Feb. 9, 1954 N. E. KLEIN 2,668,671

WINDING MACHINE

Filed Dec. 7, 1949 3 Sheets-Sheet 1

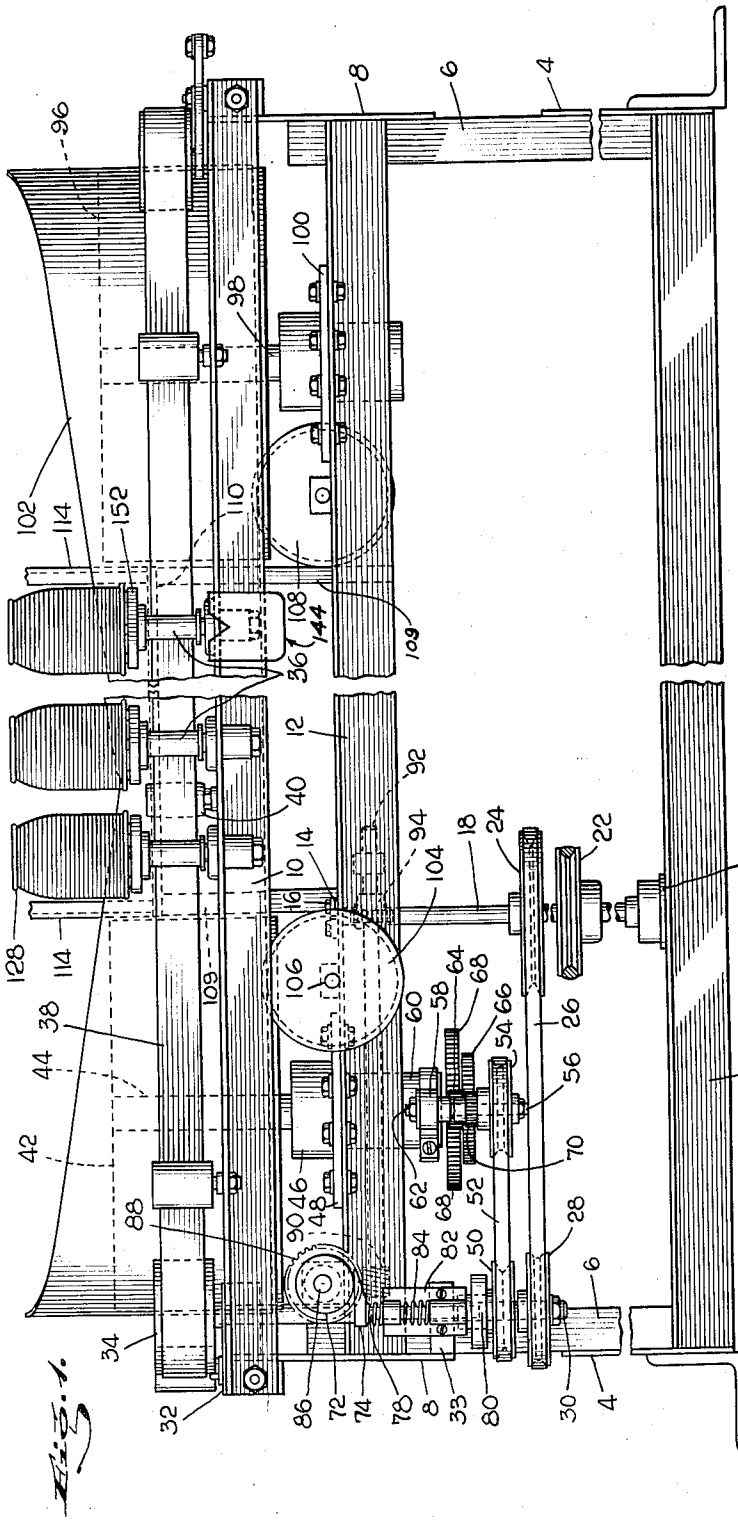


FIG. 1.

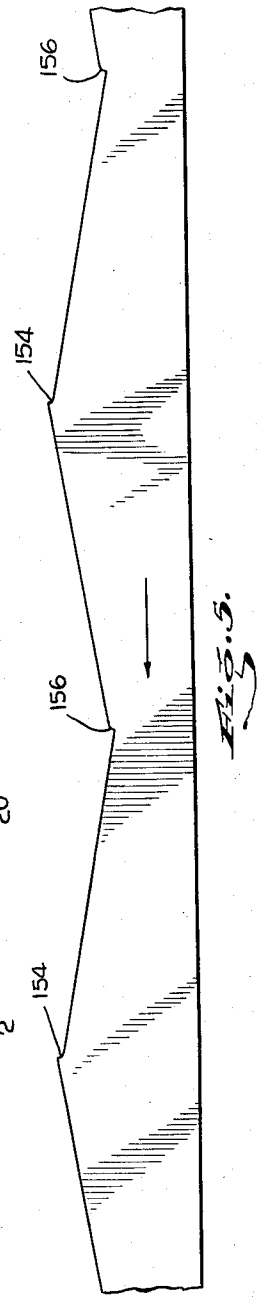


FIG. 3.

