United States Patent

Hori et al.

[15] **3,695,529**

[45] **Oct. 3, 1972**

[54] **TRAVERSE DEVICE IN PACKAGE WINDING APPARATUS**

[72] Inventors: **Kikuo Hori; Hiroshi Yamada; Hiroshi Itoh,** all of Matsuyama, Japan

[73] Assignee: **Teijin Limited,** Osaka, Japan

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[52] **U.S. Cl.**.....**242/26.3,** 242/26.43
[51] **Int. Cl.** **B65h 54/36**
[58] **Field of Search**.....242/26.1, 26.2, 26.3, 26.4, 242/26.41, 26.43, 26.45; 57/95, 98, 99

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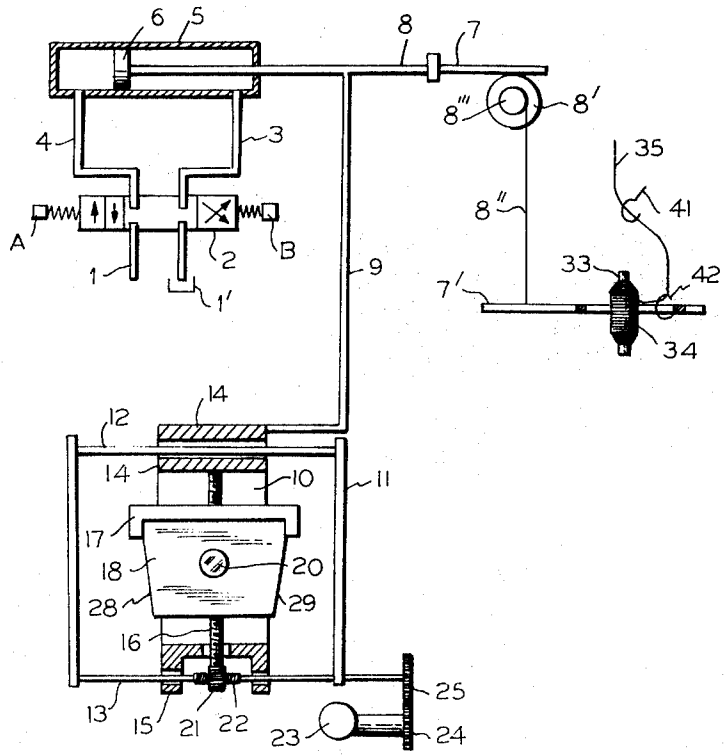
Primary Examiner—Werner H. Schroeder
Attorney—Wenderoth, Lind & Ponack

[57] **ABSTRACT**

Traverse device for a package winding apparatus whereby the mode of yarn traversing motions in the traversing mechanism of the package winding apparatus is controlled by the relative motion, interlocked with said traversing mechanism, of a pattern member and a photo-electric system, and the mode of yarn traversing motion and consequently the build-up of a package is accurately controlled to a desired shape.

