United States Patent

[11] 3,585,779

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[45] Patented **June 22, 1971**

[73] Assignee **Thayer, Inc.**
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[54] **APPARATUS FOR WINDING RIBBON MATERIAL APPLYING WRAPPING TAPE THERETO**
23 Claims, 28 Drawing Figs.

[52] **U.S. Cl.** **53/118,** 53/21, 72/148, 242/56, 242/67.1, 242/74
[51] **Int. Cl.** B65b 49/00, B65h 19/20
[50] **Field of Search** ..... 242/56, 78.1, 57, 64, 81, 55, 13 T, 74, 56 A, 18 A; 72/148; 53/118

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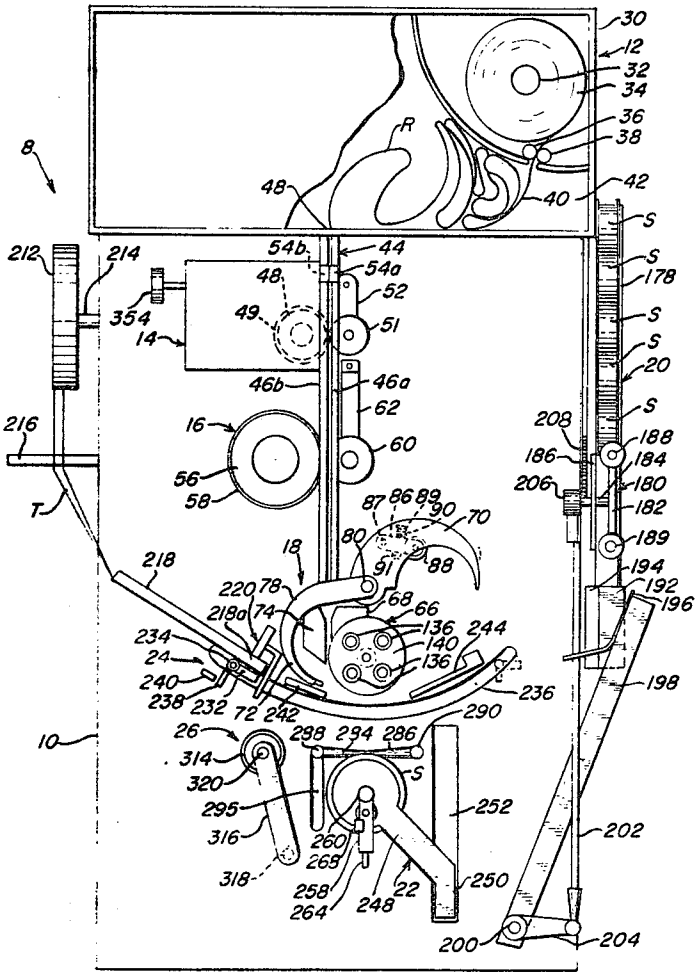
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Primary Examiner—George Mautz
Attorney—Pendleton, Neuman, Williams & Anderson

ABSTRACT: Spools are fed sequentially to a rotatable support where they are rotated. The leading end of an indeterminate length of ribbon is projected and guided around the core of the rotating spool and is pressed inward against the core for frictional engagement therewith to assist in feeding of the ribbon and to effect snubbing of the ribbon end on the rotating core. Continued rotation of the core winds the ribbon thereon. An adjustable reset meter is driven by the ribbon passing to the core and is operative to stop the rotating support to control the length of ribbon wound on each spool. Wrapping tape is positioned beside the filled spool on the support. The tape and ribbon are temporarily clamped to the spool core and the ribbon is cut. The spool is then moved in a direction toward the tape and between a pair of folders which fold the tape ends about the ribbon into overlapping relation where they are secured together.



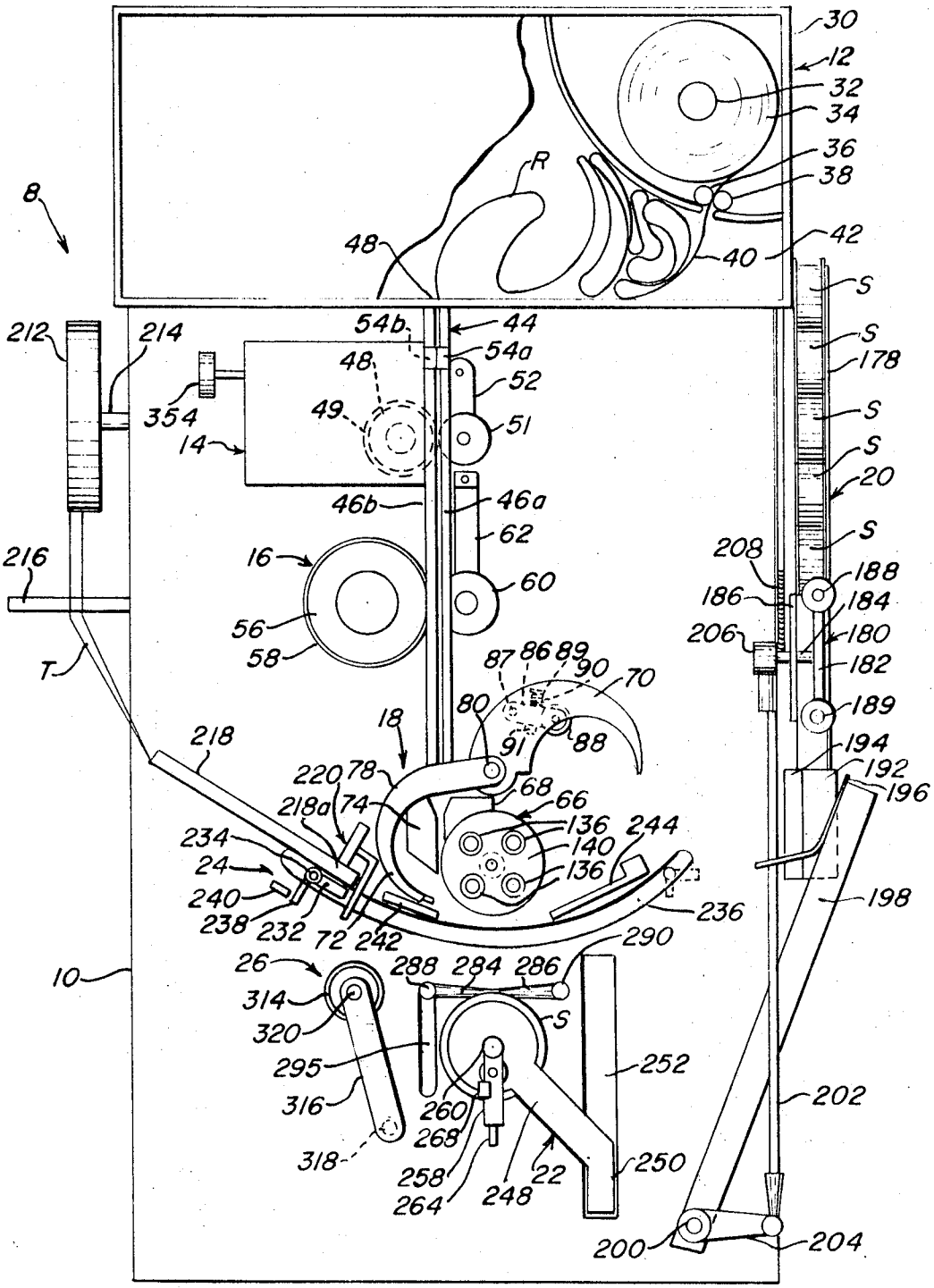


Fig. 1

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Fig. 2

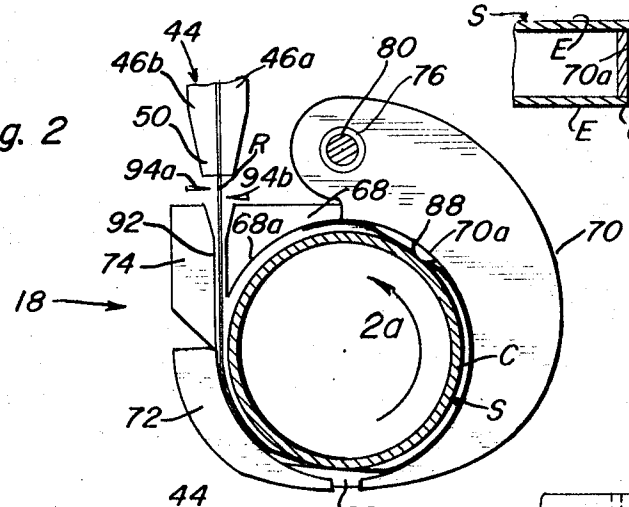


Fig. 2a

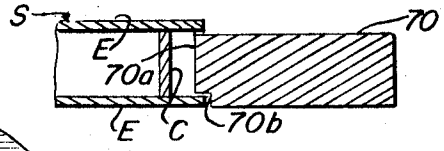


Fig. 3a

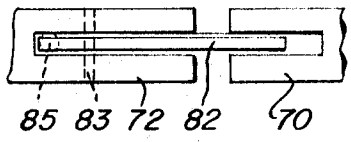


Fig. 3

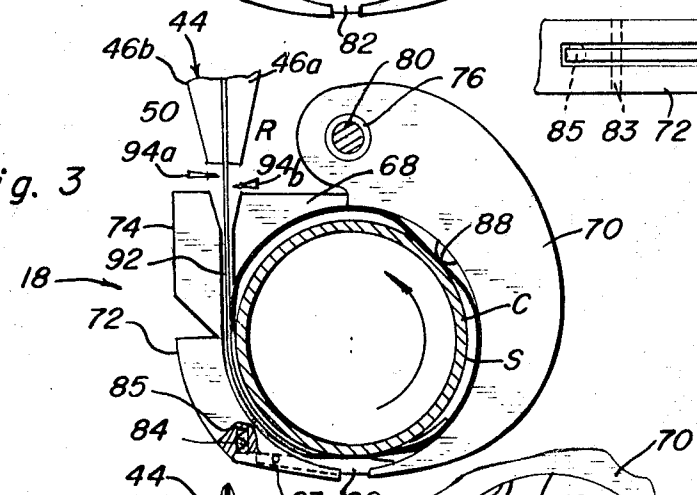
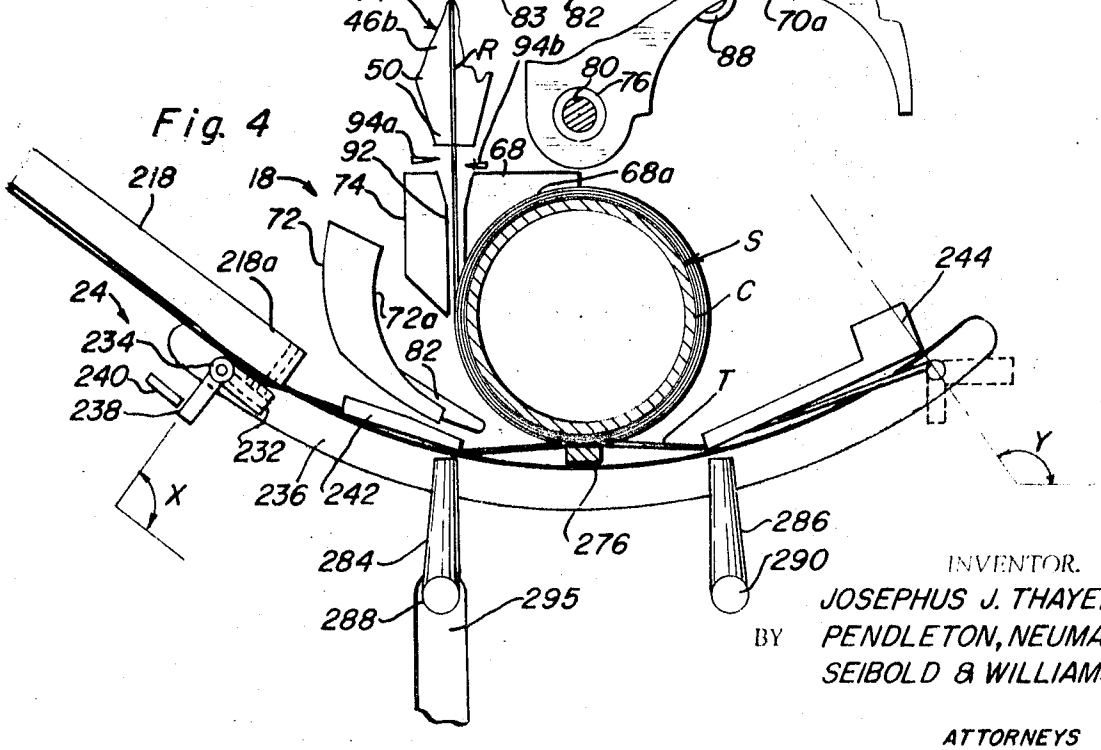


