

Sept. 22, 1959

E. A. LAINE

2,905,078

APPARATUS FOR HANDLING COILS

Filed Aug. 9, 1956

4 Sheets-Sheet 1

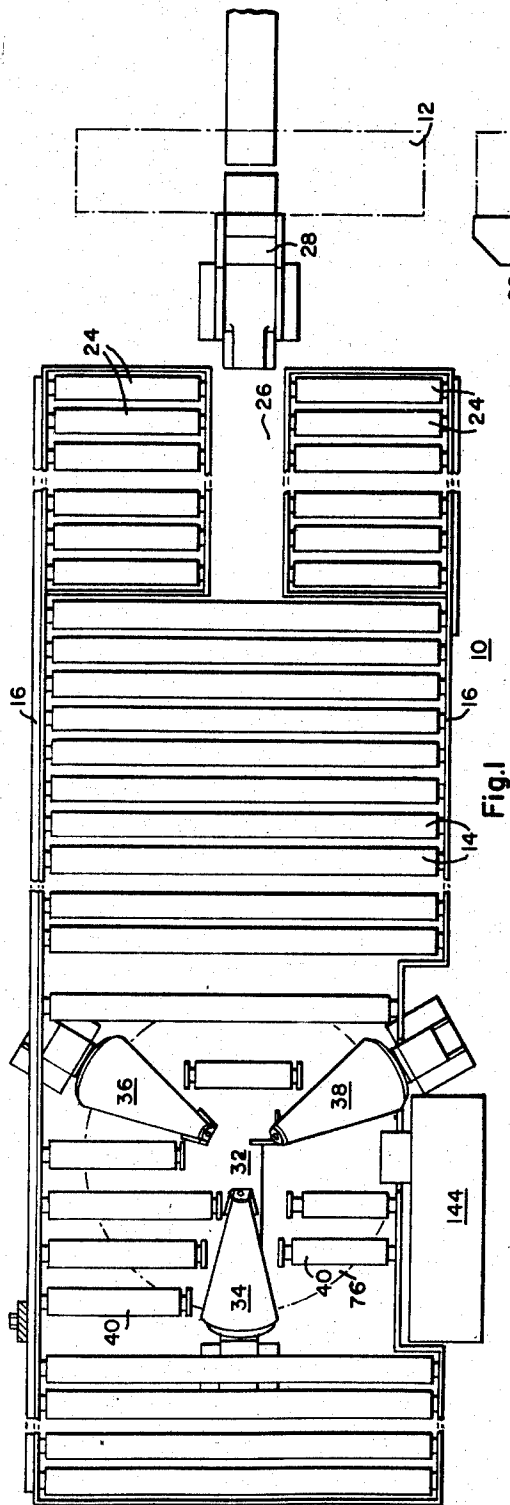


Fig. 1

