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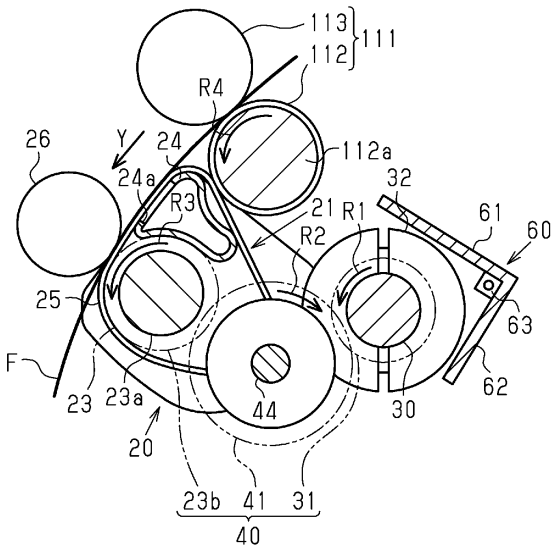
(54) FIBER BUNDLE CONCENTRATING DEVICE IN SPINNING FRAME

(57) In a fiber bundle concentrating device (20), a counter shaft (30) rotates in the same rotation direction (R1) as a front bottom roller (112) and transmits rotation of the counter shaft to a bottom delivery roller (23) through a power transmission device (40) such that the bottom delivery roller rotates in the same rotation direction (R3) as the front bottom roller (112).

Fig.6



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Description

BACKGROUND

1. Field

[0001] The present disclosure relates to a fiber bundle concentrating device in a spinning frame.

2. Description of Related Art

[0002] A spinning frame includes a draft device and a fiber bundle concentrating device. The draft device includes a pair of feeding rollers including a top roller and a bottom roller. A fiber bundle drafted by the draft device is fed from the pair of the feeding rollers toward the fiber bundle concentrating device.

[0003] The fiber bundle concentrating device includes a pair of delivery rollers including a top delivery roller and a bottom delivery roller. The fiber bundle fed from the pair of the feeding rollers of the draft device is concentrated in advance by the fiber bundle concentrating device before a twisting process. The fiber bundle concentrated by the fiber bundle concentrating device is fed by the pair of the delivery rollers in a feeding direction and twisted.

[0004] The fiber bundle concentrating device includes a rotary shaft provided with the bottom delivery roller and a counter shaft for rotating the rotary shaft, as disclosed, for example, in European Patent Application Publication No. 1473388. A driving gear is arranged for the counter shaft, and a driven gear is arranged for the rotary shaft. The driving gear meshes with the driven gear. The rotation of the counter shaft is transmitted to the rotary shaft of the bottom delivery roller through the driving gear and the driven gear. This rotates the bottom delivery roller and drives the pair of delivery rollers. The rotation direction of the counter shaft is opposite to the rotation directions of the bottom delivery roller and the bottom roller of the feeding rollers in the pair.

[0005] In a fiber bundle concentrating device including a counter shaft as disclosed in European Patent Application Publication No. 1473388, foreign material such as a fiber bundle cut near the feeding roller in the pair may be wound around the bottom roller of the draft device and fed toward the counter shaft. In this case, the counter shaft rotates in a direction opposite to the bottom roller. Thus, the foreign material is likely to be drawn between the counter shaft and the bottom roller.

SUMMARY

[0006] This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter.

[0007] In one general aspect, a fiber bundle concentrating device in a spinning frame is provided. The fiber bundle concentrating device includes a compacting unit and a counter shaft. The compacting unit includes a suction portion that draws in and concentrates a fiber bundle fed from a pair of feeding rollers in a feeding direction, and a bottom delivery roller that feeds the concentrated fiber bundle in the feeding direction. The counter shaft is driven independently of a feeding bottom roller that is one of the feeding rollers in the pair. The counter shaft rotates to rotate the bottom delivery roller and is arranged adjacent to the feeding bottom roller. The counter shaft rotates in the same rotation direction as the feeding bottom roller. Further, the counter shaft is configured to transmit the rotation of the counter shaft to the bottom delivery roller through a power transmission device such that the bottom delivery roller rotates in the same rotation direction as the feeding bottom roller.

[0008] Other features and aspects will be apparent from the following detailed description, the drawings, and the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

Fig. 1 is a front view schematically showing a fiber bundle concentrating device in a spinning frame.
Fig. 2 is a front view showing a state in which a compacting unit is removed.
Fig. 3 is a cross-sectional view showing a draft device and the fiber bundle concentrating device.
Fig. 4 is a side view showing a stand and a support plate.
Fig. 5 is a front view of a bottom delivery roller.
Fig. 6 is a cross-sectional view showing the fiber bundle concentrating device.
Fig. 7 is a perspective view of the shaft guard.
Fig. 8 is a plan view schematically showing a fiber bundle concentrating device in a modified example.
Fig. 9 is a cross-sectional view schematically showing a power transmission device in a modified example.

[0010] Throughout the drawings and the detailed description, the same reference numerals refer to the same elements. The drawings may not be to scale, and the relative size, proportions, and depiction of elements in the drawings may be exaggerated for clarity, illustration, and convenience.

DETAILED DESCRIPTION

[0011] This description provides a comprehensive understanding of the methods, apparatuses, and/or systems described. Modifications and equivalents of the methods, apparatuses, and/or systems described are apparent to one of ordinary skill in the art. Sequences

of operations are exemplary, and may be changed as apparent to one of ordinary skill in the art, with the exception of operations necessarily occurring in a certain order. Descriptions of functions and constructions that are well known to one of ordinary skill in the art may be omitted.

[0012] Exemplary embodiments may have different forms, and are not limited to the examples described. However, the examples described are thorough and complete, and convey the full scope of the disclosure to one of ordinary skill in the art.

[0013] In this specification, "at least one of A and B" should be understood to mean "only A, only B, or both A and B."

[0014] A fiber bundle concentrating device 20 in a spinning frame 10 according to one embodiment will now be described with reference to Figs. 1 to 7.

Spinning Frame

[0015] As shown in Fig. 1, the spinning frame 10 includes a draft device 11, the fiber bundle concentrating device 20, an out-end head 101, a gear-end head 102, stands 50, and support plates 51.

[0016] The out-end head 101 and the gear-end head 102 are arranged on a frame 105 shown in Fig. 4. As shown in Figs. 1 and 2, the gear-end head 102 includes a bottom front roller driving unit 103 and a counter shaft driving unit 104. The bottom front roller driving unit 103 and the counter shaft driving unit 104 are motors. The bottom front roller driving unit 103 rotates a rotary shaft 112a of a bottom front roller 112 of the draft device 11 described later. The counter shaft driving unit 104 rotates counter shafts 30 of the fiber bundle concentrating device 20 described later.

[0017] A direction in which the out-end head 101 and the gear-end head 102 are opposed to each other is referred to as a longitudinal direction X of the spinning frame 10. The stands 50 are arranged between the out-end head 101 and the gear-end head 102 in the longitudinal direction X. The stands 50 are spaced apart from each other in the longitudinal direction X.

[0018] As shown in Fig. 4, the stands 50, each extending in a front-rear direction Z of the spinning frame 10, project frontward from a front surface 105a of the frame 105. The support plates 51 are fixed to a front portion of the stand 50. Two support plates 51 serving as a single group are fixed to each stand 50. The support plates 51 each project frontward from the stand 50. Further, the support plates 51 with the stand 50 in between in the longitudinal direction X are fixed to the side surfaces of the stand 50.

