United States Patent

Macedo et al.

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[54] WINDING APPARATUS

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[52] **U.S. Cl.** ..... **242/18 R**, 242/18 DD, 242/18 B

[51] **Int. Cl.** **B65h 54/52**

[58] **Field of Search** ..... 242/18 R, 18 B, 18 DD, 65

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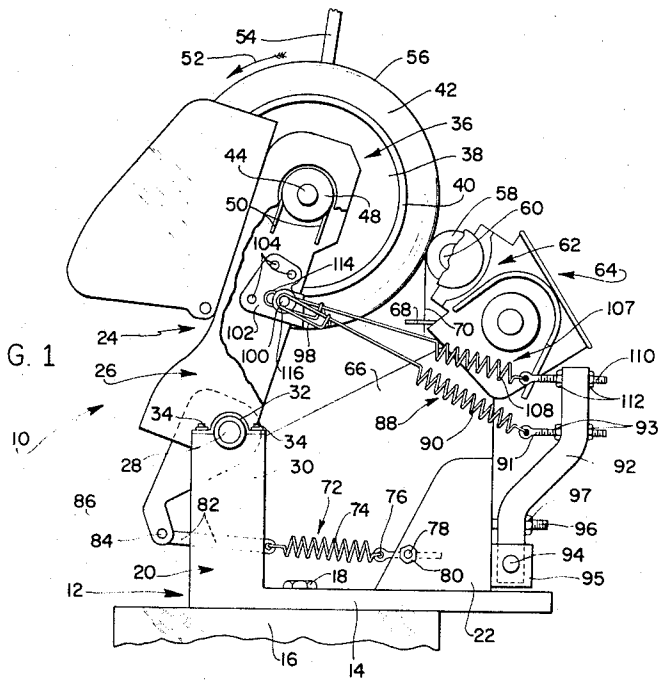
[57] **ABSTRACT**

Apparatus for winding a package rotatably mounted on a spindle assembly and held against a roller bail with selectively adjustable decreasing winding pressure as winding progresses and the spindle assembly moves across dead center, with gravity first urging the package toward the roller bail and then away from the roller bail. Upon initiating winding, a primary spring urges the package in a direction away from the roller bail to reduce winding pressure and then second and third springs urge the package against the roller bail. The second and third springs are connected with a lever or, alternatively, each is connected with a respective lever, for adjusting the point at which these springs come into play to regulate the winding pressure.

10 Claims, 4 Drawing Figures

G. 1



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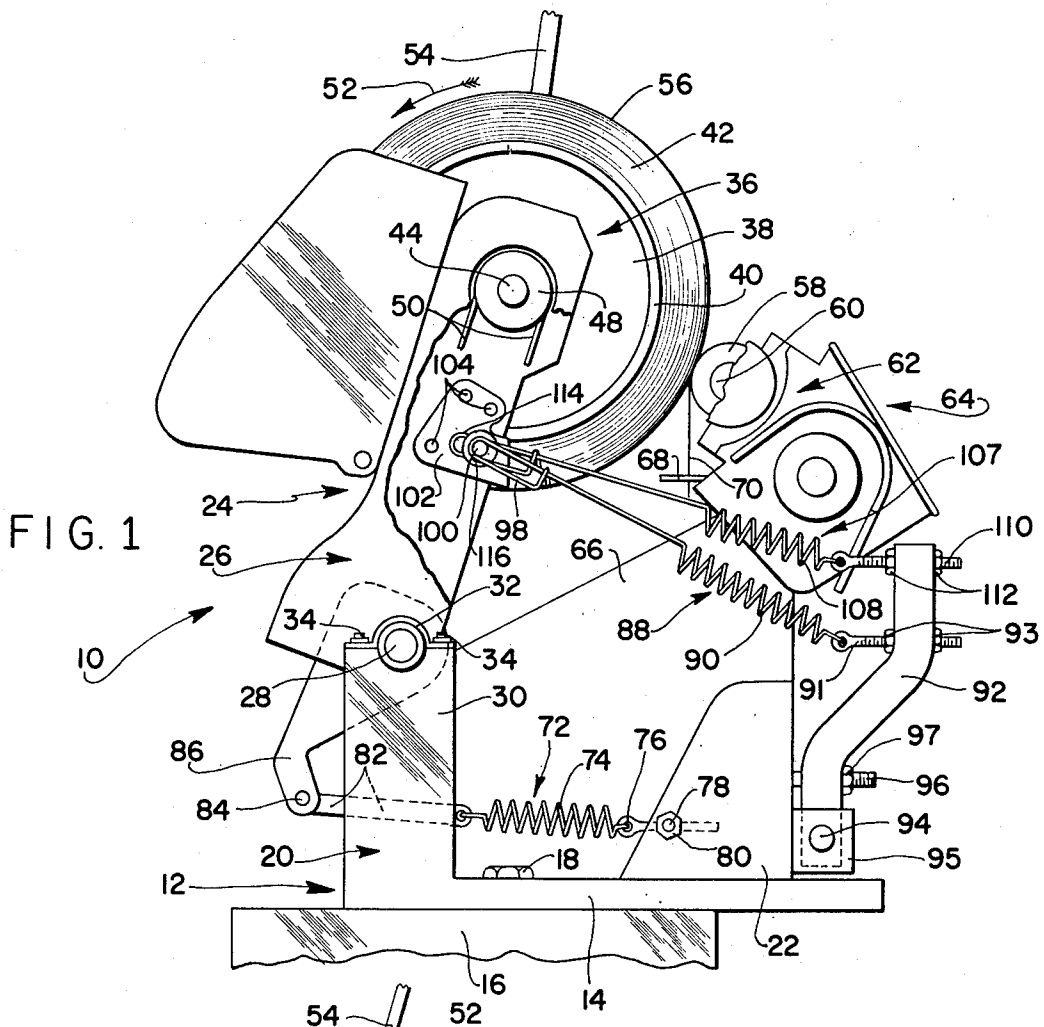