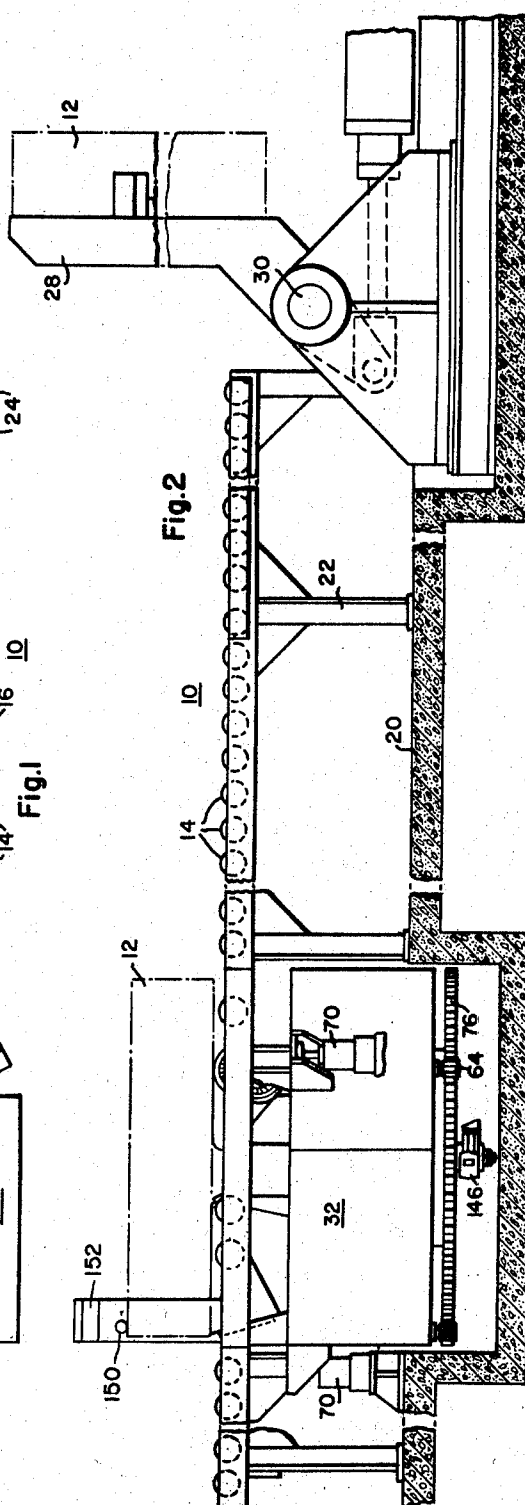


Fig. 2

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Fig.3

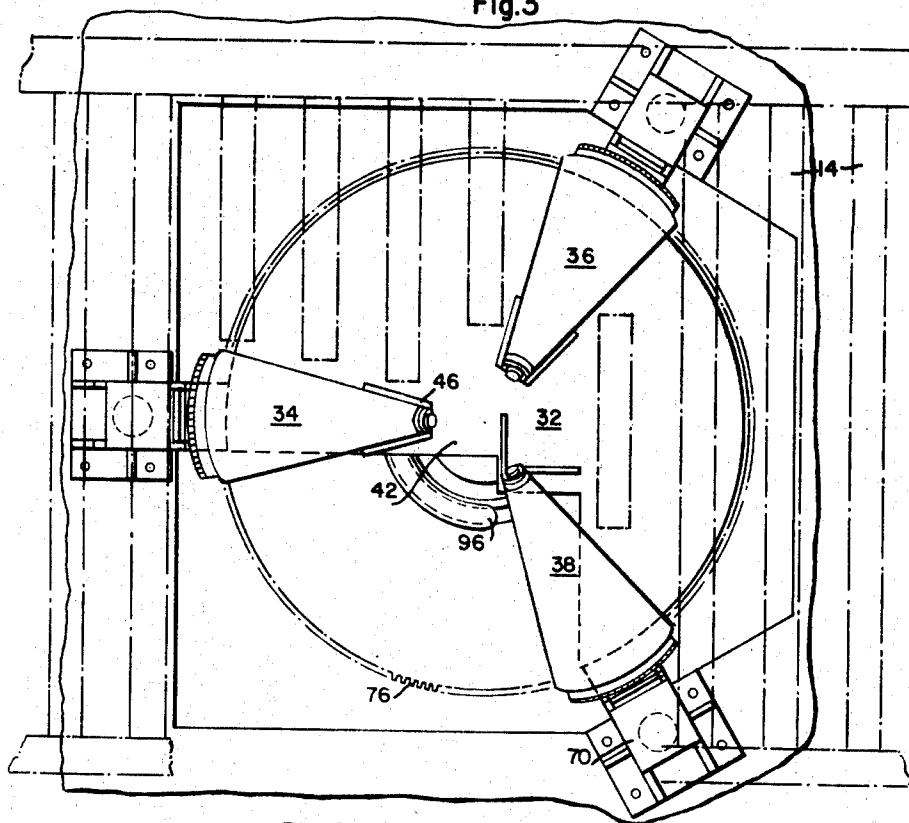
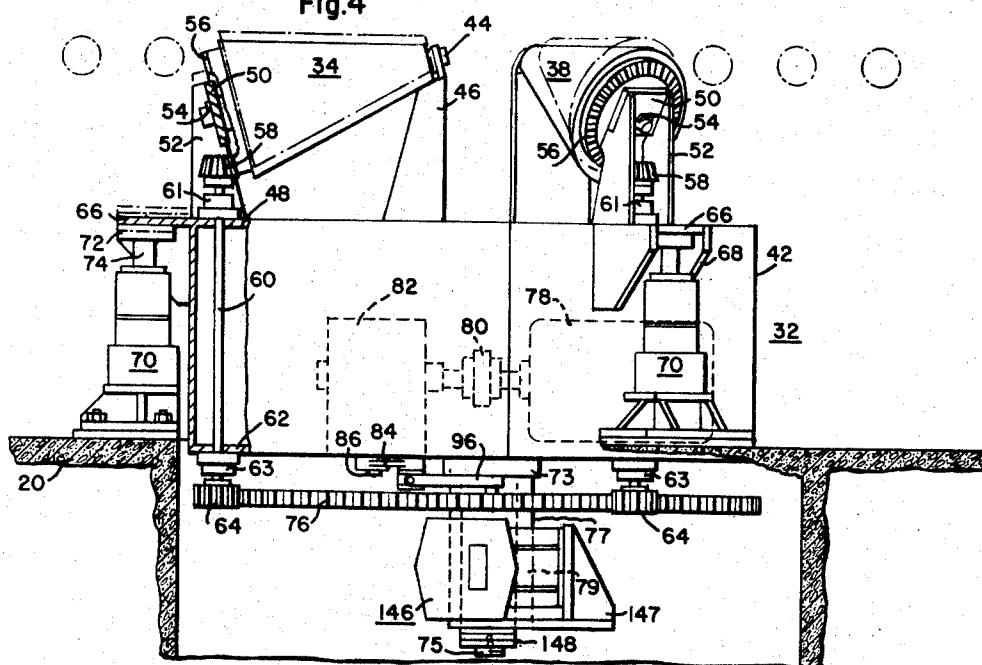