6 Claims, 18 Drawing Figures



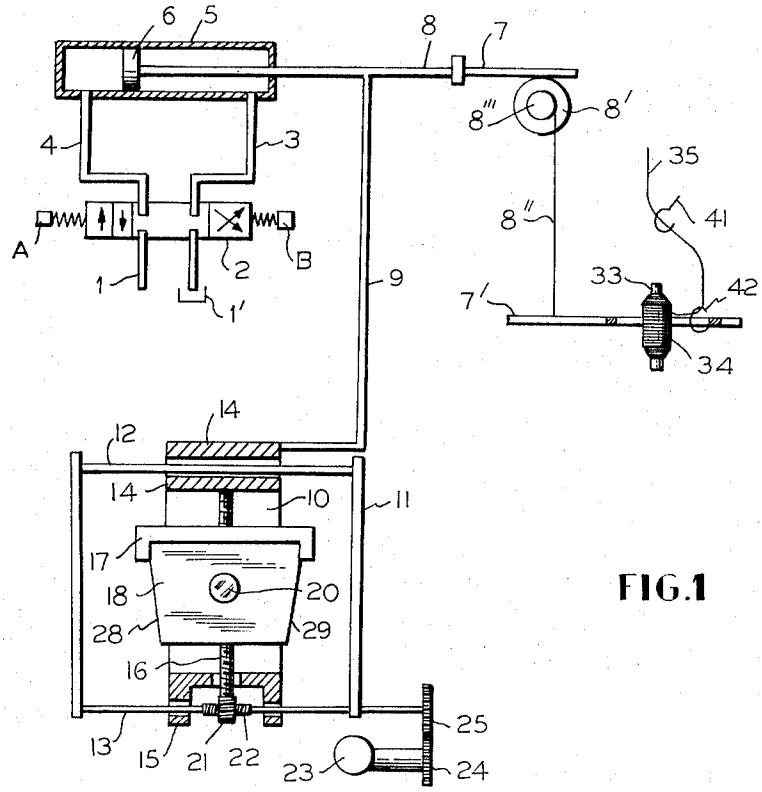


FIG. 1

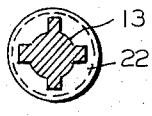


FIG. 2

INVENTORS
KIKUO HORI
HIROSHI YAMADA
HIROSHI ITOH

BY Wenderoth, Lind & Ponack
ATTORNEYS

FIG. 3A

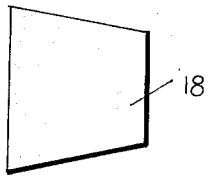


FIG. 3B

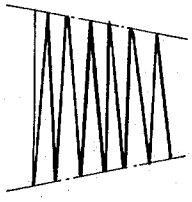


FIG. 3C

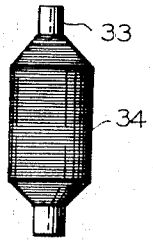


FIG. 4A

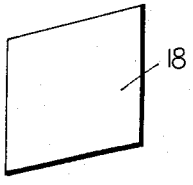


FIG. 4B

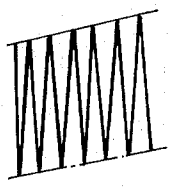


FIG. 4C

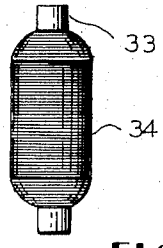


FIG. 5A

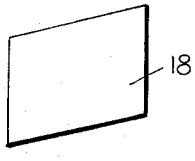


FIG. 5B

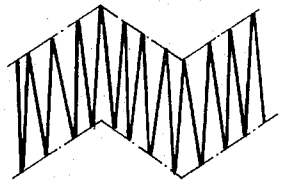


FIG. 5C

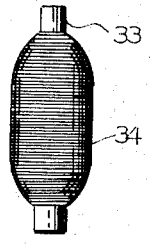


FIG. 6A

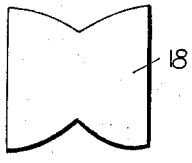


FIG. 6B

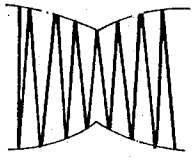
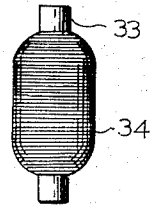