INVENTOR
NORMAN E. KLEIN
BY Louis E. Norton
ATTORNEY

Feb. 9, 1954 N. E. KLEIN 2,668,671

WINDING MACHINE

Filed Dec. 7, 1949 3 Sheets-Sheet 2

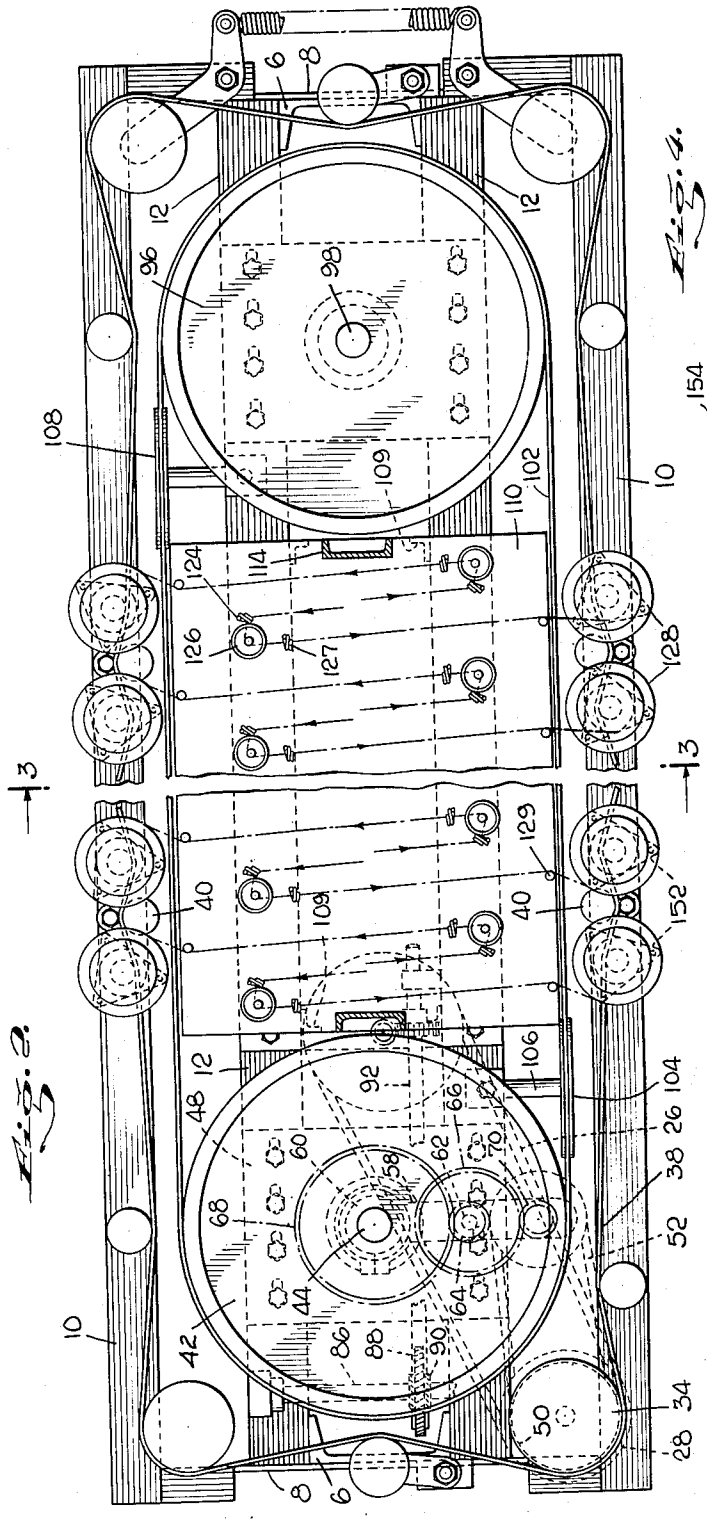


Fig. 2.

