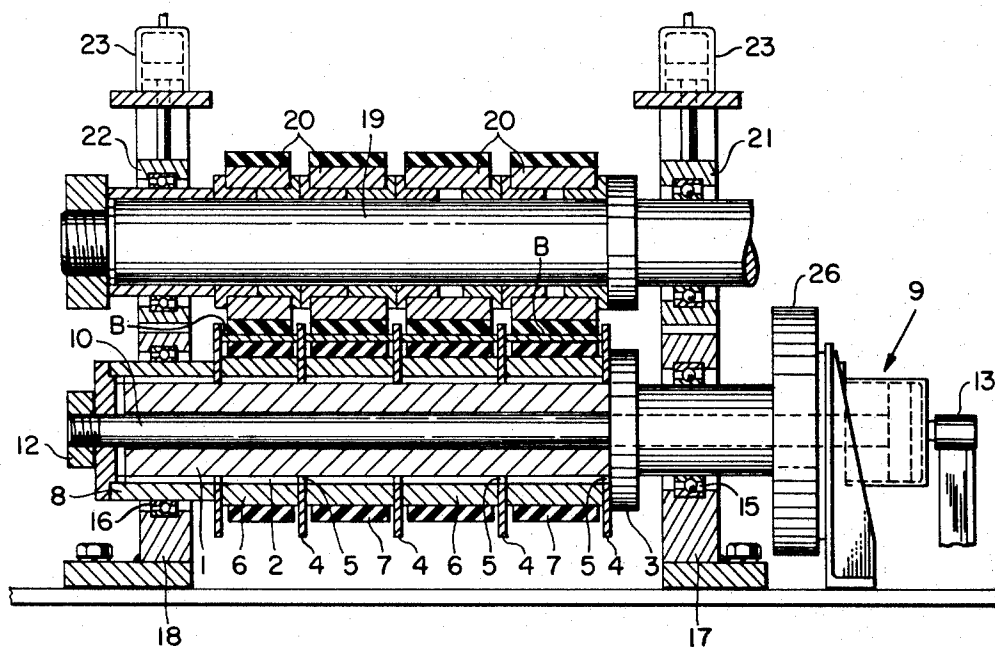
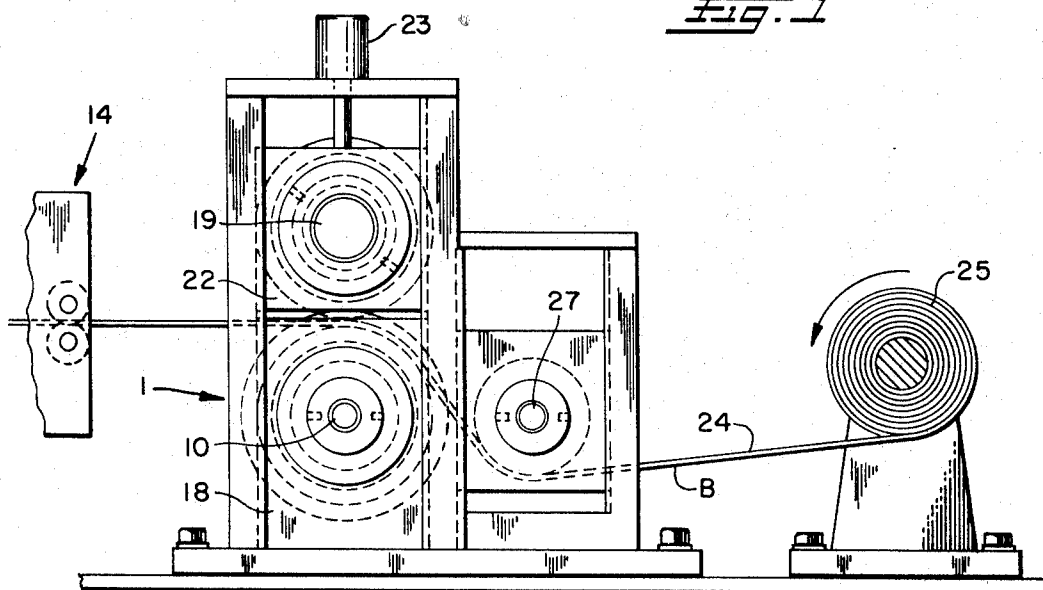


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MULTIPLE STRIP TENSIONING DEVICE

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ABSTRACT OF THE DISCLOSURE

A slitting line including a power driven recoiler with a tensioning device between the slitter and recoiler which tensioning device comprises a plurality of individual tensioning rollers in frictional driven engagement with each of the slit strips and which are mounted on a shaft provided with a drag brake, the rollers being free to rotate on the shaft but interposed between disks keyed to the shaft with axial compression of the disks and rollers providing controlled slippage between the rollers.

