Aug. 14, 1951 I. S. ROBERTS 2,564,033

WINDING MACHINE SPEED CONTROLLER

Filed Feb. 17, 1948

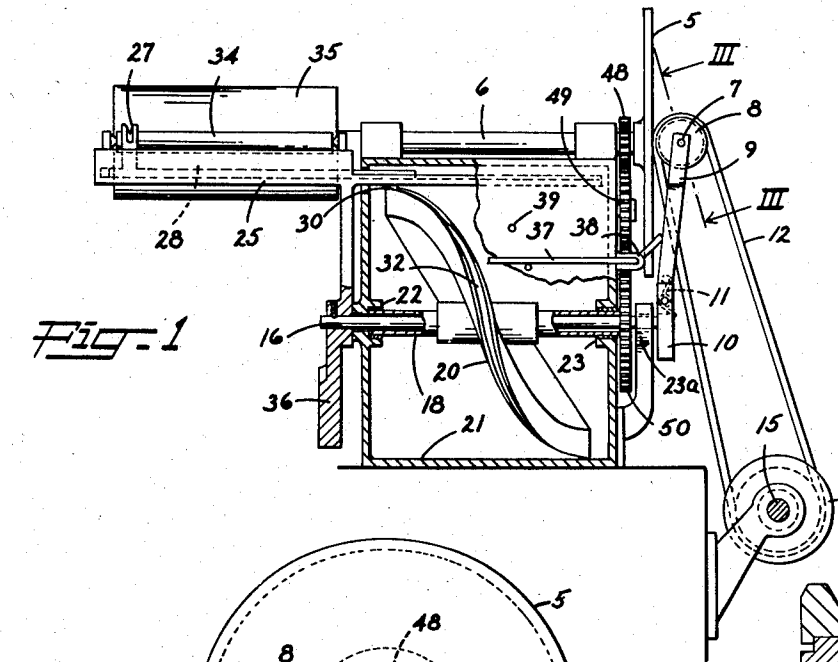


Fig. 1

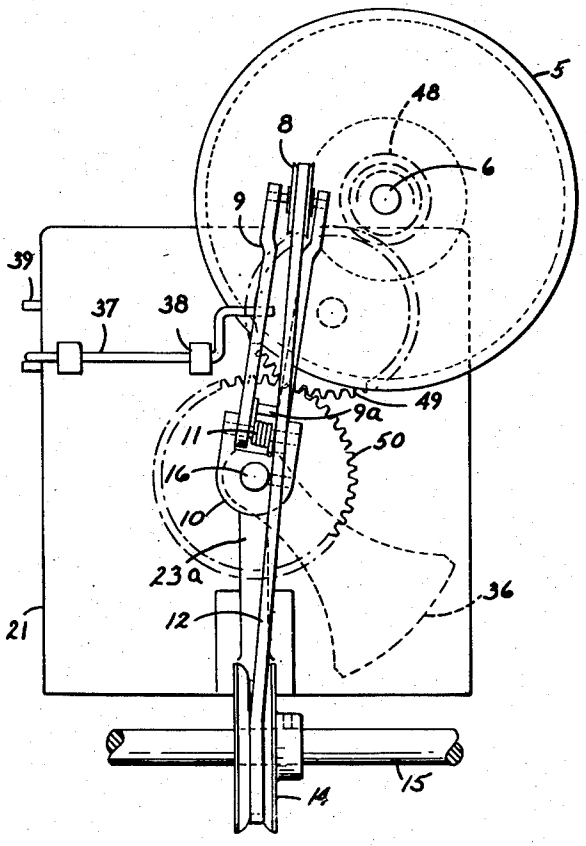


Fig. 2

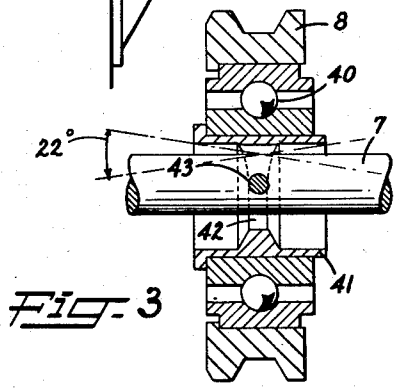


Fig. 3

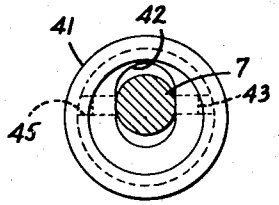


Fig. 4

INVENTOR.
INGHAM S. ROBERTS
BY
Thomas R. O'Malley

Patented Aug. 14, 1951

2,564,033

UNITED STATES PATENT OFFICE

2,564,033

WINDING MACHINE SPEED CONTROLLER

Ingham S. Roberts, Ridley Park, Pa., assignor to American Viscose Corporation, Wilmington, Del., a corporation of Delaware

