United States Patent [19]

Seney

[11] **3,761,029**

[45] **Sept. 25, 1973**

[54] **YARN WINDING APPARATUS**

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[73] Assignee: **E.I. Du Pont de Nemours & Company,** Wilmington, Del.

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[21] Appl. No.: **273,867**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 56,501, July 20, 1970, abandoned.

[52] **U.S. Cl.** ..... **242/18 A,** 242/18 PW

[51] **Int. Cl.** **B65h 54/02**

[58] **Field of Search** ..... 242/18 A, 18 PW

[56] **References Cited**

UNITED STATES PATENTS

3,310,247	3/1967	Emery	242/18 A
3,428,266	2/1969	Emery	242/18 PW

Primary Examiner—Stanley N. Gilreath
Assistant Examiner—Milton S. Gerstein
Attorney—Howard P. West, Jr.

[57] **ABSTRACT**

A yarn transfer device for use with a yarn windup of the type which is provided with rotatable package supports carried on chucks alternately movable into surface driven engagement with a drive roll on the windup. When actuated, the transfer device swings into engagement with a driven chuck carrying an empty support, cuts the yarn advancing to the package being doffed and threads the severed end of the feed yarn through a hollow shaft in the chuck by means of an air transport system. The severed end of yarn is centrifugally clamped in the driven chuck shaft until the centrifugal force applied drops low enough to release it to the end of the package support forming a readily accessible transfer tail thereon.

