Oct. 22, 1968 R. L. SNYDER, JR 3,407,262

WINDING MACHINE TRAVERSE CAM AND FOLLOWER THEREFOR

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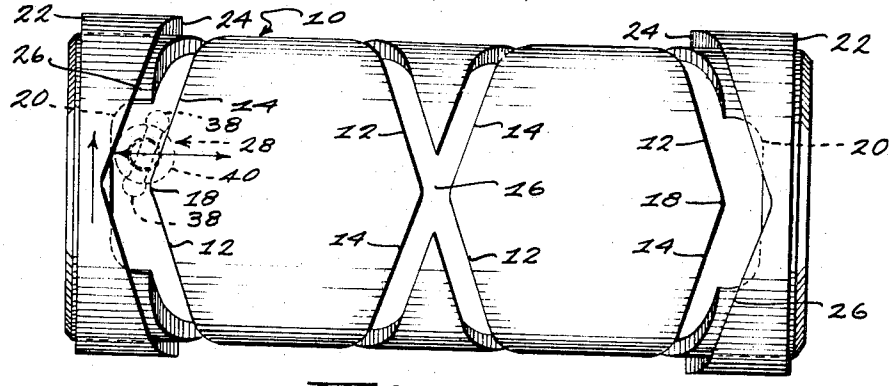

