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(54) THREAD REMAINING AMOUNT DETECTING DEVICE

VORRICHTUNG ZUR BESTIMMUNG DER FADENRESTMENGE

DISPOSITIF DE DETERMINATION DE LA QUANTITÉ DE FIL RESTANTE

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Description

TECHNICAL FIELD

[0001] The disclosure relates to a technique of a thread remaining amount detecting device that detects a remaining amount of thread wound around a cone.

BACKGROUND ART

[0002] Conventionally, a technique of a thread remaining amount detecting device that detects a remaining amount of thread wound around a cone has been known, for example, as described in JP H8-277069 A.

[0003] JP H8-277069 A discloses a thread remaining amount detecting device (thread detecting device) including an optical sensor that irradiates with light a side surface of a thread wound around a cone to detect reflected light from a thread surface. When the thread is fed from the cone to a knitting machine and the thread wound around the cone is used up, the optical sensor detects reflected light from the surface of the cone. The thread remaining amount detecting device can identify the presence or absence of the thread wound around the cone based on a change in the reflected light detected by the optical sensor (difference between the reflected light from the thread surface and the reflected light from the cone surface).

[0004] CN 103 981 631 B relates to a yarn changing assisting device, a usage method thereof and textile equipment utilizing the yarn changing assisting device. The device comprises a body, a bobbin fixing unit, a setting unit, a weighing unit, a processor and an alarm unit. The bobbin fixing unit is detachably arranged on the body and used for fixing a bobbin with yarns wound. The setting unit is arranged on the front side of the body and used for setting a first threshold which is the weight sum of the bobbin weight and the weight of the yarns when one layer of yarns is left on the bobbin. The weighing unit is arranged inside the body and used for weighting the bobbin and in-service yarn online weight. The processor is arranged inside the body and compares the online weight with the first threshold and outputs a first alarm signal. The alarm unit receives the first alarm signal and sends out a first alarm. By means of the device, workers can know about the remaining amount of yarn in real time. Alarm will be sent to the workers through the alarm unit when only a small amount of yarn is left on the bobbin, and accordingly, workers can change the yarns timely.

[0005] However, in general, the cone for feeding thread to the knitting machine is used in a state in which a plurality of cones are arranged in a densely packed state. Therefore, when the thread is detected by using the optical sensor disposed on the side of the cone as described in JP H8-277069 A, it is difficult to secure a space for disposing the optical sensor. Therefore, a save-spacing thread remaining amount detecting device has been demanded.

SUMMARY OF INVENTION

[0006] The disclosure has been made in view of the above circumstances. It is therefore an object of the disclosure to provide a thread remaining amount detecting device that can save space. This object is achieved by the features in the independent claim. Particular embodiments are defined in the dependent claims.

[0007] A problem to be solved by the disclosure is as described above, and a solution to the problem will be described next.

[0008] A thread remaining amount detecting device according to the disclosure has a pedestal on which a cone can be placed, and a detector that is disposed on the pedestal and includes a light emitter that irradiates with light a bottom surface of a thread-wound part of the cone and a light receiver that receives reflected light from the bottom surface.

[0009] With this configuration, the thread remaining amount detecting device can save space by providing the detector using the pedestal on which the cone is placed.

[0010] Further, the thread remaining amount detecting device according to the disclosure may further include a positioning part that positions an axial core of the cone with respect to the detector.

[0011] With this configuration, a detection accuracy of the detector can be improved by positioning the cone.

[0012] Further, the thread remaining amount detecting device according to the disclosure may further include a thread remaining amount estimation part that estimates a thread remaining amount according to a light receiving amount of the light receiver.

[0013] With this configuration, the thread remaining amount can be estimated according to the light receiving amount.

[0014] Further, the thread remaining amount estimation part may estimate the thread remaining amount according to at least a yarn count, color or material of the thread wound around the cone.

[0015] With this configuration, it is possible to improve an estimation accuracy of the thread remaining amount by performing estimation according to the yarn count or the like.

[0016] Further, the thread remaining amount detecting device according to the disclosure may further include a communication unit that can communicate information regarding a detection result of the detector.

[0017] With this configuration, the detection result can be effectively used (for example, construction of a database related to detection and control of the operation of the knitting machine).

[0018] Further, the light emitter may be disposed closer to the axial core of the cone than the light receiver.

[0019] With this configuration, even when the thread remaining amount is reduced, it is possible to facilitate detection by the detector.

[0020] Further, the thread remaining amount detecting

device according to the disclosure may further include an adjustment part that can adjust a distance between the bottom surface and the detector.

[0021] With this configuration, the detection accuracy by the detector can be improved by adjusting the distance between the bottom surface of the thread-wound part and the detector according to a thread type or the like.

[0022] The disclosure has an effect of saving space in the thread remaining amount detecting device.

BRIEF DESCRIPTION OF DRAWINGS

[0023]

Fig. 1A is a perspective view and Fig. 1B is a partial cross-sectional view of a side surface of a thread remaining amount detecting device and a thread cone according to a first embodiment of the disclosure;

Fig. 2 is a perspective view and a partially enlarged view of the thread remaining amount detecting device;

Fig. 3A is a plan view and Fig. 3B is a side view of the thread remaining amount detecting device;

Fig. 4 is a cross-sectional view taken along line A-A;

Fig. 5 is a graph showing an example of a temporal change of a detection result of a detector; and

Fig. 6 is a perspective view and a partially enlarged view of a thread remaining amount detecting device according to a second embodiment.

DESCRIPTION OF EMBODIMENTS

[0024] In the following description, directions indicated by arrows U, D, F, B, L, and R in the drawings are defined as upward, downward, forward, backward, left, and right, respectively.

[0025] First, a thread cone 10 held by a thread remaining amount detecting device 100 according to a first embodiment of the disclosure will be described with reference to Figs. 1A and 1B.

[0026] In the thread cone 10, a thread to be fed to a knitting machine (weft knitting machine, warp knitting machine, circular knitting machine, or the like.) is wound around a cone 11. In this embodiment, it is assumed that a paper cone 11 is used. The cone 11 is formed in a substantially hollow truncated cone shape. By winding a thread around a side surface of the cone 11, a thread-wound part 12 having a shape along the side surface of the cone 11 (substantially truncated cone shape) is formed.

[0027] Next, a configuration of the thread remaining amount detecting device 100 according to the first embodiment of the disclosure will be described with reference to Figs. 2 to 4.

[0028] The thread remaining amount detecting device 100 holds the thread cone 10 and detects a remaining thread amount in the thread cone 10. The thread remaining amount detecting device 100 mainly includes a pedestal 110, an inner positioning part 120, a detector 130, a controller 140, and a communication unit 150.

[0029] The pedestal 110 is a part on which the thread cone 10 (cone 11) is placed. The pedestal 110 mainly includes a main body 111 and an outer positioning part 112.

[0030] In a plan view, the main body 111 is formed in a substantially elliptical shape long in the front-back direction. The main body 111 is formed in a substantially plate shape having a fixed vertical width (thickness). A recess 111a is formed in the main body 111.

[0031] The recess 111a is a portion where the outer positioning part 112, which will be described later, is disposed. The recess 111a is formed at the left and right center of a front end of the main body 111. The recess 111a is formed so as to dent downward an upper surface of the main body 111.

[0032] The outer positioning part 112 positions the cone 11. The outer positioning part 112 is formed in a substantially rectangular parallelepiped shape. The outer positioning part 112 is disposed in the recess 111a of the main body 111. A vertical width (thickness) of the outer positioning part 112 is formed so as to be slightly larger than a vertical width (depth) of the recess 111a. As a result, when the outer positioning part 112 is disposed in the recess 111a, an upper end of the outer positioning part 112 slightly protrudes upward from the upper surface of the main body 111. The outer positioning part 112 mainly includes a recess 112a and a transmissive portion 112b.

