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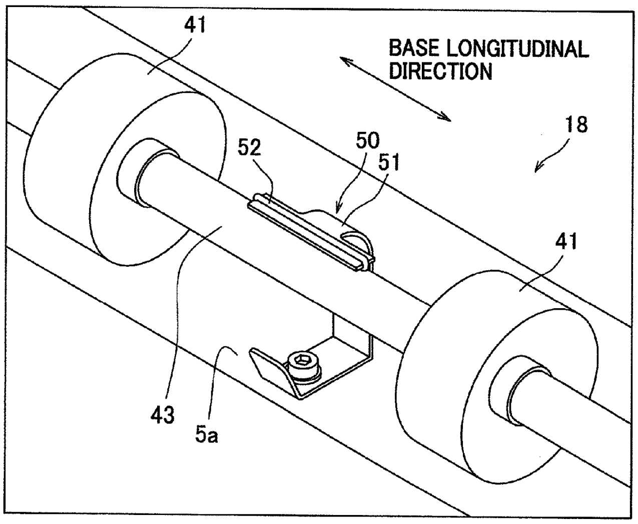
(54) TEXTILE MACHINE

(57) A textile machine (1) configured to produce or process a synthetic fiber yarn comprises a static-buildup part (18, 43); an antistatic unit (50) configured to remove static electricity from the static-buildup part (18, 43) at which the static electricity is generated due to the yarn (Y) running while being in contact with the static-buildup part; wherein the static-buildup part is a rotating body configured to rotate while being in contact with the yarn (Y), and the antistatic unit is provided with respect to the rotating body; a high-speed feed roller (18) of the textile machine feeds the yarn; a low-speed feed roller (20) provided downstream of the high-speed feed roller in a yarn running direction and feeds the yarn at a conveyance speed lower than that of the high-speed feed roller so that the yarn is relaxed between the high-speed feed roller and the low-speed feed roller, the high-speed and low-speed feed rollers functioning as the rotating body, wherein the antistatic unit is provided with respect to at least the high-speed feed roller in a manner to prevent buildup of static electricity in the high-speed feed roller.

FIG.4



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Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a textile machine configured to produce or process synthetic fiber yarns.

[0002] Textile machines configured to process yarns include, for example, a draw texturing machine disclosed in Japanese Unexamined Patent Publication No. 2007-277751. In such a machine, yarns running along a yarn path are processed. In this process, static electricity is generated at parts of the machine with which the running yarns are in contact with, due to the friction between the yarns and the parts. In general, static electricity does not have a fatal effect, and therefore no special countermeasure against the static electricity has been taken so far in textile machines.

SUMMARY OF THE INVENTION

[0003] However, demands on the textile machines in regard to processing quality and operability have been increasing, and in recent years, it has been considered that the effect of the static electricity should not be overlooked. Specifically, the static electricity may cause the following problem: the static electricity possibly makes the running of the yarns unstable, and this worsens the performance in yarn placement and/or increases the rate of occurrence of yarn breakage due to yarn swing, leading to poor operability. Furthermore, if the running of the yarns becomes unstable due to the effect of the static electricity, the yarns may deviate from the intended yarn path. In this case, there is a possibility that the yarns cannot be properly processed and therefore the yarns have poor quality.

[0004] The present invention has been made in view of the above-described problems. An object of the present invention is, in a textile machine configured to produce or process a synthetic fiber yarn, to minimize the effect of static electricity which has not been dealt with, and thereby to stabilize the running of the yarn.

[0005] According to an embodiment of the present invention, a textile machine configured to produce or process a synthetic fiber yarn includes an antistatic unit configured to remove static electricity from a static-buildup part at which the static electricity is generated due to the yarn running while being in contact with the static-buildup part.

[0006] In the present invention, the antistatic unit is provided to remove the static electricity from the static-buildup part. This arrangement minimizes the effect of the static electricity at the static-buildup part, and enables stabilization of the running of the yarn.

[0007] Furthermore, in the present invention, the static-buildup part is a rotating body configured to rotate while being in contact with the yarn, and the antistatic unit is provided with respect to the rotating body.

[0008] In this arrangement, although static electricity is generated by the friction between the yarn and the rotating body, buildup of the static electricity in the rotating body is prevented because the antistatic unit is provided with respect to the rotating body.

[0009] Furthermore, in the present invention, the textile machine further includes: a high-speed feed roller configured to feed the yarn; and a low-speed feed roller provided downstream of the high-speed feed roller in a yarn running direction and configured to feed the yarn at a conveyance speed lower than that of the high-speed feed roller so that the yarn is relaxed between the high-speed feed roller and the low-speed feed roller, the high-speed and low-speed feed rollers functioning as the rotating body, and the antistatic unit is provided with respect to at least the high-speed feed roller in a manner to prevent buildup of static electricity in the high-speed feed roller.

[0010] When the yarn is relaxed between the high-speed feed roller and the low-speed feed roller, it is more likely that the running of the yarn relaxed on the downstream side of the high-speed feed roller in the yarn running direction becomes unstable due to the effect of the static electricity building up in the high-speed feed roller on the upstream side in the yarn running direction. Accordingly, the running of the relaxed yarn is able to be stabilized by providing the antistatic unit with respect to the high-speed feed roller.

[0011] For example, when a twisting unit configured to twist the yarn is provided upstream of the high-speed feed roller in the yarn running direction, and a heater configured to heat the yarn is provided between the high-speed feed roller and the low-speed feed roller in the yarn running direction, it is effective to provide the antistatic unit with respect to the high-speed feed roller because the yarn heated by the heater is in a relaxed state.

[0012] Besides, it is also effective to provide the antistatic unit with respect to the high-speed feed roller when an interlacing device configured to impart entanglement to the yarn is provided between the high-speed feed roller and the low-speed feed roller in the yarn running direction. This is because the yarn to which entanglement is imparted by the interlacing device is in the relaxed state.

[0013] Furthermore, in the present invention, it is preferable that the antistatic unit is provided so as not to be in contact with the rotating body.

[0014] If the antistatic unit is in contact with the rotating body, the antistatic unit and the rotating body may wear out. This causes a possibility that the static electricity cannot be properly removed and/or the frequency of part replacement increases. In addition, the contact of the antistatic unit with the rotating body may increase, rather than decrease, the amount of static electricity generated between the antistatic unit and the rotating body. In the above arrangement, however, the antistatic unit is not in contact with the rotating body. In this case, the problems such as above are avoidable.

[0015] Furthermore, in the present invention, it is preferable that the rotating body includes: a rotation shaft;

and a roller attached to the rotation shaft and having an outer circumferential surface with which the yarn is in contact, and that the antistatic unit is provided with respect to the rotation shaft.

[0016] Because the antistatic unit is provided with respect to the rotation shaft, the antistatic unit has a smaller size in the radial direction of the rotation body than in the case in which the antistatic unit is provided with respect to a roller. Thus, this arrangement enables the antistatic unit to have a compact structure.

[0017] Furthermore, in the present invention, it is preferable that the antistatic unit includes: a grounded supporting member; and an antistatic member attached to the supporting member so as to be along the outer circumferential surface of the rotation shaft.