Application February 17, 1948, Serial No. 8,908

15 Claims. (Cl. 242—18)

1

This invention relates to apparatus for winding strands of filamentary or analogous material into packages such as tubes, cones, and spools, particularly to machines of the type wherein the speed of rotation of a package supporting spindle is varied to maintain constant peripheral speed at the portion of the surface of a package receiving a strand material.

One object of this invention is to form packages of a strand material by a process in which the rotation of the package is varied so that the strand-receiving portion of the surface is moving at constant speed. It is also an object to provide a package-building apparatus for strand materials having a means for positively and automatically varying the speed of the package supporting spindle with the diameter of the package. Another object of the invention is to provide a satisfactory pulley system whereby power may be transmitted to a winding machine spindle at adjustable spindle speeds. Still another object is to provide a thread-guide responsive friction-drive for a winding machine spindle which imposes minimum pressure variations on the thread guide as it follows the surface of a strand package. Other objects, advantages, and features will be apparent from the drawings and the following description.

In the drawings illustrative of the invention,

Figure 1 is an elevation, with parts in section, of a winding machine embodying the invention;

Figure 2 is an end elevation of the machine shown in Figure 1;

Figure 3 is a sectional view taken on line III—III of Figure 1; and

Figure 4 is an end view of the pulley supporting axle and the shaft in section shown in Figure 4.

According to the invention, a winding machine spindle may be caused to operate at varying angular speeds so as to maintain constant linear speed of a strand material being collected thereon, by the operation of a friction drive controlled by a pivoted lever following the outer radius of a strand package supported on the spindle.

Referring to Figure 1, a disc member 5 is secured to a spindle shaft 6. Pulley 8 is supported on a shaft 7 which extends through a bracket or yoke 9 pivoted in a bracket support, such as a clevis 10. The pulley 8 is urged toward the disc surface of member 5 by a spring 11 acting on a cross-pin 9a on the bracket 9. V-belt 12 provides power transmission from a pulley 14 secured to a power shaft 15. The belt 12 more

2

than completely fills the channel therefor about the pulley 8 so that its outer side furnishes a friction surface for producing turning movement of member 5. Clevis 10 is secured on a shaft 16 passing through a hollow cam shaft 18 supported at either side of cam housing 21 by bearings 22 and 23. Shaft 16 is supported by bearings 22a and 23a concentrically with shaft 18. The traverse frame or bracket 25 is secured to the shaft 16 so that movement of bracket 25 about the axis of shaft 16 produces a similar movement in the bracket 9. Bracket 25 supports the thread guide 27 secured to the slide bar 28. A projecting lug or cam roller 30 secured to the end portion of bar 28 extends into a groove 32 of the cam 20 to effect reciprocation of the slide bar 28 and thread guide 27 when the cam 20 is rotated. In the embodiment shown, cam 20 is driven from the spindle shaft 6 by gears 48, 49 and 50. A bail roll 34, supported also by the bracket 25, rolls freely against the surface of the strand package 35 at a pressure determined by the adjustment of a counterweight 36. The winding machine may be operated without a roll such as roll 34 by letting the thread guide operate as the medium for transmitting pressure to the package 35. However, in winding packages such as tubes, the use of a roll contributes to a package having more uniform density, and to greater freedom from vibration in the thread guiding assembly. In operation it is desired to keep the bracket 25 free from uncontrolled or variable torque forces, such as that which would be produced if the rotating shaft 18 were in contact with the shaft 16. Such forces affect the pressure of the thread guide assembly upon the package and thus, the density of the package.

