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(54) **Suction gun for use in threading a take-up winding apparatus**

(57) [Object] Object of the invention is providing yarn threading method of take-up winding apparatus, the take-up winding apparatus, and suction gun which make decrease entanglement between yarns and vibration and make good for take-up yarns.

[Solution means Purpose] A method for threading to a take-up winding apparatus using a suction gun includes regulating yarn paths for a plurality of yarns using a first roller 21 or a first yarn path guide 22 of the take-up winding apparatus. Between the suction gun 61 and a second

roller or a second yarn path guide 23 of the take-up winding apparatus, a third roller 24 is brought into contact with the yarns Y. The second roller and the second yarn path guide 23 are on a downstream side relative to the first roller 21 and the first yarn path guide 22.

With the third roller 24 in contact with the yarns Y, the yarns Y are fed onto the second roller or the second yarn path guide 23. After the yarns are fed onto the second roller or the second yarn path guide 23, the third roller 24 is brought out of contact with the yarns Y.

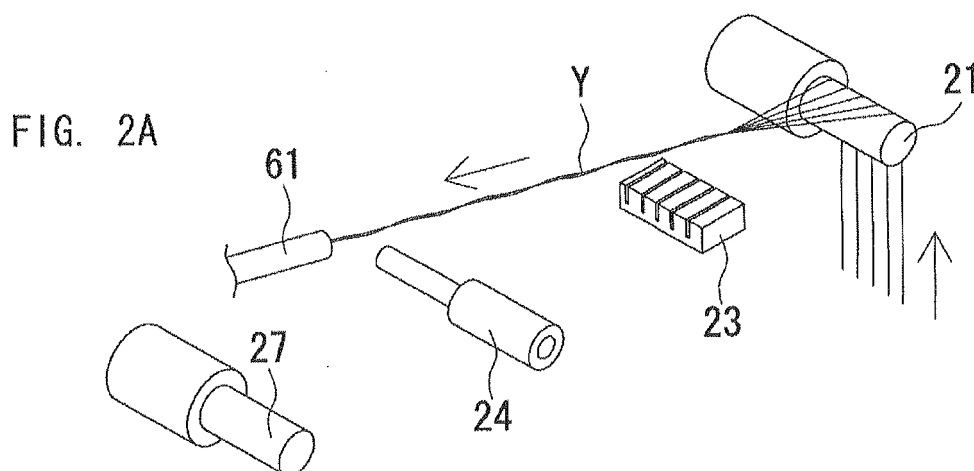
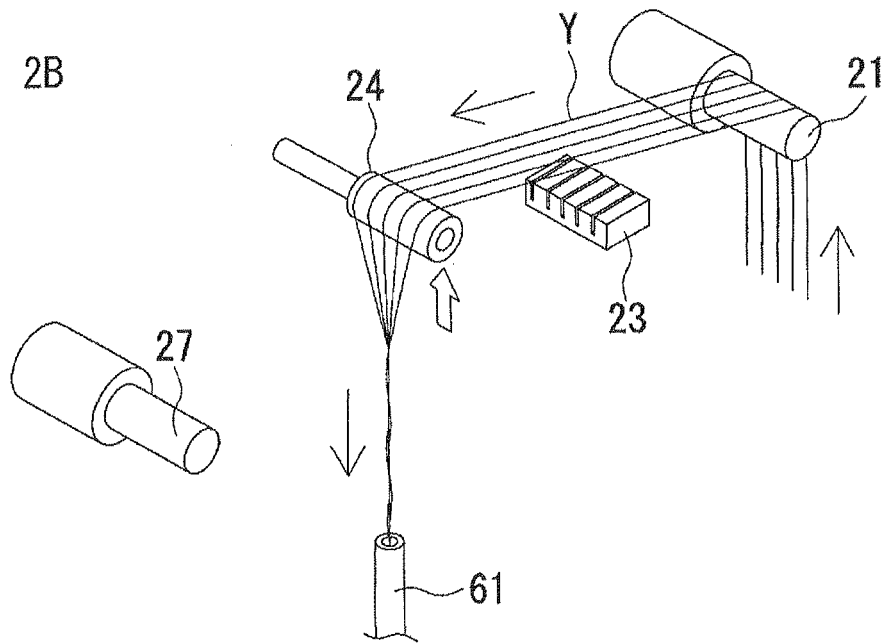


FIG. 2B



Description

[The summary of the invention]

[Field of the Invention]**[Object of the Invention]**

[0001] The present invention relates to a method for threading to a take-up winding apparatus, a take-up winding apparatus, and a suction gun.

[Description of the Related Art]

[0002] Spun yarn winding apparatuses spin a plurality of yarns and wind the spun yarns around packages. The spun yarn winding apparatuses each include a multiplicity of rollers and yarn path guides to regulate yarn paths. A spinning machine supplies a plurality of yarns that are then fed onto the rollers and the yarn path guides from the upstream side toward the downstream side in the travel direction of the yarns. This threading operation needs to be carried out one after another before a winder starts winding the plurality of yarns. In the threading operation in particular for each of the yarn path guides, it is necessary to separate the plurality of yarns one by one (separating operation) and to guide each of the yarns to an individual, corresponding guide of the yarn path guide.

[0003] In the threading operation to the rollers and the yarn path guides, a suction gun is used to collectively handle the plurality of yarns. An operator uses the suction gun to collectively suck the plurality of yarns and then threaded the plurality of yarns onto the rollers and the yarn path guides with appropriate positioning and orientation of the suction gun. This threading operation is carried out one after another (see, for example, Japanese Unexamined Patent Application Publication No. 2008-239294 and Japanese Unexamined Patent Application Publication No. 2008-297078).

[0004] Incidentally, in recent years, the number of yarns spun by a single take-up winding apparatus has been increased (multi-ends) in conjunction with an increase in spinning speed and winding speed. In the course of the threading operation prior to the start of yarn winding* it is required to draw in a multiplicity of yarns to be spun at high speed using the suction gun while maintaining predetermined tension on the multiplicity of yarns. In an attempt to improve the yarn suction forces of the suction gun and thereby to cope with the multi-ends of the take-up winding apparatus and the speed-up of the spinning and winding speeds, the suction gun generates therein a high-speed air flow and draws in the multiplicity of yarns by the air flow.

[0005] The contents of Japanese Unexamined Patent Application Publication No 2008-239294 and Japanese Unexamined Patent Application Publication No 2008-297078 are herein incorporated by reference in their entirety, in particular with regard to those features which are described above with reference to the mentioned documents.

[0006] Unfortunately, although the air flow generated inside the suction gun improves the yarn suction forces, the air flow causes twisting and/or vibration to the plurality of yarns drawn into the suction gun. The twisting and/or vibration propagate to yarns on the upstream side relative to the suction gun and to the vicinity of an immediately preceding roller or yarn path guides on the upstream side relative to the suction gun. This causes the plurality of yarns to vibrate while being entangled with each other.

[0007] More specifically, when the yarns are fed onto the rollers or yarn path guides, the rollers or yarn path guides regulate the yarn paths of the yarns. The twisting and/or vibration caused by the suction gun do not propagate further upstream than the rollers or yarn path guides. However, there is no means to regulate the yarn paths between the suction gun and the immediately preceding roller or yarn path guides on the upstream side relative to the suction gun. Hence, the twisting and/or vibration propagate to the vicinity of the immediately preceding rollers or yarn path guides on the upstream side relative to the suction gun. As a result, the plurality of yarns vibrate while being entangled with each other. This will be described in more detail with reference to accompanying drawings.

[0008] FIG 15 is a front view of a conventional take-up winding apparatus 111. A spinning machine 112 spins a plurality of yarns Y, and a winder 113 winds the plurality of spun yarns Y around packages P. The take-up winding apparatus 111 includes a multiplicity of rollers and yarn path guides to regulate yarn paths. A chain double-dashed line of FIG. 15 shows a yarn path. The take-up winding apparatus 111 includes, from an upstream side to a downstream side in the travel direction of the plurality of yarns Y, a first yarn path guide 122, an interlace 128, a transfer forwarding roller 129, and immediately-preceding forwarding rollers 130 and 131. The interlace 128 also acts as a yarn path guide, so that it is required to guide each of the plurality of yarns Y to an individual, corresponding guide constituting the interlace 128. With respect to the conventional take-up winding apparatus 111, the threading operation to the interlace 128 will be exemplified.

[0009] FIG. 16A is an enlarged front view of the conventional take-up winding apparatus 111, illustrating the threading operation to the interlace 128. FIG. 16B is an enlarged perspective view of the conventional take-up winding apparatus 111, illustrating the vicinity of the interlace 128 in the state shown in FIG. 16A. As shown in FIGs. 16A and 16B, it is assumed that an operator (not shown) carries out the threading operation to draw in the plurality of yarns Y with a suction gun 161, and that the plurality of yarns Y are already fed onto the first yarn path guide 122, which is an immediately preceding yarn path guide for the interlace 128. Since the first yarn path guide

122 on which the plurality of yarns Y are fed regulates yarn paths, twisting and/or vibration caused by the suction gun 161 do not propagate to further upstream than the first yarn path guide 122. However, there is no means to regulate the yarn paths between the suction gun 161 and the first yarn path guide 122 that is an immediately preceding yarn path guide on the upstream side relative to the suction gun 161. Hence, the twisting and/or vibration propagate to the vicinity of the first yarn path guide 122. As a result, the plurality of yarns Y vibrate while being entangled with each other, as shown in FIG. 16B.

[0010] If the plurality of yarns Y vibrate while being entangled with each other in the vicinity of the first yarn path guide 122 on the upstream side relative to the suction gun 161, the following problem occurs with the threading operation to the interlace 128. In the threading operation to the interlace 128, after the separating operation of separating the plurality of yarns Y one by one, another operation needs to be carried out to guide each of the plurality of yarns Y to an individual, corresponding guide constituting the interlace 128, as described above. Unfortunately, the interlace 128 to which the operator is about to carry out the threading operation is positioned between the suction gun 161 and the first yarn path guide 122 on the upstream side relative to the suction gun 161. That is, in the vicinity of the interlace 128 targeted for the threading operation, the plurality of yarns Y are, vibrating while being entangled with each other.

[0011] When a single operator carries out the threading operation, the operator has to hold the suction gun 161, carry out the separating operation of separating the plurality of vibrating and entangled yarns Y one by one, and carry out the operation of guiding each of the plurality of yarns Y to an individual, corresponding guide constituting the interlace 128. Actually, it is extremely difficult for a single operator to carry out the threading operation. Hence, the threading operation necessarily involves two or more operators. Moreover, the threading operation is significantly time consuming.

[0012] While the above description is regarding the threading operation to the interlace, similar problems occur with the threading operation for rollers and yarn path guides provided in take-up winding facilities.

[0013] The present invention has been made in view of the above-described problems. It is an object of the present invention to provide a method for threading to a take-up winding apparatus, a take-up winding apparatus, and a suction gun that are capable of preventing a plurality of yarns from vibrating and becoming entangled with each other due to twisting and/or vibration caused by the suction gun, and capable of facilitating the threading operation. It is another object to the present invention to provide a method for threading to a take-up winding apparatus, a take-up winding apparatus, and a suction gun that are capable of allowing a single operator to carry out the threading operation and capable of shortening the time required for the threading operation.

[means of solving the problems]

[0014] The problems to be solved by the present invention have been described hereinabove, and subsequently, means of solving the problems are described.

[0015] According to one aspect of the present invention, a method for threading to a take-up winding apparatus using a suction gun includes regulating yarn paths for a plurality of yarns using at least one of a first roller and a first yarn path guide of the take-up winding apparatus. Between the suction gun and at least one of a second roller and a second yarn path guide of the take-up winding apparatus, a third roller is brought into contact with the plurality of yarns. The second roller and the second yarn path guide are on a downstream side relative to the first roller and the first yarn path guide. With the third roller in contact with the plurality of yarns, the plurality of yarns are fed onto the at least one of the second roller and the second yarn path guide. After the plurality of yarns are fed onto the at least one of the second roller and the second yarn path guide, the third roller is brought out of contact with the plurality of yarns.

[0016] In the foregoing aspect of the present invention, the third roller may be disposed in the take-up winding apparatus.

[0017] In the foregoing aspect of the present invention, the third roller may be disposed in the suction gun.

[0018] According to another aspect of the present invention, a take-up winding apparatus includes at least one of a first roller and a first yarn path guide, at least one of a second roller and a second yarn path guide, and a third roller. The at least one of the first roller and the first yarn path guide is configured to regulate yarn paths for a plurality of yarns. The at least one of the second roller and the second yarn path guide are on a downstream side relative to the first roller and the first yarn path guide. The third roller is configured to come into contact with the plurality of yarns between a suction gun and the at least one of the second roller and the second yarn path guide when the plurality of yarns are fed onto the at least one of the second roller and the second yarn path guide using the suction gun. The third roller is configured to move out of contact with the plurality of yarns after the plurality of yarns are fed onto the at least one of the second roller and the second yarn path guide with the third roller in contact with the plurality of yarns.

[0019] According to the other aspect of the present invention, a suction gun is for use in threading to a take-up winding apparatus. The take-up winding apparatus includes at least one of a first roller and a first yarn path guide and at least one of a second roller and a second yarn path guide. The at least one of the first roller and the first yarn path guide are configured to regulate yarn paths for a plurality of yarns. The at least one of the second roller and the second yarn path guide are on a downstream side relative to the first roller and the first yarn path guide. The suction gun includes a third roller. The third roller is configured to come into contact with the

plurality of yarns between an inlet of the suction gun and the at least one of the second roller and the second yarn path guide when the plurality of yarns are fed onto the at least one of the second roller and the second yarn path guide. The third roller is configured to move out of contact with the plurality of yarns after the plurality of yarns are fed onto the at least one of the second roller and the second yarn path guide with the third roller in contact with the plurality of yarns.

