July 21, 1970 E. R. BENTLEY 3,521,347

APPARATUS FOR REMOVING AND DISPOSING OF WRAPPING BANDS

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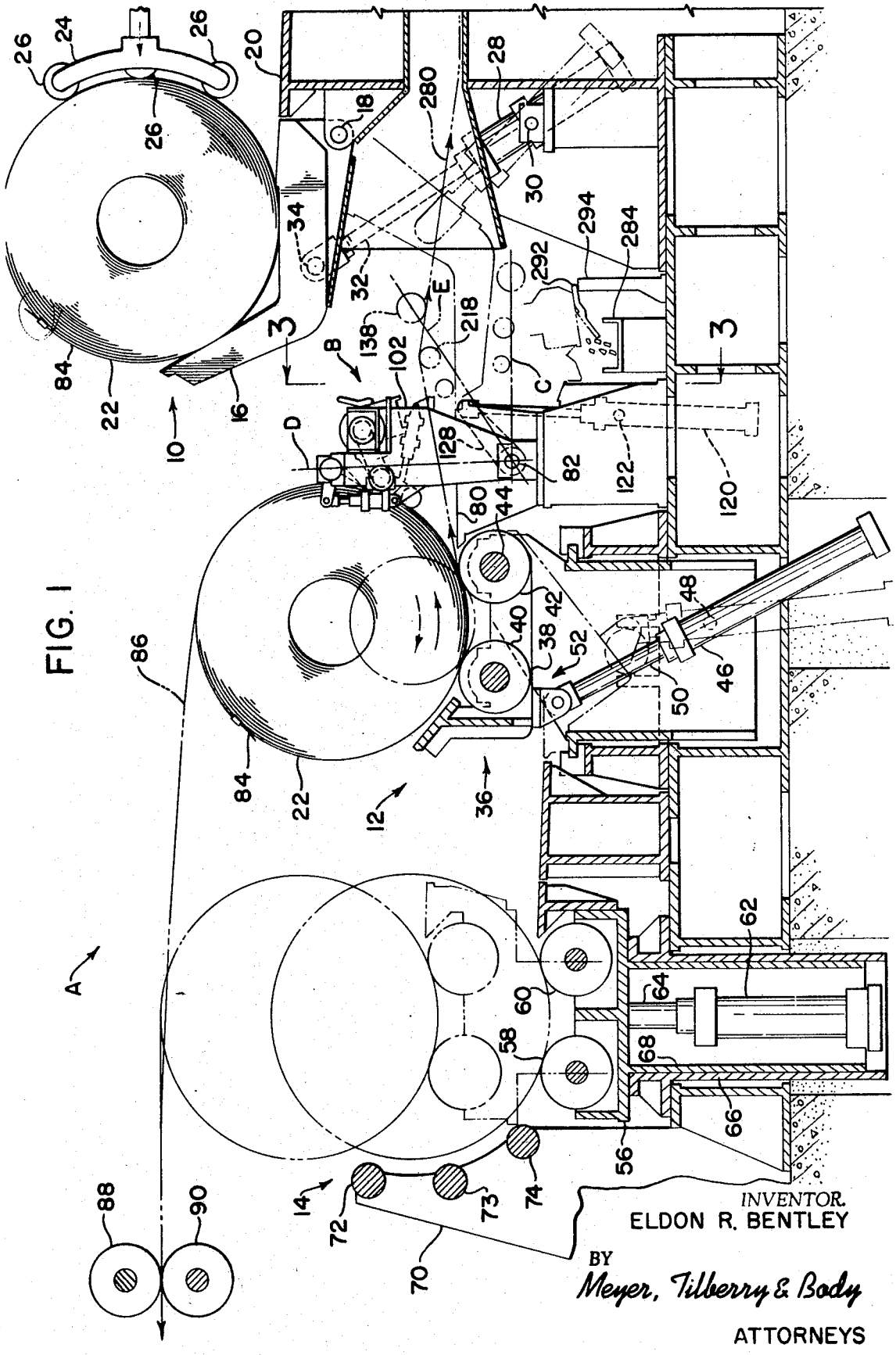


