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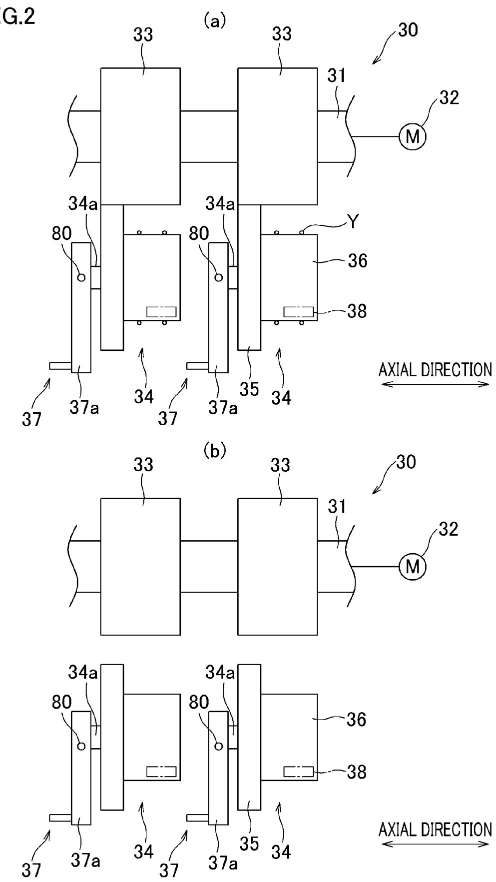
(54) YARN SENDING DEVICE AND FALSE-TWIST TEXTURING MACHINE

(57) An object of the present invention is to provide a yarn sending device (30, 40, 46, 50, 60) which is able to reduce the burden of maintenance and to achieve cost reduction.

A yarn sending device (30) includes: drive rollers (33) fixed to a drive shaft (31) which is rotationally driven; and driven rollers (34) which are rotated by making contact with circumferential surfaces of the drive rollers (33) and receiving a rotational force from the drive rollers (33). At a part of each driven roller (34) in an axial direction of the driven roller (34), a rotational force receiver (35) configured to make contact with a circumferential surface of one drive roller (33) and a yarn feeding unit (36) configured not to make contact with the circumferential surface of the drive roller (33) are formed. A yarn Y is wound onto the yarn feeding unit (36).

FIG.2



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a yarn sending device configured to send yarns and a false-twist texturing machine including the yarn sending device.

[0002] A known yarn sending device is configured to send yarns while sandwiching the yarns between drive rollers and driven rollers in a yarn processor including a crimp processing part configured to crimp the yarns made of synthetic fibers. For example, Patent Literature 1 (Japanese Laid-Open Patent Publication No. H1-132843) discloses a false-twist texturing machine including a yarn sending device having (i) drive rollers fixed to a shaft which is rotatably driven and (ii) driven rollers in contact with circumferential surfaces of the drive rollers. In this yarn sending device, yarns are sandwiched between the drive rollers and the driven rollers. Furthermore, as the drive rollers is rotated, the yarns are sent.

SUMMARY OF THE INVENTION

[0003] Patent Literature 1 discloses a so-called nip-roller type yarn sending device configured to send yarns while sandwiching the yarns between drive rollers and driven rollers. With this arrangement, when a contact state between circumferential surfaces of the drive rollers and circumferential surfaces of the driven rollers is not appropriate, the yarns may slip. To avoid the slipping of the yarns, it is required to adjust the drive rollers to be exactly in parallel to the driven rollers. This makes maintenance laborious.

[0004] In this regard, it is conceivable to send the yarns not by means of the nip-roller type yarn sending device but by means of godet rollers which are rotationally driven by motors. In this case, each yarn is not sandwiched between two rollers but is simply wound onto a circumferential surface of one of the godet rollers. Therefore, the maintenance for maintaining the two rollers to be in parallel to each other is not required. However, the number of the godet rollers with the motors is required to be the same as that of the yarns. This results in cost increase.

[0005] The present invention has been made in view of this problem. An object of the present invention is to provide a yarn sending device which is able to reduce the burden of maintenance and to achieve cost reduction.

[Solution to Problem]

[0006] A yarn sending device of the present invention is provided in a yarn processor including a crimp processing part configured to crimp at least one yarn made of synthetic fibers, the yarn sending device comprising: drive rollers fixed to a drive shaft which is rotationally driven; and driven rollers which are rotated by making contact with circumferential surfaces of the drive rollers and receiving a rotational force from the drive rollers. At a part of each of the driven rollers in an axial direction of the each of the driven rollers, a rotational force receiver configured to make contact with a circumferential surface of corresponding one of the drive rollers and a yarn feeding unit which is configured not to make contact with the circumferential surface of the corresponding one of the drive rollers and onto which the at least one yarn is wound are formed.

[0007] With this arrangement, the drive rollers are fixed to the drive shaft. It is therefore possible to rotate the drive rollers by using a single driving source configured to rotationally drive the drive shaft. Cost reduction is therefore achieved. The each of the driven rollers includes the rotational force receiver configured to make contact with the circumferential surface of the corresponding one of the drive rollers and the yarn feeding unit configured not to make contact with the circumferential surface of the corresponding one of the drive rollers. As the each of the driven rollers is rotated by receiving the rotational force of the corresponding one of the drive rollers via the rotational force receiver, the at least one yarn wound onto the yarn feeding unit is sent to the downstream side in a yarn running direction. Although it is required to remain an appropriate contact state between each of the drive rollers and the rotational force receiver of the each of the driven rollers, fine adjustment such as that in a nip-roller type yarn sending device is not required. This is because the at least one yarn is not sent while being sandwiched between the each of the drive rollers and the each of the driven rollers. As a result, the burden of maintenance is reduced. As such, the above-described arrangement makes it possible to reduce the burden of maintenance and to achieve cost reduction.

[0008] In the present invention, the each of the driven rollers and the corresponding one of the drive rollers may form a pair, a large diameter portion and a small diameter portion which is smaller in outer diameter than the large diameter portion may be formed in one roller among the pair of the each of the driven rollers and the corresponding one of the drive rollers, and the large diameter portion may be configured to make contact with a circumferential surface of the other roller among the pair of the each of the driven rollers and the corresponding one of the drive rollers.

[0009] With this arrangement, there is a space between a circumferential surface of the small diameter portion of the one roller and a part of a circumferential surface of the other roller. The part of the circumferential surface of the other roller opposes the small diameter portion. Therefore, when the at least one yarn is wound onto the circumferential surface of the small diameter portion of the one roller or onto the part of the circumferential surface of the other roller which opposes the small diameter portion, the at least one yarn is sent on account of a holding force, i.e., a friction force of the at least one wounded yarn without being sandwiched between the one roller and the other roller.

[0010] In the present invention, the small diameter portion in the axial direction may be larger than the large diameter portion in the axial direction.

[0011] With this arrangement, the small diameter portion is able to have a large part onto which the at least one yarn is wounded. As a result, yarn threading is facilitated.

[0012] In the present invention, the one roller may be structured so that the large diameter portion is attachable to and detachable from the small diameter portion.

[0013] When the large diameter portion of the one roller is worn as a result of contact with the other roller, the number of rotations of the each of the driven rollers changes so that the conveyance speed of conveying the at least one yarn changes. With the above-described arrangement, when the large diameter portion is worn, the change of conveyance speed of conveying the at least one yarn is avoided by performing replacement of the large diameter portion.

[0014] In the present invention, at least a part of the small diameter portion formed in the one roller may be provided to oppose a circumferential surface of the other roller.

[0015] For example, when the at least one yarn is thick, the at least one yarn is stably sent by a nip-roller type yarn sending device. As such, the type of an appropriate yarn sending device changes depending on the type of the at least one yarn. With the above-described arrangement, when the large diameter portion is detached from the small diameter portion, the yarn sending device is usable as the nip-roller type yarn sending device configured to send the at least one yarn while sandwiching the at least one yarn between the small diameter portion and the other roller. This makes it possible to provide the yarn sending device which is appropriate for various types of yarns. When the large diameter portion is detached from the small diameter portion in one or some of the driven rollers, the various types of yarns are simultaneously sent by the single yarn sending device.

[0016] In the present invention, the large diameter portion and the small diameter portion may be formed in the each of the driven rollers, the large diameter portion may function as the rotational force receiver, and the small diameter portion may function as the yarn feeding unit.

[0017] According to this, a level difference is formed between the large diameter portion and the small diameter portion. This makes it possible to prevent the at least one yarn wounded onto the small diameter portion from moving to the large diameter portion. It is therefore possible to prevent the at least one yarn from being unintentionally sandwiched between the large diameter portion and the each of the drive rollers.

[0018] In the present invention, a fixing shaft which rotatably supports the each of the driven rollers and a supporter which supports the fixing shaft may be provided in the each of the driven rollers, and the fixing shaft may be fixed to the supporter so as to be attachable to and detachable from the supporter.

[0019] With this arrangement, replacement of the each of the driven rollers is easily performed in such a way that the fixing shaft is detached from the supporter along with the each of the driven rollers.

[0020] In the present invention, both the large diameter portion and the small diameter portion may be formed in the each of the driven rollers.

[0021] With this arrangement, a space required for providing a unit including the each of the driven rollers, the fixing shaft, and the supporter is small as compared to a case where the large diameter portion and the small diameter portion are formed in different driven rollers. As the fixing shaft is detached from the supporter along with the each of the driven rollers, the large diameter portion and the small diameter portion are simultaneously detached.

[0022] In the present invention, the each of the driven rollers may be structured so that a ring-shaped member is attached to a circumferential surface of a cylindrical roller main body and, in the roller main body, a part to which the ring-shaped member is attached may function as the large diameter portion and a part to which the ring-shaped member is not attached may function as the small diameter portion.