9 Claims, 8 Drawing Figures

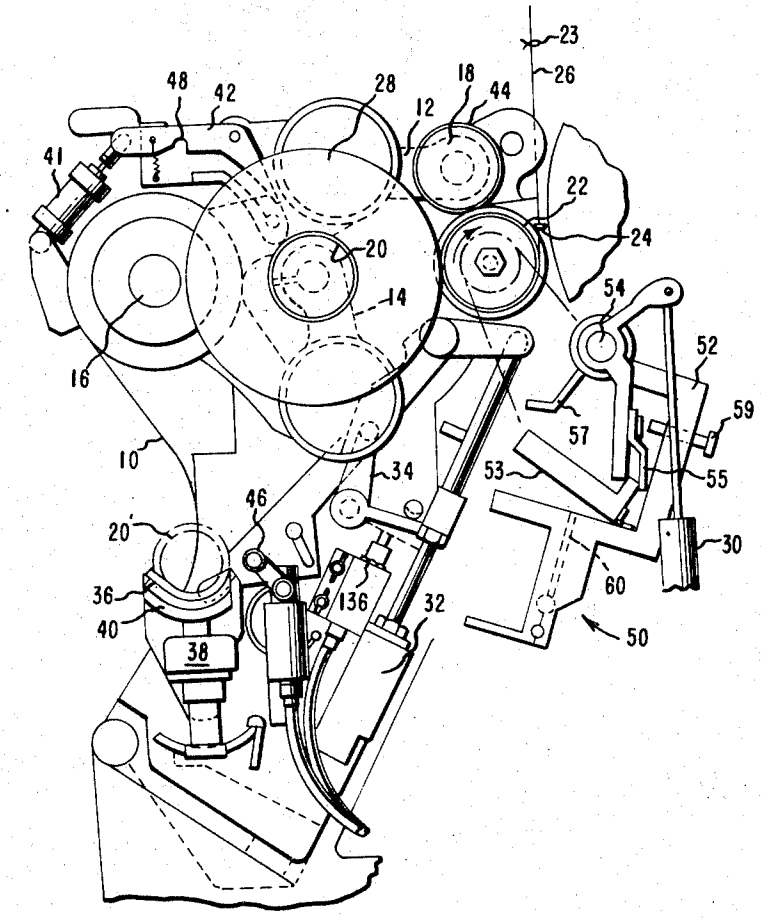


FIG. 1

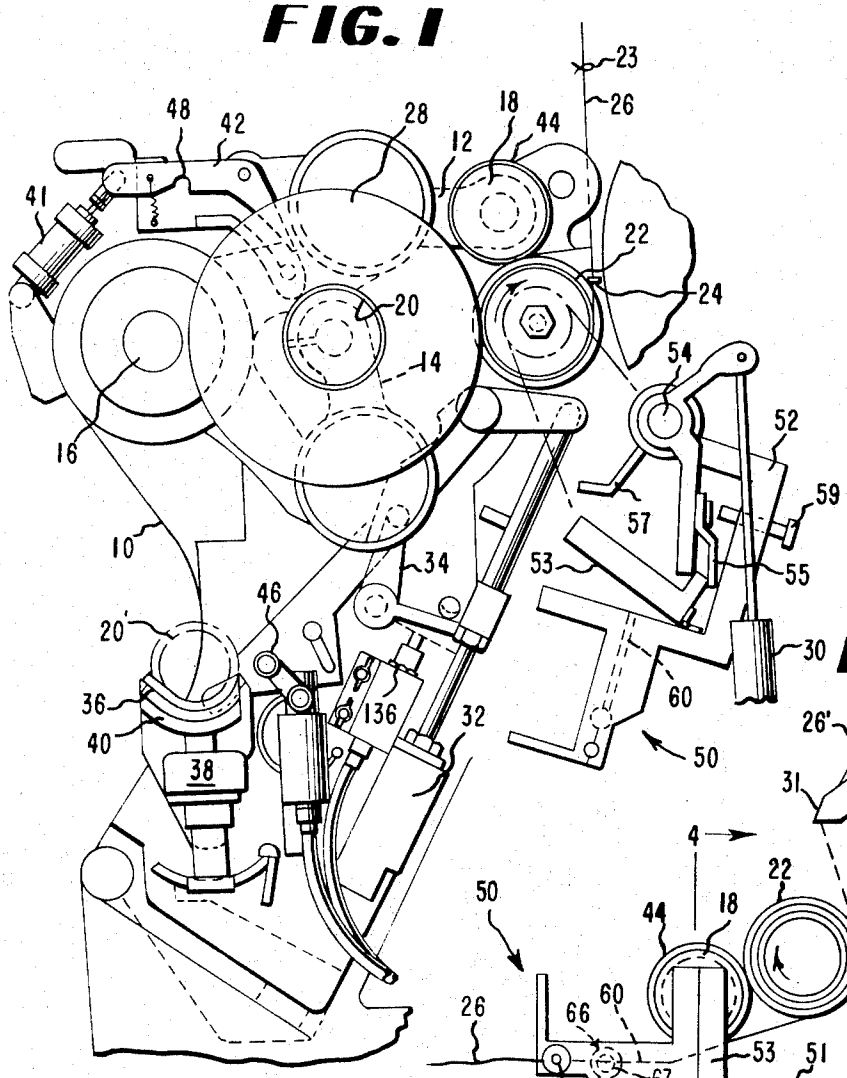


FIG. 2

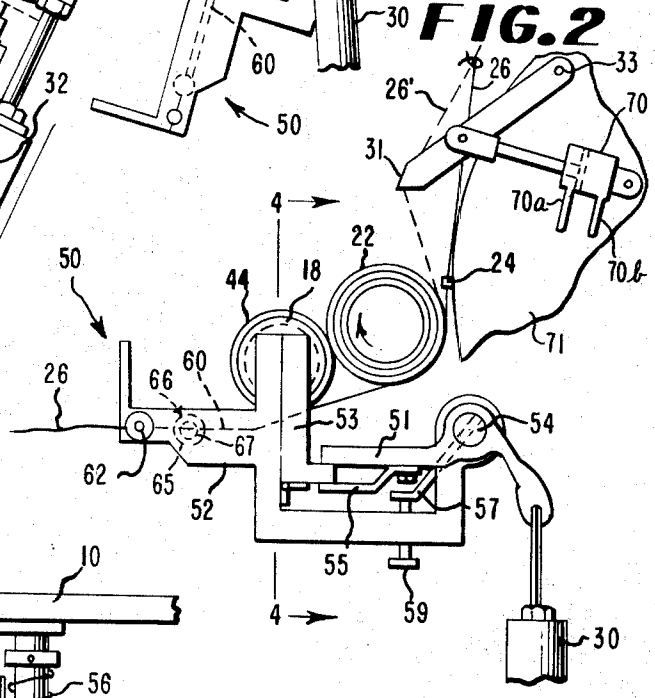
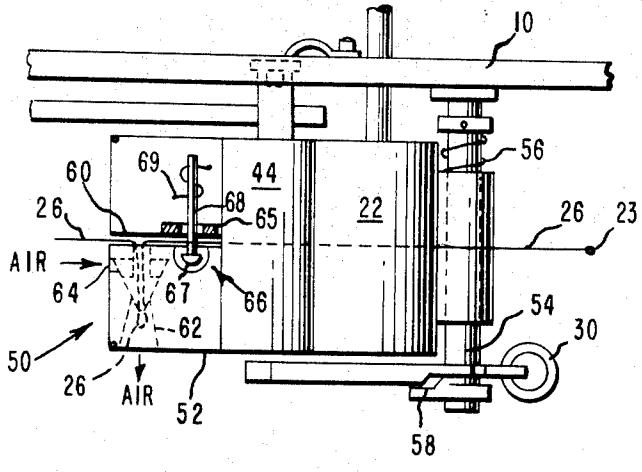


