

[54] **SUPPLY REEL FOR BANDING APPARATUS**

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[51] Int. Cl. **B65h 75/48**

[58] Field of Search **242/75.4, 107-107.7; 191/12.2, 12.4**

[56] **References Cited**

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[57] **ABSTRACT**

A heat seal type banding machine, in which tapes are fed in opposite directions into a working space, is provided with a tape supply means in which the tapes are double wound so that substantially equal lengths of each tape are dispensed simultaneously. A spring means is provided to constantly exert forces on the tapes, urging them in directions opposite to those directions in which the respective tapes move into the working space of the apparatus. Keying means prevents mounting of the tape supply means in an improper operating position.

11 Claims, 8 Drawing Figures

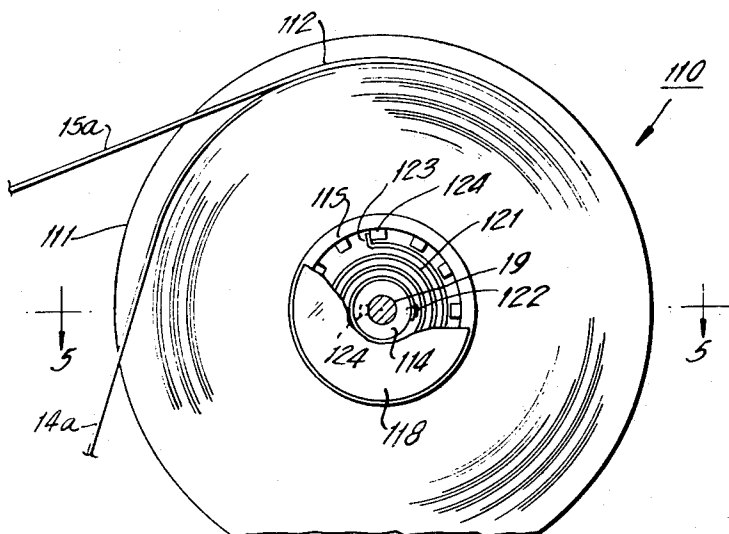


FIG. 1.

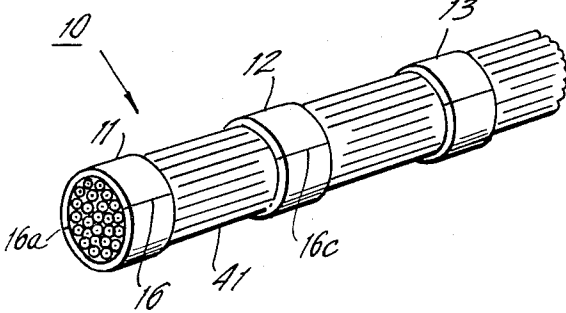


FIG. 3.

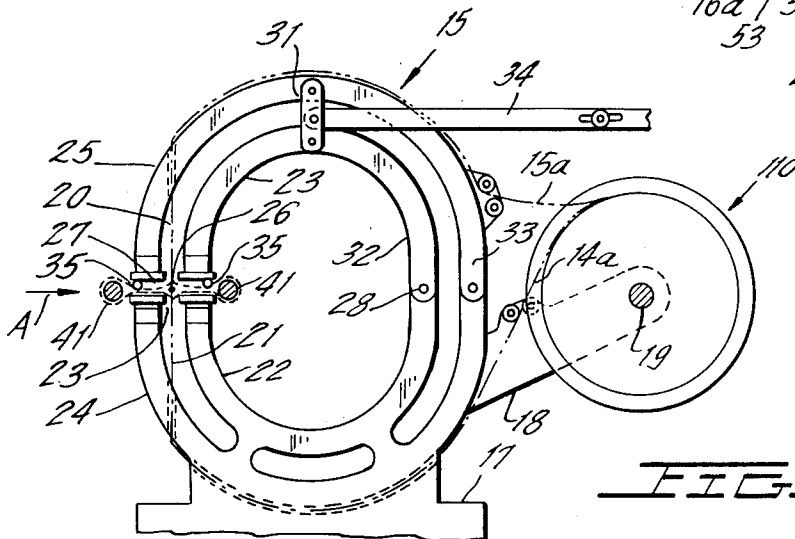
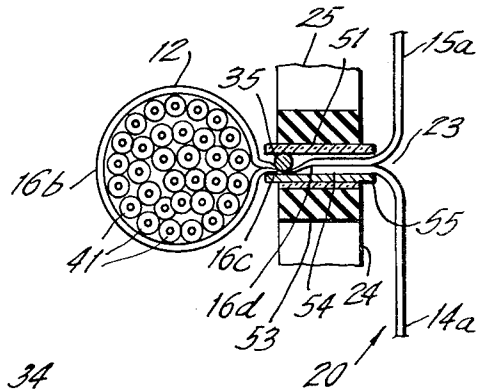


