(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 752 384 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
08.01.1997 Bulletin 1997/02

(51) Int. Cl.[6]: **B65H 54/28**

(21) Application number: **96110606.9**

(22) Date of filing: **01.07.1996**

(84) Designated Contracting States:
CH DE IT LI

(30) Priority: **01.07.1995 JP 188489/95**
01.07.1995 JP 188490/95

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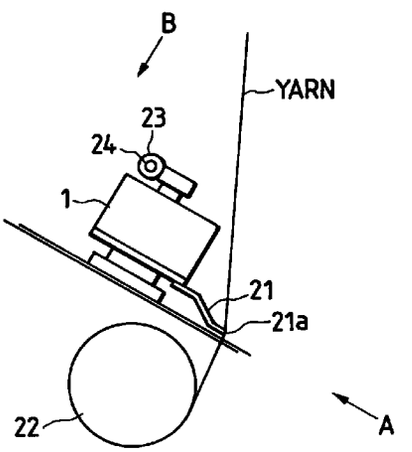
(54) Yarn traverse apparatus

(57) A yarn traverse apparatus which prevents adjacent blades from interfering with each other and breaking even if blades of any of traverse mechanisms are out of phase and which allows the traverse mechanisms to be installed and removed easily. The yarn traverse apparatus includes a plurality of traverse mechanisms arranged so as to be adjacent to one another with respect to a plurality of juxtaposed bobbins. Each traverse mechanism has a set of two shafts arranged upstream of a corresponding bobbin. The two shafts are orthogonal to a shaft of the corresponding bobbin and rotate in opposite directions. Each of the two rotating shafts has blades attached thereto, the blades serving to traverse a yarn. Each traverse mechanism is arranged to form two surfaces of rotation when the blades attached to the set of two rotating shafts rotate. The plurality of such traverse mechanisms are arranged so that loci of rotation of the blades belonging to adjacent sets partially intersect. When yarns are traversed by such yarn traverse apparatus, surfaces of rotation formed by the blades attached to the two shafts of rotation of each of the adjacent traverse mechanisms are uniformly as well as sufficiently inclined with respect to a surface formed by a yarn in a single direction as viewed in vertical directions, so that the surfaces of rotation formed by the blades belonging to the adjacent sets will not interfere with each other.

FIG. 1



EP 0 752 384 A2

Description

BACKGROUND OF THE INVENTION

a. Field of the Invention

The invention relates to a yarn traverse apparatus that is used when a yarn is wound onto a bobbin. In particular the invention is applicable to a yarn traverse apparatus for traversing many yarns simultaneously.

b. Related Art

The yarn traverse apparatus of the type that traverses many yarns simultaneously is generally constructed so that a plurality of yarn traverse mechanisms are arranged one adjacent to another for the respective yarns, and each yarn traverse mechanism traverses the corresponding yarn by delivering the yarn between oppositely rotating blade bodies provided in each mechanism as a set. Various attempts have been made for improving such yarn traverse apparatus, as disclosed in US Patents 4,505,436, 4,505,437 and 4,646,983 and Unexamined Japanese Patent Publication No. Hei. 5-24740.

In the Unexamined Japanese Patent Publication No. Hei. 5-24740, each yarn traverse mechanism is arranged offset axially from the adjacent yarn traverse mechanism so that only one of the blade bodies in the yarn traverse mechanism rotates on the single, same plane with respect to one of the blade bodies in the adjacent yarn traverse mechanism.

Because of the axially offset arrangement, the traverse apparatus thus disclosed suffers from a problem in that the position where the yarn is released from the blade body in the traverse mechanism is axially different from the position where the yarn is released from the blade body in the adjacent traverse mechanism, and consequently the width of winding inevitably differs from one package to another. Thus, the outer diameters of the packages are not consistent, which in turn has imposed the problem of cob-webbing.

Further, since the one blade body in the traverse mechanism and the one blade body in the adjacent traverse mechanism rotate on the same plane, once the blade body of either of the traverse mechanisms is out of a predetermined phase difference, the adjacent blade bodies may have, in some cases, interfered with one another and broken.

SUMMARY OF THE INVENTION

An object of the invention is to provide a yarn traverse apparatus including at least one yarn traverse mechanism or unit featured by a novel inclined arrangement of blade bodies to overcome the deficiencies of the Prior Art.