[0033] The recess 112a is formed at the left and right center of the rear end of the outer positioning part 112. The recess 112a is formed so as to dent downward the upper surface of the outer positioning part 112.

[0034] The transmissive portion 112b shown in Fig. 4 is a portion capable of transmitting light emitted and received by the detector 130, which will be described later. The transmissive portion 112b is formed of a light-transmitting material. The transmissive portion 112b is provided to form a bottom of the recess 112a (a portion above the detector 130 described later). Fig. 4 shows an example in which the transmissive portion 112b is formed (only a part of the outer positioning part 112) above the detector 130. However, for example, the entire outer positioning part 112 may be formed of a light transmissive material.

[0035] The inner positioning part 120 shown in Figs. 2, 3A, and 3B positions the cone 11. The inner positioning part 120 is formed in a substantially truncated cone shape that becomes narrower toward the upper end. The inner positioning part 120 is provided at the substantially center of an upper surface of the pedestal 110.

[0036] The detector 130 shown in Figs. 2 to 4 detects the remaining amount of thread wound around the cone 11. The detector 130 mainly includes a substrate 131, a light emitter 132, and a light receiver 133.

[0037] The substrate 131 shown in Fig. 4 is a plate-shaped member provided with the light emitter 132 and

the light receiver 133.

[0038] The light emitter 132 is an element (light emitting element) that irradiates light (infrared rays). The light emitter 132 is provided on the upper surface of the substrate 131. The light emitter 132 can irradiate light (infrared rays) upward. Note that Fig. 4 schematically shows a light-emitting range of infrared rays emitted from the light emitter 132 by two-dot chain lines.

[0039] The light receiver 133 is an element (light receiving element) that receives light (infrared rays). The light receiver 133 is provided on an upper surface of the substrate 131. The light receiver 133 is provided in front of the light emitter 132. The light receiver 133 can receive light (reflected light) that is emitted from the light emitter 132 and reflected outside (a bottom surface of the thread-wound part 12 in the present embodiment). Fig. 4 schematically shows a light-receiving range of the light receiver 133 by two-dot chain lines.

[0040] In this way, the detector 130 is formed by an optical sensor that detects reflected light. The detector 130 is disposed inside the pedestal 110 (outer positioning part 112). Specifically, the detector 130 is disposed below the transmissive portion 112b of the outer positioning part 112. As a result, the light emitter 132 can irradiate light (infrared rays) upward through the transmissive portion 112b. Further, the light receiver 133 can receive the reflected light entering through the transmissive portion 112b.

[0041] By disposing the detector 130 using the pedestal 110 in this way, it is possible to secure space for disposing the detector 130. Further, by disposing the detector 130 in the recess 112a (a lower part of the recess 112a), it is possible to prevent dust from entering and accumulating on the detector 130. As a result, it is possible to prevent the light emitted and received by the detector 130 from being blocked.

[0042] Further, the light emitter 132 is disposed behind the light receiver 133. In other words, the light emitter 132 is disposed closer to the inner positioning part 120 than the light receiver 133. As a result, with respect to the light receiver 133, the light emitter 132 is disposed on an axial core side of the thread cone 10 placed on the pedestal 110. As a result, even when the thread of the thread cone 10 is reduced as described later, the thread-wound part 12 can be easily irradiated with light from the light emitter 132. Therefore, the light receiver 133 can easily detect the reflected light.

[0043] The controller 140 shown in Figs. 2, 3A, and 3B estimates the remaining amount of thread wound around the cone 11 based on the detection result of the detector 130. The controller 140 is disposed inside the pedestal 110 (outer positioning part 112). Specifically, the controller 140 is disposed in the vicinity (front side) of the detector 130 of the outer positioning part 112. The controller 140 includes an arithmetic processing unit such as a CPU, a storage unit such as RAM and ROM, and the like. The storage unit of the controller 140 stores various information, programs, and the like used for estimating the remaining thread amount.

[0044] The controller 140 is electrically connected to the detector 130 so that the detection result of the detector 130 can be obtained. The arithmetic processing unit of the controller 140 executes the program and performs predetermined arithmetic processing or the like using the detection result or the like of the detector 130 to estimate the remaining amount of thread wound around the cone 11.

[0045] The communication unit 150 is capable of telecommunications with an external device. The communication unit 150 is disposed inside the pedestal 110 (outer positioning part 112). Specifically, the communication unit 150 is disposed in the vicinity (front side) of the detector 130 of the outer positioning part 112. The communication unit 150 is electrically connected to the controller 140 to obtain various information (for example, an estimation result of the remaining thread amount) from the controller 140, and transmit the information to the outside via wireless communication. The communication unit 150 can also transmit information received from an external device or the like to the controller 140.

[0046] Next, a method of holding the thread cone 10 by the thread remaining amount detecting device 100 will be described.

[0047] When the thread cone 10 is held by the thread remaining amount detecting device 100, the thread cone 10 is placed on the pedestal 110 while the inner positioning part 120 is inserted into the cone 11 as shown in Fig. 2.

[0048] Here, as shown in Fig. 4, the cone 11 is placed on the upper surface of the pedestal 110 so that the front lower end of the cone 11 fits in a gap (groove) between the inner positioning part 120 and the outer positioning part 112. By sandwiching the lower end of the cone 11 between the inner positioning part 120 and the outer positioning part 112 in this way, the axial core of the cone 11 can be positioned. Further, by positioning only a portion (front portion) of the cone 11 instead of the entire lower end (entire circumference), various types of cones 11 with different diameters can be supported. Positioning the cone 11 in this way can improve the accuracy of detecting the remaining thread amount, using the detector 130.

[0049] Further, in the state where the cone 11 is placed on the pedestal 110, the inner positioning part 120 is inserted inside the cone 11 to prevent the cone 11 from tipping over or falling off.

[0050] When the position of the cone 11 is displaced forward at placing the cone 11 on the pedestal 110, the front lower end of the cone 11 is placed on the upper surface of the outer positioning part 112. In this case, since the upper surface of the outer positioning part 112 is protruded from the upper surface of the pedestal 110 (main body 111), the entire cone 11 will slightly tilt backward. An operator who has installed the thread cone 10 in the thread remaining amount detecting device 100 can visually confirm whether or not the cone 11 (thread cone 10) is tilted so that whether or not the cone 11 is accu-

rately placed on the thread remaining amount detecting device 100 (whether or not the cone 11 is positioned) can be confirmed.

[0051] In this way, the thread cone 10 can be placed (held) on the thread remaining amount detecting device 100. The thread can be fed from the thread cone 10 to the knitting machine.

[0052] Next, a method of detecting the remaining thread amount in the thread cone 10 by the thread remaining amount detecting device 100 will be described.

[0053] When the thread is fed from the thread cone 10 placed on the thread remaining amount detecting device 100 to the knitting machine, the remaining thread amount gradually decreases. When the remaining thread amount is reduced to some extent, it is necessary to replace the thread cone 10. In order to grasp the timing of such replacement of the thread cone 10, it is desirable to grasp the remaining thread amount in the thread cone 10. In the present embodiment, the remaining thread amount in the thread cone 10 can be detected (estimated) by using the thread remaining amount detecting device 100.

[0054] The thread remaining amount detecting device 100 can detect (estimate) the remaining thread amount in the thread cone 10 in roughly two steps. Specifically, the thread remaining amount detecting device 100 can detect the remaining thread amount according to the next two steps: (1) "step of detecting a light receiving amount of reflected light by the detector 130" and (2) "step of estimating the remaining thread amount based on the light receiving amount". Hereinafter, these steps will be described in turn.

