United States Patent

Carr et al.

[15] **3,688,998**

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[54] **AUTOMATIC WASTELESS TRANSFER WINDING APPARATUS**

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[73] Assignee: **Allied Chemical Corporation,** New York, N.Y.

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[21] Appl. No.: **834,697**

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

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

[58] **Field of Search** .....242/18, 18 A, 18 PW, 25 A, 242/19

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[57] **ABSTRACT**

Salient structural features employed within such winding apparatus include, inter alia, a pair of rotatably mounted chucks with pirns retained thereon, a pair of pivotally mounted transfer arms for transferring yarn between said pirns, a guide assembly with fixed and movable components for feeding the yarn alternately to the first or the second pirn, cutting means for automatically severing the yarn, hook means on the chucks for grabbing the leading segment of the yarn, power means for rotating the chucks and oscillating the transfer arms, and control means, including programming circuitry means and microswitches, for energizing said power means in properly timed sequence.

2 Claims, 11 Drawing Figures

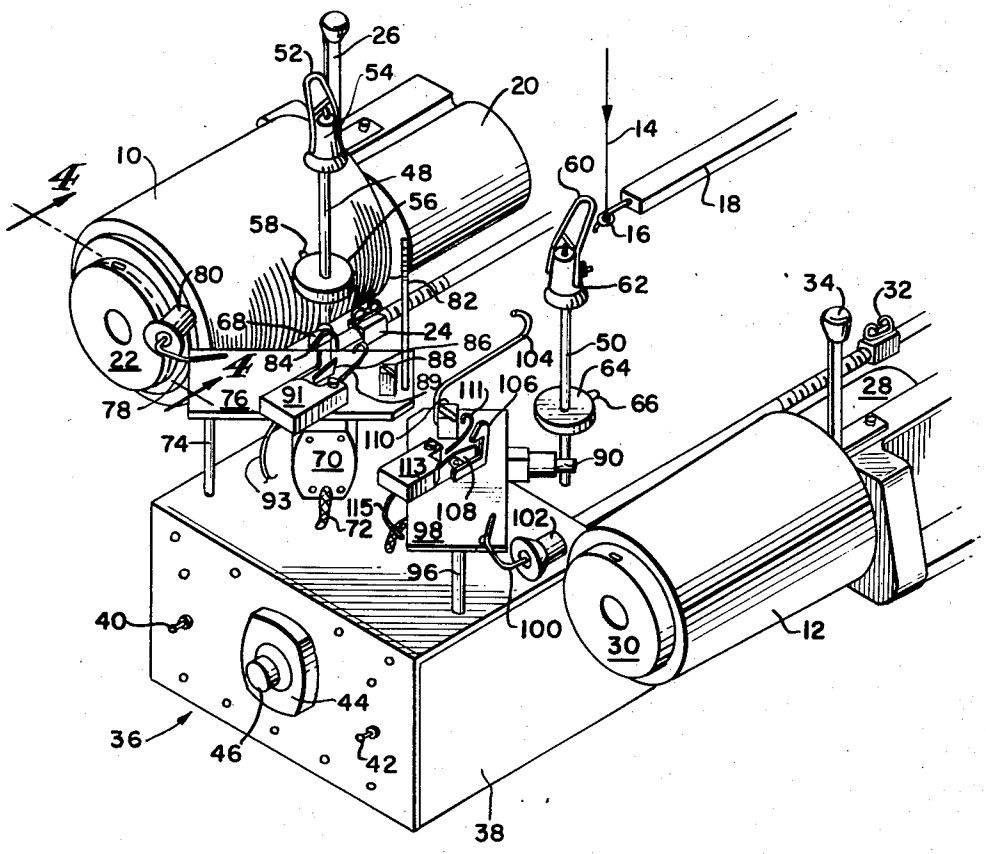


Fig. 1.

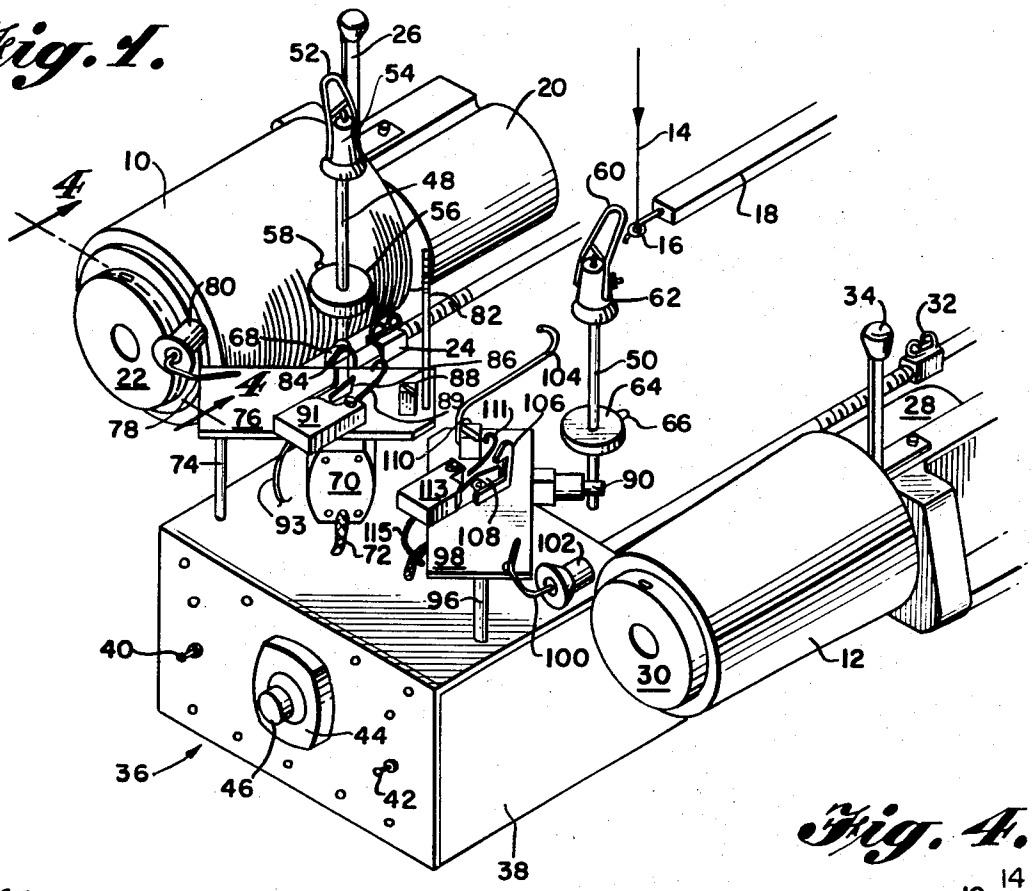


Fig. 2.