To achieve the above-noted object, the present invention provides a yarn traverse apparatus having at least one traverse unit for reciplocatingly traversing a running yarn in a traverse direction to thereby uniformly wind the yarn onto a bobbin rotatable about a bobbin axis, the at least one traverse unit comprising: a first blade body having first blades and driven to rotate about a first axis in a first direction, the first blades defining a first rotation plane when the blade body is driven to rotate; and a second blade body having second blades and driven to rotate about a second axis in a second direction opposite to a first direction, the second axis being parallel to the first axis and displaced from the first axis in the traverse direction, the second blades defining a second rotation plane when the blade body is driven to rotate, the second rotation plane is displaced axially from the first rotation plane, the first and second blades cooperatively traversing the yarn in the traverse direction; and wherein each of the first and second rotation planes is inclined at a predetermined acute angle α with respect to a horizontal line parallel to the bobbin axis.

Because of the novel inclined arrangement of the first and second rotation planes, a distance from the bobbin to a first position where the yarn is released from the first blade by the second blade can be made equal to a distance from the bobbin to a second position where the yarn is release from the second blade by the first blade. In case where a plurality of yarn traverse units are provided, such distances of one yarn traverse units and another adjacent traverse units can also be set equal to each other.

Further, in case where a plurality of yarn traverse units are provided one adjacent to another, each of the first and second planes of the first unit is displaced axially from either of the first and second planes of the second unit without any substantial difference in distance from the first and second units to respective contact rollers or bobbins, in order to avoid any interferences between the blades of the adjacent units.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a front view showing a contact roller and a traverse apparatus according to a first embodiment of the present invention.

Fig. 2 is a diagram as viewed from an arrow A in Fig. 1.

Fig. 3 is a diagram as viewed from an arrow B in Fig. 1.

Fig. 4 is a detailed view of a portion C in Fig. 2.

Fig. 5 is a sectional view taken along a line X-X in Fig. 3.

Fig. 6 is a detailed view of another embodiment of the present invention, corresponding to Fig. 4 of the first embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The invention will now be described in detail with reference to an embodiment shown in the drawings. Fig. 1 is a front view showing a contact roller and a traverse apparatus; Fig. 2 is a diagram as viewed from an arrow A in Fig. 1; Fig. 3 is a diagram as viewed from an arrow B in Fig. 1; Fig. 4 is a detailed view of a portion C in Fig. 2; and Fig. 5 is a sectional view taken along a line X-X in Fig. 3.

In Fig. 5, reference numeral 1 denotes the main body of a traverse mechanism. A shaft 2 is secured to the main body 1 while attached to a shaft attachment hole 1a formed in the upper portion of the main body 1.

A hollow shaft 3 is cylindrical and is rotatably supported by bearings 4a, 4b that are fitted with a lower portion of the shaft 2. An external gear 3a is integrally formed with the upper outer circumference of the hollow shaft 3. It may be noted that a distance piece 31 is interposed between the bearings 4a, 4b and that a stopper ring 5 stops the hollow shaft 3 and the bearings 4a, 4b with respect to the shaft 2.

A hollow shaft 6 is cylindrical and is of such a size as to accommodate the hollow shaft 3 therein. The hollow shaft 6 is rotatably supported by a recess 1b on the lower side of the main body 1 through bearings 14a, 14b that are fitted over the outer circumference of the hollow shaft 6. It may be noted that reference numeral 15 denotes a bearing press, which is attached to the main body by a bolt 16 to press the bearing 14b.

The main body 1 has the recess 1b formed on the lower side thereof and has an opening 1c communicating with the recess 1b formed so as to run in parallel with the shaft attachment hole 1a. A shaft 7 is supported by bearings 8a, 8b arranged inside the opening 1c so as to be rotatable with respect to the main body 1. It may be noted that a stopper ring 9 allows the bearing 8a to be fixed to the main body 1. A distance piece 10 is interposed between the bearings 8a, 8b.

Not only a screw gear 11 is put over the shaft 7 that projects from the main body 1, but also external gears 7a, 7b are arranged one above another so as to either be integral to the shaft 7 or be formed separately and arranged integrally with the shaft 7.

