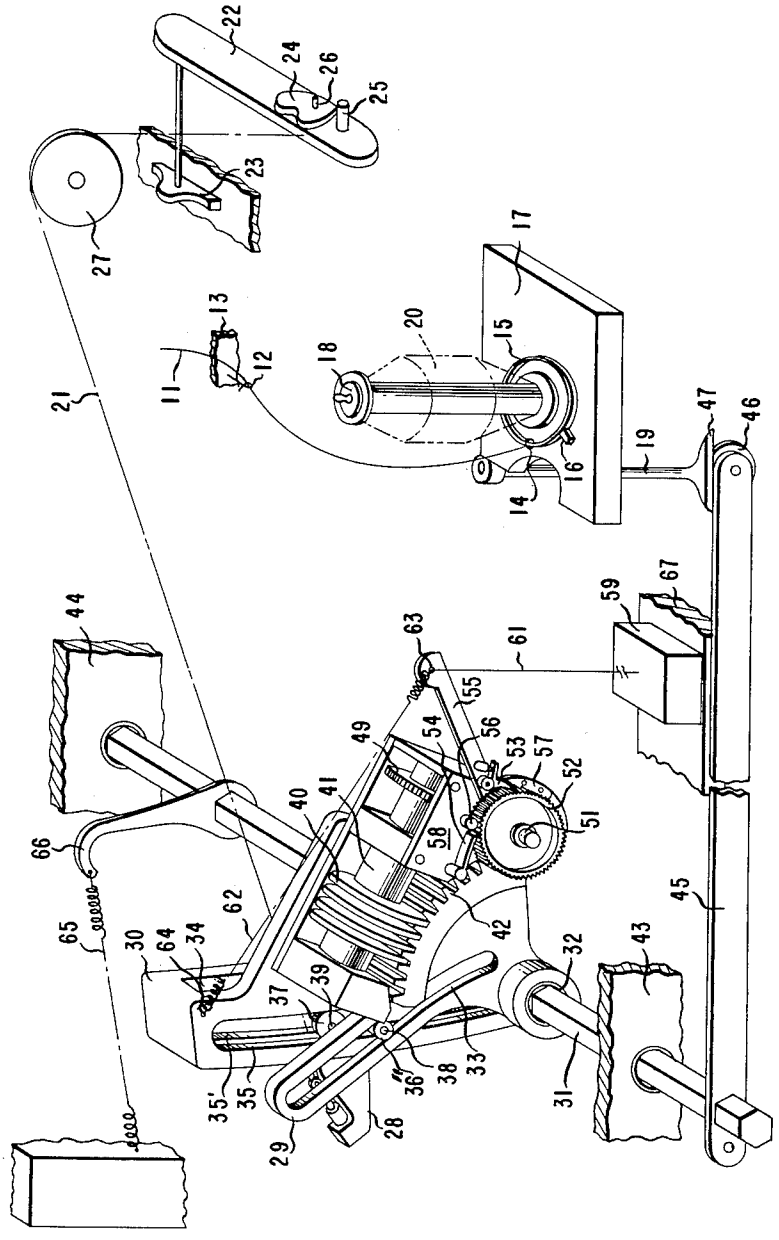
July 3, 1962 A. B. HUGHES ET AL 3,042,325