The position of pulley 8 and the thread guide 28 will be such with respect to the axis of spindle shaft 6 that the circular path of the belt 12 upon the disc member 5 at any given instant is approximately of the same diameter as the cylindrical surface of the package in contact with the thread guide 27. Obviously, as the driving pulley 14 turns at constant speed, an increase in the diameter of the package moves the thread guide assembly farther from the spindle axis while also moving the pulley 8 outwardly on the disc surface of member 5. By this movement of the pulley 8, the spindle speed is reduced in such simple inverse proportion by an increase in package diameter that the linear speed of the strand take-up is maintained at a constant rate. To stop the spindle assembly, a lever 37 is pivoted

in the bracket 38, engaging the bracket 9 to swing it outward from the winding machine. When the lever 37 is turned clockwise, frictional engagement of the portion of the belt 12 extending around the pulley 8 with the disc member 5 is interrupted. To maintain the lever 37 in a position whereby the rotational movement of the spindle is interrupted, the end of the lever 37 may be hooked over the pin 39.

As an essential feature of the invention, the pulley 8 is supported on an axle 41 which may pivot on an axis, that of pin 43, which is perpendicular, or preferably slightly inclined from the perpendicular, to the drive surface of disc member 5. Such an arrangement permits the pulley 8 to better align itself with a tangent to the path upon the disc 5 of the point of contact between the drive belt 12 and the disc. As a result, components of the drive force between the belt and the disc which would otherwise be exerted parallel to the axis of pulley 8 and be transmitted through bracket 9, shaft 16, and bracket 25 to the thread guide 27, are practically eliminated. Cancellation of these forces is desirable since they contribute to forming packages lacking uniformity in density by varying the pressure of the roll 34 (or the thread guide 27 in contact with the package in the absence of such a roll) against the package. This arrangement also eliminates sidewise slippage of the belt at its point of contact with the disc and reduces wear upon the belt and the disc and loss of power.

In Figure 3 pulley 8 is shown pivotably and rotatably supported on a non-rotatable shaft 7 by a tilting axle 41 pivotable on a pin 43 which passes transversely through the axle 41 and the shaft 7. The pulley 8 rotates freely about the axle 41 on a bearing 40. Axle 41 has a central longitudinal passageway of sufficient diameter to permit the necessary tilting movement of pulley 8 with respect to the shaft 7. The amount of tilting to which the pulley 8 is subjected will be dependent upon the range of movement of pulley 8 relative to the spindle axis, and the radius of the arc through which the pulley 8 moves while supported on the swingable bracket 12. The range of movement is determined generally by the strand package size; the radius of the arc is determined by the length of the bracket 9. A tilting range of 30° is ample for permitting adjustment of the pulley 8 to a large range of package sizes or bracket lengths, although in the apparatus described a range of 22° (indicated in Fig. 3) was found quite satisfactory in winding packages in sizes up to 8 pounds or more.

The passageway, however, has a narrowed middle portion 42, a cross section of which has the contour shown by the end view thereof in Figure 4. From this figure it will be seen that the opening 42 has one pair of parallel sides. A bore 45 for the pin 43 extends through the axle 41 along an axis which perpendicularly intersects a plane containing the longitudinal axis of the exterior surface of the axle but passes to one side of this axis. The bore 45 also passes perpendicularly through the center of the parallel sides of opening 42. Consequently, the opening 42 and the shaft 7 extending therethrough are eccentric with respect to the exterior cylindrical surface of the axle 41 and the periphery of pulley 8. By reason of this eccentricity, the pulley 8 is self aligning when driven by a belt from a driving pulley such as the pulley 14 when the axis of pin 43 and the remotely spaced pulley 14 lie on opposite sides

of the longitudinal axis of the exterior surface of axle 41.

By this invention the drive for controlling the spindle speed is responsive merely to the radial movement of the thread-guide relative to a spindle axis. In the embodiment shown, such radial movement is carried to the drive by the traverse frame 25 conveniently pivoted on the shaft 16 extending through the cam shaft in order to obtain neatness and simplicity in design. However, the frame may be pivoted on any axis substantially parallel to the spindle axis in the vicinity of any plane approximately parallel to the spindle axis and passing through a driving pulley such as pulley 14 and through which pulley 8 moves during its travel across the disc 5 while duplicating radial movement of a thread guide device.

It is to be understood that changes and variations may be made without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. A winding machine for strand material comprising a spindle, a disc fixed to the spindle, a frame supported and pivoted on the winding machine on an axis approximately parallel to the spindle, a thread guide supported by the frame, a pulley for driving the disc supported rotatably on an axis approximately tangent to an arc determined by a radius approximately equal to the distance from the frame axis to the spindle axis, and means for moving the pulley generally axially along said arc.