[0023] With this arrangement, for example, when the large diameter portion is worn, the worn ring-shaped member is detached from the roller main body and a new ring-shaped member is attached to the roller main body. This facilitates replacement of the large diameter portion.

[0024] In the present invention, the large diameter portion may be formed of a central portion and an outer circumferential portion which is detachably attached to a circumferential surface of the central portion.

[0025] With this arrangement, for example, when the large diameter portion is worn, replacement is performed not for the entire large diameter portion but only for the outer circumferential portion. Therefore, running costs are reduced.

[0026] In the present invention, the large diameter portion may be attached to an end face of the small diameter portion in the each of the driven rollers.

[0027] When the large diameter portion is formed of the ring-shaped member described above, the ring-shaped member may be broken because the strength of the ring-shaped member is insufficient. Meanwhile, when the large diameter portion is attached to the end face of the small diameter portion, the large diameter portion is shaped as a disc to improve the strength of the large diameter portion.

[0028] In the present invention, the driven rollers may be respectively replaceable with cylindrical rollers each of which has a constant outer diameter.

[0029] With this arrangement, when the each of the driven rollers each of which is configured to send the at least one yarn by means of the small diameter portion without sandwiching the at least one yarn is replaceable with a roller which is configured to send the at least one yarn while sandwiching the at least one yarn with one of the drive rollers, the yarn sending device which is appropriate for various types of yarns is provided. When one or some of the driven rollers is/are replaced with one or some of the cylindrical rollers each of which has a constant outer diameter, the various types of yarns are simultaneously sent by the single yarn sending device.

[0030] In the present invention, the each of the driven rollers in the axial direction may be larger than each of the drive rollers in an axial direction of the each of the drive rollers and, in the each of the driven rollers, a part which is in contact with a circumferential surface of the corresponding one of the drive rollers may function as the rotational force receiver and a part which is not in contact with the circumferential surface of the corresponding one of the drive rollers may function as the yarn feeding unit.

[0031] With this arrangement, the driven rollers and the drive rollers are cylindrical in shape. Therefore, the structures of the driven rollers and drive rollers are simplified as compared to a case where the large diameter portion and the small diameter portion are formed in the each of the driven rollers or the each of the drive rollers.

[0032] In the present invention, a circumferential surface of the yarn feeding unit may be made of metal.

[0033] When the circumferential surface of the yarn feeding unit is worn as a result of friction with the at least one yarn, the at least one yarn may get damaged or may not be reliably sent. When the circumferential surface of the yarn feeding unit is made of metal, wearing of the circumferential surface of the yarn feeding unit is preferably suppressed.

[0034] In the present invention, a circumferential surface of the rotational force receiver may be made of a material a friction coefficient of which is larger than a friction coefficient of a material of the circumferential surface of the yarn feeding unit.

[0035] With this arrangement, when the rotational force receiver is in contact with a circumferential surface of the each of the drive rollers, the rotational force receiver further reliably receives the rotational force from the each of the drive rollers.

[0036] The yarn sending device of the present invention may further include a detector configured to detect the number of rotations of the each of the driven rollers.

[0037] When the rotational force is transmitted as a result of the contact between the each of the drive rollers and the each of the driven rollers, the number of rotations of the each of the driven rollers may change because of wearing of the each of the driven rollers. In this regard, when the detector configured to detect the number of rotations of the each of the driven rollers is provided, the change of number of rotations of the each of the driven rollers is grasped and suitably dealt with.

[0038] In the present invention, the each of the driven rollers may include a movement mechanism configured to move the each of the driven rollers between a contact position where the each of the driven rollers makes contact with a circumferential surface of the corresponding one of the drive rollers and a separated position where the each of the driven rollers is separated from the corresponding one of the drive rollers.

[0039] With this arrangement, when the at least one yarn is broken, the yarn breakage is dealt with in such a way that one of the driven rollers which sends the at least one broken yarn is separated from corresponding one of the drive rollers.

[0040] In the present invention, a separate roller may be provided in the vicinity of the each of the driven rollers, and the at least one yarn may be wound onto the yarn feeding unit and the separate roller.

[0041] With this arrangement, the at least one yarn is further reliably sent by the yarn feeding unit.

[0042] In the present invention, the number of the drive rollers may be identical with the number of the driven rollers.

[0043] As such, when the number of the drive rollers is identical with the number of the driven rollers, the size of the each of the drive rollers in the axial direction is small as compared to a case where, e.g., two driven rollers are provided to correspond to the each of the drive rollers. It is therefore possible to reduce the total weight of all of the drive rollers, and to rotate the drive rollers with small power. In order to remain an appropriate contact state between the drive rollers and the driven rollers, the drive rollers are preferably provided to correspond to the respective driven rollers.

[0044] In the present invention, the axial direction of the each of the drive rollers may be in parallel to a direction in which the drive rollers are aligned.

[0045] When known godet rollers with motors are aligned, the godet rollers are typically provided so that an axial direction of each godet roller is orthogonal to a direction in which the godet rollers are aligned. As a result, space saving is achieved in the direction in which the godet rollers are aligned. In this case, however, a space equal to the size of the diameter of each godet roller or the size of each motor is required. Meanwhile, in the above-described arrangement of the present invention, it is not required to provide the drive rollers with motors configured to drive the respective drive rollers. Therefore, the drive rollers are provided as described above to achieve space saving.

[0046] A false-twist texturing machine of the present invention includes the yarn sending device arranged as described above, the false-twist texturing machine being configured to false-twist yarns sent by the yarn sending device.

[0047] The false-twist texturing machine structured as described above makes it possible to reduce the burden of maintenance of the yarn sending device and to achieve cost reduction.

BRIEF DESCRIPTION OF THE DRAWINGS

[0048]

FIG. 1 is a schematic diagram of a false-twist texturing machine in an embodiment of the present invention.

Each of FIG. 2(a) and FIG. 2(b) is a schematic diagram of a part of a yarn sending device.

FIG. 3 is a schematic diagram of each separate roller.

FIG. 4 is a schematic diagram of each driven roller which has been replaced with a cylindrical roller.

FIG. 5 is a schematic diagram of a part of a yarn sending device in a first modification.

FIG. 6 is a schematic diagram of a part of a yarn sending device in a second modification.

FIG. 7 is a schematic diagram of a part of a yarn sending device in a third modification.

FIG. 8 is a schematic diagram of a part of a yarn sending device in a fourth modification.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0049] The following will describe an embodiment of the present invention with reference to figures.

(Overall Structure of False-Twist Texturing Machine)

[0050] FIG. 1 is a schematic diagram of a false-twist texturing machine 1 (corresponding to a yarn processor of the present invention) in an embodiment of the present invention. The false-twist texturing machine 1 includes: a yarn supplying part 2 configured to supply yarns Y made of synthetic fibers; a processing part 3 (corresponding to a crimp processing part of the present invention) configured to perform false-twisting (one type of crimping of the present invention) for the yarns Y supplied from the yarn supplying part 2; and a winding part 4 configured to wind the yarns Y false-twisted by the processing part 3 so as to form packages P. In the processing part 3, processing units 10 (these units may be referred to spindles) configured to false-twist the yarns Y are aligned in a direction perpendicular to the sheet of FIG. 1. It is therefore possible to simultaneously false-twist the running yarns Y aligned in the direction perpendicular to the sheet of FIG. 1.

[0051] The yarn supplying part 2 is configured to supply the yarns Y from yarn supply packages Q to the processing part 3. The processing part 3 is configured to false-twist the yarns Y running along yarn paths. Each processing unit 10 forming the yarn processing part 3 includes the following members provided along the yarn paths in this order from the upstream side in a yarn running direction: a first feed roller 11; a twist-stopping guide 12; a first heater 13; a cooler 14; a false-twisting device 15; a second feed roller 16; an interlacing device 17; a third feed roller 18; a second heater 19; and a fourth feed roller 20. In the winding part 4, the yarns Y false-twisted by the processing part 3 are wound by winding devices 21 so as to form the packages P.

[0052] The false-twist texturing machine 1 includes a main base 5 and a winding base 6 which are placed to be spaced apart from each other in a left-right direction of FIG. 1. The main base 5 and the winding base 6 extend in the direction perpendicular to the sheet of FIG. 1, and are placed to oppose each other. An upper part of the main base 5 is connected to an upper part of the winding base 6 by a supporting frame 7. Each device forming the processing part 3 is mainly attached to the main base 5 or the supporting frame 7. A working space 8 surrounded by the main base 5, the winding base 6, and the supporting frame 7 is a space where an operator performs various operations such as yarn threading.

(Processing Part)

[0053] Each first feed roller 11 is provided at an upper portion of the winding base 6, and configured to send a yarn Y supplied from the yarn supplying part 2 to a corresponding first heater 13.

[0054] Each twist-stopping guide 12 is provided downstream of the first feed roller 11 and upstream of the first heater 13 in the yarn running direction. The twist-stopping guide 12 is configured to prevent twist of the yarn Y from being propagated to the upstream side in the yarn running direction of the twist-stopping guide 12. The twist of the yarn Y is formed by a corresponding false-twisting device 15 described later.

[0055] The first heater 13 is provided at the supporting frame 7, and configured to heat the yarn Y sent from the first feed roller 11.

[0056] Each cooler 14 is provided downstream of the first heater 13 and upstream of the false-twisting device 15 in the yarn running direction, and configured to cool the yarn Y heated by the first heater 13.

[0057] The false-twisting device 15 is provided at an upper portion of the main base 5, and configured to twist the yarn Y. Examples of the type of the false-twisting device 15 include a belt-type false-twisting device, a friction-disc type false-twisting device, and a pin-type false-twisting device. In the present embodiment, the type of the false-twisting device 15 is not limited to these.

[0058] Each second feed roller 16 is provided below the false-twisting device 15 in the main base 5, and configured to send the yarn Y twisted by the false-twisting device 15 to a corresponding interlacing device 17. The conveyance speed of conveying the yarn Y by the second feed roller 16 is higher than the conveyance speed of conveying the yarn Y by the first feed roller 11. The yarn Y is therefore drawn between the first feed roller 11 and the second feed roller 16.

