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DIFFERENTIAL TRAVERSE WINDING MECHANISM

Original Filed Feb. 26, 1965

2 Sheets-Sheet 1

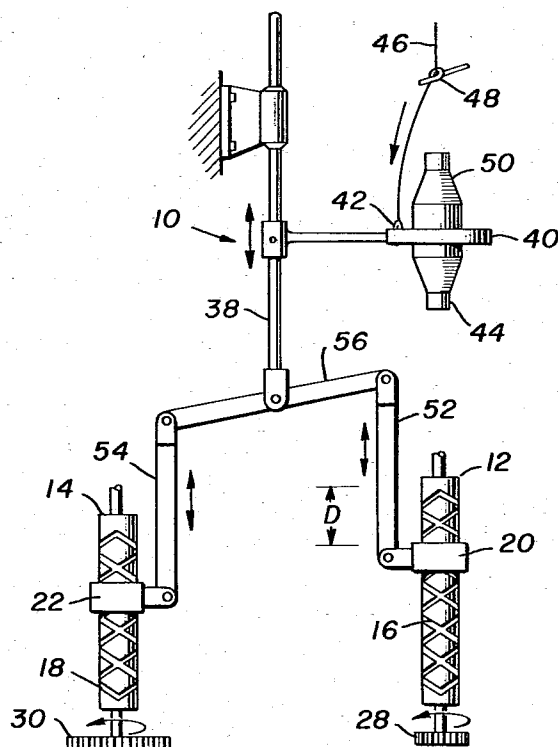


FIG. 1.

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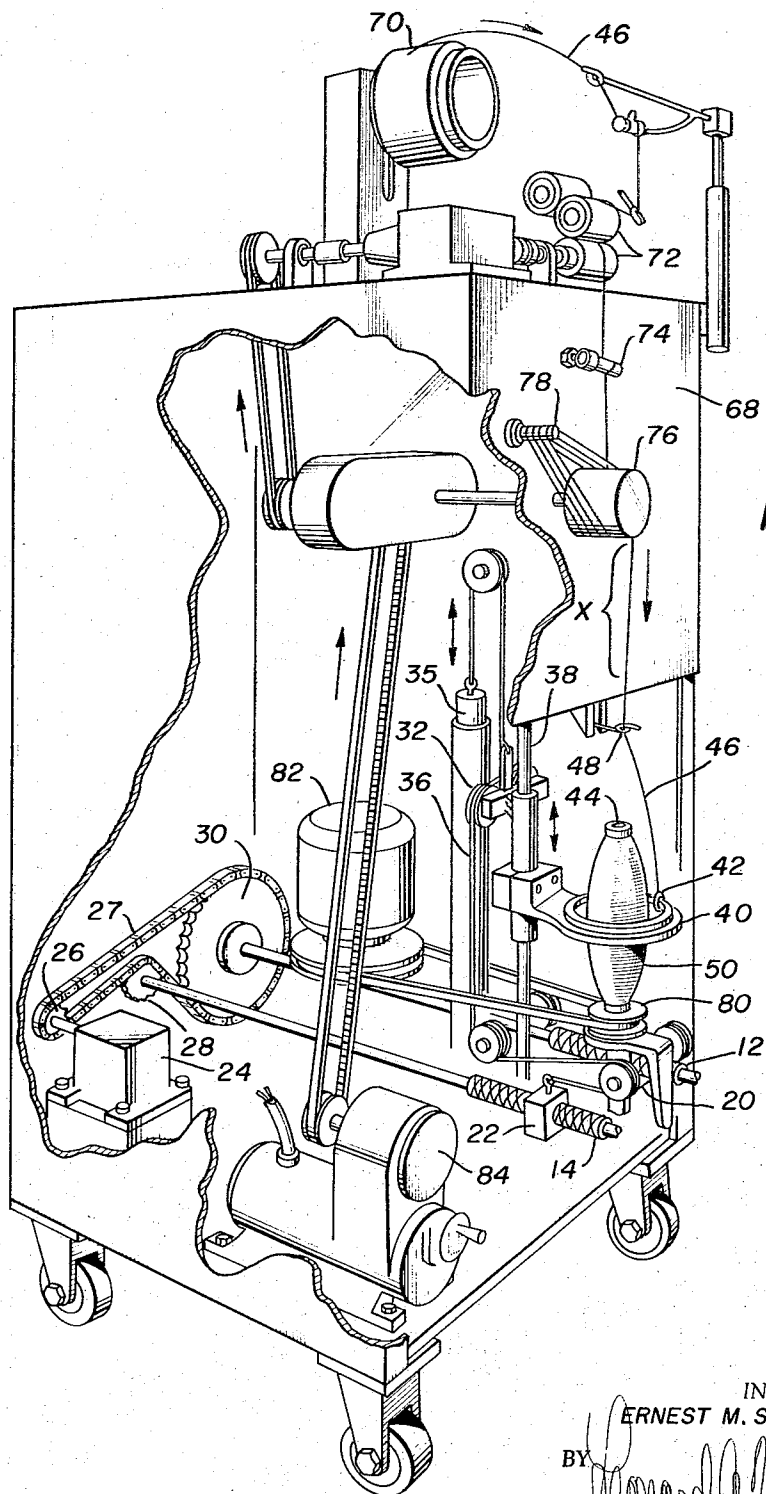