BUILDER MOTION

Filed Sept. 29, 1960 2 Sheets-Sheet 1

FIG. 1



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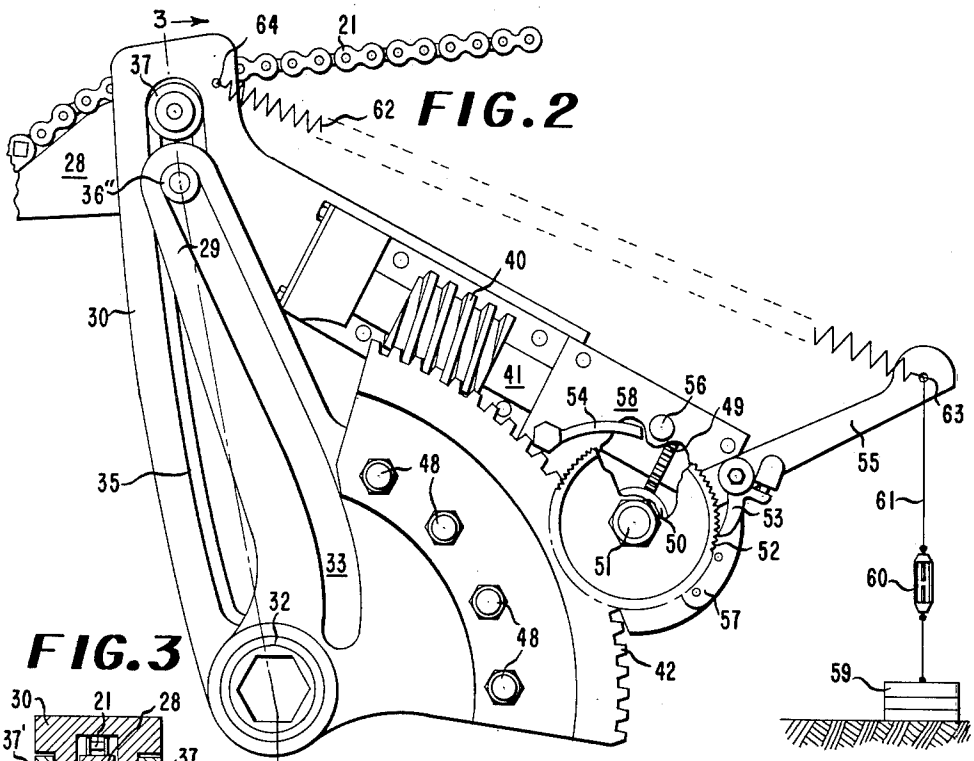


FIG. 2

FIG. 3

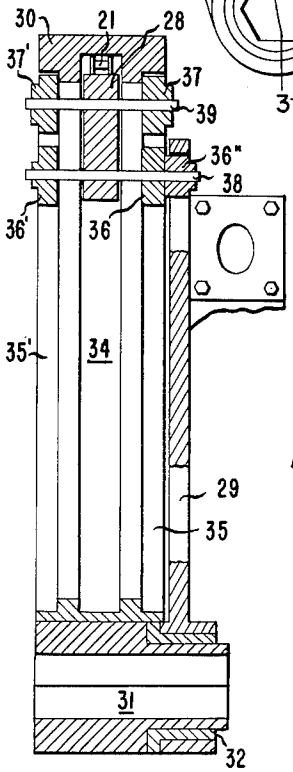


FIG. 4



FIG. 4a



FIG. 5

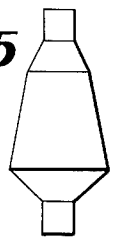


FIG. 5a



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BUILDER MOTION

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This invention relates to novel yarn packages and to improved apparatus for winding such packages. More particularly, the invention relates to an improvement in the builder motion of ring twisters.

Various types of apparatus are utilized for winding double-tapered yarn packages. In one type of apparatus, the package is formed by superimposing two motions on the guide which directs the yarn onto the bobbin. An up-and-down traversing or chasing motion and a slow, progressive feed or lift for building the package have been used. In other apparatus, both the traversing mechanism as well as the spindle are moved. A builder motion has also been superimposed on the traverse stroke in another type of apparatus. In each type, the length of the stroke remains constant. As a result, the tension on the yarn along the yarn package, particularly at the tapered portions, tends to vary, causing difficulty in unwinding in knitting and weaving operations.

The most important objection of this invention is the provision of an improved apparatus for winding yarn packages. A further object of this invention is the provision of a differential wind downtwister which is of simple construction and may be readily adapted to wind a variety of types of yarn packages. A still further object of this invention is the provision of an adjustable radius arm for use in yarn winding apparatus, the length of which is changed incrementally while winding the yarn on a package.