The internal gear 12 is tightened by a bolt 13 on top of the hollow shaft 6. The internal gear 12 is meshed with the gear 7b of the shaft 7 and transmits the rotation of the shaft 7 to the hollow shaft 6. Further, the gear 7a of the shaft 7 is meshed with the gear 3a of the hollow shaft 3 and transmits the rotation of the shaft 7 to the hallow shaft 3. It may be noted that the reduction ratio of the gear 7 to the gear 12 is set to a value equal to the reduction ratio of the gear 7a to the gear 3a, so that the rotation of the shaft 7 allows the hollow shafts 3, 6 to rotate at an equal speed in opposite directions.

A blade body 17 is arranged by integrally forming three blades 17a, 17b, 17c equidistantly around the center of the shaft. The blade main body 17 is attached to the lower surface of the hollow shaft 6 by a bolt 19. When the shaft 7 (Fig. 5) rotates, the blade main body 17 is caused to rotate clockwise as viewed in Fig. 3.

Similarly, a blade body 18 is arranged by integrally forming three blades 18a, 18b, 18c equidistantly around the center of the shaft. The blade main body 18 is attached to the lower surface of the hollow shaft 3 by a bolt 20. When the shaft 7 (Fig. 5) rotates, the blade main body 18 is caused to rotate counterclockwise as viewed in Fig. 3.

As shown in Fig. 3, the center of rotation b of the blade body 17 and the center of rotation a of the blade body 18 are arranged so as to be eccentric in opposite directions a predetermined distance L/2 from the traverse center O in the traverse direction. Because of the eccentric arrangement, the rotation loci respectively created by the blades 17a, 17b, 17c of the blade body 17 and the blades 18a, 18b, 18c of the blade body 18 intersect with each other in a plane view of Fig. 3 to define traverse ends at which the delivery of the yarn from one blade of the blade body 17 to one blade of the blade body 18 or vice verse is effected reliably.

A guide rail 21 is secured to the bearing press 15 (Figs. 3 and 5), and through moving the yarn carried by the blade bodies 17, 18 along a yarn guide portion 21a, a traverse speed is set to a predetermined value.

The yarn carried from right to left by the blade 17a in Fig. 3 this way meets the blade 18a at the traverse end on the left, and the yarn is released from the blade 17a by the blade 18a; then, the yarn is carried from left to right by the blade 18a; and the blade 18a meets the blade 17c at the traverse end on the right, and the yarn is released from the blade 18a by the blade 17c. The yarn is similarly carried in the opposite directions.

This is how a single traverse unit U (traverse mechanism) is constructed. That is, the traverse unit is a mechanism for winding a single package. The traverse apparatus of the invention is designed to prepare a plurality of packages. Not only the loci of rotation of a set of adjacent units out of a plurality of traverse units partially intersect in a plan view of Fig. 3, but also, as shown in Fig. 2, each unit U is arranged at a predetermined angle of inclination α with respect to a horizontal straight line H.

As shown in Fig. 4, this angle of inclination α is set to a sufficiently large value. With respect to the blade bodies 17, 18 belonging to adjacent traverse units U, this angle of inclination α is set so that the blades of one of the traverse units will not interfere with the blades of the other traverse unit even if the blades of such one of the traverse units are out of phase. More specifically, the angle of inclination α is set so that $\beta < \alpha \leqq \beta'$. That is, the angle of inclination α is set so as to stay within a range between a lower critical angle β at which the surface of rotation of each upper blade of one traverse unit does not overlap the surface of rotation of each lower blade of the other traverse unit out of two adjacent traverse units and an angle β' at which errors between the positions at which the yarn is released from the upper and lower blades at both left and right traverse ends of a single traverse unit are allowable as judged from the shape of winding of a package into which the yarn has been wound. More preferably, the angle of inclination α of the invention is set to about $\alpha \cong \gamma$. The angle of inclination γ is such that the surface of rotation of each upper blade of one of two adjacent traverse units will not interfere with the surface of rotation of each lower blade of the other traverse unit and that a gap between these surfaces is 0.3 mm. For example, the values β, β', and γ are given by the following mathematical expressions.

$$\beta = \tan^{-1} \text{(outer dimension of the blade / distance between adjacent traverse units)}$$

$$\beta' = \tan^{-1} \text{((outer dimension of the blade + 5 mm) / distance between adjacent traverse units)}$$

$$\gamma = \tan^{-1} \text{((outer dimension of the blade + 0.3 mm) / distance between adjacent traverse units)}$$

It may be noted that by the distance between the adjacent traverse units it is intended to mean a distance between the corresponding positions of the two traverse units that are arranged adjacent to each other and that by the outer dimension of the blade it is intended to mean a value obtained by adding the thicknesses of the upper and lower blades to a distance between such upper and lower blades.