This invention relates generally as indicated to a multiple strip tensioning device and more particularly to a tension device for simultaneously winding or recoiling multiple bands of slit strip.

Users of rolled strip coils encounter difficulties inherent in the imperfections in the strip rolling process itself.

For example, the transverse section of a rolled strip in a band has thicknesses which are variable from one edge to the other. Upon observation of the band when it is flat, it is generally noted that when there is a decrease in the thickness there is an overlengthening of the strip and the converse is also true. These defects are known to metallurgists by the terms of "long edges or rims," "long at the center," etc.

These defects show up at the time the strip is worked and, more particularly, to a considerable extent at the time of the winding of the slit strips into multiple narrow strips.

The variations in thickness of each slit strip brings about variations in the diameter of the coils at the time of winding. These variations in diameter, for a constant angular speed, result in differences of the linear speed of the bands with respect to each other.

Considering for example, the case of slitting into three narrow strips of equal width of a biconvex rolled strip, i.e., having a variation in thickness which continues to decrease from the center towards the edges, the angular velocity of winding of the three narrow strips being uniform, it is evident that the central narrow strip having a greater thickness will produce a coil having a larger diameter than those coils of the lateral strips. Thus, the central strip will be taut and the lateral narrow strips, which are wound on smaller diameters, will not be taut. This defect in tightness or tension is, moreover, all the more considerable in the case of very fine narrow bands which are likewise very long.

The absence of tension or tightness in the winding continues to exist in the corresponding coils and such coils show evidence of defects which are well known to the users. These slack coils have the major inconvenience of giving way or collapsing or sagging when they are placed on a workbench, thus resulting in a sliding of the windings or spires on each other, which brings about an alteration of the appearance of the surface of the band. Also, the subsequent return or recovery of these coils on the unwinding mandrel is endangered by reason of the deformation of their interior diameter.

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It is well known that several processes which are capable of reducing these difficulties have been attempted, namely:

Unwinding and rewinding by means of take-up or recovery of each defective coil on a separate installation;

Winding of slit narrow bands on several different recoilers;

Wood or felt presses, which serve the purpose of assuring the retention of the slit small bands before winding;

Insertion of paper strips between the windings or convolutions, which serve the purpose of re-establishing uniform winding diameters.

However, all of these processes only partially solve the problem, and at the same time bring about a series of supplementary difficulties, such as the increase in the cost of installation, the deterioration of the appearance of the strip, additional manual labor, etc.

A principal object of the present invention is the provision of a mechanism for winding a group of slit strips each under sufficient tension on a single recoiler.

Another principal object is the provision of certain improvements in a slitting line which will produce uniformly tight coils.

Another object is the provision of an accessory positioned in the course or path of the slit bands and before rewinding which assures both the separation of the small bands and a sufficient winding tension or tightness for each of the coils.

Yet another object is the provision of a slitting line recoiling accessory of simplified construction obtaining uniformly tight coils by strip driven rollers having special friction surfaces which are braked individually.

Other objects and advantages of the present invention will become apparent as the following description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawing setting forth in detail a certain illustrative embodiment of the invention, this being indicative, however, of but one of the various ways in which the principles of the invention may be employed.

In said annexed drawing:

FIGURE 1 is a vertical section taken substantially on the line 1—1 of FIG. 2 of a slitting line installation in accordance with the present invention.

FIGURE 2 is a side elevation of the slitting line incorporating the installation shown in FIG. 1.

Referring first to FIG. 1, there can be seen the main shaft 1 of the tensioning installation equipped at its periphery with keyways 2 and including a flange 3 in the vicinity of one of its extremities. On this shaft there are alternately stacked disks 4, the interior opening of which is equipped with teeth or keys 5 having a profile corresponding to that of the grooves 2 so as to be thus rotatively fixed to the shaft 1, and rollers 6 capable of turning freely on the shaft 1 and equipped preferably with rubber rims 7 at their periphery in order to increase the adherence at the contact of the slit bands B.

