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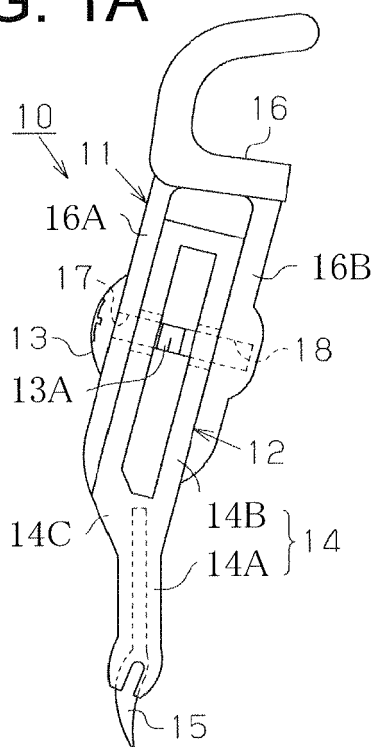
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(54) **Top comb device of comb**

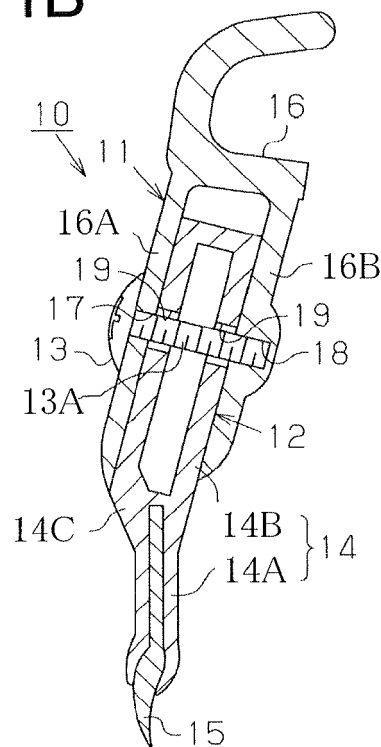
(57) There is provided a top comb device (10) of a comb, including a top comb holder (11) that is moveable in synchronization with a nipper frame (21), and a top comb (12) that is detachably fixed to the top comb

holder. The top holder has a U-shaped fixing support member (16) that clamps the top comb by engagement with the top comb at opposite sides thereof across thickness thereof.

**FIG. 1A**



**FIG. 1B**



## Description

### BACKGROUND OF THE INVENTION

**[0001]** The present invention relates generally to a top comb device of a comber and, more specifically, to a top comb device of a comber, having a top comb and a top comb holder.

**[0002]** A comber has a plurality of combing heads (eight combing heads in general). A series of operations for making sliver from lap as material is performed at each combing head. FIG. 5 is a schematic side view of one of the combing heads of a known comber. It is noted that the left-hand side and right-hand side of FIG. 5 correspond to the front and the rear of a combing head 51, respectively. As shown in FIG. 5, the combing head 51 includes a nipper device 53, a combing cylinder 54, and two pairs of detaching rollers 55, 56. The nipper device 53 has a feed roller 52 and the paired detaching rollers 56 are located forward of the paired detaching rollers 55. The nipper device 53 has a nipper frame 57 that is disposed above the combing cylinder 54 and pivotally supported by a shaft so as to be swingable back and forth. The nipper frame 57 has at the bottom thereof a bottom nipper 58.

**[0003]** The nipper frame 57 is configured so that the front end of the bottom nipper 58 is moved toward and away from the detaching rollers 55. A nipper arm 59 having at one end thereof a top nipper 59A is pivotally connected at the end thereof to the nipper frame 57 through a shaft. The top nipper 59A is operated to be opened and closed at a predetermined time in synchronization with the back-and-forth movement of the nipper frame 57 thereby to hold a lap L in conjunction with the bottom nipper 58.

**[0004]** A top comb 60 is mounted to the nipper frame 57 at a position that is forward of the bottom nipper 58 and operable to move in synchronization with the nipper frame 57. The top comb 60 combs the rear end of fleece combed by the combing cylinder 54. The top comb 60 is fixed to a plate-shaped top comb holder 61 at a plurality of positions by screws not shown in the drawing.