FIG. 3



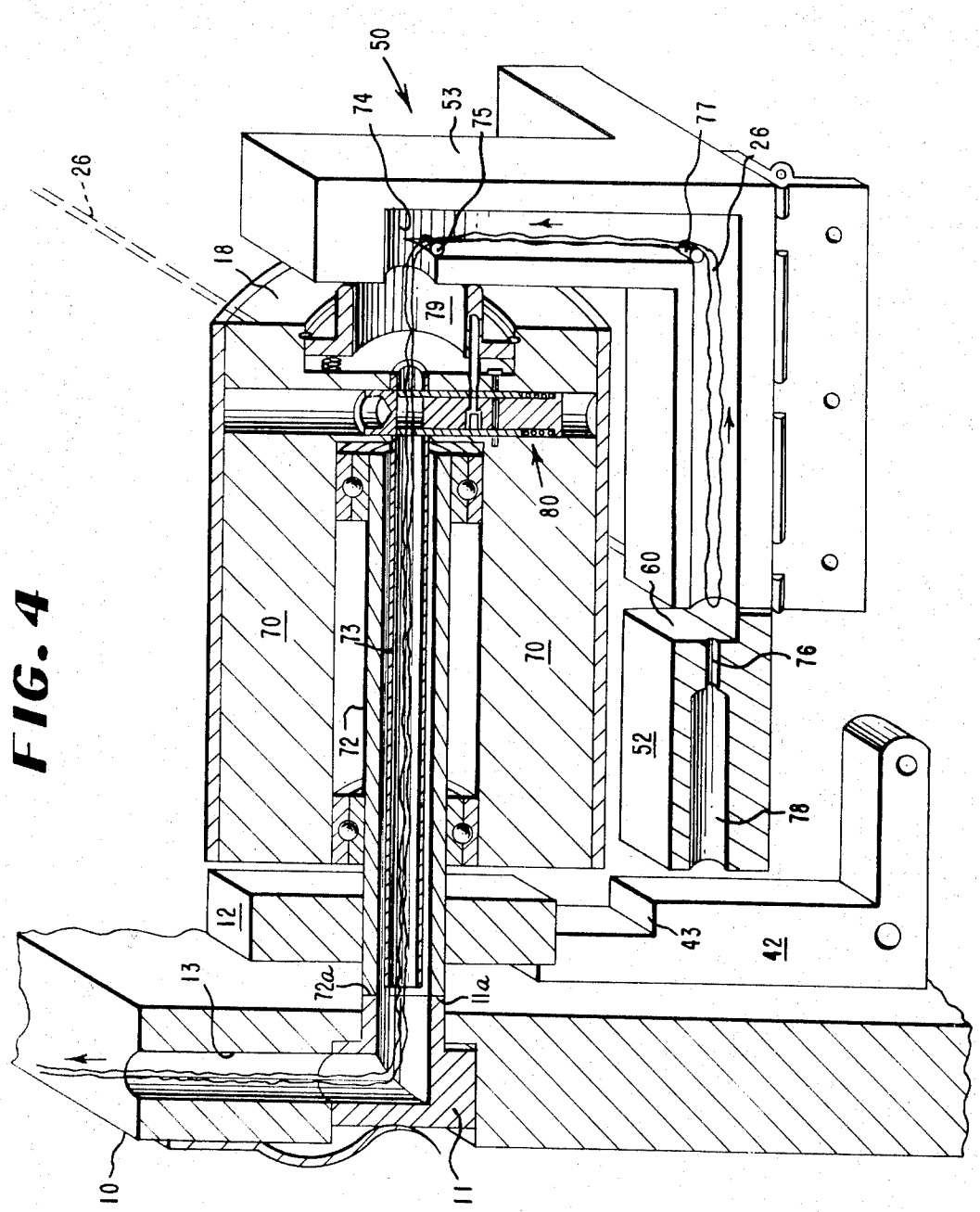

50
74
53
75
77
26
26
18
79
80
60
70
73
72
70
76
52
78
12
43
42
13
72a
11a
10
11

FIG. 4

FIG. 5

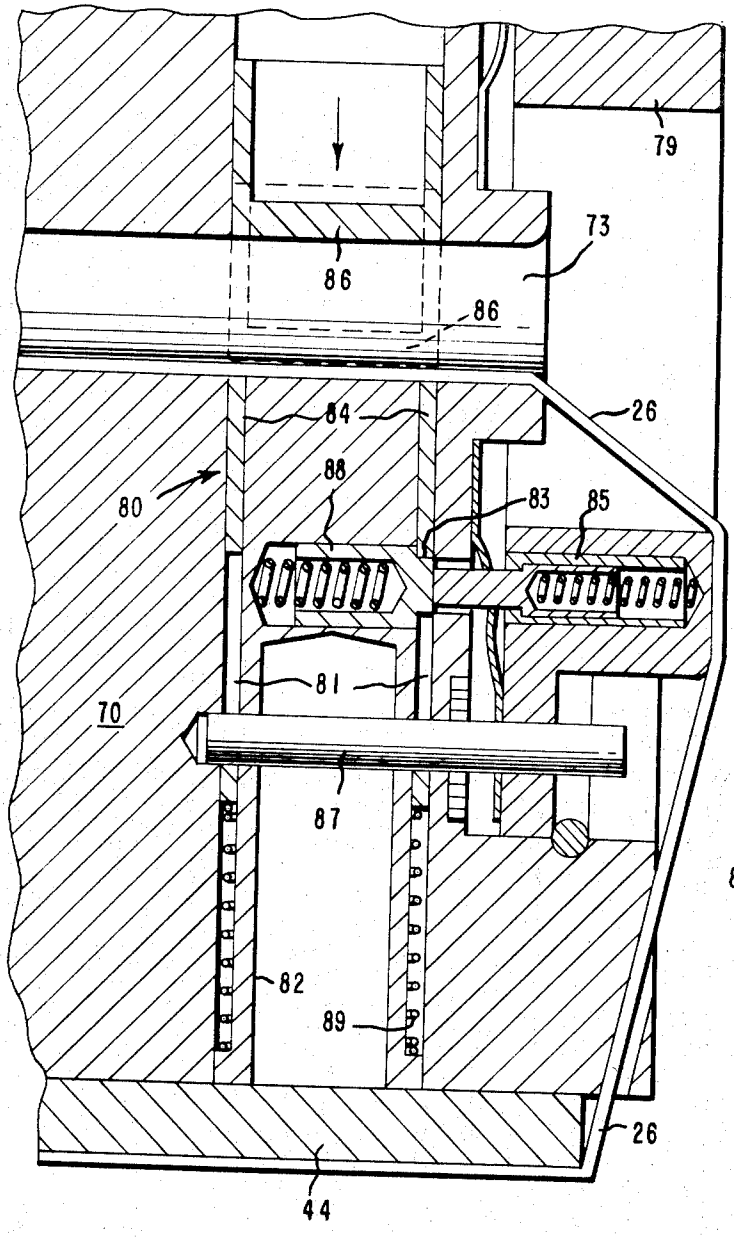

79
73
86
86
26
84
88
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83
85
81
70
87
82
89
26
44

FIG. 6

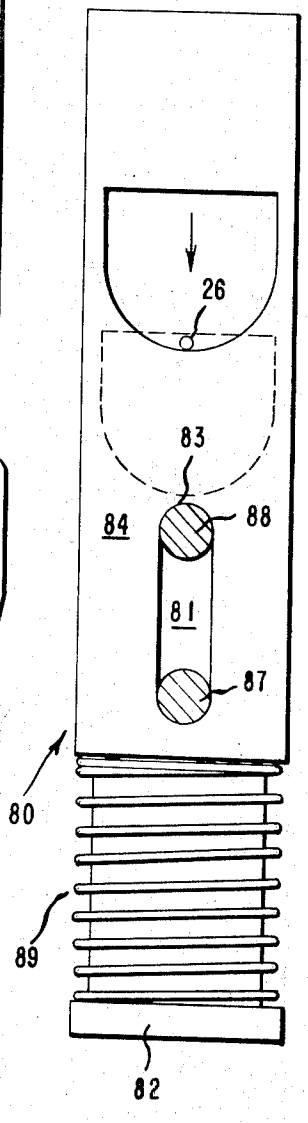

26
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81
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80
89
82

