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(11) **EP 1 081 081 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
07.03.2001 Bulletin 2001/10

(51) Int. Cl.⁷: **B65H 54/28, B65H 54/32**

(21) Application number: **00117550.4**

(22) Date of filing: **14.08.2000**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **30.08.1999 JP 24286499**

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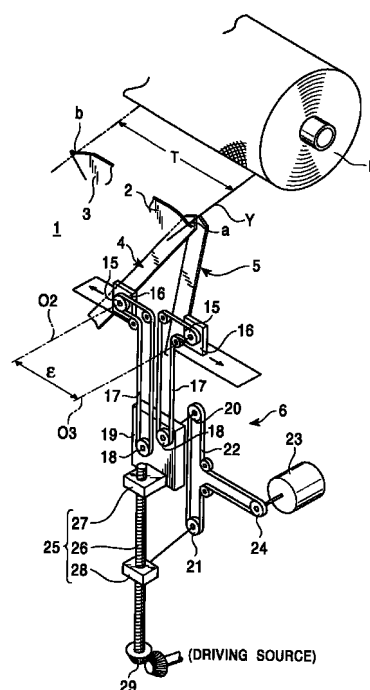
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(54) **Yarn traverse apparatus**

(57) The present invention is a wing traverse apparatus capable of performing creeping, and capable of forming yarn packages with tapered ends.

In the present invention, the rotary centers O2, O3 are moved away from each other as yarn is wound into a package P. This movement changes the eccentricity ϵ between the rotary centers O2, O3, thereby changing the traverse width.

FIG. 4



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Description

Field of the Invention

[0001] The present invention relates to a wing traverse apparatus (also known as a "rotary traverse apparatus") that traverses a yarn by transferring it between a set of oppositely rotating traverse wings.

Background of the Invention

[0002] A conventional wing traverse apparatus provided with traverse guides that form a traverse track in which the yarn wound into a package is traversed, and with a set of oppositely rotating traverse wings that transfer the yarn therebetween at yarn transfer points defining lateral ends of the traverse track, is known. Such a traverse apparatus traverses the yarn by transferring it between the traverse wings at the yarn transfer points.

[0003] This traverse apparatus, however, is arranged such that the rotary track of the traverse wings and the traverse tracks of the traverse guides set a fixed traverse width between the yarn transfer points. Consequently, it is very difficult to change the traverse width to perform "creeping" or to form packages with tapered ends.

Summary of the Present Invention

[0004] It is an object of the present invention to provide a wing traverse apparatus capable of performing creeping, and capable of forming a package with tapered ends.

[0005] The present invention discloses a wing traverse apparatus having a traverse guide that defines a traverse track for a yarn, and a set of traverse wings that rotate in opposite directions and which transfer the yarn at yarn transfer points defining lateral ends of the traverse track, the apparatus characterized in that it is provided with a means for changing the distance between the rotary centers of the traverse wings.

[0006] Thus, by changing the distance between the rotary centers of the traverse wings during winding, the yarn transfer points can be moved in the directions in which the yarn is traversed, thereby changing the traverse width.

[0007] Gradually narrowing the traverse width during winding results in a package with tapered ends. Alternatively, appropriately narrowing and widening the traverse width during winding allows creeping to be reliably performed, thereby helping to prevent the formation of so-called "saddle-bag" packages.

[0008] In the present invention, the traverse guides of the wing traverse apparatus are formed as a pair of guide plates, each guide plate is connected to the respective rotary centers of a respective traverse wing, and the guide plates move in concert with the move-

ment of the rotary centers of the respective traverse wings.

[0009] When the guide plates are moved in concert with the shifting of the traverse wings, the yarn transfer points on the guide plates remain precisely in the rotary tracks of the traverse wings around their respective rotary centers even though those rotary centers are shifted.

[0010] In the present invention, a yarn guiding surface on each traverse wing is arranged so as to become parallel to the movement track of the rotary centers of the traverse wings at the yarn transfer points.

[0011] When the yarn guiding surfaces of the traverse wings are arranged parallel to the movement track in which the rotary centers are shifted at the yarn transfer point, the yarn transfer points on the guide plates can be matched to the tracks of the traverse wings with even greater precision, and the yarn transfer operation can be performed even more smoothly. This even despite the fact that the rotary centers are shifted.

Brief Description of the Drawing

[0012]

Figure 1 is a perspective view showing an embodiment of the wing traverse apparatus of the present invention.

Figure 2 is a frontal view showing an A-A perspective in Figure 1 of the wing traverse apparatus.

Figure 3 is a top-down view showing a B-B perspective in Figure 2 of the wing traverse apparatus.

Figure 4 is a perspective view showing an embodiment of the driving device of the wing traverse apparatus.

Figure 5 is a frontal view showing the rotary centers of the traverse wings shifted such that eccentricity is large.

Figure 6 is a diagram showing wound packages.

Figure 7 is a diagram showing an alternate embodiment of the traverse guide of the wing traverse apparatus.

Figure 8 is a diagram showing a relationship between the traverse apparatus and the winding of the package.

Figure 9 is a perspective view showing the wing traverse apparatus of the present invention employed in a winder.

Figure 10 is an enlarged partial view of Figure 9.

Detailed Description of the Preferred Embodiment

[0013] The preferred embodiments of the present invention will now be explained in detail with reference to the accompanying drawings.

[0014] The wing traverse apparatus traverses a yarn into a package by rotating a set of two traverse wings arranged one in front of the other relative to the

direction in which the yarn runs toward the package. The rotary wings are moved apart or brought close together by changing the distance between the rotary centers of the wings. This enables the traverse width to be changed.

[0015] As shown in Figure 1 to Figure 4, the wing traverse apparatus 1 is comprised of a traverse guide 10 that guides the yarn along a traverse track, and a set of traverse wings 4, 5 arranged one in front of the other that traverse the yarn Y that is taken up into a package P. The traverse apparatus 1 is also provided with a driving device 6 (see Figure 4) that rotates the traverse wings 4, 5 and laterally shifts both the traverse wings 4, 5 and the traverse guide 10. The rotary centers 02, 03 of the traverse wings 4, 5 are arranged eccentrically in the lateral (traverse) direction.