[0018] As the antistatic member is provided so as to be along the outer circumferential surface of the rotation shaft, a large area is reserved for the static electricity discharged from the rotation shaft to the antistatic member. This further ensures the removal of the static electricity.

[0019] Furthermore, in the present invention, it is preferable that the antistatic member is provided along an axial direction of the rotation shaft.

[0020] This arrangement reduces non-uniformity of the antistatic ability in the axial direction. As a result, the static electricity is preferably removed.

[0021] Furthermore, in the present invention, it is preferable that the antistatic member includes conductive fibers exposed on a surface of the antistatic member at a plurality of positions.

[0022] With the use of this antistatic member, the static electricity is discharged to the plurality of positions at which the conductive fibers exposed. Thus, this arrangement improves the antistatic ability of the antistatic member.

[0023] Furthermore, in the present invention, it is preferable that a cover member covering the antistatic member is provided to prevent exposure of the antistatic member.

[0024] Dust or the like attached to the antistatic member may make it difficult for the static electricity to be discharged to the antistatic member, and thereby reduce the antistatic ability. In this regard, however, the cover member provided as described above prevents dust or the like from being attached to the antistatic member, and therefore the reduction of the antistatic ability is avoided.

[0025] Furthermore, in the present invention, the textile machine may be configured to process the yarn, which is made of nylon.

[0026] When the nylon yarn is processed, it is particularly more likely that static electricity is generated by the friction between the yarn and the static-buildup part. For this reason, the advantageous effects brought about by providing the antistatic unit are further noticeable.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027]

FIG. 1 is a schematic diagram illustrating the structure of a draw texturing machine related to an embodiment.

FIG. 2 is a schematic diagram illustrating the structure of a twisting unit.

FIG. 3 is a perspective view of a part of a third feed roller.

FIG. 4 is a perspective view of a part of the third feed roller.

FIG. 5 is a cross section illustrating how an antistatic unit and a cover member are attached.

DESCRIPTION OF EMBODIMENTS

[0028] The following will describe an embodiment of the present invention with reference to the drawings. In this embodiment, a textile machine of the present invention is applied to a draw texturing machine configured to false-twist synthetic fiber yarns such as nylon or polyester yarns to get the yarns textured, and thereby to produce processed yarns having good stretchability.

(Overall Structure of Draw Texturing Machine)

[0029] FIG. 1 is a schematic diagram illustrating the structure of a draw texturing machine 1 of the present embodiment. The draw texturing machine 1 includes: a yarn supplying unit 2 configured to supply yarns Y; a processing unit 3 configured to subject the yarns Y supplied by the yarn supplying unit 2 to false-twist texturing, and a winding unit 4 configured to wind the yarns Y having been subjected to false-twist texturing by the processing unit 3, to form packages P.

[0030] The yarn supplying unit 2 includes creel stands 10 each configured to support a plurality of yarn supply packages Q. The yarn supplying unit 2 is configured to supply yarns Y to the processing unit 3. The processing unit 3 includes a first feed roller 11, twist-stopping guides 12, first heaters 13, coolers 14, twisting units 15, a second feed roller 16, interlacing devices 17, a third feed roller 18, second heaters 19, and a fourth feed roller 20. These members are arranged in this order from an upstream side in a yarn running direction. Note that the yarn running direction is the direction in which yarns Y run along their yarn path. The winding unit 4 is configured to wind, by using winding devices 21, the yarns Y having been subjected to false-twist texturing in the processing unit 3, and to form packages P.

[0031] The draw texturing machine 1 includes main frames 5 and winding bases 6. Each winding base 6 is provided apart from the corresponding main frame 5 in a left-right direction in FIG. 1. Hereinafter, this direction is referred to as a "base width direction". The main frame 5 and the winding base 6 extend in a direction orthogonal to the sheet of FIG. 1 (hereinafter, this direction is referred to as a "base longitudinal direction"), and have the substantially same length in the base longitudinal direction. The winding base 6 is opposed to the main frame 5. An upper portion of the main frame 5 is connected with an upper portion of the winding base 6 by a supporting frame 7. Each of the devices structuring the processing unit 3 is mostly attached to the main frame 5 or the supporting frame 7. There is a working space 8 surrounded by the main frame 5, the winding base 6, and the supporting frame 7. In other words, the main frame 5, the winding base 6, and the supporting frame 7 are arranged so as to surround the working space 8, so that yarns Y run mainly around the working space 8.

[0032] The draw texturing machine 1 has unit sections called spans. In each span, the main frame 5 and the winding base 6 opposed to the main frame 5 are included as a set. In each span, the above-mentioned devices are arranged so that yarns Y running while being arranged side by side in the base longitudinal direction can be subjected to false-twist texturing at the same time. In the draw texturing machine 1, pairs of spans are lined up in the base longitudinal direction. Each pair of spans are provided left-right symmetrically with respect to a center line C of the main frame 5 that is at the center in the base width direction. Note that the main frame 5 is common between the left and right spans. The following describes the details of the processing unit 3.

(Processing Unit)

[0033] The first feed roller 11 is configured to feed yarns Y supplied from the yarn supplying unit 2 toward the first heaters 13. The first feed roller 11 is provided to an upper portion of the winding base 6. The first feed roller 11 is constituted by drive and driven rollers (not illustrated) provided for the respective yarns Y supplied from the yarn supplying unit 2. The drive rollers are aligned and the driven rollers are aligned, both in the base longitudinal direction.

[0034] Each twist-stopping guide 12 is configured to prevent twisting of the corresponding yarn Y imparted by the later-described twisting unit 15 from being transmitted to the upstream side relative to the twist-stopping guide 12 in the yarn running direction. The twist-stopping guides 12 are provided downstream of the first feed roller 11 in the yarn running direction, and upstream of the first heaters 13 in the yarn running direction. The twist-stopping guides 12 are provided for the respective yarns Y supplied from the yarn supplying unit 2, and aligned in the base longitudinal direction. The specific structure of each twist-stopping guide 12 is not limited. For example, it is possible to adopt the configuration described in Published Japanese Translation of PCT Application No. 2008-544100 or the configuration described in Japanese Unexamined Patent Publication No. 2012-102452.

[0035] The first heaters 13 are configured to heat the yarns Y fed from the first feed roller 11, and provided onto the supporting frame 7. Each first heater 13 extends obliquely in a plane orthogonal to the base longitudinal direction. The twist-stopping guides 12, the coolers 14, and the twisting units 15 are provided substantially along the direction in which the first heaters 13 extend. The first heaters 13 are provided for the yarns Y supplied from the yarn supplying unit 2, and aligned in the base longitudinal direction.

[0036] The coolers 14 are configured to cool the yarns Y heated by the first heaters 13. The coolers 14 are provided downstream of the first heaters 13 in the yarn running direction and upstream of the twisting units 15 in the yarn running direction. The coolers 14 are provided for the respective yarns Y supplied from the yarn supplying unit 2, and aligned in the base longitudinal direction.

[0037] The twisting units 15 are configured to twist the yarns Y and provided to an upper portion of the main frame 5. The twisting units 15 are provided for the respective yarns Y cooled by the coolers 14, and aligned in the base longitudinal direction. The details of each twisting unit 15 will be described later.

