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(54) **Take-up winding facility**

(57) An object of the present invention is to provide a take-up winding facility which is miniaturized by reducing take-up winding device height and which is simplified by simplifying the layout of vicinity of a take-up winding machine.

The present invention provides a take-up winding facility 100 configured to feed a plurality of filament yarns spun out by a spinning machine 10, from above to below to simultaneously wind the plurality of filament yarns 1 around respective plural bobbins 21 installed on a bobbin holder shaft 23 in one take-up winding machine 22, wherein a plurality of yarn feeding rollers (yarn feeding rollers 30, 31) are arranged immediately before the take-up winding machine 22, and the plurality of filament yarns 1 spun out by the spinning machine 10 are divided into a plurality of groups (filament yarn groups 2, 3) which are then fed to the respective plural yarn feeding rollers (yarn feeding rollers 30, 31) arranged immediately before the take-up winding machine 22, and the groups of filament yarns are distributively wound around respective bobbins 21 via the plurality of yarn feeding rollers (yarn feeding rollers 30, 31).

FIG.1A

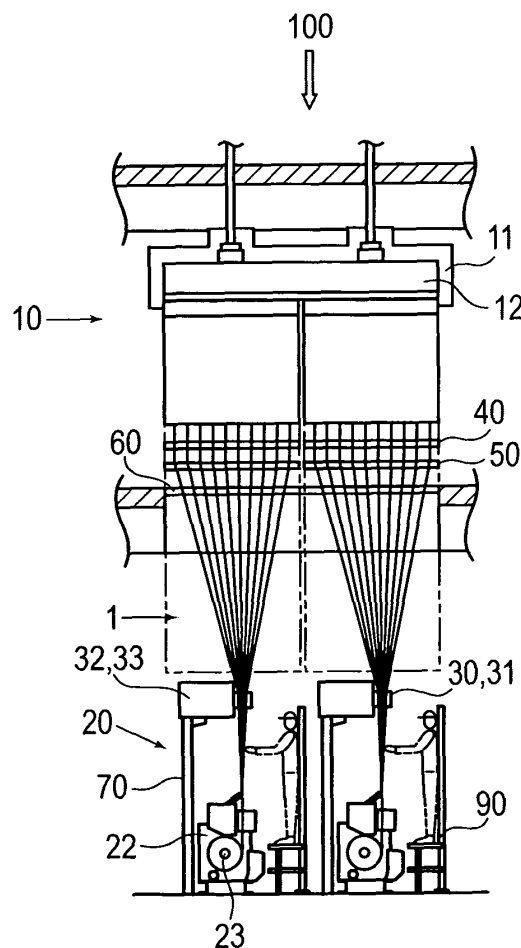
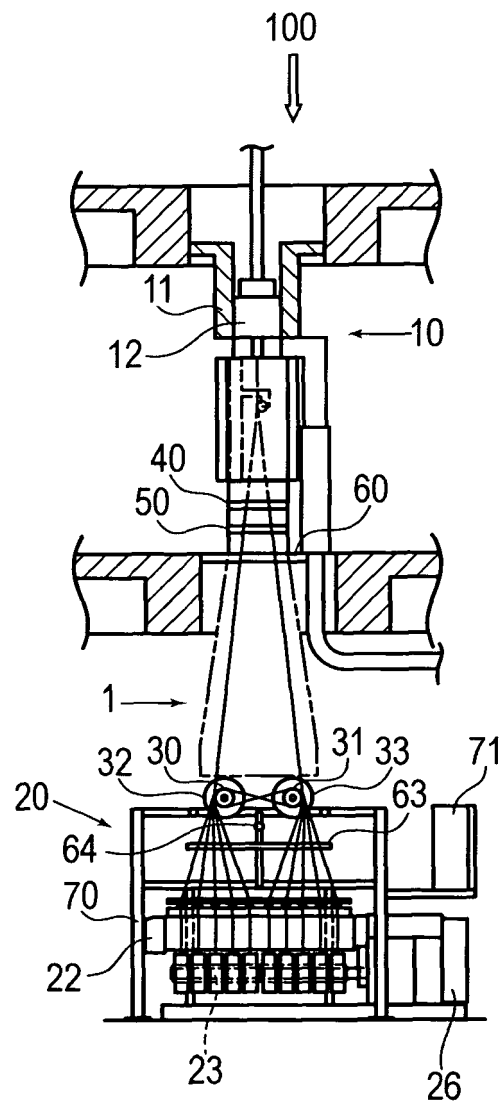


FIG. 1B



Description

Field of the Invention

[0001] The present invention relates to a take-up winding facility in which a winding machine winds a plurality of filament yarns (hereinafter simply referred to as yarns) spun out by a spinning machine, via a plurality of rollers.

Background of the Invention

[0002] In a conventional take-up winding facility, one yarn feeding roller is located immediately before each take-up winding machine so that all of a plurality of spun-out yarns are spread by the yarn feeding roller located immediately before the take-up winding machine and are then wound around a plurality of bobbins installed in the take-up winding machine (see the Unexamined Japanese Patent Application Publication (Tokkai) No. 2003-285972).

[0003] In the take-up winding facility disclosed in the Unexamined Japanese Patent Application Publication (Tokkai) No. 2003-285972, the spread angle of the yarns between the yarn feeding roller located immediately before the take-up winding machine and each of the bobbins installed in the take-up winding machine (the spread angle is the angle between the yarn path from the yarn feeding roller to the bobbin and the vertical direction) is set to at most a predetermined value. This is because when the spread angle is larger than the predetermined value, the friction between the yarns and a guide configured to spread the yarns becomes more serious, varying yarn quality among the plurality of bobbins.

[0004] In another example of a conventional take-up winding facility, a plurality of yarn feeding rollers arranged immediately before a take-up winding machine are provided for each take-up winding machine. A plurality of yarns spun out by the spinning machine are distributively guided from the yarn feeding rollers to bobbins installed in the take-up winding machine and the number of which is the same as that of the plurality of yarns, and are then wound around the bobbins (see PCT National Publication No. 2005-534825).

[0005] However, in the take-up winding facility disclosed in the Unexamined Japanese Patent Application Publication (Tokkai) No. 2003-285972, an increase in the number of bobbins installed in one take-up winding machine increases the length of the bobbin holder and the number of yarns to be spread by one yarn feeding roller. This increases the distance over which the yarns are spread by one yarn feeding roller, making the spread angle of the yarns larger than the predetermined value. Thus, in the take-up winding facility disclosed in the Unexamined Japanese Patent Application Publication (Tokkai) No. 2003-285972, to allow the spread angle of the yarns to be set to at most the predetermined value, the distance from the take-up winding machine to the yarn feeding roller located immediately before the take-

up winding machine has to be increased. Thus, disadvantageously, take-up winding device height increases, resulting in a larger take-up winding facility. The larger take-up winding facility disadvantageously contributes to increasing the costs of a building in which the take-up winding facility is installed, degrading the operability of yarn hooking and the like, and increasing costs for air conditioning in the building in which the take-up winding facility is installed.

[0006] On the other hand, in the take-up winding facility disclosed in PCT National Publication No. 2005-534825, the operation of spreading the yarns is shared by the plurality of yarn feeding rollers. This reduces the number of yarns to be spread by one yarn feeding roller and thus the distance over which the yarns are spread by one yarn feeding roller. As a result, the spread angle of the yarns can be set to at most the predetermined value even with an increase in the number of bobbins installed in one take-up winding machine. This eliminates the need to increase the distance from the take-up winding machine to the yarn feeding roller located immediately before the take-up winding machine. The take-up winding facility can therefore be miniaturized. However, a separate yarn feeding roller needs to be provided which takes off the yarns spun out by the spinning machine. Thus, disadvantageously, the yarn feeding rollers are densely arranged close to the take-up winding machine, thereby complicating the take-up winding facility.

[0007] The present invention has been developed in order to solve the above-described problems. An object of the present invention is to provide a take-up winding facility which is miniaturized by reducing the take-up winding device height and which is simplified by simplifying the layout of vicinity of the take-up winding machine.

Summary of the Invention

[0008] The problems to be solved by the present invention have been described. Now, means for solving the problems will be described.

[0009] A first invention provides a take-up winding facility configured to feed a plurality of yarns spun out by a spinning machine, from above to below to simultaneously wind the plurality of yarns around respective plural bobbins installed on a bobbin holder shaft in one take-up winding machine, wherein a plurality of yarn feeding rollers are arranged immediately before the take-up winding machine, and the plurality of yarns spun out by the spinning machine are divided into a plurality of groups which are then fed to the respective plural yarn feeding rollers arranged immediately before the take-up winding machine, and the groups of yarns are distributively wound around respective bobbins via the plurality of yarn feeding rollers.

[0010] A second invention corresponds to the take-up winding facility according to the first invention, wherein the plurality of yarn feeding rollers arranged immediately before the take-up winding machine include at least a

first yarn feeding roller and a second yarn feeding roller arranged at a distance from each other in an axial direction of the bobbin holder shaft to feed out a first yarn group and a second yarn group including all or a part of the plurality of yarns, to the take-up winding machine, the first yarn feeding roller rotates so as to take off the first yarn group from the spinning machine to feed out the first yarn group to the second yarn feeding roller and to take off the second yarn group fed out from the second yarn feeding roller to feed out the second yarn group to the take-up winding machine, the second yarn feeding roller rotates so as to take off the second yarn group from the spinning machine to feed out the second yarn group to the first yarn feeding roller and to take off the first yarn group fed out from the first yarn feeding roller to feed out the first yarn group to the take-up winding machine, and the take-up winding machine winds the second yarn group spreadingly fed out from the first yarn feeding roller and the first yarn group spreadingly fed out from the second yarn feeding roller, around the bobbins.

[0011] A third invention corresponds to the take-up winding facility according to the second invention, wherein the first yarn feeding roller and the second yarn feeding roller rotate in opposite directions, the first yarn feeding roller rotates so as to feed out the first yarn group taken off from the spinning machine, to the second yarn feeding roller while allowing the first yarn group to be guided around a lower portion of the first yarn feeding roller and to feed out the second yarn group taken off from the second yarn feeding roller, to the take-up winding machine while allowing the second yarn group to be guided around an upper portion of the first yarn feeding roller, and the second yarn feeding roller rotates so as to feed out the second yarn group taken off from the spinning machine, to the first yarn feeding roller while allowing the second yarn group to be guided around a lower portion of the second yarn feeding roller and to feed out the first yarn group taken off from the first yarn feeding roller, to the take-up winding machine while allowing the first yarn group to be guided around an upper portion of the second yarn feeding roller.

[0012] A fourth invention corresponds to the take-up winding facility according to the second or third invention, wherein in each of the first yarn feeding roller and the second yarn feeding roller, a friction coefficient of a yarn contact portion that comes into contact with the first yarn group is relatively different from a friction coefficient of a yarn contact portion that comes into contact with the second yarn group.