[0016] Traverse guide 10 is comprised of a right traverse guide plate 2 and a left traverse guide plate 3. In the present embodiment, lateral yarn transfer points a, b (points where the traverse direction of the yarn is reversed), are formed at an equal distance L from the midpoint of the traverse track along the axis of the package P. The traverse guide plates 2, 3 form a guiding contour 7 along the traverse track between the yarn transfer points a, b. The guiding contour 7 is comprised of a flat section 7a that runs parallel to the axis of the package P, a curved section 7b formed radially around the rotary centers 02, 03 of the traverse wings 4, 5 and extending from the end of the flat section 7a to the yarn transfer points a, b, and a reverse straight section 7c where the yarn reverses direction, formed parallel to the axis of the package P. The traverse guide plates 2, 3 are arranged one in front of the other. The left guide plate 3 is coupled to the traverse wing 5 via a shaft at the rotary center 03 of the traverse wing 5, the axis arranged eccentrically to the right of the rotary center 02 of the other traverse wing 4. The right traverse guide plate 2 is coupled to the traverse wing 4 via a rotary shaft at the rotary center 02 of the traverse wing 4. By coupling the right traverse guide plate 2 at the rotary center 02 (rotary shaft) and the left traverse guide plate 3 at the rotary center 03 (rotary shaft), the traverse guide plates 2, 3 partially overlap, and bring the yarn transfer points a, b into symmetrical alignment.

[0017] The traverse wings 4, 5 are arranged in parallel planes with the traverse guide plates 2, 3. The traverse wing 4 is arranged between the two traverse guide plates 2, 3, and rotates freely around the rotary center 02 (rotary shaft) on the side of the yarn transfer point b. The traverse wing 5 is arranged between the traverse wing 4 and the traverse guide plate 3, and rotates freely around the rotary center 03 (rotary shaft) on the side of the yarn transfer point a. Each of the traverse wings 4, 5 are formed in point symmetry relative to their respective rotary centers 02, 03 (rotary shafts). Wing tip sections 4a, 4b are formed on either side of the traverse wing 4, separated 180 degrees in the direction of rotation from each other. Similarly, wing

tip sections 5a, 5b are also formed on either side of the traverse wing 5, again separated 180 degrees in the direction of rotation. Each wing tip section 4a, 4b, 5a, 5b is provided with a yarn release point c arranged at the end of the respective tip on a central axis running lengthwise through the middle of the respective traverse wing 4, 5. Yarn guiding surfaces 8, 9 extend away from the yarn release point c at 45 degrees angles to the yarn release point c. The angle θ at which the yarn guiding surfaces 8, 9 extend away from their respective yarn release point c need not be set at 45 degrees, but it should preferably be set at an angle θ at which the guiding surfaces 8, 9 and the track f along which the rotary centers 02, 03 of the traverse wings 4, 5 are moved become parallel.

[0018] The traverse wings 4, 5 rotate in opposite directions. When the wing tip sections of either of the traverse wings 4, 5 reach the yarn transfer point a, the yarn release point c of the traverse wing 4 aligns with the yarn transfer point a, and the yarn guiding surfaces 8 on each of the wing tip sections 4a, 4b, 5a, 5b become parallel to the straight section 7c of the traverse guide plate 2. Alternatively, when the wing tip sections of either of the traverse wings 4, 5 reach the yarn transfer point b, the yarn release point c of the traverse wing 5 aligns with the yarn transfer point b, and the yarn guiding surfaces 9 on each of the wing tip sections 4a, 4b, 5a, 5b become parallel to the straight section 7c of traverse guide plate 3 (See Figure 2).

[0019] The traverse wings 4, 5 have rotational tracks S1, S2, respectively, that extend slightly beyond the periphery of their respective traverse guide plate 2, 3. When the traverse wings 4, 5 are rotated in tandem, they function in concert to traverse the yarn Y by transferring the yarn Y at the yarn transfer points a, b. The rotational track S1 of the traverse wing 4 passes through the yarn transfer point a, and the rotational track S2 of the traverse wing 5 passes through the yarn transfer point b.

[0020] The traverse wing 4 rotates clockwise, with the traverse wing 5 rotating counter-clockwise. When the yarn guiding surface 9 of the traverse wing 4 reaches the yarn transfer point b, it meets the yarn Y and carries it back towards the yarn transfer point a, thereby traversing the yarn Y. The traversed yarn Y is guided along the curved section 7b of the traverse guide plate 2, moving along the yarn guiding surface 9 of the traverse wing 4 towards release point c as the yarn Y and the traverse wing 4 approach the yarn transfer point a. When the yarn release point c of the traverse wing 4 meets the yarn transfer point a, the yarn Y slides past the release point c and is released from the traverse wing 4. At the moment the yarn Y is released, the yarn guiding surface 8 of the traverse wing 5 aligns with and becomes parallel to the straight section 7c of the traverse guide plate 2, and the yarn Y released by the traverse wing 4 is smoothly transferred to the guiding surface 8 of the traverse wing 5. The yarn Y is then tra-

versed to back to the yarn transfer point b where the same process is repeated, thus smoothly and continuously traversing the yarn Y between the traverse wings 4, 5. As it is traversed, the yarn Y is taken up into package P at a traverse width T equal to the distance between the two yarn transfer points a, b. Since the yarn Y is always transferred at the yarn transfer points a, b by the traverse wings 4, 5 and the traverse guide plates 2, 3 as described above, the traverse width can be stabilized, enabling nice packages P to be regularly produced.

[0021] The traverse guide plates 2, 3 and the traverse wings 4, 5 are driven by the driving device 6 shown in Figure 4.

[0022] The driving device 6 is provided with a pair of freely rotatable pulleys 15 at the rotary centers 02 and 03. The rotation of the pulleys 15 rotates the respective traverse wings 4, 5 independently of the traverse guide plates 2, 3. The driving device 6 is also provided with a pair of sliders 16 ("guiding mechanisms") which slide the respective rotary centers 02, 03 in the axial plane of the package P. The sliders 16 are arranged one in front of the other so that they do not interfere with each other. The sliders 16 apply force to the rotary centers 02, 03, pushing them away from each other. Each pulley 15 is connected to a transmission pulley 18 via a timing belt 17. The timing belts 17 are guided by rollers positioned outside thereof, and extends to the transmission pulleys 18. Each transmission pulley 18 is engaged with a rotary conversion mechanism 19 through a respective output shaft on the rotary conversion mechanism 19. The rotary conversion mechanism 19 is connected to a pulley 24 of a driving motor 23 via input-side pulley 20, transmission pulley 21, and timing belt 22. The rotary conversion mechanism 19 imparts rotation in the opposite direction to each of the transmission pulleys 18 arranged on the input side of the driving motor 23, and therefore may be comprised as a gear, a pulley, a timing belt, etc.

