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[54] **WINDING MACHINES WITH PIVOTABLE RAIL-GUIDED TOGGLE TRAVERSING ROD GUIDES**

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[51] **Int. Cl.**.....**B65h 54/32**

[58] **Field of Search**.....242/43.1, 43, 18.1

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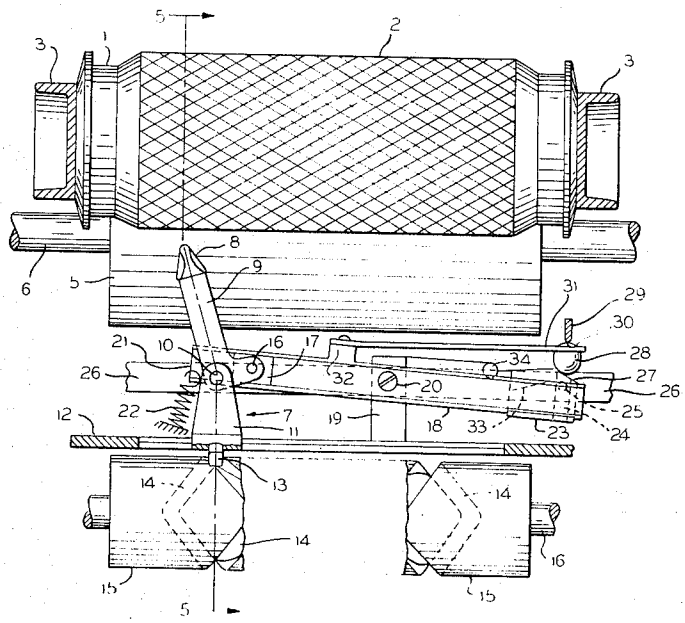
[57] **ABSTRACT**

Winding machine for yarns, tapes, etc. with a traversing yarn guide embodying a toggle lever having one arm slidably guided in a pivotable guide rail, the pivotal position of which is variable in response to increasing winding package diameter and/or periodic rhythmic impulses of a reciprocating nature and disengageable clutch means connecting said guide rail and adjusting members movable in response to increasing package diameter, whereby flat-ended packages or conical-ended packages may be formed.

