

April 23, 1963

M. V. ALTICE ET AL  
YARN TRAVERSE MECHANISM

3,086,722

Filed April 26, 1962

2 Sheets-Sheet 1

FIG. 1

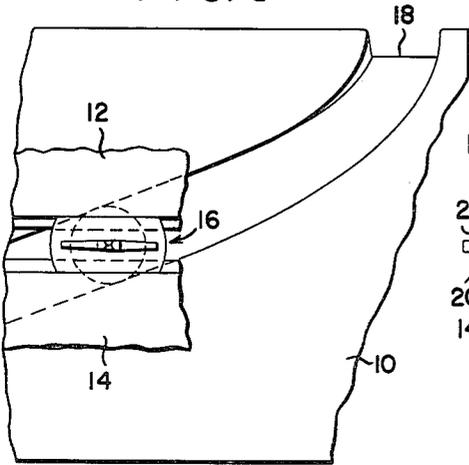


FIG. 2

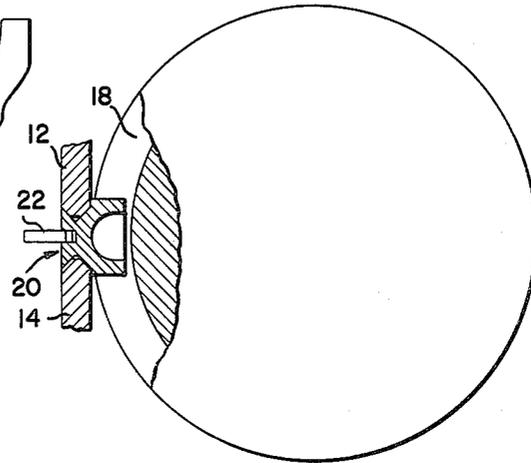


FIG. 3

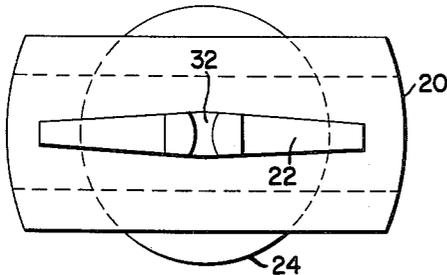


FIG. 6

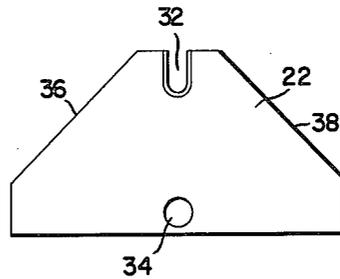


FIG. 4

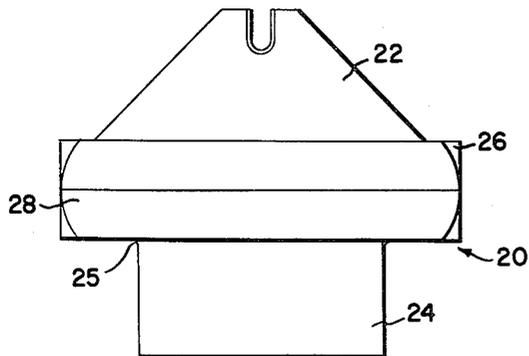
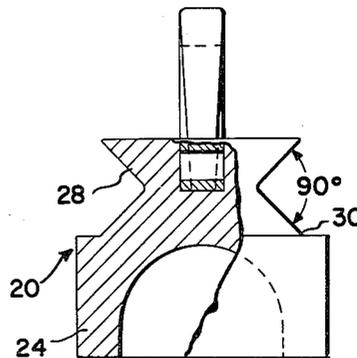


FIG. 5



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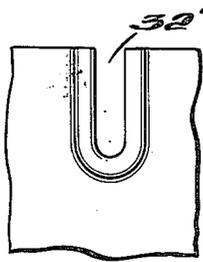
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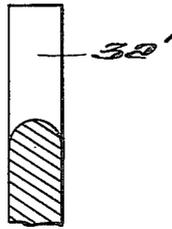
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*Fig. 7.*