[The effect of invention]

[0020] The embodiments of the present invention provide the following advantageous effects.

[0021] With the one aspect of the present invention, during the threading operation, the third roller is temporally brought into contact with the plurality of yarns between the suction gun and the second roller or the second yarn path guide, which is targeted for the threading operation. Although this involves propagation of twisting and/or vibration caused by the suction gun to the vicinity of the third roller, the twisting and/or vibration do not propagate further upstream than the third roller. This ensures that the plurality of yarns in the vicinity of the second roller or the second yarn path guide targeted for the threading operation do not vibrate or become entangled with each other. This facilitates the separating operation while the plurality of yarns are in contact with the third roller, and thus facilitates the threading operation of feeding the plurality of yarns onto the second roller or the second yarn path guide. After feeding the plurality of yarns onto the second roller or the second yarn path guide, the third roller is brought out of contact with the plurality of yarns. This ensures that the third roller does not become an obstacle to the original yarn paths. Thus, the third roller is temporally brought into contact with the plurality of yarns during the threading operation to facilitate the threading operation. This enables a single operator to carry out the threading operation and shortens the time required for the threading operation.

[0022] With the one aspect of the present invention, since the third roller is provided in the take-up winding apparatus, the third roller is disposed at an optimum position for workability, thereby facilitating the threading operation.

[0023] With the one aspect of the present invention, since the third roller is provided in the suction gun, it is unnecessary to individually provide the third roller in the take-up winding apparatus. Manipulating the suction gun temporally brings the third roller into contact with the plurality of yarns during the threading operation. This facilitates the threading operation.

[0024] With the another aspect of the present invention, during the threading operation, the third roller provided in the take-up winding apparatus is temporally brought into contact with the plurality of yarns between the suction gun and the second roller or the second yarn path guide targeted for the threading operation. Although

this involves propagation of twisting and/or vibration caused by the suction gun to a vicinity of the third roller, the twisting and/or vibration do not propagate further upstream than the third roller. This ensures that the plurality of yarns in the vicinity of the second roller or the second yarn path guide targeted for the threading operation do not vibrate or become entangled with each other. This facilitates the separating operation with the plurality of yarns in contact with the third roller, and thus facilitates the threading operation of feeding the plurality of yarns onto the second roller or the second yarn path guide. After feeding the plurality of yarns onto the second roller or the second yarn path guide, the third roller is brought out of contact with the plurality of yarns. This ensures that the third roller does not become an obstacle to the original yarn paths. Thus, the third roller is temporally brought into contact with the plurality of yarns during the threading operation to facilitate the threading operation. This enables a single operator to carry out the threading operation and shortens the time required for the threading operation.

[0025] With the other aspect of the present invention, between the suction gun and the second roller or the second yarn path guide targeted for the threading operation, the third roller provided in the suction gun apparatus is temporally brought into contact with the plurality of yarns during the threading operation. Although this involves propagation of twisting and/or vibration caused by the suction gun to a vicinity of the third roller, the twisting and/or vibration do not propagate further upstream than the third roller. This ensures that the plurality of yarns in the vicinity of the second roller or the second yarn path guide targeted for the threading operation do not vibrate or become entangled with each other. This facilitates the separating operation with the plurality of yarns in contact with the third roller, and thus facilitates the threading operation of feeding the plurality of yarns onto the second roller or the second yarn path guide. After feeding the plurality of yarns onto the second roller or the second yarn path guide, the third roller is brought out of contact with the plurality of yarns. This ensures that the third roller does not become an obstacle to the original yarn paths. Thus, the third roller is temporally brought into contact with the plurality of yarns during the threading operation to facilitate the threading operation. This enables a single operator to carry out the threading operation and shortens the time required for the threading operation.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] A more complete appreciation of the invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

FIG. 1A is a diagram schematically illustrating a first roller 21 and a third roller 24 on which a plurality of yarns Y are fed;

FIG. 1B is a plan view of Fig. 1A;

FIG. 2A is a diagram schematically illustrating a method for threading to a take-up winding apparatus 11 according to embodiment 1 at the previous stage of the threading operation;

FIG. 2B is a diagram illustrating a first process of the threading operation according to embodiment 1;

FIG. 3A is a diagram illustrating a second process of the threading operation according to embodiment 1;

FIG. 3B is a diagram illustrating a third process of the threading operation according to embodiment 1;

FIG. 4 is a front view of a take-up winding apparatus 11 according to embodiment 2;

FIG. 5A is an enlarged front view illustrating a threading operation according to embodiment 2 at the previous stage of the threading operation to the interlace 28 of the take-up winding apparatus 11;

FIG. 5B is an enlarged perspective view of the vicinity of the interlace 28 at the state of FIG. 5A;

FIGs. 6A is an enlarged front view illustrating the threading operation according to embodiment 2 at the first process of the threading operation;

FIG. 6B is an enlarged perspective view of the vicinity of the interlace 28 at the state of FIG. 6A;

FIGs. 7A is an enlarged front view illustrating the threading operation according to embodiment 2 at the second process of the threading operation to the interlace 28 of the take-up winding apparatus 11;

FIG. 7B is an enlarged perspective view of the vicinity of the interlace 28 at the state of FIG. 7A;

FIGs. 8A is an enlarged front view illustrating the threading operation according to embodiment 2 at the third process of the threading operation to the interlace 28 of the take-up winding apparatus 11;

FIG. 8B is an enlarged perspective view of the vicinity of the interlace 28 at the state of FIG. 8A;

FIG. 9A is a side view of a suction gun 61 according to embodiment 3, illustrating a vicinity of a tip portion of the suction gun 61;

FIG. 9B is a side view of a suction gun 61 according to embodiment 3, illustrating a vicinity of a tip portion of the suction gun 61;

FIG. 10A is a cross-sectional view of an embodiment of a third roller 24;

FIG. 10B is a cross-sectional view of another embodiment of a third roller 24;

FIG. 11 is a diagram illustrating a threading operation using the suction gun 61 according to embodiment 3;

FIG. 12 is a diagram illustrating the first process of the threading operation according to embodiment 3;

FIG. 13 is a diagram illustrating the second process of the threading operation according to embodiment 3;

FIG. 14 is a diagram illustrating the third process of

the threading operation;

FIG. 15 is a front view of a conventional take-up winding apparatus 111;

FIGs. 16A is an enlarged front view illustrating the threading operation to the interlace 128 of the conventional take-up winding apparatus 111; and

FIGs. 16B is an enlarged perspective view of the vicinity of the interlace 128 at the state of FIG. 16A.

DESCRIPTION OF THE EMBODIMENTS

[0027] The embodiments will now be described with reference to the accompanying drawings, wherein like reference numerals designate corresponding or identical elements throughout the various drawings.

[0028] First, description will be given with regard to how the embodiments of the present invention prevent propagation of twisting and/or vibration caused by a suction gun to rollers or yarn path guides targeted for the threading operation. Specifically, the following description is in terms of a certain behavior characteristic of a plurality of yarns Y that are fed on rollers with reference to schematic drawings. FIG. 1A is a side view of a first roller 21 and a third roller 24 on which the plurality of yarns Y are fed. FIG. 1B is a plan view of the first roller 21 and the third roller 24 on which the plurality of yarns Y are fed.

[0029] As shown in FIGs. 1A and 1B, the plurality of yarns Y are fed at predetermined intervals on the first roller 21 on the upstream side in the travel direction of the yarns Y. Each of the plurality of yarns Y on the first roller 21 comes into contact with the circumferential surface of the first roller 21 at a contact starting point 21a on the upstream side in the rotational direction of the first roller 21, and moves out of contact with the circumferential surface of the first roller 21 at a contact finishing point 21b on the downstream side in the rotational direction of the first roller 21. In this respect, from the contact starting point 21a to the contact finishing point 21b, each of the plurality of yarns Y comes into contact with the circumferential surface of the first roller 21 orthogonal to an axis 21c of the first roller 21. The orthogonal contact is presumably because of the frictional force between each of the plurality of yarns Y and the circumferential surface of the first roller 21; each of the plurality of yarns Y does not slip off in the axial direction of the first roller 21 while in contact with the circumferential surface of the first roller 21. Consequently, the plurality of yarns Y in contact with the first roller 21 at predetermined intervals move out of contact with the first roller 21 while maintaining the predetermined intervals.

[0030] It is assumed that the intervals between the plurality of yarns Y are varied (widened or narrowed) on the downstream side relative to the first roller 21. The influence of the varied intervals extends to the vicinity of the first roller 21, more precisely, to the vicinity of the contact finishing point 21b of the first roller 21. However, the influence does not propagate to the plurality of yarns Y between the contact starting point 21a and the contact

finishing line 21b, and further, to the plurality of yarns Y on the upstream side relative to the first roller 21. Since each of the plurality of yarns Y is in contact with the circumferential surface of the first roller 21 orthogonal to the axis 21c of the first roller 21, the frictional force between the each of the plurality of yarns Y and the circumferential surface of the first roller 21 prevents each of the plurality of yarns Y from slipping off in the axial direction of the first roller 21. Thus, the variation of the intervals between the plurality of yarns Y on the downstream side relative to the first roller 21 does not affect the upstream side relative to the contact finishing point 21 b of the first roller 21.

[0031] Subsequently, the plurality of yarns Y moving out of contact with the circumferential surface of the first roller 21 come into contact with the circumferential surface of a third roller 24 while maintaining the predetermined intervals. Each of the plurality of yarns Y on the third roller 24 come into contact with the circumferential surface of the third roller 24 at a contact starting point 24a on the upstream side in the rotational direction of the third roller 24, and moves out of contact with the circumferential surface of the third roller 24 at a contact finishing point 24b on the downstream side in the rotational direction of the third roller 24. Similarly to the case of the first roller 21, from the contact starting point 24a to the contact finishing point 24b, each of the plurality of yarns Y is in contact with the circumferential surface of the third roller 24 orthogonal to an axis 24c of the third roller 24. Consequently, the plurality of yarns Y in contact with the third roller 24 at predetermined intervals move out of contact with the third roller 24 while maintaining the predetermined intervals.

[0032] It is assumed that the intervals between the plurality of yarns Y are varied (widened or narrowed) on the downstream side relative to the third roller 24. The influence of the varied intervals extends to the vicinity of the third roller 24, more precisely, to the vicinity of the contact finishing point 24b of the third roller 24. However, for the same reason for the first roller 21 described above, the influence does not propagate to the plurality of yarns Y between the contact starting point 24a and the contact finishing line 24b, and further, to the plurality of yarns Y on the upstream side relative to the third roller 24. Thus, the variation of the intervals between the plurality of yarns Y on the downstream side relative to the third roller 24 does not affect the upstream side relative to the contact finishing point 24b of the third roller 24, and does not affect the intervals between the plurality of yarns Y interposed between the third roller 24 and the first roller 21.

[0033] Thus, when a plurality of yarns are fed onto a roller, the variation of the intervals between the plurality of yarns on the downstream side relative to the roller does not affect the downstream side relative to the roller. This is a behavior characteristic of yarns and applies to twisting and/or vibration. The influence of twisting and/or vibration does not extend to the downstream side relative to the roller. The present invention takes advantage of

this behavior characteristic of yarns. Specifically, during the threading operation to the roller or yarn path guide, another roller is temporally brought into contact with the plurality of yarns between the suction gun and the roller or the yarn path guide targeted for the threading operation. This involves propagation of twisting and/or vibration caused by the suction gun to the vicinity of the roller that temporally is in contact with the plurality of yarns. However, the propagation does not exceed the roller to the upstream side. This ensures that the plurality of yarns in the vicinity of the roller or yarn path guide targeted for the threading operation do not vibrate or become entangled with each other. This facilitates the threading operation.

Embodiment 1

[0034] Next, a method for threading to a take-up winding apparatus according to embodiment 1 of the present invention will be described with reference to FIGs. 2A, 2B, 3A, and 3B, which schematically show arrangements of rollers and yarn path guides of the take-up winding apparatus.

[0035] As shown in FIGs. 2A, 2B, 3A, and 3B, a first roller 21, a second yarn path guide 23, and a fourth roller 27 are disposed in order from the upstream side. A plurality of yarns Y are fed onto the first roller 21, the second yarn path guide 23, and the fourth roller 27 in order from the upstream side. In the threading operation shown in FIGs. 2A, 2B, 3A, and 3B, the plurality of yarns Y are already fed on the first roller 21, and the yarn paths are regulated by the first roller 21. The plurality of yarns Y are to be fed onto the second yarn path guide 23 on the downstream side relative to the first roller 21 using a suction gun 61.

[0036] FIG. 2A shows a preliminary process of the threading operation. In the threading operation to the second yarn path guide 23, after the separating operation of separating the plurality of yarns Y one by one, it is necessary to guide each of the yarns to an individual, corresponding guide constituting the second yarn path guide 23. However, the second yarn path guide 23 to which the operator is about to carry out the threading operation is located between the suction gun 61 and the first roller 21 on the upstream side relative to the suction gun 61, and the plurality of yarns Y on the upstream side relative to the suction gun 61 vibrate while being entangled with each other. In other words, in the vicinity of the second yarn path guide 23 targeted for the threading operation, the plurality of yarns Y are vibrating while being entangled with each other.