[0038] The second feed roller 16 is configured to feed the yarns Y twisted by the twisting units 15 toward the interlacing devices 17. The second feed roller 16 is provided to the main frame 5 and below the twisting units 15. The second feed roller 16 is constituted by drive and driven rollers (not illustrated) provided for the respective yarns Y twisted by the twisting units 15. The drive rollers are aligned and the driven rollers are aligned, both in the base longitudinal direction. The conveyance speed at which the yarns Y are conveyed by the second feed roller 16 is higher than the conveyance speed at which the yarns Y are conveyed by the first feed roller 11, and therefore the yarns Y are drawn between the first feed roller 11 and the second feed roller 16.

[0039] The interlacing devices 17 are configured to impart entanglement to the yarns Y by ejecting air to the yarns Y. The interlacing devices 17 are provided to the main frame 5 and below the second feed roller 16. The interlacing devices 17 are provided for the respective yarns Y fed by the second feed roller 16, and aligned in the base longitudinal direction.

[0040] The third feed roller 18 is configured to feed the yarns Y to which entanglement has been imparted by the interlacing devices 17, toward the second heaters 19. The third feed roller 18 is provided to the main frame 5 and below the interlacing devices 17. The third feed roller 18 is constituted by drive and driven rollers (not illustrated) provided for the respective yarns Y to which entanglement has been imparted by the interlacing devices 17. The drive rollers are aligned and the driven rollers are aligned, both in the base longitudinal direction. The conveyance speed at which the yarns Y are conveyed by the third feed roller 18 is lower than the conveyance speed at which the yarns Y are conveyed by the second feed roller 16, and therefore the yarns Y are relaxed between the second feed roller 16 and the third feed roller 18.

[0041] The second heaters 19 are configured to heat the yarns Y fed by the third feed roller 18. The second heaters 19 are provided to the main frame 5 and below the third feed roller 18. Each second heater 19 extends in the vertical direction. For each of the spans, one second heater 19 is provided.

[0042] The fourth feed roller 20 is configured to feed the yarns Y heated by the second heaters 19 toward the winding devices 21. The fourth feed roller 20 is provided to a lower portion of the winding base 6. The fourth feed roller 20 is constituted by drive and driven rollers (not illustrated) provided for the respective yarns Y heated by the second heaters 19. The drive rollers are aligned and the driven rollers are aligned, both in the base longitudinal direction. The conveyance speed at which the yarns Y are conveyed by the fourth feed roller 20 is lower than the conveyance speed at which the yarns Y are conveyed by the third feed roller 18, and therefore the yarns Y are relaxed between the third feed roller 18 and the fourth feed roller 20.

[0043] In the processing unit 3 structured as above, the yarns Y having been drawn between the first feed roller 11 and the second feed roller 16 are twisted by the twisting units 15. Twisting by the twisting units 15 is transmitted to the positions corresponding to the twist-stopping guides 12, but the twisting is not transmitted to the upstream side relative to the twist-stopping guides 12 in the yarn running direction. The yarns Y twisted while being drawn are heated by the first heaters 13, and then cooled by the coolers 14, to be thermally set. The false-twisted yarns Y are untwisted after passing through the twisting units 15 and before reaching the second feed roller 16. Because the twisting of the yarns Y have been thermally set as described above, filaments of the yarns are kept wavy, i.e., textured. Subsequently, entanglement is imparted to the yarns Y by the interlacing devices 17 while the yarns Y are relaxed between the second feed roller 16 and the third feed roller 18. The yarns Y, to which entanglement has been imparted, are thermally set by the second heaters 19 while being relaxed between the third feed roller 18 and the fourth feed roller 20. Finally, the yarns Y fed by the fourth feed roller 20 are wound by the winding devices 21, with the result that packages P are formed.

(Twisting Unit)

[0044] FIG. 2 is a schematic diagram illustrating the structure of the twisting unit 15. Each twisting unit 15 of the present embodiment is of a so-called friction disc type. The twisting unit 15 has three spindles 31 to which friction discs 32 are attached. To each spindle 31, two friction discs 32 are provided apart from each other in an axial direction of the spindles ("spindle axial direction"). The friction discs 32 are arranged so that their positions in the spindle axial direction are different from one another among the spindles 31. Furthermore, the three spindles 31 are arranged so that their respective centers are respectively positioned at the vertexes of an equilateral triangle when viewed from the spindle axial direction. As a result, in the twisting unit 15, the plurality of (six, in the present embodiment) friction discs 32 are arranged in a spiral manner.

[0045] As an unillustrated motor is driven, the spindles 31 rotate, and the friction discs 32 also rotate together with the spindles 31. Then, a yarn Y runs substantially in the spindle axial direction through the set of the friction discs 32 while being in contact with the circumferential surfaces of the rotating friction discs 32, and thereby twist is imparted to the yarn Y.

(Effect of Static Electricity)

[0046] In the draw texturing machine 1 structured as above, there has arisen the following problem: between the third feed roller 18 and the fourth feed roller 20, a failure in yarn placement tends to occur, and the rate of occurrence of yarn breakage is high due to a large amount of yarn swing. As a result of wholehearted study on the problem above, the inventor found that the problem is caused by static electricity building up in the third feed roller 18. In actual, after the static electricity was removed from the third feed roller 18, the voltage at the third feed roller 18 drops below 100 volts from approximately 1500 volts, and the running of the yarns Y between the third feed roller 18 and the fourth feed roller 20 was stabilized. As a result, the performance in yarn placement was improved and the rate of occurrence of yarn breakage was reduced, and consequently, the operability was improved. Furthermore, improvement in quality of the yarns Y can be expected as a result of stabilization of the running of the yarns Y.

[0047] In view of the above result of the study, an antistatic unit is provided with respect to the third feed roller 18 in the draw texturing machine 1 of the present embodiment. The following will describe the antistatic unit provided with respect to the third feed roller 18. Such an antistatic unit may be provided with respect to, not only the third feed roller 18, but also any static-buildup part of the draw texturing machine 1 at which harmful effect can be caused by static electricity.

(Antistatic Unit)

[0048] FIG. 3 and FIG. 4 each is a perspective view of a part of the third feed roller 18. To be more specific, FIG. 3 shows the state in which cover members 45 covering a rotation shaft 43 and a cover member 60 covering an antistatic unit 50 are attached, and therefore the rotation shaft 43 and the antistatic unit 50 cannot be seen. Meanwhile, FIG. 4 shows the state in which the cover members 45 and 60 are detached, and therefore the rotation shaft 43 and the antistatic unit 50 are exposed. Note that in FIG. 4, driven rollers 42 and support brackets 44 are not illustrated.

[0049] The third feed roller 18 includes: drive rollers 41 configured to be rotated by an unillustrated drive motor; and driven rollers 42 each in contact with the corresponding drive roller 41 and configured to rotate with the rotation of the drive roller 41. Each drive roller 41 is made of metal, i.e., conductive material, while each driven roller 42 is made of rubber, i.e., insulating material. Although not illustrated in FIG. 3 and FIG. 4, a yarn Y is nipped between the drive roller 41 and the driven roller 42. The yarn Y is fed to the downstream side in the yarn running direction as the drive roller 41 rotates in a predetermined direction.