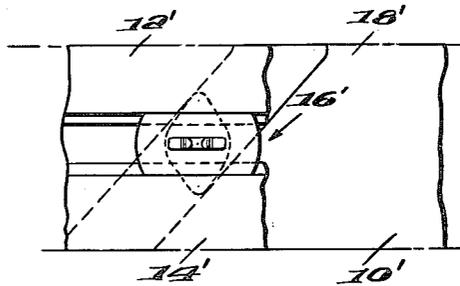
*Fig. 8.*



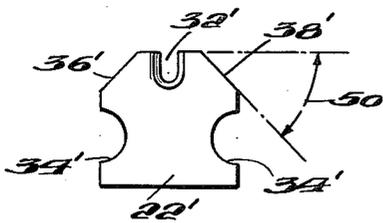
*Fig. 9.*



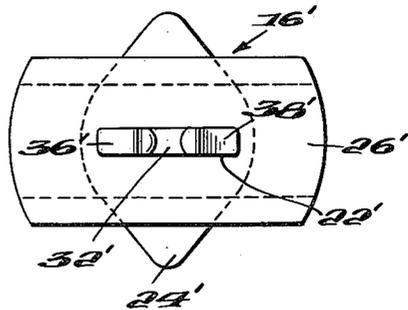
*Fig. 11.*



*Fig. 10.*



*Fig. 12.*



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**YARN TRAVERSE MECHANISM**

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 Filed Apr. 26, 1962, Ser. No. 190,428  
 8 Claims. (Cl. 242—43)

This invention relates generally to the traverse winding of yarn at high speeds and, more particularly, to the reciprocating yarn guides and cam followers employed in the winding apparatus.

It is well known in the textile field that substantially cylindrical packages of yarn, thread or the like may be built on a bobbin in a traverse winding apparatus. In such an apparatus the yarn passes through a reciprocating guide to a rotating package. The guide is constrained to follow a linear path as it is reciprocated by a barrel cam. An apparatus of this type has been disclosed by Hunter in U.S. Pat. No. 2,689,694. Although entirely suitable for use at the speeds contemplated, it has been found that devices made in accordance with the teachings of Hunter are subject to failure when used in a very high speed winding apparatus where the acceleration forces acting on the guide may exceed 5000 g. (The symbol "g," as used herein, signifies a force of one gravity, i.e., "g" is the gravitational constant.) The difficulties are caused by the excessive mass of the devices and by the excessive friction and bending moments resulting from the use of cantilevered weights.

The most important object of the present invention is to provide a combination cam follower and yarn guide in which the various portions are aligned and disposed in an integrated construction.

Another important object of the invention is the provision of a reciprocating yarn guide in which the surfaces engaging the traverse rails are opposed and situated substantially midway between those which engage the cam groove and yarn in a traverse winding apparatus.

A further object is to provide a rail-traversing cam follower and yarn guide which because of the arrangement of components and the materials employed is light in weight, inexpensive and has an unusually long life even when reciprocated at very high speeds and subjected to abnormal acceleration forces.

These and other objects are accomplished by the provision of a rail-traversing cam follower and yarn guide which comprises a formed unitary structure having a yarn guide embedded therein. The structure includes a cylindrical portion which is adapted to ride in the continuous, generally helical groove of a barrel cam and an adjoining portion having opposed parallel notches each adapted to receive a traverse rail. The guide has a yarn-receiving slot which is substantially in alignment with the axis of the cylindrical cam-engaging portion.

In the drawing:

FIGURE 1 is a partial elevational view of a winding apparatus into which the cam follower and the yarn guide of the present invention have been incorporated;

FIG. 2 is an end view, partially in section, of the apparatus of FIG. 1;

FIGS. 3-5 are top, side and end views, respectively, of one embodiment of the cam follower and yarn guide shown in FIG. 1;

FIG. 6 is an elevation of the yarn guide shown in FIGS. 3-5;

FIGS. 7 and 8 are enlarged views of the slots shown in the yarn guides of FIGS. 1-6, 9 and 10;

FIGS. 9 and 10 are top and side views, respectively, of a second embodiment of the yarn guide; and

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FIGS. 11 and 12 are partial elevational and top views, respectively, of an alternate follower embodiment which includes the yarn guide of FIGS. 9 and 10.

The yarn-winding apparatus chosen for illustration in FIGS. 1 and 2 includes, as components thereof, a rotatably driven barrel cam 10, a pair of traverse rails 12, 14 and a reciprocating yarn guide 16. Barrel cam 10 is circular in cross section and has a single continuous groove 18 in its surface. The path of cam groove 18 is generally helical but is not a true helix since the reversal angles are quite sharp. Rails 12, 14 are equidistant from the axis of rotation of cam 10 and have opposed and spaced V-shaped edges.