FIG. 2.

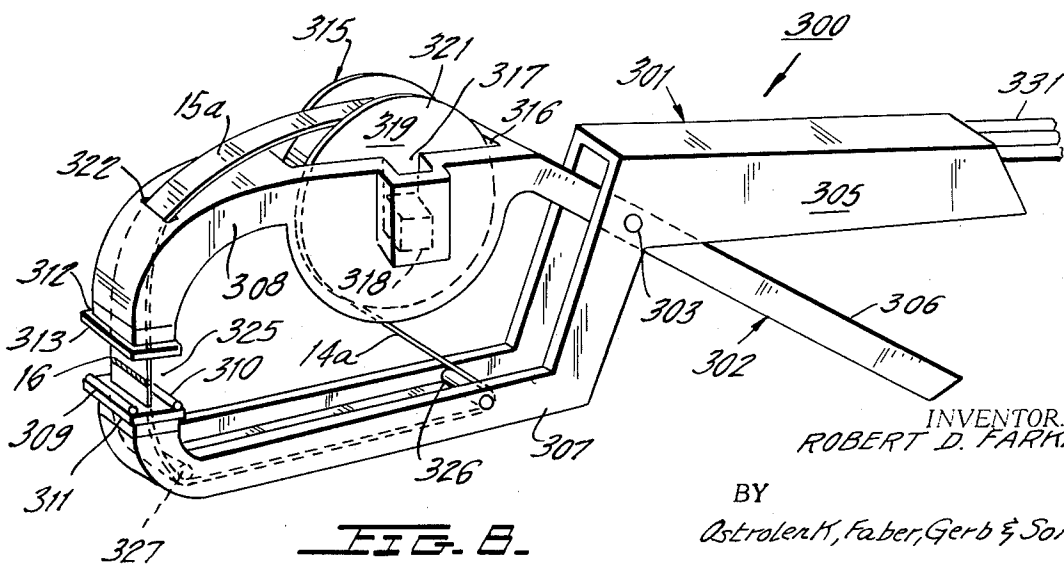


FIG. B.

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FIG. 4.

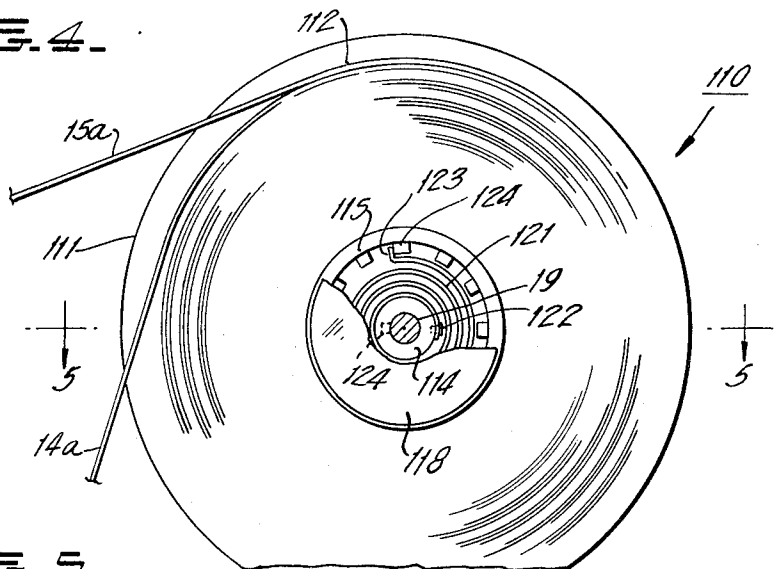


FIG. 5.

