



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**26.05.2010 Bulletin 2010/21**

(51) Int Cl.:  
**D05B 3/06 (2006.01) D05B 71/00 (2006.01)**

(21) Application number: **09176579.2**

(22) Date of filing: **20.11.2009**

(84) Designated Contracting States:  
**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 SE SI SK SM TR**

(30) Priority: **20.11.2008 JP 2008296573**

(71) Applicant: **JUKI Corporation**  
**Chofu-Shi,**  
**Tokyo 182-8655 (JP)**

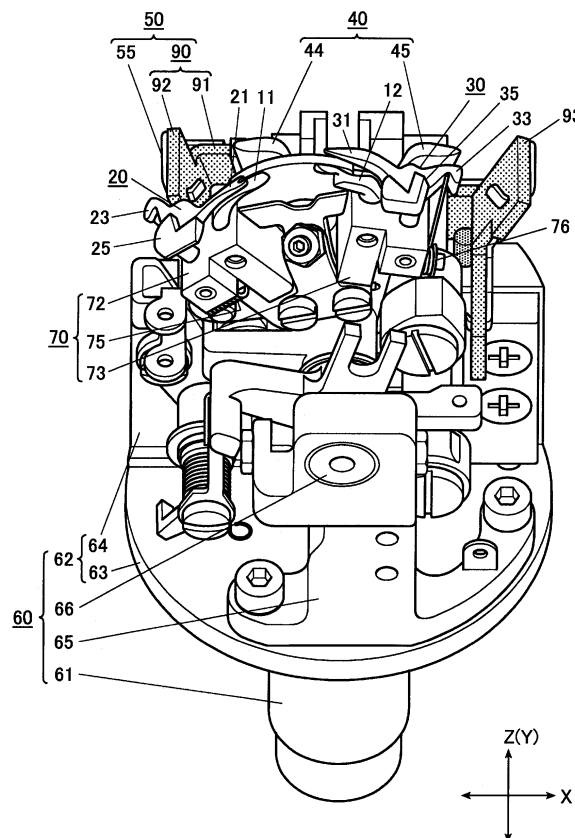
(72) Inventors:  
• **Murai, Kenji**  
**Tokyo 182-8655 (JP)**  
• **Sugiyama, Takashi**  
**Tokyo 182-8655 (JP)**

(74) Representative: **Boehme, Ulrich**  
**HOEGER, STELLRECHT & PARTNER**  
**Patentanwälte**  
**Uhlandstrasse 14 c**  
**70182 Stuttgart (DE)**

(54) **Looper mechanism of buttonholing machine**

(57) The invention relates to a looper mechanism (10) of a buttonholing machine (1). The looper mechanism (10) includes two loopers (11, 12) which catch a sewing thread to form a loop, two spreaders (20, 30) which expand the loop of the sewing thread, a looper base (60) which is supported below a sewing needle (3) so as to be turnable about a centerline extending in a vertical direction (Z), a looper mount (70) on which the loopers (11, 12) and the spreaders (20, 30) are mounted and which is swingably supported on the looper base (60) such that the loopers (11, 12) and the spreaders (20, 30) move toward and away from the up-down movement path of the sewing needle (3), and a spreader cam (40) which is swingably supported on the looper base (60) to give a rotation movement to each of the spreaders (20, 30) to expand the loop. The looper mechanism (10) is characterized by further comprising a lubricant oil feeding member (90) which is brought into contact with the contact portion (23, 33) of each of the spreaders (20, 30) in accordance with the swinging of the looper mount (70) to provide a lubricant oil to the contact portion (23, 33), wherein the lubricant oil feeding member (90) is fixedly equipped on the looper base (60).

**FIG. 3**



## Description

**[0001]** The present invention relates to a looper mechanism of a buttonholing machine.

**[0002]** Conventionally, for example, as described in JP2007-061326A, inside a bed portion of an eyelet buttonholing machine, a looper mechanism which is disposed at a position just below a needle bar and supported so as to turn concentrically with the needle bar, is known.

**[0003]** The conventional looper mechanism is shown in Fig. 12.

**[0004]** The looper mechanism 100 includes a looper base (not shown), a looper mount 102 which is made to swing in the left-right direction by a support shaft 101 directed in a horizontal direction at an upper part of the looper base, and a spreader cam 103 which is provided along with the looper mount 102 and is made to swing by the support shaft 101.

**[0005]** On the looper mount 102, loopers (not shown) are provided on the left and right across an up-down movement path of a sewing needle, and near the loopers, spreaders 106, 107 are disposed. The above-described spreader cam 103 includes a pair of left and right cam portions 104, 105 extended upward, and the looper mount 102 and the spreader cam 103 swing in a phase so as to pass opposite each other in synchronization with up-down movements of the sewing needle.

**[0006]** On the other hand, the spreaders 106, 107 are pivotally supported on the looper mount 102, and around the pivot, on one sides in the radial directions, thread hooks 106a and 107a for expanding a loop of a thread are extended, and on the opposite sides, contact portions 106b, 107b which are brought into contact with the cam portions 104, 105 of the spreader cam 103 are extended. When sewing, the looper mount 102 and the spreader cam 103 swing in phases opposite to each other, and accordingly, when the thread hook 106a of the spreader 106 approaches the sewing needle, the contact portion 106b is brought into contact with the cam portion 104 of the spreader cam 103 and the thread hook 106a is turned to expand the loop of the thread caught by the looper. Similarly, when the thread hook 107a of the spreader 107 approaches the sewing needle, the contact portion 107b is brought into contact with the cam portion 105 of the spreader cam 103 and the thread hook 107a is turned to expand the loop of the thread caught by the looper.

**[0007]** In the conventional looper mechanism 100, the contact portions 106b, 107b of the spreaders 106, 107 repeatedly come into sliding contact with the cam portions 104, 105 of the spreader cam 103, so that lubrication is essential for preventing wear and for securing movement smoothness.

**[0008]** Therefore, generally, the sliding contact portions are manually lubricated.

**[0009]** Therefore, in the conventional looper mechanism 100, lubricant oil supply grooves 108, 109 are formed along the cam portions 104, 105 on one flat surface of the spreader cam 103, and by using a centrifugal

force of swinging of the spreader cam 103, a lubricant oil supplied from an oil wick 110 is further supplied to the cam portions 104, 105 on the upper side through the supply grooves 108, 109.

**[0010]** However, for manual lubrication, a complicated operation for opening the looper mechanism inside the bed of the sewing machine is required, and this significantly deteriorates working efficiency.

**[0011]** The conventional looper mechanism 100 is structured so that a lubricant oil is supplied to the cam portions 104, 105 through the supply grooves 108, 109 formed substantially along the up-down direction, so that the lubricant oil scatters upward of the spreader cam 103 due to a centrifugal force of a swinging movement of the cam 103. A throat plate (not shown) is disposed above the spreader cam 103, and a lubricant oil is attached to a thread passing through the throat plate and contaminates a workpiece, and as a result, the quality is deteriorated.

**[0012]** It is an object of the present invention to prevent deterioration of working efficiency and/or to prevent a lubricant oil from being adhered to a workpiece.

**[0013]** According to a first aspect of the present invention, a looper mechanism of a buttonholing machine is provided. The looper mechanism includes: two loopers which catch a sewing thread to form a loop; two spreaders which expand the loop of the sewing thread; a looper base which is supported below a sewing needle so as to be turnable about a centerline extending in a vertical direction; a looper mount on which the loopers and the spreaders are each disposed on respective sides of an up-down movement path of the sewing needle, wherein the looper mount is swingably supported on the looper base such that the loopers and the spreaders move toward and away from the up-down movement path of the sewing needle; and a spreader cam which is swingably supported on the looper base, wherein the spreader cam includes two cam portions which are brought into contact with contact portions of the spreaders respectively to give a rotation movement to each of the spreaders to expand the loop. The spreader cam gives the rotation movement to one of the spreaders that has moved toward the sewing needle. The looper mechanism further includes a lubricant oil feeding member which is brought into contact with the contact portion of each of the spreaders in accordance with the swinging of the looper mount to provide a lubricant oil to the contact portion, wherein the lubricant oil feeding member is fixedly equipped on the looper base.

**[0014]** With the above-described configuration, the lubricant oil is supplied to the contact portion of each of the spreaders by the lubricant oil feeding member fixedly equipped on the looper base. Thus, unlike a case in which a lubricant oil is supplied by using the spreader cam which swings, the lubricant oil can be restrained from scattering upward due to swinging, and contamination of a sewing thread and a workpiece by the lubricant oil can be reduced and the quality can be improved.

**[0015]** Further, each of the spreaders, which moves toward and away from the sewing needle in accordance with the swinging of the looper mount, is supplied with the lubricant oil from the lubricant oil feeding member, so that even if the lubricant oil scatters in the movement directions of the spreaders, the lubricant oil is prevented from scattering upward, and in this regard, contamination of a sewing thread and a workpiece by the lubricant oil can be reduced and the quality can be improved.

**[0016]** According to a second aspect of the present invention, the lubricant oil feeding member is configured and disposed such that each of the spreaders contacts the lubricant oil feeding member when moved away from the up-down movement path of the sewing needle.

**[0017]** With the above-described configuration, each of the spreader is brought into contact with the cam portion of the spreader cam when moved toward the sewing needle, and is brought into contact with the lubricant oil feeding member when moved in the opposite direction. Therefore, interference between the lubricant oil feeding member and the spreader cam can be avoided, and smooth movements of the spreaders can be maintained.

**[0018]** According to a third aspect of the present invention, the lubricant oil feeding member is configured and disposed so as to provide the lubricant oil to the respective spreaders when the looper mount is at a swinging stop position.

**[0019]** With the above-described configuration, scattering of the lubricant oil at the time of providing the lubricant oil can be further reduced. Therefore, contamination of a sewing thread and a workpiece by the lubricant oil can be further reduced, and the quality can be further improved.

**[0020]** According to a fourth aspect of the present invention, each of the spreaders is configured such that the contact portion and a thread hook on which the sewing thread is hooked to expand the loop are provided on opposite sides to each other with respect to a rotation support shaft of the spreader.

**[0021]** With the above-described configuration, the thread hook and the contact portion of each of the spreaders are provided on the sides opposite to each other with respect to the rotation support shaft, so that the lubricant oil does not move to the thread hook by the rotation movement of the spreader, and accordingly, contamination of a sewing thread and a workpiece by the lubricant oil can be further reduced, and the quality can be further improved.

**[0022]** According to a fifth aspect of the present invention, a groove is formed on the contact portion of each of the spreaders.

**[0023]** With the above-described configuration, the supplied lubricant oil spreads along the groove and can realize effective sliding of the contact portion in a wide range. The lubricant oil can be held inside the groove, so that lubrication is possible for a long period of time.

**[0024]** According to a sixth aspect of the present invention, the contact portion of each of the spreaders in-

cludes a permeable member which allows the lubricant oil to permeate therethrough.

**[0025]** With the above-described configuration, the lubricant oil can be held in the permeable member, so that lubrication is possible for a long period of time.

**[0026]** According to a seventh aspect of the present invention, the contact portion of each of the spreaders includes a roller which rolls in contact with the associated cam portion of the spreader cam.