The guide and follower shown in FIGS. 1-6 consists of a molding 20 and a plate member 22 which is embedded therein. The molding 20 includes a cylindrical cam-engaging portion 24 which is circular in cross section and a rectangularly shaped rail-engaging portion 26. A generous radius should be provided where cylindrical portion 24 merges with portion 26, as indicated at 25 in FIG. 4. The radius 25 matches the complementally rounded edges of groove 18 for the purpose of reducing stress concentrations and promoting long life. The portion 26 has a pair of opposed V-shaped notches 28, 30 which receive the guide rails 12, 14. Molding 20 is of a thermoplastic resin having good friction and wearing properties, such as nylon.

The plate member 22, shown in FIG. 6, has an upper section which is provided with a slot 32 for engaging the yarn line and a lower section from which a portion has been removed as at 34 to provide for retention in the molding 20. Slot 32 and the center of mass of portion 26 are aligned with the axis of cylindrical portion 24. The upper section of member 22 includes a pair of sloping surfaces 36, 38 which act to cam or deflect a yarn line up into the slot 32 when the apparatus is first strung-up, i.e., slot 32 is self-stringing. In this respect, the angle which the surfaces 36, 38 make with the top surface of the plate member 22 should not exceed 50° if the guide is to be self-stringing. Further details of slot 32 are shown in FIGS. 7 and 8. As best shown in FIGS. 3 and 5, plate member 22 is tapered and narrows gradually from its center to its end (FIG. 3) and from top to bottom (FIG. 5). Thus, where heavier yarns such as tire yarn are being wound, member 22 is reinforced only where necessary and without adding excessive weight. Plate member 22 may be made from any suitable material having a high strength-to-weight ratio. A wear-resistant ceramic material is usually employed. When light metals such as aluminum are used, they are usually coated with aluminum oxide or other suitable coating having superior wear resistance. Other materials that may be used include solid (or homogeneous) aluminum oxide and synthetic sapphire.

Referring now to FIGS. 9 and 10, a second embodiment of the plate member has been illustrated and designated with the numeral 22'. This form is adapted for use where lighter weight textile yarn is being wound and includes an upper section having the slot 32' and the sloping surfaces 36', 38'. As mentioned previously, the angle 50 should not exceed 50°. A pair of cutouts 34' in the lower section of member 22' provide for retention in the molding. Member 22' does not have any thickened central segment or reinforcement and is therefore relatively lighter than member 22, i.e., member 22' is flat on both sides whereas member 22 is tapered on both sides. In an intermediate form (not shown), the plate member is flat on one side and tapered on the other side. The mass of the cam-engaging portion 24 is reduced correspondingly in an effort to maintain the mass relationships which will be explained more fully hereinafter.

Although it is preferred that both rails 12, 14 be provided with V-shaped edges, as shown, it is also possible to have one of the rails provided with a planar surface. One of the grooves 28, 30 is then replaced with a mating flat surface which may be done without relocating the center of mass of the rail-engaging portion. This arrangement has the advantage that the rail-to-rail alignment is not as critical as in the preferred arrangement.

In operation, yarn guide 16 is reciprocated on rails 12, 14 as cylindrical portion 24 follows groove 18. Portion 24 rides in groove 18, making only line contacts with cam 10. A yarn line, not shown, passes through slot 32 to a rotating bobbin on which it is wound as a cylindrical package. The respective centers of mass of the plate 22, the rail-engaging portion 26, and the cylindrical portion 24 are substantially on a common line which line also bisects the slot 32 and which line passes about at the mid point between the opposed V faces of the guide rails 12, 14 and substantially at right angles to the plane defined by the crests of the rail V edges; the center of mass of the entire assembly, comprising the rail-engaging portion 26, the cylindrical portion 24, and the plate 22 (plus any bonding agent, if used), preferably is situated substantially at the geometrical center of the rail-engaging portion 26, i.e., the over-all center of mass should preferably be situated along the above-described line and in the plane defined by the crests of the rail V edges. In any case, the over-all center of mass should never lie outside of the rail-engaging portion 26. Adjustments in the location of the over-all center of mass may be effected by increasing or decreasing the size of the hollow in the cylindrical cam-engaging portion 24. In view of the above weight and alignment relationships, bending forces and moments are at a minimum. The portion 24 of molding 20 is hollow not only for purposes of weight reduction but also so that its center of mass and that of plate member 22 will be substantially equidistant from the center of mass of rail-engaging portion 26.