[0023] The driving motor 23 of the driving device 6 rotates the timing belt 22, and the pulleys 20 and 21, providing input to the rotary conversion mechanism 19. The rotary conversion mechanism 19 rotates the respective pulleys 18, 18 in opposite directions, thereby imparting rotation via the timing belts 17, 17 to the rotary axis pulleys 15, 15. This rotates the traverse wings 4, 5 in opposite directions.

[0024] The driving device 6 is also provided with a ball screw 25. The ball screw 25 is comprised of a ball screw shaft 26, and a pair of nuts 27, 28, namely, an upper nut 27 and a lower nut 28. The ball screw shaft 26 engages with a bevel gear 29 which is driven by a driving source (not shown in the drawing). The upper nut 27 supports the rotary conversion mechanism 19, and the lower nut 28 rotatably supports the transmission pulley 21. The input-side pulley 20, the transmission pulley 21, and the timing belt 22 on the input side of the rotary conversion mechanism 19 are all arranged between the

upper nut 27 and the lower nut 28 of the ball screw 25. The timing belt 22 is guided on the outside of the belt by rollers, and extends to a pulley 24 on the driving motor 23. It should be noted that the pulley 20 can be connected directly to the driving motor 23, and the driving motor 23 can be arranged so as to move vertically.

[0025] The driving device 6 elevates the rotary conversion mechanism 19 and the transmission pulley 21. This is accomplished by rotation of the ball screw shaft 26 by the driving source, which causes the upper and lower nuts 27, 28 to elevate, thereby lifting the rotary conversion mechanism 19 and the transmission pulley 21. The sliders 16 are pushed in opposite directions by the force operating against them, moving with their respective timing belts 17, thus moving the rotary centers 02, 03 away from each other (in the axial plane of the package P). This consequently increases the eccentricity ϵ between the rotary centers 02, 03. Alternatively, the rotating the ball screw shaft 26 in reverse pulls the rotary centers 02, 03 closer together, decreasing the eccentricity ϵ between the rotary centers 02, 03. As shown in Figure 5, the traverse wing 4 moves with the traverse guide plate 2, and the traverse wing 5 moves with the traverse guide plate 3, enabling adjustment in the traverse width T. Thus, increasing the eccentricity ϵ between the rotary centers 02, 03 of the traverse wings 4, 5 decreases the traverse width T, while reducing the eccentricity ϵ increases the traverse width T.

[0026] In other words, the wing traverse apparatus 1, as shown in Figure 5, allows the eccentricity ϵ between the rotary centers 02, 03 of the traverse wings 4, 5 to be adjusted by adjusting the relative positions of the rotary centers 02, 03, thereby allowing the yarn Y's traverse width T to be adjusted. Consequently, by gradually decreasing the traverse width T, T1, T2, T3, over time, as shown in Figure 6, the package P with a tapered end can be formed.

[0027] By comprising the apparatus such that the contours of the traverse wings 4, 5 at the yarn transfer points a, b become parallel with the track in which the rotary centers 02, 03 are slid, and by moving the traverse guide plates 2, 3 in concert with the rotary centers 02, 03, the yarn Y can be uniformly transferred even when the rotary centers 02, 03 are moved.

[0028] Specifically, when the rotary centers 02, 03 are moved:

- 1) The rotational tracks S1, S2 of the traverse wings 4, 5 intersect the yarn transfer points a, b on the respective yarn traverse guide plates 2, 3;
- 2) The yarn release points c of the traverse wings 4, 5 intersect the respective yarn transfer points a, b;
- 3) The yarn guiding surfaces 8, 9 of the traverse wings 4, 5 align with the straight surface 7c of its respective traverse guide plate 2, 3, whereupon the guiding surfaces 8, 9 become parallel with the track in which the rotary centers 02, 03 move.

4) Even if the timing or location of the yarn transfer between the traverse wings 4, 5 varies slightly due to changes in the yarn tension, the shape of the traverse guide plates 2, 3 ensure that the yarn will always be transferred at the same location (yarn transfer points a and b), ensuring a stable traverse width;

5) Even if the rotary centers 02, 03 of the traverse wings 4, 5 are moved, the vertical distance H between the respective rotary centers 01-03 (movement track f) and the respective yarn transfer points a, b remains constant (See Figure 5).

[0029] In other words, moving the rotary centers 02, 03 does not interfere with the normal yarn transfer operation.

[0030] Additionally, by periodically narrowing and widening the traverse width, the formation of saddle-bagged packages can be avoided. In other words, as shown in Figure 6A, creeping can be performed by periodically changing the traverse width between Ta1 and Tb1 ($Tb1 < Ta1$). Creeping, by alternating the traverse width between the yarn turn points d and e ($d > e$) can thus help prevent the formation of the saddle-bagged packages.

[0031] By providing a traverse guide plate 11, as shown in Figure 7, the package winding density across the traverse width T can be held constant. In order to achieve a fixed winding density, the traverse guide plate 11 may need to be formed to a particular curved contour. This curved contour should set both a constant rotary angle θ 1 of the traverse wings 4, 5, and a constant winding width increment h. Moreover, the rotary shafts of the traverse wings 4, 5 should be coupled to their respective traverse guide plates 2, 3 formed as the curved contour as shown in Figure 7.

[0032] In the traverse apparatus 1 of the present invention, setting the angle θ of the tip sections of the traverse wings 4, 5 to 45 degrees allows the height of the yarn transfer points a, b relative to the rotary centers 02, 03 to be held constant. Thus, in order to ensure reliable performance of the yarn transfer operation, it is preferable to have the angles θ of the tip sections 4a, 4b, 5a, 5b set at 45 degrees so as to create the arrangement shown in Figures 1 to 4. Although the traverse wings 4, 5 in shapes other than those shown in Figures 1 to 4 may be employed by the wing traverse apparatus 1 of the present invention, for example, one in which the angle θ of the tip sections of the traverse wings 4, 5 is set to approximately 90 degrees or 90 degrees. However, in such an arrangement, when the eccentricity ϵ at which the rotary centers 02, 03 are shifted is large, the vertical distance H between the yarn transfer points a, b and the rotary centers 02, 03 can no longer be held constant (as shown in Figure 8A). The lowering of the yarn transfer points a, b relative to the rotary centers 02, 03 changes the distance D between the yarn transfer points a, b and the package P, as shown in Figure 8B.

This change in the distance D may have negative effects on the winding of the yarn Y into package P.

[0033] Consequently, although different shapes of the traverse wings 2, 3 can be employed, in order to maintain a fixed distance D and a fixed height H of the yarn transfer points, the angle of the tip sections in the area at which the traverse wings 2, 3 approach each other and reach the yarn transfer point should preferably be 45 degrees or approximately 45 degrees.