FIG. 6C



INVENTORS
KIKUO HORI
HIROSHI YAMADA
HIROSHI ITOH

BY Wenderoth, Lind & Ponack
ATTORNEYS

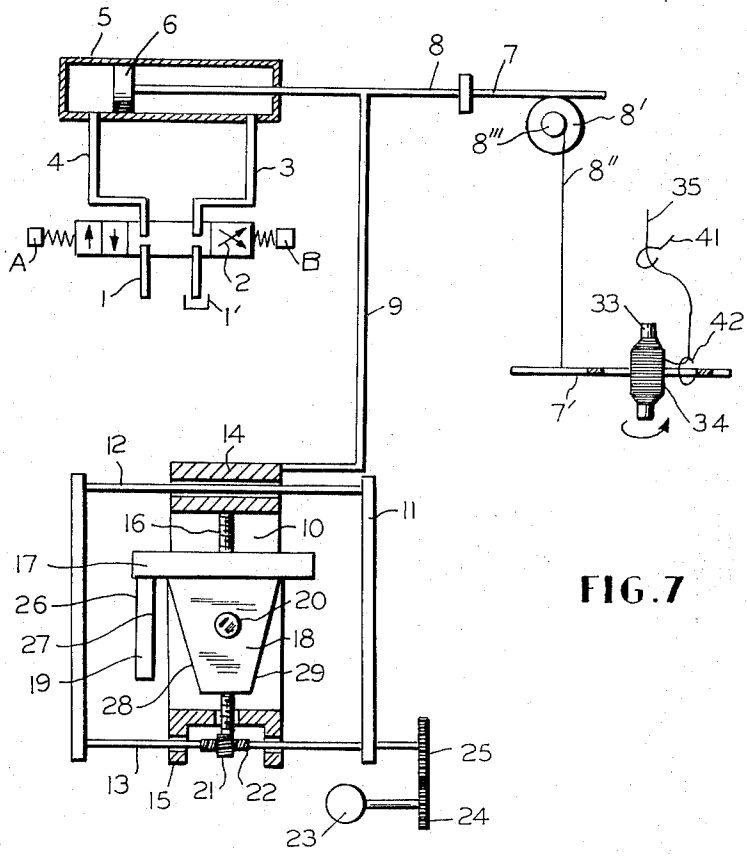


FIG. 7

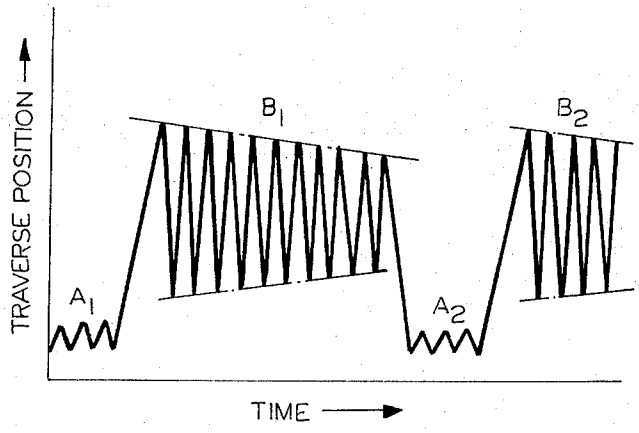


FIG. 8

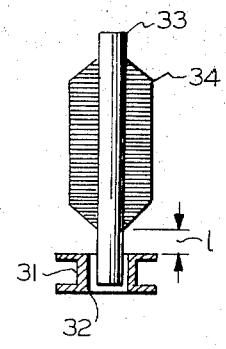


FIG. 9

INVENTORS
KIKUO HORI
HIROSHI YAMADA
HIROSHI ITOH

BY Wenderoth, Lind & Ponack
ATTORNEYS

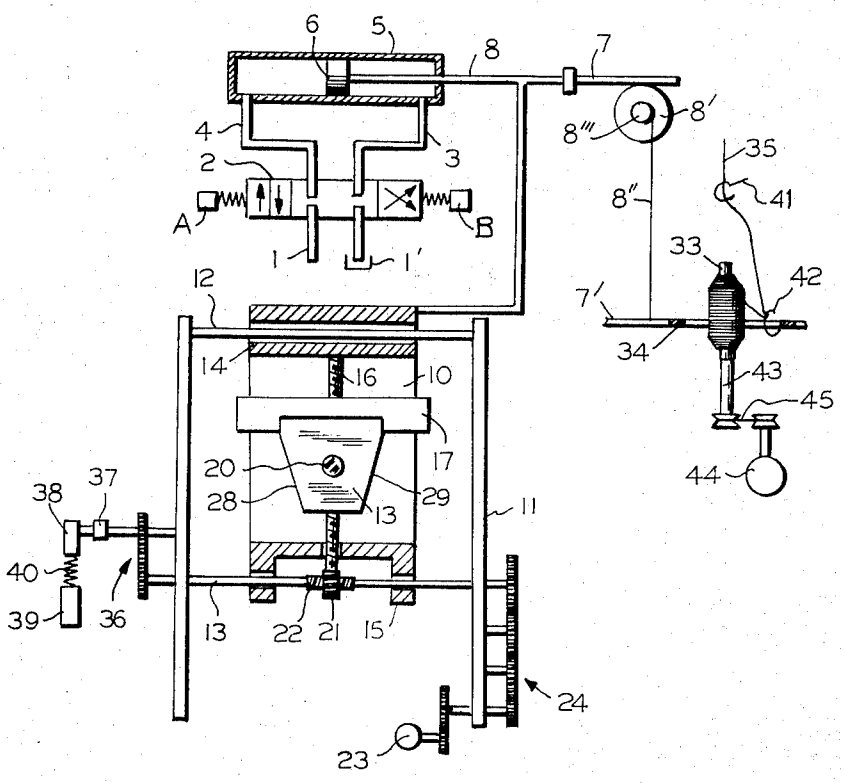


FIG. 10

INVENTORS
KIKUO HORI
HIROSHI YAMADA
HIROSHI ITOH

BY Wenderoth, Lind & Ponack
ATTORNEYS

TRAVERSE DEVICE IN PACKAGE WINDING APPARATUS

The present invention relates to a traverse device for a package winding apparatus and more particularly to a traverse device for a package winding apparatus whereby the mode of yarn traversing motions in a traversing mechanism of a package winding apparatus is controlled by the relative motion, interlocked with said traversing mechanism, of a pattern member and a photoelectric system, and the mode of yarn traversing motion and consequently the build-up of a package is accurately controlled to a desired shape.

It is well known that in winding yarn with a textile machine, whereby yarn or fibers are wound, such as spinning machines, fly frames, twisters, and drawing machines, various types of wound-up packages are produced by altering the traverse position and traverse length in the traverse device in the course of the package winding. As one of the traverse devices to control traverse mode is known a device whereby a pair of controlling plates connected to a piston which gives a traverse bar up-and-down motion and a pair of controlling plates which alter their positions according to the progress of traversing motion between the pair of controlling plates, engage with each other to alter the traverse position and/or traverse length.

However, in such a traverse device the mode of traverse is mechanically controlled, and so there is naturally a limitation to possible traverse modes and it has a drawback that the structure is generally involved and complicated.

Further it is desirable that to alter the shape of the wound package according to the type, size, amount of wound yarn, the mode of traverse in the traverse device be altered. In these well-known traverse devices, such operations for alteration are very troublesome and many parts must be replaced to alter the traverse mode.