Draft Device

[0019] As shown in Figs. 3 and 4, the draft device 11 includes a pair of back rollers (not shown), a pair of middle rollers 114, partially shown in Fig. 3, and a pair of front rollers 111 serving as a pair of feeding rollers. The pair of the front rollers 111 is arranged at the downstream sides of the pair of the back rollers and the pair of the middle rollers 114 in a feeding direction Y of a fiber bundle F. The pair of the front rollers 111 is arranged frontward from the pair of the middle rollers 114 in the front-rear direction Z.

[0020] The pair of the front rollers 111 includes a bottom front roller 112 and a top front roller 113. The bottom front roller 112 is a feeding bottom roller that is one of the feeding rollers in the pair. The top front roller 113 is the other one of the feeding rollers that is made of rubber. The bottom front roller 112 is a metal roller. Multiple bottom front rollers 112 are formed by increasing the diameter of multiple portions of the rotary shaft 112a located in the axial direction. Thus, the bottom front rollers 112 are rotated integrally with the rotary shaft 112a. The rotary shaft 112a and the bottom front rollers 112 are rotated by the bottom front roller driving unit 103. Thus, the bottom front roller driving unit 103 is a driving unit that rotates each bottom front roller 112 that is one of the front rollers 111 in the pair. The rotary shaft 112a of the bottom front rollers 112 is rotatably supported by the stands 50. That is, the stands 50 rotatably support the rotary shaft 112a that rotates integrally with the bottom front rollers 112. Thus, in the spinning frame 10, the stands 50 are arranged next to each other in the axial direction of the rotary shaft 112a, that is, in the longitudinal direction X. The top front roller 113 is rotatably supported by support arms (not shown).

[0021] The pair of the front rollers 111 is the pair of the feeding rollers that is located at the most downstream location in the feeding direction Y of the draft device 11 including the pair of the front rollers 111, the pair of the middle rollers 114, and the pair of the back rollers. The draft device 11 drafts a fiber bundle F using the peripheral speed difference between the pair of the front rollers 111, the pair of the middle rollers 114, and the pair of back rollers. The fiber bundle F drafted by the draft device 11 is fed from the pair of the front rollers 111 toward the fiber bundle concentrating device 20.

Fiber Bundle Concentrating Device

[0022] As shown in Figs. 1 and 3, the fiber bundle concentrating device 20 is arranged between the out-end head 101 and the gear-end head 102 in the longitudinal direction X. The fiber bundle concentrating device 20 includes compacting units 21, counter shafts 30, and a power transmission device 40 arranged for each compacting unit 21. The fiber bundle concentrating device 20 includes a shaft guard 60 that extends over each counter shaft 30.

Compacting Unit

[0023] Each compacting unit 21 concentrates fiber bundles F drafted by the draft device 11. Specifically, the compacting unit 21 draws in and concentrates the

fiber bundles F fed from the pair of the front rollers 111.

[0024] As shown in Figs. 1 to 3, each compacting unit 21 includes bottom delivery rollers 23, one suction portion 24, ventilation aprons 25 of the same quantity as the bottom delivery rollers 23, guide portions 29 of the same quantity as the bottom delivery rollers 23, top delivery rollers 26 of the same quantity as the bottom delivery rollers 23, and support portions 21a.

[0025] The bottom delivery rollers 23 are arranged on the circumferential surface of a delivery rotary shaft 23a that rotates integrally with the bottom delivery rollers 23. The bottom delivery rollers 23 are spaced apart from each other in the axial direction of the delivery rotary shaft 23a.

[0026] As shown in Fig. 5, the diameter of the bottom delivery rollers 23 are greater than the diameter of the delivery rotary shaft 23a. The delivery rotary shaft 23a includes a first shaft portion 231 at a first end in the axial direction and a second shaft portion 232 at a second end in the axial direction. The first shaft portion 231 is arranged beyond the bottom delivery roller 23 that is closest to the first end in the axial direction. The second shaft portion 232 is arranged beyond the bottom delivery roller 23 that is closest to the second end in the axial direction. The first shaft portion 231 is longer than the second shaft portion 232 in the axial direction of the delivery rotary shaft 23a. The delivery rotary shaft 23a includes a driven gear 23b on the circumferential surface of the first shaft portion 231. The diameter of the driven gear 23b is substantially the same as the diameter of the bottom delivery roller 23. The driven gear 23b is rotated integrally with the delivery rotary shaft 23a and the bottom delivery roller 23. Then, the bottom delivery roller 23 feeds concentrated fiber bundles F in the feeding direction Y.

[0027] As shown in Figs. 1 and 3, the suction portion 24 has a pipe shape elongated in the longitudinal direction X. The suction portion 24 includes suction holes 24a. The suction holes 24a are spaced apart from each other in the longitudinal direction X. The suction portion 24 draws in and concentrates fiber bundles F fed from the pair of front rollers 111 in the feeding direction Y.

[0028] The ventilation aprons 25 are each formed by an endless woven fabric that ensures air permeability. The ventilation aprons 25 are wound around the bottom delivery rollers 23, portions of the suction portion 24 in which the suction holes 24a are formed, and the guide portions 29. The suction portion 24 draws in the conveyed fiber bundle F through the ventilation apron 25. The ventilation apron 25 is rotated around the suction portion 24, the bottom delivery roller 23, and the guide portion 29.

[0029] Each top delivery roller 26 is one of a pair of the rollers that is made of rubber. The corresponding bottom delivery roller 23 is arranged at a position opposed to the top delivery roller 26. The ventilation apron 25 is sandwiched between the top delivery roller 26 and the bottom delivery roller 23.

[0030] The support portions 21a are arranged at the opposite ends of the delivery rotary shaft 23a in the axial direction. The support portions 21a rotatably support the delivery rotary shaft 23a and support the suction portion 24. Each compacting unit 21 is attached to the spinning frame 10 with the support portions 21 a supported by the support plates 51 adjacent to each other in the longitudinal direction X.

Counter Shaft

[0031] As shown in Fig. 2, the counter shafts 30 are arranged in the longitudinal direction X to be located on the same straight line. The counter shafts 30 are rotatably supported by the support plates 51. The counter shafts 30 adjacent to each other in the longitudinal direction X are coupled to each other by coupling units 32 in a state in which the ends of the counter shafts 30 face each other in the axial direction.

[0032] Each counter shaft 30 includes a driving gear 31 at one end in the axial direction. The driving gear 31 rotates integrally with the counter shaft 30. The counter shaft 30 rotates to rotate the bottom delivery rollers 23 of each compacting unit 21.

[0033] As shown in Fig. 3, the counter shaft 30 is arranged adjacent to the bottom front roller 112 in a position that is diagonally downward and rearward from the bottom front roller 112.

[0034] As shown in Fig. 2, the counter shaft 30 that is closest to the gear-end head 102 among the counter shafts 30 is connected to the counter shaft driving unit 104. When the counter shaft driving unit 104 rotates the counter shaft 30 that is closest to the gear-end head 102, the other counter shafts 30 coupled by the coupling units 32 are rotated. Thus, the counter shaft 30 is driven independently of the bottom front roller 112 that is one of the front rollers 111 in the pair.