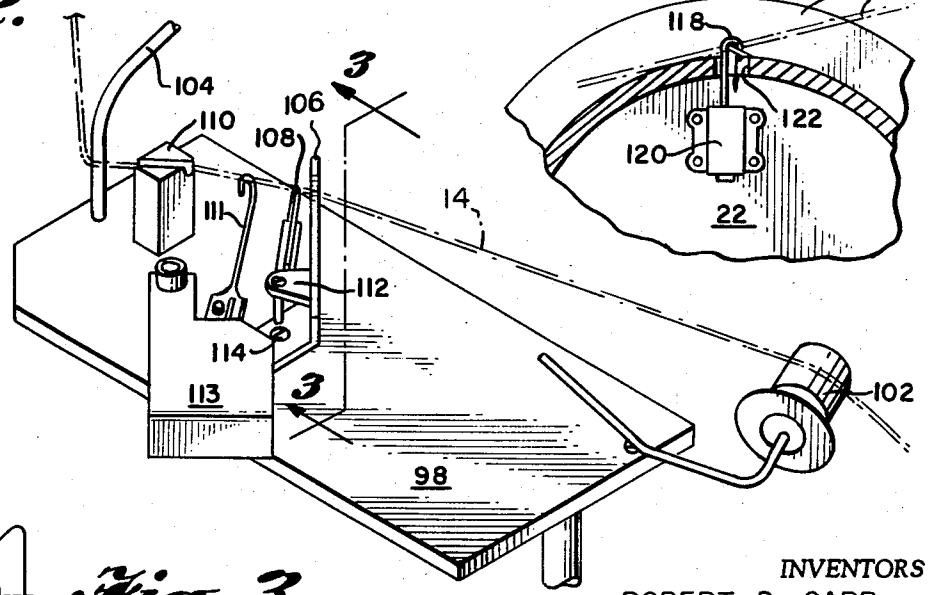
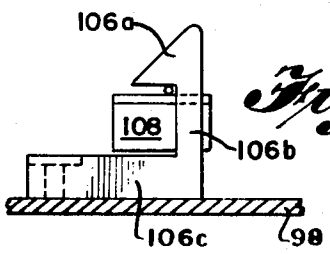


Fig. 4.

Fig. 3.



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Fig. 5.

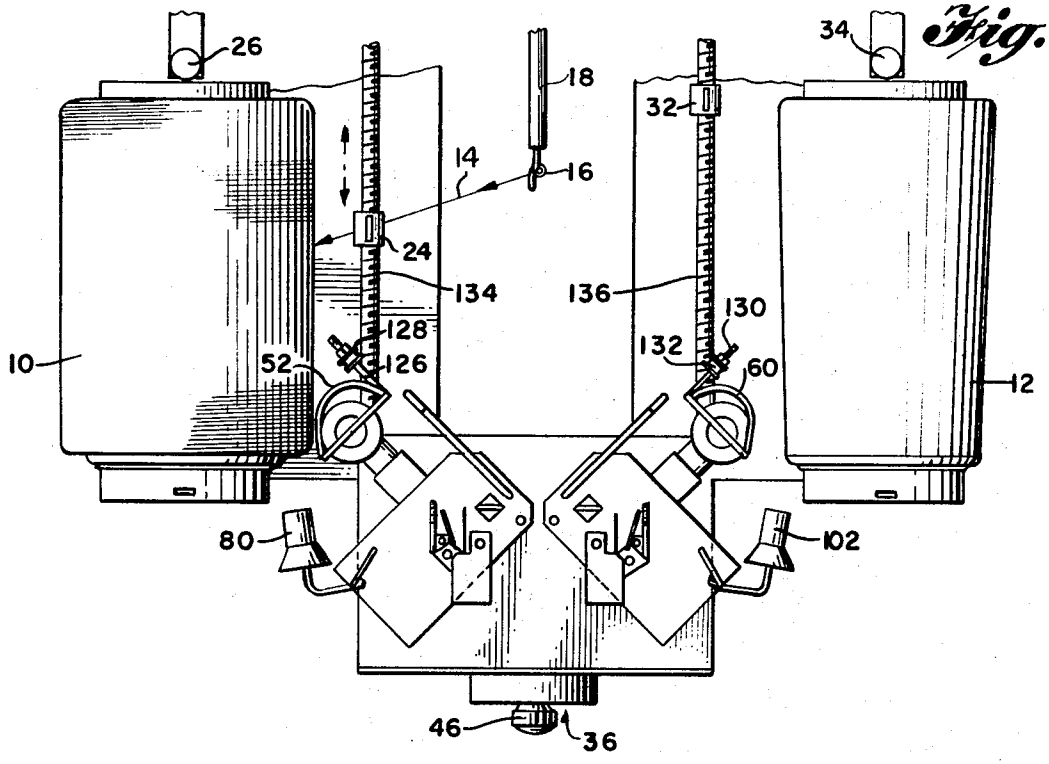
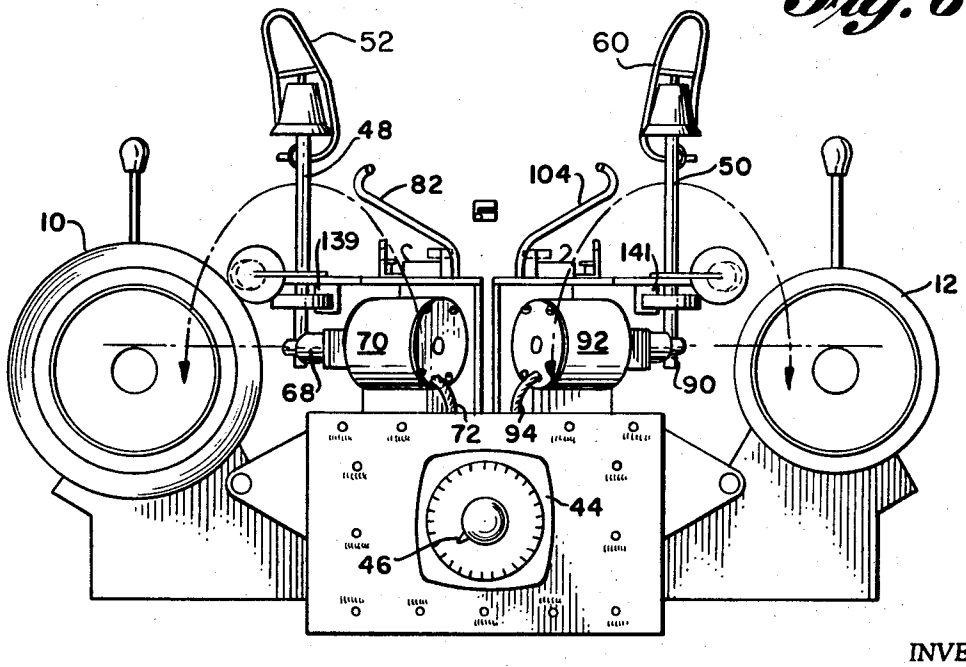


Fig. 6.