Fig. 4



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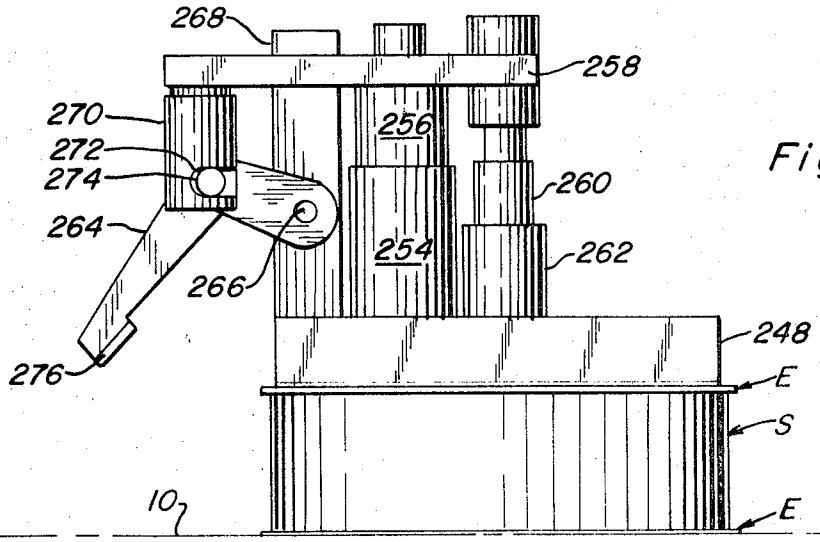


Fig. 5

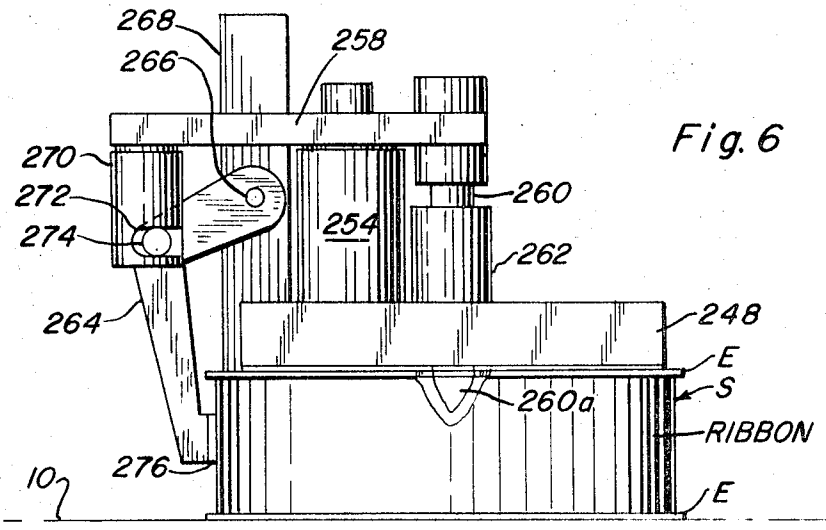


Fig. 6

Fig. 7

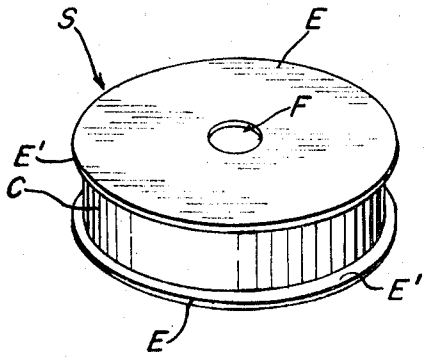
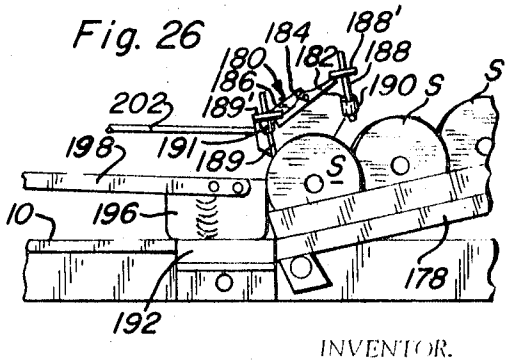


Fig. 26



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Fig. 8

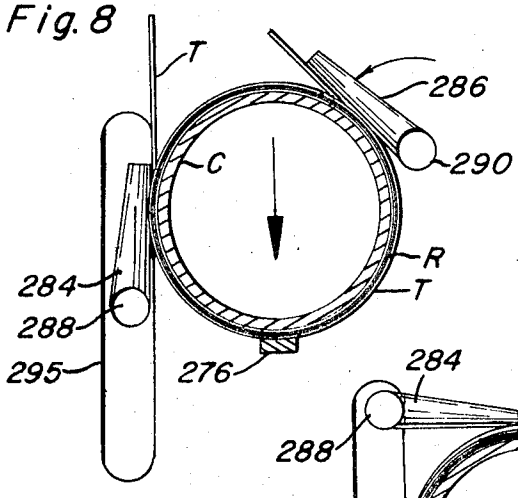


Fig. 9

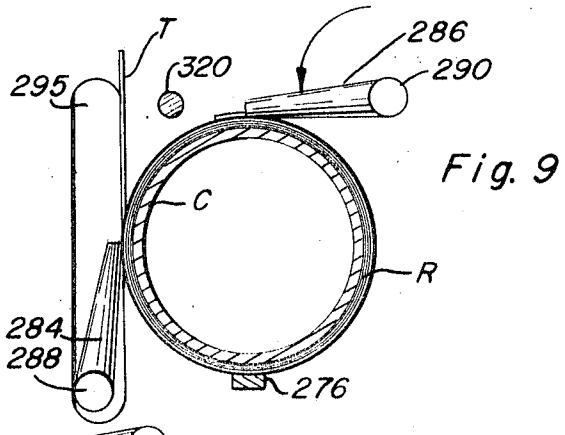


Fig. 10

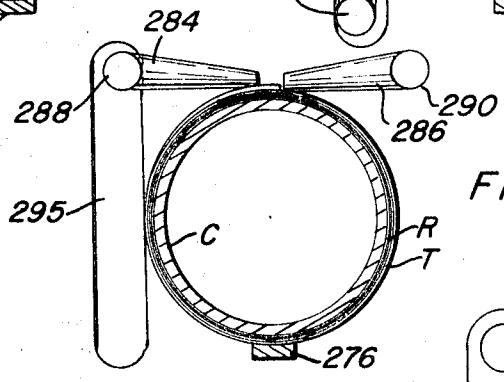


Fig. 13

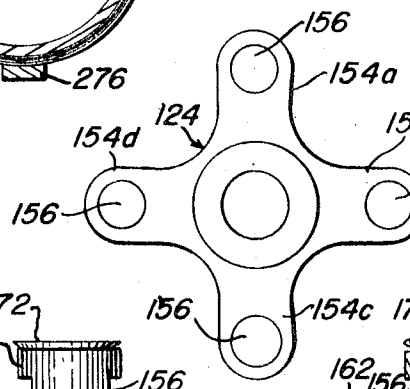


Fig. 11

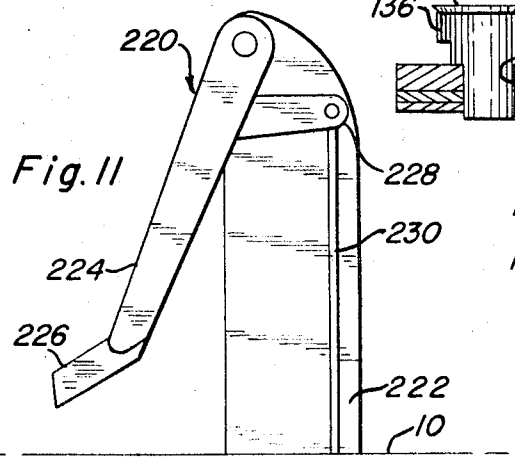
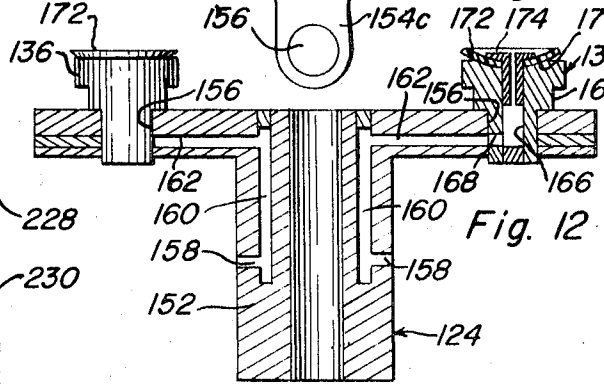