On top of the respective traverse units extends a horizontal shaft 24 in the traverse directions. Not only a drive motor (not shown) is coupled to an end of the shaft 24 close to the outer side of the traverse apparatus, but also screw gears 24a, 24b, 24c, 24d, 24e are attached to the shaft 24 equidistantly. The screw gears 24a to 24e engage with the screw gears 11 on top of the shafts 7 of the units U to rotate the shafts 7 of the units U in the same direction by the motor, respectively. As long as the rotation of the shaft 24 can be transmitted to the shafts 7 of the respective units U that are substantially orthogonal to the shaft 24, the respective screw gears 24a to 24e and the screw gears 11 may be arranged by combining, e.g., worms with worm wheels or combining bevel gears, and the like.

A contact roller 22 (Fig. 1) is arranged at the lower portion of the each traverse unit U, so that the yarn traversed by the each traverse unit U is printed on the contact roller 22 and wound onto bobbin holder (not shown) that rotates while coming in contact with the contact roller 22.

The invention is characterized as arranging the traverse apparatus so that adjacent blades will not interfere with each other by inclining the blades at a predetermined sufficiently large angle of inclination. Therefore, it becomes easy to install and remove the traverse apparatus, which in turn contributes to preventing cob-webbing with the shapes of the end faces being the same and thus improving commercial value such as the shape of winding.

The invention is also characterized as not only preventing the blades of the traverse apparatus from interfering with one another but also minimizing errors between the positions at which the yarn is released by the respective blades at the traverse ends (the distance from the contact roller to the release position). Therefore, cob-webbing can be prevented and the shape of winding can be improved.

Fig. 6 shows another embodiment of the present invention wherein the above-noted angle of inclination α is determined in a different manner. The angle of inclination α of a single unit is, as shown in Fig. 6, set to such a value as to substantially align the positions at which the yarns carried by the blades of the blade bodies 17, 18 are released at both left and right traverse ends with a single horizontal straight line H or align such positions extremely close to such horizontal straight line H.

That is, a yarn carried from right to left by the blade 17a in Fig. 3 this way meets the blade 18a at the traverse end on the left, and the yarn is released from the blade 17a by the blade 18a; the yarn is carried from left to right by the blade 18a; and then, the blade 18a and the blade 17c meets at the traverse end on the right, and the yarn is released from the blade 18a by the blade 17c. The yarn is carried in the opposite directions in a similar operation. Yarns are similarly traversed sequentially. Therefore, when a single traverse unit is observed, the position at which the yarn is released from the blade 17a at the left traverse end and the position at which the yarn is released from the blade 18a at the right traverse end are either on or extremely close to the single horizontal straight line H.

In addition, with respect to the positions at which the yarns carried by the blades of the blade bodies 17, 18 of respective units are released from the blades at both left and right traverse ends, the angle of inclination α as well as the setting position of each unit are set so that such release positions in all units are either substantially alighted with or extremely close to the horizontal straight line H.

It is acceptable as long as the angle of inclination α of the invention is set to such a value as satisfying the above

conditions. More specifically, the angle of inclination α is set so that $\beta < \alpha \leqq \beta'$. That is, the angle of inclination α is set so as to stay within a range between a lower critical angle β at which the surface of rotation of each upper blade of one traverse unit do not overlap the surface of rotation of each lower blade of the other traverse unit out of two adjacent traverse units and an upper critical angle β' at which surfaces of rotation of the upper blades belonging to one of two adjacent traverse units do not overlap surfaces of rotation of the lower blades belonging to the other traverse unit. More preferably, the angle of inclination α of the invention is set to about $\alpha = \gamma$. The angle of inclination γ is such that the positions at which the yarns are released from the upper and lower blades at both left and right traverse ends are substantially the same in a single traverse unit are substantially the same. In other words, the angle of inclination γ is such that the central point between the upper and lower blades in the thickness direction is substantially aligned with the horizontal line H.