[0037] FIG. 2B shows a first process of the threading operation. The third roller 24 is moved upward as seen in the figure, and the suction gun 61 is manipulated to bring the third roller 24 into contact with the plurality of yarns Y between the suction gun 61 and the second yarn path guide 23 targeted for the threading operation. The third roller 24 is in contact with the plurality of yarns Y

temporally, that is, only during the threading operation. A freely rotatable roller is used for the third roller 24 that is driven to rotate by contact with the plurality of travelling yarns Y. When the third roller 24 is in contact with the plurality of yarns Y, the above-described behavior characteristic of the plurality of yarns Y ensures that twisting or vibration, if any, of the plurality of yarns Y on the downstream side relative to the third roller 24 does not affect the upstream side relative to the third roller 24. It should be noted that if the contact between the plurality of yarns Y and the third roller 24 is a point contact or a short-distance contact close to a point contact, the resulting frictional force is not sufficient between the circumferential surface of the third roller 24 and the plurality of yarns Y. In view of this, the contact distance between the third roller 24 and the plurality of yarns Y should be sufficient for the frictional force to work, while considering the coefficient of friction of the third roller 24 and the plurality of yarns Y. Preferably, the contact distance is equal to or more than one-fourths of the circumference of the third roller 24.

[0038] FIG. 3A shows a second process of the threading operation. In the second process, with the plurality of yarns Y in contact with the third roller 24, the third roller 24 is moved downward as seen in the figure to make the yarn paths of the plurality of yarns Y pass through the second yarn path guide 23. Specifically, each of the plurality of yarns Y is guided to an individual, corresponding guide constituting the second yarn path guide 23, thus feeding the plurality of yarns Y onto the second yarn path guide 23. While in this embodiment the plurality of yarns Y are guided to the second yarn path guide 23 by moving the third roller 24 downward as seen in the figure, other methods than the above method may be used to guide the plurality of yarns Y to the second yarn path guide 23. Further, the plurality of yarns Y and the individual guides may be positioned such that the intervals between the plurality of yarns Y on the first roller 21 are adjusted to the intervals between the individual guides of the second yarn path guide 23. This ensures that each of the plurality of yarns Y is guided to an individual, corresponding guide constituting the second yarn path guide 23 merely by moving the third roller 24 downward as seen in the figure. This in turn ensures an expeditious threading operation.

[0039] FIG. 3B shows a third process of the threading operation. In the third process, after feeding the plurality of yarns Y onto the second yarn path guide 23, the suction gun 61 is manipulated to feed the plurality of yarns Y onto the fourth roller 27, and then the third roller 24 is moved downward as seen in the figure to bring the third roller 24 out of contact with the plurality of yarns Y.

[0040] The method for threading to the take-up winding apparatus 11 according to embodiment 1 of the present invention provides the following advantageous effects.

[0041] During the threading operation, the third roller 24 is temporally brought into contact with the plurality of yarns Y between the suction gun 61 and the second yarn path guide 23 targeted for the threading operation. Al-

though this involves propagation of twisting and/or vibration caused by the suction gun 61 to the vicinity of the third roller 24, the twisting and/or vibration do not propagate further upstream than the third roller 24. This ensures that the plurality of yarns Y in the vicinity of the second yarn path guide 23 targeted for the threading operation do not vibrate or become entangled with each other. This facilitates the separating operation while the plurality of yarns Y are in contact with the third roller 24, and thus facilitates the threading operation of feeding the plurality of yarns Y onto the second yarn path guide 23. After feeding the plurality of yarns Y onto the second yarn path guide 23, the third roller 24 is brought out of contact with the plurality of yarns Y. This ensures that the third roller 24 does not become an obstacle to the original yarn paths. Thus, the third roller 24 is temporally brought into contact with the plurality of yarns Y during the threading operation to facilitate the threading operation. This enables a single operator to carry out the threading operation and shortens the time required for the threading operation.

Embodiment 2

[0042] Next, a take-up winding apparatus 11 according to embodiment 2 of the present invention will be described with reference to FIGs. 4 to 8B. In embodiment 2, a major difference from the other embodiments is that the third roller 24 is provided in the take-up winding apparatus 11.

[0043] FIG. 4 is a front view of the take-up winding apparatus 11 according to embodiment 2 of the present invention. The general arrangement of the take-up winding apparatus 11 according to embodiment 2 will be described with reference to FIG. 4. The take-up winding apparatus 11 mainly includes a spinning machine 12 and a winder 13. The take-up winding apparatus 11 extrudes thermal plastic resin (polymer) melted at high temperatures through fine nozzles, and cools and winds the resin into yarns Y. Generally, spun yarn winding apparatuses are classified into two types; namely, POY-dedicated spun yarn winding apparatuses to wind POY (Partially Oriented Yarn) and FDY-dedicated spun yarn winding apparatuses to wind FDY (Fully Drawn Yarn). The take-up winding apparatus 11 according to the embodiments of the present invention can be applied to both POY-dedicated and FDY-dedicated take-up winding facilities. The spun yarn winding apparatus 11 according to embodiment 2 is a POY-dedicated spun yarn winding apparatus.

[0044] The spinning machine 12 spins a plurality of filaments and supplies the spun filaments from the upward direction toward the downward direction. The spinning machine 12 receives a synthetic material (a raw material of the filaments), pumps the synthetic material through an extruder, and spins the synthetic material through a plurality of spinnerettes disposed at a spinning head (not shown). A predetermined number of filaments, among

the plurality of filaments spun through the spinnerettes of the spinning head, are bundled together into one of a plurality of yarns Y to be guided to the winder 13. That is, each of the plurality of yarns Y is made of a bundle of a predetermined number of filaments. The plurality of yarns Y are guided to the winder 13.

[0045] The winder 13 winds up the plurality of yarns Y from the spinning machine 12 around a plurality of bobbins B to form a plurality of packages P. In order from the upstream side along the travel direction of the plurality of yarns Y, the winder 13 includes a first yarn path guide 22, an interlace 28 as a second yarn path guide, a third roller 24, a transfer forwarding roller 29 as a fourth roller, immediately-preceding forwarding rollers 30 and 31, and a package formation unit 15.

[0046] The first yarn path guide 22 regulates the yarn paths of the plurality of yarns Y from the spinning machine 12 to guide the plurality of yarns Y to the interlace 28 on the downstream side. The interlace 28 uses a fluidic injection nozzle to interlace the filaments constituting the plurality of yarns Y and thus to impart collectability, that is, to inhibit expansion and separation of fibers. The interlace 28 also serves as a yarn path guide.

This necessitates each of the plurality of yarns Y to be guided to an individual, corresponding guide constituting the interlace 28. The threading operation to the interlace 28 will be described in detail later.

[0047] The third roller 24 is temporally brought into contact with the plurality of yarns Y during the threading operation to the interlace 28. The third roller 24 is disposed away from the yarn paths between the interlace 28 and the transfer forwarding roller 29 on the downstream side so as not to impede the original yarn paths after the threading operation to the interlace 28. Moreover, the third roller 24 is disposed at an optimum position for workability of the threading operation to the interlace 28 with the suction gun 61.

[0048] The transfer forwarding roller 29 receives the plurality of yarns Y from the spinning machine 12. The immediately-preceding forwarding rollers 30 and 31 are provided on the downstream side relative to the transfer forwarding roller 29. The immediately-preceding forwarding rollers 30 and 31 forward the plurality of yarns Y to the package formation unit 15.

[0049] A threading device 41 is disposed in parallel with the interlace 28. The threading device 41 is used for the threading operation to the interlace 28 in order to temporally change the yarn paths of the yarns to be guided to the interlace 28 or guide the plurality of yarns Y to the interlace 28 (see FIGs. 5B and 6B). The threading device 41 includes an arm 42 and a threading guide bar 43. The threading guide bar 43 is formed of a material of low frictional resistance and comes into contact with the plurality of yarns Y. The arm 42 supports the threading guide bar 43 and swings the threading guide bar 43 about its axis 44 so as to change the yarn paths of the plurality of yarns Y. The operation of the threading device 41 will be described in detail later.

[0050] The package formation unit 15 winds the plurality of yarns Y forwarded from the immediately-preceding forwarding rollers 30 and 31 around the bobbins B. The package formation unit 15 includes the bobbins B that rotate to wind the plurality of yarns Y therearound, a bobbin holding shaft 17 to which the bobbins B are mounted, a traverse device 20 to traverse the plurality of yarns Y to be wound around the bobbins B, a roller (not shown) to rotationally drive the bobbins B and packages P formed over the bobbins B, and a driving device 18 to drive the traverse device 20 and the roller.

[0051] Each of the plurality of yarns Y guided to the package formation unit 15 are traversed by the traverse device 20 in the lateral direction (the axial direction of the bobbin holding shaft 17) and wound around a corresponding rotating bobbin B. The plurality of yarns Y wound around the plurality of bobbins B form the packages P over the plurality of bobbins B.

[0052] Next, the threading operation to the interlace 28 by the take-up winding apparatus 11 will be described. FIG. 5A is an enlarged front view of the take-up winding apparatus 11, illustrating a preliminary process of the threading operation to the interlace 28. FIG. 5B is an enlarged perspective view of the take-up winding apparatus 11, illustrating the vicinity of the interlace 28 as shown in FIG. 5A. As shown in FIGs. 5A and 5B, it is assumed that an operator (not shown) carries out the threading operation using the suction gun 61 that draws in the plurality of yarns Y, and that the plurality of yarns Y are already fed on the first yarn path guide 22, which is located immediately before the interlace 28.

[0053] The intervals between the plurality of yarns Y on the first yarn path guide 22 are adjusted to the intervals between the individual guides of the interlace 28. This brings the first yarn path guide 22 and the interlace 28 into such a positional relationship that advancing each of the plurality of yarns Y straightforwardly through the first yarn path guide 22 guides each yarn Y to an individual, corresponding guide of the interlace 28.

[0054] However, the interlace 28 targeted for the threading operation is located between the suction gun 61 and the first yarn path guide 22 on the upstream side relative to the suction gun 61. As shown in FIG. 5B, on the upstream side relative to the suction gun 61, the plurality of yarns Y are vibrating while being entangled with each other. That is, in the vicinity of the interlace 28 targeted for the threading operation, the plurality of yarns Y are vibrating while being entangled with each other. This makes it difficult to guide each of the plurality of yarns Y to an individual, corresponding guide constituting the interlace 28.

[0055] FIG. 6A is an enlarged front view of the take-up winding apparatus 11, illustrating a first process of the threading operation to the interlace 28. FIG. 6B is an enlarged perspective view of the take-up winding apparatus 11, illustrating the vicinity of the interlace 28 as shown in FIG. 6A. In the first process, the suction gun 61 is manipulated to bring the third roller 24 into contact with

the plurality of yarns Y between the suction gun 61 and the interlace 28 targeted for the threading operation. That is, the third roller 24 is brought into contact with the plurality of yarns Y temporarily, that is, only during the threading operation. When the third roller 24 is in contact with the plurality of yarns Y, the above-described behavior characteristic of the plurality of yarns Y ensures that twisting or vibration, if any, of the plurality of yarns Y on the downstream side relative to the third roller 24 does not affect the upstream side relative to the third roller 24.

[0056] In this respect, the swing of the arm 42 positions the threading guide bar 43 of the threading device 41 to bring the threading guide bar 43 into contact with the plurality of yarns Y at a distance from the inlets of the individual guides constituting the interlace 28. Since the threading guide bar 43 is disposed at a distance from the inlets of the individual guides, the yarn paths of the plurality of yarns Y, while otherwise pass through the interlace 28, are temporarily kept away from the interlace 28. This prevents inadvertent contact of the plurality of yarns Y with the interlace 28, and prevents the plurality of yarns Y from entering wrong guides of the interlace 28, while an operator is manipulating the suction gun 61 during the first process.

[0057] FIG. 7A is an enlarged front view of the take-up winding apparatus 11, illustrating a second process of the threading operation to the interlace 28. FIG. 7B is an enlarged perspective view of the take-up winding apparatus 11, illustrating the vicinity of the interlace 28 as shown in FIG. 7A. In the second process, with the plurality of yarns Y in contact with the third roller 24, each of the plurality of yarns Y is guided to an individual, corresponding guide constituting the interlace 28, thus feeding the plurality of yarns Y onto the interlace 28. In embodiment 2 of the present invention, the swing of the arm 42 moves the threading guide bar 43 of the threading device 41 away from the yarn paths of the plurality of yarns Y. This allows the plurality of yarns Y to advance straightforwardly after passing through the first yarn path guide 22. Each of the plurality of yarns Y is then guided into an individual, corresponding guide of the interlace 28. Thus, setting each of the plurality of yarns Y to advance straightforwardly after passing through the first yarn path guide 22 makes each yarn Y guided directly into an individual, corresponding guide of the interlace 28. This only involves activation of the threading device 41 to guide each of the plurality of yarns Y into an individual, corresponding guide constituting the interlace 28. This in turn facilitates the threading operation.