**[0027]** With the above-described configuration, wear of the spreader due to contact with the cam portion can be further reduced, and a smoother rotation movement of the spreader can be realized.

**[0028]** According to an eighth aspect of the present invention, the looper mechanism further includes a lubricant oil tank disposed away from the lubricant oil feeding member.

**[0029]** With the above-described configuration, an operation for directly replenishing the lubricant oil feeding member with the lubricant oil is unnecessary, and the lubricant oil tank can reduce the frequency of oil supply to the tank.

**[0030]** According to a ninth aspect of the present invention, the looper mount and the spreader cam are pivotally supported by a common support shaft, and an oil wick which supplies the lubricant oil to the support shaft is provided inside an accommodation hole which is provided inside the support shaft. The oil wick is disposed so as to be supplied with the lubricant oil by contacting the lubricant oil feeding member.

**[0031]** With the above-described configuration, an oil supply operation to the support shaft does not require a separate oil supply path just for the support shaft, the burden of the oil supply operation can be reduced, and the number of components such as oil supplying means can be reduced.

**[0032]** According to a tenth aspect of the present invention, the looper mechanism further includes: a first felt which is disk-shaped and is connected to the lubricant oil tank, wherein the first felt is fixed to a frame of the buttonholing machine, and is disposed to face a lower surface of the looper base; and a second felt which is arc-shaped and is connected to the lubricant oil feeding member, wherein the second felt is fixed to the lower surface of the looper base, and is disposed concentrically with the turning center of the looper base, and wherein the first felt and the second felt are vertically in contact with each other.

**[0033]** With the above-described configuration, the lubricant oil can always be supplied to the lubricant oil feeding member without fail even when the looper base turns.

**[0034]** Other aspects and advantages of the present invention will be apparent from the following description, the drawings and the claims.

**[0035]** The following description of preferred embodiments of the invention serves to explain the invention in greater detail in conjunction with the drawings. These show:

- Fig. 1: a side view of an eyelet buttonholing machine;
- Fig. 2: a perspective view of a looper mechanism of the eyelet buttonholing machine;
- Fig. 3: a perspective view of a front side of a portion of the looper mechanism, viewed obliquely from above;
- Fig. 4: a perspective view of a back side and a lateral side of the portion of the looper mechanism, viewed obliquely from below;
- Fig. 5: a sectional view of the portion of the looper mechanism, taken along the Y-Z plane including a turning center of a looper bracket of the looper mechanism;
- Fig. 6: an exploded perspective view of a portion including spreaders of the looper mechanism and components around the spreaders;
- Fig. 7: a perspective view of a left spreader;
- Fig. 8: a top view of the looper mechanism;
- Fig. 9: an exploded perspective view of the back side and the lateral side of the looper mechanism, viewed obliquely from above;
- Fig. 10: a perspective view of another example of the left spreader;
- Fig. 11A: a perspective view of still another example of the left spreader;
- Fig. 11B: a sectional view of a contact portion of the left spreader of Fig. 11A; and
- Fig. 12: an exploded perspective view of a portion of a conventional looper mechanism.

**[0036]** Overall Configuration of Embodiment

**[0037]** A looper mechanism 10 of an eyelet buttonholing machine 1 as a buttonholing machine of an embodiment of the present invention will be described with reference to Fig. 1 to Fig. 9.

**[0038]** As shown in Fig. 1, the looper mechanism 10 is disposed at a position which is inside the bed portion 2a of a machine frame 2 of the eyelet buttonholing machine 1 and is just below a needle bar 4 holding a sewing needle 3. For eyelet buttonholing, the needle bar 4 can tilt by a predetermined angle from a reference state where the needle bar 4 is directed in a vertical direction to enable needle swing, and is supported so as to be turnable around a vertical axis line of the needle bar 4 oriented in the vertical direction. The looper mechanism 10 is also supported inside the bed portion 2a so that a looper bracket 60 described later becomes turnable concentrically with the needle bar 4.

**[0039]** In the description given below, the vertical direction is defined as a Z-axis direction, the longitudinal direction of the bed portion 2a orthogonal to the Z-axis direction is defined as a Y-axis direction, and a direction orthogonal to both of the Y-axis direction and the Z-axis direction is defined as an X-axis direction.

**[0040]** The looper mechanism 10 includes a left looper 11 which catches an upper thread as a sewing thread

and forms a loop, and forms double chainstitches by tying a lower thread as a sewing thread to the upper thread, a left spreader 20 which is provided along with the left looper 11 and expands the loop of the upper thread when forming double chainstitches, a right looper 12 which catches the upper thread and forms single-thread chainstitches, a right spreader 30 which is provided along with the right looper 12 and expands the loop of the upper thread when forming single-thread chainstitches, a looper bracket 60 (a looper base) supported on the machine frame 2 turnably around the same centerline as that of the needle bar 4 parallel to the Z-axis direction, a looper mount 70 on which the left looper 11 and the left spreader 20 is disposed on one side of an up-down movement path of the sewing needle 3 and the right looper 12 and the right spreaders 30 are disposed on the other side of the up-down movement path of the sewing needle 3 opposite the left looper 11 and the left spreader 20, and which is swingably supported on the looper bracket 60 such that the loopers 11, 12 and the spreaders 20, 30 move toward and away from the up-down movement path of the sewing needle 3, a spreader cam 40 which gives a rotation movement for expanding the loop to each of the left and right spreaders 20, 30, a drive mechanism 50 which gives a sewing movement to the loopers 11, 12 and the spreaders 20, 30, and an oil supply mechanism 50 which supplies a lubricant oil to the respective components of the looper mechanism 10.

**[0041]** Looper Bracket

**[0042]** The looper bracket 60 includes, as shown in Fig. 2 to Fig. 5, a shaft portion 61 positioned at a lower portion of the looper bracket 60 and a base 62 positioned at an upper portion, and the shaft portion 61 is supported rotatably by the machine frame 2 via a bearing not shown. As described above, the shaft portion 61 is concentric with the needle bar 4 at a reference position, and the needle bar 4 and the shaft portion 61 of the looper bracket 60 are turnable concentrically along the Z-axis direction. The shaft portion 61 has a central portion formed to have a cylindrical shape penetrating up and down through the shaft portion 61.

**[0043]** The base 62 includes a circular base portion 63 which is positioned at a lower portion of the base 62 and formed integrally with the shaft portion 61, and an upright wall portion 64 erected at a position close to the back surface on the upper surface of the base portion 63, and the base portion is equipped with a shaft support portion 65 erected at a position close to the front surface on the upper surface of the base portion 63, and a support shaft 66 laid across the upright wall portion 64 and a shaft support portion 65.

**[0044]** The looper bracket 60 of this looper mechanism 10 is supported turnably, however, its basic posture is in a state where the support shaft 66 is parallel to the Y-axis direction and the shaft support portion 65 is positioned on the front surface side, and in the description of the present embodiment, all descriptions based on the X-axis, Y-axis, and Z-axis directions indicate directions,

orientations, and positions when the looper bracket 60 is in the basic posture unless special explanation is given.

**[0045]** The base portion 63 is formed to have a substantially disk shape concentric with the shaft portion.

**[0046]** The upright wall portion 64 is formed integrally with the base portion 63, and is formed to have a substantially flat plate shape along the X-Y plane. A throat plate not shown is fixed to the upper end portion of the upright wall portion 64.

**[0047]** The shaft support portion 65 is fixed to the base portion 63 while being erected on the front surface side of the upright wall portion 64 opposite to the upright wall portion 64.

**[0048]** In upper portions of the upright wall portion 64 and the shaft support portion 65, insertion holes for the support shaft 66 are formed at positions on the same axis parallel to the Y-axis direction. The support shaft 66 is inserted through the insertion holes of the upright wall portion 64 and the shaft support portion 65 is fixed by a blind screw 67 on a side of the upright wall portion 64 so as not to come off or rotate.

**[0049]** The support shaft 66 has a function of supporting the looper mount 70 and the spreader cam 40 swingably. This support shaft 66 has an accommodation hole 66a formed at the center along the longitudinal direction for an oil wick 57. The accommodation hole 66a is opened on a side of on the upright wall portion 64, and is closed on a side of the shaft support portion 65. A plurality of through holes 66b are formed from the accommodation hole 66a toward the outer peripheral surface of the support shaft 66 to enable supply of a lubricant oil from the oil wick 57 so as to allow the looper mount 70 and the spreader cam 40 to smoothly swing with respect to the support shaft 66.

**[0050]** Spreader Cam

**[0051]** Fig. 6 is an exploded perspective view around the spreaders.

**[0052]** The spreader cam 40 is formed to have a flat plate shape as shown in Fig. 6, and has a support hole 41 in which the support shaft 66 is inserted through perpendicularly to the plate surface of the spreader cam 40 so that the inner peripheral surface of the support hole 41 is in sliding contact with the outer peripheral surface of the support shaft 66 so as to allow the spreader cam 40 to swing.

**[0053]** The spreader cam 40 includes two extending portions 42, 43 extended in two radial directions with a predetermined opening angle therebetween around the support hole 41 so that the entire spreader cam 40 has a substantially V shape. On edge portions on mutually outer sides of the two extending portions 42, 43, a left cam portion 44 and a right cam portion 45 are formed. The left cam portion 44 gives a rotation movement for expanding the loop to the left spreader 20 by contacting the left spreader 20 in accordance with a reciprocating swing movement of the spreader cam 40, and the right cam portion 45 gives a rotation movement for expanding the loop to the right spreader 30 by contacting the right

spreader 30 in accordance with a reciprocating swing movement of the spreader cam 40.

**[0054]** Further, the spreader cam 40 includes an input arm portion 46 extended in a direction different from the directions of the extending portions 42, 43, and a reciprocating swing movement is applied to the spreader cam 40 from the input arm portion 46 by the drive mechanism.

**[0055]** Loopers, Spreaders, and Looper Mount

**[0056]** The looper mount 70 includes a cylindrical insertion portion 71 in which the support shaft 66 is inserted through on a lower portion of the looper mount 70, and includes, on an upper portion, block-shaped support portions 72, 73 which support the left looper 11 and the left spreader 20 and the right looper 12 and the right spreader 30, respectively, and an input arm portion 74 through which a reciprocating swing movement is applied to the looper mount 70 from the drive mechanism, and these are formed integrally.

**[0057]** The insertion portion 71 is cylindrical, and the inner peripheral surface of the insertion portion 71 comes into sliding contact with the outer peripheral surface of the support shaft 66 and allows the looper mount 70 to swing.

**[0058]** The support portions 72, 73 are disposed along two radial directions with a predetermined opening angle therebetween around the insertion portion 71, and the opening angle is set to be slightly smaller than the opening angle between the two extending portions 42, 43 of the spreader cam 40.

**[0059]** The looper mount 70 has a reciprocating swing angle set so that the up-down movement path of the sewing needle 3 parallel to the Z-axis direction is always positioned between the two support portions 72, 73.

**[0060]** The upper surfaces of the support portions 72, 73 are formed into flat surfaces perpendicular to the extending directions of the support portions 72, 73, and the left looper 11 and the left spreader 20 are provided on the flat surface of the support portion 72, and the right looper 12 and the right spreader 30 are provided on the flat surface of the support portion 73.

