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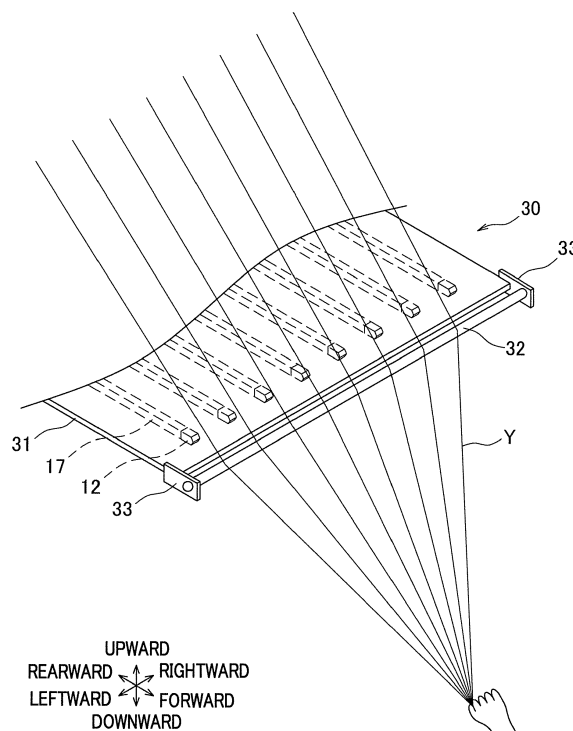
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(54) **YARN PRODUCTION SYSTEM**

(57) Static electricity generated due to contact of yarns with a metal member is suppressed during yarn threading in a yarn production system. A yarn production system in which yarns Y made of synthetic resin and spun out from a spinning apparatus are wound by a winding device includes: a metal member 32 which is used in yarn threading of threading the yarns Y spun out from the spinning apparatus to the winding device and members along a yarn path and makes contact with the yarns Y; and an insulator 33 which prevents static electricity generated in the metal member 32 due to contact with the yarns Y from escaping from the metal member 32 to a ground plane.

FIG.4



Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a yarn production system in which yarns made of synthetic resin and spun out from a spinning apparatus are wound by a winding device.

[0002] In a yarn production system in which yarns made of synthetic resin and spun out from a spinning apparatus are wound by a winding device, yarn threading of threading yarns spun out from the spinning apparatus to the winding device and members along a yarn path is required at the start of the production. As described in Patent Literature 1 (Japanese Patent No. 6291049), a typical yarn production system is arranged such that a spinning apparatus is provided on the second floor of a building (hereinafter, second floor) whereas a winding device is provided on the first floor of the building (hereinafter, first floor). In the yarn threading, to begin with, the yarns are taken down from the second floor to the first floor, and are threaded in order onto guides and godet rollers which are provided along a yarn path. In order to facilitate the yarn threading, several members are used in the yarn threading.

[0003] For example, in order to prevent the yarns from being disadvantageously hooked at an oil supply guide on the second floor when the yarns are taken down from the second floor to the first floor, an auxiliary cover is provided to cover the oil supply guide. This auxiliary cover is made of a metal material such as stainless steel, in consideration of the strength, cost, etc. On this account, when the yarns make contact with the leading end of the auxiliary cover when the yarns are taken down, static electricity is generated in the yarns due to frictional electrification. Apart from the auxiliary cover in the example above, when a member used in the yarn threading is a metal member, static electricity is also generated due to the contact of the yarns with the metal member. Such static electricity generated due to the contact of yarns with a metal member in yarn threading, however, was negligibly small in amount and no special countermeasure was taken.

SUMMARY OF THE INVENTION

[0004] However, depending on the material of yarns, for example, static electricity generated in the yarns may not be negligibly small in amount. In such a case, yarn shaking may occur due to the repulsion between yarns or yarn split may occur due to the repulsion between filaments in a single yarn, with the result that yarn threading cannot be properly done. Under this circumstance, it is demanded to suppress as much as possible the generation of static electricity in yarns due to the contact of the yarns with a metal member in yarn threading. The generation of static electricity is typically suppressed by employing a member made of ceramic as a member in con-

tact with yarns. Ceramic, however, is easily damaged and expensive. The use of ceramic is therefore an unrealistic solution.

[0005] The present invention has been done to solve the problem above, and an object of the present invention is to suppress static electricity generated due to contact of yarns with a metal member during yarn threading in a yarn production system.

[0006] The present invention relates to a yarn production system in which yarns made of synthetic resin and spun out from a spinning apparatus are wound by a winding device includes: a metal member which is used in yarn threading of threading the yarns spun out from the spinning apparatus to the winding device and members along a yarn path, the metal member making contact with the yarns; and an insulator which prevents static electricity generated in the metal member due to contact with the yarns from escaping from the metal member to a ground plane.

[0007] In the measurement of static electricity generated in yarns, the inventors found that an amount of static electricity increased in proportion to the time of contact between the yarns and a metal member. Through a diligent study, the inventors concluded that the reason of the proportional increase was that the metal member was unintentionally grounded. That is to say, static electricity is generated not only in the yarns but also in the metal member due to the contact between the yarns and the metal member, but the static electricity generated in the metal member is able to escape to the ground plane. A state in which the movement of electrons between the yarns and the metal member tends to occur is therefore maintained, with the result that an amount of static electricity in the yarns increases as the time of the contact between the yarns and the metal member increases. Under this circumstance, the insulator was provided to prevent static electricity generated in the metal member from escaping from the metal member to the ground plane. With this arrangement, the static electricity tended to saturate in the metal member, and the movement of electrons between the yarns and the metal member became suppressed. The amount of the static electricity in the yarns was therefore suppressed to a predetermined amount.

[0008] According to the first aspect of the present invention, the yarn production system further includes: oil supply guides which are provided below the spinning apparatus and apply oil to the yarns; and an auxiliary cover provided to cover the oil supply guides in the yarn threading, the auxiliary cover including: a cover main body; and a contact member which temporarily makes contact with the yarns in the yarn threading, the insulator being provided between the contact member which is the metal member and the ground plane.

[0009] In this first aspect, static electricity is generated in both the yarns and the contact member as the yarns make contact with the contact member of the auxiliary cover in the yarn threading. However, because the con-

tact member is insulated from the ground plane by the insulator, the static electricity becomes saturated in the contact member. It is therefore possible to suppress the static electricity in the yarns to a predetermined amount.

[0010] According to the first aspect of the present invention, the insulator is preferably provided between the contact member and the cover main body.

[0011] As the insulator is provided between the contact member and the cover main body, i.e., provided at a location close to the contact member, saturation of the static electricity is facilitated in the contact member. It is therefore possible to effectively suppress the static electricity in the yarns.

[0012] According to the first aspect of the present invention, preferably, the contact member is supported by the cover main body through a holder member which is made of an insulative material and the holder member functions as the insulator.

[0013] Because the holder member functions as the insulator, no dedicated member is required in addition to the holder member.

[0014] According to the first aspect of the present invention, preferably, the contact member is supported by the cover main body through a holder member, and the insulator is provided between the holder member and the cover main body.

[0015] When the insulator is provided between the holder member and the cover main body in this way, the insulator is advantageously a simple member such as a spacer.

[0016] According to the first aspect of the present invention, preferably, the contact member is a rod-shaped member which extends at least in a direction in which the oil supply guides are aligned, a cap member made of an insulative material is attached to an end portion of the contact member and the contact member is supported by the cover main body through the cap member, and the cap member functions as the insulator.

[0017] Because the cap member which is the insulator is attached to the contact member, attachment of the insulator can be easily done.

[0018] According to the first aspect of the present invention, preferably, the contact member is a rod-shaped member which extends at least in a direction in which the oil supply guides are aligned, a supported member made of an insulative material is joined with an end portion of the contact member and the contact member is supported by the cover main body through the supported member, and the supported member functions as the insulator.

[0019] As such, because the supported member functioning as the insulator is integrated with the contact member, a step of attaching the insulator is unnecessary.

[0020] According to the first aspect of the present invention, preferably, the contact member is attached to the cover main body without being in contact with the cover main body, by a fastening member which is made of an insulative material, and the fastening member func-

tions as the insulator.

[0021] Because the fastening member by which the contact member is attached to the cover main body functions as the insulator, members such as the holder members are unnecessary, and hence the number of components can be reduced.

[0022] According to the second aspect of the present invention, the yarn production system further includes: a separation guide which defines intervals of the yarns; an auxiliary member which makes contact with the yarns and moves the yarns when the yarns are threaded to the separation guide in the yarn threading; and a supporter which supports the auxiliary member to be movable, the insulator being provided between the auxiliary member which is the metal member and the ground plane.

[0023] In this second aspect, static electricity is generated in both the yarns and the auxiliary member as the auxiliary member makes contact with the yarns in the yarn threading. However, because the auxiliary member is insulated from the ground plane by the insulator, the static electricity becomes saturated in the auxiliary member. It is therefore possible to suppress the static electricity in the yarns to a predetermined amount.

[0024] According to the second aspect of the present invention, preferably, the auxiliary member temporarily makes contact with the yarns when the yarns are threaded to the separation guide in the yarn threading.

[0025] When the auxiliary member makes contact with the yarns only temporarily in the yarn threading to the separation guide, the static electricity in the yarns is further effectively suppressed.

[0026] According to the second aspect of the present invention, preferably, the insulator is provided between the auxiliary member and the supporter.

[0027] As the insulator is provided between the auxiliary member and the supporter, i.e., provided at a location close to the auxiliary member, saturation of the static electricity is facilitated in the auxiliary member. It is therefore possible to effectively suppress the static electricity in the yarns.

[0028] According to the second aspect of the present invention, preferably, the auxiliary member is supported by the supporter through a holder member made of an insulative material, and the holder member functions as the insulator.

[0029] Because the holder member functions as the insulator, no dedicated member is required in addition to the holder member.

[0030] According to the second aspect of the present invention, preferably, the auxiliary member is supported by the supporter through a holder member, and the insulator is provided between the holder member and the supporter.

[0031] When the insulator is provided between the holder member and the supporter in this way, the insulator is advantageously a simple member such as a spacer.

[0032] According to the second aspect of the present

invention, preferably, the auxiliary member is a rod-shaped member which extends at least in a direction in which the yarns are aligned at the separation guide, a cap member made of an insulative material is attached to an end portion of the auxiliary member and the auxiliary member is supported by the supporter through the cap member, and the cap member functions as the insulator.

[0033] Because the cap member which is the insulator is attached to the auxiliary member, attachment of the insulator can be easily done.

[0034] According to the second aspect of the present invention, preferably, the auxiliary member is a rod-shaped member which extends at least in a direction in which the yarns are aligned at the separation guide, a supported member made of an insulative material is joined with an end portion of the auxiliary member and the auxiliary member is supported by the supporter through the supported member, and the supported member functions as the insulator.

[0035] As such, because the supported member functioning as the insulator is integrated with the auxiliary member, a step of attaching the insulator is unnecessary.