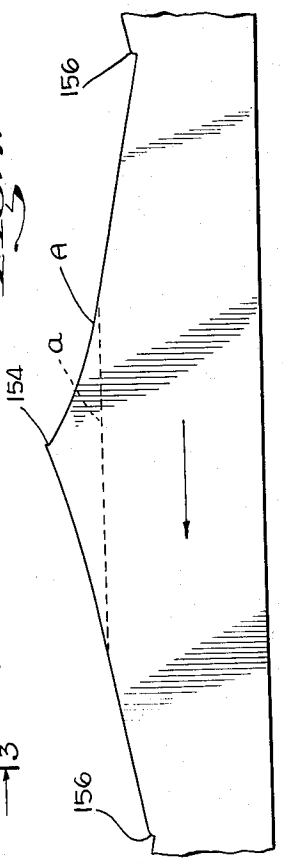


Fig. 4.

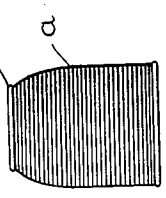


Fig. 4a.

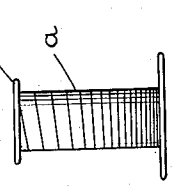


Fig. 4a

INVENTOR
NORMAN E. KLEIN
BY Louis E. Norton
ATTORNEY

Feb. 9, 1954 N. E. KLEIN 2,668,671

WINDING MACHINE

Filed Dec. 7, 1949 3 Sheets-Sheet 3

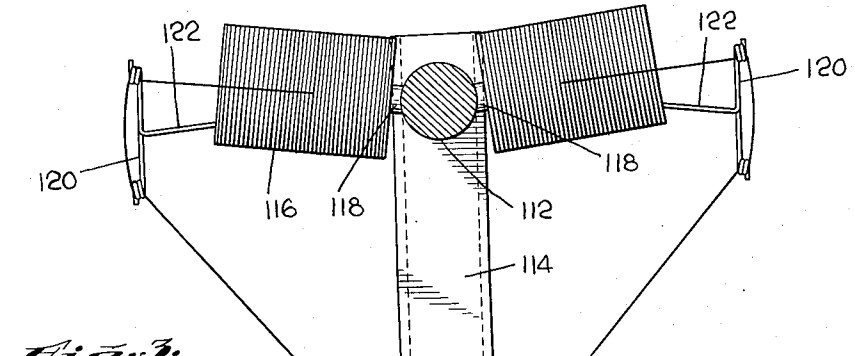


Fig. 3.

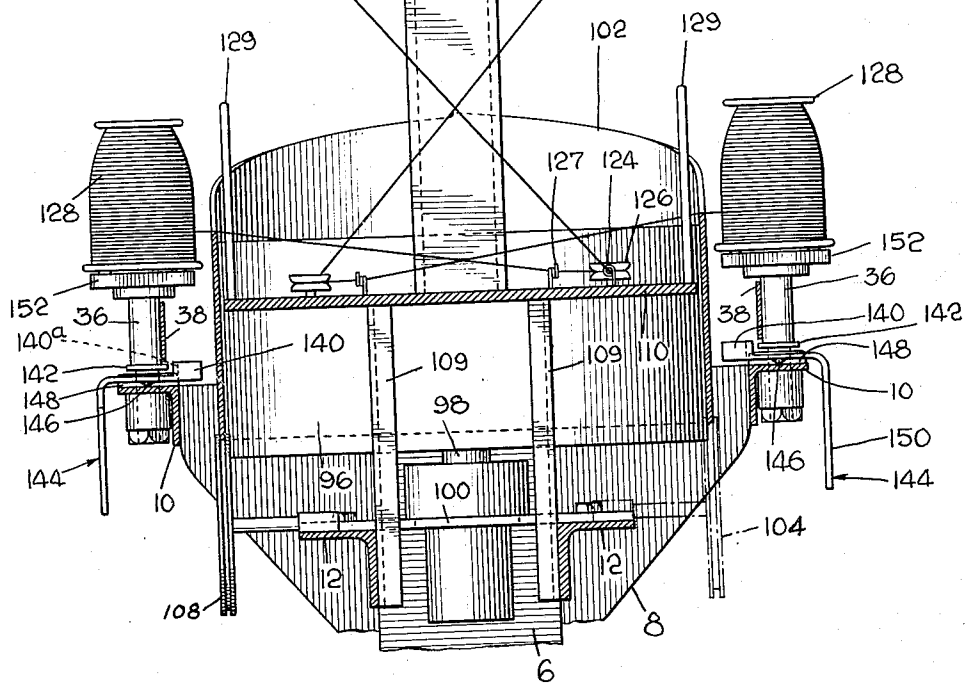
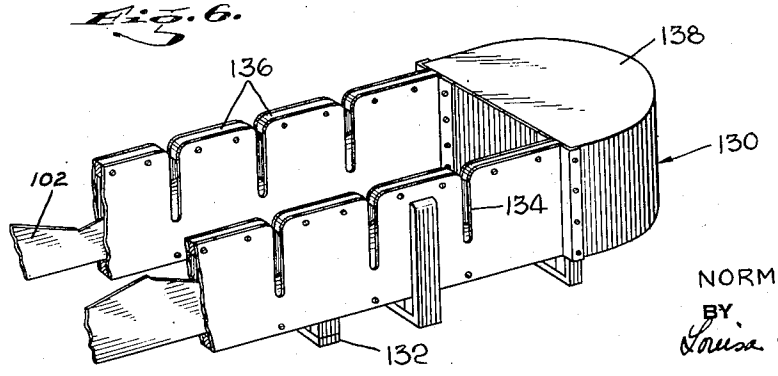