FIG. 1

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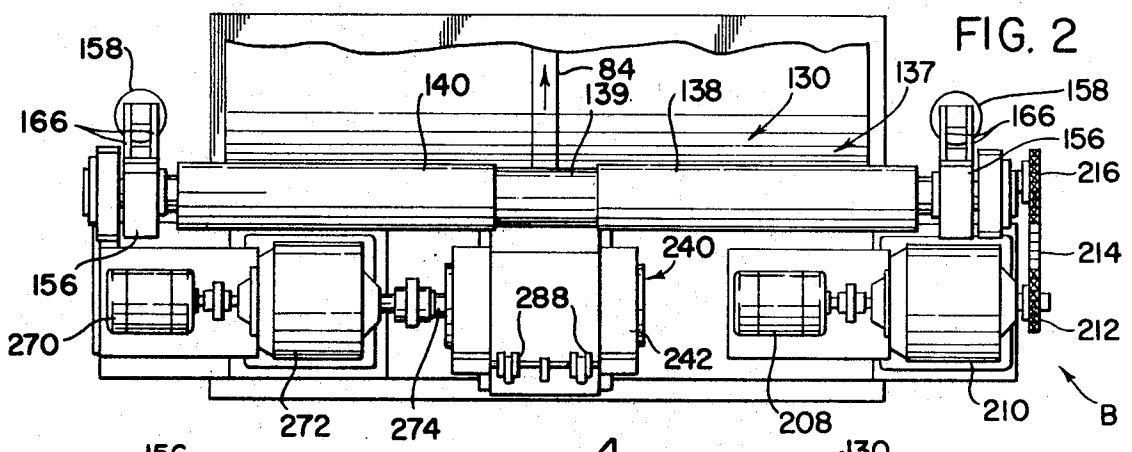
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APPARATUS FOR REMOVING AND DISPOSING OF WRAPPING BANDS