**[0061]** The left looper 11 is fixed to the support portion 72 in a state where its tip end portion which catches the upper thread is extended toward the up-down movement path side (the right looper 12 side) of the sewing needle, and the right looper 12 is fixed to the support portion 73 in a state where its tip end portion which catches the upper thread is extended toward the up-down movement path side (the left looper 11 side) of the sewing needle.

**[0062]** As shown in Fig. 6 and Fig. 7, the left spreader 20 has a thread hook 21 which is for expanding the upper thread loop and is extended toward the up-down movement path side (the right spreader 30 side) of the sewing needle, and the left spreader 20 is supported turnably around a shaft portion 22 (a rotation support shaft) thereof with respect to the support portion 72 for the function of expanding the loop by turning the thread hook 21. Similarly, the right spreader 30 also has a thread hook 31 which is for expanding the upper thread loop and is ex-

tended toward the up-down movement path side (the left spreader 20 side) of the sewing needle, and the right spreader 30 is also supported turnably around its shaft portion (not shown) with respect to the support portion 73 for the function of expanding the loop by turning the thread hook 31.

**[0063]** The left spreader 20 has a contact portion 23 extended to the opposite side of the thread hook 21 around the shaft portion 22, and the contact portion 23 is always pressed on its front surface side to the back surface side by a torsion coil spring 75, and when the left cam portion 44 of the spreader cam 40 described above is brought into contact with the contact portion 23 and pushes back the contact portion 23 against the pressing force, the left spreader 20 turns for expanding the loop. On the back surface side of this contact portion 23 (on the contact surface side with the spreader cam 40), two grooves 24 are provided in a lateral direction. The contact portion 23 of the left spreader 20 is supplied with a lubricant oil by an oil supply mechanism described later, and the supplied lubricant oil can be spread along the grooves 24 and held inside the grooves 24.

**[0064]** Similar to the left spreader 20, the right spreader 30 also has a shaft portion not shown and a contact portion 33 having the same structures, and the contact portion 33 is pressed to the back surface side by a torsion coil spring 76, and when the right cam portion 45 of the spreader cam 40 described above is brought into contact with the contact portion 33 and pushes back the contact portion 33 against the pressing force, the right spreader 30 turns for expanding the loop. Two grooves not shown are also provided in the lateral direction on the contact portion 33 of the right spreader 30, and can spread and hold a lubricant oil supplied by the oil supply mechanism.

**[0065]** The reference numerals 25 and 35 denote stoppers for preventing the left spreader 20 and the right spreader 30 from coming off.

**[0066]** A reciprocating swing movement is applied to the looper mount 70 by the drive mechanism from the input arm portion 74. Here, a timing of the reciprocating swing movement to be applied to the looper mount 70 and a timing of the reciprocating swing movement to be applied to the spreader cam 40 will be described.

**[0067]** Fig. 8 shows a case in which the right looper 12 moves forward toward the sewing needle up-down movement path. As shown in the figure, movement timings are set so that, in accordance with the swinging of the looper mount 70, the right cam portion 45 does not press the contact portion 33 during the forward movements of the right looper 12 and the right spreader 30, and at a timing at which the tip end portions of the right looper 12 and the right spreader 30 catch the upper thread and enter the loop and stop moving forward, the spreader cam 40 starts swinging to the right in Fig. 8, and the right cam portion 45 presses the contact portion 33 and turns the right spreader 30.

**[0068]** The same applies to the left looper 11 and the left spreader 20 although this is not shown, and move-

ment timings are set so that after the left looper and the left spreader 11 enter the loop and stop moving forward, the spreader cam 40 starts swinging to the left in Fig. 8 and the left cam portion 44 presses the contact portion 23 and turns the left spreader 20.

**[0069]** Drive Mechanism

**[0070]** The above-described reciprocating swing movements of the looper mount 70 and the spreader cam 40 are realized by a drive mechanism.

**[0071]** The drive mechanism mainly consists of a cylindrical looper drive shaft 81 inserted through the inside of the through hole of the shaft portion 61 of the looper bracket 60 shown in Fig. 5, a spreader drive shaft 82 inserted through the inside of the looper drive shaft 81, a link not shown which joins the looper drive shaft 81 to the input arm portion 74 of the looper mount 70, a link not shown which joins the spreader drive shaft 82 to the input arm portion 46 of the spreader cam 40, a cam mechanism (not shown) which moves the looper drive shaft 81 up and down so as to give the predetermined swing movement, and another cam mechanism (not shown which) moves the spreader drive shaft 82 up and down so as to give the predetermined swing movement.

**[0072]** The cam mechanisms periodically give the up-down movements to the drive shaft 81, 82 in synchronization with the up-down movements of the sewing needle by a rotary cam plate having a predetermined shape fixed to a lower shaft to be driven to rotate by a sewing machine motor as a sewing drive source, and a driven member which engages with the cam.

**[0073]** Oil Supply Mechanism

**[0074]** As shown in Fig. 2 to Fig. 9, the oil supply mechanism 50 includes a lubricant oil tank 51 which is disposed on the bottom of the bed portion 2a below the looper bracket 60 and stores a lubricant oil, a first felt 52 which is a disk-shaped lubricant oil feeding member (permeable member) opposed and in contact with the lower side of the base portion 63 of the looper bracket 60, and fixed to the machine frame 2, an oil wick 53 which supplies the lubricant oil to the first felt 52 from the lubricant oil tank 51, a second felt 54 which is an arc-shaped lubricant oil feeding member (permeable member) disposed inside an arc-shaped recess 63a provided on the bottom surface of the base portion 63, a third felt 90 which is a lubricant oil feeding member (permeable member) provided on a back surface side upper portion of the upright wall portion 64 of the looper bracket 60, a felt fixing plate 55 which maintains a predetermined shape of the third felt 90 and fixes it to the upright wall portion 64, an oil wick 56 which supplies the lubricant oil from the second felt 54 to the third felt 90, and oil wicks 57, 58, 59 as lubricant oil feeding members (permeable members) which are supplied with the lubricant oil by contact of one end portions with the third felt 90, and supplies the lubricant oil to the surrounding components.

**[0075]** The lubricant oil tank 51 is disposed at a position away from the third felt 90, and is an airtight container having a cover which can open and close. By removing

the cover, the lubricant oil tank 51 can be replenished with the lubricant oil inside.

**[0076]** The first felt 52 is disposed concentrically with the turning center of the looper bracket 60, and the arc-shaped second felt 54 is disposed so as to become flush with the lower surface of the looper bracket 60 or slightly project downward. Accordingly, the first felt 52 and the second felt 54 are always in contact with each other even when the second felt 54 is moved by a turning movement of the looper bracket 60, and the lubricant oil is supplied from the first felt 52.

**[0077]** The oil wick 56 is inserted in a through hole 64a penetrating up and down through the inside of the upright wall portion 64, and an upper end portion of the oil wick 56 is brought into contact with the inside flat surface of the third felt 90 to allow the lubricant oil to be supplied to the third felt 90 from the second felt 54 side.

**[0078]** The third felt 90 includes a main body portion 91 in contact with the back surface of the upright wall portion 64, and left and right side face portions 92, 93 positioned on the left and right of the main body portion 91. The main body portion 91 and the left and right side face portions 92, 93 are formed by bending one plate-shaped felt material, and have a substantially U shape as viewed from above.

**[0079]** The left side face portion 92 is positioned so that the contact portion 23 and the side edge of the left side face portion 92 come into sliding contact with each other when the left spreader 20 swings in a direction of separating from the up-down movement path of the sewing needle 3 by the looper mount 70 and substantially stops at a maximum separated position.

**[0080]** Similarly, the right side face portion 93 is positioned so that the contact portion 33 and the side edge of the right side face portion 93 come into sliding contact with each other when the right spreader 30 swings in a direction of separating from the up-down movement path of the sewing needle 3 by the looper mount 70 and substantially stops at a maximum separated position.

**[0081]** The felt fixing plate 55 is formed of one metal plate having substantially the same shape as that of the third felt 90 so as to cover substantially the entire outer side surface of the third felt 90. The felt fixing plate 55 is provided with four claws 55a, 55b, 55c, 55d, and holds the third felt 90 by the rigidity of the felt fixing plate 55 so that the third felt 90 can maintain its predetermined shape.

**[0082]** The felt fixing plate 55 is fixed to the upright wall portion 64 by screws, and accordingly, the third felt 90 can be fixed to the looper bracket 60.

**[0083]** The oil wick 57 is accommodated in the above-described accommodation hole 66a inside the support shaft 66. The support shaft 66 is inserted in the through hole of the upright wall portion 64, and the end portion at which the accommodation hole 66a opens of the support shaft 66 faces the back surface side of the upright wall portion 64. One end portion of the oil wick 57 projects from the opening of the accommodation hole 66a and is

brought into contact with the inner side surface of the main body portion 91 of the third felt 90. Accordingly, the lubricant oil is supplied to the oil wick 57 from the third felt 90.

**[0084]** The oil wicks 58, 59 are also disposed in a state in which they are inserted in through holes provided in the upright wall portion 64, and supply the lubricant oil to various members which move on the front surface side of the upright wall portion 64 by contact with these. One end portions of the oil wicks 58, 59 also project on the back surface side of the upright wall portion 64 and are brought into contact with the inner side surface of the main body portion 91 of the third felt 90, and are supplied with the lubricant oil from the third felt 90.

**[0085]** Operations of Looper Mechanism

**[0086]** Operations of the looper mechanism 10 having the configuration described above will be described.

**[0087]** First, in the oil supply mechanism 50 of the looper mechanism 10, the lubricant oil is supplied to the first felt 52 from the lubricant oil tank 51 via the oil wick 53, the lubricant oil is supplied to the third felt 90 from the first felt 52 via the second felt 54 and the oil wick 56, the lubricant oil is supplied to the oil wicks 57, 58, 59 from the third felt 90, and the lubricant oil is spread over the entire looper mechanism 10.

**[0088]** Then, when sewing, the looper mechanism 10 swings the looper mount 70 and the spreader cam 40 to the left and right by moving up and down the looper drive shaft 81 and the spreader drive shaft 82 at predetermined timings by the drive mechanism in accordance with the driving of the sewing machine motor of the eyelet button-holing machine 1.

**[0089]** At this time, in accordance with the swing of the left looper 11 on the looper mount 70 toward the sewing needle up-down movement path (rightward), the left looper 11 catches the upper thread from the sewing needle 3 moved down in order to form the loop, and the thread hook 21 of the left spreader 20 also enters the upper thread loop. Then, in accordance with the swing of the spreader cam 40, the left cam portion 44 is brought into contact with the contact portion 23 of the left spreader 20 and the thread hook 21 turns to expand the loop.

**[0090]** On the other hand, in accordance with the forward movement of the left spreader 20, the right spreader 30 turns to a maximum separated position from the sewing needle up-down movement path, and at this time, the contact portion 33 comes into sliding contact with the right side face portion 93 of the third felt 90 and the lubricant oil is applied thereto. Then, the lubricant oil is spread to the contact portion 33 by the groove provided on the contact portion 33, and held inside the groove.