Fig. 12



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Fig. 14

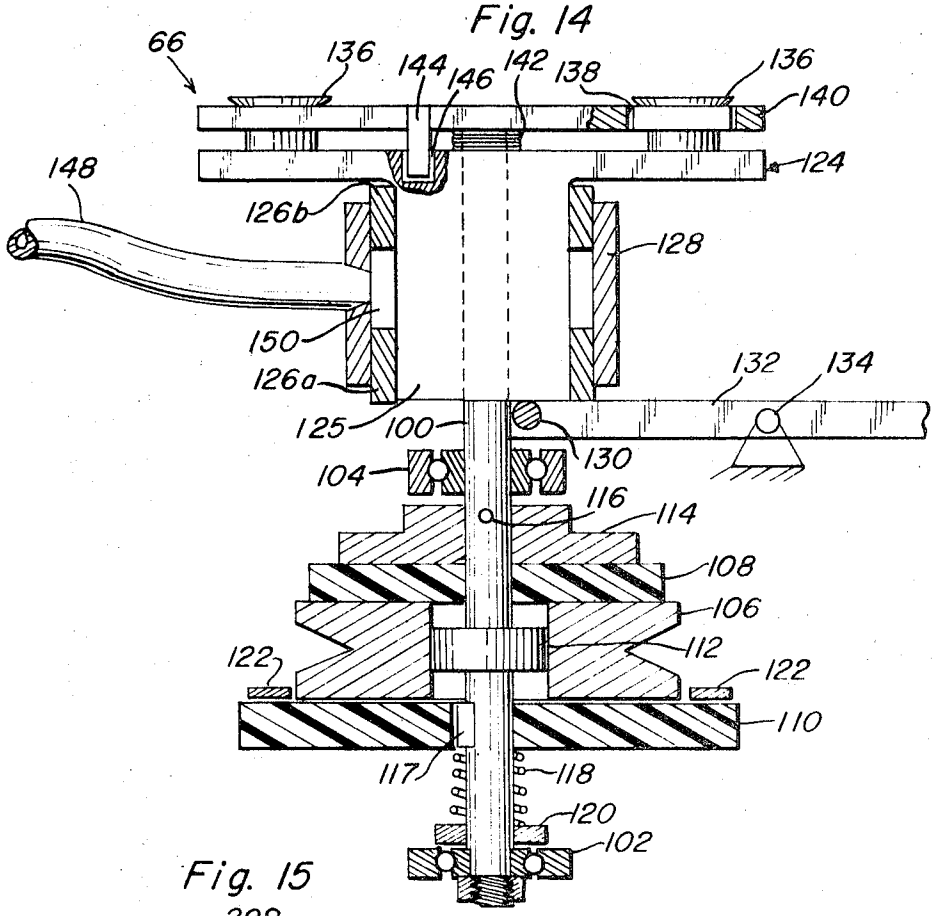


Fig. 15

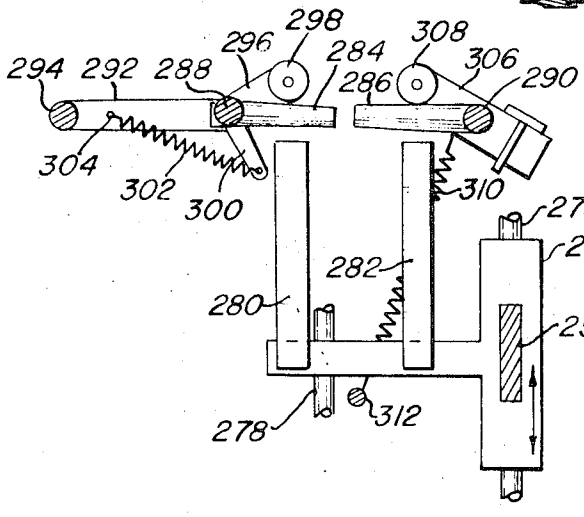
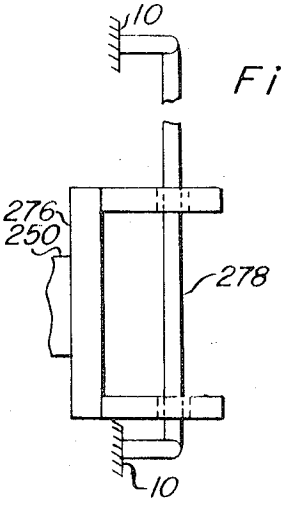


Fig. 16



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Fig. 17

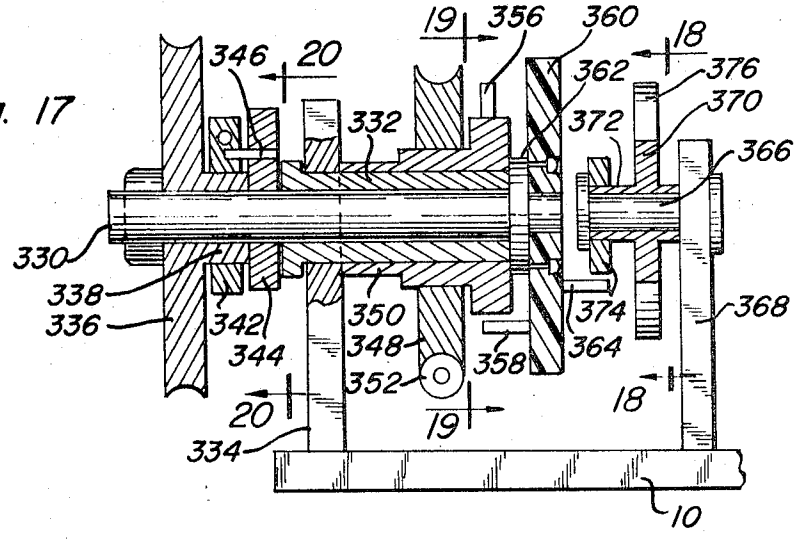


Fig. 18

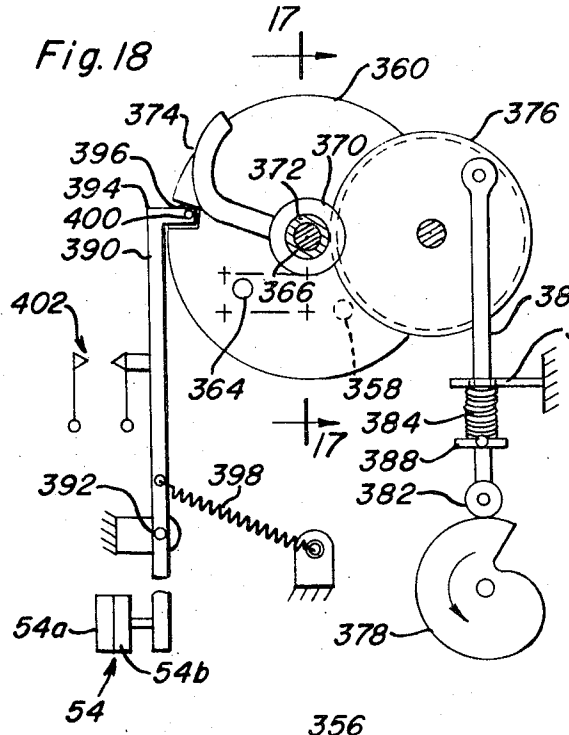
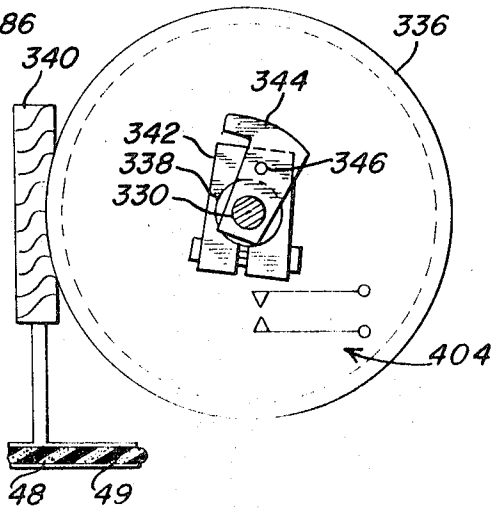


Fig. 20



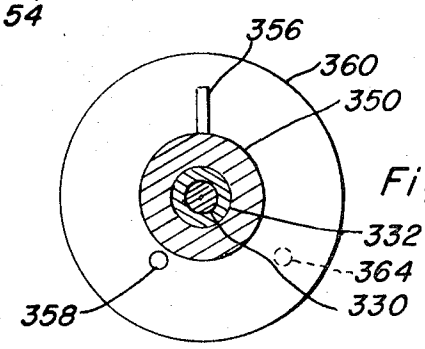


Fig. 19

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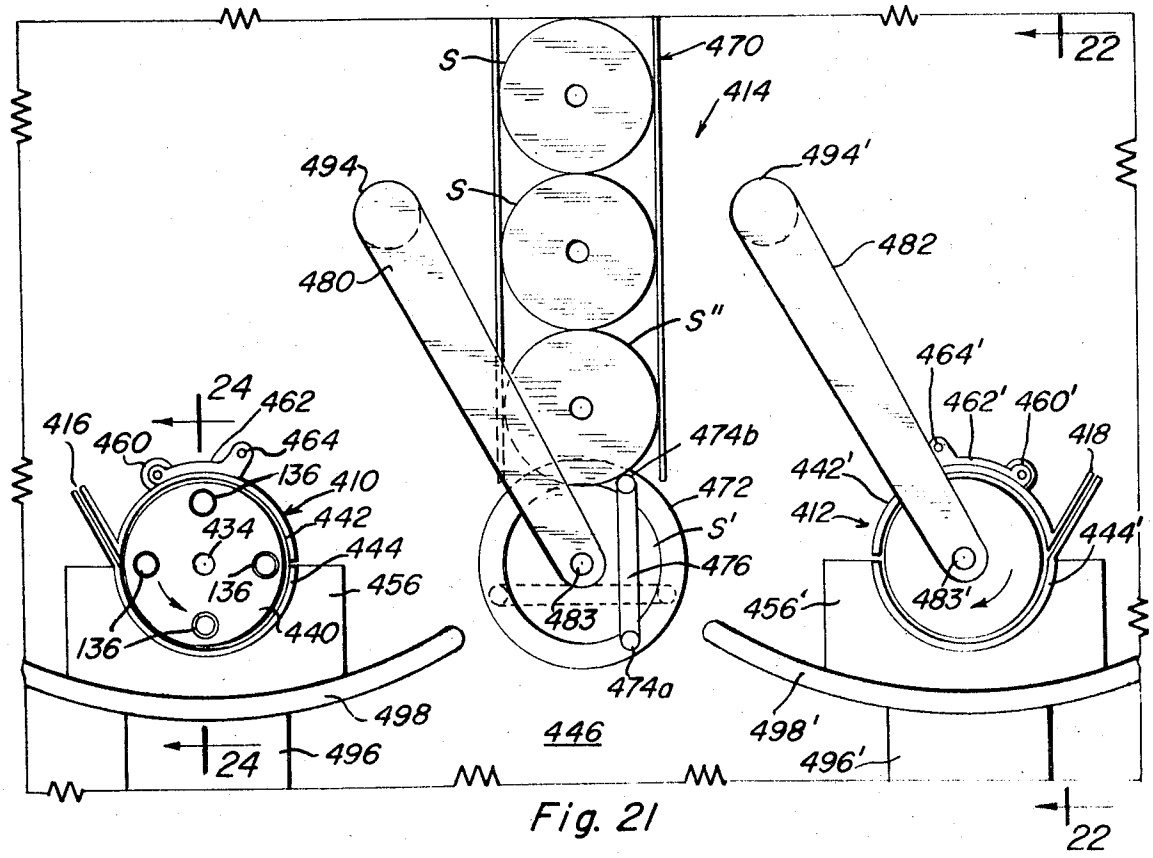