[0058] FIG. 8A is an enlarged front view of the take-up winding apparatus 11, illustrating a third process of the threading operation to the interlace 28. FIG. 8B is an enlarged perspective view of the take-up winding apparatus 11, illustrating the vicinity of the interlace 28 as shown in FIG. 8A. In the third process, which is after the plurality of yarns Y are threaded onto the interlace 28, the suction gun 61 is manipulated to feed the plurality of yarns Y onto the transfer forwarding roller 29 and sub-

sequently onto the immediately-preceding forwarding roller 30. The third roller 24 is disposed away from the yarn paths of the plurality of yarns Y between the interlace 28 and the transfer forwarding roller 29 on the downstream side. Specifically, the third roller 24 is moved away from the yarn paths of the plurality of yarns Y upon feeding the plurality of yarns Y onto the transfer forwarding roller 29. When the plurality of yarns Y are fed onto the transfer forwarding roller 29, the threading operation to the interlace 28 is substantially completed.

[0059] The take-up winding apparatus 11 according to embodiment 2 of the present invention provides the following advantageous effects.

[0060] During the threading operation, the third roller 24 is temporally brought into contact with the plurality of yarns Y between the suction gun 61 and the interlace 28 targeted for the threading operation. Although this involves propagation of twisting and/or vibration caused by the suction gun 61 to the vicinity of the third roller 24, the twisting and/or vibration do not propagate further upstream than the third roller 24. This ensures that the plurality of yarns Y in the vicinity of the interlace 28 targeted for the threading operation do not vibrate or become entangled with each other. This facilitates the separating operation while the plurality of yarns Y are in contact with the third roller 24, and thus facilitates the threading operation of feeding the plurality of yarns Y onto the interlace 28. After feeding the plurality of yarns Y onto the interlace 28, the third roller 24 is brought out of contact with the plurality of yarns Y. This ensures that the third roller 24 does not become an obstacle to the original yarn paths. Thus, the third roller 24 is temporally brought into contact with the plurality of yarns Y during the threading operation to facilitate the threading operation. This enables a single operator to carry out the threading operation and shortens the time required for the threading operation.

Embodiment 3

[0061] A suction gun 61 and a method for using the suction gun 61 according to embodiment 3 of the present invention will be described with reference to FIGs. 9A to 14. In embodiment 3, a major difference from the other embodiments is that the third roller 24 is provided in the suction gun 61.

[0062] FIGs. 9A and 9B are side views of the suction gun 61, illustrating the vicinity of its tip portion. As shown in FIG. 9A, an arm 63 is mounted in the vicinity of the tip portion of the suction gun 61. As shown in FIG. 9B, the arm 63 swings by a predetermined angle about its axis 64. The third roller 24 is provided on the arm 63. The third roller 24 temporally comes into contact with the plurality of yarns Y during the threading operation.

[0063] As shown in FIGs. 9A and 9B, the arm 63 swings to change the position of the third roller 24 relative to a suction inlet 62 of the suction gun 61. The third roller 24 shown in FIG. 9A is positioned to come into contact with

the plurality of yarns Y that are straightforwardly drawn into the suction gun 61. The third roller 24 shown in FIG. 9B is positioned away from the plurality of yarns Y that are straightforwardly drawn into the suction gun 61, instead of being in contact with the plurality of yarns Y.

[0064] FIGs. 10A and 10B are cross-sectional views of the third roller 24, illustrating examples of the profile of the third roller 24. As shown in FIG. 10A, a contact surface 25 for the plurality of yarns Y may be formed in an approximately V shape. Alternatively, as shown in FIG. 10B, the contact surface for the plurality of yarns Y may be flat with flanges 26 on both sides to prevent displacement of the plurality of yarns Y. Due to the above-described behavior characteristic, the plurality of yarns Y in contact with the third roller 24 tend to expand on the upstream side relative to the third roller 24. Hence, the shape shown in FIG. 10B provides a greater width of contact with the plurality of yarns Y. It should be noted that the profiles of the third roller 24 shown in FIGs. 10A and 10B are provided for exemplary purposes only, and the illustrated dimensions, shapes, and dimensional ratios are not intended to be construed in a limiting sense.

[0065] Next, one example of the method for using the suction gun 61 according to embodiment 3 of the present invention will be described. The suction gun 61 described below is used for the threading operation to a threading device 51 of the take-up winding apparatus 11.

[0066] First, the take-up winding apparatus 11 and the threading device 51 will be described. FIG. 11 is a perspective view of the take-up winding apparatus 11 before the threading operation is carried out to the threading device 51. FIG. 12 is a perspective view of the take-up winding apparatus 11, illustrating that the plurality of yarns Y shown in FIG. 11 are brought into contact with the third roller 24. FIG. 13 is a perspective view of the take-up winding apparatus 11, illustrating the threading operation carried out to threading members 54 of the threading device 51. FIG. 14 is a perspective view of the take-up winding apparatus 11 with the threading members 54 of the threading device 51 extended. The take-up winding apparatus 11 mainly includes a body frame 14, a turret plate 16 that rotates about a horizontal axis, two bobbin holding shafts 17A and 17B projecting on the turret plate 16, a driving device 18 that rotationally drives the bobbin holding shafts 17A and 17B, a supporting frame 19 that moves vertically, upward and downward, along the body frame 14, a touch roller (not shown) disposed in the supporting frame 19, and a traverse device (not shown).

[0067] The spinning speed of the extruder is uniform, and the bobbin holding shafts 17A and 17B are rotationally driven to maintain a predetermined winding speed. When the packages on the bobbin holding shaft 17A become full, the turret plate 16 rotates 180 degrees to turn the bobbin holding shaft 17A with the full packages into a waiting position "b" and to turn the bobbin holding shaft 17B with empty bobbins B into a winding position "a". The plurality of yarns Y are transferred from the full pack-

ages to the empty bobbins B, where the winding continues. Specifically, the bobbin holding shaft 17A with the full packages gradually decelerates and comes to a stop, and the full packages are replaced with new, empty bobbins B.

[0068] Incidentally, this take-up winding apparatus 11 of the turret type enables automatic yarn transfer from a fully loaded bobbin B to an empty bobbin B by a continuous operation using a yarn transfer device (not shown). However, some occasions, such as the start of yarn winding before the continuous operation, involve manual threading to an empty bobbin B using the threading device 51.

[0069] The threading device 51 will be described. The threading device 51 includes a threading cylinder device 52 and a rotary separator 56. The threading cylinder device 52 includes a cylinder 53, threading members 54, and a rod 55. The number of the threading members 54 are equal to the number of the bobbins B. The threading members 54 are slidable in the cylinder 53. The threading members 54 are arranged at predetermined intervals therebetween and connected with each other by a belt. The threading member 54 shown at the left end in the figures is secured to the cylinder 53, while the threading member 54 shown at the right end in the figures is connected to a tip end of the rod 55. As shown in FIGs. 11, 12, and 13, drawing the rod 55 through the cylinder 53 concentrates the threading members 54 at the left end of the cylinder 53. As shown in FIG. 14, pushing the rod 55 through the cylinder 53 extends the threading members 54 at predetermined intervals that are determined by the length of the belt. The rotary separator 56 has guide grooves 57 arranged at predetermined pitches and is operated by an actuator.

[0070] Next, an operation of the threading device 51 will be described. As shown in FIGs. 11 and 12, the rod 55 is drawn to concentrate the threading members 54 at the left end of the cylinder 53. Then, the plurality of the yarn Y spun out via traverse support point guides 71 are passed through the supporting frame 19 and collectively drawn into the suction gun 61. Subsequently, as shown in FIG. 13, each of the plurality of yarns Y is fed onto an individual, corresponding threading member 54. The threading operation to the threading members 54 will be described in detail later.

[0071] As shown in FIG. 14, pushing the rod 55 through the cylinder 53 extends the threading members 54 to respective positions at the predetermined pitches, and causes the plurality of yarns Y to travel immediately under the traverse support point guides 71. The actuator of the rotary separator 56 is activated to rotate the rotary separator 56 in the direction E shown in FIG. 14. Each of the yarns Y is guided into an individual, corresponding guide groove 57 of the rotary separator 56. Then, the yarn paths of the plurality of yarns Y are bent to the side of the bobbins B on the bobbin holding shaft 17A, and the plurality of yarns Y are simultaneously caught into slits Ba of the bobbins B. Thus, winding on the bobbins B starts.

[0072] The take-up winding apparatus 11 and the threading device 51 are constituted as described above. Next, the threading operation to the threading members 54 will be described in detail. As shown in FIG. 11, it is assumed that an operator (not shown) carries out the threading operation using the suction gun 61 that draws in the plurality of yarns Y, and the plurality of yarns Y are already fed onto the traverse support point guides 71, which serve as first yarn path guides immediately before the threading members 54 serving as second yarn path guides.

[0073] The threading members 54 targeted for the threading operation are located between the suction gun 61 and the traverse support point guides 71 on the upstream side relative to the suction gun 61. On the upstream side relative to the suction gun 61, the plurality of yarns Y are vibrating while being entangled with each other. In other words, in the vicinity of the threading members 54 targeted for the threading operation, the plurality of yarns Y are vibrating while being entangled with each other. This makes it significantly difficult to carry out the separating operation and to guide each of the plurality of yarns Y to an individual, corresponding threading member 54.

[0074] FIG. 12 shows a first process of the threading operation to the threading members 54. In the first process, an arm 63 of the suction gun 61 is manipulated to bring the third roller 24 into contact with the plurality of yarns Y between the suction gun 61 and the threading members 54 targeted for the threading operation. The third roller 24 is brought into contact with the plurality of yarns Y temporarily, that is, only during the threading operation. When the third roller 24 is brought into contact with the plurality of yarns Y, the above-described behavior characteristic of the plurality of yarns Y ensures that twisting or vibration, if any, of the plurality of yarns Y on the downstream side relative to the third roller 24 does not affect the upstream side relative to the third roller 24.

[0075] FIG. 13 shows a second process of the threading operation to the threading members 54. In the second process, with the plurality of yarns Y in contact with the third roller 24, each of the plurality of yarns Y is fed onto an individual, corresponding threading member 54. In embodiment 3 of the present invention, since the plurality of yarns Y are brought into contact with the third roller 24, the twisting or vibration of the plurality of yarns Y caused by the suction gun 61 does not propagate further upstream than the third roller 24. This facilitates the separating operation, which in turn facilitates the threading operation of feeding the plurality of yarns Y onto the threading members 54.

[0076] FIG. 14 shows a third process of the threading operation to the threading members 54. In the third process, after the plurality of yarns Y are fed onto the threading members 54, the arm 63 of the suction gun 61 is manipulated to move the third roller 24 away from the yarn paths of the plurality of yarns Y. Then, pushing the rod 55 through the cylinder 53 extends the threading

members 54 at predetermined intervals that are determined by the length of the belt. Manipulating the arm 63 of the suction gun 61 to bring the third roller 24 out of contact with the yarn paths of the plurality of yarns Y substantially completes the threading operation to the threading members 54.

[0077] The suction gun 61 according to embodiment 3 of the present invention provides the following advantageous effects.

[0078] During the threading operation, the third roller 24 provided in the suction gun 61 is temporally brought into contact with the plurality of yarns Y between the suction gun 61 and the threading members 54 targeted for the threading operation. Although this involves propagation of twisting and/or vibration caused by the suction gun 61 to the vicinity of the third roller 24, the twisting and/or vibration do not propagate further upstream than the third roller 24. This ensures that the plurality of yarns Y in the vicinity of the threading members 54 targeted for the threading operation do not vibrate or become entangled with each other. This facilitates the separating operation while the plurality of yarns Y are in contact with the third roller 24, and thus facilitates the threading operation of feeding the plurality of yarns Y onto the threading members 54. After the plurality of yarns Y are fed onto the threading members 54, the third roller 24 is brought out of contact with the plurality of yarns Y. This ensures that the third roller 24 does not become an obstacle to the original yarn paths. Thus, the third roller 24 is temporally brought into contact with the plurality of yarns Y during the threading operation to facilitate the threading operation. This enables a single operator to carry out the threading operation and shortens the time required for the threading operation.

[0079] Since the third roller 24 is provided in the suction gun 61, it is unnecessary to individually provide the third roller 24 in the take-up winding apparatus 11. Manipulating the suction gun 61 to temporally bring the third roller 24 into contact with the plurality of yarns Y during the threading operation facilitates the threading operation.

[0080] While the present invention has been described with reference to embodiments, this description is not intended to be construed in a limiting sense. It is possible to make numerous modifications and variations. For example, while in embodiment 2 the third roller 24 used for the threading operation to the interlace 28 is provided in the take-up winding apparatus 11, another third roller 24 for use in the threading operation to some other roller or yarn path guide may be provided in the take-up winding apparatus 11.

[0081] While in embodiment 3 the third roller 24 is provided in the swingable arm 63 as the structure to bring the third roller 24 provided in the suction gun 61 into temporary contact with the plurality of yarns Y, this structure is not intended to be construed in a limiting sense. While in embodiment 3 the description of the threading operation using the third roller 24 provided in the suction gun 61 is regarding the threading operation to the threading

device 51 of the take-up winding apparatus 11, the threading operation may be carried out to some other roller or yarn path guide. For example, the threading operation using the third roller 24 provided in the suction gun 61 may be applied to the interlace 28 described in embodiment 2.

[0082] Obviously, numerous modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.

The following items also form part of the disclosure.

1. A method for threading to a take-up winding apparatus using a suction gun, the method comprising:

regulating yarn paths for a plurality of yarns using at least one of a first roller and a first yarn path guide of the take-up winding apparatus; between the suction gun and at least one of a second roller and a second yarn path guide of the take-up winding apparatus, bringing a third roller into contact with the plurality of yarns, the second roller and the second yarn path guide being on a downstream side relative to the first roller and the first yarn path guide; with the third roller in contact with the plurality of yarns, feeding the plurality of yarns onto the at least one of the second roller and the second yarn path guide; and after feeding the plurality of yarns onto the at least one of the second roller and the second yarn path guide, bringing the third roller out of contact with the plurality of yarns.