FIG. 2.

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DIFFERENTIAL TRAVERSE WINDING MECHANISM

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Divided and this application Dec. 20, 1966, Ser. No. 603,350

7 Claims. (Cl. 242—26.1)

ABSTRACT OF THE DISCLOSURE

A traverse mechanism characterized by a pair of input elements reciprocally driven through paths of pre-selected lengths at differential velocities to drive a reciprocally mounted traversing guide in a direction and at a velocity according to the algebraic sum of the individual velocity of the input elements.

The present application constitutes a division of copending application Ser. No. 435,636, filed Feb. 26, 1965.

This invention relates to package winding mechanisms for winding strands, yarns, threads, slivers, or the like, of filamentous materials on cones, tubes, bobbins, or other similar revoluble package supporting members at high speeds. More particularly, the invention relates to novel traversing mechanisms for use in winding continuous filamentous material on a spool, bobbin or like holder in a uniform, controllable manner.

Throughout the instant specification and claims, the term "strand" is intended to include thread, yarn, sliver, fiber, filament, wire, ribbons, fibrous or filamentary bundles, and the like.

In the textile industry, strands obtained by various processes are wound into packages on bobbins or like revoluble supporting members. In such winding operations, it is necessary to employ some means of axially traversing the strand back and forth along the package. Various and sundry traversing means have heretofore been proposed for use in such winding operations. These prior devices have ordinarily comprised a reciprocating member or guide which travels back and forth adjacent the surface of the rotating package support member on which the strand material is being wound. In general, the reciprocating motion of the guide member has been accomplished by means of a cam, or the like. As is widely recognized, such prior cam arrangements suffer from undue wear, are limited and cumbersome in the manner of their manipulation, and lack the degree of compactness desired in many limited scale operations, particularly those encountered in testing and experimentation.

With these desires and prior art shortcomings in mind, it therefore becomes a general object of my invention to provide an improved traversing mechanism for use in strand winding and packaging operations, which mechanism possesses a compactness of arrangement, flexibility in manipulation and precision of result heretofore unattained.

A further object is such a traversing mechanism which may be economically manufactured in the form of one or more packaging stations.

According to the present invention, the foregoing and other objects are attained by providing an improved traverse mechanism of newfound compactness of arrangement and flexibility of operation, a mechanism which effects a uniquely advantageous use of the basic principle of converting two independent inputs into a combined differential output to thereby control the program of movement of a traverse guide along a strand package to obtain a high precision of widely variable package configurations.

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Basically, such a mechanism takes the form of a pair of input elements driven through reciprocal paths of pre-selected lengths at a pre-determined difference in velocities, which input elements are linked to drive a reciprocally mounted output element and an associated traversing guide in a direction and at a velocity according to the algebraic sum of the individual velocities of the input elements. A preferred embodiment of the invention takes the form of a pair of parallel rotating "fishing-reel-type" winding screws driven at different velocities of rotation, the enclosed helical grooves of which are each engaged by one of a pair of input elements to be urged therealong through reciprocating strokes to drive a floating lever arrangement according to the algebraic sum of the input element velocities. A further important aspect of this invention essential to optimum package configurations resides in the provision for a high ratio of input speeds productive of greater uniformity in traverse guide speed and in the provision that such input speeds are relatively prime to one another, a feature which minimizes the number of coincident reversal points experienced in the travel of the traverse guide. As employed in the instant specification and appended claims, the term relatively prime input speeds connotes that relationship wherein one of the input speeds is not divisible by the other. (An example of such relationship being the numbers, or speeds, 12 and 25. That is, the input speeds are so related as to have no common divisor save unity.)