**[0091]** Then, in accordance with the swing of the looper mount 70 on the right looper 12 toward the sewing needle up-down movement path (leftward), the right looper 12 catches the upper thread from the sewing needle 3 moved down in order to form the loop, and the thread hook 31 of the right spreader 30 also enters the upper thread loop. Then, in accordance with the swing of the

spreader cam 40, the right cam portion 45 is brought into contact with the contact portion 33 of the right spreader 30, and the thread hook 31 turns to expand the loop. At this time, the lubricant oil is stored in the groove of the contact portion 33, so that the contact portion 33 smoothly slides even when it is in contact with the right cam portion 45 of the spreader cam 40, and movement smoothness is maintained and wear is also suppressed.

**[0092]** In accordance with the forward movement of the right spreader 30, the left spreader 20 turns to the maximum separated position and the contact portion 23 comes into sliding contact with the left side face portion 92 of the third felt 90 and the lubricant oil is applied thereto, and the lubricant oil is spread along the groove 24 and held inside the groove 24. Accordingly, when the left spreader 20 moves forward, the left spreader 20 smoothly slides on the left cam portion 44, and wear is also suppressed.

**[0093]** By repeating swinging to the left and right, double chainstitches and single-thread chainstitches are alternately formed, and buttonhole sewing is performed along a buttonhole.

**[0094]** Advantageous Effects of Embodiment

**[0095]** The looper mechanism 10 supplies a lubricant oil to the contact portions 23, 33 of the spreaders 20, 30 by the third felt 90 fixed to the looper bracket 60, so that unlike the case where the lubricant oil is supplied by using a spreader cam which swings, the lubricant oil can be restrained from scattering upward due to swinging, and contamination of the sewing thread and the workpiece by the lubricant oil can be reduced and the quality can be improved.

**[0096]** The spreaders 20, 30 which move toward and away from the sewing needle 3 in accordance with the swinging of the looper mount 70 are supplied with the lubricant oil from the third felt 90, so that even when the lubricant oil scatters in the movement directions of the spreaders 20, 30, the lubricant oil does not scatter upward, and in this regard, contamination of the sewing thread and the workpiece by the lubricant oil can be reduced and the quality can be improved.

**[0097]** The left and right side face portions 92, 93 of the third felt 90 are disposed at positions at which these are contacted by the spreaders 20, 30 when the spreaders 20, 30 move in the directions of separating from the up-down movement path of the sewing needle 3. Therefore, the spreaders 20, 30 can be prevented from interfering with the third felt 90 when the spreaders 20, 30 are brought into contact with the cam portions 44, 45 of the spreader cam 40, and smooth movements of the spreaders 20, 30 can be maintained.

**[0098]** Further, the left and right side face portions 92, 93 of the third felt 90 are disposed so as to provide the lubricant oil to the spreaders 20, 30 near the stop positions as maximum separated positions from the sewing needle up-down movement path in swinging of the looper mount 70, so that the lubricant oil is applied at a low speed, and scattering of the lubricant oil can be further

reduced, and therefore, contamination of the sewing thread and the workpiece by the lubricant oil can be further reduced and the quality can be further improved.

**[0099]** The thread hooks 21, 31 and the contact portions 23, 33 of the spreaders 20, 30 are provided on mutually opposite sides with respect to the rotation support shafts, so that the lubricant oil is prevented from moving to the thread hook 21, 31 by the rotation movements of the spreaders 20, 30, so that contamination of the sewing thread and the workpiece by the lubricant oil can be further reduced and the quality can be further improved.

**[0100]** The grooves 24 (not shown on the spreader 30) are formed on the contact portions 23, 33 of the spreaders 20, 30, so that the supplied lubricant oil spreads along the grooves and can realize effective sliding of the contact portions 23, 33 in wide ranges. Further, the lubricant oil can be held inside the grooves, so that lubrication is possible for a long period of time.

**[0101]** Further, the oil supply mechanism 50 of the looper mechanism 10 includes the lubricant oil tank 51 and the felts 52, 54, 90 and the oil wicks 53, 56, 57, 58, 59 for supplying the lubricant oil to the components, so that the lubricant oil permeates through these and spreads thoroughly, and therefore, an operation for directly replenishing a oil supply target position with a lubricant oil becomes unnecessary, and the lubricant oil tank 51 can reduce the frequency of oil supply to the tank.

**[0102]** Further, felt materials which are permeable members are used as the lubricant oil feeding members, so that by permeating the lubricant oil into these, the spreaders 20, 30 can be supplied with oil while the lubricant oil is held for a long period of time. Therefore, the frequency of replenishment of the lubricant oil to the lubricant oil feeding members can be reduced.

**[0103]** The oil wick 57 inside the support shaft 66 is brought into contact with the third felt 90 and is supplied with the lubricant oil, so that the oil supply operation to the support shaft 66 does not require preparation of an oil supply passage unique to the support shaft 66, and the burden of the oil supply operation can be reduced and the number of components such as oil supplying means can be reduced.

**[0104]** Further, in the oil supply mechanism 50 of the looper mechanism 10, tubes and piping (tubular members) may be used instead of the oil wick for supplying the lubricant oil to the third felt 90, and other felts.

**[0105]** As shown in Fig. 10, instead of the grooves provided on the spreaders 20, 30, felt materials 24A as permeable members may be provided at the contact portions 23, 33 (in Fig. 10, only the left spreader is shown, and the right spreader is not shown). These felt materials 24A can also spread and hold the lubricant oil similar to the grooves.

**[0106]** As shown in Figs. 11, instead of the grooves provided on the spreaders 20, 30, rollers 24B having partially exposed outer peripheral surfaces may be provided at the contact portions 23, 33 (in Figs. 11, only the left spreader is shown, and the right spreader is not shown).



**[0107]** By these rollers 24B, wear due to the contacts between the contact portions 23, 33 of the spreaders 20, 30 and the cam portions 44, 45 of the spreader cam can be further reduced, and smoother rotation movements of the spreaders 20, 30 can be realized.

## Claims

1. A looper mechanism (10) of a buttonholing machine (1), the looper mechanism (10) comprising:

two loopers (11, 12) which catch a sewing thread to form a loop;  
two spreaders (20, 30) which expand the loop of the sewing thread;  
a looper base (60) which is supported below a sewing needle (3) so as to be turnable about a centerline extending in a vertical direction (Z);  
a looper mount (70) on which the loopers (11, 12) and the spreaders (20, 30) are each disposed on respective sides of an up-down movement path of the sewing needle (3), wherein the looper mount (70) is swingably supported on the looper base (60) such that the loopers (11, 12) and the spreaders (20, 30) move toward and away from the up-down movement path of the sewing needle (3); and  
a spreader cam (40) which is swingably supported on the looper base (60), wherein the spreader cam (40) comprises two cam portion (44, 45)s (44, 45) which are brought into contact with contact portion (23, 33)s (23, 33) of the spreaders (20, 30) respectively to give a rotation movement to each of the spreaders (20, 30) to expand the loop,

wherein the spreader cam (40) gives the rotation movement to one of the spreaders (20, 30) that has moved toward the sewing needle (3),

**characterized in that** the looper mechanism (10) further comprises a lubricant oil feeding member (90) which is brought into contact with the contact portion (23, 33) of each of the spreaders (20, 30) in accordance with the swinging of the looper mount (70) to provide a lubricant oil to the contact portion (23, 33), wherein the lubricant oil feeding member (90) is fixedly equipped on the looper base (60).

2. The looper mechanism (10) according to claim 1, wherein the lubricant oil feeding member (90) is configured and disposed such that each of the spreaders (20, 30) contacts the lubricant oil feeding member (90) when moved away from the up-down movement path of the sewing needle (3).  
3. The looper mechanism (10) according to claim 1 or 2, wherein the lubricant oil feeding member (90) is

configured and disposed so as to provide the lubricant oil to the respective spreaders (20, 30) when the looper mount (70) is at a swinging stop position.

4. The looper mechanism (10) according to any one of claims 1 to 3, wherein each of the spreaders (20, 30) is configured such that the contact portion (23, 33) and a thread hook (21, 31) on which the sewing thread is hooked to expand the loop are provided on opposite sides to each other with respect to a rotation support shaft (22) of the spreader (21,31).  
5. The looper mechanism (10) according to any one of claims 1 to 4, wherein a groove (24) is formed on the contact portion (23, 33) of each of the spreaders (20, 30).  
6. The looper mechanism (10) according to any one of claims 1 to 4, wherein the contact portion (23, 33) of each of the spreaders (20, 30) comprises a permeable member (24A) which allows the lubricant oil to permeate therethrough.  
7. The looper mechanism (10) according to any one of claims 1 to 4, the contact portion (23, 33) of each of the spreaders (20, 30) comprises a roller (24B) which rolls in contact with the associated cam portion (44, 45) of the spreader cam (40).  
8. The looper mechanism (10) according to any one of claims 1 to 7, further comprising a lubricant oil tank (51) which is disposed away from the lubricant oil feeding member (90).  
9. The looper mechanism (10) according to claim 8, wherein the looper mount (70) and the spreader cam (40) are pivotally supported by a common support shaft (66), and an oil wick (57) which supplies the lubricant oil to the support shaft (66) is provided inside an accommodation hole (66a) which is provided inside the support shaft (66), wherein the oil wick (57) is disposed so as to be supplied with the lubricant oil by contacting the lubricant oil feeding member (90).  
10. The looper mechanism (10) according to claim 8 or 9, further comprising:

a first felt (52) which is disk-shaped and is connected to the lubricant oil tank (51), wherein the first felt (52) is fixed to a frame (2) of the buttonholing machine (1), and is disposed to face a lower surface of the looper base (60); and  
a second felt (54) which is arc-shaped and is connected to the lubricant oil feeding member (90), wherein the second felt (54) is fixed to the lower surface of the looper base (60), and is disposed concentrically with the turning center of

the looper base (60),

wherein the first felt (52) and the second felt (54) are vertically in contact with each other.