FIG. 1

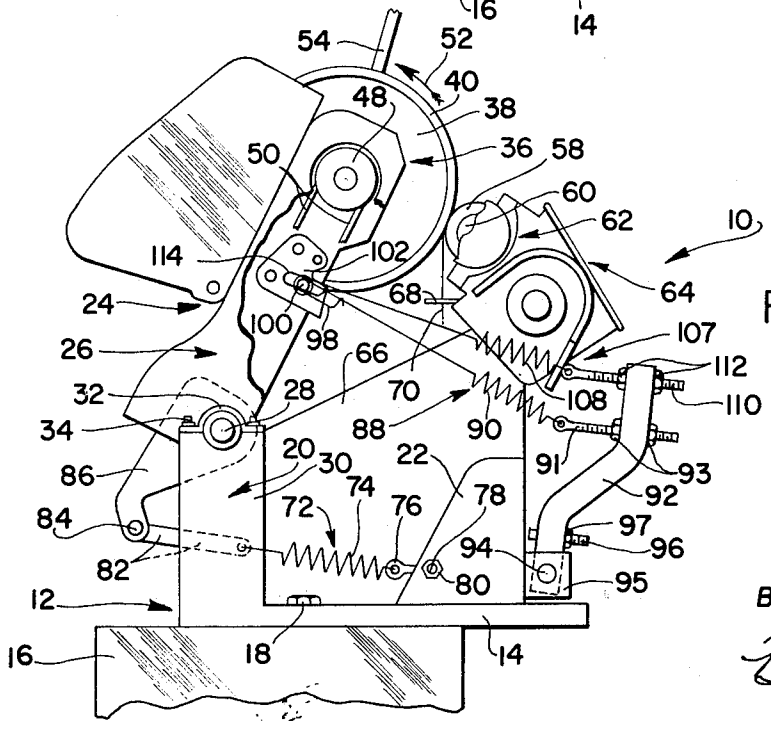

FIG. 2

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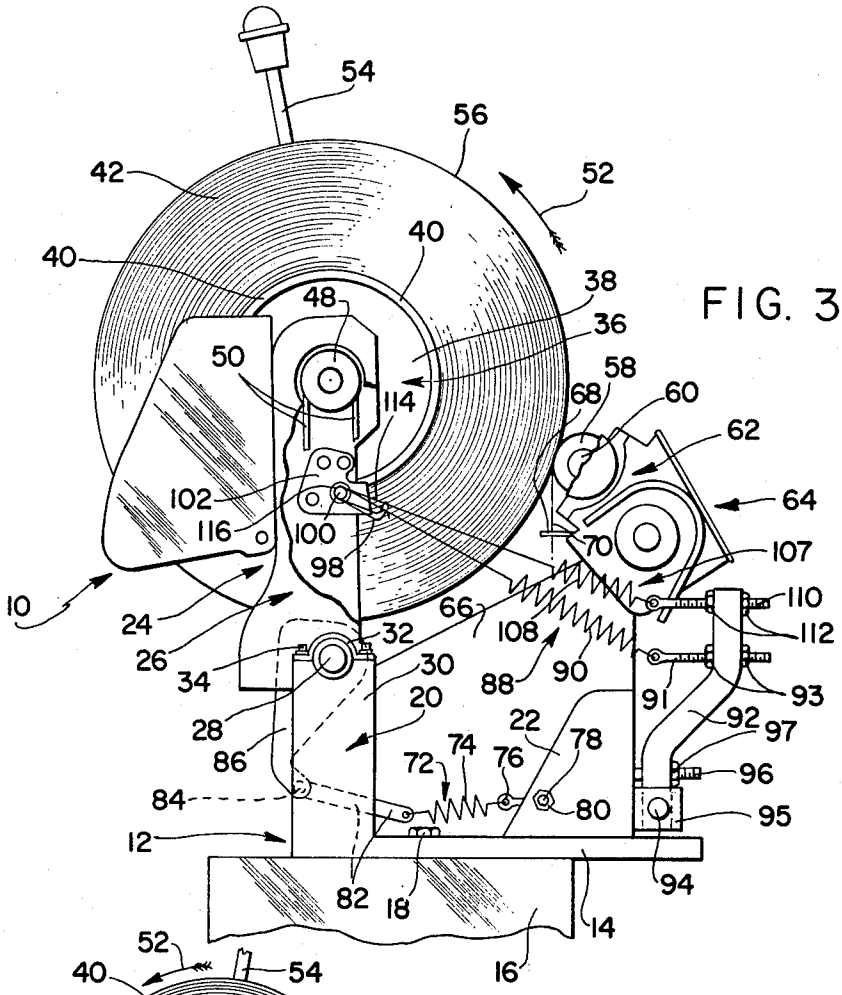

FIG. 3

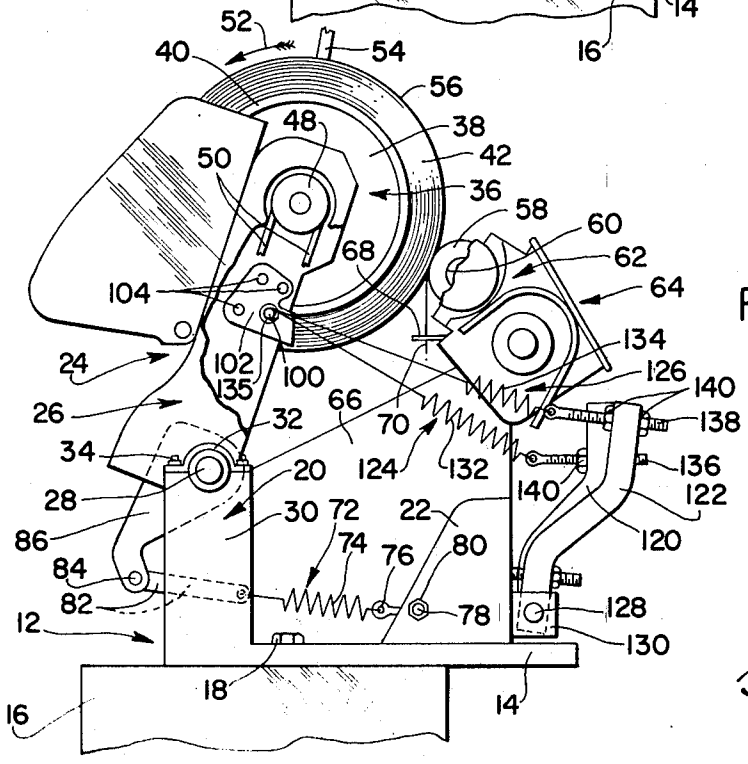

FIG. 4

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WINDING APPARATUS

This invention relates to winding and, more particularly, to apparatus for winding a package.