**[0005]** In these years, bending of a top comb has become a problem with an increasing operating speed and production volume (or increasing amount of cotton to be handled per unit time). FIG. 6 is a side view of a top comb device according to a background art. To solve the problem with the bending of the top comb, as shown in FIG. 6, European Patent Application Publication No. 2085505 discloses a configuration in which the top comb holder 61 is strengthened by a reinforcing member 62 and the top comb 60 interposed between a clamp plate 63 and the top comb holder 61 is fixed by a screw 64.

**[0006]** In the configuration according to the above-cited Publication in which the top comb holder 61 is strengthened by the reinforcing member 62 and the top comb 60 is fixed through the clamp plate 63 to the top comb holder 61, the bending of the top comb 60 in the

longitudinal direction thereof (in the perpendicular direction to the surface of paper of FIG. 6) is suppressed. However, since the detaching rollers 55 are disposed just forward of the top comb holder 61, as shown in FIG. 5, the reinforcing member 62 can only extend to a position adjacent to the upper end of the top comb 60. Therefore, the bending of the top comb 60 in the longitudinal direction thereof cannot be suppressed enough to improve the combing performance.

**[0007]** The present invention, which has been made in light of the above problems, is directed to providing a top comb device of a comber, which can secure the combing performance at increased operating speed and for increased production by appropriately suppressing the bending of the top comb in the longitudinal direction.

### SUMMARY OF THE INVENTION

**[0008]** There is provided a top comb device of a comber, including a top comb holder that is moveable in synchronization with a nipper frame, and a top comb that is detachably fixed to the top comb holder. The top holder has a U-shaped fixing support member that clamps the top comb by engagement with the top comb at opposite sides thereof across thickness thereof.

**[0009]** Other aspects and advantages of the invention will become apparent from the following description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the invention.

### BRIEF DESCRIPTION OF THE DRAWINGS

**[0010]** The invention together with objects and advantages thereof, may best be understood by reference to the following description of the presently preferred embodiments together with the accompanying drawings in which:

FIG. 1A is a side view of a top comb device according to an embodiment of the present invention and FIG. 1B is a sectional view of the top comb device of FIG. 1A;

FIG. 2 is a schematic side view showing the relation between the top comb device and a nipper according to the embodiment;

FIG. 3 is a side view of a top comb device according to another embodiment of the present invention;

FIG. 4A is a side view of a top comb device according to still another embodiment of the present invention and FIG. 4B is a side view of a top comb device according to yet another embodiment of the present invention;

FIG. 5 is a schematic side view of a known conventional comber; and

FIG. 6 is a side view of a top comb device of the comber of FIG. 5.

#### DETAILED DESCRIPTION OF THE EMBODIMENTS

**[0011]** The following will describe a top comb device of a comber according to an embodiment of the present invention with reference to FIGS. 1A, 1B, and 2. As shown in FIGS. 1A and 1B, the top comb device is designated by reference numeral 10 and has a top comb holder 11 and a top comb 12. The top comb holder 11 is operable to move in synchronization with a nipper frame 21 (shown in FIG. 2) of the comber. The top comb 12 is detachably fixed to the top comb holder 11. The top comb 12 has a comb body 14 and a comb teeth member 15. The comb body 14 is fixed to the top comb holder 11 by a screw 13. The comb teeth member 15 is formed separately and combined with the comb body 14 at a position adjacent to the top end of the comb body 14.

**[0012]** The comb body 14 has a clamped portion 14B, a comb teeth combining portion 14A, and a thickness increasing portion 14C. The clamped portion 14B is fixed to the top comb holder 11 by being clamped by a fixing support member 16 which will be described later. The comb teeth member 15 is held and fixed in the comb teeth combining portion 14A. The thickness increasing portion 14C extends between the clamped portion 14B and the comb teeth combining portion 14A and formed in such a way that the thickness of the thickness increasing portion 14C is increased toward the clamped portion 14B, so that the clamped portion 14B is formed thicker than the comb teeth combining portion 14A. To be more specific, in the top comb 12, the clamped portion 14B clamped by the above-described fixing support member 16 is thicker than a portion of the top comb 12 between the clamped portion 14B and the comb teeth member 15. As shown in FIG. 1A, the clamped portion 14B is hollowed.

**[0013]** The comb body 14 and the comb teeth member 15 are made of different materials. The comb body 14 is made of a lightweight material with a rigidity such as aluminum alloy. The comb teeth member 15 is made of a material such as steel having durability against combing. The comb teeth member 15 is fixed to the comb body 14, for example, by insert molding.