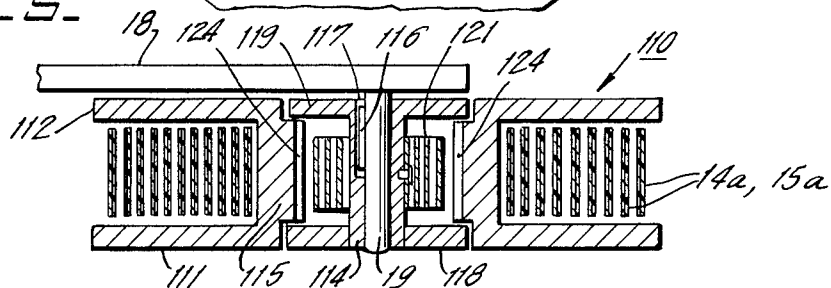


FIG. 6.

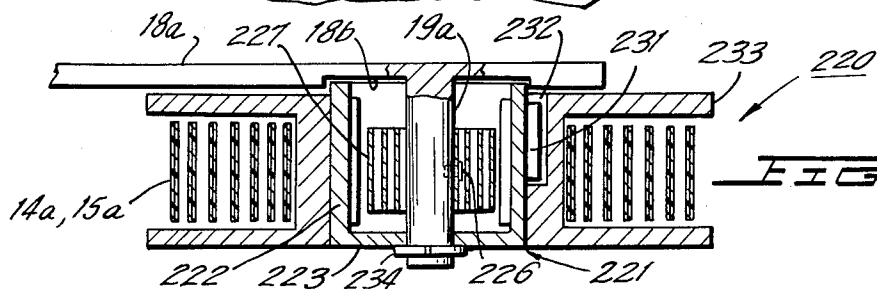
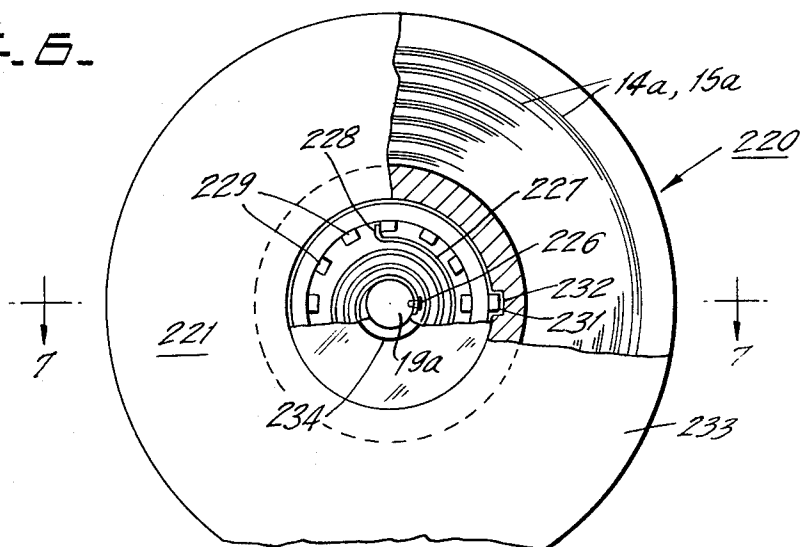


FIG. 7.

SUPPLY REEL FOR BANDING APPARATUS

This invention relates to banding apparatus in general, and more particularly relates to improved supply means for dispensing plastic tapes used in a heat-sealed type banding machine.

My U.S. Pat. No. 3,466,847 issued Sept. 16, 1969 for "Apparatus for Forming and Applying Bands" discloses apparatus in which there is a first and second set of jaw means, each carrying an individual heat sealing means. First and second tapes of heat sealable plastic move into the space between first and second jaw means and are joined to form a web which is positioned so that it intercepts and wraps around an article that is moved along a path extending between the jaws of the first jaw means and then between the jaws of the second jaw means.