2. A winding machine as in claim 1 wherein the pulley is driven by a belt connecting it to another pulley secured on a power shaft, and the first named pulley is tiltable about an axis approximately perpendicular to a plane passing through the first pulley and containing the axis of the power shaft pulley.

3. A winding machine for strand materials comprising a package winding spindle, a disc fixed on the spindle, a thread guide, a frame supported on the machine and pivoted on an axis approximately parallel to the spindle axis having guide means for supporting the thread guide, means for reciprocating the guide along the guide means, a friction member rotatably supported against the disc on an axis approximately tangential to an arc determined by a radius approximately equal to the distance from the frame axis to the spindle axis, said friction member being connected to the frame for movement therewith about the axis of the frame.

4. A tiltable pulley support including a principal elongated supporting member, a shaft passing transversely through the member, a tilting axle having an outer bearing surface for the hub of the pulley and having a longitudinal passageway for the supporting member offset from the bearing surface axis and a transverse bore for the shaft passing through the axle to one side of the bearing surface axis and intersecting the passageway at its central portion, the passageway having sufficient clearance with the supporting member along its walls cut by planes perpendicular to the shaft axis to permit limited tilting of the axle about the shaft.

5. A thread guide supporting device for a winding machine having a spindle terminating at one end in a disc having a driving surface comprising a frame pivoted on the machine, a thread guide supported by the frame, a pulley-supporting bracket pivoted in a plane of rotation including

approximately the thread guide and the axis of the frame pivot, a rotatable pulley supported by the bracket on an axis approximately tangential to the arc determined by a radius approximately equal to the distance from the frame pivot to the spindle axis, a belt for connecting the pulley with a driving means, means for urging the pulley and the belt against the disc surface, and means for urging the frame about its pivot until the thread guide rests against the package.

6. A winding machine comprising a package-building spindle ending in a disc-surface, a thread guide, a cam for reciprocating the thread guide, a frame pivoted on the cam axis for supporting the thread guide and a bracket connected to the frame for swingably supporting a pulley with its axis along a path tangential to an arc determined by a radius approximately equal to the distance from the cam axis to the spindle axis, means for urging the pulley toward the disc surface, and means for urging the frame about its pivot toward the spindle axis.

7. In a winding machine for packages of strand material, a spindle driving device substantially free of radial forces translatable to the package comprising a spindle having a coaxial disc surface, a self-aligning pulley for driving the spindle supported with its axis approximately at right angles to the axis of the disc surface, driving means, a belt for connecting the driving means with the pulley and for providing a frictional medium between the disc surface and the pulley, and means for urging the pulley with the belt therearound against the disc surface.

8. A machine for winding strand material comprising a winding spindle, a disc fixed to the spindle, a swingably mounted frame for supporting a thread guide having an axis approximately parallel to the spindle axis, a support pivotally mounted on the frame axis and connected to the frame for movement therewith, a yoke mounted on the support on a pivotal axis parallel to a line normal to the axis of the frame, a rotatable friction member supported within the yoke, means for urging the thread guide toward the spindle axis, means for urging the yoke about its pivotal axis in a direction to bring the friction member into engagement with the surface of the disc, and means for driving the friction member.

9. A machine for winding strand material comprising a winding spindle, a disc fixed to the spindle, a swingably mounted frame for supporting a thread guide having an axis approximately parallel to the spindle axis, a support pivotally mounted on the frame axis and connected to the frame for movement therewith, a yoke mounted on the support on a pivotal axis parallel to a line perpendicular to the axis of the frame, a rotatable friction member supported on a transverse member of the yoke extending in a direction approximately tangent to an arc approximately determined by a radius approximately equal to the distance from the frame pivot to the spindle axis, said friction member being tiltable on an axis approximately perpendicular to the surface of the disc, means for urging the thread guide toward the spindle axis, means for urging the yoke about its axis in a direction to bring the friction member into engagement with the surface of the disc, and means for driving the friction member.