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Fig. 7.

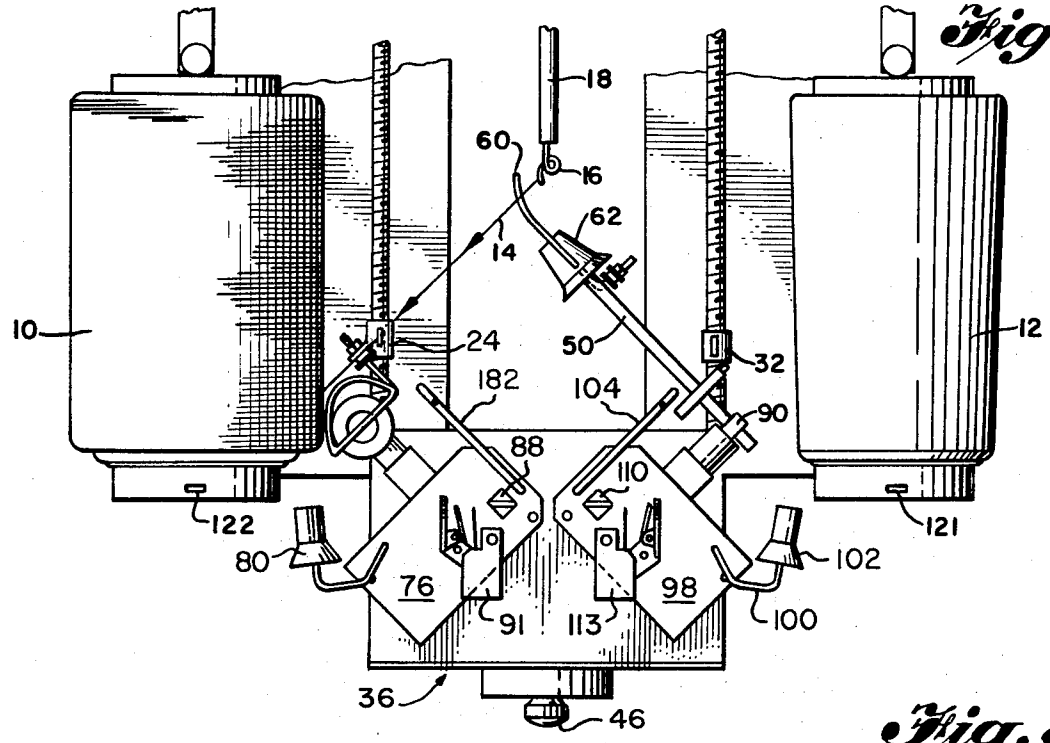
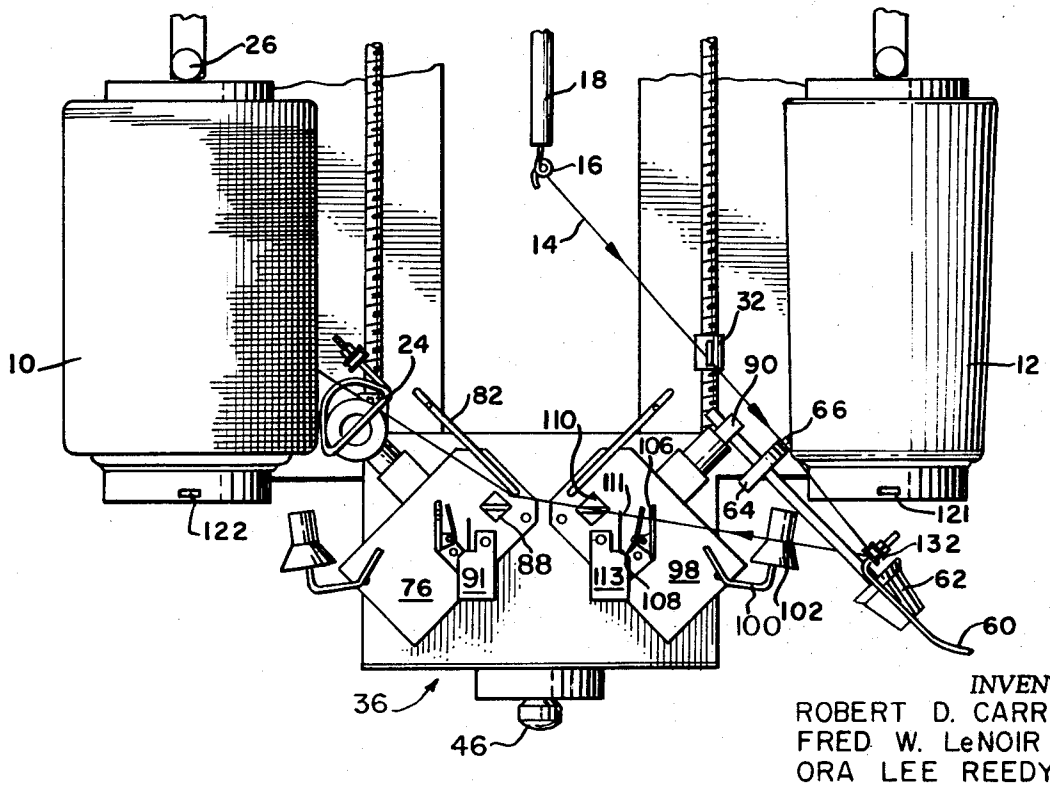


Fig. 8.



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Fig. 9.