Power Transmission Device

[0035] As shown in Figs. 2 and 6, the power transmission device 40 includes the driven gear 23b arranged on the circumferential surface of the delivery rotary shaft 23a, the driving gear 31 arranged on the circumferential surface of the counter shaft 30, and an intermediate gear 41 meshing with the driven gear 23b and the driving gear 31. The counter shaft 30 and the bottom delivery roller 23 are connected to each other by the power transmission device 40.

[0036] The intermediate gear 41 is fixed by a gear bracket 42 to one of the support plates 51 in the group. The gear bracket 42 is fixed to the support plate 51 that is closer to the driving gear 31. The gear bracket 42 includes a plate-shaped bracket body 43 fixed to the support plate 51, and a support shaft 44 extending from the bracket body 43. The support shaft 44, extending from the bracket body 43 in the longitudinal direction X, is bent toward the counter shaft 30, and is further bent to extend parallel to the counter shaft 30. The intermediate gear 41 is rotatably supported by the support shaft 44 at the distal

end. Thus, the intermediate gear 41 is rotatably supported by the gear bracket 42 extending from the support plate 51.

[0037] The intermediate gear 41 is arranged between the delivery rotary shaft 23a and the counter shaft 30 in the front-rear direction Z of the spinning frame 10. Thus, the counter shaft 30 is arranged rearward from the intermediate gear 41. That is, the counter shaft 30 is arranged at a position closer to the frame 105 than the intermediate gear 41 is to the frame 105.

[0038] As shown in Figs. 1 and 2, the size of the intermediate gear 41 in the longitudinal direction X is less than the sizes of the driven gear 23b and the driving gear 31 in the longitudinal direction X. The intermediate gear 41 is arranged within the dimensions of the driven gear 23b in the longitudinal direction X and within the dimensions of the driving gear 31 in the longitudinal direction X.

[0039] The counter shaft driving unit 104 rotates all the counter shafts 30 in synchronization. As shown in Fig. 6, when the counter shaft 30 is rotated, the driving gear 31 is rotated in a rotation direction R1 together with the counter shaft 30. The rotation direction R1 is the same as a rotation direction R4 of the bottom front roller 112. The rotation of the driving gear 31 is transmitted to the intermediate gear 41, and the intermediate gear 41 rotates in a rotation direction R2. The intermediate gear 41 rotates in a direction opposite to the rotation direction R1 of the driving gear 31. The rotation of the intermediate gear 41 is transmitted to the driven gear 23b. The driven gear 23b rotates in a rotation direction R3 opposite to the rotation direction R2 of the intermediate gear 41. As a result, the delivery rotary shaft 23a integrated with the driven gear 23b, and the bottom delivery roller 23 also rotate in the rotation direction R3. Thus, the power transmission device 40 transmits the rotation of the counter shaft 30 to the bottom delivery roller 23, and adjusts the rotation direction R3 of the bottom delivery roller 23 to correspond to the rotation direction R4 of the bottom front roller 112. In other words, the power transmission device 40 allows the rotation direction R1 of the counter shaft 30 and the rotation direction R3 of the bottom delivery roller 23 to be the same.

[0040] In the fiber bundle concentrating device 20, the power transmission device 40 is driven by the counter shaft driving unit 104. In contrast, the bottom front rollers 112 are driven by the bottom front roller driving unit 103. That is, the power transmission device 40 and the bottom front rollers 112 are driven independently of each other.

Shaft Guard

[0041] As shown in Figs. 3, 4, and 7, the shaft guard 60 is arranged between two support plates 51 sandwiching a single compacting unit 21. The shaft guard 60 has a plate shape elongated in the longitudinal direction X. The shaft guard 60 includes a first guard portion 61 that extends over the counter shaft 30 from above, and a second guard portion 62 that extends over the counter shaft 30 at a side closer to the frame 105. The first guard portion 61 and the second guard portion 62 each have a flat shape elongated in the longitudinal direction X.

[0042] The shaft guard 60 includes two attachment pieces 63 for attaching the shaft guard 60 to the support plates 51. The attachment pieces 63 are arranged at the opposite ends of the shaft guard 60 in the longitudinal direction. One of the two attachment pieces 63 is attached to one of the two support plates 51, and the other one of the two attachment pieces 63 is attached to the other one of the two support plates 51. Thus, the shaft guard 60 is arranged between the stands 50 adjacent to each other in the axial direction of the rotary shaft 112a. The first guard portion 61 and the second guard portion 62 have flat shapes that extend entirely over the counter shaft 30 in the axial direction.

[0043] The shaft guard 60 is spaced apart from the counter shaft 30 and extends over the counter shaft 30. As described above, the counter shaft 30 and the bottom delivery roller 23 are connected to each other by the power transmission device 40. The counter shaft 30 is arranged rearward from the intermediate gear 41 of the power transmission device 40. In other words, the intermediate gear 41 of the power transmission device 40 is arranged frontward from the counter shaft 30. The driving gear 31 of the power transmission device 40 is arranged integrally with the counter shaft 30. The shaft guard 60 is spaced apart from the counter shaft 30. Thus, the shaft guard 60 is arranged at a position free from interference with the intermediate gear 41 and the driving gear 31 of the power transmission device 40.

Operation of Embodiment

[0044] In the spinning frame 10, when the draft device 11 is driven, a fiber bundle F is drafted using the peripheral speed difference between the pair of the back rollers (not shown), the pair of the middle rollers 114, and the pair of the front rollers 111.

[0045] As shown in Figs. 3 and 6, the fiber bundle F drafted by the draft device 11 is fed from the pair of the front rollers 111 toward the fiber bundle concentrating device 20.

[0046] The fiber bundle F fed from the pair of the front rollers 111 is supplied to the fiber bundle concentrating device 20. The fiber bundle F is sandwiched between the bottom delivery roller 23 and the top delivery roller 26, and fed in the feeding direction Y while being drawn in by the suction portion 24 through the ventilation apron 25. This concentrates the fiber bundle F.

[0047] The bottom front roller 112 and the bottom delivery roller 23 feed the fiber bundle F in the feeding direction Y. Thus, the rotation direction R3 of the bottom delivery roller 23 is the same as the rotation direction R4 of the bottom front roller 112. The power transmission device 40 including the intermediate gear 41, arranged between the counter shaft 30 and the bottom delivery

roller 23, allows the rotation direction R1 of the counter shaft 30 to be the same as the rotation direction R4 of the bottom front roller 112.

Advantages of Embodiment

[0048] The above-described embodiment has the following advantages.

(1) The rotation of the counter shaft 30 rotating in the rotation direction R1, which is the same as the rotation direction R4 of the bottom front roller 112, is transmitted to the bottom delivery roller 23 through the power transmission device 40 such that the bottom delivery roller 23 rotates in the same rotation direction as the bottom front roller 112. Thus, even when foreign material such as cotton fly is sent toward the counter shaft 30 through the rotation of the bottom front roller 112, the rotation of the counter shaft 30 will sweep out the foreign material from between the bottom front roller 112 and the counter shaft 30 in the feeding direction Y. This prevents the entrance of the foreign material between the bottom front roller 112 and the counter shaft 30.