[0050] The drive rollers 41 are attached to the rotation shaft 43 (see FIG. 4) extending along the base longitudinal direction. That is, the drive rollers 41 are supported by the single rotation shaft 43. The rotation shaft 43 is rotated by the above-described drive motor, and as the rotation shaft 43 rotates, the drive rollers 41 rotate. Similarly to the drive rollers 41, the rotation shaft 43 is also made of metal, i.e., conductive material. The driven rollers 42 are provided in correspondence with the drive rollers 41, respectively, so as to be arranged in the base longitudinal direction. Each driven roller 42 is supported rotatably by the support bracket 44 and by an unillustrated bearing which are provided for the driven roller 42.

[0051] In the third feed roller 18, static electricity generated by the friction between the roller and the yarns Y is less likely to move to the driven rollers 42 that are insulating members. Because of this, the static electricity is moved to the drive rollers 41 that are conductive members, and is further movable to the rotation shaft 43, which is a conductive member, via the drive rollers 41. The rotation shaft 43 is rotatably supported by an unillustrated bearing. In the bearings supporting the driven rollers 42 and the bearing supporting the rotation shaft 43, insulating grease is used for lubrication, and therefore it is difficult to dissipate the static electricity via these bearings. For this reason, static electricity is more likely to build up particularly in the drive rollers 41 and the rotation shaft 43 each made of conductive material.

[0052] To deal with this, in this embodiment, the antistatic unit 50 including a supporting member 51 and an antistatic member 52 is provided in the vicinity of the rotation shaft 43 to remove static electricity from the rotation shaft 43, as shown in FIG. 4. FIG. 5 is a schematic cross section illustrating how the antistatic unit 50 and the cover member 60 are attached. The cross section is taken orthogonally to the base longitudinal direction.

[0053] The antistatic unit 50 includes: the supporting member 51 made of metal and fixed to a metal frame 5a structuring the main frame 5; and the antistatic member 52 attached to the supporting member 51. The supporting member 51 is fixed to the frame 5a, and thereby indirectly grounded via the frame 5a. The supporting member 51 may be directly grounded.

[0054] As shown in FIG. 5, the supporting member 51 includes: a fixed portion 51a bolted to the frame 5a; a holding portion 51b holding the antistatic member 52; a connecting portion 51c connecting the fixed portion 51a with the holding portion 51b; and a cover attaching portion 51d to which the cover member 60, which will be described later, is attached.

[0055] The fixed portion 51a and the holding portion 51b are opposed to each other, and the rotation shaft 43 is interposed between the fixed portion 51a and the holding portion 51b. The holding portion 51b has a flat-plate shape extending along the axial direction of the rotation shaft 43. The holding portion 51b is positioned approximately 5 mm to 10 mm above an upper end portion (top portion) of the rotation shaft 43. The antistatic member 52 has conductive fibers exposed on its surface at multiple positions. Because the antistatic member 52 is provided along the rotation shaft 43, electricity is discharged from the rotation shaft 43 to the multiple positions of the antistatic member 52. As a result, static electricity is efficiently removed from the rotation shaft 43. According to the above-described arrangement, static electricity generated by the contact between the third feed roller 18 and the yarns Y is discharged through the drive rollers 41, the rotation shaft 43, the antistatic member 52, the supporting member 51, and the frame 5a. It should be noted that both of the supporting member 51 and the antistatic member 52 are arranged so as not to be in contact with the rotation shaft 43.

[0056] The antistatic unit 50 fixed to the frame 5a is covered with the cover member 60. The cover member 60 has a substantially U shape, and includes: a cover portion 60a covering the antistatic unit 50; and a fixed portion 60b formed by bending so as to form a substantially right angle at an end portion of the cover portion 60a. The fixed portion 60b of the cover member 60 is bolted to the frame 5a, and the other end portion of the cover portion 60a of the cover member 60 is bolted to the cover attaching portion 51d of the supporting member 51. As shown in FIG. 3, the outer circumferential surface of the cover portion 60a is substantially at the same position as the outer circumferential surfaces of the drive rollers 41 with respect to the radial direction. Due to this, the antistatic unit 50 and the cover member 60 do not greatly project radially outward relative to the drive rollers 41.

(Advantageous Effects)

[0057] In the present embodiment, the machine includes the antistatic unit 50 configured to remove static electricity from a static-buildup part (the third feed roller 18) at which the static electricity is generated due to the yarns Y running while being in contact with the static-buildup part. This arrangement minimizes the effect of the static electricity at the static-buildup part, and enables stabilization of the running of the yarns Y.

[0058] Furthermore, in the present embodiment, the static-buildup part is a rotating body (the third feed roller 18) with which the running yarns Y are in contact, and the antistatic unit 50 is provided with respect to the rotating body. In this arrangement, although static electricity is generated by the friction between the yarns Y and the rotating body, buildup of the static electricity in the rotating body is prevented because the antistatic unit 50 is provided with respect to the rotating body.

[0059] Furthermore, in the present embodiment, the machine includes a high-speed feed roller (the third feed roller 18) configured to feed the yarns Y; and a low-speed feed roller (the fourth feed roller 20) provided downstream of the high-speed feed roller in the yarn running direction and configured to feed the yarns Y at a conveyance speed lower than that of the high-speed feed roller so that the yarns Y are relaxed between the high-speed feed roller and the low-speed feed roller, the high-speed and low-speed feed rollers functioning as the rotating body, and the antistatic unit 50 is provided with respect to at least the high-speed feed roller. When the yarns Y are relaxed between the high-speed feed roller and the low-speed feed roller as above, it is more likely that the running of the yarns Y relaxed downstream of the high-speed feed roller in the yarn running direction becomes unstable due to the effect of the static electricity building up in the high-speed feed roller on the upstream side in the yarn running direction. The running of the relaxed yarns Y is able to be stabilized by providing the antistatic unit 50 with respect to the high-speed feed roller.

[0060] Furthermore, in the present embodiment, the twisting units 15 configured to twist the yarns Y are provided upstream of the high-speed feed roller (the third feed roller 18) in the yarn running direction, and the second heaters 19 configured to heat the yarns Y are provided between the high-speed feed roller and the low-speed feed roller (the fourth feed roller 20) in the yarn running direction. In this arrangement, because the yarns Y heated by the second heaters 19 are in the relaxed state, yarn swing of the yarns Y is more likely to occur downstream of the high-speed feed roller in the yarn running direction. Thus, it is particularly effective to provide the antistatic unit 50 with respect to the high-speed feed roller.

[0061] Moreover, in the present embodiment, the antistatic unit 50 is provided so as not to be in contact with the rotating body (the third feed roller 18, particularly the rotation shaft 43). If the antistatic unit 50 is in contact with the rotating body, the antistatic unit 50 and the rotating body may wear out. This causes a possibility that the static electricity cannot be properly removed and/or the frequency of part replacement increases. In addition, the contact of the antistatic unit 50 with the rotating body may increase, rather than decrease, the amount of static electricity generated between the antistatic unit 50 and the rotating body. In this regard, however, the antistatic unit 50 is not in contact with the rotating body in the embodiment. In this case, the wear out of the antistatic unit 50 and the rotating body is preventable, and problems such as above are avoidable.