[0013] A fifth invention corresponds to the take-up winding facility according to any one of the second to fourth inventions, wherein in each of the first yarn feeding roller and the second yarn feeding roller, a roller diameter of the yarn contact portion that comes into contact with the first yarn group is relatively different from a roller diameter of the yarn contact portion that comes into contact with the second yarn group.

[0014] A sixth invention corresponds to the take-up winding facility according to any one of the second to fifth inventions, Claims 2 to 5, further including a yarn hooking assisting guide configured to temporarily hold the first yarn group or the second yarn group when the first yarn group or the second yarn group is hooked on the first yarn feeding roller and the second yarn feeding roller.

[0015] A seventh invention corresponds to the take-up winding facility according to any one of the second to sixth inventions, further including an interlace provided between the first yarn feeding roller and the second yarn feeding roller or between the first yarn feeding roller and the take-up winding machine, and between the second yarn feeding roller and the take-up winding machine to form a interlaced portion on the yarns.

[0016] An eighth invention corresponds to the take-up winding facility according to any one of the second to seventh inventions, further including an oiling device provided below a spin-out section of the spinning machine to apply lubricant to the yarns.

[0017] A ninth invention corresponds to the take-up winding facility according to the eighth invention, further including a migration nozzle provided downstream side of the oiling device in a yarn feeding direction to eject gas onto the yarns.

[0018] A tenth invention corresponds to the take-up winding facility according to any one of the second to ninth inventions, further including a shutter provided below the spin-out section of the spinning machine to prevent a broken yarn from falling.

[0019] An eleventh invention corresponds to the take-up winding facility according to any one of the second to tenth inventions, wherein a common inverter is used to drive the first yarn feeding roller and the second yarn feeding roller.

[0020] A twelfth invention corresponds to the take-up winding facility according to any one of the second to eleventh inventions, wherein the spinning machine includes the spin-out section located along the axial direction of the bobbin holder shaft, and the first yarn feeding roller and the second yarn feeding roller feed out the first yarn group and second yarn group including all or a part of the plurality of yarns spun out by the spin-out section, to the take-up winding machine.

[0021] The present invention exerts the following effects.

[0022] In the first invention, the operation of spreading the yarns is shared by the plurality of yarn feeding rollers arranged immediately before the take-up winding machine. This reduces the number of yarns to be spread by one yarn feeding roller and thus the distance over which the yarns are spread by one yarn feeding roller. As a result, the spread angle of the yarns can be set to at most a predetermined value even with an increase in the number of bobbins installed in one take-up winding machine. Thus, a variation in yarn quality among the plurality of bobbins can be reduced to ensure yarn quality. The first invention also eliminates the need to increase the

distance from the take-up winding machine to the yarn feeding roller located immediately before the take-up winding machine. Thus, the take-up winding device height decreases, resulting in a smaller take-up winding facility. This serves to reduce the costs of a building in which the take-up winding facility is installed, improve the operability of yarn hooking and the like, and reduce costs for air conditioning in the building in which the take-up winding facility is installed.

[0023] In the second invention, each of the yarn feeding rollers provides both the function of taking off the yarns spun out by the spinning machine and the function of feeding out the yarns to the take-up winding machine. This eliminates the need to provide a separate yarn feeding roller configured to take off the yarns spun out by the spinning machine, between the spinning machine and the yarn feeding roller located immediately before the take-up winding machine. This in turn prevents the yarn feeding rollers from being densely arranged close to the take-up winding machine, thus allowing the take-up winding facility to be simplified.

[0024] In the third invention, each of the yarn feeding rollers can reliably take off the yarns spun out by the spinning machine. The yarn feeding roller can also take off the yarns fed out from the other yarn feeding rollers to reliably feed out the yarns to the take-up winding machine.

[0025] In the fourth invention, in each of the yarn feeding rollers, the friction coefficient of the yarn contact portion corresponding to a yarn group take-off portion is different from that of the yarn contact portion corresponding to a yarn group feed-out portion. Thus, tension applied to the yarns is optimized, ensuring appropriate yarn quality and enabling stable yarn winding.

[0026] In the fifth invention, in each of the yarn feeding rollers, the roller diameter of the yarn group take-off portion is different from that of the yarn group feed-out portion. Thus, the tension applied to the yarns is optimized, ensuring the appropriate yarn quality and enabling stable yarn winding.

[0027] In the sixth invention, the yarns can be temporarily held before being hooked on each of the yarn feeding rollers. Thus, a yarn hooking operation is facilitated.

[0028] In the seventh invention, the interlace located between the yarn feeding rollers, or between each of the yarn feeding rollers and the take-up winding machine allows the yarn path to be fixed. This enables stable yarn winding.

[0029] In the eighth invention, the oiling device can be installed away from the take-up winding machine. Thus, the layout of vicinity of the take-up winding machine can be simplified.

[0030] In the ninth invention, the migration nozzle can be installed away from the take-up winding machine. Thus, the layout of vicinity of the take-up winding machine can be simplified.

[0031] In the tenth invention, the shutter can be installed away from the take-up winding machine. Thus,

the layout of vicinity of the take-up winding machine can be simplified.

[0032] In the eleventh invention, the yarn feeding rollers can be easily controlled. This enables a reduction in the number of components required and thus in costs.

[0033] In the twelfth invention, the spinning machine can be located below the yarn feeding rollers with the same level of yarn quality maintained. Furthermore, the plurality of yarns spun out by the spinning machine can be fed to the yarn feeding rollers so as to be evenly distributed between the yarn feeding rollers.

Other features, elements, processes, steps, characteristics and advantages of the present invention will become more apparent from the following detailed description of preferred embodiments of the present invention with reference to the attached drawings.

Brief Description of the Drawings

[0034]

Figure 1A is a front view of a take-up winding facility 100 according to a first embodiment of the present invention, and Figure 1B is a side view of the take-up winding facility 100 according to the first embodiment of the present invention.

Figure 2 is a perspective view of a take-up winding device 20.

Figure 3 is a side view of the take-up winding device 20.

Figure 4A is a plan view of yarn feeding rollers 30, 31, Figure 4B is a side view of the yarn path of a first yarn group 2 and the yarn feeding rollers 30, 31, and Figure 4C is a side view of the yarn path of a second yarn group 3 and the yarn feeding rollers 30, 31, Figure 5 is a plan view of yarn feeding rollers 30, 31 in a take-up winding facility 100 according to a second embodiment of the present invention.

Figure 6A is a plan view of yarn feeding rollers 30, 31 in a take-up winding facility 100 according to a third embodiment of the present invention, Figure 6B is a side view of the yarn feeding rollers 30, 31 in the take-up winding facility 100 according to the third embodiment of the present invention, and Figure 6C is a side view of the yarn path of a second yarn group 3 and the yarn feeding rollers 30, 31, in the take-up winding facility 100 according to the third embodiment of the present invention.

Figure 7A is a front view of the take-up winding facility 100 according to the first embodiment of the present invention, Figure 7B is a front view of a take-up winding facility 100 according to a fourth embodiment of the present invention, and Figure 7C is a side view of the take-up winding facility 100 according to the fourth embodiment of the present invention.

Figure 8 is a side view of yarn feeding rollers 30, 31 in the take-up winding facility 100 according to the fourth embodiment of the present invention.

Figure 9 is a side view of a take-up winding facility 100 according to a fifth embodiment of the present invention.

Detailed Description of the Preferred Embodiments

[0035] First, the general configuration of a take-up winding facility 100 according to a first embodiment of the present invention will be described with reference to the drawings. Figure 1A is a front view of the take-up winding facility 100 according to the first embodiment of the present invention. Figure 1B is a side view of the take-up winding facility 100 according to the first embodiment of the present invention. Figure 2 is a perspective view of a take-up winding device 20. Figure 3 is a side view of the take-up winding device 20. In the description below, the direction in which gravity acts is defined as the vertical direction. The axial direction of a bobbin holder shaft 23 provided in a take-up winding machine 22 described below is defined as a front-back direction. A side of the bobbin holder shaft 23 coupled to a driving device 26 is defined as a back side. The other side of the bobbin holder shaft 23 is defined as a front side. Furthermore, when the take-up winding machine 22 is viewed from the front thereof, a direction orthogonal to the vertical direction and the front-back direction is defined as a lateral direction.

[0036] As shown in Figures 1A and 1B, the take-up winding facility 100 is composed mainly of a spinning machine 10 spinning a plurality of yarns 1 and a take-up winding device 20 winding the yarns 1 spun out by the spinning machine 10.

[0037] A synthetic filament yarn material from a chip hopper (not shown in the drawings) is introduced into the spinning machine 10. The spinning machine 10 then feeds the introduced synthetic filament yarn material to a spin-out section 11 via an extruder (not shown in the drawings) and a prefilter (not shown in the drawings). A spinning head 12 included in the spin-out section 11 spins out and feeds a plurality of yarns (filament yarns), 1 to a take-up winding device 20.

[0038] As shown in Figures 2 and 3, the take-up winding device 20 is composed mainly of the take-up winding machine 22, a first yarn feeding roller 30, and a second yarn feeding roller 31.

[0039] As shown in Figures 2 and 3, the take-up winding machine 22 winds the yarns 1 spun out by the spinning machine 10, around a plurality of bobbins 21. The take-up winding machine 22 includes a bobbin holder shaft 23 on which the plurality of bobbins 21 are installed, a contact roller (not shown in the drawings) configured to rotate in contact with packages 24 formed on the respective bobbins 21, a plurality of traverse devices 25, 25, ... configured to traverse the yarns 1 being wound around the respective bobbins 21, and the driving device 26 configured to drive the bobbin holder shaft 23 and the traverse devices 25, 25, ...

[0040] As shown in Figures 1A, 1B, 2, and 3, the yarn

feeding rollers 30, 31 are arranged above and immediately before the take-up winding machine 22 at a distance from each other in the axial direction of the bobbin holder shaft 23. The yarn feeding rollers 30, 31 take off a first yarn group 2 and a second yarn group 3 including the plurality of spun yarns 1 spun out by the spinning head 12 and feed out the taken-off yarn groups 2, 3 to the take-up winding machine 22. That is, each of the yarn feeding rollers 30, 31 provides the function of taking off the yarn groups 2, 3 and the function of feeding out the yarn groups 2, 3.

[0041] Specifically, the first yarn feeding roller 30 includes a first roller section 30b having a yarn contact portion that comes into contact with the yarn groups 2, 3, and a first roller shaft 30a corresponding to a rotating shaft to which the first roller section 30a is fixed. The first yarn feeding roller 30 takes off the first yarn group 2 spun out by the spinning machine 10 and also takes off the second yarn group 3 fed out from the second yarn feeding roller 31 and also feeds out the second yarn groups to the take-up winding machine 22.

[0042] On the other hand, the second yarn feeding 31 includes a second roller section 31b having a yarn contact portion that comes into contact with the yarn groups 2, 3, and a second roller shaft 31a corresponding to a rotating shaft to which the second roller section 31b is fixed. The second yarn feeding roller 31 takes off the second yarn group 3 spun out by the spinning machine 10 and also takes off the first yarn group 2 fed out from the first yarn feeding roller 30 and also feeds out the first yarn groups to the take-up winding machine 22.

[0043] The roller shafts 30a, 31b of the yarn feeding rollers 30, 31 are provided so as to extend orthogonally to the bobbin holder shaft 23 of the take-up winding machine 22 and in the horizontal direction. Furthermore, the roller shafts 30a, 31b of the yarn feeding rollers 30, 31 have substantially the same axial length. The yarn feeding rollers 30, 31 are positioned such that the peripheral surfaces thereof lie opposite each other.

[0044] Furthermore, the yarn feeding rollers 30, 31 rotate in the opposite directions. The first yarn feeding roller 30 is rotationally driven by a first motor unit 32. The first motor unit 32 is fixedly supported on a frame 70. Thus, the first yarn feeding roller 30 is indirectly supported on the frame 70 by the first motor unit 30. On the other hand, the second yarn feeding roller 31 is rotationally driven by a second motor unit 33. The second motor unit 33 is fixedly supported on the frame 70. Thus, the second yarn feeding roller 31 is indirectly supported on the frame 70 by the second motor unit 33.

[0045] The motor units 32, 33 are connected to an inverter 71 and supplied with power by the inverter 71. That is, the inverter 71 is shared by the motor units 32, 33 configured to rotationally drive the yarn feeding rollers 30, 31, respectively. The inverter 71 controllably drives the motor units 32, 33 in the same manner so as to allow the yarn feeding rollers 30, 31 to rotate at the same rotation speed.

[0046] As shown in Figures 1A and 1B, the spinning machine 10 is located above the take-up winding device 20. The spinning machine 10 includes a spin-out section 11 configured to spin out the plurality of yarns 1. The spin-out section 11 includes the spinning head 12 including spinnerets (not shown in the drawings) corresponding to a plurality of holes through which the yarns 1 are spun out. The spinning head 12 is located in a direction (the lateral direction of the take-up winding facility 100) or orthogonal to the axial direction of the bobbin holder shaft 23 of the take-up winding device 20. Specifically, the spinning head 12 is located such that the spinnerets formed in the bottom surface of the spinning head 12 are arranged substantially linearly in the direction orthogonal to the axial direction of the bobbin holder shaft 23.

[0047] Furthermore, as shown in Figures 1A and 1B, an oiling device 40, a migration nozzle 50, and a shutter 60 are provided below the spinning section 11 included in the spinning machine 10.

[0048] The oiling device 40 supplies lubricant to the yarns 1 in order to reduce the friction between the yarns and a guide and the like, thus preventing possible charging and providing the yarns 1 with flexibility and the like.

[0049] The migration nozzle 50 appropriately disturbs the flow of the yarns 1 in order to uniformly migrate the lubricant applied to the yarns 1 by the oiling device 40.

[0050] The shutter 60 is moved to prevent any broken yarn 1 from falling. The shutter 60 may push the broken yarn away to an admission port formed close to the shutter 60 for removal or the opening of the shutter may be adjusted according to a variation in outside air temperature to control the temperature of the spin-out section 11.

[0051] In this manner, the oiling device 40, the migration nozzle 50, and the shutter 60 are provided below the spinning head 12 included in the spin-out section of the spinning machine 10. Thus, the vicinity of the take-up winding machine 22 of the take-up winding device 20 can be simplified.

[0052] The arrangement of the oiling device 40, the migration nozzle 50, and the shutter 60 is not limited to this order. For functional reasons, it is only necessary that the migration nozzle 50 is located downstream side of the oiling device 40 in the yarn feeding direction. Furthermore, not all of the oiling device 40, the migration nozzle 50, and the shutter 60 are provided below the spin-out section 11. For example, with only the shutter 60 located below the spin-out section 11, the remaining oiling device 40 and migration nozzle 50 may be arranged immediately before the yarn feeding rollers 30, 31.

[0053] Now, the yarn paths of the yarn groups 2, 3 taken off from the spinning machine 10 by the yarn feeding rollers 30, 31 and fed out to the take-up winding machine 22 will be described. Figure 4A is a plan view of the yarn feeding rollers 30, 31. Figure 4B is a side view of the yarn path of the first yarn group 2 and the yarn feeding rollers 30, 31. Figure 4C is a side view of the yarn path of the second yarn group 3 and the yarn feeding rollers 30, 31.

[0054] The plurality of yarns 1 spun out by the spinning head 12 of the spinning machine 10 are divided into the first yarn group 2 and the second yarn group 3 between the spinning machine 10 and the yarn feeding rollers 30, 31. The first yarn group 2 and the second yarn group 3 are spun out in a line in the lateral direction. The first yarn group 2 is taken off from the spinning machine 10 by the first yarn feeding roller 30. The second yarn group 3 is taken off from the spinning machine 10 by the second yarn feeding roller 31. That is, as shown in Figures 1A, 1B, and 2, after spun out by the spinning head 12, the first yarn group 2 is guided along the rotating direction of the first yarn feeding roller 30, and the second yarn group 3 is guided along the rotation direction of the second yarn feeding roller 31, respectively, with the distances between the yarns 1 gradually reduced.

[0055] As shown in Figures 4A and 4B, the first yarn group 2 to be guided to the first yarn feeding roller 30 is guided to a base end side portion 30c of the first roller section 30b of the first yarn feeding roller 30 (to the first motor unit 32 side of the first roller section 30b) and then to a base end side portion 31c of the second roller section 31b of the second yarn feeding roller 31 (to the second motor unit 33 side of the second roller section 31b).

[0056] Specifically, the first yarn group 2 travels from the left side, in the figures, of the first yarn feeding roller 30 to the base end side portion 30c of the first yarn feeding roller 30. The first yarn group 2 then passes around the lower portion of the first yarn feeding roller 30 along the rotating direction (counterclockwise in the figures) of the first yarn feeding roller 30. The first yarn group 2 then approaches the base end side portion 31c of the second yarn feeding roller 31. The first yarn group 2 further passes around the upper portion of the second yarn feeding roller 31 along the rotating direction (clockwise in the figures) of the second yarn feeding roller 31. The first yarn group 2 is then spread on the right side, in the figures, of the second yarn feeding roller 31. The yarns 1 are guided to the take-up winding machine 22 located below.

[0057] On the other hand, as shown in Figures 4A and 4C, the second yarn group 3 to be guided to the second yarn feeding roller 31 passes through a leading end side portion 31d of the second roller section 31b of the second yarn feeding roller 31 and a leading end side portion 30d of the first roller section 30b of the first yarn feeding roller 30.

[0058] Specifically, the second yarn group 3 travels from the right side, in the figures, of the second yarn feeding roller 31 to the leading end side portion 31d of the second yarn feeding roller 31. The second yarn group 3 then passes around the lower portion of the second yarn feeding roller 31 along the rotating direction (clockwise in the figures) of the second yarn feeding roller 31. The second yarn group 3 then approaches the leading end side portion 30d of the first yarn feeding roller 30. The second yarn group 3 further passes around the upper portion of the first yarn feeding roller 30 along the rotating direction (clockwise in the figures) of the first yarn feeding

roller 30. The second yarn group 3 is then spread on the left side, in the figures, of the first yarn feeding roller 30. The yarns 1 are guided to the take-up winding machine 22 located below.

[0059] As described above, the first yarn group 2 is taken off and fed out on the base end side portions 30c, 31c of the yarn feeding rollers 30, 31. The second yarn group 3 is taken off and fed out on the leading end side portions 30d, 31d of the yarn feeding rollers 30, 31. Thus, the yarn groups 2, 3 are prevented from interfering with each other on the roller sections 30b, 31b of the yarn feeding rollers 30, 31.

[0060] The yarns 1 fed from the yarn feeding rollers 30, 31 to the take-up winding machine 22 are interlaced before being fed to the take-up winding machine 22. An interlace 63 is provided between the first yarn feeding roller 30 and the take-up winding machine 22, and between the second yarn feeding roller 31 and the take-up winding machine 22. Interface nozzles (not shown in the drawings) eject air to form a partial interlaced portion on the yarns 1. Thus, yarns included in the yarns 1 are entangled with one another so as to converge. The interlace 63 has only to process the tensed yarns 1. Consequently, the interlace 63 need not be located between the first yarn feeding roller 30 and the take-up winding machine 22, and the second yarn feeding roller 31 and the take-up winding machine 22 but on the yarn paths of the yarns 1 between the yarn feeding rollers 30, 31.

[0061] As shown in Figures 2 and 3, the yarns 1 having passed through the interlace 63 are fed to the traverse device 25 via a traverse support point guide 25a. Thereafter, the yarns 1 are traversed by the traverse device 25 and then wound around the bobbins 21 installed on the bobbin holder shaft 23.

[0062] Now, a take-up winding facility 100 according to a second embodiment of the present invention will be described below. In the description below, the same arrangements as those of the take-up winding facility 100 according to the first embodiment are denoted by the same reference numerals and will not be described. Figure 5 is a plan view of yarn feeding rollers 30, 31 in the take-up winding facility 100 according to the second embodiment of the present invention.

[0063] As shown in Figure 5, in the first yarn feeding roller 30, the roller peripheral surface of a first roller section 30b is surface-treated such that the friction coefficient of a yarn contact portion that comes into contact with a first yarn group 2 is relatively different from that of a yarn contact portion that comes into contact with a second yarn group 3.

[0064] Specifically, on the roller peripheral surface of a first roller section 30b of the first yarn feeding roller 30, mirror finish is applied to a base end side portion 30c of the first roller section 30b corresponding to the yarn contact portion that comes into contact with the first yarn group 2 and to the portion (take-off portion) on which the first yarn group 2 taken off from the spinning machine 10 is placed so that the base end side portion 30c has a

large friction coefficient with respect to the yarns 1. Satin finish is applied to a leading end side portion 30d of the first roller section 30b corresponding to the yarn contact portion that comes into contact with the second yarn group 3 and to the portion (feed-out portion) from which the second yarn group 3 is fed out so that the leading end side portion 30d has a small friction coefficient with respect to the yarns 1.

[0065] Similarly, as shown in Figure 5, in the second yarn feeding roller 30, the roller peripheral surface of a second roller section 31b is surface-treated such that the friction coefficient of a yarn contact portion that comes into contact with the first yarn group 2 is relatively different from that of a yarn contact portion that comes into contact with the second yarn group 3.