**[0014]** The top comb holder 11 includes the aforementioned fixing support member 16 that has a U-shaped cross-section. The fixing support member 16 has a front wall portion 16A through which a hole 17 is formed for receiving therethrough the screw 13 and a rear wall portion 16B in which an internal thread portion 18 is formed for receiving therein the end of an external thread portion 13A of the screw 13. The fixing support member 16 holds the top comb 12 with the clamped portion 14B of the comb body 14 of the top comb 12 held between the front wall portion 16A and the rear wall portion 16B. Tightening the screw 13 through the hole 17 of the front wall portion 16A and an elongated hole 19 of the top comb 12, the

top comb 12 is fixed securely to the top comb holder 11. It is noted that the front wall portion 16A is disposed on the side of top comb 12 that is opposite from a top nipper 24A (shown in FIG. 2).

**[0015]** The following will describe the operation of the above-described top comb device 10. As shown in FIG. 2, the top comb device 10 is fixed to a support lever (not shown) of a nipper frame 21 of a nipper device 20 of the comber at a position above the top comb holder 11. The nipper frame 21 is pivotally supported by a shaft (not shown) mounted to the support lever. Lap L supplied from a lap supply source (not shown) is delivered toward a position forward of a bottom nipper 23 by a feed roller 22. The top nipper 24A is fixed to a nipper arm 24 that is pivotally supported by a shaft mounted in the nipper frame 21. The top nipper 24A is operated to be opened and closed at a controlled timing in synchronization with the back-and-forth movement of the nipper frame 21 thereby to hold the lap L in conjunction with the bottom nipper 23.

**[0016]** During the operation of the comber, the bottom nipper 23 is swung back and forth with the nipper frame 21, with the result that the leading end of the lap L held by the bottom nipper 23 and the top nipper 24A is combed by a combing cylinder (not shown), thus being formed into a fleece F and the resulting fleece F is moved toward detaching rollers 25 by forward movement of the nipper frame 21. In accordance with the forward movement of the fleece F, the detaching rollers 25 are reversed thereby to move the preceding fleece backward. Thus, the rear end of the preceding fleece and the front end of the newly combed fleece (following fleece) are lapped one on the other. When the detaching roller 25 is rotated in forward direction, the fleece F is moved forward from the nipper device 20 and the trailing end of the preceding fleece F is combed by the comb teeth member 15 of the top comb 12. Repeating such operations, the fleece F fed by each combing head is bundled, drafted and compressed into sliver by a calendar roller.

**[0017]** The quality of the fleece F combed by the top comb 12 depends on whether all the teeth of the comb teeth member 15 of the top comb 12 repeat the insertion into the fleece F to a predetermined depth at the respective positions across the fleece F. The depth to which the teeth of the comb teeth member 15 is inserted into the fleece F may be adjusted by changing the position of the top comb 12 relative to the fixing support member 16. The top comb 12 is allowed to move along the length thereof for the adjustment by the provision of the elongated hole 19.

**[0018]** The fleece F is transferred by the detaching roller 25 while being inserted by the comb teeth member 15 of the top comb 12, so that the top comb 12 receives through the comb teeth member 15 a force of the fleece F acting toward the detaching roller 25. The force is increased with an increase of the operating speed of the comber and of the production amount.

**[0019]** In the present embodiment, the top comb holder

11 has the U-shaped fixing support member 16 having a pair of front and rear wall portions 16A, 16B that holds therebetween the top comb 12. As compared to the configuration of the back background art in which the reinforcing member 62 is provided above the top comb 60 (FIG. 6), the top comb 12 in the present embodiment, which is engaged with the front and rear wall portions 16A, 16B of the U-shaped fixing support member 16 over a length that is large enough to resist the force created when the fleece is transferred by the detaching rollers 25 with the comb teeth member 15 inserted in the fleece is harder to be bent in the longitudinal direction thereof. It is noted that the longitudinal direction of the top comb 12 indicates the perpendicular direction to the surface of paper of FIG. 2 and the top comb 12 is bent in the longitudinal direction when receiving the above-cited force of the fleece F. According to the above-described configuration, bending of the top comb 12 in the longitudinal direction thereof is suppressed successfully and the desired combing performance can be secured at an increased operating speed of the comb for an increased production.