FIG. 7

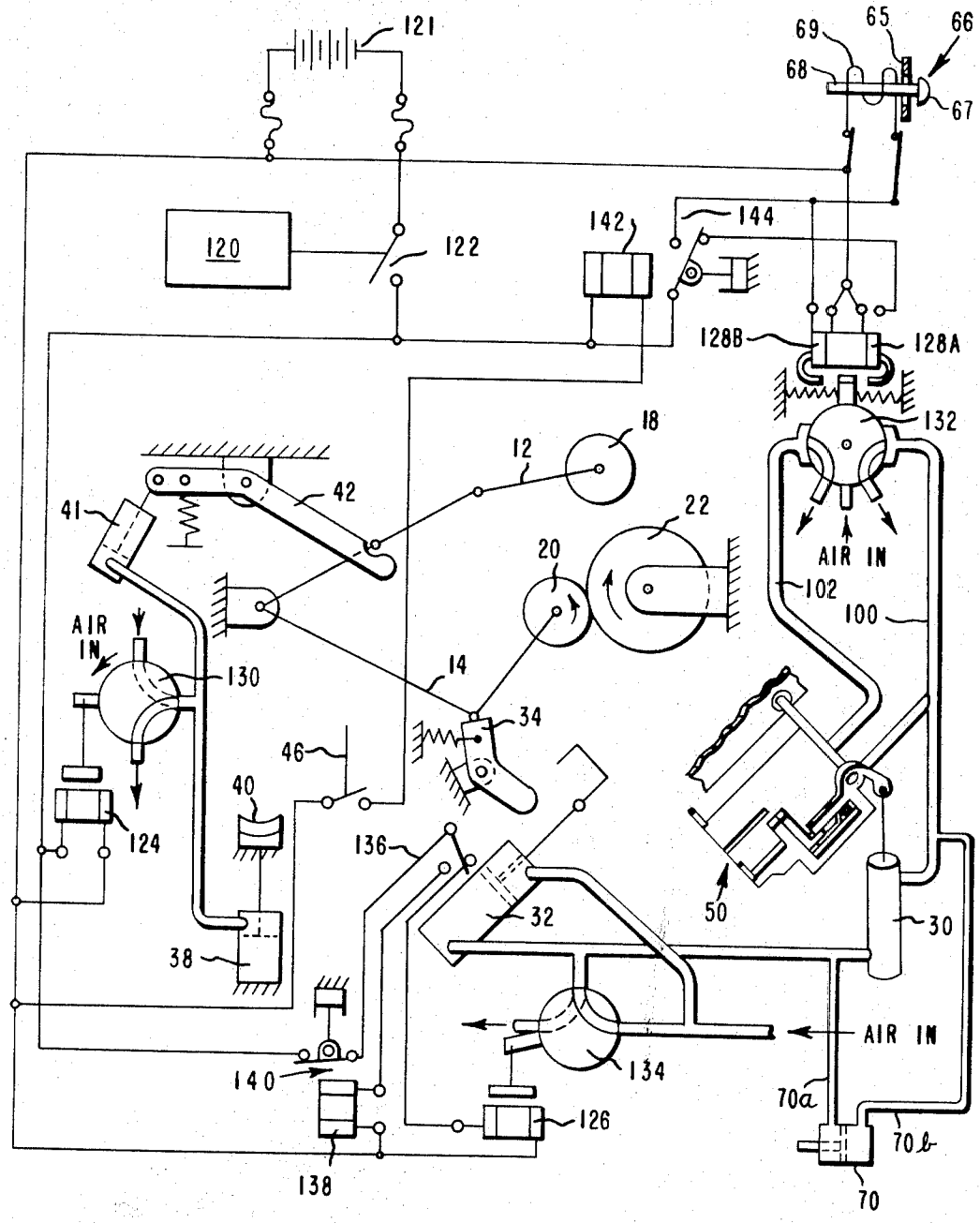
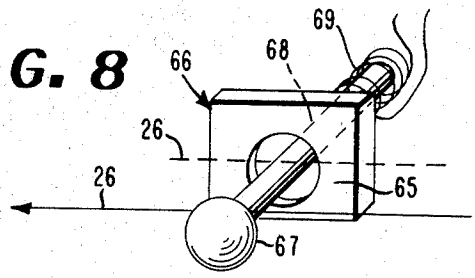

121
69
65
66
68
67
120
122
142
144
128B
128A
132
18
12
42
41
22
20
AIR IN
102
100
AIR IN
130
14
34
46
40
124
136
32
50
30
38
AIR IN
140
134
70a
126
70b
138
70

FIG. 8


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67

YARN WINDING APPARATUS

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of my co-pending application Ser. No. 56,501 filed July 20, 1970 and now abandoned.

BACKGROUND OF THE INVENTION

This invention relates generally to a winding apparatus and, more particularly, to the equipment with which yarn, advancing continuously from a source, is wound on successive packages.

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 known. To avoid waste during doffing such windups have been provided with rotatable chucks alternately movable into surface driven engagement with the drive roll and auxiliary equipment for accomplishing transfer of the yarn from a full to an empty support package carried by a chuck.

It is also known in the art to include a transfer tail in the initial length of yarn wound on a support. The purpose in providing a transfer tail on the yarn package is to enable an uninterrupted flow of yarn from one package to another in textile processes by providing an end length of yarn that is freely available for tying to the leading end of an adjacent package.

Equipment is available for winding yarn with transfer tails on package supports and securing the tail thereto. For example, the winding operation may be initiated by snagging the running yarn in snaring and severing elements on the chucks to secure the transfer tail thereto. A windup of this type incorporating such equipment is disclosed by Emery in U. S. Pat. No. 3,310,247, dated Mar. 21, 1967.

Although this technique is effective for severing then holding the starting end of yarn securely in position during winding, the transfer tail is not readily accessible when the time comes for doffing the package and it must be manually untangled from the cutter mechanism before the package can be doffed. It is highly desirable to eliminate the need for this time consuming step.