[0066] Specifically, on the roller peripheral surface of the second roller section 31b of the second yarn feeding roller 31, mirror finish is applied to a leading end side portion 31d of the second roller section 31b corresponding to the yarn contact portion that comes into contact with the second yarn group 3 and to the portion (take-off portion) on which the second yarn group 3 taken off from the spinning machine 10 is placed so that the leading end side portion 31d has a large friction coefficient with respect to yarns 1. Satin finish is applied to a base end side portion 31c of the second roller section 31b corresponding to the yarn contact portion that comes into contact with the first yarn group 2 and to the portion (feed-out portion) from which the first yarn group 2 is fed out so that the base end side portion 31c has a small friction coefficient with respect to the yarns 1.

[0067] The take-off portion is subjected to mirror finish so as to have an increased friction coefficient as described above. Thus, the roller peripheral surfaces of the roller sections 30b, 31b are treated so as to prevent the yarns 1 from slipping easily over the roller peripheral surfaces. This allows the rotational driving force of the yarn feeding rollers 30, 31 to be reliably transmitted to the yarns 1. Furthermore, the feed-out portion is subjected to satin finish so as to have a reduced friction coefficient. This reduces a variation in the tension of the yarns 1 in the take-up winding machine 22.

[0068] The surface treatment of the roller peripheral surfaces of the roller sections 30b, 31b is not limited to mirror finish and satin finish. The surface treatment method is not particularly limited provided that the roller peripheral surfaces of the roller sections 30b, 31b are surface-treated as follows: for the first yarn feeding roller 30, the friction coefficient of the roller peripheral surface of the portion that comes into contact with the first yarn group 2 is larger than that of the roller peripheral surface of the portion that comes into contact with the second yarn group 3, and for the second yarn feeding roller 31, the friction coefficient of the roller peripheral surface of the portion that comes into contact with the second yarn group 3 is larger than that of the roller peripheral surface of the portion that comes into contact with the first yarn group 2. Furthermore, the friction coefficient has the op-

posite relationship depending on the yarn type.

[0069] Now, a take-up winding facility 100 according to a third embodiment of the present invention will be described below. In the description below, the same arrangements as those of the take-up winding facilities 100 according to the first and second embodiments are denoted by the same reference numerals and will not be described. Figure 6A is a plan view of yarn feeding rollers 30, 31 in the take-up winding facility 100 according to the third embodiment of the present invention. Figure 6B is a side view of the yarn path of a first yarn group 2 and the yarn feeding rollers 30, 31 in the take-up winding facility according to the third embodiment of the present invention. Figure 6C is a side view of the yarn path of a second yarn group 3 and the yarn feeding rollers 30, 31 in the take-up winding facility 100 according to the third embodiment of the present invention.

[0070] As shown in Figures 6A and 6B, in the first yarn feeding roller 30, the roller diameter of a yarn contact portion that comes into contact with a first yarn group 2 is relatively different from that of a yarn contact portion that comes into contact with a second yarn group 3. Specifically, the roller diameter of a leading end side portion 30d of the first yarn feeding roller 30 is larger than that of a base end side portion 30c of the first yarn feeding roller 30: the leading end side portion 30d corresponds to the yarn contact portion that comes into contact with the second yarn group 3 and to a portion (feed-out portion) from which the second yarn group 3 is fed out to a take-up winding machine 22, and the base end side portion 30c corresponds to the yarn contact portion that comes into contact with the first yarn group 2 and to a portion (take-off portion) on which the first yarn group 2 taken off from a spinning machine 10 is placed.

[0071] Similarly, as shown in Figures 6A and 6C, in the second yarn feeding roller 31, the roller diameter of a yarn contact portion that comes into contact with the first yarn group 2 is different from that of a yarn contact portion that comes into contact with a second yarn group 3. Specifically, the roller diameter of a base end side portion 31c of the second yarn feeding roller 31 is larger than that of a leading end side portion 31d of the second yarn feeding roller 31: the base end side portion 31c corresponds to the yarn contact portion that comes into contact with the first yarn group 2 and to a portion (feed-out portion) from which the first yarn group 2 is fed out to the take-up winding machine 22, and the leading end side portion 31d corresponds to the yarn contact portion that comes into contact with the second yarn group 3 and to a portion (take-off portion) on which the second yarn group 3 taken off from the spinning machine 10 is placed.

[0072] The roller diameter of the feed-out portion is set to be larger than that of the take-off portion as described above. This makes the peripheral speed of the yarn feeding rollers 30, 31 at the yarn group 2, 3 feed-out portion higher than that of the yarn feeding rollers 30, 31 at the yarn group 2, 3 take-off portion.

[0073] The yarn feeding rollers 30, 31 in the take-up

winding facility 100 according to the fourth embodiment may be processed as follows. As is the case with the yarn feeding rollers 30, 31 in the take-up winding facility according to the third embodiment, the yarn group 2, 3 take-off portion of the roller peripheral surface of each of the roller sections 30b, 31b is subjected to mirror finish, whereas the yarn group 2, 3 feed-out portion of the roller peripheral surface of each of the roller sections 30b, 31b is subjected to satin finish. Furthermore, the roller diameter of the portion subjected to satin finish is set to be larger than that of the portion subjected to mirror finish.

[0074] Now, a take-up winding facility 100 according to a fourth embodiment of the present invention will be described below. In the description below, the same arrangements as those of the take-up winding facilities 100 according to the first to third embodiments are denoted by the same reference numerals and will not be described. Figure 7A is a front view of the take-up winding facility 100 according to the first embodiment of the present invention (the take-up winding facility 100 in which the spinning head 12 is located in the direction orthogonal to the axial direction of the bobbin holder shaft 23). Figure 7B is a front view of the take-up winding facility 100 according to the fourth embodiment of the present invention. Figure 7C is a side view of the take-up winding facility 100 according to the fourth embodiment of the present invention. Figure 8 is a side view of yarn feeding rollers 30, 31 in the take-up winding facility 100 according to the fourth embodiment of the present invention.

[0075] As shown in Figures 7B and 7C, in the take-up winding facility 100 according to the fourth embodiment, a spinning head 12 included in a spin-out section 11 of a spinning machine 10 is located along the axial direction (the front-back direction of the take-up winding facility 100) of a bobbin holder shaft 23 provided in a take-up winding machine 22 in a take-up winding device 20. Specifically, the spinning head 12 is located such that spinnerets formed in the bottom surface of the spinning head 12 are arranged substantially linearly in the axial direction of the bobbin holder shaft 23.

[0076] As shown in Figure 8, when being fed from the spinning head 12 to each of the yarn feeding rollers 30, 31, the yarn group 2, 3 approaches the yarn feeding roller 30, 31 at an approach angle B to the yarn feeding roller 30, 31. Here, the approach angle B refers to the angle between the yarn path from the spinning head 12 to each of the yarn feeding rollers 30, 31 and the horizontal direction.

[0077] Since the spinning head 12 is located along the axial direction of the bobbin holder shaft 23 (Figures 7B and 7C), the approach angle B is larger than that obtained in the case where the spinning head 12 is located in the direction orthogonal to the axial direction of the bobbin holder shaft 23 (Figure 7A). Thus, when the spinning head 12 is located along the axial direction of the bobbin holder shaft 23 (Figures 7B and 7C), tension applied to the yarn group 2, 3 approaching the yarn feeding roller 30, 31 is optimized. Consequently, the quality of yarns 1

can be maintained at the same level.

[0078] Furthermore, since the spinning head 12 is located along the axial direction of the bobbin holder shaft 23 (Figures 7B and 7C), the spinning machine 10 can be placed, with respect to a take-up winding device 20, at a lower position than in the case where the spinning head 12 is located in the direction orthogonal to the axial direction of the bobbin holder shaft 23 (Figure 7A). Additionally, the yarns 1 spun out by the spinning head 12 can be fed to the yarn feeding rollers 30, 31 so as to be evenly distributed between the yarn feeding rollers 30, 31.

[0079] Now, a take-up winding facility 100 according to a fifth embodiment of the present invention will be described below. In the description below, the same arrangements as those of the take-up winding facilities 100 according to the first to fourth embodiments are denoted by the same reference numerals and will not be described. Figure 9 is a side view of a take-up winding facility 100 according to a fifth embodiment of the present invention.

[0080] As shown in Figure 9, in the take-up winding facility 100 according to the fifth embodiment, at least two, plural yarn feeding rollers are arranged above and immediately before a take-up winding machine 22 at intervals along the axial direction of a bobbin holder shaft 23. Specifically, four yarn feeding rollers, a first yarn feeding roller 30, a second yarn feeding roller 31, a third yarn feeding roller 35, and a fourth yarn feeding roller 36 are arranged above and immediately before the take-up winding machine 22 at intervals along the axial direction of the bobbin holder shaft 23.

[0081] The yarn feeding rollers provided in the take-up winding facility 100 according to the fifth embodiment are arranged such that the first yarn feeding roller 30 is located on the front side of the bobbin holder shaft 23 (the leading end side of the bobbin holder shaft 23) and followed by the second yarn feeding roller 31, third yarn feeding roller 35, and fourth yarn feeding roller 36 arranged in this order at intervals.

[0082] The yarn feeding rollers 30, 31, 35, 36 form yarn feeding roller groups each composed of every two yarn feeding rollers starting with the first yarn feeding roller 30 located on the front side of the bobbin holder shaft 23 (the leading end side of the bobbin holder shaft 23). Specifically, the first yarn feeding roller 30 and the second yarn feeding roller 31, located opposite the first yarn feeding roller 30, form a first yarn feeding roller group 37. The third yarn feeding roller 35, located opposite the second yarn feeding roller 31, and the fourth yarn feeding roller 36, located opposite the third yarn feeding roller 35, form a second yarn feeding roller group 38.

[0083] Now, the yarn paths of the yarns 1 in the take-up winding facility 100 according to the fifth embodiment will be described. As shown in Figure 9, a plurality of yarns 1 spun out by a spinning head 12 are divided into four equal groups between a spinning machine 10 and the yarn feeding rollers 30, 31, 35, 36. As a result, a first

yarn group 2, a second yarn group 3, a third yarn group 4, and a fourth yarn group 5 are formed.

[0084] The yarn groups 2, 3, 4, 5 are further divided into two sets of yarn groups, that is, a set of the yarn groups 2, 3 and a set of the yarn groups 4, 5. Then, the set of the yarn groups 2, 3 is supplied to the first yarn feeding roller group 37. The set of the yarn groups 4, 5 is supplied to the second yarn feeding roller group 38.

[0085] For the yarn groups 2, 3 supplied to the first yarn feeding roller group 37, the first yarn group 2 is taken off from the spinning machine 10 by the first yarn feeding roller 30. The second yarn group 3 is taken off from the spinning machine 10 by the second yarn feeding roller 31.

[0086] Likewise, for the yarn groups 4, 5 supplied to the second yarn feeding roller group 38, the third yarn group 4 is taken off from the spinning machine 10 by the third yarn feeding roller 35. The fourth yarn group 5 is taken off from the spinning machine 10 by the fourth yarn feeding roller 36.

[0087] As described above, the yarn groups 2, 3, 4, 5 are divided into the yarn feeding roller groups 37, 38, which are then taken off from the spinning machine 10 by the corresponding yarn feeding rollers. The subsequent yarn paths in the first yarn feeding roller group 37 and the second yarn feeding roller group 38 are similar to those in the take-up winding facilities 100 according to the first to fourth embodiments, that is, those obtained when only the first yarn feeding roller 30 and the second yarn feeding roller 31 are provided.

[0088] The yarn groups 2, 3, 4, 5 taken off by the yarn feeding rollers are spread, on the yarn feeding rollers 30, 31, 35, 36, into the yarns 1 in the front-back direction of the take-up winding facility 100. The spread yarns 1 are then supplied to the take-up winding machine 22. At this time, the spread angle of the yarn 1 (yarn spread angle A) is at most a predetermined angle (for example, at most 20 degrees) to the vertical line so as to maintain the same level of yarn quality.

[0089] Now, the operation of hooking each of the yarns 1 from the take-up winding machine 10 on a corresponding bobbin 21 will be described with reference to the first embodiment.

[0090] First, as shown in Figure 1A, an operator stands on a working step 90. The operator allows a suction device to suck and hold the first yarn group 2 spun out by the spinning head 12. The operator then operates the suction device to hook the first yarn group 2 on the first yarn feeding roller 30. The operator then passes the first yarn group 2 onto the second yarn feeding roller 31 so that the first yarn group 2 extends in S form. The operator then places the first yarn group 2 onto a yarn hooking assisting guide 64 provided on the frame 70 located behind the second yarn feeding roller 31.

[0091] Thereafter, the operator allows the second yarn group 3 spun out by the spinning head 12 to be sucked and held and then passed from the second yarn feeding roller 31 to the first yarn feeding roller 30 so that the second yarn group 3 extends in S form. The operator then

allows the second yarn group 3 to be placed on a yarn hooking assisting guide 64 positioned in front of the first yarn feeding roller 30. Thereafter, the operator guides the yarns 1 in the first yarn group 2, via the interlace 63, to the traverse support point guide 25a included in the traverse device 25. The operator then guides the yarns 1 in the second yarn group 3, via the interlace 63, to the traverse support point guide 25a included in the traverse device 25.

[0092] As described above, the yarn hooking assisting guide 64 is provided such that with the first yarn group 2 or the second yarn group 3 temporarily hooked on the yarn hooking assisting guide 64, the yarns 1 are fed out from the yarn feeding rollers 30, 31 as in the case of the present embodiment. In this case, the yarn hooking operation can be easily achieved.

[0093] Whether the yarn hooking assisting guide 64 is positioned close to each of the yarn feeding rollers 30, 31 or midway between the yarn feeding rollers 30, 31 is determined according to the shape of the suction device and the like. The specific position of the yarn hooking assisting guide 64 is not limited.

While the present invention has been described with respect to preferred embodiments thereof, it will be apparent to those skilled in the art that the disclosed invention may be modified in numerous ways and may assume many embodiments other than those specifically set out and described above. Accordingly, it is intended by the appended claims to cover all modifications of the present invention that fall within the scope of the invention.

Claims

1. A take-up winding facility configured to feed a plurality of filament yarns spun out by a spinning machine, from above to below to simultaneously wind the plurality of filament yarns around respective plural bobbins installed on a bobbin holder shaft in one take-up winding machine, the facility being **characterized in that:**

a plurality of yarn feeding rollers are arranged immediately before the take-up winding machine, and the plurality of filament yarns spun out by the spinning machine are divided into a plurality of groups which are then fed to the respective plural yarn feeding rollers arranged immediately before the take-up winding machine, and the groups of filament yarns are distributively wound around respective bobbins via the plurality of yarn feeding rollers.

2. The take-up winding facility according to Claim 1, **characterized in that** the plurality of yarn feeding rollers arranged immediately before the take-up winding machine include at least a first yarn feeding

roller and a second yarn feeding roller arranged at a distance from each other in an axial direction of the bobbin holder shaft to feed out a first filament yarn group and a second filament yarn group including all or a part of the plurality of filament yarns, to the take-up winding machine, the first yarn feeding roller rotates so as to take off the first filament yarn group from the spinning machine to feed out the first filament yarn group to the second yarn feeding roller and to take off the second filament yarn group fed out from the second yarn feeding roller to feed out the second filament yarn group to the take-up winding machine, the second yarn feeding roller rotates so as to take off the second filament yarn group from the spinning machine to feed out the second filament yarn group to the first yarn feeding roller and to take off the first filament yarn group fed out from the first yarn feeding roller to feed out the first filament yarn group to the take-up winding machine, and the take-up winding machine winds the second filament yarn group spreadingly fed out from the first yarn feeding roller and the first filament yarn group spreadingly fed out from the second yarn feeding roller, around the bobbins.

3. The take-up winding facility according to Claim 2, **characterized in that:**

the first yarn feeding roller and the second yarn feeding roller rotate in opposite directions, the first yarn feeding roller rotates so as to feed out the first filament yarn group taken off from the spinning machine, to the second yarn feeding roller while allowing the first filament yarn group to be guided around a lower part of the first yarn feeding roller and to feed out the second filament yarn group taken off from the second yarn feeding roller, to the take-up winding machine while allowing the second filament yarn group to be guided around an upper part of the first yarn feeding roller, and the second yarn feeding roller rotates so as to feed out the second filament yarn group taken off from the spinning machine, to the first yarn feeding roller while allowing the second filament yarn group to be guided around a lower part of the second yarn feeding roller and to feed out the first filament yarn group taken off from the first yarn feeding roller, to the take-up winding machine while allowing the first filament yarn group to be guided around an upper part of the second yarn feeding roller.

4. The take-up winding facility according to Claim 2 or Claim 3, **characterized in that** in each of the first yarn feeding roller and the second yarn feeding roller, a friction coefficient of a yarn contact portion that

comes into contact with the first filament yarn group is relatively different from a friction coefficient of a yarn contact portion that comes into contact with the second filament yarn group.

5. The take-up winding facility according to any one of Claims 2 to 4, **characterized in that** in each of the first yarn feeding roller and the second yarn feeding roller, a roller diameter of the yarn contact portion that comes into contact with the first filament yarn group is relatively different from a roller diameter of the yarn contact portion that comes into contact with the second filament yarn group. 5 10
6. The take-up winding facility according to any one of Claims 2 to 5, **characterized by** further including a yarn hooking assisting guide configured to temporarily hold the first filament yarn group or the second filament yarn group when the first filament yarn group or the second filament yarn group is hooked on the first yarn feeding roller and the second yarn feeding roller. 15 20
7. The take-up winding facility according to any one of Claims 2 to 6, **characterized by** further including an interlace provided between the first yarn feeding roller and the second yarn feeding roller or between the first yarn feeding roller and the take-up winding machine, and between the second yarn feeding roller and the take-up winding machine to form a interlaced portion on the filament yarns. 25 30
8. The take-up winding facility according to any one of Claims 2 to 7, **characterized by** further including an oiling device provided below a spin-out section of the spinning machine to apply lubricant to the filament yarns. 35
9. The take-up winding facility according to Claim 8, **characterized by** further including a migration nozzle provided downstream side of the oiling device in a yarn feeding direction to eject gas onto the filament yarns. 40
10. The take-up winding facility according to any one of Claims 2 to 9, **characterized by** further including a shutter provided below the spin-out section of the spinning machine to prevent a broken yarn from falling. 45 50
11. The take-up winding facility according to any one of Claims 2 to 10, **characterized in that** a common inverter is used to drive the first yarn feeding roller and the second yarn feeding roller. 55
12. The take-up winding facility according to any one of Claims 2 to 11, **characterized in that** the spinning machine includes the spin-out section located along

the axial direction of the bobbin holder shaft, and the first yarn feeding roller and the second yarn feeding roller feed out the first filament yarn group and second filament yarn group including all or a part of the plurality of filament yarns spun out by the spin-out section, to the take-up winding machine.