2. The method according to item 1, wherein the third roller is disposed in the take-up winding apparatus.

3. The method according to item 1, wherein the third roller is disposed in the suction gun.

4. A take-up winding apparatus comprising:

at least one of a first roller and a first yarn path guide configured to regulate yarn paths for a plurality of yarns; at least one of a second roller and a second yarn path guide on a downstream side relative to the first roller and the first yarn path guide; and a third roller configured to come into contact with the plurality of yarns between a suction gun and the at least one of the second roller and the second yarn path guide when the plurality of yarns are fed onto the at least one of the second roller and the second yarn path guide using the suction gun, and configured to move out of contact with the plurality of yarns after the plurality of

yarns are fed onto the at least one of the second roller and the second yarn path guide with the third roller in contact with the plurality of yarns.

5. A suction gun for use in threading to a take-up winding apparatus, the take-up winding apparatus comprising:

at least one of a first roller and a first yarn path guide configured to regulate yarn paths for a plurality of yarns; and at least one of a second roller and a second yarn path guide on a downstream side relative to the first roller and the first yarn path guide, the suction gun comprising a third roller configured to come into contact with the plurality of yarns between an inlet of the suction gun and the at least one of the second roller and the second yarn path guide when the plurality of yarns are fed onto the at least one of the second roller and the second yarn path guide, and configured to move out of contact with the plurality of yarns after the plurality of yarns are fed onto the at least one of the second roller and the second yarn path guide with the third roller in contact with the plurality of yarns.

Claims

1. A suction gun for use in threading to a take-up winding apparatus, the take-up winding apparatus comprising:

at least one of a first roller (21) and a first yarn path guide configured to regulate yarn paths for a plurality of yarns; and at least one of a second roller and a second yarn path guide (23) on a downstream side relative to the first roller and the first yarn path guide, the suction gun (61) comprising an arm (63) mounted in the vicinity of the tip portion of the suction gun, and a third roller (24) provided on the arm (63) and configured to come into contact with the plurality of yarns (Y) between an inlet of the suction gun and the at least one of the second roller and the second yarn path guide (23) before the plurality of yarns (Y) are fed onto the at least one of the second roller and the second yarn path guide (23), and configured to move out of contact with the plurality of yarns after the plurality of yarns are fed onto the at least one of the second roller and the second yarn path guide (23), wherein the arm (63) is swingable to change the position of the third roller (24) relative to the suction inlet (62) of the suction gun.

2. The suction gun according to claim 1, wherein a contact surface (25) of the third roller (24), in a cross-sectional view, for the plurality of yarns has an approximately V-shape.

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3. The suction gun according to claim 1, wherein a contact surface (25) of the third roller (24), in a cross-sectional view, for the plurality of yarns is flat and has flanges (26) on both sides to prevent displacement of the plurality of yarns.