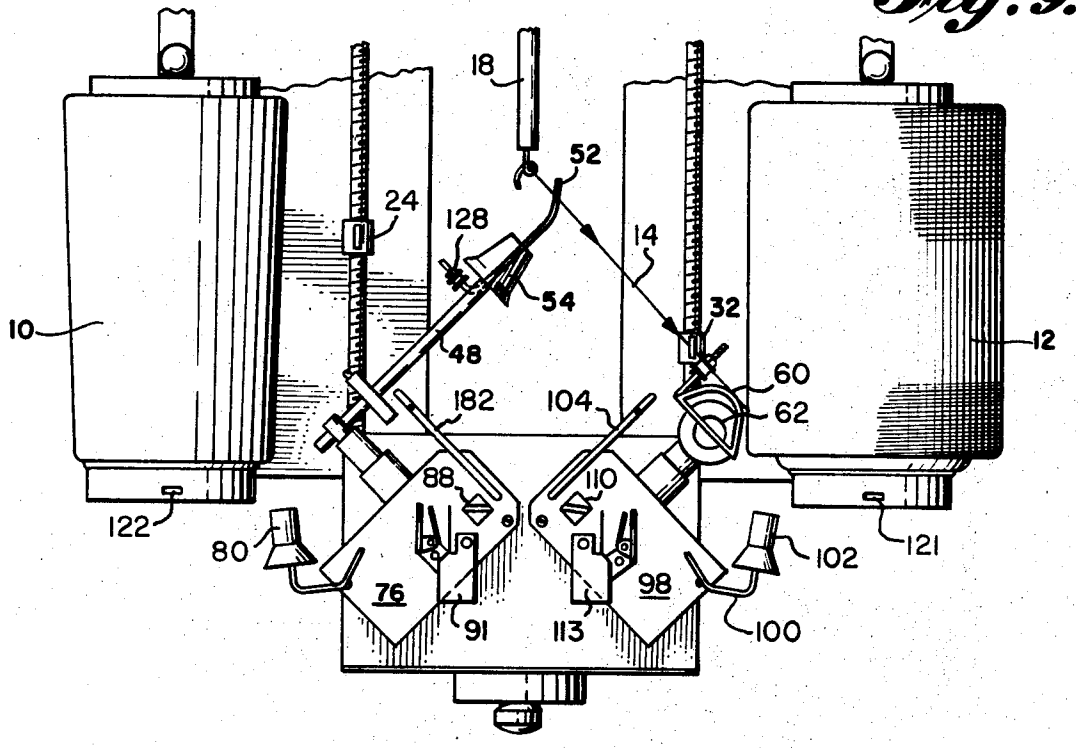
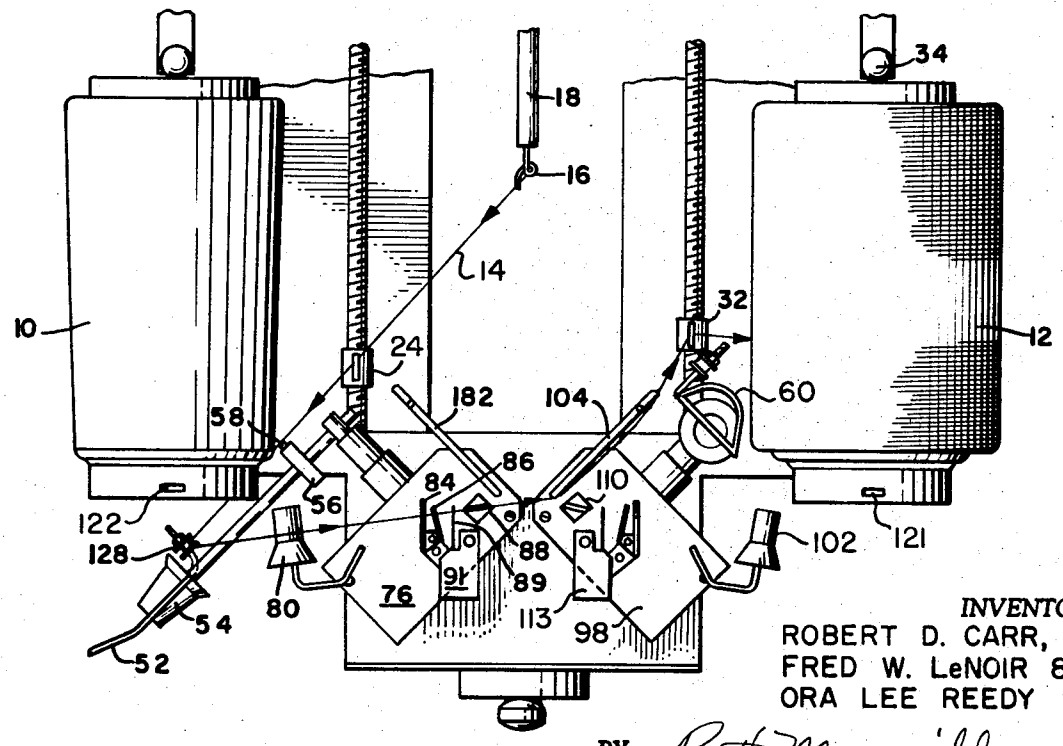


Fig. 10.



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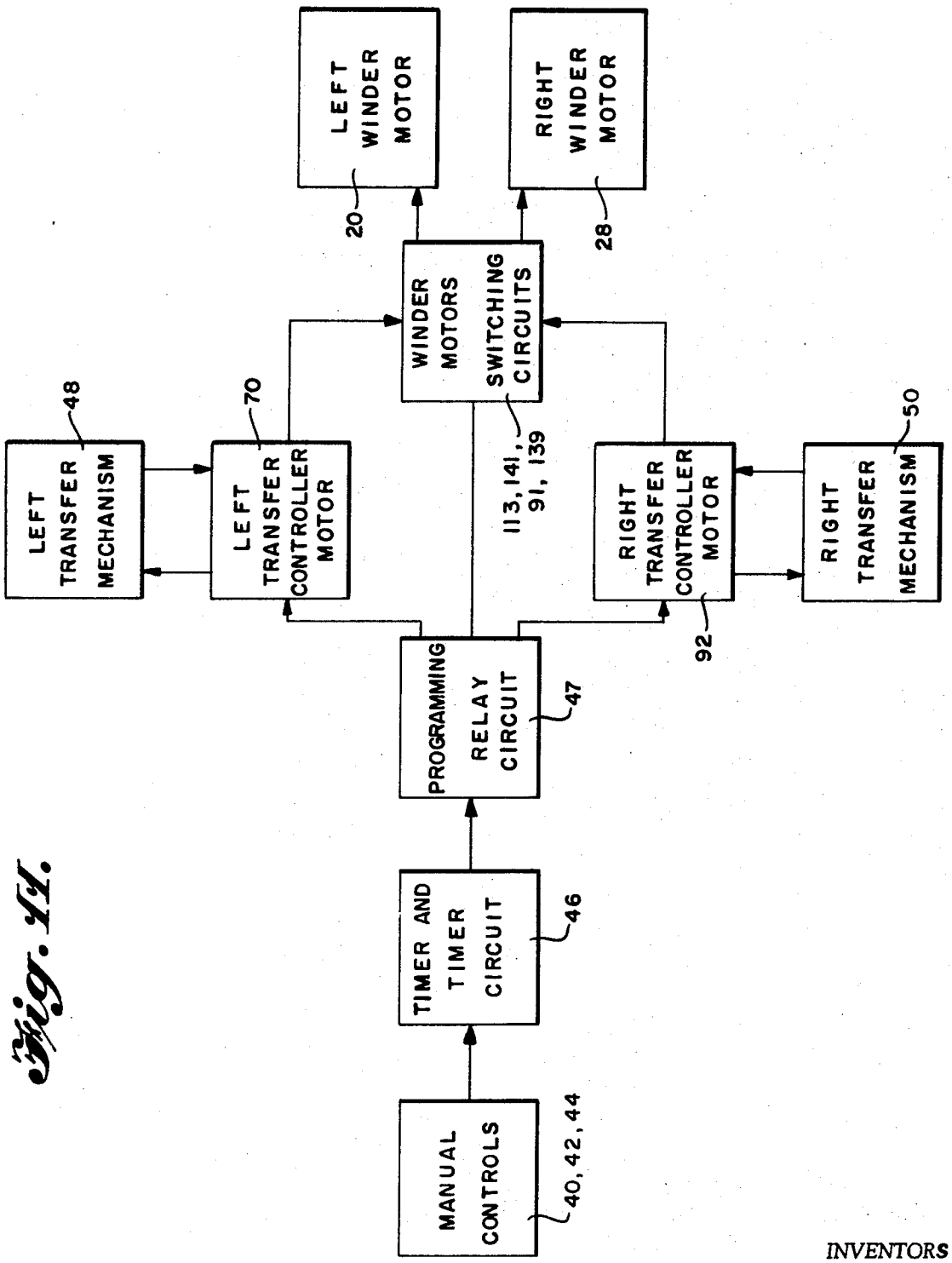