The apparatus shown in FIGS. 11 and 12 is structurally similar to that shown in FIGS. 1-6 except for the employment of a plate member 22' of the type shown in FIG. 10 and the provision of a cylindrical portion 24' which is rhomboidal in cross section. This modified follower is also functionally similar to that shown in FIGS. 1-6.

When used herein in connection with descriptions of the cam-engaging portion, the term "cylindrical" is intended to encompass the circular and rhomboidal cross sections shown in the drawings as well as other cylindrical cross sections which meet the specified mass and symmetry requirements.

In actual tests, the combination rail-traversing cam followers disclosed herein have withstood high acceleration loads without fracture or severe wear when used for fifty million cycles or more. When the heavier construction, involving plate member 22 (FIGS. 3-6), is employed, the device was subjected to acceleration loads of at least 3500 g. With the lighter construction (FIGS. 9 and 10), acceleration loads of at least 5000 g. were sustained. In neither case was the noise level above 85 decibels measured at a distance of five feet.

The cam- and rail-engaging portions have been described herein as a molding of a thermoplastic material. It is apparent that the molding may also be made of any suitable lightweight thermosetting or otherwise moldable synthetic resin. The unitary structure comprised of the cam- and rail-engaging portions may be machined from solid stock in those instances where low unit cost is not a factor. When this unitary structure is machined, plate member 22 is bonded thereto within a suitable cavity with a thermosetting or polymerizable resin such as epoxy, phenolic or polyvinyl acetate.

This is a continuation-in-part of our copending application Serial No. 859,323, filed December 14, 1959.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In a yarn-winding apparatus including a cam cylinder and a pair of spaced guide rails, a rail-traversing cam follower comprising cam-, rail- and yarn-engaging portions, the cam- and rail-engaging portions being a unitary structure, the yarn-engaging portion being a plate member, said cam-engaging portion being substantially cylindrical, said rail-engaging portion having opposed notches therein for reception of said rails, said member having a bottom section integrally, fixedly embedded in and a top section projecting from said rail-engaging portion in substantially bisecting relationship to an imaginary projection of said cylindrical cam-engaging portion, there being a yarn-guiding slot in said top section, said slot having a mid-point coaxial with said cam-engaging portion.

2. The cam follower of claim 1 wherein each of said portions has its weight substantially evenly distributed on opposite sides of planes substantially normal and parallel to said plate member and passing through the center of said slot.

3. The cam follower of claim 2 wherein said cam- and rail-engaging portions are molded from a synthetic resin and said plate member is of a wear-resistant material having a high strength-to-weight ratio.

4. The cam follower of claim 3 wherein said bottom section of the plate member has a portion removed therefrom to provide for retention in said rail-engaging portion, said removed portion being filled by molded resin forming a part of the rail-engaging portion.

5. The cam follower of claim 4 wherein said top section of the plate member is provided with a pair of opposed surfaces sloping toward said slot.

6. The cam follower of claim 2 wherein said cylindrical cam-engaging portion is circular in cross section.

7. The cam follower of claim 2 wherein said cylindrical cam-engaging portion is rhomboidal in cross section.

8. In a yarn-winding apparatus: a driven cylinder having a helical cam groove in its surface; a pair of spaced guide rails disposed in parallelism with said cylinder, said rails each having a V-shaped edge; and a follower assembly including a cylindrical portion fitted in said groove, a solid intermediate portion having opposed notches receiving said V-shaped edges, and a yarn-guiding portion extending from said intermediate portion in opposed relationship to said cylindrical portion, each of said portions having its weight substantially evenly distributed on opposite sides of a radial plane of said driven cylinder which bisects said cylindrical portion, said cylindrical and intermediate portions being a unitary structure, said yarn-guiding portion being fixedly embedded in said structure, made of a wear-resistant material having a high strength-to-weight ratio and provided with a yarn-receiving slot having a mid-point disposed coaxially with said cylindrical portion.

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