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FIG. 2



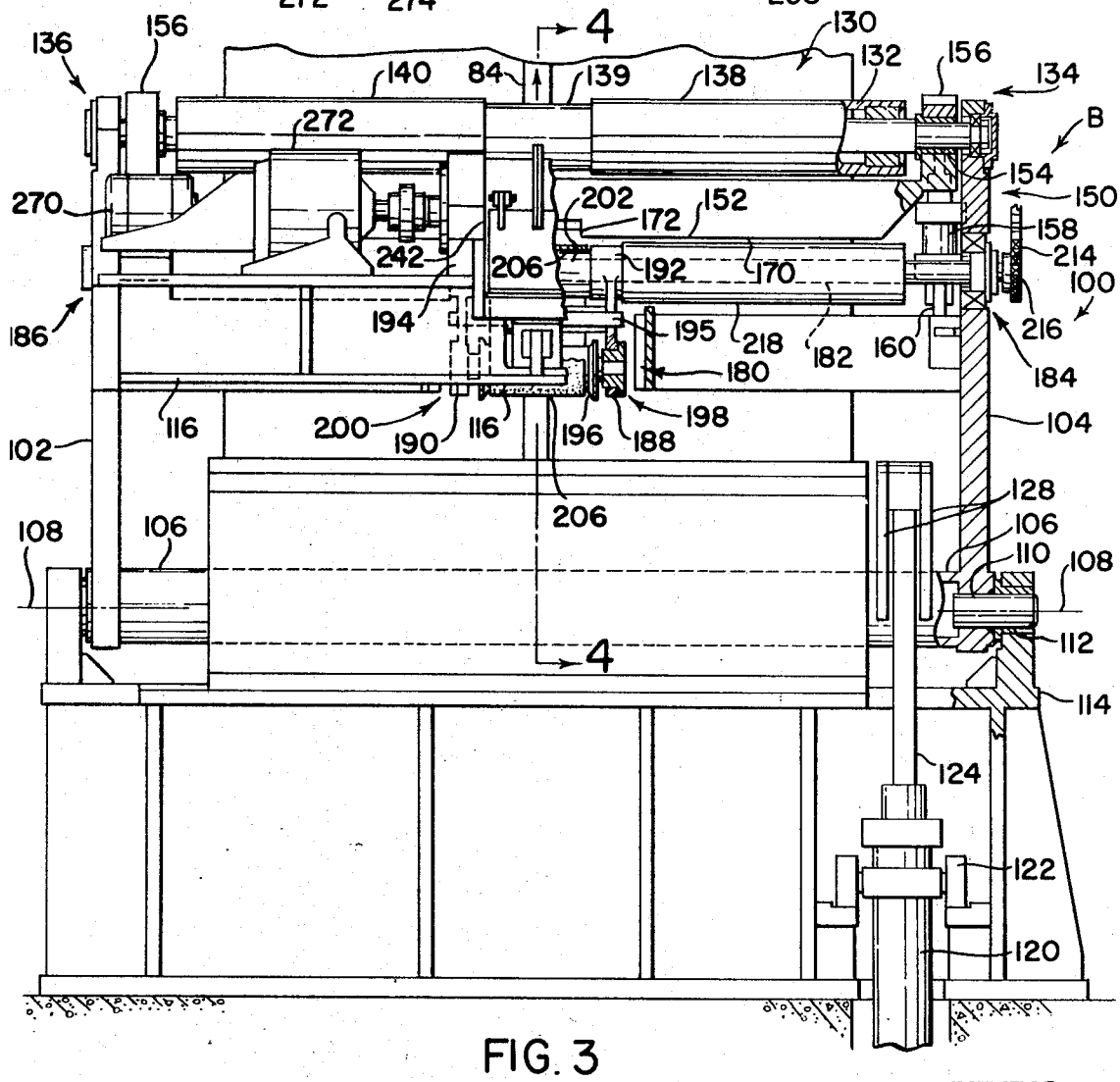


FIG. 3

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APPARATUS FOR REMOVING AND DISPOSING OF WRAPPING BANDS

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FIG. 5

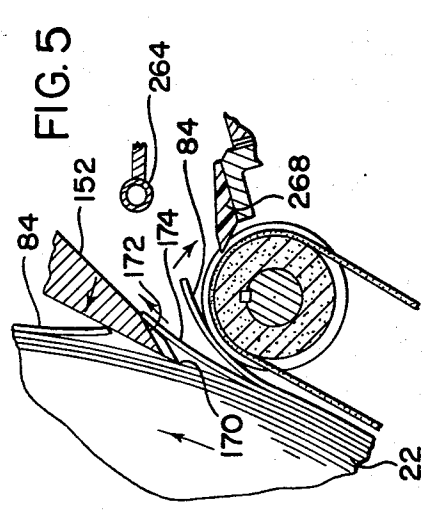


FIG. 4

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3,521,347

APPARATUS FOR REMOVING AND DISPOSING OF WRAPPING BANDS

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Int. Cl. B23p 19/02
U.S. Cl. 29—427 13 Claims

ABSTRACT OF THE DISCLOSURE

The disclosure is directed to a method and apparatus for removing and disposing of a circumferentially extending wrapping band from a bound coil. The method comprises the steps of rotating the coil about its axis; severing the band while the coil is rotating; continuing to rotate the coil while conveying the severed band away from the coil along a predetermined path; providing, along said path, means for reducing the severed band to a more easily handled configuration; and, inserting the band into the means and continuing to rotate the coil until substantially all of the band has been fed into the means. The apparatus disclosed comprises means which can be operated to carry out the described method.

The present invention is directed toward the binding art and, more particularly, to an improved method and apparatus for removing and disposing of wrapping straps or bands from wound coils.

The invention is especially suited for removing and disposing of wrapping bands from coils of strip steel and will be described with particular reference thereto; however, it will be appreciated the invention is capable of broader application and could be utilized for removing and disposing of circumferential wrapping or banding strips on many types of bound coils or cylindrical members.

As is well known, coils of rolled strip steel are normally bound or wrapped with a narrow, circumferentially extending steel band the ends of which are joined by a connector. Further processing of the coiled steel, such as additional rolling or cutting to shape, requires that the wrapping band be removed and disposed of. In the past, this band removal and disposal has normally been done manually. Because on the larger size coils the bands are often 20 or more feet in length, problems are encountered in this process. As can be appreciated, handling such bands can be both difficult and dangerous. Additionally because of their flexibility and length the bands are difficult to dispose of since they tend to twist and coil, and take up an undue amount of space considering their actual volume.