In accordance with this invention there is provided apparatus for winding yarn onto packages comprising a primary cam which imparts a constant reciprocating primary motion to a yarn guide rail, and an adjustable radius arm in the linkage between the primary cam and the yarn guide rail which provides incremental changes in the length of stroke of the guide rail while the yarn is being wound onto the package.

By utilizing the apparatus of this invention, the yarn is distributed along the length of the package core without laying consecutive windings precisely on top of each other from one stroke to the next.

Further details of the apparatus of this invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings in which:

FIGURE 1 is a diagrammatic arrangement of the apparatus of this invention;

FIGURE 2 is a side view of the adjustable radius arm of the apparatus;

FIGURE 3 is a partial sectional view of the adjustable radius arm taken along the lines 3—3 of FIGURE 2;

FIGURE 4 is an illustration of one type of double-tapered yarn package prepared by using the apparatus of this invention;

FIGURE 4*a* illustrates the cyclic fashion in which the guide rail strokes are diminished in preparing the package of FIGURE 4;

FIGURE 5 illustrates another type of double-tapered yarn package prepared by using the apparatus of this invention; and

FIGURE 5*a* illustrates the cyclic fashion in which the guide rail strokes are diminished in preparing the package of FIGURE 5.

Referring now to FIG. 1, a yarn 11 is passed from a

source, not shown, through a pigtail guide 12 positioned on support 13. The yarn is threaded through a traveler 14 on a spinning ring 15 set in ring holder 16 which is mounted on guide rail 17. A plurality of spinning positions are normally carried by guide rail 17.

The yarn 11 is taken up on a rotating bobbin 18 which is positioned on a rotatable spindle, not shown. A vertical reciprocating builder motion is imparted to guide rail 17 through lifter rod 19. The motion of guide rail 17 determines the shape of the yarn package 20.

In the apparatus of the present invention, the vertical reciprocating motion is imparted to guide rail 17 as follows: Oscillatory motion is imparted to chain 21 by arm 22 which is caused to pivot about its support 23 by the movement of heart-shaped primary cam 24 against cam follower 25. The cam 24 is driven at a constant speed through shaft 26 by means not shown. Chain 21 passes over pulley 27 and is adjustably attached to follower plate 28 which forms a part of an adjustable radius arm which is further illustrated in FIGS. 2 and 3.

Referring now to FIGS. 1, 2, and 3, the adjustable radius arm includes two arm members 29 and 30 which are positioned in side-by-side relationship on cross shaft 31. Arm member 29 is mounted for rotation on shaft 31 through bearing 32 and is provided with an elongated cam slot 33. Arm member 30, which is provided with a cavity 34 for receiving follower plate 28, has two elongated arcuate cam slots 35 and 35'. Mounted on follower plate 28 are two sets of cam rollers 36 and 36' and 37—37', respectively, which are rotatably mounted on shafts 38 and 39, and a single cam roller 36'' rotatably mounted on shaft 38, and ride in cam slots 35, 35', and 33, respectively. In this manner the follower plate and cam rollers provide a movable coupling between arm members 29 and 30. Arm members 29 and 30 are normally locked together through teeth 40 on worm gear 41, engaging the teeth of segment gear 42, and rotate as a unit with cross shaft 31.

When the arm members 29 and 30 are rotated as a unit, oscillation of chain 21 imparts a rotary motion to cross shaft 31 which is supported in bearing blocks 43 and 44. The rotation of cross shaft 31 transmits an oscillatory motion to lever 45 which acts through roller 46 and plate 47 to raise and lower lifter rod 19 and guide rail 17. The length of the stroke of guide rail 17 is dependent on the amount of rotation imparted to cross shaft 31 by the oscillatory motion of chain 21 acting through the adjustable radius arm.

From FIG. 1 it can be seen that the amount of rotation of cross shaft 31 can be increased or decreased by varying the distance between the cross shaft 31 and follower plate 28 to which chain 21 is attached. In FIG. 1, the position of follower plate 28 and arm members 29 and 30 is such that the effective length of the radius arm is approximately half the maximum length which can be attained. Referring to FIG. 2, the position of follower plate 28 is at its uppermost location and thus the effective length of the radius arm is at a maximum. At this point the effective stroke of the guide rail is at a minimum.