Fig.4



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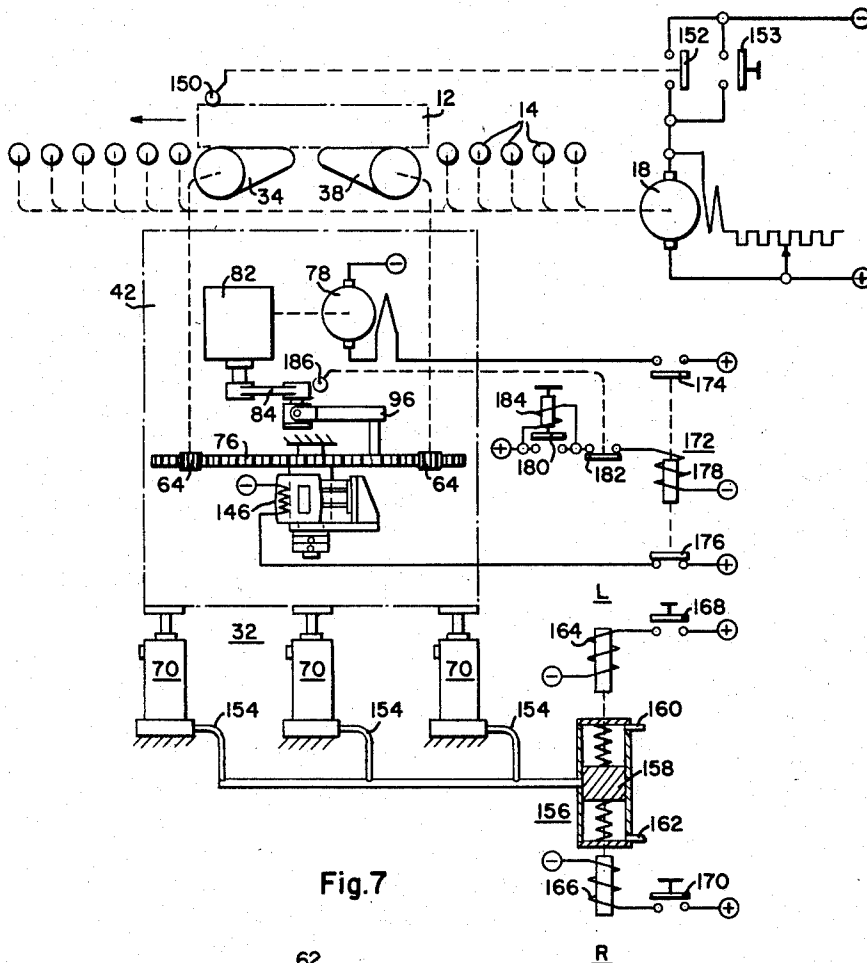


Fig. 7

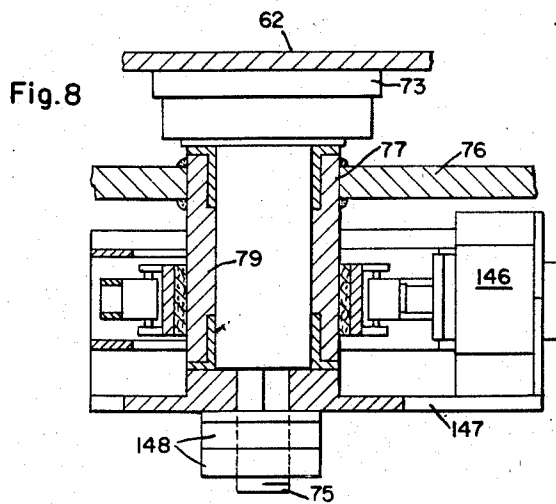


Fig. 8

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APPARATUS FOR HANDLING COILS

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Application August 9, 1956, Serial No. 603,022

9 Claims. (Cl. 100—12)

This invention relates to apparatus for handling slit strip coils of steel and the like for facilitating the banding thereof.

When steel such as stainless, electrical silicon-iron, or the like, is rolled and finished in wide strip form, the strip is usually wound into coils. Thereafter the coils are slit to predetermined widths and a plurality of slit strip coils, usually of different widths, is obtained from a single coil. In shipping such slit strip coils it is desirable to band the individual coils to hold them compact and to prevent shifting of the convolutions thereof with accompanying damage to the edges of the strip and introduction of strains therein.

Because of the weight of the wound coil, it has heretofore been difficult to handle the coil during the banding thereof without introducing strains into the strip and in particular into the electrical silicon-iron grade of steel. Considerable efforts have heretofore been expended in attempting to perfect an integrated handling and banding apparatus, some of which have not proven to be commercially successful because of the mechanical operations required, or where mechanized equipment has been produced and used, it has been found that the coils are often damaged during the handling and banding operation.

An object of this invention is to provide apparatus for mechanically handling slit strip coils for facilitating the banding thereof.

Another object of this invention is to provide, in a roller conveyor system for conveying wound coils from one position to another, means intermediate the ends of the roller conveyor for lifting a wound coil therefrom and sequentially rotating the wound coil through a plurality of banding positions to facilitate the banding thereof.

Other objects of this invention will become apparent from the following description when taken in conjunction with the accompanying drawings in which:

Figure 1 is a top plan view and partly in section of apparatus embodying the features of this invention with the banding machine removed;

Fig. 2 is a view in side elevation of the apparatus of Fig. 1;

Fig. 3 is a top plan view greatly enlarged of the coil supporting apparatus utilized in the system of Fig. 1, the conveyor rollers and adjacent portions of the device being shown generally in dashed lines;

Fig. 4 is a view in side elevation and partly in section of the apparatus of Fig. 3;

Fig. 5 is a top plan view of certain of the actuating mechanism of the apparatus illustrated in Fig. 4;

Fig. 6 is a view in side elevation of the actuating mechanism illustrated in Fig. 5;

Fig. 7 is a schematic diagram illustrating a control system suitable for use in conjunction with the apparatus of Figs. 1 through 4;

Fig. 8 is a view in side elevation and partly in section of a portion of the apparatus of Fig. 4 and illustrates the assembly of the magnetic brake; and

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Fig. 9 is a view in end elevation and partly in section of a portion of the apparatus of Figs. 5 and 6.