The present invention provides a method and apparatus for removing and disposing of such bands which overcomes the above problems. By use of the subject method and apparatus the band is simultaneously removed and reduced to a configuration suitable for easy disposal. In accordance with one aspect of the invention there is provided a method for removing and disposing of a circumferentially extending wrapping band from a bound coil. The method comprises the steps of:

(a) rotating the coil about its axis;
(b) severing the band while the coil is rotating;
(c) continuing to rotate the coil while conveying the severed band away from the coil along a predetermined path;
(d) providing, along said path, means for reducing the severed band to a more easily handled configuration; and
(e) inserting the band into the means and continuing to rotate the coil until substantially all of the band has been fed into the means.

In accordance with another aspect of the present invention apparatus is provided for removing and disposing of a circumferentially extending wrapping band from a bound coil. The apparatus includes first means for rotating the coil about its axis and second means for severing the band while the coil is rotating. Third means are provided for reducing the severed band to a more-easily handled configuration. Additionally, fourth means function to convey the severed band away from the coil and along a predetermined path and insert the band into the third means.

Accordingly, a primary object of the present invention is the provision of a method and apparatus for simultaneously removing and disposing of wrapping bands from bound coils.

An additional object of the present invention is the provision of an apparatus which allows wrapping bands to be removed without manual handling of the bands.

A still further object of the present invention is the provision of apparatus of the type described wherein the severed bands are positively engaged and conveyed directly to means for reducing them to a more easily handled configuration.

Yet another object is the provision of apparatus of the type described wherein during the severing and disposing operations, the lead end of the coil is unwound and the "set" removed.

These and other objects and advantages will become apparent from the following description when read in connection with the accompanying drawings wherein:

FIG. 1 is an elevational, partial in section, of a coil handling system A which includes a band removing and disposing apparatus B formed in accordance with the present invention;

FIG. 2 is a plan view of the band removing and disposing apparatus B shown in FIG. 1;

FIG. 3 is a side-elevation of apparatus B taken on line 3—3 of FIG. 1;

FIG. 4 is a cross-sectional view taken on line 4—4 of FIG. 3; and

FIG. 5 is an enlarged view showing the band severing portion of the apparatus in operation.

Referring now to the drawings wherein the showings are for the purpose of illustrating a preferred embodiment of the invention only and not for the purpose of limiting same, FIG. 1 shows the overall arrangement of a coil processing system A which includes a coil band removing and disposing unit B formed in accordance with a preferred embodiment of the subject invention.

Although the details and specific arrangement of the coil handling system A is not of particular importance to the invention it is shown as including three separate coil handling stations **10**, **12** and **14**. Station **10** is defined by a generally L-shaped support platform **16** which is mounted for pivotal movement about a shaft **18** which is supported from a welded steel frame **20**. The wound steel coils **22** are moved onto the platform **16** in any convenient manner, such as for example, by a horizontally reciprocated pusher member **24** provided with a plurality of rollers **26** arranged to engage the coil **22** in the manner shown. Platform **16** is arranged to be selectively moved between the position shown in solid lines to the lower dotted line position by a fluid cylinder **28** which is pivotally connected by bearings **30** with frame **20**. The piston rod **32** of cylinder **28** is pivotally con-

nected at 34 with the platform 16. Accordingly, with unit B lowered, lowering of platform 16 causes coil 22 to be rolled onto station 12.

Station 12 is defined by a second pivotally mounted platform 36. Platform 36 includes a frame 38 which supports a coil cradle defined by rollers 40 and 42. Preferably, at least one of the rollers 40 and 42 is connected with reversible drive means, not shown, for rotating a coil positioned thereon in either direction for purposes which will hereafter become apparent. As shown, the platform 36 is mounted in conventional manner for pivotal movement about the axis 44 or roller 42. A fluid cylinder 46 is positioned subjacent the platform 36 and is mounted for oscillation about a horizontally extending shaft 48. The piston rod 50 of cylinder 46 is connected through a crevice and bracket arrangement 52 with the bottom of platform 36. Accordingly, the platform 36 can be selectively moved from the position shown solid to the position shown by dotted lines, to thus permit the coil 22 to be moved to the station 14.

