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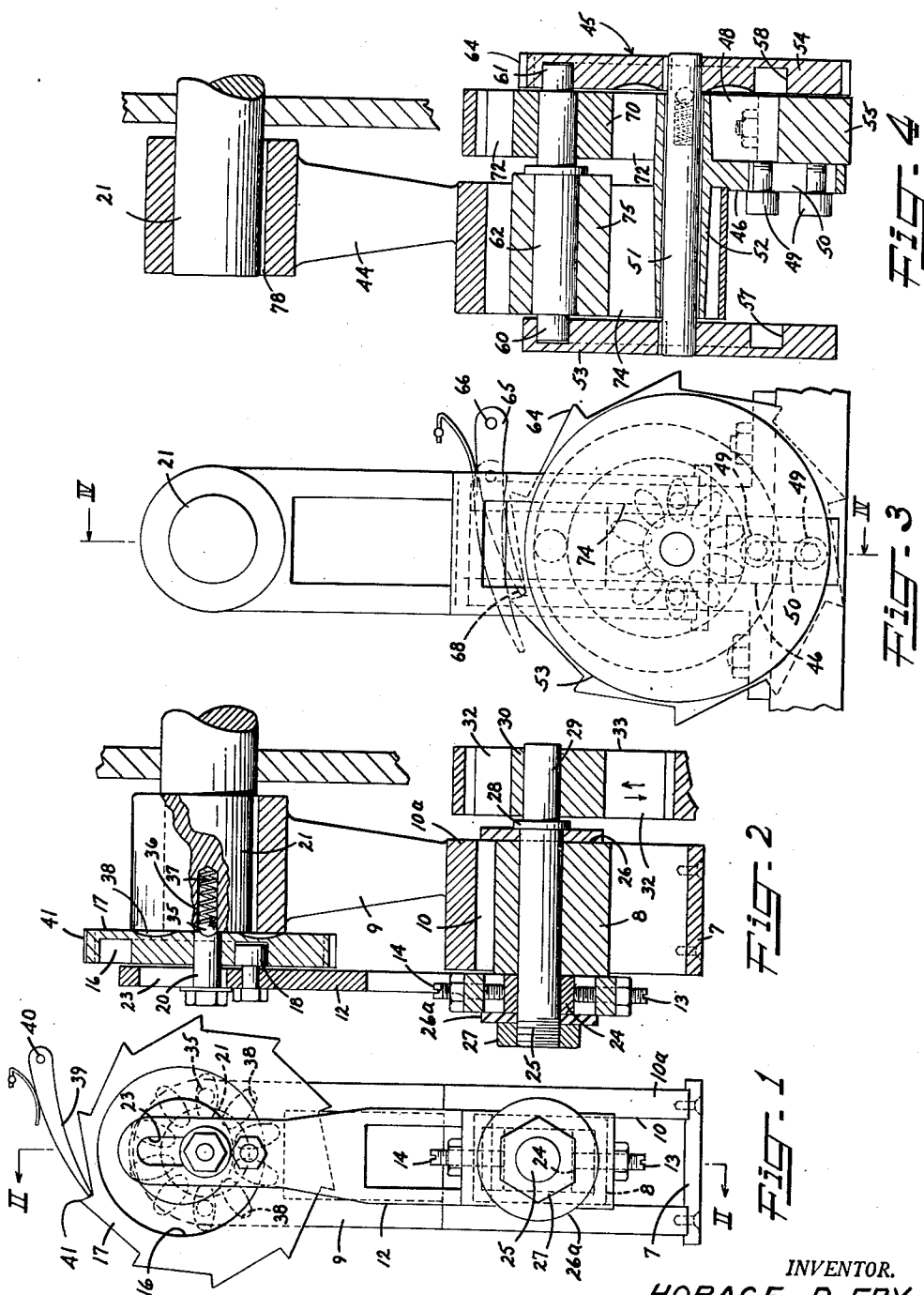
H. P. FRY, JR