Here the values β, β', and γ are given by the following mathematical expressions.

$$\beta = \tan^{-1} \text{(thickness of the blade / distance between adjacent traverse units)}$$

$$\beta' = \tan^{-1} \text{(outer dimension of the blade / distance between adjacent traverse units)}$$

$$\gamma = \tan^{-1} \text{(distance between the blades rotating in opposite directions / traverse stroke)}$$

It may be noted that by the distance between the adjacent traverse units it is intended to mean a distance between the positions of the two traverse units that are arranged adjacent to each other; by the outer dimension of the blade it is intended to mean a value obtained by adding the thicknesses of the upper and lower blades to a distance between such upper and lower blades; by the distance between the blades rotating in opposite directions it is intended to mean a distance between the centers of the upper and lower blades (the so-called "pitch"); and by the traverse stroke it is intended to mean a traverse length of a single traverse unit.

According to the invention, the yarns are released from the blades at the same position from the contact rollers. Therefore, the shapes of the end faces of packages on the left and right sides are the same, which in turn prevents cobwebbing and therefore improves commercial values such as the shape of winding. In addition, the second embodiment is applicable not only to the yarn traverse apparatus provided with a plurality of yarn traverse units but also a yarn traverse apparatus provided only with a single yarn traverse unit.

Claims

1. A yarn traverse apparatus having at least one traverse unit for traversing a yarn in a traverse direction to thereby uniformly wind said yarn onto a bobbin rotatable about a bobbin axis, said at least one traverse unit comprising:

   a first blade body having first blades and driven to rotate about a first axis in a first direction, said first blades defining a first rotation plane when said blade body is driven to rotate; and
   a second blade body having second blades and driven to rotate about a second axis in a second direction opposite to a first direction, said second axis being parallel to said first axis and displaced from said first axis in said traverse direction, said second blades defining a second rotation plane when said blade body is driven to rotate, said second rotation plane is displaced axially from said first rotation plane, said first and second blades cooperatively traversing said yarn in said traverse direction; and

   wherein each of said first and second rotation planes is inclined at a predetermined acute angle α with respect to a horizontal line parallel to said bobbin axis.

2. A yarn traverse apparatus according to claim 1, wherein a first position where said yarn is released from said first blade by said second blade and a second position where said yarn is released from said second blade by said first blade are both located on said horizontal line.

3. A yarn traverse apparatus according to claim 1, wherein a distance from a contact roller to a first position where said yarn is released from said first blade by said second blade is equal to a distance from said contact roller to a second position where said yarn is release from said second blade by said first blade.

4. A yarn traverse apparatus according to claim 1, wherein at least two first and second traverse units are provided so as to be adjacent to each other in such a manner that said first and second planes of said first traverse unit and said first and second planes of said second traverse unit are all inclined at a predetermined acute angle α with respect to said horizontal line.

5. A yarn traverse apparatus according to claim 4, wherein said first traverse unit defines a first distance from a first contact roller to a first position where a first yarn is released from said first blade of said first unit by said second blade of said first unit and a second distance from said first contact roller to a second position where said first yarn is released from said second blade of said first unit by said first blade of said first unit; said second traverse unit similarly defines a third distance from a second contact roller to a third position where a second yarn is released from said first blade of said second unit by said second blade of said second unit and a fourth distance from said second contact roller to a fourth position where said second yarn is released from said second blade of said second unit by said first blade of said second unit; and said first, second, third and fourth distances are equal to each other.

6. A yarn traverse apparatus according to claim 4, wherein said first plane of said first unit is displaced axially from either of said first and second planes of said second unit.

7. A yarn traverse apparatus according to claim 6, wherein said second plane of said first unit is displaced axially from either of said first and second planes of said second unit.