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FIG. 1A

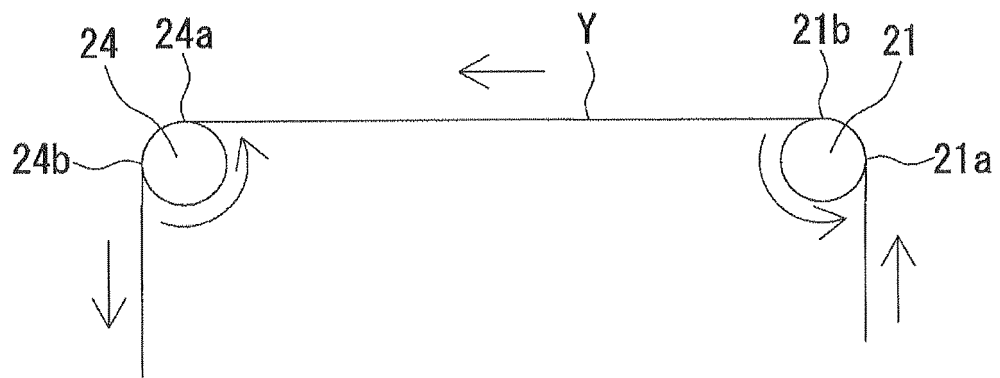


FIG. 1B

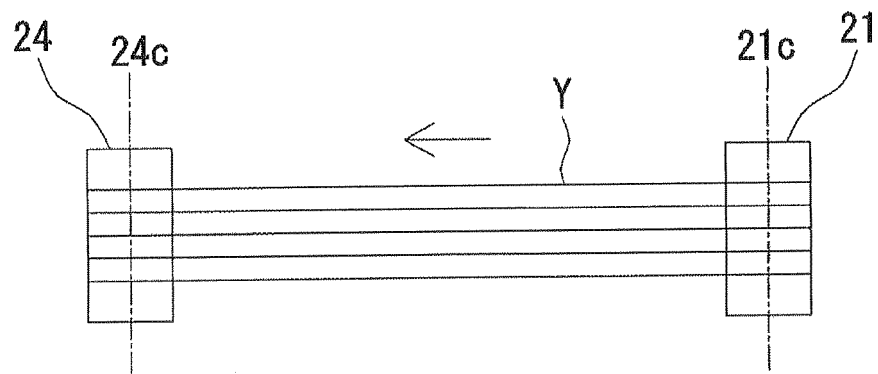


FIG. 2A

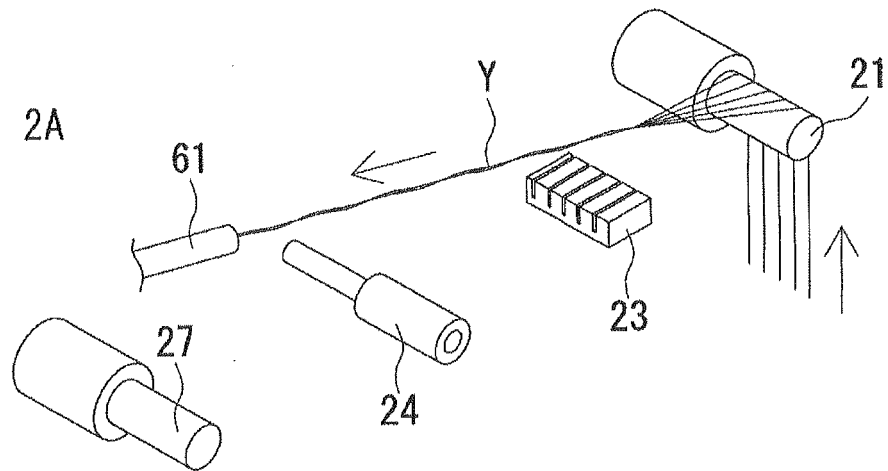


FIG. 2B

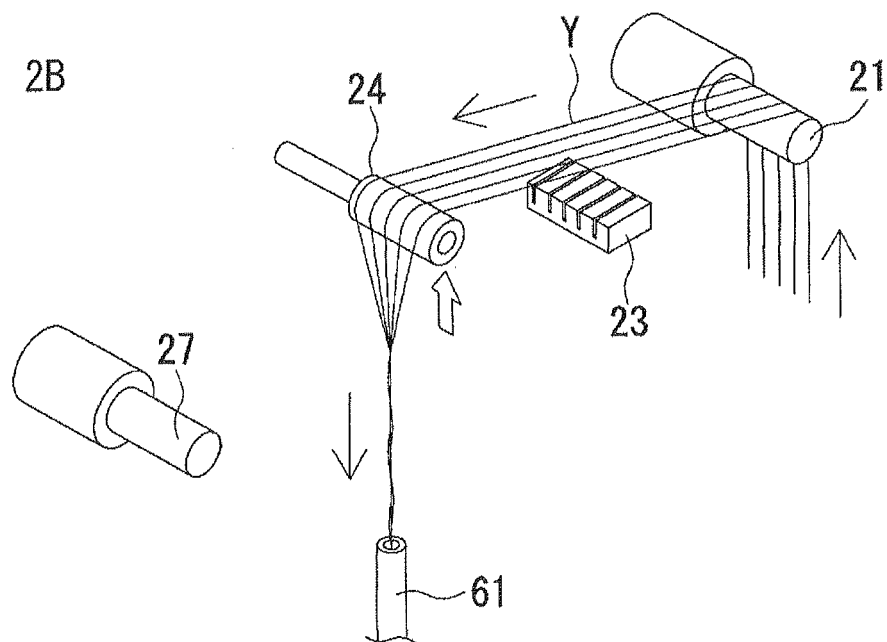


FIG. 3A

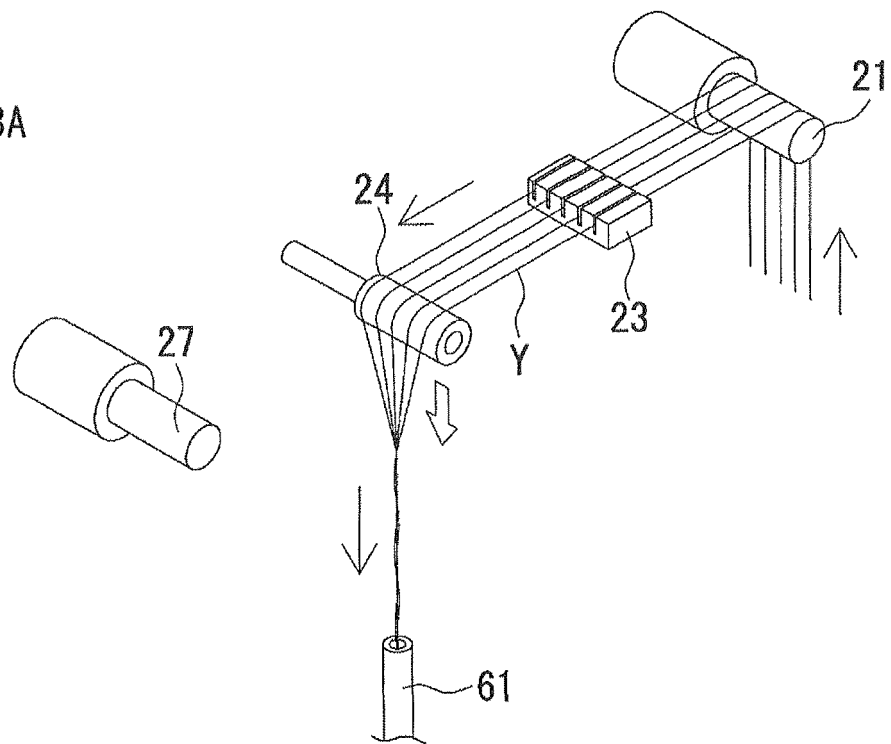


FIG. 3B

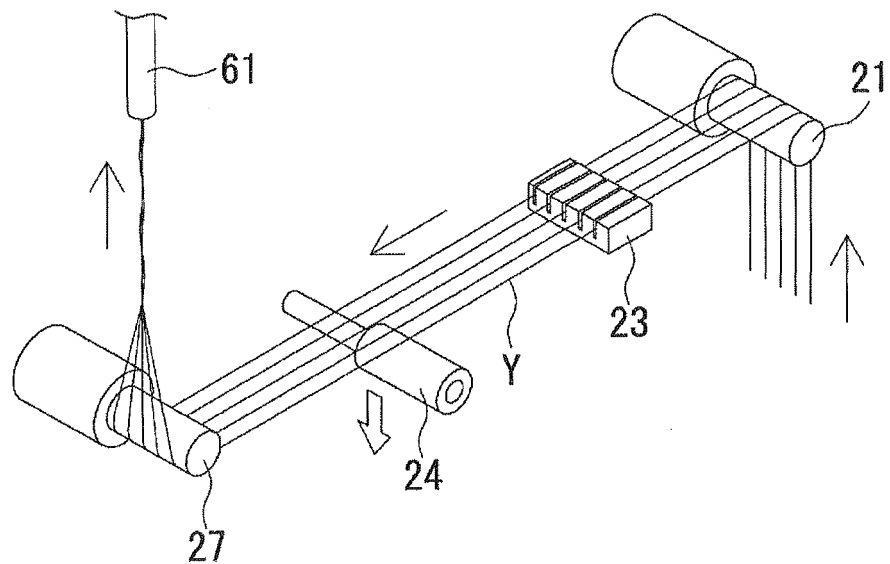


FIG. 4

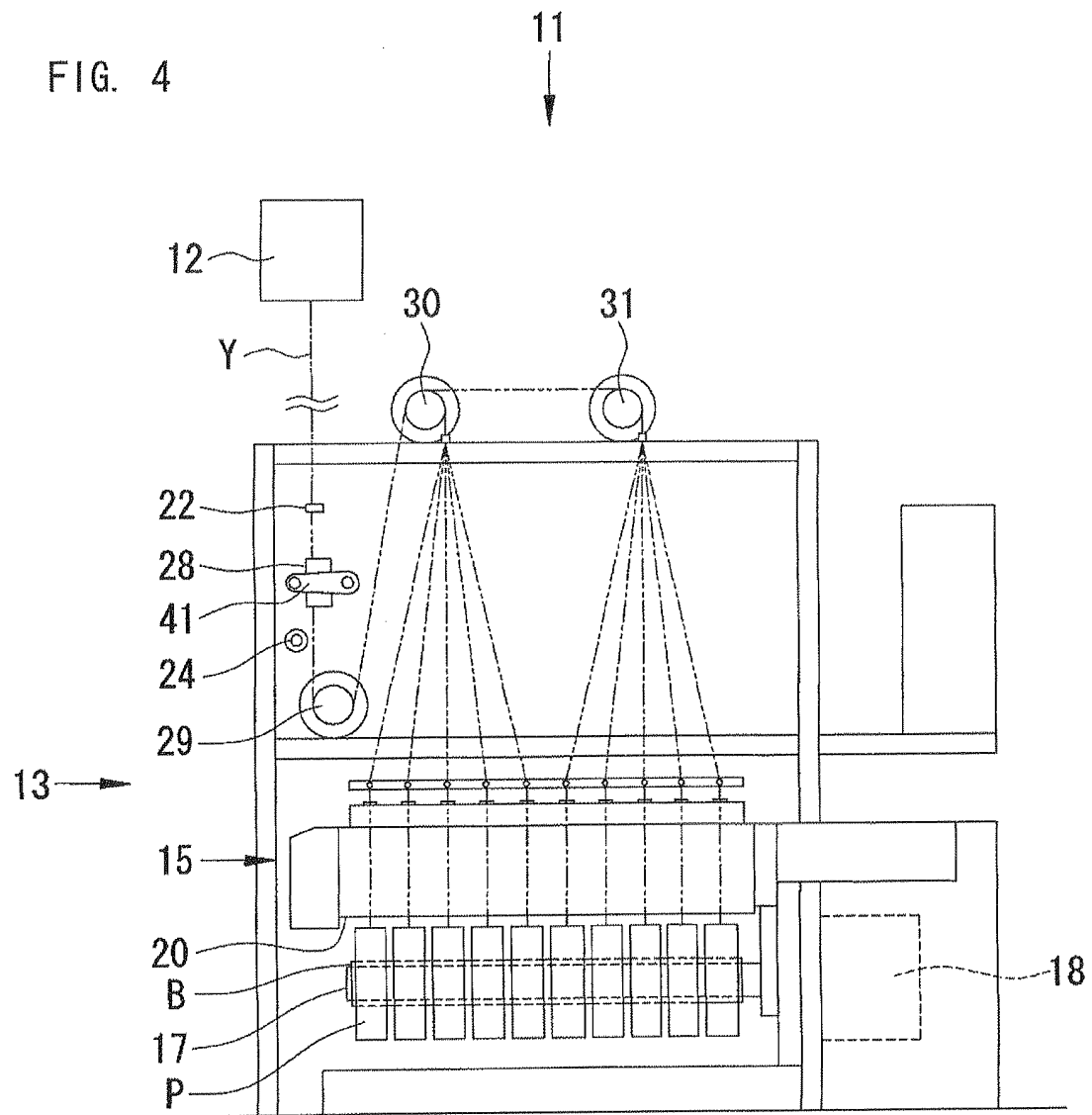


FIG. 5A

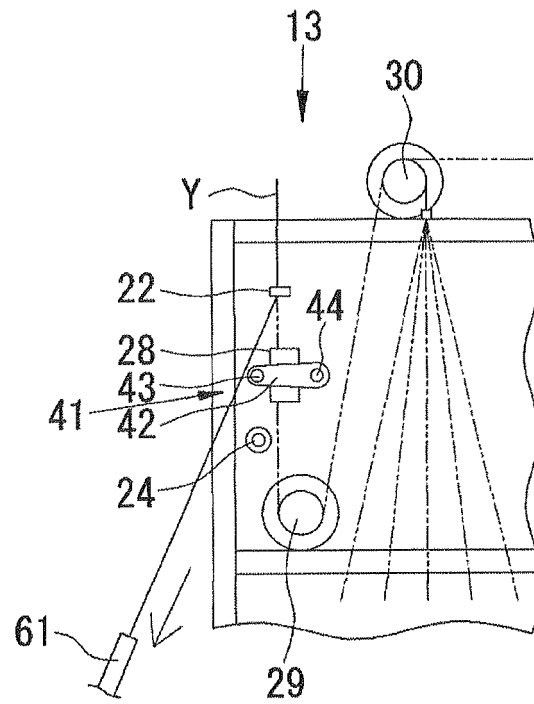