Station 14 includes a platform 56 which includes a pair of coil holding rollers 58 and 60. The platform 56 is arranged to be moved vertically from the position shown by solid lines to the upper dotted line position. The means for raising the platform include a fluid cylinder 62 which has its piston rod 64 connected to the under side of the platform 56. A guide clinder 66 is supported by frame 20 and cooperates with a cylindrical piston or sleeve 68 which is connected to the underside of platform 56 in any convenient manner. Station 14 also includes an endstop 70 provided with three rollers 72 through 74 which are positioned so as to be capable of engaging the outer surface of a coil 22 to prevent it from being moved off the platform 56.

In operation, the coil handling system functions in the following manner. First, a coil is moved by the pusher 24 from a conveying apparatus not shown, to the position shown on platform 16. Platform 16 is subsequently lowered to the dotted line position and coil 22 rolled over a platform 80 to station 12. Prior to the lowering of platform 16 the coil band removing and disposing apparatus B has been pivoted clockwise in a manner hereafter described in detail about axis 82 to a lowered position shown dotted and labeled with the letter C. When the coil 22 has been received on the pltaform 36, which is then in the raised position, the apparatus B is pivoted counterclockwise to the position shown by solid lines. At this time, apparatus B functions to sever and remove the outer circumferentially extending wrapping strip or band 84, while simultaneously unwinding the lead end of the coil and removing its "set." The precise operation and functioning of the coil band removing apparatus and manner in which the lead end 86 is unwound will subsequently be described in detail; however, for the present it is sufficient to note that after the band 84 has been removed and disposed of, the lead end 86 is passed to a pair of pinch rollers 88 and 90 which pass the strip on for subsequent processing. With the lead end 86 gripped by the pinch rolls 88 and 90 subsequent rotation of the rolls causes the coil to be unwound and, at this time, the platform 36 is lowered to a dotted line position and the coil 22 moved to the lowered platform 56. When the coil has been received on platform 56, platform 56 is actuated upwardly under the influence of cylinder 62 and the coil maintained in this position during the period during which it is unwound and passed through the subsequent processing equipment. Although the operation has been described with reference to a single coil moving serially through stations 10, 12 and 14, it should be understood that in normal operation three coils would be in the system at any one time i.e. one coil is being unwound at station 14, another at station 12 having its band removed and a third at station 10 ready for supply to station 12.

The feature of the subject invention of which is of particular importance is the method and apparatus provided for removing the band 84 and disposing of the band while simultaneously freeing the lead end of the coil. As best shown in FIGS. 3 and 4, band removing and disposing apparatus B includes a frame 100 which comprises a pair of spaced side plates 102 and 104. Plates 102 and 104 are joined at their lower end by a transversely extending section of heavy walled pipe 106 which is welded at its opposite end to the respective side plates. The frame is mounted for oscillation about an axis 108 by a pair of outwardly extending pivot pins 110 which are welded to the side frame members and received in suitable bearings 112 supported from a welded plate stand 114. The frame 100 is further rigidified by a generally L-shaped reinforcement plate 116 which extends transversely between the side plates and is welded thereto. Additionally, plates 117 and 119 are welded to the top of plate 116 and provide a mounting platform for drive motors, etc.

As best shown in FIGS. 1 and 4, the frame is arranged to be oscillated about axis 82 by a fluid cylinder 120 which is mounted for oscillation about bearings 122 and base stand 114. The upwardly extending piston rod 124 is pivotally connected by a pivot pin 126 with a pair of arms 128 which extend outwardly from pipe 106. As shown in FIG. 1, fluid cylinder 120 is arranged to move the unit B into any selected position between a lowered position shown by center line C to a raised position shown by center line D.

Referring specifically to FIG. 3 it is seen that an upper roller unit 130 is rotatably mounted at the upper end of the frame 100. As shown, the roller unit 130 comprises a shaft 132 which extends between suitable bearings 134 and 136 carried at the upper end of side plates 104 and 102, respectively. A roller 137 including three sections 138, 139 and 140 is positively connected at its ends to the shaft 132. As best shown in FIGS. 2 and 3, the center roller section 139 if of a lesser diameter than the outer sections 138 and 140. This allows the band 84 to pass freely under the roller when roller sections 138 and 140 are in engagement with the outer periphery of the coil 22 as shown in FIG. 4.