Referring to the drawings, and in particular to Figs. 1 and 2 thereof, this invention is illustrated by reference to a roller conveyor system shown generally at 10 which embodies features of this invention for facilitating the handling and banding of slit strip coils 12 represented by the dot-dash outline in Figs. 1 and 2. The roller conveyor system 10 is formed of a plurality of rollers 14 suitably supported in a support frame 16 with an end of each of the rollers connected by a conventional chain drive to be simultaneously driven from a source of power such as the motor 18 illustrated in the schematic diagram of Fig. 7. In order to control the speed of the motor 18, an adjustable rheostat 17 is connected in series circuit with the shunt field windings 19 of the motor 18 and is disposed to be manually operated to control the field excitation of the motor. The frame 16 supporting the rollers 14 is suitably carried in spaced relation with respect to the floor 20 of the operating plant as by means of upright support members 22 spaced along the edges of the roller conveyor 10. As illustrated, one end of the roller conveyor system 10 is formed of two sections of relatively short rollers 24 suitably carried in support frame members having the inner ends of the rollers 24 spaced apart to provide a space 26 therebetween. A rotatable arm 28 is positioned adjacent the end of the roller conveyor 10 and is disposed for pivotal movement about a shaft 30 from the vertical position illustrated in Fig. 2 to a substantially horizontal position in the space 26 between the ends of the short rollers 24. The details of the rotatable arm 28 and the operating mechanism therefor form no part of this invention, but are illustrated and claimed in my copending application Ser. No. 530,463 filed August 25, 1955, now Patent No. 2,780,985, issued February 12, 1957. In practice, the rotatable arm 28 is disposed adjacent the end of the roller conveyor 10 so that when the arm 28 is in the vertical position illustrated in Fig. 2, a wound coil 12 of strip steel is positioned on the arm as described said Patent No. 2,780,985, and when the arm 28 is rotated from the vertical position illustrated in Fig. 2 through a substantially horizontal position and into the space 26 between the rollers 24, the arm 28 will deposit the wound coil 12 in a horizontal position on the rollers 24.

In accordance with this invention a coil supporting and indexing apparatus 32 is disposed intermediate the ends of the roller conveyor system 10 for engaging the coil 12 when the coil is moved over the rollers 14 to a position over the coil supporting apparatus 32. The term "indexing apparatus," as used herein, means a movement controlling means for effecting a predetermined step movement of a coil through a predetermined number of band receiving positions as will be described more fully hereinafter. In this embodiment the coil supporting apparatus 32 is formed of three radially spaced conical roller members 34, 36 and 38 disposed substantially 120° apart and angularly mounted with the upper line edge of each conical roller in a common horizontal plane and disposed for movement upwardly with respect to the rollers 14 from a normal position shown in solid outline in Fig. 4 to a coil supporting and rotating position shown in dashed outline. As illustrated in Fig. 1, suitable short rollers 40 are disposed between certain of the conical rollers 34, 36 and 38 and supported by suitable stanchions in position therebetween for aiding in supporting the wound coil 12 as it is moved along the roller conveyor 10. The manner of supporting the shorter rollers 40 forms no part of this invention, as any suitable frame or upright support members (not shown) may be utilized for supporting the same.

Referring to Figs. 3 and 4, where the details of the coil supporting apparatus 32 are particularly illustrated, it is noted that each conical roller 34, 36 and 38 is supported in operative position on a housing 42 which contains and carries means for effecting a simultaneous rotatable movement of the spaced conical rollers 34, 36 and 38. Each conical roller is provided with a roller shaft 44 which is disposed to extend centrally therethrough, one end being suitably carried as by means of a support bracket 46 mounted on the upper plate 48 of the housing 42, the other end of the roller shaft extending through a cross support 50 of a bracket 52 which is carried by the upper plate 48, a key plate 54 carried by the cross support 50 being employed for maintaining the shaft 44 in position. The conical rollers are provided with suitable sleeve bearings for effecting rotation of the rollers about the shafts 44. As illustrated, the outer or large end of each of the conical rollers 34, 36 and 38 is provided with a bevel gear 56 about the periphery thereof disposed to be engaged and driven by a miter gear 58. Each of the miter gears is secured to the upper end of an associated shaft 60 which extends vertically through the upper plate 48 and the lower plate 62 of the housing 32 and is provided with a pinion gear 64 at the lower end thereof. Each of the shafts 60 is mounted in suitable bearings 61 and 63 carried by the upper and lower plates 48 and 62, respectively, of the housing 32 whereby, when the pinion gears 64 are driven as will be described, operation of the miter gears 58 and consequently a rotation of the associated conical rollers is effected.