With regard to the feature of maintaining a high ratio of input speeds, it has been found impractical to operate the present device at ratios of less than 3:1 where optimum package configurations are to be obtained. At input speed ratios less than 3:1, it has been found that the resulting package often exhibits objectionable ridge formations because of an undue lack of uniformity of traverse guide speed. This result becomes readily apparent when one considers the program described by a traverse guide driven according to the present invention at an input speed ratio of, for example, 2:1. The traverse guide will experience a variation in velocity between a maximum factor of 2 and a minimum of 0.5, a normally intolerable variation; however, at a ratio of input speeds of, for example, 11:1, traverse guide velocity will only vary between the limits of a factor of 6 and 5; similarly, at still higher input ratios, the percentage variation in guide velocity becomes proportionately smaller. It is therefore preferred to operate the herewith disclosed traverse mechanism at as high a ratio of input speeds as is practicable.

Where it is desired to produce package configurations exhibiting flat mid-portions, a further important aspect of this invention resides in the provision of a differential in stroke lengths of the input elements, an arrangement which causes the traverse guide to travel uniformly over the mid-portion of the package being constructed. Additionally, where it is desired to construct a package exhibiting a difference in tapers adjacent each end, such as is expressed by the efficient "tear drop" configuration, the helix angle formed in at least one of the fishing-reel-type winding screws is caused to decrease to a minimum adjacent one lengthwise extremity of the stroke of the input element, an arrangement which causes the traverse guide to accelerate its travel over that portion of the package being constructed.

To facilitate a better understanding of the details of construction of some possible embodiments of my invention, reference shall now be had to the drawings as being illustrative, but not limitative, thereof, wherein like reference numerals refer to like parts and in which:

FIG. 1 is a simplified schematic depicting my invention as characterized by a free-floating, combined differential output lever, and

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FIG. 2 is a perspective view of a portable, single station draw-twister arrangement incorporating the principles of my traverse mechanism.

Referring now to the schematic representation of FIG. 1, the traversing mechanism, generally indicated by numeral 10, is seen to comprise a pair of parallel extending, fishing-reel-type traverse winding screws 12, 14, which screws are each characterized by endless, reverse helical cam grooves 16, 18, respectively, formed in the surfaces thereof, such that a follower inserted therein will trace the groove from one end of the screw to the other in a continuous fashion as the screw is caused to rotate. Each of the winding screws 12, 14 has coaxially mounted thereon and in sliding engagement therewith a sleeve-like input element 20, 22, respectively, each having a follower shoe protruding from its inner surface and sized to snugly engage the endless grooves 16, 18. It will be apparent that, upon causing the screws to rotate about fixed axes, the input elements will be caused to travel along the length of the screws at a rate dependent upon both the speed of screw rotation and the helix angle at a given point along the groove, which angle is that described by a tangent to a given point along the groove with a line parallel to the axes of rotation of the screw.

An advantageous arrangement for driving the screws at the desired speed ratio is found in the provision of a variable speed motor driving a timing belt, chain or the like, not shown, the belt being entrained around sprockets 28, 30 to drive screws 12, 14 respectively.

A most beneficial feature of the present invention resides in the provision of a reciprocating mechanism which is so designed as to drive the input elements 20, 22 at a high velocity ratio of speeds relatively prime to one another, i.e. indivisible by one another. For example, this may be accomplished by providing a 19-tooth sprocket for element 28 and a 61-tooth sprocket for the element 30, an arrangement resulting in a speed ratio, for a given identity of helix angles, between the input elements greater than the 3:1 ratio considered requisite to optimum package formation, as well as being a speed ratio possessing the relationship of being relatively prime to one another. It is, of course, contemplated that a suitable gear train may be incorporated between the power source and sprockets 28, 30 to produce still higher ratios of input velocities and a concomitant more uniform velocity of output through the combined differential output element 32, which, in FIG. 1, takes the form of free-floating output lever 56.

There are provided linkages 52, 54, each interconnecting one of the input elements 20, 22 with one end of the floating, combined differential output lever 56, the motion of which is transmitted to the ring-traveler arrangement 40, 42 via transmission rod 38. By this arrangement, output variations may expediently be effected by, inter alia, varying the ratio of the lever arms through which linkages 52, 54 act upon floating lever 56.

The motion of the combined differential output lever 56 is transmitted by suitable means, such as a rod 38, to a conventional ring-traveler arrangement normally comprising a ring member 40 and a strand traveler 42 mounted to slide along the ring with a minimum of friction. Bobbin 44 is driven at high rotative speeds by any suitable means, not shown, to cause the supply strand 46 to travel through balloon guide 48, thence through traveler 42 to then be enwrapped about the forming strand package 50. By operation of the described traversing mechanism, the ring-traveler assembly is caused to traverse bobbin 44 axially at a speed equal or proportional to and in a direction according to the algebraic sum of the velocities of the respective input elements 20, 22. It will be appreciated that, by operation of the instant traversing mechanism, there is produced a package characterized by a differential fill winding wherein the traverse of the yarn traveler guide axially of the package is of

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uniform, successively displaced strokes lengthwise of the package during the winding operation.