The primary object of the instant invention is to provide a novel construction for the supply means that dispenses the heat sealable plastic tapes in heat-sealed type banding apparatus that requires two equal lengths of tapes to be dispensed simultaneously.

Another object is to provide tape supply means of this type in which the tapes are double-wound so that substantially equal lengths of each tape are dispensed simultaneously.

Still another object is to provide supply means of this type including means for preventing improper mounting of the supply means to the banding apparatus.

A further object is to provide supply means of this type, including a device which prevents the tapes from unwinding freely.

A still further object is to provide supply means of this type, having a device for generating a biasing force, acting to maintain both tapes under tension.

These objects as well as other objects of this invention will become readily apparent after reading the following description of the accompanying drawings in which:

FIG. 1 is a fragmentary perspective, illustrating a bundle of wires secured by thermoplastic bands applied by heat-sealed type banding apparatus.

FIG. 2 is a side elevation of banding apparatus, including tape supply means constructed in accordance with teachings of the instant invention for applying the bands illustrated in FIG. 1.

FIG. 3 is a fragmentary portion of FIG. 2, enlarged to more clearly illustrate the apparatus elements at the time when the band is being severed from the holding web.

FIG. 4 is an enlarged side elevation of the tape supply means of FIG. 2.

FIG. 5 is a cross-section taken through line 5-5 of FIG. 4, looking in the direction of arrows 5-5.

FIG. 6 is a side elevation of a modified version of the tape supply means of FIGS. 4 and 5.

FIG. 7 is a cross-section taken through line 7-7 of FIG. 6, looking in the direction of arrows 7-7.

FIG. 8 is a perspective of a hand-held heat seal type banding machine.

Now referring to the figures, and more particularly to FIGS. 1-5. Cable 10 is constructed of a plurality of insulation covered wires, bundled together by bands 11, 12, 13, which, as will hereinafter be explained, are applied by apparatus 15 of FIG. 2. Bands 11-13 are preferably constructed of heat sealable plastic cross-oriented material, known in the trade as "shrink material." Such material will shrink when heated to a particular temperature below the fusion temperature of the material. Even though bands 11-13 are somewhat loose at the time they are formed, shrinkage thereof causes them to tightly enwrap the wires comprising cable 10.

Apparatus 15 includes stationary frame 17 having rearwardly extending arm 18 mounting horizontal post 19 for supporting tape supply means 110 from which thermoplastic tapes 14a, 15a are drawn. Tapes 14a, 15a are joined end to end by heat seal 16 to form holding web 20, which extends through space 21 between pairs of jaws 22, 23 and 24, 25, with heat seal 16 being positioned generally in alignment with the respective gaps 26, 27 formed when the respective jaws 22, 23

and 24, 25 are separated. Jaws 22 and 24 constitute parts of the stationary portions of generally C-shaped mounting members 32, 33 respectively, while jaws 23 and 25 constitute parts of the movable portions of the respective members 32, 33. Pins 28, 29 at the web sections of the respective members 32, 33 provide pivotal supports for the respective jaws 23, 25. Tie bar 31 mechanically connects jaws 23, 25 for movement in unison, with such movement being effected by pivoted rod 34 connected at one end to tie bar 31 and at the other end to an operating mechanism (not shown).

As seen most clearly in FIG. 3, each of the movable jaws 23 and 25 carries a cutting and sealing means comprising wire 35 (seen most clearly in FIG. 3), extending transverse to the longitudinal axis of portions of holding web 20 within space 21. As is well known to the art, wire 35 is of the resistance heating type, so that upon passage of sufficient current therethrough, wire 35 becomes hot enough to cut through a double thickness of holding web 20, with plastic flow taking place on both sides of the cut to form heat seals. Wire 35 is heated intermittently in accordance with a heating and cutting technique known in the art as "impulse" heating.