6 Claims, 7 Drawing Figures



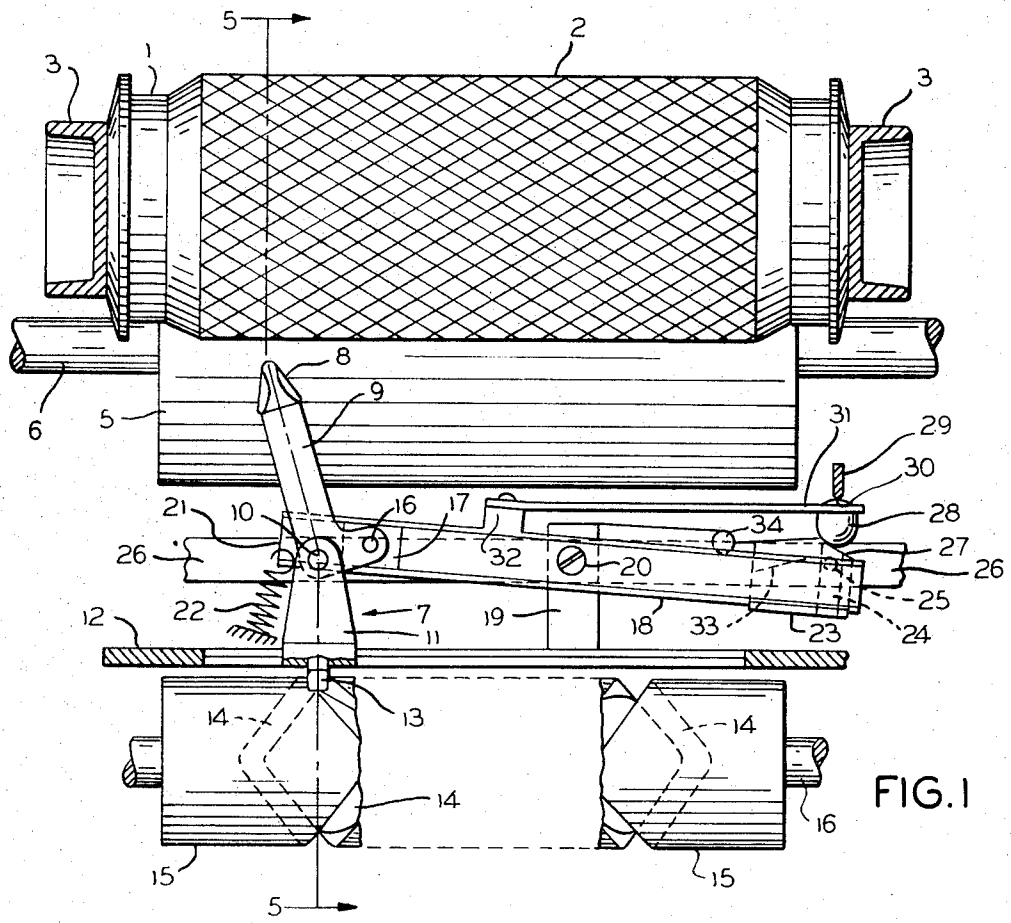


FIG. 1

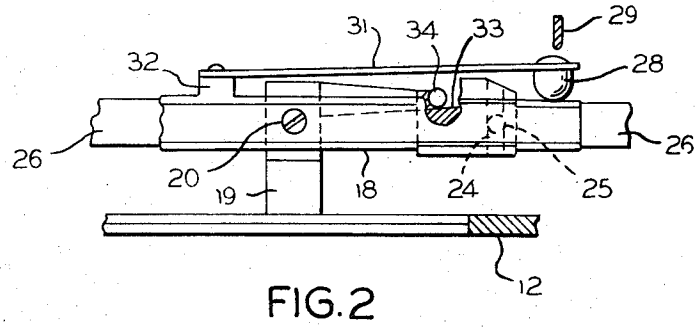


FIG. 2

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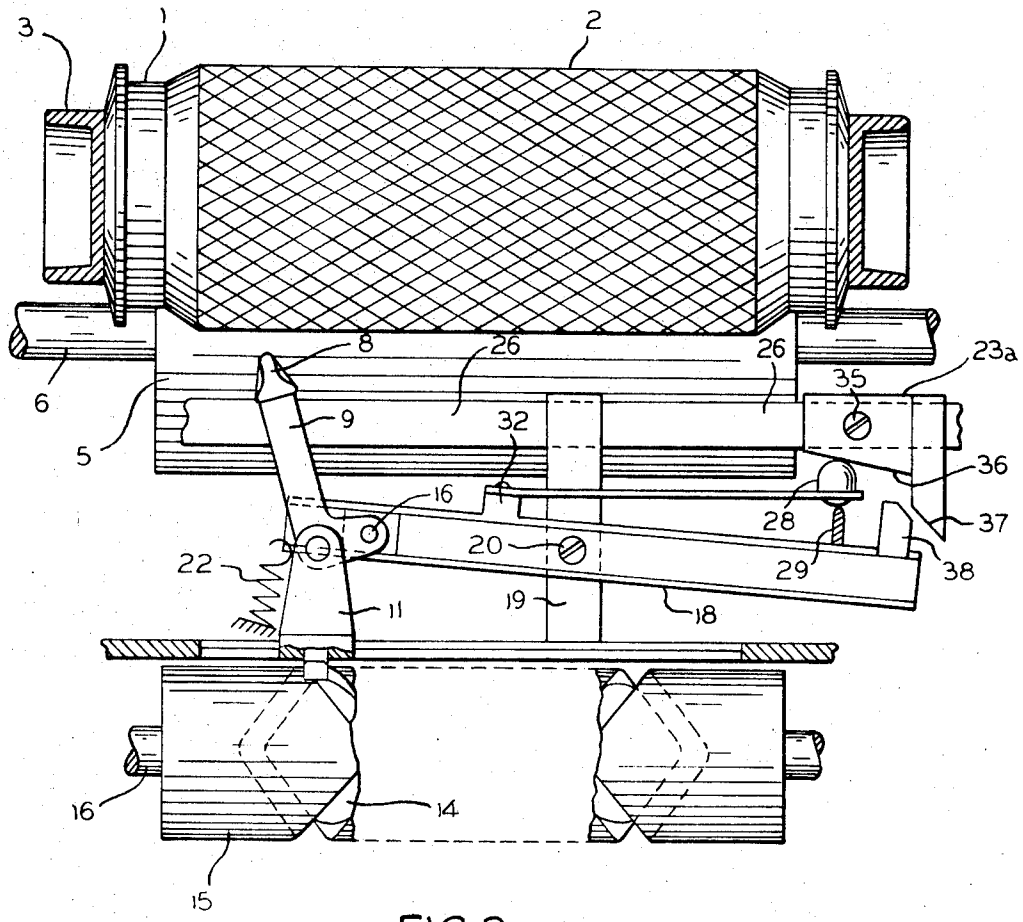