Fig. 21

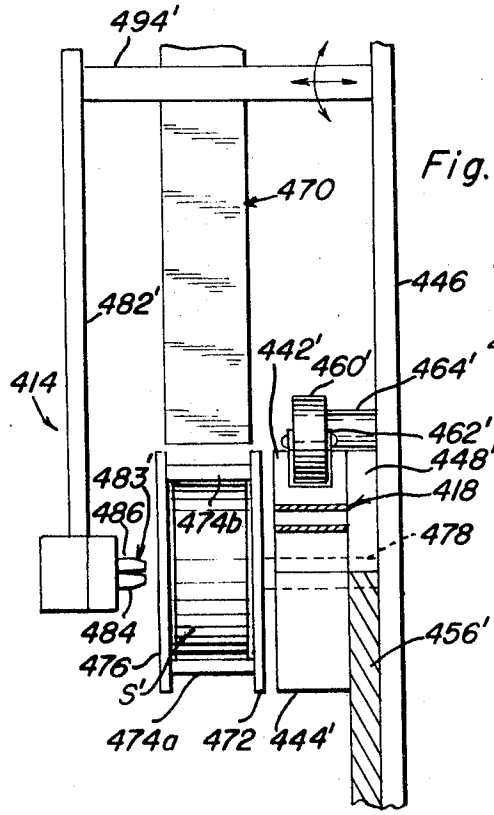


Fig. 22

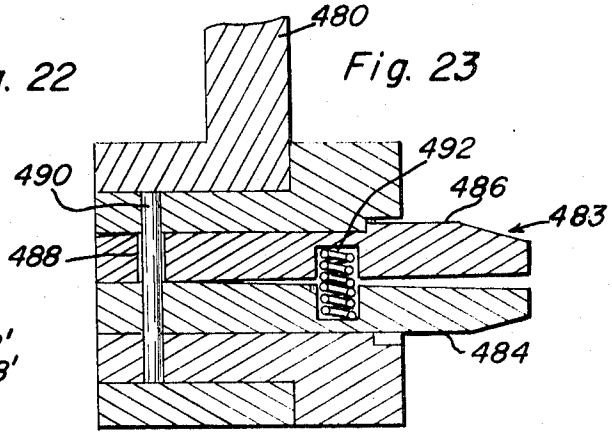


Fig. 23

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Fig. 24

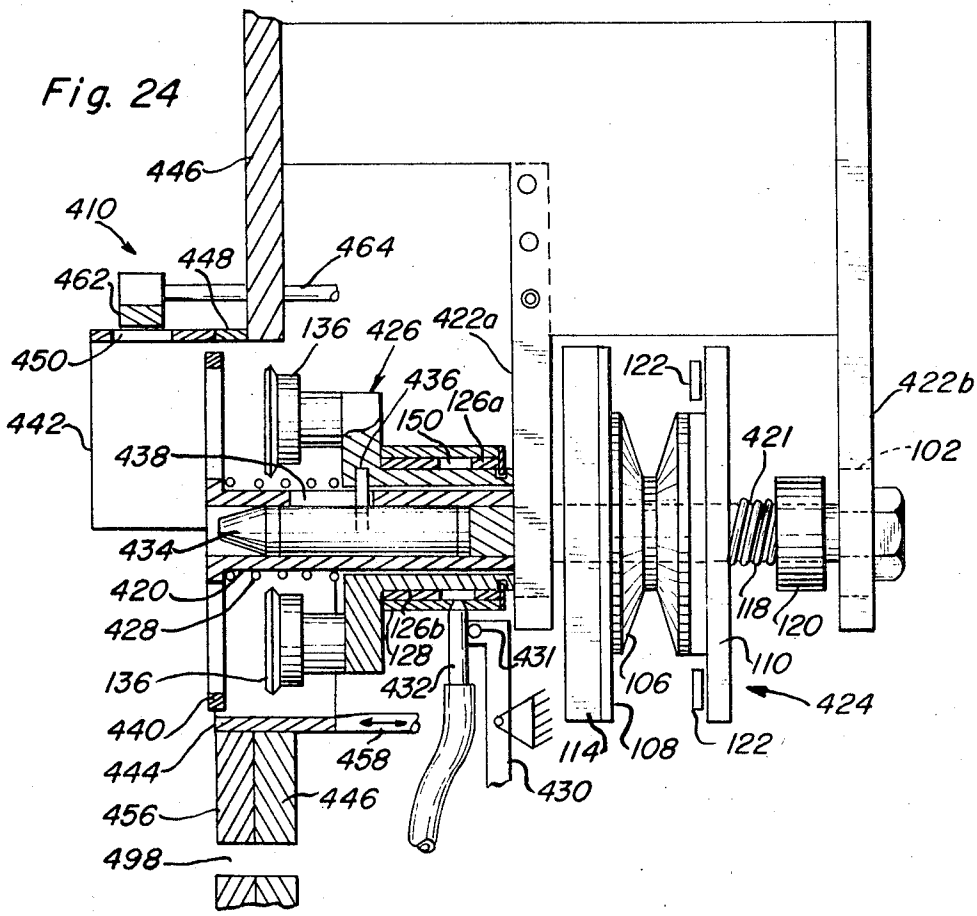
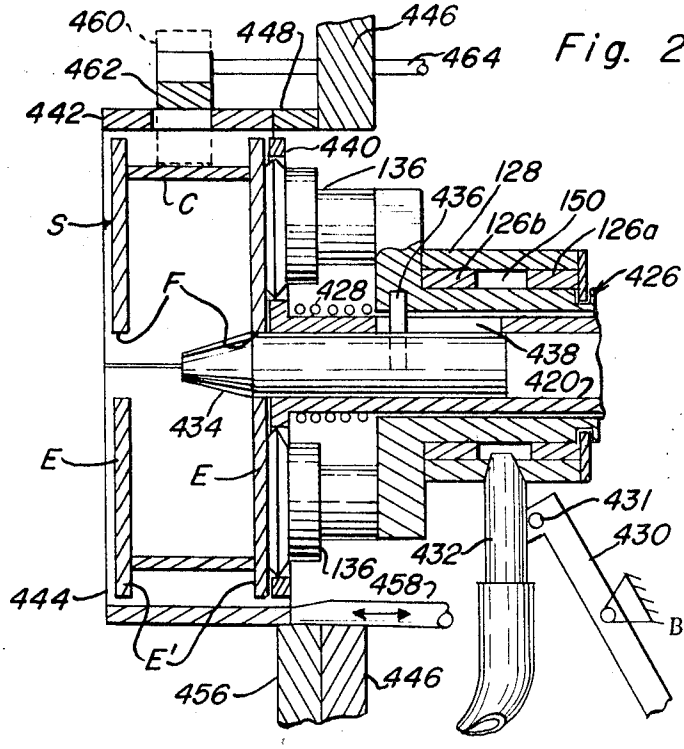


Fig. 25



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APPARATUS FOR WINDING RIBBON MATERIAL APPLYING WRAPPING TAPE THERETO

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention pertains to machines and methods for winding spools and more particularly to machines and methods for automatically winding a predetermined length of ribbon onto each of a series of spools with the ribbon being drawn from a supply of indeterminate length.

2. Description of the Prior Art

Various types of ribbon, tape, or other ribbonlike materials are often produced in essentially continuous processes and are supplied on reels each of which contains a large quantity of ribbon in one continuous length. Much of this ribbon is ultimately sold to the purchaser in relatively short lengths, such as lengths of a few feet or a few yards. A popular manner of packaging and marketing such short lengths is with each length wound on an individual spool. Thus there is a requirement for machines and methods for rapidly, accurately and economically winding predeterminable and usually short lengths of ribbon on individual spools from a supply of indeterminate length. One specific prior machine for serving this general purpose is disclosed in my prior U.S. Pat. No. 2,984,425, issued May 16, 1961.

Summary of the Invention

It is an object of this invention to provide a new and useful approach in automatically winding ribbonlike materials on spools. Further objects of this invention are to provide novel machines of simple and economical construction for automatically winding a predetermined length of ribbon on each of a succession of spools; to provide new and useful methods and apparatus for securing the leading end of a length of ribbon on a spool in a winding operation; to provide new and useful methods and apparatus for retaining ribbon on a spool and more particularly for wrapping ribbon which has been wound on a spool; and to provide new and useful control apparatus for metering ribbon and controlling the winding of the ribbon on spools.

In carrying out this invention in one illustrative form to accomplish the foregoing objects, means is provided for supporting and rotating a spool. Feed means project the leading end portion of a length of ribbon circumjacent the spool in an inwardly spiralling convolution while the spool is rotated. A presser engages at least a portion of the innermost turn of such ribbon against the periphery of the spool whereby the ribbon is automatically snubbed on the spool core by the rotational movement thereof and by the frictional engagement of the core with the ribbon material. Continued rotation of the spool winds the ribbon thereon. Apparatus is provided for positioning a length of wrapping tape adjacent the wound spool. The filled spool is moved transversely of the tape to engage the tape and to cause the tape to envelop the ribbon wound on the spool. Folding means fold the ends of the wrapping tape into overlapping relation, and the overlapped ends are secured together to cover and retain the ribbon on the spool. An adjustable control mechanism accurately controls the amount of ribbon wound on each spool.

For a more complete understanding of this invention reference should now be had to the embodiments illustrated in the drawings by way of examples of the invention.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of a spool winding machine employing teachings of this invention;

FIGS. 2 and 3 are enlarged plan views of mechanism at the spool winding station of the machine in FIG. 1, with a spool shown in section in the winding position;

FIG. 2*a* is a partial cross-sectional view taken on line 2*a*–2*a* of FIG. 2;

FIG. 3*a* is an elevation view of parts of the mechanism of FIGS. 2 and 3;

FIG. 4 is a plan view of the apparatus of FIGS. 2 and 3 during another stage in the operation of the machine, and includes elements of the spool wrapping mechanism;

FIGS. 5 and 6 are enlarged elevation views of the spool transfer mechanism of the machine in FIG. 1;

FIG. 7 is a perspective view of a ribbon spool;

FIGS. 8, 9 and 10 are schematic illustrations of steps in the operation of the spool wrapping mechanism of the machine in FIG. 1;

FIG. 11 is an elevation view of a tape severing mechanism;

FIG. 12 is an enlarged cross-sectional view of the spool gripping elements of the machine in FIG. 1;

FIG. 13 is a plan view of the spider element of FIG. 12, on a reduced scale;

FIG. 14 is an enlarged view, partially in section, of the spool support mechanism of the machine of FIG. 1;

FIG. 15 is a plan view of the arrangement for support and movement of the spool transfer mechanism and operation of the folders of the machine of FIG. 1;

FIG. 16 is a right end view of a part of the mechanism of FIG. 14;

FIG. 17 is a schematic cross-sectional view of a ribbon metering apparatus employing teachings of this invention, taken along line 17–17 of FIG. 18;

FIGS. 18, 19 and 20 are cross-sectional views taken along lines 18–18, 19–19 and 20–20, respectively, of FIG. 17;

FIG. 21 is a front elevation view of the spool winders and spool supply apparatus of another spool winding machine employing teachings of this invention;

FIG. 22 is an enlarged view, partially in cross section, taken generally along line 22–22 of FIG. 21;

FIG. 23 is an enlarged partial cross-sectional view of the outer end portion of a spool transfer arm of the machine in FIG. 21;

FIG. 24 is an enlarged view, partially in cross section, taken generally along line 24–24 of FIG. 21, with the lower half of the ribbon guide retracted;

FIG. 25 is an enlarged view similar to FIG. 24 with a spool in position to be wound with ribbon, and

FIG. 26 (see sheet 3) is a side elevation view of a portion of the spool supply mechanism of the machine in FIG. 1.

DESCRIPTION

The illustrated embodiments of the invention are adapted for winding a predetermined length of ribbon on each of a succession of spools S, see FIG. 7. Each of these spools comprises a circular cylindrical core C and opposed circular end rims E, and may be formed of paper stock, sheet metal or other suitable material. The rims E are of a larger diameter than the core C to form annular flanges E′ protruding beyond the core C. The spool S is formed with axial openings F in the ends E.

Referring particularly to FIG. 1, the illustrated machine 8 comprises a frame 10 on which is supported ribbon supply apparatus 12, ribbon metering means 14, ribbon feeding apparatus 16, spool winding mechanism 18, empty spool supply mechanism 20 and spool transfer means 22 which cooperates with wrapper applying mechanism 24 and 26 for applying a wrapper to a spool of ribbon after winding is completed.

The ribbon supply mechanism 12 includes a housing 30 in which is provided a spindle 32, for supporting a spool of ribbon, tape, or other ribbonlike material R, as at 34, together with a pair of feed rolls 36 and 38, one of which is driven to provide a supply of loose folds of ribbon 40 in compartment 42 in a manner generally known in this art. A ribbon guide 44, comprising a pair of spaced bars 46*a* and 46*b*, extends from an outlet opening 48 in housing 30 to a terminal or outlet end 50 adjacent the winding mechanism 18 (see FIGS. 2—4).

Ribbon metering mechanism 14 and ribbon feed mechanism 16 are disposed along the guide 44 as illustrated in FIG. 1. The metering mechanism may be of any type adapted

for controlling the operating cycle of the machine 8 in response to the passage of a predetermined length of ribbon. One particular advantageous metering mechanism 14 disclosed herein utilizes as its sensing element a metering wheel 48 having a frictional peripheral surface element such as a rubber O-ring 49 for engaging the ribbon. An opposed presser roller 51, supported on arm 52, presses the ribbon into frictional engagement with the peripheral element on wheel 48. Opposed blocks 54*a* and 54*b* serve as a brake mechanism, as will be described further below.

The ribbon feed mechanism 16 includes a driven feed wheel 56, having a suitable frictional peripheral surface element, such as a rubber O-ring 58, and a cooperating opposed presser roller 60 for engaging ribbon against the frictional element on wheel 56. Wheel 60 is mounted on arm 62 for movement into and out of engagement with the ribbon in guide 44.