(2) The size of the intermediate gear 41 in the longitudinal direction X is less than the sizes of the driven gear 23b and the driving gear 31 in the longitudinal direction X. Further, the driving gear 31 is arranged on only part of the counter shaft 30 in the axial direction. Thus, even though the rotation direction R1 of the driving gear 31 and the rotation direction R2 of the intermediate gear 41 are opposite to each other, foreign material is less likely to enter between the driving gear 31 and the intermediate gear 41.

(3) The power transmission device 40 includes the driving gear 31, the driven gear 23b, and the intermediate gear 41. The power transmission device 40 is arranged on part of the counter shaft 30 and the delivery rotary shaft 23a in the axial direction. Thus, the counter shaft 30 and the delivery rotary shaft 23a mesh with each other through the intermediate gear 41 at portions in which the intermediate gear 41 is arranged. However, the counter shaft 30 and the delivery rotary shaft 23a are spaced apart from each other in the other portions. Thus, although the layout may allow foreign material to enter between the counter shaft 30 and the delivery rotary shaft 23a, the rotation of the counter shaft 30 will sweep out the foreign material from between the bottom front roller 112 and the counter shaft 30. This prevents the entrance of the foreign material between the bottom front roller 112 and the counter shaft 30.

(4) The driving gear 31 is arranged on the existing counter shaft 30, and the driven gear 23b is arranged on the existing delivery rotary shaft 23a. Thus, in the fiber bundle concentrating device 20, the power transmission device 40 can be arranged simply by adding the intermediate gear 41. Since the intermediate gear 41 is fixed to the support plate 51 by the gear bracket 42, there is no need to include a new stand 50 for adding the intermediate gear 41. Thus, the power transmission device 40 can be arranged in the spinning frame 10 without adding a large component such as the stand 50.

(5) A fiber bundle F may be cut and hang down between the pair of the middle rollers 114 and the pair of the back rollers (indicated by an imaginary line in Fig. 3) or at the rear side of the pair of the back rollers of the draft device 11. The hanging fiber bundle F may be wound around the counter shaft 30. However, the shaft guard 60 prevents the winding of the fiber bundle F around the counter shaft 30.

(6) The counter shaft 30 and the bottom delivery roller 23 are connected to each other by the power transmission device 40. The plate-shaped shaft guard 60 extends entirely over the counter shaft 30 continuously in the axial direction of the counter shaft 30 at a position free from interference with the power transmission device 40. As a result, the shaft guard 60 prevents the winding of the fiber bundle F around the counter shaft 30 in a further ensured manner.

(7) The counter shaft 30 is arranged at a position closer to the frame 105 than the intermediate gear 41 is to the frame 105. In other words, the counter shaft 30 is spaced apart from the bottom front roller 112 by the intermediate gear 41. This further prevents, even when foreign material is sent toward the counter shaft 30 through the rotation of the bottom front roller 112, the entrance of the foreign material between the bottom front roller 112 and the counter shaft 30.

Modified Examples

[0049] The present embodiment may be modified as described below. The present embodiment and the following modifications can be combined if the combined modifications remain technically consistent with each other.

[0050] As shown in Fig. 8, the spinning frame 10 includes an intermediate stand 53 arranged between two stands 50 adjacent to each other in the longitudinal direction X. The intermediate stand 53 extends forward from the frame 105 (not shown in Fig. 8).

[0051] In this case, the counter shafts 30 adjacent to each other in the longitudinal direction X are coupled to each other by the coupling unit 32 with a gear shaft 34 in between. The gear shaft 34 includes a shaft portion 34a and gear portions 34b that rotate integrally with the shaft portion 34a. The counter shafts 30 and the gear shaft 34 are adjacent to one another in the longitudinal direction X and are coupled to one another by the coupling units 32. In the gear shaft 34, a part of the shaft portion 34a that is located between the two gear portions 34b is supported by the intermediate stand 53 with a bearing 35.

[0052] Further, one compacting unit 21 is supported

between the stand 50 and the intermediate stand 53 adjacent to each other in the longitudinal direction X. In this case, two compacting units 21 are supported by the intermediate stand 53 between the two stands 50, adjacent to each other in the longitudinal direction X. In the two compacting units 21, the driven gears 23b are each arranged closer to the intermediate stand 53 than to the stands 50.

[0053] The intermediate stand 53 rotatably supports a support shaft 56 formed integrally with intermediate gears 55. The intermediate gears 55 are arranged at the opposite ends of the support shaft 56. The intermediate gears 55 mesh with the gear portions 34b and the driven gears 23b. Thus, the spinning frame 10 includes two power transmission devices 40 with the intermediate stand 53 in between. The power transmission devices 40 each include the driven gear 23b rotating integrally with the bottom delivery roller 23, the gear portion 34b rotating integrally with the counter shaft 30, and the intermediate gear 55.

[0054] With this structure, the gear portion 34b is arranged on the existing counter shaft 30, and the driven gear 23b is arranged on the existing delivery rotary shaft 23a. Thus, in the fiber bundle concentrating device 20, the power transmission device 40 can be arranged simply by adding the intermediate gear 55. The intermediate gear 55 is supported by the intermediate stand 53 with the support shaft 56. The intermediate stand 53 separate from the stand 50 is directly fixed to the frame 105. Thus, even when the compacting unit 21 and the support plates 51 are removed from the spinning frame 10 during a change in the spinning specifications from a compact yarn to a normal yarn, the intermediate stand 53 and the intermediate gear 55 can remain installed in the spinning frame 10.

[0055] As shown in Fig. 9, the power transmission device may be a driving belt 70 that transmits the rotation of the counter shaft 30 to the bottom delivery roller 23 such that the bottom delivery roller 23 rotates in the same rotation direction as the bottom front roller 112. This eliminates the need for the intermediate gear 41, the driven gear 23b, and the driving gear 31.

[0056] The power transmission device may be a friction wheel that transmits the rotation of the counter shaft 30 to the bottom delivery roller 23 such that the bottom delivery roller 23 rotates in the same rotation direction as the bottom front roller 112. The friction wheel slides in contact with the delivery rotary shaft 23a and the counter shaft 30. In other words, the power transmission device may have any structure as long as the rotation of the counter shaft 30 is transmitted to the bottom delivery roller 23 such that the bottom delivery roller 23 rotates in the same rotation direction as the bottom front roller 112.

[0057] The fiber bundle concentrating device 20 of the spinning frame 10 does not need to include the shaft guard 60.

[0058] The shaft guard 60 may include only the first guard portion 61 and the attachment pieces 63. The shaft guard 60 may include a guard portion extending over the counter shaft 30 other than the first guard portion 61 and the second guard portion 62. In other words, the shape of the shaft guard 60 may be changed in order to extend over the counter shaft 30.

[0059] The draft device 11 may include two pairs of rollers. In this case, one of the two pairs of the rollers that is located at the most downstream location in the feeding direction Y serves as a pair of feeding rollers.

[0060] In the fiber bundle concentrating device 20 of the spinning frame 10, the quantity of the compacting units 21 and the quantity of the counter shafts 30 may be changed.

[0061] Various changes in form and details may be made to the examples above without departing from the spirit and scope of the claims and their equivalents. The examples are for the sake of description only, and not for purposes of limitation. Descriptions of features in each example are to be considered as being applicable to similar features or aspects in other examples. Suitable results may be achieved if sequences are performed in a different order, and/or if components in a described system, architecture, device, or circuit are combined differently, and/or replaced or supplemented by other components or their equivalents. The scope of the disclosure is not defined by the detailed description, but by the claims and their equivalents. All variations within the scope of the claims and their equivalents are included in the disclosure.