5

10

15

20

25

30

35

40

45

50

55

FIG. 1

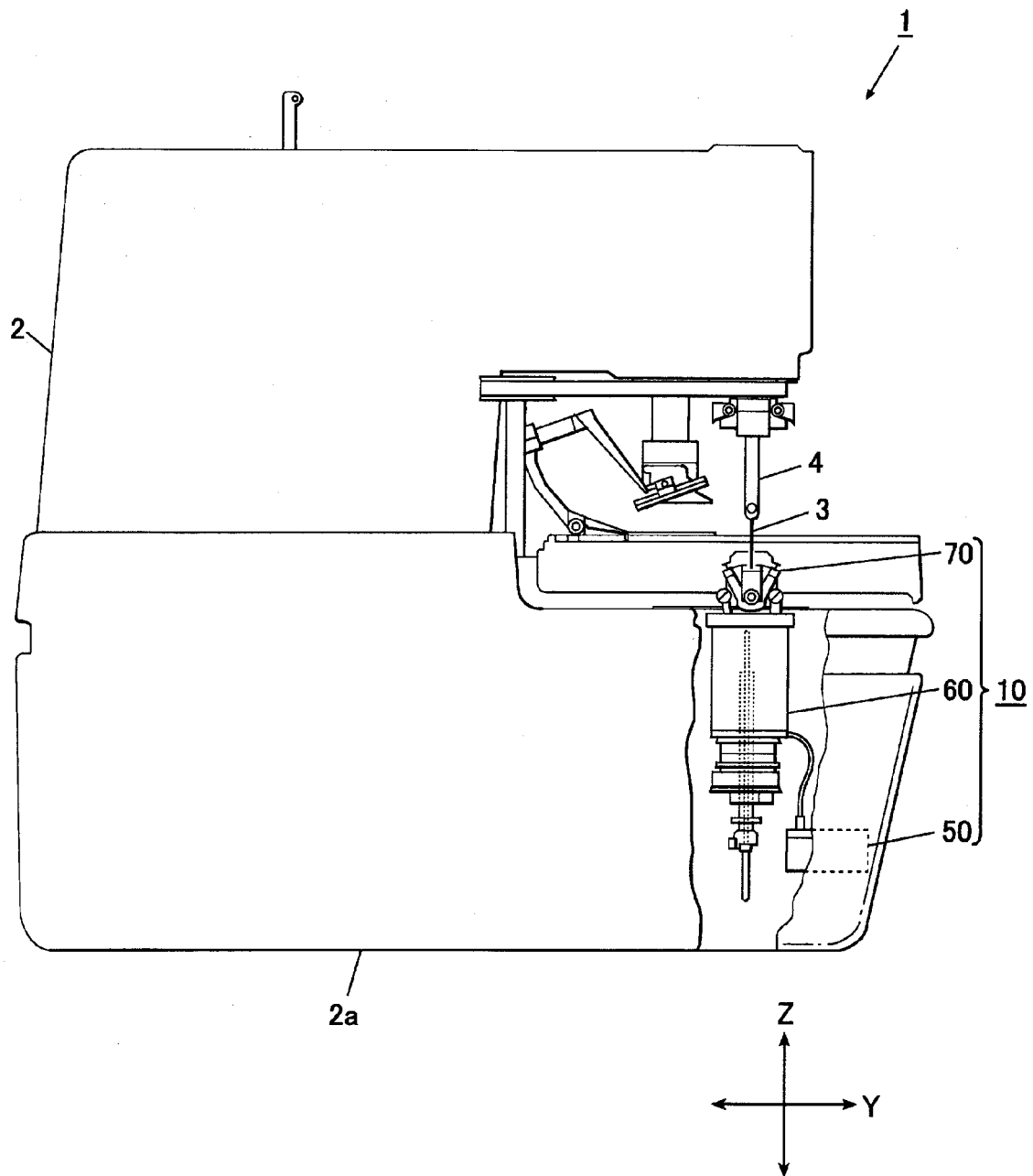
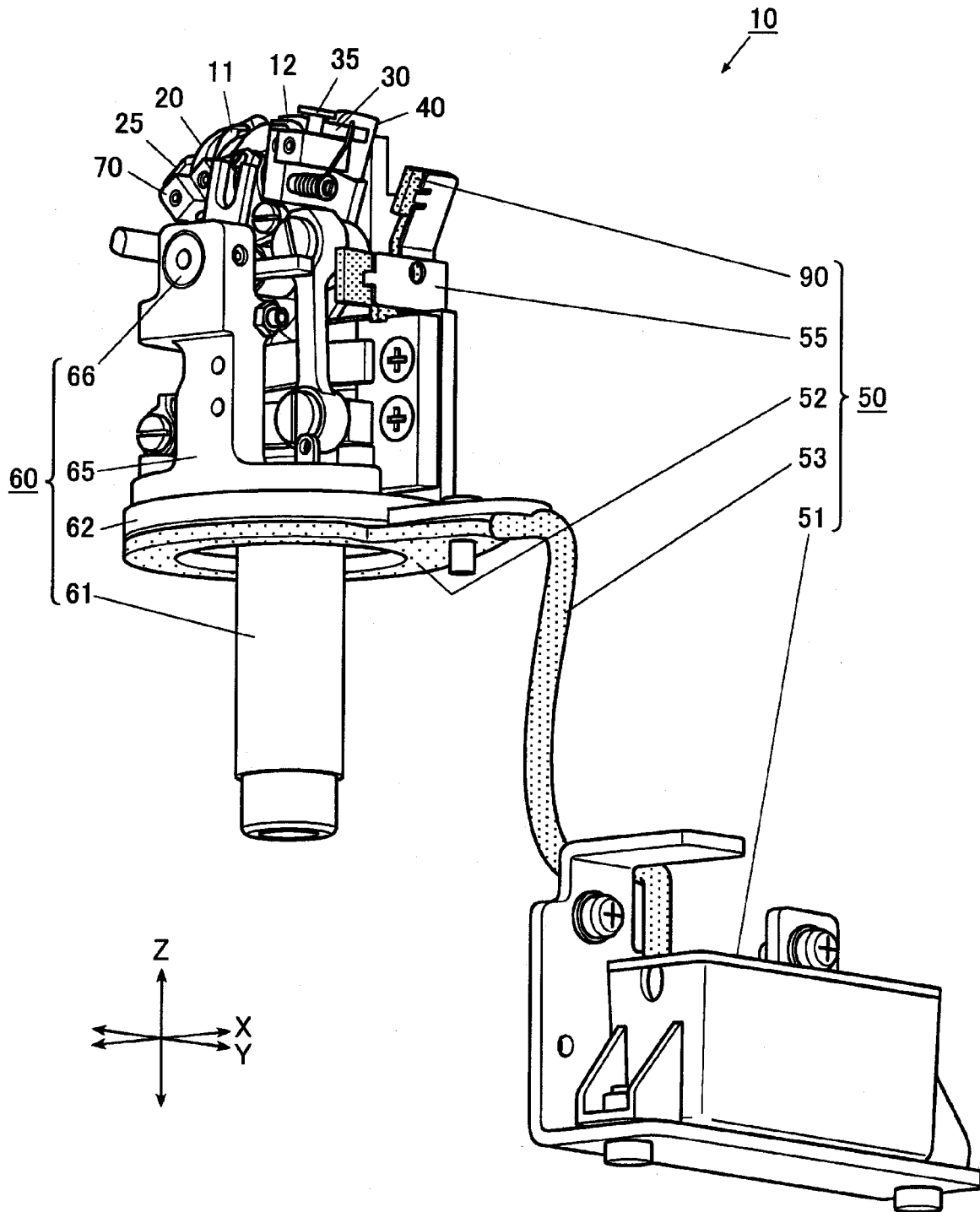
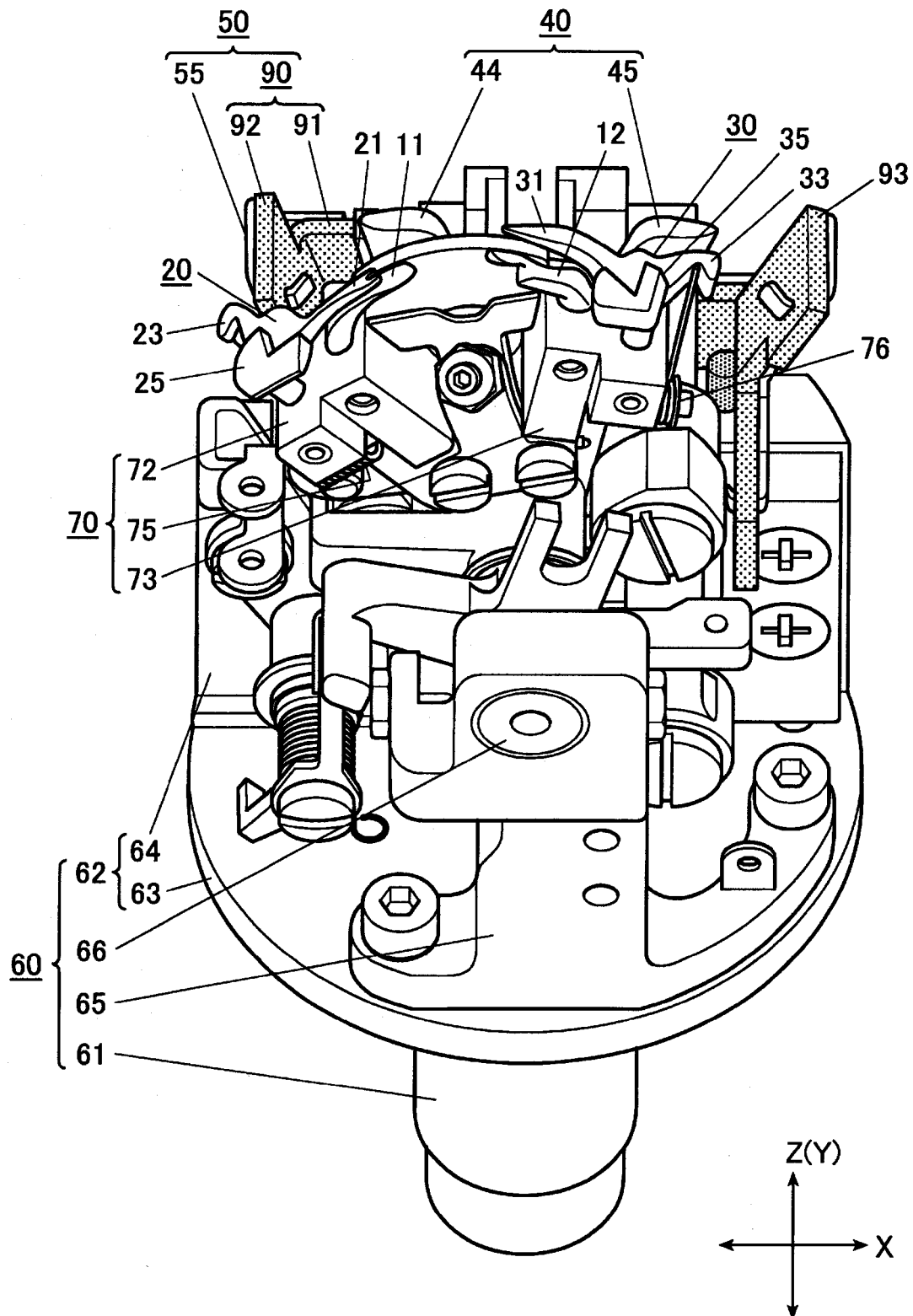