A thin sheet of glass cloth 51 provides a thermal barrier between wire 35 and rubber insulator 52 mounted to the lower end of movable jaw 25. Another rubber insulator 53, topped by metal foil 54, is mounted at the upper end of stationary jaw 24. A thin layer of glass cloth 55 is mounted on top of foil 54. Duplicates of elements 51 and 52 are mounted to movable jaw 23, and duplicates of elements 53, 54, 55 are mounted to stationary jaw 22.

Operation of apparatus 15 proceeds in the following manner to form bands 11-13 around wire bundle 41. Jaws 23, 25 are separated from jaws 22, 24, respectively, to a point where gaps 26, 27 are larger than the diameter of bundle 41. An operator, either by hand or with a tool, holds bundle 41 with its longitudinal axis horizontal and moves bundle 41 at right angles to such axis, and in the direction (indicated by arrow A) transverse to the plane of holding web 20. This movement is also parallel to the plane of C-shaped mounting members 32, 35, with bundles 41 moving first through gap 27, then space 21 and finally through gap 26. Since the path for bundle 41 through space 21 is blocked by holding web 20, the latter folds around bundle 41 as bundle 41 moves through gap 26 to the position at the right thereof (shown in phantom in FIG. 2). Rod 34 is operated to substantially close gaps 26, 27, bringing cutting and sealing wire 35 mounted to jaw 23 into engagement with the double thickness of holding web 20 disposed between jaws 22, 23. Electric power 35 is then applied to wire 35, causing heating thereof to a temperature which enables wire 35 to cut through the double thickness of holding web 20 and fuse the material adjacent to the cut. When power is no longer applied to wire 35, the fuse material cools forming heat seals 16a, 16b, with the former heat seals 16a closing the loop 11 around bundle 41 and the latter seal 16b joining the remaining portions of tapes 14a, 15a end to end.

To apply band 12 it is not necessary to move bundle 41 around holding web 20. That is, with bundle 41 at the interior of member 32, bundle 41 is merely moved along its longitudinal axis the short distance required to align the location where band 12 is to be applied with the sets of jaws 22, 23 and 24, 25. The sets of jaws 22, 23 and 24, 25 are separated, and bundle 41 is moved rearward (opposite to the direction indicated by arrow A), first through gap 26, next through space 21 and then through gap 27. With bundle 41 in a position just to the left of gap 27 of FIG. 2, rod 34 is again operated to substantially close gaps 26, 27, bringing wire 34 mounted to jaw 25 into firm engagement with the double thickness of holding web 20 drawn between jaws 24, 25 by the movement of bundle 41 through space 21 and gap 27. Cutting and heat sealing power is then applied to this wire 35, severing loop 12 from holding web 20, and fusing the material inside of the cut. When electric power to wire 35 is discontinued, this fuse material cools, forming heat seals 16c, 16d. Heat seal 16c

serves to close band 12, and heat seal 16d serves to join the remaining portions of tape 14a, 15a end to end. By repeating the steps just recited, band 13 and other bands (not shown) of thermoplastic material are applied to bundle 41 at desired locations along its length. In some instances, it may be desirable to apply two or more overlying bands, in which event bundle 41 is maintained in the same longitudinal position for successive movement to gaps 26, 27 and space 21. After the desired number of bands is applied to bundle 41, the assembly is subjected to relatively low level heating, which causes the bands around bundle 41 to shrink and thereby tightly hold the wires of bundle 41 together.

Tape supply means 110 includes reel 111 having tape storage spool section 112 upon which tapes 14a, 15a are double wound so that equal lengths of tapes 14a, 15a are removed simultaneously from spool section 112. The interior of reel 111 comprises concentric interior and exterior hub sections 114, 115 mounted for relative rotation. Interior hub section 114 is provided with an axial bore which receives stub shaft 19 with a frictional fit. Key 116, extending radially from shaft 19 and only partway along the length thereof, is received by keying slot 117 in the wall defining the axial bore of interior hub section 114. Key 116 cooperates with slot 117 to assure that tape supply means 110 will be mounted to arm 118 in a predetermined position, for a reason which will become obvious.