[0034] Application of the wing traverse apparatus of the present invention in a take-up winder will now be explained with reference to Figure 9.

[0035] The take-up winder 51 of Figure 9 winds a yarn Y being unwound from a supply bobbin E on a frame 52, passes the yarn Y through feed rollers 54, 55 and the wing traverse apparatus 1, and winds it into a package P on a bobbin B, which is rotated by a drum 56. The take-up winder 51 is provided with a cradle 57 that holds both ends of the bobbin B. The bobbin B is held in pressured contact with the drum 56. The cradle 57 is attached to the frame 52 such that it is pivotable against the frame 52, and it pivots as the package P grows into a full package, the cradle 57 pivoting such that it moves away from the drum 56.

[0036] The wing traverse apparatus 1 is arranged between the feed roller 55 and the drum 56, and is attached to the frame 52. The wing traverse apparatus 1 is connected on the beveled gear 29 side of the ball screw 25 to the cradle 57 via a planetary bevel gear train 58, a gear mechanism 59, a lever mechanism (not shown in the diagram), a pulley 60, and a timing belt 61. Thus, wing traverse apparatus 1 allows the eccentricity between the rotary centers 02, 03 to be adjusted through the pivoting of the cradle 57. Moreover, the lever mechanism is used in shaping the package. Specifically, in order to keep the sides of the package from bulging outwards because the contact pressure against the package, the package ends are made to be convex. The lever helps make the convex form.

[0037] The wing traverse apparatus 1 is also connected to a folding-fan shaped segment gear 63 via the planetary bevel gear train 58 and the gear mechanism 62, as shown in Figure 10. A segment gear 63 is rotated by a circular cam plate 65 of a driving motor 64, thus enabling the wing traverse apparatus 1 to perform the creeping operation.

[0038] At the start of winding, the cradle 57 takes hold of bobbin B, and the drum 56 is held in contact pressure with the bobbin B as the cradle 57 is pivoted, rotating the ball screw 25 (and the ball screw shaft 26). This changes the eccentricity ϵ between the rotary centers 02, 03 of the traverse wings 4, 5. At the start of winding, the traverse width of the wing traverse apparatus 1 is T.

[0039] With the take-up winder 51 in this state, the drum 56 is driven, rotating the bobbin B. The driving motor 23 drives the traverse wings 4, 5 in opposite directions. The yarn Y being unwound from the supply

bobbin E is then traversed by the wing traverse apparatus 1, and wound into a package P around the bobbin B.

[0040] As the yarn Y is wound into the package P, the diameter of the package P grows larger, pivoting the cradle 57 and moving it away from the drum 56. The pivoting of the cradle 57 rotates the ball screw shaft 26 via the ball screw 25, the rotation imparted via the timing belt 61, the lever mechanism, the gear mechanism 59, and the planetary bevel gear train 58. This functions to separate the rotary centers 02, 03 of the traverse wings 4, 5, increasing the eccentricity ε between the rotary centers 02, 03, and narrowing the traverse width T. In this manner, the eccentricity ε is adjusted and the traverse width T is narrowed in proportion to the degree of pivot of the cradle 57 (and consequently the package build amount). This winds the yarn Y into a package P with a tapered end, as shown in Figure 6.

[0041] It should be noted that by adjusting the lever ratio of the lever mechanism, the tapered shape of the package P can be adjusted.

[0042] By controlling the driving motor 64 during the winding of the yarn Y, the rotation of ball screw 25 (and the ball screw shaft 26) via the segment gear 63 and the planetary bevel gear train 58 can be reversed periodically, allowing the traverse width at which the package is wound to be periodically alternated between gradual narrowing and gradual widening, thus performing the creeping operation. The creeping parameters can be adjusted by changing the shape of the circular cam plate 65 and the rotary speed of the cam. As should be clear, the creeping operation helps to prevent the package P from saddle-bagging at the ends.

[0043] As described above, the wing traverse apparatus of the present invention changes the distance separating the rotary centers of a set of traverse wings, thus moving the yarn transfer points in the direction of the yarn traverse. This allows creeping to be performed, or may allow the formation of a package with tapered ends.

[0044] Additionally, the traverse guide is comprised as a pair of guide plates, and when the guide plates are moved in concert with the shifting of the rotary centers of the traverse wings, the yarn transfer points remain precisely in the tracks of the traverse wings even though the rotary centers of the traverse wings are shifted. Consequently, the vertical distance separating the yarn transfer points and the rotary centers can be held constant, and the yarn transfer operation can be performed smoothly all the time.

[0045] Still further, when the yarn guiding surfaces of the traverse wings are arranged parallel to the plane in which the rotary centers are shifted at the point of yarn transfer, the yarn transfer points on the guide plates can be matched to the tracks of the traverse wings with even greater precision, and the yarn transfer operation can be performed even more smoothly. This even despite the fact that the rotary centers are shifted.

Claims

1. A wing traverse apparatus having a traverse guide that defines a traverse track for a yarn, and a set of traverse wings that rotate in opposite directions and transfer the yarn at yarn transfer points defining lateral ends of a traverse track, characterized in that a means for changing the distance between the rotary centers of the traverse wings is provided.
2. The wing traverse apparatus of claim 1 characterized in that said traverse guide is comprised as a pair of guide plates, each of said guide plates is connected to the respective rotary centers of a respective traverse wing, and said guide plates move in concert with the movement of said rotary centers of the respective traverse wings.
3. The wing traverse apparatus of claim 2 characterized in that a yarn guiding surface on each traverse wing is arranged so as to become parallel to the movement track of the rotary centers of the traverse wings at said yarn transfer points.