Claims

1. A fiber bundle concentrating device (20) in a spinning frame (10), the fiber bundle concentrating device (20) comprising:

   a compacting unit (21) including a suction portion (24) that draws in and concentrates a fiber bundle (F) fed from a pair of feeding rollers (111) in a feeding direction, and a bottom delivery roller (23) that feeds the concentrated fiber bundle (F) in the feeding direction; and

   a counter shaft (30) that is driven independently of a feeding bottom roller (112) that is one of the feeding rollers in the pair of feeding rollers (111), the counter shaft (30) rotating to rotate the bottom delivery roller (23) and being arranged adjacent to the feeding bottom roller (112),

   wherein the counter shaft (30) is configured to rotate in a same rotation direction as the feeding bottom roller (112) and to transmit a rotation of the counter shaft (30) to the bottom delivery roller (23) through a power transmission device (40) such that the bottom delivery roller (23) rotates in the same rotation direction as the feeding bottom roller (112).

2. The fiber bundle concentrating device (20) according to claim 1, wherein

the spinning frame (10) includes:

stands (50) rotatably supporting a rotary shaft (112a) that rotates integrally with the feeding bottom roller (112) and being arranged next to each other in an axial direction of the rotary shaft (112a); and
a support plate (51) extending from each of the stands (50) and rotatably supporting the counter shaft (30),

the power transmission device (40) includes:

a driving gear (31) arranged on a circumferential surface of the counter shaft (30);
a driven gear (23b) arranged on a circumferential surface of a delivery rotary shaft (23a) that rotates integrally with the bottom delivery roller (23); and
an intermediate gear (41) meshing with the driving gear (31) and the driven gear (23b), and

the intermediate gear (41) is rotatably supported by a gear bracket (42) extending from the support plate (51).

3. The fiber bundle concentrating device (20) according to claim 1, wherein

the spinning frame (10) includes:

stands (50) rotatably supporting a rotary shaft (112a) that rotates integrally with the feeding bottom roller (112) and being arranged next to each other in an axial direction of the rotary shaft (112a); and
an intermediate stand (53) arranged between the stands (50), adjacent to each other in the axial direction, the intermediate stand (53) rotatably supporting a delivery rotary shaft (23a) that rotates integrally with the bottom delivery roller (23) and rotatably supporting the counter shaft (30),

the power transmission device (40) includes:

a driving gear (34b) arranged on a circumferential surface of the counter shaft (30);
a driven gear (23b) arranged on a circumferential surface of the delivery rotary shaft (23a); and
an intermediate gear (55) meshing with the driving gear (34b) and the driven gear (23b), and

the intermediate gear (55) is rotatably supported by the intermediate stand (53).

4. The fiber bundle concentrating device (20) according to claim 2 or 3, further comprising:
a shaft guard (60) arranged between the stands (50), adjacent to each other in the axial direction, the shaft guard (60) extending over the counter shaft (30), wherein the shaft guard (60) has a plate shape that extends entirely over the counter shaft (30) in the axial direction.

5. The fiber bundle concentrating device (20) according to claim 2 or 3, wherein the stands (50) extend forward from a frame (105) of the spinning frame (10), and the counter shaft (30) is arranged at a position closer to the frame (105) than the intermediate gear (41) is to the frame (105).

Fig.1

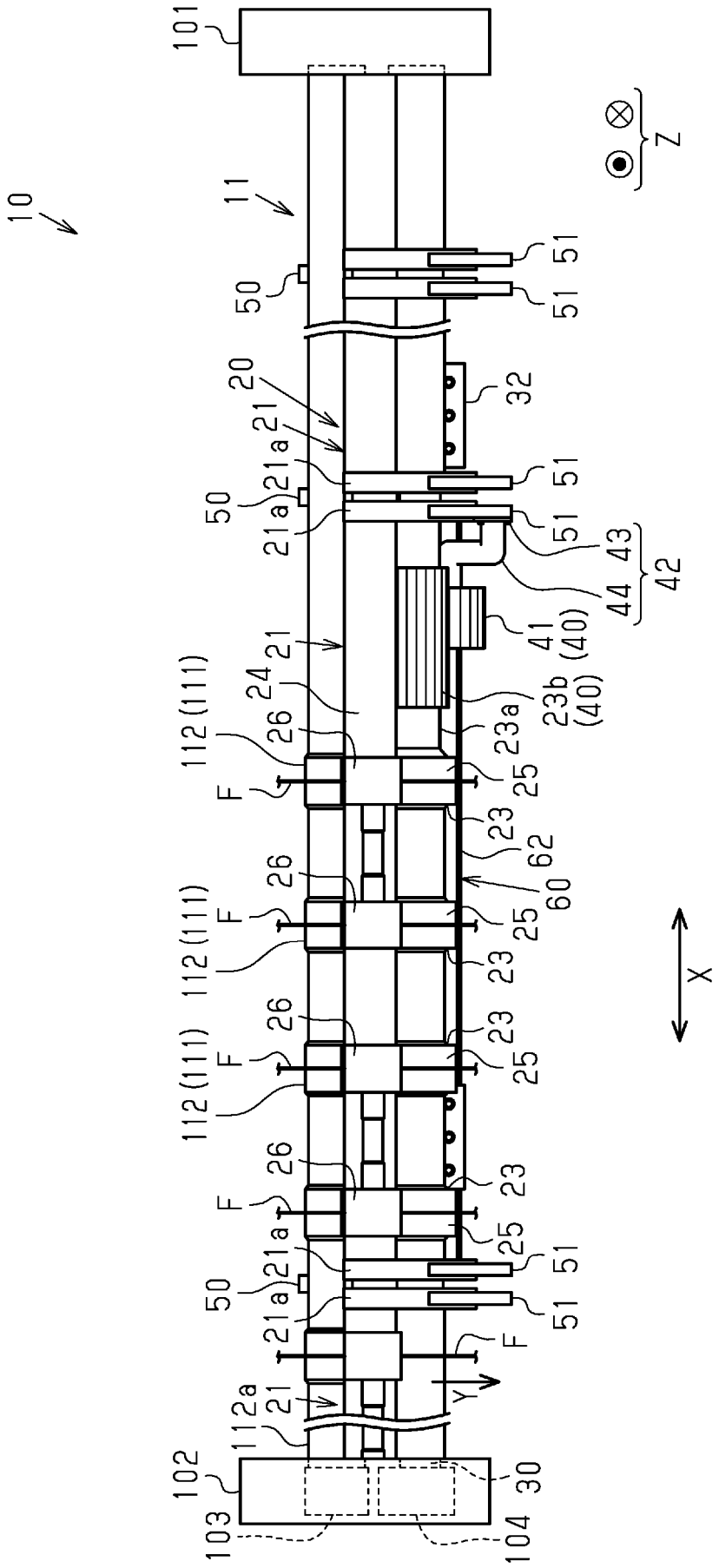

10
11
101
102
103
104
112a
112(111)
20
21
21a
30
32
41
42
43
44
50
51
60
62
23
23a
23b
24
25
26
(40)
F
X
Y
Z