One end of interior hub 114 is provided with an integrally formed circular flange 119, while the other end of interior hub 114 has circular flange 118 permanently affixed thereto. Flanges 118, 119 secure spool section 112 to interior hub 114, and maintain the concentric relationship therebetween while permitting spool 112 to rotate as interior hub 114 is held against rotation through the cooperation of key 116 and slots 117. Coil spring 121 is wound about interior hub 114, with the inner end of spring 121 being fixedly secured to the interior hub 114 by rivet 122, and the outer or free end of spring 121 being bent to form tab 123 which is engaged by radially extending elongated teeth 124 that are arranged in a circular array and project inward from interior hub 115.

As tapes 14a, 15a drawn from tape supply means 110, spool 112 rotates in a counterclockwise direction with respect to FIG. 4. The engagement of one of the teeth 124 with tab 123 causes winding or loading of spiral spring 121, thereby creating a biasing force which opposes counterclockwise rotation of spool 112 to maintain tapes 14a, 15a taut, especially in working gap or space 23. When the loading of spring 121 has reached a high enough level, tab 123 bends to thereby move free of the projection 124 then in engagement therewith, and moves into engagement with the projection 124 immediately clockwise of projection 124 with which tab 123 had been in engagement. During this period, spring 121 continues to exert a biasing force on tapes 14a, 15a, even though the strength of this biasing force is reduced slightly.

In the embodiment of FIG. 6, tape supply means 220 is constructed so that spool section 223 is removable from the remainder of supply means reel 221. In particular, spool section 223 is removably mounted and frictionally fitted to exterior hub 222, which is a cylinder having one closed end 223. The central opening of end 223 receives interior hub in the form of horizontal stub shaft 19a so that hubs 222, 19a are relatively rotatable. Split retaining ring 234 on hub 19a holds hubs 19a, 222 in operative relationship. The other end of exterior hub 222 is received in circular cutout 18b of frame arm 18a, with cutout 18b acting as a bearing support for exterior hub 222. Shaft 19a is mounted to frame arm 18a and is secured against rotation with respect thereto. Rivet 226 secures the inner end of spiral spring 227 to shaft 19a and the outer end of spring 227 is provided with out-turned tab 228, which engages teeth 229 extending radially inward from outer hub 222. The engagement between tab 228 and teeth 229 provides a ratchet type connection. Key 231 projecting from the outer surface of outer hub section 222 extends parallel to the axis thereof, and extends only part way along the length

thereof to provide an asymmetrical keying formation that cooperates with keying notch 232 in the bore of spool section 233. The frictional engagement between spool section 233 and the exterior surface of outer hub 222 and the cooperation of key formation 231, 232 assures that spool 233 and outer hub 222 will rotate together as tapes 14a and 15a are being withdrawn from spool 233. However, when the supply of tapes 14a and 15a on spool 233 is exhausted, the latter may be flipped off of outer hub 222 and replaced by a full spool.

In the embodiment of FIG. 8, hand-held banding tool 300 is illustrated. In particular, banding tool 300 includes frame elements 301, 302, connected at their mid-regions by pivot pin 303. The portions of members 301, 302 to the right of pivot 303 constitute handles 305, 306, respectively, and the portions to the left of pivot 303 constitute jaws 307, 308, respectively. Heating and cutting wires 309, 310 are mounted to insulating sheet 311 at the free end of lower jaw 307. The free end of upper jaw 308 carries conducting member 312, and glass cloth sheet 313 which separates elements 309 and 310 from element 312 when jaws 307, 308 are closed. Tape supply means 315 is mounted to upper jaw 308 by being inserted into top cutout 316, with axial extensions (only one of which 318 is shown) at the center thereof being received by slots 317 in the sides of upper jaw 308. These slots 317 are of dissimilar cross-section, and the radial projections from tape supply means 315 are also dissimilar, to serve as a keying means which assures proper orientation of tape supply means 315. The axial projection 318 (shown dotted in FIG. 8) of tape supply means 318 is of square cross-section so that it cooperates with slot 317 to prevent rotation of the inner hub portion of tape supply means 315. The depths of slots 317 properly position tape supply means 315.