Fig. 6.



INVENTOR
NORMAN E. KLEIN
BY Louisa E. Norton
ATTORNEY

Patented Feb. 9, 1954 2,668,671

UNITED STATES PATENT OFFICE

2,668,671

WINDING MACHINE

Norman E. Klein, Stamford, Conn., assignor to Deering Milliken Research Trust, Greenwich, Conn.

Application December 7, 1949, Serial No. 131,538

11 Claims. (Cl. 242—35.5)

1

The present invention relates to textile winding machines, more particularly to machines known as Winding Machine and comprises a novel machine of this character that may be efficiently operated at speeds substantially higher than those at which redraw machines heretofore in use have been operated and that winds firm uniform packages. The invention comprises also a novel method of winding a bobbin that may be practised on the new machine and a new type of package that may be formed thereon, the package being so wound as to minimize any tendency of the yarn to slough off from the sides thereof.

An important feature of the new machine is an endless belt, one edge of which guides the yarn to the take-up bobbins and the contour of which provides the desired traversing action and determines the shape of the completed package.

Another feature of the new machine is the vertical mounting of the spindles carrying the take-up bobbins, permitting safe operation of the machine at high rates of spindle rotation.

An optional feature of the machine is the means for cyclically varying the rate of travel of the traverse belt which prevents ridges or "hilling" in the wound package by eliminating tracking.

Other features of the invention will become apparent as the description proceeds.

Of the accompanying drawings:

Figs. 1 and 2 are side and plan views, respectively, partly in section, of a vertical redraw frame embodying the invention;

Fig. 3 is a vertical sectional view taken on the line 3—3 of Fig. 2;

Fig. 4 is a detail view on an enlarged scale showing a belt contoured for winding a tapered package;

Figs. 4*a* and 4*b* are views illustrating steps in the method of winding a bobbin on the machine of Figs. 1 to 3 when a belt of the contour of Fig. 4 is employed, Fig. 4*a* showing the initial layer of yarn on the bobbin and Fig. 4*b* the completed package;

Fig. 5 is a detail view similar to Fig. 4 and showing a belt suitably contoured for winding a cylindrical package and

Fig. 6 is a fragmentary view in perspective of a protective shield for the traverse belt, suitable for use with the machine of Figs. 1 to 3.

As shown in Figs. 1 to 3, the new redraw frame is mounted on a pair of longitudinal rails 2 interconnected at each end of the frame by an end plate 4. An upright frame member 6 is secured to each end plate 4 and supports at its upper end a second or upper end plate 8 which in turn

2

supports two spindle rails 10. Also supported by the upright frame members 6 are two longitudinal rails 12. A cross bar 14 which is secured to the rails 12 near one end of the frame, supports an upper bearing 16 for the drive shaft 18 of the frame, the lower bearing for the shaft being carried by a cross support 20 mounted on the rails 2.

Fixedly secured to the drive shaft 18 are two pulleys, 22 and 24, the former being adapted to be coupled by a belt to a suitable drive motor (not shown), and the latter being coupled by means of a belt 26 to a pulley 28 fixed on the lower end of a spindle drive shaft 30. Shaft 30, which is suitably mounted in bearings carried by upper and lower supports 32 and 33 secured, respectively, to the spindle rail 10 and plate 8, carries at its upper end a spindle drive pulley 34. Spindles 36 are rotatably mounted in suitable bearings in the spindle rails 10 and are driven from the pulley 34 by means of an endless belt 38, suitable idler pulleys 40 being mounted on the spindle rails adjacent the spindles to guide the drive belt into engagement with the spindles.