When the unit B has been oscillated to its vertical position as shown in FIG. 4, the rollers sections 138 and 140 engage the outer periphery of the coil 22 and limit further movement of the unit in a counterclockwise direction. With the unit in the vertical position and the rollers 138 and 140 in engagement with the coil 22 means are provided for severing the band 84. In the particular embodiment under consideration, these means include a transversely extending wedge or peeler bar unit 150. As shown in FIGS. 3 and 4, unit 150 includes a transversely extending bar 152 of generally knife or wedge shaped cross-section. Bar 152 is mounted so as to be freely rotatable relative to shaft 132 by a pair of bearings 154 received in plates 156 which are attached to the opposite ends of the bar 152. Power means are provided for selectively oscillating bar 152 about the shaft 132. The power means could take a variety of forms; however, they are shown as a pair of air cylinders 158 which are each supported from a separate bracket plate 160 welded to frame 100. As best shown in FIG. 4, the air cylinders 158 are pivotally connected at their lower ends to their respective bracket plate 160 by a pivot pin 162. The upper ends of the piston rods 164 are in turn connected by a pivot pin 168 to respective pairs of bracket plates 166 which extend outwardly from each of the members 156. Accordingly, by controlling the air cylinders 158 the peeler bar can be oscillated to selected position about shaft 132.

The operation of the peeler bar unit 150 can best be understood by reference to FIGS. 4 and 5. With the unit B oscillated to a vertical position and with rollers 138 and 140 in engagement with the outer periphery or surface of the coil 22, the air cylinders 158 are actuated to oscillate the peeler bar 152 clockwise until its tip 170 engages the outer surface of the coil 22. At this time the

coil is rotated in a counterclockwise direction as shown by the arrow. The center section of the bar **152** has a cutout portion **172** as best shown in FIGS. 3 and 4. Accordingly, the band **84** is not engaged by the bar; however, with the coil rotating in a counterclockwise direction and the bar **152** biased into engagement with the outer surface of the coil, as the coil rotates to the position shown in FIG. 4, the tip or edge **170** of the bar enters between the lead end portion of the coil **174** and pulls or wedges it outwardly away from the main body of the coil as shown in FIG. 5. This causes the band **84** to be tensioned and broken approximately at the point where it is engaged by the end portion **174** of the coiled strip. As can be understood, with the band broken the continued rotation of the coil **22** in a counterclockwise direction will cause the coil to be unwound and the winding band **84** to be fed to the right away from the coil. Additionally, the lead end **174** is unwound and engages the backside of bar **152** as shown by dotted lines.

In order to separate the now severed band **84** from the unwound portion of the coil and convey it along a separate predetermined path, unit B includes a conveyor unit **180** which is positioned for engaging the band **84**. Referring to FIGS. 3 and 4, it is seen that conveyor **180** is carried on the center section of a shaft **182** which extends transversely between the side frame members **102** and **104** and is rotatably mounted therein by bearings **184** and **186**. The conveyor unit **180** includes a pair of bracket arms **188** and **190** which are freely movable relative to shaft **82** and carried thereon by a pair of hubs **192** and **194**, respectively. A cross-pin or shaft **195** extends between arms **188** and **190** and is positively connected to each. A conveyor belt guide roller **196** is rotatably mounted in the lower end of arms **188** and **190** by suitable bearings **190** and **200**, respectively. A second conveyor roller **202** is carried by shaft **182** and, as shown in FIG. 4, is positively connected thereto by a key member **204**. An endless conveyor belt **206** is trained about the rollers **196** and **202**.

The means for rotating the roller **202** and driving the belt **206** includes an electric motor **208** which is connected through a gear reducer unit **210** with a sprocket **212** (see FIG. 2). Sprocket **212** is in turn connected through a roller chain **214** with a sprocket **216** keyed or otherwise positively connected to the end of shaft **182**.

In order to cause the band **84** to be gripped or engaged by the conveyor and directed along a path different from the path of the lead end of the coil, roller **202** is preferably formed from a magnet or includes magnets therein. Additionally, the belt **206** is also preferably of magnetic material. Accordingly, when the band **84** is broken, the magnetic attraction of the roller **202** and belt **206** cause the band to be pulled away from the tail end **174** of the coil. Additionally, in order to guide the lead end of the coil **174**, as well as, to assist in removing the "set" from the lead end of the strip, as will subsequently be discussed, a pair of rollers **218** are positioned for free rotation on shaft **182** and on opposite sides of the conveyor roller **202**. As best shown in FIG. 3, the diameters of rollers **218** are slightly larger than the outer diameter of the roller **202** including the thickness of the belt **206**, so that the band **84** can be in engagement with the conveyor while the strip is in engagement with rollers **218**. Although only one roller **218** is shown in FIG. 3 it is to be appreciated that a second roller positioned identically with the one shown is mounted on the left-hand end of shaft **182**.