FIG. 1A

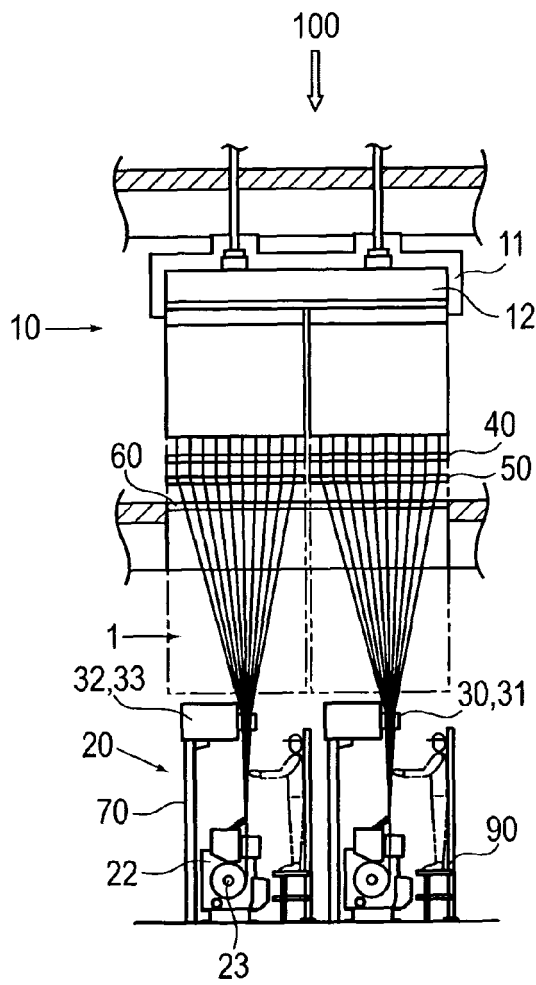


FIG. 1B

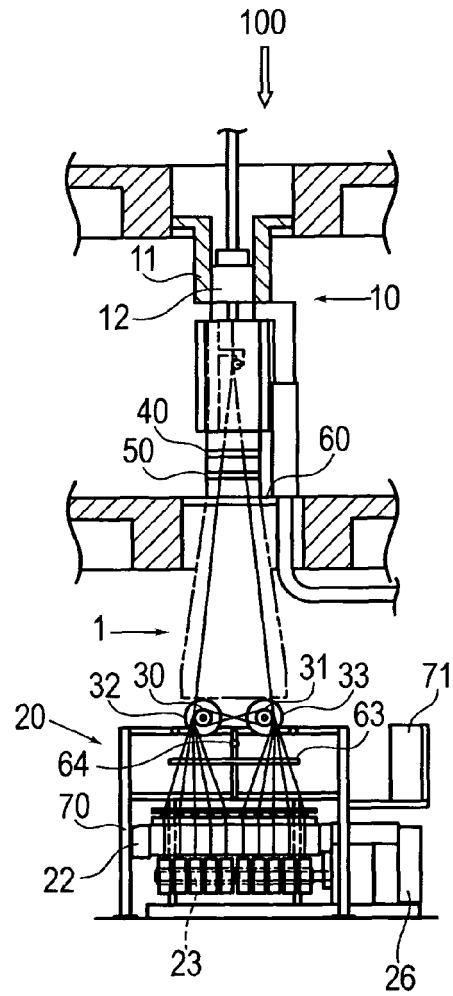


FIG.2

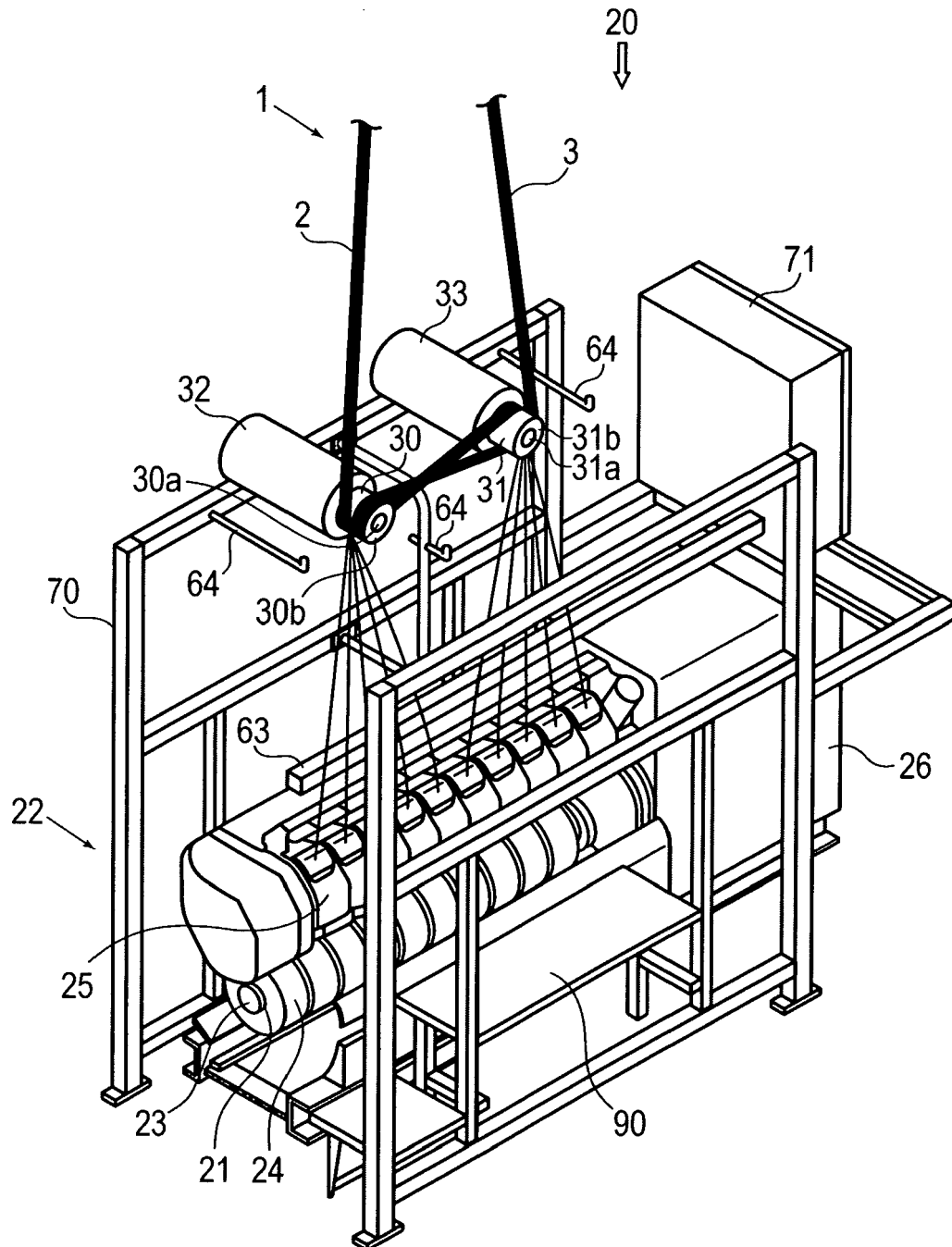


FIG.3

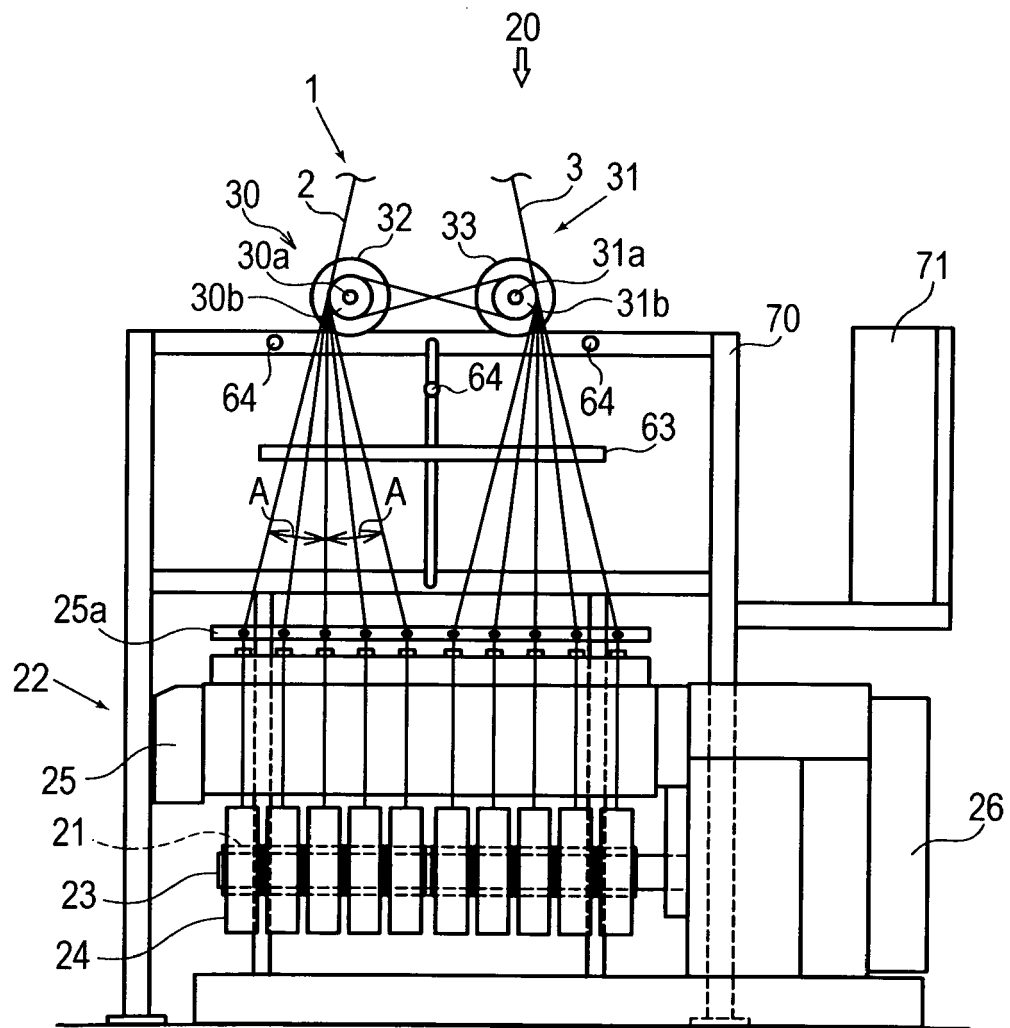


FIG. 4A

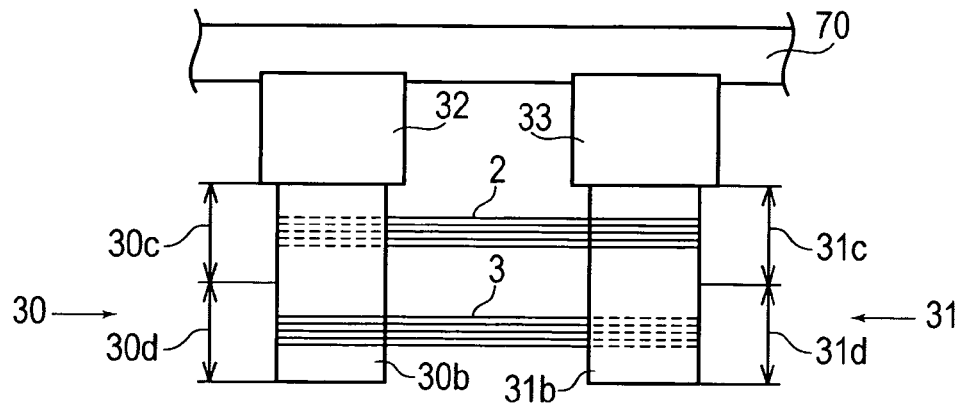


FIG. 4B

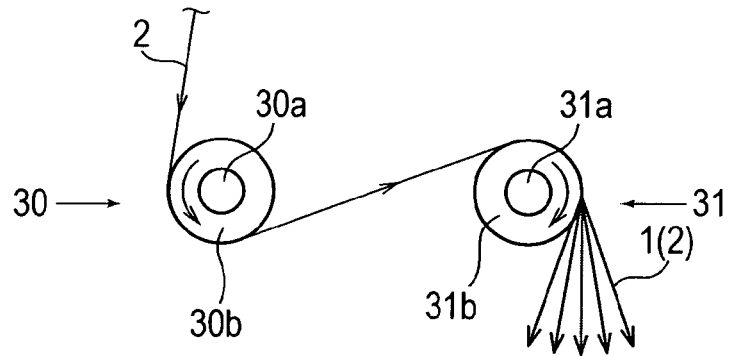


FIG. 4C