At one end of the frame a relatively large pulley 42 is mounted on a shaft 44. The shaft 44 is rotatably mounted in a bearing housing 46 supported by a cross plate 48 secured to the longitudinal rails 12. The shaft 44 is driven from the spindle drive shaft 30, and preferably the speed ratio of the shafts 44 and 30 is cyclically varied by means now to be described. A variable pitch pulley 50 is mounted on the shaft 30 and coupled by a belt 52 to a pulley 54 rotatably mounted on a stub shaft 56. Shaft 56 is carried by a horizontally disposed change gear arm 58 which in turn is mounted on a sleeve 60 concentric with the shaft 44 and fixed to the plate 48. The arm 58 supports a second stub shaft 62 upon which are mounted gears 64 and 66 which mesh, respectively, with a gear 68 on shaft 44 and a gear 70 integral with the pulley 54 on stub shaft 56. The pitch of pulley 50 on shaft 30 is cyclically varied by means of a cam 72 which engages a shoe 74 fixed to a rod 78, the lower end of which bears upon the plate 80 of the variable pitch pulley 50. The rod 78 is supported in a bracket 82 carried by the bearing support 33. A coiled spring 84 about the rod 78 maintains the shoe 74 in contact with the cam 72. Cam 72 is fixedly mounted on a horizontal shaft 86 which is mounted in bearings carried by the longitudinal rails 12 and carries a gear 88. Gear 88 is driven by a worm gear 90 secured to a horizontal shaft 92 driven from the main shaft 18 by gearing 94, shaft 92 being mounted in suitable

bearings secured to one longitudinal rail 12. Thus during operation of the frame, shaft 44 is continuously driven from shaft 30 and the ratio of rate of rotation of shaft 44 to that of shaft 30 is cyclically varied through a small range.

A large idler pulley 98 is mounted at the other end of the frame on a stub shaft 98 rotatably mounted in a bearing carried by a plate 100, the plate being so mounted on the rails 12 as to permit adjustment of its position longitudinally of the frame. The belt 102, the contour of which provides the traversing action of bobbins carried by the spindles and determines the shape of the completed package, encompasses the pulleys 42 and 96, being driven by the former and driving the latter. A disk 104 having an annular groove for reception of the lower edge of the traverse belt 102, is rotatably mounted on a horizontal shaft 106 carried by one rail 12, and serves to guide and position the belt as it approaches the pulley 42. A similar guide disk 108 is provided on the other side of the frame for guiding and positioning the belt as it approaches the pulley 96.

Supported above the rails 12, as by struts 109 (see Fig. 3) is a platform 110 which extends the length of the frame between the pulleys 42 and 96 and mounted on this platform are yarn guide and tensioning devices and a suitable creel for the supply packages of the yarn to be wound. In the particular embodiment of the invention illustrated in the drawings, a longitudinal rod 112 is supported above the platform 110 by uprights 114 and the supply packages 116 are mounted on pegs 118 secured to the rod 112 and suitably spaced there along. Pigtail guides 120 are mounted in pairs on rods 122 carried by the rod 112 intermediate the pegs 118. Yarn drawn off over-end from a supply package passes through the eyes of the associated guides 120 and then through guides 124 and a tension device 126, both suitably positioned on the platform 110, through a second guide 127 also mounted on the platform, over the guiding edge of the traverse belt 102 to one of the bobbins 128 on the spindles 36. The tension devices 126 are indicated in the drawings as of the weighted disk type, but other conventional types of additive tension devices could be employed if desired.

The tension devices 126 and associated guides 124 and 127 are preferably positioned adjacent the sides of the platform 110, those along one side serving to guide and tension yarn delivered to bobbins on spindles on the other side of the frame. This arrangement provides a relatively long free path for the yarn prior to its passage over the traverse belt and thus minimizes tension variations during traverse.

It is important that each end of yarn be so guided in its path to and over the contour belt to its respective take-up bobbin that deflections of the path in the direction of belt travel be avoided while vertical shifting of the path, in accordance with the contour of the belt, be permitted. Vertical guide rods 129 are positioned on the platform 110 adjacent the belt to so guide the yarn to the belt and take-up bobbins. The position of a guide rod 129 with reference to its adjacent bobbin 128 is important for optimum winding. Preferably, as indicated in the drawings, the rod is so positioned that the yarn path from the rod to an empty bobbin is substantially perpendicular to the direction of travel of the belt.