SUMMARY OF THE INVENTION

A yarn transfer device for use in a windup which includes a frame, a drive roll, a plurality of rotatable chucks having yarn package supports thereon mounted to the frame for alternate movement into surface driven engagement with the drive roll and a traverse guide through which yarn advances around the drive roll to a package support on a driven chuck. The transfer device includes an elongated housing which has a yarn cutting means at one end, an open ended passage is formed in the housing, the chucks are equipped with hollow tubular shafts and a waste port is located in the frame. When the housing is in position for transferring the yarn, the cutting means severs the yarn which is threaded through the passage, the tubular chuck shaft and into the waste port by means of an air transport system. Subsequently, the yarn is positioned on the driven support for winding a package and the length of yarn leading to the waste port is cut off at the waste port and forms a tail inside the chuck shaft for the package being wound. A clamping device for holding the tail in the shaft for slow release and winding on the end of the package support after the package reaches a particular size is also contemplated as well as a guide linked to the operation of the housing for moving yarn to and from an engaging position with the traverse guide during transfer.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of a windup into which the transfer device of this invention has been incorporated;

FIG. 2 is an abbreviated view similar to FIG. 1, showing the yarn transfer device in operative engagement with the windup;

FIG. 3 is a top view of FIG. 2;

FIG. 4 is a section view of FIG. 2 taken along 4—4;

FIG. 5 is an enlarged partial view of FIG. 4 showing the yarn clamping means;

FIG. 6 is an end view of the yarn clamping means of FIG. 5.

FIG. 7 is a schematic illustration of the control features for the windup and the transfer device;

FIG. 8 is a schematic perspective illustration of the yarn cutting means mounted on the transfer device.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1–3, it will be seen that the windup chosen for purposes of illustration includes generally, as components thereof, an equipment frame 10, a pair of articulated swing arms 12, 14 mounted for relative rotation about a common pivot 16, rotatable chucks 18, 20 on stub shafts at the extremities of arms 12, 14, a drive roll 22, a reciprocating traverse guide 24 through which yarn 26 normally advances around drive roll 22 to a package 28 on chuck 20 and a transfer device 50.

At the timed completion of package 28, a piston and cylinder assembly 32 and coupled linkages are actuated to release a pawl 34 and to prepare the illustrated cams for descent of arm 14 to a point where the stub shaft rests on a cradle 36. Simultaneously, a piston and cylinder assembly 38 is actuated to withdraw a brake shoe 40, against the bias of a spring (not shown) so that the chuck will continue to rotate and take up yarn when it reaches the position shown in phantom at 20'. A piston and cylinder assembly 41 is actuated to pivot a latch 42 clockwise, thereby releasing arm 12 from its "ready" position to one in which an empty support tube 44 on chuck 18 is in surface driven engagement with drive roll 22.

As described more fully hereinafter, the descent of package 28 trips a switch 46 to initiate pivotal movement of device 50 to a level position (FIG. 2) beneath drive roll 22 and in engagement with the driven but empty package support 44. When yarn 26 has been transferred to and is winding on support 44, device 50 is returned to the position shown in FIG. 1 and braking means (not shown) engages chuck 20'. This leaves package 28 ready for doffing, which is accomplished after arm 14 has been swung manually to a position where it is held in a notch 48 on latch 42. After replacement of the full package with an empty tube 44, arm 14 remains in this position while the package is being built on chuck 18. It is then automatically unlatched at 48 and swung further to the "ready" position, i.e., before the instant of transfer, to the position shown for arm 12 in FIG. 1. In the meantime, a package is being built on chuck 18.

In general, yarn transfer device **50** includes an elongated frame member **52** mounted for swinging movement about shaft **54** attached to frame **10.** Member **52** is under lateral tension by spring **56** which coacts with the frame member, the shaft **54** and cam **58** on the outboard end of the shaft to urge the transfer device into engagement with chuck **18.** Arm **51** pivotally attached at one end to cylinder **30** couples to duct section **53** hinged to frame **52** via leaf spring **55** attached to the arm. A fixed stop **57** is keyed to shaft **54** and an adjustable stop **59** adapted to engage the fixed stop is connected to frame member **52.** A centrally located slot **60** runs longitudinal through one end of frame member **52.** At this same end of member **52** is located a yarn tension control jet **62** supplied with air through port **64.** The jet functions to take up any slack that may develop in the yarn **26** running to an undriven package being doffed. This insures that the yarn remains under uniform tension in the bottom of slot **60.** Adjacent the jet is an electromagnetically operated cutting means **66** comprised of shear elements **65, 67** disposed on opposite sides of the yarn path through slot **60.** Cutting means **66** is activated by energizing solenoid **69** encircling the extended shaft **68** of shear element **67.** Retraction of shaft **68** into coil **69** moves the threadline **26** to position **26'** where it is severed between the shear elements **65, 67** (FIG. **8**).

In order to get into slot **60,** the yarn **26** is first disengaged from traverse guide **24** by guide **31** positioned above drive roll **22** (FIG. **2**). This guide is mounted for pivotal movement about fixed pin **33** and operated for simultaneous movement with transfer device **50** such movement being made via double acting pneumatic cylinder **70** which is pivotally mounted on traverse housing **71** and connected to guide **31.** Pneumatic cylinder **70** is operated through air lines **70***a*, **70***b* simultaneously with cylinder **30** which operates transfer device **50.** When device **50** is moved into transfer position (FIG. **2**), guide **31** disengages yarn **26** from traverse guide **24** and moves it to the alternate path indicated as **26'** which movement along with the action of jet **62** allows the yarn to align with and enter into slot **60.** When transfer device **50** is moved out of position, cylinder **70** is operated to move guide **31** back toward housing **71** releasing yarn **26** so it will again be engaged by traverse guide **24.**

The structure of chucks **18, 20** has been shown in detail in FIGS. **4–6** and in general each chuck includes a body **70,** rotatably mounted on a hollow tubular shaft **72** fixed to swing arm **12** which in turn is held in "ready" position by latch **42.** An elbow **11** in frame **10** places one end of shaft **72** in communication with a waste port **13** in the frame. The other end of the shaft is in communication with one end of passage **74** in duct **53.** Passage **74** is open on one side as shown but is enclosed when frame member **52** is in the position shown in FIG. **2.** The other end of passage **74** opens to slot **60** and opposite this end is a nozzle **76** connected to an air supply port **78.**

Centrifugal clamping means **80** are mounted in body **70** and cooperate with the shaft for holding severed yarn in the shaft during part of the formation of a package. An outwardly biased seal **79** is coupled with clamping means **80** to initiate its operation as well as provide for a continuity of passage **74** and the hollow shaft **72** through rotating inner shaft tube **73** attached to clamping means **80.** The rotation of tube **73** prevents twisting yarn **26** while a package is being wound.

Referring to FIGS. **5–6,** it will be seen that clamping means **80** comprises an inner bolt section **82** being solid on one end and hollow on the other end, fitted into an outer tube **84** having one end closed by a solid portion **86.** Section **82** is fitted with a spring loaded pin **88** which penetrates opposed slots **81** in section **84.** In the position shown, pin **88** engages the upper edge **83** of slot **81** preventing outward movement of tube **84.** Attached to seal **79** is another spring loaded pin **85** which engages pin **88** with an end that is slightly smaller than the opposed end of pin **88.** Pin **87** locks bolt **82** into body member **70.** Spring **89** around section **82** biases section **84** of the clamp inwardly toward the center of the chuck.

The condition of various related control components while a package is being wound on chuck **20** has been shown schematically in FIG. **7.** Completion of the package is determined by a timer **120** which closes a switch **122** to connect solenoids **124, 126** and **128***a* to the illustrated source of power **121.** With the energization of solenoid **124,** a coupled valve plug **130** is rotated to admit air under pressure to assemblies **38, 41** thereby withdrawing brake shoe **40** and releasing arm **12** from its "ready" position. Energization of solenoid **128***a* pulls the spring biased actuator on coupled valve plug **132** to the right, thereby delivering air through conduit **100** to swing transfer device **50** to its operable position (FIG. **2**) and supply air to tension control jet **62** and the back end of cylinder **70.** Energization of solenoid **126** rotates a coupled valve plug **134** to its second position in which the lower ends of cylinders **30, 32** and the front end of cylinder **70** are exhausted to atmosphere. Resulting movement of the associated linkages causes clockwise rotation of pawl **34,** permitting descent of arm **14.** In its movement, pawl **34** also reverses the position of switch **136,** thereby de-energizing solenoid **126** and energizing a solenoid **138.** De-energization of solenoid **126** permits the counterclockwise return of valve plug **134** to supply air to the lower end of cylinder **30** and both ends of cylinder **32.** With both ends of cylinder **32** pressurized, the piston therein returns relatively slowly to its initial position. Responsive to the action of a spring, pawl **34** also returns to its initial position where it can block descent of arm **12.** In the meantime, momentary energization of solenoid **138** has opened switch **140** which then closes against the action of an attached dashpot, thereby insuring that solenoid **126** will not be energized a second time during the doffing cycle. Yarn guide **31** moves yarn **26** from traverse guide **24** and it then follows a path through slot **60** to the full package which still has enough rotational inertia to take up yarn.

The descent of a full package trips and closes switch **46,** closing the circuit to a solenoid **142** which reverses the position of a switch **144.** The latter action energizes coil **69** to operate cutting means **66** and energizes solenoid **128***b* which pulls the actuator on valve plug **132** to pressurize conduit **102** admitting air to the nozzle **76** through air supply port **78** (FIG. **4**). At the instant the yarn is severed, air from nozzle **76** forces the severed yarn end through passage **74** around guide pins **75, 77** in duct **53,** seal **79,** through rotating tube **73** inside shaft **72,** elbow **11** and through port **13** in frame **10** to a waste collecting system (not shown) in communication with port **13.** Guide pins **75, 77** serve to prevent

the yarn from snagging at the inside corners of passage 74.