Fig. 1

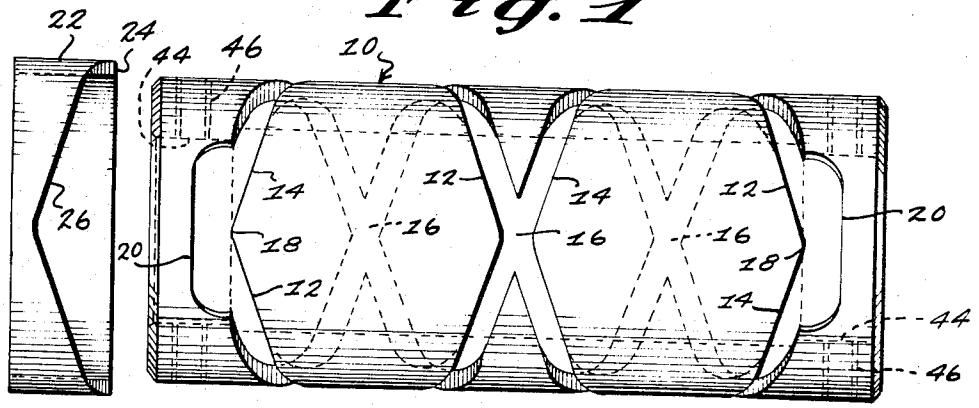

Fig. 3

Fig. 2

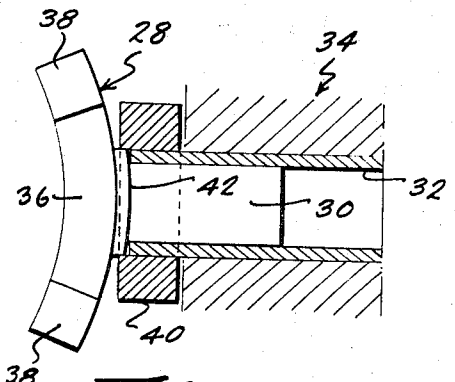

Fig. 5

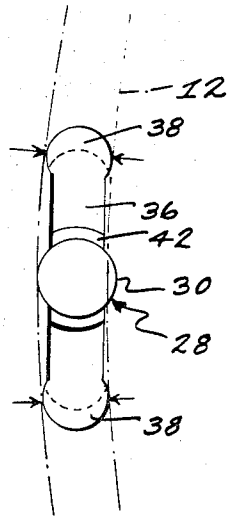

Fig. 6

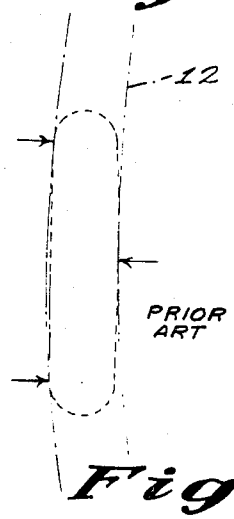

Fig. 7

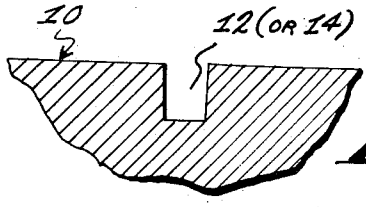

Fig. 4

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WINDING MACHINE TRAVERSE CAM AND FOLLOWER THEREFOR

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This invention relates in general to winding machines of the type incorporating traverse mechanisms, and more particularly to machines of this sort adapted to build packages of textile strand material by placing successive, alternately reversed, spiral-wound layers of the strand material on a supporting core or bobbin. An example is the take-up machines employed for winding packages of synthetic filament as the filament is delivered following extrusion.

The winding of texile packages on such machines is characteristically done at relatively high speeds, and the traverse mechanism accordingly needs to run as free of vibration as possible and needs to effect the reversals for the successive winding layers as rapidly as possible in order to build sound packages. The present invention provides substantially improved compliance with both of these requirements.

A traverse mechanism for these machines basically comprises a cylindrical traverse cam having intersecting, oppositely directed, spiral grooves formed therein, and a follower means including an elongated slider element (or boat) adapted for riding in the cam grooves to produce reciprocal motion from cam rotation. The slider element of the follower means must have a sufficiently elongated form to lead smoothly across the cam groove intersections and this factor, as will appear further presently, makes it difficult to fit the slider element to the cam grooves without play that can allow vibration, and to provide for sufficiently rapid reversal at the traverse ends. The manner in which the present invention deals with both of these difficulties is described in detail below in connection with the accompanying drawings, in which:

FIG. 1 is a side elevation of an assembled traverse cam with the follower means indicated in dotted lines as it approaches reversal in accordance with the present invention;

FIG. 2 is a corresponding side elevation of the traverse cam body;

FIG. 3 is a related side elevation of one of the reversing collars;

FIG. 4 is an enlarged transverse section detail of the cam grooves;

FIG. 5 is an enlarged side elevation of the slider element employed according to the present invention, with the related roll element provided for reversal shown superposed thereon;

FIG. 6 is a plan detail of the FIG. 5 slider element, with the fitted disposition in the cam grooves diagrammed thereat; and

FIG. 7 is a comparable plan detail illustrating the differently fitted disposition that is common in the prior art.

Referring more particularly at first to FIGS. 1, 2, and 3 of the drawing, the illustrated traverse cam is seen to have a cylindrical body **10** in which oppositely directed spiral grooves **12** and **14** are formed in a given traverse pattern, as to stroke and pitch and so forth. Because the spiral grooves **12** and **14** are oppositely directed (i.e., progress, respectively, from left-to-right and right-to-left), they necessarily cross intermediate the length of the cam body **10** to form intersections in the conventional manner, as at **16**. However, the groove intersection that would result at the traverse ends is specially formed according to the present invention so that only the inner groove walls are left to merge regularly thereat, as indicated by the reference character **18**; while the outer walls are relieved substantially, as at **20**, in relation to reversing collars **22** that are fitted on the traverse cam body **10** adjacent its ends to form opposed cylindrical shoulders **24** thereat at which portions **26** are developed for camming the traverse reversals.

As indicated in FIG. 4, the spiral grooves **12** and **14** have the side walls thereof formed virtually square with their bottom, and the slider element employed to engage these grooves for producing the winding traverse is designated generally by the reference character **28** in FIG. 5. As shown, this slider element **28** has a shank portion **30** by which it is adapted for connecting disposition within a locating sleeve **32** of a strand guide structure (indicated at **34**) to which the reciprocal traverse motion is to be delivered. This shank portion **30** extends symmetrically from a boat portion **36** that is curved lengthwise to present a concave bottom face shaped for positioning in relation to the curvature at the groove bottom resulting from the cylindrical form of the traverse cam **10**, and that is characterized in particular by end portions **38** having opposite groove contacting sides that are shaped cylindrically in plan (compare FIGS. 5 and 6) on a diameter corresponding to the width of the cam grooves **12** (or **14**).