FIG. 1

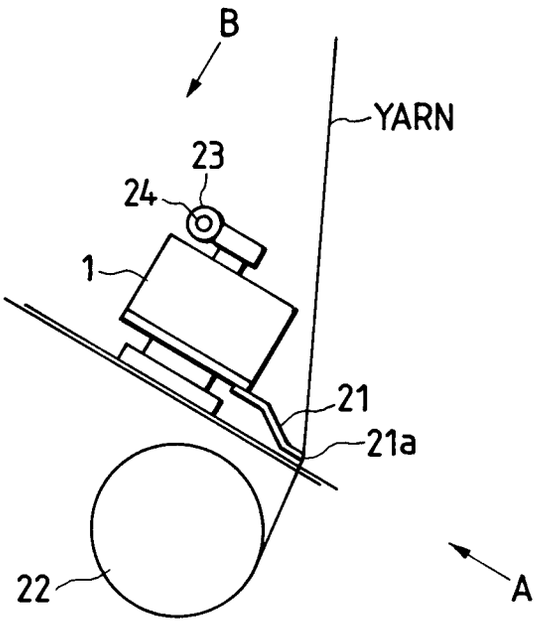


FIG. 4

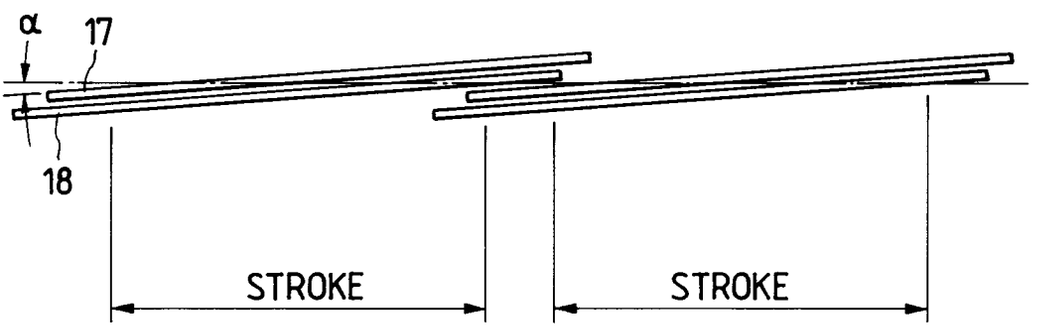