Fig. 11.

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AUTOMATIC WASTELESS TRANSFER WINDING APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The instant invention relates generally to the winding of yarn, wire, and similar strand-like materials, and more particularly to an efficient wasteless system for continuously winding yarn on a succession of rotating yarn packages and automatically severing said yarn when the package has reached the desired size.

2. Description of the Prior Art

During the processing of yarn, it has been customary to collect the yarn by winding same onto pirns, bobbins or similar packages. The winding process, however, is discontinuous in nature, for each time an individual collection package is filled, the yarn traveling thereto is broken or cut by shears and thence transferred to a waste roll while the completed package is replaced by an empty pirn. Then the leading end of the yarn is attached to the empty pirn and the winding process is repeated. Obviously, the steps of breaking or severing the yarn, doffing the full package and substituting an empty package therefor, attaching the leading end of the yarn to the empty package, etc., are time consuming operations which waste yarn and entail substantial labor costs. These losses are compounded when a large number of packages are being wound at the same time at high operating speeds as is customary in the textile field.

Numerous solutions to these problems have been attempted with qualified success, at best. One solution entailed the provision of a pair of articulated arms pivotally mounted side by side on a common horizontal axis. A mandrel at the end of each arm rotatably mounted an empty yarn package. At the beginning of the operation of the yarn winding apparatus, one arm was swung downward into operative position while the other arm was maintained thereabove in inoperative position. The arms were maintained in their relative positions by a locking mechanism.

After the desired quantity of yarn had been wound on the first yarn package, the locking mechanism was released so that the second arm with its empty yarn package was swung downwardly into operative position while the first arm with its full yarn package was swung into an inoperative position. During the swinging movement of the arms, a switch was tripped and a cutter blade severed the trailing end of the yarn. A stream of air directed the newly formed leading end of the yarn against the empty yarn package on the second arm. The full yarn package on the first arm was then doffed and an empty yarn package was then slipped onto the mandrel on the first arm and the first arm was rotated to a position above the second arm, so that the process could be repeated. The locking mechanism was actuated to maintain the arms in proper orientation. U.S. Pat. Nos. 2,789,774 and 3,310,247 granted to Svend A. Peterson et al and Michael Emery, respectively, exemplified this proposed solution for minimizing the time and material wastage encountered with high speed doffing operations.

The above described two-arm yarn windup mechanisms, however, were cumbersome in nature and required a considerable amount of floor space be left vacant between adjacent packaging stations. Consequently the expenses attributed to under utilization of available floor space added to the costs inherent in installing and maintaining such relatively complicated mechanisms in operating condition. Additionally, such mechanisms failed to fully eliminate yarn wastage during doffing, particularly when the yarn was fed to the yarn packages at high rates of through-put. The wastage problem was further aggravated by the difficulty in accurately positioning the leading end of the yarn in operative association with the empty yarn package.

SUMMARY

Thus, with the deficiencies of the prior art structures and techniques enumerated above in mind, the instant invention contemplates an automatic transfer winding system that can accomplish high speed, wasteless transfer of yarn between a pair of winding heads or pirns. Additionally, the instant transfer winding system, which is characterized by a pair of oscillatable transfer arms and automatic severing means responsive to changes in the tension of the yarn being wound, is compact in size and can be installed between a pair of closely-spaced winding heads. Furthermore, at high rates of through-put, the instant system is safer from an operating standpoint and is economical to operate with regard to both labor and material costs. Under experimental conditions, the instant system transferred yarn running at 6,000 feet per minute from one winding head to another without any yarn wastage.

Other advantages attributable to the instant invention will become readily apparent in light of the following description of the invention when construed in connection with the accompanying sheets of drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a pair of winding pirns with a transfer winding system, constructed in accordance with the principles of this invention, disposed in operative association therebetween;

FIG. 2 is a perspective view, on an enlarged scale, of guide means and cutting means for the transfer winding system;

FIG. 3 is a side elevation of the cutting means, such view being taken along line 3—3 in FIG. 2 and in the direction indicated;

FIG. 4 is a front elevational view of a fragment of the winding pirn, such view being taken along line 4—4 of FIG. 1 and in the direction indicated;

FIG. 5 is a top plan view of the pair of pirns with the transfer winding system disposed therebetween with the transfer arms in neutral position;

FIG. 6 is a front elevation of the pair of pirns with the pair of transfer arms of the transfer winding system held in neutral position;

FIGS. 7–10 are top plan views similar to FIG. 5 but depicting four sequential stages in the transfer process; and

FIG. 11 is a diagrammatic representation of the components of the transfer system and the sequence of interrelated command signals involved in the transfer process.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now in greater detail to the drawings in which similar reference numerals refer to similar parts, FIG. 1 depicts a first pirn 10 and a second pirn 12 which alternatively receive the yarn 14 passing downwardly from an overhead supply through an eye 16 secured to support member 18. Eye 16 serves as the center-line for the instant system for the components to the left and to the right of such center line are mirror images of one another.