In the illustrated embodiment, these end portions **38** are shown entirely cylindrical beyond the intermediate boat portion that is reduced in width sufficiently to avoid side contact in the cam grooves **12** (or **14**); however, the cylindrical form needs to be maintained at the boat end portions **38** only over the range of side surface that has an opportunity for groove contact and both end extremities might alternatively have pointed or tapering configurations if that were desired to facilitate crossing at the groove intersections **16**.

The operative advantage obtained through the cylindrical form of the boat end portions **38** provided in the slider element **28** of the present invention is illustrated by FIG. 6 in comparison with FIG. 7. The advantage follows from the manner in which the necessarily elongated slider element is made to assume a riding fit readily along the curving path of the spiral cam grooves **12** (or **14**). The spiral groove path is not greatly curved, but it does curve enough to result in three-point contact with an elongated slider element (as at **28'** in FIG. 7) that is not shaped to avoid groove contact intermediate its ends.

Such three-point riding contact has been the common condition in the prior art and it has meant that some play of the slider element in the cam groove has been a practical prior art characteristic simply because the shaping of a slider element closely for such three-point contact depends on an involved calculation for determination of the dimensional relations needed. Moreover, the needed dimensional relations change as the pitch or lead of traverse cam is changed for varying the winding pattern, so that the fit of a three-point slider element will assume an intended fit only with a given traverse cam

and must be changed to maintain the same fit with a changed cam.

In contrast, a slider element **28** having the cylindrical end portions **38** establishes four-point riding contact at the sides of the cam grooves **12** (or **14**), and only needs shaping in correspondence with the groove width to fit any cam over a wide range of pitch or lead. The result is a close riding fit readily obtained that effectively minimizes operating play and thereby makes for a smooth operation free of the troublesome vibration tendencies that can disturb the winding pattern undesirably.

Accordingly, a slider element **28** of the illustrated sort is preferably employed with the traverse cam of the present invention, although the traverse cam arrangement provided will also effect improved traverse reversals with sliders of the prior art sort. The reversing is done through a roll element **40** superposed on the slider element (compare FIGS. 1 and 5) for operation at the reversing collars **22**. As superposed, the roll element **40** is disposed for rotation principally about the guide structure locating sleeve **32**, in which the slider element shank portion **30** is arranged so that it may also turn to leave the boat portion **36** free to assume the riding alignment required by the cam grooves **12** (or **14**). A spacer shoulder **42** is formed at the base of the slider element shank portion **30** to face the adjacent end of the locating sleeve **32** and bear all endwise turning contact therewith, as well as maintain the guide structure **34** clear of the roll element **40** so that it may rotate about the locating sleeve **32** as it rides against the facing shoulder **42** at its superposed position on the slider element **28**.

The action of the roll element **40** during reversal is indicated in FIG. 1 by the dotted line representation which illustrates the slider element **28** approaching reversal under the control of the roll element **40** at the left hand reversing collar **22**; it being understood that the traverse cam **10** and fitted collars **22** are rotating so that the visible surface is moving upwardly and the slider element **28** and superposed roll element **40** are constrained in a reciprocal path parallel to the axis of cam rotation, all as indicated by the directional arrows in FIG. 1.

Before reaching the illustrated FIG. 1 position, the roll element **40** will have made contact with the camming portion **26** of the adjacent collar **22** while the slider element boat portion **36** was still riding in the cam groove **14**, so as to prepare for opposing the momentum of the slider element **28** and connected guide structure **34** upon release of the bolt portion **36** at the groove wall relief **20** adjacent the traverse end being approached. The FIG. 1 illustration shows the leading slider element end portion **36** as having just lost contact with the inner groove wall at the involved traverse end and, thus, to be ready for starting reversal upon additional cam rotation sufficient to bring the opposite slope of the collar camming portion **26** in contact with the roll element **40**.