**[0020]** In the embodiment, the top comb 12 is formed so that the clamped portion 14B of the comb body 14 clamped by the fixing support member 16 is formed with a thickness that is greater than the thickness of the portion of the comb body 14 between the clamped portion 14B and the comb teeth member 15, or the comb teeth combining portion 14A and the thickness increasing portion 14C. The thickness increasing portion 14C of the top comb 12 between the thickness increasing portion 14C and the comb teeth combining portion 14A has a thickness that increases toward the clamped portion 14B. Therefore, rigidity of the comb body 14 against the bending in back and forth direction of the top comb 12 is higher as compared to the configuration in which the comb body of the top comb is made of a flat plate, with the result that the bending of the comb teeth combining portion 14A in back and forth of the top comb 12 during combing operation of the top comb 12 is suppressed.

**[0021]** Specifically, the bending resistance of cross section of a member is proportional to the second moment of area. When the entire area of the section and a differential area in the section are expressed by A and dA, respectively, the second moment of area is calculated by integrating the product of a differential area dA in the section and squared distance from an axis by reference to the geometric center of the section, in the entire sectional region. A comb body having a thickness increasing portion such as 14C has a greater second moment of area than a comb body that has the same length but is formed with a constant thickness. Therefore, the former comb body 14 is harder to bend. The thickness of the comb teeth combining portion 14A remains unchanged, so that combing performance is not deteriorated.

**[0022]** Furthermore, as compared to a case in which the clamped portion such as 14B is formed with a con-

stant thickness, the clamped portion 14B of the comb body 14 of the top comb 12 is formed thicker than the comb teeth combining portion 14A, with the result that the secondary moment of area of the top comb holder 11 is greater and the bending rigidity in the longitudinal direction of the top comb holder 11 becomes greater, accordingly. As a result, the bending of the top comb 12 in the longitudinal direction of the top comb 12 during combing operation is suppressed.

**[0023]** The present embodiment has the following advantageous effects.

(1) The top comb device 10 of the comb has the top comb holder 11 that is moveable in synchronization with the nipper frame 21 and the top comb 12 that is detachably fixed to the top comb holder 11. The top comb holder 11 has the U-shaped fixing support member 16 that clamps the top comb 12 at the opposite sides thereof with the top comb 12 across the thickness thereof. Therefore, the bending of the top comb 12 in the longitudinal direction thereof is suppressed appropriately and, therefore, the combing may be accomplished successfully at an increased combing speed and for an increased production.

(2) The top comb 12 is formed so that the clamped portion 14B clamped by the fixing support member 16 is thicker than the comb teeth combining portion 14A and the thickness increasing portion 14C that extend from the clamped portion 14B toward the comb teeth member 15. In the top comb 12 having the thickened clamped portion 14B, the secondary moment of area of the top comb holder 11 is larger than that of a comb holder which is formed with a constant thickness and therefore, the rigidity of the top comb 12 against bending in the longitudinal direction of the top comb holder 11 becomes larger. As a result, the bending of the top comb 12 in the longitudinal direction thereof is suppressed during the combing operation.

(3) The U-shaped fixing support member 16 has the front wall portion 16A through which the hole 17 is formed for receiving therethrough the screw 13 and the rear wall portion 16B in which the internal thread portion 18 is formed for receiving therein the end of the external thread portion 13A of the screw 13. In fixing the top comb 12 to the top comb holder 11, generally the top comb 12 is fixed to the fixing support member 16 by the screw 13 with the top comb 12 clamped by the U-shaped fixing support member 16. Then, in order to prevent the top comb device 10 from interfering with the top nipper 24A, it is preferable that the protrusion of the rear wall portion 16B of the top comb holder 11 should be small. If the screw 13 is disposed with its head located on the rear wall portion 16B side, the protrusion of the top

comb holder 11 increases by the protrusion of the head of the screw 13. However, in the configuration of the top comb holder 11 in which the head of the screw 13 is located on the front wall portion 16A side, the protrusion of the top comb holder 11 on the rear wall portion 16B side is small enough to prevent the interference even if a portion of the rear wall portion 16B is thickened so as to form the internal thread portion 18 for receiving therein the end of external thread portion 13A of the screw 13.

**[0024]** The present invention is not limited to the above-described embodiment, but may be embodied in various manners as follows. It is noted that same reference numerals are used in the following description to denote parts or elements that are similar to the counterparts of the embodiment described above with reference to FIGS. 1A, 1B, and 2. As shown in FIG. 3, in the top comb 12, the clamped portion 14B clamped by the fixing support member 16 need not be thicker than the portion of the top comb 12 extending from the clamped portion 14B to the comb teeth member 15.