[0055] First, the above (1) "step of detecting a light receiving amount of reflected light by the detector 130" will be described.

[0056] When detecting the remaining thread amount in the thread cone 10, as shown in Fig. 4, the detector 130 detects the reflected light (light emission and reception). Specifically, light is emitted upward from the light emitter 132. Since the thread-wound part 12 of the thread cone 10 is located above the light emitter 132, the light from the light emitter 132 irradiates the bottom surface of the thread-wound part 12. The light receiver 133 receives the light reflected on the bottom surface of the thread-wound part 12.

[0057] Here, the light receiving amount detected by the light receiver 133 changes according to a winding thickness T of the thread-wound part 12 (radial thickness of the thread-wound part 12) of the thread cone 10. For example, when the winding thickness T is sufficiently large (that is, when the remaining thread amount in the thread cone 10 is large), as in the thread-wound part 12 shown by two-dot chain lines in Fig. 4, most of the light emitted from the light emitter 132 will be reflected on the bottom surface of the thread-wound part 12. In this case, the light receiving amount detected by the light receiver 133 becomes relatively large.

[0058] On the other hand, when the winding thickness T is relatively small (that is, when the remaining thread amount in the thread cone 10 is small), as in the thread-wound part 12 shown by solid lines in Fig. 4, the light emitted from the light emitter 132 will only be partially reflected on the bottom surface of the thread-wound part 12. In this case, the light receiving amount detected by the light receiver 133 becomes relatively small.

[0059] As a specific example showing a change of the light receiving amount in line with a change of remaining thread amount (change of the winding thickness T), Fig. 5 shows an example of a temporal change of the detection result (light receiving amount) by the detector 130. Fig. 5 shows an example in which the detector 130 detects the light receiving amount from three types of threads with different thread diameters (three types of thread cones 10).

[0060] Fig. 5 shows detection results of three types of threads that are thread A with a medium thread diameter: Cotton (double thread with a cotton count of 30), thread B with a relatively fine thread diameter: Wool (triple thread with a yarn count of 72), and thread C with relatively thick thread diameter: Acryl (double thread with a yarn count of 20). It is assumed that the initial winding thickness T of the thread cone 10 is 20 mm for each thread and a feed speed of the thread to the knitting machine is 5 m/s.

[0061] In all threads, a light receiving amount is almost constant for a while from the start of feeding the thread to the knitting machine (elapsed time: 0 seconds). This is because when the winding thickness T of the thread-wound part 12 is sufficiently large, most of the light emitted from the light emitter 132 is reflected on the bottom surface of the thread-wound part 12 although the remaining thread amount is slightly reduced, and there is no change in a detection result (light receiving amount) of the light receiver 133. Note that a difference in the light receiving amount among three types of threads at the start of feeding thread is due to the difference in thread diameter, material, and the like.

[0062] Further, in all types of thread, the light receiving amount starts to decrease after a certain period of time passes. This is because the winding thickness T of the thread-wound part 12 becomes smaller, and a part of the light emitted from the light emitter 132 is not reflected on the bottom surface of the thread-wound part 12 (see Fig. 4). Since the winding thickness T gradually decreases as time passes, the light receiving amount will also gradually decrease.

[0063] Further, in all types of thread, the light receiving amount becomes constant again at a value close to 0 when further time passes. This means that the thread of the thread-wound part 12 has been used up.

[0064] Comparing the three types of threads, the larger the thread diameter is, the earlier the light receiving amount begins to decrease. This is because, when comparing threads with the same winding thickness T (20 mm), the winding thickness T of the thread-wound part 12 of thread with larger diameter reduces faster. For this reason, the larger the thread diameter is, the steeper the slope (decrease per unit time) in the graph while the light

receiving amount is decreasing.

[0065] Next, the above (2) "step of estimating the remaining thread amount based on a light receiving amount" will be described.

[0066] The controller 140 estimates the remaining thread amount in the thread cone 10 based on the detection result (light receiving amount) by the detector 130. Specifically, the controller 140 refers to information indicating the relationship between the light receiving amount and the remaining thread amount obtained by experiments (actual measurement values), numerical analysis, and the like (for example, a graph showing their relationship), and calculates (estimates) a remaining thread amount (m) from the detection result (light receiving amount) by the detector 130.

[0067] Here, the relationship between the light receiving amount and the remaining thread amount, which is the basis of estimation (hereinafter, also simply referred to as "basic information for estimation"), differs by a range of conditions, such as a yarn count, color, material, and type (size, shape, etc.) of the thread cone 10. Therefore, the controller 140 stores in advance the basic information for estimation under various conditions. The controller 140 selects suitable basic information for estimation according to the type and the like of the thread cone 10, which is a target for actually estimating the remaining thread amount, and estimates the remaining thread amount based on the basic information for estimation. In this way, the estimation accuracy can be improved by estimating the remaining amount according to the basic information for estimation (yarn count, etc.).

[0068] The basic information for estimation used for estimation is not limited to the information stored in the controller 140 in advance. For example, it is also possible to transmit the basic information for estimation from an external device to the controller 140 via the communication unit 150 and store the basic information for estimation in the controller 140. Further, which basic information for estimation to use (select) can be automatically determined by the controller 140 based on information on the thread cone 10 received from the external device. Alternatively, an operator may arbitrarily select which basic information for estimation to use (select) by using the external device (for example, an input device such as a keyboard or a switch).

[0069] In this way, by estimating the remaining thread amount using the detection result (light receiving amount) obtained by the detector 130, not only the presence or absence of the thread but also the remaining thread amount and its state of temporal change can be grasped.

[0070] The information on the remaining thread amount estimated in this way is transmitted to the external device via the communication unit 150 so that the information can be arbitrarily used. For example, the remaining thread amount can be displayed on a monitor screen to grasp a timing to replace the thread cone 10. Further, when the remaining thread amount is reduced to some extent, a buzzer or the like can be used to notify the reduction to the operator. Further, by accumulating the information, it is possible to construct a database related to detection of the remaining thread amount, or to control the operation of the knitting machine based on the information. Accordingly, by using the communication unit 150, detection results (estimation results) of the remaining thread amount can be effectively utilized.

[0071] The outer positioning part 112 and the inner positioning part 120 in the present embodiment are one embodiment of positioning parts according to the disclosure.

[0072] Further, the controller 140 in the present embodiment is one embodiment of the thread remaining amount estimation part according to the disclosure.

[0073] Although the embodiment of the disclosure has been described above, the disclosure is not limited to the above embodiment, and appropriate modifications can be made within the scope of the technical idea of the disclosure described in the claims.

[0074] For example, the disclosure does not limit a type of thread cone 10 for which the remaining thread amount is detected by the thread remaining amount detecting device 100. For example, the present embodiment refers to the truncated cone-shaped thread cone 10 (cone 11), but cones having other shapes (for example, a substantially cylindrical shape with substantially fixed diameter) can also be used.

[0075] Further, the configuration of the thread remaining amount detecting device 100 illustrated in the present embodiment is an example, and the shape and the like of each part can be arbitrarily changed. For example, the size and shape of the pedestal 110 or the inner positioning part 120, and positions of the detector 130 and the controller 140 can be arbitrarily changed. However, in order to improve the estimation accuracy of the remaining thread amount, the detector 130 is preferably disposed in a position where the winding thickness T of the thread can be easily detected.

[0076] Further, the configurations of the outer positioning part 112 and the inner positioning part 120 illustrated in the present embodiment are examples, and the configurations can be arbitrarily changed as long as the thread cone 10 can be positioned. For example, it is possible to position the thread cone 10 using other grooves and protrusions, in addition to the groove between the outer positioning part 112 and the inner positioning part 120 as in the present embodiment. Further, for example, by configuring the inner positioning part 120 along the inner side of the thread cone 10 (cone 11) slidable in the radial direction of the cone 11, a width of the groove between the inner positioning part 120 and the outer positioning part 112 can be adjusted. As a result, the width of the groove can be adjusted according to various shapes of the thread cone 10, and the thread cone 10 can be easily positioned.

[0077] Further, the present embodiment shows an example of providing one detector 130 in the thread remaining amount detecting device 100, but the disclosure is

not limited to this. A plurality of detectors 130 may be provided in the thread remaining amount detecting device 100. For example, by providing a plurality of detectors 130 in the radial direction about the axial core of the thread cone 10, the remaining thread amount in the thread cone 10 can be detected in more detail.

[0078] Further, a method of supplying power to the thread remaining amount detecting device 100 illustrated in the present embodiment is not limited. For example, a dry battery or other batteries may be provided inside the pedestal 110 or the inner positioning part 120. Alternatively, power may be supplied from outside by using appropriate wiring.

[0079] Further, the communication unit 150 communicates with the external device via wireless communication in the embodiment, but the disclosure is not limited to this. For example, the communication unit 150 may be configured to communicate via wired communication or the like.

[0080] Further, the present embodiment shows an example in which information on the remaining thread amount is transmitted to the external device via the communication unit 150 for effective use, but the disclosure is not limited to this. For example, the thread remaining amount detecting device 100 itself may be provided with a display unit, such as a monitor, and a notification unit, such as an emergency lamp or buzzer, to notify the operator that the remaining thread amount is reduced, using the display unit or the notification unit.

[0081] Further, the present embodiment shows the configuration in which the remaining thread amount is estimated by the controller 140 of the thread remaining amount detecting device 100 itself, but the disclosure is not limited to this. For example, it is also possible to transmit the detection result of the detector 130 to an external device via the communication unit 150 to calculate (estimate) the remaining thread amount by the external device (for example, a personal computer).

[0082] A second embodiment of the disclosure will be described below.

[0083] A thread remaining amount detecting device 200 according to the second embodiment shown in Fig. 6 is different from the thread remaining amount detecting device 100 (see Fig. 2, etc.) according to the first embodiment in that an adjustment part 160 is provided.

[0084] The adjustment part 160 adjusts a distance between the thread cone 10 (the bottom surface of the thread-wound part 12) and the detector 130. The adjustment part 160 mainly includes an operation part 161 and a shaft 162.

[0085] The operation part 161 is a portion formed in a substantially circular plate shape. The operation part 161 is disposed inside the pedestal 110 (lower part of the detector 130). A part (front end) of the operation part 161 is disposed so as to be exposed forward from the front side surface of the pedestal 110.

[0086] The shaft 162 is a portion formed in a substantially columnar shape. The shaft 162 is provided at the center of the operation part 161 and extends upward. A male screw is formed on the shaft 162. The shaft 162 (male screw) is inserted into a female screw (not shown) formed on a lower surface of the outer positioning part 112.

[0087] By rotating the operation part 161 of the adjustment part 160 configured in this way from the outside of the pedestal 110, a screwing depth of the shaft 162 with respect to the outer positioning part 112 can be changed. As a result, the outer positioning part 112 can be vertically moved to adjust the height of the outer positioning part 112.

[0088] By adjusting the height of the outer positioning part 112 in this way, a distance between the thread cone 10 (bottom surface of the thread-wound part 12) placed on the pedestal 110 and the detector 130 can be arbitrarily adjusted. As a result, for example, the distance between the thread-wound part 12 and the detector 130 can be adjusted to an optimum distance according to the thread type. Accordingly, the detection accuracy by the detector 130 can be improved.

[0089] The configuration of the adjustment part 160 is not limited to the embodiment, and can be changed as appropriate. Further, the adjustment part 160 may be configured to vertically move the detector 130 only without moving the outer positioning part 112. Further, as long as the distance between the bottom surface of the thread-wound part 12 and the detector 130 is adjusted, the adjustment part 160 may be configured to, for example, vertically move the thread cone 10 instead of the detector 130 (outer positioning part 112).

Claims

1. A thread remaining amount detecting device (100) comprising:

   a pedestal (110) on which a cone (11) of a thread cone (10) can be placed; and
   a detector (130) that includes a light emitter (132) and a light receiver (133),
   wherein the thread remaining amount detecting device (100) is configured to detect a remaining amount of yarn of said thread cone (10) supplied to a knitting machine, and is **characterized in that**
   the detector (130) is disposed on the pedestal (110),
   the light emitter irradiates with light a bottom surface of a thread-wound part (12) of the thread cone (10), and
   the light receiver (133) receives reflected light from the bottom surface.

2. The thread remaining amount detecting device (100) according to claim 1, further comprising a positioning part (112, 120) that positions an axial core of the

cone (11) with respect to the detector (130).

3. The thread remaining amount detecting device (100) according to claim 1 or 2, further comprising a thread remaining amount estimation part (140) that estimates a remaining thread amount according to a light receiving amount of the light receiver (133).

4. The thread remaining amount detecting device (100) according to claim 3, wherein the thread remaining amount estimation part (140) estimates the remaining thread amount based on basic information for estimation indicating a relationship between the light receiving amount of the light receiver (133) and the remaining thread amount, wherein the basic information for estimation differs by a range of conditions, such as yarn count, color, and material of a thread wound around the cone (11).

5. The thread remaining amount detecting device (100) according to any one of claims 1 to 4, further comprising a communication unit (150) capable of communicating information regarding a detection result of the detector (130).

6. The thread remaining amount detecting device (100) according to any one of claims 1 to 5, wherein the light emitter (132) is disposed closer to a side of the axial core of the cone (11) than the light receiver (133).

7. The thread remaining amount detecting device (100) according to any one of claims 1 to 6, further comprising an adjustment part (160) capable of adjusting a distance between the bottom surface and the detector (130).

Patentansprüche

1. Fadenrestmengen-Detektionsvorrichtung (100), aufweisend:

einen Sockel (110), auf dem ein Konus (11) eines Fadenkonus (10) angebracht sein kann; und
einen Detektor (130), der einen Lichtsender (132) und einen Lichtempfänger (133) aufweist,
wobei die Fadenrestmengen-Detektionsvorrichtung (100) derart konfiguriert ist, dass sie eine Restmenge an Garn des Fadenkonus (10) detektiert, der einer Strickmaschine zugeführt wird, und
dadurch gekennzeichnet ist, dass
der Detektor (130) auf dem Sockel (110) angeordnet ist,
der Lichtsender eine Bodenfläche eines fadenumwickelten Teils (12) des Fadenkonus (10) mit Licht bestrahlt, und
der Lichtempfänger (133) das von der Bodenfläche reflektierte Licht empfängt.

2. Fadenrestmengen-Detektionsvorrichtung (100) nach Anspruch 1, ferner aufweisend ein Positionierungsteil (112, 120), das einen axialen Kern des Konus (11) in Bezug auf den Detektor (130) positioniert.

3. Fadenrestmengen-Detektionsvorrichtung (100) nach Anspruch 1 oder 2, ferner aufweisend ein Fadenrestmengen-Schätzungsteil (140), das eine Fadenrestmenge gemäß einer Lichtempfangsmenge des Lichtempfängers (133) schätzt.

4. Fadenrestmengen-Detektionsvorrichtung (100) nach Anspruch 3, wobei das Fadenrestmengen-Schätzungsteil (140) die Fadenrestmenge anhand von wesentlichen Informationen zur Schätzung schätzt, die eine Beziehung zwischen der Lichtempfangsmenge des Lichtempfängers (133) und der Fadenrestmenge angeben,
wobei sich die wesentlichen Informationen zur Schätzung durch eine Reihe von Bedingungen unterscheiden, wie etwa Garnstärke, Farbe und Material eines um den Konus (11) gewickelten Fadens.

5. Fadenrestmengen-Detektionsvorrichtung (100) nach einem der Ansprüche 1 bis 4, ferner aufweisend eine Kommunikationseinheit (150), die in der Lage ist, Informationen bezüglich eines Erfassungsergebnisses des Detektors (130) zu übermitteln.

6. Fadenrestmengen-Detektionsvorrichtung (100) nach einem der Ansprüche 1 bis 5, wobei der Lichtsender (132) näher an einer Seite des axialen Kerns des Konus (11) angeordnet ist als der Lichtempfänger (133).

7. Fadenrestmengen-Detektionsvorrichtung (100) nach einem der Ansprüche 1 bis 6, ferner aufweisend ein Einstellungsteil (160), das in der Lage ist, einen Abstand zwischen der Bodenfläche und dem Detektor (130) einzustellen.

Revendications

1. Dispositif de détection de la quantité de fil restante (100) comprenant :

un socle (110) sur lequel un cône (11) d'un cône de fil (10) peut être placé ; et
un détecteur (130) qui inclut un émetteur de lumière (132) et un récepteur de lumière (133) ;
dans lequel le dispositif de détection de la quantité de fil restante (100) est configuré pour détecter une quantité de fil restante dudit cône de

fil (10) fournie à une machine à tricoter, et est **caractérisé en ce que**
le détecteur (130) est disposé sur le socle (110), l'émetteur de lumière irradie d'une lumière une surface inférieure de la partie enroulée de fil (12) du cône de fil (10), et
le récepteur de lumière (133) reçoit une lumière réfléchie depuis la surface inférieure.

2. Dispositif de détection de la quantité de fil restante (100) selon la revendication 1, comprenant en outre une partie de positionnement (112, 120) qui positionne un noyau axial du cône (11) par rapport au détecteur (130).

3. Dispositif de détection de la quantité de fil restante (100) selon la revendication 1 ou 2, comprenant en outre une partie d'estimation de la quantité de fil restante (140) qui estime une quantité de fil restante en fonction d'une quantité de réception de lumière du récepteur de lumière (133).

4. Dispositif de détection de la quantité de fil restante (100) selon la revendication 3, dans lequel la partie d'estimation de la quantité de fil restante (140) estime la quantité de fil restante sur la base d'informations de base pour l'estimation indiquant une relation entre la quantité de réception de lumière du récepteur de lumière (133) et la quantité de fil restante,
dans lequel les informations de base pour l'estimation diffèrent d'une plage de conditions, telles que le titrage, la couleur, et le matériau d'un fil enroulé autour du cône (11).

5. Dispositif de détection de la quantité de fil restante (100) selon l'une quelconque des revendications 1 à 4, comprenant en outre une unité de communication (150) apte à communiquer des informations concernant un résultat de détection du détecteur (130).

6. Dispositif de détection de la quantité de fil restante (100) selon l'une quelconque des revendications 1 à 5, dans lequel l'émetteur de lumière (132) est disposé plus proche d'un côté du noyau axial du cône (11) que le récepteur de lumière (133).

7. Dispositif de détection de la quantité de fil restante (100) selon l'une quelconque des revendications 1 à 6, comprenant en outre une partie de réglage (160) apte à régler une distance entre la surface inférieure et le détecteur (130).