FIG. 1

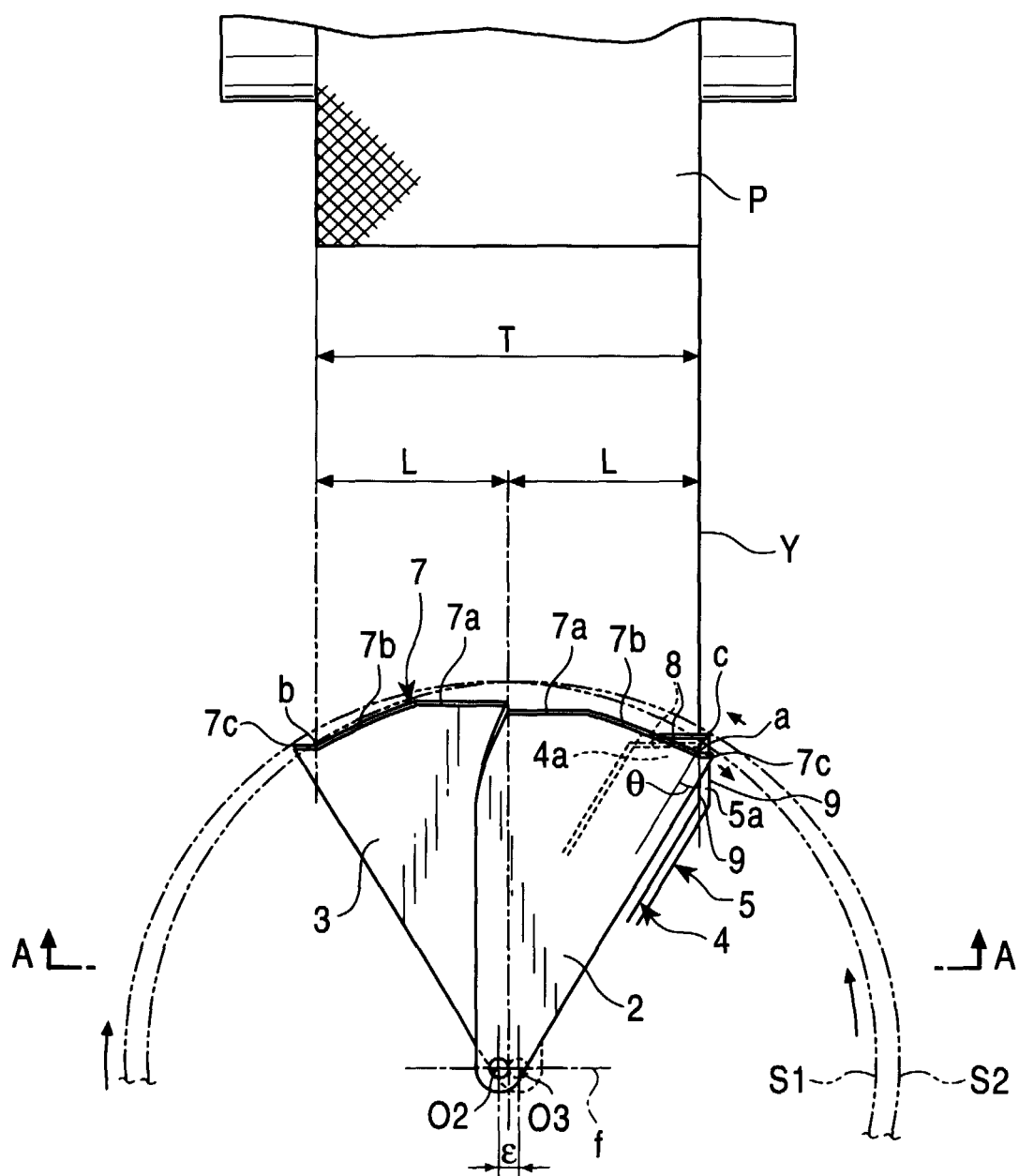


FIG. 2

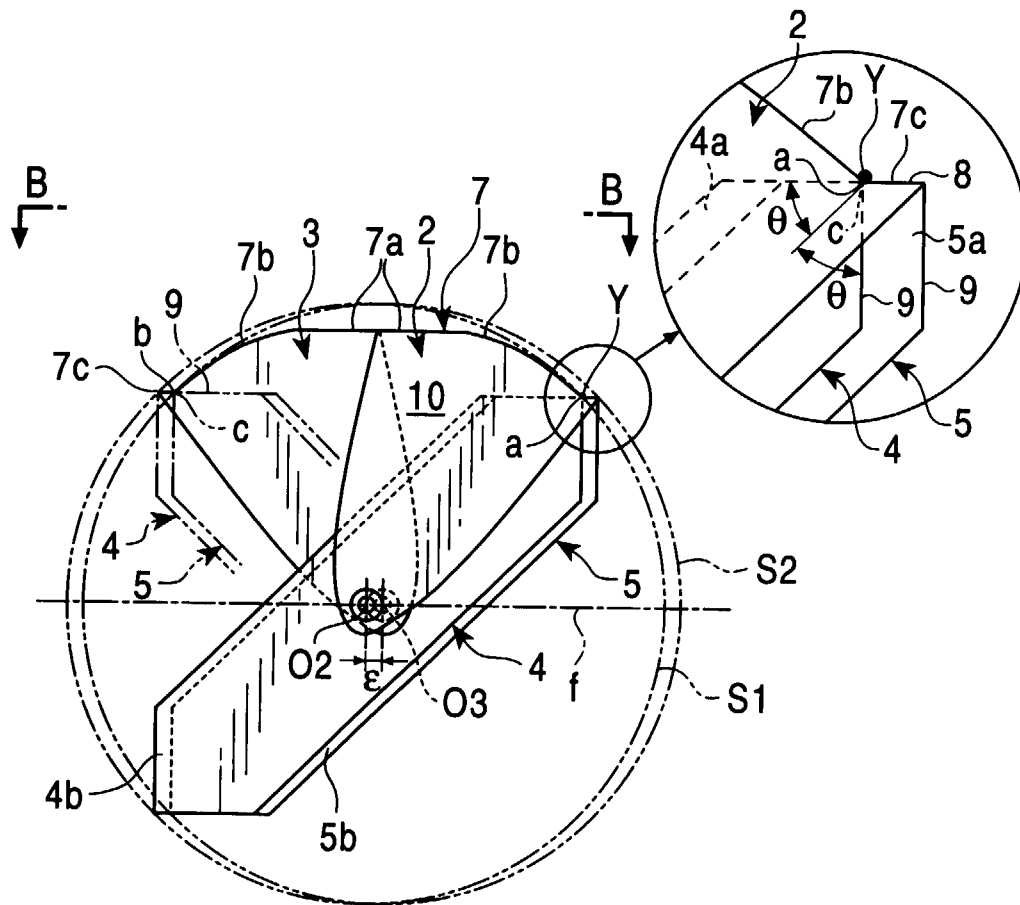


FIG. 3

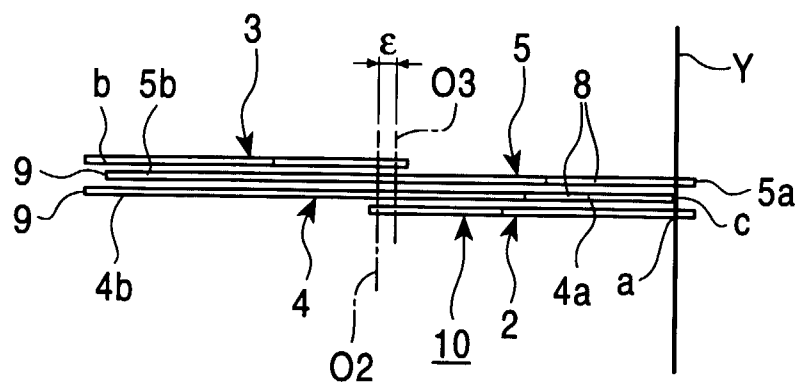


FIG. 4

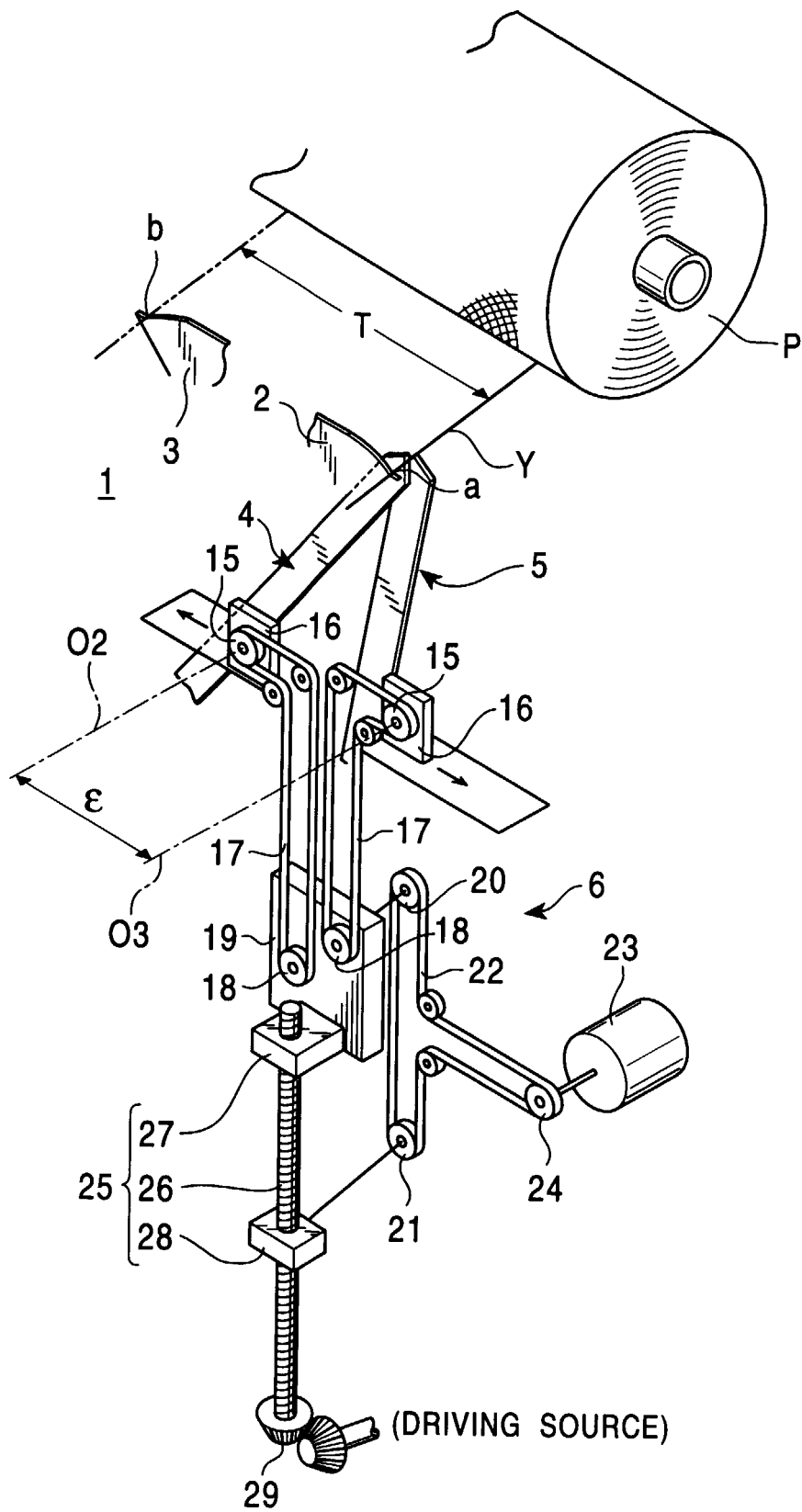


FIG. 5

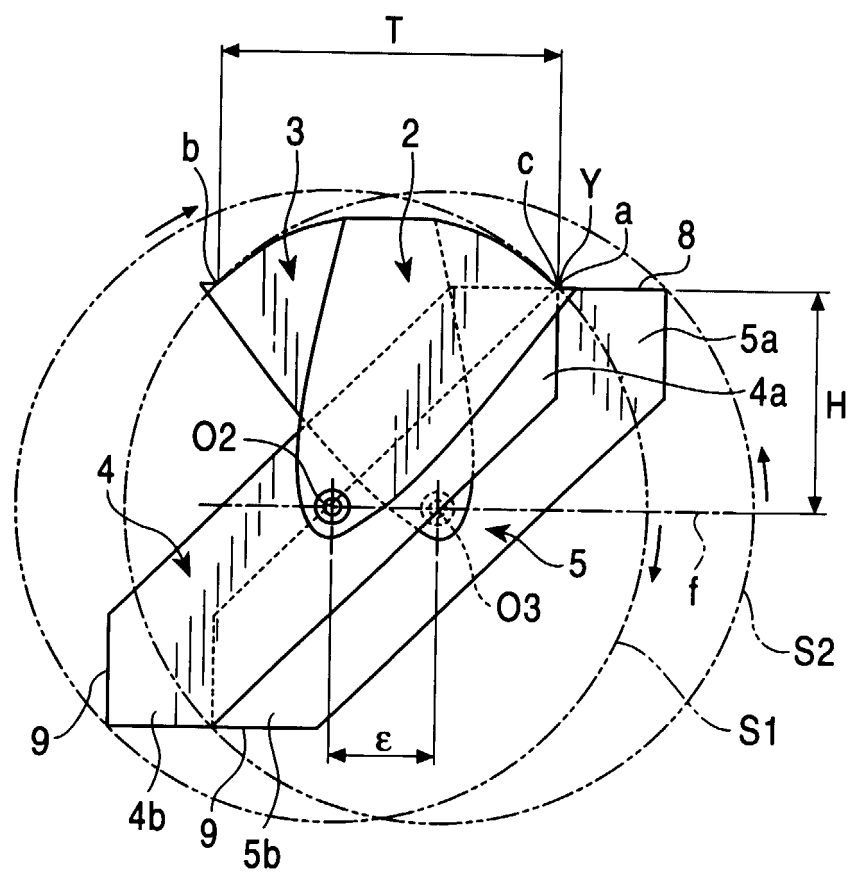


FIG. 6A

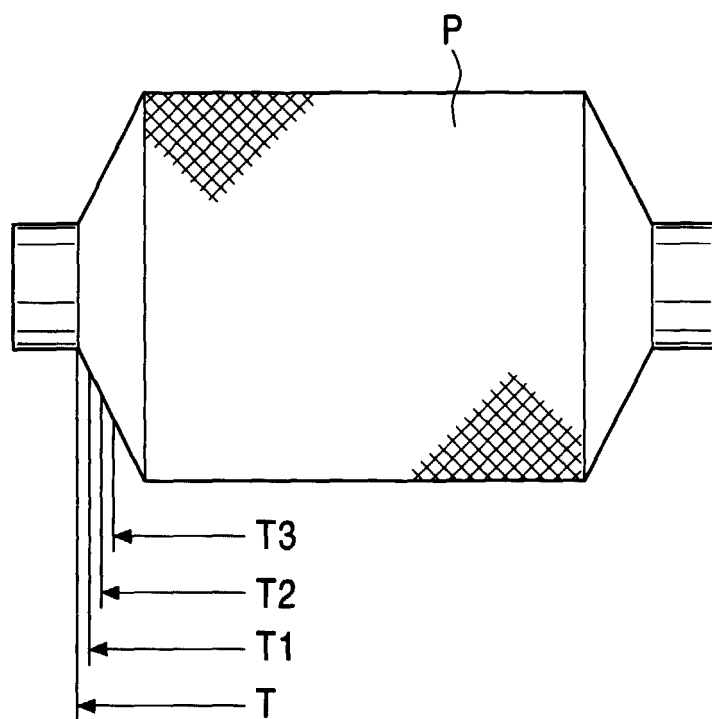