Left winder motor 20, when energized, causes chuck 22, upon which pirn 10 is seated, to rotate at a high rate of speed. A longitudinally reciprocating traverse guide 24 receives yarn 14 and deposits same on pirn 10 during the course of its movement. The longitudinal movement of guide 24 is coordinated with the speed of rotation of chuck 22 and pirn 10 so that the yarn is evenly distributed along the length pirn 10. Release lever 26 at the rear of chuck 22 permits pirn 10, when filled to the desired package size, to be manually removed or doffed from chuck 22 and an empty pirn substituted therefor. The shading on pirn 10 indicates the presence of the yarn package being wound.

Right winder motor 28, when energized, causes chuck 30 upon which pirn 12 is mounted, to rotate at a high rate of speed. A reciprocating traverse guide 32 receives yarn 14 from eye 16 and deposits same on pirn 12 during its longitudinal movement. Release lever 34 at the rear of chuck 30 permits the pirn 12, when filled to the desired package size, to be manually removed or doffed from chuch 30 and an empty pirn substituted therefor.

An automatic wasteless transfer system embodying the principles of this invention is disposed between pirns 10 and 12 and is identified generally by reference numeral 36. System 36 includes a control console 38 with manually operable switches 40, 42 and an adjustable timer 44 visible on the front face of the console. Timer 44 is set into operation by rotatable adjustment of knob 46. Console 38 contains conventional electromagnetic relay programming circuitry 47 (see FIG. 11) that cooperates with a plurality of position-defining microswitches to energize the components of system 36 in the proper sequence of operation.

System 36 further includes a pair of transfer arms 48, 50 that are pivotally mounted for oscillatory movement in the clockwise and counterclockwise directions away from the normal, or neutral, vertical position seen in FIGS. 1, 5 and 6. Left transfer arm 48 has a substantially A-shaped wire guide 52 at its upper end which straddles a rotating guide cone 54. Guide 52 is asymmetrical when viewed in a vertical plane (see FIG. 6); consequently the guide can pass freely beneath the yarn being wound when oscillating in a first direction and contact and retain the yarn thereupon when oscillating in a second direction. An annular collar 56, with a lug 58 projecting therefrom, is positioned toward the lower end of arm 48. Guide 52 is fixedly mounted, but collar 56 can be rotatably adjusted about arm 48 to alter the position of lug 58.

In identical fashion, right transfer arm 50 has a substantially A-shaped wire guide 60 and guide cone 62 at its upper end. An annular adjustable collar 64 with a projecting lug 66 is positioned toward the lower end of arm 50.

Referring again to left transfer arm 48, it is seen that transfer arm 48 is pivotally joined near its lower end to shaft 68. The shaft is oscillated through an arc of approximately 200°, i.e., 100° in each direction from the neutral position of FIG. 1, by left transfer controller motor 70 which is mounted atop control console 38 and is connected thereto by electrical cable 72.

Posts 74 extend vertically from console 38 to left support plate 76 which is angularly oriented with respect to pirn 10. A horizontally extending member 78 is affixed to the corner of plate 76 adjacent to pirn 10 and a guide roller 80 is rotatably mounted thereon. A curved bar 82 is located at the end of plate 76 closest to the center line of system 36. Disposed between roller 80 and bar 82 is a first guide 84, a knife 86, and a second or clothesline guide 88 which has a slot in its upper surface to allow the yarn to pass freely therethrough. A switch arm 89 with a curved loop is located between knife 86 and clothesline guide 88; movement of the arm trips microswitch 91 which is operatively associated by cable 93 with the programming relay circuitry within console 38.

Referring again to right transfer arm 50, it is seen that arm 50 is pivotally joined near its lower end to shaft 90. The shaft is oscillated through an arc of approximately 200°, i.e., 100° in each direction from the neutral position of FIG. 1, by right transfer controller motor 92 (not seen in FIG. 1) which is mounted atop control console 38 and is connected thereto by electrical cable 94, as shown in FIG. 6.

Posts 96 extend vertically from control console 38 to right support plate 98 which is angularly oriented with respect to pirn 12. A horizontally extending member 100 is affixed to the corner of plate 98 adjacent to pirn 12 and a guide roller 102 is rotatably mounted thereon. A curved bar 104 is located at the end of plate 98 closest to the center of system 36. Disposed between roller 102 and bar 104 is a first guide 106, a knife 108, and a second guide 110 which has a slot in its upper surface to allow the yarn to pass freely therethrough.

A switch arm 111 with a curved loop at its outermost end is located between clothesline guide 110 and knife 108; movement of the arm trips microswitch 113 which is operatively associated by cable 115 with the programming relay circuitry within console 38.

FIGS. 2 and 3 show the structural and functional interrelationships of the components mounted upon right support plate 98. Guide 106 has an upper overhanging portion 106*a* which defines the height of the yarn passing above plate 98, a vertical portion 106*b* and a horizontal portion 106*c*. A ledge 112 extends away from guide 106 to serve as a support for knife 108 which bears lightly against the yarn as it passes beneath overhanging portion 106*a* of guide 106. Screw 114 retains guide 106 fixed to plate 98.

FIG. 4 shows an additional unique feature of the instant invention. An extensible hook 118 is provided near, or on, the front face of chuck 22 to securely grasp the leading end, or the so-called transfer tail, of the yarn to the empty pirn about which the yarn is to be wrapped. Hook 118, which has an inverted-J configuration, emerges from its housing 120 to extend through a radial opening 122 in chuck 22, in response to centrifugal force generated by rotation of chuck 22. In this manner, hook 118 will be fully extended through opening 122 when chuck 22 is brought up to full running

speed. An identical hook (not shown) is provided for chuck **30**.

FIG. **5** presents a top plan view of pirns **10** and **12** with automatic winding system **36** disposed therebetween. Transfer arms **48** and **50** are shown in their normal neutral position wherein they are vertically oriented. A rearwardly extending portion **126** of guide **52** has a small roller **128** secured thereon, and the identical extending portion **130** of guide **60** has a small roller **132** secured thereon. This view also reveals rotatable threaded shaft **134** which advances traverse guide **24** along its reciprocatory path, as well as rotatable threaded drive shaft **136** which advances traverse guide **32** along its reciprocatory path. The drive shafts **134** and **136** are alternatively driven by winder motors **20** and **28** (seen in FIG. **1**), through conventional power transmission means.