[0036] According to the second aspect of the present invention, preferably, the auxiliary member is attached to the supporter without being in contact with the supporter, by a fastening member which is made of an insulative material, and the fastening member functions as the insulator.

[0037] Because the fastening member by which the auxiliary member is attached to the supporter functions as the insulator, members such as the holder members are unnecessary, and hence the number of components can be reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0038]

FIG. 1 is a schematic diagram of a yarn production system of an embodiment.

FIG. 2 is a side view showing a state of an auxiliary cover in package production.

FIG. 3 is a side view showing a state of the auxiliary cover in yarn threading.

FIG. 4 is a perspective view showing a state of the auxiliary cover in yarn threading.

FIG. 5 is a perspective view showing a state in which an auxiliary member is at a standby position.

FIG. 6 is a perspective view showing a state in which the auxiliary member is at a contact position.

FIG. 7 is a perspective view showing a state in which an auxiliary member of a modification is at a contact position.

FIG. 8 is a perspective view showing a state in which the auxiliary member of the modification is at a standby position.

FIG. 9(a) shows a chemical formula of nylon 6 and FIG. 9(b) shows a chemical formula of PET-cation.

FIG. 10 shows a graph indicating measurement results of an amount of static electricity in yarns.

FIG. 11 shows a first modification of an arrangement for insulating the auxiliary member.

FIG. 12 shows a second modification of the arrangement for insulating the auxiliary member.

FIG. 13 shows a third modification of the arrangement for insulating the auxiliary member.

FIG. 14 shows a modification of an arrangement for insulating a contact member of an auxiliary cover.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

(Outline of Structure)

[0039] The following will describe an embodiment of the present invention. FIG. 1 is a schematic diagram of a yarn production system of the present embodiment. The yarn production system 1 is divided into a first floor (lower floor) and a second floor (upper floor) by a partition floor 2. The yarn production system 1 is configured to produce packages P in such a way that yarns Y made of synthetic resin and spun out from a spinning apparatus 3 on the second floor are wound by a winding device 4 on the first floor. In the yarn production system 1, plural spinning apparatuses 3 and plural winding devices 4 are aligned in the direction perpendicular to the plane of FIG. 1. For convenience of explanation, an up-down direction in FIG. 1 is regarded as the up-down direction of the yarn production system 1, a left-right direction in FIG. 1 is regarded as the front-rear direction of the yarn production system 1, and a direction perpendicular to the plane of FIG. 1 is regarded as the left-right direction of the yarn production system 1.

[0040] The spinning apparatus 3 is provided on the second floor and includes spinnerets 10 which are aligned in the left-right direction. As hot molten polymer is pushed out from the spinnerets 10, plural yarns Y are spun out from a single spinning apparatus 3. To be exact, narrow fibers immediately after being spun out from a spinneret 10 are called filaments. The filaments spun out from a single spinneret 10 are combined by a later-described oil supply guide 12 into a single yarn Y. In the present embodiment, eight yarns Y are spun out from the spinning apparatus 3 having eight spinnerets 10 and eight packages P are formed by the winding device 4. The number of the yarns and the number of the packages may be suitably changed.

[0041] Below the spinning apparatus 3, cooling cylinders 11 and oil supply guides 12 are aligned in the left-right direction to correspond to the spinnerets 10. Each cooling cylinder 11 is provided directly below the corresponding spinneret 10. When passing through the cooling cylinders 11, the yarns Y spun out from the spinnerets 10 are cooled by gas supplied to the cooling cylinders 11 and solidified. The oil supply guides 12 are provided below the cooling cylinders 11. The oil supply guides 12 apply oil to the yarns Y having been solidified at the cool-

ing cylinders 11.

[0042] In the partition floor 2, an opening 2a is formed to connect the first floor with the second floor. A separation guide 13 is provided directly below the opening 2a. The separation guide 13 is a comb teeth guide by which the yarns Y taken down from the second floor through the opening 2a are arranged at predetermined intervals. Godet rollers 14 and 15 are provided downstream of the separation guide 13 in the yarn running direction.

[0043] Each of the godet rollers 14 and 15 is rotationally driven by an unillustrated motor. The yarns Y are fed to the winding device 4 by the godet rollers 14 and 15. Among the godet rollers 14 and 15, the godet roller 14 which is the upstream roller in the yarn running direction is provided substantially directly below the separation guide 13. Meanwhile, the godet roller 15 which is the downstream roller in the yarn running direction is arranged to be movable between a yarn threading position which is close to the godet roller 14 (i.e., a position indicated by a two-dot chain line in FIG. 1) and a package production position directly above the winding device 4 (i.e., a position indicated by a full line in FIG. 1).

[0044] The winding device 4 includes members such as a turret 21, two bobbin holders 22, a traverse unit 23, and a contact roller 24. By the turret 21, the two bobbin holders 22 are rotatably supported. As the turret 21 rotates, the positions of the two bobbin holders 22 are changed upside down. To each bobbin holder 22, bobbins B are attached. The traverse unit 23 includes traverse guides 23a which correspond to the respective bobbins B attached to the bobbin holder 22. As each traverse guide 23a reciprocates, the yarn Y is wound onto the bobbin B while being traversed about a corresponding fulcrum guide 25, with the result that a package P is formed. The contact roller 24 makes contact with the packages P formed on the upper bobbin holder 22 to apply contact pressure to each package P.

(Yarn Threading)

[0045] At the start of the production of packages P by the yarn production system 1 structured as described above, it is necessary to perform yarn threading of threading yarns Y spun out from the spinning apparatus 3 onto the winding device 4 and members along a yarn path. In the yarn threading, to begin with, yarns Y spun out from the spinning apparatus 3 are taken down by an operator on the second floor to the first floor through the opening 2a, and an operator on the first floor sucks and retains, by a suction gun, the yarns Y having been taken down. Subsequently, the yarns Y sucked and retained by the operator using the suction gun are threaded to the separation guide 13, the godet rollers 14 and 15, and the winding device 4 in order.

[0046] In order to facilitate the yarn threading, several members are temporarily used in the yarn threading. Examples of such members include an auxiliary cover which covers the oil supply guides 12 during the yarn threading

and an auxiliary member which is utilized when the yarns Y are threaded to the separation guide 13. The auxiliary cover and the auxiliary member are typically made of a metal material such as stainless steel, in consideration of the strength, cost, etc. On this account, static electricity may be generated in the yarns due to frictional electrification as a result of the contact of the yarns Y with the auxiliary cover or the auxiliary member during the yarn threading, and such static electricity may cause a problem in the yarn threading. As a solution to this problem, the auxiliary cover and the auxiliary member are arranged to be able to suppress the generation of static electricity in the yarns Y. The arrangements of these members will be detailed later.

(Auxiliary Cover)

[0047] To begin with, the auxiliary cover will be explained. FIG. 2 is a side view showing a state of the auxiliary cover 30 in package production. FIG. 3 is a side view showing a state of the auxiliary cover 30 in yarn threading. FIG. 4 is a perspective view showing the state of the auxiliary cover 30 in yarn threading.

[0048] The oil supply guides 12 are aligned in the left-right direction to correspond to the spinnerets 10. Each oil supply guide 12 is connected to an oil supply unit 17. The oil supply unit 17 extends in the front-rear direction, i.e., extends forward and substantially horizontally from a frame 5 which is provided on the second floor. The oil supply guide 12 is attached to a front end portion of the oil supply unit 17. The oil supply guide 12 has a guiding surface 12a in which an unillustrated oil discharge port is formed. The oil supply unit 17 is connected to an unillustrated oiling device. Oil from the oiling device is supplied from the oil discharge port to the guiding surface 12a.

[0049] As shown in FIG. 2, the oil supply guide 12 is positioned slightly forward as compared to the spinneret 10. In package production, the yarns Y make contact with the guiding surface 12a and are bent. With this arrangement, the yarns Y are pressed onto the guiding surface 12a in package production, and hence the oil supplied to the guiding surface 12a is applied to the yarns Y. The oil supply unit 17 may not extend forward, and may extend in another direction (e.g., rearward or in an oblique direction). As long as the yarns Y are bent at the guiding surface 12a, the oil supply guide 12 may be provided directly below the spinneret 10 or slightly rearward as compared to the spinneret 10.

[0050] Plural oil discharge members 18 are aligned in the left-right direction to correspond to the oil supply guides 12. Each oil discharge member 18 is provided below the corresponding oil supply guide 12. The oil discharge member 18 extends forward and slightly upward from the frame 5. A front end portion of the oil discharge member 18 has an opening at an upper portion so as to be able to receive the oil trickling from the oil supply guide 12. The oil received by the front end portion of the oil

discharge member 18 is discharged through the oil discharge member 18. The oil discharge member 18 is omitted from FIG. 4.

[0051] As such, the oil supply guides 12, the oil supply units 17, and the oil discharge members 18 are provided below the spinning apparatus 3. Because of this arrangement, if the yarns Y spun out downward from the spinning apparatus 3 are simply taken down to the first floor, the yarns Y tend to be entwined around the members 12, 17, and 18. In this way, the yarns Y may not be successfully taken down. In order to easily take down the yarns Y, the auxiliary cover 30 is provided.

[0052] The auxiliary cover 30 is attached to a cover attachment 38 fixed to the frame 5 to be swingable in the front-rear direction about a hinge 39 having the axis extending in the left-right direction. The auxiliary cover 30 is movable between a retracted position (shown in FIG. 2) where the auxiliary cover 30 does not cover the oil supply guides 12 and a covering position (shown in FIG. 3) where the auxiliary cover 30 covers the oil supply guides 12. As shown in FIG. 2, in package production, the auxiliary cover 30 is maintained at the retracted position in order to prevent the yarns Y from interfering with the auxiliary cover 30. Meanwhile, as shown in FIG. 3 and FIG. 4, in yarn threading, the auxiliary cover 30 is positioned at the covering position in order to prevent the yarns Y from being entwined with the members 12, 17, and 18. The auxiliary cover 30 at the covering position is directly below the spinning apparatus 3 and directly above the oil supply guide 12.

[0053] The auxiliary cover 30 includes a cover main body 31, a contact member 32, and two holder members 33. The cover main body 31 is a plate-shaped member made of stainless steel and is a portion covering the members 12, 17, and 18. The contact member 32 is a rod-shaped member which extends in the left-right direction and is made of stainless steel. The contact member 32 is provided on the leading end side of the cover main body 31 (i.e., on the side opposite to the hinge 39) to be slightly separated from the cover main body 31. The holder members 33 are provided to support the contact member 32. The two holder members 33 are fixed to the left and right leading end portions of the cover main body 31 by unillustrated bolts, for example. The left and right end portions of the contact member 32 are attached to the left and right holder members 33, respectively. In this way, the contact member 32 is supported by the cover main body 31 through the two holder members 33.

[0054] In yarn threading, as shown in FIG. 3 and FIG. 4, the auxiliary cover 30 is moved to the covering position so that the members 12, 17, and 18 are covered with the auxiliary cover 30. In this state, the yarns Y spun out downward from the spinning apparatus 3 drop on the cover main body 31 of the auxiliary cover 30. The operator on the second floor collects the yarns Y having dropped on the auxiliary cover 30, and takes the yarns Y down to the first floor through the opening 2a. After the yarns Y are sucked and retained by the operator on the

first floor by using the suction gun and the yarns Y become tensioned, as shown in FIG. 2, the operator on the second floor returns the auxiliary cover 30 to the retracted position and threads the yarns Y to the oil supply guides 12.

[0055] When the yarns Y are taken down to the first floor, as shown in FIG. 3 and FIG. 4, static electricity is generated in the yarns Y because the yarns Y make contact with the leading end portion of the auxiliary cover 30, i.e., the contact member 32. In the present embodiment, an amount of static electricity generated in the yarns Y is suppressed to a predetermined amount, because the holder members 33 are made of an insulative material such as resin, for example. In other words, the holder members 33 function as an insulator of the present invention. A mechanism of suppressing an amount of static electricity generated in the yarns Y to a predetermined amount will be detailed later.

(Auxiliary Member)

[0056] The following will describe the auxiliary member. FIG. 5 is a perspective view showing a state in which the auxiliary member 40 is at a standby position. FIG. 6 is a perspective view showing a state in which the auxiliary member 40 is at a contact position. The separation guide 13 is a comb teeth guide in which the yarn threading portions 13a are aligned in the left-right direction, and the separation guide 13 is fixed to an unillustrated frame and is at a location directly below the opening 2a. Each yarn threading portion 13a is a slit which is open forward. As the yarns Y are inserted into the respective yarn threading portions 13a from the front side, the yarns Y are threaded to the separation guide 13.

[0057] The yarns Y taken down from the second floor to the first floor in the yarn threading are sucked and retained by an operator on the first floor by using a suction gun S. The yarns Y before threaded to the separation guide 13 therefore form a triangle connecting the spinnerets 10 on the second floor to the suction gun S (see FIG. 5). On this account, the intervals of the yarns Y vary in the up-down direction. It is therefore difficult to thread the yarns Y to the separation guide 13. The auxiliary member 40 is provided to facilitate threading of the yarns Y to the separation guide 13.

[0058] The auxiliary member 40 is a rod-shaped member which extends in the left-right direction, is made of stainless steel, and is cantilevered by a holder member 41. The holder member 41 is fixed to the supporter 42 by an unillustrated bolt, for example. The supporter 42 is rotatable about a supporting shaft 42a which extends in the left-right direction. The auxiliary member 40 is therefore arranged to be rotatable about the supporting shaft 42a. The auxiliary member 40 is movable between a standby position (see FIG. 5) which is positioned forward of the separation guide 13 and a contact position (see FIG. 6) which is positioned rearward of and above the front end portion of each of the yarn threading portions

13a of the separation guide 13 (i.e., openings of the yarn threading portions 13a). Alternatively, the contact position of the auxiliary member 40 may be positioned rearward of and below the front end portion of each of the yarn threading portions 13a of the separation guide 13. The supporter 42 is rotatably attached to an unillustrated frame through the supporting shaft 42a.

[0059] When the yarns Y are threaded to the separation guide 13, to begin with, the auxiliary member 40 is positioned at the standby position as shown in FIG. 5. The operator sucking and retaining the yarns Y by using the suction gun S moves the suction gun S so that the yarns Y are positioned between the auxiliary member 40 and the separation guide 13. Furthermore, the operator appropriately adjusts the vertical position of the suction gun S with the intension of causing the auxiliary member 40 to insert the yarns Y into the yarn threading portions 13a after the auxiliary member 40 is moved to the contact position later.

[0060] Once the position adjustment of the suction gun S is finished, the operator moves the auxiliary member 40 from the standby position to the contact position. As a result, on the upstream of the separation guide 13 in the yarn running direction, the auxiliary member 40 makes contact with the yarns Y from the front side, as shown in FIG. 6. Because the position of the suction gun S is adjusted in advance as described above, the yarns Y are pushed into the yarn threading portions 13a as the auxiliary member 40 is moved to the contact position. In this way, the yarns Y are easily threaded to the separation guide 13. After the completion of the threading of the yarns to the separation guide 13, the auxiliary member 40 is preferably maintained at the contact position in order to prevent the yarns Y from being detached from the separation guide 13. As long as the auxiliary member 40 prevents the yarns Y from being detached from the separation guide 13, the auxiliary member 40 may not be kept in contact with the yarns Y. When it is unlikely that the yarns Y are detached from the separation guide 13, the auxiliary member 40 may be returned to the standby position.

[0061] The specific locations and use of the auxiliary member 40 are not limited to those described above. FIG. 7 is a perspective view showing a state in which an auxiliary member 40 of a modification is at a contact position. FIG. 8 is a perspective view showing a state in which the auxiliary member 40 of the modification is at a standby position. In this modification, the contact position of the auxiliary member 40 is positioned forward of the separation guide 13 (see FIG. 7) whereas the standby position of the auxiliary member 40 is positioned rearward of and below the front end portion of each of the yarn threading portions 13a of the separation guide 13 (i.e., openings of the yarn threading portions 13a). Alternatively, the standby position of the auxiliary member 40 may be positioned rearward of and above the front end portion of each of the yarn threading portions 13a of the separation guide 13.

[0062] When the yarns Y are threaded to the separation guide 13, to begin with, the auxiliary member 40 is positioned at the contact position as shown in FIG. 7. Subsequently, the operator adjusts the position of the suction gun S to cause the yarns Y to make contact with the auxiliary member 40 from the front side. The yarns Y are bent due to the contact with the auxiliary member 40, and a tension is exerted to push the auxiliary member 40 rearward. As the auxiliary member 40 in this state is moved to the standby position, as shown in FIG. 8, the yarns Y in contact with the auxiliary member 40 are moved rearward and are inserted into the yarn threading portions 13a. The auxiliary member 40 is detached from the yarns Y during the movement to the standby position. In this modification, after the completion of the yarn threading to the separation guide 13, the auxiliary member 40 is maintained at the standby position.

[0063] As shown in FIG. 6 or FIG. 7, static electricity is generated in the yarns Y due to the contact of the yarns Y with the auxiliary member 40. In the present embodiment, an amount of static electricity generated in the yarns Y is suppressed to a predetermined amount, because the holder member 41 is made of an insulative material such as resin, for example. In other words, the holder member 41 functions as an insulator of the present invention. A mechanism of suppressing an amount of static electricity generated in the yarns Y to a predetermined amount will be detailed later.

(Suppression of Static Electricity)

[0064] Due to the contact of the contact member 32 of the auxiliary cover 30 with the yarns Y or the frictional contact of the auxiliary member 40 with the yarns Y, electrons move between the yarns Y and the contact member 32 or the auxiliary member 40, with the result that static electricity is generated in the yarns Y. In the present embodiment, the contact member 32 and the auxiliary member 40 are made of stainless steel, whereas the yarns Y are made of nylon 6 (PA6) having a chemical formula shown in FIG. 9(a) or PET (polyethylene terephthalate)-cation having a chemical formula shown in FIG. 9(b). Because nylon 6 and PET-cation are significantly different from stainless steel in the triboelectric series, an amount of static electricity in the yarns Y tends to be significantly large. For this reason, yarn shaking may occur due to the repulsion between yarns Y or yarn split may occur due to the repulsion between filaments in a single yarn Y, with the result that yarn threading cannot be properly done.

[0065] In the course of searching for a method of suppressing static electricity, the inventors measured an amount of static electricity generated in the yarns Y made of nylon 6 due to the contact with the auxiliary member 40. FIG. 10 is a graph showing results of the measurement. The elapsed time on the horizontal axis indicates the time elapsed from the start of the contact of the auxiliary member 40 with the yarns Y. As a result of the meas-

urement, it was found that, in a case of a conventional auxiliary member 40 made of stainless steel, an amount of static electricity in the yarns Y proportionally increased in accordance with the time of the contact with the auxiliary member 40 (see the conventional example in FIG. 10).

[0066] Through a diligent study, it is considered that the reason of the proportional increase is that the auxiliary member 40 is supported on the ground plane through several metal members, and hence the auxiliary member 40 is unintentionally grounded. That is to say, static electricity is generated not only in the yarns Y but also in the auxiliary member 40 due to the contact between the yarns Y and the auxiliary member 40, but the static electricity generated in the auxiliary member 40 is able to escape to the ground plane. A state in which the movement of electrons between the yarns Y and the auxiliary member 40 tends to occur is therefore maintained, with the result that an amount of static electricity in the yarns Y increases as the time of the contact between the yarns Y and the auxiliary member 40 increases.

[0067] Based on this consideration, in order to prevent the static electricity generated in the auxiliary member 40 from escaping from the auxiliary member 40 to the ground plane, the auxiliary member 40 made of stainless steel was insulated from the ground plane by supporting the auxiliary member 40 by the holder member 41 made of an insulative material, as described above. As a result of this, the amount of the static electricity in the yarns Y was constant at around 0.15 kV, and did not increase from this level (see the example in FIG. 10). This is presumably because, as the auxiliary member 40 is insulated from the ground plane, the static electricity tends to saturate in the auxiliary member 40, and the movement of electrons between the yarns Y and the auxiliary member 40 becomes suppressed.

[0068] The generation of static electricity can be suppressed by an auxiliary member 40 made of ceramic (see the reference example shown in FIG. 10). Ceramic, however, is easily damaged and expensive. The use of the auxiliary member 40 made of ceramic is therefore unrealistic. Meanwhile, insulating the auxiliary member 40 by supporting the auxiliary member 40 made of stainless steel by the holder member 41 made of an insulative material is a realistic solution and considerably effective.

[0069] In the present embodiment, an insulator (holder member 41) is provided between the auxiliary member 40 and the supporter 42. As the insulator is provided between the auxiliary member 40 and the supporter 42, i.e., provided at a location close to the auxiliary member 40, saturation of the static electricity is facilitated in the auxiliary member 40. It is therefore possible to effectively suppress the static electricity in the yarns Y.

[0070] In the present embodiment, the auxiliary member 40 is supported by the supporter 42 through the holder member 41 made of an insulative material, and hence the holder member 41 functions as an insulator. Because the holder member 41 functions as an insulator, no ded-

icated member is required in addition to the holder member 41.

[0071] While the auxiliary member 40 has been described, the contact member 32 of the auxiliary cover 30 is similarly arranged in the present embodiment. That is to say, the contact member 32 made of stainless steel is supported by the cover main body 31 through the holder members 33 made of an insulative material. An effect similar to the effect obtained when the auxiliary member 40 is supported by the holder member 41 is therefore obtained.

(Modifications of Insulator)

[0072] The embodiment above has described a case where the insulator of the present invention is holder members 33 and 41. The following will describe several modifications of the insulator.

(First Modification)

[0073] FIG. 11 shows a first modification of the arrangement for insulating the auxiliary member 40. In this modification, a plate-shaped insulator 43 which is made of, for example, resin is provided between the holder member 41 and the supporter 42. The insulator 43 is jointly fastened by a bolt 45 and a nut 46 by which the holder member 41 is fixed to the supporter 42.

[0074] With this arrangement, because the escape of static electricity from the holder member 41 to the supporter 42 is prevented, the escape of static electricity from the auxiliary member 40 is prevented. Static electricity escapes from the holder member 41 to the supporter 42 through the bolt 45 when the bolt 45 is made of a metal material. The bolt 45 is therefore required to be made of an insulative material. When the insulator 43 is provided between the holder member 41 and the supporter 42 in this way, the insulator 43 is advantageously a simple member such as a spacer.

[0075] The arrangement of this modification may be applied to the contact member 32 of the auxiliary cover 30. In other words, an insulator may be provided between the holder members 33 and the cover main body 31.

(Second Modification)

[0076] FIG. 12 shows a second modification of the arrangement for insulating the auxiliary member 40. In this modification, as shown in FIG. 12(a), a cap member 47 made of an insulative material (e.g., rubber) is attached to an end portion of the auxiliary member 40. Furthermore, as shown in FIG. 12(b), the auxiliary member 40 with the cap member 47 is attached to the holder member 41. As a result, the auxiliary member 40 is supported by the supporter 42 through the cap member 47 and the holder member 41. The holder member 41 may be made of a metal material.

[0077] With this arrangement, because the cap mem-

ber 47 functions as an insulator of the present invention, the escape of static electricity from the auxiliary member 40 to the holder member 41 is prevented. Furthermore, because the cap member 47 which is an insulator is attached to the auxiliary member 40, attachment of the insulator can be easily done. In this modification, the auxiliary member 40 with the cap member 47 is attached to the holder member 41. Alternatively, the holder member 41 may be omitted, and the auxiliary member 40 with the cap member 47 may be directly attached to the supporter 42. In other words, the auxiliary member 40 may be indirectly supported by the supporter 42 through the cap member 47 or directly supported by the supporter 42.

[0078] The arrangement of this modification may be applied to the contact member 32 of the auxiliary cover 30. In other words, a cap member formed of an insulator may be attached to an end portion of the contact member 32, and the contact member 32 may be supported by the cover main body 31 through the cap member. Also in this case, the contact member 32 may be indirectly supported by the cover main body 31 through the cap member or directly supported by the cover main body 31.

(Third Modification)

[0079] FIG. 13 shows a third modification of the arrangement for insulating the auxiliary member 40. In this modification, as shown in FIG. 13, a supported member 48 made of an insulative material (e.g., ceramic) is joined with an end portion of the auxiliary member 40. As the auxiliary member 40 with which the supported member 48 is joined is attached to the holder member 41, the auxiliary member 40 is supported by the supporter 42 through the supported member 48 and the holder member 41. The jointing may be done by using an adhesive, for example, but may be done in a different way. The holder member 41 may be made of a metal material.

[0080] With this arrangement, because the supported member 48 functions as an insulator of the present invention, the escape of static electricity from the auxiliary member 40 to the holder member 41 is prevented. Furthermore, because the supported member 48 functioning as an insulator is integrated with the auxiliary member 40, a step of attaching the insulator is unnecessary. In this modification, the auxiliary member 40 with which the supported member 48 is joined is attached to the holder member 41. Alternatively, the holder member 41 may be omitted, and the auxiliary member 40 with the supported member 48 may be directly attached to the supporter 42. In other words, the auxiliary member 40 may be indirectly supported by the supporter 42 through the supported member 48 or directly supported by the supporter 42.

[0081] The arrangement of this modification may be applied to the contact member 32 of the auxiliary cover 30. In other words, a supported member formed of an insulator may be attached to an end portion of the contact member 32, and the contact member 32 may be supported by the cover main body 31 through the supported

member. Also in this case, the contact member 32 may be indirectly supported by the cover main body 31 through the supported member or directly supported by the cover main body 31.

(Fourth Modification)

[0082] FIG. 14 shows a modification of the arrangement for insulating the contact member 32 of the auxiliary cover 30. In this modification, the contact member 32 is attached to the cover main body 31 without being in contact with the cover main body 31, by a bolt 34 (fastening member of the present invention) which is made of an insulative material (e.g., resin). To be more specific, the bolt 34 is inserted into an attaching portion 31a of the leading end portion of the cover main body 31 and the contact member 32, and the bolt 34 is fixed to the attaching portion 31a by a nut 35. The contact member 32 is positioned by nuts 36 and 37 screwed to the bolt 34 on the respective sides of the contact member 32.

[0083] With this arrangement, because the bolt 34 functions as an insulator of the present invention, the escape of static electricity from the contact member 32 to the cover main body 31 is prevented. Furthermore, because the bolt 34 by which the contact member 32 is attached to the cover main body 31 functions as an insulator, members such as the holder members 33 are unnecessary, and hence the number of components can be reduced. While in this modification a through hole is formed in the contact member 32 and the bolt 34 is inserted thereto, the contact member 32 may be fixed to the bolt 34 by forming a screw hole in the contact member 32 and screwing the bolt 34 into the screw hole.

[0084] The arrangement of this modification may be applied to the auxiliary member 40. That is to say, the auxiliary member 40 may be attached to the supporter 42 without being in contact with the supporter 42, by a fastening member such as a bolt made of an insulative material.

(Other Modifications)

[0085] The arrangement for insulating the contact member 32 of the auxiliary cover 30 and the auxiliary member 40 from the ground plane is not limited to those described above. For example, the contact member 32 may be insulated from the ground plane by arranging the hinge 39 attached to the auxiliary cover 30 to be made of an insulative material. In this regard, in order to effectively prevent static electricity from escaping from the contact member 32 and the auxiliary member 40, the insulator is preferably positioned to be as close as possible to the contact member 32 and the auxiliary member 40.

[0086] In the embodiment above, the contact member 32 of the auxiliary cover 30 and the auxiliary member 40 are fixed to the holder members 33 and 41. Alternatively, the contact member 32 and the auxiliary member 40 may

be passively rotatable about the respective axes. This reduces the friction with the yarns Y, with the result that the amount of the static electricity is further reduced.

[0087] In the embodiment above, the contact member 32 of the auxiliary cover 30 and the auxiliary member 40 are made of stainless steel, and the yarns Y are made of nylon 6 or PET-cation. Alternatively, the contact member 32 and the auxiliary member 40 may be made of metal which is not stainless steel, and the yarns Y may be made of synthetic resin which is neither nylon 6 nor PET cation.

[0088] The embodiment above deals with a case where the present invention is applied to the auxiliary cover 30 and the auxiliary member 40. When there is another metal member with which the yarns Y temporarily makes contact during yarn threading, the present invention can be applied to such a metal member, as a matter of course.

[0089] In the embodiment above, a series of operations in yarn threading, e.g., taking the yarns Y down from the second floor to the first floor and threading yarns to members such as the separation guide 13 and the godet rollers 14 and 15 on the first floor, are performed by the operator. Alternatively, at least one of these operations in the yarn threading may be automatically done by a machine. A machine for automatically taking yarns down from the second floor to the first floor may be a yarn take-down device recited in Japanese Patent No. 6291049, for example. A machine for automatically threading yarns to members such as the separation guide 13 and the godet rollers 14 and 15 may be a yarn threading robot recited in Japanese Laid-Open Patent Publication No. 2018-066088, for example.

Claims

1. A yarn production system (1), in which yarns (Y) made of synthetic resin and spun out from a spinning apparatus (3) are wound by a winding device (4), comprising:

a metal member (32, 40) which is used in yarn threading of threading the yarns (Y) spun out from the spinning apparatus (3) to the winding device (4) and members along a yarn path, the metal member (32, 40) making contact with the yarns (Y); and
an insulator (33, 34, 41, 43, 47, 48) which prevents static electricity generated in the metal member (32, 40) due to contact with the yarns (Y) from escaping from the metal member (32, 40) to a ground plane.

2. The yarn production system (1) as claimed in claim 1, further comprising:

oil supply guides (12) which are provided below

the spinning apparatus (3) and apply oil to the yarns (Y); and
an auxiliary cover (30) provided to cover the oil supply guides (12) in the yarn threading, the auxiliary cover (30) including:

a cover main body (31); and
a contact member (32) which temporarily makes contact with the yarns (Y) in the yarn threading,

the insulator (33, 34) being provided between the contact member (32) which is the metal member and the ground plane.

3. The yarn production system (1) as claimed in claim 2, wherein, the insulator (33, 34) is provided between the contact member (32) and the cover main body (31).
4. The yarn production system (1) as claimed in claim 3, wherein,
the contact member (32) is supported by the cover main body (31) through a holder member (33) which is made of an insulative material, and
the holder member (33) functions as the insulator.
5. The yarn production system (1) as claimed in claim 3, wherein,
the contact member (32) is supported by the cover main body (31) through a holder member (33), and
the insulator is provided between the holder member (33) and the cover main body (31).
6. The yarn production system (1) as claimed in claim 3, wherein,
the contact member (32) is a rod-shaped member which extends at least in a direction in which the oil supply guides (12) are aligned,
a cap member made of an insulative material is attached to an end portion of the contact member (32) and the contact member (32) is supported by the cover main body (31) through the cap member, and
the cap member functions as the insulator.
7. The yarn production system (1) as claimed in claim 3, wherein,
the contact member (32) is a rod-shaped member which extends at least in a direction in which the oil supply guides (12) are aligned,
a supported member made of an insulative material is joined with an end portion of the contact member (32) and the contact member (32) is supported by the cover main body (31) through the supported member, and
the supported member functions as the insulator.
8. The yarn production system (1) as claimed in claim

- 3, wherein,
the contact member (32) is attached to the cover main body (31) without being in contact with the cover main body (31), by a fastening member (34) which is made of an insulative material, and
the fastening member (34) functions as the insulator.
9. The yarn production system (1) as claimed in claim 1, further comprising:
- a separation guide (13) which defines intervals of the yarns (Y);
an auxiliary member (40) which makes contact with the yarns (Y) and moves the yarns (Y) when the yarns (Y) are threaded to the separation guide (13) in the yarn threading; and
a supporter (42) which supports the auxiliary member (40) to be movable,
the insulator (41, 43, 47, 48) being provided between the auxiliary member (40) which is the metal member and the ground plane.
10. The yarn production system (1) as claimed in claim 9, wherein, the auxiliary member (40) temporarily makes contact with the yarns (Y) when the yarns (Y) are threaded to the separation guide (13) in the yarn threading.
11. The yarn production system (1) as claimed in claim 9 or 10, wherein, the insulator (41, 43, 47, 48) is provided between the auxiliary member (40) and the supporter (42).
12. The yarn production system (1) as claimed in claim 11, wherein,
the auxiliary member (40) is supported by the supporter (42) through a holder member (41) made of an insulative material, and
the holder member (41) functions as the insulator.
13. The yarn production system (1) as claimed in claim 11, wherein,
the auxiliary member (40) is supported by the supporter (42) through a holder member (41), and
the insulator (43) is provided between the holder member (41) and the supporter (42).
14. The yarn production system (1) as claimed in claim 11, wherein,
the auxiliary member (40) is a rod-shaped member which extends at least in a direction in which the yarns (Y) are aligned at the separation guide (13),
a cap member (47) made of an insulative material is attached to an end portion of the auxiliary member (40) and the auxiliary member (40) is supported by the supporter (42) through the cap member (47), and
the cap member (47) functions as the insulator.
15. The yarn production system (1) as claimed in claim 11, wherein,
the auxiliary member (40) is a rod-shaped member which extends at least in a direction in which the yarns (Y) are aligned at the separation guide (13),
a supported member (48) made of an insulative material is joined with an end portion of the auxiliary member (40) and the auxiliary member (40) is supported by the supporter (42) through the supported member (48), and
the supported member (48) functions as the insulator.
16. The yarn production system (1) as claimed in claim 11, wherein,
the auxiliary member (40) is attached to the supporter (42) without being in contact with the supporter (42), by a fastening member which is made of an insulative material, and
the fastening member functions as the insulator.

FIG. 1

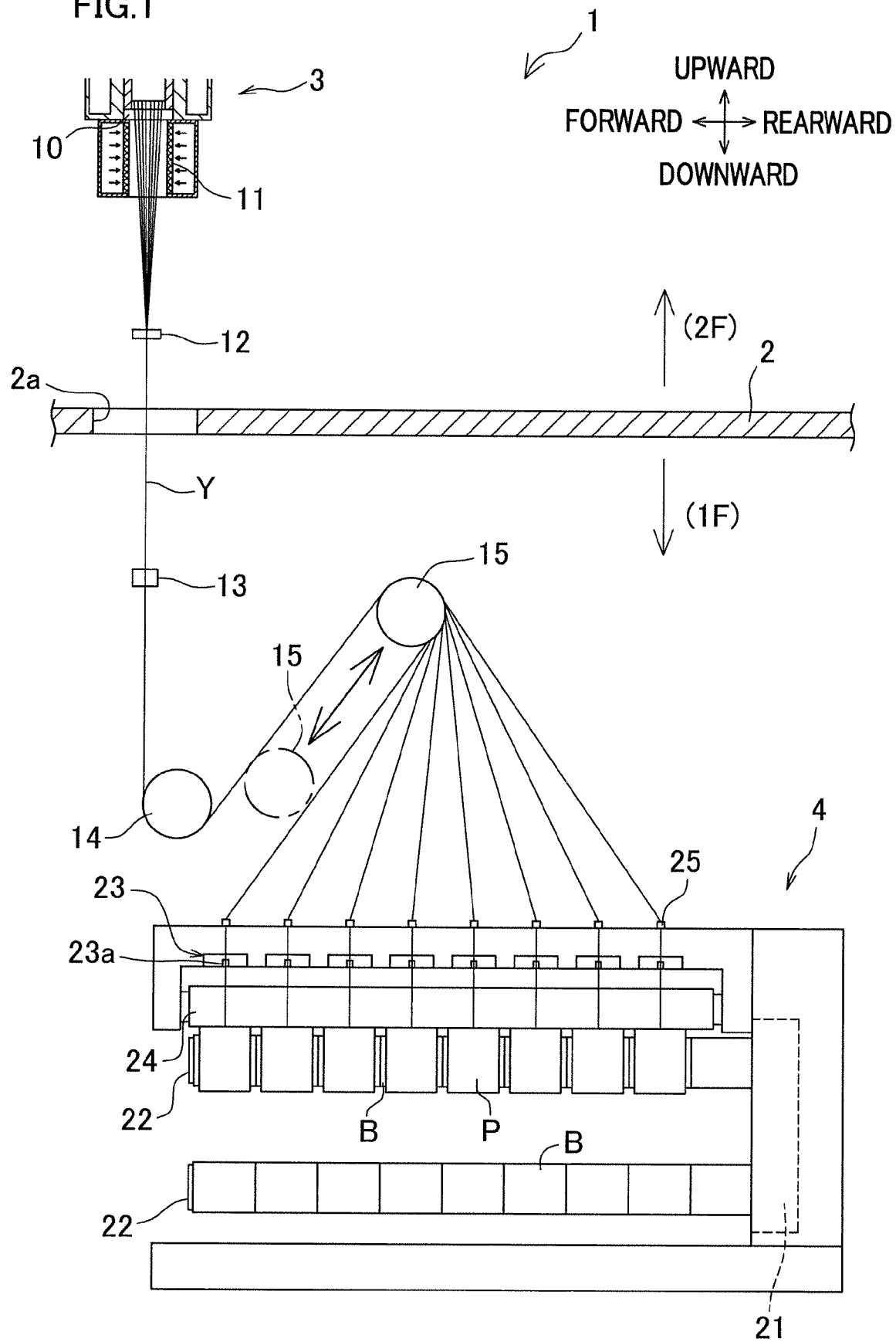


FIG.2

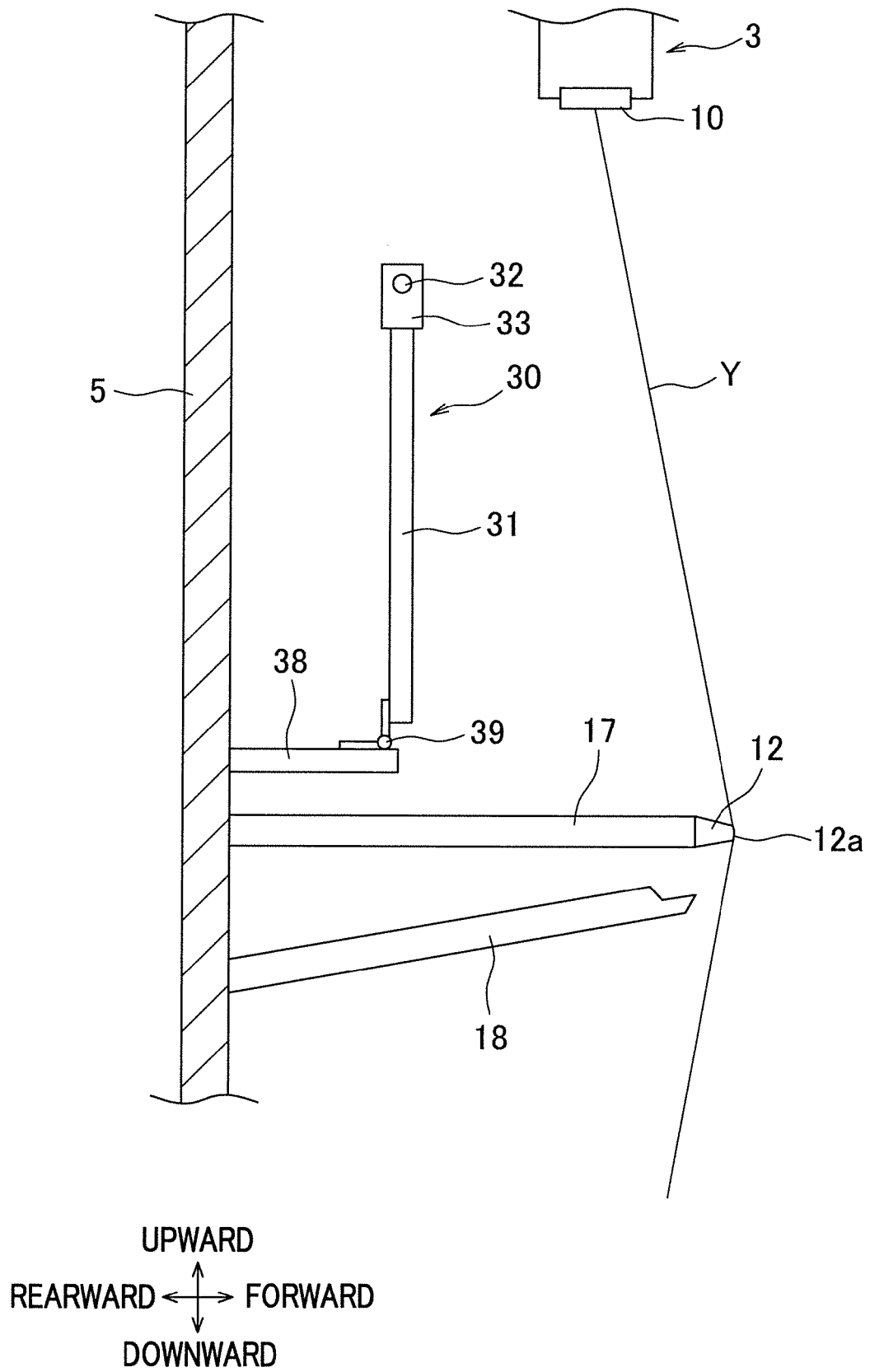


FIG.3

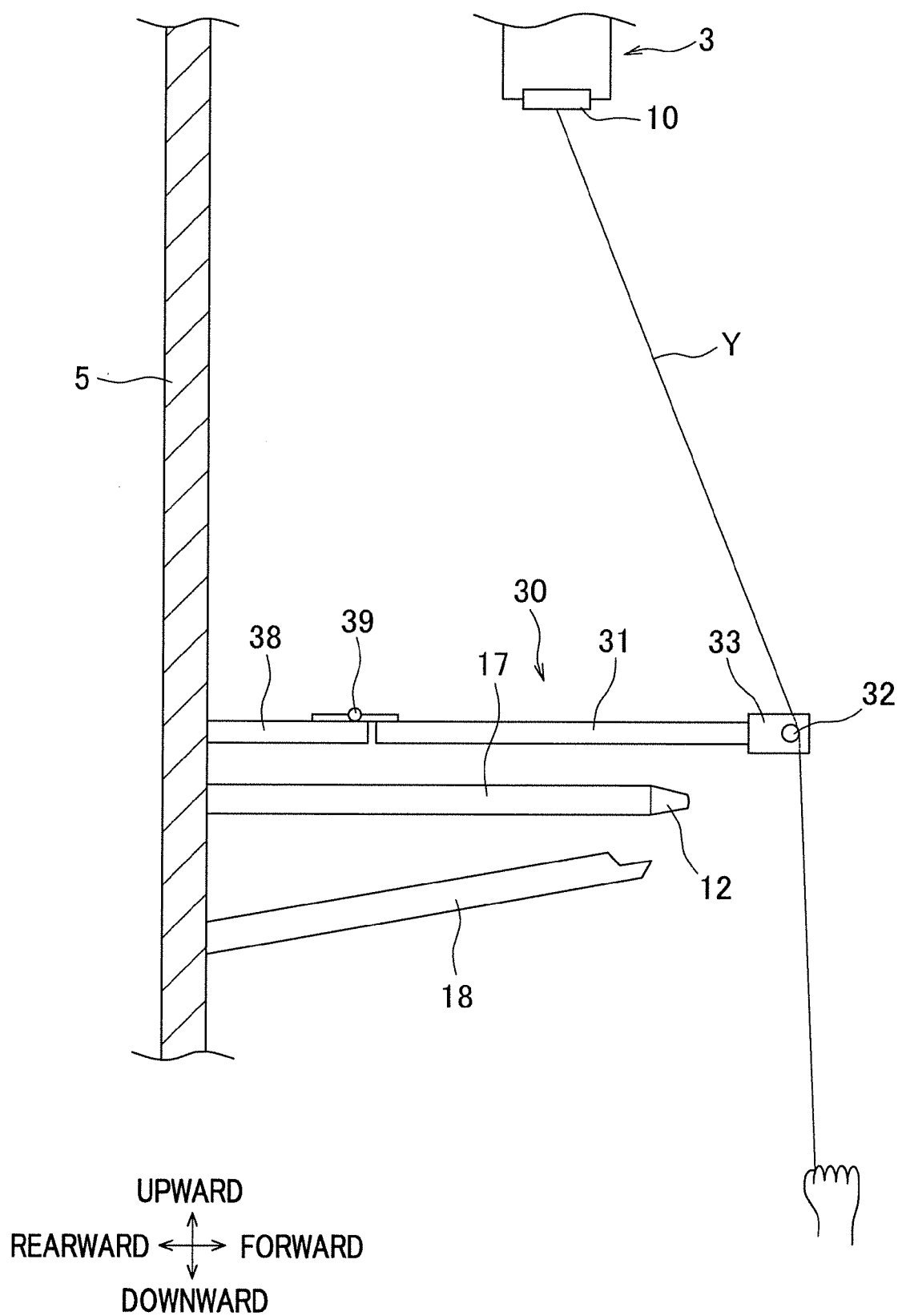


FIG.4

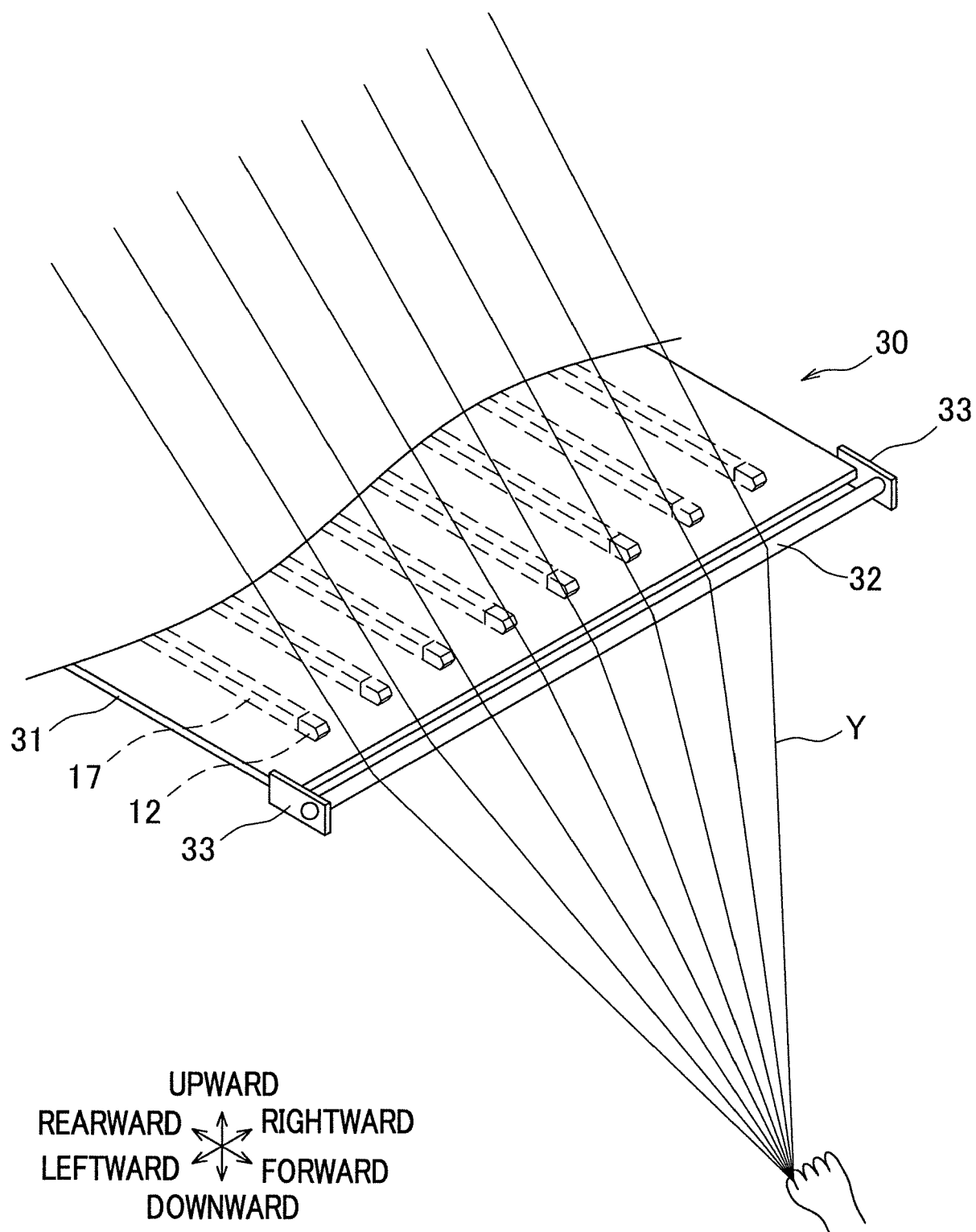


FIG.5

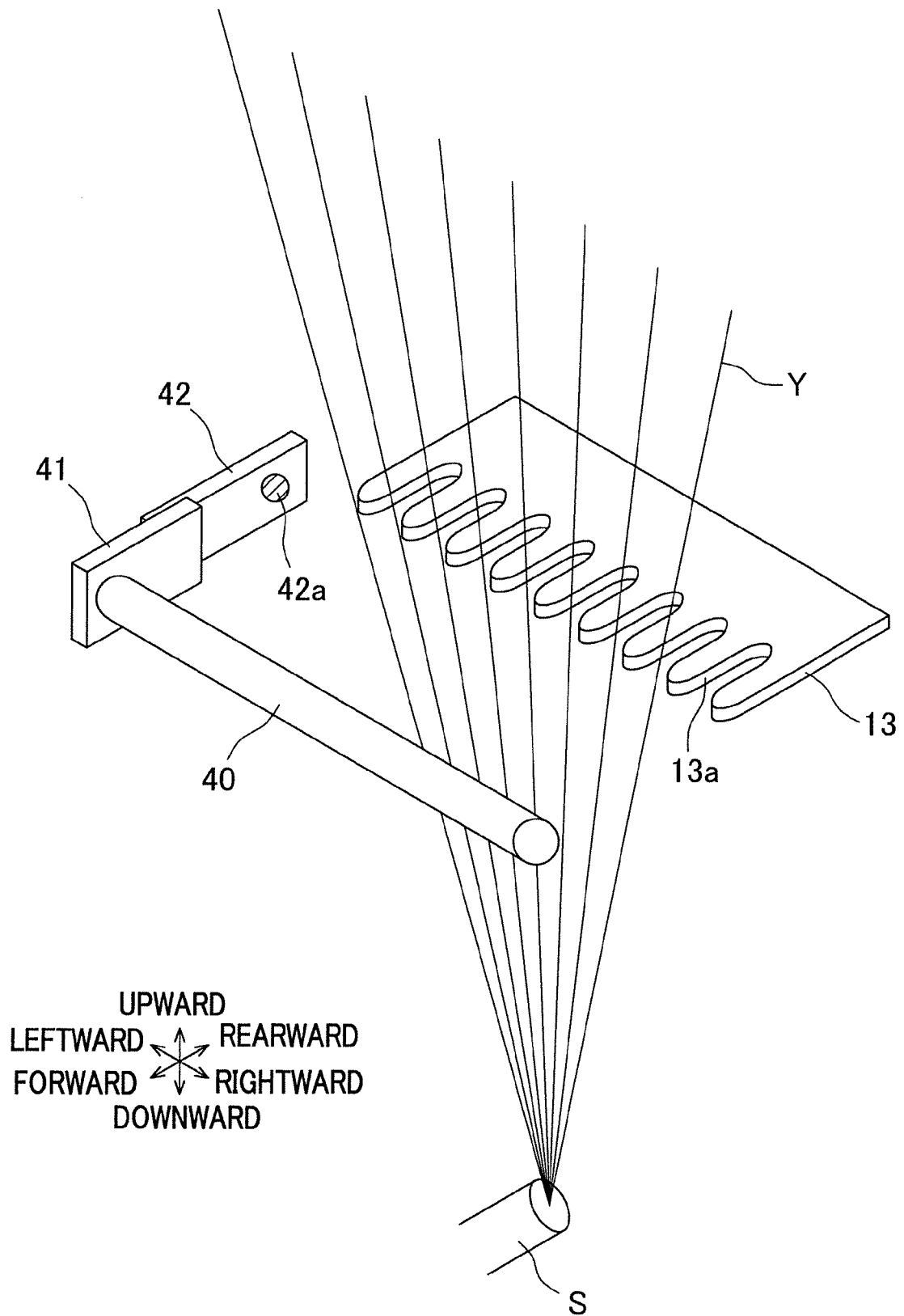


FIG.6

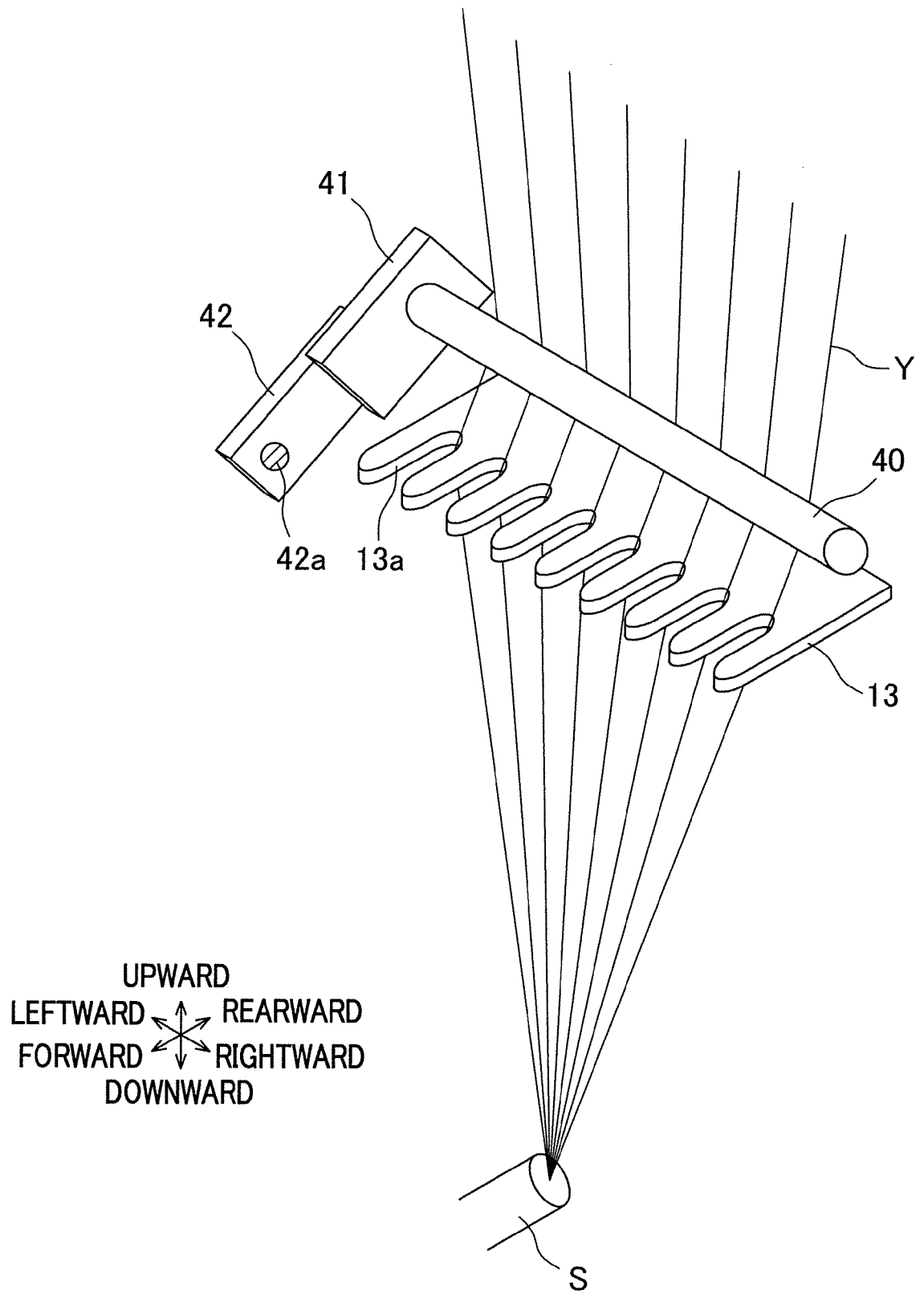


FIG. 7