[0059] The interlacing device 17 is provided below the second feed roller 16 in the main base 5, and configured to interlace the yarn Y.

[0060] Each third feed roller 18 is provided below the interlacing device 17 in the main base 5, and configured to send the yarn Y interlaced by the interlacing device 17 to a corresponding second heater 19. The conveyance speed of conveying the yarn Y by the third feed roller 18 is lower than the conveyance speed of conveying the yarn Y by the second feed roller 16. The yarn Y is therefore relaxed between the second feed roller 16 and the third feed roller 18.

[0061] The second heater 19 is provided below the third feed roller 18 in the main base 5, and configured to heat the yarn Y sent from the third feed roller 18.

[0062] Each fourth feed roller 20 is provided at a lower portion of the winding base 6, and configured to send the yarn Y thermally treated by the second heater 19 to a corresponding winding device 21. The conveyance speed of conveying the yarn Y by the fourth feed roller 20 is lower than the conveyance speed of conveying the yarn Y by the third feed roller 18. The yarn Y is therefore relaxed between the third feed roller 18 and the fourth feed roller 20.

[0063] In the processing part 3 arranged as described above, the yarn Y drawn between the first feed roller 11 and the second feed roller 16 is twisted by the false-twisting device 15. The twist formed by the false-twisting device 15 propagates to the twist-stopping guide 12, but does not propagate to the upstream of the twist-stopping guide 12 in the yarn running direction. The yarn Y twisted while being drawn is heated by the first heater 13, and then cooled and thermally set by the cooler 14. The twisted yarn Y passes the false-twisting device 15. After that, the yarn Y is unwound before reaching the second feed roller 16. However, because the twist of the yarn Y is thermally set as described above, each filament is maintained to be wavy in shape.

[0064] Subsequently, the yarn Y is interlaced by the interlacing device 17 while being relaxed between the second feed roller 16 and the third feed roller 18. The interlaced yarn Y is then thermally set by the second heater 19 while being relaxed between the third feed roller 18 and the fourth feed roller 20. Finally, the yarn Y sent from the fourth feed roller 20 is wound by the winding device 21 to form each package P.

(Yarn sending device)

[0065] Each of FIG. 2(a) and FIG. 2(b) is a schematic diagram of a part of a yarn sending device 30. The yarn sending device 30 is applied to at least one or all of each first feed roller 11, each second feed roller 16, each third feed roller 18, and each fourth feed roller 20. The yarn sending device 30 includes a drive shaft 31, a motor 32, drive rollers 33, and driven rollers 34.

[0066] The drive shaft 31 extends in the direction perpendicular to the sheet of FIG. 1, i.e., in a direction in which the yarns Y are aligned at the processing part 3. The drive shaft 31 is rotationally driven about its axis by the motor 32. To the drive shaft 31, the drive rollers 33 are fixed at regular intervals in an axial direction of the drive shaft 31 (hereinafter, this direction will be simply referred to as the axial direction). As the drive shaft 31 is rotationally driven by the motor 32, the drive rollers 33 are simultaneously rotated. The drive rollers 33 are cylindrical rollers each of which has a constant outer diameter and which are made of metal. However, the drive rollers 33 may be made of a material which is not metal.

[0067] The number of the driven rollers 34 is the same as that of the drive rollers 33. The driven rollers 34 are provided at regular intervals in the axial direction, so as to oppose the respective drive rollers 33. However, the number of the driven rollers 34 may not be the same as that of the drive rollers 33. For example, the driven rollers 34 may be provided for a single drive roller 33 which is large in the axial direction. In each driven roller 34, a lever mechanism 37 (corresponding to a movement mechanism of the present invention) is provided. Each driven roller 34 is attached to an unillustrated base through a supporter 37a of the lever mechanism 37. In each driven roller 34, a detector 38 configured to detect the number of rotations of the driven roller 34 is provided. However, the detector 38 may be omitted. Alternatively, the detector 38 may be provided in only one or some of the driven rollers 34.

[0068] The lever mechanism 37 is able to move a corresponding driven roller 34 between a contact position (see FIG. 2(a)) where the driven roller 34 (specifically, a large diameter portion 35) is in contact with a circumferential surface of a drive roller 33 and a separated position (see FIG. 2(b)) where the driven roller 34 (specifically, the large diameter portion 35) is separated from the circumferential surface of the drive roller 33. In the lever mechanism 37, an unillustrated biasing member (such as a spring) configured to bias the driven roller 34 toward the drive roller 33 is embedded. The biasing member is adjusted so that the driven roller 34 is in contact with the drive roller 33 with suitable contact pressure.

[0069] Each driven roller 34 includes a fixing shaft 34a supporting the driven roller 34 to be rotatable. The fixing shaft 34a is in parallel to the drive shaft 31. Between the driven roller 34 and the fixing shaft 34a, an unillustrated bearing is provided. The fixing shaft 34a is fixed to the supporter 37a of the lever mechanism 37 by a fixing mechanism. The fixing shaft 34a is detached from the supporter 37a (lever mechanism 37) by releasing the fixing mechanism. That is, the fixing shaft 34a is detachably attached to the supporter 37a. When attached to the supporter 37a, the fixing shaft 34a is not rotated. The fixing shaft 34a can be detached from the supporter 37a, along with the driven roller 34. The above-described fixing mechanism is, e.g., a bolt 80. That is, when the bolt 80 is loosened, the fixing shaft 34a is detachable from the supporter 37a. In this state, the driven rollers 34 shown in FIG. 2 are replaceable with cylindrical rollers 39 each of which has a constant outer diameter as shown in FIG. 4. Each driven roller 34 may be fixed to a shaft which is rotatably supported by the supporter 37a.

[0070] The fixing shaft 34a is detached from the supporter 37a by being pulled off from the supporter 37a in the axial direction. With this arrangement, when (i) each unit including the driven roller 34, the fixing shaft 34a, and the lever mechanism 37 is provided and (ii) the fixing shaft 34a is detached from the supporter 37a, a space for pulling off the fixing shaft 34a from the supporter 37a is required in addition to the space occupied by the unit.

[0071] In this regard, a mechanism for moving the driven roller 34 is not limited to the lever mechanism 37. A different mechanism may be used as the mechanism for moving the driven roller 34. In the present embodiment, the yarn threading is possible in the state shown in FIG. 2(a). Therefore, an operation of the lever mechanism 37 is not required in the yarn threading. The lever mechanism 37 is used for separating the driven roller 34 from the drive roller 33 in case of an accident such as production stop, malfunction, and yarn breakage.

[0072] On a circumferential surface of the driven roller 34, a level difference is formed so that the large diameter portion 35 (corresponding to a rotational force receiver of the present invention) and a small diameter portion 36 (corresponding to a yarn feeding unit of the present invention) are provided. The small diameter portion 36 is smaller in outer diameter than the large diameter portion 35. In other words, both the large diameter portion 35 and the small diameter portion 36 are formed in each driven roller 34. When the driven roller 34 is at the contact position, the large diameter portion 35 is in contact with the circumferential surface of the drive roller 33 to receive rotational force from the drive roller 33. The small diameter portion 36 is provided to oppose the circumferential surface of the drive roller 33. A direction in which the small diameter portion 36 opposes the drive roller 33 is orthogonal to the axial direction. In the present embodiment, the entire small diameter portion 36 is provided to oppose the circumferential surface of the drive roller 33 in the axial direction. The small diameter portion 36 is provided so that at least a part of the small diameter portion 36 opposes the circumferential surface of the drive roller 33 in the axial direction. When the large diameter portion 35 is provided to oppose the circumferential surface of the drive roller 33, the small diameter portion 36 may not be provided to oppose the circumferential surface of the drive roller 33. Even when the driven roller 34 is at the contact position, there is a space between the small diameter portion 36 and the circumferential surface of the drive roller 33. That is, a circumferential surface of the small diameter portion 36 is separated from the circumferential surface of the drive roller 33.

[0073] In this regard, the large diameter portion 35 and the small diameter portion 36 may be formed in different driven rollers 34. In this case, each driven roller 34 is fixed to a shaft rotatably supported by the supporter 37a. Furthermore, the rotational force received by the large diameter portion 35 is transmitted to the small diameter portion 36 via the shaft.

[0074] FIG. 3 is a schematic diagram of a separate roller 71 viewed from the right side of the sheet of FIG. 2 (one side in the axial direction). The separate roller 71 is provided in the vicinity of each driven roller 34. Between the small diameter portion 36 of the driven roller 34 and the separate roller 71, a yarn Y is wound onto the small diameter portion 36 of the driven roller 34 and the separate roller 71 plural times. A rotational axis of the separate roller 71 is slightly inclined with respect to a rotational axis of the driven roller 34 so that the yarn Y, which is wound onto the small diameter portion 36 of the driven roller 34 and the separate roller 71 plural times, does not overlap with itself. When grooves or protruding portions are provided on the circumferential surface of the separate roller 71 and/or the circumferential surface of the small diameter portion 36 to prevent the yarn Y from overlapping with itself, the rotational axis of the separate roller 71 may be in parallel to the rotational axis of the driven roller 34. The grooves or protruding portions provided on the circumferential surface of the separate roller 71 and/or the circumferential surface of the small diameter portion 36 may be in parallel to one another. While the separate roller 71 is arranged to be rotationally driven in the present embodiment, the separate roller 71 may be fixed. Alternatively, the separate roller 71 may not be provided. For example, a guide may be provided instead of the separate roller 71. Assume that the separate roller 71 and the guide are not provided. In this case, when a spiral groove is formed on the circumferential surface of the small diameter portion 36, the yarn Y is wound onto the small diameter portion 36 of the driven roller 34 plural times along the spiral groove so that the yarn Y does not overlap with itself. With this arrangement, slipping of the yarn Y is prevented.