FIG.3

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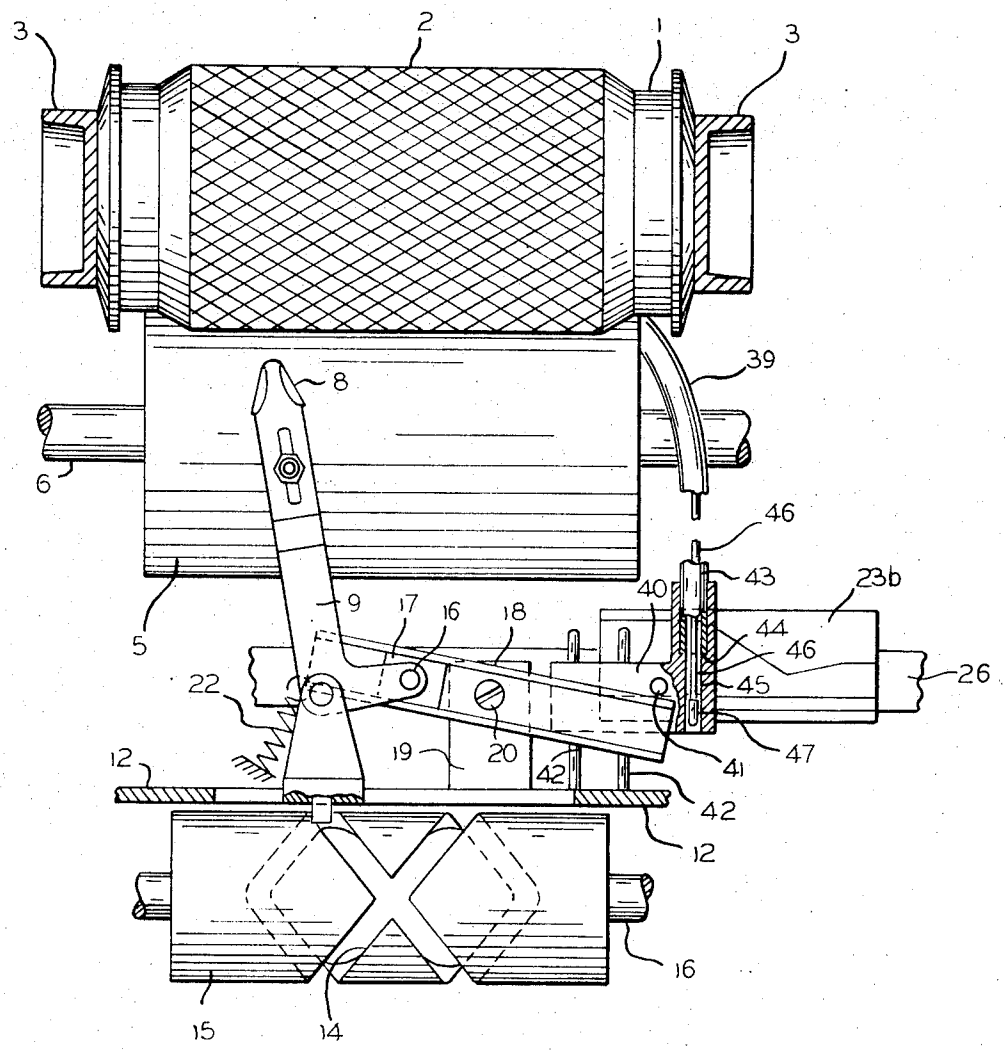

FIG.4

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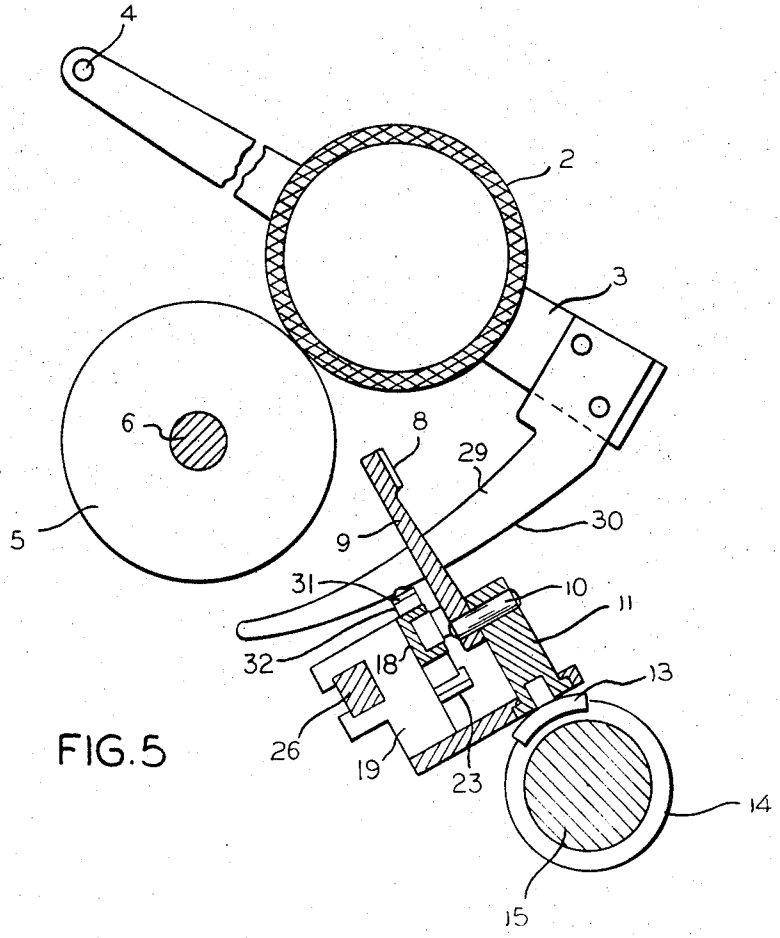