Accordingly, as can be seen in FIG. 4, when the band **84** has been broken and the coil is continued to be rotated in the counterclockwise direction, the magnetic conveyor unit conveys the broken band along a predetermined path separate from the normal path of movement of the lead end of the coil strip.

Although conveyor unit **180** could be rigidly mounted relative to frame **100**, it is preferably mounted for pivotal movement about shaft **182**. This allows the position of the conveyor to be shifted to better engage coils of different diameters. The means for shifting conveyor **180**, as well as, maintaining it under a constant bias toward the coil while it is performing its conveying function includes an air cylinder **181** (see FIG. 4) which is pivotally connected by a pin **183** to a plate **185** welded on plate **116**. The piston rod **187** is connected through a pivot pin **189** and a Y-bracket **191** to a sleeve **193** which is rotatably received on shaft **195**. As shown, the Y-bracket has its legs positioned on opposite sides of the rear run of belt **206** and welded to sleeve **193**.

As previously discussed, because of the length and flexibility of the steel binding straps normally used for wrapping steel coil, problems are encountered in disposing of these strips. For this reason, positioned along the path of movement of the strip **84**, as shown in FIG. 4, are means to reduce the severed band to a more easily handled configuration. Although these means could be of a variety of types, in the preferred embodiment they include a rotatable cutter unit **240**. As best shown in FIGS. 3 and 4 the cutter unit **240** includes a housing **242** which is formed of welded plate construction and is supported from frame **100**. Positioned within the housing and mounted on suitable bearings carried in the side walls thereof is a cutter unit **244**. Cutter unit **244** includes a main rotor **246** which carries a pair of cutter blades **248** which are releasably and adjustably connected to the rotor by screws **250**. Blades **248** are arranged to cooperate in shearing relationship with a third blade **252** which is connected to an adjustable block **254** by a screw **256**. A threaded stud **258** extends through the side wall of the housing **242** and into threaded engagement with adjusting block **254**. A lock nut **260** is arranged for locking the threaded stud in the proper adjusted position to assure the correct shearing relationship between the blades **248** and **252**. The unit **240** also includes means for directing the band **84** into the housing **242** and between the rotating blades **248** and the stationary blade **252**. These means include a round pipe section **264** which is welded across the top edge of the side opening **266**. Additionally, a lower guide member **268** is connected to the lower side of the opening **266**. Accordingly, as can be seen, with the rotor **246** being rapidly rotated and the band being fed into the housing it will be severed into a plurality of short pieces which can be more readily disposed of. The means for rotating the rotor **246** include a motor **270** which is supported on the left-hand end of frame **100** as viewed in FIGS. 2 and 3. Motor **270** is connected through a gear reducer unit **272** with the rotor drive shaft **274**.

Although it is apparent that assembly B could be maintained in the positions shown in FIGS. 1 and 4 throughout the band removing and disposing operation. Preferably, after the band is broken and has started feeding to the unit **240**, the entire assembly B is pivoted clockwise under the influence of fluid cylinder **120** to a position indicated by center line E in FIG. 1. While in this position the coil **22** is still being rotated to assist in feeding the band **84** through the unit **240**. Rotation of coil **22** continues to take place until all of the band **84** has been fed to the unit **240**. As is apparent, this would normally take approximately one revolution of the coil. During the period that the band is being fed through the cutter, the coil is fed along a path as indicated by the dash dot line **280** in FIG. 1. During this period, the strip is being given a reverse bend between rolls **218** and rolls **138** and **140**. This "breaks the back" of the strip and removes the "set" it had taken during original coiling. When the coil has been rotated sufficiently to feed all of the wrapping band **84** through the chopper the direction of rotation is reversed and the lead end portion rewound onto the coil. The direction of rotation is again reversed, i.e. rotated in a counterclockwise direction, and the unit D oscillated to approximately a 1 or 2 o'clock position. The lead end of the coil engages the opposite side of rolls

138 and is directed upwardly over the top of the coil and is then guided to a position between the pinch rolls 88 and 90 for feeding to the process line. The platform 36 is then oscillated down and the coil pulled by pinch rolls 88 and 90 to the lowered platform 56. In the meantime, the unit B has been oscillated back downwardly to the C position. The platform 16 is then oscillated downwardly to roll a new coil onto the platform 36.