Further it is very often desired in package winding that on the same bobbin or a plurality of bobbins or spools on the same spindle, different types of traversing operations spaced from each other be carried out to form a plurality of winding parts or sections spaced from each other.

For instance, it is essential that in processing and winding yarn with draw-twisters, ring twisters, etc., initially wound yarns, which are inconsistent in the number of twist and other properties at the time of string-up or the beginning of package winding, be removed from the winding section for normal yarn and wound separately.

For this reason, these preliminary windings have been wound on a waste spool or a preliminary winding section of a bobbin via travellers set to the traverse ring positioned lower than the normal yarn winding section, and after the yarn becomes normal and uniform, the traverse ring is pushed up manually or automatically to the normal yarn winding section of the bobbin to allow normal package winding.

However, in the prior art it is difficult to carry out traversing motions of the preliminary windings and to prevent sloughing at the winding section for the preliminary windings.

It is the object of this invention to provide a traverse device for a package winding apparatus whereby the mode of traverse is controlled by the relative movement of a pattern member and a photoelectric system interlocking with said traversing mechanism such that the traverse mode, that is, the shape of the wound package is easily and optionally formed.

It is another object of the present invention to provide a traverse device whereby the mode of traverse is easily altered only by a change in pattern plates.

It is further another object of the present invention to provide a traverse device whereby it is possible to carry out a plurality of traversing operations and to form a plurality of sloughless winding sections spaced from each other.

It is a further object of the present invention to provide a package winding apparatus which accelerates the number of revolutions of a spindle at the beginning of winding and decelerates it at the end of winding relative to the mode of traverse.

The present invention relates to a traverse device for a package winding apparatus comprising a cylinder provided with a piston capable of making reciprocating motions by fluid pressure, a traversing mechanism actuated by the reciprocating motions of said piston, a change over valve for changing the running direction of the fluid fed to the cylinder, a photoelectric system consisting of a light source and a light-receiving mechanism, a pattern member determining traverse length adapted to cross the light paths of the photoelectric system, an oscillating mechanism to permit said pattern member or said photo-electric system to make reciprocating motions, interlocking with said piston, and a driving mechanism to give reciprocating motions to the pattern member attached to said oscillating mechanism movable in a direction intersecting the piston reciprocating direction at right angles or to the photoelectric system whereby said change-over valve is actuated by a signal caused to generated at the edge of the pattern member in the photoelectric system by the relative motion between the pattern member and the photo-electric system.

Preferred embodiments will be described below with reference to the accompanying drawings.

FIG. **1** is a simplified arrangement diagram for explaining the traverse device of this invention.

FIG. **2** is a side view showing the relation between oscillating spline shaft **13** and worm **22** in FIG. **1** partly cut away.

FIGS. **3A** to **6A** are a plan views illustrating various shapes of pattern plates.

FIGS. **3B** to **6B** are diagrams describing the mode of traverse obtained by using pattern plates having the shapes in FIGS. **3A** to **6A**. As abscissa is plotted time and as ordinate traverse length.

FIGS. **3C** to **6C** show the build-ups of packages formed by the mode of traverse as shown in FIGS. **3B** to **6B**.

FIGS. **7** is a simplified arrangement diagram for explaining another embodiment of the traverse device of the present invention.

FIG. **8** is a diagram explaining the mode of traverse obtained by using the traverse device in FIG. **7**.

FIG. **9** is a cross sectional view illustrating the shapes of a package formed by the mode of traverse in FIG. **8**.

FIG. **10** is a simplified arrangement diagram for explaining another device, or package winding apparatus of the present invention.

In FIG. 1 pressure fluid supplied from conduit (1) is passed through either conduit 3 or 4 by actuating an electro-magnetic valve 2 and is selectively fed into both sides of piston 6 of cylinder 5. When solenoid A of electromegnetic valve 2 is excited, pressure fluid supplied from conduit 1 is fed into the left-hand side of cylinder 5 via conduit 4 to move piston 6 in the right direction, whereas when solenoid B of electromagnetic valve 2 is excited, pressure fluid supplied from conduit 1 is fed into the right-hand side of cylinder 5 via conduit 3 to move piston 6 in the left-hand direction. The fluid in cylinder 5 present in piston reciprocating direction is discharged into storage tank 1' via pipe 3 or 4 and electromagnetic valve 2.

To said piston 6 is connected piston rod 8 and to piston rod 8 is connected traverse bar 7 through a joint. The reciprocating motions of piston 6 are transmitted to the traverse bar 7. The traverse bar 7 gives pulley 8' reciprocating rotary motion to impart up-and-down motion to a ring rail 7' hung by belt 8'' from pulley 8''' disposed concentrically with pulley 8'. To the ring rail 7' are attached rings. The yarn is wound on bobbin 33 via traveller 42 mounted on the ring while making traversing motions according to that of the ring rail 7', that is, that of the piston rod.