**[0025]** Additionally, as shown in FIG. 3, the top comb holder 11 may be provided with a reinforcing member 30 at a position adjacent to the front wall portion 16A of the top comb holder 11 as in the case of the above-cited European Patent Application Publication No. 2085505. As shown in FIG. 4A, the clamped portion 14B of the top comb 12 clamped by the fixing support member 16 may be thicker than the portion of the top comb 12 extending from the clamped portion 14B to the comb teeth member 15. Additionally, the portion of the top comb 12 extending from the fixing support member 16 toward the comb teeth member 15 may be bent so that the comb teeth member 15 extends in parallel to a contact surface 31 between the rear wall portion 16B of the fixing support member 16 and the clamped portion 14B of the top comb 12 at a position behind the contact surface 31. According to the above-described configuration, the clamped portion 14B can be thicker. The secondary moment of area of the top comb 12 according to the above-described configuration becomes larger than that of the top comb 12 having a configuration in which a portion from the clamped portion 14B clamped by the fixing support member 16 of the top comb 12 toward the comb teeth member 15 extends straight, with the result that a portion adjacent to the top of the top comb 12 is hard to be bent.

**[0026]** In the configuration of FIG. 4B in which the portion of the top comb 12 extending from the fixing support member 16 toward the comb teeth member 15 is bent, the rear wall portion 16B may be formed thinner than the front wall portion 16A. The screw 13 may be disposed with the head thereof located on the rear wall portion 16B side of the top comb 12, as shown in FIG. 4B. The top comb 12 is clamped by the fixing support member 16 with the end of the external thread portion 13A of the screw 13 engaged with the internal thread portion 18 formed in the front wall portion 16A.

**[0027]** In the configuration of FIG. 4B in which the head of the screw 13 is in contact with the rear wall portion 16B, a recess may be formed in the rear wall portion 16B for accommodating therein the head of the screw 13 instead of thinning the rear wall portion 16B.

**[0028]** The internal thread portion 18 receiving the end of the external thread portion 13A of the screw 13 may be provided in the form of a through hole or a blind hole in the front wall portion 16A or the rear wall portion 16B.

**[0029]** A bolt and a nut may be used instead of the screw 13 as a means for detachably holding the top comb holder 11 by the top comb 12. If the clamped portion 14B of the top comb 12 is formed thick, the clamped portion 14B of the top comb 12 may be formed solid instead of being hollowed.

**[0030]** There is provided a top comb device of a comb, including a top comb holder that is moveable in synchronization with a nipper frame, and a top comb that is detachably fixed to the top comb holder. The top holder has a U-shaped fixing support member that clamps the top comb by engagement with the top comb at opposite sides thereof across thickness thereof.

## Claims

1. A top comb device (10) of a comb, comprising:

a top comb holder (11) that is moveable in synchronization with a nipper frame (21); and  
a top comb (12) that is detachably fixed to the top comb holder (11),

### characterized in that

the top comb holder (11) has a U-shaped fixing support member (16) that clamps the top comb (12) by engagement with the top comb (12) at opposite sides thereof across thickness thereof.

2. The top comb device (10) of the comb according to claim 1, wherein the top comb (12) has a clamped portion (14B) clamped by the fixing support member (16), a comb teeth member (15) and a portion (14A, 14C) that extends from the clamped portion (14B) toward the comb teeth member (15), and wherein the clamped portion (14B) is thicker than the portion (14A, 14C) that extends from the clamped portion (14B) toward the comb teeth member (15).

3. The top comb device (10) of the comb according to claim 2, wherein the portion (14A) of the top comb (12) extending from the clamped portion (14B) toward the comb teeth member (15) is bent so that the comb teeth member (15) extends in parallel to a contact surface (31) between a rear wall portion (16B) of the fixing support member (16) and the clamped portion (14B) at a position behind the contact surface (31).

4. The top comb device (10) of the comber according to any one of claims 1 through 3, wherein the U-shaped fixing support member (16) has a front wall portion (16A) through which a hole (17) is formed for receiving therethrough a screw (13) and a rear wall portion (16B) in which an internal thread portion (18) is formed for receiving therein an external thread portion (13A) of the screw (13).