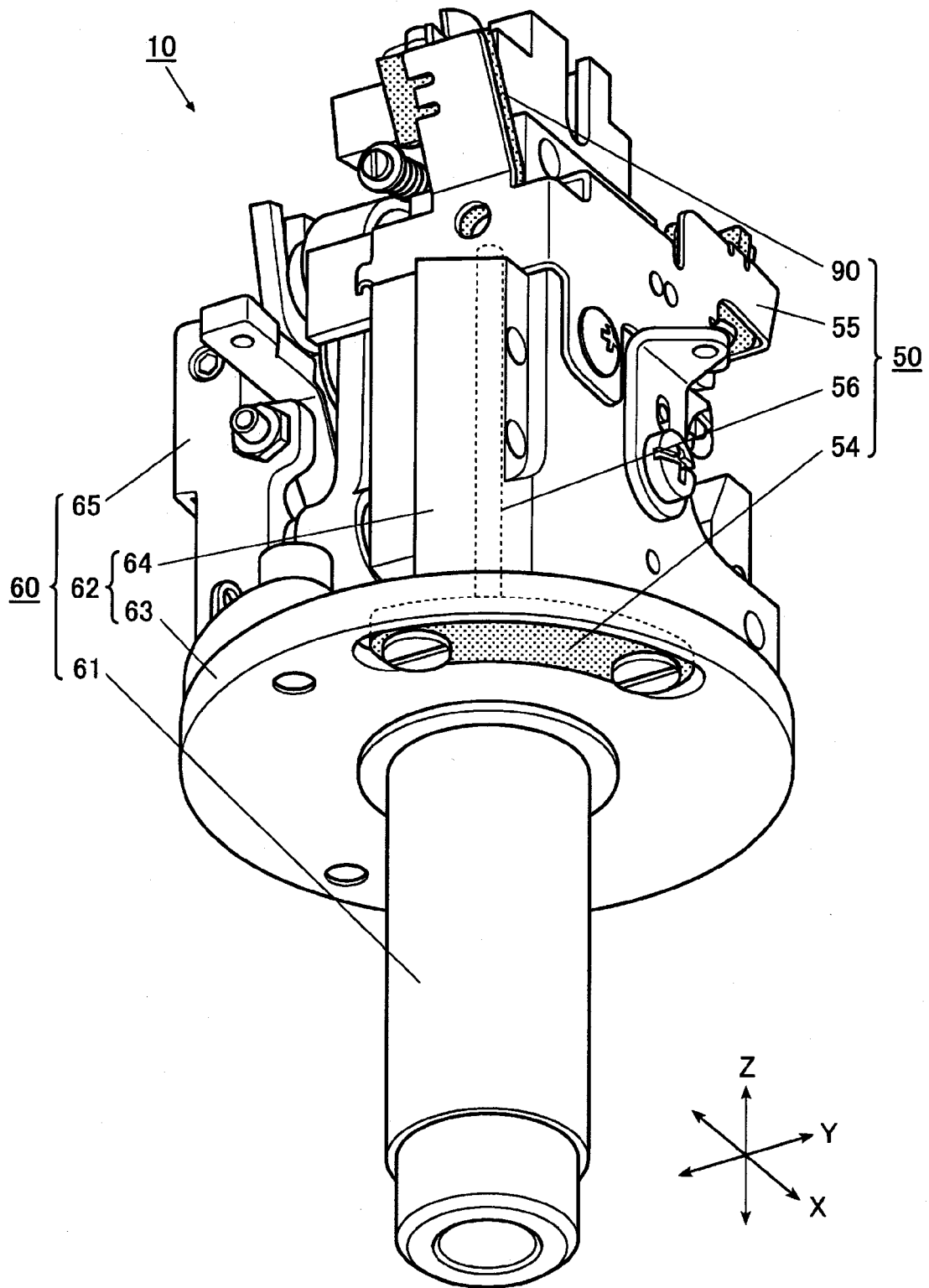
FIG. 2



**FIG. 3**



*FIG. 4*



**FIG. 5**

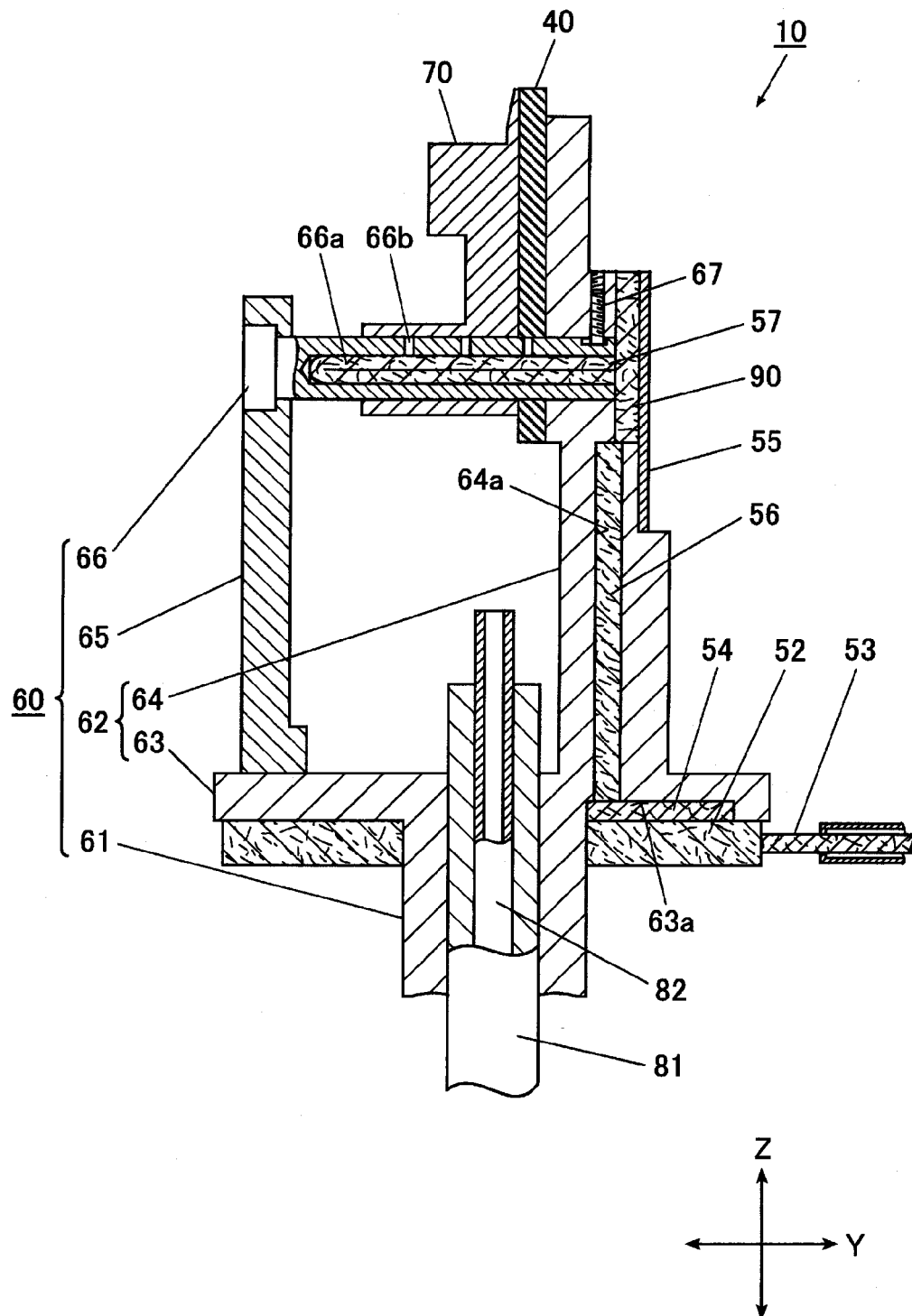
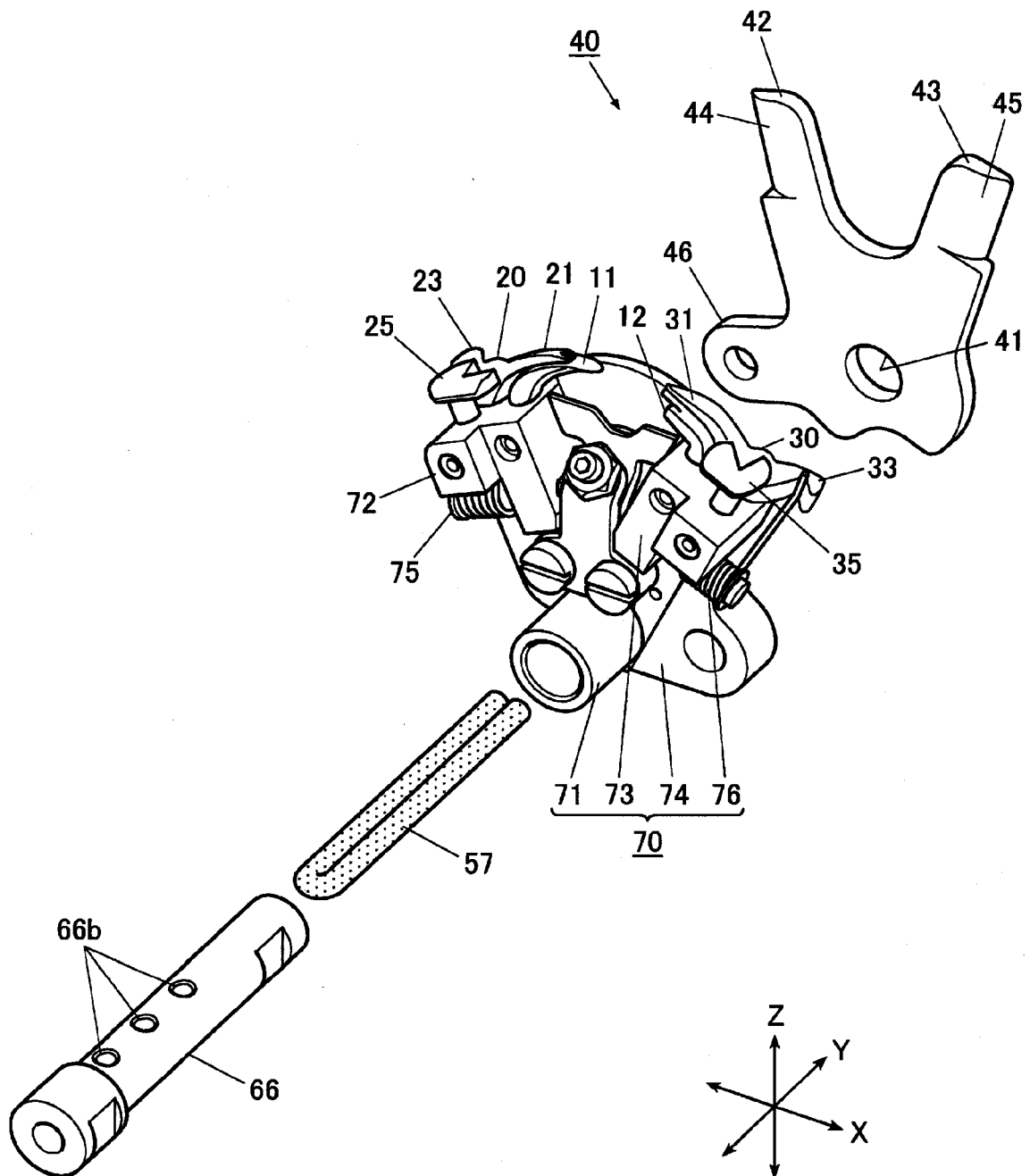
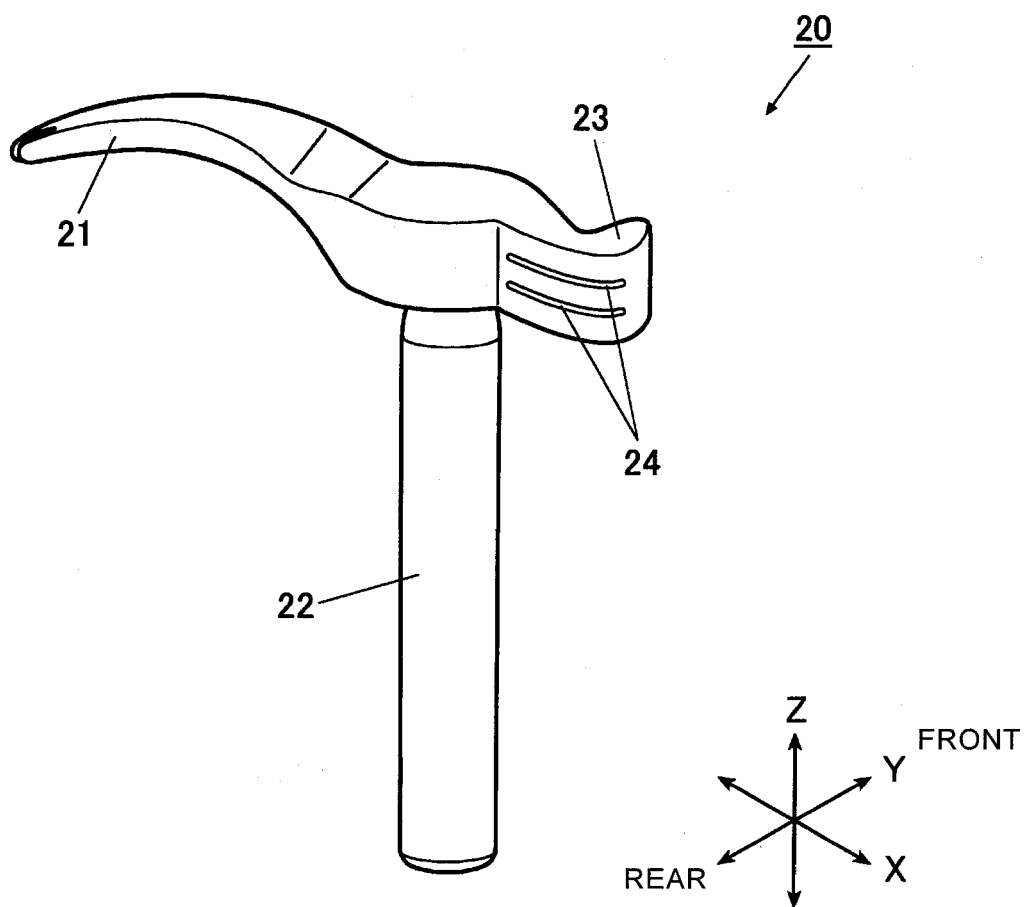