FIG.5

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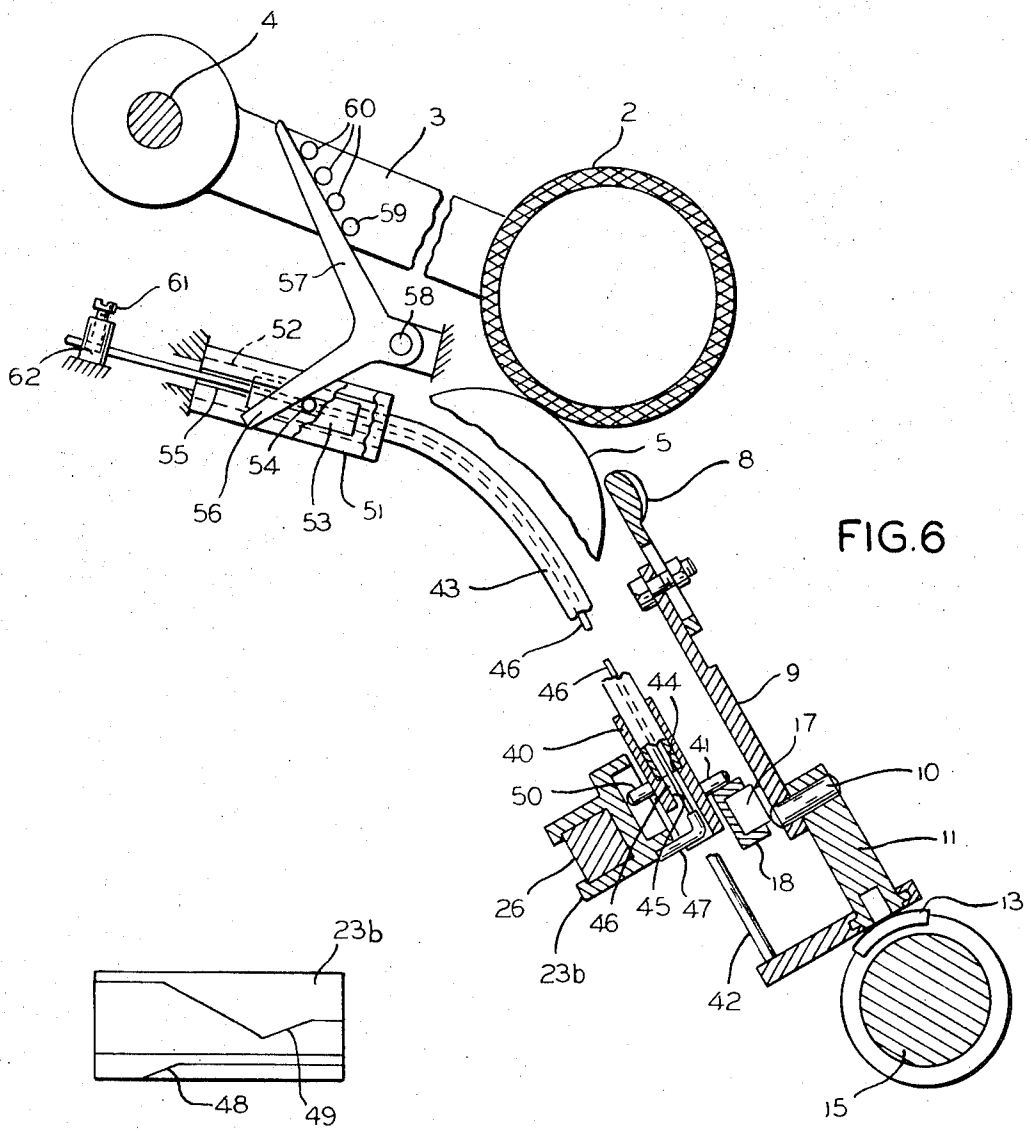

FIG.6

FIG.7

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WINDING MACHINES WITH PIVOTABLE RAIL-GUIDED TOGGLE TRAVERSING ROD GUIDES

INTRODUCTION

This invention relates to a winding machine for yarns, strands, tapes or the like. The traversing yarn guides of the machine are connected to a cam drum or the like and guided through toggle levers in pivotable guide rails, the position of which is adjusted in response to the increasing package diameter on the one hand and through a periodic reciprocating movement on the other hand.

In winding machines of this kind, it is known that the stroke of the traversing yarn guides can be gradually shortened by using guide rails which can be pivoted about a point like a double-armed lever. One end of a toggle lever is guided in the guide rail while its other end carries the yarn guide. The drive for the reciprocation of the toggle lever and hence of the yarn guide acts on the center of rotation of the toggle lever. If the guide rail occupies a position lying parallel to the axis of the bobbin, the stroke of the traversing yarn guide is identical with the stroke of the drive mechanism. If, however, the guide rail is inclined more or less steeply towards the bobbin axis, the driving stroke has superimposed upon it an additional stroke, which is generated as a result of the fact that, due to the inclined position of the guide rail, the end of the toggle lever guided in the guide rail is additionally moved up and down during its reciprocation. According to German Pat. No. 655,504, an arrangement of this kind can be used to produce packages with conical ends when the guide rail is connected through a linkage with the pivotal bobbin arm by which it is pivoted as the package increases in diameter.