The stacking is completed by a holder or sleeve 8 on which is exerted a stress of compression furnished by a pneumatic jack 9 and transmitted by a rod 10 extending axially through the entire shaft 1. A plate 11 bearing on sleeve 8 is fixed to the end of the rod by means of a nut 12. A rotary union or supply joint 13 makes it possible to feed the jack 9 during rotation of the shaft 1, and the stress produced by this jack compresses the entire stack or pile of alternating disks 4 and rollers 6. Since the disks and rollers are in side-by-side contact, the jack 9 obtains a substantially uniform braking torque for each of the

rollers and such may be adjusted by the pressure of the jack.

As can be seen on FIGURE 2, the unitary metal strip, as soon as it is sheared into multiple small bands B in the slitter shown schematically at 14, passes over the rollers on the shaft and between the disks which have just been described. The shaft assembly is supported on bearings 15 and 16 in shaft stands 17 and 18, respectively. Each one of the small bands B is separated from the others by the disks 4 and frictionally bears against the upper portion of the rollers 6.

In order to obtain adherence pressure of the bands B against the rollers 6, a second shaft 19 is provided comprising a series of rollers 20 corresponding with the rollers 6 and also preferably equipped with rubber rims, these rollers being capable of rotating freely on the shaft 19. This shaft is supported by two bearings 21 and 22 which are capable of sliding in the stands 17 and 18, and each one of which is urged downwardly by a jack 23. The stress supplied or furnished by these jacks 23 is transmitted by the shaft 19 and presses each one of the small bands B against the resilient rim 7 of the corresponding roller 6. This makes it possible for the small bands B to drive the rollers and therefore the shaft 1 by virtue of the adjustable friction pressure acting between each one of the rollers 6 and the disks 4 on each side thereof.

The small differences in speed between the various bands B can thus be absorbed by the slippage of the rollers 6 with respect to the disks 4. On the other hand, the assembly of the shaft 1 is driven at the average speed of the winding of the bands B. In order to obtain the desired tension of the portion 24 of the bands B located between the tensioning device and each one of the coils 25 mounted on the power driven mandrel of the recoiler, a drag brake 26 is provided, as seen in FIG. 1 which may also be activated by compressed air, the braking torque of which corresponds to the desired tension.

The control pressure of the brake 26 is therefore selected in terms of the desired tension for the assembly or group of bands 24. The control pressure of the jack 9 is then regulated to a value so that the rollers 6 carry along or draw the disks 4 practically without sliding, with the exception of the one or more which might have a slight difference in speed in the winding of the bands. Finally, the feed pressure of the jacks 23 is regulated in such a manner so that the rollers 6 might effectively be driven by the bands and that the latter might not slide with respect to the rims of the rollers.

If it is desired to improve the force of tension of the bands and their adherence to the rollers, it is permissible to replace the shaft 19 having rollers 20 with a shaft similar to the shaft 1 described previously, and by equipping it with grooves and drawing disks as well as with a pressure jack 9 and a brake 26. In this manner use may be made of the adherence of the packings or rims 7 on both surfaces of the band, but the disks 4 of the upper roller must then be of a reduced diameter.

It is likewise permissible, according to the invention, to obtain the winding of the bands B on a certain arc of rollers 6 of the shaft 1, by arranging another shaft 27 to the rear of the first two, as shown on FIGURE 2. This shaft may comprise slack rollers and simply serves the purpose of deflecting the band B about the rollers 6. The shaft 27 could, however, be replaced by a shaft of a construction similar to that of the main shaft 1 in order further to increase the braking power.

The rollers which are illustrated as having a rubber rim or covering may, of course, be employed with any material having a sufficient coefficient of friction. Moreover the fluid pressure jack may either be hydraulic or pneumatic, or mechanical springs or electro-mechanical devices may be employed.

The energy absorbed by the frictional slippage between the disks and rollers is, of course, limited to the stresses brought about by the differences in the linear speeds of

the small bands B. The total amount of energy transmitted is absorbed by the brake 26 which may be mechanical, hydraulic or electrical.

The separation of the bands B can, of course, be obtained by the drive disks 4, but it will be appreciated that a separate shaft having either fixed or rotating separating disks, or guide plates can be employed to obtain the separation.

The device described and its alternatives thus make it possible to achieve a stress of uniform retention of all of the small bands B having a relatively high value, so as to obtain coils 25 which are sufficiently rigid so that the difficulties indicated hereinabove no longer develop. Coils of sufficient rigidity are generally achieved after the unitary stress of retention attains and surpasses 0.5 kg. per mm. of the width of the band.

Other modes of applying the principles of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims or the equivalent of such be employed.