10. A machine for winding strand material comprising a winding spindle, a disc fixed to the spindle, a frame for supporting a thread guide, a shaft having an axis extending transversely of the spindle axis and movable with its axis in a plane approximately at right angles to the spindle axis, interconnecting means for communicating movement of the thread guide relative to the spindle axis to the shaft, means for driving the disc comprising a friction member for engaging the surface of the disc and rotatable about the shaft at substantially the same distance from the spindle axis as the thread guide, said friction member being tiltable on an axis approximately perpendicular to the surface of the disc, means for urging the thread guide toward the spindle axis, means for urging the friction member and the shaft toward the driving disc, and means for driving the friction member.

11. A machine for winding strand packages comprising a winding spindle, a disc fixed to the spindle, a frame for supporting a thread guide, a shaft having an axis extending transversely of the spindle axis and movable with its axis in a plane approximately at right angles to the spindle axis, interconnecting means for communicating movement of the thread guide relative to the spindle axis to the shaft, means for driving the disc comprising a friction member for engaging the surface of the disc and rotatable about the shaft at substantially the same distance from the spindle axis as the thread guide, means for urging the thread guide toward the spindle axis, means for urging the friction member and the shaft toward the driving disc, and rotatable means for driving the friction member, said friction member being tiltable on an axis approximately perpendicular to a plane passing through the friction member and containing the axis of the rotatable means.

12. A machine for winding strand material comprising a winding spindle, a disc fixed to the spindle, a frame for supporting a thread guide, a shaft having an axis extending transversely of the spindle axis and movable with its axis in a plane approximately at right angles to the spindle axis, interconnecting means for communicating movement of the thread guide relative to the spindle axis to the shaft, means for driving the disc comprising a belt for engaging the surface of the disc, a pulley rotatably supported on the shaft for supporting the belt in engagement with the disc at substantially the same distance from the spindle axis as the thread guide, said pulley being tiltable on an axis approximately perpendicular to the surface of the disc, means for urging the thread guide toward the spindle axis, means for urging the pulley and the belt toward the driving disc, a power shaft rotatable about a fixed axis having a pulley secured thereon in alignment with the first named pulley, said belt extending around both pulleys in driving relationship.

13. A machine for winding strand material comprising a winding spindle, a frame for supporting a thread guide, a shaft having an axis extending transversely of the spindle axis and movable toward and away from the axis in a plane approximately at right angles to the axis, interconnecting means for communicating movement of the thread guide relative to the spindle axis to the shaft, means for driving the disc comprising a friction member for engaging the surface of the disc and rotatable about the shaft at substantially the same distance from the spindle axis as the thread guide, an axle for the friction member having a longitudinal passageway through which the shaft extends, a pin extending transversely through the axle and the shaft, the

axis thereof passing to one side of the longitudinal axis of the exterior surface of the axle but approximately intersecting the axis of the shaft, means for urging the thread guide toward the spindle axis, means for urging the friction member and the shaft towards the driving disc, and means for driving the friction member.

14. A winding machine for strand material comprising a spindle, a disc fixed to the spindle, a frame supported and pivoted on the winding machine on an axis approximately parallel to the spindle, a thread guide supported by the frame in spaced relationship with respect to its pivotal axis, a support connected to the frame and extending away from the axis of the frame, a yoke having a pivotal axis parallel to a line which perpendicularly intersects the axis of the frame, and a rotatable friction member for driving the disc supported by the yoke in engagement with the surface of the disc at a distance from the axis of the frame approximately equal to the distance between said axis and the thread guide.

15. A winding machine for strand materials comprising a package winding spindle, a disc fixed on the spindle, a frame pivotably supported on the machine with respect to an axis which is approximately parallel to the spindle axis, a thread guide supported by the frame in spaced relationship with respect to its pivotal axis, a support connected to the frame and extending away from

the axis of the frame, a yoke member having a pivotal axis parallel to a line which perpendicularly intersects the axis of the frame, a rotatable friction member for driving the disc supported by the yoke at a distance from the axis of the frame approximately equal to the distance between said frame axis and the thread guide, resilient means associated with the frame urging the yoke about its axis to bring the friction member into engagement with the surface of the disc, and resilient means urging the frame and other members attached thereto about its axis in a direction to carry the thread guide toward the spindle axis.

INGHAM S. ROBERTS.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,093,820	Siegenthaler	Sept. 21, 1937

FOREIGN PATENTS

Number	Country	Date
108,259	Switzerland	Mar. 16, 1925
222,277	Great Britain	Oct. 2, 1924
571,581	Germany	Mar. 2, 1933