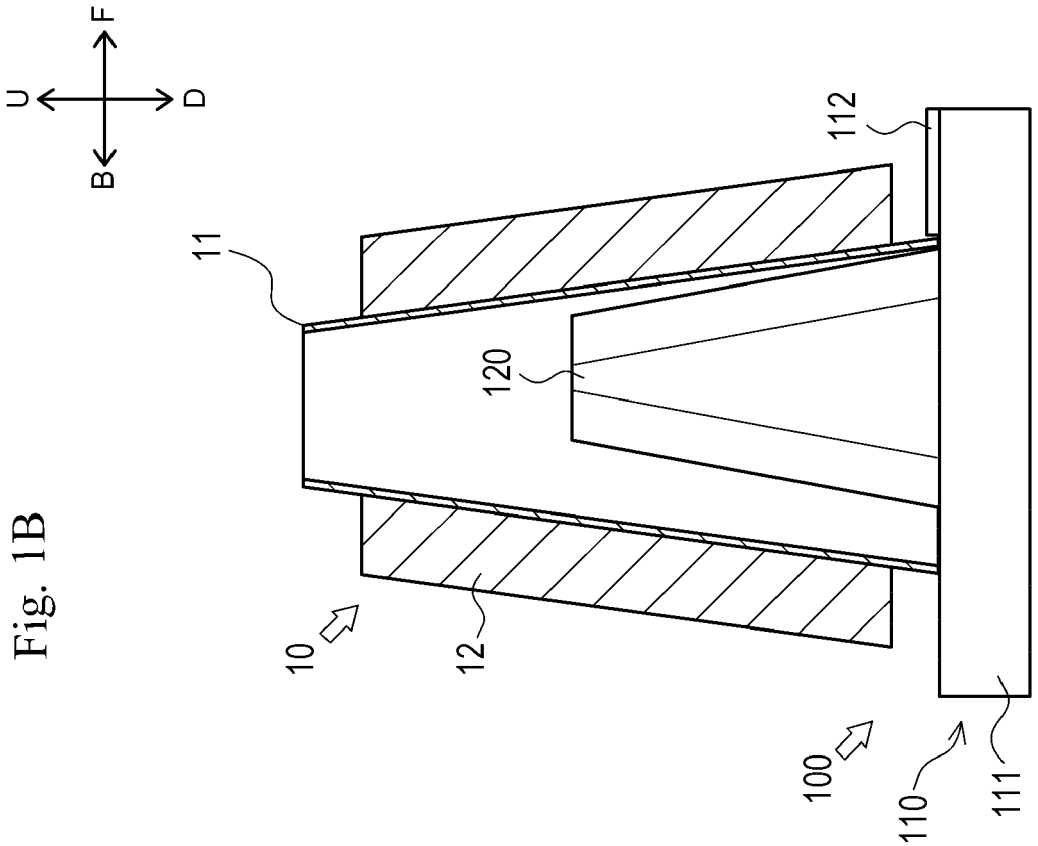

U
F
B
D
112
11
120
10
12
100
110
111

Fig. 1B

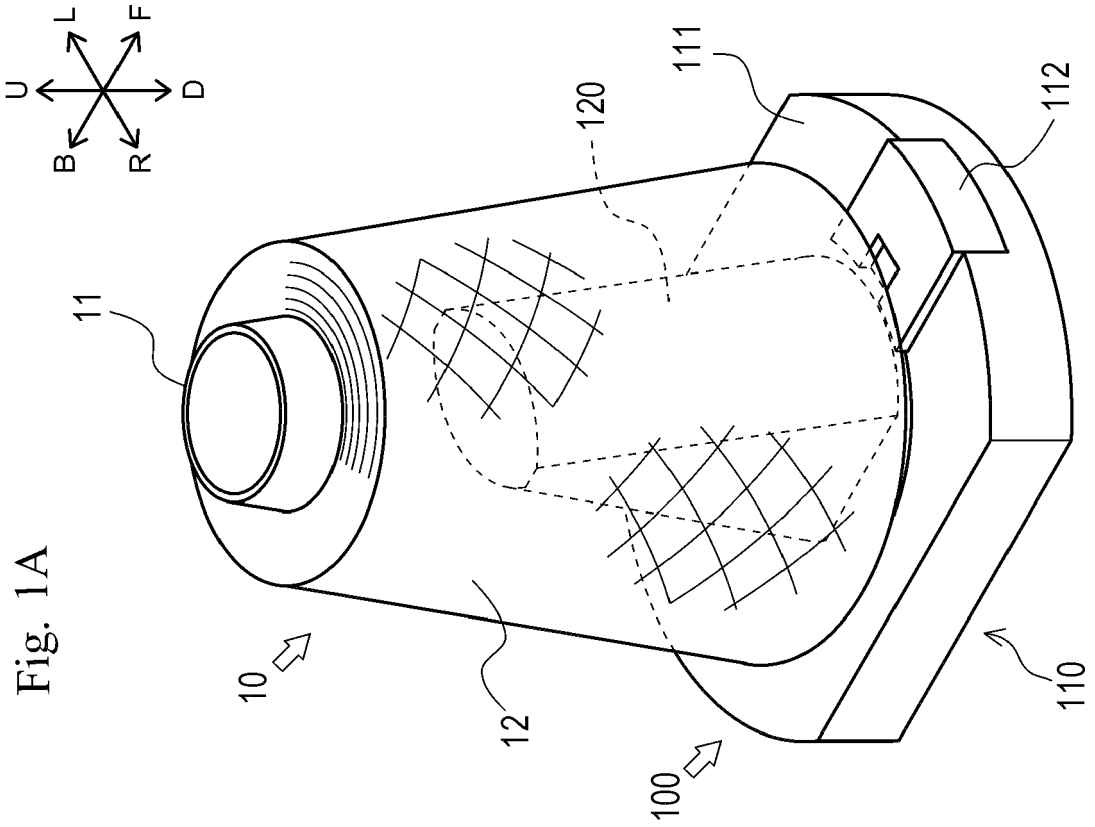

U
L
F
B
R
D
111
120
112
11
10
12
100
110

Fig. 1A

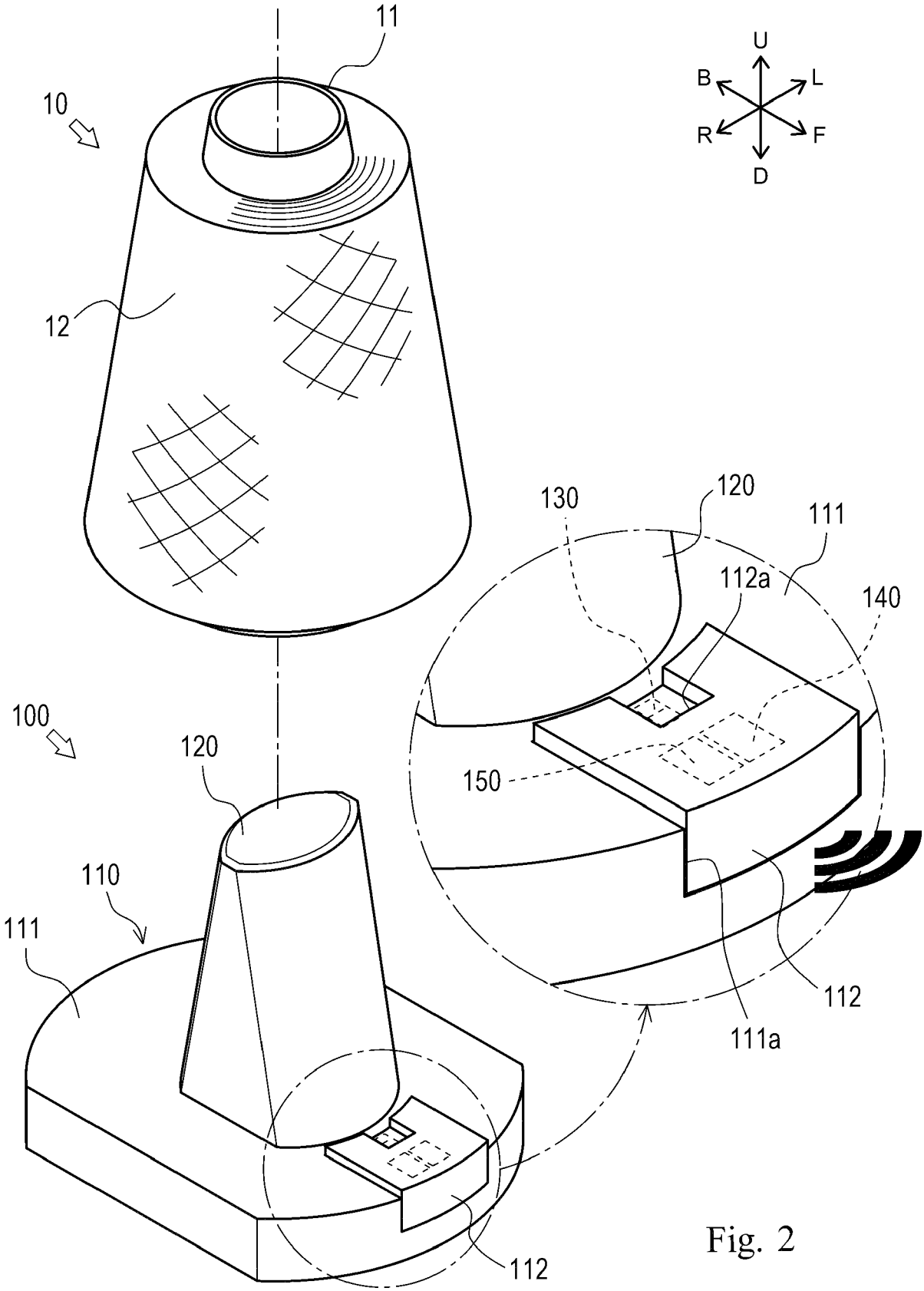

11
10
12
U
B
L
R
F
D
130
120
111
112a
140
150
100
120
110
111
112
111a