The housing 32 is provided with suitable outwardly extending support lugs 66 disposed in spaced relation about the periphery of the upper plate 48. Each of the lugs 66 is supported as by means of the spaced side flange members 68 mounted on the sides of the housing 32. Associated with each of the lugs 66 is a suitable lifting cylinder 70 mounted as illustrated in Fig. 4 on the floor 20 in spaced relation about the housing 32. The lifting cylinders 70 may be of any suitable fluid type and may be operated either by action of liquid or air as desired, it being understood that each such lifting cylinder 70 is provided with a piston disposed to be actuated so that when the upper support member 72 mounted on the piston shaft 74 is seated against the associated lug 66, the entire housing assembly 32 can be suitably lifted to move at least the coil supporting surfaces of the conical rollers 34, 36 and 38 above the level of the rollers 14 of the conveyor. A typical hydraulic jack that may be utilized as the lifting cylinder 70 is that known to the industry as the Hanna Hydraulic Cylinder Model 18 or Model 18½ as illustrated and described in catalog No. 233A (1950) of the Hanna Engineering Works of Chicago, Illinois. In a normal position the conical rollers 34, 36 and 38 are normally disposed beneath the support level of the rollers 14 as shown in solid outline in Fig. 4 whereby the spaced conical rollers 34, 36 and 38 will not interfere with movement of a wound coil 12 on the roller conveyor system, but under predetermined conditions can be operated upwardly to the position shown in dashed outline in Fig. 4 whereby the rollers 34, 36 and 38 engage a wound coil 12 positioned thereover and lift it above the supporting surface of the rollers 14.

In order to effect a simultaneous operation of the rollers 34, 36 and 38, a drive mechanism such as a large gear wheel 76 is disposed to engage the spaced pinion gears 64 previously referred to. The gear wheel 76 is provided with a hub 77 as shown in Figs. 6 and 8 disposed about and supported on shaft 75, the upper end of the shaft 75 being flanged (not shown) and being supported in a downwardly projecting non-rotating position from a suitable housing 73 carried by the lower side of the bottom plate 62, the details of such support not being necessary for the purpose of this invention. A downwardly extending section of the hub 77 forms a rotating brake wheel

or sleeve 79 as will be referred to hereinafter. The gear wheel 76 is disposed to be operated in response to the energization of a motor 78 carried within the housing 32 and which is connected through a flexible drive coupling 80 and a gear reducer 82 to drive a crank 84 mounted on the lower end of the gear reducer shaft 86 to effect a rotation of the crank 84 as the shaft 86 of the gear reducer is rotated. The details of the mounting of the crank 84 and actuating mechanism for the gear wheel 76 are illustrated in the enlarged views of Figs. 5 and 6 of the drawing. As shown, the crank 84 is provided with a hub 83 at one end thereof disposed about and secured to the gear reducer shaft 86 by means of a driven key 85. Referring to Fig. 9, the other end of the crank 84 is provided with a downwardly projecting pin 88 about which a collar 90 is positioned being spaced by a washer 81 from the crank 84 and maintained in rotatable position as by means of a keeper plate 92 held in position by means of a set screw 94 which projects upwardly into the lower end of the pin 88. An arm 96 having a fork end with arms 98 and 100 spaced to receive the collar 90 is disposed for connecting the crank 84 with the gear wheel 76. The arm 96 is mounted as by means of pins 102 and 104 projecting through arms 98 and 100, respectively, into the collar 90, such pins being held in operative relation as by means of set screws 106 and 108, respectively, whereby the arm 96 is disposed for pivotal movement about the downwardly projecting pin 88 and for vertical pivotal movement about the pins 102 and 104. The other end of the arm 96 is provided with a downwardly projecting pin 110 disposed to cooperate for engaging the gear wheel 76 to effect a predetermined movement thereof.

As illustrated in Figs. 5 and 6, the upper surface of the gear wheel 76 is provided with two indexing cam patterns 112 and 114, each of the cam patterns forming a circle disposed about the centrally disposed supporting shaft 75. The cam pattern 112 is the larger of the cam patterns and is provided with four cam surfaces 116, 118, 120 and 122, terminating in pin receiving abutments 124, 126, 128 and 130, respectively, whereas cam pattern 114 is provided with only three cam surfaces 132, 134 and 136, which terminate in pin receiving abutments 138, 140 and 142, respectively. The arm 96 is disposed to be lifted and moved about the downwardly projecting pin 88 between the cam patterns 112 and 114 as desired, depending upon whether the coil 12 is to be banded, as will be described hereinafter, in four positions or in three positions, it being noted that the weight of the arm 96 is sufficient to normally maintain the pin 88 in the cam pattern selected.

In practice the banding machine 144, represented in rectangular block outline and which may be of any suitable construction for effectively banding a wound coil 12 supported on the conical rollers 34, 36 and 38, is positioned as illustrated in Fig. 1 for movement into juxtaposition with the conveyor system 16 for passing the band around a coil 12 to securely band the coil while the coil is supported on the rollers 34, 36 and 38. As illustrated in Figs. 1 and 3, the housing 32 is recessed whereby the banding machine 144 may be moved into operative position between the conical rollers 38 and 34 for effectively banding the coil 12.

As illustrated in Fig. 4 and Fig. 8 of the drawing, the shaft 75 which supports the gear wheel 76 and its integrally welded hub 77 and brake sleeve 79 extends downwardly therefrom and supports a suitable magnetic brake represented at 146 which is carried on a non-rotating brake shoe mounting 147 and which is disposed to effectively brake the movement of the gear 76 in a well known manner when the brake 146 is energized. The magnetic brake 146 may be of the type illustrated having two brake shoes disposed to be actuated to engage the brake sleeve 79, the details of such a magnetic brake being well known and shown in the publication entitled "General Electric Instructions—D.C. Magnet-Operated Two-Shoe Brakes,

IC-9528 (GEH-1930). The magnetic brake mounting member 147 and the brake carried thereby are suitably held in operative position on the shaft 75 in juxtaposition to the brake sleeve 79 as by means of a threaded fastener 148 threaded on the end of the shaft 75.