FIG. **6** indicates, by way of directional arrows, the arcuate path through which transfer arms **48** and **50** are driven by transfer controller motors **70** and **92**, respectively. Arm **48** is oscillated approximately 100° in the clockwise sense and approximately 100° in the counterclockwise sense from its vertical, neutral position. Arm **50** accomplishes the same angular movement. Such angular movement is necessary for left transfer arm **48** to pick up yarn **14** from pirn **12** and transfer the yarn to pirn **10**; similarly, such angular movement is necessary for right transfer arm **50** to pick up yarn **14** from pirn **10** and transfer the yarn to pirn **12**. Furthermore, FIG. **6** shows microswitch **139** mounted beneath left support plate **76** in operative association with transfer arm **48** and shaft **68**, and microswitch **141** mounted beneath right support plate **98** in operative association with right transfer arm **50** and shaft **90**. These microswitches define the limits of oscillatory movement for transfer arms **48** and **50** in one direction only.

SEQUENCE OF OPERATION

The manner in which left transfer arm **48** and right transfer arm **50** alternatively perform the wasteless transfer of yarn between pirns **10** and **12** is fully described in conjunction with FIGS. **6–10**. The desired rate of through-put for yarn **14** in feet per minute is known and the length of time that it will take for pirn **12** to be filled is then calculated. This time period is then set into timer **44** on control console **38** by rotatably setting knob **46**. Then the winding operation is initiated on pirn **10** while both transfer arms are in their neutral position, as shown in FIG. **6**.

Before the time period has elapsed, timer **44** transmits a control signal via cable **94** to the electromagnetic relay programming circuitry (FIG. **11**) disposed within console **38** to turn on right transfer controller motor **92**. Motor **92** then oscillates shaft **90** and right transfer arm **50** pivotally secured thereto until arm **50** oscillates counterclockwise below the plane of eye **16** and the yarn passing therethrough. Microswitch **141** is tripped when arm **50** reaches its extreme counterclockwise position, and the closure of the first microswitch causes motor **92** to reverse the sense of rotation of shaft **90** and thereby start to pivot arm **50** in the clockwise sense. Microswitch **141** simultaneously transmits an electrical signal to winder motor **28** to start rotation of chuck **30** and bring same up to a predetermined rotational speed.

Arm **50** then pivots almost 200° in the clockwise sense, or 100° past the neutral position of FIGS. **1** and **6**, to the extreme position shown in FIG. **8**. The path of yarn **14**, which moved directly from eye **16** to reciprocating shuttle **24** to pirn **10**, as seen in FIG. **7**, is gradually lengthened as guide **60** on arm **50** moves clockwise until it reaches the limit of its movement. At this limit position for arm **50**, the yarn traces its path from eye **16** to lug **66** on collar **64**, then to roller **132**, roller **102**, on plate **98**, beneath the overhanging surface **106***a* of guide **106**, across knife **108**, into the slot in the upper surface of clothesline guide **110**, around the lower portion of guide **82** on plate **76** and finally to traverse guide **24** and pirn **10**. A microswitch not shown, is tripped when arm **50** reaches its limit position and right transfer controller motor **92** again reverses direction and oscillates arm **50** to its vertical neutral position. Other microswitches (not shown) are actuated when the arm reaches its neutral position (seen in FIGS. **1**, **5** and **6**) to shut off motor **92**.

While transfer arm **50** is moving first counterclockwise and then clockwise from its neutral position, pirn **12**, which is stationary in FIG. **7**, is slowly brought up to running speed by winder motor **28**. As chuck **30** and pirn **12** are brought up to speed, a hook (not shown but identical to hook **118**) is extended from its housing through opening **121**. As chuck **30** rotates, the hook grabs yarn **14** and exerts a sudden force thereon. This force, which opposes the usual tension force in the yarn, pulls the yarn sharply against the knife **108** and cleanly severs the yarn. The severance of the yarn releases the tension exerted upon switch arm **111** and trips microswitch **113** which sends a signal via cable **115** to the electromagnetic relay programming circuit disposed with console **38**.

The programming circuit, in turn, produces an electrical signal that transfers control from winder motor **20** to winder motor **28** whereby pirn **10** stops and pirn **12** is rotated at a suitable windup speed as determined by the tension on the yarn.

The portion of the yarn passing between knife **108**, clothesline guide **110**, traverse **24** and pirn **10**, constitutes the trailing end of the yarn package wound upon pirn **10**. The portion of the yarn passing between knife **108**, guides **106** and **102**, roller **132**, lug **66** and eye **16**, constitutes the so-called "transfer tail" for the package to be subsequently wound upon pirn **12**. The "transfer tail" is the lead portion of the yarn first wound onto the yarn package, such portion being disposed so as to be positively secured to the package but freely available for tying directly to the leading end of a second package. The "transfer tail", which may be between 6 and 30 inches in length, can be easily varied in length in the instant apparatus simply by rotating collar **64** about arm **50**. Rotation of collar **64** alters the position of lug **66**, which changes the entry of the yarn to the chuck, and thus varies the length of the transfer tail when the yarn is severed.

Pirn **10** is then manually removed from chuck **30** by a machine operator who operates lever **26** and an empty pirn is slipped onto the chuck, which is motionless during these operations. During the sequence of operations of arm **50** shown in FIGS. **7** and **8**, left transfer arm **48** remains motionless in its neutral vertical position. FIGS. **9** and **10**, however, illustrate the

same sequence of operations for left transfer arm **48** thereby completing the transfer cycle. Arm **50** remains motionless throughout the sequence of operations shown in FIGS. **9** and **10** for the electromagnetic relay programming circuitry contained within console **38**, and the plurality of microswitches operatively associated therewith, are designed to insure alternate operation of the transfer arms.

In FIG. **9**, left transfer arm **48** has been oscillated by left transfer controller motor **70** almost 100° in the clockwise sense until guide **52** slips beneath yarn **14** which is not being fed to pirn **12** via traverse **32**. Microswitch **139** (FIG. **6**) is tripped when arm **48** reaches its extreme clockwise position, and the tripping of such microswitch causes motor **70** to reverse the sense of rotation of shaft **68** and thereby start to oscillate arm **48** in a counterclockwise sense. Simultaneously, microswitch **139** transmits an electrical signal to winder motor **20** to bring pirn **10** up to a predetermined speed.