[0062] Furthermore, in the present embodiment, the rotating body (the third feed roller 18) includes: the rotation shaft 43; and the rollers 41 attached to the rotation shaft 43 and having the outer circumferential surfaces with which the yarns Y are in contact. In addition, the antistatic unit 50 is provided with respect to the rotation shaft 43. Because the antistatic unit 50 is provided with respect to the rotation shaft 43 as described above, the antistatic unit 50 has a smaller size in the radial direction than in the case in which the antistatic unit 50 is provided with respect to the rollers 41. Thus, this arrangement enables the antistatic unit 50 to have a compact structure.

[0063] Furthermore, in the present embodiment, the antistatic unit 50 includes: the grounded supporting member 51; and the antistatic member 52 attached to the supporting member 51 so as to be along the outer circumferential surface of the rotation shaft 43. As the antistatic member 52 is provided so as to be along the outer circumferential surface of the rotation shaft 43, a large area is reserved for the static electricity discharged from the rotation shaft 43 to the antistatic member 52. This further ensures the removal of the static electricity.

[0064] Furthermore, in the present embodiment, the antistatic member 52 is provided along the axial direction of the rotation shaft 43. This arrangement reduces non-uniformity of the antistatic ability in the axial direction. As a result, the static electricity is preferably removed.

[0065] Furthermore, in the present embodiment, the static electricity is discharged to the plurality of positions at which the conductive fibers are exposed on the surface of the antistatic member 52. This arrangement improves the antistatic ability of the antistatic member 52.

[0066] Furthermore, in the present embodiment, the cover member 60 covering the antistatic member 52 is provided to prevent exposure of the antistatic member 52. Dust or the like attached to the antistatic member 52 may make it difficult for the static electricity to be discharged to the antistatic member 52, and thereby reduce the antistatic ability. In this regard, however, the cover member 60 provided as described above prevents dust or the like from being attached to the antistatic member 52, and therefore the reduction of the antistatic ability is avoidable.

[0067] When yarns Y made of nylon are processed, it is particularly more likely that static electricity is generated by the friction between the yarns Y and the static-buildup part. For this reason, when the nylon yarns Y are processed in the draw texturing machine 1 of the present embodiment, the advantageous effects brought about by providing the antistatic unit 50 are further noticeable.

(Other Embodiments)

[0068] An embodiment of the present invention has been described above. The present invention is not limited to the embodiment above and is applicable to other embodiments, for example, as described below. Various modifications and variations are possible within the scope of the spirit of the invention.

[0069] For example, in the above-described embodiment, the present invention is applied to the draw texturing machine 1. In this regard, however, the present invention is applicable to textile machines configured to produce or process synthetic fiber yarns, such as a draw texturing machine having a structure other than that of the above-described embodiment and a spun yarn take-up apparatus.

[0070] Further, as mentioned in the above-described embodiment, the part with respect to which the antistatic unit 50 is provided is not limited to the third feed roller 18. For example, the running of the yarns Y tends to be unstable in the interlacing devices 17 due to the effect of static electricity building up in the second feed roller 16 provided upstream of the interlacing devices 17 in the yarn running direction, because the yarns Y are relaxed to appropriately impart entanglement to the yarns Y For this reason, it is also effective to provide the antistatic unit 50 with respect to the second feed roller 16. In this case, the second feed roller 16 is equivalent to the "high-speed feed roller" in the present invention, and the third feed roller 18 is equivalent to the "low-speed feed roller" in the present invention. The basic structure of the second feed roller 16 is similar to that of the third feed roller 18.

[0071] If static electricity is generated at the friction disc type twisting units 15, the running of the yarns Y becomes unstable at the twisting units 15. This causes a possibility that the yarns Y deviate from the intended yarn path and the yarns Y cannot be properly twisted. For this reason, it is also effective to provide the antistatic unit 50 with respect to the twisting units 15.

[0072] The antistatic unit 50 may be provided with respect to any static-buildup part other than the above, such as the first feed roller 11, the fourth feed roller 20, and the twist-stopping guides 12.

[0073] Furthermore, the specific structure of the antistatic unit 50 is not limited to that described in the above-described embodiment. For example, while in the above-described embodiment the antistatic unit 50 is provided with respect to the rotation shaft 43 of the drive rollers 41, the antistatic unit 50 may be provided with respect to the drive rollers 41. Further, the antistatic unit 50 may be configured to be in contact with the static-buildup part. Alternatively, the antistatic unit 50 may include an antistatic metal needle or the like provided in the vicinity of the static-buildup part, so that static electricity is discharged from the static-buildup part to the antistatic needle. Still alternatively, the antistatic member 52 may be yarns incorporating therein conductive fibers and tied in a bundle. Because the antistatic member 52 is the bundle of the yarns, the antistatic member 52 is easily attached to the supporting member 51. To be more specific, it is possible: to tie the bundle of the yarns bent in an annular shape to the supporting member 51; to adhere the bundle of the yarns to the supporting member 51 using a conductive adhesive; or to fix the bundle of the yarns to the supporting member 51 using suitable wire or the like. Thus, the antistatic member 52 is easily attached to the supporting member 51.

[0074] While in the above-described embodiment each twisting unit 15 is a friction disc type twisting unit, a belt type nip twister as disclosed in Japanese Unexamined Patent Publication No. 2010-65354 may be used, for example.

[0075] The following items define other embodiments of the invention:

Item 1. A textile machine configured to produce or process a synthetic fiber yarn, the textile machine comprising an antistatic unit configured to remove static electricity from a static-buildup part at which the static electricity is generated due to the yarn running while being in contact with the static-buildup part.

Item 2. The textile machine according to item 1, wherein the static-buildup part is a rotating body configured to rotate while being in contact with the yarn, and the antistatic unit is provided with respect to the rotating body.

Item 3. The textile machine according to item 2, further comprising: a high-speed feed roller configured to feed the yarn; and a low-speed feed roller provided downstream of the high-speed feed roller in a yarn running direction and configured to feed the yarn at a conveyance speed lower than that of the high-speed feed roller so that the yarn is relaxed between the high-speed feed roller and the low-speed feed roller, the high-speed and low-speed feed rollers functioning as the rotating body, wherein the antistatic unit is provided with respect to at least the high-speed feed roller.

Item 4. The textile machine according to item 3, wherein a twisting unit configured to twist the yarn is provided upstream of the high-speed feed roller in the yarn running direction, and a heater configured to heat the yarn is provided between the high-speed feed roller and the low-speed feed roller in the yarn running direction.

Item 5. The textile machine according to item 3, wherein an interlacing device configured to impart entanglement to the yarn is provided between the high-speed feed roller and the low-speed feed roller in the yarn running direction.

Item 6. The textile machine according to any one of items 2 to 5, wherein the antistatic unit is provided so as not to be in contact with the rotating body.

Item 7. The textile machine according to any one of items 2 to 6, wherein the rotating body includes a rotation shaft, and a roller attached to the rotation shaft and having an outer circumferential surface with which the yarn is in contact, and wherein the antistatic unit is provided with respect to the rotation shaft.

Item 8. The textile machine according to item 7, wherein the antistatic unit includes: a grounded supporting member; and an antistatic member attached to the supporting member so as to be along the outer circumferential surface of the rotation shaft.

Item 9. The textile machine according to item 8, wherein the antistatic member is provided along an axial direction of the rotation shaft.

Item 10. The textile machine according to item 8 or 9, wherein the antistatic member includes conductive fibers exposed on a surface of the antistatic member at a plurality of positions.

Item 11. The textile machine according to any one of items 8 to 10, wherein a cover member covering the antistatic member is provided to prevent exposure of the antistatic member.

Item 12. The textile machine according to any one of items 1 to 11, wherein the textile machine is configured to process the yarn and the yarn is made of nylon.

Claims

1. A textile machine (1) configured to produce or process a synthetic fiber yarn, the textile machine (1) comprising:

a static-buildup part (18, 43);
an antistatic unit (50) configured to remove static electricity from the static-buildup part (18, 43) at which the static electricity is generated due to the yarn (Y) running while being in contact with the static-buildup part (18, 43);
wherein the static-buildup part (18, 43) is a rotating body configured to rotate while being in contact with the yarn (Y), and the antistatic unit (50) is provided with respect to the rotating body;
the textile machine (1) further comprising:

a high-speed feed roller (18) configured to feed the yarn (Y); and
a low-speed feed roller (20) provided downstream of the high-speed feed roller (18) in a yarn running direction and configured to feed the yarn (Y) at a conveyance speed lower than that of the high-speed feed roller (18) so that the yarn (Y) is relaxed between the high-speed feed roller (18) and the low-speed feed roller (20),
the high-speed (18) and low-speed feed rollers (20) functioning as the rotating body,
wherein the antistatic unit (50) is provided with respect to at least the high-speed feed roller (18) in a manner to prevent buildup of static electricity in the high-speed feed roller (18).

2. The textile machine (1) according to claim 1, wherein a twisting unit (15) configured to twist the yarn (Y) is provided upstream of the high-speed feed roller (18) in the yarn running direction, and a heater (19) configured to heat the yarn (Y) is provided between the high-speed feed roller (18) and the low-speed feed roller (20) in the yarn running direction.

3. The textile machine (1) according to claim 1, wherein an interlacing device configured to impart entanglement to the yarn (Y) is provided between the high-speed feed roller (18) and the low-speed feed roller (20) in the yarn running direction.

4. The textile machine (1) according to any one of claims 1 to 3, wherein the antistatic unit (50) is provided so as not to be in contact with the rotating body.

5. The textile machine (1) according to any one of claims 1 to 4, wherein
the rotating body includes

a rotation shaft (43), and
a roller (41) attached to the rotation shaft 843) and having an outer circumferential surface with which the yarn (Y) is in contact, and wherein
the antistatic unit (50) is provided with respect to the rotation shaft (43).

6. The textile machine (1) according to claim 5, wherein the antistatic unit (50) includes:

a grounded supporting member (51); and
an antistatic member (52) attached to the supporting member (51) so as to be along the outer circumferential surface of the rotation shaft (43).

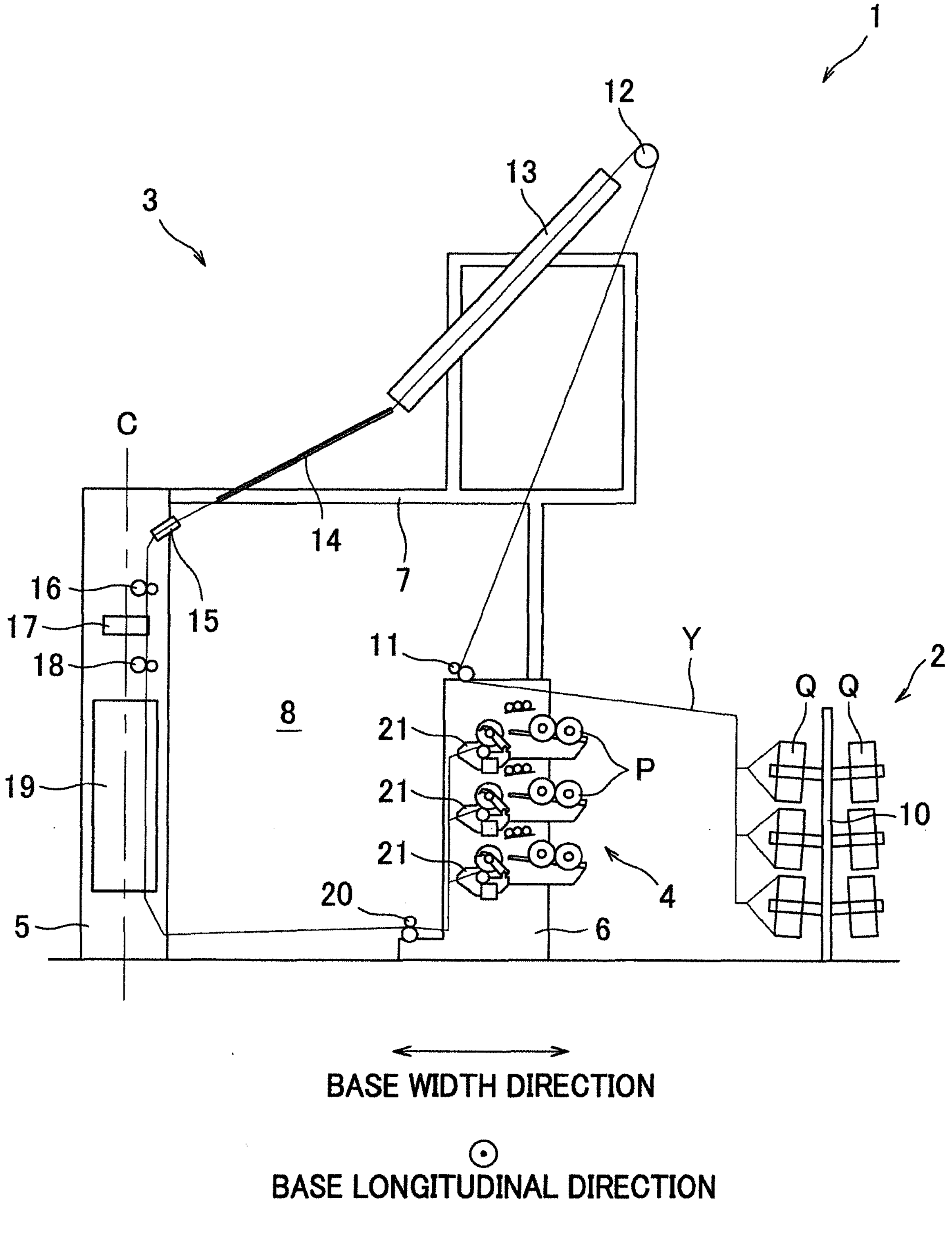
7. The textile machine (1) according to claim 6, wherein the antistatic member (52) is provided along an axial direction of the rotation shaft (43).

8. The textile machine (1) according to claim 6 or 7, wherein the antistatic member (52) includes conductive fibers exposed on a surface of the antistatic member (53) at a plurality of positions.