As used herein the term "package" means a strand wound so that it may be readily moved from place to place, and the term "yarn" means any strandular material, whether textile or otherwise.

In various industrial yarn take-up machines a spindle assembly is mounted to move toward dead center as a package is wound on a spindle and increases in diameter and weight. While the spindle assembly is approaching dead center the package is gravitationally urged against the roller bail and a spring counteracts the gravitational force to urge the package away from the roller bail and to provide a generally continually decreasing winding pressure between the package and the roller bail. As the spindle assembly moves proximate dead center the weight of the assembly and the increasing weight of the package would cause the package and roller bail contact to be erratic. To maintain adequate winding pressure between the roller bail and the package, a secondary spring has been provided for urging the package against the roller bail as the spindle assembly approaches dead center. However, when the final diameter of the package is increased to the extent that considerable movement of the spindle assembly past dead center is required prior expedients have not operated entirely satisfactorily for providing packages of desired quality.

The present invention is, in brief, directed to apparatus for winding a package on a spindle assembly. The package and a roller bail are held against each other with provision for maintaining a desired winding pressure therebetween as the diameter of the package increases. More particularly, the package is urged away from the roller bail as the spindle assembly moves toward a dead center position, and at least one spring urges the package toward the roller bail when the spindle assembly passes dead center. The spring or springs are connected with a lever or, alternatively, the springs are connected with respective levers, for determining the point at which the spring or springs pass between operative and inoperative positions to regulate the winding pressure.

It is a primary object of this invention to provide a new and improved apparatus for winding a package.

Another object is provision of a new and improved winding apparatus in which a spindle assembly carries a package and moves across dead center during winding of the package. A related object is provision for maintaining an adequate and, preferably, a substantially continually decreasing winding pressure between the package and a member which facially receives the package. Another related object is provision of a resilient force in the form of at least one spring for urging the package toward the receiving member to maintain the winding pressure. Still another related object is provision of novel apparatus for adjusting operation of the spring to vary the application of the winding pressure. A further related object is provision of a plurality of such springs, and mechanisms for adjusting their operation to vary the application of winding pressure. Still further related objects are: provision of a lever to which the springs are attached for adjustment of the springs or, alternatively, provision of a plurality of levers, one for each of the springs. A further object is provision of the spring or springs in the form of tension springs.

These and other objects and advantages of the invention will be apparent from the following description and the accompanying drawings, in which:

FIG. 1 is a schematic elevational view of a preferred embodiment of the invention, in an intermediate position during winding of a package, with parts broken away and removed for clearer illustration;

FIG. 2 is a schematic elevational view, similar to FIG. 1, but to a reduced scale, showing the apparatus in position for initiating winding;

FIG. 3 is a schematic elevational view, similar to FIG. 2, but showing the apparatus in position at termination of winding; and

FIG. 4 is a schematic elevational view, similar to FIG. 1, of another embodiment of the invention.

Referring to FIGS. 1–3 of the drawings, a winding machine in the form of a take-up machine 10 has a base 12 including a horizontal plate 14 fixedly secured to a support 16 by bolts 18 (only one visible) with a spindle support 20 and a spring mount 22 integral with and extending upwardly from the plate 14.

A spindle assembly 24 is mounted on the spindle support 20 and includes a spindle frame 26 having at a lower end opposed bearings 28 (only one visible) each journaled in adjacent pedestals 30 (only one visible) of the spindle support 20 and each held in place by suitable caps 32 releasably secured to the respective pedestal by bolts 34, for pivotal movement of the spindle assembly 24 about a substantially horizontal axis. At an end opposite its pivotal mounting, the spindle frame 26 carries a spindle 36 having a chuck 38 for telescopically receiving and clamping a core 40 on which a package 42 of yarn is wound. The spindle chuck 38 is secured to a spindle shaft 44 suitably journaled on the spindle frame 26 with a pulley 48 receiving a drive belt 50 from a pulley on a drive shaft (not shown), for rotating the spindle 36 in the direction indicated by the arrow 52. A conventional doffing handle 54 is part of the spindle frame 26 for operating the spindle chuck 36 during doffing and donning operations.