Arm **48** then oscillates almost 200° in the counterclockwise sense, or 100° past the neutral position of FIGS. **1** and **6**, to the extreme position shown in FIG. **10**. The path of yarn **14**, which moved directly from eye **16** to reciprocating shuttle **32** to pirn **12**, as seen in FIG. **9**, is gradually lengthened by the urging of guide **52** on arm **48** as the arm moves clockwise until it reaches the limit of its movement. At this limit position for arm **48**, the yarn traces its path from eye **16** to lug **58** on collar **56**, then to roller **128**, roller **80** on plate **76**, beneath the overhanging surface of guide **84**, across knife **86**, into the slot in the upper surface of clothesline guide **88**, across knife **86**, into the slot in the upper surface of clothesline guide **88**, around the lower portion of bar **104** on plate **98**, and finally to traverse **32** and pirn **12**. A microswitch, not shown, is tripped when arm **48** reaches the limit position of FIG. **10**; at this point, a signal is sent to left controller motor **70** to reverse same and return arm **48** to its vertical neutral position.

While transfer arm **48** is moving first clockwise and then counterclockwise from its neutral position, pirn **10**, which is stationary in FIG. **9**, is slowly brought up to running speed by motor **20**. When chuck **22** and pirn **10** are up to speed, hook **118** is extended from its housing **120** through opening **122**, as shown in FIG. **4**. As chuck **22** rotates, hook **118** grabs yarn **14** and exerts a sudden force thereon. This force, which opposes the usual tension force in the yarn, pulls the yarn sharply against knife **86** and cleanly severs the yarn.

When the yarn is severed, the tension normally exerted upon switch arm **89** is released and microswitch **91** is tripped. The tripping of microswitch **91** produces an electrical signal that transfers control from winder motor **28** to winder motor **20** whereby pirn **10** stops and pirn **12** is rotated at a suitable wind-up speed as determined by the tension on the yarn. Other microswitches (not shown) are actuated when the arm reaches its neutral position to shut off the motor **90**.

The portion of the yarn passing between knife **86**, guide **84**, rollers **80** and **128**, lug **58** and eye **16** comprises the so-called "transfer tail" for the package to be subsequently wound upon pirn **10**. The length of the transfer tail is varied simply by rotating collar **54** about arm **48**. After the severing operation, pirn **12** is then manually removed from chuck **30** by the machine operator, who releases lever **34**, and an empty pirn is slipped onto chuck **30** while the cycle of operation is repeated and pirn **10** is receiving the yarn to be wound.

FIG. **11** sets out, in schematic fashion, the description of the interrelationships between mechanical and electrical components set forth in FIGS. **1–10**. For purposes of illustration, let us assume that yarn **14** is being wound onto pirn **10** as it is rotatably driven by left winder motor **20** and that pirn **12** is stationary for the power to motor **28** has been shut off. Transfer arms **48** and **50** assume the vertical neutral position of FIGS. **1**, **5** and **6** for microswitches (not shown) are tripped when this position is attained and shut off the power to left and right transfer controller motors **70** and **92**, respectively. Knob **46** on timer **44** is then set to the desired size and/or weight to be wound upon pirn **10**.

When the predetermined time period expires, timer **44** sends a signal through electromagnetic relay programming circuit **47** to a first relay for the right transfer controller motor **92**. This signal starts motor **92** in a counterclockwise direction and drives right transfer arm **50** in the same direction via shaft **90**. Arm **50** moves counterclockwise until a microswitch **141** is tripped when the arm reaches the extreme position, as indicated in FIG. **6**. The tripping of microswitch **141** energizes relay circuitry (not shown) which reverses the direction of travel of arm **50** and starts winder motor **28** which brings pirn **12** up to a predetermined rotational speed.

Upon reversal, arm **50** picks up the running end of yarn **14** as the yarn moves from guide **16** to traverse **14** to pirn **10**. This clockwise movement continues for an arc of substantially 200° until the yarn is brought through guide **106** to bear against knife **108** (FIG. **3**). A microswitch, not shown, which defines the limit of movement of arm **50**, is tripped and arm **50** returns to its neutral position.

When yarn **14** is severed by knife **108** due to the reversal of tension in the yarn as the hook on chuck **30** grabs the yarn, the tension on switch blade **111** for microswitch **113** is released. Consequently, microswitch **113** is tripped and programming relay circuit **47** sends out a signal which switches right winder motor **28** from start to run power supply and stops left winder motor **20** by deenergizing the relay circuitry operatively connected to motor **20**.

Programming relay circuit **47** also provides a signal to reverse the direction of travel of arm **50**. Arm **50** is stopped in its neutral position by another microswitch (not shown) which removes power from motor **92**. This sequence of events covers only one half of the complete transfer cycle; however, the other half of the cycle utilized for transfer arm **48** to transfer yarn **14** from pirn **12** back to pirn **10** is substantially similar, and is omitted in the interest of clarity.

Since numerous modifications of the instant invention may be made without departing from the scope thereof, such as in the number and positioning of the microswitches, the configuration of the guides for the yarn, the orientation of the knives, etc., it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative in nature and not in a limiting sense.

What is claimed is:

1. An automatic wasteless transfer precision winder apparatus for winding up continuously advancing yarn, said apparatus comprising:

a. a pair of spaced chucks with pirns operatively mounted and connected to independent drive means for rotating said pirns,

b. guide means for guiding the yarn to one of said pair of pirns,

c. automatic movable transfer yarn means comprising a pair of transfer arms for alternately transferring the yarn from a full pirn to an empty pirn, each arm having a rotatively adjustable collar with a peripherally protruding lug guide means nearer one end of each transfer arm, and a cone-shaped guide means nearer the opposite end of each transfer arm, means for moving said transfer arm whereby said cone-shaped guide means intersects the path of yarn movement for alternate transfer of the yarn from the full pirn to the empty pirn upon a predetermined length of yarn being wound on the full pirn, said protruding lug guide means being so positioned as to control the length of a transfer tail upon transfer of the advancing yarn from said full pirn, a severing means for severing said advancing yarn upon transfer of yarn from said full pirn to said empty pirn, and

d. automatically electrically sequencing circuitry means for interrelating said advancing yarn with said drive means and said yarn transfer means.

2. The winder apparatus of claim 1 wherein the drive means comprise individual motors, said yarn transfer means comprise individual motors, and a power supply means for said motors, said sequencing circuitry means energizing said empty pirn drive motor and deenergizing said full pirn drive motor upon reaching a predetermined length of yarn on said full pirn.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,688,998 Dated September 5, 1972

Inventor(s) Robert D. Carr, Fred W. Lenoir, Ora L. Reedy

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 7, "alternatively" should be --alternately--.

Column 3, line 20, insert --of-- after "length".

Column 5, line 15, "alternatively" should be --alternately--.

Column 5, line 41, "alternatively" should be --alternately--.

Column 7, line 12, "not" should be --now--.

Column 8, line 33, "traverse 14" should be --traverse 24--.

Signed and sealed this 6th day of February 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents