



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
27.12.2017 Bulletin 2017/52

(51) Int Cl.:
D01H 5/62 (2006.01)

(21) Application number: **17176773.4**

(22) Date of filing: **20.06.2017**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

(71) Applicant: **Murata Machinery, Ltd.**
Kyoto-shi,
Kyoto 601-8326 (JP)

(72) Inventor: **MORITA, Akihiro**
Kyoto-shi, Kyoto 612-8686 (JP)

(74) Representative: **Weickmann & Weickmann**
PartmbB
Postfach 860 820
81635 München (DE)

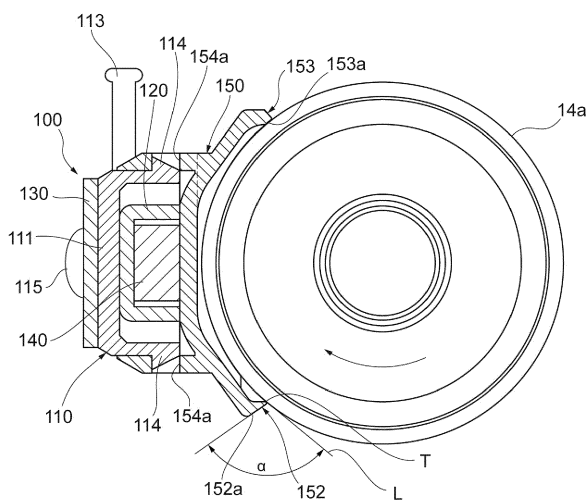
(30) Priority: **24.06.2016 JP 2016125537**

(54) **CLEANING DEVICE FOR DRAFTING ROLLER**

(57) A cleaning device (100) for a drafting roller (14a, 14b, 15a, 15b, 17a, 17b) includes a scraper (150; 150A; 150B) extending along a width direction of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b) and contacting an outer circumferential surface of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b). The scraper (150; 150A; 150B) is provided with, at an end portion on an upstream side in a rotational direction of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b), a scraper edge portion (152) contacting the outer circumferential surface of the drafting roller. An angle (α) being formed by a tangent-line upstream portion (L) that is on a tangent line of the drafting

roller (14a, 14b, 15a, 15b, 17a, 17b) passing a contact point (T) with the scraper edge portion (152) and extends from the contact point (T) toward the upstream side of the rotational direction of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b), and by an upstream-side outer surface (152a) that is in an outer surface of the scraper edge portion (152) and is a surface facing the upstream side in the rotational direction of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b), when viewed along an axial direction of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b), is an obtuse angle.

Fig.5



Description

TECHNICAL FIELD

[0001] The present disclosure relates to a cleaning device for a drafting roller.

BACKGROUND

[0002] A drafting device provided with a drafting roller that drafts a fiber band has been known. On an outer circumferential surface of the drafting roller of such a drafting device, fibers of the fiber band may adhere. Because of this, in Japanese Unexamined Patent Publication No. 2015-101797, a cleaning device that removes fibers that adhered on the outer circumferential surface of the drafting roller is described, for example.

SUMMARY

[0003] In the field of the above-described cleaning device for a drafting roller, it has been desired to reliably remove fibers that adhered on the outer circumferential surface of the drafting roller.

[0004] Thus, an object of the present disclosure is to provide a cleaning device for a drafting roller which is capable of removing fibers adhering on the outer circumferential surface of the drafting roller more reliably.

[0005] One form of the present disclosure is a cleaning device for a drafting roller including a scraper extending along a width direction of the drafting roller and configured to come into contact with an outer circumferential surface of the drafting roller; and the scraper is provided with, at an end portion on an upstream side in a rotational direction of the drafting roller, a scraper edge portion configured to come into contact with the outer circumferential surface of the drafting roller; and an angle being formed by a tangent-line upstream portion that is on a tangent line of the drafting roller passing a contact point with the scraper edge portion and extends from the contact point toward the upstream side in the rotational direction of the drafting roller, and by an upstream-side outer surface that is on an outer surface of the scraper edge portion and is a surface facing the upstream side in the rotational direction of the drafting roller, when viewed along an axial direction of the drafting roller, is an obtuse angle.

[0006] In the cleaning device for a drafting roller, because the angle being formed by the tangent-line upstream portion and the upstream-side outer surface is an obtuse angle, the scraper edge portion is in a state of scraping off the fibers adhering on the outer circumferential surface of the drafting roller. Thus, the scraper edge portion is restrained from escaping toward a downstream side in the rotational direction of the drafting roller, and it is possible to remove the fibers adhering on the outer circumferential surface of the drafting roller more reliably.

[0007] In one form of the disclosure, the angle being formed by the tangent-line upstream portion and the up-

stream-side outer surface may be greater than 90° but less than or equal to 135° when viewed along the axial direction of the drafting roller. For example, when the angle being formed by the tangent-line upstream portion and the upstream-side outer surface is increased, there is a need to make the scraper edge portion thin. Thus, when the angle being formed by the tangent-line upstream portion and the upstream-side outer surface is made to be greater than 90° but less than or equal to 135°, it is possible to remove the fibers adhering on the outer circumferential surface of the drafting roller more reliably while ensuring the thickness of the scraper edge portion and keeping the strength thereof.

[0008] In one form of the disclosure, the scraper may further include a scraper main-unit portion on which the scraper edge portion is provided and facing the outer circumferential surface of the drafting roller, and a projecting portion provided on a surface facing the drafting roller in the scraper main-unit portion. When the projecting portion is provided on the scraper main-unit portion, because the scraper edge portion and the projecting portion come into contact with the outer circumferential surface of the drafting roller, it is possible to restrain the scraper main-unit portion from wearing out. Accordingly, it is suppressed that the scraper main-unit portion wears out and the scraper deforms greatly, for example, and it is possible to prolong the usable period of the scraper.

[0009] In one form of the disclosure, the cleaning device may further include a pressing unit configured to press the scraper main-unit portion toward the outer circumferential surface of the drafting roller, and the projecting portion may be provided in a region sandwiched between a pressing area, in which the pressing unit presses the scraper main-unit portion, and the outer circumferential surface of the drafting roller. In the region pressed by the pressing unit, abrasion is likely to be promoted. However, because the projecting portion is provided in the region sandwiched between the pressing area and the outer circumferential surface of the drafting roller, it is possible to further restrain the scraper main-unit portion from wearing out.

[0010] In one form of the disclosure, the scraper main-unit portion may be provided with a stopper portion projecting toward the outer circumferential surface of the drafting roller, on at least either one of end portions thereof in the width direction of the drafting roller, and a distance between a distal end portion of the stopper portion and the outer circumferential surface of the drafting roller may be narrower than a distance between a surface pressed by the pressing unit in the scraper main-unit portion and the outer circumferential surface of the drafting roller. In this case, when the scraper edge portion and the like wear out and a whole of the scraper comes close to the outer circumferential surface side of the drafting roller, the distal end of the stopper portion comes into contact with the outer circumferential surface of the drafting roller. Because the stopper portion is provided on the end portion of the scraper main-unit portion, an operator

can visually recognize the stopper portion easily. Thus, the operator can understand, by visually recognizing the distance between the distal end portion of the stopper portion and the outer circumferential surface of the drafting roller, a state of abrasion of the scraper easily. Accordingly, the operator can easily understand the time to replace the scraper. Furthermore, the distance between the distal end portion of the stopper portion and the outer circumferential surface of the drafting roller is narrower than the distance between the surface pressed by the pressing unit in the scraper main-unit portion and the outer circumferential surface of the drafting roller. Thus, at the time the distal end portion of the stopper portion first comes into contact with the outer circumferential surface of the drafting roller, there is some thickness remaining to the scraper main-unit portion. That is, the operator can understand, by checking whether the stopper portion has come into contact with the outer circumferential surface of the drafting roller, the time to replace the scraper, before the scraper main-unit portion wears out and has holes and the like.

[0011] In one form of the disclosure, the drafting roller may be provided with, on the outer circumferential surface thereof, a drafting surface on which a plurality of grooves extending in a direction intersecting with the rotational direction are provided and a smooth surface having a surface smoother than the drafting surface; the drafting surface and the smooth surface may be provided at locations different from each other in the width direction of the drafting roller and be extending over an entire area in a circumferential direction of the outer circumferential surface of the drafting roller; the scraper edge portion may come into contact with the drafting surface; and the stopper portion may be projecting toward the smooth surface. As just described, because the stopper portion comes into contact with the smooth surface, the abrasion of the stopper portion is reduced as compared with when the stopper portion comes into contact with the drafting surface. Furthermore, because the stopper portion comes into contact with the smooth surface, the scraper is restrained from further nearing the drafting surface. Accordingly, the scraper main-unit portion is restrained from wearing out and having holes and the like, and the pressing unit is restrained from being brought into contact directly with the drafting surface.

[0012] In one form of the disclosure, the projecting portion may be provided at a location avoiding, in the width direction of the drafting roller, an area in which a sliver that wound around the outer circumferential surface of the drafting roller passes. In this case, because the fibers adhering on the outer circumferential surface of the drafting roller are never to be pressed by the projecting portion, it is possible to prevent the projecting portion from interfering with the removal of fibers by the scraper edge portion.

[0013] In one form of the disclosure, the cleaning device may further include a pressing unit configured to press the scraper toward the outer circumferential sur-

face of the drafting roller, and the pressing unit may press the scraper such that one end portion in the width direction of the drafting roller in the scraper and the other end portion thereof are pressed with different force (at strengths different from each other). For example, by the orientation of the grooves provided on the outer circumferential surface of the drafting roller, and by the variance and others in the manufacturing accuracy of various portions, the bias in abrasion of the scraper may occur. Even when such bias in abrasion occurs, by providing the pressing unit in the above-described configuration, it is possible to reduce the bias in abrasion of the scraper and prolong the usable period of the scraper.

[0014] In one form of the disclosure, the drafting roller may be, out of a top roller and a bottom roller vertically arranged in juxtaposition, the bottom roller, and the scraper edge portion may come into contact with the outer circumferential surface of the drafting roller at a location on a lower side than a horizontal line that passes an axis of the drafting roller when viewed along the axial direction of the drafting roller. In this case, it is possible to efficiently drop the fibers that are removed from the drafting roller, to the outside (lower side) of the scraper. When the angle by the tangent-line upstream portion and the upstream-side outer surface is made to be an obtuse angle, the scraper edge portion and others are to be located on the more downstream side in the rotational direction of the drafting roller than a region at which the scraper edge portion comes into contact with the outer circumferential surface of the drafting roller. Thus, by bringing the scraper edge portion into contact with the outer circumferential surface of the drafting roller at the above-described location, while ensuring the placement space of the members such as the scraper, without interfering with the placement of the top roller and others, the scraper edge portion can be brought into contact with the outer circumferential surface of the drafting roller such that the tangent-line upstream portion and the upstream-side outer surface form an obtuse angle.

[0015] In one form of the disclosure, the scraper may be provided with a positioning claw portion configured to come into contact with the outer circumferential surface of the drafting roller and to make positioning of the scraper, at an end portion on the downstream side in the rotational direction of the drafting roller, and the positioning claw portion may be provided at a location avoiding, in the width direction of the drafting roller, the area in which the sliver that wound around the outer circumferential surface of the drafting roller passes. In this case, because the fibers adhering on the outer circumferential surface of the drafting roller are never to be pressed by the positioning claw portion, it is possible to prevent the positioning claw portion from interfering with the removal of fibers by the scraper edge portion.

[0016] According to one aspect of the present disclosure, it is possible to remove fibers adhering on the outer circumferential surface of the drafting roller more reliably.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

FIG. 1 is a front view of a spinning machine according to an embodiment;

FIG. 2 is a plan view of a drafting device of a spinning unit in FIG. 1;

FIG. 3 is a side view of the drafting device of the spinning unit in FIG. 1;

FIG. 4 is a diagram of a cleaning device provided on a back-bottom roller in FIG. 2 viewed from the upstream side in a flow direction of slivers;

FIG. 5 is a cross-sectional view of the cleaning device in FIG. 2;

FIG. 6 is a front view of a scraper in FIG. 5;

FIG. 7 is a cross-sectional view of the scraper along the line VII-VII in FIG. 6;

FIG. 8 is a perspective view of the scraper in FIG. 6;

FIG. 9 is a front view of a scraper according to a first modification;

FIG. 10 is a cross-sectional view of the scraper along the line X-X in FIG. 9;

FIG. 11 is a perspective view of the scraper in FIG. 9;

FIG. 12 is a perspective view of a scraper according to a second modification;

FIG. 13 is a diagram illustrating a periphery of a stopper portion in a state that the scraper in FIG. 12 was brought into contact with the back-bottom roller; and
FIG. 14 is a cross-sectional view of the stopper and the back-bottom roller, in a state that the scraper in FIG. 12 was brought into contact with the back-bottom roller.

DETAILED DESCRIPTION

[0018] The following describes an exemplary embodiment of the present disclosure in detail with reference to the accompanying drawings. In the respective drawings, for portions that are identical or equivalent, identical reference signs are given to and redundant explanations are omitted.

[0019] As illustrated in FIG. 1, a spinning machine 1 includes a plurality of spinning units 2, a yarn piecing carrier 3, a doffing carrier (depiction omitted), a first end frame 4, and a second end frame 5. The spinning units 2 are arrayed in a row. Each spinning unit 2 produces a yarn Y and takes up to a package P. The yarn piecing carrier 3, when the yarn Y is cut in a spinning unit 2 or the yarn Y breaks for some reason, performs a yarn piecing operation on the spinning unit 2. The doffing carrier, when the package P is fully wound in a spinning unit 2, doffs the full package P and supplies a new bobbin B to the relevant spinning unit 2.

[0020] In the first end frame 4, accommodated are a recovery apparatus, which recovers fiber waste and yarn waste that arise in the spinning units 2, and others. In the second end frame 5, accommodated are an air sup-

plier that adjusts an air pressure of compressed air (air) supplied to the spinning machine 1 and supplies the air to various units of the spinning machine 1, and drive motors and others for supplying power to various units of the spinning units 2. On the second end frame 5, a machine control device 51, a display screen 52, and input keys 53 are provided.

[0021] The machine control device 51 centrally manages and controls the various units of the spinning machine 1. The display screen 52 can display information containing at least either of information concerning the setting content of the spinning units 2 and information concerning the state thereof. By an appropriate operation by an operator using the input keys 53, a setting work of the spinning units 2 can be performed.

[0022] Each spinning unit 2 includes, in order from the upstream side in a traveling direction of the yarn Y, a drafting device 6, an air spinning device 7, a yarn monitor 8, a tension sensor 9, a yarn storage device 11, a waxing device 12, and a winding device 13. A unit controller 10 is provided for each certain number of spinning units 2 and controls the operation of the spinning units 2.