FIG. 2

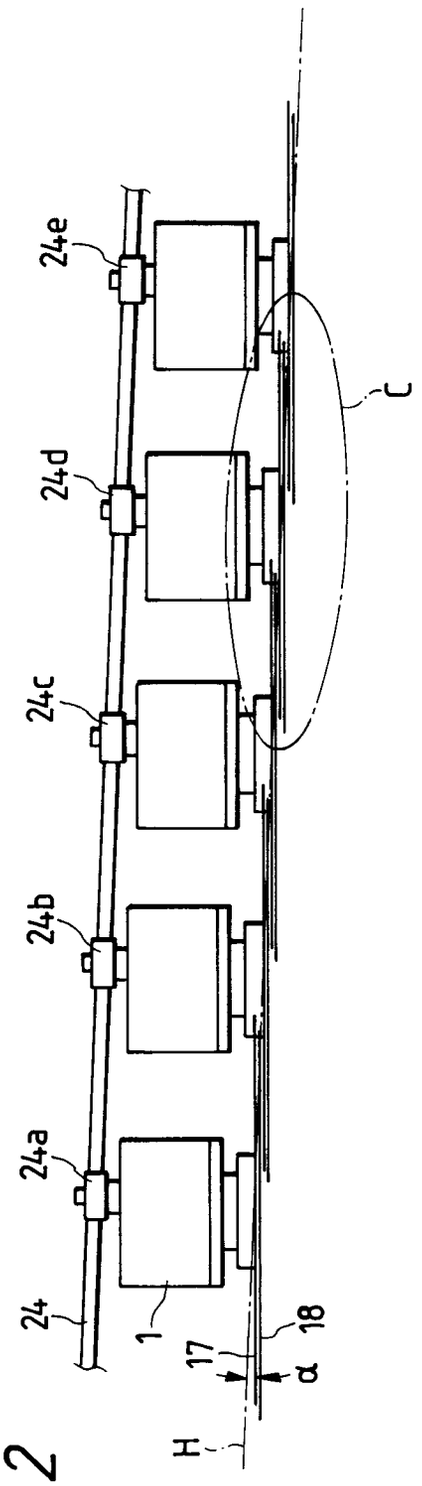
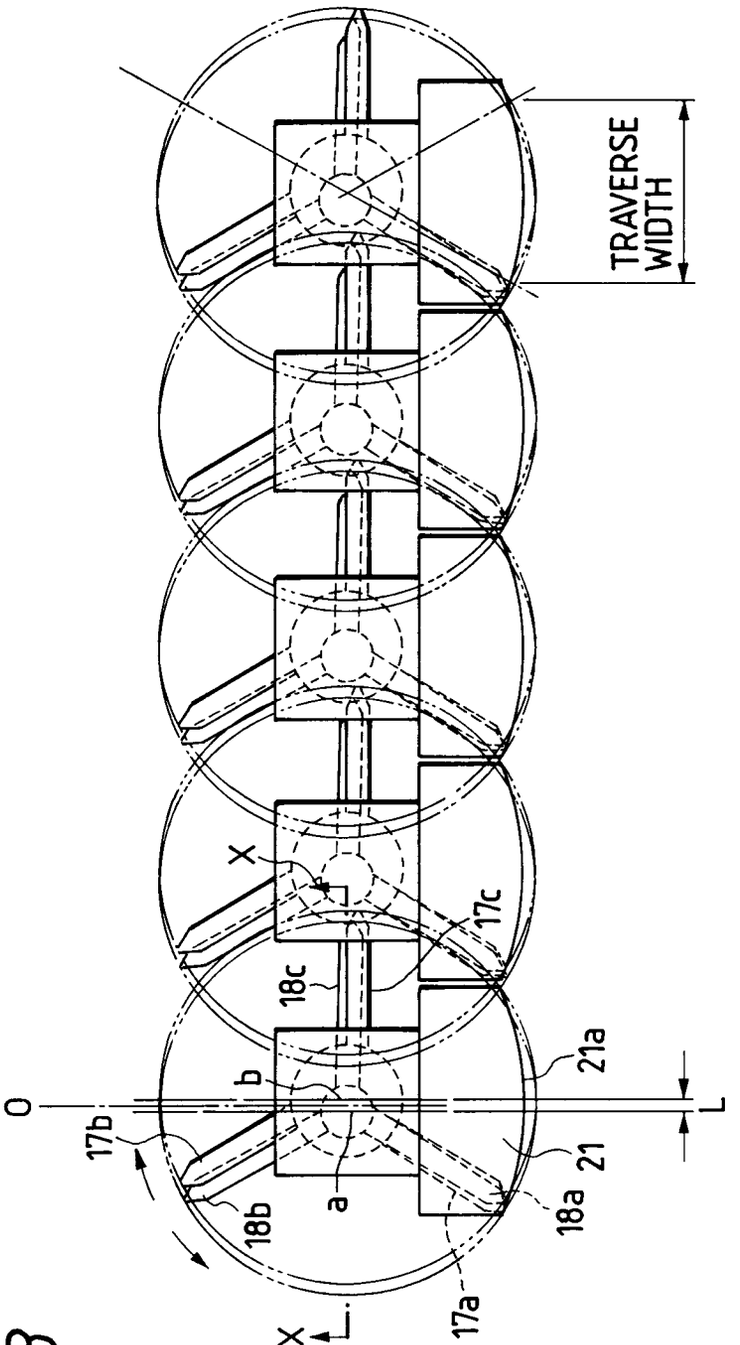