FIG. 6B

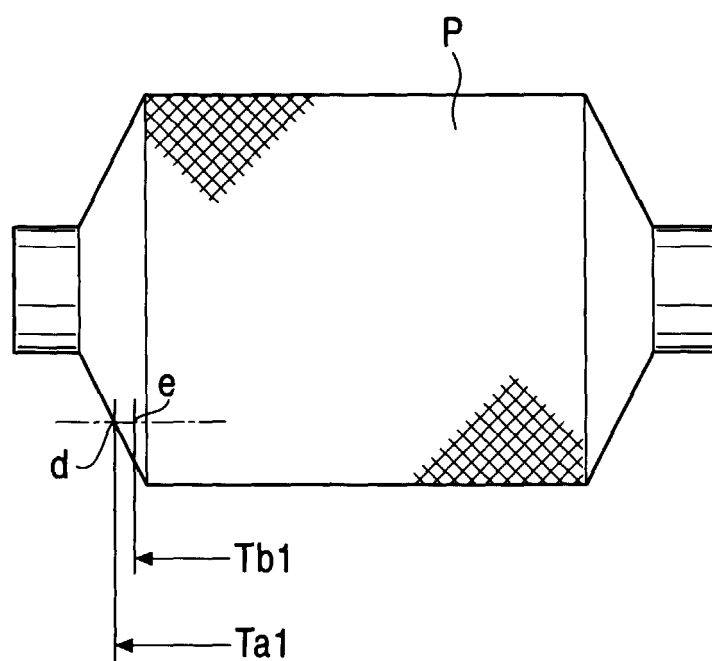


FIG. 7

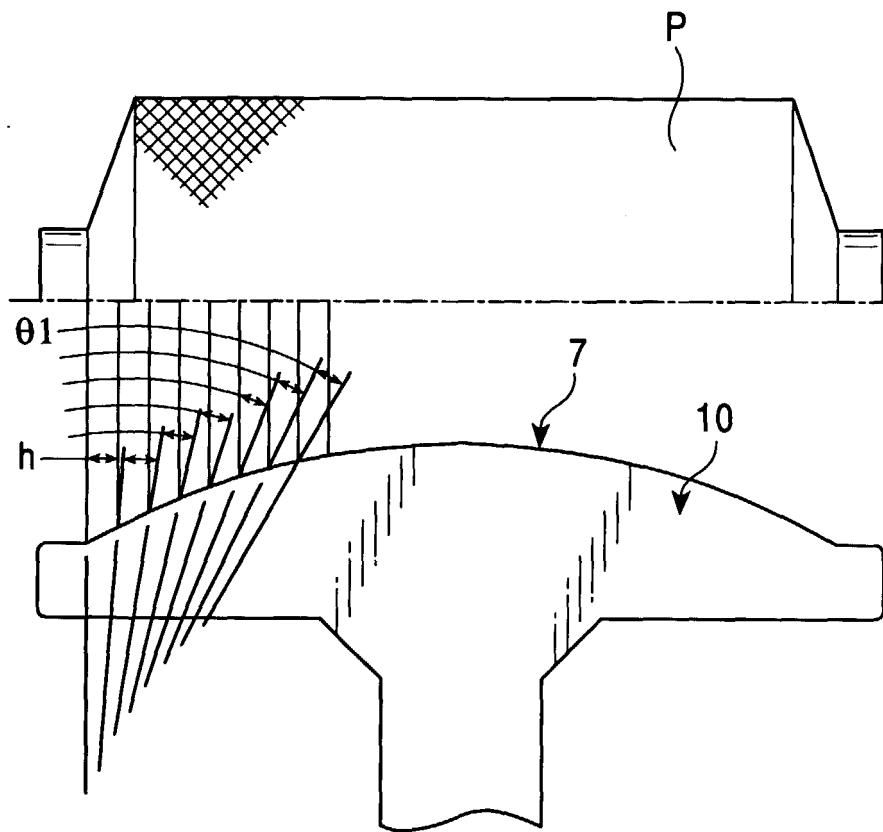


FIG. 8A