FIG. 5B

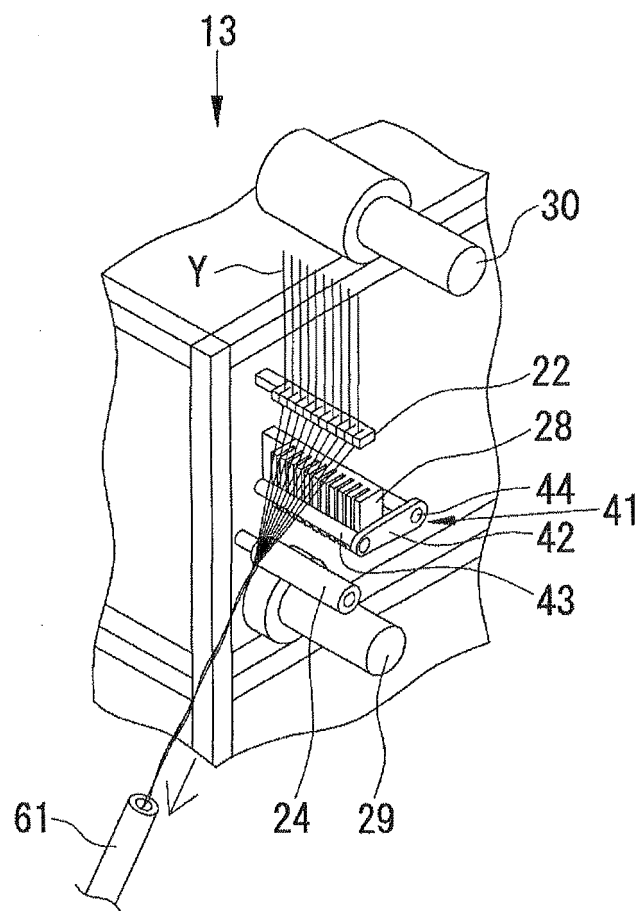


FIG. 6A

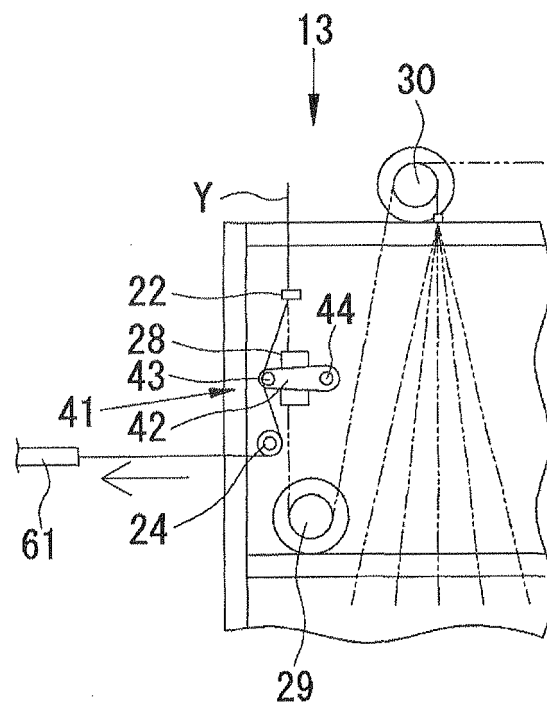


FIG. 6B

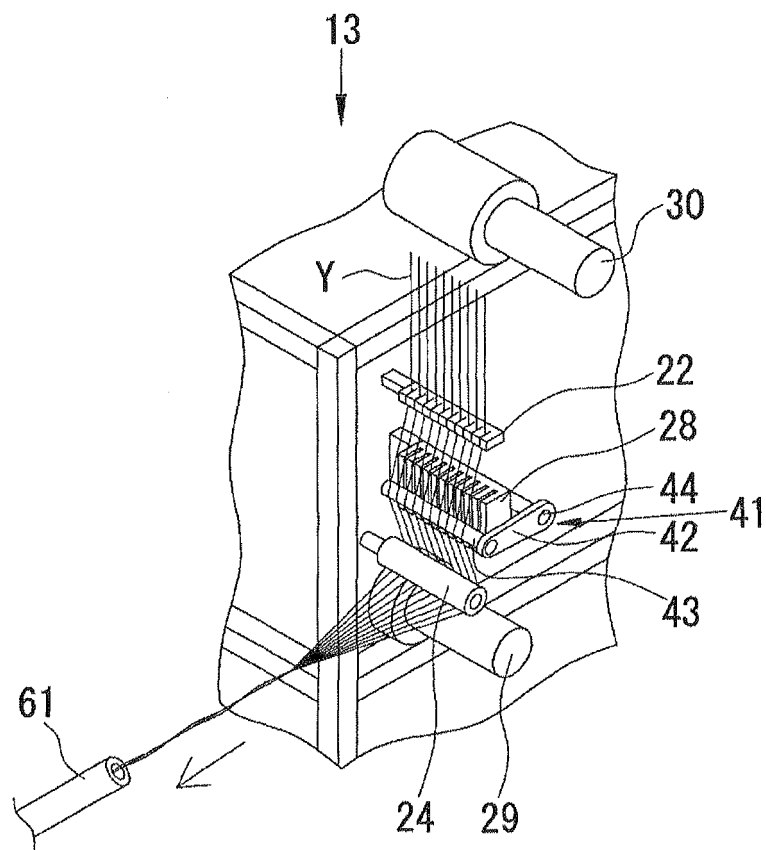


FIG. 7A

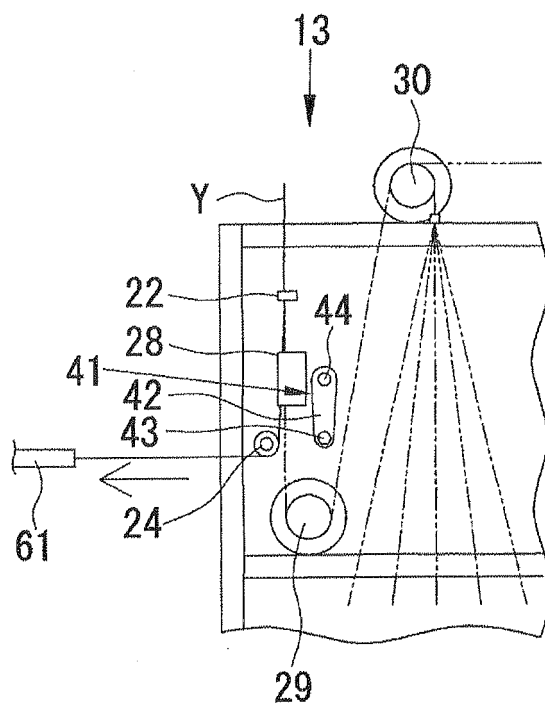


FIG. 7B

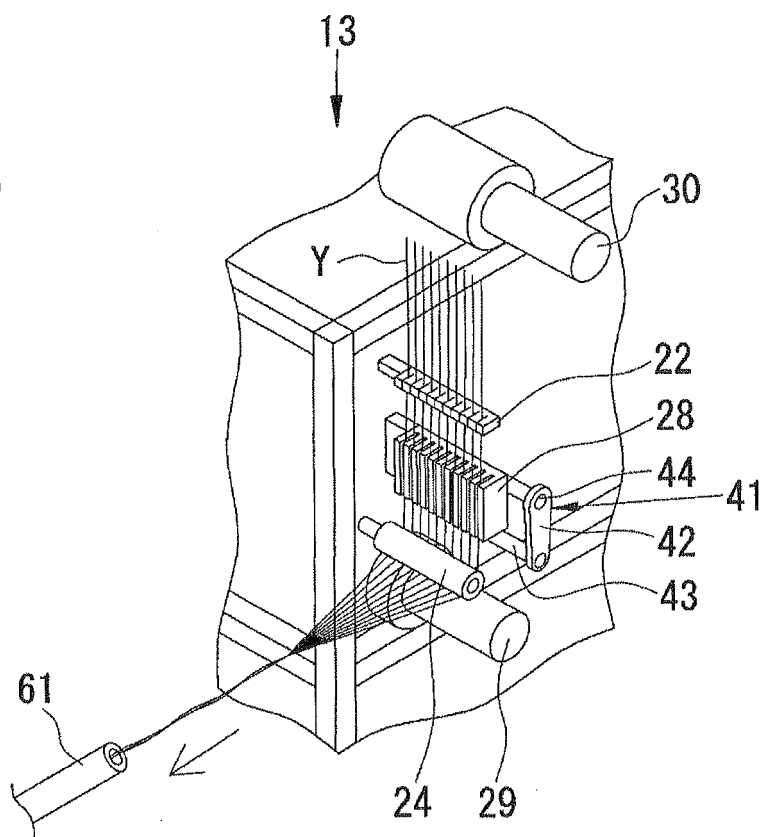


FIG. 8A

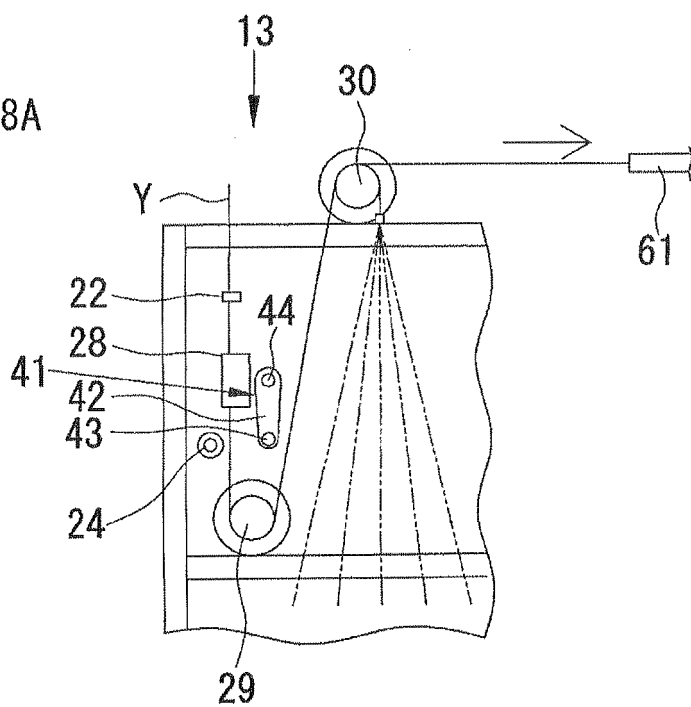
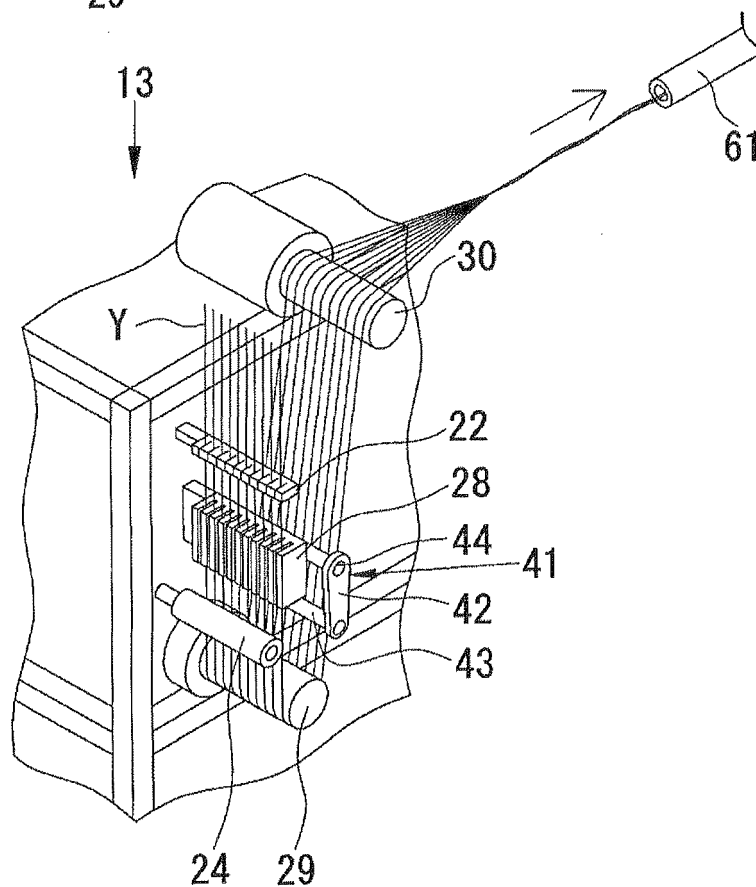


FIG. 8B



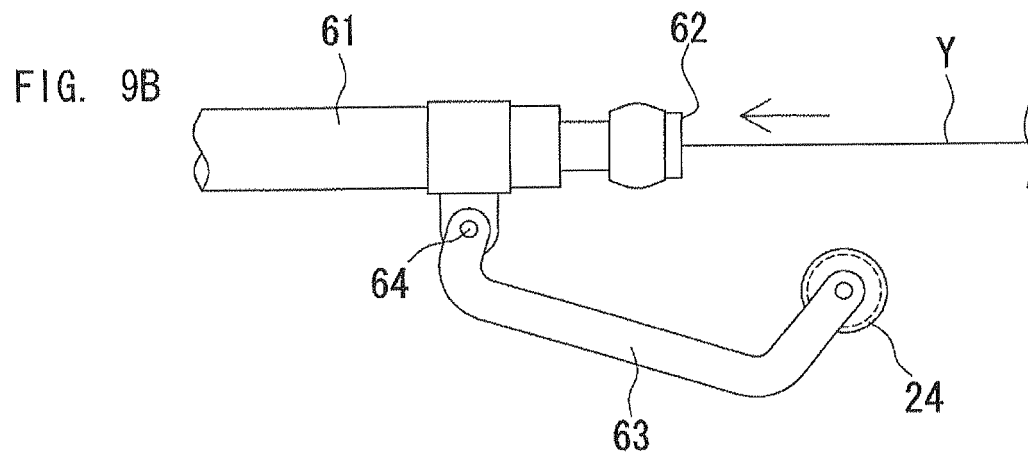
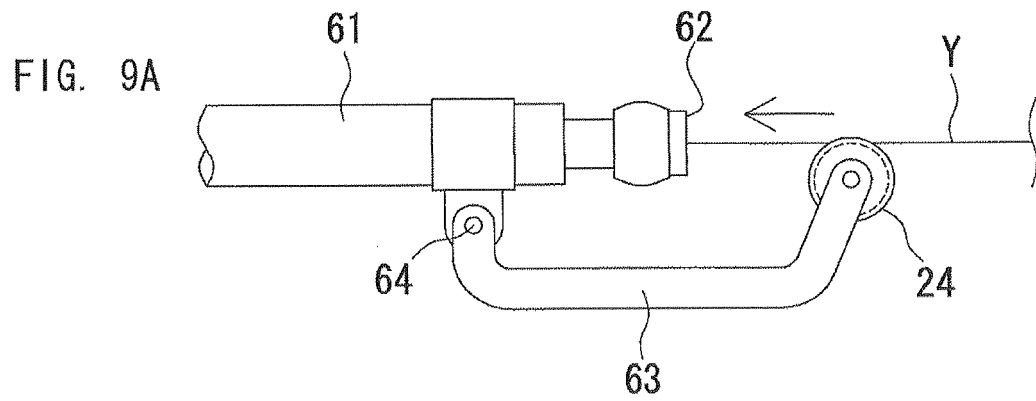