[0023] The drafting device 6 drafts a sliver (fiber band) S. The air spinning device 7 gives twist to a fiber band F, which has been drafted by the drafting device 6, by a swirl airflow and produces the yarn Y. The yarn storage device 11 takes up the slack of the yarn Y between the air spinning device 7 and the winding device 13. The waxing device 12 applies wax to the yarn Y between the yarn storage device 11 and the winding device 13. The winding device 13 takes up the yarn Y onto a bobbin B and forms the package P.

[0024] The yarn monitor 8 monitors information on the traveling yarn Y between the air spinning device 7 and the yarn storage device 11 and, based on the monitored information, detects the presence of a yarn defect. The yarn monitor 8, when a yarn defect is detected, transmits a yarn-defect detection signal to the unit controller 10. The tension sensor 9 measures the tension of the traveling yarn Y between the air spinning device 7 and the yarn storage device 11, and transmits a tension measurement signal to the unit controller 10. When the unit controller 10 determines, based on the detection result of at least either of the yarn monitor 8 and the tension sensor 9, that there is abnormality, the yarn Y is cut in the spinning unit 2.

[0025] The above-described drafting device 6 will be described in detail. As illustrated in FIGS. 2 and 3, the drafting device 6 includes, in order from the upstream side in a traveling direction of the sliver S, a back-roller pair 14, a third roller pair 15, a middle roller pair 16, and a front roller pair 17.

[0026] The back-roller pair 14 includes, as a drafting roller that drafts the sliver S, a back-bottom roller (bottom roller) 14a and a back top roller 14b that face each other across a traveling path R through which the sliver S is made to travel. The third roller pair 15 includes, as a drafting roller that drafts the sliver S, a third bottom roller

(bottom roller) 15a and a third top roller 15b that face each other across the traveling path R.

[0027] The middle roller pair 16 includes a middle bottom roller 16a and a middle top roller 16b that face each other across the traveling path R. On the middle bottom roller 16a, an apron belt 18a is wound. On the middle top roller 16b, an apron belt 18b is wound. The front roller pair 17 includes, as a drafting roller that drafts the sliver S, a front bottom roller 17a and a front top roller 17b that face each other across the traveling path R. The back-bottom roller 14a, the third bottom roller 15a, the middle bottom roller 16a, and the front bottom roller 17a are rotatably driven by drive motors provided on the second end frame 5 or by drive motors provided to each of the spinning unit 2.

[0028] A plurality of roller pairs 14, 15, 16, and 17 make the sliver S, which is supplied from a can (depiction omitted), travel from the upstream side to the downstream side while drafting, and supplies the fiber band F to the air spinning device 7. In the following description, the direction along the traveling path R is referred to as "drafting direction". The upstream side in the drafting direction is simply referred to as "upstream side" and the downstream side in the drafting direction is simply referred to as "downstream side".

[0029] The back-bottom roller 14a is rotatably supported on a back-roller housing 61. The third bottom roller 15a is rotatably supported on a third roller housing 62. The middle bottom roller 16a is rotatably supported on a middle roller housing 63. The front bottom roller 17a is rotatably supported on a front roller housing 64. The respective roller housings 61, 62, 63, and 64 are mounted on a machine frame 20. The respective bottom rollers 14a, 15a, 16a, and 17a are made to rotate at different rotational speeds from one another so as to become faster toward the downstream side.

[0030] The respective top rollers 14b, 15b, 16b, and 17b are rotatably supported on a drafting cradle 65. The top rollers 14b, 15b, 16b, and 17b are brought into contact with the bottom rollers 14a, 15a, 16a, and 17a at a certain pressure and are driven to rotate, respectively.

[0031] The drafting cradle 65 is provided so as to be turnable about a spindle 67 to a position at which the top rollers 14b, 15b, 16b, and 17b come into contact with the bottom rollers 14a, 15a, 16a, and 17a at the certain pressure, respectively, and to a position at which the top rollers 14b, 15b, 16b, and 17b are spaced apart from the bottom rollers 14a, 15a, 16a, and 17a, respectively. The drafting cradle 65 rotatably supports the respective top rollers 14b, 15b, 16b, and 17b of the drafting device 6 that adjacent spinning units 2 making a pair each include.

[0032] In a state that the back-roller pair 14 is located on the upper side and the front roller pair 17 is located on the lower side with respect to the vertical direction, the drafting device 6 is arranged at an angle in a direction that the bottom rollers 14a, 15a, 16a, and 17a are located on the lower side with respect to the top rollers 14b, 15b, 16b, and 17b, respectively.

[0033] On the upstream side of the back-roller pair 14, a guide member 71 is arranged (omitted in FIG. 1). On the guide member 71, a through hole 71a is provided through which the sliver S is passed. The guide member 71 guides, onto the traveling path R, the sliver S supplied from the can (depiction omitted).

[0034] Between the third roller pair 15 and the middle roller pair 16, a regulating member 72 is arranged (omitted in FIG. 1). On the regulating member 72, provided is a through hole 72a through which the sliver S is passed. The regulating member 72 regulates the width of the sliver S to the width of the through hole 72a.

[0035] On the back-bottom roller 14a, a cleaning device 100 is provided (omitted in FIG. 1). The cleaning device 100 removes fibers that adhered on the outer circumferential surface of the back-bottom roller 14a. On the third bottom roller 15a also, as with the back-bottom roller 14a, a cleaning device 100 that removes fibers that adhered on the outer circumferential surface of the third bottom roller 15a is provided.

[0036] On the opposite side of the top rollers 14b, 15b, and 16b with respect to the bottom rollers 14a, 15a, and 16a, a fiber recovery device 80 is arranged (omitted in FIG. 1). As illustrated in FIG. 3, the fiber recovery device 80 includes a main unit portion 81. On the main unit portion 81, a suction path 82 is provided. On the main unit portion 81, a suction inlet 83 is further provided. In FIG. 3, to illustrate the suction inlet 83, a part of the main unit portion 81 is illustrated being broken. The suction inlet 83 is provided only one for the drafting device 6, and is facing the third bottom roller 15a of the third roller pair 15 that is the third roller pair from the downstream side.

[0037] On the opposite side of the suction inlet 83 in the suction path 82, a suction pipe 90 is connected. The suction pipe 90 is connected to a blower (depiction omitted) that generates a suction airflow. Accordingly, pieces of fibers that arose in the drafting device 6 are sucked from the suction inlet 83, pass through the suction path 82 and the suction pipe 90, and reach a fiber discharge device (depiction omitted) provided in the vicinity of the blower.

[0038] Next, details of the cleaning device 100 will be described. In the following description, the cleaning device 100 provided on the back-bottom roller 14a will be described as an example. The cleaning device 100 provided on the third bottom roller 15a has the same configuration as that of the cleaning device 100 that is provided on the back-bottom roller 14a.

[0039] As illustrated in FIGS. 4 and 5, the cleaning device 100 includes a magnet case 110, an inner yoke 120, an outer yoke 130, a pair of magnets (pressing unit) 140, and a scraper 150. The cleaning device 100 is mounted on the back-bottom roller 14a by the magnetic force of the magnets 140.

[0040] The magnet case 110 is made of resin and is a case to accommodate the magnets 140. The magnet case 110 is formed in a box shape for which the side facing the back-bottom roller 14a is open. The magnet

case 110 includes a base plate 111, a pair of arms 112 (see FIG. 4), a pair of grasping portions 113, a pair of engaging portions 114, and screws 115.

[0041] The base plate 111 constitutes a bottom portion of the box-shaped magnet case 110. On the base plate 111, formed are holes through which the screws 115 can be inserted. The pair of arms 112, as illustrated in FIG. 4, are respectively extending toward the outside from both end portions in the axial direction of the back-bottom roller 14a in the base plate 111. The axial direction of the back-bottom roller 14a is the extending direction of a rotating shaft of the roller. As illustrated in FIGS. 2 and 4, on the upper surface of the back-roller housing 61, stoppers 66 are provided. The stopper 66 has a folded portion 66a that is folded back toward the lower side from the upper surface of the back-roller housing 61. By locating the stoppers 66 on the more downstream side in the rotational direction of the back-bottom roller 14a than the arms 112, the arms 112 come into contact with the distal end portions of the folded portions 66a, and the rotation of the cleaning device 100 attempting to rotate integrally with the back-bottom roller 14a is prevented.

[0042] The pair of grasping portions 113 is a region that is grasped by the operator when removing the cleaning device 100 mounted on the back-bottom roller 14a. The pair of grasping portions 113 are respectively provided on both end portions in the axial direction of the back-bottom roller 14a in the base plate 111. The grasping portions 113 are extending from the base plate 111 toward the downstream side in the rotational direction of the back-bottom roller 14a.

[0043] The pair of engaging portions 114 respectively engage with engaging holes 154a (see FIG. 8 and others) provided on the scraper 150, thereby securing the scraper 150 to the magnet case 110 by snap-fit. By securing the scraper 150 to the magnet case 110 by snap-fit, it is possible to replace the scraper 150 easily.

[0044] The inner yoke 120 and the outer yoke 130 vary the direction that the magnetic force of the magnets 140 is exerted such that the magnetic force of the magnets 140 is exerted toward the back-bottom roller 14a side. The inner yoke 120 is a member having a substantially U-shaped cross section. The inner yoke 120 is arranged on the surface of the base plate 111 on the back-bottom roller 14a side so that the open side of the substantially U-shaped cross section faces the back-bottom roller 14a. The outer yoke 130 is a plate-like member and is arranged on the surface of the opposite side of the back-bottom roller 14a with the base plate 111 interposed.

[0045] On the outer yoke 130, holes are formed through which the screws 115 can be inserted. On the inner yoke 120, threaded holes are formed that can secure the screws 115. By inserting the screws 115 from the outer yoke 130 toward the inner yoke 120 with the base plate 111 interposed, the inner yoke 120 and the outer yoke 130 are secured to the magnet case 110. Note that, the inner yoke 120 and the outer yoke 130 may be secured to the magnet case 110 by fixtures other than

the screws 115.

[0046] The pair of magnets 140 presses, by the action that the magnets 140 are attracted to the back-bottom roller 14a by the magnetic force, the scraper 150 toward the outer circumferential surface of the back-bottom roller 14a. The pair of magnets 140 is, as illustrated in FIGS. 2 and 5, arranged in juxtaposition along the axial direction of the back-bottom roller 14a so as to avoid a middle portion in the axial direction of the back-bottom roller 14a. That is, the pair of magnets 140 is arranged so as to avoid, in the outer circumferential surface of the back-bottom roller 14a, the region with which the sliver S comes in contact. The magnets 140 are fixed to the inner yoke 120 by an adhesive, an adhesive tape, or the like.

[0047] The scraper 150 is extending along the width direction of the back-bottom roller 14a and, by the magnetic force of the magnets 140, is pressed onto the outer circumferential surface of the back-bottom roller 14a that rotates. Note that, the width direction of the back-bottom roller 14a is the extending direction of the rotating shaft of the back-bottom roller 14a. The scraper 150 removes, by being pressed onto the outer circumferential surface of the back-bottom roller 14a, fibers adhering on the outer circumferential surface of the back-bottom roller 14a. The scraper 150 is made of resin. The scraper 150 wears out by contacting with the back-bottom roller 14a. When the scraper 150 wears out, the scraper 150 is removed from the magnet case 110 of the cleaning device 100 and replaced.

[0048] As illustrated in FIGS. 5 to 8, the scraper 150 includes a scraper main-unit portion 151, a scraper edge portion 152, a pair of positioning claw portions 153, a pair of engaging pieces 154, and projecting portions 155.

[0049] The scraper main-unit portion 151 is a plate-like member facing the outer circumferential surface of the back-bottom roller 14a, and is extending along the width direction of the back-bottom roller 14a. Furthermore, the scraper main-unit portion 151, when viewed along the axial direction of the back-bottom roller 14a, is further curved so as to lie along the outer circumferential surface of the back-bottom roller 14a. On the end portion of the downstream side in the rotational direction of the back-bottom roller 14a in the scraper main-unit portion 151, a cutout portion 151a is provided.

[0050] The cutout portion 151a is provided at a location including a substantially middle portion in the width direction of the back-bottom roller 14a. In more detail, the cutout portion 151a is provided, in the width direction of the back-bottom roller 14a, at a location including a region in which the sliver that wound around the outer circumferential surface of the back-bottom roller 14a passes when the back-roller pair 14 drafts the sliver S.

[0051] The scraper edge portion 152 is provided on the end portion of the upstream side in the rotational direction of the back-bottom roller 14a in the scraper main-unit portion 151. The scraper edge portion 152 is provided so as to project from the scraper main-unit portion 151 toward the outer circumferential surface of the back-bot-

tom roller 14a. In the present embodiment, the scraper main-unit portion 152 is brought into line contact along the width direction of the back-bottom roller 14a with respect to the outer circumferential surface of the back-bottom roller 14a. For example, the distal end portion of the scraper edge portion 152 may be formed in a circular arc shape having a small radius in cross section so as to be possible to be brought into line contact with the outer circumferential surface of the back-bottom roller 14a.

[0052] As illustrated in FIG. 5, on the outer circumferential surface of the back-bottom roller 14a, the region that the distal end portion of the scraper edge portion 152 comes into contact is denoted as a contact point T. On a tangent line that passes the contact point T on the back-bottom roller 14a when viewed along the axial direction of the back-bottom roller 14a, the region extending from the contact point T toward the upstream side of the back-bottom roller 14a is denoted as a tangent-line upstream portion L. In the outer surface of the scraper edge portion 152, the surface facing toward the upstream side in the rotational direction of the back-bottom roller 14a is denoted as an upstream-side outer surface 152a. When viewed along the axial direction of the back-bottom roller 14a, the angle that is formed by the tangent-line upstream portion L and the upstream-side outer surface 152a is denoted as an angle α .

[0053] The scraper edge portion 152 is formed such that, when being brought into contact with the outer circumferential surface of the back-bottom roller 14a, the angle α is to be an obtuse angle. The scraper edge portion 152 may be formed such that the angle α is to be greater than 90° but less than or equal to 135° . Furthermore, the scraper edge portion 152 may be formed such that the angle α is to be greater than or equal to 100° but less than or equal to 120° . Moreover, the scraper edge portion 152 may be formed such that the angle α is to be greater than or equal to 100° but less than or equal to 110° .

[0054] Note that, the upstream-side outer surface 152a does not include the circular arc shaped region that is provided at the distal end portion of the scraper edge portion 152 to bring the scraper edge portion 152 into line contact. The scraper edge portion 152 comes into contact with the outer circumferential surface of the back-bottom roller 14a at a location on the lower side than a horizontal line that passes the axis of the back-bottom roller 14a when viewed along the axial direction of the back-bottom roller 14a.

[0055] The pair of positioning claw portions 153 is, in the end portion of the downstream side in the rotational direction of the back-bottom roller 14a in the scraper main-unit portion 151, provided in regions that the cutout portion 151a is not provided. That is, the pair of positioning claw portions 153 is, in the end portion of the downstream side in the rotational direction of the back-bottom roller 14a in the scraper main-unit portion 151, adjacent by interposing the cutout portion 151a. The positioning

claw portions 153 are provided so as to project from the scraper main-unit portion 151 toward the outer circumferential surface of the back-bottom roller 14a. In the present embodiment, at the distal end portion of the positioning claw portion 153, a contact surface portion 153a that comes into contact with the outer circumferential surface of the back-bottom roller 14a is provided. The contact surface portions 153a come into contact with the outer circumferential surface of the back-bottom roller 14a, thereby bringing the positioning claw portions 153 into surface contact with respect to the outer circumferential surface of the back-bottom roller 14a.

[0056] Herein, the cutout portion 151a is provided at a location including a region in which the sliver that wound around the outer circumferential surface of the back-bottom roller 14a passes. That is, the pair of positioning claw portions 153 is provided at locations avoiding the region through which the sliver that wound around the outer circumferential surface of the back-bottom roller 14a passes.

[0057] The pair of engaging pieces 154 is provided on the surface (the surface on the side the magnets 140 face) of the opposite side with respect to the side facing the back-bottom roller 14a in the scraper main-unit portion 151. The pair of engaging pieces 154 is provided leaving a certain distance in the rotational direction of the back-bottom roller 14a. The distance of the pair of engaging pieces 154 is smaller than the length in the rotational direction of the back-bottom roller 14a in the scraper main-unit portion 151. The pair of engaging pieces 154 is provided in substantially the middle in the rotational direction of the back-bottom roller 14a in the scraper main-unit portion 151. That is, the scraper main-unit portion 151 is extending toward the more upstream side in the rotational direction of the back-bottom roller 14a than the pair of engaging pieces 154 and is extending toward the downstream side in the rotational direction of the back-bottom roller 14a.

[0058] As just described, by configuring the scraper main-unit portion 151 so as to be extending on the more upstream side and the more downstream side in the rotational direction of the back-bottom roller 14a than the pair of engaging pieces 154, it is possible to ensure a wide interval between the scraper edge portion 152 and the positioning claw portions 153. Accordingly, when the scraper 150 is brought into contact with the outer circumferential surface of the back-bottom roller 14a, the positioning of the cleaning device 100 can be made.

[0059] On the pair of engaging pieces 154, respective engaging holes 154a are provided. With the engaging holes 154a of the pair of engaging pieces 154, the engaging portions 114 of the magnet case 110 engage.

[0060] The projecting portions 155 are provided on the surface facing the outer circumferential surface of the back-bottom roller 14a in the scraper main-unit portion 151, and are projecting from the outer surface of the scraper main-unit portion 151 toward the outer circumferential surface of the back-bottom roller 14a. The pro-

jecting portions 155 are extending along the rotational direction of the back-bottom roller 14a. The projecting portions 155 are extending from near the end portion of the upstream side in the rotational direction of the back-bottom roller 14a in the scraper main-unit portion 151 up to the end portion (the positioning claw portions 153) of the downstream side in the rotational direction of the back-bottom roller 14a. That is, the projecting portions 155 are provided on the more downstream side than the scraper edge portion 152 and on the more upstream side than the positioning claw portions 153.

[0061] In the present embodiment, four pieces of the projecting portions 155 are provided. The projecting portions 155 are provided so as to run through the region sandwiched between pressing areas Q (see FIG. 6) in which the magnets 140 press the scraper main-unit portion 151, and the outer circumferential surface of the back-bottom roller 14a. In the present embodiment, two pieces of the projecting portions 155 are provided so as to run through the region sandwiched between the pressing area Q by one magnet 140 of the pair of magnets 140, and the outer circumferential surface of the back-bottom roller 14a; and the remaining two pieces of the projecting portions 155 are provided so as to run through the region sandwiched between the pressing area Q by the other magnet 140 of the pair of magnets 140, and the outer circumferential surface of the back-bottom roller 14a.

[0062] The surfaces of the back-bottom roller 14a side in the projecting portions 155 are formed in a circular arc shape so as to lie along the outer circumferential surface of the back-bottom roller 14a. In a state that the scraper edge portion 152 and the positioning claw portions 153 are in contact with the outer circumferential surface of the back-bottom roller 14a, the projecting portions 155 are provided so as to have a slight gap between the projecting portion 155 and the outer circumferential surface of the back-bottom roller 14a. Accordingly, the scraper 150 can reliably bring the scraper edge portion 152 into contact with the outer circumferential surface of the back-bottom roller 14a.

[0063] In a state that the scraper edge portion 152 and the positioning claw portions 153 are in contact with the outer circumferential surface of the back-bottom roller 14a, the projecting portions 155 may be in contact with the outer circumferential surface of the back-bottom roller 14a. In this case, the projecting portions 155 can, immediately after the cleaning device 100 is installed on the back-bottom roller 14a, suppress the abrasion of the scraper edge portion 152 and the like.

[0064] Furthermore, the projecting portions 155 are provided at locations avoiding the region in which the sliver that wound around the outer circumferential surface of the back-bottom roller 14a passes. In the present embodiment, the projecting portions 155 are provided at locations avoiding the substantially middle portion in the width direction of the back-bottom roller 14a.

[0065] Herein, on the scraper 150, the amount of abra-

sion may be different at one end portion and the other end portion, in the width direction of the back-bottom roller 14a. For example, when grooves provided on the outer circumferential surface of the back-bottom roller 14a are inclined having an angle other than the right angle with respect to the rotational direction of the back-bottom roller 14a, the amount of abrasion may, due to the inclination of the grooves, be different at one end portion of the scraper 150 and the other end portion thereof. Specifically, because the grooves provided on the outer circumferential surface of the back-bottom roller 14a are inclined, one end portion of the scraper 150 may be attracted strongly toward the rotational direction side of the back-bottom roller 14a, as compared with the other end portion, for example. In this case, in the scraper 150, the way of contact with respect to the outer circumferential surface of the back-bottom roller 14a is to be different at the one end portion and the other end portion. Accordingly, the amount of abrasion may be different at one end portion of the scraper 150 and the other end portion thereof. When the grooves of the back-bottom roller 14a are inclined upward toward the right, there is a tendency that the scraper 150 is pushed in the right-hand direction and the right-hand side portion wears out fast. When the grooves of the back-bottom roller 14a are inclined downward toward the right, there is a tendency that the scraper 150 is pushed in the left-hand direction and the left-hand side portion wears out fast.

[0066] Furthermore, for example, due to the variance and others in the manufacturing accuracy of the various portions, in the scraper 150, the way of contact with respect to the outer circumferential surface of the back-bottom roller 14a may be different at the one end portion and the other end portion. Accordingly, the amount of abrasion may be different at one end portion of the scraper 150 and the other end portion thereof.

[0067] Because of this, the pair of magnets 140 presses the scraper 150 such that one end portion of the scraper 150 and the other end portion thereof are pressed at different strengths from each other so that the amount of abrasion of the scraper 150 becomes uniform. Specifically, in the pair of magnets 140 that biases the scraper 150, the magnetic force of the pair of magnets 140 is different from each other such that the amount of abrasion of the scraper 150 becomes uniform. For example, the magnetic force of the magnet 140 disposed on the side in which the amount of abrasion of the scraper 150 is great is small with respect to the magnetic force of the other magnet 140.

[0068] The present embodiment is thus configured, and in the cleaning device 100, the angle α being formed by the tangent-line upstream portion L of the bottom roller 14a or 15a, with which the scraper 150 comes into contact, and the upstream-side outer surface 152a of the scraper edge portion 152 is an obtuse angle. Because of this, the scraper edge portion 152 is in a state of scraping off fibers adhering on the outer circumferential surface of the bottom roller 14a or 15a. Thus, the scraper

edge portion 152 is restrained from escaping toward the downstream side in the rotational direction of the bottom roller 14a or 15a, and it is possible to remove the fibers adhering on the outer circumferential surface of the bottom roller 14a or 15a more reliably.

[0069] By making the angle α , which is formed by the tangent-line upstream portion L and the upstream-side outer surface 152a, be an obtuse angle, the scraper edge portion 152 can be brought into contact with the outer circumferential surface of the bottom roller 14a or 15a, and regardless of the type of the sliver S to be drafted, it is possible to remove the fibers reliably.

[0070] For example, when the angle α being formed by the tangent-line upstream portion L of the bottom roller 14a or 15a and the upstream-side outer surface 152a of the scraper edge portion 152 is increased, there is a need to make the scraper edge portion thin. Thus, when the angle α being formed by the tangent-line upstream portion L and the upstream-side outer surface 152a is made to be greater than 90° but less than or equal to 135° , it is possible to remove the fibers adhering on the outer circumferential surface of the bottom roller 14a or 15a more reliably while ensuring the thickness of the scraper edge portion 152 and keeping the strength thereof.

[0071] Note that, by forming the scraper edge portion 152 so that the angle α is greater than or equal to 100° but less than or equal to 120° , it is possible to remove the fibers adhering on the outer circumferential surface of the bottom roller 14a or 15a even more reliably while ensuring the thickness of the scraper edge portion 152 and keeping the strength thereof. Furthermore, by forming the scraper edge portion 152 so that the angle α is to be greater than or equal to 100° but less than or equal to 110° , it is possible to remove the fibers adhering on the outer circumferential surface of the bottom roller 14a or 15a further reliably while ensuring the thickness of the scraper edge portion 152 and keeping the strength thereof.

[0072] On the scraper main-unit portion 151 of the scraper 150, the projecting portions 155 projecting toward the bottom roller 14a or 15a side are provided. As just described, when the projecting portions 155 are provided, because the projecting portions 155 come into contact with the outer circumferential surface of the bottom roller 14a or 15a, it is possible to restrain the scraper main-unit portion 151 from wearing out. Accordingly, it is avoided that the scraper main-unit portion 151 wears out and the scraper 150 deforms greatly, for example, and it is possible to prolong the usable period of the scraper 150.

[0073] The projecting portions 155 are provided in the region sandwiched between the pressing areas Q in which the magnets 140 press the scraper main-unit portion 151, and the outer circumferential surface of the bottom roller 14a or 15a. In the regions pressed by the magnets 140, abrasion is likely to be promoted. However, because the projecting portions 155 are provided in the regions sandwiched between the pressing areas Q and

the outer circumferential surface of the bottom roller 14a or 15a, it is possible to further restrain the scraper main-unit portion 151 from wearing out.

[0074] The projecting portions 155 are provided at locations avoiding the region in which the sliver that would around the outer circumferential surface of the bottom roller 14a or 15a passes. In this case, because the fibers adhering on the outer circumferential surface of the bottom roller 14a or 15a are never to be pressed by the projecting portions 155, it is possible to prevent the projecting portions 155 from interfering with the removal of fibers by the scraper edge portion 152.

[0075] The pair of magnets 140 presses the scraper 150 such that one end portion of the scraper 150 and the other end portion thereof are pressed at different strengths from each other so that the amount of abrasion of the scraper 150 becomes uniform. For example, by the orientation of grooves (grooves m illustrated in FIG. 13) provided on the outer circumferential surface of the bottom roller 14a or 15a, and by the variance and others in the manufacturing accuracy of various portions, the bias in abrasion of the scraper 150 may occur. Even when such bias in abrasion occurs, by providing the magnets 140 in the above-described configuration, it is possible to suppress the bias in abrasion of the scraper 150 and prolong the usable period of the scraper 150. As just described, on the outer circumferential surface of the drafting roller, a plurality of grooves in a shape inclined at an angle other than the right angle with respect to the width direction (direction of a rotating shaft) of the drafting roller are formed, and in accordance with the inclination of the grooves, the pressing unit can change a pressing force in the width direction of the drafting roller.

[0076] The scraper edge portion 152 comes into contact with the outer circumferential surface of the bottom roller 14a or 15a at a location lower than the horizontal line that passes the axis of the bottom roller 14a or 15a when viewed along the axial direction of the bottom roller 14a or 15a. In this case, it is possible to efficiently drop the fibers that are removed from the bottom roller 14a or 15a, to the outside (lower side) of the scraper 150. On the lower side of the bottom roller 14a or 15a, because the fiber recovery device 80 is arranged, it is possible to efficiently recover the fibers removed by the cleaning device 100 by the fiber recovery device 80.

[0077] Herein, when the angle α by the tangent-line upstream portion L of the bottom roller 14a or 15a and by the upstream-side outer surface 152a of the scraper edge portion 152 is made to be an obtuse angle, the scraper 150 and others are to be located more downstream in the rotational direction of the bottom roller 14a or 15a than the contact point T at which the scraper edge portion 152 comes into contact with the outer circumferential surface of the bottom roller 14a or 15a. Thus, by bringing the scraper edge portion 152 into contact with the outer circumferential surface of the bottom roller 14a or 15a at the above-described location, the scraper edge portion 152 can be brought into contact with the outer

circumferential surface of the bottom roller 14a or 15a such that the angle by the tangent-line upstream portion L and the upstream-side outer surface 152a is to be an obtuse angle while ensuring the placement space of the members such as the scraper 150, without interfering with the placement of the top roller 14b or 15b.

[0078] The scraper 150 includes the pair of positioning claw portions 153. The pair of positioning claw portions 153 is provided at locations avoiding the region in which the sliver that wound around the outer circumferential surface of the bottom roller 14a or 15a passes. In this case, because the fibers adhering on the outer circumferential surface of the bottom roller 14a or 15a are never to be pressed by the positioning claw portions 153, it is possible to prevent the positioning claw portions 153 from interfering with the removal of fibers by the scraper edge portion 152.

[0079] Next, a first modification of the scraper will be described. As illustrated in FIGS. 9 to 11, a scraper 150A according to the first modification includes projecting portions 155A and projecting portions 155B. In the scraper 150A in the first modification, the configurations other than the projecting portions 155A and 155B are the same as those of the scraper 150 in the embodiment, and by giving identical reference signs, the explanations thereof are omitted. The scraper 150A in the first modification is, as with the scraper 150 in the embodiment, provided on the cleaning device 100.

[0080] The projecting portions 155A are of the configuration the same as that of the projecting portions 155 provided on the scraper 150. Two pieces of the projecting portions 155B, when the scraper main-unit portion 151 is viewed from the back-bottom roller 14a side, are provided so as to cover a whole of the pressing areas Q that are pressed by the magnets 140. The projecting portions 155B are projecting from the outer surface of the scraper main-unit portion 151 toward the outer circumferential surface of the back-bottom roller 14a. That is, the projecting portions 155B are provided in regions sandwiched between the pressing areas Q by the magnets 140 and the outer circumferential surface of the bottom roller 14a. The surfaces of the back-bottom roller 14a side in the projecting portions 155B are formed in a circular arc shape so as to lie along the outer circumferential surface of the back-bottom roller 14a. The surfaces of the back-bottom roller 14a side in the projecting portions 155A and the surfaces of the back-bottom roller 14a side in the projecting portions 155B are on the same surface without causing a stepped portion and the like.