During winding of the package 42, a cylindrical face 56 of the package is in facial engagement with a roller bail 58 mounted at opposite ends in suitable journals 60 (only one visible) fixedly mounted on a cam housing 62 of a yarn traverse mechanism 64. The cam housing 62 is fixedly secured to the base 12 by a suitable bracket 66 bolted to the cam housing and to the base. The traverse mechanism 64 includes a yarn guide 68 which is traversed to and fro as the yarn 70 passes through the guide and to a nip between the package 42 and the roller bail 58.

As the package 42 is being wound on the spindle 36, the package diameter and weight increase and the spindle assembly 24 pivots to the left from a starting position shown in FIG. 2 through the position shown in FIG. 1 and to a terminal position as shown in FIG. 3. In doing so the spindle assembly 24 moves overcenter from an inclination in which it is gravitationally urged to the right as shown in FIGS. 1 and 2, to an inclination in which it is gravitationally urged to the left as shown in FIG. 3.

In order to maintain the desired winding pressure between the cylindrical surface 56 of the package 42 and the roller bail 58, the package 42 is resiliently urged away from the roller bail 58 (FIGS. 1 and 2) by a first or primary control assembly 72 including a first or primary tension spring 74 which partially counteracts the gravitational force urging the package 42 against the roller bail 58 as the spindle assembly moves toward dead center. The primary spring 74 has its right end attached to the eye of an eye bolt 76 which is threadedly received in a threaded bore of a shouldered stud 78. The stud 78 has a shank extending from its shoulder through the spring mount 22 of the base and is fixedly secured in place by a nut 80. The left end of the spring is pivotally received in a hole in one end of a lost motion connecting link 82 which is pivoted by means of a pin 84 to the lower end of a pressure control arm 86 which is adjustably secured to the lower end of the spindle frame 26 for pivotal movement about the axis of the bearings 28 to adjust the effective moment arm (to be discussed later) of the primary control assembly 72. The adjustable connection is not illustrated but may be of any suitable form such as a bolt passing through a quadrant slot in the arm 86 and threaded into the spindle frame 26, to clamp the arm in adjusted position. This adjustment varies the force applied by the primary control assembly 72 to the spindle frame 26 and, more particularly, varies the initial winding pressure and the pressure differential between starting and terminal winding pressure. By adjusting the eye bolt 76 the resilient force exerted by the spring 74 may be adjusted. Thus, as the diameter of the package 42 increases, the spindle assembly 24 is pivoted to the left and the increasing weight of the growing package 42 is carried more and more by the spindle frame bearings 28 and less and less by the roller bail 58. The force

exerted by the primary spring assembly **72** is continually reduced and, as desired, the control assembly **72** may be taken out of play as the link **82** and the spring **74** pivot downwardly and out of the way, as in FIG. **3**.

The package **42** is resiliently urged against the roller bail **58** by a second control assembly **88** which counteracts the primary control assembly **72** and continues to urge the package **42** against the roller bail **58** as the spindle assembly **24** passes dead center and is moved to the termination of winding, generally as shown in FIG. **3**. The second control assembly **88** has a second tension spring **90** connected at its right end to an adjustably eye bolt **91** slidably received in a bore in a lever **92** and adjustably anchored on the lever **92** by bolts **93** embracing opposite faces of the lever. The lever **92** is pivoted at its lower end, for movement about a generally horizontal axis, by means of a pin **94**, to a bracket **95** fixedly secured by bolts (not shown) to the spring mount **22**. The eye bolt **91**, and an adjusting screw **96** threadedly received in a bore in the lever **92** and held in adjusted position by a lock nut **97**, provide for adjusting the resilient force applied by the spring **90** and the point in the movement of the spindle assembly **24** at which the spring comes into play. The left end of the second spring **90** has an axially elongated lost motion eye **98** which receives and is slidably pivoted on a pin **100** to a plate **102** fixedly secured to the inner face of the far end of the spindle frame **26**, as by bolts **104** (FIG. **1**). In the position shown in FIG. **2**, the second control assembly **88** is relaxed and the eye **98** of the spring **90** is loose on the pin **100**. As the spindle assembly **24** moves to the left, the second spring assembly **88** comes into play as the adjusting screw **96** seats against a stop provided by the spring mount **22** and the eye **98** is firmly engaged by the pin **100** so that the slack in the second spring **90** is eliminated whereupon the spring **90** becomes taut (FIG. **1**) and proceeds to resiliently urge the package **42** against the roller bail **58**.