112

Fig. 2

Fig. 3A

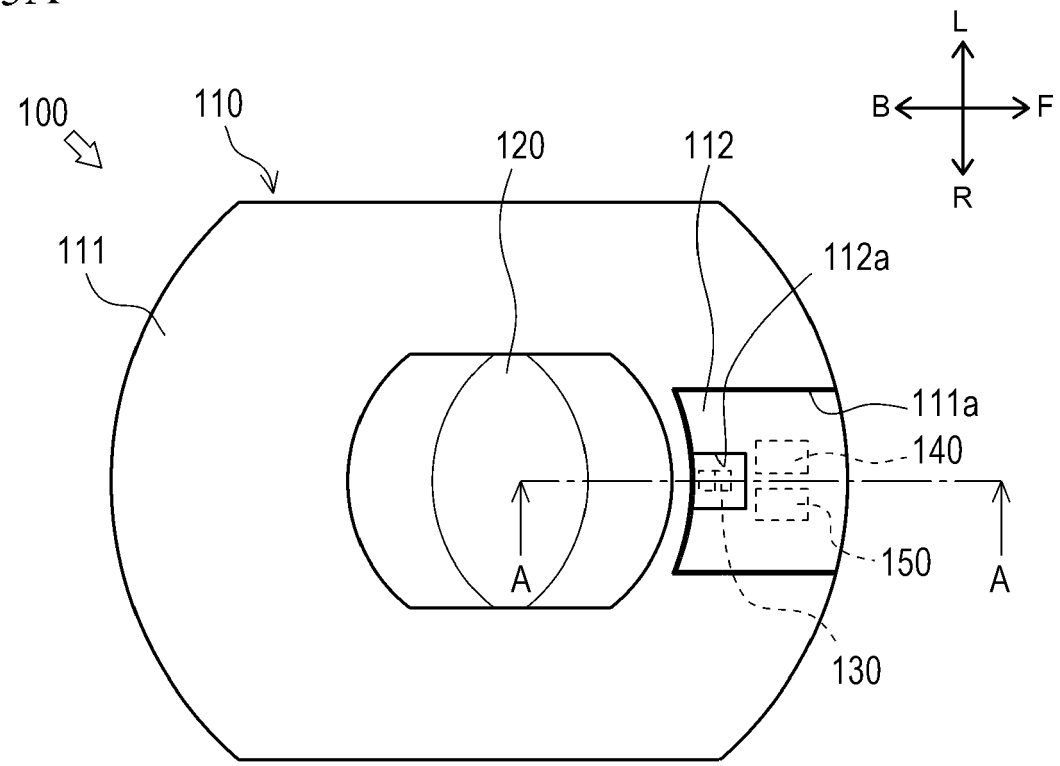
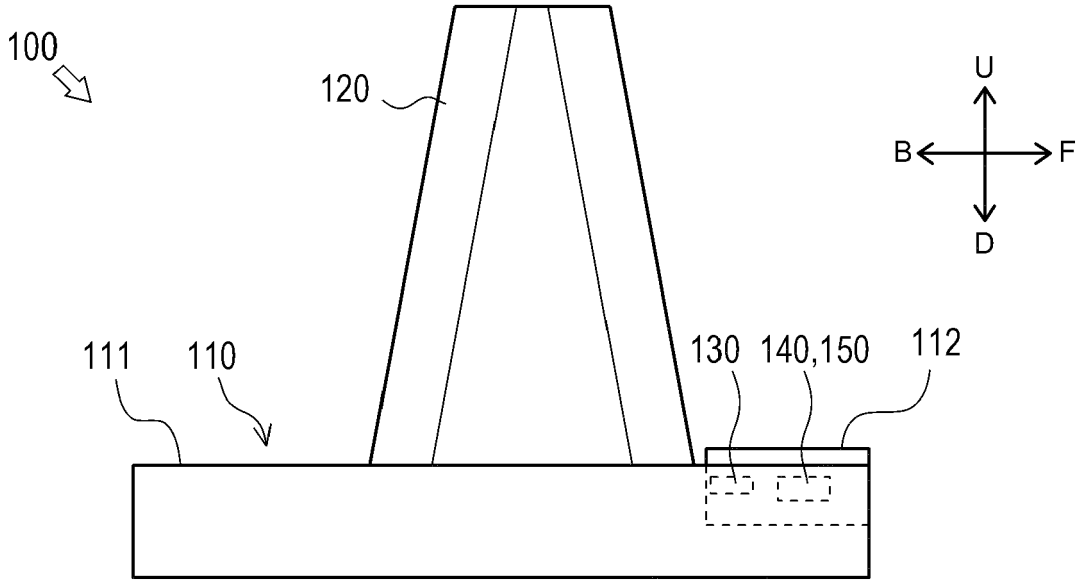

100
110
120
112
111
112a
111a
140
150
130
A
A
L
B
F
R

Fig. 3B


100
120
U
B
F
D
111
110
130
140,150
112

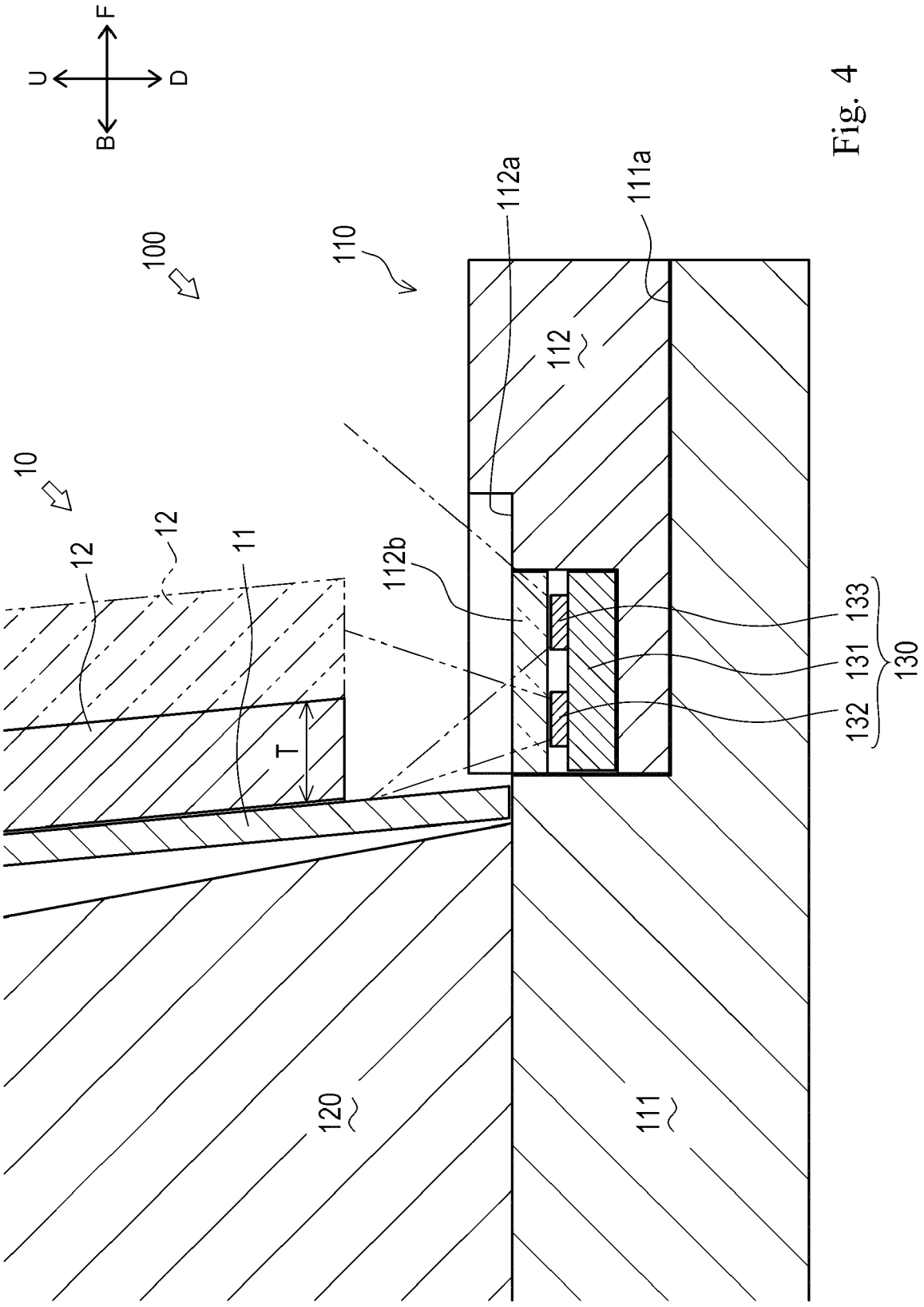
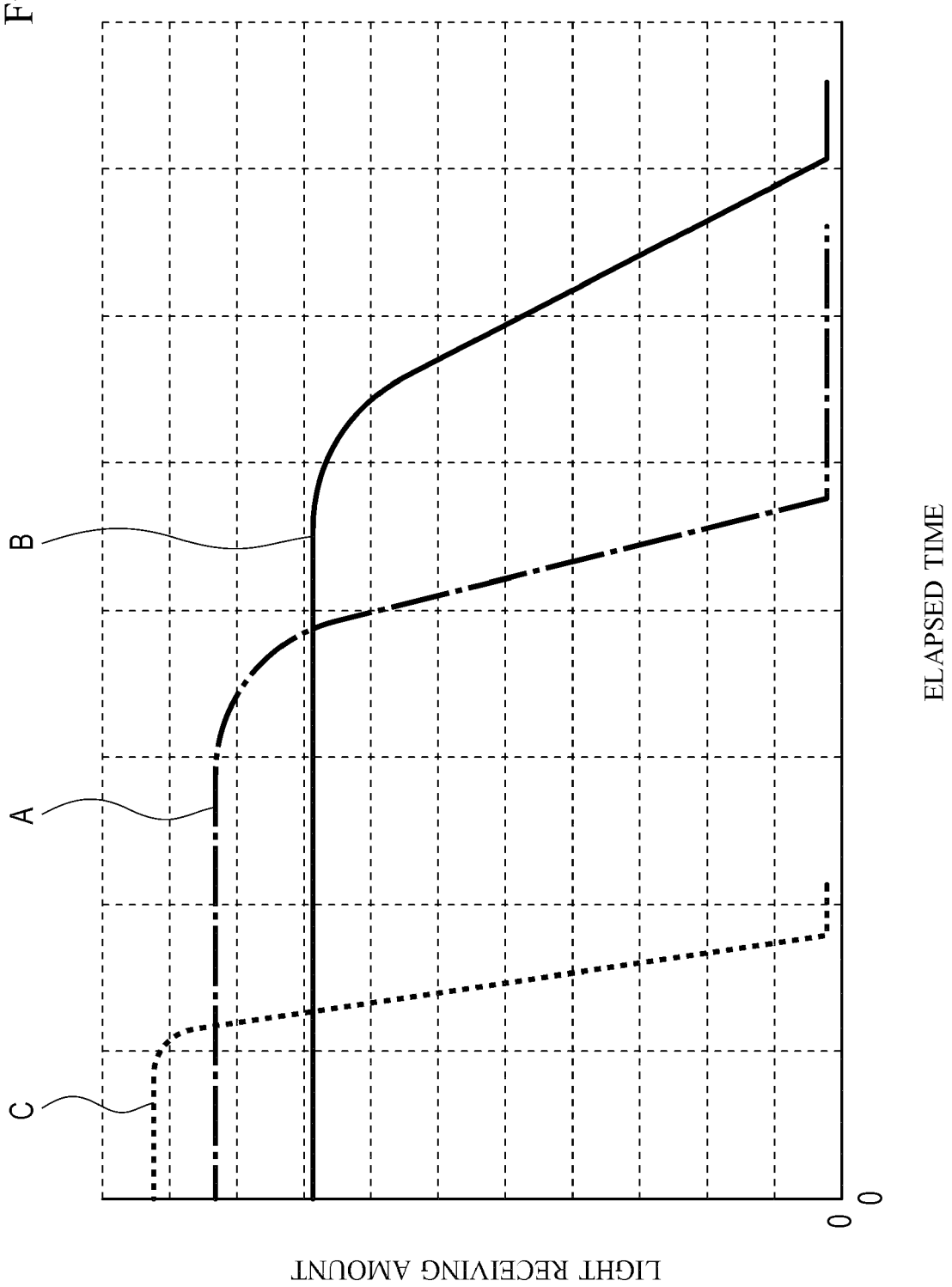

F
U
D
B
100
110
112a
111a
112
10
12
12
11
112b
133
131
130
132
T
120
111

Fig. 4

Fig. 5



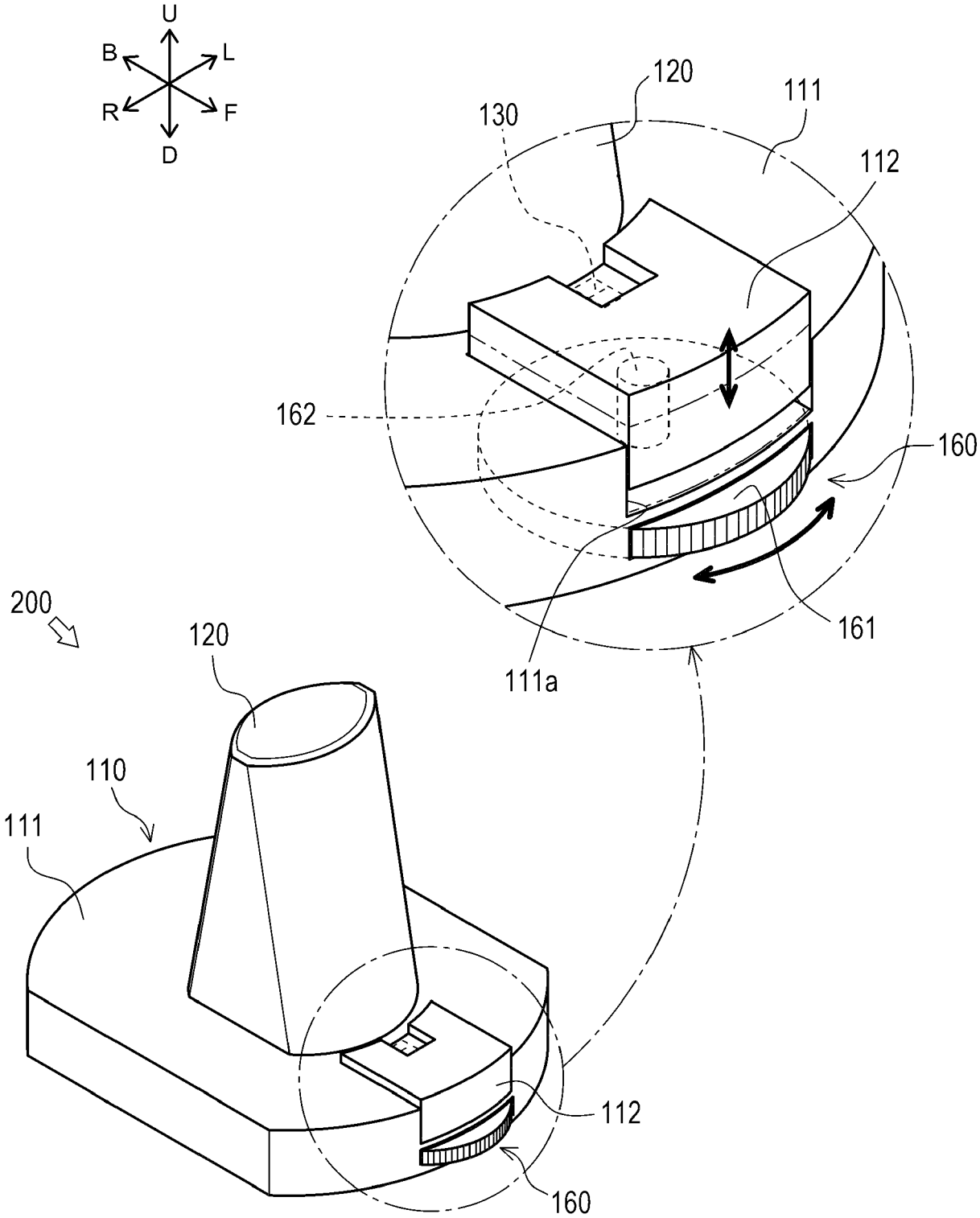


Fig. 6

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP H8277069 A **[0002] [0003] [0005]**
- CN 103981631 B **[0004]**