A convenient arrangement which provides suitable control of the yarn path and at the same time serves to protect the operator of the machine from accidental contact with the rapidly travelling traverse belt 102 is shown in Fig. 6. In this arrangement the belt 102 is enclosed within a shield 130 of sheet steel or the like which is mounted on a series of cross members 132 supported by the upper longitudinal rails 12 of the frame. In the shield adjacent each spindle position is a vertical slot 134 having rounded edges serving in lieu of the guide rods 129 to guide the yarn and to prevent horizontal deflection of its path. Preferably the inner and outer walls of the shield 130 are connected together near their upper edges between the slots 134 by removable spacers 136 to permit ready substitution of a belt of different contour. Guards 138 are also provided for the terminal pulleys 42 and 96 and these also are preferably constructed so as to be readily removable for change of belt.

In order to permit doffing and replenishing of individual bobbins without shutdown of the frame, a separate spindle brake is provided at each spindle position. Each brake comprises a block 140 of friction material having a concave surface adapted to be brought into contact with the flange 142 of the spindle whorl to brake the spindle. The block 140 is mounted on a U-shaped plate member 144, which in turn is mounted for limited pivotal motion about the axes of rods 146 brazed to the under surface thereof. The rods 146 extend inwardly from the arms of the U-shaped member 144 and enter diametral slots in a ring 148 encompassing a spindle, the ring 148 and rods 146 resting on the spindle rail 10. Depending from the legs of each member 144 and preferably formed integral therewith, is an apron 150 for engagement by the knee of an operator, pressure on the apron 150 rocking the member 144 about the axes of the rods 146 and bringing the braking surface of block 140 into engagement with flange 142. The bobbins 128 rest on shoulders or flanges 152 on the spindles 36 and these shoulders, as best shown in Fig. 2, are preferably triangular in horizontal section to permit the engagement of the under surface of the lower flange of the bobbin by the fingers of the operator when doffing. This construction avoids the necessity for handling of the delicate yarn on the bobbin and thus minimizes damage or soiling of the yarn.

As heretofore indicated the contour of the traverse belt 102 determines the shape of the completed package. Fig. 4 illustrates a suitable contour of belt for use in winding a package of the shape illustrated in Fig. 4b. To wind such package the upper portion thereof is traversed more rapidly than the lower portion. Also, to provide the proper taper to the package, the traversing should be such that the spacing between adjacent turns of the yarn gradually increases from the base of the tapered portion, indicated at *a* in Figs. 4*a* and 4*b*, to a maximum at the top of the bobbin. Below the line *a* the guiding edge of the belt has a constant slope to provide the uniform wind of the cylindrical part of the package. Adjacent the highest and lowest points of the upper edge of the traverse belt, corresponding to the top and bottom of the package, the slope of the trailing edge is abruptly increased through a short distance as indicated at 154 and 156 respectively. This abrupt change in curvature prevents "hilling" at the ends of the bobbin by compensating for the delay in transmitting to the point of application of wind on the bobbin the effect of change in direction

of traverse occasioned by the distance between the traverse belt and the bobbin.

From the foregoing description it will be apparent that the redraw frame of the invention when provided with a belt of the contour of Fig. 4 will wind packages such as that of Fig. 4b, in which the tapered and cylindrical portions are formed without change in length of traverse. Thus except at the upper and lower ends of the bobbin, there is no change in direction of traverse and the resulting package has consequently less tendency to slough off than packages formed by machines which vary the length of traverse or add a traverse action to a builder motion. Due to the fast wind at the upper end of the bobbin resulting from the abrupt change of slope at the peaks of the contoured edge of the traverse belt, the packages are formed with a wide angle of wind at the tapered ends. Consequently "creasing-in" or "trapping" of yarn under the upper bobbin flange is avoided and drawing off of yarn over-end from the packages is facilitated.

When it is desired to wind cylindrical packages, a belt of the contour of that shown in Fig. 5 may be employed. In this instance the yarn engaging edges have a constant slope except for the short stretches 154 and 156 adjacent the highest and lowest points respectively of the upper edge of the belt; these short stretches, as in the case of belt of Fig. 4, have a greater slope along the trailing edge to insure against hilling at the ends of the bobbin.