[0075] The small diameter portion 36 in the axial direction is larger than the large diameter portion 35 in the axial direction. The large diameter portion 35 is attached to an end face of the small diameter portion 36 by a bolt, etc. Furthermore, the large diameter portion 35 is attachable to and detachable from the small diameter portion 36. The large diameter portion 35 is a disc-shaped member made of rubber. The small diameter portion 36 is a cylindrical member made of metal. The circumferential surface of the small diameter portion 36 may be mirror-finished or matte-finished. A friction coefficient of the circumferential surface of the large diameter portion 35 is larger than a friction coefficient of the circumferential surface of the small diameter portion 36. With this arrangement, the large diameter portion 35 is suitable for receiving the rotational force by making contact with the circumferential surface of the drive roller 33. However, the circumferential surface of the large diameter portion 35 may be made of a material which is not rubber, and the circumferential surface of the small diameter portion 36 may be made of a material which is not metal and which is unlikely to be worn. The friction coefficient of the circumferential surface of the large diameter portion 35 may not be larger than the friction coefficient of the circumferential surface of the small diameter portion 36. The large diameter portion 35 may not be detachably attached to the small diameter portion 36.

[0076] In the yarn sending device 30 arranged as described above, as the drive shaft 31 is rotationally driven by the motor 32, the drive rollers 33 simultaneously rotate so that the rotational force is transmitted from the drive roller 33 to the large diameter portions 35 of the respective driven rollers 34. As a result, the driven rollers 34 are rotated so that the yarns Y wound onto the small diameter portions 36 of the respective driven rollers 34 are sent.

(Effects)

[0077] In the yarn sending device 30 of the present embodiment, the drive rollers 33 are fixed to the drive shaft 31. It is therefore possible to rotate the drive rollers 33 by using the single motor 32 (driving source) configured to rotationally drive the drive shaft 31. Cost reduction is therefore achieved. Each driven roller 34 includes the rotational force receiver (large diameter portion 35) configured to make contact with the circumferential surface of a corresponding drive roller 33 and the yarn feeding unit (small diameter portion 36) configured not to make contact with the circumferential surface of the drive roller 33. As the driven roller 34 are rotated by receiving the rotational force of the drive roller 33 via the rotational force receiver 35, a yarn Y wound onto the yarn feeding unit 36 is sent. Although it is required to remain an appropriate contact state between each drive roller 33 and the rotational force receiver 35 of each driven roller 34, fine adjustment such as that in a nip-roller type yarn sending device is not required. This is because the yarn Y is not sent while being sandwiched between the drive roller 33 and the driven roller 34. As a result, the burden of maintenance is reduced. It is therefore possible to achieve cost reduction and to reduce the burden of maintenance by using the yarn sending device 30.

[0078] In the present embodiment, the large diameter portion 35 and the small diameter portion 36 which is smaller in outer diameter than the large diameter portion 35 are formed in one roller (each driven roller 34 in the present embodiment) among each pair of the drive roller 33 and the driven roller 34. The large diameter portion 35 is configured to make contact with the circumferential surface of the other roller (each drive roller 33 in the present embodiment) among the pair of the drive roller 33 and the driven roller 34. With this arrangement, there is a space between the circumferential surface of the small diameter portion 36 of the one roller 34 and a part of the circumferential surface of the other roller 33. The part of the circumferential surface of the other roller 33 opposes the small diameter portion 36. Therefore, when the yarn Y is wound onto the circumferential surface of the small diameter portion 36 of the one roller 34 or onto the part of the circumferential surface of the other roller 33 which opposes the small diameter portion 36, the yarn Y is sent on account of a holding force, i.e., a friction force of the wounded yarn Y without being sandwiched between two rollers 33 and 34.

[0079] In the present embodiment, the small diameter portion 36 in the axial direction is larger than the large diameter portion 35 in the axial direction. With this arrangement, the small diameter portion 36 is able to have a large part onto which the yarn Y is wounded. As a result, the yarn threading is facilitated.

[0080] In the present embodiment, the above-described one roller (each driven roller 34) is structured so that the large diameter portion 35 is attachable to and detachable from the small diameter portion 36. When the large diameter portion 35 is worn as a result of contact with the above-described other roller (each drive roller 33), the number of rotations of the driven roller 34 changes so that the conveyance speed of conveying the yarn Y changes. In the embodiment above, when the large diameter portion 35 is worn, the change of conveyance speed of conveying the yarn Y is avoided by performing replacement of the large diameter portion 35. When the large diameter portion 35 is made of resin such as rubber as described in the present embodiment, the conveyance speed of conveying the yarn Y may be adjusted by polishing the surface of the large diameter portion 35.

[0081] In the present embodiment, the small diameter portion 36 formed in the above-described one roller (each driven roller 34) is provided to oppose the circumferential surface of the above-described other roller (each drive roller 33). For example, when the yarn Y is thick, the yarn Y is stably sent by the nip-roller type yarn sending device. As such, the type of an appropriate yarn sending device changes depending on the type of the yarn Y. With this arrangement, when each large diameter portion 35 is detached from a corresponding small diameter portion 36, the yarn sending device 30 is usable as the nip-roller type yarn sending device configured to send each yarn Y while sandwiching the yarn Y between the small diameter portion 36 and the above-described other roller 33. This arrangement makes it possible to provide a yarn sending device which is appropriate for various types of yarns Y. When the large diameter portion 35 is detached from the small diameter portion 36 in one or some of the driven rollers 34, the various types of yarns Y are simultaneously sent by a single yarn sending device.

[0082] In the present embodiment, the large diameter portion 35 and the small diameter portion 36 are formed in each driven roller 34. The large diameter portion 35 functions as the rotational force receiver, and the small diameter portion 36 functions as the yarn feeding unit. Furthermore, a level difference is formed between the large diameter portion 35 and the small diameter portion 36. This arrangement makes it possible to prevent the yarn Y wounded onto the small diameter portion 36 from moving to the large diameter portion 35. It is therefore possible to prevent each yarn Y from being unintentionally sandwiched between the large diameter portion 35 and the drive roller 33.

[0083] In the present embodiment, each driven roller 34 includes (i) the fixing shaft 34a which supports the driven roller 34 to be rotatable and (ii) the supporter 37a which supports the fixing shaft 34a. The fixing shaft 34a is fixed to the supporter 37a so as to be attachable to and detachable from the supporter 37a. With this arrangement, replacement of the driven roller 34 is easily performed in such a way that the fixing shaft 34a is detached from the supporter 37a along with the driven roller 34.

[0084] In the present embodiment, the large diameter portion 35 and the small diameter portion 36 are formed in each driven roller 34. With this arrangement, a space required for providing each unit including the driven roller 34, the fixing shaft 34a, and the supporter 37a is small as compared to a case where the large diameter portion 35 and the small diameter portion 36 are formed in different driven rollers 34. As the fixing shaft 34a is detached from the supporter 37a along with the driven roller 34, the large diameter portion 35 and the small diameter portion 36 are simultaneously detached.

[0085] In the present embodiment, the large diameter portion 35 is attached to the end face of the small diameter portion 36. As described in a modification later, the large diameter portion 35 may be a ring-shaped member. However, in this case, the ring-shaped member may be broken because the strength of the ring-shaped member is insufficient. Meanwhile, when the large diameter portion 35 is attached to the end face of the small diameter portion 36, the large diameter portion 35 is shaped as a disc to improve the strength of the large diameter portion 35.

[0086] In the present embodiment, the driven rollers 34 are replaceable with the respective cylindrical rollers 39 (see FIG. 4) each of which has a constant outer diameter. For example, when each yarn Y is thick, the yarn Y is stably sent by the nip-roller type yarn sending device. As such, the type of an appropriate yarn sending device changes depending on the type of the yarn Y. When each driven roller 34 which is configured to send the yarn Y by means of the small diameter portion 36 without sandwiching the yarn Y is replaceable with a roller which is configured to send the yarn Y while sandwiching the yarn Y with the drive roller 33, the yarn sending device 30 which is appropriate for various types of yarns Y is provided. When one or some of the driven rollers 34 is/are replaced with one or some of the cylindrical rollers 39 each of which has a constant outer diameter, the various types of yarns Y are simultaneously sent by the single yarn sending device 30.

[0087] In the present embodiment, the circumferential surface of the yarn feeding unit 36 is made of metal. When the circumferential surface of the yarn feeding unit 36 is worn as a result of friction with each yarn Y, the yarn Y may get damaged or may not be reliably sent. When the circumferential surface of the yarn feeding unit 36 is made of metal, wearing of the circumferential surface of the yarn feeding unit 36 is preferably suppressed.

[0088] In the present embodiment, the circumferential surface of the rotational force receiver 35 is made of a material whose friction coefficient is larger than that of a material of the circumferential surface of the yarn feeding unit 36. With this arrangement, when the rotational force receiver 35 is in contact with the circumferential surface of the drive roller 33, the rotational force receiver 35 further reliably receives the rotational force from the drive roller 33.

[0089] In the present embodiment, the detector 38 configured to detect the number of rotations of the driven roller 34 is provided. When the rotational force is transmitted as a result of the contact between the drive roller 33 and the driven roller 34, the number of rotations of the driven roller 34 may change because of wearing of the driven roller 34. In this regard, when the detector 38 configured to detect the number of rotations of the driven roller 34 is provided, the change of number of rotations of the driven roller 34 is grasped and suitably dealt with.

[0090] In the present embodiment, each driven roller 34 includes the lever mechanism 37 (movement mechanism) which is able to move the driven roller 34 between the contact position where the driven roller 34 is in contact with the circumferential surface of the drive roller 33 and the separated position where the driven roller 34 is separated from the drive roller 33. With this arrangement, when one yarn Y is broken, the yarn breakage is dealt with in such a way that one driven roller 34 sending this broken yarn Y is separated from a corresponding drive roller 33.

[0091] In the present embodiment, the separate roller 71 is provided in the vicinity of each driven roller 34, and the yarn Y is wound onto the yarn feeding unit 36 and the separate roller 71. With this arrangement, the yarn Y is further reliably sent by the yarn feeding unit 36.

[0092] In the present embodiment, the number of the drive rollers 33 is the same as that of the driven rollers 34. As such, when the number of the drive rollers 33 is the same as that of the driven rollers 34, the size of each drive roller 33 in the axial direction is small as compared to a case where, e.g., two driven rollers 34 are provided to correspond to each drive roller 33. It is therefore possible to reduce the total weight of all drive rollers 33, and to rotate the drive rollers 33 with small power. In order to remain the appropriate contact state between the drive rollers 33 and the driven rollers 34, the drive rollers 33 are preferably provided to correspond to the respective driven rollers 34.

[0093] In the present embodiment, the axial direction of each of the drive rollers 33 is in parallel to the direction in which the drive rollers 33 are aligned. When known godet rollers with motors are aligned, the godet rollers are typically provided so that an axial direction of each godet roller is orthogonal to a direction in which the godet rollers are aligned. As a result, space saving is achieved in the direction in which the godet rollers are aligned. With this arrangement, however, a space equal to the size of the diameter of each godet roller or the size of each motor is required. Meanwhile, in the present embodiment, it is not required to provide the drive rollers 33 with motors configured to drive the respective drive rollers 33. Therefore, the drive rollers 33 are provided as described above to achieve the space saving.

(Other Embodiments)

[0094] The following describes modifications of the present invention. It should be noted that the arrangements and effects identical with those in the above-described embodiments are not repeated here.

[0095] FIG. 5 is a schematic diagram of a part of a yarn sending device 46 in a first modification. In the embodiment above, the large diameter portion 35 of each driven roller 34 is formed of a single member. However, as described in the present modification, a large diameter portion 47 of the driven roller 34 may be formed of a central portion 48 and an outer circumferential portion 49 which is attachable to and detachable from a circumferential surface of the central portion 48. With this arrangement, for example, when the large diameter portion 47 is worn, replacement is performed not for the entire large diameter portion 47 but only for the outer circumferential portion 49. Therefore, running costs are reduced.

[0096] FIG. 6 is a schematic diagram of a part of a yarn sending device 40 in a second modification. In the embodiment above, the large diameter portion 35 of each driven roller 34 is attached to the end face of the small diameter portion 36. However, as described in the present modification, each driven roller 41 may be structured so that a ring-shaped member 43 is attached to a circumferential surface of a cylindrical roller main body 42. The ring-shaped member 43 is preferably made of an elastic material such as rubber. In the roller main body 42 of this case, a part to which the ring-shaped member 43 is attached functions as a large diameter portion 44 (rotational force receiver), and a part to which the ring-shaped member 43 is not attached functions as a small diameter portion 45 (yarn feeding unit). With this arrangement, for example, when the large diameter portion 44 is worn, the worn ring-shaped member 43 is detached from the roller main body 42 and a new ring-shaped member 43 is attached to the roller main body 42. This facilitates replacement of the large diameter portion 44.

[0097] FIG. 7 is a schematic diagram of a part of a yarn sending device 50 in a third modification. In the embodiment above, the large diameter portion 35 and the small diameter portion 36 are formed in each driven roller 34. However, as described in the present modification, a large diameter portion 52 and a small diameter portion 53 may be formed in each of drive rollers 51 and driven rollers 54 may be provided as cylindrical rollers each of which has a constant outer diameter. In each driven roller 54 of this case, a part which is in contact with a circumferential surface of the large diameter portion 52 of a corresponding drive roller 51 functions as a rotational force receiver 55, and a part which is separated from the circumferential surface of the large diameter portion 52 functions as a yarn feeding unit 56. In order to suppress wearing of the driven roller 54 as a result of friction with the yarn Y, the circumferential surface of the driven roller 54 is preferably made of metal. However, the circumferential surface of the driven roller 54 may be made of a material which is not metal as long as the material is unlikely to be worn. In order to ensure the transmission of the rotational force from the drive roller 51 to the driven roller 54, the circumferential surface of at least the large diameter portion 52 of the drive roller 51 is preferably made of a material such as rubber whose friction coefficient is large. However, the materials of the drive roller 51 and driven roller 54 may be suitably changed.

[0098] FIG. 8 is a schematic diagram of a part of a yarn sending device 60 in a fourth modification. In the embodiment above, the large diameter portion 35 and the small diameter portion 36 are formed in each driven roller 34. However, as described in the present modification, (i) each driven roller 62 in the axial direction may be larger than each drive roller 61 in the axial direction and (ii) neither the drive roller 61 nor the driven roller 62 may not be provided with a large diameter portion and a small diameter portion. In the driven roller 62 of this case, a part which is in contact with a circumferential surface of the drive roller 61 functions as a rotational force receiver 63, and a part which is separated from the circumferential surface of the drive roller 61 functions as a yarn feeding unit 64. With this arrangement, the driven roller 62 and the drive roller 61 are cylindrical in shape. Therefore, the structures of the driven roller 62 and drive roller 61 are simplified as compared to a case where a large diameter portion and a small diameter portion are formed in the driven roller 62 or the drive roller 61.

[0099] In the embodiment above, the large diameter portion 35 and the small diameter portion 36 are formed only in each driven roller 34. However, a large diameter portion and a small diameter portion may be formed not only in each driven roller 34 but also in each drive roller 33.

[0100] The rotational force may be further reliably transmitted in the embodiment above by forming a gear or an anti-slip mechanism (such as a groove) on the circumferential surface of the drive roller 33 and the circumferential surface of the large diameter portion 35 of the driven roller 34.

[0101] In the embodiment above, the yarn sending device 30 is applied to the false-twist texturing machine 1. However, the yarn sending device 30 may be applied to a yarn processor of another type which is configured to crimp a yarn made of synthetic fibers.

Claims

1. A yarn sending device (30, 40, 46, 50, 60) provided in a yarn processor (1) including a crimp processing part (3) configured to crimp at least one yarn (Y) made of synthetic fibers, the yarn sending device (30, 40, 46, 50, 60) comprising:

   drive rollers (33, 51, 61) fixed to a drive shaft (31) which is rotationally driven; and
   driven rollers (34, 41, 54, 62) which are rotated

by making contact with circumferential surfaces of the drive rollers (33, 51, 61) and receiving a rotational force from the drive rollers (33, 51, 61), a rotational force receiver (35, 44, 47, 55, 63) configured to make contact with a circumferential surface of corresponding one of the drive rollers (33, 51, 61) and a yarn feeding unit (36, 45, 56, 64) which is configured not to make contact with the circumferential surface of the corresponding one of the drive rollers (33, 51, 61) and onto which the at least one yarn (Y) is wound being formed in a part of each of the driven rollers (34, 41, 54, 62) in an axial direction of the each of the driven rollers (34, 41, 54, 62) .

2. The yarn sending device (30, 40, 46, 50) according to claim 1, wherein, the each of the driven rollers (34, 41, 54, 62) and the corresponding one of the drive rollers (33, 51, 61) form a pair, a large diameter portion (35, 44, 47, 52) and a small diameter portion (36, 45, 53) which is smaller in outer diameter than the large diameter portion (35, 44, 47, 52) are formed in one roller (34, 41, 51) among the pair of the each of the driven rollers (34, 41, 54, 62) and the corresponding one of the drive rollers (33, 51, 61), and the large diameter portion (35, 44, 47, 52) is configured to make contact with a circumferential surface of the other roller (33, 54) among the pair of the each of the driven rollers (34, 41, 54, 62) and the corresponding one of the drive rollers (33, 51, 61).

3. The yarn sending device (30, 40, 46, 50) according to claim 2, wherein, the small diameter portion (36, 45, 53) in the axial direction is larger than the large diameter portion (35, 44, 47, 52) in the axial direction.

4. The yarn sending device (30, 40, 46, 50) according to claim 2 or 3, wherein, the one roller (34, 41, 51) is structured so that the large diameter portion (35, 44, 47, 52) is attachable to and detachable from the small diameter portion (36, 45, 53).

5. The yarn sending device (30, 40, 46, 50) according to claim 4, wherein, at least a part of the small diameter portion (36, 45, 53) formed in the one roller (34, 41, 51) is provided to oppose a circumferential surface of the other roller (33, 54).

6. The yarn sending device (30, 40, 46) according to any one of claims 2 to 5, wherein, the large diameter portion (35, 44, 47) and the small diameter portion (36, 45) are formed in the each of the driven rollers (34, 41), the large diameter portion (35, 44, 47) functions as the rotational force receiver, and the small diameter portion (36, 45) functions as the yarn feeding unit.

7. The yarn sending device (30, 40, 46) according to claim 6, wherein, a fixing shaft (34a) which rotatably supports the each of the driven rollers (34, 41) and a supporter (37a) which supports the fixing shaft (34a) are provided in the each of the driven rollers (34, 41), and
the fixing shaft (34a) is fixed to the supporter (37a) so as to be attachable to and detachable from the supporter (37a).

8. The yarn sending device (30, 40, 46) according to claim 7, wherein, both the large diameter portion (35, 44, 47) and the small diameter portion (36, 45) are formed in the each of the driven rollers (34, 41).

9. The yarn sending device (40) according to claim 8, wherein, the each of the driven rollers (41) is structured so that a ring-shaped member (43) is attached to a circumferential surface of a cylindrical roller main body (42) and, in the roller main body (42), a part to which the ring-shaped member (43) is attached functions as the large diameter portion (44) and a part to which the ring-shaped member (43) is not attached functions as the small diameter portion (45).

10. The yarn sending device (46) according to claim 8, wherein, the large diameter portion (47) is formed of a central portion (48) and an outer circumferential portion (49) which is detachably attached to a circumferential surface of the central portion (48).

11. The yarn sending device (30, 46) according to claim 8, wherein, the large diameter portion (35, 47) is attached to an end face of the small diameter portion (36) in the each of the driven rollers (34).

12. The yarn sending device (30, 40, 46) according to any one of claims 8 to 10, wherein, the driven rollers (34, 41) are respectively replaceable with cylindrical rollers (39) each of which has a constant outer diameter.

13. The yarn sending device (60) according to claim 1, wherein, the each of the driven rollers (62) in the axial direction is larger than each of the drive rollers (61) in an axial direction of the each of the drive rollers (61) and, in the each of the driven rollers (62), a part which is in contact with a circumferential surface of the corresponding one of the drive rollers (61) functions as the rotational force receiver (63) and a part which is not in contact with the circumferential surface of the corresponding one of the drive rollers (61) functions as the yarn feeding unit (64).

14. The yarn sending device (30, 40, 46, 50, 60) according to any one of claims 1 to 13, wherein, a circumferential surface of the yarn feeding unit (36, 45, 56, 64) is made of metal.

15. The yarn sending device (30, 40, 46, 50, 60) according to any one of claims 1 to 14, wherein, a circumferential surface of the rotational force receiver (35, 44, 47, 55, 63) is made of a material whose friction coefficient is larger than a friction coefficient of a material of the circumferential surface of the yarn feeding unit (36, 45, 56, 64) .

16. The yarn sending device (30, 40, 46, 50, 60) according to any one of claims 1 to 15, further comprising a detector (38) configured to detect the number of rotations of the each of the driven rollers (34, 41, 54, 62).

17. The yarn sending device (30, 40, 46, 50, 60) according to any one of claims 1 to 16, wherein, the each of the driven rollers (34, 41, 54, 62) includes a movement mechanism (37) configured to move the each of the driven rollers (34, 41, 54, 62) between a contact position where the each of the driven rollers (34, 41, 54, 62) makes contact with a circumferential surface of the corresponding one of the drive rollers (33, 51, 61) and a separated position where the each of the driven rollers (34, 41, 54, 62) is separated from the corresponding one of the drive rollers (33, 51, 61) .

18. The yarn sending device (30, 40, 46, 50, 60) according to any one of claims 1 to 17, wherein, a separate roller (71) is provided in the vicinity of the each of the driven rollers (34, 41, 54, 62), and
the at least one yarn (Y) is wound onto the yarn feeding unit (36, 45, 56, 64) and the separate roller (71).

19. The yarn sending device (30, 40, 46, 50, 60) according to any one of claims 1 to 18, wherein, the number of the drive rollers (33, 51, 61) is identical with the number of the driven rollers (34, 41, 54, 62).

20. The yarn sending device (30, 40, 46, 50, 60) according to any one of claims 1 to 19, wherein, the axial direction of the each of the drive rollers (33, 51, 61) is in parallel to a direction in which the drive rollers (33, 51, 61) are aligned.

21. A false-twist texturing machine (1) comprising the yarn sending device (30, 40, 46, 50, 60) according to any one of claims 1 to 20, the false-twist texturing machine (1) being configured to false-twist yarns (Y) sent by the yarn sending device (30, 40, 46, 50, 60).

FIG.1

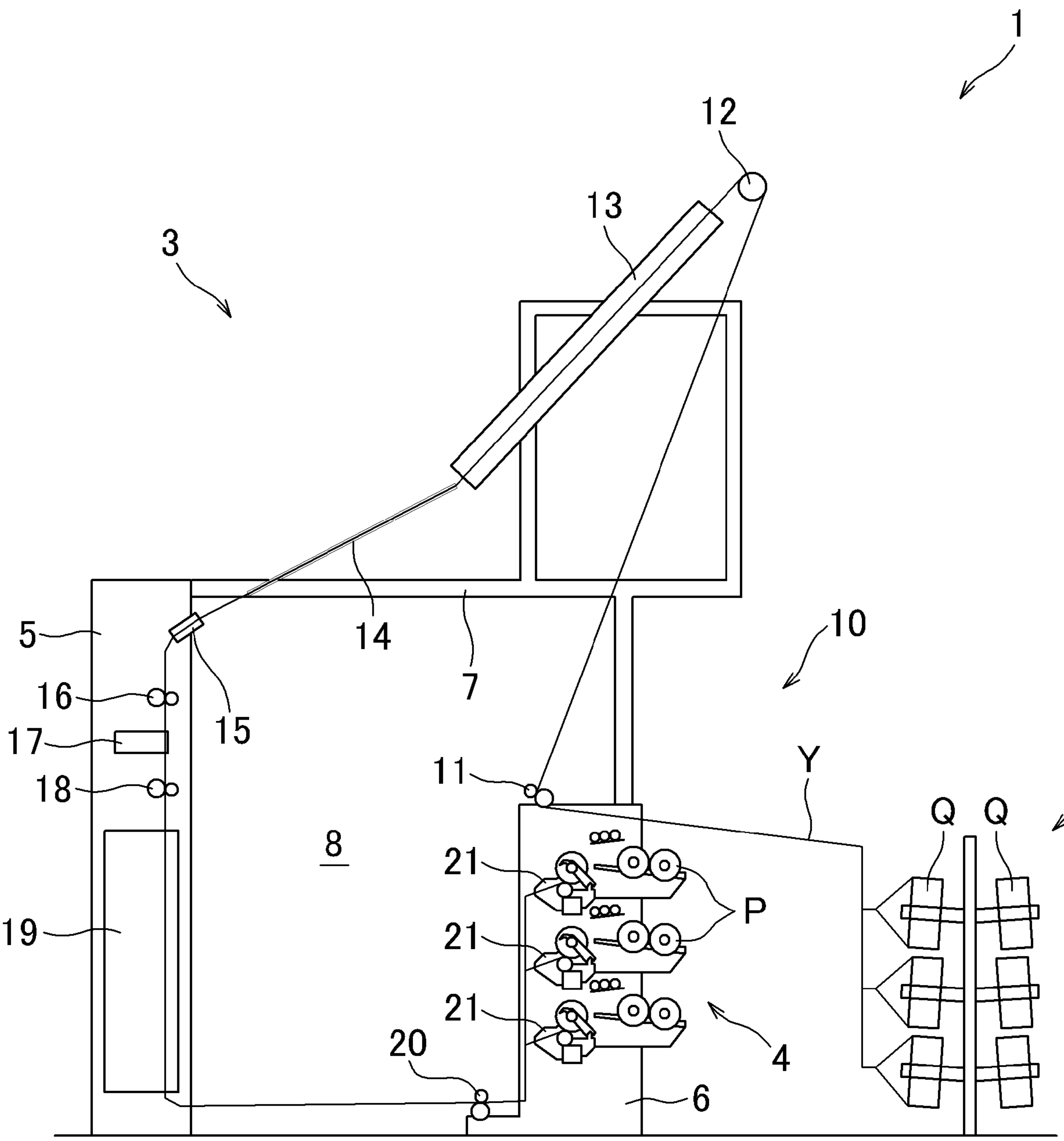

FIG.2

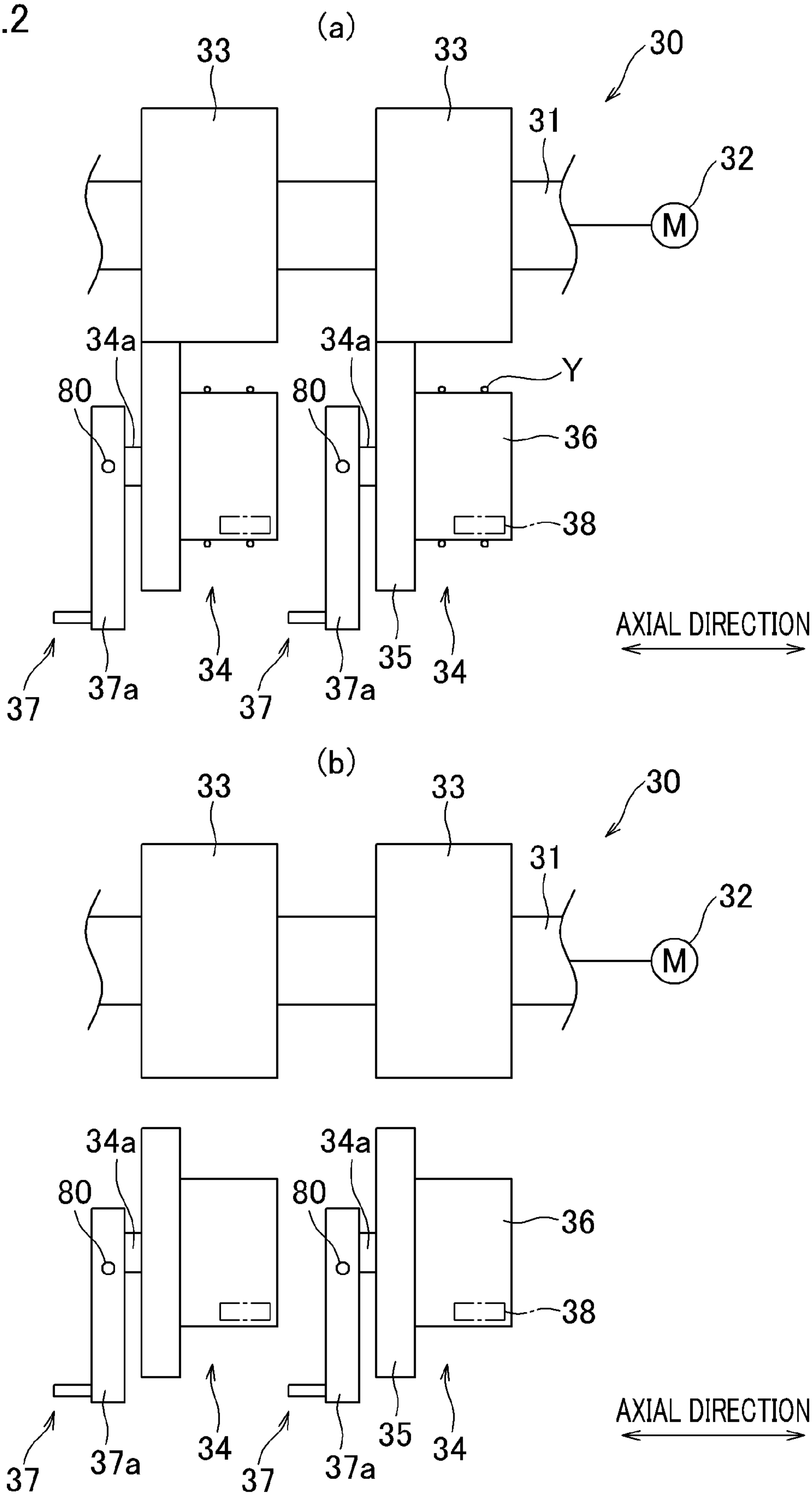
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FIG.3