German Pat. No. 969,169 discloses a precision cross-winding machine in which a rocker arm, which shortens the traversing stroke during winding, can also be pivoted in dependence upon the diameter of the package. In this arrangement, however, there is no need for a mechanical link between the package support and the rocker because in this case the bobbin carrier is fixedly arranged and the yarn guide itself is moved forward by the bobbin carrier as the package increases in diameter. The rocker of each yarn guide is guided at one of its two ends in a slot formed in a lever mounted in the machine frame. It is also known from this patent that a periodically increasing and decreasing change in stroke can be superimposed upon the traversing stroke in order to avoid so-called hard edges. To this end, the levers of all the winding stations of one machine are fixed to a rod extending over the entire length of the machine which can be periodically reciprocated with a short stroke.

If the package form of the windings is to be changed, in other words if it is intended to produce cylindrical packages with plain ends for example rather than cylindrical packages with conical ends, or if it is intended to change the characteristic of the reciprocating movement, the levers or adjusting members of all the winding stations have to be individually replaced. This is a time-consuming operation, especially in the case of relatively large machines with numerous winding stations. In many cases it cannot be carried out by the machine operator and further involves a large inventory of parts.

THE INVENTION

An object of the present invention is to provide a winding machine for yarns, strands, tapes or the like in which changeover from one package form to another can be carried out simply by switching over rather than by dismantling and re-fitting.

According to the invention, there is provided a winding machine for yarns, strands, tapes or the like, having winding stations, each comprising a traversing yarn guide reciprocally driven by a cam drum or the like and guided through a toggle lever in a pivotal guide rail whose angular position is changed by the increasing package diameter on the one hand and through a periodic reciprocating movement on the other hand, wherein said guide rail is connected with adjusting members through a clutch by means of which the effect of the increasing package diameter can be optionally applied or eliminated.

More particularly, the clutch can be in the form of a curved section displaceable longitudinally of the machine. The cam surface is arranged between the guide rail and an abutment. In order to produce packages with flat ends, the curved section can be displaced into a position in which it rests against an abutment whose position is independent of the package diameter. In order to produce packages with conical ends the curved section can be displaced into another position in which the curved section rests against an abutment whose position is governed by the package diameter. In either case, the arrangement is such that in either position the curved section can be additionally displaced periodically back and forth by a small amount by means of an adjusting element.

The arrangement of a displaceable curved section of this kind can be obtained by mounting the curved section of each traversing yarn guide on the associated guide rail itself, and, to obtain packages with flat ends, the curved section can be displaced into a position in which its working surface rests under spring pressure against a fixed point of the machine frame. To obtain packages with conical ends, the curved section can be displaced into another position in which its working surface rests under spring pressure against a transmission member whose position is variable by the bobbin supporting arm with increasing package diameter. In either position the curved section on the guide rail can additionally be periodically reciprocated by a small amount by means of an adjusting element. This adjusting element can then be used both to adjust the curved section from one working position into the other and to periodically reciprocate the curved section by a small amount.

On the other hand, it is also possible to arrange the curved sections to act as a clutch on the adjusting element and to arrange the machine in such a way that to produce packages with flat ends, the curved section can be displaced into a position in which its working surface rests under spring pressure directly against the associated guide rail. To produce packages with conical ends the curved section can be displaced into a position in which it rests under spring pressure against the associated guide rail in the presence of a transmission element whose position is governed by the increasing package diameter and which can be deflected perpendicularly of the displacement direction.

Finally, it is also possible, as in the previous embodiment, to arrange the curved sections to act as a clutch on the adjusting element, in which case, to produce flat-ended packages, the curved section can be displaced into a position in which its working surface rests under spring pressure against the associated guide rail through a slide, comprising two pins, of a Bowden cable which can be separated from the deflectable bobbin arm. To produce packages with conical ends, the curved section can be displaced into another position in which its working surface rests against the guide rail through the free end of a curved Bowden cable anchored at its other end, through the Bowden-cable conduit and through a slide member with a follower pin attached to the end of the conduit, the Bowden cable conduit resting under spring pressure against a toggle lever whose position can be varied by the increasing package diameter.

The particular embodiment which is selected in any given case is governed inter alia by the space available, by the required working speed and also by the outlay in terms of machinery required in any given case.

In one advantageous embodiment of the machine according to the invention, the curved sections of the individual traversing yarn guides can be displaced all together or in groups of several by a common adjusting element. The concept according to the invention makes it possible to design the machines as required in such a way that all the winding stations can be switched from one package form to the other in a single operation, or even for example to combine only the winding stations of one side of the machine into groups that can be switched together or finally to go even further in the subdivision and to combine only a few winding stations, depending on what exactly is required by the machine operator.