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STROKE VARIATION DEVICE FOR WINDING MACHINES

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2 SHEETS—SHEET 1



INVENTOR.
HORACE P. FRY, JR.
BY
Thomas R. McNally

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H. P. FRY, JR

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2 SHEETS—SHEET 2

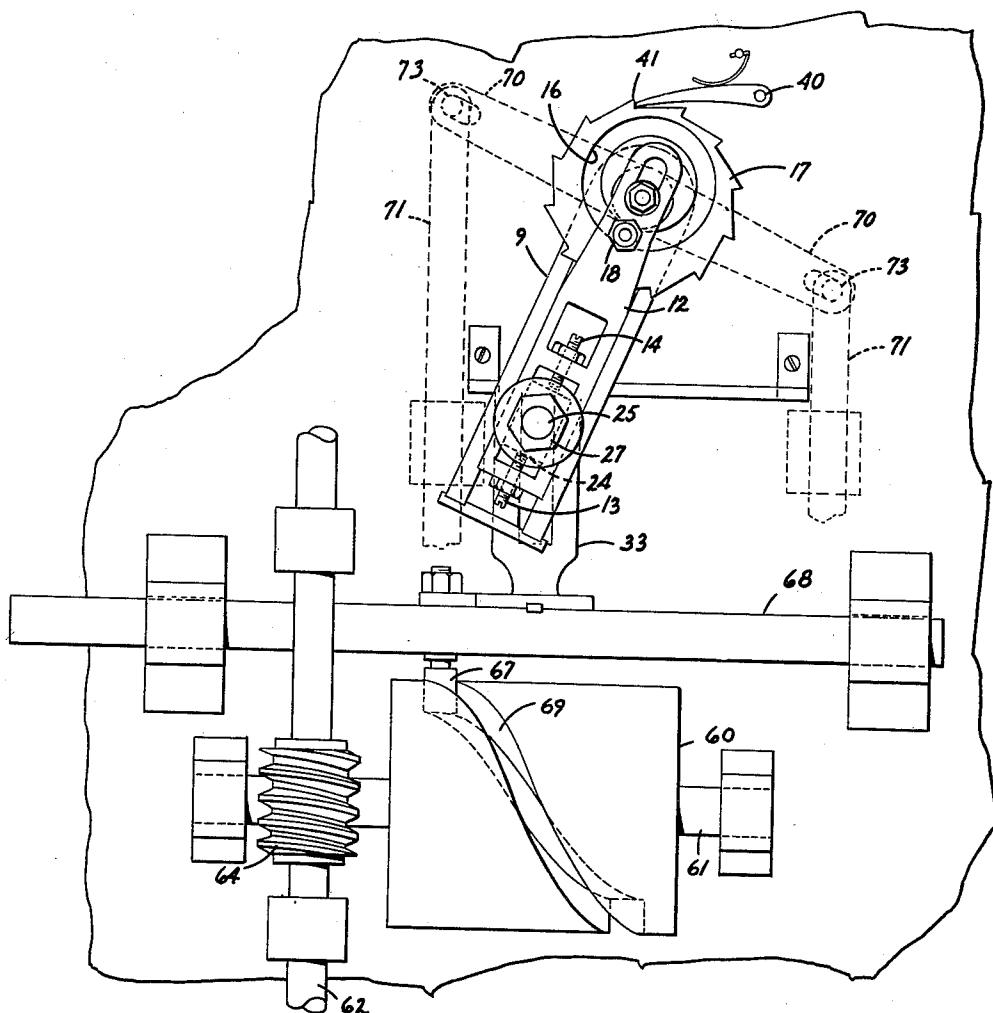


Fig. 5

INVENTOR.

HORACE P. FRY, JR.

BY

Thomas R. Mally

UNITED STATES PATENT OFFICE

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STROKE VARIATION DEVICE FOR WINDING
MACHINESHorace Pugh Fry, Jr., Swarthmore, Pa., assignor
to American Viscose Corporation, Wilmington,
Del., a corporation of Delaware

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This invention relates to a method and device for forming strand packages and particularly to the manner and means by which winding of the strand is effected during the building of packages, such as rayon cakes.