SPOOL WINDING APPARATUS

Referring to FIGS. 2, 3 and 4, as well as to FIG. 1, the winding mechanism 18 includes a rotatable support 66 with suitable means for gripping a spool placed thereon, and guide blocks 68, 70, 72 and 74. Blocks 68 and 74 are fixed to frame 10. Block 70 is pivotally supported on a sleeve 76, and block 72 is mounted on the underside of an arm 78 (see FIG. 1), which is pivotally supported on a shaft 80. Blocks 68, 70 and 72 have inner arcuate surfaces 68*a*, 70*a* and 72*a* which are complementary with block 74 in that, when blocks 70 and 72 are in a closed position as in FIGS. 2 and 3, they define a right circular cylindrical enclosure axially aligned with the rotatable support 66. This enclosure is of a diameter somewhat greater than the diameter of a core C, but which may be less than the diameter of the core ends E, whereby the guide blocks and a core C on support 66 define an annular cavity circumjacent the core.

The blocks 70 and 72 are undercut along the lower edges of their inner surfaces, as at 70*b* in FIG. 2*a*, to the diameter of the lower rim E. That is, when the blocks 70 and 72 are completely closed, i.e., with the distal ends abutting one another, the undercut portions define a circle of a diameter substantially corresponding to the diameter of the lower rim E to accurately position a spool coaxial with support 66. Block 68 may be similarly undercut if its position is such that its surface 68*a* protrudes within this defined circle.

The adjacent ends of blocks 70 and 72 are bifurcated (see FIG. 3*a*). A finger 82 is mounted between the end portions of block 72 and extends between the adjacent end portions of block 70 when the blocks are in their closed position. Finger 82 is pivotally supported on a pivot pin 83 (see also FIG. 3). A compression spring 84 is seated in a recess 85 and bears against the adjacent end of finger 82 to urge the outer or distal end of the finger inwardly against the core C.

Referring again to FIG. 1, a yoke 86 is disposed in a recess in block 70 and is pivotally supported on a pin 87. A presser roller 88 is supported in the outer end of the yoke. A compression spring 89 disposed in a recess 90 urges yoke 86 outward toward a stop 91, and thereby presses roller 88 against core C when block 70 is in its closed position as in FIGS. 2 and 3.

Block 74 cooperates with the adjacent edge of block 68 to form a guide channel 92 extending from a point adjacent the outlet end of channel 44 to the space defined by blocks 68—74. As seen in FIGS. 2—3, the axis of channel 92 extends tangentially of the circular space defined by the blocks. A suitable ribbon cutting mechanism is provided, such as a solenoid operated scissors mechanism having blades 94*a* and 94*b* protruding upwardly through an opening in frame 10, to sever the ribbon between the end of channel 44 and the inlet end of channel 92.

Referring now to FIGS. 12, 13 and 14 the support mechanism 66 comprises a shaft 100 rotatably mounted in a thrust bearing 102 and a journal bearing 104 suitably supported in frame 10. A constantly driven pulley 106 is positioned between a pair of clutch plates 108 and 110 and is journaled on a bearing 112 on shaft 100. A retainer plate 114 is fixed to shaft 100 above the clutch plate 108 as by a pin or set screw 116. A key 117 is fixed in shaft 100 and engages a slot in clutch plate 110 to provide rotary drive engagement therebetween while permitting movement of the plate 110 axially of the shaft. A compression spring 118 is confined between the lower clutch plate 110 and a collar 120 fixed to shaft 100 to engage the clutch plates with the pulley 106 and to engage plate 108 with plate 114. A clutch fork is provided with arms 122 for moving clutch plate 110 downwardly against the force of spring 114 to disengage the pulley and clutch plates and to exert a braking action on the plate 110.

Surrounding the upper portion of shaft 100 is a gripper support and manifold element 124 comprising a spider 125, spaced rings 126*a* and 126*b*, and a sleeve 128. The rings are mounted in sleeve 128, which is fixed against rotation, and a rotary seal is provided between each ring and the spider 125. Element 124 has limited reciprocating movement along shaft 100 and is supported on a pin 130 in a rocker arm 132 which is supported on frame 10 as illustrated schematically at 134. Four gripper elements 136 are mounted on the spider 125 and project upwardly through openings 138 in a disc or plate 140 which is carried on the upper end of shaft 100. A compression spring 142 urges manifold 124 downwardly along shaft 100, against support pin 130. A drive pin 144 is secured in plate 140 and projects into a recess 146 to maintain rotary drive engagement between plate 140 and spider 125 as element 124 reciprocates. A conduit 148 communicates with the annular space 150 surrounding element 124 within sleeve 128, between rings 126*a* and 126*b*, and with suitable means (not shown), such as an air pump, for providing a vacuum.

With particular reference to FIGS. 12 and 13, the spider 125 includes an annular body section 152 and four radial arms 154*a—d*. A gripper 136 is supported in an opening 156 in each of these arms. Bores 158, 160, and 162 define passages communicating with the annular space 150 (see FIG. 14) and with each of the openings 156. Each of the grippers 136 includes a stem 164 having a central bore 166 and a lateral bore 168 communicating with the bore 166 and with the respective bore 162. The upper surface of stem 164 is formed with a concave depression 170. A resilient disc 172 is secured in this depression by a hollow screw 174 to form a suction cup at the upper end of each gripper.

The four grippers 136 are positioned to engage and grip a spool S in the annular area between the center opening F and the outer periphery of a rim E.

SPOOL SUPPLY MECHANISM

Referring to FIGS. 1 and 26, the spool supply mechanism 20 comprises an inclined channel-shaped guide 178 and a spool release mechanism 180. The guide 178 supports a series of spools S in single file and is at an angle of inclination such that the spools will roll down the guide under their own weight. The mechanism 180 comprises a rocker arm 182 on a shaft 184 which is mounted in a support plate 186 extending vertically from frame 10. Stop pins 188 and 189 are freely reciprocable in sleeves 190 and 191 mounted on plate 186 over the lower end of guide 178. Collars 188′ and 189′ on the pins extend over the respective ends of arm 182, whereby each pin may be raised by arm 182 from a lower position, in which the pin extends into the path of a spool S moving down guide 178, to a retracted position permitting passage of such a spool therebeneath. The spacing between pins 188 and 189 corresponds to or is slightly less than the diameter of a spool S. As the arm 182 is pivoted to raise pin 188, a spool will move downward along guide 178, beneath pin 188, against pin 189. Thereafter when arm 182 is pivoted in the opposite direction, i.e., to raise pin 189, pin 188 will drop into the path of the second spool before pin 189 is raised a sufficient distance to release the leading spool.

When the leading spool is released by pin 189, it rolls onto a plate 192 having a recess 194 at its inner edge. The inner rim

E drops into recess 194 and the spool abuts an angular guide plate 196 mounted on arm 198 whereby the spool is stopped in its forward motion and tips inwardly to lie flat atop frame 10. Arm 198 is then pivoted inward on mounting shaft 200 to slide the spool into a position to be engaged by block 70 when this block is moved from the open position of FIG. 1 to the closed position of FIGS. 2 and 3.

A connecting rod 202 is joined to an operating arm 204 on shaft 200 and to a similar arm 206 secured to shaft 184 to effect the aforementioned rocking motion of arm 182 during the feed movement of arm 198. A spring 208 secured to arm 206 and to frame 10 assists in the operating movement of the arm 198 and the release mechanism 180. Thus as arm 198 moves inward to position a spool within the arc of movement of block 70, pin 188 is raised to permit the column of spools in guide 178 to advance against pin 189. As arm 198 returns to its retracted position, as in FIG. 1, the arm 182 is pivoted to its opposite position to release the leading spool S for movement into feeding position.

Other suitable feed means may be utilized to supply the empty spools. For instance, one alternative is to provide a magazine which supplies the spools to a position immediately above the area between support 66 and the retracted position of block 70, with the rims parallel to the upper surface of frame 10. The back portion of block 70 may then be extended to support the lowermost spool when the block is closed, and this lowermost spool will be dropped in front of the block when the block is retracted as in FIG. 1.

OPERATION OF WINDING APPARATUS

In the operation of the mechanism thus far described, ribbon is threaded from the loose folds 40 through guide 44, between the brake elements 54*a* and 54*b*, between metering wheel 48 and presser roller 51, and between feed wheel 56 and presser roller 60. Manifold element 124 is lowered to retract the grippers 136 beneath the upper surface of plate 140, and the clutch between pulley 106 and shaft 100 is disengaged. The feed mechanism 20 is operated as aforedescribed to position an empty spool S within the arc of movement of block 70. The blocks 70 and 72 then move from the open position of FIGS. 1 and 4 to a completely closed position to locate the spool atop support 66 in axial alignment with the shaft 100, by engagement of the undercut portions with the lower rim E. Arm 132 is then moved to raise the manifold element 124 to place the grippers 136 in abutment with the lower rim E, whereupon a vacuum is drawn in the cups 172, through conduit 148, to grip the superposed spool. Thereafter, the arms 70 and 74 move outward slightly, to the positions illustrated in FIGS. 2 and 3, to allow the spool to turn freely within the blocks. Arms 122 are then moved upward to permit engagement of the clutch plates 108 and 110 with the driven pulley 106 and with the plate 114 for rotating the support 66 and the spool S thereon.

Feed wheel 56 of feed mechanism 16 is rotated to project the leading end portion of the ribbon through guide 44 and along the annular cavity between the core C and the blocks 68, 70, 72 and 74, in the direction of rotation of the spool; see FIG. 2. The length of ribbon fed by the movement of wheel 56 is at least sufficient to extend the ribbon beneath finger 82 and presser roller 88. The flanges E' prevent the ribbon from escaping from the annular cavity during this initial feeding operation.

As the leading end portion of the ribbon is projected about the annular cavity, the natural resilience of the ribbon normally will cause it to conform to the outer surface of the cavity, i.e., the inner arcuate surfaces of the blocks. However, the finger 82 and the presser roller 88 press the ribbon thereunder against the core C. This radial pressure on the ribbon assures frictional engagement between the core and the ribbon whereby the rotary movement of the core will draw the ribbon into the annular space and continue the projection of the leading end around the core. Thus the feeding action of wheel 56 may be discontinued at this stage of the operation.

As the leading end of the ribbon completes one convolution about the core and again passes under finger 82 and roller 88, beneath the now completed first turn of ribbon, the continued rotation of the core causes the innermost convolution of ribbon to be drawn snug (i.e., to be snubbed) on the core C. This places the entire inner convolution of ribbon in frictional engagement with the core C in a self-actuating gripping action whereupon continued rotation of the spool draws ribbon from the supply through the guide 44 and winds the ribbon about the core.

It has been found that either the finger 82 or the roller 88 alone will establish adequate initial frictional engagement of the ribbon with the core whereby the rotating core will draw the ribbon into the annular cavity and complete the first convolution to establish the snubbing action. However, the roller presser arrangement is preferred as the roller provides less drag on the ribbon than a stationary finger.

With a presser element such as finger 82 and/or roller 88, the feed wheel 56 is required only to feed the leading end of the ribbon beneath the presser. However, providing an initial feed motion of wheel 56 adequate to extend the leading end of the ribbon one full turn and beneath the ribbon at the point it passes beneath the presser insures feeding of the ribbon to the snubbing point. Moreover, it has been found that in many instances snubbing action may be obtained without any presser element by projecting the ribbon end more than one turn. It is believed that in this latter type of operation the overlying ribbon serves to press the underlying end into frictional engagement with the core to initiate the snubbing action. However, the use of an extrinsic presser greatly enhances the reliability of promptly obtaining the snubbing action in a high speed operation.