Referring to Fig. 7, there is illustrated a schematic diagram of a control system suitable for controlling the operation of the apparatus previously described. The rollers 14 of the roller conveyor system 10 are disposed to be driven by a motor 18 connected to be energized as from a source represented by the positive and negative terminals. In order to provide for a positive stop of a wound coil 12 in the proper position over the conical rollers 34, 36 and 38, any suitable limit indicator 150 may be disposed in the path of movement of the coil 12 so when the coil 12 is properly positioned over the conical rollers 34, 36 and 38, the limit indicator 150 will be actuated to operate a limit switch 152 to which the indicator is mechanically connected, to a circuit interrupting position to effectively deenergize the motor 18 and stop the operation of the roller conveyor system 10. A manually operable switch 153 is disposed for operation to establish a shunt across the limit switch 152 to initiate the operation of the motor 18 as will be referred to hereinafter. Each of the lifting cylinders 70 is suitably connected as by means of a conduit 154 to a suitable valve mechanism 156, the valve 158 of which is disposed to be operated to permit a flow of fluid pressure through the port 160 to the conduit 154 or a flow of the fluid pressure from the lifting cylinders 70 and conduits 154 through the port 162. In order to control the movement of the valve 158, the valve is connected at the one end to a suitable electromagnet 164 and at the other end to a suitable electromagnet 166, the energization of the electromagnets 164 and 166 being controlled as by means of the manually operated contact members 168 and 170, respectively, to effectively control the simultaneous operation of the lifting cylinders 70.

As illustrated, the motor 78 which controls the drive of the gear wheel 76 is disposed to be energized from any suitable source represented by the positive and negative terminals and is connected through the gear reducer 82 to drive the crank 84. Likewise, the magnetic brake 146 is disposed to be connected to a suitable source of power represented by the positive and negative terminals. As illustrated, the connection of both the motor 78 and the magnetic brake 146 to their power sources is controlled by operation of an electromagnetic interlock 172 having contact members 174 and 176 disposed to be simultaneously operated thereby, the operation of the interlock being controlled by means of the energizing windings 178 which are disposed to be energized from a suitable source represented by the positive and negative terminals. The energization of the windings 178, however, is controlled as by means of manually operated contact member 180 and a limit switch 182. The manually operated contact member 180 is provided with an energizing coil 184 for interlocking the contact member 180 into a circuit establishing position until the limit switch 182 is actuated as by means of a limit indicator 186 which is mechanically connected to the limit switch 182. The limit indicator 186 is disposed in the path of movement of the crank 84 and the operation thereof will be described hereinafter.

In operation, a wound coil 12 is loaded on a rotatable arm 28 from a suitable source of supply and the arm 28 is moved from a vertical position to a substantially horizontal position to deposit the wound coil 12 on the rollers 24. With the switch 152 or 153 in a circuit closing position, the motor 18 is energized to actuate the rollers 14 and move the wound coil of steel lengthwise of the conveyor system 10 to a point where the wound coil 12 is disposed substantially over the spaced conical rollers 34, 36 and 38. As long as a coil 12 is not positioned over the conical rollers, the limiting mechanism 150 is not

operated and the switch 152 is placed in a circuit closing position whereby the manually operable switch 153 need not be actuated or may be released to return to its circuit interrupting position. When the wound coil 12 contacts the limiting mechanism 150 the limit switch 152 is operated to its circuit interrupting position to effectively stop the operation of the motor 18 and consequently the operation of the rollers 14 of the conveyor system.

With the wound coil 12 disposed over the conical rollers 34, 36 and 38, contact member 170 is manually operated to energize the electromagnet 166 and actuate the valve 158 downwardly to a position where the fluid pressure is admitted through the port 160 and conduits 154 to the lifting cylinders 70 to effect an upward movement of the housing 32 and consequently an upward movement of the rollers 34, 36 and 38 whereby the upper contacting surfaces thereof engage the wound coil 12 to lift the wound coil 12 above the plane of movement of the rollers of the conveyor system 10. When the coil 12 is supported in this manner the banding machine 144 is moved into a banding position to effectively band the wound coil in one position. When such a banding operation is completed, the manually operated contact member 180 is actuated to a circuit closing position whereby an energizing circuit is established through the limit switch 182 to energize the windings 178 of the interlock 172 and the holding winding 184 to effectively hold the contact member 180 in its circuit establishing position. When the winding 178 is energized, contact member 176 is moved to a circuit interrupting position and contact member 174 is moved to a circuit establishing position to effect the energization of the motor 78 to drive the gear reducer 82 and effect a rotating movement of the crank 84.