FIG. 6





*FIG. 7*



**FIG. 8**

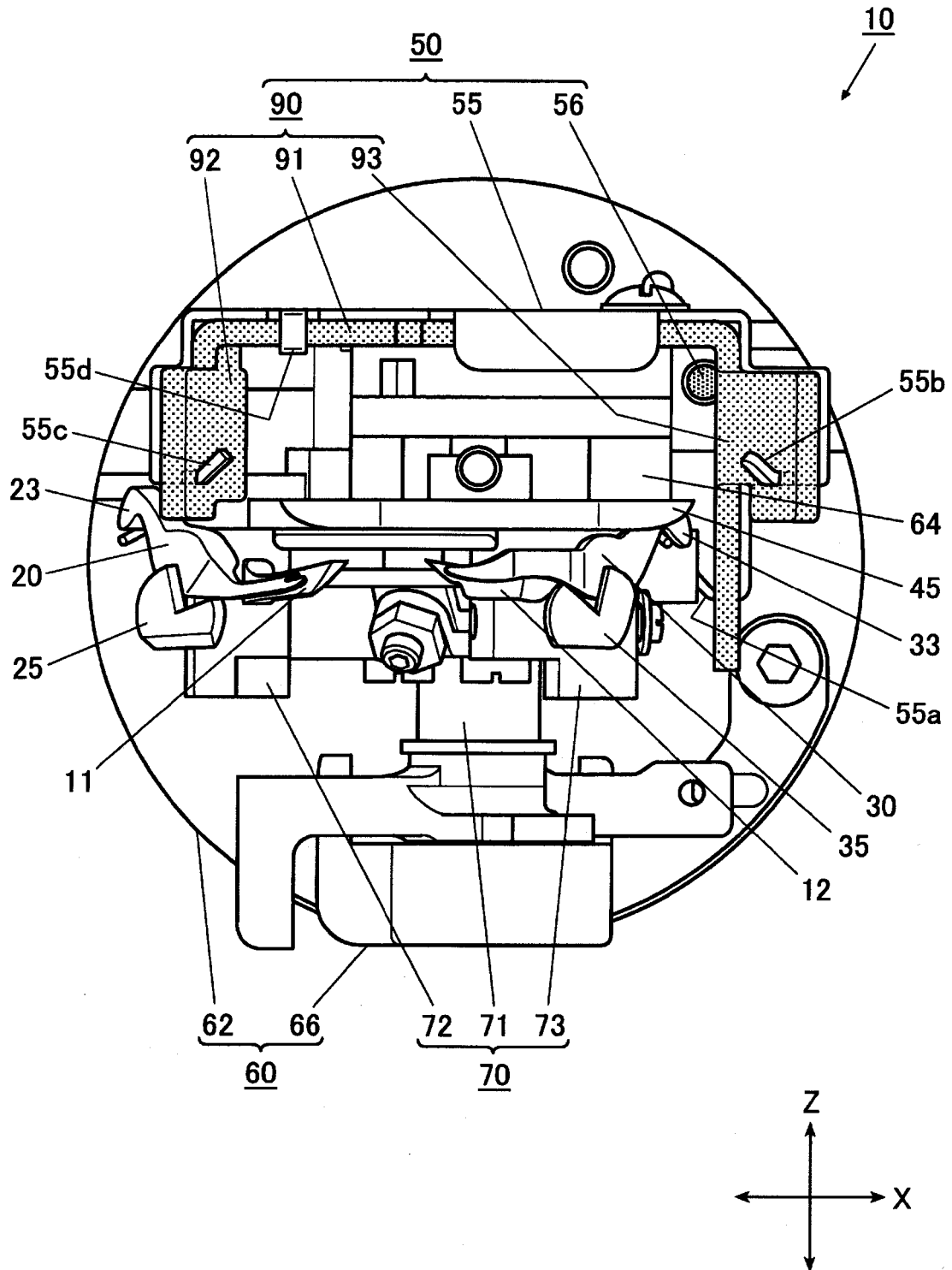
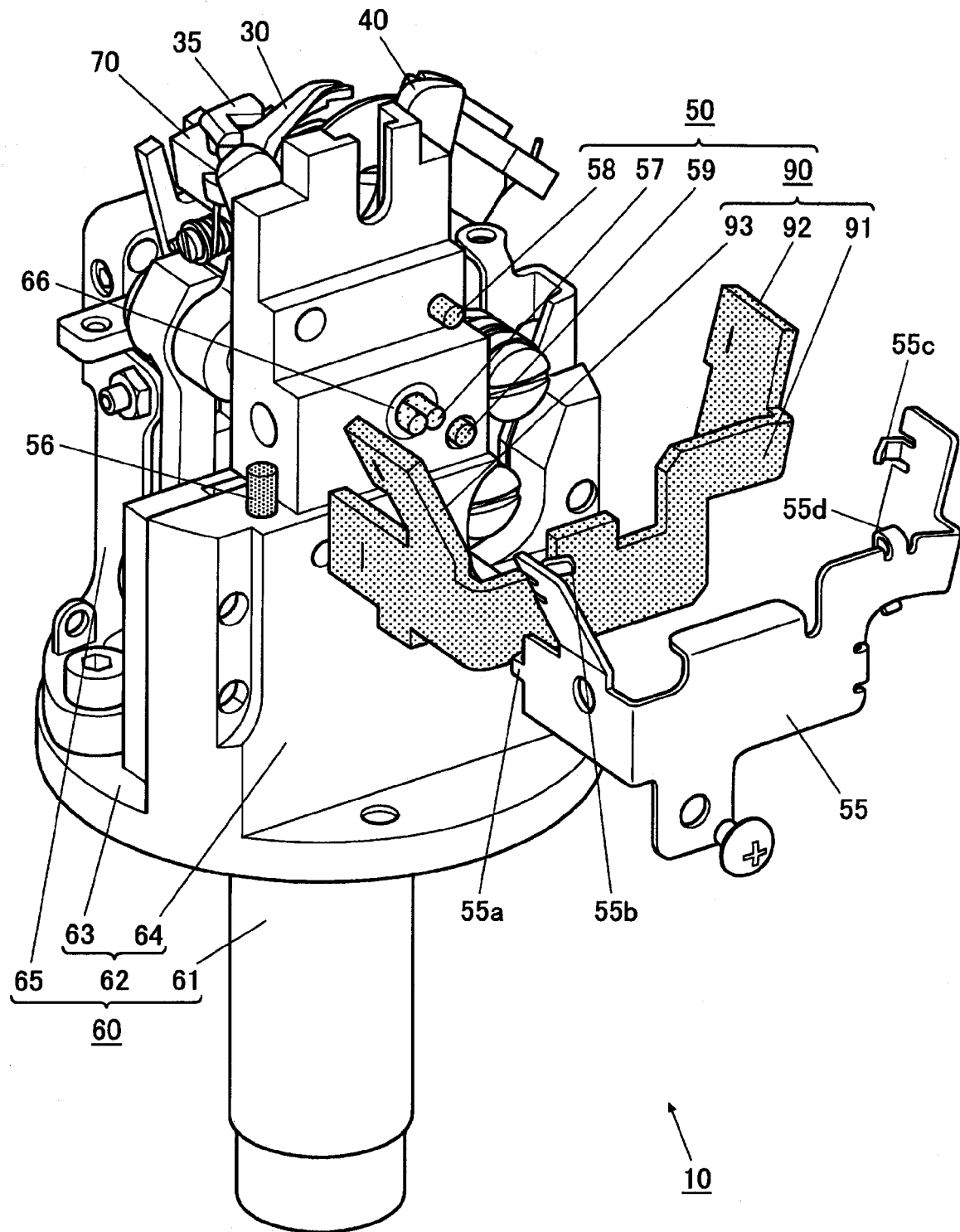
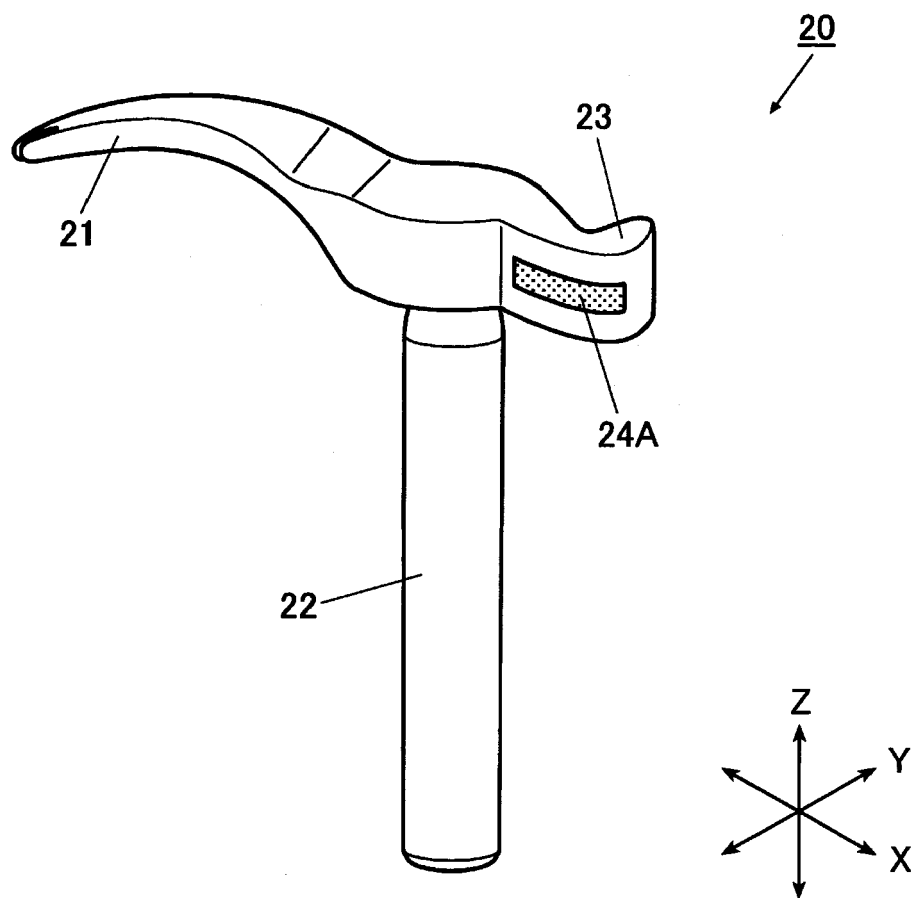