The operation of the above described machine will be readily understood from the foregoing description. When the frame is in operation the drive shaft which is driven from the frame motor (not shown) drives the spindle drive shaft 30 through the belt 26 and pulleys 24 and 28 and the spindle drive shaft, through belt 38 and pulley 34 drives the spindles and, through the variable pitch pulley 50, belt 52 and the gear train, drives the shaft of drum 42. Rotation of drum 42 causes unidirectional travel of the traverse belt 102 past each spindle which in turn causes the yarn, drawn from the creel by the rotating spindles, to traverse the spindles in accordance with the contour thereof. Drive shaft 18, through shaft 92, gears 88 and 90 rotates cam 72 which, through shoe 74 causes cyclical variations in the pitch of pulley 50 and thereby varies the ratio between the rate of rotation of the spindles and the rate of travel of the traverse belt. This cyclical variation is small, preferably of the order of about five percent. The shape of the completed package will depend, as heretofore described in connection with Figs. 4 and 5, upon the contour of the particular traverse belt used in the machine, belts with contours of uniform slope building cylindrical packages, and those with contours concave upward building tapered packages.

As the vertical distance between the highest and lowest points of the contoured edge of the belt determines the axial length of package to be wound, the bobbins used on the frame should have a length of barrel correlated to the particular traverse belt or, conversely, the traverse belt should be designed with reference to the particular bobbin to be used on the machine. Preferably, bobbins of the general proportions shown in Fig. 4a having a barrel length of about 5½ inches are employed when the package is to have the tapered form shown in Fig. 4b. Such a bobbin forms the subject matter of a co-pending application of the present applicant, Ser. No. 122,626, filed October 21, 1949, now abandoned. When a bobbin of the proportions illustrated in Fig. 4a and of the size specifically described in said application is wound with 100–40–3 acetate (100 ends of 40 denier per filament twisted three times per inch) using a traverse belt contoured as in Fig. 4, a package is formed that weighs about one and one tenth pound and that is suitable for use as the yarn supply in a two-for-one twister. The redraw frame of the present invention can wind such package in substantially less time than conventional redraw frames in which the packages are formed on horizontally disposed axes can wind packages of lesser weight. For example, $1\frac{1}{16}$ pound packages have been wound on the new machine in one and one quarter of an hour, using a spindle speed of 4000 R. P. M. and a traverse belt speed such that the rate of traverse was 54 cycles per minute, the particular belt having a peak to peak length measured along the belt of four feet and moving at an average speed of about 220 feet per minute. This is a substantial improvement over redraw frames now in use which have a rate of spindle rotation of about 900 R. P. M. or less. Such machines require about five hours to wind a $\frac{9}{16}$ pound package.

The invention has now been described with reference to one specific embodiment thereof. Obviously various changes in the construction of the specific redraw frame illustrated in the drawing could be made and parts could be added or omitted without departing from the spirit of the invention. For example although in the particular machine illustrated in the drawings, yarn is delivered over the upper contoured edge of a traverse belt which is frictionally driven by a rotating drum, obviously the lower edge rather than the upper edge of the belt could be contoured and the yarn fed thereunder, and chain or other drive means for the traverse belt could be employed if desired. Various shapes of packages other than those specifically described could be produced by suitably varying the contour of the belt. For example, if the contour near the bottom of the troughs or dales is curved so as to accelerate the traverse at the lower end of the bobbin and the contour near the peaks is also so curved, packages roundly tapering at both ends will be formed, with or without a central cylindrical portion, depending upon whether or not an intermediate section of the contour has a constant slope. On the other hand, if the contour of the belt were such as to provide uniform rate of traverse near the ends of the barrel of a bobbin with accelerated and decelerated traverse over the central portion, packages with cylindrical end portions and restricted central portions would be formed. Thus the invention provides a method and means for forming substantially any desired form of yarn package and such package due to the fact that it will be formed of successive layers each extending the full length of the package, will have less tendency to slough off when handled than packages wound with a traverse length less than the full length of the package.

The following is claimed:

1. A textile winding machine comprising a plurality of substantially vertically disposed rotatable spindles adapted to support bobbins, drive means for said spindles, an endless sheet member having a contour along one edge defining a succession of hills and dales, the difference between the maximum and minimum widths of the sheet member being substantially equal to the

length of the package to be wound on a bobbin, means for moving said sheet member unidirectionally in a fixed closed path adjacent said spindles, support means for yarn supply packages and means for guiding yarn from a supply package to a bobbin, said guide means being positioned to cause the contoured edge of the sheet member to be engaged by the yarn in its travel to a bobbin whereby the yarn is caused to traverse the bobbin in accordance with the hills and dales of the contoured edge of said sheet member.

2. The winding machine according to claim 1 wherein said means for moving said sheet member includes a pair of rotatable drums encompassed by said sheet member and means for driving one of said drums.

3. The winding machine according to claim 2 wherein said means for driving one of said drums includes means for cyclically varying the rate of rotation thereof.