As the spindle assembly **24** continues to pivot to the left an additional resilient force is applied to urge the package **42** against the roller bail **58**, and to this end a third control assembly **107** including a third tension spring **108** is provided. The third spring **108** has its right end secured to an eye bolt **110** having its threaded shank slidably received in a bore in the lever **92** above the eye bolt **91** and secured in adjusted position by nuts **112** tightened against opposite faces of the lever for adjusting the resilient force applied by the third spring **108**. The left end of the third spring **108** has an elongated eye **114** slidably pivoted by the pin **100** to the mounting plate **102** on the spindle frame **26**. A sleeve (not shown) on the pin **100** maintains the eyes **98** and **114** spaced apart so that they may move freely past each other upon movement between the positions shown in FIGS. **2** and **3**. As the spindle assembly **24** moves to the left from the position shown in FIG. **1** to the position shown in FIG. **3**, the slack in the third spring **108** is taken up as its eye **114** is firmly engaged by the pin **100** whereupon the third spring comes into play and aids the second control assembly **88** in resiliently urging the package **42** against the roller bail **58**.

In adjusting the second and third control assemblies **88** and **107**, the adjusting screw **96** may first be adjusted to provide a rough adjustment of the lost motion feature and the eye bolts **91** and **110** may be adjusted to provide the precise point in the travel of the spindle assembly between the positions of FIGS. **1** and **3** at which the second and third control assemblies move from inoperative positions to operative positions and come into play. When the control assemblies are in their inoperative position, an overcenter configuration of the lever **92** retracts the springs (FIG. **2**).

As will be seen from the following table, the winding pressure substantially continually decreases as the diameter of the package **42** increases. Surges in winding pressure are avoided. It is sometimes desirable during the initial stage of winding to maintain a substantially constant winding pressure (Example **1**), but once the winding pressure reduces it is desirable that it substantially continually reduce without appreciable surges in winding pressure although a leveling off is tolerable, as is well understood in the field.

The examples in the following table indicate the relationship of winding pressure of the package **42** on the roller bail **58** in pounds to package diameter D in inches for the various adjustments of the control assemblies **72, 88** and **107** to provide desired package characteristics and, as applied in these examples, to a Model 959 take-up machine, manufactured by Leesona Corporation, Warwick, Rhode Island and carrying a chuck for a 5⅝ inches I.D. × 16 inch long core having a 6⅛ inch O.D., and a half pound dampening drag applied to the spindle assembly **24** in known manner. It should be noted, in general, that the diameter of the package at which the spindle assembly **24** is on dead center is between 12 inches and 13 inches diameter and will very slightly depending on the density of the yarn **70** being wound onto the package. The center of mass of the spindle assembly is to the left of the spindle shaft axis. The pivot pin **100** is generally centered between the axes of the bearings **28** and the spindle shaft **44**, and the right ends of the spring connections are preferably as shown in FIG. **2**. A force F in pounds tangent to the pivoted position of the center of mass of the spindle assembly **24** and the package **42**, and applied to the top of the spindle frame, is required to lift the package **42** from the roller bail **58** at various package diameters D, when the control assemblies **72, 88** and **107** are disconnected. A moment arm of 2½ inches at the start of winding was provided as measured along a radius from the pivotal mounting of the adjustable arm **86** about the axis of the bearings **28** with the radius normal to the longitudinal axis of the first spring **74**. The first spring **74** has a rate of 9 lbs./inch and becomes inoperative at about 12 inches package diameter the second spring **90** has a rate of 9½ lbs./inch and becomes operative at about 10 inches package diameter, and the third spring **108** has a rate of 16 lbs./inch and becomes operative at about 12¾ inches package diameter. These tests were run while winding 2,000 denier multifilament undrawn polypropolene yarn.