THE DRAWINGS

Embodiments of the invention are illustrated by way of preferred forms in the accompanying drawings, wherein:

FIG. 1 is a front elevation of a winding machine according to the invention with a clutch for the guide rail, in which the displaceable curved cam section is mounted on the guide rail and is shown in the position for producing packages with conical ends;

FIG. 2 is a fragmentary view of the embodiment of FIG. 1, in which the curved cam section is shown in the position for producing flat-ended packages;

FIG. 3 is a front elevation of another embodiment of a winding machine according to the invention with a clutch for the guide rail in which the displaceable cam section is arranged on the adjusting element, a rigid link being present to transmit the effect of the package diameter;

FIG. 4 is a front elevation of a third embodiment of a winding machine according to the invention with a clutch for the guide rail in which the displaceable cam section is also arranged on the adjusting element, a flexible link being present to transmit the effect of the package diameter;

FIG. 5 is a section taken on section plane 5—5 of FIG. 1;

FIG. 6 is a fragmentary side elevation of the machine shown in FIG. 4; and

FIG. 7 shows a cam section of the kind used in FIGS. 4 and 6.

THE ILLUSTRATED EMBODIMENTS

FIG. 1 shows a bobbin tube 1 on which a package 2 is to be built up during winding. The bobbin tube 1 is carried by bobbin arms 3 (cf. also FIGS. 5 and 6) which can pivot about a pivot 4 as the package diameter increases.

The package 2 is driven at a uniform speed by a friction roller 5 on which it rests. The friction roller 5 is in turn driven through a shaft 6 which preferably extends over the entire length of the machine and is common to all the friction rollers 5 of one side of the machine.

A traversing mechanism 7 is intended to guide the yarn to be wound onto the bobbin and to deposit it exactly. It consists of a yarn guide 8 arranged on one end of a toggle lever 9 by which it is reciprocated longitudinally of the bobbin. To drive the toggle lever 9, its pivot pin 10 is coupled to a slide head 11 which in turn is mounted in a guide rail 12 arranged parallel to the bobbin axis. The slide head 11 has a slide shoe 13 extending through a slot in the guide rail 12. The slide shoe 13 rides in a helical or spiral groove 14 of a cam drum 15. Since the slide 11 cannot be deflected perpendicularly of the guide rail 12 when the cam drum 15 rotates as it is mounted axially parallel in the guide rail 12, it is reciprocated parallel to the surface of the package 2 by the groove 14.

Arranged on the other end of the toggle lever 9 is a slide block 17 which is rotatable about a pin 16. The block 17 is guided in the guide groove of a guide rail 18 in such a way that, during reciprocation of the slide 11, the slide block 17 can slide to and fro in guide rail 18. The slide rail 18 in turn is mounted in a pivot bearing support 19 and is a double-armed lever with a mid-center pivot axis 20. One end 21 of the guide rail 18 is coupled by a spring 22 anchored to the machine frame to pull the end 21 downward with limited force.

According to the invention, a cam head 23 is slidably mounted on the guide rail 18. The cam head 23 surrounds the guide rail 18 in sliding relation thereon. In the embodiment shown, there is machined into the back of the cam head 23 a groove 24. A pin 25 is fixedly connected to an adjusting bar 26. The pin 25 is used to set the position of cam head 23 on guide rail 18. The groove 24 is slightly arcuately curved which is necessary in view of the tilting movement of the guide rail 18 around the pivot axis 20.

The cam head 23 has a cam working surface 27 which engages indirectly the transmission element 29 through a transmission cam 28. The aforementioned spring 22 provides for the non-positive contact. The transmission element 29 can be in the form of a tapering tongue as shown in FIG. 5. If is fixed to the bobbin arm 3 in such a way that it is deflected outwardly as the package diameter increases, in such a way that its contact edge 30 is withdrawn further relative to the transmission cam 28 on account of the aforementioned taper. As a result, the guide rail 18 is also reset under the influence of the spring 22 so that its position changes more towards the horizontal. The effect of this change in position as already mentioned is to shorten the traversing stroke so that, in this position of the cam head 23, packages with conical ends are formed.

The object of the transmission cam 28 is to keep laterally directed displacement forces away from the transmission element 29, forces which would otherwise inevitably occur on account of the inclined position of the working surface 27. The cam itself is adapted to the path of the working surface 27 on the one hand and to the shape of the contact edge 30 on the other hand and is itself prevented from being laterally displaced by means of the leaf spring 31 fixed at 32 to the guide rail 18.

The arrangement illustrated also enables a periodically increasing and decreasing change in stroke to be superimposed upon the traversing stroke in order to avoid so-called hard edges. This can be done for example by reciprocating the adjusting element 26 by a small amount in a predetermined rhythm, the inclined position of the working surface 27 of the cam head 23 making the guide rail 18 swing up and down.