[0081] As with the projecting portions 155 described in the embodiment, in a state that the scraper edge portion 152 and the positioning claw portions 153 are in contact with the outer circumferential surface of the back-bottom roller 14a, the projecting portions 155B are provided so as to have a slight gap between the outer circumferential surface of the back-bottom roller 14a and the projecting portion 155B. Alternatively, in a state that the scraper edge portion 152 and the positioning claw portions 153

are in contact with the outer circumferential surface of the back-bottom roller 14a, the projecting portions 155B may be in contact with the outer circumferential surface of the back-bottom roller 14a.

[0082] As just described, in addition to the projecting portions 155A, by including the projecting portions 155B provided so as to cover the whole of the pressing areas Q pressed by the magnets 140, the scraper 150A can further restrain the scraper main-unit portion 151 from wearing out. Consequently, it is possible to further prolong the usable period of the scraper 150A.

[0083] Next, a second modification of the scraper will be described. As illustrated in FIG. 12, a scraper 150B according to the second modification includes stopper portions 160 that are added to the scraper 150A in the first modification. The configurations other than the stopper portions 160 in the scraper 150B are the same as those of the scraper 150A, and by giving identical reference signs, the explanations thereof are omitted. The scraper 150B in the second modification is, as with the scraper 150 in the embodiment, provided on the cleaning device 100.

[0084] As illustrated in FIGS. 12 to 14, on both end portions (both end portions in the width direction of the back-bottom roller 14a) of the scraper main-unit portion 151 in the scraper 150B, the respective stopper portions 160 are provided. The stopper portions 160 are projecting from the scraper main-unit portion 151 toward the outer circumferential surface of the back-bottom roller 14a. In the present embodiment, the stopper portions 160 are provided at the locations closest to the ends in the width direction of the back-bottom roller 14a in the scraper main-unit portion 151. The stopper portions 160 are provided near the middle in the rotational direction of the back-bottom roller 14a in the scraper main-unit portion 151.

[0085] Herein, as illustrated in FIG. 13, on the outer circumferential surface of the back-bottom roller 14a, a drafting surface H1 and smooth surfaces H2 are provided. On the drafting surface H1, a plurality of grooves m extending in the direction intersecting with the rotational direction of the back-bottom roller 14a are provided. By being provided with the grooves m, when drafting the sliver S by the back-bottom roller 14a, the slippage of the sliver S with respect to the back-bottom roller 14a is suppressed. The drafting surface H1 is extending over the entire area in the circumferential direction of the outer circumferential surface of the back-bottom roller 14a.

[0086] On the smooth surface H2, being different from the drafting surface H1, the grooves m are not provided. The smooth surface H2 has a smoother surface than that of the drafting surface H1. The smooth surface H2 is extending over the entire area in the circumferential direction of the outer circumferential surface of the back-bottom roller 14a. In the present embodiment, the region on which the smooth surface H2 in the back-bottom roller 14a is provided has a small diameter with respect to the region on which the drafting surface H1 in the back-bot-

tom roller 14a is provided.

[0087] The drafting surface H1 and the smooth surfaces H2 are provided at locations different from each other in the width direction of the back-bottom roller 14a. In the present embodiment, in the width direction of the back-bottom roller 14a, the smooth surfaces H2 are provided at two locations on the outer circumferential surface of the back-bottom roller 14a so as to sandwich the drafting surface H1.

[0088] As illustrated in FIG. 13, in a state that the scraper 150B was brought into contact with the outer circumferential surface of the back-bottom roller 14a, the positioning claw portions 153 and the scraper edge portion 152 come into contact with the drafting surface H1. The stopper portions 160 are projecting toward the smooth surfaces H2.

[0089] Herein, a distance between the distal end portion of the stopper portion 160 and the smooth surface H2 is denoted as K1 (see FIG. 13). As illustrated in FIG. 14, a distance between the surface (hereinafter referred to as "pressing surface 151b") that is pressed by the magnets 140 in the scraper main-unit portion 151 and the outer circumferential surface (the drafting surface H1) of the back-bottom roller 14a is denoted as K2. The distance K1 is narrower than the distance K2. That is, the projecting height of the stopper portions 160 and the thickness of the scraper main-unit portion 151 are set, so as to satisfy this condition of the distance K1 and the distance K2.

[0090] As just described, in the scraper 150B, when the scraper edge portion 152 and the like wear out and a whole of the scraper 150 comes close to the outer circumferential surface side of the back-bottom roller 14a, the distal end of the stopper portion 160 comes into contact with the smooth surface H2. Because the stopper portions 160 are provided on both end portions of the scraper main-unit portion 151, the operator can visually recognize the stopper portions 160 easily. Thus, the operator can, by visually recognizing the distance between the distal end portion of the stopper portion 160 and the smooth surface H2, easily understand a state of abrasion of the scraper 150B. Accordingly, the operator can easily understand the time to replace the scraper 150B.

[0091] The distance K1 is narrower than the distance K2. Thus, at the time the distal end portion of the stopper portion 160 first comes into contact with the smooth surface H2, there is some thickness remaining to the scraper main-unit portion 151. That is, the operator can understand, by checking whether the stopper portion 160 has come into contact with the smooth surface H2, the time to replace the scraper 150B, before the scraper main-unit portion 151 wears out and has holes and the like.

[0092] The stopper portions 160 are extending toward the smooth surface H2 of the back-bottom roller 14a. When the scraper edge portion 152 and the like wear out, the stopper portions 160 come into contact with the smooth surfaces H2. Thus, the abrasion of the stopper portions 160 is reduced as compared with when the stop-

per portions 160 are in contact with the drafting surface H1 having the grooves m. Furthermore, because the stopper portions 160 come into contact with the smooth surfaces H2, the scraper 150B is restrained from further nearing the drafting surface H1. Accordingly, the scraper main-unit portion 151 is restrained from wearing out and having holes and the like, and the magnets 140 are restrained from being brought into contact directly with the drafting surface H1.

[0093] The color of the distal end portion of the stopper portion 160 may be different from the color of the base portion of the stopper portion 160. For example, the distal end portion of the stopper portion 160 may be colored in a color different from that of the base portion of the stopper portion 160. In this case, when the distal end portion of the stopper portion 160 comes into contact with the smooth surface H2 and wears out, the colored portion of the distal end portion disappears. Thus, the operator can visually recognize easily that the stopper portion 160 has come into contact with the smooth surface H2.

[0094] The stopper portions 160 are not limited to being provided on both end portions of the scraper main-unit portion 151. The stopper portion 160 may be provided on either one of the two end portions of the scraper main-unit portion 151.

[0095] As in the foregoing, one embodiment of the present disclosure has been described. The disclosure, however, is not limited to the above-described embodiment. For example, the cleaning device 100 may, out of the various drafting rollers that the drafting device 6 includes, be provided on a drafting roller other than the back-bottom roller 14a and the third bottom roller 15a. For example, when the configuration of the drafting device 6 is different from that of the embodiment and is of a three-line type that includes no third roller pair 15 but includes three drafting roller pairs, it is preferable that the cleaning device 100 be provided (mounted) only on the back-bottom roller 14a. However, the cleaning device 100 may be provided on a drafting roller other than the back-bottom roller 14a. The angle α being formed by the tangent-line upstream portion L of the drafting roller (for example, the bottom roller 14a or 15a), on which the cleaning device 100 is mounted, and the upstream-side outer surface 152a of the scraper edge portion 152 only needs to be an obtuse angle, but is not indispensable to be greater than 90° but less than or equal to 135°. Furthermore, it is not indispensable to provide the projecting portions 155, 155A, and 155B on the scrapers 150, 150A, and 150B, respectively. When the projecting portions 155 and the like are provided on the scraper main-unit portion 151, it is not indispensable to provide them in the region sandwiched between the pressing areas Q, in which the magnets 140 press the scraper main-unit portion 151, and the outer circumferential surface of the bottom roller 14a or 15a. It is not indispensable that, in the width direction of the bottom roller 14a or 15a, the projecting portions 155, 155A, and 155B are provided at locations avoiding the region in which the sliver that wound around

the outer circumferential surface of the bottom roller 14a or 15a passes. The stopper portions 160 of the scraper 150B in the second modification may be provided on the scraper 150 in the embodiment.

[0096] The magnets 140 may press the scraper 150 such that both end portions of the scraper 150 are pressed onto the bottom roller 14a or 15a with the same strength to each other. The scraper edge portion 152 may come into contact with the outer circumferential surface of the bottom roller 14a or 15a not at a location on the lower side than the horizontal line that passes the axis of the bottom roller 14a or 15a when viewed along the axial direction of the bottom roller 14a or 15a. The positioning claw portions 153 may be provided not at locations avoiding the region in which the sliver that wound around the outer circumferential surface of the bottom roller 14a or 15a passes.

[0097] While the scraper 150 has been pressed toward the outer circumferential surface of the bottom roller 14a or 15a by the magnets 140, it may be pressed by a pressing unit other than the magnets 140.

[0098] As another modification, a cleaning device may include no projecting portions 155, 155A, or 155B in the above-described cleaning device 100 and may, in addition, include no configuration in which the angle α being formed by the tangent-line upstream portion L of the bottom roller 14a or 15a and the upstream-side outer surface 152a of the scraper edge portion 152 is an obtuse angle. The cleaning device in this modification is provided with the above-described pair of magnets 140. In the cleaning device in this modification, the magnets 140 press a scraper such that one end portion of the scraper and the other end portion thereof are pressed at different strengths from each other so that the amount of abrasion of the scraper becomes uniform. The cleaning device in this modification, by having the configuration of the above-described magnets 140, can suppress the bias in abrasion of the scraper and can prolong the usable period of the scraper. That is, the cleaning device for a drafting roller in this modification is a cleaning device for a drafting roller that includes a scraper extending along the width direction of the drafting roller and configured to come into contact with the outer circumferential surface of the drafting roller, and is provided with a pressing unit that presses the scraper toward the outer circumferential surface of the drafting roller, and the pressing unit presses the scraper such that one end portion in the width direction of the drafting roller in the scraper and the other end portion thereof are pressed at different strengths from each other.

[0099] By providing the cleaning device 100 on the drafting device 6 of the spinning unit 2 provided with the air spinning device 7, it is possible to remove fibers adhering on the bottom roller 14a or 15a by the cleaning device 100 and to draft the sliver S. The cleaning device 100 may, however, be provided on a drafting device that drafts the sliver and the like spun by a spinning device other than the air spinning device 7.

[0100] In the spinning unit 2, in the direction of machine height, the various devices have been arranged such that the yarn Y supplied on the upper side is taken up on the lower side. However, the various devices may be arranged such that the yarn Y supplied on the lower side is taken up on the upper side. In FIG. 1, the spinning machine 1 is illustrated so as to take up the package P of a cheese shape. However, it is possible to take up the package P of a cone shape.

[0101] In the spinning unit 2, the yarn storage device 11 has the function of extruding the yarn Y from the air spinning device 7. However, the yarn Y may be extruded from the air spinning device 7 by a delivery roller and a nip roller. When the yarn Y is extruded from the air spinning device 7 by the delivery roller and the nip roller, in place of the yarn storage device 11, a slack tube absorbing the slack of the yarn Y by a suction airflow, or a mechanical compensator and the like may be provided.

[0102] In the traveling direction of the yarn Y, the tension sensor 9 may be provided on the upstream side of the yarn monitor 8. The unit controller 10 may be provided to each of the spinning units 2. In the spinning unit 2, the waxing device 12, the tension sensor 9, and the yarn monitor 8 may be omitted.

[0103] At least a part of the above-described embodiment and modifications may be combined in any desired manner.

[0104] The cleaning device for a drafting roller according to one form of the present disclosure is a cleaning device for a drafting roller including a scraper extending along the width direction of the drafting roller and configured to come into contact with an outer circumferential surface of the drafting roller; and includes a pressing unit configured to press the scraper toward the outer circumferential surface of the drafting roller; the scraper includes a scraper main-unit portion on which a scraper edge portion and a stopper portion are provided and facing the outer circumferential surface of the drafting roller; the scraper main-unit portion is pressed toward the outer circumferential surface of the drafting roller by the pressing unit; the scraper edge portion comes into contact with the outer circumferential surface of the drafting roller; the stopper portion is provided on at least either one of end portions in the width direction of the drafting roller in the scraper edge portion and is projecting toward the outer circumferential surface of the drafting roller; and the distance between the distal end portion of the stopper portion and the outer circumferential surface of the drafting roller is narrower than the distance between the surface pressed by the pressing unit in the scraper main-unit portion and the outer circumferential surface of the drafting roller.

[0105] In this case, in the scraper, when the scraper edge portion and the like wear out and a whole of the scraper comes close to the outer circumferential surface side of the drafting roller, the distal end of the stopper portion comes into contact with the outer circumferential surface of the drafting roller. Because the stopper portion

is provided on both end portions of the scraper main-unit portion, the operator can visually recognize the stopper portion easily. Thus, the operator can understand, by visually recognizing the distance between the distal end portion of the stopper portion and the outer circumferential surface of the drafting roller, a state of abrasion of the scraper easily. Accordingly, the operator can easily understand the time to replace the scraper. The distance between the distal end portion of the stopper portion and the outer circumferential surface of the drafting roller is narrower than the distance between the surface pressed by the pressing unit in the scraper main-unit portion and the outer circumferential surface of the drafting roller. Thus, at the time the distal end portion of the stopper portion first comes into contact with the outer circumferential surface of the drafting roller, there is some thickness remaining to the scraper main-unit portion. That is, the operator can understand, by checking whether the stopper portion has come into contact with the outer circumferential surface of the drafting roller, the time to replace the scraper, before the scraper main-unit portion wears out and has holes and the like.

[0106] The cleaning device for a drafting roller according to one form of the present disclosure is a cleaning device for a drafting roller, including a scraper extending along the width direction of the drafting roller and configured to come into contact with an outer circumferential surface of the drafting roller; and a pressing unit configured to press the scraper toward the outer circumferential surface of the drafting roller. The drafting roller is provided with, on the outer circumferential surface thereof, a drafting surface on which a plurality of grooves extending in a direction intersecting with the rotational direction are provided and a smooth surface having a surface smoother than the drafting surface. The drafting surface and the smooth surface are provided at locations different from each other in the width direction of the drafting roller and are extending over the entire area in the circumferential direction of the outer circumferential surface of the drafting roller. The scraper includes a scraper main-unit portion on which a scraper edge portion and a stopper portion are provided and facing the outer circumferential surface of the drafting roller. The scraper main-unit portion is pressed toward the outer circumferential surface of the drafting roller by the pressing unit. The scraper edge portion comes into contact with the drafting surface of the drafting roller. The stopper portion is projecting toward the outer circumferential surface of the drafting roller. The distance between the distal end portion of the stopper portion and the smooth surface of the drafting roller is narrower than the distance between the surface pressed by the pressing unit in the scraper main-unit portion and the drafting surface of the drafting roller.