Fig.2

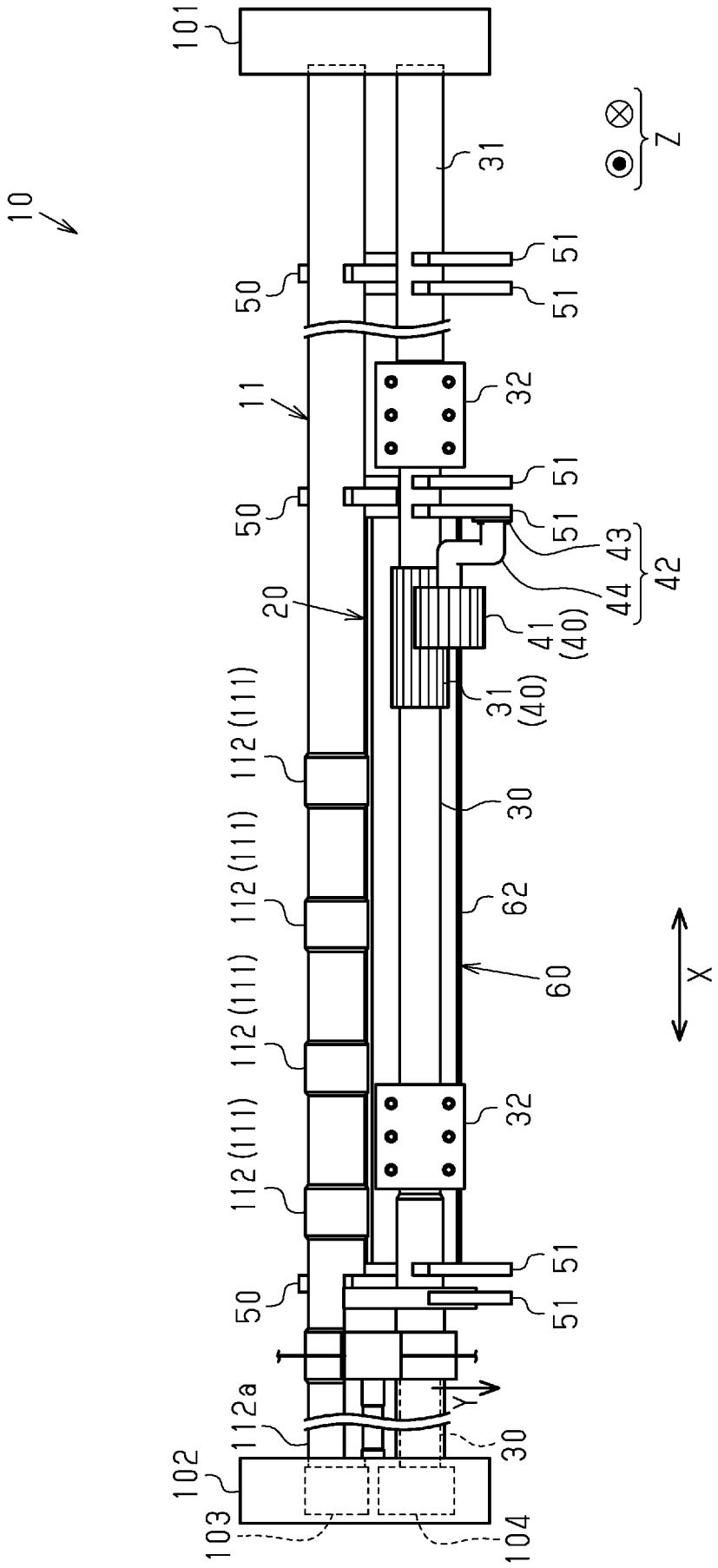

10
101
31
Z
50
51
51
11
32
50
51
51
43
42
44
20
41
(40)
31
(40)
112(111)
30
112(111)
62
112(111)
60
X
112(111)
32
112(111)
50
51
51
Y
112a
30
102
103
104

Fig.3

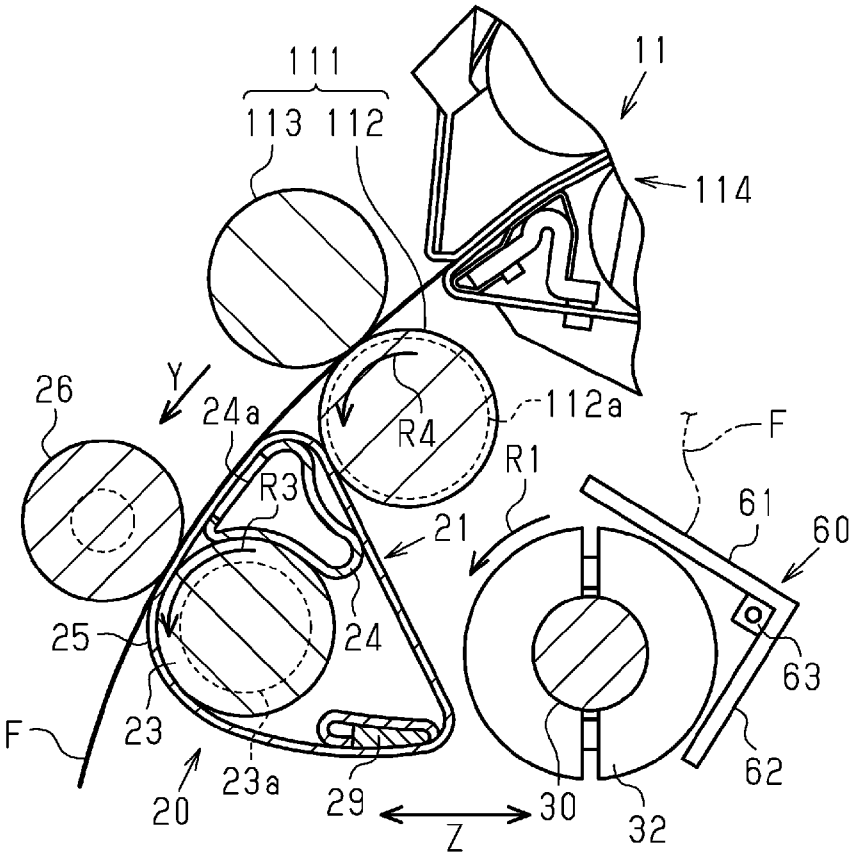

111
113
112
11
114
26
Y
24a
R4
112a
F
R3
R1
61
60
21
25
24
63
F
23
62
20
23a
29
30
32
Z