A further factor in feeding the ribbon and snubbing it on the core is the velocity of the ribbon projected by wheel 56 relative to the peripheral velocity of the core. The feeding and snubbing functions may be carried out with the ribbon being initially projected at a velocity greater than the peripheral velocity of the core. However, rotating the spool at a rate to provide a peripheral velocity of the core greater than the velocity of projection of the ribbon by the initial feed means is preferred. This enhances any tendency of the ribbon to engage the core and thus facilitates the snubbing action. Further, such overspeed of the core permits the rotating core to control the feeding and winding motion as soon as the ribbon is adequately engaged thereby for prompt and smooth transition from the initial projection feed motion to the winding operation. Feed wheel 56 may be driven through a one-way clutch to facilitate this transition. In addition, the preferred overspeed of the core insures against wrinkling or pile-up of the ribbon between the channel 92 and the point of gripping of the ribbon on the core, as beneath presser 82 or 88.

The blocks 70 and 72 are opened immediately after the ribbon is snubbed. This insures ample room for the ribbon to accumulate on the core during the winding operation and allows the ribbon to be secured on the core as soon as the winding is completed.

After the initial feed rotation of wheel 56, presser roller 60 is withdrawn, as by a suitable cam drive to arm 62, to prevent drag upon the ribbon by the feed mechanism 16. When a predetermined length of ribbon has been wound on the core, as measured by the metering mechanism 14, the rotation of the support 66 is halted by moving fork 122 downward against plate 110 to disengage the clutch. The braking action of the fork on plate 110 also assists in bringing the winding mechanism to a stop and holds the support 66 in a fixed position after it has been stopped. Brake elements 54*a* and 54*b* also may be used to clamp the ribbon and thus to assist in preventing coasting of the winding mechanism in high speed operations.

After the wound ribbon is clamped or otherwise secured against springing loose on the spool, as will be described below, the ribbon cutting mechanism (scissors blades 94*a* and 94*b*) is actuated to sever the ribbon.

Utilizing the aforedescribed apparatus, with only finger 82 as a presser, and projecting the ribbon slightly over one full turn by wheel 56 at a velocity less than the peripheral velocity of the core, a smooth glossy nonwoven ribbon product has been successfully wound on spools with uncovered paper tube cores, as well as on similar spools having a cover of this ribbon over the cores. Thus, the relation of the coefficients of friction between the core and the ribbon and between successive turns of the ribbon does not presently appear to be critical. The ribbon, of course, must be of sufficient body to sustain being projected about the spool to form the first convolution in the aforedescribed operation.

WRAPPER APPLYING APPARATUS

Referring to FIG. 1, a spool of tape T suitable for wrapping the ribbon wound on spool S between flanges E' is mounted on a support 214 on the frame 10. The tape T, which may be clear acetate, is threaded over a guide 216 and through an open channel member 218. The member 218 is provided with openings in its front face at the inner end 218*a*, with these openings being in communication with suitable means (not shown) to provide light vacuum retention of the tape end. A tape cutting mechanism 220 is mounted for cutting the tape T adjacent the inner end 218*a*. As illustrated in FIG. 11, the mechanism 220 includes a support 222 secured to frame 10, a knife arm 224 carrying a cutting blade 226, an arm 228 secured to arm 224 and an operating rod 230 connected to suitable drive means, such as a solenoid or pneumatic piston (not shown). Other suitable cutting means, such as a scissors or other shear device may be utilized.

Referring now to FIG. 4, as well as to FIG. 1, a tape feed pad 232 is mounted on a hollow carrier stem 234 suitably supported on a pivot arm which is driven for movement of the pad 232 along the arcuate slot 236 between the end positions illustrated in FIGS. 1 and 4. The pad 232 is provided with bores having openings in its forward face. These bores are also in communication with a vacuum means (not shown), through the hollow carrier stem 234, to provide suction and friction gripping of the tape T against pad 232. The suction gripping of the tape on pad 232 is greater than at end 218*a* to permit the pad to withdraw the tape from the guide 218. A finger 238 on pad 232 engages a stop 240 on frame 10 when the pad is at the tape pickup station to position the pad parallel to and in contact with guide 218. The pad 232 is spring loaded to turn in a clockwise direction as soon as it moves to the right away from stop 240; note the angles designated as X and Y in FIG. 4. This insures that the pull on the tape will not be in a direction away from the front face of pad 232 as the pad moves from the pickup station to the opposite end of slot 236. In this movement the pad 232 draws the tape over the outer edge surfaces of stationary tape guide blocks 242 and 244. The tape thus extends from guide 218*a* to the pad 232 in the right end position shown in dashed lines in FIGS. 1 and 4 and, in elevation, is positioned between the planes of the flanges E', directly opposite the ribbon on core C. The length of tape from the cutter mechanism 220 to the right end position of pad 232 is sufficient to circumscribe the ribbon wound on core C and to provide overlap of the tape ends.

The spool transfer mechanism 22 illustrated in FIGS. 1, 5 and 6 comprises a carrier plate 248 mounted on a post 250 which is reciprocated along a slot 252 in frame 10. Plate 248 is spaced above the top of frame 10 a distance somewhat greater than the thickness of spool S. Mounted on carrier 248 is a pneumatic cylinder 254 in which is received a reciprocating piston 256. A cross arm 258 is mounted on the upper end of piston 256 and carries a pin 260 which reciprocates in a sleeve 262 on plate 248. Pin 260 extends through an aligned opening in plate 248 when moved downward and has a tapered lower end 260*a* (see FIG. 6) for engaging the opening F in a spool S. A bellcrank arm 264 is pivotally mounted as at 266 on a support 268 extending upwardly from member 248. A stud 270 carried on cross bar 258 is provided with a slot 272 which engages a pin 274 on the bellcrank 264. A resilient gripper pad 276 is secured on the distal end of the crank 264. The vacuum source communicates with cylinder 254 through suitable bores in the carrier 248 for operation of the piston 256 between its extended position as illustrated in FIG. 5, and the retracted position illustrated in FIG. 6. A spring is provided within cylinder 254 to urge piston 236 towards the extended position of FIG. 5.

As shown in FIGS. 15 and 16, the transfer mechanism 22 is supported by post 250 on a support 276 which is reciprocable along a pair of slide rods 278 supported on frame 10. A pair of cam bars 280 and 282 are carried on support 276 and extended parallel to the direction of reciprocation of support 276.

Referring to FIGS. 1, 4, 15 and 16, a pair of folders 284 and 286 are mounted on pivot shafts 288 and 290. Shaft 288 is carried on an arm 292 pivotally mounted on a shaft 294. Shaft 294 is secured to frame 10 in a position located on a line normal to slot 295 (see FIG. 1), and the slot is of a width greater than the diameter of shaft 288 whereby the shaft 288 may be reciprocated along slot 295 by oscillation of arm 292 about the axis of shaft 294. A rocker arm 296 is also secured to shaft 288 and carries a cam follower roller 298 positioned in the path of cam bar 280. An arm 300 is also secured to shaft 288, and a tension spring 302 extends from the distal end of arm 300 to a pin 304 fixed on arm 292. Shaft 290 is pivotally supported on frame 10. A rocker arm 306 is secured to shaft 290 and carries a cam follower roller 308 positioned in the path of cam bar 282. A tension spring 310 is also affixed to rocker arm 306 and to a pin 312 fixed to frame 10. Springs 302 and 310 urge the folders 284 and 286 against stops at the folding position illustrated in FIGS. 1 and 15.

In applying tape T to a spool S wound with ribbon on support 66 as aforedescribed, the leading end of the tape is gripped on pad 232, and the pad is driven along slot 236, from left to right in FIGS. 1 and 6, to thereby position a length of tape T in front of the spool. The spool transfer means 22 is moved forward on slide rods 278 by a suitable reciprocating driven, with the pin 260 and the gripper arm 264 retracted as in FIG. 5. During this forward movement, cam bars 280 and 282 engage rollers 298 and 308 and pivot folders 284 and 286 to the open position as shown in FIG. 4. In the forward position, pin 260 is axially aligned with spindle shaft 100 and thus with the opening F of the wound spool atop support 66. The piston 256 is then actuated by placing cylinder 254 in communication with the vacuum source, thereby moving pin 260 downward to engage its end 260*a* in the opening F of the filled spool and to move arm 264 to the closed position thereby clamping the midportion of the withdrawn length of tape T against the ribbon on spool S and retaining the ribbon on the spool; see FIGS. 4 and 6. The cutting devices 94*a*—94*b* and 220 are then actuated, as by suitable solenoids or pneumatic cylinders, to cut the ribbon at the outlet end of channel 44 and to cut the wrapper tape T adjacent the inner end of guide 218. The spool is released from grippers 136 and the grippers are retracted. Thereupon the transfer mechanism 22 is retracted along rods 278 and the filled spool is pulled outward thereby between the open folders 284 and 286.

As the spool S is withdrawn, folder 286 is released by cam bar 282 and spring 310 causes this folder to follow the periphery of the wound ribbon thus wrapping the right end of the tape T around the ribbon, see FIGS. 8 and 9. During this movement, arm 292 is rotated, clockwise in FIG. 15, to move folder 284 with the retracting spool, as also illustrated in FIGS. 8 and 9. After the spool is fully retracted and folder 286 is closed as seen in FIG. 9, arm 292 moves forward and spring 302 causes folder 284 to follow the periphery of the wound ribbon whereby the folder 284 wraps the left end of the tape over the ribbon. In the wrapped position, as shown in FIG. 10, the ends of the tape T overlap to the left of folder 286. The overlapped ends of the wrapping tape are secured together. This may be accomplished by placing a suitable adhesive on the underside of the second or overlapping end of the tape T

by an adhesive applicator **26** (FIG. 1). Thereafter, pin **260** is withdrawn, and the wrapped spool is removed by any suitable removal means, or by hand.

Referring to FIG. 1, the adhesive applicator mechanism **26** includes an adhesive container **314** supported on frame **10**, and an arm **316** mounted on a shaft **318** driven for reciprocating and rotary oscillating motion as indicated below. At its distal end arm **316** carries a dauber pin **320** which is extended into the adhesive in container **314** by downward movement of shaft **318** when arm **316** is in the position illustrated in FIG. 1. Prior to movement of folder **284** to its closed position, shaft **318** is raised, rotated clockwise, as viewed in FIG. 1, and lowered to place the adhesive carrying pin **320** in the path of the left end of tape T, see FIG. 9. Thus as this end of the tape is folded into overlapping relation with the first end, its inner surface wipes over pin **320** and picks up adhesive for subsequently securing the tape ends together.

Other suitable means may be used to secure the tape ends together. For instance, in one alternative arrangement for use with a thermoplastic tape, a heating element may be applied between the folders, or through an opening in the distal end of folder **284**, to "spot-weld" the overlapping ends of the tape, thereby retaining the wound ribbon on the spool.

METERING APPARATUS

FIGS. **17—20** illustrate one mechanical device for controlling the length of ribbon fed to each spool S as it is wound on the above-described apparatus. Referring first to FIG. **17**, a shaft **330** is journaled in a sleeve **332** mounted on a support **334** on frame **10**. A worm wheel **336** having a hub **338** is rotatably journaled on shaft **330**. A worm gear **340** (FIG. **20**) engages worm wheel **336** and is driven by metering wheel **48** (see also FIG. **1**). A clamp **342** has yieldable frictional engagement on hub **338**. A cam **344** is affixed to shaft **330** and is joined to clamp **342** for conjoint rotation, as by a pin **346**. A second worm wheel **348** is fixed on a hub **350** which is journaled on sleeve **332**. Wheel **348** is positioned by a worm gear **352** on the shaft of a hand adjustment knob **354** (see FIG. **1**). A pin **356** is mounted in hub **350** and extends into the path of movement of a pin **358** which is mounted in a disc **360** affixed to flange **362** of shaft **330**. A second pin **364** projects from the opposite face of disc **360** (see FIG. **18**).