[0107] In this case, when the scraper edge portion and the like wear out and a whole of the scraper comes close to the outer circumferential surface side of the drafting roller, the distal end of the stopper portion comes into contact with the smooth surface of the drafting roller. The

operator can understand, by visually recognizing the distance between the distal end portion of the stopper portion and the outer circumferential surface of the drafting roller, a state of abrasion of the scraper. Accordingly, the operator can easily understand the time to replace the scraper. Furthermore, the distance between the distal end portion of the stopper portion and the outer circumferential surface of the drafting roller is narrower than the distance between the surface pressed by the pressing unit in the scraper main-unit portion and the outer circumferential surface of the drafting roller. Thus, at the time the distal end portion of the stopper portion first comes into contact with the outer circumferential surface of the drafting roller, there is some thickness remaining to the scraper main-unit portion. That is, the operator can understand, by checking whether the stopper portion has come into contact with the outer circumferential surface of the drafting roller, the time to replace the scraper, before the scraper main-unit portion wears out and has holes and the like. The stopper portion is extending toward the smooth surface of the drafting roller. When the scraper edge portion and the like wear out, the stopper portion comes into contact with the smooth surface. Thus, the abrasion of the stopper portion is reduced as compared with when the stopper portion comes into contact with the drafting surface having the grooves. Furthermore, because the stopper portion comes into contact with the smooth surface, the scraper is restrained from further nearing the drafting surface. Accordingly, the scraper main-unit portion is restrained from wearing out and having holes and the like, and the pressing unit is restrained from being brought into contact directly with the drafting surface.

Claims

1. A cleaning device (100) for a drafting roller (14a, 14b, 15a, 15b, 17a, 17b) comprising:

a scraper (150, 150A, 150B) extending along a width direction of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b) and configured to come into contact with an outer circumferential surface of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b), **characterized in that**

the scraper (150; 150A; 150B) is provided with, at an end portion on an upstream side in a rotational direction of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b), a scraper edge portion (152) configured to come into contact with the outer circumferential surface of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b), and an angle (α) being formed by a tangent-line upstream portion (L) that is on a tangent line of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b) passing a contact point (T) with the scraper edge portion (152) and extends from the contact point

- (T) toward the upstream side of the rotational direction of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b), and by an upstream-side outer surface (152a) that is in an outer surface of the scraper edge portion (152) and is a surface facing the upstream side in the rotational direction of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b), is an obtuse angle when viewed along an axial direction of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b).
2. The cleaning device (100) for a drafting roller (14a, 14b, 15a, 15b, 17a, 17b) according to claim 1, **characterized in that** the angle (α) formed by the tangent-line upstream portion (L) and the upstream-side outer surface (152a) is greater than 90° but less than or equal to 135° when viewed along the axial direction of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b).
 3. The cleaning device (100) for a drafting roller (14a, 14b, 15a, 15b, 17a, 17b) according to claim 1 or 2, **characterized in that** the scraper (150; 150A; 150B) further comprises:
 - a scraper main-unit portion (151) provided with the scraper edge portion (152) and facing the outer circumferential surface of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b); and
 - a projecting portion (155; 155A; 155B) provided on a surface facing the drafting roller (14a, 14b, 15a, 15b, 17a, 17b) in the scraper main-unit portion (151).
 4. The cleaning device (100) for a drafting roller (14a, 14b, 15a, 15b, 17a, 17b) according to claim 3, further comprising a pressing unit (140) configured to press the scraper main-unit portion (151) toward the outer circumferential surface of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b), **characterized in that** the projecting portion (155; 155A; 155B) is provided in a region sandwiched between a pressing area (Q) in which the pressing unit (140) presses the scraper main-unit portion (151), and the outer circumferential surface of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b).
 5. The cleaning device (100) for a drafting roller (14a, 14b, 15a, 15b, 17a, 17b) according to claim 4, **characterized in that** the scraper main-unit portion (151) is provided with a stopper portion (160) projecting toward the outer circumferential surface of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b) on at least either one of end portions thereof in the width direction of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b), and a distance (K1) between a distal end portion of the stopper portion (160) and the outer circumferential surface of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b) is narrower than a distance (K2) between a surface (151b) pressed by the pressing unit (140) in the scraper main-unit portion (151) and the outer circumferential surface of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b).
 6. The cleaning device (100) for a drafting roller (14a, 14b, 15a, 15b, 17a, 17b) according to claim 5, **characterized in that** the drafting roller (14a, 14b, 15a, 15b, 17a, 17b) is provided with, on the outer circumferential surface thereof, a drafting surface (H1) on which a plurality of grooves (m) extending in a direction intersecting with the rotational direction are provided and a smooth surface (H2) having a surface smoother than the drafting surface (H1), the drafting surface (H1) and the smooth surface (H2) are provided at locations different from each other in the width direction of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b) and are extending over an entire area in a circumferential direction of the outer circumferential surface of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b), the scraper edge portion (152) comes into contact with the drafting surface (H1), and the stopper portion (160) is projecting toward the smooth surface (H2).
 7. The cleaning device (100) for a drafting roller (14a, 14b, 15a, 15b, 17a, 17b) according to any one of claims 3 to 6, **characterized in that** the projecting portion (155; 155A; 155B) is provided at a location avoiding, in the width direction of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b), an area in which a sliver (S) that wound around the outer circumferential surface of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b) passes.
 8. The cleaning device (100) for a drafting roller (14a, 14b, 15a, 15b, 17a, 17b) according to any one of claims 1 to 7, further comprising a pressing unit (140) configured to press the scraper (150; 150A; 150B) toward the outer circumferential surface of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b), **characterized in that** the pressing unit (140) presses the scraper (150; 150A; 150B) such that one end portion in the width direction of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b) in the scraper (150; 150A; 150B) and the other end portion thereof are pressed with different force.
 9. The cleaning device (100) for a drafting roller (14a, 14b, 15a, 15b, 17a, 17b) according to any one of claims 1 to 8, **characterized in that** the drafting roller (14a, 14b, 15a, 15b, 17a, 17b) is, out of a top roller (14b, 15b, 17b) and a bottom roller

(14a, 15a, 17a) vertically arranged in juxtaposition, the bottom roller (14a, 15a, 17a), and the scraper edge portion (152) comes into contact with the outer circumferential surface of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b) at a location lower than a horizontal line that passes an axis of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b) when viewed along the axial direction of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b).

10. The cleaning device (100) for a drafting roller (14a, 14b, 15a, 15b, 17a, 17b) according to any one of claims 1 to 9, wherein the scraper (150; 150A; 150B) is provided with a positioning claw portion (153) configured to come into contact with the outer circumferential surface of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b) and to make positioning of the scraper (150; 150A; 150B), at an endportion on a downstream side in the rotational direction of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b), and the positioning claw portion (153) is provided at a location avoiding, in the width direction of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b), an area in which a sliver (S) that wound around the outer circumferential surface of the drafting roller (14a, 14b, 15a, 15b, 17a, 17b) passes.