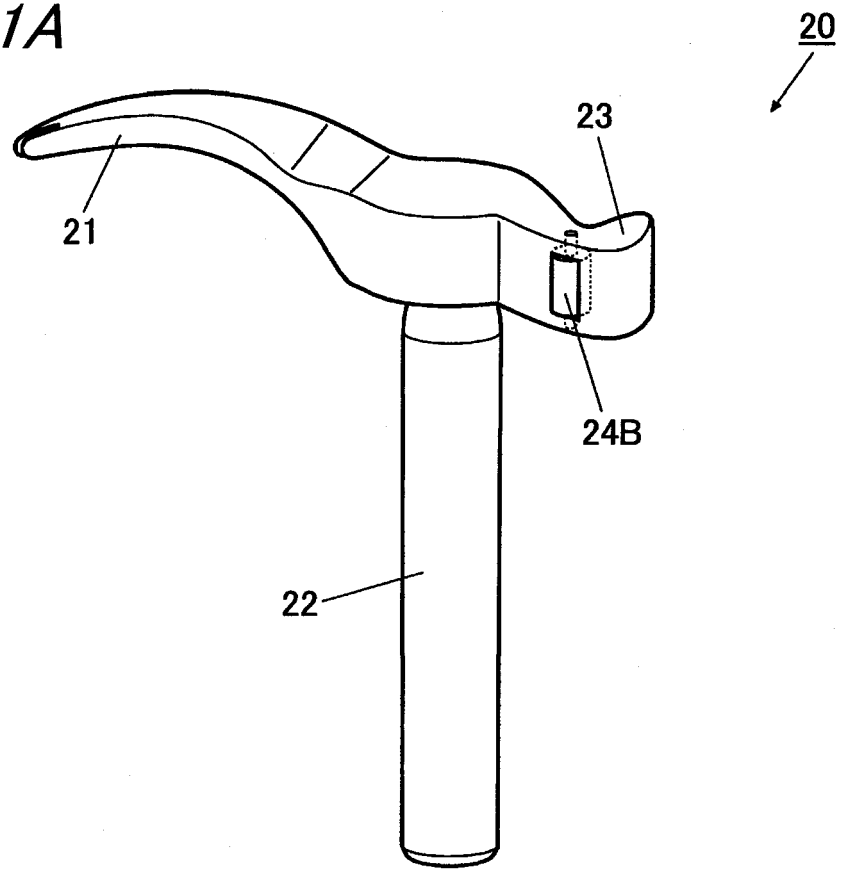
FIG. 9



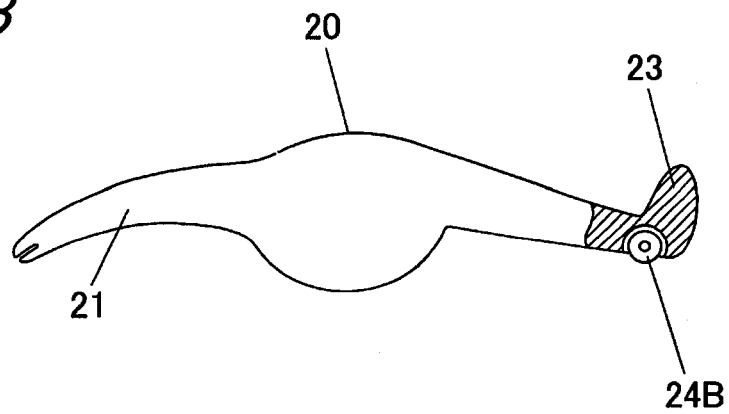
*FIG. 10*



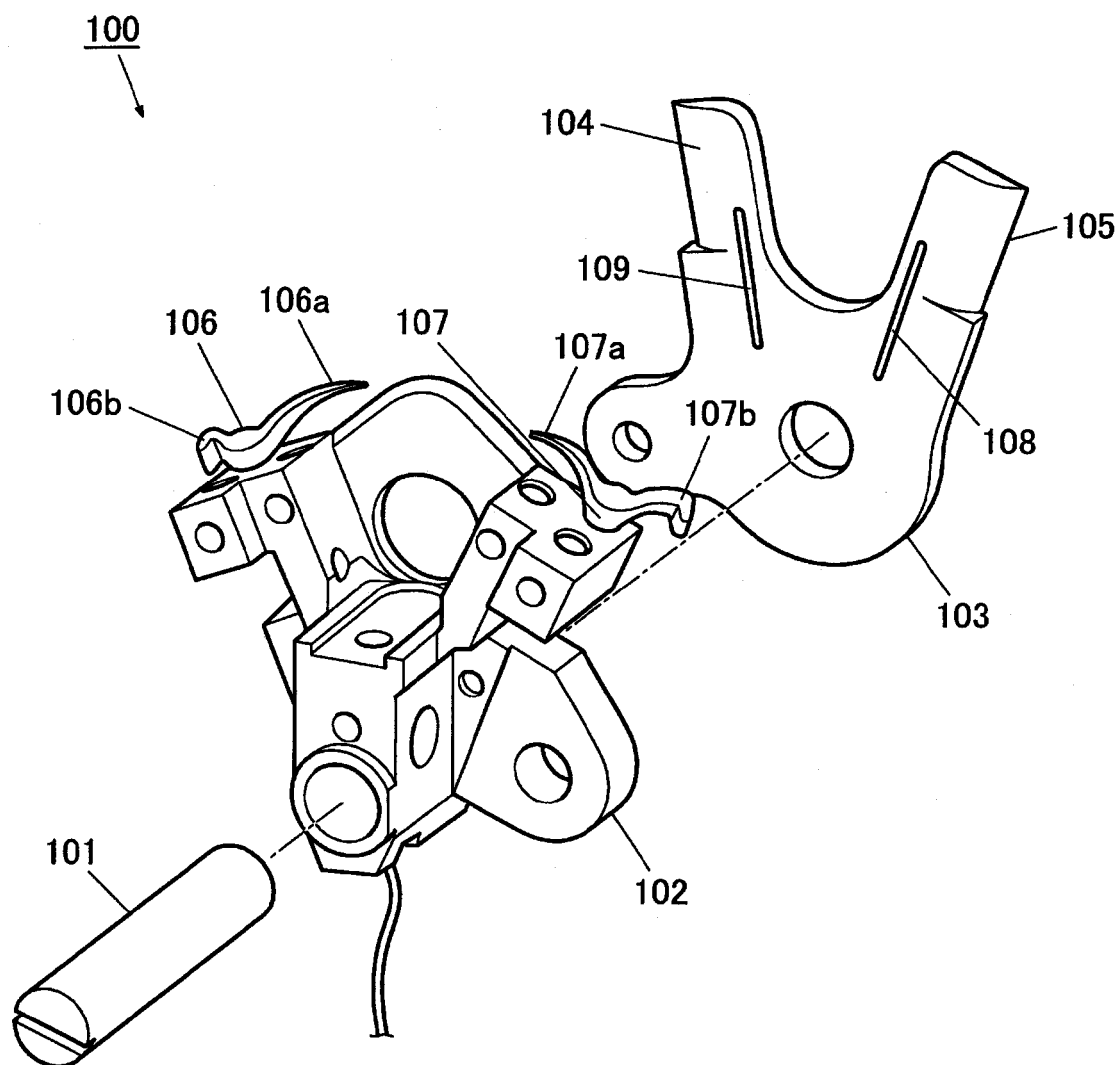
**FIG. 11A**



**FIG. 11B**



**FIG. 12**





## EUROPEAN SEARCH REPORT

Application Number  
EP 09 17 6579

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	DE 29 28 077 B1 (PFAFF IND MASCH) 11 September 1980 (1980-09-11) * column 4, line 2 - column 6, line 41; figures 1-2 *	1-10	INV. D05B3/06 D05B71/00
A	US 1 970 428 A (WALTER MYERS) 14 August 1934 (1934-08-14) * page 1, line 29 - page 1, line 87; figures 1-6 *	1-10	
A	GB 423 408 A (SINGER MFG CO) 31 January 1935 (1935-01-31) * page 1, line 95 - page 5, line 119; figures 1-30 *	1-10	
A,D	JP 2007 061326 A (BROTHER IND LTD) 15 March 2007 (2007-03-15) * figures 1-10 *	1-10	
			TECHNICAL FIELDS SEARCHED (IPC)
			D05B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 24 March 2010	Examiner Herry-Martin, D
<p>CATEGORY OF CITED DOCUMENTS</p> <p>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</p> <p>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 &amp; : member of the same patent family, corresponding document</p>			

3

EPO FORM 1503 03.82 (P04C01)

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

EP 09 17 6579

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.

24-03-2010

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 2928077	B1	11-09-1980	IT 1128480 B 28-05-1986
		JP 1251069 C 14-02-1985	
		JP 56015789 A 16-02-1981	
		JP 59023238 B 31-05-1984	
		US 4350105 A 21-09-1982	
US 1970428	A	14-08-1934	NONE
GB 423408	A	31-01-1935	NONE
JP 2007061326	A	15-03-2007	CN 1924147 A 07-03-2007



**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 2007061326 A [0002]