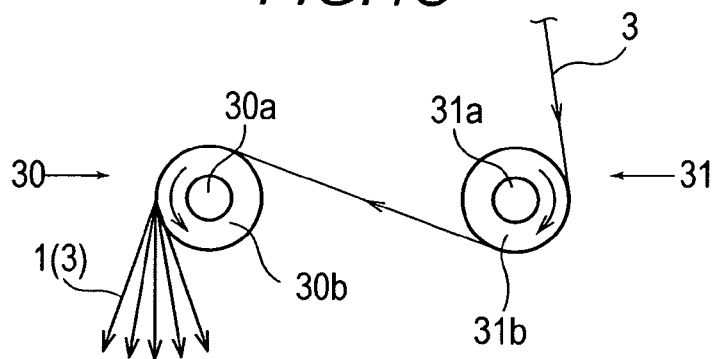


FIG.5

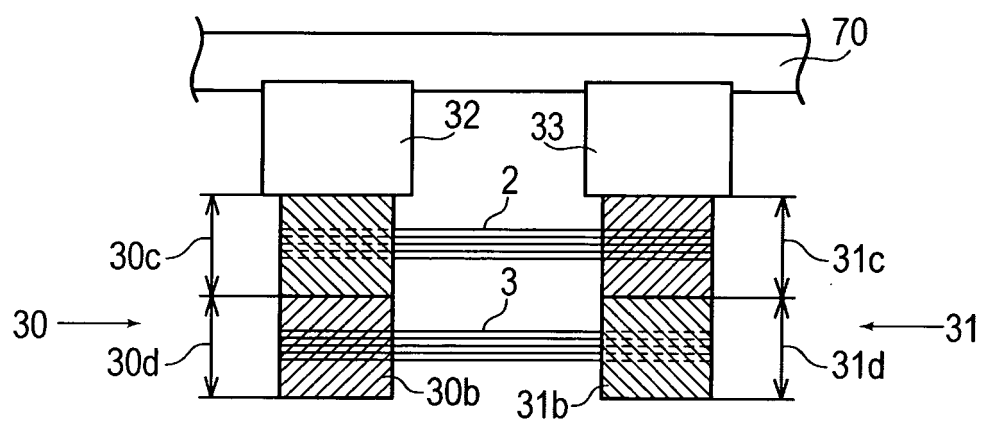


FIG. 6A

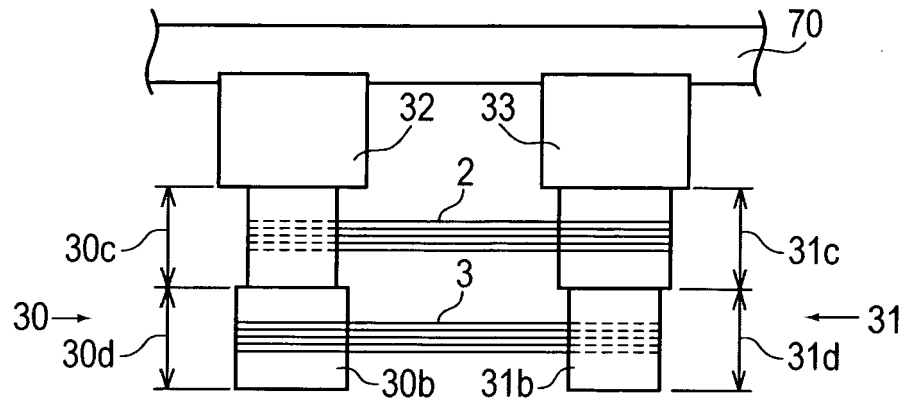


FIG. 6B

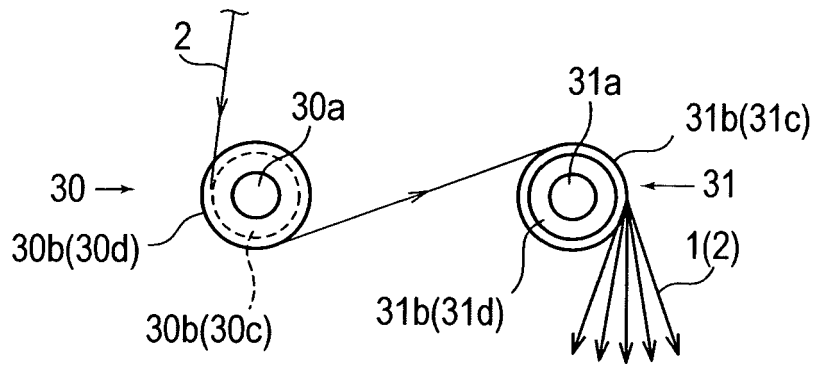


FIG. 6C

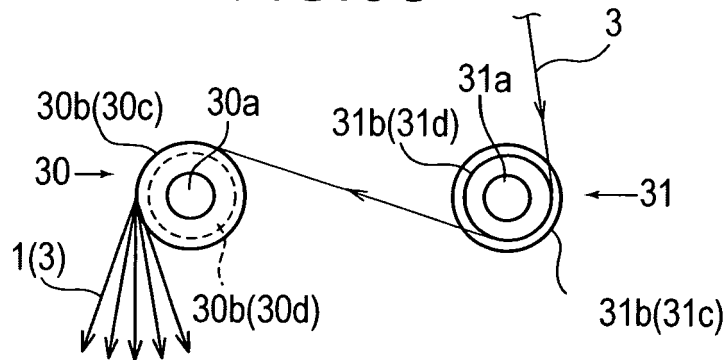


FIG.7A

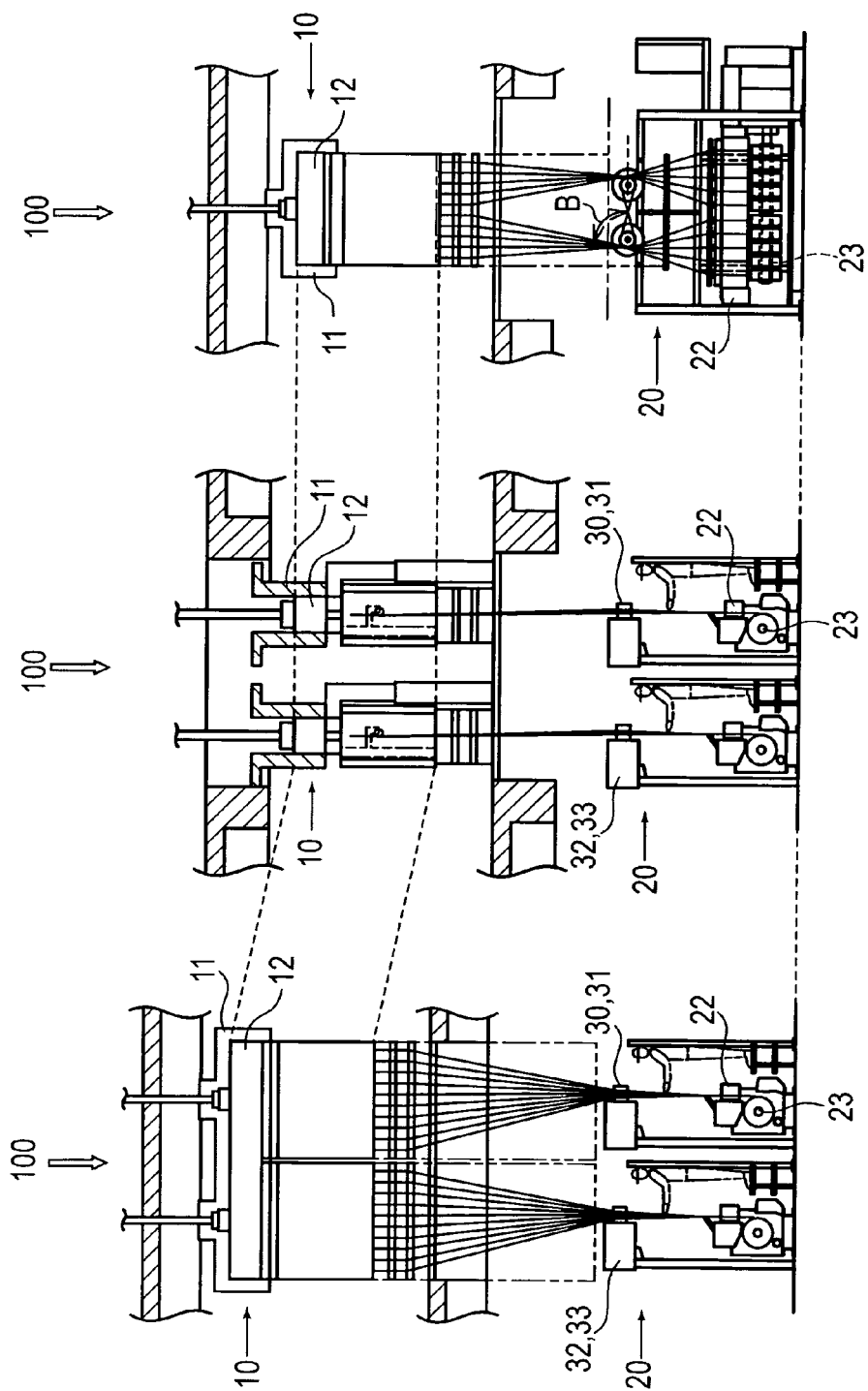


FIG.7B