Pressurization of the lower end of cylinder 30 moves transfer device 50 back to the position shown in FIG. 1 and returns guide 31 to its original position. When the transfer mechanism 50 clears bobbin 44 on chuck 18, latch 42 drops arm 12 to the winding position on shoulder 43 of the latch (FIG. 4). This movement of shaft 72 past spring loaded elbow 11, the contacting surfaces (11*a*, 72*a*) of which form a sharp shear, cuts the yarn inside the shaft 72 forming a uniform length transfer tail for the package being wound.

The yarn clamping means 80 has as its prime purpose the retention of the transfer tail in the shaft 72 so that it will not be whipped out of the shaft after it has been cut and become overwound into the package when the package is just starting to be formed. Later as the package builds up in size, the bobbin rotational speed has decreased until the centrifugal force can no longer maintain the clamp closed on the yarn and the tail is then slowly released from rotating tube 73 and winds on the outer end of bobbin 44 to form a readily accessible transfer tail of uniform length. In its operation contact of duct 53 and seal 79 (FIGS. 4–6) forces the seal back into chuck 18 and pin 88 is forced back into bolt section 82 by pin 85 carried by seal 79. This places pin 88 inside tube 84 and tube 84 due to centrifugal force from rotating chuck 18, moves outward against pin 85 and the clamp 80 is cocked for action. When duct 53 is swung away from seal 79, the seal moves outward withdrawing pin 85 from its locking position in slot 81 allowing full closure (due to centrifugal force) of tube 84 against bolt section 82, thus, clamping the yarn in tube 73. As the package builds up and the bobbin rotational speed decreases, spring 89 opens the clamp against the reduced centrifugal force on tube 84.

In an actual embodiment, all of the functional events described in connection with transfer device 50 and its operation occur within a relatively short period of time. Thus, yarn is not only transferred reliably and uniformly but also with the formation of defect free, unattached transfer tails, permitting truly automatic donning and doffing.

It is apparent that many changes and modifications of the disclosed windup may be made without departing from the spirit of the present invention which is accordingly intended to be limited only by the scope of the appended claims.

What is claimed is:

1. In a winding apparatus of the type which includes a frame, a drive roll and a plurality of rotatable chucks having yarn supports thereon mounted to said frame for alternate movement into surface driven engagement with said drive roll around which yarn normally advances in a path to a package support on a driven chuck, a device for initiating winding the yarn on a driven support and severing the yarn while it is still advancing to a full package on another chuck said device comprising: an elongated member provided with means for cutting yarn adjacent one of its ends, said member having a passage therethrough, said chucks having tubular shafts, there being a port in said frame; means mounting said member for swinging movement of said one end to a position adjacent said driven chuck, said cutting means and one end of said passage being in alignment with said path and the tubular shaft of the driven chuck being in communication with the other end of said passage and said port when said one end of said member is at said position; and means coupled with said member for swinging it to said position then actuating said cutting means and threading the severed yarn through said passage, said shaft and said port.

2. The apparatus as defined in claim 1, said means for threading the severed yarn through the passage, the shaft and the port being an air transport system comprising an air supply nozzle on the opposite side of the yarn path from said one end of the passage and a waste collecting system in communication with said port.

3. The apparatus as defined in claim 1, including centrifugal clamping means coupled with said shaft for holding the severed yarn within the tubular shaft during a part of the formation of the package.

4. The apparatus as defined in claim 1, including cooperating means on said shaft and said port for severing the yarn during said alternate movement.

5. In a winding apparatus of the type which includes a frame, a drive roll, a pair of rotatable chucks having yarn package supports thereon mounted to said frame for alternate movement into surface driven engagement with said drive roll and a traverse guide through which yarn normally advances around the drive roll to a package support on a driven chuck, a device for initiating winding the yarn on the driven support and severing the yarn while it is still advancing in a path to a full package on the other chuck, said device comprising: an elongated housing provided with a means for cutting yarn adjacent one of its ends, said housing having a passage therethrough, said chucks having tubular shafts, there being a port in said frame; means mounting said housing for swinging movement of said one end to a position adjacent said driven chuck, said cutting means and one end of said passage being in alignment with said path, the tubular shaft of a driven chuck being in communication with the other end of said passage and said port when said one end of said housing is at said position; means coupled to said housing for sequentially swinging it to said position and actuating the cutting means for severing the yarn; an air transport system for threading the severed yarn through said passage, said shaft and said port; and clamping means coupled with said shaft for holding the severed yarn within the shaft during initial formation of a package.

6. The apparatus as defined in claim 5, including cooperating means on said shaft and said port for severing the yarn at said port during said alternate movement.

7. The apparatus as defined in claim 5, including means for maintaining tension on said yarn advancing to a full package on another chuck.

8. The apparatus as defined in claim 5, said chucks having rotatable tubular shafts.

9. The apparatus as defined in claim 5, including guide means mounted in the passage of the housing.

* * * * *