A second shaft **366** is supported in a bracket **368**, also mounted on frame **10**, and is axially aligned with shaft **330**. A gear **370**, having a hub **372**, is journaled on shaft **366**, and a J-shaped cam **374** (see FIG. **18**) is affixed to hub **372**. Gear **370** is driven by a relatively large spur gear **376**. The gear **376** is driven in an oscillating motion, having one cycle of oscillation for each cycle of the machine **8** in winding, wrapping and discharging a spool. For instance this oscillating motion may be provided by a cam and spring mechanism as illustrated somewhat schematically in FIG. **18** and including an edge cam **378**, a connecting rod **380** carrying a cam follower roller **382** and a compression spring **384** confined between a plate **386** secured to frame **10** and a washer **388** affixed to rod **380**. As cam **378** is rotated, in a counterclockwise direction as seen in FIG. **18**, and follower **382** passes off of the tip of the cam, spring **384** will drive the rod **380** downward and thus rotate gear **376** clockwise and thereby rotate gear **370** and cam **374** counterclockwise. Continued rotation of cam **378** will reciprocate rod **380** upward against the force of spring **384** and return the gears **376** and **370** as well as cam **374** to the position illustrated in FIG. **18**.

A latch arm **390** is pivotally mounted on frame **10** as indicated at **392** and is provided with a latch end **394** which is urged against the periphery of disc **360**, and into a notch **396** when the notch is aligned with the latch end, by a tension spring **398**. A pin **400** is mounted on latch end **394** and protrudes into the path of cam **374**. A microswitch **402** is suitably positioned to be open when latch **390** engages in notch **396** and to be closed by arm **390** when the latch is raised from the notch. This switch is in the control circuit for suitable means, such as a solenoid or pneumatic cylinder, for operating the clutch fork arms **122** (FIG. **14**) to engage the clutch for driving of shaft **100** when the control circuit is complete and to disengage the clutch mechanism when the switch **402** is open. As also indicated schematically in FIG. **18**, latch **390** may be connected to one of the ribbon brake elements **54***b* to effect a braking action on the ribbon when the latch engages in notch **396**.

In the operation of the above-described metering mechanism, after an empty spool S has been gripped on the support **66**, cam **378** releases follower **382** which causes rotation of cam **374** as aforenoted. The outer flank of cam **374** is of a configuration to engage pin **400** and thereby raise the latch out of notch **396** as the leading edge of the cam engages pin **364** and rotates plate **360**. Plate **360**, along with shaft **330**, cam **344** and clamp **342** are thus rotated under the influence of spring **384** until pin **358** engages the radial stop pin **356** on hub **350**. The frictional engagement of clamp **342** on hub **338** permits slippage of the clamp **342** on the hub during this setting of disc **360** but is sufficient to effect driving of shaft **330** and plate **360** by wheel **336** as outlined below. Continued rotation of cam **378** drives rod **380** upward thereby returning cam **374** to its initial position.

Lifting of latch **390** by cam **374** releases brake **54** and closes the switch **402**. Another switch in this clutch control circuit is subsequently closed by a timing cam (not shown), after cam **374** is cleared from pin **364**, to complete this control circuit, thereby raising arms **122** to engage the clutch on the drive shaft. It will be appreciated that this movement of the latch **390** also may be utilized to initiate the ribbon feeding operation of the feed mechanism **16**, with other means being provided to disengage the feed elements after the required initial feeding action.

As the ribbon is wound on the spool, the ribbon passing through guide **44** drives the metering wheel **48** which rotates worm **340** and thereby drives worm wheel **336** in direct proportion to the length of ribbon passing through guide **44** to the spool. Wheel **336** drives clamp **342**, due to the frictional engagement of the clamp on hub **338**, and thereby rotates cam **344**, shaft **330** and plate **360** in a clockwise direction, as viewed in FIGS. **18** and **20** (counterclockwise in FIG. **19**), until notch **396** is returned to a position of engagement by latch end **394**. The latch **390** then drops into the notch thereby opening switch **402** to disengage the drive clutch and to engage the brake elements **54** to stop further feeding of the ribbon. The point of engagement of latch **390** with notch **396** thus comprises a fixed reference point in the operation of the metering mechanism. The position of pin **356** constitutes a second reference point which may be conveniently adjusted by the operator through the rotation of the adjustment knob **354** (FIG. **1**) to provide accurate control of the length of ribbon wound on each of the spools. Substantial changes in the length of ribbon to be wound on the spools (e.g., **0—30** feet) may be effected merely by changing the position of pin **356** through rotation of knob **354**. Larger changes may be effected by altering the speed reduction ratio of the drive from the moving ribbon to shaft **330**.

Cam **344** and/or other cams on shaft **330** may be utilized to control other operations of the machine **8**. For instance, a speed change mechanism may be included to provide a very high speed drive to support **66** for rapid winding, with a shift to a slower speed as the winding of each spool nears completion. To this end, a control switch **404** (FIG. **20**) may be placed to be operated by cam **344** just prior to the engagement of latch **390** in notch **396**.

EMBODIMENT OF FIGS. 21—25

The machine of FIGS. **21—25** includes two sets of winding apparatus **410** and **412** disposed for rotation about spaced horizontal axes, with spool supply apparatus **414** positioned between the winders as seen in FIG. **21**. The winders **410** and **412** are substantially identical to one another, except that they

are adapted for counterrotation, as indicated by the arrows in FIG. 21 and by the direction of the ribbon guide channel 416 of winder 410 and the ribbon guide channel 418 of winder 412. Each of these winders is similar to the winding apparatus 18 described above, and the same identifying numerals have been applied to some of the components not otherwise referred to below.

Ribbon supply, ribbon metering and ribbon feeding apparatus, as well as wrapper applying apparatus such as those described above with respect to machine 8 may be utilized with each of the winders 410 and 412. It will be appreciated that it is convenient to feed the wrapping tape from the left-hand side (as seen in FIG. 21) for winder 410, and to feed the wrapper tape from the right-hand side for winder 412.

Referring to FIGS. 24 and 25, winder 410 includes a rotatable hollow shaft 420 extending from a shaft 421 journaled in supports 422*a* and 422*b*. The shaft 420—421 is driven by a pulley and clutch plate mechanism 424 which is substantially identical to the drive described above in conjunction with support 66. A support and manifold unit 426, which is substantially identical to element 124, is reciprocated along shaft 420 by a compression spring 428 and a rocker arm 430 carrying a pin 431 which engages the vacuum conduit 432. A spool centering pin 434 is disposed within the hollow shaft 420 and is connected to element 426 by a pin 436 extending through a slot 438 in shaft 420. The reciprocating movement of element 426 preferably is adequate to retract pin 434 within shaft 420 as in FIG. 24 during removal of a spool from support disc 440 and to extend the pin as in FIG. 25 for centering and supporting a spool on the winder.

An upper semicylindrical shroud 442 and a complementary semicylindrical shroud 444 are adapted to define a ribbon guide shell about the disc or plate 440, see FIGS. 21 and 25. Shroud 442 is fixed to the machine frame 446, as at 448, and is provided with an aperture 450 for a presser roller. The lower shroud 444 is suitably supported and guided, as by frame 446 and plate 456 for reciprocation from the retracted position illustrated in FIG. 24 to the extended, ribbon guiding position of FIG. 25. The guide channel 416, which is also fixed to the machine frame 446, directs ribbon generally tangentially of a spool supported on the winder 410 within the shrouds 442—444, in the direction of rotation of said winder, see FIG. 21.

The shroud 444 may be moved between its retracted and extended positions by any suitable means, such as a drive rod 458 which is reciprocated in appropriate timed relation with the operation of the winding apparatus as indicated below.

Referring to FIGS. 21, 22 and 25, a presser roller 460 is supported on an arm 462 pivotally mounted on a shaft 464. Shaft 464 is movable to extend the roller 460 through opening 450 to engage ribbon against the core of a spool in the winder (see FIG. 25), and for retracting the roller during positioning of an empty spool therein as outlined below.

The spool winder 412 is identical with winder 410 except for the rearrangement of parts required by its opposite direction of rotation, and corresponding parts are indicated by the same numbers with a prime (') designation.

The spool supply mechanism 414 includes a channel-type guide 470 having a terminal portion midway between and above the axes of rotation of winders 410 and 412, as seen in FIG. 21. A disc 472 is mounted immediately beneath and behind the outlet end of channel 470, see FIG. 22. A pair of spaced pins 474*a* and 474*b* extend from disc 472 and are joined at their distal ends by a bar 476, the spacing of bar 476 from disc 472 being slightly greater than the width of the spools S being supplied to the winders. Disc 472 is mounted on a shaft 478 which is rotatable as indicated below for oscillating disc 472 to release spools from the magazine 470. It will be observed that the channel 470 and disc 472 are positioned outwardly from the machine frame 446, beyond the outermost edge of the ribbon guide shells of the two winders.

A pair of transfer arms 480 and 482 are mounted on the machine frame 446, with one arm at each side of the channel 470. Arm 480 is provided with an expandable pin 483 at its distal end and arm 482 is similarly provided with an identical pin 483' for gripping the spools for transfer from the disc 472 to the respective winding mechanism. Referring to FIG. 23, each of the transfer pins 483—483' has a tapered outer end and comprises a fixed pin half 484 and a movable complementary portion 486. The movable portion 486 is mounted for limited free pivotal movement toward and away from portion 484, as by providing a mounting bore 488 therein larger than the retainer pin 490. A spring 492 urges the movable pin portion 486 to the spread or expanded position illustrated in FIG. 23 whereby, when the pin is forced into the opening F of a spool, the spring 492 causes frictional engagement of the spool on the pin.

Arm 480 is pivotally supported on a rod 494 and arm 482 is similarly supported on a rod 494' for movement from a position wherein the respective transfer pin is concentric with disc 472, as illustrated by arm 480 in FIG. 21, to an opposite end position wherein the transfer pin therein is concentric with the respective winder, as illustrated by arm 482 in FIG. 21.

In the operation of the transfer mechanism 414, disc 472 is first rotated to a position with pins 474 at the lower side of the disc as illustrated by the dashed line positions in FIG. 21. The lowermost spool in magazine 470 moves downward as the pins are rotated, to the position illustrated by the spools S' in FIG. 21. The arm 480 is then pivoted to align the transfer pin 483 thereon with the bore F in the spool S', and the support rod 494 is reciprocated to move the transfer pin 483 into the opening F of this spool for engaging the spool. Disc 472 then rotates counterclockwise to the solid line position illustrated in FIG. 21 and thereby releases spool S' for movement to the winder 410 by pivotal movement of the arm 480. When the arm 480 reaches a position wherein the spool carried thereon is axially aligned with the winder 410, the support rod 494 is moved inward to position the spool within the ribbon guide shell and on the pin 434 which has been extended, as in FIG. 25. The vacuum grippers, which abut the adjacent spool rim E in this position, are then actuated to retain the spool as the transfer arm is disengaged by outward movement of shaft 494.

In the position of disc 472 illustrated in solid lines in FIG. 21, the upper pin 474*b* engages spool S'' and retains the spools in channel 470 during removal of the lowermost spool S'. After the spool S' is removed by arm 480, the disc 472 is rotated clockwise back to the neutral position illustrated in dashed lines, thereby permitting the spools remaining in the magazine 470 to move downward whereby the next spool S'' will be positioned on the pins 474*a* and 474*b* in the S' position of FIG. 21. Thereafter arm 482 is moved to engage pin 483' in this spool. Disc 472 is then rotated clockwise to release this spool for movement to the winder 412 by arm 482 and to position pin 474*a* to retain the remaining spools in the same manner as described above with respect to the movement of a spool to the winder 410 by arm 480 and the retention of the remaining spools by pin 474*b*.