4. The winding machine according to claim 1 including means preventing displacement of the yarn in the direction of travel of the sheet member.

5. A textile winding machine comprising a plurality of substantially vertically disposed rotatable spindles each adapted to carry a winding core, support means for yarn supply packages, yarn guide means for leading yarn from a package to a winding core, means engageable by the yarn in its travel from said guide means to a core for causing the yarn to traverse the core during winding thereon, said traverse means comprising an endless sheet member having a contour along one edge defining a series of hills and dales, the difference between the width of the sheet member at the bottom of a dale and that at the peak of an adjacent hill being substantially equal to the length of package to be wound on a core, the yarn engaging said contoured edge, and means for rotating said spindles and for moving said sheet member in a fixed path adjacent said spindles.

6. In a winding machine of the type wherein a plurality of spindles are rapidly rotated to draw yarn from supply packages for winding on cores carried by the spindles, the combination comprising an endless flexible belt having a contoured edge positioned for travel of yarn thereover during the winding operation and means for moving said belt in a direction substantially at right angles to the direction of travel of the yarn in approaching the cores to cause the path of each yarn end to be deflected parallel to the axis of the associated core in accordance with the contour of the belt, said contoured edge comprising a succession of hills and dales, the transverse distance between the narrowest and widest parts of the belt being substantially equal to the axial length of packages to be wound on the cores.

7. The combination according to claim 6 wherein at least a part of the contoured edge of the belt between the base of a dale and the peak of the adjacent hill is straight whereby a corresponding length of the packages wound on the cores will be cylindrical in shape.

8. The combination according to claim 6 wherein a part of the contoured edge of the belt is in the form of a curve increasing in slope to a maximum at the peak of each hill whereby a corresponding length of the packages wound on the cores will be tapered in shape.

9. The combination, with a winding machine of the type wherein ends of yarn are drawn from supply packages by rotation of vertical spindles carrying cores upon which the yarn is wound, of a traversing means determinative of the shape of the packages to be wound comprising an endless flexible belt having one straight edge and the other edge cut in the form of a series of hills and dales so that the width of the belt varies along its length from a minimum at the bottom of each dale to a maximum at the peak of each hill, means for causing unidirectional travel of said belt in a fixed circuit with its straight edge in a horizontal plane and with one face adjacent the spindles, and yarn guide means positioned to cause yarn in traveling from the supply packages to the winding cores to engage said contoured edge of the belt for traverse thereby of the cores, the contour of said belt between the bottom of a dale and the next succeeding peak having a constant slope for a portion of its distance and a gradually increasing slope for the rest of its distance whereby the shape of each package wound on the machine is cylindrical for a portion of its length and tapered for the remainder of its length.

10. A textile winding machine comprising a plurality of rotatable spindles adapted to support winding cores, drive means for said spindles, an endless sheet member having a contour along one edge defining a succession of hills and dales, the maximum transverse distance between the bottom of a dale and the peak of a hill being substantially equal to the length of package to be wound on a core, means for moving said sheet member in a fixed path adjacent said spindles, support means for yarn supply packages and means for guiding yarn from a supported supply package to a winding core, said guide means being positioned to cause the contoured edge of the sheet member to be engaged by the yarn in its travel to a winding core whereby the yarn is caused to traverse the winding core in accordance with the hills and dales of the contoured edge of said sheet member.

11. The textile winding machine according to claim 10 wherein the contour of said sheet member between the bottom of a dale and the next succeeding peak has a constant slope for a portion of its distance and a gradually increasing slope for the rest of its distance whereby the shape of each package wound on the machine is cylindrical for a portion of its length and tapered for the remainder of its length.

NORMAN E. KLEIN.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
661,209	Duffy	Nov. 6, 1900
1,078,574	Colman	Nov. 11, 1913
1,343,481	Schaufelberger	June 15, 1920
1,357,434	Anderson	Nov. 2, 1920
1,647,535	McKean	Nov. 1, 1927
2,091,902	Auten	Aug. 31, 1937
2,131,470	Bowden	Sept. 27, 1938
2,210,839	Marsh	Aug. 6, 1940
2,301,712	Seem	Nov. 10, 1942
2,326,307	Peterson	Aug. 10, 1943
2,345,601	Hickes	Apr. 4, 1944
2,475,895	Hill	July 12, 1949

FOREIGN PATENTS

Number	Country	Date
137	Great Britain	Jan. 20, 1853
991	Great Britain	Apr. 5, 1870
423,658	Great Britain	Feb. 4, 1935