The result of such opposite slope contact is an abrupt traverse reversal that can be made as rapid as the requirements of good package building dictate. If the slider element boat portion **36** were not free during the reversal its elongated form would impose a much slower reversing time and a consequent tendency toward objectionable circumferential bulging at the package ends. Prior art practice has sought to deal with this problem by forming the cam grooves specially to provide for differential action of the slider structure at the package ends, but such prior art expedients have complicated the cam structure materially both as to design and burden of construction. In contrast, the traverse cam body **10** of the present invention is formed with cam grooves **12** and **14** that are entirely regular throughout their length, and that may be cut readily with an abrasive wheel cutter having a relatively large diameter (i.e., about 18") so as to be able to sustain a relatively high feed rate. A cutter of this sort is employed in a width suited for cutting the width of groove desired and set at the angle with respect to the axis of the tubular cam body **10** that will develop the selected spiral form of grooves **12** (or **14**) as the cam body **10** is rotated and fed axially to generate the spiral cutting path.

The outer groove well relief **20** at each traverse end is suitably formed in the cam body with a milling cutter and is proportioned in size not only to free the slider element boat portion **36** for reversal but to allow for run out of the groove cutter as the grooves **12** (or **14**) terminate thereat. When a groove cutter having a diameter in the order of 18" is employed, the sizing of the relief recesses **20** to provide for cutter run out will afford adequate freedom for the boat portion reversal.

The traverse cam body is satisfactorily formed of a low carbon machine steel, which may have the grooves **12** and **14** and relief areas rough machined therein first, and then finished after case hardening. The traverse cam body **10** is otherwise of a generally tubular form that is shaped to provide seating bores **44** adjacent each end for mounting on an operating shaft (not shown), with tapped holes **46** arranged at each of these end bores **44** to receive set screws (not shown) so that the cam body **10** may be fixed to rotate with the operating shaft on which it is mounted.

The reversing collars **22** are preferably formed of a hardened tool steel and are proportioned for a press fit to secure them on the traverse cam body **10** at an assembled disposition presenting their developed camming portions **26** for reversing action in relation to the slider roll element **40** as previously described. The slider and roll elements **26** and **40** may be satisfactorily formed of either plastic or steel, the principal consideration being that of limiting the weight of these elements and of the connected guide structure **34** so that the mass that must be reversed in following the traverse pattern is restricted reasonably.

This invention has been described in detail above for purposes of illustration only and is not intended to be limited by this description or otherwise except as defined in the appended claims.

I claim:

1. In a winding machine for textile strand material and the like, a grooved traverse cam and a follower means disposed thereat, said follower means incorporating an elongated slider element for riding said cam to produce reciprocal motion from cam rotation and a superposed roll element for controlling reversal of said reciprocal motion, and said grooved traverse cam having intersecting, oppositely directed, spiral grooves formed therein for engaging said elongated slider element in riding relation, and being fitted adjacent each end with collar members for reversing contact with said superposed roll element, the spiral cam grooves having the outer wall thereof adjacent each cam end relieved sufficiently to free said elongated slider element during reversal, and the cam collar members having the roll element contacting portion thereof developed for camming said reversal.

2. In a winding machine, the structure defined by claim **1** and further characterized in that said traverse cam has a cylindrical body, in that said collar members form opposing cylindrical camming shoulders thereon, and in that said slider element is formed with a shank portion on which said roll element is carried free of said cam body for selective reversing contact with said collar members at said camming shoulders.

3. In a winding machine, the structure defined by claim **2** and further characterized in that said collar members are fitted on said traverse cam so that the camming shoulders formed thereby establish contact with said roll element just before said slider element is freed by said outer wall groove relief for reversal and continue said contact until just after the reversed slider element is again engaged in riding relation beyond said relief.

4. In a winding machine, the structure defined by claim

1 and further characterized in that said elongated slider element has end portions formed with opposite groove contacting sides that are shaped cylindrically in plan on a diameter corresponding to the width of said cam grooves, and the body of said slider element intermediate said end portions is reduced in width sufficiently to avoid side contact in said grooves.

5. A slider element adapted to serve as a follower for a cylindrical traverse cam having intersecting, oppositely directed, grooves therein, said slider element being elongated sufficiently for leading across the intersections of said grooves and having end portions formed with opposite groove contacting sides that are shaped cylindrically in plan on a diameter corresponding to the width of said grooves with a remaining body intermediate said end

portions that is reduced in width sufficiently to avoid side contact in said grooves.

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