For the purpose of this description it can be assumed that the wound coil 12 is to be banded in four positions. This being the case, arm 96 is placed in the position illustrated in Fig. 5 where the pin 110 cooperates with and engages a cam surface of the cam pattern 112. This being the case, as the crank 84 is rotated as by means of the shaft 86 of the gear reducer, the pin 110 engages the pin receiving abutment 124 to effect a clockwise movement of the gear wheel 76 as viewed in Fig. 5, it being noted that for one complete revolution of the crank 84 the gear wheel 76 will be indexed one-quarter of a revolution. As the crank 84 approaches the completion of a revolution it engages and lifts the limit mechanism 186 to actuate the limit switch 182 to a circuit interrupting position whereby the windings 184 and 178 are deenergized and the deenergized interlock 172 returns to the position illustrated, the simultaneous movement of the contact members 174 and 176 to the positions illustrated being effective to interrupt the energizing circuit of the motor 78 and establish an energizing circuit for the magnetic brake 146, respectively, it being noted that the drive of the crank is sufficient to effect a movement of the crank 84 past the limit mechanism 186 prior to the stoppage of the gear reducer 82 so that the limit mechanism 186 is reset for the next rotating movement of the crank 84 and the limit switch 182 is returned to a circuit establishing position. Simultaneously the magnetic brake 146 effectively stops the gear wheel 76 from further movement thereby preventing further rotation of the conical rollers 34, 36 and 38 whereby the wound coil 12 carried thereby is maintained in the next predetermined banding position to be banded by the banding machine 144. It is to be noted that during the revolutions of the crank 84 the arm 96 is first actuated while the pin 110 thereof engages the pin receiving abutment 124 to effect a quarter turn of the gear wheel 76 and as the movement of the crank 84 continues to complete a revolution, the pin 110 rides on the cam surface 116 to a position where, upon completion of a revolution of the crank 84, the pin 110 will be seated in engagement with the pin receiving abutment 130 which has been in-

dexed forwardly one-quarter of a turn. This operation is continued until the coil 12 has been moved through four successive positions and banded in such four positions.

Upon completion of the banding of the coil 12, contact member 168 is moved to a circuit establishing position to energize the winding 164 to effect the movement of the valve 158 upwardly whereby the fluid pressure of the lifting cylinders 70 flows through the conduits 154 and the port 162 of the valve mechanism 156 to permit the housing 32 and consequently the conical rollers 34, 36 and 38 to return to their normal position by gravity and deposit the banded wound coil 12 on the rollers 14 of the conveyor system 10 and the conical rollers 34, 36 and 38 are disposed below the plane of movement of the coil 12 on the rollers 14 as shown in solid lines in Fig. 4. When the coil supporting mechanism 32 is in its lowered position, the contact member 153 is again actuated to energize the motor 18 to effectively drive the rollers 14 to move the banded wound coil 12 from its position over the conical rollers at which time the switch 152 is moved to its circuit closing position and the switch 153 can be released. The motor 18 is thus maintained energized to operate the conveyor system to move another unbanded wound coil 12 into position over the conical rollers 34, 36 and 38 where the limit switch 152 is again operated and the sequence of operating the lifting mechanism and indexing equipment is repeated.

If the wound coil 12 is to be banded in only three positions, the arm 96 is manually lifted about its pivot formed by the pins 102 and 104 and is pivotally moved about the downwardly projecting pin 88 of the crank 84 to a position where the pin 110 will engage one of the cam surfaces 132, 134 or 136 of the smaller cam pattern 114. The same sequence of operation of the controls will be had except that the wound coil will be actuated through only three banding positions instead of the four referred to hereinbefore when the arm 96 is positioned to cooperate with the cam pattern 112.

As is evident from the foregoing description, apparatus is provided for the mechanical handling of a wound strip coil for facilitating the banding thereof in a predetermined number of positions. With the apparatus described it has been found that there is little if any damage to the coil during handling and movement thereof in effecting the banding of the coil.

I claim:

1. In apparatus for effecting the banding of a wound coil disposed horizontally on a roller conveyor for lengthwise movement thereof in a predetermined plane of movement, the combination therewith of, coil engaging means associated with the roller conveyor and normally disposed below said plane of movement, means for actuating said coil engaging means from said normal position upwardly to engage the coil and lift the coil above said plane of movement and out of contact with the roller conveyor, said coil engaging means comprising a plurality of radially spaced cone rollers and means for supporting the spaced cone rollers in radially disposed angularly displaced relation whereby the upper surface of each cone roller has a lengthwise contact line in a common horizontal plane, and means disposed to drive the cone rollers when the coil is lifted above said plane of movement to rotatably index the coil through a predetermined number of band receiving positions.

2. Apparatus for effecting the banding of a wound coil disposed horizontally on a roller conveyor for lengthwise movement thereof in a predetermined plane of movement, the combination therewith of, coil engaging means disposed intermediate the ends of the roller conveyor and normally disposed below said plane of movement, means for actuating said coil engaging means upwardly from said normal position to engage the lower surface of the horizontally disposed coil when the coil is positioned thereover and lift the coil above said plane of move-

ment and out of contact with the roller conveyor, said coil engaging means comprising a plurality of radially extending spaced cone rollers and means for supporting the spaced cone rollers in radially disposed angularly displaced relation whereby the upper surface of each cone roller has a lengthwise contact line in a common horizontal plane for engaging the coil, and means disposed to simultaneously drive the cone rollers when the coil is lifted above said plane of movement to rotatably index the coil through a predetermined number of band receiving positions.

3. In apparatus for effecting the banding of a wound coil disposed horizontally on a roller conveyor for lengthwise movement thereof in a predetermined plane of movement, the combination therewith of, coil engaging means disposed intermediate the ends of the roller conveyor and normally below said plane of movement, said coil engaging means comprising a housing disposed for vertical movement and a plurality of radially extending spaced cone rollers disposed in angularly displaced relation on the upper end of the housing whereby the upper surface of each cone roller has a lengthwise contact line in a common horizontal plane, means disposed to actuate the housing upwardly to move the cone rollers into engagement with the coil and lift the coil above said plane of movement and out of contact with the roller conveyor, and means connected with each of the cone rollers disposed to be driven to simultaneously drive the cone rollers when the coil is lifted above said plane of movement to rotatably index the coil through a predetermined number of band receiving positions.