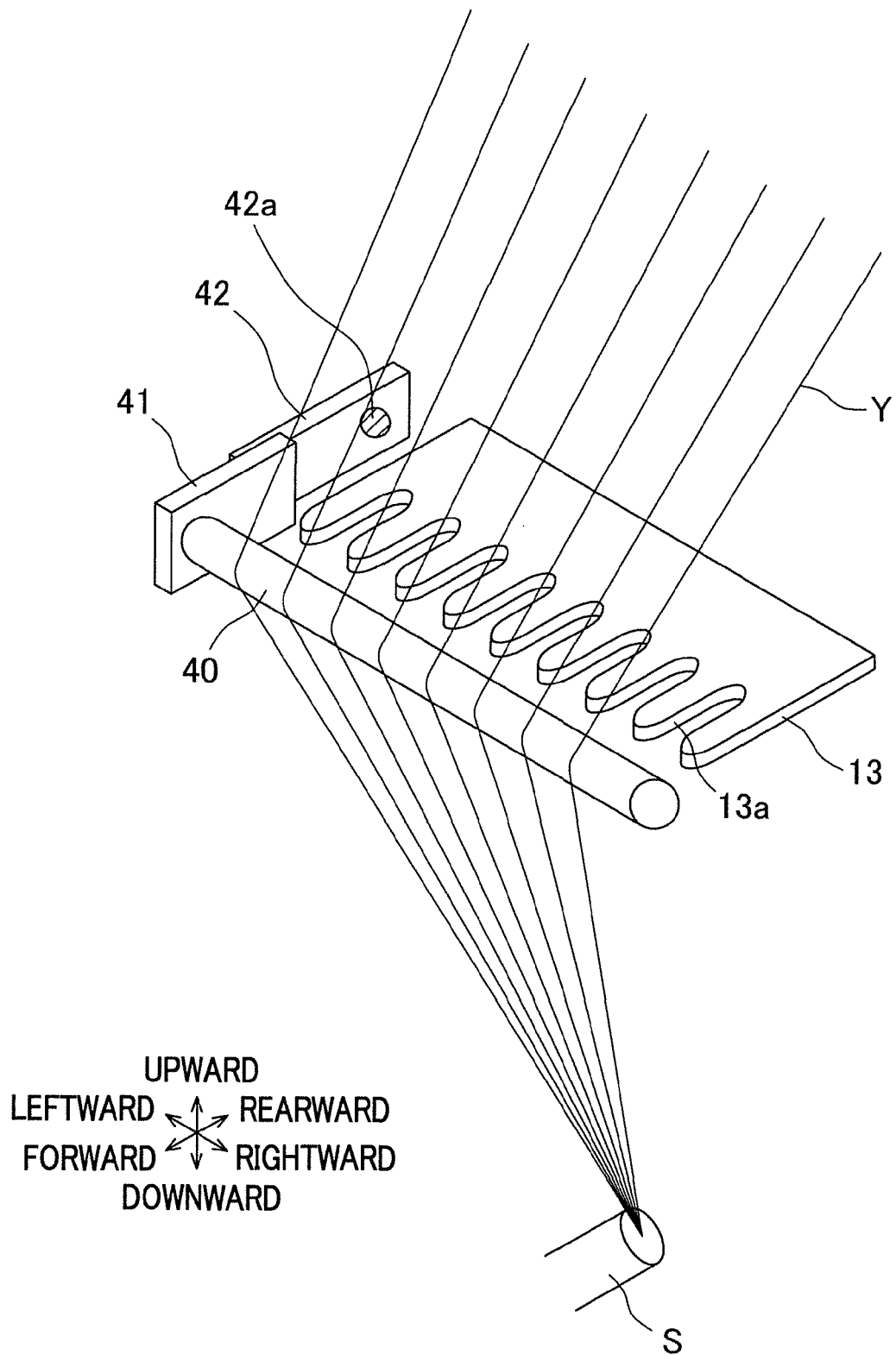


FIG.8

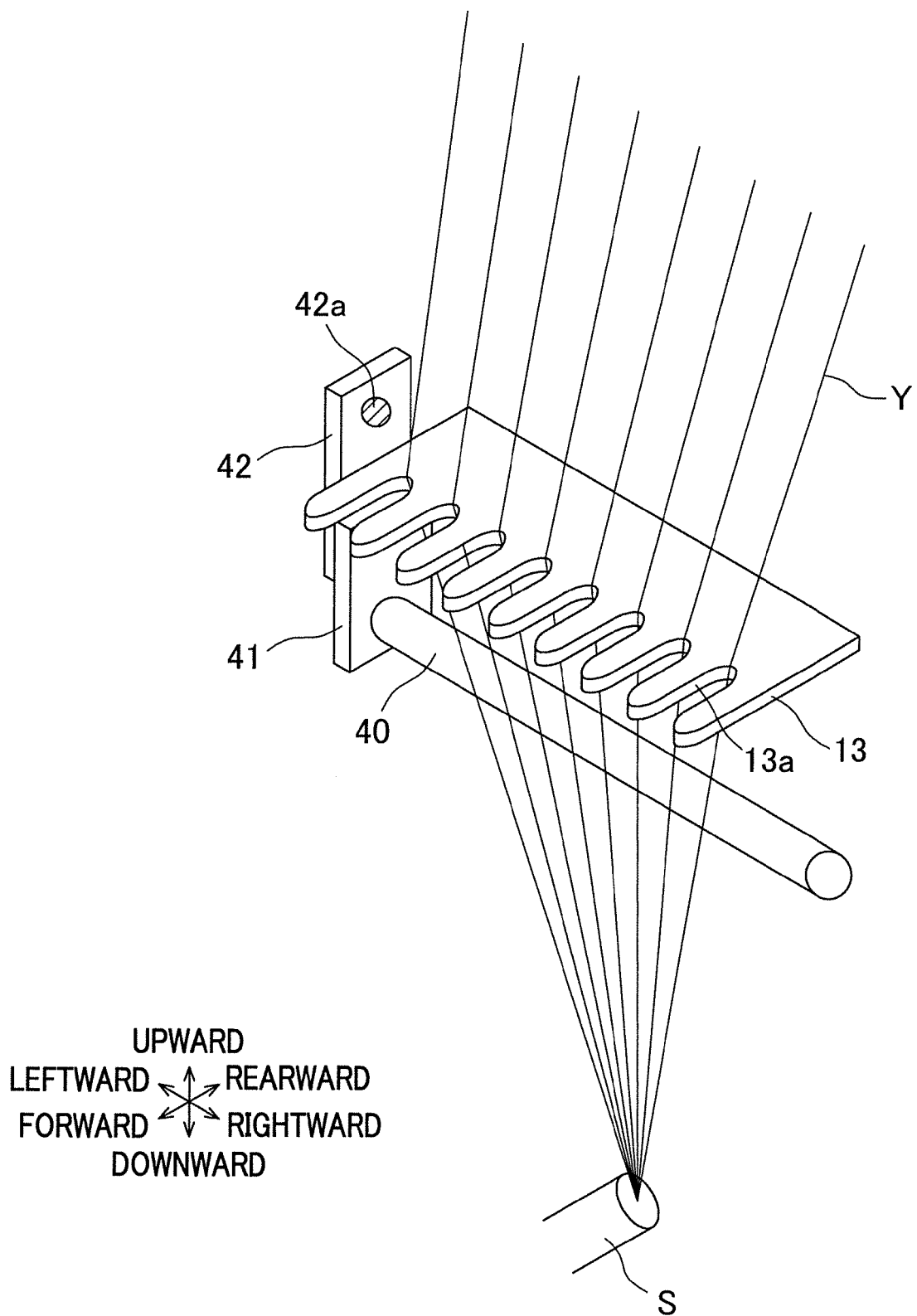
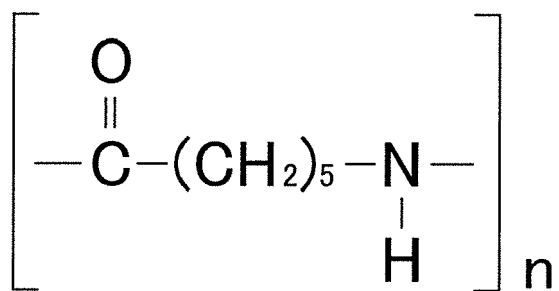


FIG.9

(a)



(b)