Diameter Din.	Force F lbs.	Winding Pressure-Pounds Example 1	Example 2
6 ⅛	14	8	9
7	13 ½	8	8.75
8	12 ¼	7.7	8.35
9	10 ½	7.2	8
10	7 ½	7	7.7
11	4 ½	6.2	6.5
12	¾	5.5	5.25
13	−4 ½	3.4	4.75
13 13/16	−10		
14		2	3.3

Referring to the embodiment shown in FIG. **4**, the same reference numerals as used in the embodiment of FIGS. **1–3** are used in FIG. **4** to identify parts which are substantially identical to those in the embodiment of FIGS. **1–3**. In FIG. **4**, a pair of levers **120** and **122** are provided, one for each of second and third control assemblies **124** and **126**, respectively, in lieu of the single lever **92** in FIGS. **1–3**. Each of the levers **120** and **122** is pivoted on a common pin **128** to a bracket **130** secured to the spring mount **22** by bolts (not shown). Tension springs **132** and **134** of the assemblies **124** and **126**, respectively, have eyes at one end snugly pivoted on the pin **100** of the plate **102** secured to the spindle frame **24** with a sleeve **135** between the eyes, as previously noted. Opposite ends of the springs **132** and **134** are pivoted to eye bolts **136** and **138**, respectively. These eye bolts **136** and **138** are adjustably mounted on the levers **120** and **122**, respectively, each by passing through a bore in the associated lever and held in adjusted position by bolts **140** tightened against opposite faces of the associated lever. Thus, each of the control assemblies **124** and **126** may be adjusted completely independently of the other assembly, and together provide the same result as the control assemblies in FIGS. **1–3**. As in the prior embodiment, the levers **120** and **122** are mounted overcenter to retract the springs **132** and **134** in their inoperative positions.

While this invention has been described with reference to particular embodiments in a particular environment, various changes may be apparent to one skilled in the art and the invention is therefore not to be limited to such embodiments or environment except as set forth in the appended claims.

What is claimed is:

1. Apparatus for winding a package, comprising means for engaging the periphery of the package during package winding, means for holding the package, means mounting the holding means for movement between a first position where the holding means is gravitationally biased toward said engaging means during a first interval of package winding and a second position where said holding means is gravitationally biased away from said engaging means as said package increases in size; and control means operable as said holding means moves between said first and second positions to maintain a substantially constantly decreasing pressure between said package and said engaging means, said control means including first means for urging the holding means away from said engaging means under a decreasing force correlated with increase in size of said package as said holding means moves toward said second position, second means for urging said holding means toward said engaging means under increasing force correlated with increase in size of said package as said holding means moves in said second position, lever means arranged for pivotal movement relative to said holding means, said second means being connected with said holding means and said lever means, and means for locating said lever means to render said second means inactive during at least a portion of the movement of said holding means in said first position and thereafter render said second means active to exert said increasing force on said holding means.

2. Apparatus as set forth in claim 1 wherein said holding means is mounted for pivotable movement between said first and second positions, said lever means is pivotable in a sense corresponding to the sense in which said holding means is pivoted as said package increases in size, and said locating means for said lever includes stop means limiting the pivoting motion of said lever means as said package increases in size.

3. Apparatus as set forth in claim 2 wherein said holding means includes a frame with a spindle assembly mounted thereon proximate one end thereof for supporting said package; said first means is connected with said frame at a locus proximate the opposite end of the frame from said one end, and said second means is connected with said frame at a position intermediate said spindle assembly and said opposite end.

4. Apparatus as set forth in claim 3 wherein said frame is pivotable about a horizontal pivot positioned intermediate said spindle assembly and said opposite end, and said second means is connected with said frame between said pivot and said spindle assembly.

5. Apparatus as set forth in claim 1 wherein said second means includes a plurality of biasing elements.

6. Apparatus as set forth in claim 5 wherein said biasing elements include at least first and second extendable members, and including means mounting said first member in position to be extended and thereby exert a biasing force on said holding means for a predetermined interval before said second member is extended to exert a further biasing force on said holding means.

7. Apparatus as set forth in claim 1 wherein said holding means passes through a dead center position in its movement from said first to said second position, and said control means is operable to exert a biasing force on said holding means toward said engaging means as said holding means passes through said dead center position.

8. Apparatus as set forth in claim 1 wherein said second means is connected with said lever means by adjustable means.

9. Apparatus as set forth in claim 1 wherein said second means includes a plurality of extendable members, and said lever means includes a separate movable lever for receiving each of said extendable members.

10. Apparatus as set forth in claim 1 wherein said second means includes a plurality of extendable members, and said lever means includes a lever having one end of each of the members connected thereto.

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