4. Apparatus for effecting the banding of a wound coil disposed horizontally on a roller conveyor for lengthwise movement thereof in a predetermined plane of movement, the combination therewith of, coil engaging means disposed intermediate the ends of the roller conveyor and normally below said plane of movement, said coil engaging means comprising a housing disposed for vertical movement and a plurality of radially extending spaced cone rollers disposed in angularly displaced relation in the upper end of the housing whereby the upper surface of each cone roller has a lengthwise contact line in a common horizontal plane, means disposed to actuate the housing upwardly to move the cone rollers into engagement with the coil when the coil is positioned thereover and lift the coil above said plane of movement, and out of contact with the roller conveyor gear means connected between the cone rollers and disposed to be driven to effect simultaneous rotating movement thereof, and means disposed to intermittently drive said gear means and rotate the cone rollers whereby the coil carried thereby is rotatably indexed through a predetermined number of band receiving positions.

5. Apparatus for effecting the banding of a wound coil disposed horizontally on a roller conveyor for lengthwise movement thereof in a predetermined plane of movement, the combination therewith of, coil engaging means disposed intermediate the ends of the roller conveyor and normally below said plane of movement, means for actuating said coil engaging means upwardly from said normal position to engage the coil and lift the coil upwardly above said plane of movement and out of contact with the roller conveyor, said coil engaging means comprising a plurality of radially spaced cone rollers and means for supporting the spaced cone rollers in radially disposed angularly displaced relation with the upper surface of each of the cone rollers having a lengthwise coil engaging contact line disposed in a common horizontal plane, means disposed to simultaneously drive the cone rollers when the coil is lifted above said plane of movement to rotatably index the coil through a predetermined number of band receiving positions, and means disposed to be operated as the coil is indexed to each of said positions to stop the drive of the cone rollers to maintain the coil in a band receiving position.

6. Apparatus for effecting the banding of a wound coil disposed horizontally on a roller conveyor for lengthwise movement thereof in a predetermined plane of movement, the combination therewith of, coil engaging means disposed intermediate the ends of the roller conveyor and normally below said plane of movement, means for actuating said coil engaging means upwardly from said normal position to engage the coil and lift the coil upwardly above said plane of movement and out of contact with the roller conveyor, said coil engaging means comprising a plurality of radially spaced cone rollers and means for supporting the spaced cone rollers in radially disposed angularly displaced relation with the upper surfaces thereof having a lengthwise coil engaging contact line disposed in a common horizontal plane, gear means connected between the cone rollers and disposed to be operated to effect a simultaneous rotation of the cone rollers, indexing means disposed to be operated to effect an operation of the gear means to rotatably index the coil carried by the cone rollers through a number of predetermined band receiving positions, and means disposed to be operated by the indexing means as the coil is indexed to each of said predetermined positions to stop the operation of the gear means and rotation of the cone rollers to maintain the coil in a band receiving position.

7. Apparatus for effecting the banding of a wound coil disposed horizontally on a roller conveyor for lengthwise movement thereof in a predetermined plane of movement, the combination therewith of, coil engaging means disposed intermediate the ends of the roller conveyor and normally below said plane of movement, means for actuating said coil engaging means upwardly from said normal position to engage the coil and lift the coil upwardly above said plane of movement and out of contact with the roller conveyor, said coil engaging means comprising a plurality of radially spaced cone rollers and means for supporting the spaced cone rollers in radially disposed angularly displaced relation with the upper surfaces thereof having a lengthwise coil engaging contact line disposed in a common horizontal plane, gear means connected between the cone rollers and disposed to be operated to effect a simultaneous rotation of the cone rollers, indexing means disposed to be operated to effect an operation of the gear means to rotatably index the coil carried by the cone rollers through a number of predetermined band receiving positions, a motor disposed to be energized to effect an operation of the indexing means, limit switch means disposed to be operated by a

predetermined operation of the indexing means to effect the deenergization of said indexing motor and stop the operation of the gear means to maintain the coil in a band receiving position, and manual switch means disposed to be operated for effecting the energization of said indexing motor after each banding operation.

8. In apparatus for supporting and rotating a horizontally disposed coil, the combination comprising, a plurality of radially spaced cone rollers, means for supporting the spaced cone rollers in radially disposed angularly displaced relation with the upper surface of each of the cone rollers having a lengthwise coil engaging contact line disposed in a first common plane above the supporting means for receiving a coil thereon, means connected to the supporting means and disposed to actuate the radially spaced cone rollers upwardly and move the coil engaging contact lines to a second common plane above said first common plane, and means connected between said cone rollers disposed for operation to simultaneously drive the cone rollers in a predetermined direction.

9. In apparatus for supporting and rotating a horizontally disposed coil, the combination comprising, a plurality of radially spaced cone rollers, means for supporting the spaced cone rollers in radially disposed angularly displaced relation mounted with the upper surface of each of the cone rollers having a lengthwise coil engaging contact line disposed in a first common plane above the supporting means for receiving a coil thereon, means connected to the supporting means and disposed to actuate the radially spaced cone rollers upwardly and move the coil engaging contact lines to a second common plane above said first common plane, gears means connected between the cone rollers and disposed to be driven to effect a simultaneous rotating movement thereof in a predetermined direction, and means connected to the gear means disposed to be intermittently operated to effect an intermittent drive of the gear means and rotation of the cone rollers.

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