Upper tape 15a extends from spool 321 of reel 319 to the left and downward through slot 322 in upper jaw 308, and emerges through aligned elongated slots in elements 312, 313 into working space or gap 325 to connect with tape 14a at seal line 16. Lower tape 14a is drawn from spool section 321 of reel 319 and passes to the right of guide roller 326 and below guide roller 327. Both rollers 326 and 327 extend between the bifurcated sections of lower jaw 307. After passing beneath roller 327, tape 14a extends upward through an elongated slot in insulating sheet 311 into working space 325 to join tape 15a at seal line 16. Cable 331 at the right of handle 305 brings sealing and cutting power to banding tool 300, with this power being controlled by foot operated elements (not shown) or by switches (not shown) that may be mounted to one or both of the handles 305, 306.

While the tape supply means of the instant invention has been illustrated and described as having tapes in which the layers are interleaved (double wound), it should now be apparent to those skilled in the art that the double wound tape may be replaced by a pair of single wound tapes on a common hub.

Further, the ratchet type connection between the inner and outer hub sections of the reel to supply the biasing force, urging the tapes in opposite directions away from the working space, may be replaced by a construction in which a single coil spring acts on a slipping clutch engaged with the side of the spool, with removal of tape from the spool serving to wind the spring and create a bias opposing unwinding of the tape. When this biasing force reaches a predetermined level, below the breaking point of the tapes, the clutch will slip to prevent damage to the tape.

It should also now be apparent to those skilled in the art that the ratchet type biasing means illustrated may also be replaced by a system in which a drag force acts directly on the spool so that tape may be withdrawn only by application of a force exceeding a predetermined level. In addition, springs acting at forces below this drag force bias the tapes in opposite directions away from the working space.

Although in the foregoing there have been described preferred embodiments of this novel invention, many variations and modifications will now become apparent to those

skilled in the art, and it is preferred therefore that the instant invention be limited not by the disclosure contained herein but only by the appending claims.

The embodiments of the invention in which an exclusive privilege or property is claimed are defined as follows.

1. Supply means including first and second heat sealable plastic tapes adapted to move in opposite directions into a working space of a heat seal type banding machine, a reel means having a storage unit in which said tapes are wound so that substantially equal lengths of said tapes are withdrawn simultaneously from said reel means, said reel means having a keying formation adapted to prevent improper orientation of said supply means when the latter is mounted on a banding machine.

2. Supply means as set forth in claim 1, in which the reel means includes a hub portion including concentric relatively rotatable interior and exterior sections, and means acting between said sections to resist withdrawal of said tapes from said reel means.

3. Supply means as set forth in claim 2, in which said means acting between said sections comprises a spring fastened to one of said sections and in operative engagement with the other of said sections.

4. Supply means as set forth in claim 3, in which the spring is spirally wound and engages radial protrusions on the other of said section.

5. Supply means as set forth in claim 4, in which engagement of said spring and said protrusions is effective to load said spring as said tapes are being withdrawn from said storage unit.

6. Supply means as set forth in claim 5, in which there is slipping between said spring and said protrusions when loading of said spring is at a level below that which will damage said tapes.

7. Supply means as set forth in claim 1, in which the tapes are wound with the turns thereof interleaved.

8. Supply means as set forth in claim 1, in which the keying formation is at the center of said reel means and comprises first and second dissimilar elements extending beyond opposite sides of said storage unit.

9. Supply means as set forth in claim 2, in which the keying formation is on the interior section and serves to prevent rotation of said interior section when said supply means is operatively mounted to a banding machine.

10. Supply means as set forth in claim 2, in which the storage unit is separable from the hub portion and the exterior section has a formation cooperating with said keying formation to prevent relative rotation between said storage unit and the external section.

11. Supply means including first and second heat sealable plastic tapes adapted to move in opposite directions into a working space of a heat seal type banding machine, a reel means having a storage unit in which said tapes are wound so that substantially equal lengths of said tapes are withdrawn simultaneously from said reel means, and biasing means urging both of said tapes in directions opposite to the directions in which said tapes are moved in being withdrawn from said storage unit, said biasing means acting on said tapes with forces that are insufficient to damage said tapes.

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