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FIG. 1A

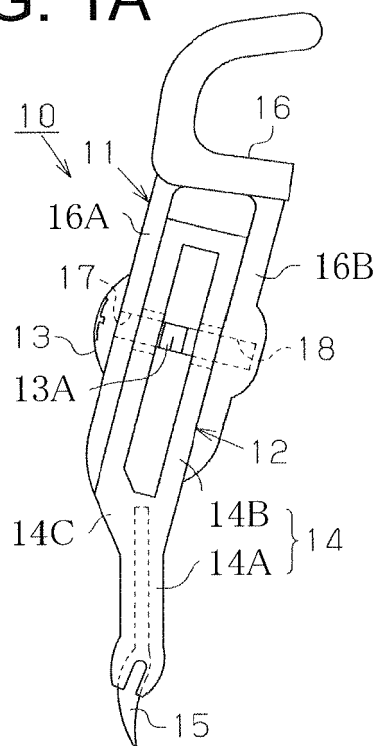


FIG. 1B

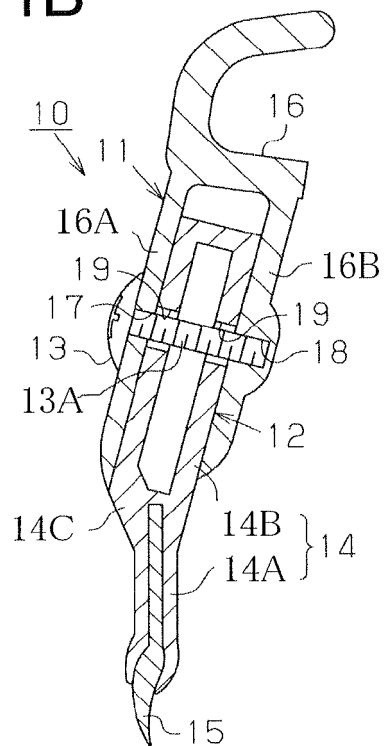


FIG. 2

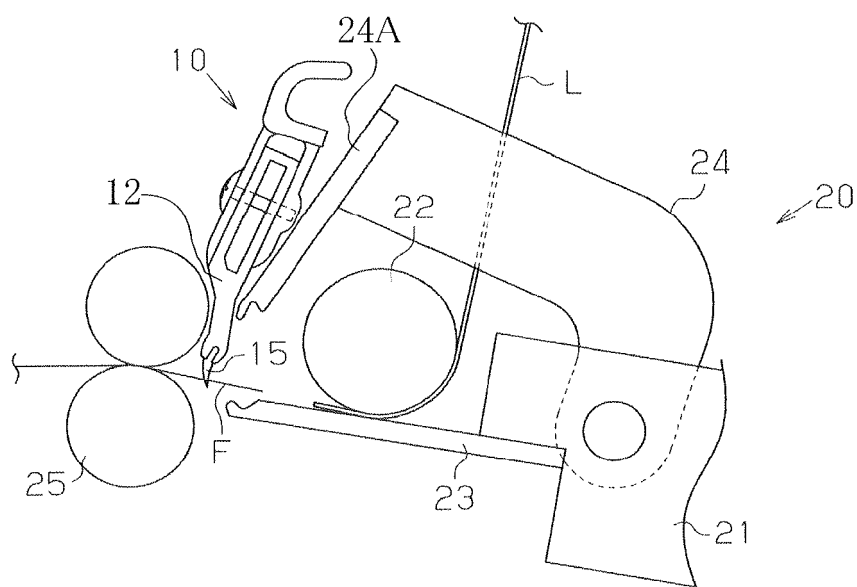


FIG. 3

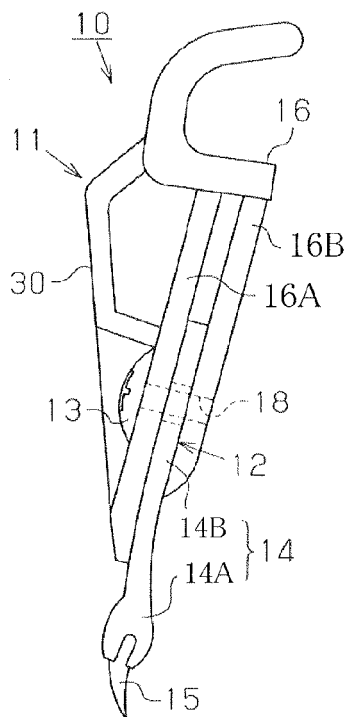


FIG. 4A