Although the invention has utility in winding devices generally, it will be described in connection with the initial spinning and collecting of viscose rayon filamentary material. In the collecting of yarn in a spinning bucket, yarn is deposited against the interior wall of the growing package in a helical pattern from the stem of a vertically reciprocating funnel, traversing a path approximately along the axis of the spinning bucket. The funnel is caused to reciprocate through substantially identical cycles. The number of cycles traversed will bear a definite ratio to the rotational speed of the spinning bucket, such as for example, five revolutions of the bucket for each cycle of the spinning funnel. Regardless of the ratio selected, at certain stages during the building of the package, groups of parallel strands will be laid down at various cylindrical layers within the growing package. These groups of parallel strands will be observed as a helically shaped "band" or "ribbon" along some cylindrical section comprising fifty to one hundred or more individual layers within the package. Normally, a single layer of yarn is formed by several turns being deposited along the interior surface of the cake in a helical pattern; the next layer is deposited on an oppositely wound helix. Two or more adjacent layers form a web with relatively large interstices between individual strands. Convolutions of the strands are spaced uniformly from each other throughout the package when compared with adjacent convolutions in the same layer. However when compared with the parallel convolutions of alternate layers the spacing of strands may not be uniform or constant in successively wound portions of the package. For example, if a cylindrical section is selected in the cake at random containing a dozen successively wound layers, it will be found that alternate layers 1, 3, 5, 7, 9 and 11 contain parallel convolutions spiraling in one direction and the convolutions of layers 2, 4, 6, 8, 10 and 12 spiral in an opposite direction. It will be found also that on account of the very small diameter change caused in the package by a single layer or even one hundred or so layers, the dozen layers of strands occupy an extremely thin cylindrical section. If merely alternate layers 1, 3, 5, 7, 9 and 11 are considered it will be observed that the

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strand will occur in helical groups of six parallel strands for almost any cylindrical section of 12 layers selected from the package since parallel convolutions of the six layers are not likely to be uniformly spaced. However the spacing of the convolutions in successive layers throughout the package will vary from uniformity to superimposition. It is in the sections where the strands of alternate layers are superimposed or lie close together, that "bands" or "ribbons" are to be observed. Strands from fifty or a hundred layers may contribute to the forming of a band. Band formation will normally occur along different cylindrical sections to form several bands within a package.

The formation of such a band or ribbon has a serious disadvantage in acting as a dam which impedes the flow of fluid treating materials through the package. Instead of flowing through the ribbon the fluid is diverted to channels through the package in which the strands are maximumly spaced from each other. Several such bands in a single package at various diameters seriously affect the uniformity of fluid flow during treating operations. Moreover, such ribbons of yarn are more dense and therefore, more resistant to fluid treatment such as washing or dyeing. Consequently finished products obtained from such yarn frequently lack uniformity in physical characteristics and dye distribution.

Bands or ribbons of parallel strands also result in what is commonly known as "lap-overs" of the package ends. "Lap-over" refers to the protrusion of bunches of strands from the normally smooth-surfaced ends of the package. Such a package has a very ragged irregular appearance and is unwound for further packaging with difficulty if the overlapping strands have become tangled or damaged. The overlapping strands are found to be extensions of the helical ribbons of parallel strands extending beyond each end of the package as they curve inward to start a reverse helix. The strand ribbons are heavy compared with other portions of a package; and they are acted upon by centrifugal force imparted by a spinning bucket rotating at spinning speeds often in the neighborhood of 6000 to 8000 revolutions per minute. At the ends of the packages, less dense portions of the package yield to permit the looped portions of the ribbons near the package ends to be forced axially and radially outward between the lower package end and the bottom of the spinning box, and the upper package end and the spinning box lid. During the various handling operations to which rayon is subjected while in the

cake form, the overlapping strands become loose and are often tangled, abraded, or broken. Consequently, delays are caused in subsequent re-winding or repackaging operations.

It is an object therefore, to produce a strand package having great uniformity in strand distribution and spacing in which "banding" is practically eliminated, which may be readily and uniformly processed by liquids. It is another object to produce strand packages which are free from bunches of strands protruding from the ends thereof. It is a further object to provide an apparatus which eliminates the formation of bands or ribbons of parallel strands in strand packages and produces packages in accordance with the foregoing objects.

Other objects, advantages and features will be obvious from the drawings and the following description of the invention.

In the drawings illustrative of the invention, Fig. 1 is an end elevation of one embodiment of the invention;

Fig. 2 is a section on line II—II of Figure 1;

Fig. 3 is an end elevation of another embodiment;

Fig. 4 is a section on line IV—IV of Fig. 3; and

Fig. 5 is an elevation view of a part of a rayon spinning machine to which the embodiment of Figs. 1 and 2 have been applied.

Broadly, the invention comprises varying the reciprocal motion of a rocker shaft over a series of reciprocal cycles by cyclicly controlling the position of a pin which extends through a crank arm attached to the rocker shaft and a reciprocator moving along a path tangent to an arc about the rocker shaft, said pin forcing the crank arm to follow the reciprocator. In the first described embodiment the position of the slide pin is varied slightly, between successive reciprocations with respect to the crank arm; in the second embodiment, with respect to the slide bar.

In Figs. 1 and 2, apparatus is illustrated which controls the position of slide block 8 with respect to a slot 10 in a yoke 10a at the end of the crank arm 9. A slot 10 is enclosed at the outer end of the crank arm by the cap 7. The position of slide block 8 within the slot 10 of yoke 10a is controlled by link member 12. Slide block 8, though having no movement relative to the link member 12 during operation of the traversing mechanism, is adjustable with respect thereto by means of set screws 13 and 14 which bear on a sleeve 24 about the slide block pin 25 which extends also through the slide block 8. Link member 12 is tightly clamped against the end of slide block 8 by a nut 27 which clamps also between it and a shoulder 28 of the pin 25 an assembly including the washer or slide plate 26, slide block 8, sleeve 24, washer or slide plate 26a. As the slide block 8 is slightly longer than the width of the slot 10, the clamped assembly has freedom of movement relative to crank arm 9 to the extent permitted by longitudinal movement of link 12. The end portion 29 of the slide block pin 25 extends through a slipper block 30 and is rotatable therein. During operation of the traverse mechanism, the slipper block reciprocates within the slot 32 of the slipper bracket 33 secured to a reciprocator, such as the rod 68 in Fig. 5.

Movement of slide-block 8 within the slot 10 occurs when the link member 12 responds to cam action transmitted to it through a cam follower 18 attached thereto, which follower moves within a cam groove 16 on the ratchet wheel 17. A supporting pin, such as the stud 20, extending

coaxially from the shaft 21, serves as an axle for a ratchet wheel 17 and as a guide operating in the slot 23 in link 12 for limiting the link 12 to longitudinal movement, generally parallel to the crank arm.

So that the ratchet wheel 17 will not be uncontrollably rotated by compressive and tensile forces tending to elongate or shorten the effective lever length of the crank arm 9, and which becomes maximum near the points of reversal in the reciprocatory cycle of the traverse mechanism, frictional force is supplied between the ratchet wheel and the crank arm. To accomplish this result, a ball clutch is provided comprising one or more balls 35 housed within a like number of holes 36 and urged toward the inner surface of the ratchet wheel 17 by springs 37. The inner surface of the ratchet wheel has depressions 38 which are arranged about its axis in a circular path which coincides with the position of clutch balls 35. The ball clutch thus formed produces sufficient friction between the ratchet wheel 17 and the crank arm 9 to cause the ratchet wheel to turn with the crank arm when it swings in a counter-clockwise direction as viewed in Fig. 1. A pawl 39, mounted in a stationary pivot 40, secured to the frame of the winding machine as shown in Fig. 5, permits counter-clockwise rotation of the ratchet-wheel but prevents clockwise rotation by engaging the teeth 41 when the crank arm swings back.

Movement of the slide block 8 within the slot 10 changes the effective lever length of the crank arm 9. As the crank arm is acted upon through slide block pin 25 by the slipper bracket 33 moving along a straight line path tangent to a radius measured from the axis of shaft 21, variation in the lever length causes a corresponding change in the amount of movement of the shaft 21 during a half-cycle of reciprocation. This change of movement is transmitted to a strand guide device, such as a spinning funnel, through a lever system illustrated in Fig. 5 and later described. Looking at Fig. 1, turning of the crank arm 9 about the axis of shaft 21 in a counter-clockwise manner turns also the ratchet wheel 17 as the result of the friction produced therebetween by the ball clutch. The teeth 41 are arranged and of a number so that the minimum stroke through which the crank arm turns will cause a linear displacement at the tooth-circle of at least one tooth-length. The pawl 39 then progressively engages at least one tooth for each succeeding cycle of reciprocation. Since the ratchet wheel shown has ten teeth, the arc traveled by the crank arm in a half cycle must be at least 36 degrees so that another tooth will be engaged by the pawl for every succeeding reciprocation. For engaging less than single tooth-lengths, a plurality of staggered pawls (not shown) may be employed.

As the ratchet wheel 17 rotates with respect to the crank arm 9 during the forward swing, the cam 16 produces longitudinal movement of the link 12 and slide block 8 relative to the crank arm 9. One complete revolution of the ratchet wheel (accomplished by the apparatus shown, in ten crank arm reciprocatory cycles) gradually changes the effective crank arm length from a minimum to a maximum and vice versa. When the slide block pin 25 is at the farthest position away from the axis of rocker shaft 21 the effective crank arm is at a maximum and consequently the angle through which the shaft 21 turns is smallest and the angular velocity of turning just before reversal of the shaft is slower; conversely,

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when the pin 25 is closest to the rocker shaft 21, the rocker shaft is turning more rapidly through a greater arc. Oscillatory motion of varying angular swing such as described, may be transmitted through a conventional lever system, such as that comprising lever 70 and links 71 shown in Fig. 5 used on rayon spinning machines to raise and lower spinning funnels. By the apparatus shown, ten successive traverses of different lengths will be made by the spinning funnels and then the cycle is repeated. The variation in the maximum and minimum lengths of the traverses may be varied to suit specific conditions. However, only a small variation is needed to prevent the formation of bands of parallel strands within cakes or packages.

In building a rayon cake in a standard spinning box, the stroke of the spinning funnel is ordinarily shorter than the height of the cake so as to compensate for the additive effect of a strand laid down during a reversal of the funnel in addition to that laid down during a full stroke. For example, a standard cake may have a height of $5\frac{3}{8}$ inches while the spinning funnel traverses a stroke of only $5\frac{1}{8}$ inches. In adapting the invention to build this size of cake, the average stroke length may be made $5\frac{5}{8}$ inches. A variation in stroke length of $\frac{1}{8}$ to $\frac{1}{4}$ of an inch is well suited to the purposes of the invention. When $\frac{1}{4}$ of an inch is adopted as the difference between the maximum and the minimum strokes, the spinning funnel reciprocates distances varying over ten stages between $5\frac{3}{4}$ inches and $5\frac{1}{2}$ inches.

Another embodiment of the invention is shown in Figs. 3 and 4 which differs from the arrangement shown in Figs. 1 and 2 principally in the manner in which reciprocative power is transmitted from the slipper bracket of the reciprocator to the crank arm of the rocker shaft. In both types of apparatus, a slide block pin assembly comprising a slide block, a slipper block and a slide block pin which passes through both blocks transfers the reciprocating motion laterally from the slipper bracket to the crank arm. In the apparatus already described, the slide block pin assembly has unrestricted reciprocatory movement within the slipper bracket slot but is automatically controlled and restricted to small change per reciprocation along the slot in the crank arm 9.

In the apparatus now to be described a rocker shaft 21 may be reciprocated by a reciprocator such as slipper bracket 48 for Figs. 3 and 4 by employing a slide block pin 62, similar to pin 29 of Figs. 1 and 2, to transmit movement from the slipper bracket 48 to a crank arm 44. The slide block pin 62 is limited to small change of movement per reciprocation within a slot 72 of the slipper bracket 48, while allowed to change its position freely in self-adjustment along the slot of the crank arm 44.

For automatic adjustment of a slide block pin assembly along a slipper bracket as in Fig. 3, a ratchet operated cam device 45 is supported by a bearing bracket 46 secured to the slipper bracket 48 by screws 49. As shown, one of the screws 49 is screwed into a slide-bar 55 which supports the bracket 48. Aperture 50, provided for passage of the screws 49 through the bearing bracket 46, is sufficiently long to permit adjustment of the bracket 46 relative to the slipper bracket 48 in a direction extending toward the rocker shaft 21. By adjustment of the bracket 46, the average amplitude of the crank arm reciprocation may be varied. Bearing 52 is a portion of the bracket 46 and provides rotatable support for a shaft 51

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which supports cam wheels 53 and 54. Positive return, exactly similar cam grooves 57 and 58 extend about the inner surfaces of the wheels 53 and 54 respectively. The wheels 53 and 54 are secured to the shaft 51 so that the cam grooves 57 and 58 are exactly in phase with each other and will cause a slide block pin 62 to be constantly parallel to the rocker shaft 21 when cam followers 60 and 61 of the pin 62 are engaged by the surfaces 57 and 58.

The cam wheel assembly is restricted to rotative motion in one direction only. Accordingly, cam wheel 54 is provided with ratchet teeth 64 which are engaged by a pawl 65 supported on a stationarily mounted pivot 66. In the arrangement shown in Fig. 4 wherein the cam wheel assembly is supported on the bracket 46 and therefore moves reciprocatively with respect to the pawl 65, the design of the pawl is such that it will disengage the toothed cam wheel periphery after relative reciprocative movement therebetween of at least a tooth length. Referring to the drawing it will be seen from the dotted outline of the pawl 65 that the tooth immediately behind the tooth face engaged by the pawl point acts on the underneath surface 66 to lift the pawl point 68 away from the cam wheel periphery. After disengagement, the cam wheel together with the reciprocator on which it is supported moves to the end of the path of reciprocation, and returns. During the return portion of the reciprocation cycle, the pawl 65 merely slides over the wheel 54 and after passing over the wheel assumes proper alignment for engaging another tooth on wheel 54 on the succeeding reciprocation cycle.

The amount of rotation per reciprocal cycle may be regulated also by the changing of the spacing of the pivot 66 relative to the path of the reciprocator, especially to that part of the path traversed by the portion of the ratchet wheel which is engaged by the pawl 65. For example, if pivot 66 is spaced in the plane of the ratchet teeth relatively far from or above the path of reciprocation traversed by the ratchet-wheel, the pawl 65 stays in contact with teeth of the ratchet wheel during a greater degree of its rotation before becoming disengaged. The amount of rotation per reciprocal cycle may also be varied by the shape of the pawl, number of teeth, and position of pawl longitudinally as well as laterally of the reciprocator or slipper bracket path.

In operation, a reciprocator drives the slipper bracket 48 along a path tangent to an arc about the axis of shaft 21. During each reciprocation, the cam wheel assembly 45 is rotated slightly to produce a small movement of the slide block pin assembly relative to the slipper bracket. As a result, slipper block 70 is shifted slightly along the slipper bracket slot 72. Although, in the apparatus illustrated, about ten reciprocations of the cam wheel 54 past the pawl 65 are required for one revolution of the cam wheel assembly, the number of teeth provided on the wheel 54, or the setting of the pawl may be changed for slower or more rapid rotation of the cam wheel assembly. Since the slide block pin 62 is substantially restricted during a single reciprocation to the straight line motion of the slipper bracket 48, the crank arm 44 tends to rotate away from the pin when passing from the middle to the extremities of the reciprocation cycle. To accommodate this relative movement of the crank arm 44 with the pin 62, a slot 74 in the crank arm permits movement longitudinally of the crank arm of the slip-

per block 15 through which a portion of the pin 62 extends and may rotate relatively therewith. Crank arm 44 is firmly secured on the end portion of shaft 21 by a device such as a key 78.

Fig. 5 illustrates a traverse mechanism for a viscose rayon spinning machine employing the embodiment of the invention illustrated in Figs. 1 and 2. A cam roll 60 and a shaft 61 therefor is driven from a power-shaft 62 through intermeshing gears, one of which is gear 64 attached to the shaft 62. The follower 67 which follows cam roll path 69 and is attached to slide bar 68 causes reciprocal movement of the bar 68 and the slipper bracket 33 attached thereto. Oscillating motion is imparted to the crank arm 9 fixed to the rocker shaft 21 in a manner already described. Rocker arms fixed also to rocker shaft 21 oscillate to raise and lower funnel supporting members 71 pivotably connected with the rocker arms 70 by pins 73. The lower ends of members 71 (not shown) are adapted for supporting spinning funnels (not shown). The crank arm assembly shown in Fig. 5 may be simply replaced by that shown in Figs. 3 and 4 without material alteration of other parts of the spinning machine.

The invention has been described in connection with machinery used in spinning rayon, particularly viscose yarn. The improved processability and unwindability obtained in rayon cakes through elimination of band formation results in substantial reduction of rayon processing at various stages. The invention may be easily adapted to existing spinning, twisting and winding machinery with but slightly modification and expense, and to any winding device in which it is useful to vary the length of the stroke of a reciprocating package-building device. While preferred embodiments have been shown, it is to be understood that changes and variations may be made without departing from the spirit and scope of the invention as defined by the appended claims.

I claim:

1. In a winding machine having a rocker shaft element and a slotted reciprocator element movable along a path parallel to a normal to the shaft axis, mechanism for transmitting the reciprocating motion of the reciprocator element to the shaft element to produce rocking motion thereof comprising a crank arm attached to the shaft element and extending to one side of the path of the reciprocator element, slots extending through overlapping portions of the crank arm and the reciprocator element, a member extending through the slots in a direction parallel to the shaft, a rotor having an endless cam surface carried by one of the elements, a cam follower secured to the member and engaging the cam surface for varying the position of the member relative to the element carrying the rotor, and means for rotating the rotor.

2. In a winding machine having a rocker shaft and a slotted reciprocator movable along a path parallel to a normal to the shaft axis, mechanism for transmitting the reciprocating motion of the reciprocator to the shaft to produce rocking motion thereof comprising a crank arm attached to the shaft and extending to one side of the path of the reciprocator, slots extending through overlapping portions of the crank arm and the reciprocator in a direction parallel to the shaft, a member extending through the slots in a direction parallel to the shaft, a ratchet wheel having a cam groove within a radially extending surface thereof, an axial extension to the shaft for

rotatably supporting the ratchet wheel, a link in longitudinally slidable engagement with the extension and adjustably secured to the member, and a cam follower secured to the link and extending into the cam groove.

3. In a winding machine having a rocker shaft and a slotted reciprocator movable along a path parallel to a normal to the shaft axis, mechanism for transmitting the reciprocating motion of the reciprocator to the shaft to produce rocking motion thereof comprising a crank arm attached to the shaft and extending to one side of the path of the reciprocator, slots extending through overlapping portions of the crank arm and the reciprocator, a member extending through the slots in a direction parallel to the shaft, an axial extension to the shaft, a ratchet wheel having a cam groove along a side thereof supported on the extension adjacent the crank arm, a pawl supported on a stationary pivot for engaging the ratchet wheel teeth, friction means between the wheel and the crank arm, a link having a longitudinal slot at one end-portion for admitting the extension and permitting relative movement therebetween, adjustable means at the other end portion for attaching it to the member, and a cam follower fixed to the link projecting into the cam groove.

4. A winding machine as defined in claim 3 wherein the friction means is a ball-clutch device comprising shallow depressions arranged concentrically about the center of the side of the wheel facing the crank arm and recesses disposed opposite the depressions in the side of the crank arm, balls in the recesses, and means for resiliently urging the balls toward the inner surface of the wheel and the depressions.

5. A winding machine as defined in claim 3 wherein each ratchet tooth of the wheel is subtended by an arc on the base circle of the teeth of less angularity than that traversed by the crank arm during a reciprocation thereof.