The combination of cylinder 5 provided with piston 6 capable of making reciprocating motions by fluid pressure, traverse bar 7 actuated by reciprocating motion of piston 6, and a change-over for reversing the direction of the fluid fed into the cylinder 5 is well known in a yarn traverse device.

In the present invention, a photoelectric system comprising a light source and light-receiving mechanism and a pattern member for determining traverse position and traverse length are arranged in a relative position such that light paths in the photoelectric system are intercepted by the pattern member and that either the pattern member or the photoelectric system makes reciprocating motions while interlocking with the piston and linear motion at right angles to the piston running direction. For this purpose, to an oscillating mechanism making reciprocating motion while interlocking with the piston is mounted a pattern member or a photoelectric system in a direction intersecting at right angles the piston running direction and a driving mechanism for giving reciprocating motion to the pattern member or the photoelectric system.

The pattern member consists preferably of a pattern holder and a pattern plate or plates attached thereto. By replacing a pattern plate, one can easily change the mode of traverse.

In FIG. 1 the oscillating mechanism and driving mechanism consist of two shafts 12 and 13 attached to frame 11 of the machine, bracket 10 for holding the pattern member being slidably attached to shafts 12 and 13, worm 22 slidably mounted to shaft 13 and rotatably attached to it according to its rotation, screwed shaft 16 rotatably attached to pattern member bracket 10, worm wheel 21 meshing with worm 22, attached to the tip of the screwed shaft 16, and pattern member 17 and 18 meshing with shaft 16 and movable up and down according to the revolutions thereof.

In FIG. 1, to rod 9 connected with piston rod 8 is fixed pattern member bracket 10. This bracket is slidably movable to the left and right through slide bearings 14 and 15 over shafts 12 and 13 fixed to frame 11 of the machine. To bracket 10 is attached screwed shaft 16 at right angles thereto. Pattern holder 17 having a screw meshing with screwed shaft 16 is adapted to move up-and-down along screwed shaft 16, but does not rotate therewith. To the pattern holder 17 is fixed pattern plate 18 of any shape. Photoelectric system consisting of light source and light-receiving mechanism 20 with pattern plate 18 interposed therebetween is disposed in a direction perpendicular to the face of pattern plate 18. The light source behind the plate is not shown. The light-receiving mechanism may be photoelectric cells, photomultipliers, phototransistors, etc. Screwed shaft 16 has worm wheel 21 attached to its lower tip and is rotated by being worm 22 attached to shaft 13. Shaft 13 is rotated by motor 23 through gears 24 and 25.

Pattern plate 18 serves the purpose of intercepting the light from the light source entering light-receiving mechanism 20. Suppose piston 6 moves from left to right to make pattern plate 18 move from left to right. When the left-hand edge of pattern plate 18 reaches a line connecting the light source and photoelectric cell 20, light enters photoelectric cell 20 and solenoid B is excited to move piston 6 and pattern plate 18 from right to left. During this movement, photoelectric cell 20 is intercepted by pattern plate 18 until the right-hand edge 29 of pattern plate 18 reaches a line connecting the light source and photoelectric cell 20. The cell receives light again and solenoid A is excited to permit piston 6 and pattern plate 18 to move from left to right. By the repetition of such motions, traverse bar 7 is caused to make traversing motions.

On the other hand, pattern holder 17 and pattern plate 18 are caused to move upwardly perpendicular to the oscillating direction of the bracket, independently of the above-mentioned traversing motions, by screwed shaft 16 rotated by motor 23 through gears 24 and 25, driving shaft 13, worm 22 and worm wheel 21. Therefore, traverse length and position vary with the contours of edges 28 and 29 of pattern plate 18.

When a bobbin is full, driving shaft 13 is reversely rotated at high speeds by a known reversing mechanism. Screwed shaft 16 is thus reversely rotated and pattern plate 18 and pattern holder 17 are returned to the traverse starting point.

In the present invention, an electric circuit such that electromagnetic valve 2 is operated by the photoelectric system is obvious to one skilled in the art.

Pattern plate 18 of any material such as translucent synthetic resin plates, metal plates, paper, etc. can be used.

Further in the above described embodiment, the pattern plate 18 was moved, and the photoelectric system was maintained stationary. However, the pattern plate, can be allowed to stand still and the photoelectric system may be caused to move as described above with regard to the pattern plate. In short, relative motions may be made between pattern plate 18 and photoelectric cell 20.

According to the apparatus of this invention, the mode of traverse in the traversing mechanism can accurately be controlled by the shapes of the edges of the pattern plate and the distances therebetween. Further by the selective choice of a pattern plate size and

shape, traverse of any mode is possible and the build-up of a yarn package of any shape is obtainable. Moreover by an extremely simple procedure such as replacement of a pattern plate and change in speeds of relative motion between the pattern plate and the photoelectric cell, one can easily change the mode of traverse.