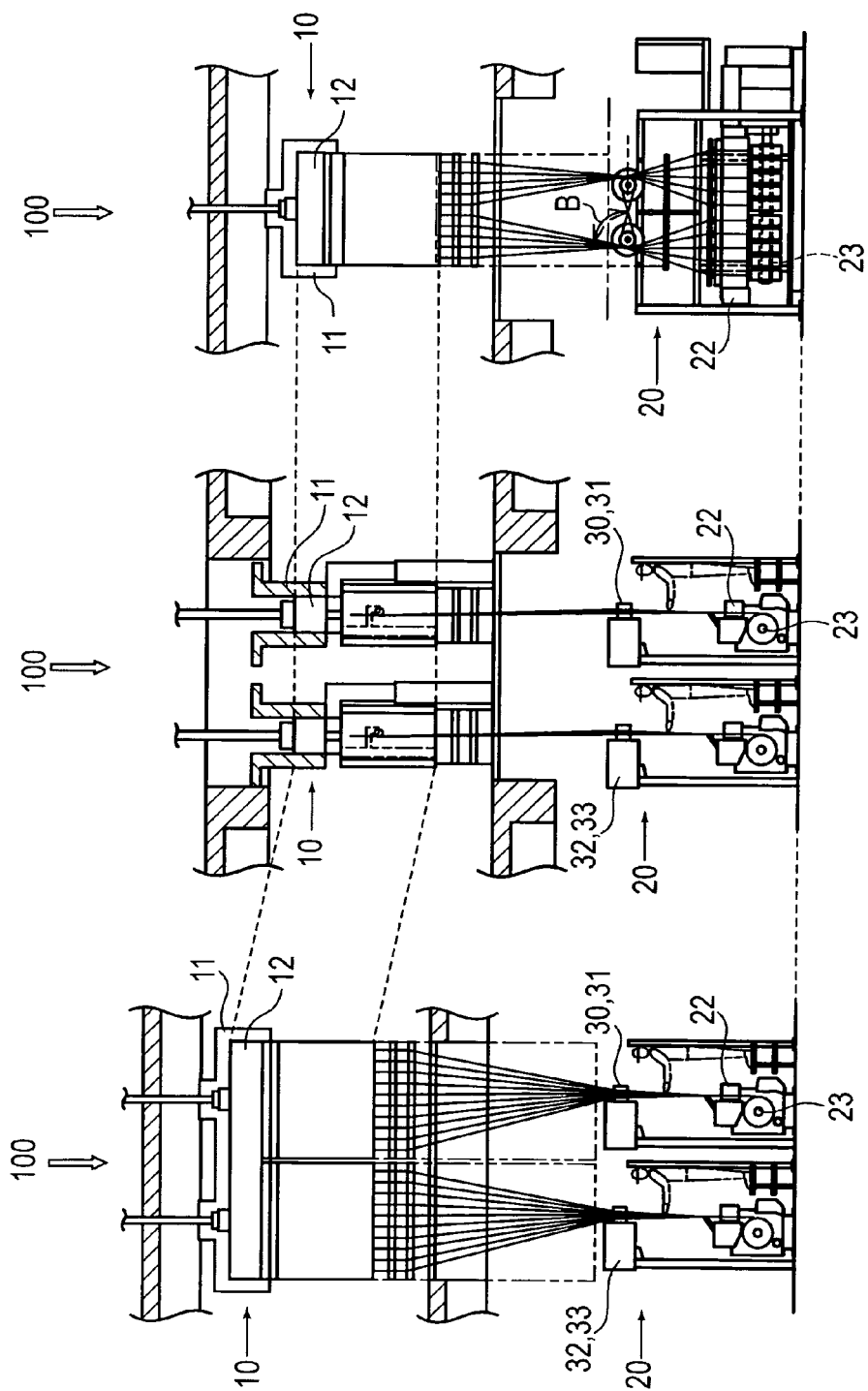


FIG.7C

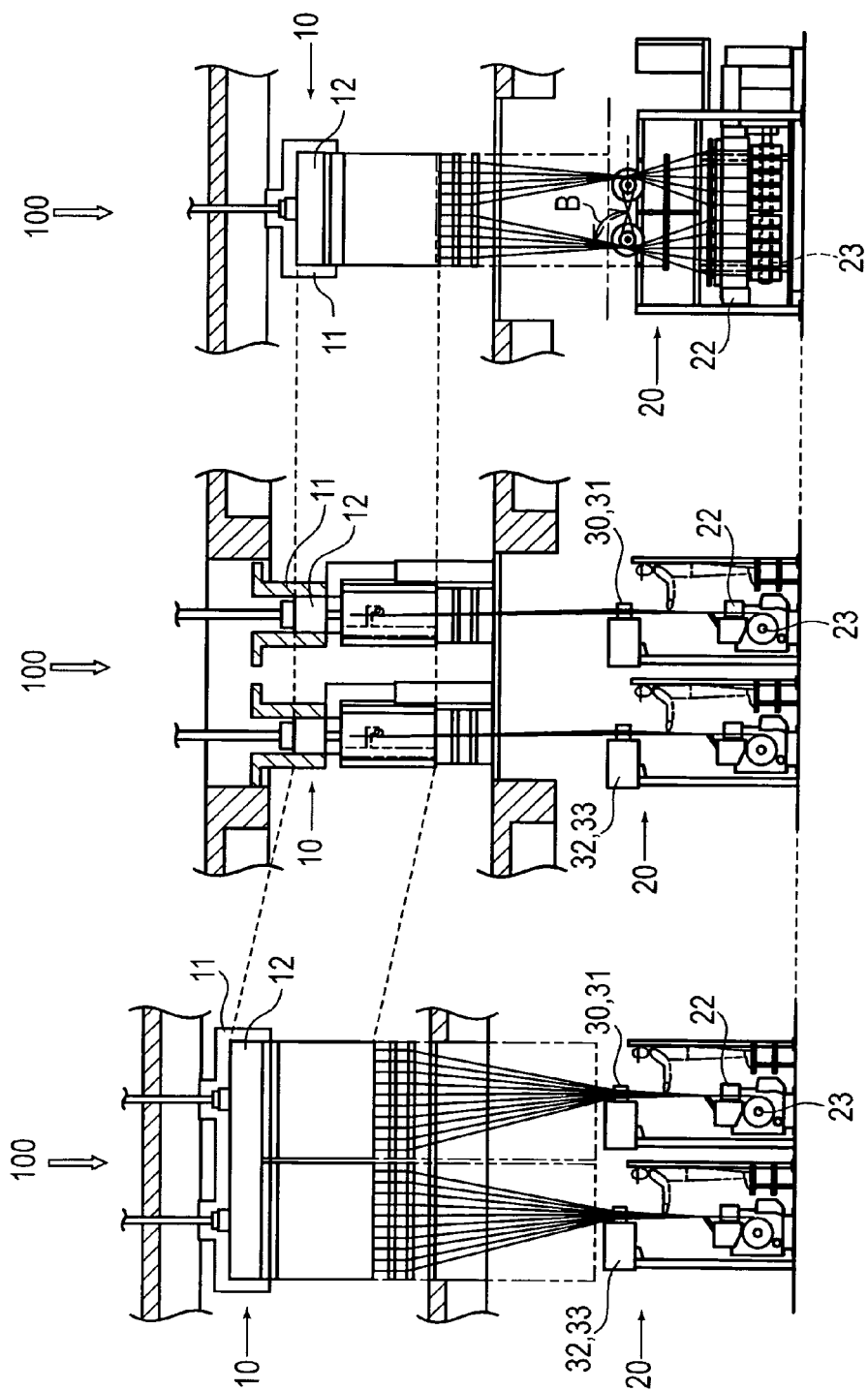


FIG. 8

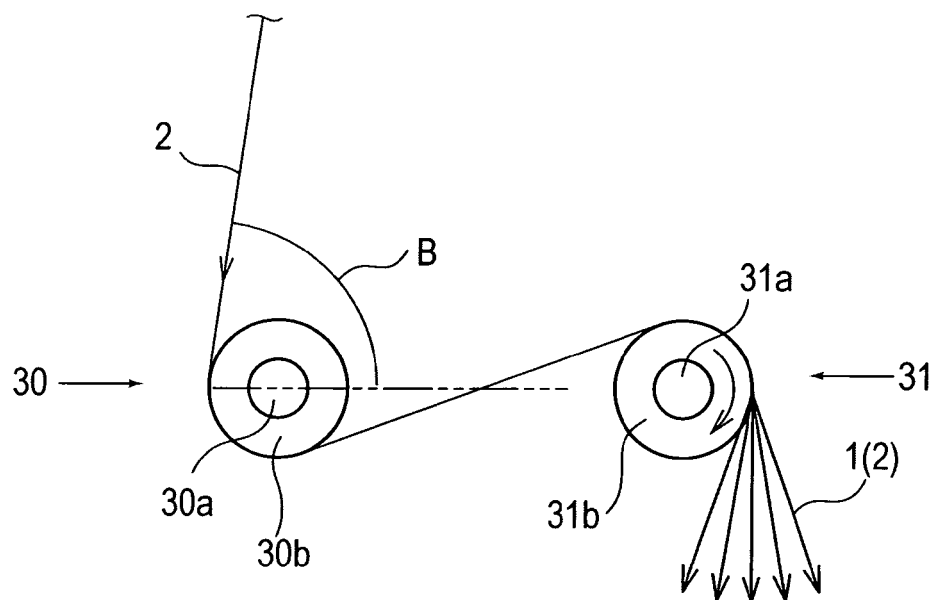
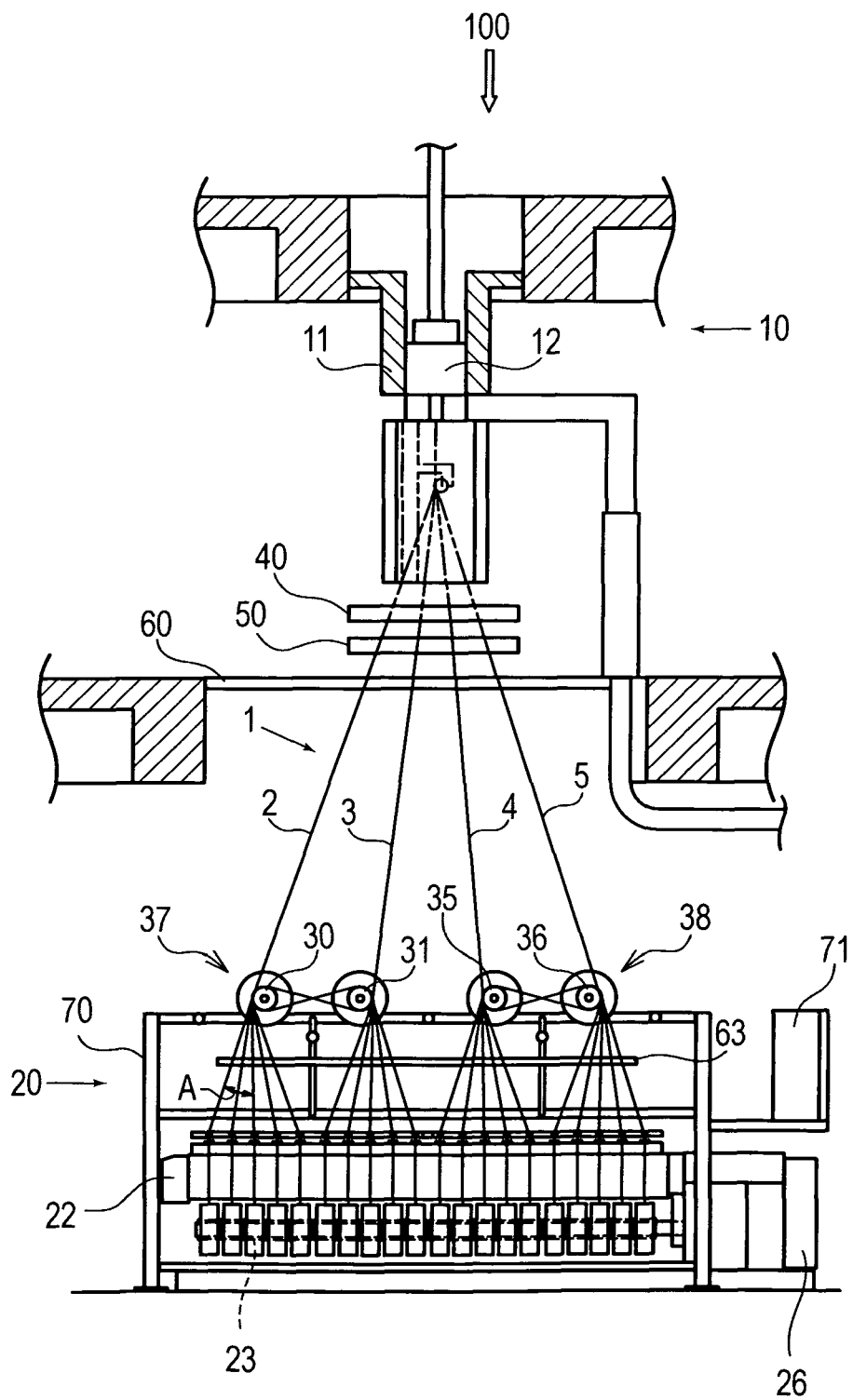


FIG. 9



REFERENCES CITED IN THE DESCRIPTION

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- JP 2005534825 PCT [0004] [0006]