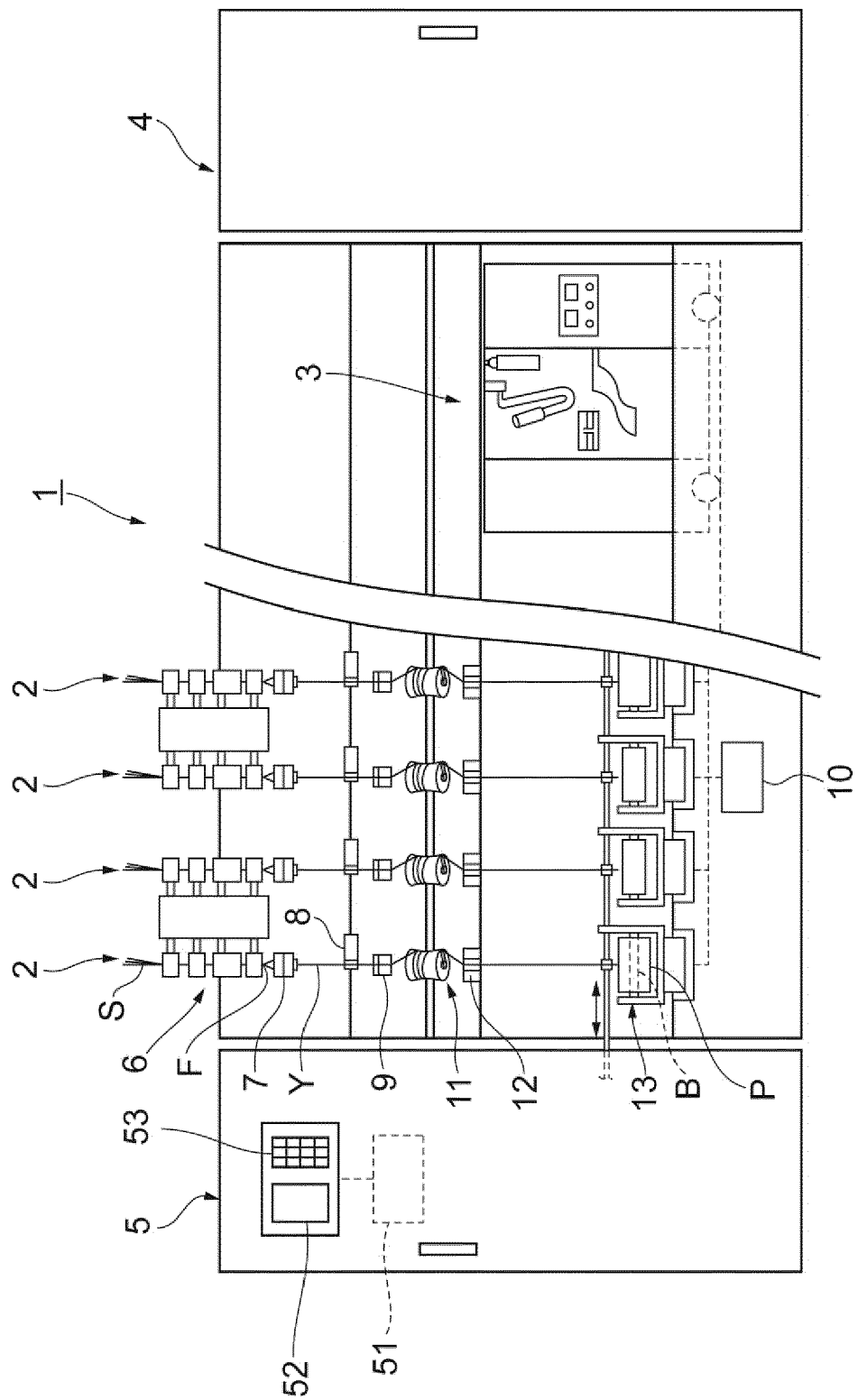


Fig. 1

Fig.2

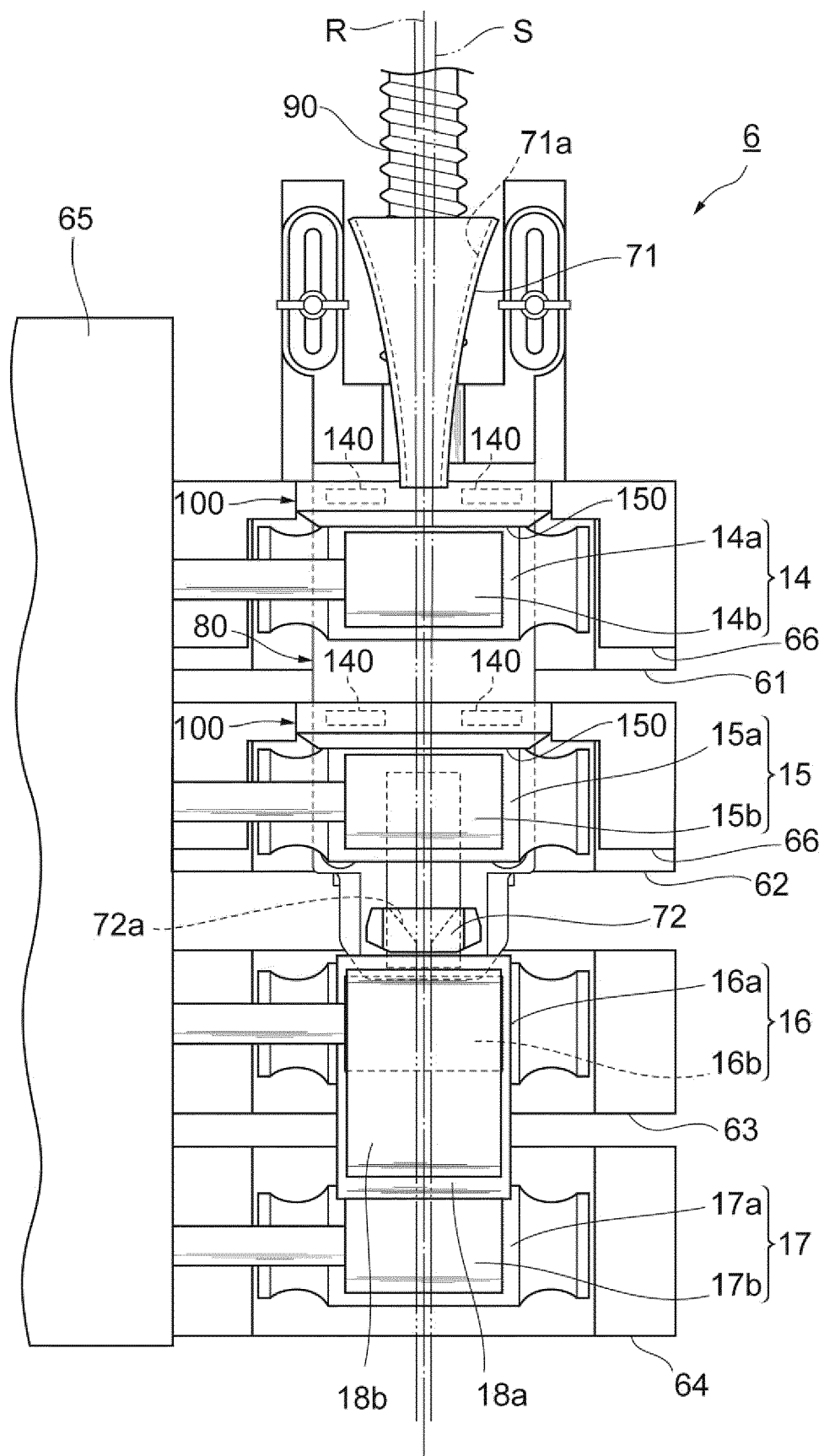


Fig.3

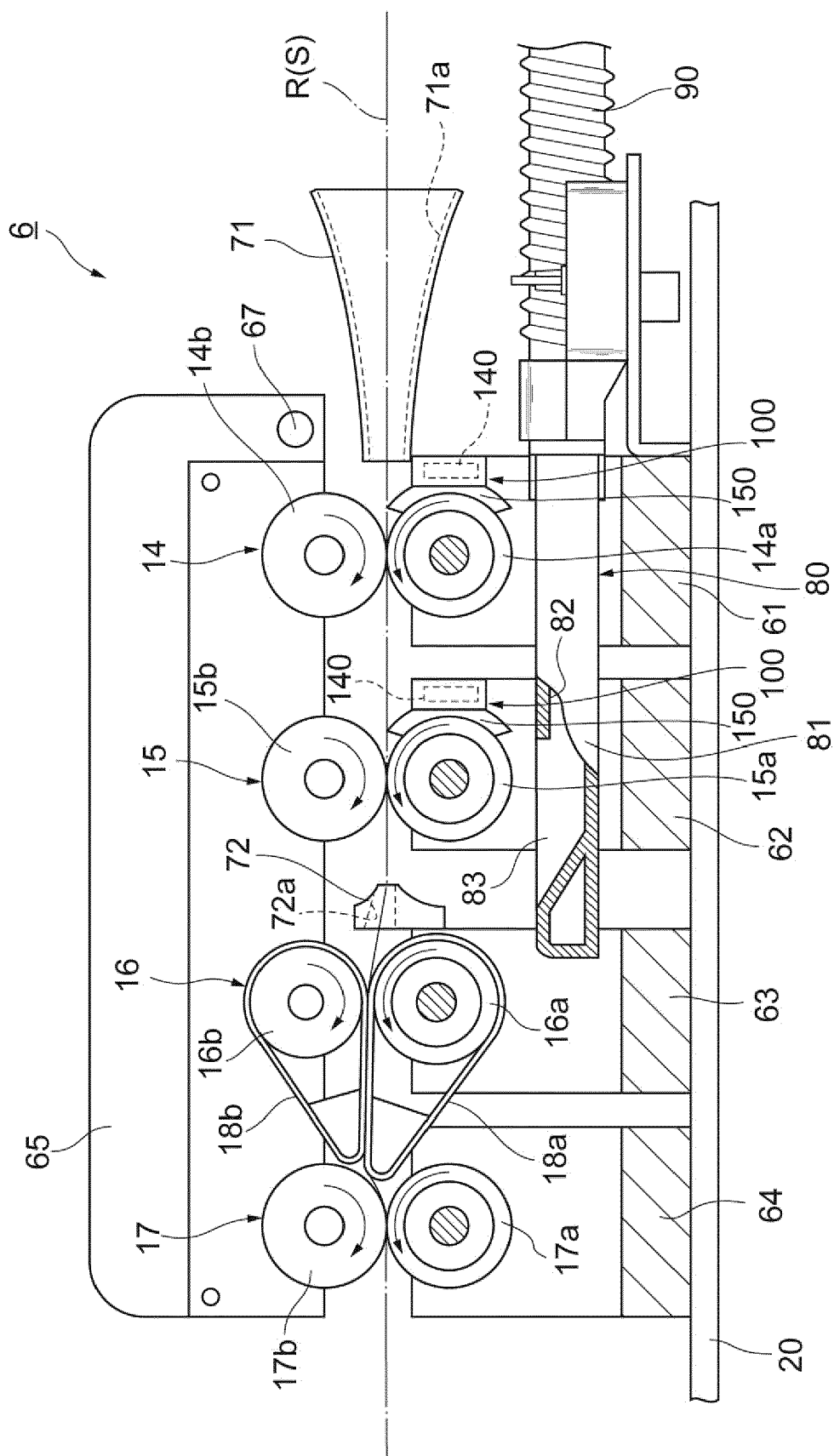


Fig.4

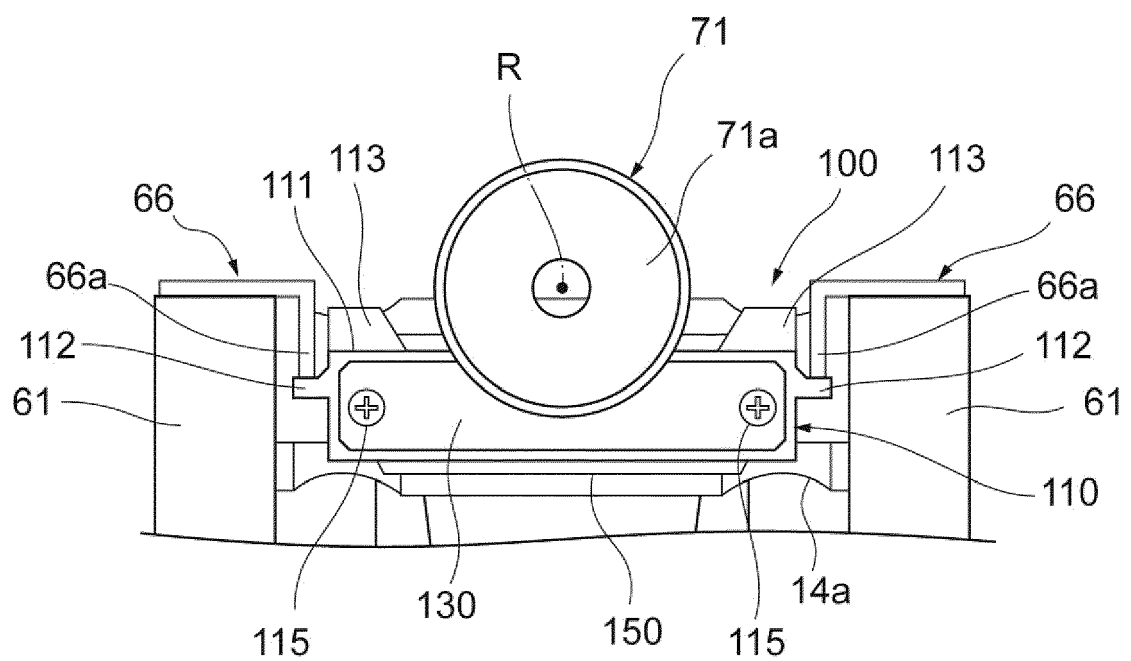
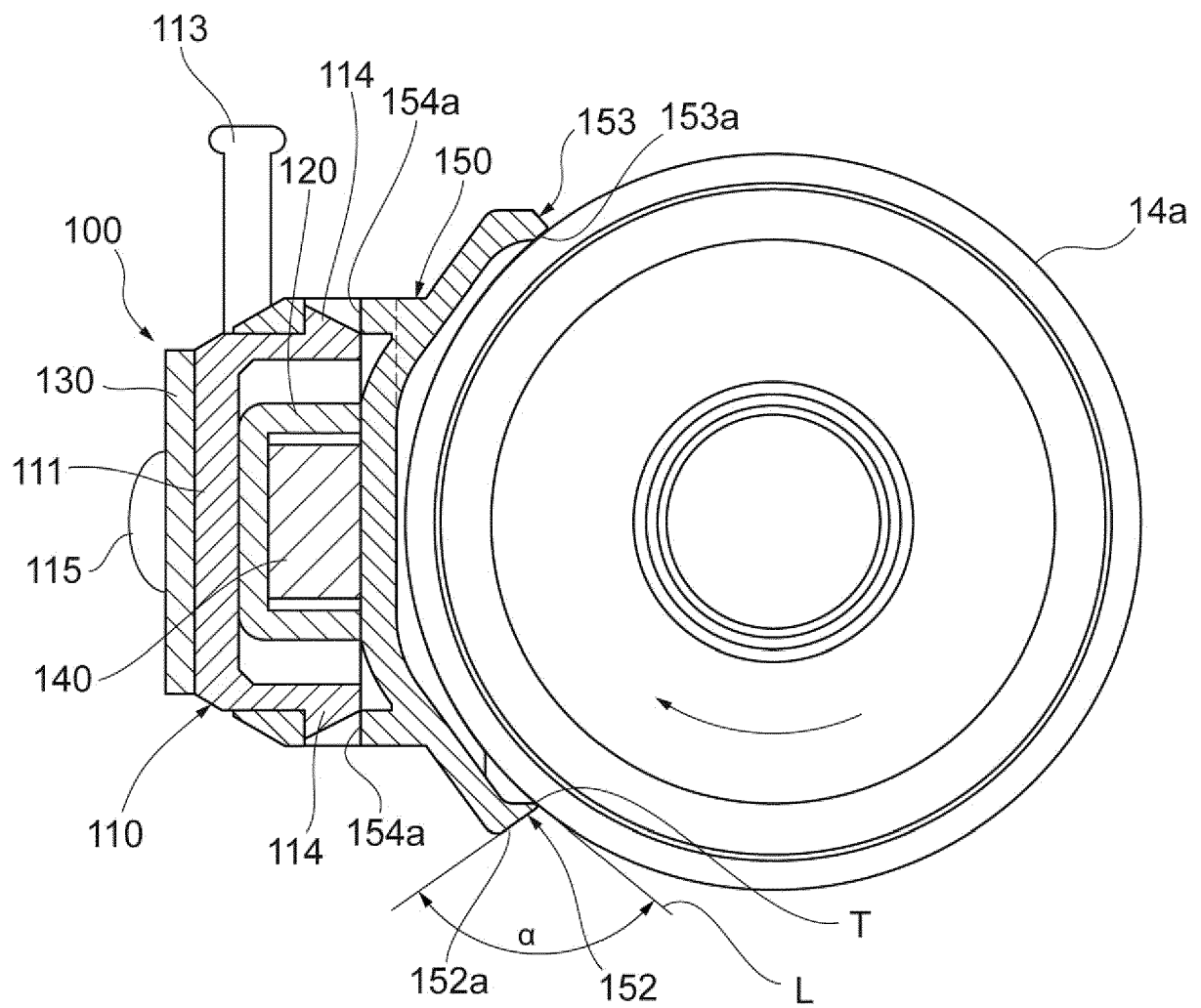


Fig.5



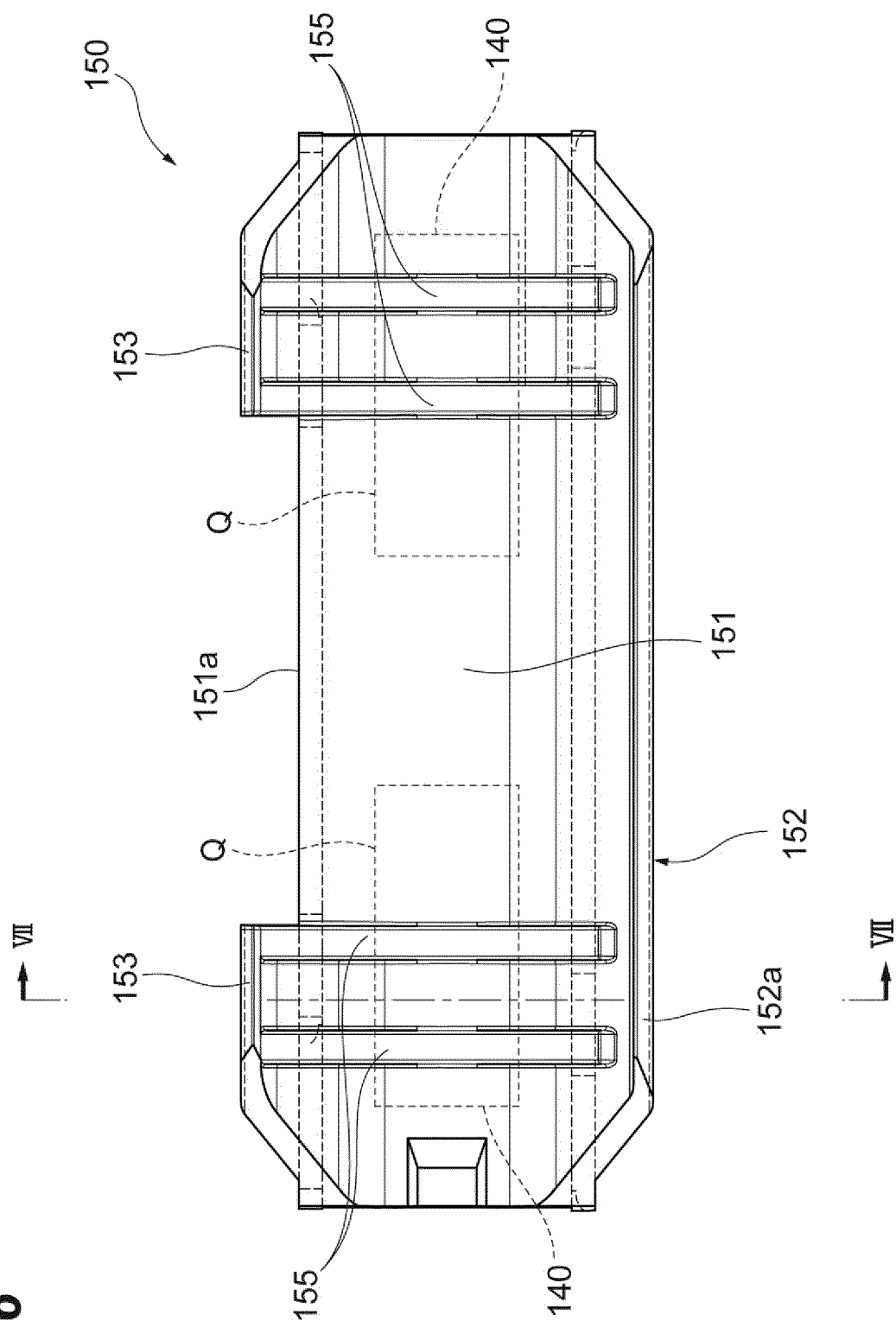
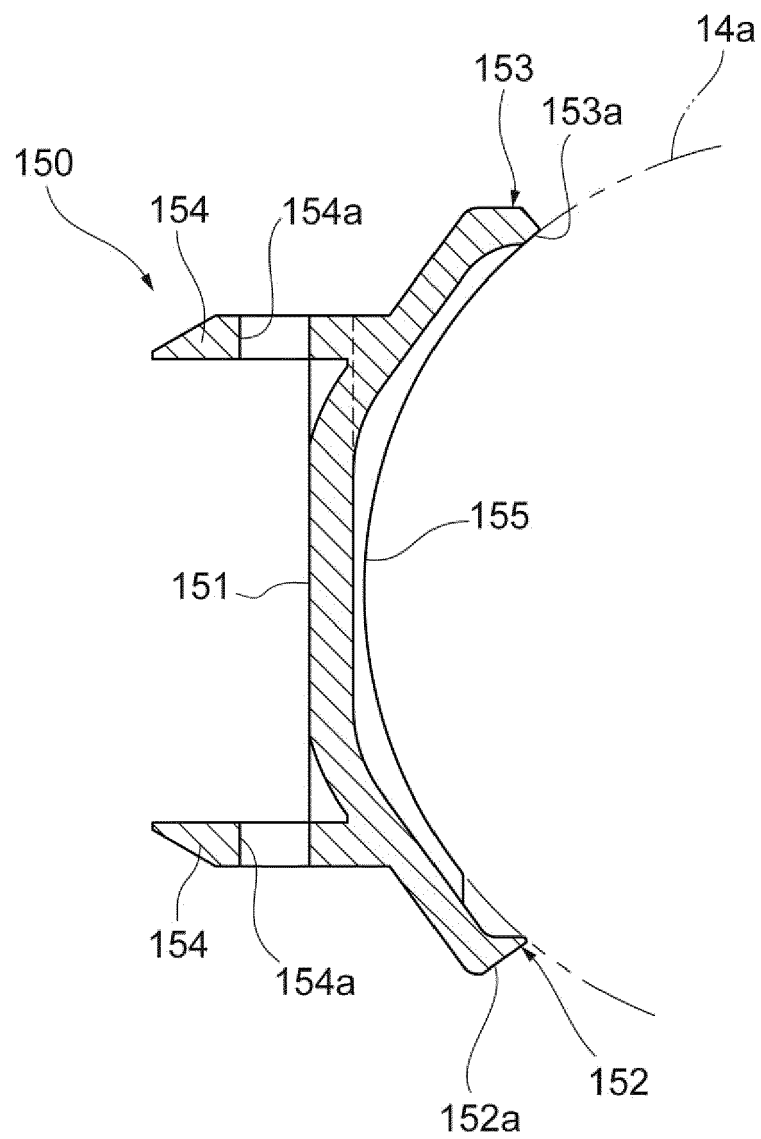


