reach of most sheet metal processors and fabricators. There has been a continuing need for an uncoiling method which while requiring only simplified, less bulky and less costly apparatus, is nevertheless operative to uncoil metal strip with reasonable and tolerable freedom from coil breaks and it is the primary object of this invention to provide such improved and simplified method and apparatus.

I have found through experimentation that the formation of coil breaks during uncoiling operations can be avoided if the metal is severely stressed upon leaving the coil but within the elastic limit thereof, and is confined transversely in a pair of pinch rolls, for example, before being fed along a straight path into a working unit such as a leveler, shear or press. Such stressing may be accomplished by causing the strip to move through a fairly open reverse loop as it leaves the coil and before it enters the confining device such as the pair of pinch rolls, and this arrangement has the very decided advantages of requiring but a minimum of equipment and of making unnecessary any close control of the location of the outer periphery of the coil with respect to the pass plane of the pinch rolls or other confining device. Thus, according to my invention the coil proper may be held or retained by any suitable equipment such as straight mandrels, cone mandrels, cradle rolls, or simply a coil confining box. The apparatus may thus be of an elemental nature requiring a minimum of skilled labor in its operation.

The invention also provides an improved and simplified arrangement for loading and handling the coil in relation to the uncoiling equipment and for initiating the threading-through of the leading end of the strip of a coil which heretofore has presented varying difficulty necessitating the use of additional equipment to guide the

leading end of the strip through the first roll pass of the uncoiling assembly. The nature of this invention is such that the coils may be handled and loaded onto the uncoiler as well as having its leading end threaded into the initial roll pass by the use and manipulation of a conventional lift truck with which practically all processing and fabrication plants are equipped.

All of the advantages above outlined, including that of economy in apparatus, may be retained even though there is associated with the uncoiler proper additional equipment to process or work the strip such as a roller leveler, for example. The use of the latter is, of course, particularly desirable were the strip is to be fed in long lengths or in continuous length to a cleaning or pickling line, for example, since it is recognized that the strip must be cold worked immediately upon leaving an uncoiler even of the kind herein contemplated if the strip is not to be cut into short lengths or otherwise worked in such manner as to relieve the preset coil stresses.

The above and other objects and advantages of the invention will become apparent upon consideration of the following specification and the accompanying drawing wherein there are disclosed certain preferred embodiments of the invention.

In the drawing:

Figure 1 is a schematic showing of a preferred embodiment of the apparatus and method for uncoiling sheet metal in accordance with the principles set forth in the present invention;

Figure 2 is a schematic view of a modification of the apparatus of Figure 1;

Figure 3 is a schematic view of still another embodiment of apparatus for uncoiling sheet metal in accordance with the invention, and

Figure 4 is a fragmentary view of part of the roller mechanism shown in Figure 3.

Referring to the drawing, and to Figure 1 in particular, the reference numeral **10** generally designates a conventional lift truck of the type commonly utilized throughout industry for the handling of heavy materials. For the purpose of better adapting the truck **10** to the use herein proposed, i. e., the handling of coils of strip and sheet metal, I provide a vertically movable fork **11** which is modified from the usual form to the extent of having two or more transverse rollers **12** whereby a coil **13** may be rotatably supported in a relatively anti-frictional manner.

In the present invention it is contemplated that a coil **13** will be picked up by the truck **10** after having been opened or peeled by any suitable apparatus, not shown, as is well known in the art. With the coil **13** supported on the truck as shown in Figure 1 the truck and lift **11** thereof may be moved to the position indicated by the broken lines of Figure 1, which position should be immediately in front of pinch rolls **14** and **15** which may be associated with a conventional roller leveler **16** or other processing device. As indicated, I prefer that the uppermost pinch roll **14** be vertically movable to facilitate the insertion of the strip material between the rolls **14** and **15**. Thus with the lift **11** and upper roll **14** in their raised positions, as shown, and with the peeled end of the coil **13** extending horizontally or approximately horizontally, the truck **10** may be driven forwardly to insert the strip into the processing apparatus. In this respect it may be desirable to provide the lift truck **10** with a fork **11** which is pivotally mounted as at **17** whereby the fork may be tilted downwardly somewhat to properly direct the extending end of the coil **13** in a horizontal direction. The material having been inserted between the rolls **14** and **15**, the fork **11** may be tilted back to its normal horizontal position in order to support the coil **13** in a more stable manner. It should be noted that

this method of loading the uncoiling and associated processing apparatus is of utmost ease and simplicity, requiring a minimum of skill on the part of the lift truck operator. And by this method I further eliminate much of the equipment heretofore necessary for guiding the leading edge of the material into the first roll pass of the apparatus.

After the material has been inserted between the rolls 14 and 15, as above described, the vertically movable upper roll 14 may be lowered and brought to bear on the strip with sufficient pressure to firmly clamp the same in position. In order to then position the coil 13 in such a manner as to cause the uncoiling material to pass through a relatively severe reverse bend it is necessary to merely lower the vertically movable fork 11 sufficiently that the coil 13 will clear the lower roll 15 and to then move the truck 10 forwardy to the position shown by the solid lines of Figure 1. In the method of operation therein shown I propose to park the truck 10 in the position indicated whereby the fork 11 may serve to support the coil 13 throughout the entire uncoiling operation. It will be apparent that with the coil 13 thus positioned on the fork 11 the uncoiling strip will wrap around the lower roll 15 to obtain the desired degree of reverse bend. It is important, however, that the coil 13 be positioned relatively close to the roll 15 to prevent buckling of the material between the point at which it leaves the coil and that at which it contacts the roll 15. In some cases it may be desirable to raise the fork 11 occasionally during an uncoiling operation to compensate for the recession of the periphery of the coil 13.