To produce packages with flat ends, the cam head 23 can be displaced by the adjusting element 26 into a position such as shown in FIG. 2. In this case, the inclined working surface 33 of the cam head 23 rests against a fixed point 34, for example, a bolt connected to the machine frame. In this position of the cam head 23, the position of the transmission element 29 does not have any influence upon the cam head or the guide rail 18. Nevertheless, it is also possible in this position to superimpose a slight rhythm movement upon the stroke of the yarn guide by slightly reciprocating the adjusting element 26.

Another embodiment of the machine according to the invention is shown in FIG. 3. In this embodiment, the cam head 23a is arranged on the adjusting element or bar 26 rather than on the guide rail 18, being fixed to it for example by means of a screw 35. Working surface 36 acts on the guide rail 18 through the transmission cam 28 and the transmission element 29 and together with the transmission element 29 determines the inclined position of this rail and hence the length of the traversing stroke. If the adjusting element 26 is periodically reciprocated by a small amount, the position of the guide rail 18 can also be periodically changed to a limited extent on account of the inclined position of the working surface, the effect of which is that a rhythm movement is superimposed upon the traversing stroke. For this to have any effect, however, the transmission element 29 must be able to be displaced by a small amount at least perpendicularly of the bobbin axis. This can be achieved by fixing the tapering tongue to the bobbin carrier by means of a swivel joint, or more simply by making this tongue out of an elastic material, for example, polyethylene, polyamide or the like.

To switch the machine over, the adjusting element 26 can be pulled to the left so that the cam head 23a contacts a shoulder 38 of the guide rail 18 by means of its working surface 37. As a result, the guide rail is tilted to such an extent that it lies outside the effective range of the transmission element 29. In this position, therefore, the diameter of the package does not have any influence upon the position of the guide rail 18 so that packages with flat ends are produced. In this case, too, the position of the guide rail 18 can be periodically varied by reciprocating the adjusting element 26 in short strokes due to the inclined position of the working surface 37 of the cam head 23*a*.

If it is intended to produce packages with conical ends with a machine of the type according to the invention, it is not absolutely necessary to transmit the influence of the increasing package diameter by means of a tapering tongue engaging the bobbin arm to the position of the guide rail. In fact, this can also be done by other means, for example with a flexible transmission link 39 in the form of a Bowden cable. An arrangement of this kind is shown in FIGS. 4 and 6. In this case, the cam head 23*b* (FIG. 7) is fixedly mounted on the adjusting element 26 extending over the entire length of the machine. The right-hand end of the guide rail 18 rests under the pressure of the tension spring 22 on a follower pin 41 fixed to a slide member 40. Two fixed guide pins 42 mounted on the guide rail 12 guide the slide member 40. A Bowden conduit 43 is inserted loosely into a stepped bore in the slide member 40 in such a way that its ends rest on the end face 44 of the bore stage or step. A Bowden cable 46 to whose end is fixed an angle member 47 extends through a bore 45 which continues with decreasing diameter. The free arm of the angle member 47 (FIG. 6) rests on a contact surface 48 (FIG. 7) of the cam head 23*b* which in turn, as already mentioned, is fixedly mounted on the adjusting element 26 extending over the entire length of the machine. The cam head 23*b* has another cam edge 49. The slide member 40 has a follower pin 50 (FIG. 6) on that side facing the cam head 23*b*.

A guide sleeve 51 is fixed to the machine frame and has a bore 52 which can have any cross section but preferably is square. Guided in the bore 52, there is a transmission slide 53 on which the Bowden conduit 43 rests. A pin 54 arranged on the transmission slide 53 projects through a slot 55 in the guide sleeve 51. The slot 55 extends over the entire length of the guide sleeve 51. An arm 56 of the double-armed transmission lever 56,57, which is rotatably mounted on a pivot pin 58, rests on the pin 54. The other arm 57 of the transmission lever 56,57 rests on a stop pin 59 seated in one of the bores 60 in the bobbin arm 3. The transmission slide 53 has a full-length longitudinal bore (not shown in detail) in which the Bowden cable 46 is slidably received and at its end is fixed by means of a clamp 61, 62 fixedly mounted on the machine frame.

At the beginning of winding, the guide rail 18 substantially occupies the position shown in FIG. 4. The main pivoting movement of the guide rail 18 about the pivot axis 20, which shortens the stroke of the yarn guide during winding in the production of packages with conical ends, is controlled in this case too by the bobbin arm deflected outwardly as the package diameter increases and is carried out under the pressure of the spring 22. The movement of the bobbin arm (FIG. 6) is transmitted through the stop pin 59, the transmission lever 57, 56, the pin 54, the transmission slide 53, the Bowden conduit 43, the slide member 40 and the follower pin 41 to the guide rail 18. The Bowden cable 46 fixedly held at one end by the clamp 61, 62, rests at its other end through the angle member 47 against the contact surface 48 of the cam head 23*b* and over a certain length provides the Bowden conduit 43 with a supporting guide between the cam head 23b and the guide sleeve 51 so that the contact pressure which is generated by the spring 22 and transmitted through the guide rail 18, the follower pin 41 and the slide member

40 and which acts between its end face 44 and the end of the Bowden conduit 43, can be propagated up to the stop pin 59.