In the apparatus of this invention the distance between the follower plate 28 and the cross shaft 31 is varied incrementally by a stepping device which is operatively connected to arms 29 and 30. The stepping device includes worm gear 41 which is attached to arm member 30 and segment gear 42 which is fixedly attached to arm member 29 by means of lug bolts 48. As illustrated most clearly in FIG. 2, rotary motion is imparted to worm gear 41 through gear 49 which is, in turn, rotated by a secondary worm gear 50. Worm gear 50 is secured to shaft 51. Pick wheel 52, which is also fixed to shaft 51, is positioned to be picked and rotated in a clockwise direction by the ratchet pawl 53. Pawl 54 is positioned adjacent to pick wheel 52 to pre-

vent counterclockwise rotation. The number of teeth which are picked is regulated by limiting the travel of ratchet arm 55 which is mounted for rotation on shaft 51 by means of a fixed stop 56 and an adjustable stop 57 which are positioned on housing 58. Weight 59, which is attached to ratchet arm 55, is made adjustable by means of turn buckle 60 on cable 61. A spring 62 is attached to ratchet arm 55 by pin 63 and to arm member 30 by pin 64. The operation of the apparatus will now be described.

Referring now to FIG. 1, in operation an oscillatory motion is imparted to chain 21 as heart-shaped cam 24 is rotated. As follower plate 28 and arm members 29 and 30 are pulled in a clockwise direction by chain 21, cross shaft 31 is rotated in a like manner, causing roller 46 to move downwardly, thereby permitting lifter rod 19 and guide rail 17 to move downwardly. As the clockwise motion continues, ratchet arm 55 will move in a counterclockwise direction under tension of spring 62, and will be arrested when it comes into contact with the fixed stop 56 on housing 58. When the high point of primary cam 24 is reached, the direction of rotation is reversed with the guide rail return spring 65 on rail return arm 66 causing follower 25 to follow along the surface of primary cam 24.

As the counterclockwise rotation begins, weight 59 which is resting on support 67 restrains ratchet arm 55 from rotating. Pick wheel 52 is picked by ratchet pawl 53 and is rotated in a clockwise direction. The weight 59 is sufficient to overcome the force of spring 62 in addition to the force required to rotate pick wheel 52 which rotates worm gear 41 through gears 49 and 50. Worm gear 41, acting on the teeth of segment gear 42, rotates arm 29 in a clockwise direction. As arm 29 is rotated, cam roller 36'' is forced upward in cam slot 33. The upward motion is transmitted by cam rollers 36—36' and 37—37' to follower plate 28 which is, in turn, moved away from cross shaft 31. Thus the effective length of the radius arm is increased. Accordingly the amount of rotation of cross shaft 31 per revolution of cam 24 is reduced, and the length of travel of guide rail 17 is likewise reduced.

Ratchet pawl 53 continues to rotate pick wheel 52 until ratchet arm 55 comes in contact with adjustable stop 57. At this point, weight 59 is lifted from support 67. The counterclockwise rotation of cross shaft 31 continues until the low point on cam 24 is reached. The direction of rotation then reverses. When weight 59 comes to rest on support 67, ratchet arm 55 begins its return toward fixed stop 56 under tension of spring 62, setting the stepping device for the next cycle.

Referring again to FIG. 2, the position of follower plate 28 and arm members 29 and 30 is such that the effective length of the radius arm is at a maximum. This is also the point at which rotation of cross shaft 31 will be at a minimum. When this point is reached in the winding of a yarn package, a stop alarm system may be actuated to indicate that a full package has been obtained. After removal of the full package, the length of the radius arm may be reduced to the minimum for the winding of other packages by disengaging pawls 53 and 54, and rotating pick wheel 52 in a counterclockwise direction. Suitable means may be connected with the alarm system previously mentioned to automatically reset the radius arm when the package is completed. Alternatively, the radius arm may be reset by manually attaching a crank to shaft 51.