Pattern plate **18** mounted to pattern holder **17** may be of the various shapes as shown in FIGS. **3A** to **6A**. By use of the pattern plates in FIGS. **3A**, **4A**, and **6A**, the modes of traverse in FIGS. **3B**, **4B**, and **6B** and packages **34** of shapes as shown in FIGS. **3C**, **4C**, and **6C** are obtained. Further by use of pattern plate **18** as shown in FIG. **5A** and by means of driving shaft **13** being reversely rotated at specified intervals, the mode of traverse as shown in FIG. **5B** and the build-up of the package in FIG. **5C** are obtained. In this case, the reverse rotation of driving shaft **13** may be effected by disposing two photoelectric systems and preferably limit switches to determine the locality of the reciprocating motions at the top and bottom of the pattern member to actuate a reversible rotary mechanism attached to motor **23** by the signals from the photoelectric systems or limit switches.

In one embodiment of the present invention, the pattern holder can support a plurality of pattern plates spaced from each other.

In FIG. **7**, a plurality of pattern plates **18** and **19** are set to pattern holder **17** spaced from each other. In this diagram, common numerals for common elements with FIG. **1** are used to avoid overlapping.

Main pattern plate **18** for determining the build-up of normal yarn on a bobbin and sub-pattern plate **19** for determining the build-up of waste yarn are mounted to pattern holder **17**. Photoelectric cell **20** is disposed where light is intercepted by either main pattern plate **18** or sub-pattern plate **19**.

Main pattern plate **18** and sub-pattern plate **19** serve the purpose of intercepting a light from light source (not shown) entering photoelectric cell **20**.

Now, as shown in FIG. **9**, when at the start of winding, initially wound non-uniform yarn **31** is wound onto an off-standard yarn winding part such as waste spool **32**, piston **6** is moved to the right and ring rail **7'** with rings attached thereto is lowered to the position of waste spool **32**. Pattern member bracket **10** is thus transferred to the right and light to photoelectric cell **20** is intercepted by sub-pattern **19**. When piston **6** and sub-pattern **19** move from left to right and the left-hand edge of the latter reaches a line between the light source and photoelectric cell **20**, light enters the photoelectric cell, solenoid B is excited, the piston moves from right to left, and the sub-pattern plate moves from right to left. During this movement light is intercepted from photoelectric cell **20**. When the plate **19** moves to the left and right-hand edge **27** of sub-pattern plate **19** reaches a line between the light source and photoelectric cell **20**, the cell receives light again to excite solenoid A. In like manner sub-pattern plate **19** moves from left to right together with piston **6**. By the repetition of such motions, ring rail **7'** is given traversing motions of small traverse length at the position of waste spool **32** as shown by A_1 in FIG. **8**.

Thus preliminary windings are built on waste spool **32** in good order and if uniform yarn begins to appear, the excitement of solenoid A is stopped one time by sending an optional signal. As a result, regardless of photoelectric cell **20** receiving light at the right-hand edge of sub-pattern plate **19**, piston **6** moves left and ring rail **7'** also moves to the part **34** of bobbin **33** to wind regular yarn as shown in FIG. **8**. And at the same time pattern member bracket **10** moves left resulting in intercepting of light to photoelectric cell **20** by main pattern plate **18**. In like manner as for sub-pattern plate **19**, at both edges **28** and **29** of main pattern plate **18** photoelectric cell **20** receives light and solenoids A and B are excited to cause piston **6** to move and a reciprocating motion to be imparted to ring rail **7'** thereby causing traversing motion for the regular building of a package. That is, in FIG. **8**, traversing motions of A_1 are changed into those of B_1. When they move from A_1 to B_1, a given length of transfer tail is wound on space λ between the lower end of regular yarn winding bobbin **34** and the upper end of waste spool **32** as shown in FIG. **9**.

On the other hand, like sub-pattern plate **19**, main pattern plate **18** makes up-and-down motions independently of the above traversing motions due to screwed shaft **16** being rotated by motor **23** through gears **24** and **25**, driving shaft **13**, worm **22**, and worm wheel **21**. Therefore, the traverse length varies according to the shapes of edges **28** and **29** of main pattern plate **18**.

When the building of yarn is finished and a bobbin is full, the excitement of solenoid B is given one rest. Thus, when piston **6** moves right because the photoelectric cell receives light at left-hand edge **28** of main pattern plate **18**, solenoid B is not excited. Accordingly, ring rail **7'** goes down to waste spool **32** as shown in FIG. **9**. And at the same time pattern member bracket **10** moves right, and main pattern plate **18** and sub-pattern plate **19** descent to permit sub-pattern plate **19** to intercept light from photoelectric cell **20**. Thus while by the previously described procedure a small traverse length is obtained by sub-pattern plate **19**, the apparatus stops. At thus time, while the yarn is allowed to stand on the apparatus, doffing is carried out by cutting off the yarn extending over waste spool **32** and bobbin **33** and an empty bobbin is replaced. AFter all the spindles have been filled with empty bobbins, the operation is started and the traversing motions of small traverse length as shown in FIG. **8** A_2 are made until standard yarn has appeared to permit the preliminary windings to be wound onto waste spool **32** in good order. Thus a transfer tail is formed while ring rail **7'** shifts to standard yarn winding portion **34** of the bobbin and traversing motions for standard yarn B_2 are made. This process is repeated hereinafter.