Fig.4

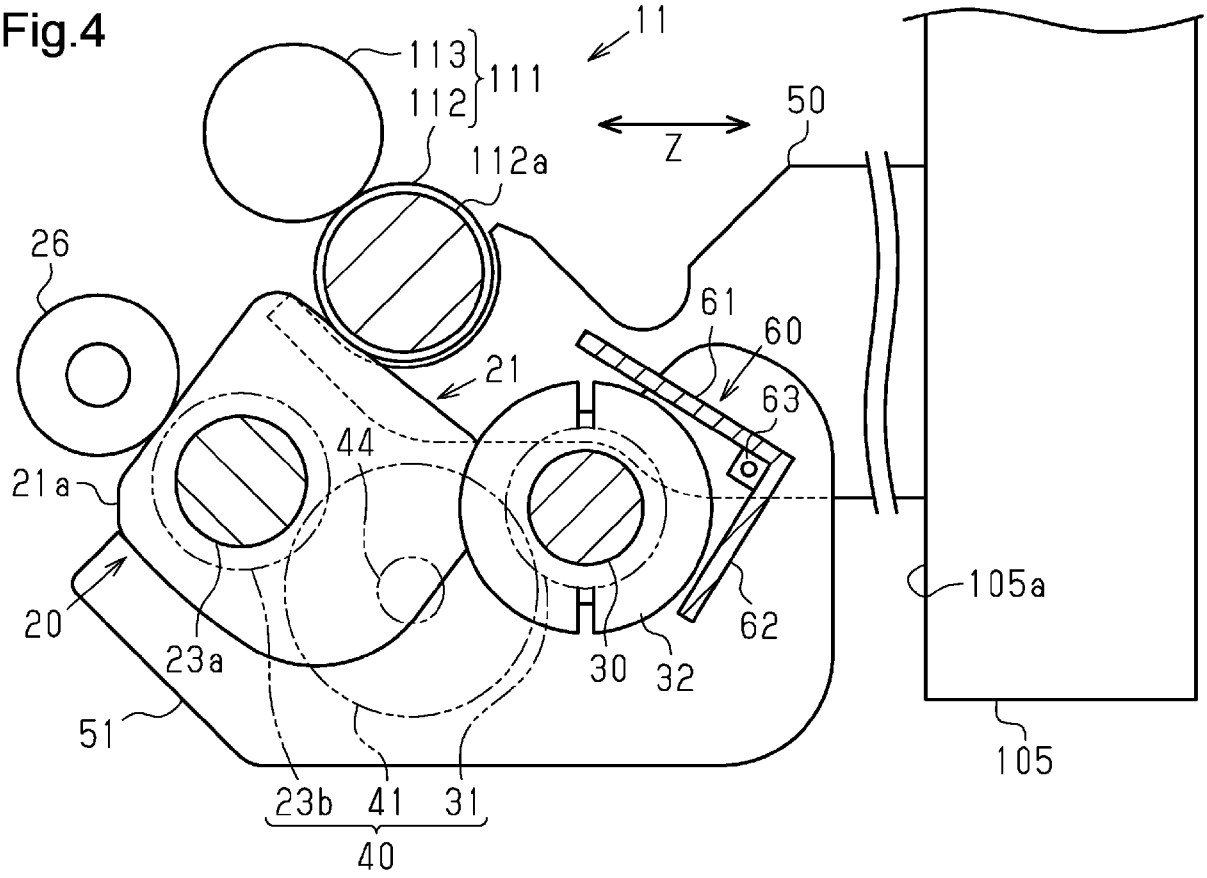

11
113
111
112
50
Z
112a
26
61
60
21
63
44
21a
105a
20
23a
30
32
62
51
105
23b
41
31
40

Fig.5

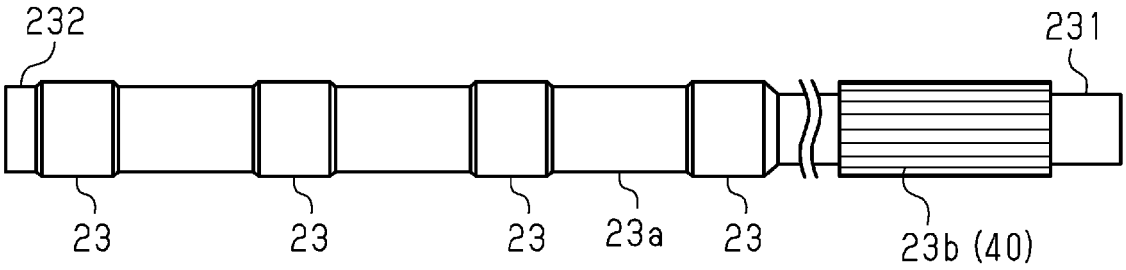

232
231
23
23
23
23a
23
23b (40)

Fig.6

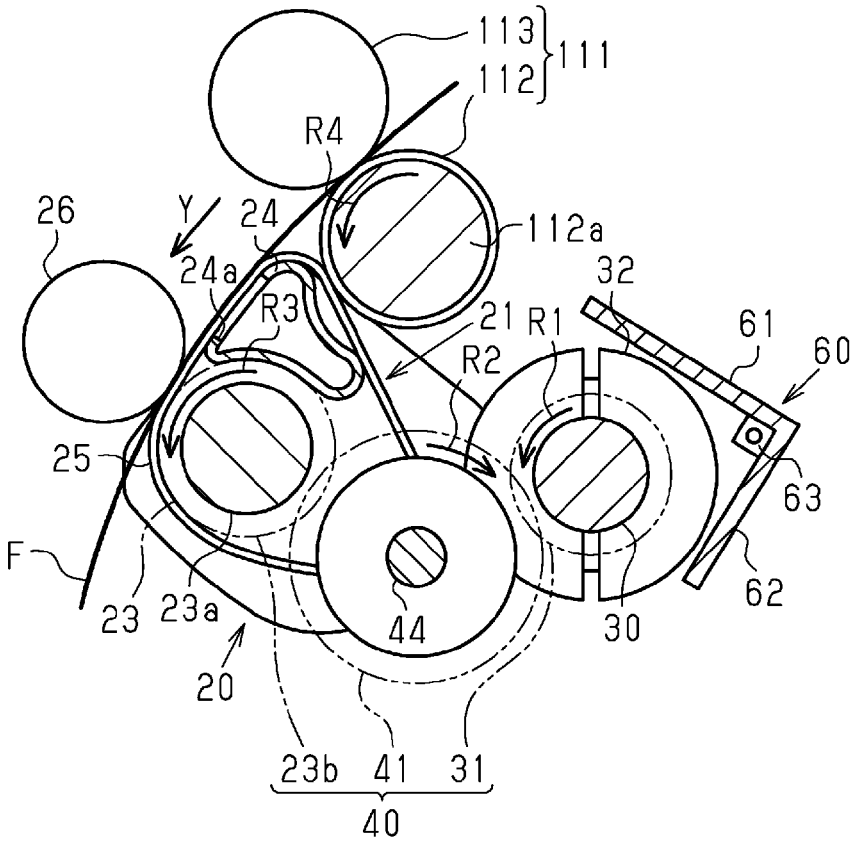

113
111
112
R4
26
Y
24
112a
24a
32
R3
21
R1
61
60
R2
25
63
F
23
23a
44
30
62
20
23b
41
31
40