Fig. 6

Fig.7



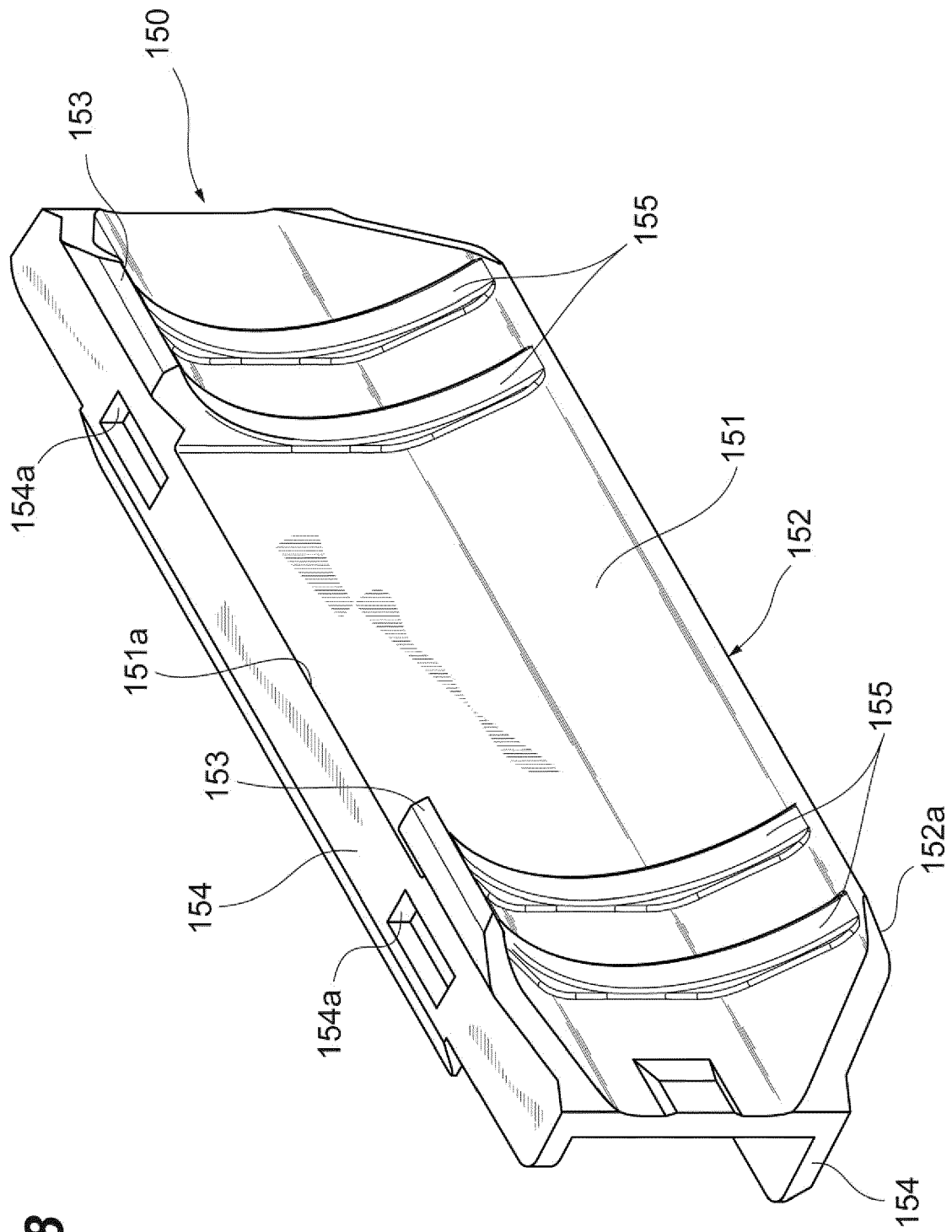


Fig. 8

Fig.9

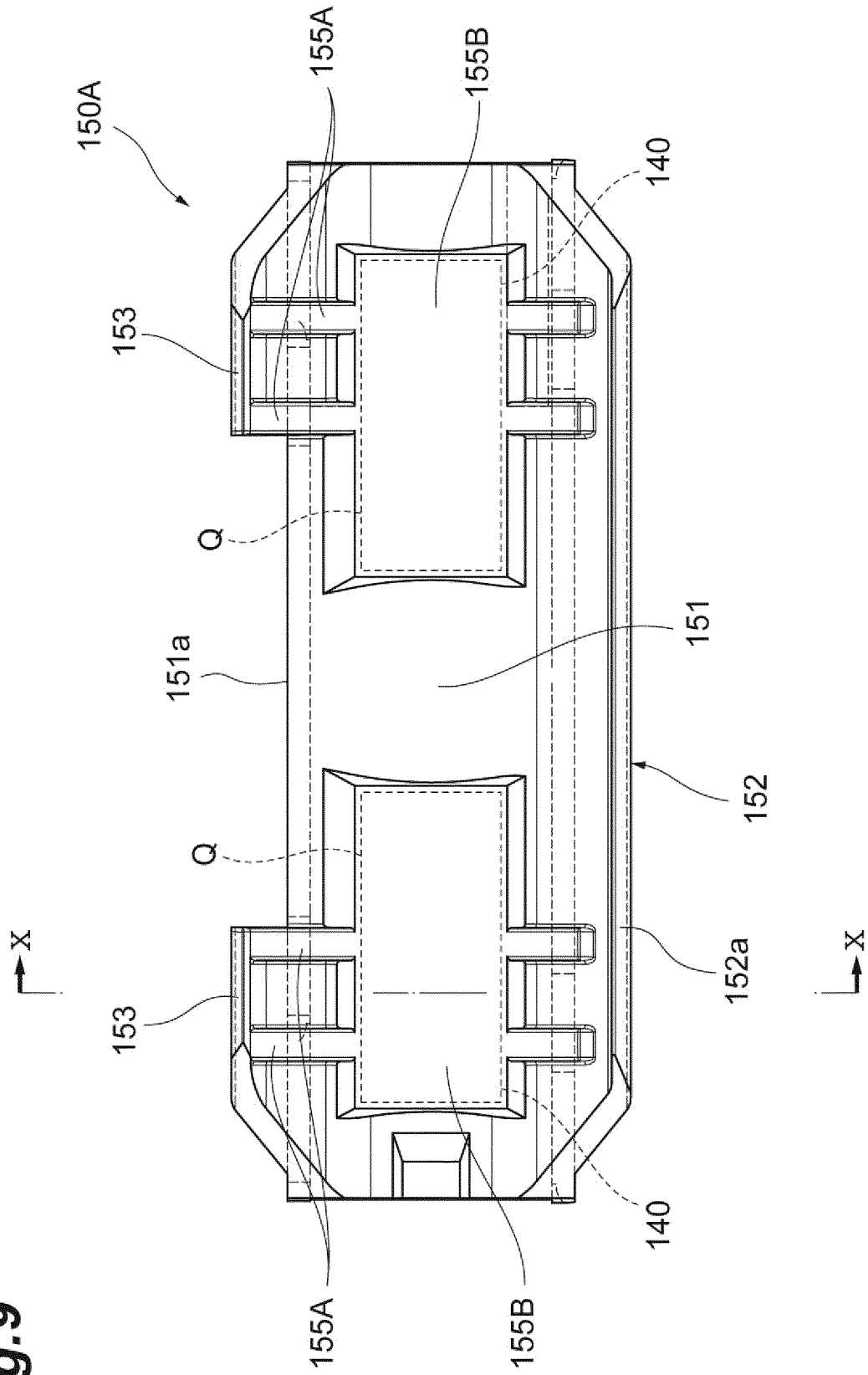
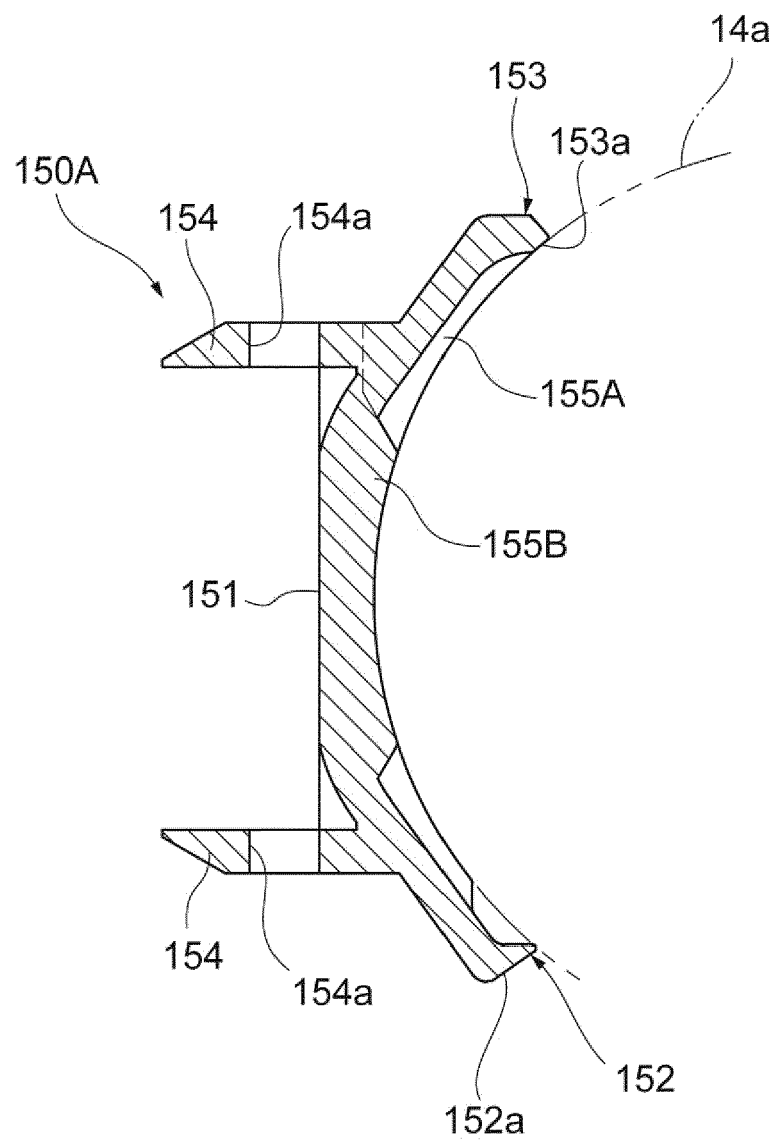