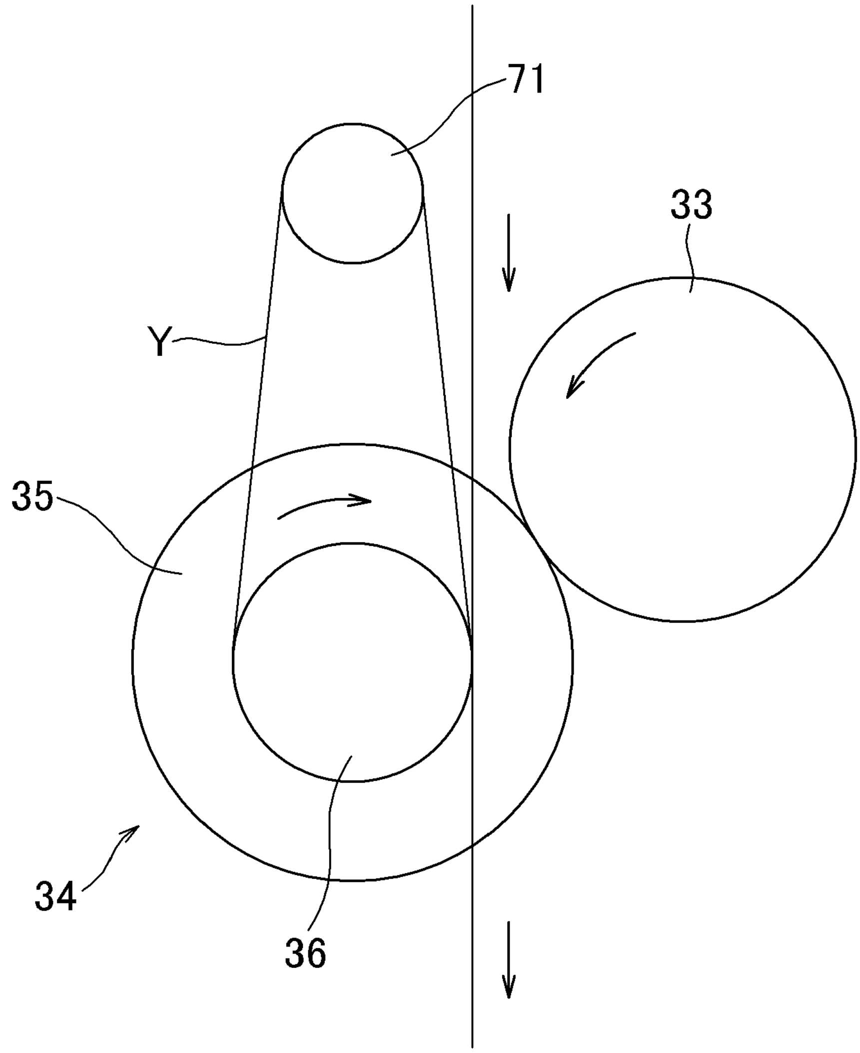

FIG.4

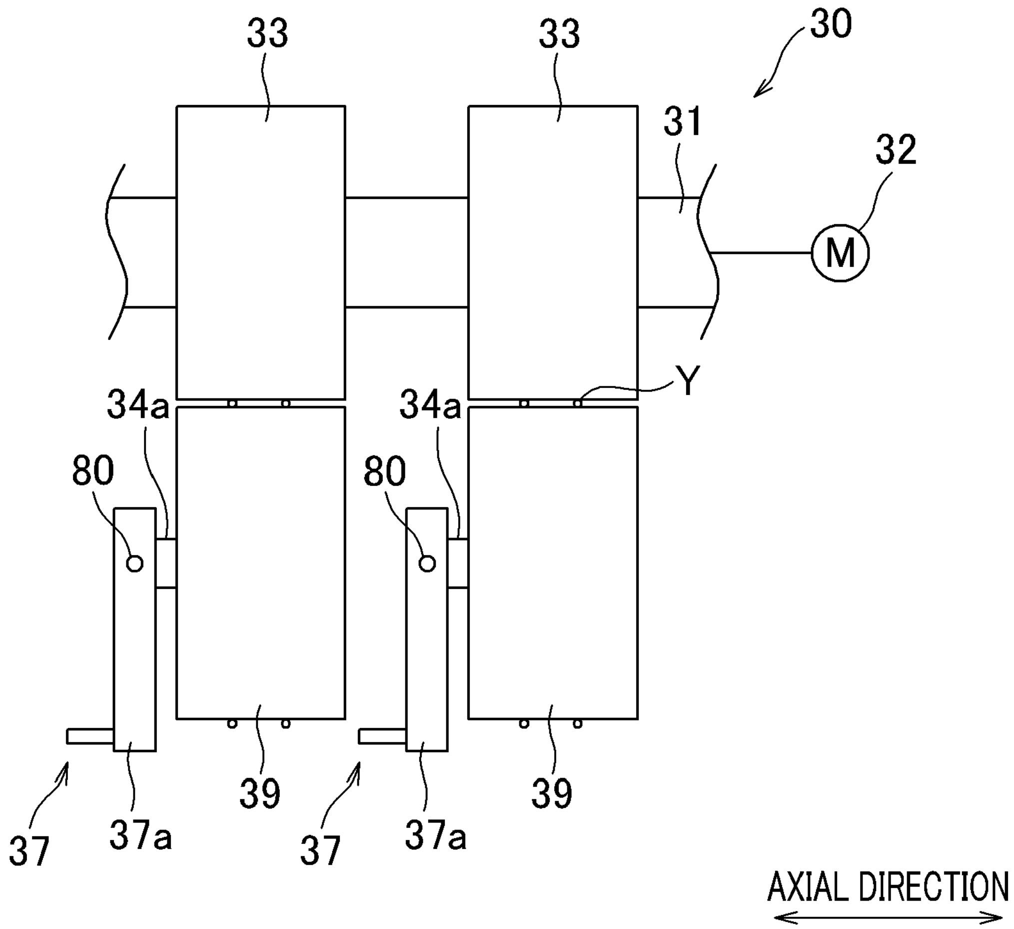
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FIG.5

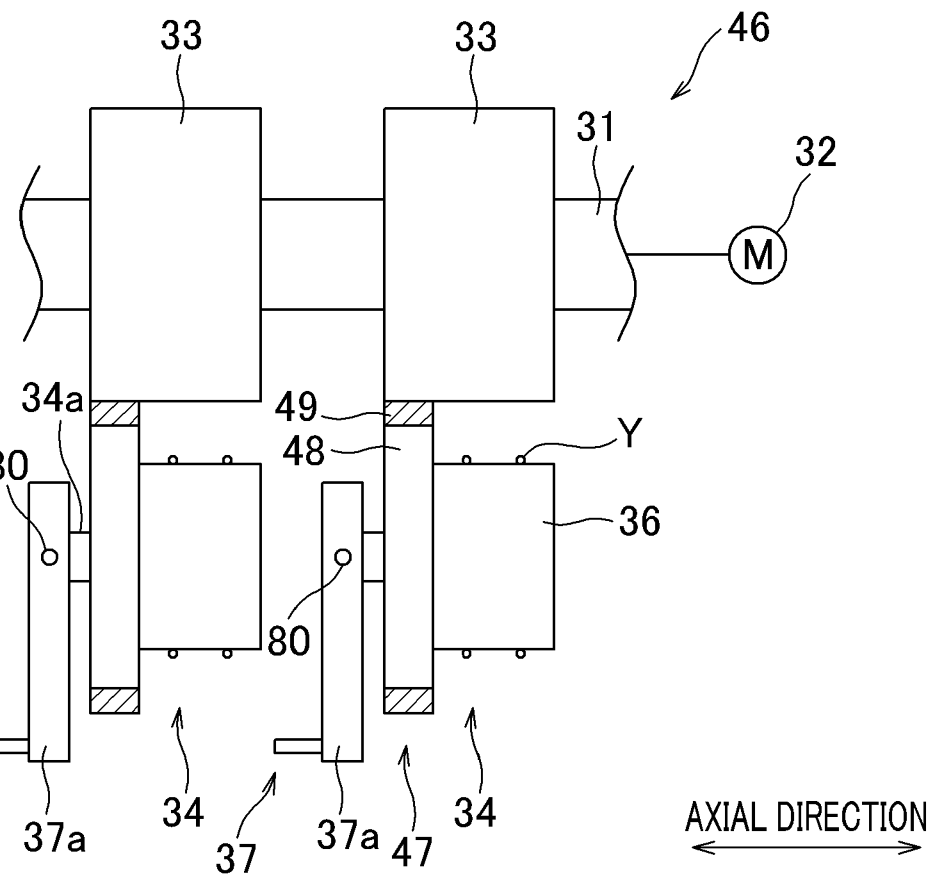
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FIG.6