Fig.7

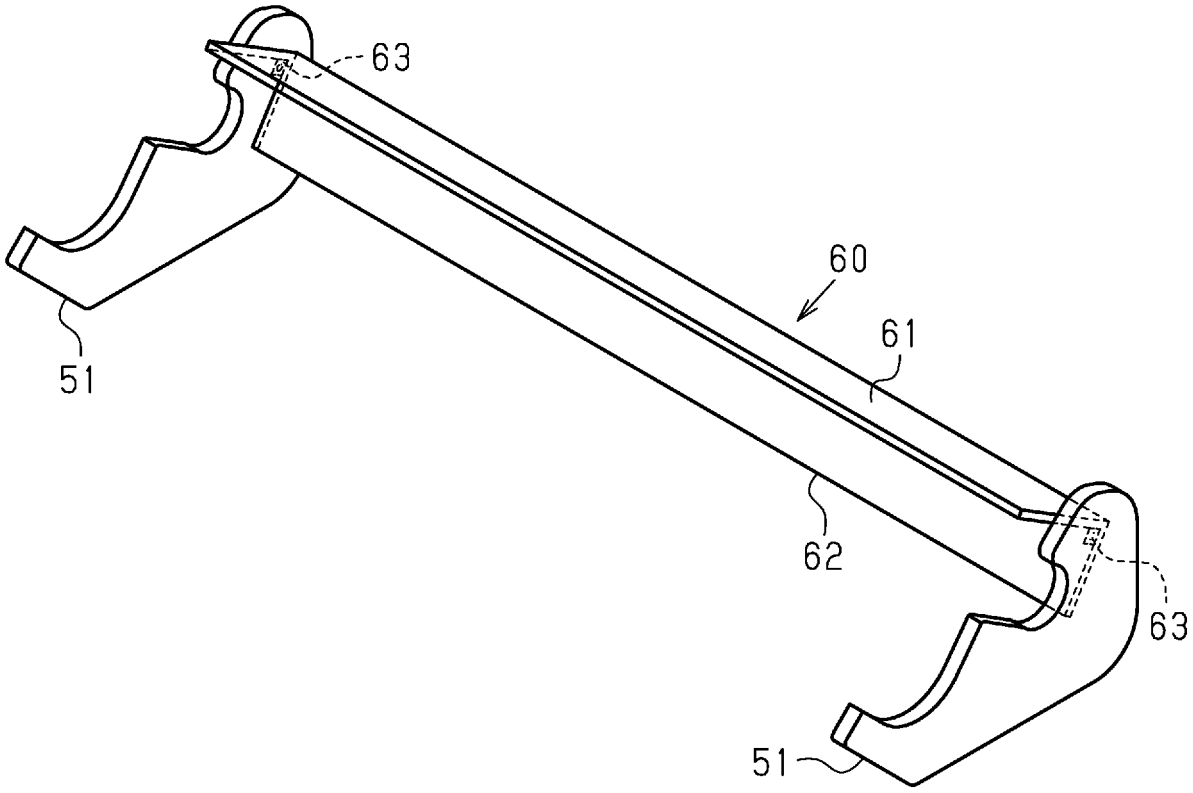

63
60
61
51
62
63
51

Fig.8

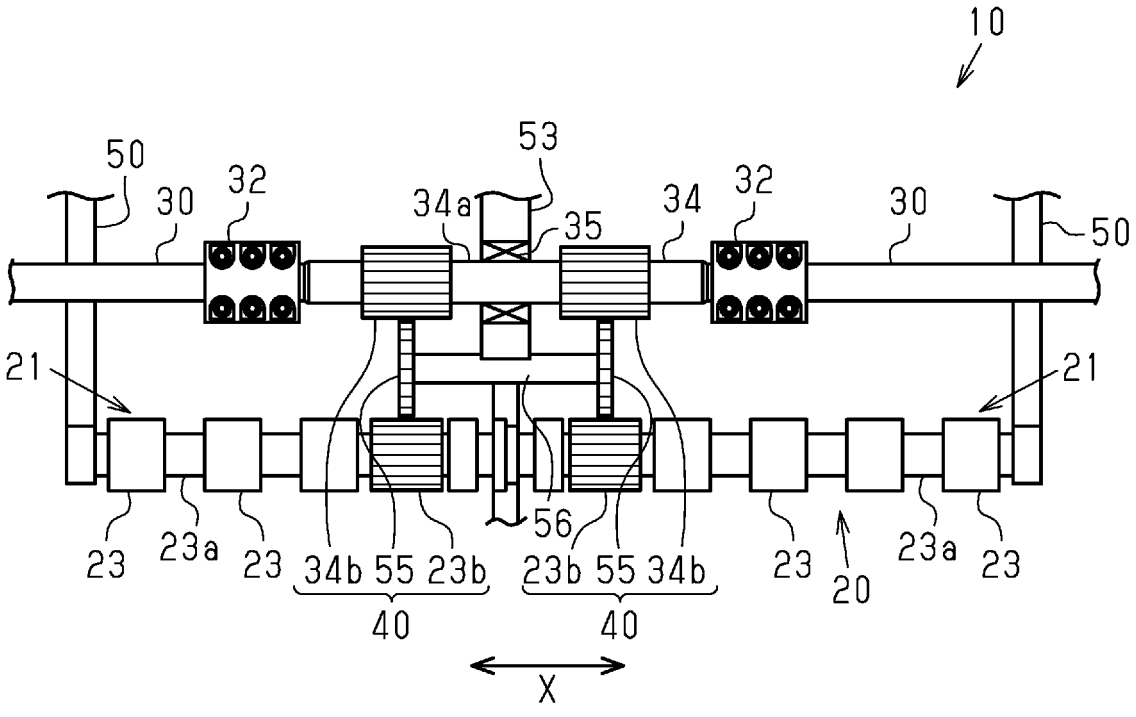
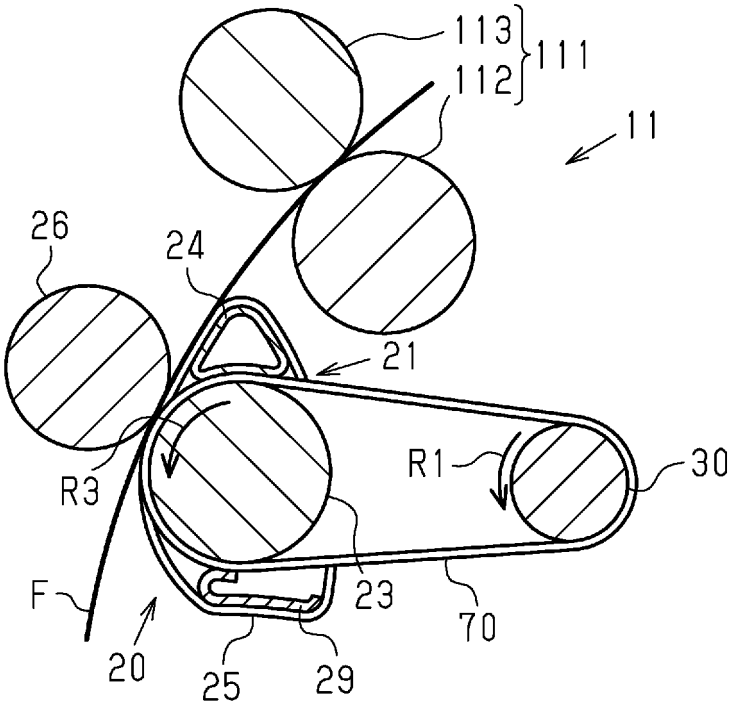

10
50
30
32
53
34a
35
34
32
30
50
21
21
23
23a
23
34b 55 23b
56
23b 55 34b
23
20
23a
23
40
40
X

Fig.9



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EUROPEAN SEARCH REPORT

Application Number
EP 24 19 8633

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 300 495 A1 (TOYOTA JIDOSHOKKI KK [JP]) 9 April 2003 (2003-04-09) * paragraph [0001] * * paragraph [0016]; figure 1 * * paragraph [0021]; figures 2-3 * * paragraph [0055] *	1	INV. D01H5/72
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TECHNICAL FIELDS SEARCHED (IPC)

D01H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	7 February 2025	Pollet, Didier

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