Fig.10



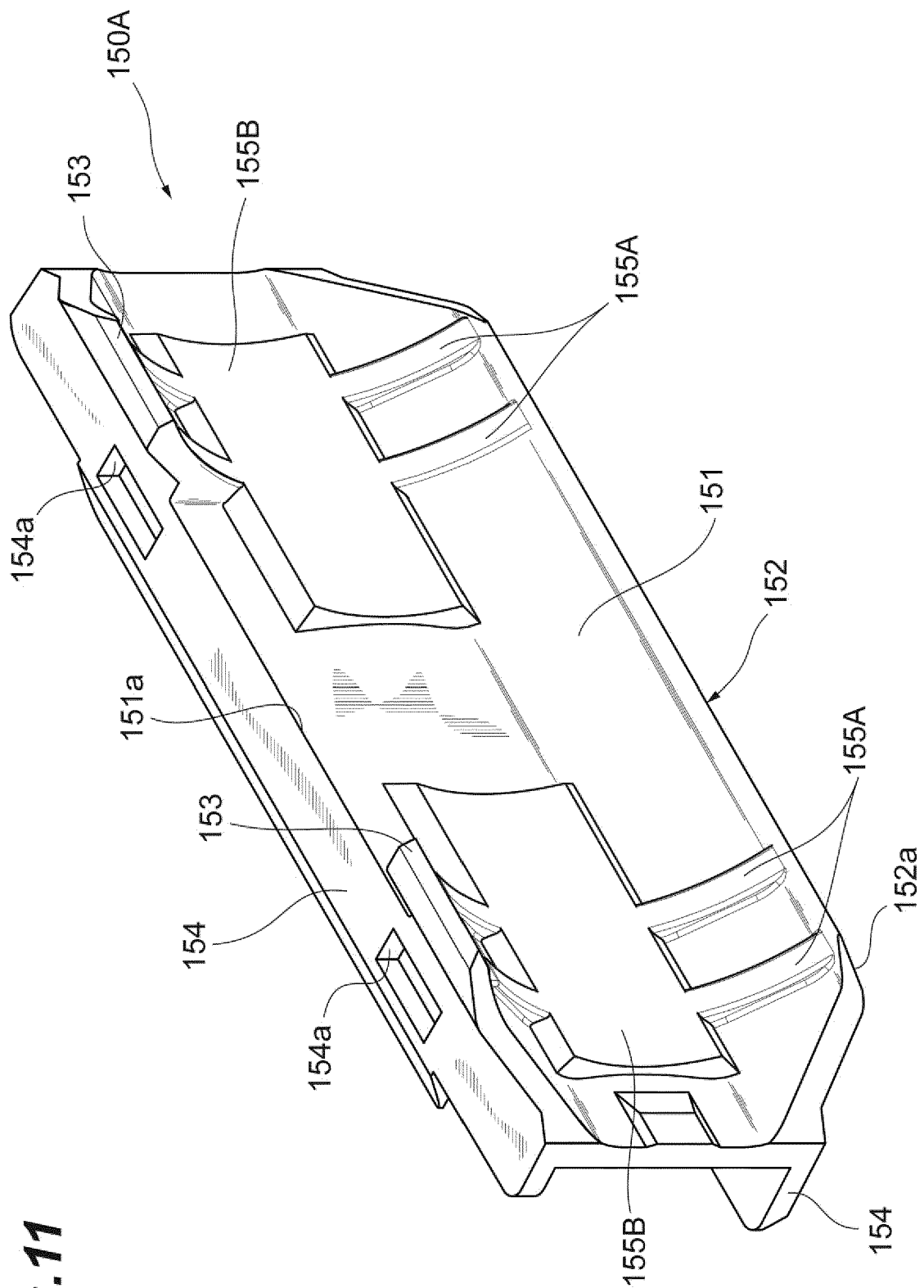


Fig. 11

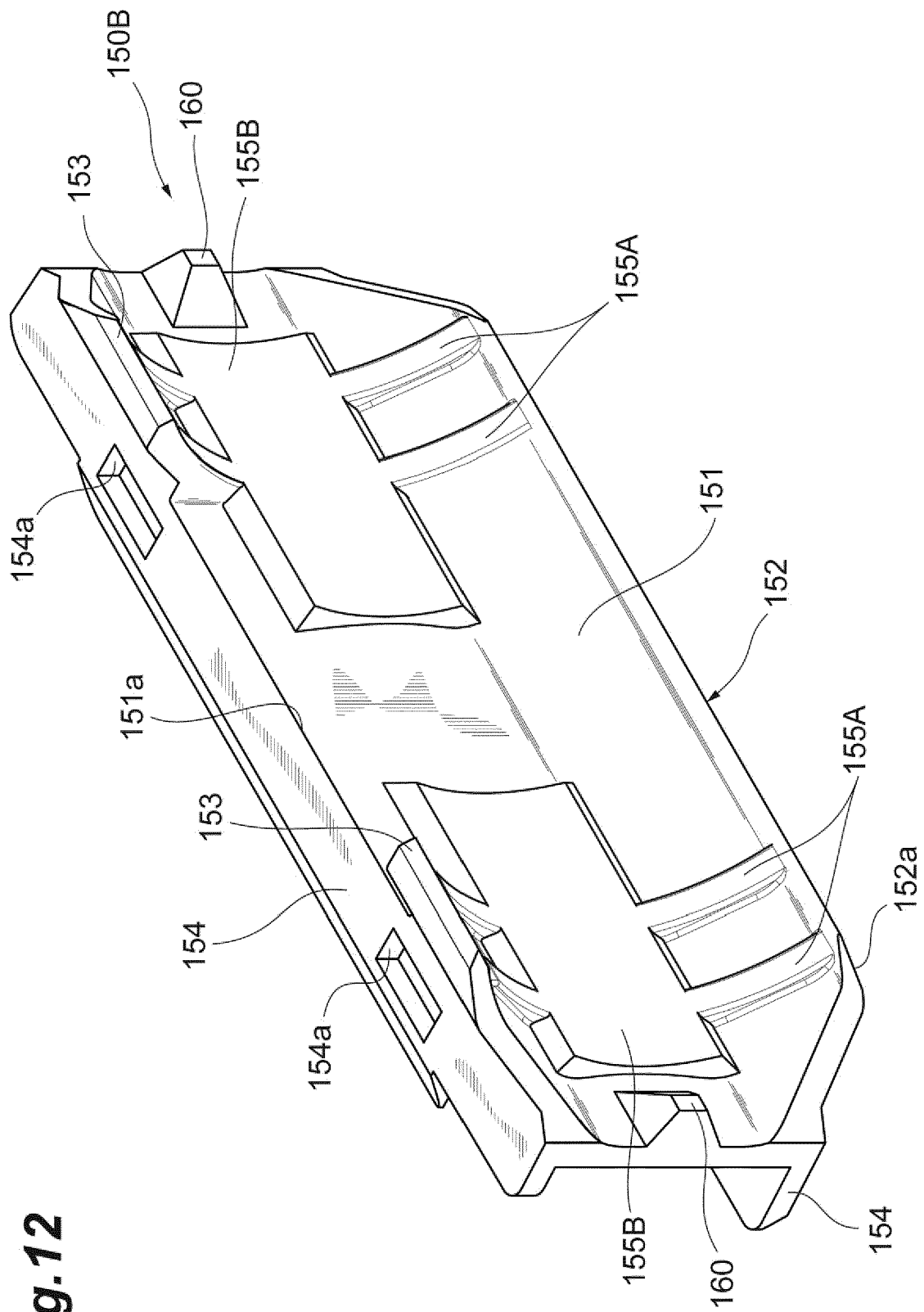


Fig. 12

Fig.13

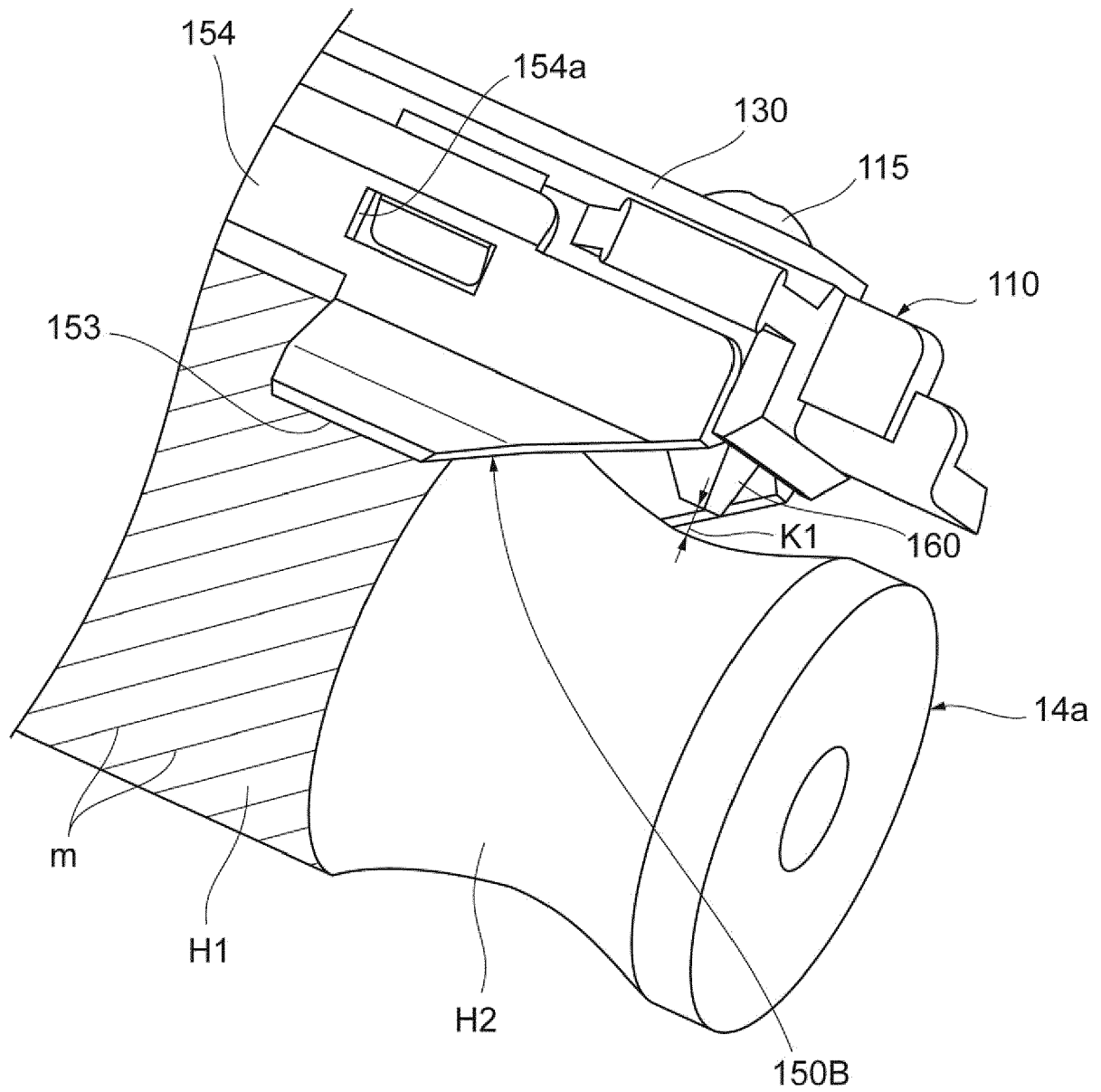
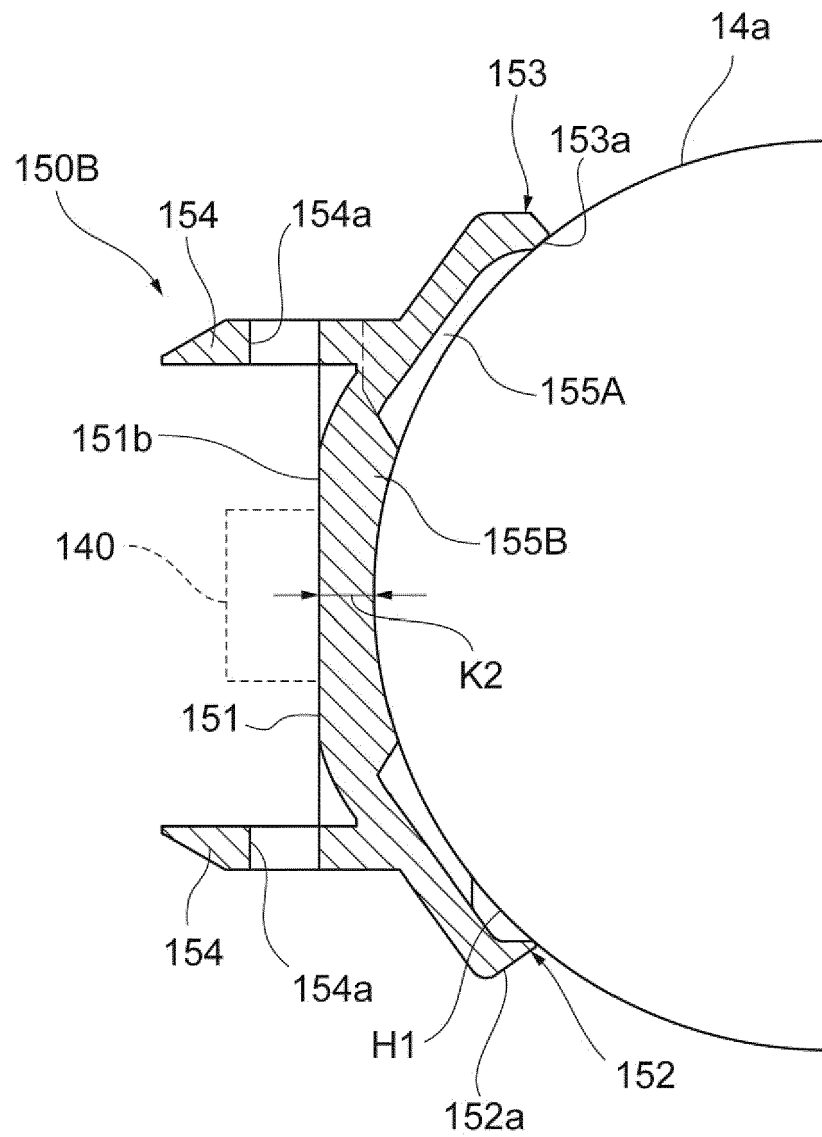


Fig.14





EUROPEAN SEARCH REPORT

 Application Number
 EP 17 17 6773

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 1 584 938 A (RIETER AG MASCHF) 18 February 1981 (1981-02-18)	1-3	INV. D01H5/62
Y	* page 1, line 10 - page 1, line 18 * * page 4, line 11 - page 4, line 18 * * claims 1,13; figure 4 *	1-4,7,9, 10	
X	FR 1 389 348 A (ZINSER TEXTILMASCHINEN GMBH) 12 February 1965 (1965-02-12) * column 1, line 1 - column 1, line 5 * * column 2, line 1 - column 2, line 11 * * column 3, line 29 - column 3, line 32 * * claim 1; figures 1-2 *	1-3	
Y,D	EP 2 876 193 A1 (MURATA MACHINERY LTD [JP]) 27 May 2015 (2015-05-27) * column 1, line 5 - column 2, line 14 * * paragraph [0033] - paragraph [0061] * * claims 1-13; figures 1-7B *	1-4,7,9, 10	
A	US 3 101 504 A (HERMANN GASSER) 27 August 1963 (1963-08-27) * column 1, line 10 - column 1, line 14 * * column 6, line 42 - column 7, line 2 * * claims 1-14; figures 6-7 *	4,8	TECHNICAL FIELDS SEARCHED (IPC)
A	EP 1 614 780 A2 (MURATA MACHINERY LTD [JP]) 11 January 2006 (2006-01-11) * paragraph [0001] - paragraph [0006] * * column 3, line 48 - column 4, line 2 * * claims 1-2; figures 1-4 *	4,8	D01H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 27 October 2017	Examiner Todarello, Giovanni
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

 1
 EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 17 17 6773

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

27-10-2017

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report		Publication date	Patent family member(s)	Publication date	
GB 1584938	A	18-02-1981	AR	215705 A1	31-10-1979
			AT	367806 B	10-08-1982
			BE	867035 A1	13-11-1978
			BR	7803037 A	29-05-1979
			CH	619744 A5	15-10-1980
			DE	2814935 A1	23-11-1978
			ES	470138 A1	16-09-1979
			FR	2391296 A1	15-12-1978
			GB	1584938 A	18-02-1981
			HK	4883 A	03-02-1983
			IN	151638 B	18-06-1983
			IT	1093713 B	26-07-1985
			NL	7803847 A	20-11-1978

FR 1389348	A	12-02-1965	NONE		

EP 2876193	A1	27-05-2015	CN	104651990 A	27-05-2015
			CN	204644540 U	16-09-2015
			EP	2876193 A1	27-05-2015
			JP	2015101797 A	04-06-2015

US 3101504	A	27-08-1963	NONE		

EP 1614780	A2	11-01-2006	CN	1718878 A	11-01-2006
			EP	1614780 A2	11-01-2006
			JP	4379599 B2	09-12-2009
			JP	2006022443 A	26-01-2006

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2015101797 A [0002]