24e
24d
24c
24b
24a
24
1
17
18
α
H
C

FIG. 3


TRAVERSE WIDTH
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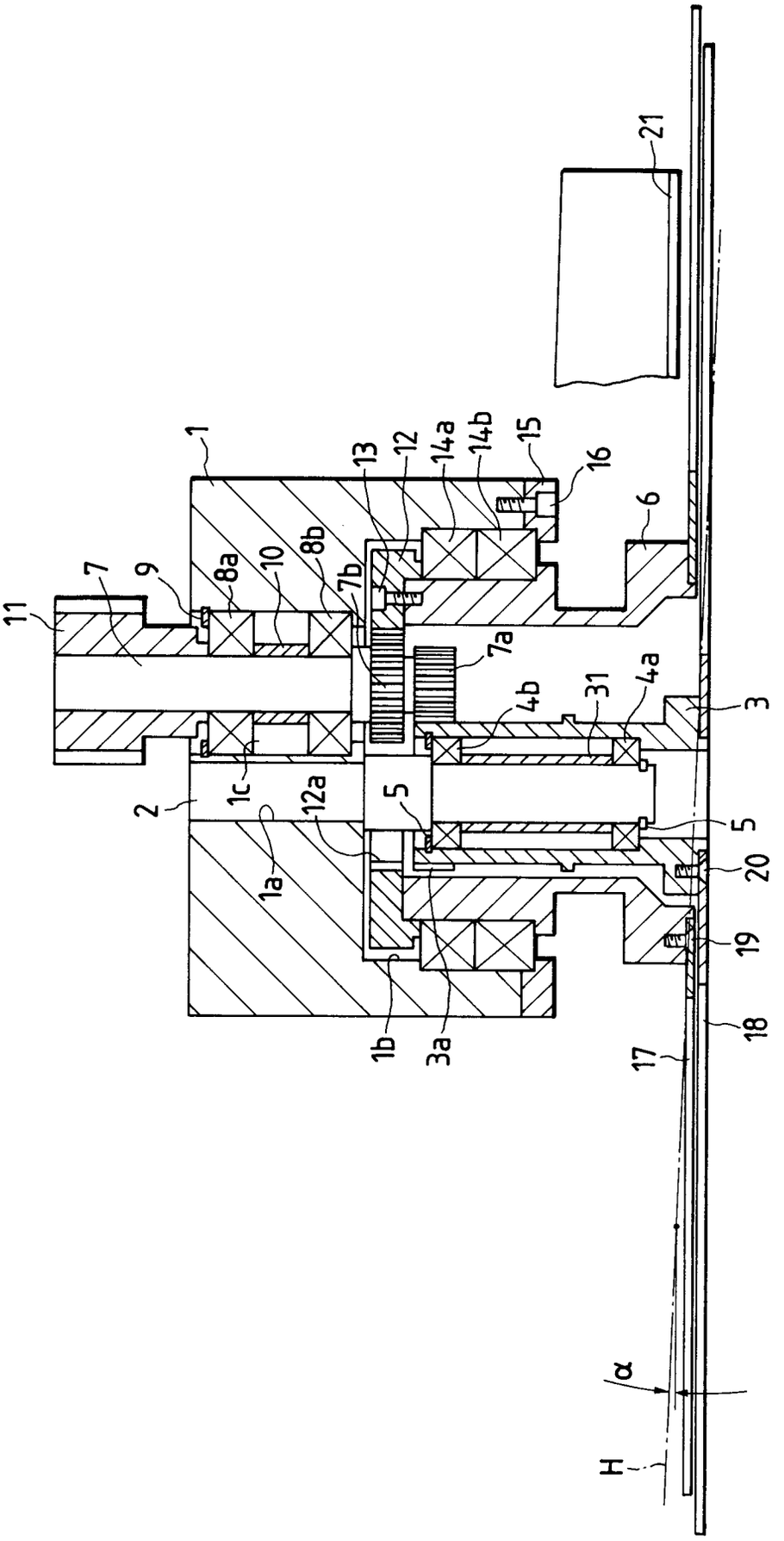
18c
21a
b
0
L
17b
18b
a
21
18a
17a
X

FIG. 5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14b
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16
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7
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8a
10
8b
7b
11
7a
4b
31
4a
3
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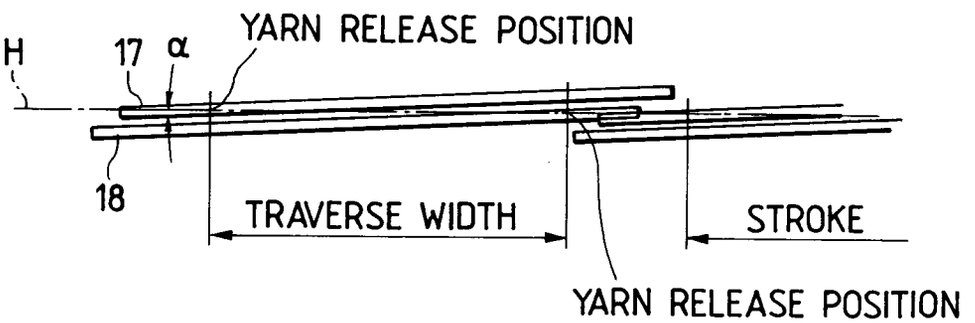
1c
12a
5
5
1a
20
19
18
1b
3a
17
α
H

FIG. 6


H
17
α
YARN RELEASE POSITION
18
TRAVERSE WIDTH
STROKE
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