According to the apparatus of the present invention, since the initially wound yarn on the waste spool is in good order by traversing motions without sloughing, the start-up of all the spindles for the building of packages can smoothly be accomplished and neither staining nor the breakage of the yarn occurs. Hence continuous operations are affectively possible until the waste spool is full and the apparatus greatly contributes to the enhancement of efficiency and increase in yields.

Further the shifting from the waste yarn winding portion to the standard yarn winding portion is mechanically and simultaneously carried out; and consequently, the length of a transfer tail and wind pitch become constant, resulting in the production of package easily reproducible in the subsequent processings.

In FIG. 7, to a pattern holder are attached main pattern plate **18** and sub-pattern plate **19** spaced from each other. Instead, a plurality of main pattern plates may be set to the pattern holder to build a plurality of yarn build-ups spaced from each other on the same bobbin.

The present invention provides a device comprising a cylinder provided with a piston capable of having a reciprocating action by fluid pressure, a traversing mechanism actuated by the reciprocating action of said piston, a change-over valve for changing over the feed direction of fluid to the cylinder, a photoelectric system consisting of a light source and a light-receiving mechanism, a pattern member for determining traverse length in the traversing mechanism, so arranged as to intercept the light paths of the photoelectric system, an oscillating mechanism to permit said pattern member or said photoelectric system to interlock with said piston, a driving mechanism to allow the pattern member or the photoelectric system to move up and down in a direction perpendicular to the piston running direction, a spindle holding a bobbin upon which yarn is wound for rotating the bobbin, a mechanism for driving the spindle and a control mechanism for controlling the number of rotations of the spindle driving mechanism whereby said control mechanism for the rotation of the spindle is driven with drive source common with the driving mechanism of the pattern member or the photoelectric system so as to synchronize with the up-and-down motions of said pattern member or photoelectric system.

In the device of the present invention, the combination of the spindle, spindle-driving mechanism and traversing mechanism described above in well-known. The control mechanism for spindle rotation driven by a driving source common with the driving mechanism for the pattern member or photoelectric system in the traverse device is so disposed as to synchronize with the mode of traverse formed by the relative motion between the pattern member and the photoelectric system and to control the number of rotations of the spindle.

In the device of this invention the oscillating mechanism and driving mechanism for forming the mode of traverse have been mentioned above. The control mechanism for spindle rotation consists preferably of a power transmission gear fitted to a driving shaft having a worm in the driving mechanism for the pattern member; a reduction gear driven through the power transmission mechanism; a cam driven through said reduction gear and a differential transformer provided with a core having a reciprocating action by the rotation of the cam.

In FIG. **10** (Parts common with those in FIG. **1** are expressed in common numerals.), the construction and function of cylindrical mechanism, traverse mechanism, change-over valve, photoelectric system, pattern member, oscillating mechanism and pattern-member-driving mechanism are identical with those of FIG. 1.

Cam **38** for controlling the speed of spindle rotation is given rotation from the left-hand edge of shaft **13** through gear train **36** and reduction gear **37**. The displacement of core **40** of differential transformer **39** varies with rotation of cam **38**. The output of differential transformer **39** is thus varied and by use of this signal the speed of rotation of driving motor **44** for the spindle is controlled. The control of speed of rotation of the driving motor **44** by use of the above-mentioned differential transformer **39** is well-known.

Pattern plate **18** ascends by the rotation of screwed shaft **16** while ring rail **7'** makes traversing motions by the action of electro-magnetic valve **2**, piston **6**, oscillating bracket **10**, pattern member **18** and photoelectric cell **20**. The speed of rotation of screwed shaft **16** is adjustable by the replacement of the change gear of feed gear train **24** for the pattern plate. Thus the traversing motions transmitted to ring rail **7'** resemble the shape of pattern plate **18**. Yarn **35** passes through guide **41** and ring **42** mounted on the ring rail **7'** hanging from traverse bar **7** and is wound on bobbin **33** held on spindle **43** and rotated with spindle driving belt **45** while making traversing motions.