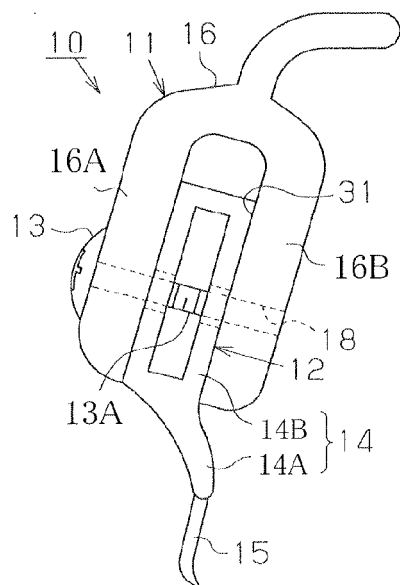


FIG. 4B

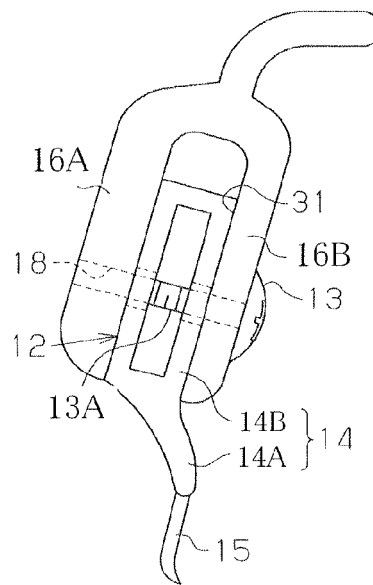




FIG. 5

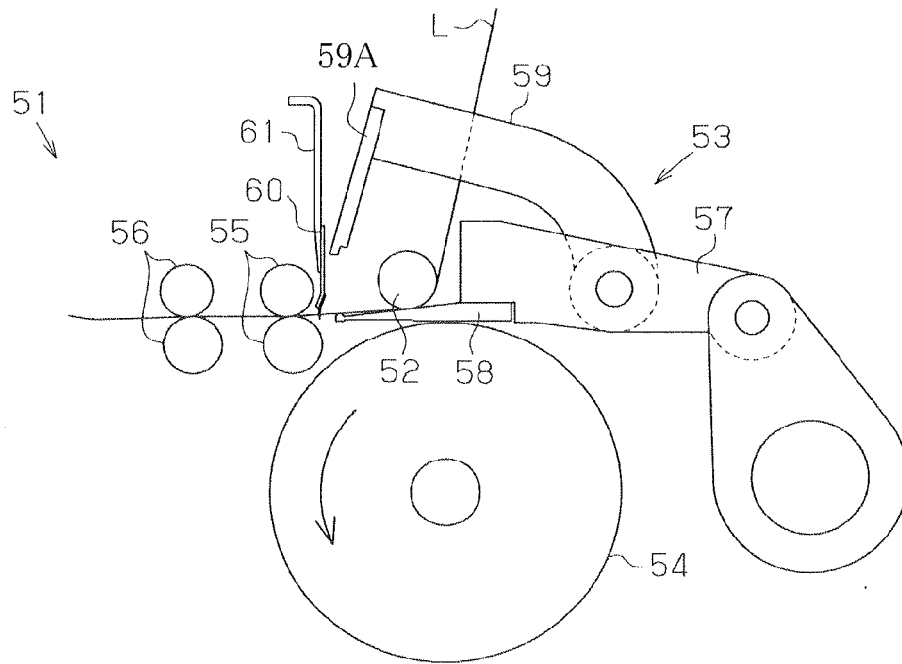
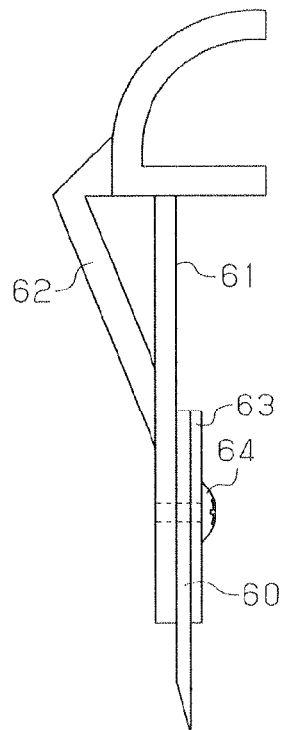


FIG. 6



**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- EP 2085505 A [0005] [0025]