A further important feature of my invention, as previously mentioned, lies in an arrangement productive of packages exhibiting uniform flat midportions. This is accomplished by sizing the longitudinal dimensions of grooves 16, 18 to have a predetermined difference in effective stroke lengths, as indicated in FIG. 1 by the distance labeled D. By this arrangement, it will be appreciated that the builder motion described by the ring-traveler will experience a uniform residence period over the mid-portion of the package equal to one-half the difference in effective stroke lengths of the input elements 20, 22. By varying this difference in stroke lengths, a package having any desired length of flat mid-portion may be formed.

Turning now to FIG. 2, there is shown in prospective a highly compact, portable draw-twister arrangement illustrative of a possible utilization of a traverse mechanism similar to that of the present invention. Though the particular traverse mechanism of FIG. 2 comprises the subject matter of my copending application Ser. No. 435,636, filed Feb. 26, 1965, its utilization is essentially the same as that of the embodiment illustrated in FIG. 1. Such an assembly is seen to comprise a suitable housing 68 mounting a conventional draw-twister arrangement and enclosing the traversing mechanism. Additionally, such an arrangement may comprise a supply package 70 from which there is withdrawn a supply strand 46 to be fed, via suitable guides, to nipped feed rolls 72, thence about draw pin 74, about draw roll 76 and separator roll 78 a suitable number of wraps to retard slippage, then through the zone indicated by the bracket labeled X, to then be taken up by the ring-traveler. The zone X is provided to facilitate the implementation of desired experimental devices. The spindle or bobbin 44 is driven at high speed through the belt-pulley arrangement 80 (which is a functional equivalent of floating lever arrangement of FIG. 1) by variable speed motor 82. The feed and draw rolls are driven by motor 84 through conventional timing belts and gear boxes.

It will now be appreciated that there has been herewith disclosed a novel and beneficial traversing mechanism of compact construction and flexible, precise operation, which mechanism embodies the principles and attendant advantages of a combined differential output motion transmitted to the traveler guide. Obviously, numerous modifications and variations of the present invention, both as to its construction and mode of operation, are possible in the light of the above teachings. It is therefore to be understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.

What is claimed is:

1. In a winding mechanism for use in strand winding operations, a traversing mechanism comprising a pair of reciprocally mounted input elements, means to reciprocate said elements through paths of pre-selected lengths at a pre-determined difference in velocities, said reciprocating means comprising a pair of rotatably mounted fishing-reel-type winding screws, each characterized by an endless, reverse helical groove formed along its surface, each of said input elements engaging one of said grooves to be urged therealong upon rotation of the screw to thereby describe said reciprocating paths, an output lever means, linkage means interconnecting one end of said lever means with one of said input elements and operative to move said output lever means according to the individual movements of said pair of input elements, a reciprocally mounted strand traversing guide connecting said lever means at a point intermediate the ends thereof, whereby said traversing guide is caused to move in a direction and at a velocity according to the algebraic sum of the velocities of said input elements.

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2. The mechanism as recited in claim 1 wherein the helix angle described by at least one of said grooves decreases to a minimum adjacent one lengthwise extremity thereof, whereby said traversing guide reaches a maximum velocity substantially at one extremity of its reciprocation.

3. The mechanism as defined in claim 1 wherein said reciprocating means is further characterized by a drive means operative to drive said screws at rotative speeds relatively prime to one another to thereby minimize the number of coincident reversal points in the travel of said traversing guide.

4. The mechanism as defined in claim 2 wherein said reciprocating means is further characterized by a drive means operative to drive said screws at rotative speeds relatively prime to one another to thereby minimize the number of coincident reversal points in the travel of said traversing guide.

5. The mechanism as defined in claim 1 wherein the reciprocal paths of said input elements are of differential lengths whereby said traversing guide experiences a maximum residence period during the mid-portion of its travel to thereby generate a package exhibiting a substantially flat mid-portion equal to one-half the difference in path lengths of said input elements.

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6. The mechanism as defined in claim 3 wherein the reciprocal paths of said input elements are of differential lengths whereby said traversing guide experiences a maximum residence period during the mid-portion of its travel to thereby generate a package exhibiting a substantially flat mid-portion equal to one-half the difference in path lengths of said input elements.

7. The mechanism as defined in claim 4 wherein the reciprocal paths of said input elements are of differential lengths whereby said traversing guide experiences a maximum residence period during the mid-portion of its travel to thereby generate a package exhibiting a substantially flat mid-portion equal to one-half the difference in path lengths of said input elements.

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