The unit 240 is arranged so that when the unit B is moved to the C position, the cut-up band sections are deposited in a conveyor trough 284 shown in FIG. 1. Referring specifically to FIGS. 2 through 4, the arrangement for permitting the cutup band sections to be discharged will be explained. As shown in FIG. 4 the housing 242 is provided with a door 286 which is pivotally connected to the housing by hinges 288. Door 286 is normally maintained closed by a tension spring 290 which is connected between the door and one of the side walls of the housing 242. An actuating lever or handle 292 extends outwardly from door 286. Handle 292 is arranged so that as the unit is lowered to the C position shown in FIG. 1, the top edge of the handle 292 engages an upwardly extending stop 294 which causes the door to be opened against the tension of spring 290. Accordingly, with the door open the cut-up sections are discharged into conveyor 284 as shown in FIG. 1.

The invention has been described in great detail sufficient to enable one of ordinary skill in the art to make and use the same. Obviously, modifications and alterations of the preferred embodiment will occur to others upon a reading and understanding of the specification, and it is my intention to include all such modifications and alterations as part of my invention isofar as they come within the scope of the appended claims.

Having thus described my invention, I claim:

1. A method for removing and disposing of a circumferentially extending wrapping band from a bound coil, said method comprising the steps of:
   (a) rotating said coil about its axis;
   (b) severing said band while said coil is rotating;
   (c) conveying said severed band away from said coil along a predetermined path;
   (d) providing along said path, means for reducing the severed band to a more easily handled configuration; and
   (e) inserting said band in said means and continuing to rotate said coil until substantially all of said band has been inserted into said means.

2. Apparatus for removing and disposing of a circumferentially extending wrapping band from a bound coil, said apparatus including: first means for rotating said coil about its axis; second means for severing said band while said coil is rotating; third means for reducing the severed band to a more easily handled configuration; and, fourth means for conveying said severed band away from said coil along a predetermined path and inserting said band into said third means.

3. The apparatus as defined in claim 2 wherein said first means includes driven roll means.

4. The apparatus as defined in claim 2 wherein said second means includes wedge means movable into engagement with said coil.

5. The apparatus as defined in claim 2 wherein said third means includes a pair of cooperating members at least one of which is rotatable.

6. The apparatus as defined in claim 2 wherein said fourth means includes a magnetic conveyor positioned between said first and third means.

7. The apparatus as defined in claim 2 wherein said second, third and fourth means are mounted on a common frame positioned adjacent said first means and movable between first and second positions relative thereto.

8. The apparatus as defined in claim 7 wherein said second means includes a pivotally mounted wedge member arranged to engage said coil when said frame is in its first position and, wherein said fourth means includes a conveyor subjacent said wedge member and adjacent said coil when said frame is in its first position.

9. The apparatus as defined in claim 7 wherein said third means includes a rotating cutter unit for cutting said severed band into a plurality of short sections.

10. Apparatus for removing and disposing of wrapping bands from bound coils; said apparatus including a frame mounted for pivotal movement about a first horizontal axis; first means comprising a horizontally positioned band breaking wedge member carried by said frame and arranged to be moved pivotally about a second axis spaced from said first axis; conveyor means mounted on said frame intermediate said first and second axes for engaging a band broken by said wedge member, and, conveying it along a path; and, means carried by said frame and in said path for reducing a band into a more easily handled configuration.

11. The apparatus as defined in claim 10 including power means for pivoting said frame about said first axis.

12. The apparatus as defined in claim 10 including a coil engaging roller mounted for rotation about said second axis.

13. The apparatus as defined in claim 10 including means for biasing said conveyor means in a first direction.

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U.S. Cl. X.R.

29—200, 83—909; 242—78