In this case, too, the so-called rhythm movement superimposed upon the stroke of the yarn guide emanates from the adjusting member 26 which is reciprocated by a gear system (not separately shown) arranged on the end of the machine. The part of cam head 23*b* fixedly mounted on the adjusting element 26 also makes the same movement. The Bowden cable 46 is thus more or less tightened due to the inclined position of the contact surface 48. The change in position, alternating in its extent, is transmitted through the Bowden conduit 43, the slide member 40, the follower pin 41 to the guide rail 18 which is thus made to undergo a reciprocating rocking movement around the pivot axis 20. The movement is further transmitted to the yarn guide 8 as already described.

In order to switch the machine, which in the position shown in FIG. 4 produces packages with conical ends, over in such a way that it now produces packages with flat ends, the adjusting element 26 together with its cam heads 23*b* is displaced far enough to the left so that the angle member 47 is displaced away from the contact surface 48. In addition, during the movement of the cam heads 23*b* to the left, the follower pin 50 is engaged by the working surface 49 of the cam head and together with the slide member 40 is displaced downwards until the follower pin 50 arrives at the lower end of the working surface 49 and slides over it. The pressure of the spring 22 engaging the left-hand lever arm of the guide rail 18 is transmitted through the right-hand arm of the guide rail 18, the follower pin 41, the slide member 40 and the follower pin 50 to the working surface 49. This pressure which in the previously described method of winding acted as a contact pressure between the slide member 40 and the Bowden cable 43 and had as its abutment the escaping stop pin 59, is now completely arrested by the cam head 23*b*. This means that the Bowden conduit 43 cannot transmit any further movement of the bobbin arm to the guide rail 18. Accordingly, there is now no shortening of the stroke of the traversing movement during winding, either. The rhythm is again superimposed upon the stroke of the yarn guide by virtue of the fact that the adjusting element 26 and with the cam head 23*b* is made to reciprocate so that an oscillating pivoting movement about the center of rotation 20 is imparted to the guide rail 18, due to the inclined position of the curve 49, through the follower pin 50, the slide member 40 and the follower pin 41.

It is thought that the invention and its numerous attendant advantages will be fully understood from the foregoing description, and it is obvious that numerous changes may be made in the form, construction and arrangement of the several parts without departing from the spirit or scope of the invention, or sacrificing any of its attendant advantages, the forms herein disclosed being preferred embodiments for the purpose of illustrating the invention.

The invention is hereby claimed as follows:

1. A winding machine for yarns, tapes or the like, having a traversing yarn guide embodying a toggle lever with one arm pivotally connected with a slide member slidable in a pivotable guide rail, means for changing the angular position of said rail in response to increasing package diameter for production of conical ended packages and for holding said rail stationary for production of other package shapes, means embodying cam means displaceable longitudinally of the rail into a first position in which the cam means rests against a first contact member whose position is independent of the package diameter for preventing angular movement of said rail or into second position in which the cam means abuts against a second contact member embodied in said means to vary the position of said rail in response to increasing package diameter, and additional means including a reciprocable member for imparting periodic small oscillations to said rail via said cam means in either of said positions of said cam means.

2. A winding machine as claimed in claim 1, wherein the cam means of said traversing yarn guide is mounted on the pivotable guide rail for said traversing yarn guide, and spring means biasing said cam means against said first contact member for producing a package with flat ends, and said reciprocable member being connected to said cam means for setting said cam means in an operative position in contact with said second contact member to vary the angular position of said pivotable rail in response to increasing package diameter for production of conical-ended packages.

3. A winding machine as claimed in claim 1, spring bias means connected to one end of said guide rail, said cam means having a plurality of contact surfaces, one of which is engageable with said first contact member when said cam means is in said first position, and another of which contact surfaces is engageable with said second contact member when said cam means is in said second position, and said contact surfaces of said cam means being oriented to translate small reciprocal movements of said reciprocable member into small oscillations of said pivotable guide rail.

4. A winding machine as claimed in claim 1, wherein said second contact member comprises an intermediate member between said cam means and a transmission element movable in response to increasing package diameter, said intermediate member being mounted on a leaf spring to prevent lateral displacement of said transmission element by movement of said cam means.

5. A winding machine as claimed in claim 2, wherein said cam means has a straight or slightly arcuately curved, vertical groove in which projects a pin projecting from said reciprocable member for imparting said periodic oscillations to said rail by small reciprocations of said cam means via horizontal reciprocation of said member and its pin.

6. A winding machine as claimed in claim 1, said means for changing the angular position of said rail and for holding said rail stationary embodying a slide member having a contact element resting under spring bias means against said pivotable guide rail, a Bowden cable connected to said slide member and adapted to move said slide member in response to increasing package diameter via mechanical linkage means for production of packages with conical ends when said cam means is in said second position, said cam means when in said first position deactivating said Bowden cable and linkage means for production of packages with flat ends.

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