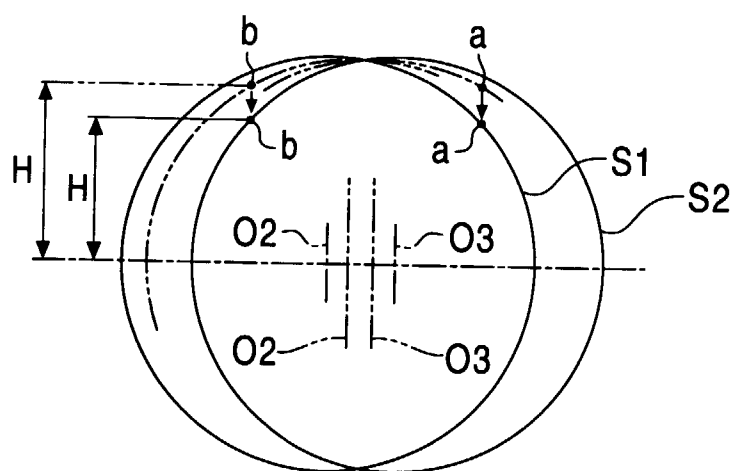


FIG. 8B

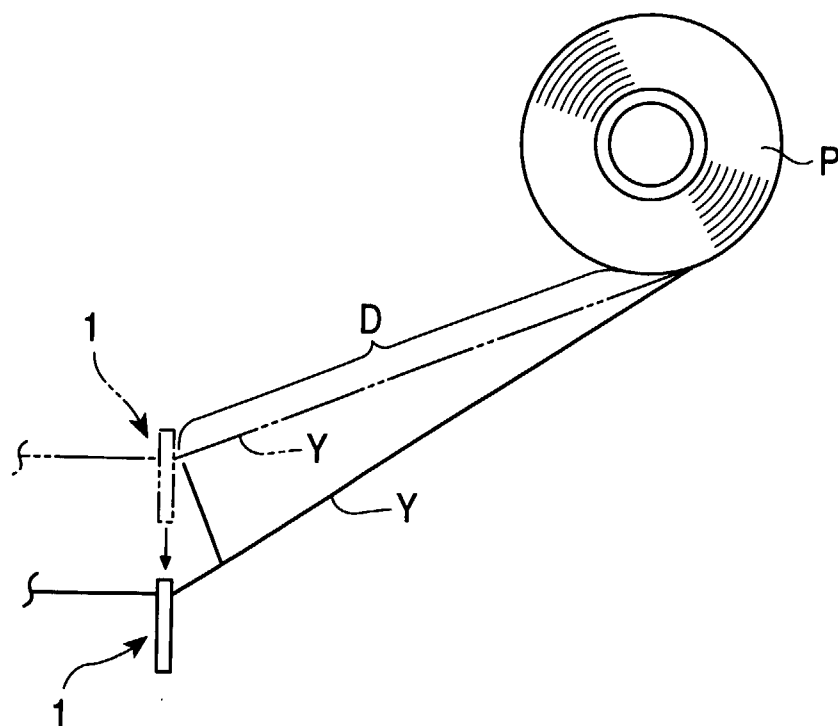


FIG. 9

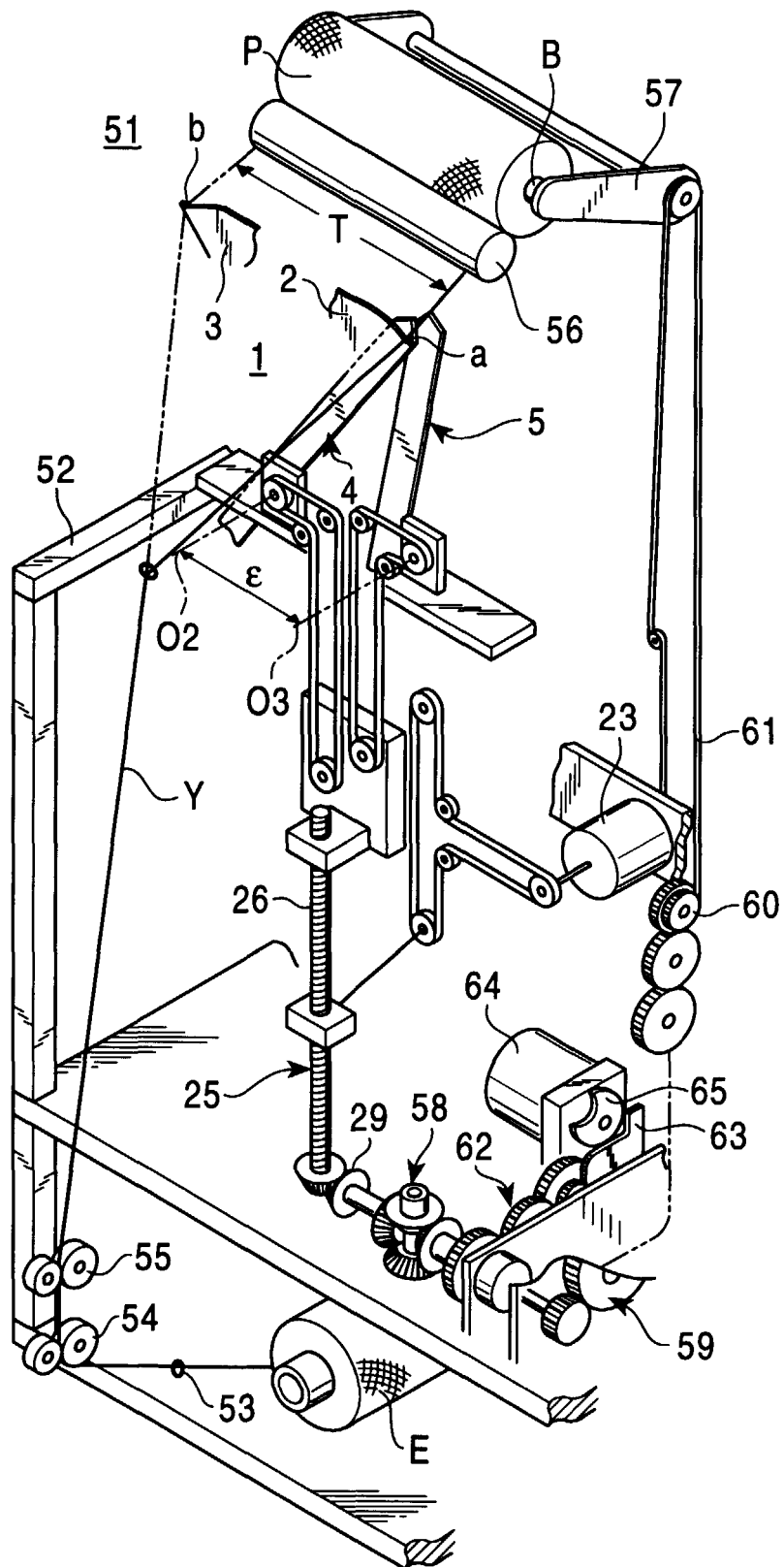


FIG. 10