9. The textile machine (1) according to any one of claims 6 to 8, wherein a cover member (60) covering the antistatic member (52) is provided to prevent exposure of the antistatic member (52).

10. The textile machine (1) according to any one of claims 1 to 9, wherein the textile machine (1) is configured to process the yarn (Y) and the yarn (Y) is made of nylon.

FIG.1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BASE WIDTH DIRECTION
BASE LONGITUDINAL DIRECTION

FIG.2

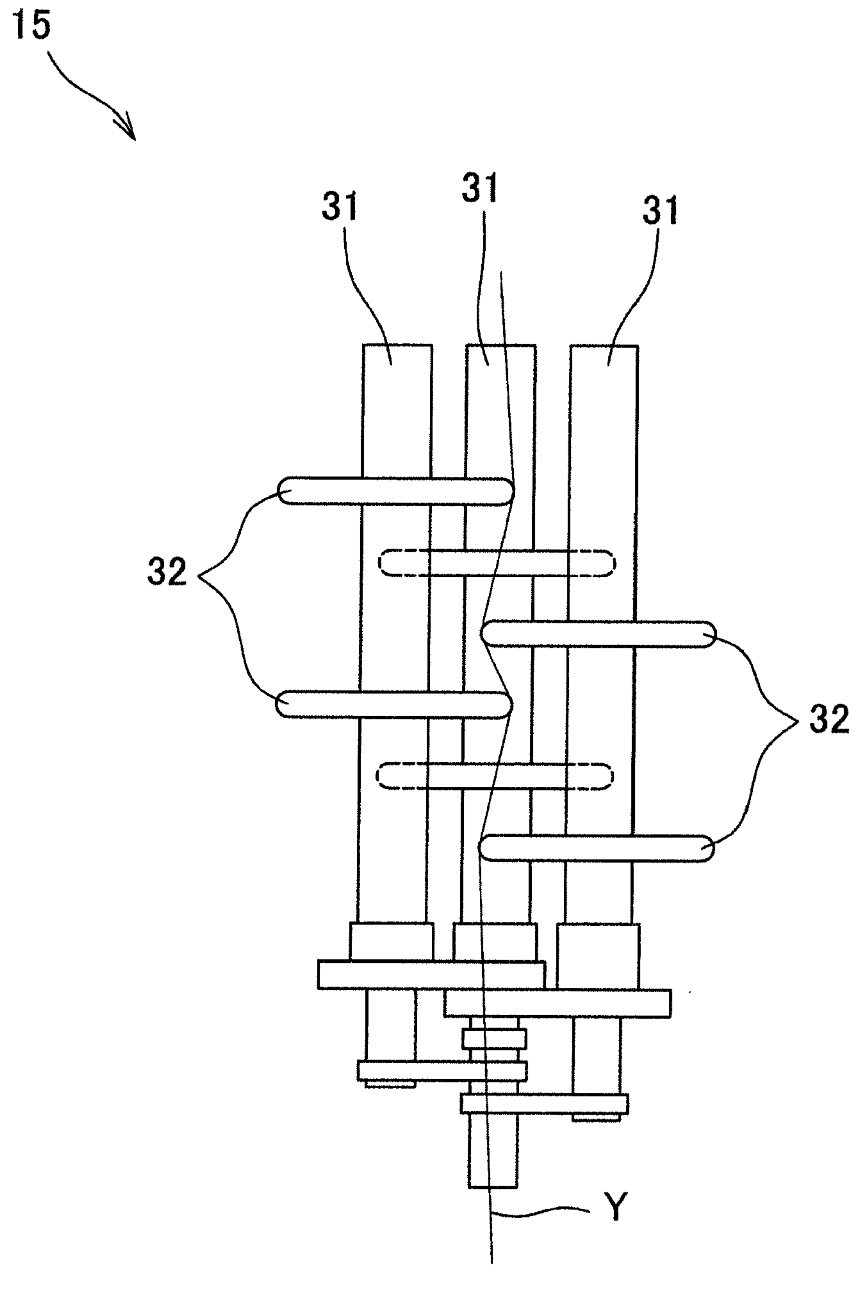


FIG.3

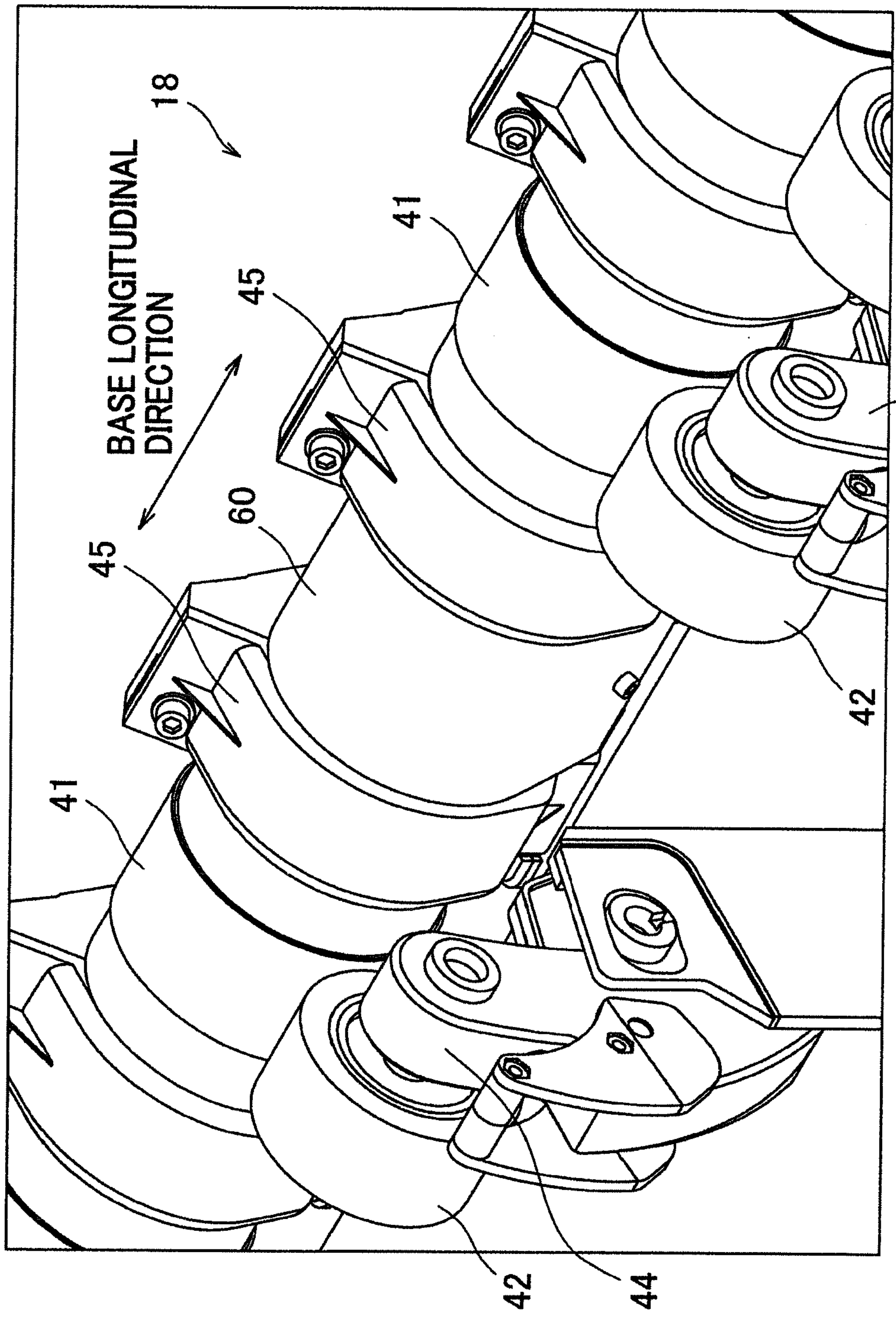


FIG.4

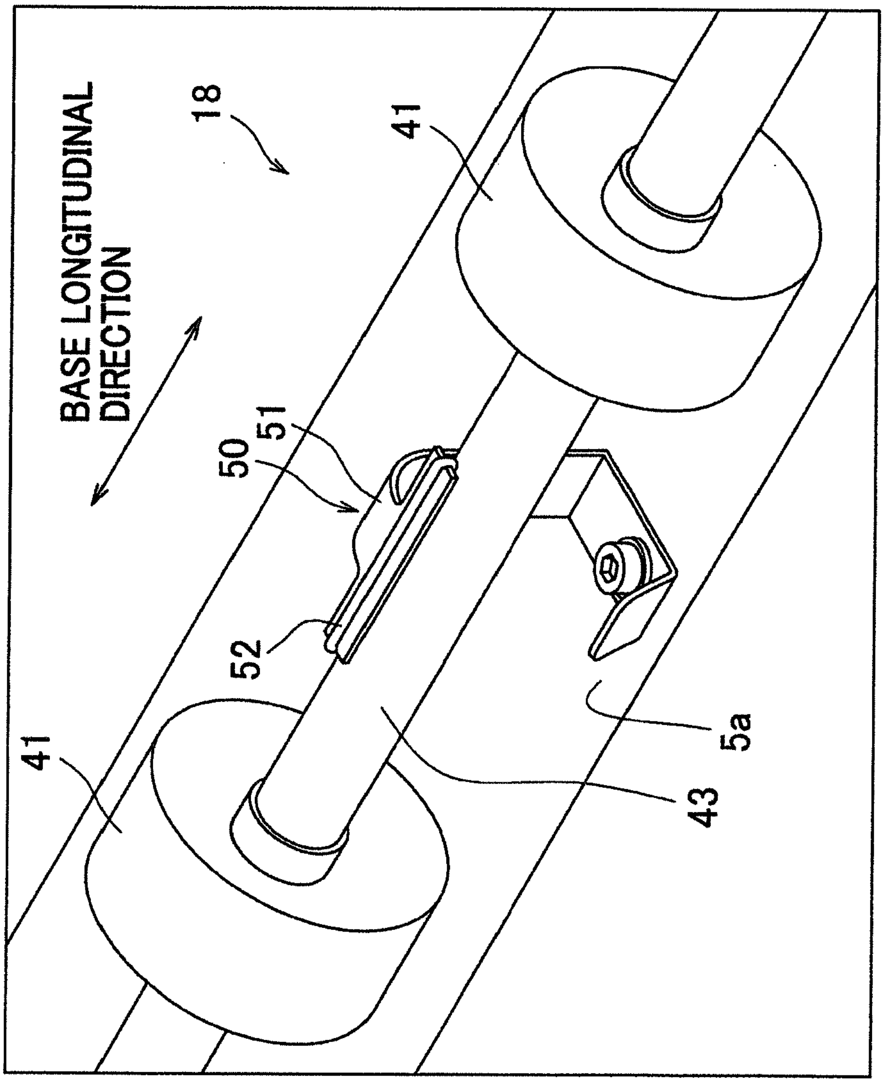
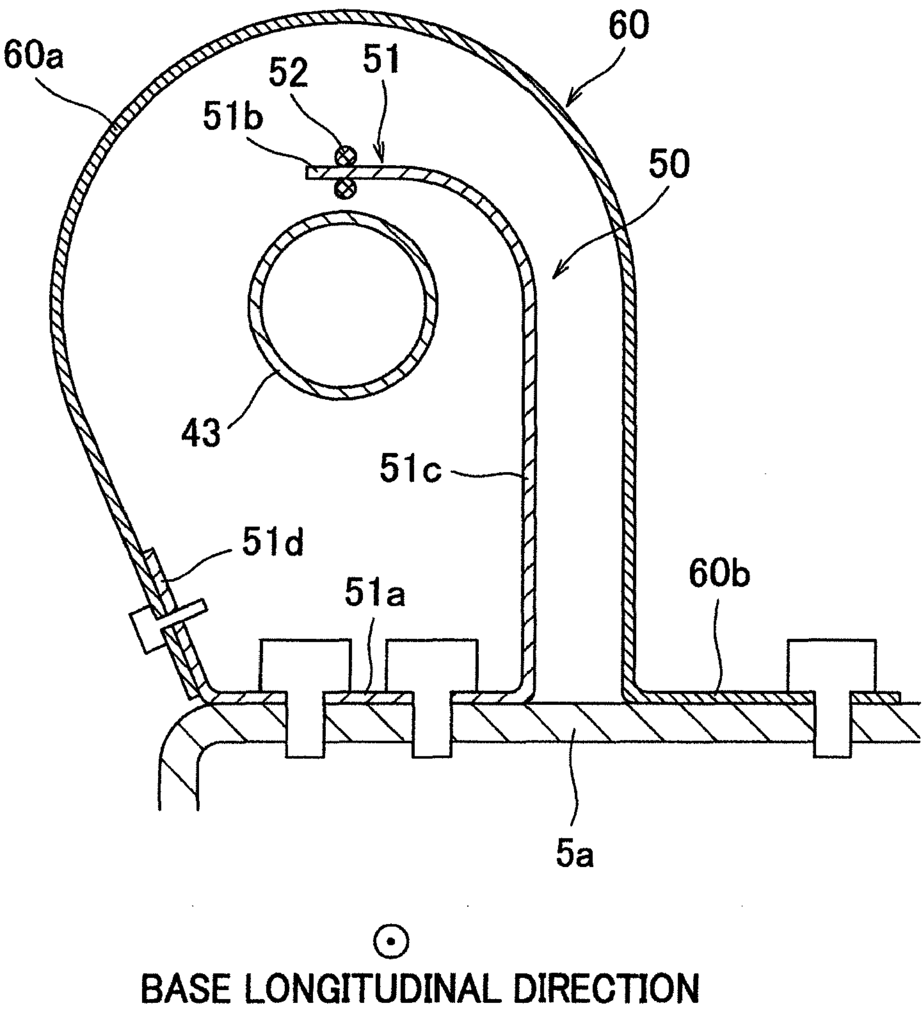


FIG.5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BASE LONGITUDINAL DIRECTION

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EUROPEAN SEARCH REPORT

Application Number
EP 21 20 6657

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Place of search	Date of completion of the search	Examiner
Munich	16 February 2022	Humbert, Thomas

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