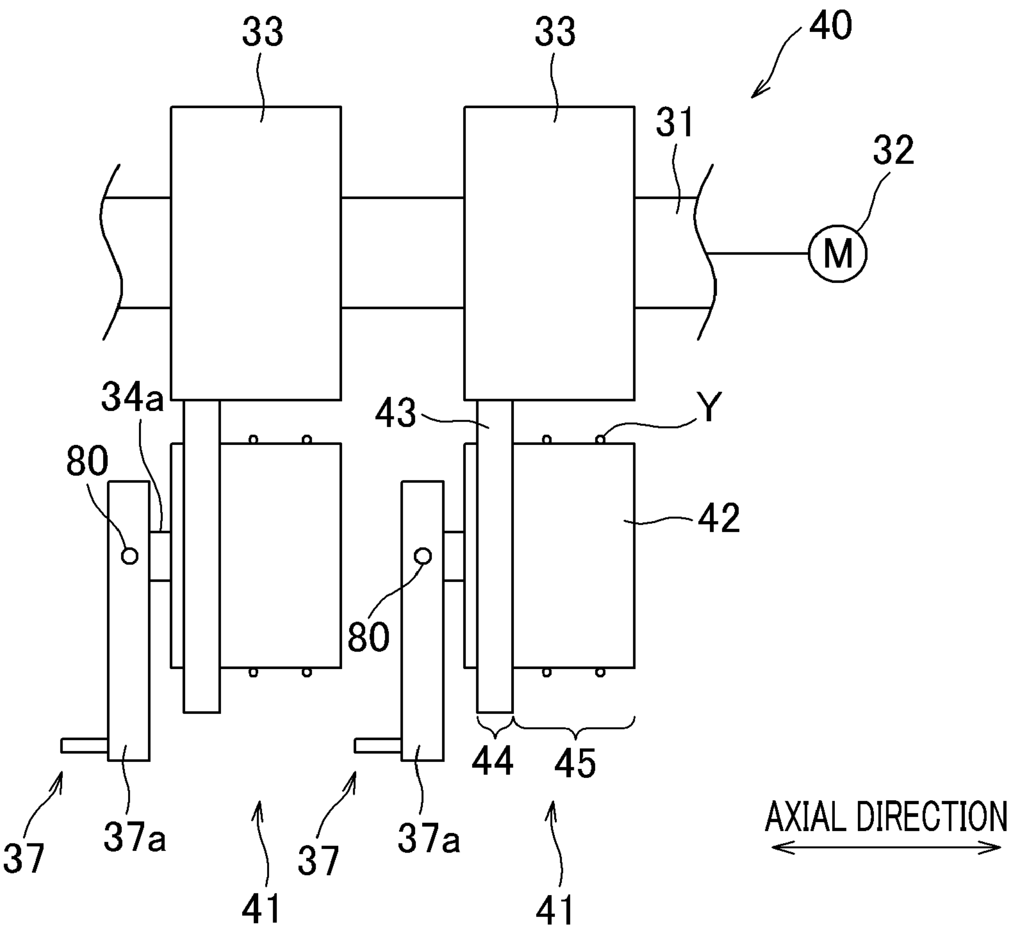
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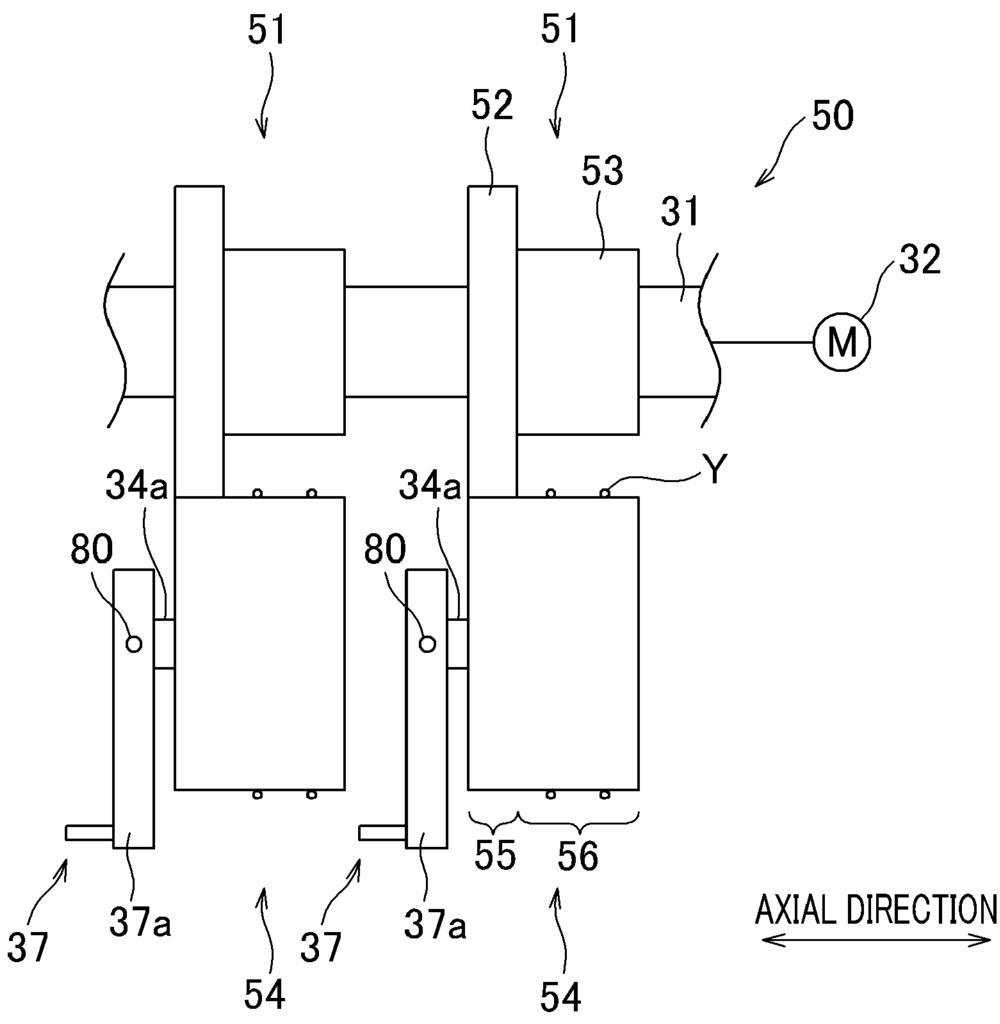
FIG.7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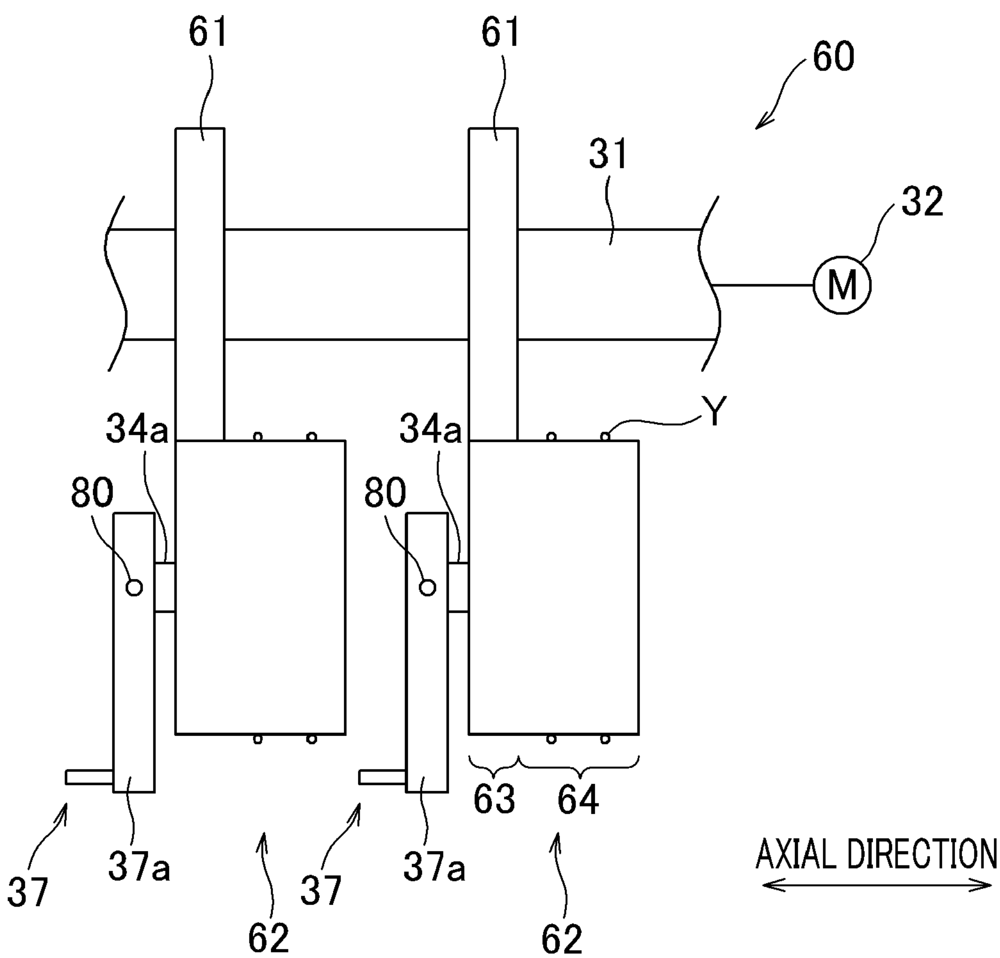
AXIAL DIRECTION

FIG.8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AXIAL DIRECTION

REFERENCES CITED IN THE DESCRIPTION

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