FIG. 10A

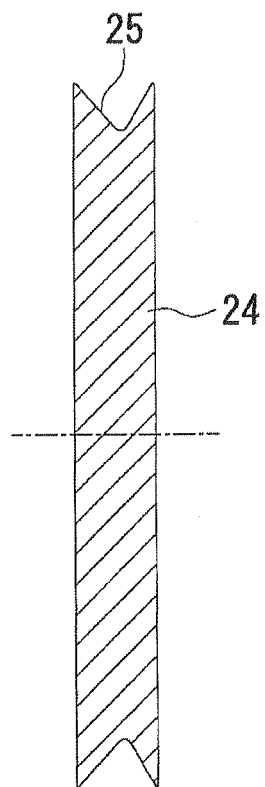


FIG. 10B

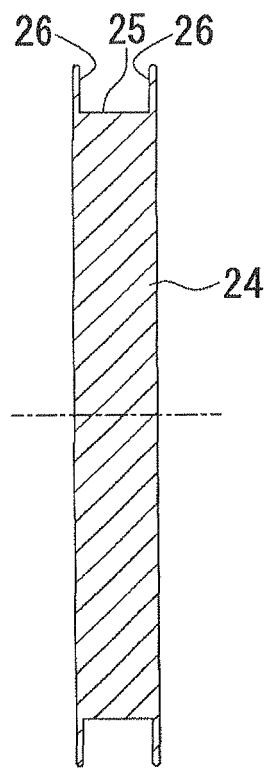


FIG. 11

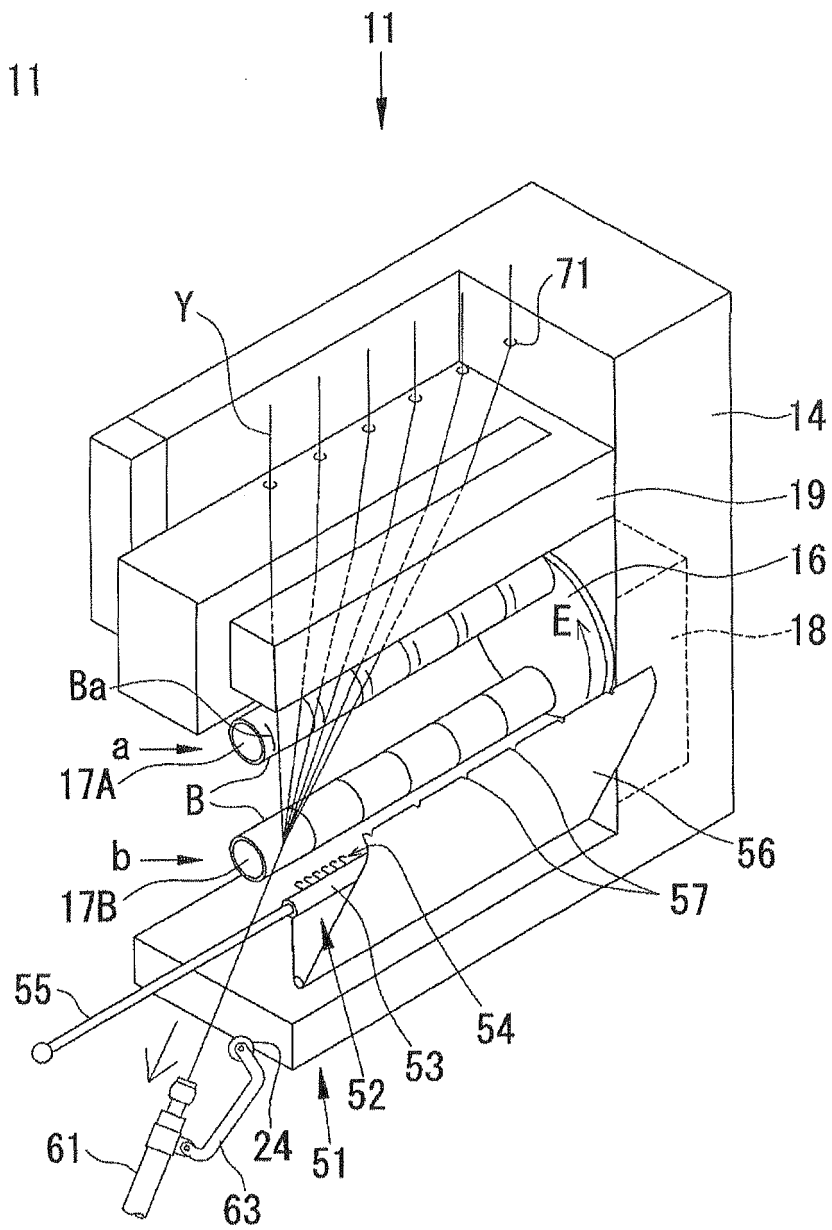


FIG. 12

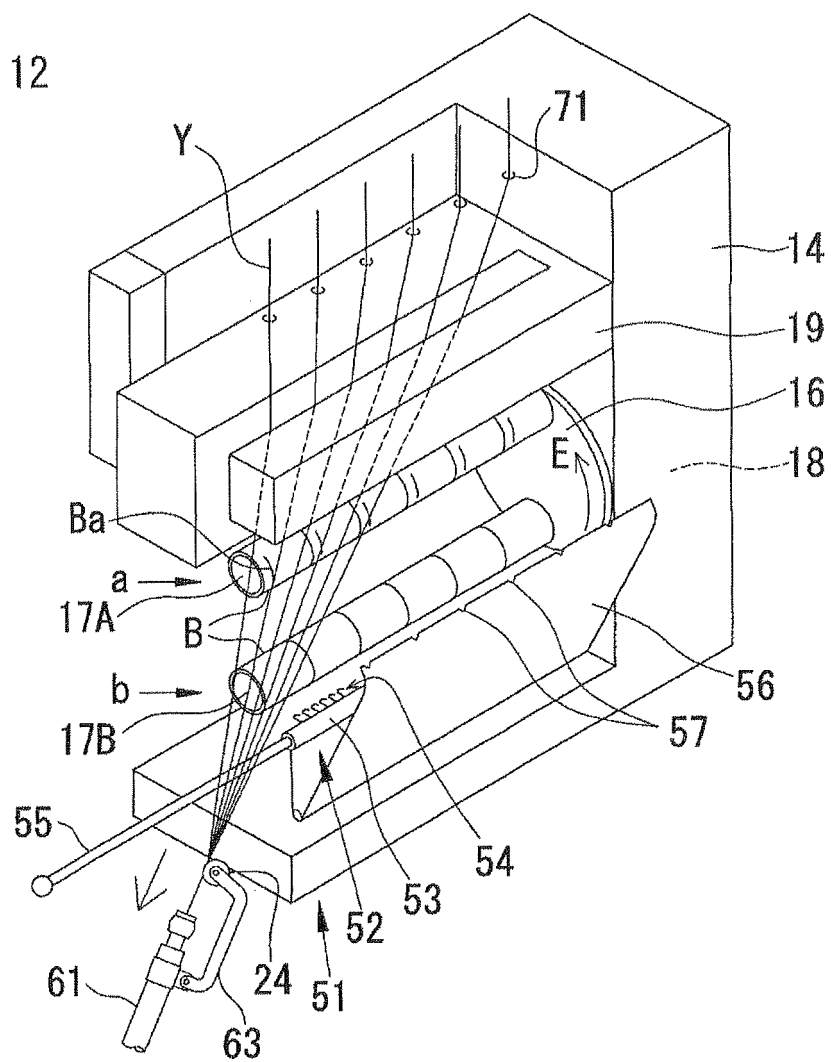
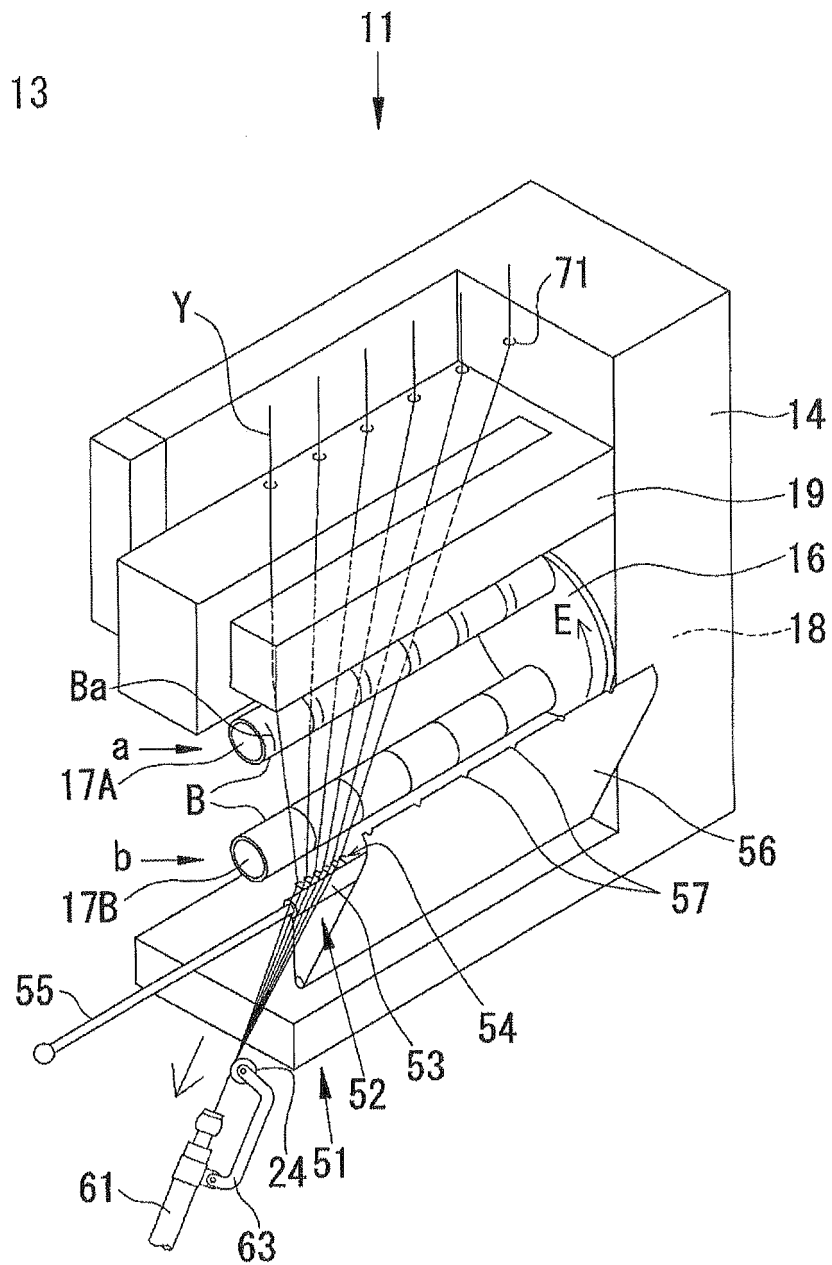


FIG. 13



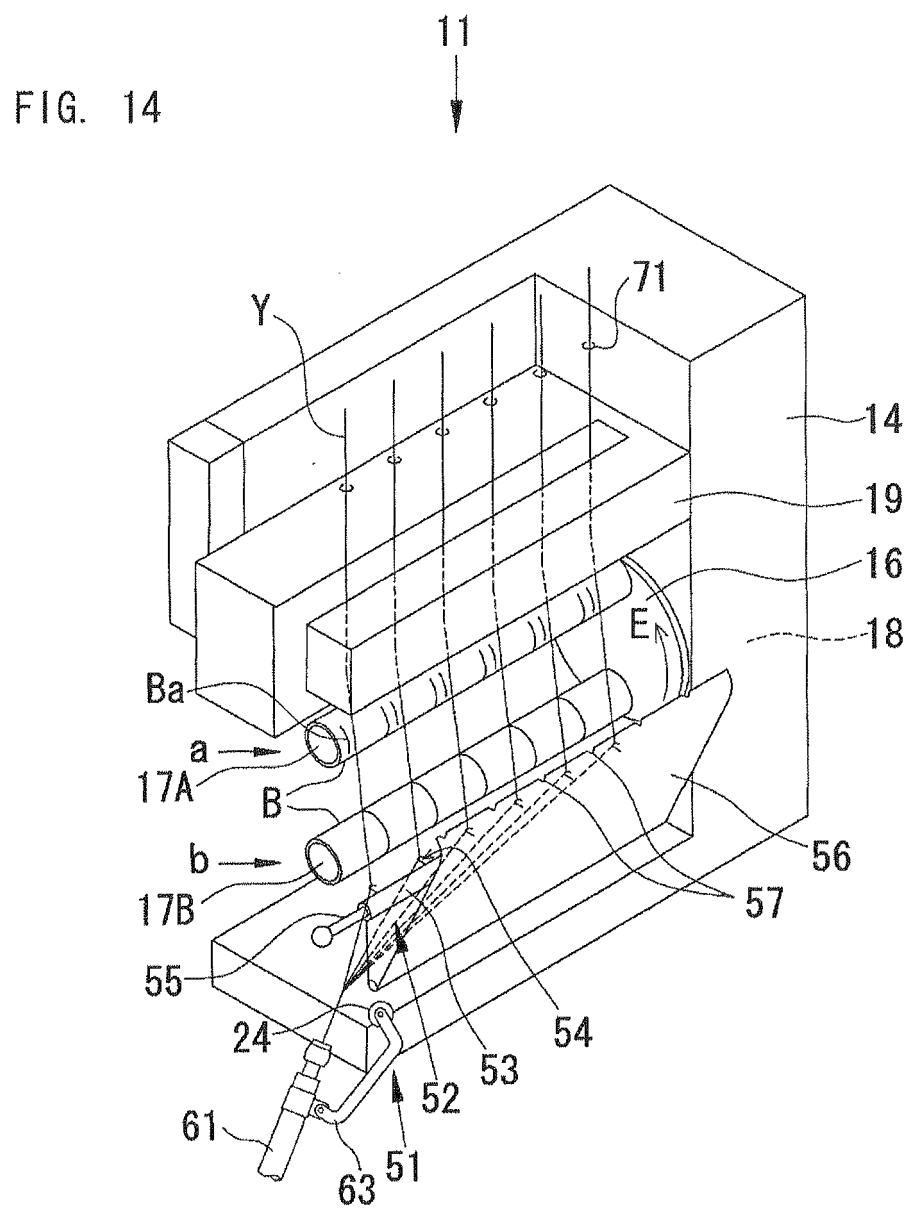


FIG. 15

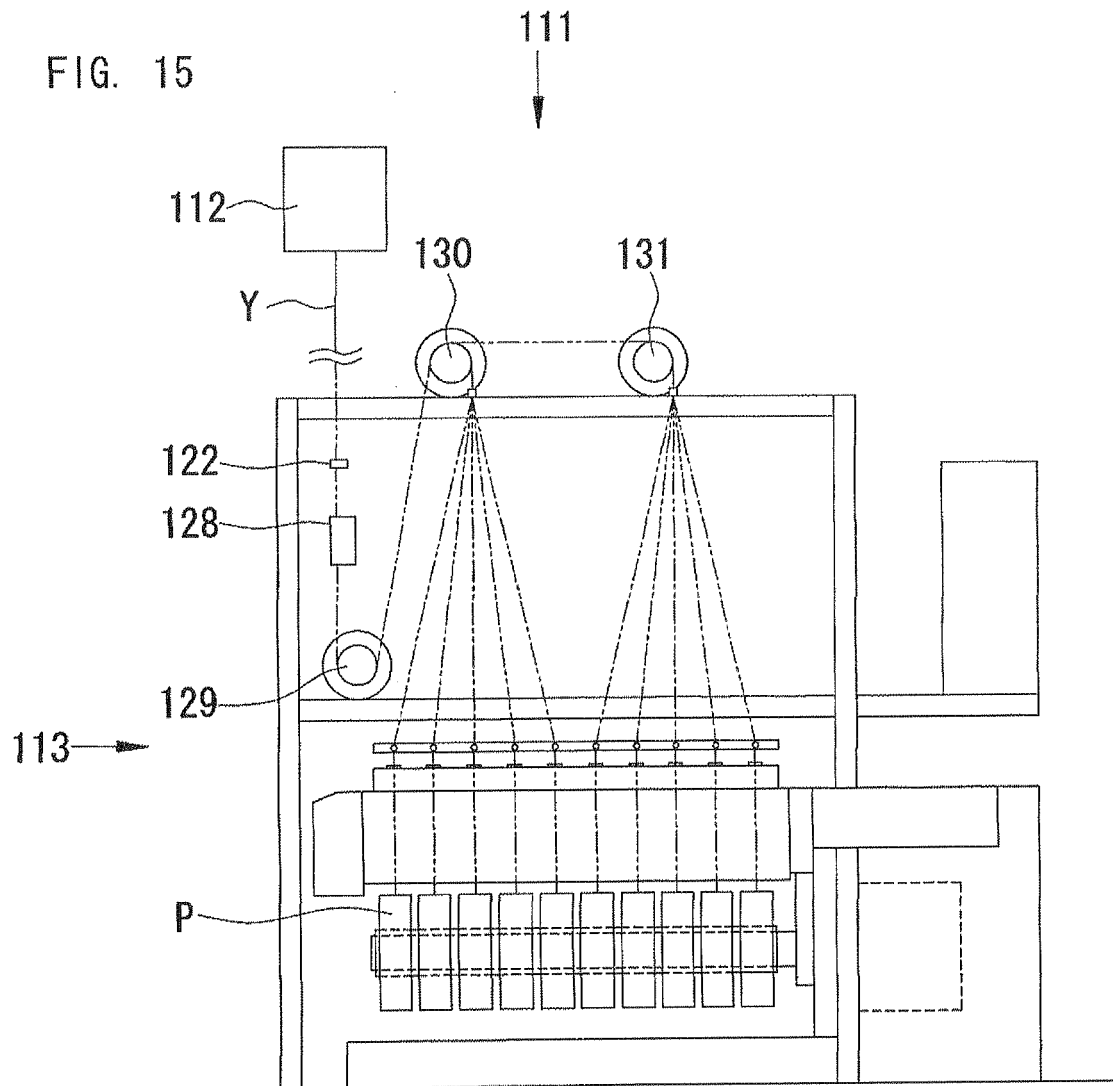


FIG. 16A

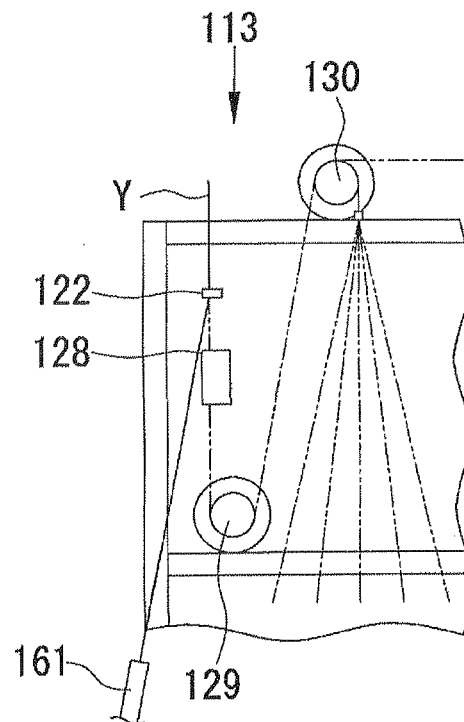
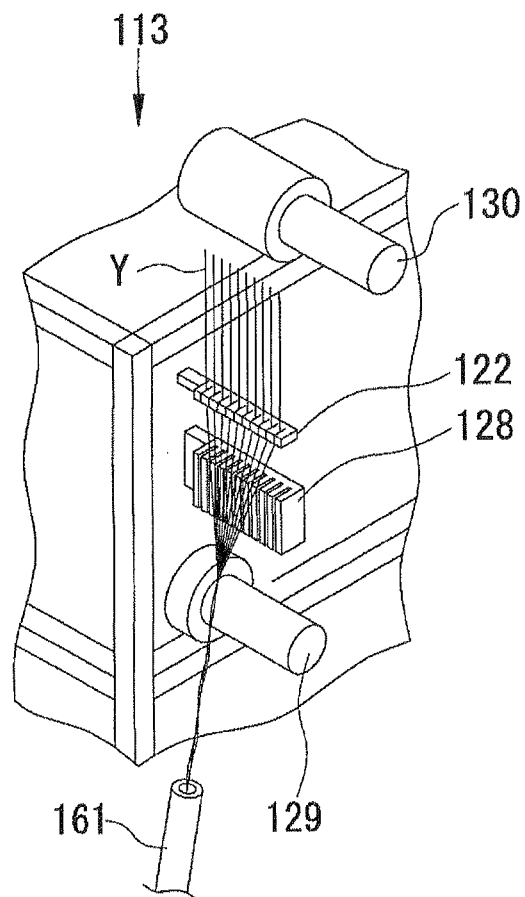


FIG. 16B





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