When a spool is in position on a winder 410 or 412, with the lower shroud extended and the presser roller extended into engagement with the core of the spool as in FIG. 25, feeding of the ribbon and winding of the ribbon on the core proceeds as described above with respect to machine 8. After the leading end of the ribbon is snubbed on the core, and while the winding is progressing, the presser roller may be retracted and the lower shroud section 444 may be retracted to the position of FIG. 24 whereupon spool transfer means, such as the mechanism 22, moves upward into position to engage the spool on the winder. Upon completion of the winding operation, the filled spool is engaged by the transfer means, as by extension of a pin 260 into the center bore F of the outermost flange E. The grippers 136 are then released, and the support unit 426 and pin 434 are retracted to the position of FIG. 24. The transfer mechanism then moves downward, sliding the filled spool downward across the respective tape feed slot 498 or 498' and over plate 496 or 496', whereby wrapping of tape therearound may be completed as described above with respect to machine 8.

It will be appreciated that one wheel, such as wheel 48 or wheel 56, may be used both for feeding and for metering the ribbon to a winding apparatus, for instance by providing a feeding drive connection to the shaft of wheel 48 through a one-way clutch. Further these machines may be adapted to grip various spools, with or without ends and/or flanges, by appropriate changes in the gripping mechanism on the rotatable support and on the transfer means.

It will be obvious that other modifications of the specific embodiments shown or described herein may be made without departing from the spirit and scope of this invention.

The essential steps in the practice of the method of this invention will be clear from the foregoing descriptions of the operation of the illustrated machines. Briefly, and in general outline, the leading end of a length of ribbon is fed to a spool which preferably is being rotated at a rate to provide a peripheral velocity of the spool core greater than the lineal rate of feed of the ribbon. The leading end portion of the ribbon is guided about the core of the rotating spool in an inwardly spiralling convolution while pressure is applied against the ribbon, radially inward against the core. This results in snubbing of the inner turn of ribbon on the core whereupon continued rotation of the spool winds the ribbon thereon. The ribbon on the spool is secured and wrapped by positioning a wrapping tape opposite the ribbon on the spool in the spool-winding position. The spool is then removed from the winding position by moving it transversely of and against the tape while restricting the end portions of the tape to thereby wrap the tape partially around the wound ribbon. The opposite ends of the wrapping tape are then folded into overlying relation and the two ends are secured together to complete the wrapping.

It will thus be seen that new and useful methods and machines have been provided for winding spools. More particularly, novel methods and machines have been provided for rapidly and automatically winding a predetermined length of ribbon on each of a succession of spools. The leading end of the ribbon is automatically snubbed on the core of each spool, and is thereby secured without the use of any auxiliary mechanism or means for tacking or otherwise securing the leading end of the ribbon to the spool core. Further, each spool is conveniently and automatically wrapped to secure and protect the ribbon wound thereon. New and useful metering control apparatus has also been provided which permits convenient and accurate control of the length of ribbon being applied to each spool from a supply of indeterminate length. Such machines and methods facilitate high production rates and economical spool winding operations.

While particular embodiments of the invention have been disclosed, it will be understood, of course, that the invention is not limited thereto since modifications may be made by those skilled in the art, particularly in light of the foregoing teachings. Therefore, it is contemplated by the appended claims to cover any such modifications as incorporate those features which may be said to constitute the essential features of the disclosure, within the true spirit and scope of the invention.

I claim:

1. Apparatus for automatically winding lengths of ribbon material onto each of a succession of individual spool cores comprising means for engaging and rotating a spool core, means for successively positioning such cores on said engaging and rotating means for rotation of such cores thereby, a plurality of guide elements cooperating to define a circular cylindrical guide chamber around a core on said engaging and rotating means for guiding a leading end portion of such ribbon material around a core thereon in an inwardly spiralling convolution, and means for extending a leading end portion of such ribbon material along said guide means and for effecting frictional engagement of at least a portion of such leading end portion with the outer surface of said core as said core is rotated to snub such leading end portion on said core and to wind a length of such ribbon material thereon by continued rotation of such core, at least one of said guide elements being movable to open one side of such chamber to permit removal of such core from said engaging and rotating means in a direction lateral to the axis of rotation of said engaging and rotating means.

2. Apparatus as in claim 1 wherein said extending and frictional engagement means include feed means for projecting such a leading end portion into and along said guide means, and presser means for pressing at least a portion of such leading end portion within said guide means against said core as said core is rotated.

3. Apparatus as in claim 1 including means for rotating such core at a peripheral velocity greater than the rate of extending of ribbon by said feed extending means.

4. Apparatus as in claim 1 including means responsive to the passing of ribbon to said core for metering the ribbon and operative to stop rotation of such core upon passage of a predetermined length of ribbon thereto.

5. Apparatus as in claim 1 wherein at least one of said elements is movable to a closed alignment position for aligning a core on said engaging and rotating means.

6. Apparatus as in claim 1 including means for removing a wound core from said engaging and rotating means in a direction lateral to the axis of such core through said one side means for positioning wrapping tape with one end of such tape in a first position adjacent said engaging and rotating means at one side of said removing means, a gripper element adapted to grip such tape and being movable in a path to engage such tape at said first position and to draw such tape across the path of movement of a core by said removal means for engagement by such core, means for severing such tape adjacent said first position and means for folding the ends of a length of such tape about such core.

7. Apparatus as in claim 1 wherein said one of said guide elements is retractable in a direction parallel to the axis of rotation of said engaging and rotating means to open said one side of such chamber to permit such removal of a core therefrom.

8. Apparatus as in claim 7 including means for moving a spool core into said ribbon guide axially of said supporting and rotating means.

9. Apparatus as in claim 1 including means for moving a wound core through said one side from a first position on said engaging and rotating means to a second position, in a direction of movement transverse to the axis of such core, means for positioning wrapping tape between said positions and in the path of movement of a core by said moving means for engagement by such core, and means for subsequently folding the ends of such tape about such core.

10. Apparatus as in claim 9 wherein said removal means includes clamping means for temporarily engaging ribbon wound on such core.

11. Apparatus as in claim 9 wherein said means for positioning said tape includes means to supply such tape with a leading end at a feed position at one side of said moving means, and a gripper element movable in a path to engage such tape at said feed position and to draw such tape across the path of movement of a core by said moving means.

12. Apparatus as in claim 9 wherein said moving means includes a pin which is extendable in said first position to engage a core for movement of such core with said moving means as said moving means is moved to said second position.

13. Apparatus as in claim 9 wherein said folding means includes a folder at each side of the path of movement of a core by said moving means, said tape positioning means being disposed to position such wrapping tape between said first position and said folders.

14. Apparatus as in claim 9 wherein said folding means includes a folder at each side of the path of movement of a core by said moving means, each of said folders being pivotally mounted for folding the ends of such tape over the trailing edge of such core.

15. Apparatus as in claim 14 wherein one of said folders is supported for movement with said moving means during a portion of its movement.

16. Apparatus as in claim 9 including an adhesive applicator and means for positioning said applicator in the path of movement of one end of such tape by said folding means.

17. Apparatus for winding ribbon material on a spool having a planar end surface, comprising means for supporting and rotating such a spool, said means including a plurality of suction gripper elements disposed around the axis of rotation of said support for gripping said planar end surface to retain and rotate said spool, each of said elements including means for engaging such surface, whereby said elements grip said surface independently of one another in an annular area around said axis of rotation, and means for securing the leading end portion of a length of ribbon on a spool on said supporting and rotating means.

18. Apparatus for automatically winding lengths of ribbon material onto each of a succession of individual spool cores comprising means for engaging and rotating a spool core, means for successively positioning such cores on said engaging and rotating means for rotation of such cores thereby, a ribbon supply support, means for guiding a leading end portion of such ribbon material around a core on said engaging and rotating means in an inwardly spiralling convolution, means for extending a leading end portion of such ribbon material along said guide means and for effecting frictional engagement of at least a portion of such leading end portion with the outer surface of said core as said core is rotated to snub such leading end portion on said core and to wind a length of such ribbon material thereon by continued rotation of such core, said extending means including means for withdrawing ribbon material from a supply of indeterminate length on said supply support and directing such ribbon material into said ribbon guide means, means responsive to passage of ribbon from said supply support to a core on said engaging and rotating means for metering the ribbon and operative to stop rotation of such core upon passage of a predetermined length of ribbon, severing means for severing such ribbon between said metering means and said engaging and rotating means, and means for removing a wound core from said engaging and rotating means and retaining the ribbon on such core.

19. A machine for winding ribbon material on spool cores comprising a pair of apparatus each for automatically winding lengths of ribbon material onto each of a succession of individual spool cores, each of said apparatus comprising means for engaging and rotating a spool core, means for guiding a leading end portion of such ribbon material around a core on said engaging and rotating means in an inwardly spiralling convolution, and means for extending a leading end portion of such ribbon material along said guide means and for effecting frictional engagement of at least a portion of such leading end portion with the outer surface of said core as said core is rotated to snub such leading end portion on said core and to wind a length of such ribbon material thereon by continued rotation of such core, said pair of apparatus being disposed in spaced, parallel relation to one another, spool core supply means between said pair of apparatus, and means for feeding cores from said supply means and successively positioning such cores on each of said engaging and rotating means for rotation of such cores thereby, a portion of said guiding means of each of said apparatus being movable to permit removal of a wound core therefrom in a direction lateral to the axis of rotation of the respective supporting and rotating means.

20. Apparatus for automatically winding lengths of ribbon material onto each of a succession of individual spool cores comprising means for engaging and rotating a spool core, means for successively positioning such cores on said engaging and rotating means for rotation of such cores thereby, means for guiding a leading end portion of such ribbon material around a core on said engaging and rotating means in an inwardly spiralling convolution, said guiding means and said positioning means including a guide section which is retractable outwardly from the position of a core on said engaging and rotating means to admit a core within said guiding means, core feed means for placing successive empty cores between said section and said engaging and rotating means when said section is retracted, said guide section being movable to a closed position for aligning a core on said engaging and rotating means, and means for extending a leading end portion of such ribbon material along said guide means and for effecting frictional engagement of at least a portion of such leading end portion with the outer surface of said core as said core is rotated to snub such leading end portion on said core and to wind a length of such ribbon material thereon by continued rotation of such core.

21. Apparatus for automatically winding lengths of ribbon material onto each of a succession of individual spool cores comprising means for engaging and rotating a spool core, said engaging and rotating means including a rotatable support and a plurality of suction gripper elements disposed around the axis of rotation of said support, means for successively positioning such cores on said engaging and rotating means for rotation of such cores thereby, means for guiding a leading end portion of such ribbon material around a core on said engaging and rotating means in an inwardly spiralling convolution, and means for extending a leading end portion of such ribbon material along said guide means and for effecting frictional engagement of at least a portion of such leading end portion with the outer surface of said core as said core is rotated to snub such leading end portion on said core and to wind a length of such ribbon material thereon by continued rotation of such core.

22. Apparatus for winding ribbon material on a spool having a planar end surface, comprising means for supporting and rotating such a spool, said means including a support surface for supporting a spool, suction gripper means for gripping said planar end surface to retain and rotate such a spool, said suction gripper means being reciprocable between a position beneath said support surface and a gripping position above said support surface, and means for securing the leading end portion of a length of ribbon on a spool on said supporting and rotating means.

23. Apparatus for winding ribbon material on a spool having a planar end surface, comprising a rotatable support having a support surface for supporting a spool, a plurality of suction gripper elements disposed around the axis of rotation of said support for gripping such a planar end surface to retain and rotate such a spool, an aligning pin disposed to engage a center opening in the end of such a spool, said suction gripper elements and said aligning pin being reciprocable between a retracted position beneath said surface and a spool engaging position above said surface, and means for securing the leading end portion of a length of ribbon on a spool on said supporting and rotating means.

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,585,779 Dated June 22, 1971

Inventor(s) Josephus J. Thayer

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

The title should read "APPARATUS FOR WINDING RIBBON MATERIAL AND APPLYING WRAPPING TAPE THERETO"; In the references, Thevenaz "242/56.13(T)X" should read -- 242/55.13(T)X --; Column 8, line 40, "driven" should read -- drive --; and Column 14, line 23 (claim 6), insert comma after "side".

Signed and sealed this 15th day of February 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents