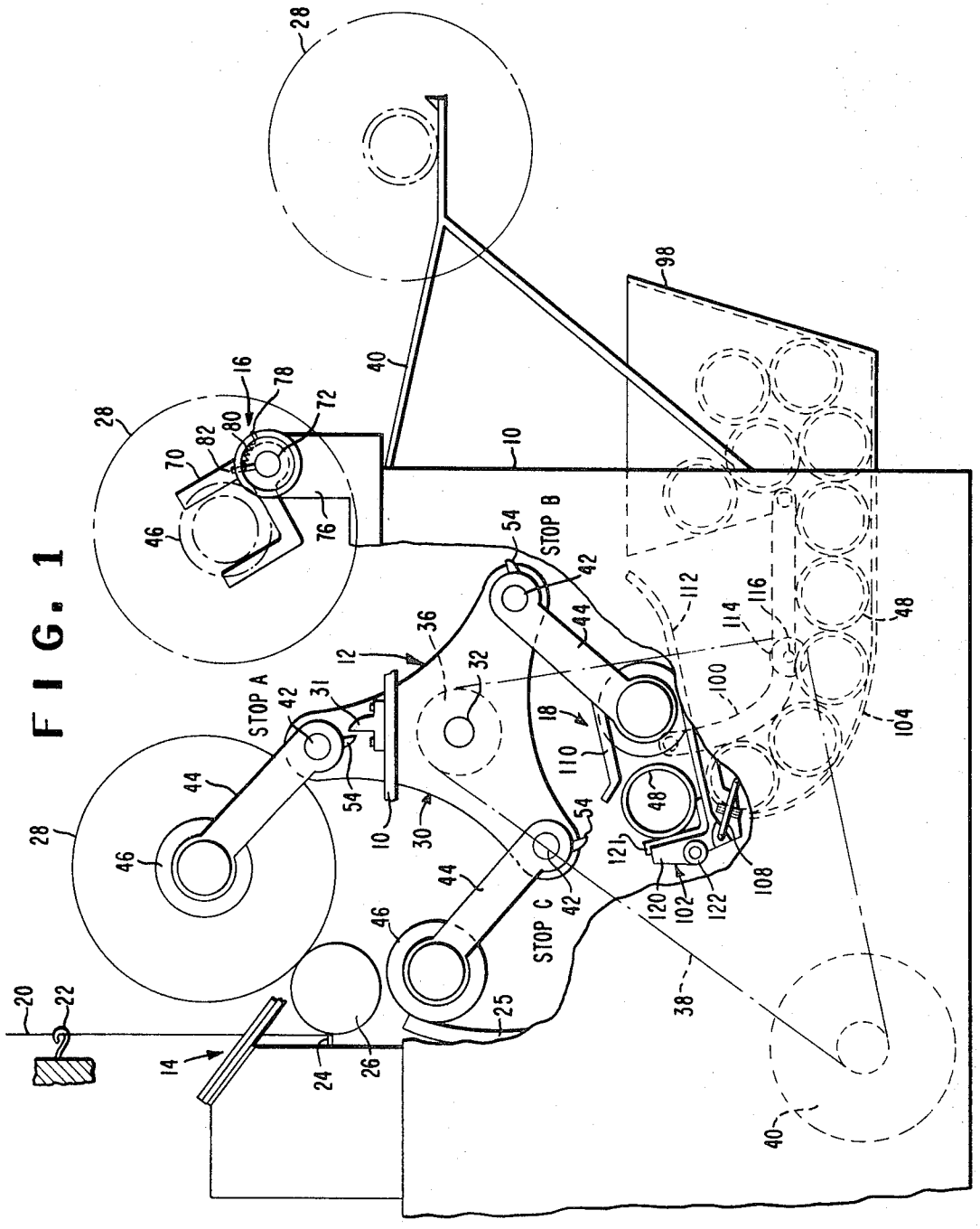
Oct. 6, 1970 W. C. SPARLING 3,532,278

YARN WINDING APPARATUS

Filed Oct. 31, 1968 5 Sheets-Sheet 1

FIG. 1



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YARN WINDING APPARATUS

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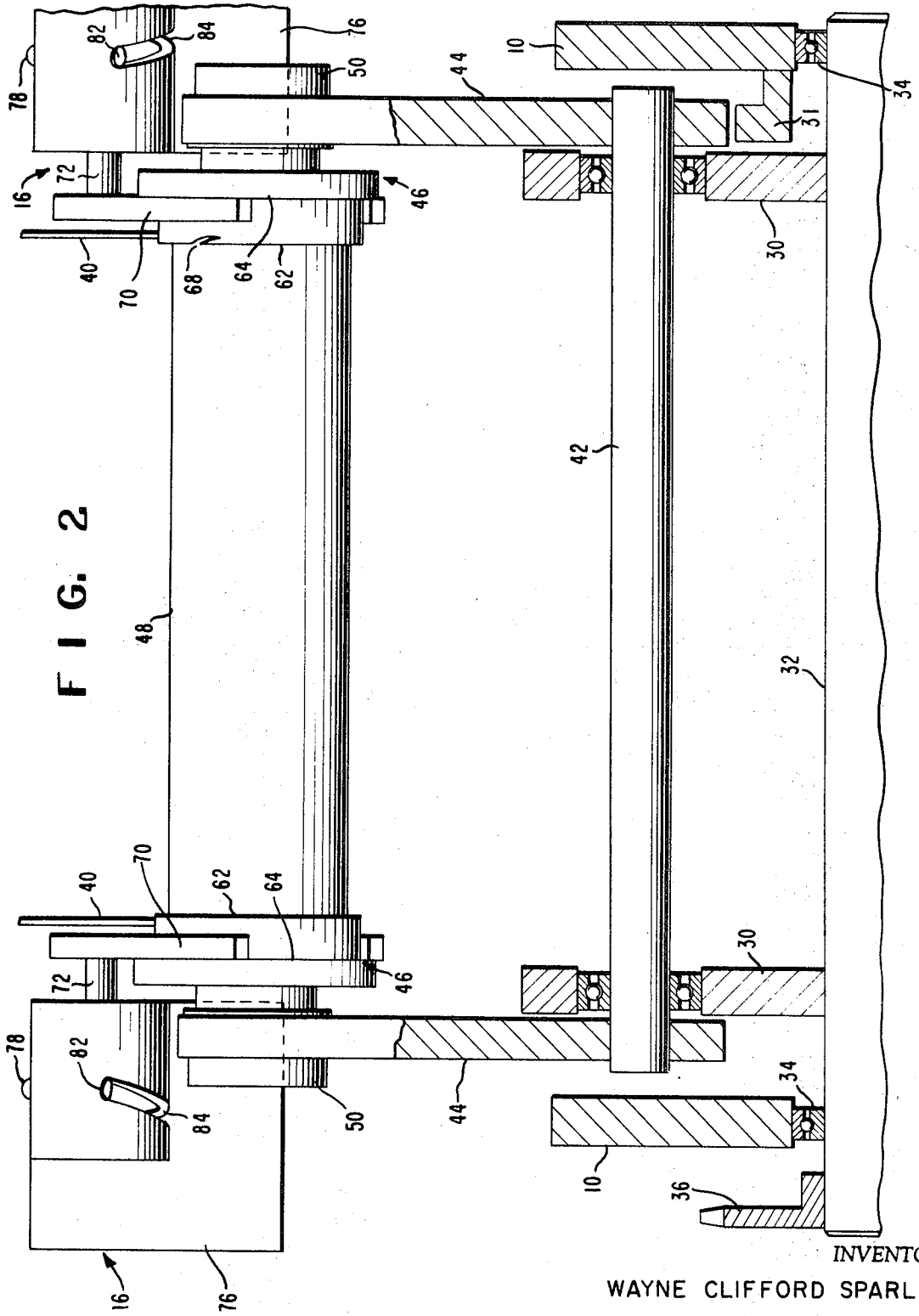


FIG. 2

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YARN WINDING APPARATUS

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FIG. 3

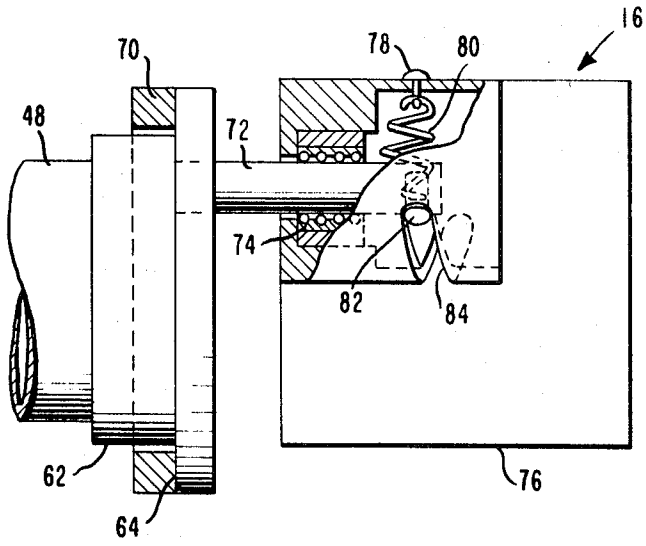
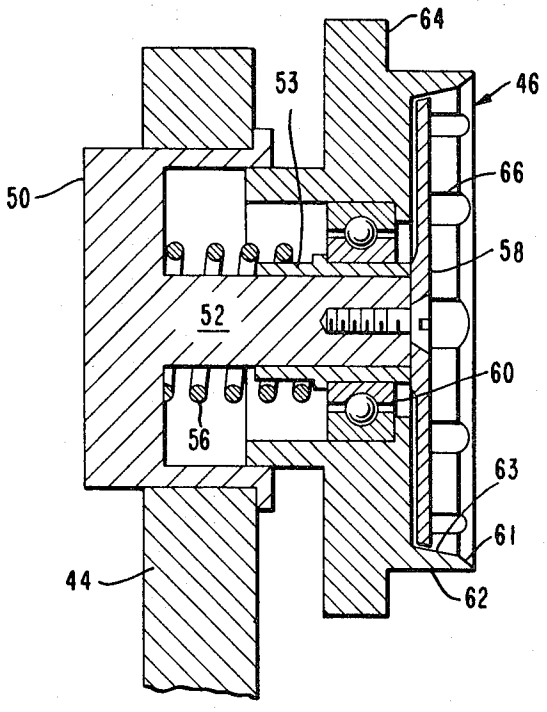


FIG. 4



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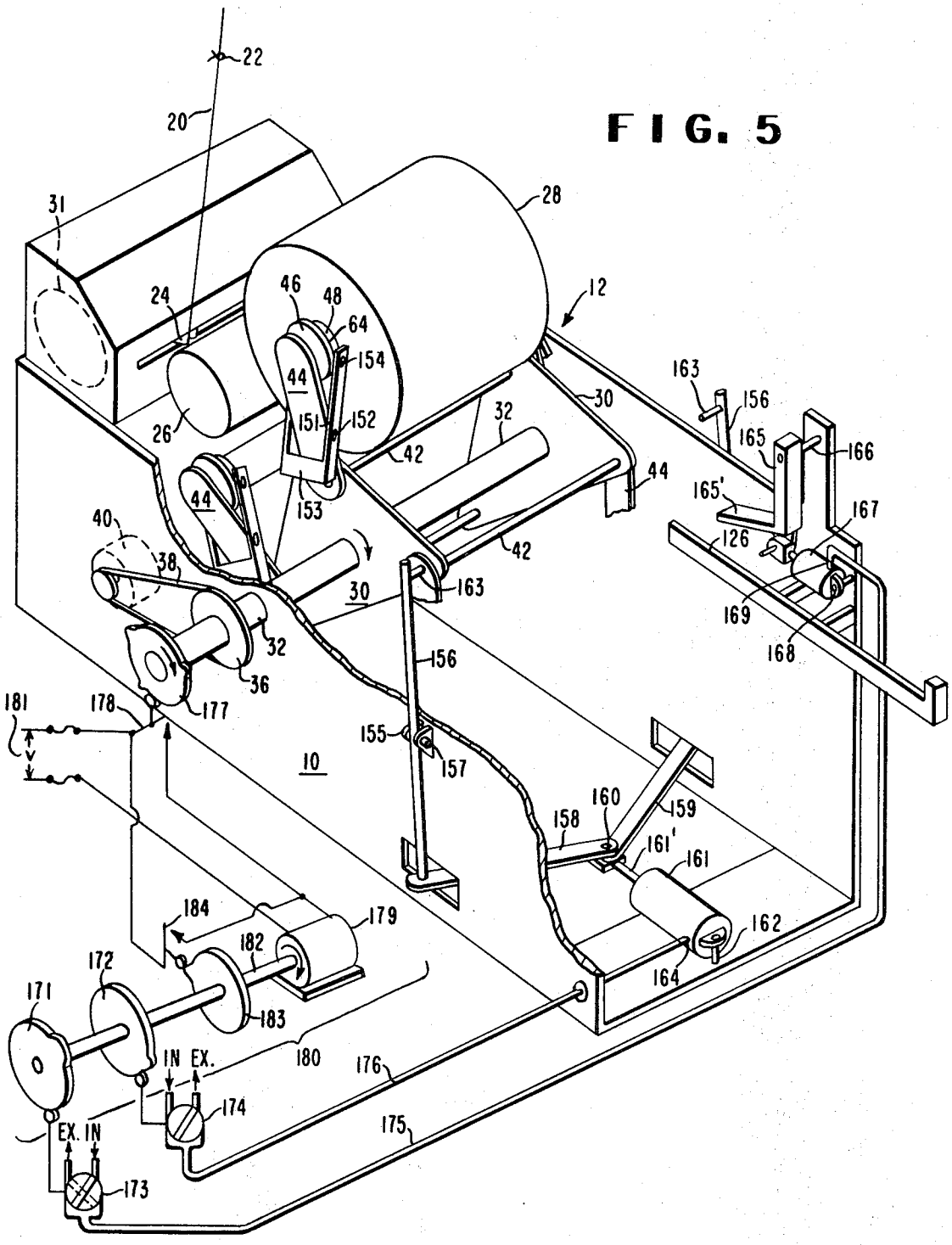
ATTORNEY

Oct. 6, 1970 W. C. SPARLING 3,532,278

YARN WINDING APPARATUS

Filed Oct. 31, 1968 5 Sheets-Sheet 4

FIG. 5



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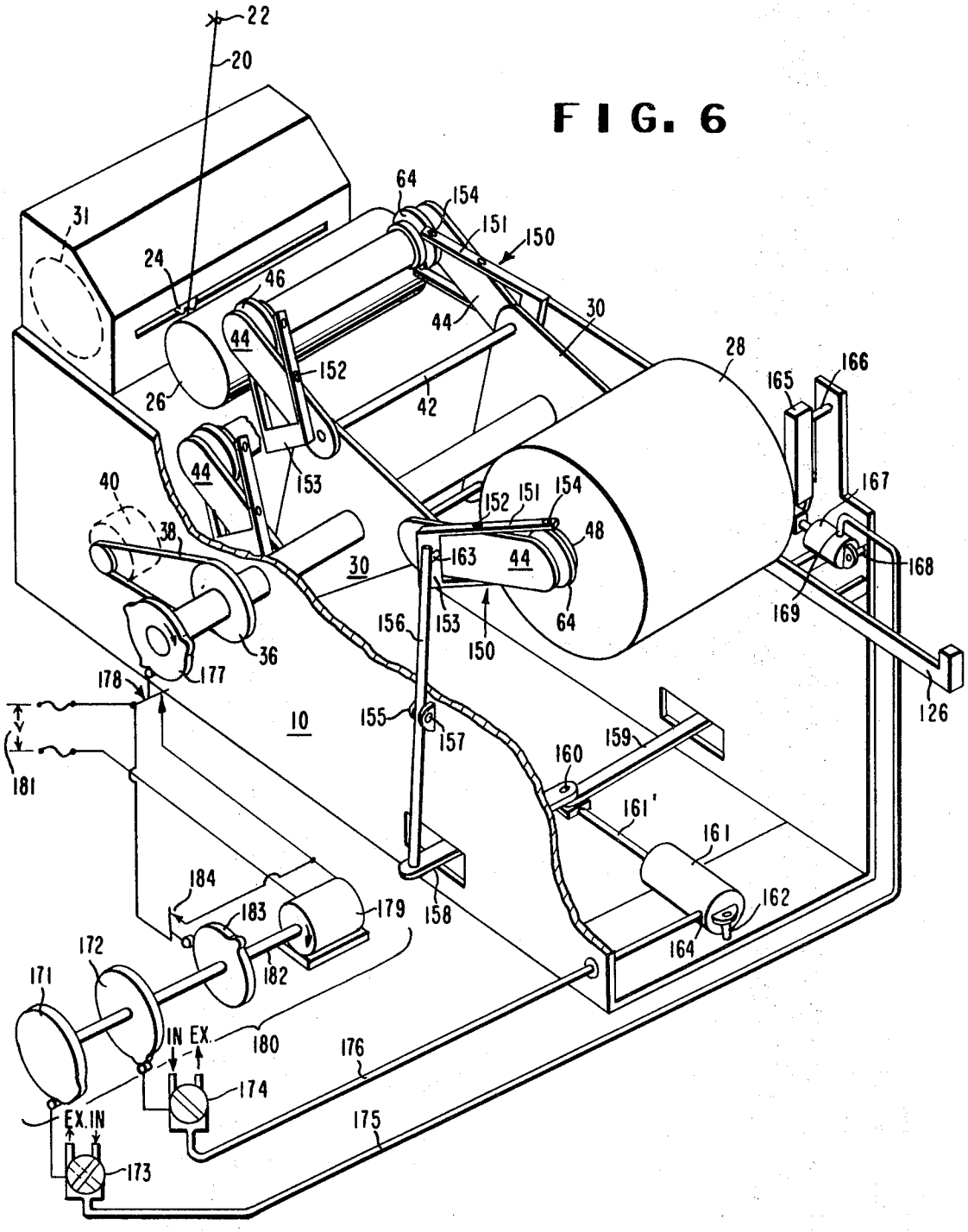
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YARN WINDING APPARATUS

Filed Oct. 31, 1968 5 Sheets-Sheet 5

FIG. 6



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United States Patent Office 3,532,278 Patented Oct. 6, 1970

3,532,278

YARN WINDING APPARATUS

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Continuation-in-part of application Ser. No. 616,909, Feb. 17, 1967. This application Oct. 31, 1968, Ser. No. 788,978

Int. Cl. B65h 54/02

U.S. Cl. 242—18 4 Claims

ABSTRACT OF THE DISCLOSURE

A print roll type winding apparatus provided with a plurality of pairs of opposed swing arms which are mounted to rotate sequentially through bobbin donning, winding and doffing stages. Movement between stages is controlled by a motor drive arrangement and automatically initiates donning of empty bobbins and doffing of full bobbins.

CROSS REFERENCE TO RELATED APPLICATION

The application is a continuation-in-part of my copending application Ser. No. 616,909, filed Feb. 17, 1967 and now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to a winding apparatus and more particularly to an automatic doffing apparatus for a yarn windup.

Windups which include a print or drive roll to which yarn advances from a reciprocating traverse guide and from which yarn is deposited on a surface driven package are in wide use. To avoid waste during a doffing cycle such windups have been modified by the provision of two or more rotatable package supports alternately movable into surface driven engagement with the drive roll and of auxiliary equipment for accomplishing the transfer of yarn from a full package to an empty driven support. Each package support is carried by a chuck or mandrel mounted near one end of a swing arm with the swing arms being pivotally mounted on a common rotatable disc or frame in such a manner that the package supports may be advanced in succession through donning, winding and doffing positions while maintaining continuity of operation. Doffing and donning of the package supports on this type of windup are usually accomplished manually by the axial movement of the support beyond the end of the chuck or supporting mandrel. This requires considerable space between adjacent winding positions in order that the package being withdrawn will clear obstructions presented by adjacent winding positions. This additional space represents a considerable investment at plant locations where a large number of windups are used. In addition the manual doffing operation is time consuming and expensive.

SUMMARY OF THE INVENTION

This invention has as its principal objective the provision of a doffing apparatus which in combination with a windup of the type described will automatically brake and doff a package support without manual assistance. A further objective of this invention is the provision of an automatic doffing apparatus which in combination with a windup of the type described will function in a space coextensive with the width of the windup.

These and other objectives are accomplished in a winding apparatus wherein a plurality of package supports are advanced in succession through a donning position into surface driven engagement with a drive roll then to a doffing position. The windup includes a plurality of pairs of arms rotatably mounted to a frame for moving the supports through the various positions and an automatic doffing apparatus. The doffing apparatus comprises: a pair of opposed chucks mounted to the ends of each pair of arms, the chucks being biased laterally inwardly from the arms and adapted for grasping the ends of a support when in the biased position; and means fastened to the frame at the doffing position for engaging the chucks and overcoming the inward bias on the chucks as a support is moved through the doffing position, thereby braking rotational movement of the package support and releasing the support from the chucks.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic side view of the windup.

FIG. 2 is a partial top view of the windup showing a package support at the doffing position.

FIG. 3 is a partially cross-sectioned view of the chuck release mechanism.

FIG. 4 is a sectional view of a chuck assembly.

FIG. 5 is a perspective view of an alternate embodiment of the windup showing a full package in the winding position and showing a doffing mechanism standing in readiness to receive the package and wherein the breaking and release functions have been separated.

FIG. 6 is a perspective view of the windup of FIG. 5 with the package and appurtenances engaged by the doffing mechanism.

DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

Referring to FIG. 1 it will be seen that the windup chosen for purposes of illustration includes generally, as components thereof, a frame **10**, a swing arm assembly **12**, a yarn transfer mechanism **14**, a combination brake and package doffing mechanism **16**, and a support donning system **18**. Yarn **20** is advanced through a guide **22** to a reciprocating traverse guide **24**, from which yarn **20** advances under drive roll **26** to a package **28** carried by swing arm assembly **12**. An arcuate guide **25** attached to frame **10** curves toward drive roll **26** and serves to guide chucks **46** close to drive roll **26** in preparation for the initiation of a new package as described in more detail hereinafter.

The swing arm assembly shown in partial cross-section in FIG. 2, comprises two spiders **30** disposed on opposite sides of the windup inside the windup frame **10**. The spiders **30** are each three-legged and are joined to a shaft **32** which is rotatably supported in bearings **34** which are secured to the frame **10**. A sprocket **36** on the shaft **32** is engaged by a chain **38** which is driven by a motor **40** (FIG. 1). Pivotally supported near the end of each leg of the spiders **30**, by means of connecting shaft **42**, is a pair of swing arms **44**. The swing arms **44** are fixed on shaft **42** and extend generally outward from the respective spiders; a given arm on one spider **30** being aligned with a like arm (of opposite hand) on the other spider. As the swing arm assembly is indexed, it is necessary to control the position of swing arms **44** as they approach the doffing station. This is accomplished in a manner described hereinafter, by means of cam **31** attached to one side of frame **10** and lugs **54**, on the ends of the swing arms. The swing arms **44** each carry a chuck **46**. The chucks on any aligned pair of swing arms face toward each other so as to grasp a package support **48** at both of its ends.

As shown in FIG. 4, the chuck **46** carried by the outer end of a swing arm **44** includes a holder **50** which has an integral projecting shaft **52** supporting the remainder of the chuck mechanism. Slidably engaged on the shaft **52** is a sleeve **53** which is urged toward the end of the shaft **52** by a helical spring **56** but is prevented from escaping by a plate **58** which is secured to the end of the shaft

52 by a machine screw. Near the outer end of the sleeve 53 is a ball bearing 60 rotatably mounted on which is a cup 62 having a shoulder 64 and a shallow bore which is adapted to receive the plate 58 as well as the end of a package support 48 (shown in FIG. 2). The sub-assembly comprising the cup 62, the bearing 60 and the sleeve 53 may be moved axially toward the swing arm 44 by overcoming the bias of spring 56. The end of the cup 62 is provided with a bell opening 61 which leads into a conical bore 63, the small end of which has a diameter only slightly larger than that of the plate 58. A plurality of longitudinal grooves or scallops 66 in the conical bore aid in gripping a support by presenting sharp edges for engaging the support. A support 48 is grasped between opposed chucks 46 by sliding the cups 62 toward their respective swing arms 44 against the urging of the springs 56, placing a support between the chucks and then releasing the cups whereupon the spring 56 urges the cup 62 toward the extreme ends of the support thus gripping it firmly while drawing it into concentricity with the cup 62 and the bearing 60. The length of the support 48 is slightly less than the distance between the faces of an opposed pair of plates 58, thus the end of the bobbin will be clear of each of the plates 58. The size of the conical bore in the cups 62, as compared to the outside diameter of the support 48, is such that each cup engages the end of the bobbin by a distance equal to about one-half of the depth of conical bore 63. In the edge of the cup 62, as viewed in FIG. 2, is a slot 68 which serves to snag and sever the yarn during the transfer of yarn from a full to an empty support.

As shown in FIG. 2, two doff mechanisms 16 of opposite hand are required. Referring now to FIG. 3, each comprises a U-shaped yoke 70 on a shaft 72 which is rotatably and slidably supported by means of a ball bushing 74 in a bracket 76 secured to frame 10. A radial pin 82 is secured to shaft 72. A generally helical cam slot 84 is formed in a curved wall of the upper portion of the bracket 76 and engages the outer end of pin 82. A tension spring 80 is located inside bracket 76. One end of spring 80 is fixed to pin 82 and the other end is secured to the wall of bracket 76 by means of a hook 78. Spring 80 is so located that it urges pin 82 against the upper end of cam slot 84 to provide a rest position for yoke 70 as shown in FIG. 1. The hand of each of the cam slots 84 is such that counterclockwise rotation of the yokes (as viewed in FIG. 1) results in axial movement of each yoke 70 toward its respective bracket 76; i.e., away from each other. The yoke is eccentric with respect to the shaft 72 and is adapted to receive a chuck 46 between the spaced arms of the yoke in such a way that the shoulder 64 of the cup 62 is engaged by the arms of yoke 70.

The support donning system 18 (FIG. 1) includes a storage hopper 98, for supports 48, a belt feeder 100, an escapement mechanism 102 and a pair of rails 110, 112 for spreading the chucks as they pass through the donning station. Belt feeder 100 is driven by motor 40 through chain 38 sprocket 114 and shaft 116 attached to the sprocket. A pair of arcuate rails 104, leading from hopper 98 serve as the lower guides for the belt feeder. Rails 110 and 112 are adapted to engage a chuck 46 at shoulder 64, guide it and an associated arm 44 through the donning station, and open the chuck against the bias of chuck spring 56 to a support receiving position. Escapement mechanism 102 includes a pair of L shaped arms 120 and a pair of arms 121 pivotally mounted at pin 122 and a latch 108 coupled to arm 120 and pivotally mounted at a point intermediate its ends. Arms 120 are biased in the clockwise direction and are in alignment with rails 110, 112 as well as contiguous to rail 112 when in the biased position as shown.

The particular windup shown utilizes three pairs of swing arms 44 which are spaced at 120 degrees apart on the spider 30. In operation a 3-step cycle is used in which the spider 30 and all sets of arms are indexed clockwise

in 120 degree increments by the motor 40 which is energized by a conventional clock timing system (not shown). The positions occupied by the axes of the swing arm shafts 42, during the period in which the spider 12 is stationary, are designated in FIG. 1 as stop A, stop B and stop C. At stop A, winding takes place; between stop A and stop B, doffing takes place; between stop B and C, donning takes place.

At the timed completion of package 28, spider 30 is indexed clockwise through 120 degrees. As a pair of swing arms 44 and their associated chucks 46 carrying package 28 are moved from the winding position (A toward B) another pair of arms 44 and their associated chucks move an empty package support 48 into engagement with drive roll 26 (C toward A) and yarn transfer mechanism 14 as disclosed in U.S. Pat. No. 3,385,532 is operated to sweep yarn 20 into engagement with snaring and severing slot 68 on the driven chuck. In this manner the yarn advancing to package 28 is severed and a new package is initiated on the driven support. Continued rotation of the spider brings lug 54 into engagement with cam 31 which results in swing arms 44 of the full package being rotated clockwise with respect to spider 30 until they pass a vertical position after which they fall to the right and yokes 70 receive chucks 46. Swing arms 44 will descend causing the yokes to rotate counterclockwise. By virtue of the relationship of cam slot 84 and pin 82, this rotational movement of yoke 70 will also result in its lateral movement into engagement with shoulder 64 on chuck 46 which reception of chucks 46 in yokes 70 serves first to brake the package to a stop and then spread the chuck cups 62 thereby releasing the support from the chucks. The fully released support and associated package drops into engagement with sloping rails 126 and rolls to a position where it may be readily removed either manually or by a conveyor. Springs 80 now bias yokes 70 upward and back to their rest positions ready for the next doffing cycle. The indexing of spider 30 also causes a third pair of swing arms 44 to drive a pair of chucks 46 into engagement with rails 110, 112 (B to C). The shoulders 64 of chucks 46 are engaged by diverging surfaces on rails 110 and 112, and in this manner the chucks are opened to receive a support. At the same time belt drive 100 propels supports 48 along guide 104 until the uppermost support is cradled in arms 121 where it stops. As swing arms 44 move they carry chucks 46 into engagement with L-shaped arms 120 and into receiving alignment with a support 48. Continued rotation of spider 30 causes arms 120, 121 to be rotated counterclockwise about pivot pin 122, releasing the chucks which grasp support 48 and then engage arcuate guide 25 leading to drive roll 26. The counterclockwise rotation of arms 120 causes latch 108 to engage the next succeeding support temporarily preventing it from further advance. Rotation of spider 30 continues until the chucks and the support clear arms 120, 121 and reach a position (stop C) just under drive roll 26. Arms 120, 121 are then biased clockwise to a normal position releasing latch 108. At this point spider indexing stops until the next cycle.

An alternate embodiment provision is made for separating the braking and package release functions. Referring to FIG. 5, each swing arm 44 has a lever 150 comprising a pair of parallel arms 151 each of which extends across the respective edges of the swing arm, being pivotally mounted thereto by means of a pin 152. At the end of each of the arms 151 nearest to the chucks 46 is a lug 154 which engages the inner face of the chuck shoulder 64 while at the opposite end is a striker plate 153 which is joined to pairs of arms 151 to form the unitary assembly of lever 150. From the foregoing, it will be realized that if mechanical pressure is exerted on the striker plate 153 the arms 151 will pivot about the pins 152 thus the lugs 154 will pull upon the shoulders 64 and the chucks 46, having the effect of forcibly removing the chuck cup 62 (FIG. 4) from engagement with the support 48.

In FIG. 5, a pair of release bars **156** are pivotally secured to the windup frame **10** by means of pins **157** and lugs **155**. The release bars are joined at their lower ends by toggle links **158, 159** which are joined to each other by a pin **160** which also serves to join the links to the piston rod **161'** of an air cylinder **161**. The cylinder **161** is anchored to the frame **10** by means of a post **162**. Inside the cylinder but not shown is a helical spring which holds the piston and rod **161'** in the retracted position (as shown in FIG. 5) while a port **164** serves to admit pressurized air to the cylinder to drive the piston and rod **161'**. Lacking pressurized air, the piston remains in the position shown, and the links **158, 159** of the toggle mechanism have an included angle, in respect to each other, of appreciably less than 180°, thus the lower ends of the release bars **156** are drawn together and situated close to the walls of the frame **10** while the upper ends of the bars **156** are spread apart to an "open" position. At their upper ends each of the bars **156** is provided with a lug **163** which faces inwardly, being adapted to perform a clamping function to be described.

On one side of the windup is a brake **165** which is pivotally mounted on the frame **10** by means of a hinge pin **166** being held in the position shown by means of an air cylinder **167**, the body of which is joined to the frame **10** by means of a pin **168**. Pressurized air applied to the port **169** of cylinder **167** holds the piston and rod and hence the brake **165** in the extended or "ready" position (shown) while a spring (not shown) inside the cylinder will cause the brake **165** to be retracted counterclockwise to a position in which the braking surface **165'** will be essentially vertical when the air pressure is relieved. When in the position shown, the brake stands in readiness to receive a chuck **46** and the outer peripheral surface of the chuck shoulder **64** is aligned with and will engage the braking surface **165'**.

At the completion of winding of a yarn package **28**, the spider **30** and its appurtenances are rotated 120° by means of a sprocket **36**, a chain **38** and a motor **40** (which is energized by a timer, not shown). Substantially at the completion of each 120° index of the spider **30**, the cylinders **161, 167** are operated in timed sequence by means of the three-lobed cam **177**, switch **178** and control **180**. The cam **177** is carried by shaft **32** and rotates therewith while the switch **178** is stationary being located angularly relative to the cam **177** so as to be "closed" momentarily in the last few degrees of motion of the spider **30** and then to "open" again just before the end of each 120° index cycle. The control **180** comprises a motor **179** having an extended shaft **182** which carries three cams, a running cam **183** and two valve actuating cams **171, 172**. The running cam **183** has a single narrow lobe which holds switch **184** "open" when motor **179** is not running but will allow it to "close" substantially at the instant that motor **179** starts to rotate after being energized momentarily by power source **181** via switch **178**. Since switch **184** is connected in parallel with switch **178**, motor **179** will remain energized after start-up for a full 360° of rotation, i.e., rotation continues until the lobe of cam **183** again opens the switch **184**. The cams **171, 172** when rotated, are adapted to actuate three-way valves **173, 174**, respectively. The valve **173** is normally "on," that is, it admits pressurized air (source not shown) to the conduit **175** and thence to the port **169** on cylinder **167**, holding the brake **165** in the extended position as described above.

The three-way valve **174** is normally "off" that is, the valve passage is aligned with the valve exhaust port, opening cylinder **161** to the atmosphere, via port **164** and conduit **176**. Thus the toggle links **158, 159** keep the upper ends of the release bars **156** apart or "open" as described above.

Upon the timed completion of a package **28**, the motor **40** in energized rotating the spider **30** and lifting the package **28** clear of the drive roll **26** in the manner previously described. Near the end of the 120° rotation of the spider, the arms **44** bearing the full package **28** reach the position shown in FIG. 6 in which the periphery of the chuck shoulder **64** engages the braking surface **165'** with immediate braking effort taking place, in effect, stopping the rotation of the chunks **46**, the support **48** and the package **28**. In the last few degrees of rotation of the spider **30** the cam **177** closes switch **178** momentarily thereby setting control **180** in motion as described above. As the package slows to a stop, the cam **172** actuates the valve **174** to the position shown in FIG. 6, admitting pressurized air to conduit **176** and thence to cylinder **161**. This drives the toggle links **158, 159** essentially to a straight line or 180° position, causing a clamping effect between lugs **163** and the striker plate **153** which are now mutually aligned. Levers **150** are pivoted and the chuck cups **62** are withdrawn from the support **48** allowing it and the package **28** to drop a short distance until the support **48** rests upon the rails **126** where it may roll clear of the windup.

After an additional small increment of rotation of the shaft **182**, cam **171** actuates valve **173** to the broken line position, in effect allowing air to exhaust from the cylinder **167** and swinging the brake **165** clear of the chuck **46**, allowing the arms **44** to drop to a support donning position. After an additional small increment of rotation of shaft **182**, the cams **171, 172** again actuate their respective valves **173, 174**. Valve **173** re-admits air to cylinder **167**, swinging the brake **165** to the "ready" position while valve **174** exhausts air causing the release bars **156** and clamping lugs **163** to resume their "open" position, all parts now being in a state of readiness to receive the next package to be doffed. Finally, the cam **183** of control **180** completes 360° of rotation and actuates switch **184**, thereby stopping the motor **179**, in effect, making the control **180** ready for the next cycle of events.

It is apparent that many changes and modifications may be made without departing from the scope and spirit of the present invention.

What is claimed is:

1. In a winding apparatus wherein a plurality of package supports are advanced in succession through a donning position into surface driven engagement with a drive roll then to a doffing position and including a plurality of pairs of spaced arms rotatably mounted in a frame for moving the supports through said positions, an apparatus for automatically doffing and braking the rotational movement of the supports, said apparatus comprising:

(a) a pair of opposed chucks having braking surface means rotatably mounted to at least one of the ends of each pair of arms, said chucks being biased laterally inwardly from said arms and being adapted for grasping the ends of a support when in said biased position; and

(b) means fastened on the frame at said doffing position for engaging said braking surface means and said chucks and overcoming said inward bias as a support is moved through said doffing position thereby braking rotational movement of and releasing the support from the chucks.

2. The apparatus of claim **1** wherein said chucks include a cuplike housing having a tapered inner wall, said inner wall being adapted to engage the outer periphery of said supports.

3. The apparatus of claim **2** wherein said tapered inner wall is provided with a plurality of longitudinal grooves.

4. In a winding apparatus wherein a plurality of package supports are advanced in succession through a donning position into surface driven engagement with a drive roll then to a doffing position and including a plurality of pairs of spaced arms rotatably mounted at one end in a frame for moving the supports through said

positions, an apparatus for automatically doffing the supports, said apparatus comprising:

(a) a pair of opposed chucks having inwardly facing shoulders rotatably mounted to the other ends of each pair of arms, said chucks being biased laterally inwardly from said arms and being adapted for grasping the ends of said supports;

(b) a pair of U-shaped yokes rotatably mounted to said frame at said doffing position, the open ends of said yokes being biased upwardly to a position of alignment with the path of said chucks through said doffing position, said chucks engaging said yokes at said doffing position, and imparting downward rotational movement to said yokes; and

(c) means connected to said yokes for imparting lateral outward movement to said yokes, said means being responsive to said downward rotational move-

ment, said outward movement providing lateral engagement of said chucks at said shoulders and said yokes overcoming the inward bias on the chucks thereby braking rotational movement of and releasing the supports from said chucks.

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