6. In a winding machine having a rocker shaft and a slotted reciprocator movable along a path parallel to a normal to the shaft axis, mechanism for transmitting the reciprocating motion of the reciprocator to the shaft comprising a crank arm attached to the shaft extending to one side of the path of the reciprocator, slots extending through the overlapping portions of the crank arm and the reciprocator, a member extending through the slots in a direction parallel to the shaft, at least one cam wheel having a cam surface on a side of the wheel and a peripheral ratchet-toothed surface, a cam follower on the end of the member for engaging the cam surface, and a pawl supported on a stationary pivot for engaging the ratchet teeth.

7. In a winding machine having a rocker shaft and a slotted reciprocator movable along a path spaced from and parallel to a normal to the shaft axis, mechanism for transmitting the reciprocating motion of the reciprocator to the shaft to produce rocking motion thereof comprising a crank arm attached to the shaft and extending to one side of the path of the reciprocator, slots extending through the overlapping portions of the crank arm and the reciprocator, a member extending through the slots in a direction parallel to the shaft, at least one ratchet wheel having a cam groove along a side thereof, said wheel being rotatably supported on an axis fixed with respect to the reciprocator and parallel to the shaft, a cam follower on the end of the member for engaging the cam groove, and

a pawl supported on a stationary pivot for engaging the ratchet teeth.

8. In a winding machine having a rocker shaft and a slotted reciprocator movable along a path parallel to a normal to the shaft axis, mechanism for transmitting the reciprocating motion of the reciprocator to the shaft to produce rocking motion thereof comprising a crank arm attached to the shaft and extending to one side of the path of the reciprocator, slots extending through the overlapping portions of the crank arm and the reciprocator, a member parallel to the shaft extending through the slots in a direction parallel to the shaft, a bearing extending through the reciprocator in a direction parallel to the shaft, a shaft supported rotatably within the bearing, two spaced coaxial cam wheels having identical cam surfaces on the sides facing each other fixed on the last-mentioned shaft so that the cam surfaces are exactly in phase with each other, cam followers on opposite ends of the member for engaging the cam surfaces, a peripheral ratchet-toothed surface on one of the wheels, and a pawl supported on a stationary pivot for engaging the ratchet teeth.

9. In a winding machine having a rocker shaft and a slotted reciprocator movable along a path parallel to a normal to the shaft axis, mechanism for transmitting the reciprocating motion of the reciprocator to the shaft to produce rocking motion thereof comprising a crank arm attached to the shaft and extending to one side of the path of the reciprocator, slots extending through the overlapping portions of the crank arm and the reciprocator, a member extending through the slots in a direction parallel to the shaft, a bearing extending through the reciprocator in a direction parallel to the shaft, a shaft supported rotatably within the bearing, two spaced coaxial cam wheels having identical cam grooves on the sides facing each other fixed on the last-mentioned shaft so that the cam surfaces are exactly in phase with each other, cam followers on opposite ends of the member for engaging the cam surfaces, a peripheral ratchet-toothed surface on one of the wheels, and a pawl supported on a stationary pivot for engaging the ratchet teeth.

10. A winding machine as defined in claim 9

which comprises friction means between one of the cam wheels and the reciprocator for retarding the rotation of the wheel relative to the reciprocator.

11. A winding machine as defined in claim 10 wherein the friction means is a ball-clutch comprising depressions arranged in a circle about the center of the wheel side facing the reciprocator, recesses disposed opposite the depressions in the side of the reciprocator, balls in the recesses, and means for urging the balls toward the surfaces of the wheels and the depressions.

12. In a winding machine having a rocker shaft element and a slotted reciprocator element movable along a path parallel to a normal to the axis of the shaft element, mechanism for transmitting the reciprocating motion of the reciprocator element to the shaft element to produce rocking motion thereof comprising a crank arm attached to the shaft element and extending to one side of the reciprocator element, slots extending through overlapping portions of the crank arm and the reciprocator element, a member extending through the slots in a direction parallel to the shaft, a rotor having a ratchet-toothed surface and at least one endless cam surface, said rotor being carried by one of the elements, a cam follower secured to the member and engaging the cam surface for varying the position of the member relative to the element carrying the rotor, and a pawl for engaging the ratchet-toothed surface mounted pivotably on a stationary portion of the machine.

HORACE PUGH FRY, JR.

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