We, therefore, particularly point out and distinctly claim as our invention:

1. In combination, a metal strip slitter operative to slit metal strip into a multiplicity of more narrow metal bands, a power driven recoiler operative to wind such bands into coils, and a tensioning device between said slitter and recoiler operative to apply a substantially uniform tension to each of such bands being wound on said recoiler regardless of variations in the thickness of such metal bands, said tensioning device including individual rollers for such bands in frictional driven engagement with each of such bands, and means providing controlled slippage between such rollers.

2. In a strip slitting line, a slitter, a power driven recoiler for coiling the slit bands of the strip, and a tensioning device for the slit bands positioned between said recoiler and slitter operative to tension each of said bands uniformly to ensure tightly wound coils, said tensioning device including drag brake means operative to tension such bands, and slip clutch means operative to apply such tension uniformly to such bands.

3. A slitting line as set forth in claim 2 wherein said tensioning device includes a shaft having rollers thereon for each such slit band in frictional driven engagement therewith, said slip clutch means mounting said rollers for controlled relative rotation on said shaft.

4. A slitting line as set forth in claim 3 including means mounting said shaft for rotation, and said drag brake means is operative to restrict rotation thereof.

5. A slitting line as set forth in claim 4 wherein said slip clutch means includes disks of larger diameter than said rollers interposed therebetween and keyed to said shaft operative to separate such bands.

6. A slitting line as set forth in claim 3 wherein said rollers are provided with a rim of material having a high coefficient of friction.

7. A slitting line as set forth in claim 6 including means operative to maintain such bands in frictional driving engagement with said rollers.

8. A tensioning device for a slitting line recoiler comprising a roll shaft journaled for rotation, a plurality of strip band engaging rolls driven by the respective band mounted on said shaft for rotation with respect thereto, disks keyed to said shaft interposed therebetween, slip clutch means operative to limit roll rotation, drag brake means operative to restrict rotation of said roll shaft, and means operative to hold each strip band and the respective roll in such driving engagement.

9. A tensioning device as set forth in claim 8 wherein each roll is provided with a covering of a material having a high coefficient of friction.

10. In combination, a metal strip slitter operative to slit metal strip into a multiplicity of more narrow metal bands, a power driven recoiler operative to wind such

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bands into coils, a tensioning device between said slitter and recoiler operative to apply a substantially uniform tension to each of such bands being wound on said recoiler regardless of variations in the thickness of such metal bands, said tensioning device including individual rollers in frictional driven engagement with each of such bands, means providing controlled slippage between such rollers, a shaft, said rollers being rotatably mounted on said shaft and not keyed thereto, disks interposed between said rollers and keyed to said shaft, and means for axially compressing said rollers and disks together to provide such controlled slippage.

11. The combination set forth in claim 10 wherein said shaft and the rollers and disks thereon are journaled for rotation as an assembly, and drag brake means operative to restrict rotation of such assembly to tension such bands with such slippage applying such tension uniformly.

12. The combination set forth in claim 10 wherein said rollers are covered with a material having a high coefficient of friction.

13. The combination set forth in claim 12 including means to press such bands against the respective rollers to ensure such frictional driving engagement.

14. The combination set forth in claim 12 including means to deflect such bands about a certain portion of the periphery of said rollers to ensure such frictional driving engagement.

15. The combination set forth in claim 10 wherein said means for axially compressing said rollers and disks together comprise a jack including a rod extending through said shaft.

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16. A tensioning device for a slitting line recoiler comprising a roll shaft journaled for rotation, a plurality of strip band engaging rolls mounted on said shaft for rotation with respect thereto, disks keyed to said shaft interposed therebetween, slip clutch means operative to limit such roller-shaft rotation, drag brake means operative to restrict rotation of said roll shaft, means operative to hold each strip band and the respective roll in driving engagement, said last mentioned means comprising a shaft opposite said roll shaft having a plurality of corresponding rolls thereon, and jack means operative to press said rolls together to force such bands against the rolls on said roll shaft.

17. A tensioning device as set forth in claim 16 wherein said last mentioned means comprises a deflecting roll operative to cause such bands to extend about a certain periphery of said rolls.

References Cited

UNITED STATES PATENTS

1,539,754	5/1925	McCullougho	242—75.2
1,544,320	6/1925	Hough	242—75.2 X
2,849,193	8/1958	Pauls et al.	242—78.1
3,078,021	2/1963	Crownfield et al.	226—21
3,098,432	7/1963	Bechtold et al.	226—195 X
3,111,285	11/1963	Coker et al.	242—75.2

FOREIGN PATENTS

11,998	1908	Great Britain.
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