Shown in Figure 2 is a slight modification of the apparatus and method described in Figure 1. In this embodiment I provide a horizontally retractible mandrel 20 which is positioned below and forward of the lower pinch roll 15 and is adapted to rotatably support a coil 13' in much the same manner as described in Figure 1. The method of loading the apparatus of Figure 2 is as above described. However before lowering the coil into position beneath the roll 15 the mandrel 20 is retracted longitudinally to the side. With the coil 13' properly positioned by the truck 10 the mandrel 20 may be extended into the center of the coil to support the same and thus permit the truck 10 to be removed for other use. This method may be desired in some cases since by permitting the truck 10 to be used for positioning a second coil in readiness for insertion into the rolls 14 and 15 the process is rendered somewhat more continuous. The apparatus is, of course, more elaborate and accordingly more costly than that required for the method shown in Figure 1 but this factor will, in many cases, be offset by increased rate of production.

With regard to the embodiment shown in Figure 2 it will be understood that the use of the mandrel 20 to support the coil 13' during uncoiling is merely exemplary. It will be obvious to those skilled in the art that a common coil box or other suitable supporting means may be employed for this purpose. The principal requirement is, of course, that the coil be retained in a position forwardly of the lower pinch roll 15 whereby a reverse bend will be imparted to the material as it leaves the coil.

In Figures 3 and 4 I show a third embodiment of the invention in which I may conveniently utilize common roller or belt type coil conveying means, as indicated by the reference numeral 24, for moving a coil 13'' of sheet or strip material into position below and forward of the first roll pass of the uncoiling apparatus. In the apparatus illustrated I provide a plurality of rollers 23 which are disposed in an arcuate path in such a manner as to partially confine the coil 13'' and to properly position the same as it is moved rearwardly by the conveyor 24.

In order that the strip may be easily threaded into the roll pass, comprising upper and lower pinch rolls 21 and 22 respectively, I have provided a carrier 24 which is pivotally mounted for rotation about the axis of the lower roll 22 and which is adapted to rotatably support the said rolls 21 and 22. A gear 25 or other equivalent machine element is secured to the carrier 24 and is associated with any suitable power means, not shown, whereby the carrier 24 may be rotated through an arc of approximately 180 degrees.

For the threading operation the carrier 24 may be rotated to the position indicated by the broken lines of Figure 3, in which position the upper roll 21 is positioned below the lower roll 2. The pre-opened coil 13'', positioned by the rollers 23, is then rotated, if necessary, to align the leading edge of the strip with the opening between the rolls 21 and 22 and to insert the strip therein.

By providing a construction such as shown in Figure 4, wherein the lower roll 22 is operated by means of an elongated shaft about which the carrier is adapted to pivot, the pinch rolls 21 and 22 may be operated regardless of the angular positioning of the carrier 24. Thus with the carrier 24 in its lower vertical position and with the edge of the strip inserted into the opening between the rolls, it is possible to then rotate the rolls 21 and 22, by means of gears 26 and 28, to thread a short length of material through the said opening. The initial threading thus completed, the shaft 27 may be locked while the carrier 24 is pivoted into its upper vertical position. It will be apparent that during this upward pivotal movement the upper roll 21 will wrap the material about the lower roll 22 to form the desired reverse bend and will also properly align the material for passage into the rolls 16 of an associated processing unit.

It should now be apparent that I have accomplished the objects initially set forth. By my invention I have provided a novel method of uncoiling metal strip whereby, with apparatus of relatively inexpensive construction the strip may be uncoiled in such a manner as to prevent the occurrence of buckles and coil breaks in the material. The invention as hereinbefore set forth is readily adaptable for use with conventional processing apparatus as should be apparent from the various embodiments illustrated.

My invention makes advantageous use of the fact that the formation of coil breaks during uncoiling may be largely prevented if the material is stressed in a relatively severe manner upon leaving the coil. By providing that the coil be positioned forwardly of the uncoiling pinch rolls and thus requiring that the material pass around one of the said pinch rolls, I cause the material to be subjected to a bend which is opposite in direction to the natural set of the coil. The resulting stress of the metal has been found to be extremely effective in preventing minute fissures and coil breaks which considerably reduce the value of the final product.

The various novel aspects of my invention render effective uncoiling apparatus available to many manufacturers and processors who have heretofore been prevented from installing such equipment due to the high cost of the same. The apparatus and method according to the teachings of the present invention as embodied in the form shown in Figures 1 and 2 require a minimum initial outlay and permit advantageous use to be made of equipment used by processors and fabricators in the normal course of business. Thus it will be understood that this apparatus is well suited for use by small manufacturing concerns having but periodical need for uncoiling equipment. The embodiment shown in Figures 3 and 4 is particularly suited for applications wherein there is a substantially constant need for uncoiling equipment and where a high rate of production is necessary. By utilizing the principles of my invention the problems of loading and handling of the material are substantially reduced whereby apparatus of relatively simplified construction may now be utilized where complicated and costly installations have heretofore been required.

Having thus described the principles of my invention

and the manner in which the same can be advantageously utilized in practical apparatus, what I claim is novel and desire to secure by Letters Patent is:

In apparatus for uncoiling metal strip to prevent the formation of coil breaks therein the combination of a pair of pinch rolls for drawing strip in a forward direction, means to rotatably support a coil of strip adjacent to and forwardly of said pinch rolls whereby a tangentially disposed projection of strip stock from said coil may be entered in a rearward direction into said pinch rolls, a carrier for said pinch rolls, and means mounting said carrier for rotation about an axis parallel and adjacent to the principal axis of one of said rolls whereby strip stock between said rollers and the coil proper may be looped reversely with respect to the curvature of the strip stock in the coil proper.

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