Certain adjustments can be readily effected when using the apparatus of this invention to provide the most efficient operation. By setting the adjustable pick stop 57 and adjusting the cable 61 on weight 59 for proper return to support 67 when cross shaft 31 is at the point of maximum clockwise rotation, weight 59 will be lifted a minimum amount. By using pick wheels having different numbers of teeth, the taper angle of the package may be changed. This adjustment is necessary for fine adjustments with various denier yarns.

In selecting the components for the apparatus of this invention, guide rail return spring 65 must be selected to resist permanent set when it is extended and must be strong enough to return guide rail 17 to its upper position. Spring 62 must be selected to elongate without permanent set and return ratchet arm 55 to its fixed stop position. The worm gears 41 and 50 should be adjustable to keep backlash to a minimum.

By using the apparatus of this invention, a number of desirable yarn packages are obtained. Using a heart-shaped cam, a package of the type shown in FIG. 4 is obtained. With the adjustable radius arm set at its minimum effective length, the length of stroke of the guide rail 17 will be at a maximum when winding is first started on bobbin 18. During the upward stroke of each cycle through the action of the cam follower rollers, the follower plate 28 will be moved away from the cross shaft, thus decreasing the effective length of stroke in cyclic fashion as illustrated in FIG. 4*a*. In the package illustrated in FIG. 4, there is no overlapping of the end yarn on the tapered portion of the package, thus the yarn may be readily removed for use under uniform tension without tangling. By changing the contours of the camming surface in the arm members and the primary cam, variations in package contour can be obtained.

A particularly desirable yarn package is shown in FIG. 5. This package is produced by utilizing a primary cam having a contour to permit guide rail 17 to travel at a progressively decreasing speed as it travels down the package, reaching the slowest speed at the bottom of the stroke. The length of stroke is varied incrementally as illustrated in FIG. 5*a*. With a package of the type shown in FIG. 5, the yarn is never taken off at the bottom taper and is always removed in the direction of a smaller diameter.

By changing the direction of rotation of the worm gears a still different type of yarn package, known as an expanding wind package, may be obtained. Other adjustments will be obvious to those skilled in the art.

As many widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that this invention is not to be limited to the specific embodiments thereof except as defined in the appended claims.

We claim:

1. An adjustable radius arm comprising two arm members on a shaft, each member having an elongated cam slot therein, one of said members being fixed to said shaft and the other being mounted for rotation thereon, a follower plate having cam rollers riding in said cam slots to provide a movable coupling between said arm members, oscillatory motion means connected to said follower plate, and means interconnected with said oscillatory motion means normally locking said arm members together, which means includes a stepping device for cyclically rotating said rotatable member relative to said fixed member in predetermined increments thereby moving said follower plate toward or away from said shaft by moving said cam rollers in said slots.

2. In a yarn winding apparatus having a rotatable spindle, a guide rail, a primary cam and an adjustable radius arm mounted for oscillatory motion on a shaft between said primary cam and said guide rail, said primary cam and said radius arm being interconnected by a first linkage for imparting rotational movement to said shaft through said radius arm, said shaft and said guide rail being interconnected by a second linkage for imparting to said guide rail a vertical reciprocating motion with relation to said spindle, said radius arm comprising two arm members, each of said members having an elongated cam slot therein, one of said members being fixed to said shaft and the other being mounted for rotation thereon, a fol-

lower plate having cam rollers riding in said cam slots to provide a movable coupling between said arm members, and means normally locking said arm members together, which means includes a stepping device for cyclically rotating said rotatable arm member relative to said fixed arm member in predetermined increments thereby moving said follower plate toward or away from said shaft by moving said cam rollers in said cam slots.

3. The apparatus of claim 2 wherein said stepping device comprises a segment gear on said rotatable arm member, a worm gear on said fixed arm member for driving said segment gear, and ratchet means for driving said worm gear.

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