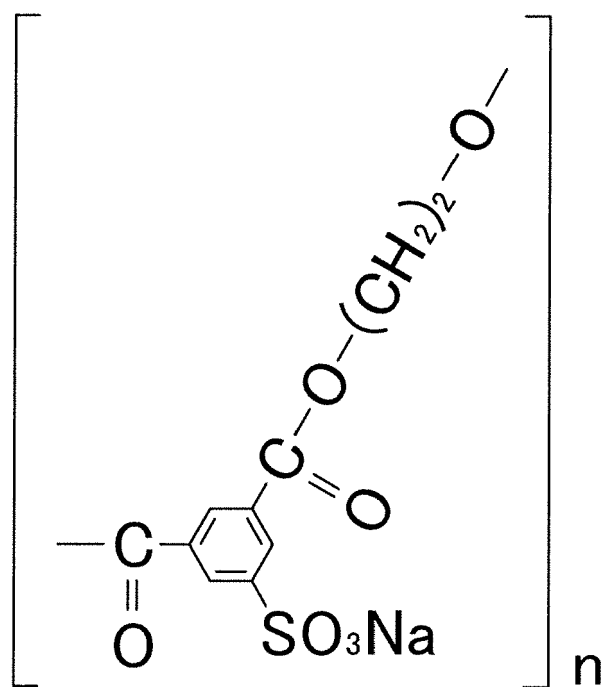


FIG.10

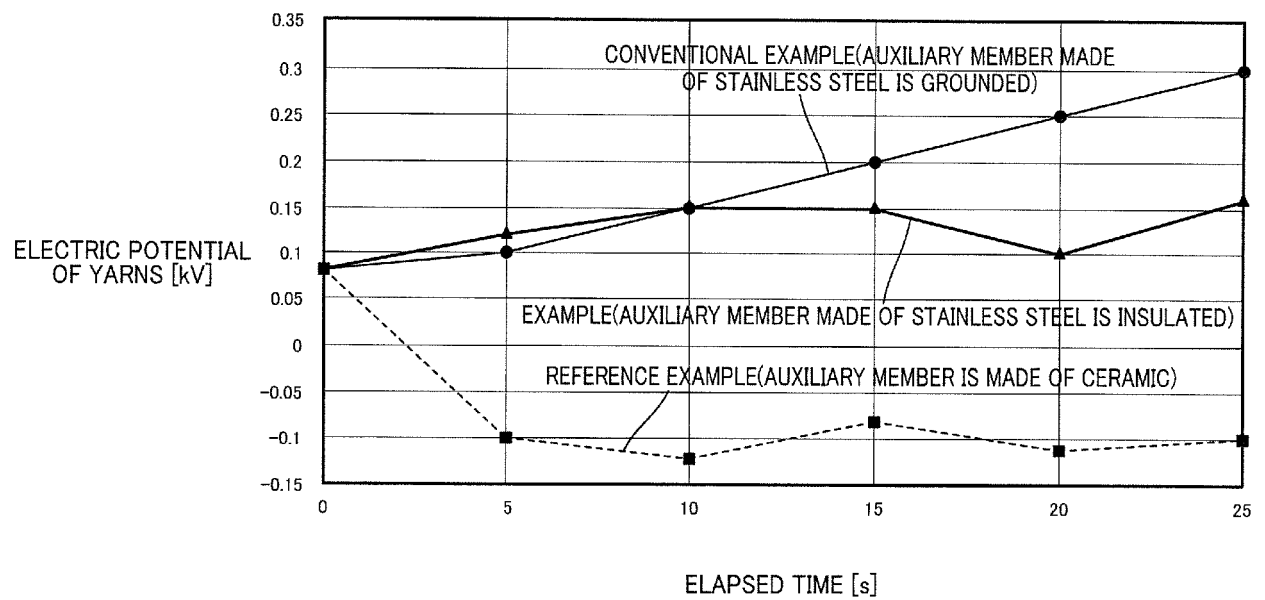


FIG.11

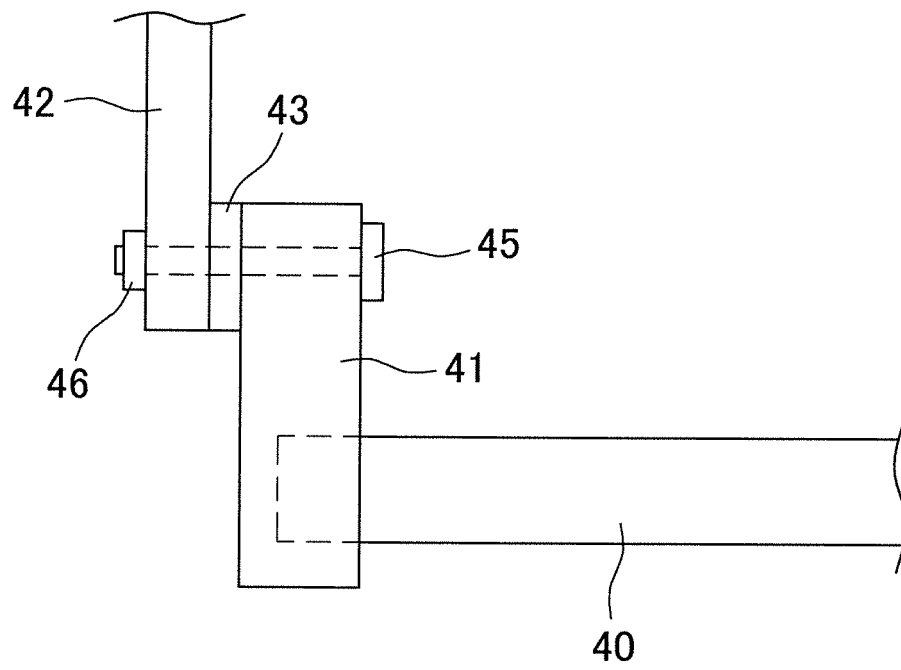
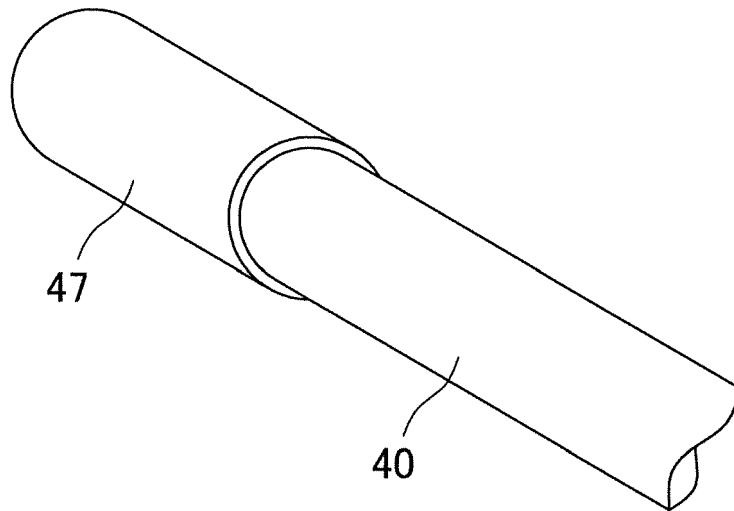


FIG.12

(a)



(b)

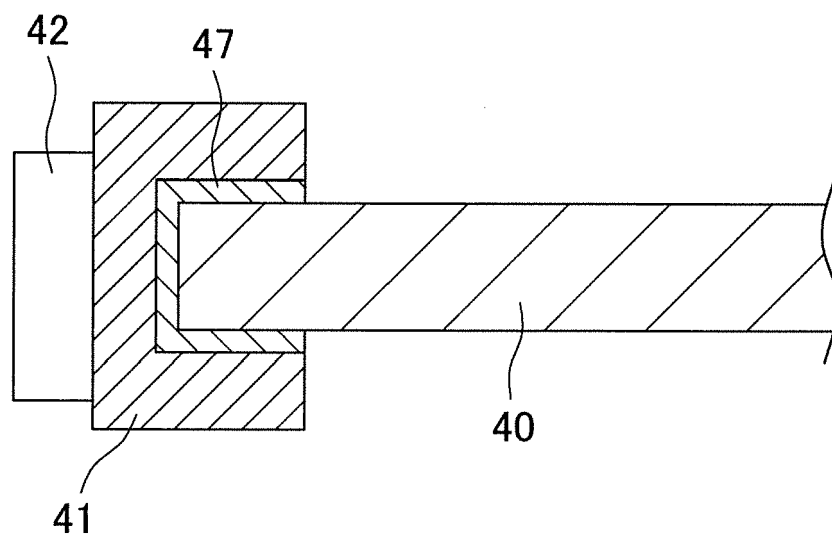


FIG.13

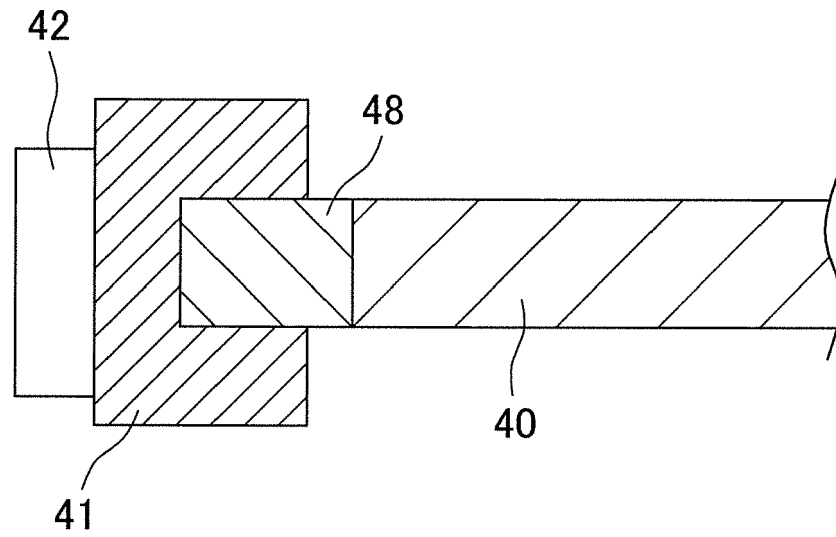
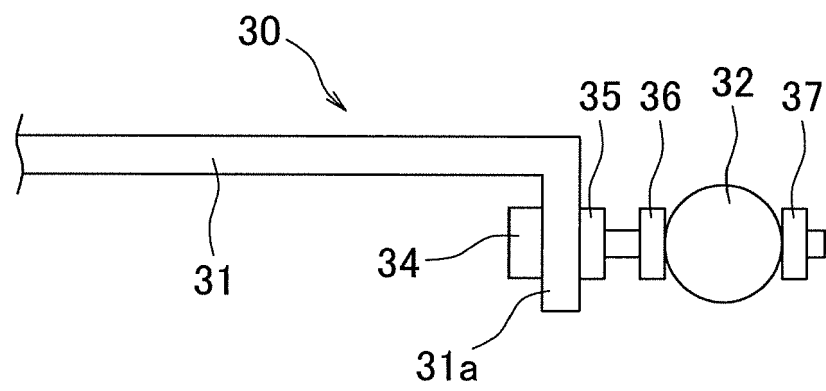


FIG.14





EUROPEAN SEARCH REPORT

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			D01D B65H
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		28 April 2020	Verschuren, Jo
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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