In the winding operations if the amount of the up-and-down motion of pattern plate **18** for the time when a bobbin becomes full is rendered constant and the screw pitch of screwed shaft **16** is constant, the number of rotations of shaft **16**, that is the number of rotations of shaft **13**, will be constant and the rotational displacement of cam **38** for controlling the number of rotations of the spindle will always be constant. For instance, suppose when with a rotational displacement of cam **38** of 300° one bobbin becomes full, a control signal for the rotational speed of the spindle is given. If gear train **36** and reduction gear **37** are adjusted so that cam **38** is displaced through 300° by the number of rotations of shaft **13** in accordance with the amount of movement of the pattern plate, the rotational speed of the spindle can receive a similar control irrespective of the length of time when the bobbin becomes full. That is, the changes in the rotational speed of a spindle corresponding to a certain displacement of pattern plate **18** are constant if the shape of cam **38** is constant irrespective of form of the products and the drawing and take-up speeds.

Especially in warp winding wherein package diameter and the displacement of the pattern have an almost constant relation with each other, the relation between package diameter and the rotational speed of the spindle are always constant, and even when drawing and take-up speeds are altered, there is no need to alter the rate of variation of spindle rotational speed. This is very convenient for operations.

Hence in the device of the present invention, it is possible to wind yarn on a bobbin in an optional shape of package winding and to make operations easier by decreasing the number of rotations of the spindle with an increase in the build-up diameter of the yarn.

We claim:

1. A traverse device for a yarn package winding apparatus comprising a cylinder having a piston reciprocatingly movable therein under action of fluid pressure; a traversing mechanism connected to said piston; a source of pressure fluid alternately connectable to opposite ends of said cylinder; a change-over valve operatively associated with said cylinder and said source for causing said fluid to alternately be fed to said opposite ends of said cylinder; a photoelectric system including a light source and a light receiving mechanism mounted to receive light from said light source; a pattern member operatively positioned to

selectively intercept said light; an oscillating mechanism means interlocking one of said photoelectric system or said pattern member with said piston to reciprocate therewith; and driving mechanism means connected to said one of said photoelectric system or said pattern member to cause said one of said photoelectric system or said pattern member to move in a direction perpendicular to the direction of reciprocation of said piston; said change-over valve being actuable by signals produced by the edges of said pattern member allowing said light from said source to be received by said light receiving mechanism.

2. A device as claimed in claim 1, wherein said pattern member comprises a pattern holder attached to said oscillating mechanism means and at least one pattern plate connected to said pattern holder.

3. A device as claimed in claim 1, wherein said oscillating mechanism means comprises a frame, a pair of shafts connected to said frame, and a pattern member bracket attached to said pattern member and slidably mounted on said shafts; and said driving mechanism means comprises a worm slidably mounted along one of said shafts, a worm wheel mounted to engage said worm, a threaded shaft attached at one end thereof to said worm wheel and threadably engaged with said pattern member bracket; whereby reciprocation of said piston causes reciprocation of said pattern member, and rotation of said one of said shafts causes said movement of said pattern member in said direction perpendicular to said direction of reciprocation of said piston.

4. A device as claimed in claim 1, wherein said pattern member comprises a pattern holder and a plurality of pattern plates spaced from each other and attached to said pattern holder.

5. A yarn package winding apparatus comprising a cylinder having a piston reciprocatingly movable therein under action of fluid pressure; a traversing mechanism connected to said piston; a source of fluid pressure alternately connectable to opposite ends of said cylinder; a change-over valve operatively associated with said cylinder and said source for causing said fluid to alternately be fed to said opposite ends of said cylinder; a photoelectric system including a light source and a light receiving mechanism mounted to receive light from said light source; a pattern member operatively positioned to selectively intercept said light; an oscillating mechanism means interlocking one of said photoelectric system or said pattern member with said piston to reciprocate therewith; driving mechanism means connected to said one of said photoelectric system or said pattern member to cause said one of said photoelectric system or said pattern member to move in a direction perpendicular to the direction of reciprocation by said piston; a spindle holding a bobbin thereon and rotatable to wind yarn on said bobbin; a spindle driving mechanism operatively positioned to drive said spindle; spindle rotation control mechanism means connected to said spindle driving mechanism for controlling the number of rotations thereof and a driving source means operatively connected to said driving mechanism means and said spindle rotation control mechanism means for correlating said rotations of said spindle with said reciprocation of said piston.

6. An apparatus as claimed in claim 5, wherein said oscillating mechanism means comprises a frame, a pair of shafts connected to said frame, and a pattern member bracket attached to said pattern member and slidably mounted on said shafts; said driving mechanism means comprises a worm slidably mounted along one of said shafts, a worm wheel mounted to engage said worm, a threaded shaft attached at one end thereof to said worm wheel and threadably engaged with said pattern member bracket; whereby reciprocation of said piston causes reciprocation of said pattern member, and rotation of said one of said shafts causes movement of said pattern member in said direction perpendicular to said direction of reciprocation of said piston; and said spindle rotation control mechanism means comprises a gear train power transmission mechanism fixed to the end of said one of said shafts, a gear reduction mechanism connected to said gear train power transmission mechanism and driven thereby, a cam mounted to be rotated by said gear reduction mechanism, and a differential transformer having a core adapted to be moved by said cam upon rotation thereof.

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