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(54) **Apparatus and method for transferring loops from the knitting machine needle**

Vorrichtung und Verfahren zur Übertragung von Schleifen aus einer Strickmaschinennadel

Appareil et procédé pour le transfert de boucles d'une aiguille de machine à tricoter

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(56) References cited:
**WO-A1-2006/048138** **US-A- 5 487 281**
**US-A- 5 586 453**

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## Description

**[0001]** This invention relates to an apparatus and method for transferring loops from any kind of knitting machine needle, and particularly for use in the stocking machines with toe closure.

**[0002]** The toe parts of the stockings manufactured in stocking machines are generally formed in an open state by a first machine. The toe parts of the stockings are manufactured in another machine.

**[0003]** Conventional stocking machines are circular knitting machines that typically have difficulty performing the toe closure process. Once the stocking has been knitted, the toe of the stocking must be stitched using another apparatus. In order to take the stocking from the stocking machine to an external machine for stitching, it is necessary to separately take and transfer the loops from the needles of the machine to the toe stitching apparatus.

**[0004]** This invention proposes an apparatus for taking and transferring the stockings loop by loop from the stocking knitting machines to the toe stitching apparatus. The apparatus according to the invention is also capable of enabling the stocking taken from the knitting machine to be attached loop by loop on the toe stitching apparatus.

**[0005]** In the stocking knitting machines, the needles placed into a plurality of channels opened on the outer longitudinal lateral surface of a cylindrical needle carrier move relative to the needle carrier along the direction of the needle axis. The loop held by the hook located at the upper end of the needle passes through the preceding loop through the upward-downward movement along the needle axis, thereby forming the knots that constitute the knit. The manufacture of the stocking in a stocking machine is carried out by knitting in sequential order the leg, heel, sole and toe, beginning from the ribbing.

**[0006]** In order to take the stocking loop by loop from the stocking machine and to attach the same to the toe stitching apparatus for stitching the toe part of the stocking, the machine is stopped while the last loops of at the end of the toe of the stocking being knitted are attached to the hooks of the needles.

**[0007]** Some solutions have been proposed for separately taking, through a transfer member, the loops attached to the needle hooks and for separately transferring the same to the teeth of the reed of the stocking toe stitching apparatus.

**[0008]** For example, in US 2004/211226, the transfer member takes the loop in a position between the needle hook and the latch, but it has to be adjusted very precisely. Even with the smallest maladjustment, it ladders the loop, thus causing the stocking to become defective.

**[0009]** The hook designed according to document no. EP2080827 enters the loop from the side of the needle, thereby taking the loop. Said hook collapses in the shape of a semicircle to perform the transfer to other needles.

**[0010]** In document nos. JP 2004143614 and JP 2001316959, a transfer member comprised by two parts is designed. However, said transfer member is not able to transfer the loops to another reed tooth.

**[0011]** US 5487281 A discloses an apparatus for joining two edges of a knitted tubular article, especially the toe of a stocking. The apparatus comprises cam means for operating the lifting and respectively the lowering of a predetermined number of needles of a first and a second semirank of stitches. The apparatus comprises means for removing the stitches from the first semirank and overturning them through 180 degree about a diametral axis of the cylinder of the needles. Cam means for operating the 180 DEG overturning in both directions of the semicircular sector about said axis of the cylinder and means for operating the transfer of the sector from a knitting station to a linking station, that is a station in which the hook-up is formed, are provided. The apparatus comprises means for keeping the sinkers housing of the machine at a fixed and predetermined angular position, a seamer-linker to operate the seaming of the pairs of stitches during the linking step, and means for ultimately cutting the linking thread and holding the end of the thread fed by a supply reel.

**[0012]** US 5586453 A discloses an apparatus for the removal of one or more stitches of a knit article from the needles of a knitting machine and for the transfer and placement thereof onto other knitting members of the same or other machine. The apparatus includes a device for driving each of the needles forming the stitches in the direction of their respective longitudinal axis, a device for removal of the stitches from the needles and the transfer thereof onto other knitting members of the same or other machine, and a device for supporting and/or driving the device for the removal and transfer of the stitches.

**[0013]** Therefore, the object of the present invention is to enable the toe sections of the stockings, manufactured in a stocking knitting machine with open toe sections, to be effectively transferred so that they may be stitched in another machine.

**[0014]** Said object is achieved by individually taking the toe loops from the knitting machine needles and individually attaching the same to the reed teeth of a stocking toe stitching apparatus.

**[0015]** In particular, said object is achieved by a device according to claim 1 and a method according to claim 10.

**[0016]** Other features and advantages of the present invention will become apparent in the following detailed description of the preferred embodiment of the invention, with reference to the accompanying drawings, in which:

Fig. 1 is a view of the loops at an open-end of the stocking attached to needle hooks of the stocking machine;

Fig. 2 shows the position assumed by a transfer apparatus of the present invention to perform the transfer on the stocking machine;

Fig. 3 is a view of the downward movement of the transfer apparatus;

Fig. 4 is a view of the closing of transfer members of the transfer apparatus towards the respective nee-

dles;
Fig. 5 shows the downward movement of strip members of the transfer apparatus;
Fig. 6 illustrates the strip members moving away from the respective needles;
Fig. 7 illustrates a downward movement of the strip members;
Fig. 8 shows the strip members moving back toward the respective needles below the loops;
Fig. 9 shows the transfer of the loops of the stocking to the respective transfer members through an upward movement of the strip members;
Fig. 10 shows the transfer members being moved away from the hooks of the respective needles;
Fig. 11 illustrates the separation of the stocking from the stocking machine through an upward movement of the transfer and strip members of the transfer apparatus;
Fig. 12 shows the stocking being moved to a stitching apparatus by the transfer and strip members of the transfer apparatus;
Fig. 13 illustrates the attachment of the loops of the stocking to teeth of a reed of the stitching apparatus through an upward movement of the transfer and strip members;
Fig. 14 depicts the reversal of the stocking and the complete transfer of the loops onto the teeth of the reed through an upward movement of the transfer member;
Fig. 15 depicts the movement of the transfer and strip members away from the teeth of the reed;
Fig. 16 shows the downward movement of the transfer and strip members;
Fig. 17 depicts the collapsing of a female reed section of the reed onto a male reed section thereof;
Fig. 18 shows the upward movement of the transfer and strip members;
Fig. 19 shows the movement of one of the strip members to the female reed section;
Fig. 20 shows the transfer of the loop from the tooth of the female reed section to the tooth of the male reed section through an upward movement of the transfer and strip members;
Fig. 21 shows the strip member being moved away from the reed;
Fig. 22 shows the female reed section pivoting away from the male reed section;
Fig. 23 shows the downward movement of a needle of a sewing machine to stitch together the loops on the tooth of the male reed section;
Fig. 24 shows the needle of the sewing machine being moved away from the male reed section once the stitching has been completed, and the upward movement of the transfer and strip members;
Fig. 25 shows the movement of the strip member to the male reed section;
Fig. 26 shows the release of the loops from the male reed section through a downward movement of the strip and transfer members;
Fig. 27 shows a downward movement of the transfer and strip members to prepare for the transfer operation of the next stocking;
Fig. 28 is a perspective view of the reed of the stitching apparatus, illustrating how the female reed section collapses below the male reed section;
Fig. 29 shows a perspective view of the structures of the male and female reed sections;
Fig. 30 shows a perspective view of the transfer of the loop from the female reed tooth to the male reed tooth;
Fig. 31 shows a perspective view of the positioning of the needle for the entry thereof into the transfer member;
Fig. 32 shows the entry of the hook of the needle into a front opening in a tip region of the transfer member;
Fig. 33 shows the upward movement of the loop results in moving a latch of the needle to the hook;
Fig. 34 shows the loop passing onto the latch;
Fig. 35 shows the loop passing to a top part of the latch;
Fig. 36 shows the loop leaving the needle and being transferred to the transfer member;
Fig.37 shows the transfer member being moved away from the needle;
Fig. 38 shows the movement of the transfer member away from the needle;
Fig.39 shows a perspective view of a transfer member bearing that belongs to the transfer member;
Fig. 40 shows a perspective view of a strip member bearing that belongs to the strip member;
Fig. 41 shows the entry of the transfer member into the tooth of the reed;
Fig. 42 shows the upward movement of the transfer member to transfer the loop to the tooth of the reed;
Fig. 43 shows the tail structures of the transfer and strip members of the transfer apparatus, and a cam mechanism for forward and backward radial movements of the transfer and strip members;
Fig. 44 shows the cross-section of the transfer member and the position thereof inside the hook;
Fig. 45 shows the cross-section of the transfer member and how it moves into the tooth of the reed; and
Fig. 46 is a view similar to Fig. 45, but illustrating how an upward movement of the transfer member results in the transfer of the loop to the tooth of the reed.

**[0017]** Although the detailed description and the drawings for a transfer apparatus (100) according to the present invention exemplify the application in a circular stocking machine (5), the proposed apparatus may also be implemented in all other circular knitting machines.

**[0018]** Knitting machines are circular type knitting machines and according to their general operating principle, the needles placed into a plurality of channels opening

longitudinally on the outer surface of a cylindrical needle carrier move relative to the needle carrier along the direction of the needle axis. The loop held by the hook located at the upper end of the needle passes through the preceding loop through the upward-downward movement along the needle axis, thereby forming the knots that constitute the knit.

**[0019]** The stocking is formed by knitting in sequential order the leg, heel, sole and toe, beginning from the ribbing. After the toe section has been knitted as the last step, the stocking is removed from the machine. However, the toe of the stocking remains non-stitched in this condition. The stockings leave the stocking machine (5) with the toe part left open, and the toes of the stockings are stitched later in a different machine.

**[0020]** A certain number of knitting machine needles are arranged along the circumference of the cylinder of the stocking machine. Although two such needles (3) arranged opposite one another have been illustrated in the description of the present invention, the transfer apparatus (100) according to this invention is applicable to all the remaining needles available in the cylinder, and the movement of all the needles in the cylinder may occur simultaneously. The stocking machine (5) is stopped while the last loops, which belong to the stocking being knitted and having the ribbing, leg, heel and toe completed, are attached to the hooks of the needles. In order to enable the stocking machine (5) to form the stocking (4), the transfer apparatus (100), like the upper cylinder or the crimping apparatus located in the top part of the cylinder, is separated from the top section of the stocking machine (5) throughout the period during which the transfer is being completed, thereby permitting the stocking (4) to be taken from the machine (5).

**[0021]** In single-cylinder stocking machines, the crimping apparatus is in the top section of the cylinder. Double-cylinder machines include an upper cylinder.

**[0022]** In order for the stocking to be taken from above the stocking machine (5), the part of the machine located in the top section must be separated from the machine (5) during the transfer. Once the transfer has been completed, the separated part returns to its position and continues manufacturing stockings.

**[0023]** In Figs. 1 and 2, a top side of the stocking machine (5) is opened to enable the transfer apparatus (100) that will carry out the transfer to assume its position on the machine (5). The stocking's (4) last loops (41), which are circular and located at an upper open end of the stocking (4), are held in circular position by hooks (3b) of the needles (3). When the knitting is completed, latches (3a) of the needles (3) that close the respective hooks (3b) during operation are open.

**[0024]** As shown in Fig. 2, the transfer apparatus (100), comprising a plurality of transfer members (1) and a plurality of strip members (2), is positioned on the stocking machine (5) whose top side has been opened. On the transfer apparatus (100), the transfer members (1) which are circularly positioned on a transfer member bearing (28) (see Fig. 39) and the strip members (2) which are positioned on acircularstripmemberbearing (29) (see Fig. 40) are present in a quantity corresponding to the number of the needles (3) in the stocking machine (5). The transfer member bearing (28) has radial channels (281) that are spaced annularly. The transfer members (1) are disposed slidably and respectively in the radial channels (281). The strip member bearing (29) has radial channels (291) that are spaced annularly. The strip members (2) are disposed slidably and respectively in the radial channels (291).

**[0025]** Each of the transfer and strip members (1, 2) extends horizontally, and is movable axially upward and downward and radially towards and away from a respective needle (3) . Each transfer member (1) is disposed horizontally above the strip member (2), and includes a radial shank portion (111), a front tip (1f) opposite the shank portion (111), and a tip region (112) extending inclinedly and downward from the shankportion (111) to the front tip (1f) and bending radially and thereafter axially and downward at the front tip (1f). The front tip (1f) is hollow, and has a substantially inverted L-shape, a front side formed with a front opening (1e) (see Figs. 31 and 32), and a top side formed with a top opening (1g) (see Fig. 41) communicating with the front opening (1e). The front opening (1e) is disposed at a location where the tip region (112) bends axially and downward to face the needle (3). The top opening (1g) is at a location where the tip region (112) bends radially. Each strip member (2) is capable of contacting the loop (41) formed on the hook (3b) of the respective needle (3) to push the loop (41) toward or away from the hook (3b).

**[0026]** Each of the transfer and strip members (1, 2) has an axially protruding tail (1a, 1b, 1c, 1d, 2a, 2b, 2c, 2d) extending upward from the respective shank (111, 121). The tails (1a-1d, 2a-2d), as will be described in the following, are intended to enable the forward-backward movement of the transfer and strip members (1, 2) according to a radial orientation. The forward-backward movement is provided by a cam mechanism (30). The radial forward-backward (opening-closing) movements take place together simultaneously. For instance, as a transfer member (1) approaches the needle (3), all the other transfer members (1) will approach to the same extent. Similarly, as a strip member (2) begins to enter between two needles (3), all the other strip members (2) will enter between the same number of the needles (3). While each transfer member (1) is positioned exactly opposite each needle (3), each strip member (2) is positioned such that it corresponds to a midpoint between two needles (3).

**[0027]** As shown in Fig. 3, first the transfer members (1) and the strip members (2) are moved downward in the direction of arrows (12) and (22), respectively, over a certain distance such that the strip members (2) can contact the loops (41) on the respective needles (3) from above. The strip members (2) then strip down the loops (41) from the respective hooks (3b) to such extent that

the loops (41) will not drop off from the respective latches (3a). In this condition, the latches (3a) are completely opened, but the loops (41) have remained on the latches (3a). If the loops (41) are stripped down further, the latches (3a) will be emptied and some latches (3a) could be closed. In case the latches (3a) are closed, the transfer members (1) will not be able to assume its position inside the hooks (3b). Moreover, this condition will cause the fracture of the latches (3a) or of the transfer members (1).

**[0028]** As shown in Fig. 4, while each strip member (2) maintains its position, each transfer member (1) is moved toward the respective needle (3) in the direction of an arrow (14) until the transfer member (1) reaches the hook (3b) and until the hook (3b) extends into the front opening (1e) in the tip region (112) of the transfer member (1). This position is also shown in a perspective view in Fig. 32. The width of the front tip (1f) of each transfer member (1) has such a size and geometric form that enables the front tip (1f) to enter into and exit from the respective hook (3b) . Once each transfer member (1) has assumed its position inside the respective hook (3b), each strip member (2) is moved downward over some distance until the loop (41) passes and is released from the respective latch (3a). This condition is shown in Figs. 5 and 32. As shown in Fig. 6, after each strip member (2) has released the loop (41) from the respective latch (3a), it is then moved backward in the direction of an arrow (23) to come out of between the needles (3), and as shown in Fig. 7, each strip member (2) is moved downward over some further distance in the direction of the arrow (22) below the respective loop (41). As shown in Fig. 8, each strip member (2) is then moved close again in the direction of an arrow (24), and enters between the two needles (3) in such a way that it can contact and push the respective loop (41) from below. Then, as shown in Figs. 9 and 36, each strip member (2) is moved upward in the direction of an arrow (21) to slide the loop (41) upward and toward the hook (3b) to enable each loop (41) to be transferred from the respective hook (3b) to the respective transfer member (1).

**[0029]** As shown in Figs. 10 and 37, each transfer member (1) is moved backward in the direction of an arrow (13) to be released from the respective hook (3b). The transfer members (1) and the strip members (2) are simultaneously moved upward in the direction of the arrows (11) and (21), respectively, and away from the needles (3) while each strip member (2) is still in contact with the respective loop (41) from below to stabilize each loop (41) on the respective transfer member (1). Hence, the loops (41) of the stocking (4) are now completely taken by the transfer members (1) and the strip members (2) (see Fig. 11).

**[0030]** As shown in Fig. 12, in combination with Figs. 28 and 29, the loops (41) of the stocking (4) taken from the stocking machine (5) are carried to a circular toe stitching apparatus through the transfer and strip members (1, 2). That is, the strip and transfer members (2, 1) together with the respective loops (41) are moved until the transfer members (1) reach a reed of the stitching apparatus. The reed of the stitching apparatus includes a semi-circular male reed section (25) having male reed teeth (6) arranged in a way to have gaps (19) in-between and in an amount to cover the circumference of a semi-circle, and a semi-circular female reed section (26) having female reed teeth (7) arranged in a way to have gaps (19) in-between, in an amount to cover the circumference of a semi-circle, and collapsible relative to the male reed section (25). The reed teeth (6, 7) have as many as the number of the transfer members (1) arranged in a circular manner. Each female reed tooth (7) is collapsible in the direction of an arrow (9) (see Fig. 17) and openable in the direction of an arrow (10) (see Fig. 22) relative to the male reed tooth (6). Each reed tooth (6, 7) comprises an extension (6c, 7b) extending downward from a shank (61, 71) thereof. As shown in Fig. 13, through the upward movement of the transfer and strip members (1, 2) in the direction of the arrows (11) and (21), respectively, the extension (6c, 7b) of each reed tooth (6, 7) enters the top opening (1g) (see Fig. 41) in the corresponding transfer member (1). This position is shown according to a perspective view in Fig. 41.

**[0031]** As shown in Figs. 14 and 42, each transfer member (1) is moved upward in the direction of the arrow (11) to some extent to release the front tip (1f) from the respective loop (41) of the stocking (4). In this way, each loop (41) can be transferred to the corresponding reed tooth (6, 7). Then, as shown in Fig. 15, each transfer member (1) is moved backward in the direction of the arrow (13) to move away from the corresponding reed tooth (6, 7). Similarly, each strip member (2) is moved away from the corresponding reed tooth (6, 7) in the direction of the arrow (23). As a result, the loops (41) in a quantity corresponding to the number of the transfer members (1) are transferred to the corresponding reed teeth (6, 7) of the toe stitching apparatus.

**[0032]** As shown in Fig. 16, through the downward movement of the transfer and strip members (1, 2) in the direction of the arrows (12) and (22), respectively, and away from the reed, a clearance required for collapsing of the female reed tooth (7) relative to the male reed tooth (6) is provided. As shown in Figs. 17, 28, and 30, the female reed section (26) collapses relative to the male reed section (25) to align vertically and contact the female reed teeth (7) with the male reed teeth (6), respectively. Since there is an even number of needles (3) in all the stocking machines (5) and since the transfer members (1), the strip members (2), and the sum of the teeth (6, 7) on the reed sections (25, 26) are accordingly present in a quantity corresponding to the number of the needles (3), these are also present in even numbers. For this reason, when the reed is collapsed, there is present a male reed tooth (6) corresponding to a female reed tooth (7).

**[0033]** As shown in Fig. 18, the transfer and strip members (1, 2) are moved upward in the direction of the arrows (11) and (12), respectively, until the left strip member (2)

is aligned with the gap (19) (see Fig. 28) between two female reed teeth (7). Then, as shown in Fig. 19, the left strip member (2) enters the gap (19) by moving forward in the direction of the arrow (24).

**[0034]** As shown in Figs. 20 and 30, through the upward movement of the transfer members (1) and the strip members (2), the loop (41) on the female reed tooth (7) is pushed and stripped upward by the left strip member (2) to combine with the loop (41) on the respective male reed tooth (6) . In other words, all the loops (41) in the female reed teeth (7) are transferred to the male reed teeth (6) so that the loops (41) on the aligned male and female reed teeth (6, 7) are juxtaposed for stitching, and so that two loops (41) are present on each male reed tooth (6).

**[0035]** According to the present invention, in order to achieve a reliable loop transfer from one tooth to another, the tip of the transferring tooth is designed to have a preferably female form, while the receiving tooth is designed to have a preferably male form. With reference to Figs. 29 and 30, the tip (7a) of each female reed tooth (7) is formed with a groove, while the tip (6a) of each male reed tooth (6) is substantially wedge-shaped to mate with the groove. Each male reed tooth (6) further has a reed tooth extension (6c) extending downward from the shank (61) thereof and having the tip (6a), and a channel (6b) (see Fig. 29) formed in an outer surface of the reed tooth extension (6c) and extending partially into the shank (61).

**[0036]** As shown in Fig. 21, the transfer of the loop (41) from the female reed tooth (7) to the male reed tooth (6) has now been completed, and the strip members (2) are opened and moved away from the reed teeth (6, 7). Then, as shown in Fig. 22, the transfer and strip members (1, 2) are moved downward, thereby forming the clearance required for the return of the female reed tooth (7), and thus the female reed section (26), back to its original position. The female reed section (26) rotates back along an axis (20) to form the circular toe stitching apparatus (see Fig. 28) with the male reed section (25).

**[0037]** As shown in Figs. 23 and 30, a needle (8) of a stitching machine, which is currently waiting in a position above the toe stitching apparatus, moves downward in the direction of an arrow (15). The needle (8) enters the channel (6b) in the direction of an arrow (27), and starts to stitch together the two loops (41). The loops (41) present on all the reed teeth (6) are individually stitched in the direction of an arrow (16), thereby completing the stitching process for closing the open-end or toe section of the stocking (4) .

**[0038]** After completing the stitching process, the stitching machine, which is represented by the needle (8) in Fig. 24, is moved upward in the direction of an arrow (17), and the transfer and strip members (1, 2) are also moved upward simultaneously. The upward movement of the transfer and strip members (1, 2) are stopped when the left strip member (2) reaches a position in alignment with the gap (19) (see Fig. 28) between two male reed teeth (6), as shown in Fig. 24. Then, as shown in Fig. 25, the strip member (2) enters the gap (19) between the reed teeth (6).

**[0039]** As shown in Fig. 26, the transfer and strip members (1, 2) are then moved downward to strip and move the stitch (18) of the toe of the stocking (4) away from the reed teeth (6).

**[0040]** As shown in Fig. 27, the toe of the stocking (4) has now been closed through the stitch (18), and is released from the stitching apparatus. Then, the transfer and strip members (1, 2) prepare for the next stocking (4) by moving downward.

**[0041]** Although it is possible to actuate the transfer members (1) and the strip members (2) in the apparatus (100) according to the invention through any drive mechanism, the opening-closing (forward-backward) movement of the transfer and strip members (1, 2) are preferably actuated through a cam mechanism (30) shown in Fig. 43. The cam mechanism (30) has a plurality of cam rings (31, 32, 33, 34) of different diameters, which are disposed one around the other over the strip member bearing (28) and which are capable of performing circular rotation. Each cam ring (31, 32, 33, 34) has a plurality of circularly arranged cams (311, 321, 331, 341) . Another cam mechanism of similar structure as that of the cam mechanism (30) has cam rings (31, 32, 33, 34) disposed over the transfer member bearing (29).

**[0042]** With reference to Fig. 43, because each cam mechanism (30) is positioned on the respective bearing (28, 29) such that each cam (311, 321, 331, 341) is in contact with the corresponding tail (1a, 1b, 1c, 1d, 2a, 2b, 2c, 2d), when the cam mechanism (30) rotates to a certain extent, the transfer members (1) and the strip members (2) can simultaneously move radially forward/backward to the same extent. The arrangement of the tails (1a, 1b, 1c, 1d) on the transfer members (6) is staggered. The arrangement of the tails (2a, 2b, 2c, 2d) on the strip members (7) is also staggered. The transfer member tails (1a, 1b, 1c, 1d) respectively engage channels (a, b, c, d) formed in the cams (31, 32, 33, 34) of the cam mechanism (30) and, likewise, the strip member tails (2a, 2b, 2c, 2d) respectively fit into channels (a, b, c, d) in the other cam mechanism. Of course, this example simplifies the mechanism. The number of such channels (a, b, c, d) in the cam mechanism (30) is the same as the number of the transfer members (1) or the number of the strip members (2). Although preferably four separate tails (1a, 1b, 1c and 1d or 2a, 2b, 2c, 2d) have been contemplated above, the number of tails (1a, 1b, 1c, 1d or 2a, 2b, 2c, 2d) could be less or more than four. Accordingly, the number of cams (311, 321, 331, 341) present in the cam mechanism (30) actuating the transfer members (1) and the strip members (2) will also vary.

## Claims

**1.** A device comprising a knitting machine and a trans-

fer apparatus (100) for transferring a stocking (4) from the knitting machine to a stitching apparatus to close an open-end of the stocking (4), the knitting machine including a needle (3) extending vertically and axially and having a hook (3b) for forming a loop (41) at the open-end of the stocking (4), and a latch (3a) that is pivotal upward and downward to move to or away from the hook (3b), said transfer apparatus (100) comprising:

a strip member (2) extending horizontally and movable axially upward and downward and radially towards and away from the needle (3), said strip member (2) being capable of contacting the loop (41) on the needle (3) to push the loop (41) toward or away from the hook (3b) of the needle (3); and

a transfermember (1) disposedhorizontally-above said strip member (2) and movable axially upward and downward and radially toward and away from the needle (3), said transfer member (1) including a tip region (112) for receiving the loop (41) from the hook (3b) of the needle (3) when said strip member (2) pushes the loop (41) to the hook (3b),

wherein said transfer apparatus is configured to:

move said strip member (2) towards the needle (3) to contact the loop (41) on the needle (3) from above and to slide downward the loop (41) from the hook (3b) of the needle (3) until the loop (41) passes the latch (3a);

move said strip member (2) away from the needle (3) after the loop (41) has passed the latch (3a) of the needle (3);

move said strip member (2) toward the needle (3) once again to contact the loop (41) from below and to slide the loop (41) upward and toward the hook (3b);

move said transfer member (1) until said transfer member (1) reaches the hook (3b) and until the hook (3b) extends into said tip region (112); and

further move said strip member (2) upward to push and transfer the loop (41) from the hook (3b) to the transfer member (1)..

**2.** The transfer apparatus (100) according to Claim 1, wherein said tip region (112) has a front tip (1f) that is hollow and that has a front opening (1e) adapted to face the needle (3) and for insertion of the needle (3).

**3.** The transfer apparatus (100) according to Claim 2, wherein said transfer member (1) further includes a radial shank portion (111), said tip region (112) extending inclinedly and downward from said shank portion (111) to said front tip (1f) and bending radially and thereafter axially and downward at said front tip (1f).

**4.** The transfer apparatus according to Claim 3, wherein said front opening (1e) is disposed at a location where said tip region (112) bends axially and downward to face the needle (3).

**5.** The transfer apparatus according to Claim 4, wherein said front tip (1f) further has a top opening (1g) at a location where said tip region (112) bends radially, said top opening (1g) being communicated with said front opening (1e) and being adapted for insertion of a tooth (6, 7) of a reed (25, 26) of the stitching apparatus.

**6.** The transfer apparatus (100) according to Claim 1, further comprising a strip member bearing (28) having radial channels (281) that are spaced annularly, a plurality of said strip members (2) being disposed slidably and respectively in said radial channels (281) of said strip member bearing (28).

**7.** The transfer apparatus (100) according to Claim 6, further comprising a transfer member bearing (29) having radial channels (291) that are spaced annularly, a plurality of said transfer members (1) being disposed slidably and respectively in said radial channels (291) of said transfer member bearing (29).

**8.** The trans fer apparatus (100) according to Claim 7, further comprising a cam mechanism (30) having a plurality of cam rings (31, 32, 33, 34) of different diameters, which are disposed one around the other over said strip member bearing (28) and each of which has a plurality of circularly arranged cams (311, 321, 331, 341), each of said strip members (2) having an axially protruding tail (2a, 2b, 2c, 2d) cammed by one of said cams (311, 321, 331, 341) to move radially forward or backward.

**9.** The transfer apparatus (100) according to Claim 8, further comprising another cam mechanism (30) having a plurality of cam rings (31, 32, 33, 34) of different diameters, which are disposed one around the other over said transfer member bearing (29) and each of which has a plurality of circularly arranged cams (311, 321, 331, 341), each of said transfer members (1) having an axially protruding tail (1a, 1b, 1c, 1d) cammed by one of said cams (311, 321, 331, 341) of said another cam mechanism (30) to move radially forward or backward.

**10.** A method for transferring an open-end of a stocking (4) from a knitting machine to a stitching apparatus by means of a transfer apparatus comprising a strip member (2) and a transfer member (1) disposed hor-

izontally above said strip member (2), the knitting machine including a needle (3), which extends vertically and axially and which has a hook (3b) to form a loop (41) at the open-end of the stocking (4), and a latch (3a) that is pivotal upward and downward to move to or away from the hook (3b), the method comprising:

moving the strip member (2) towards the needle (3) to contact the loop (41) on the needle (3) from above and to slide downward the loop (41) from the hook (3b) of the needle (3) until the loop (41) passes the latch (3a);
moving the strip member (2) away from the needle (3) after the loop (41) has passed the latch (3a) of the needle (3);
moving the strip member (2) toward the needle (3) once again to contact the loop (41) from below and to slide the loop (41) upward and toward the hook (3b);
moving the transfer member (1) disposed above the strip member (2) until the transfer member (1) reaches the hook (3b) and until the hook (3b) extends into a tip region (112) of the transfer member (1); and
moving the strip member (2) further upward to push and transfer the loop (41) from the hook (3b) to the transfer member (1),
wherein each of the strip and transfer members (2, 1) extends radially and horizontally, and is movable axially upward and downward and radially toward and away from the needle (3).

**11.** The method of Claim 10, further comprising the step of moving the strip and transfer members (2, 1) simultaneously away from the needle (3) while the strip member (2) is still in contact with the loop (41) from below to thereby stabilize the loop (41) on the transfer member (1).

**12.** The method of Claim 10, wherein the transfer member (1) has a front tip (1f) that is hollow and that has a front opening (1e) facing the needle (3), the needle (3) extending into the front opening (1e) when the transfer member (1) moves forward to the needle (3).

**13.** The method of Claim 10, further comprising:

moving upward the strip and transfer members (2, 1) together with the loop (41) until the transfer member (1) reaches a reed (25, 26) of the stitching apparatus and permits a tooth (6, 7) of the reed (25, 26) to extend into the tip region (112) of the transfer member (1);
moving the transfer member (1) away from the tooth (6, 7) to leave the loop (41) on the tooth (6, 7) while the strip member (2) is still intact; and
moving the strip member (2) away from the tooth (6, 7) after the loop (41) is left on the tooth (6, 7).

**14.** The method of Claim 13, wherein the transfer member (1) has a front tip (1f) that is hollow and that has a top opening (1g), the tooth (6, 7) extending into the top opening (1g) when the transfer member (1) reaches the reed (25, 26).

**15.** The method of Claim 10, wherein a plurality of said strip members (2) and a plurality of said transfer members (1) are used to transfer loops (41) formed at the open-end of the stocking (4), the reed (25, 26) of the stitching apparatus including a male reed section (26) having a male reed tooth (6), and a female reed section (25) having a female reed tooth (7), the reed (25, 26) being collapsible to dispose the male and female reed sections (25, 26) one over the other and to align vertically the male reed tooth (6) with the female reed tooth (7), the method further comprising:

moving upward the strip and transfer members (2, 1) together with the respective loops (41) until the transfer members (1) reach the reed (25, 26) and permit the respective male and female reed teeth (6, 7) to extend into the transfer members (1), respectively;
moving the strip members (2) and the transfer members (1) to transfer the loops (41) from the transfer members (1) to the respective male and female reed teeth (6, 7);
collapsing the reed (25, 26) while the strip and transfer members (2, 1) are moved away from the reed (25, 26) so that the male reed tooth (6) is aligned vertically with the female reed tooth (7); and
moving one of the strip members (2) to push upward and transfer the loop (41) on a lower one of the male and female reed teeth (6, 7) to an upper one of the male and female reed teeth (6, 7) so that the loops (41) on the alignedmale and female reed teeth (6, 7) are j uxtaposed for stitching.

**16.** The method of Claim 15, wherein the transfer members (1) are disposed slidably and respectively in annularly spaced-apart radial channels (291) of a transfer member bearing (29).

**17.** The method of Claim 16, wherein the strip members (2) are disposed slidably and respectively in annularly spaced-apart radial channels (281) of a strip member bearing (28).

**18.** The method of Claim 17, wherein each of the strip members (1, 2) is movable to and away from the needle (3) through a cam mechanism (30) which has a plurality of cam rings (31, 32, 33, 34) of different

diameters, the cam rings (31, 32, 33, 34) being disposed one around the other over said strip member bearing (28) and each of which has a plurality of circularly arranged cams (311, 321, 331, 341), each of the strip members (2) having an axially protruding tail (2a, 2b, 2c, 2d) cammed by one of said cams (311, 321, 331, 341) to move radially forward or backward.

**19.** The method of Claim 18, wherein each of the transfer members (1) is movable to and away from the needle (3) through another cam mechanism (30) which has a plurality of cam rings (31, 32, 33, 34) of different diameters, the cam rings (31, 32, 33, 34) being disposed one around the other over said transfer member bearing (29) and each of which has a plurality of circularly arranged cams (311, 321, 331, 341), each of said transfer members (1) having an axially protruding tail (1a, 1b, 1c, 1d) cammed by one of said cams (311, 321, 331, 341) of said another cam mechanism (30) to move radially forward or backward.

**Patentansprüche**

**1.** Eine Vorrichtung, die eine Strickmaschine und eine Transfervorrichtung (100) zum Transferieren eines Strumpfes (4) von der Strickmaschine zu einer Nähvorrichtung, um ein offenes Ende des Strumpfes (4) zu schließen, aufweist, wobei die Strickmaschine eine Nadel (3), die sich vertikal und axial erstreckt und einen Haken (3b) zum Bilden einer Schlinge (41) an dem offenen Ende des Strumpfes (4) aufweist, und eine Zunge (3a) umfasst, die nach oben und nach unten schwenkbar ist, um sich zu dem Haken (3b) hin oder von demselben weg zu bewegen, wobei die Transfervorrichtung (100) folgende Merkmale aufweist:

ein Streifenelement (2), das sich horizontal erstreckt und axial nach oben und nach unten und radial zu der Nadel (3) hin und von derselben weg bewegbar ist, wobei das Streifenelement (2) in der Lage ist, die Schlinge (41) an der Nadel (3) zu berühren, um die Schlinge (41) zu dem Haken (3b) der Nadel (3) hin oder von demselben weg zu drücken; und

ein Transferelement (1), das horizontal über dem Streifenelement (2) angeordnet ist und axial nach oben und nach unten und radial zu der Nadel (3) hin und von derselben weg bewegbar ist, wobei das Transferelement (1) eine Spitzenregion (112) zum Aufnehmen der Schlinge (41) von dem Haken (3b) der Nadel (3), wenn das Streifenelement (2) die Schlinge (41) zu dem Haken (3b) drückt, umfasst,

wobei die Transfervorrichtung dazu konfiguriert ist:

das Streifenelement (2) zu der Nadel (3) hin zu bewegen, um die Schlinge (41) an der Nadel (3) von oben zu berühren und die Schlinge (41) von dem Haken (3b) der Nadel (3) nach unten zu schieben, bis die Schlinge (41) an der Zunge (3a) vorbei gelangt;

das Streifenelement (2) von der Nadel (3) weg zu bewegen, nachdem die Schlinge (41) durch die Zunge (3a) der Nadel (3) vorbei gelangt ist;

das Streifenelement (2) erneut zu der Nadel (3) hin zu bewegen, um die Schlinge (41) von unten zu berühren und die Schlinge (41) nach oben und zu dem Haken (3b) hin zu schieben;

das Transferelement (1) zu bewegen, bis das Transferelement (1) den Haken (3b) erreicht und bis sich der Haken (3b) in die Spitzenregion (112) hinein erstreckt; und

das Streifenelement (2) weiter nach oben zu bewegen, um die Schlinge (41) von dem Haken (3b) zu dem Transferelement (1) zu drücken und zu transferieren.

**2.** Die Transfervorrichtung (100) gemäß Anspruch 1, bei der die Spitzenregion (112) eine vordere Spitze (1f) aufweist, die hohl ist und die eine vordere Öffnung (1e) aufweist, die dazu angepasst ist, der Nadel (3) zugewandt zu sein, und die für ein Einführen der Nadel (3) angepasst ist.

**3.** Die Transfervorrichtung (100) gemäß Anspruch 2, bei der das Transferelement (1) ferner einen radialen Schaftabschnitt (111) umfasst, wobei sich die Spitzenregion (112) von dem Schaftabschnitt (111) auf geneigte Weise und nach unten zu der vorderen Spitze (1f) erstreckt und sich radial und an der vorderen Spitze (1f) anschließend axial nach unten biegt.

**4.** Die Transfervorrichtung gemäß Anspruch 3, bei der die vordere Öffnung (1e) in einer Position angeordnet ist, in der sich die Spitzenregion (112) axial und nach unten biegt, um der Nadel (3) zugewandt zu sein.

**5.** Die Transfervorrichtung gemäß Anspruch 4, bei der die vordere Spitze (1f) ferner in einer Position, in der sich die Spitzenregion (112) radial biegt, eine obere Öffnung (1g) aufweist, wobei die obere Öffnung (1g) mit der vorderen Öffnung (1e) in Kommunikation steht und für ein Einführen eines Zahnes (6, 7) eines Kamms (25, 26) der Nähvorrichtung angepasst ist.

**6.** Die Transfervorrichtung (100) gemäß Anspruch 1, die ferner ein Streifenelementlager (28) aufweist, das radiale Kanäle (281) aufweist, die ringförmig be-

abstandet sind, wobei eine Mehrzahl der Streifenelemente (2) jeweils schiebbar in den radialen Kanälen (281) des Streifenelementlagers (28) angeordnet sind.

**7.** Die Transfervorrichtung (100) gemäß Anspruch 6, die ferner ein Transferelementlager (29) aufweist, das radiale Kanäle (291) aufweist, die ringförmig beabstandet sind, wobei eine Mehrzahl der Transferelemente (1) jeweils schiebbar in den radialen Kanälen (291) des Transferelementlagers (29) angeordnet sind.

**8.** Die Transfervorrichtung (100) gemäß Anspruch 7, die ferner einen Nockenmechanismus (30) aufweist, der eine Mehrzahl von Nockenringen (31, 32, 33, 34) verschiedener Durchmesser aufweist, die über das Streifenelementlager (28) um einander herum angeordnet sind und von denen jeder eine Mehrzahl kreisförmig angeordneter Nocken (311, 321, 331, 341) aufweist, wobei jedes der Streifenelemente (2) einen axial vorstehenden Vorsprung (2a, 2b, 2c, 2d) aufweist, der durch eine der Nocken (311, 321, 331, 341) dahin gehend in Eingriff genommen ist, sich radial vorwärts oder rückwärts zu bewegen.

**9.** Die Transfervorrichtung (100) gemäß Anspruch 8, die ferner einen weiteren Nockenmechanismus (30) aufweist, der eine Mehrzahl von Nockenringen (31, 32, 33, 34) verschiedener Durchmesser aufweist, die über das Transferelementlager (29) um einander herum angeordnet sind und von denen jeder eine Mehrzahl kreisförmig angeordneter Nocken (311, 321, 331, 341) aufweist, wobei jedes der Transferelemente (1) einen axial vorstehenden Vorsprung (1 a, 1b, 1 c, 1 d) aufweist, der durch eine der Nocken (311, 321, 331, 341) des weiteren Nockenmechanismus (30) dahin gehend in Eingriff genommen ist, sich radial vorwärts oder rückwärts zu bewegen.

**10.** Ein Verfahren zum Transferieren eines offenen Endes eines Strumpfes (4) von einer Strickmaschine zu einer Nähvorrichtung anhand einer Transfervorrichtung, die ein Streifenelement (2) und ein Transferelement (1), das horizontal über dem Streifenelement (2) angeordnet ist, aufweist, wobei die Strickmaschine eine Nadel (3), die sich vertikal und axial erstreckt und die einen Haken (3b) aufweist, um an dem offenen Ende des Strumpfes (4) eine Schlinge (41) zu bilden, und eine Zunge (3a) aufweist, die nach oben und nach unten schwenkbar ist, um sich zu dem Haken (3b) hin oder von demselben weg zu bewegen, wobei das Verfahren folgende Schritte aufweist:

Bewegen des Streifenelements (2) zu der Nadel (3) hin, um die Schlinge (41) an der Nadel (3) von oben zu berühren und die Schlinge (41) von dem Haken (3b) der Nadel (3) nach unten zu schieben, bis die Schlinge (41) an der Zunge (3a) vorbei gelangt;

Wegbewegen des Streifenelements (2) von der Nadel (3), nachdem die Schlinge (41) an der Zunge (3a) der Nadel (3) vorbei gelangt ist;

erneutes Bewegen des Streifenelements (2) zu der Nadel (3) hin, um die Schlinge (41) von unten zu berühren und die Schlinge (41) nach oben und zu dem Haken (3b) hin zu schieben;

Bewegen des über dem Streifenelement (2) angeordneten Transferelements (1), bis das Transferelement (1) den Haken (3b) erreicht und bis sich der Haken (3b) in eine Spitzenregion (112) des Transferelements (1) hinein erstreckt; und

Bewegen des Streifenelements (2) weiter nach oben, um die Schlinge (41) von dem Haken (3b) zu dem Transferelement (1) zu drücken und zu transferieren,

wobei sich sowohl das Streifen- als auch das Transferelement (2, 1) radial und horizontal erstreckt und axial nach oben und nach unten und radial zu der Nadel (3) hin und von derselben weg bewegbar ist.

**11.** Das Verfahren gemäß Anspruch 10, das ferner den Schritt des gleichzeitigen Wegbewegens des Streifen- und des Transferelements (2, 1) von der Nadel (3) aufweist, während das Streifenelement (2) von unten immer noch mit der Schlinge (41) in Berührung ist, um dadurch die Schlinge (41) an dem Transferelement (1) zu stabilisieren.

**12.** Das Verfahren gemäß Anspruch 10, bei dem das Transferelement (1) eine vordere Spitze (1f) aufweist, die hohl ist und die eine vordere Öffnung (1e) aufweist, die der Nadel (3) zugewandt ist, wobei sich die Nadel (3) in die vordere Öffnung (1e) hinein erstreckt, wenn sich das Transferelement (1) vorwärts zu der Nadel (3) bewegt.

**13.** Das Verfahren gemäß Anspruch 10, das ferner folgende Schritte aufweist:

Nach-Oben-Bewegen des Streifen- und des Transferelements (2, 1) zusammen mit der Schlinge (41), bis das Transferelement (1) einen Kamm (25, 26) der Nähvorrichtung erreicht und es einem Zahn (6, 7) des Kamms (25, 26) ermöglicht, sich in die Spitzenregion (112) des Transferelements (1) hinein zu erstrecken;

Wegbewegen des Transferelements (1) von dem Zahn (6, 7), um die Schlinge (41) auf dem Zahn (6, 7) zu belassen, während das Streifenelement (2) immer noch intakt ist; und

Wegbewegen des Streifenelements (2) von dem Zahn (6, 7), nachdem die Schlinge (41) auf

dem Zahn (6, 7) belassen wurde.

**14.** Das Verfahren gemäß Anspruch 13, bei dem das Transferelement (1) eine vordere Spitze (1f) aufweist, die hohl ist und die eine obere Öffnung (1g) aufweist, wobei sich der Zahn (6, 7) in die obere Öffnung (1g) hinein erstreckt, wenn das Transferelement (1) den Kamm (25, 26) erreicht.

**15.** Das Verfahren gemäß Anspruch 10, bei dem eine Mehrzahl der Streifenelemente (2) und eine Mehrzahl der Transferelemente (1) zum Transferieren von an dem offenen Ende des Strumpfes (4) gebildeten Schlingen (41) verwendet werden, wobei der Kamm (25, 26) der Nähvorrichtung einen Steckkammabschnitt (26), der einen Steckkammzahn (6) aufweist, und einen Aufnahmekammabschnitt (25), der einen Aufnahmekammzahn (7) aufweist, umfasst, wobei der Kamm (25, 26) zusammenklappbar ist, um den Steck- und den Aufnahmekammabschnitt (25, 26) übereinander anzuordnen und um den Steckkammzahn (6) mit dem Aufnahmekammzahn (7) vertikal auszurichten, wobei das Verfahren ferner folgende Schritte aufweist:

Nach-Oben-Bewegen der Streifen- und der Transferelemente (2, 1) zusammen mit den jeweiligen Schlingen (41), bis die Transferelemente (1) den Kamm (25, 26) erreichen und es dem Steck- beziehungsweise dem Aufnahmekammzahn (6, 7) ermöglichen, sich jeweils in die Transferelemente (1) hinein zu erstrecken;
Bewegen der Streifenelemente (2) und der Transferelemente (1), um die Schlingen (41) von den Transferelementen (1) zu dem Steck- beziehungsweise dem Aufnahmekammzahn (6, 7) zu transferieren;
Zusammenklappen des Kamms (25, 26), während die Streifen- und die Transferelemente (2, 1) von dem Kamm (25, 26) weg bewegt werden, so dass der Steckkammzahn (6) mit dem Aufnahmekammzahn (7) vertikal ausgerichtet ist; und
Bewegen eines der Streifenelemente (2), um die auf einem unteren des Steck- und des Aufnahmekammzahns (6, 7) befindliche Schlinge (41) nach oben zu drücken und zu einem oberen des Steck- und des Aufnahmekammzahns (6, 7) zu transferieren, so dass die Schlingen (41) auf dem Steck- und dem Aufnahmekammzahn (6, 7), wobei diese Zähne miteinander ausgerichtet sind, zum Nähen nebeneinanderliegen.

**16.** Das Verfahren gemäß Anspruch 15, bei dem die Transferelemente (1) jeweils schiebbar in ringförmig beabstandeten radialen Kanälen (291) eines Transferelementlagers (29) angeordnet sind.

**17.** Das Verfahren gemäß Anspruch 16, bei dem die Streifenelemente (2) jeweils schiebbar in ringförmig beabstandeten radialen Kanälen (281) eines Streifenelementlagers (28) angeordnet sind.

**18.** Das Verfahren gemäß Anspruch 17, bei dem jedes der Streifenelemente (1, 2) durch einen Nockenmechanismus (30), der eine Mehrzahl von Nockenringen (31, 32, 33, 34) unterschiedlicher Durchmesser aufweist, zu der Nadel (3) hin und von derselben weg bewegbar ist, wobei die Nockenringe (31, 32, 33, 34) über das Streifenelementlager (28) um einander herum angeordnet sind und wobei jeder derselben eine Mehrzahl kreisförmig angeordneter Nocken (311, 321, 331, 341) aufweist, wobei jedes der Streifenelemente (2) einen axial vorstehenden Vorsprung (2a, 2b, 2c, 2d) aufweist, der durch eine der Nocken (311, 321, 331, 341) dahin gehend in Eingriff genommen ist, sich radial vorwärts oder rückwärts zu bewegen.

**19.** Das Verfahren gemäß Anspruch 18, bei dem jedes der Transferelemente (1) durch einen weiteren Nockenmechanismus (30), der eine Mehrzahl von Nockenringen (31, 32, 33, 34) unterschiedlicher Durchmesser aufweist, zu der Nadel (3) hin und von derselben weg bewegbar ist, wobei die Nockenringe (31, 32, 33, 34) über das Transferelementlager (29) um einander herum angeordnet sind und wobei jeder derselben eine Mehrzahl kreisförmig angeordneter Nocken (311, 321, 331, 341) aufweist, wobei jedes der Transferelemente (1) einen axial vorstehenden Vorsprung (1a, 1b, 1c, 1d) aufweist, der durch eine der Nocken (311, 321, 331, 341) des weiteren Nockenmechanismus (30) dahin gehend in Eingriff genommen ist, sich radial vorwärts oder rückwärts zu bewegen.

## Revendications

**1.** Appareil comprenant une machine à tricoter et un appareil de transfert (100) pour transférer une chaussette (4) de la machine à tricoter à un appareil de couture pour fermer une extrémité ouverte de la chaussette (4), la machine à tricoter comportant une aiguille (3) s'étendant verticalement et axialement et présentant un crochet (3b) pour former une boucle (41) à l'extrémité ouverte de la chaussette (4), et un clapet (3a) qui peut pivoter vers le haut et vers le bas pour se déplacer vers le ou en s'éloignant du crochet (3b), ledit appareil de transfert (100) comprenant:

un élément en bande (2) s'étendant horizontalement et déplaçable axialement vers le haut et vers le bas et radialement vers et en s'éloignant de l'aiguille (3), ledit élément en bande (2) étant

à même d'entrer en contact avec la boucle (41) sur l'aiguille (3) pour pousser la boucle (41) vers ou éloignée du crochet (3b) de l'aiguille (3); et
un élément de transfert (1) disposé horizontalement au-dessus dudit élément en bande (2) et déplaçable axialement vers le haut et vers le bas et radialement vers et en s'éloignant de l'aiguille (3), ledit élément de transfert (1) comportant une région de pointe (112) destinée à recevoir la boucle (41) du crochet (3b) de l'aiguille (3) lorsque ledit élément en bande (2) pousse la boucle (41) vers le crochet (3b),
dans lequel ledit appareil de transfert est configuré pour:

déplacer ledit élément en bande (2) vers l'aiguille (3) pour entrer en contact avec la boucle (41) sur l'aiguille (3) depuis le haut et pour faire glisser la boucle (41) du crochet (3b) de l'aiguille (3) vers le bas jusqu'à ce que la boucle (41) passe au-delà du clapet (3a);
déplacer ledit élément en bande (2) éloigné de l'aiguille (3) après que la boucle (41) soit passée au-delà du clapet (3a) de l'aiguille (3);
déplacer ledit élément de bande (2) à nouveau vers l'aiguille (3) pour entrer en contact avec la boucle (41) depuis le bas et pour faire glisser la boucle (41) vers le haut et vers le crochet (3b);
déplacer ledit élément de transfert (1) jusqu'à ce que ledit élément de transfert (1) atteigne le crochet (3b) et jusqu'à ce que le crochet (3b) s'étende dans ladite région de pointe (112); et
déplacer davantage ledit élément en bande (2) vers le haut pour pousser et transférer la boucle (41) du crochet (3b) vers l'élément de transfert (1).

**2.** Appareil de transfert (100) selon la revendication 1, dans lequel ladite région de pointe (112) présente une extrémité avant (1f) qui est creuse et qui présente une ouverture avant (1e) adaptée de manière à faire face à l'aiguille (3) et pour insertion de l'aiguille (3).

**3.** Appareil de transfert (100) selon la revendication 2, dans lequel ledit élément de transfert (1) comprend par ailleurs une partie de tige radiale (111), ladite région de pointe (112) s'étendant inclinée et vers le bas de ladite partie de tige (111) vers ladite pointe avant (1f) et étant courbée radialement et ensuite axialement et vers le bas à ladite pointe avant (1f).

**4.** Appareil de transfert selon la revendication 3, dans lequel ladite ouverture avant (1e) est disposée à un endroit où ladite région de pointe (112) est courbée axialement et vers le bas de manière à faire face à l'aiguille (3).

**5.** Appareil de transfert selon la revendication 4, dans lequel ladite pointe avant (1f) présente par ailleurs une ouverture supérieure (1g) à un endroit où ladite région de pointe (112) est courbée radialement, ladite ouverture supérieure (1g) étant en communication avec ladite ouverture avant (1e) et étant adaptée pour insertion d'une dent (6, 7) d'un peigne (25, 26) de l'appareil de couture.

**6.** Appareil de transfert (100) selon la revendication 1, comprenant par ailleurs un palier d'élément en bande (28) présentant des canaux radiaux (281) qui sont espacés de manière annulaire, une pluralité desdits éléments en bande (2) étant disposés de manière coulissante et respectivement dans lesdits canaux radiaux (281) dudit palier d'élément en bande (28).

**7.** Appareil de transfert (100) selon la revendication 6, comprenant par ailleurs un palier d'élément de transfert (29) présentant des canaux radiaux (291) qui sont espacés de manière annulaire, une pluralité desdits éléments de transfert (1) étant disposés de manière coulissante et respectivement dans lesdits canaux radiaux (291) dudit palier d'élément de transfert (29).

**8.** Appareil de transfert (100) selon la revendication 7, comprenant par ailleurs un mécanisme à cames (30) présentant une pluralité de bagues à cames (31, 32, 33, 34) de diamètres différents qui sont disposées l'une autour de l'autre sur ledit palier d'élément en bande (28) et présentant, chacune, une pluralité de cames disposées en cercle (311, 321, 331, 341), chacun desdits éléments en bande (2) présentant une projecture faisant saillie axialement (2a, 2b, 2c, 2d) avec laquelle vient en prise l'une desdites cames (311, 321, 331, 341) pour se déplacer radialement en avant ou en arrière.

**9.** Appareil de transfert (100) selon la revendication 8, comprenant par ailleurs un autre mécanisme à cames (30) présentant une pluralité bagues à cames (31, 32, 33, 34) de diamètres différents qui sont disposées l'une autour de l'autre sur ledit palier d'élément de transfert (29) et présentant, chacune, une pluralité de cames disposées en cercle (311, 321, 331, 341), chacun desdits éléments de transfert (1) présentant une projecture faisant saillie axialement (1a, 1b, 1c, 1d) avec laquelle vient en prise l'une desdites cames (311, 321, 331, 341) dudit autre mécanisme à cames (30) pour se déplacer radialement en avant ou en arrière.

**10.** Procédé de transfert d'une extrémité ouverte d'une

chaussette (4) d'une machine à tricoter à un appareil de couture au moyen d'un appareil de transfert comprenant un élément en bande (2) et un élément de transfert (1) disposé horizontalement au-dessus dudit élément en bande (2), la machine à tricoter comportant une aiguille (3) qui s'étend verticalement et axialement et qui présente un crochet (3b) pour former une boucle (41) à l'extrémité ouverte de la chaussette (4), et un clapet (3a) qui peut pivoter vers le haut et vers le bas pour se déplacer vers le ou en s'éloignant du crochet (3b), le procédé comprenant le fait de:

déplacer l'élément en bande (2) vers l'aiguille (3) pour entrer en contact avec la boucle (41) sur l'aiguille (3) depuis le haut et pour faire glisser la boucle (41) du crochet (3b) de l'aiguille (3) vers le bas jusqu'à ce que la boucle (41) passe au-delà du clapet (3a);
déplacer l'élément en bande (2) éloigné de l'aiguille (3) après que la boucle (41) soit passée au-delà du clapet (3a) de l'aiguille (3);
déplacer l'élément en bande (2) à nouveau vers l'aiguille (3) pour entrer en contact avec la boucle (41) depuis le bas et faire glisser la boucle (41) vers le haut et vers le crochet (3b);
déplacer l'élément de transfert (1) disposé au-dessus de l'élément en bande (2) jusqu'à ce que l'élément de transfert (1) atteigne le crochet (3b) et jusqu'à ce que le crochet (3b) s'étende dans une région de pointe (112) de l'élément de transfert (1); et
déplacer l'élément en bande (2) davantage vers le haut pour pousser et transférer la boucle (41) du crochet (3b) vers l'élément de transfert (1),
dans lequel chacun parmi l'élément en bande et l'élément de transfert (2, 1) s'étend radialement et horizontalement, et est déplaçable axialement vers le haut et vers le bas et radialement vers et en s'éloignant de l'aiguille (3).

**11.** Procédé selon la revendication 10, comprenant par ailleurs l'étape consistant à déplacer l'élément en bande et l'élément de transfert (2, 1) en même temps éloignés de l'aiguille (3) tandis que l'élément en bande (2) est toujours en contact avec la boucle (41) depuis le bas, pour stabiliser ainsi la boucle (41) sur l'élément de transfert (1).

**12.** Procédé selon la revendication 10, dans lequel l'élément de transfert (1) présente une pointe avant (1f) qui est creuse et qui présente une ouverture avant (1e) faisant face à l'aiguille (3), l'aiguille (3) s'étendant dans l'ouverture avant (1e) lorsque l'élément de transfert (1) se déplace en avant vers l'aiguille (3).

**13.** Procédé selon la revendication 10, comprenant par ailleurs le fait de:

déplacer vers le haut l'élément en bande et l'élément de transfert (2, 1) ensemble avec la boucle (41) jusqu'à ce que l'élément de transfert (1) atteigne un peigne (25, 26) de l'appareil de couture et permette qu'une dent (6, 7) du peigne (25, 26) s'étende dans la zone de pointe (112) de l'élément de transfert (1);
déplacer l'élément de transfert (1) éloigné de la dent (6, 7) pour laisser la boucle (41) sur la dent (6, 7) tandis que l'élément en bande (2) est toujours intacte; et
déplacer l'élément en bande (2) éloigné de la dent (6, 7) après que la boucle (41) soit laissée sur la dent (6, 7).

**14.** Procédé selon la revendication 13, dans lequel l'élément de transfert (1) présente une pointe avant (1f) qui est creuse et qui présente une ouverture supérieure (1g), la dent (6, 7) s'étendant dans l'ouverture supérieure (1g) lorsque l'élément de transfert (1) atteint le peigne (25, 26).

**15.** Procédé selon la revendication 10, dans lequel une pluralité desdits éléments en bande (2) et une pluralité desdits éléments de transfert (1) sont utilisés pour transférer les boucles (41) formées à l'extrémité ouverte de la chaussette (4), le peigne (25, 26) du l'appareil de couture comportant un segment de peigne mâle (26) présentant une dent de peigne mâle (6), et un segment de peigne femelle (25) présentant une dent de peigne femelle (7), le peigne (25, 26) étant rabattable pour disposer les segments de peigne mâle et femelle (25, 26) l'un sur l'autre et pour aligner verticalement la dent de peigne mâle (6) avec la dent de peigne femelle (7), le procédé comprenant par ailleurs le fait de:

déplacer vers le haut les éléments en bande et les éléments de transfert (2, 1) ensemble avec les boucles respectives (41) jusqu'à ce que les éléments de transfert (1) atteignent le peigne (25, 26) et permettent que les dents de peigne mâle et femelle respectives (6, 7) s'étendent respectivement dans les éléments de transfert (1);
déplacer les éléments en bande (2) et les éléments de transfert (1) pour transférer les boucles (41) des éléments de transfert (1) vers les dents de peigne mâle et femelle respectives (6, 7);
rabattre le peigne (25, 26) tandis que les éléments en bande et les éléments de transfert (2, 1) sont éloignés du peigne (25, 26), de sorte que la dent de peigne mâle (6) soit alignée verticalement avec la dent de peigne femelle (7); et
déplacer l'un des éléments en bande (2) pour pousser vers le haut et transférer la boucle (41) sur l'une inférieure parmi la dent de peigne mâle et la dent de peigne femelle (6, 7) vers l'une

supérieure parmi la dent de peigne mâle et la dent de peigne femelle (6, 7), de sorte que les boucles (41) sur les dents de peigne mâle et femelle alignées (6, 7) soient juxtaposées pour couture.

**16.** Procédé selon la revendication 15, dans lequel les éléments de transfert (1) sont disposés de manière coulissante et respectivement dans des canaux radiaux espacés de manière annulaire (291) d'un palier d'élément de transfert (29).

**17.** Procédé selon la revendication 16, dans lequel les éléments en bande (2) sont disposés de manière coulissante et respectivement dans des canaux radiaux espacés de manière annulaire (281) d'un palier d'élément en bande (28).

**18.** Procédé selon la revendication 17, dans lequel chacun des éléments en bande (1, 2) est déplaçable vers et en s'éloignant de l'aiguille (3) par l'intermédiaire d'un mécanisme à cames (30) qui présente une pluralité de bagues à cames (31, 32, 33, 34) de diamètres différents, les bagues à cames (31, 32, 33, 34) étant disposées l'une autour de l'autre sur ledit palier d'élément en bande (28) et présentant, chacune, une pluralité de cames disposées en cercle (311, 321, 331, 341), chacun des éléments en bande (2) présentant une projecture faisant saillie axialement (2a, 2b, 2c, 2d) avec laquelle vient en prise l'une desdites cames (311, 321, 331, 341) pour se déplacer radialement en avant ou en arrière.

**19.** Procédé selon la revendication 18, dans lequel chacun des éléments de transfert (1) est déplaçable vers et en s'éloignant de l'aiguille (3) par l'intermédiaire d'un autre mécanisme à cames (30) qui présente une pluralité de bagues à cames (31, 32, 33, 34) de diamètres différents, les bagues à cames (31, 32, 33, 34) étant disposées l'une autour de l'autre sur ledit palier d'élément de transfert (29) et présentant, chacune, une pluralité de cames disposées en cercle (311, 321, 331, 341), chacun desdits éléments de transfert (1) présentant une projecture faisant saillie axialement (1a, 1b, 1c, 1d) avec laquelle vient en prise l'une desdites cames (311, 321, 331, 341) dudit autre mécanisme à cames (30) pour se déplacer radialement en avant ou en arrière.

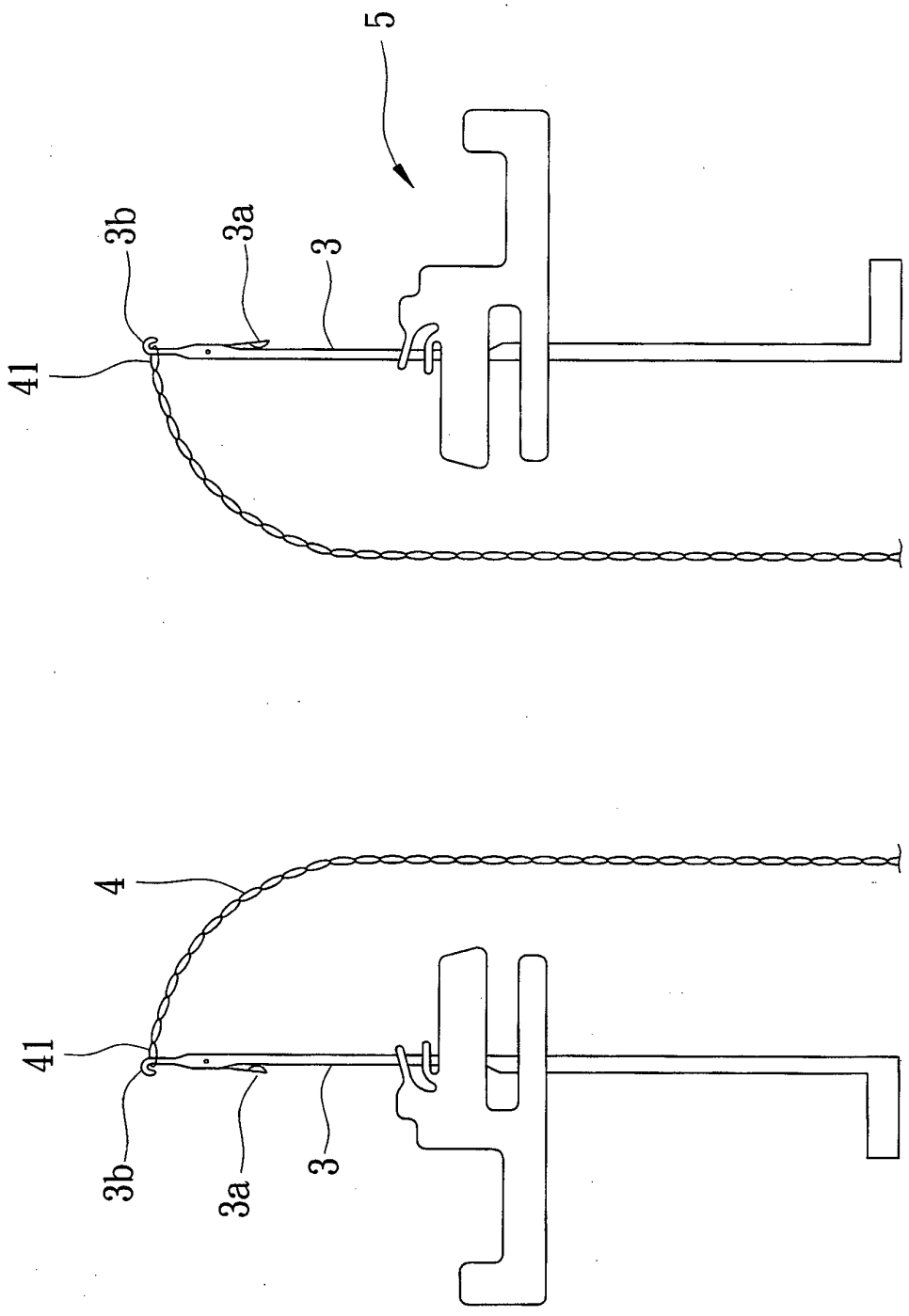



FIG. 1

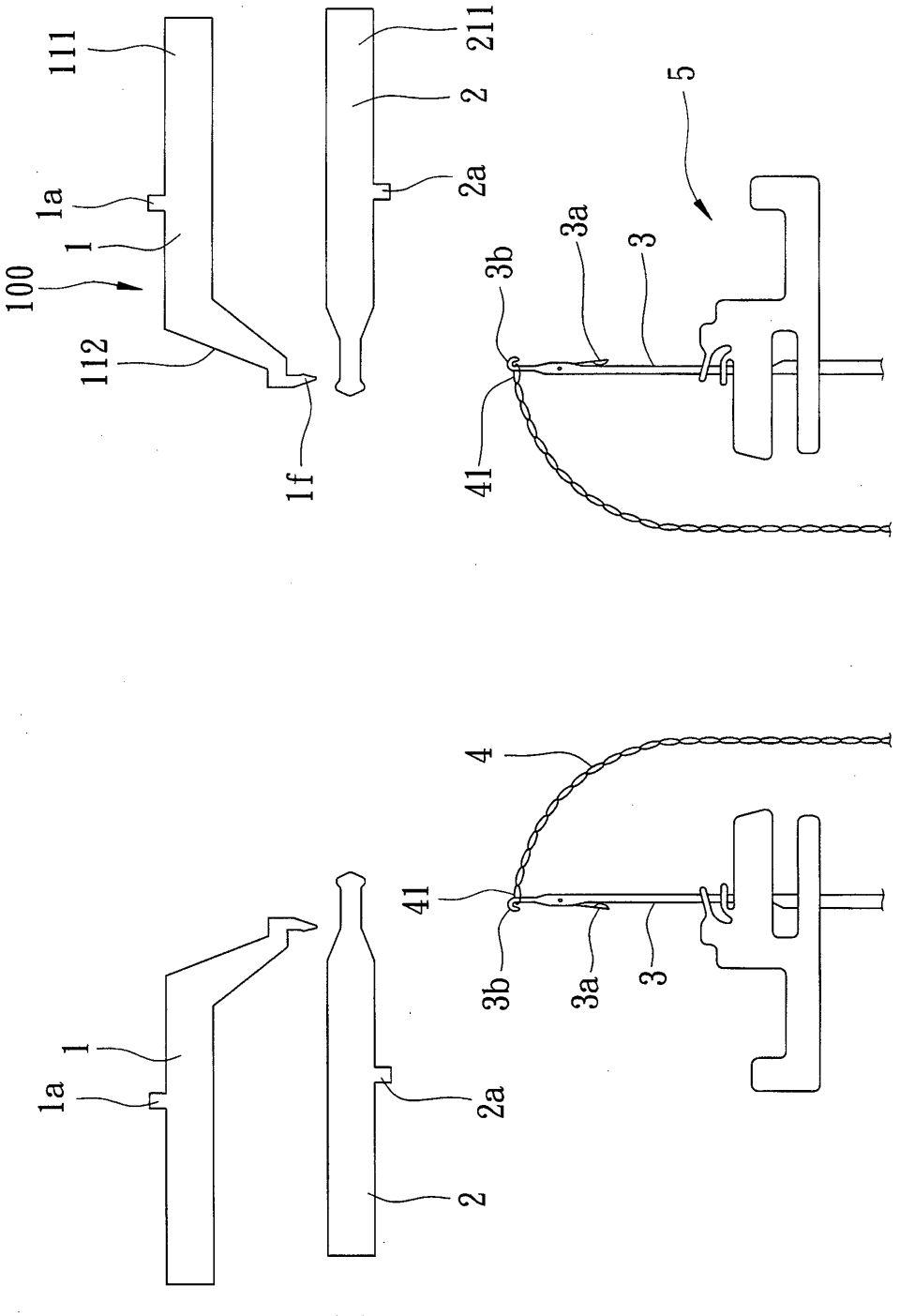



FIG. 2

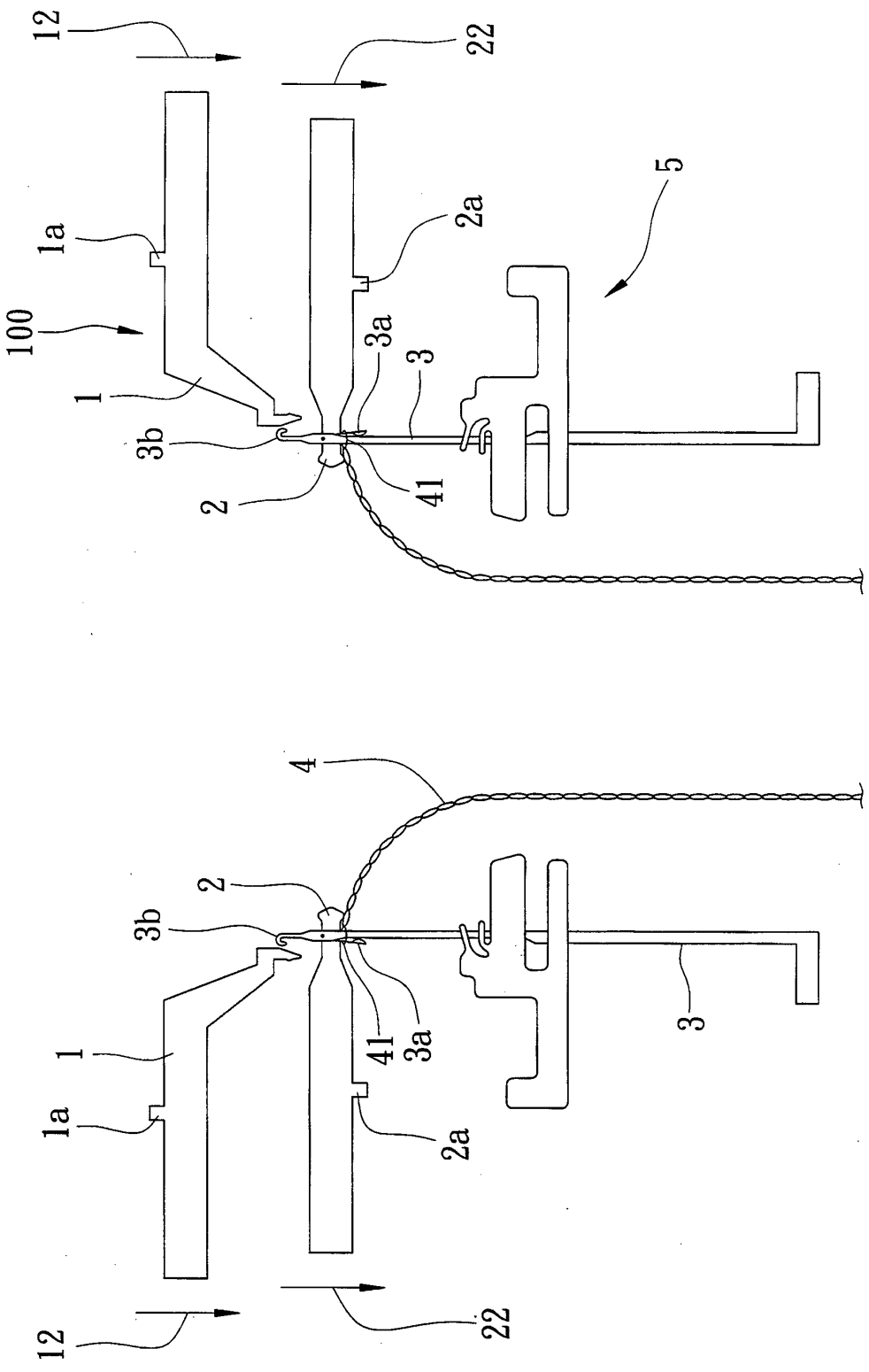



FIG. 3

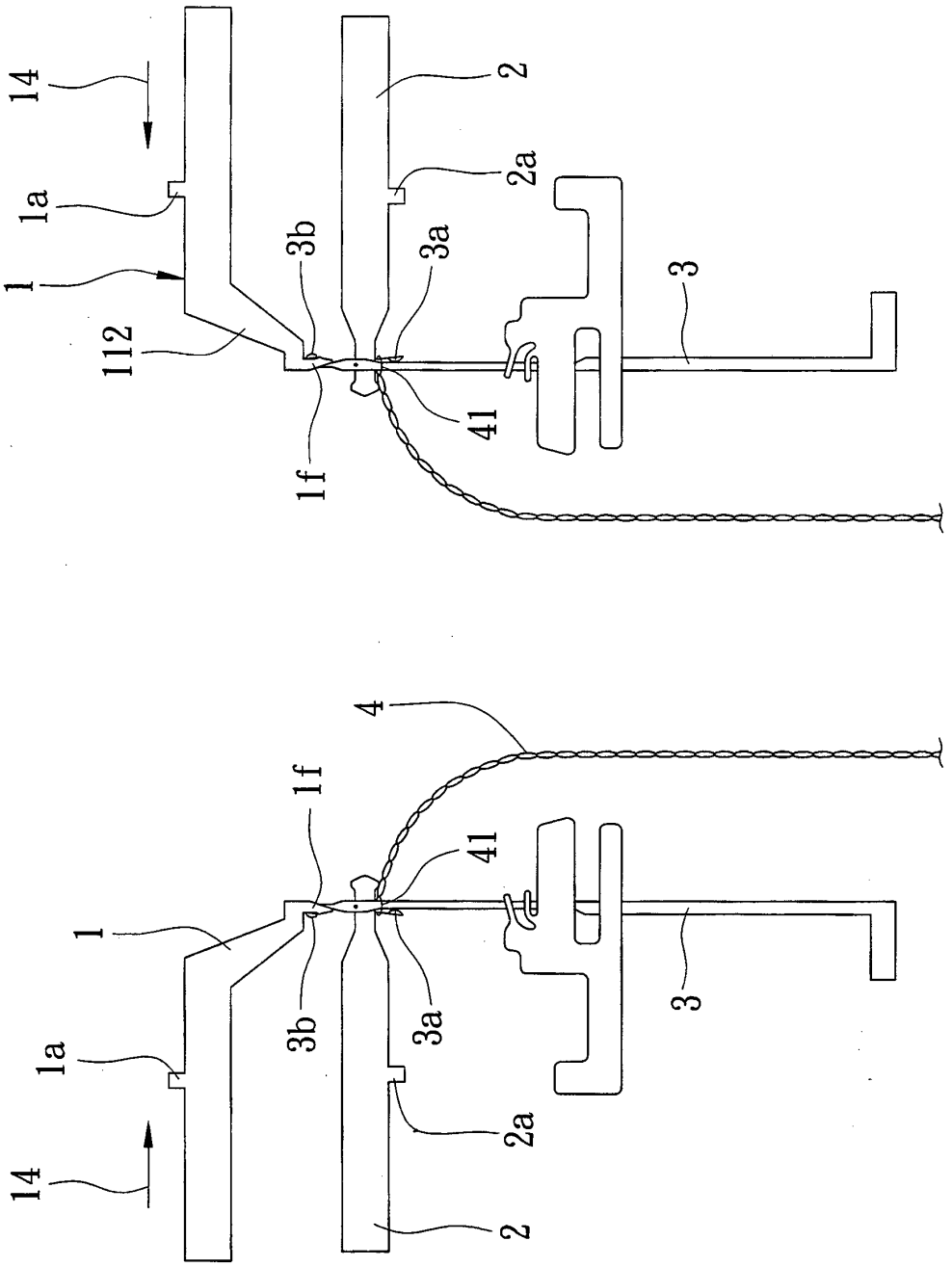



FIG. 4

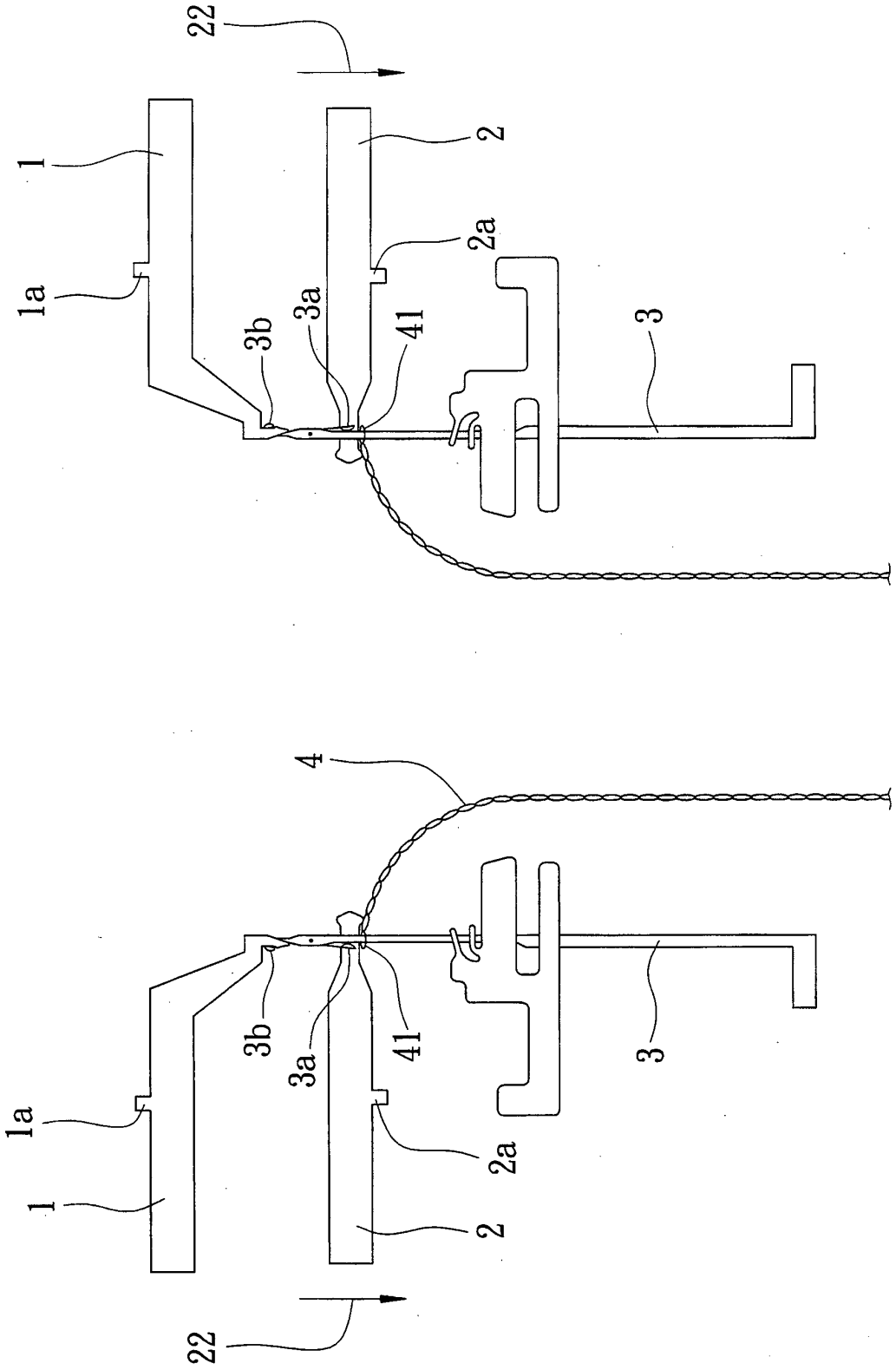



FIG. 5

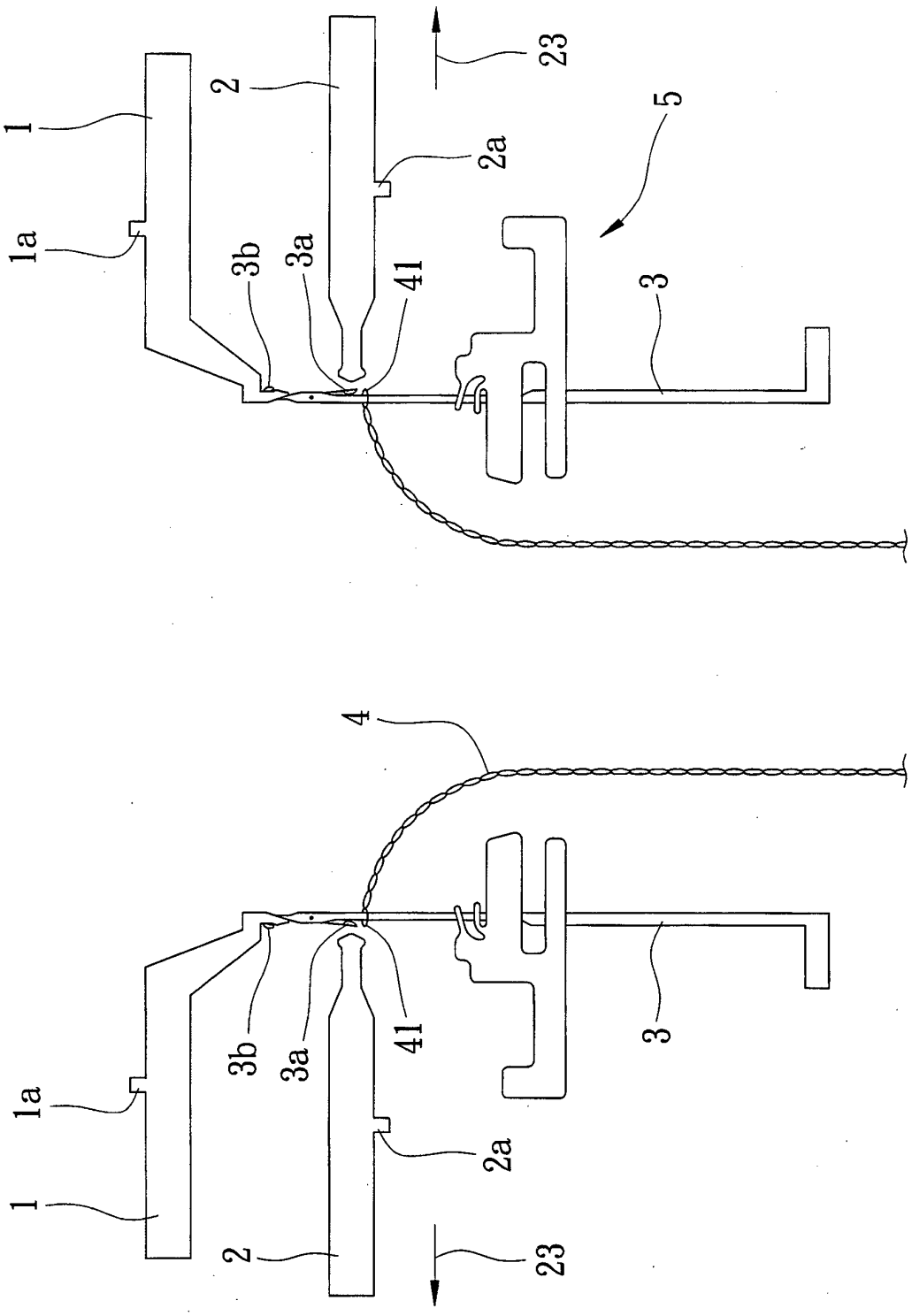



FIG. 6

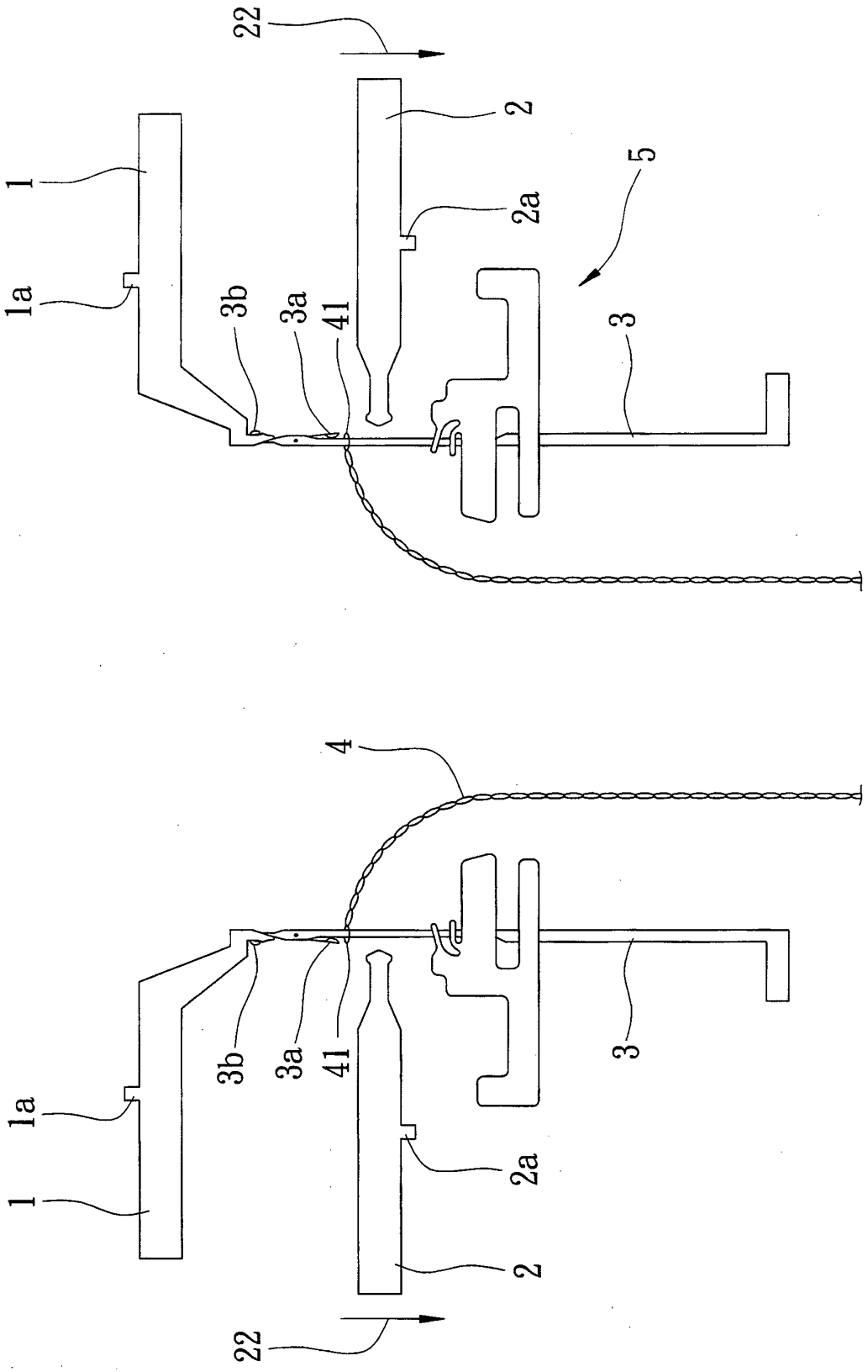



FIG. 7

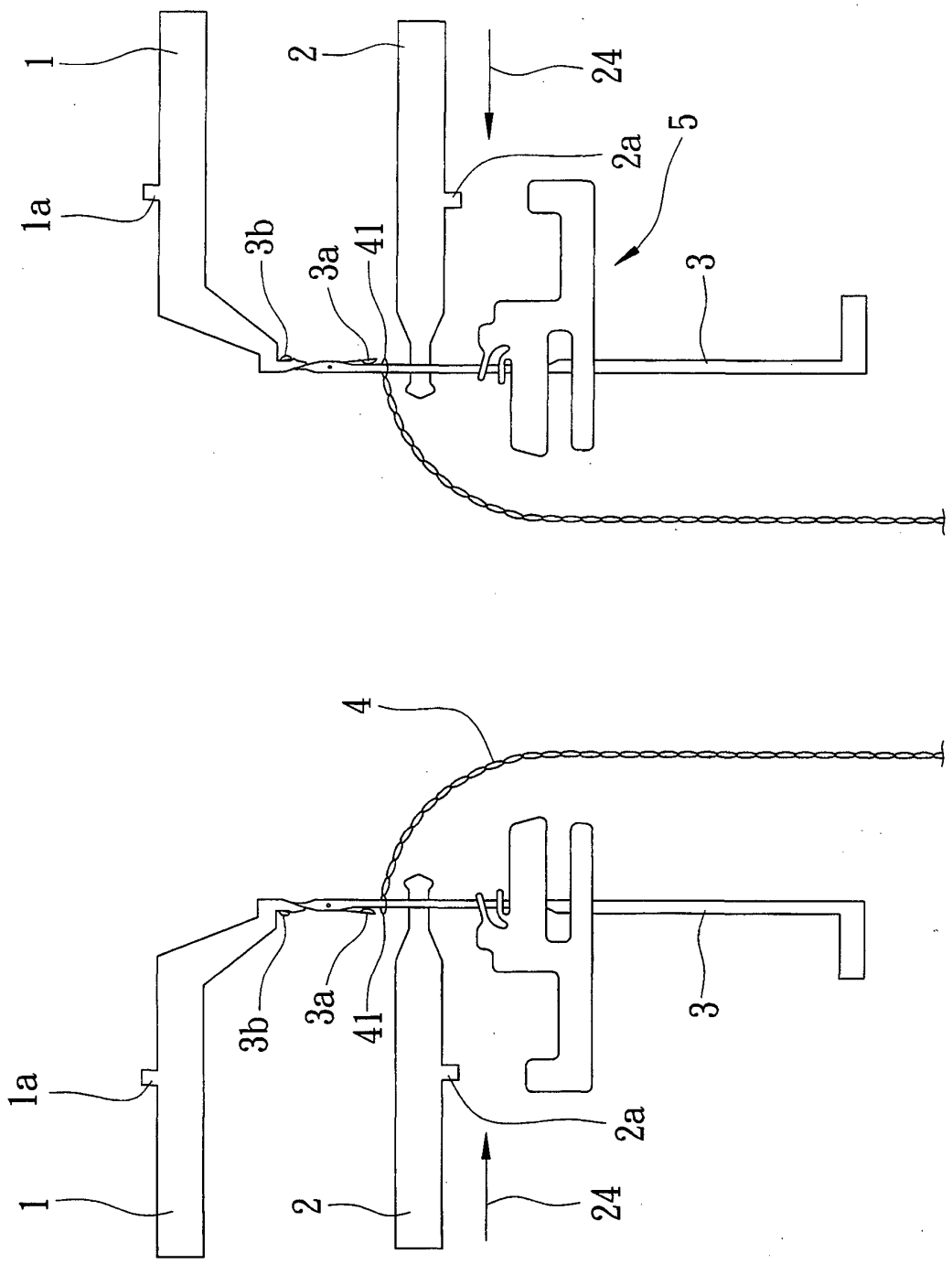



FIG. 8

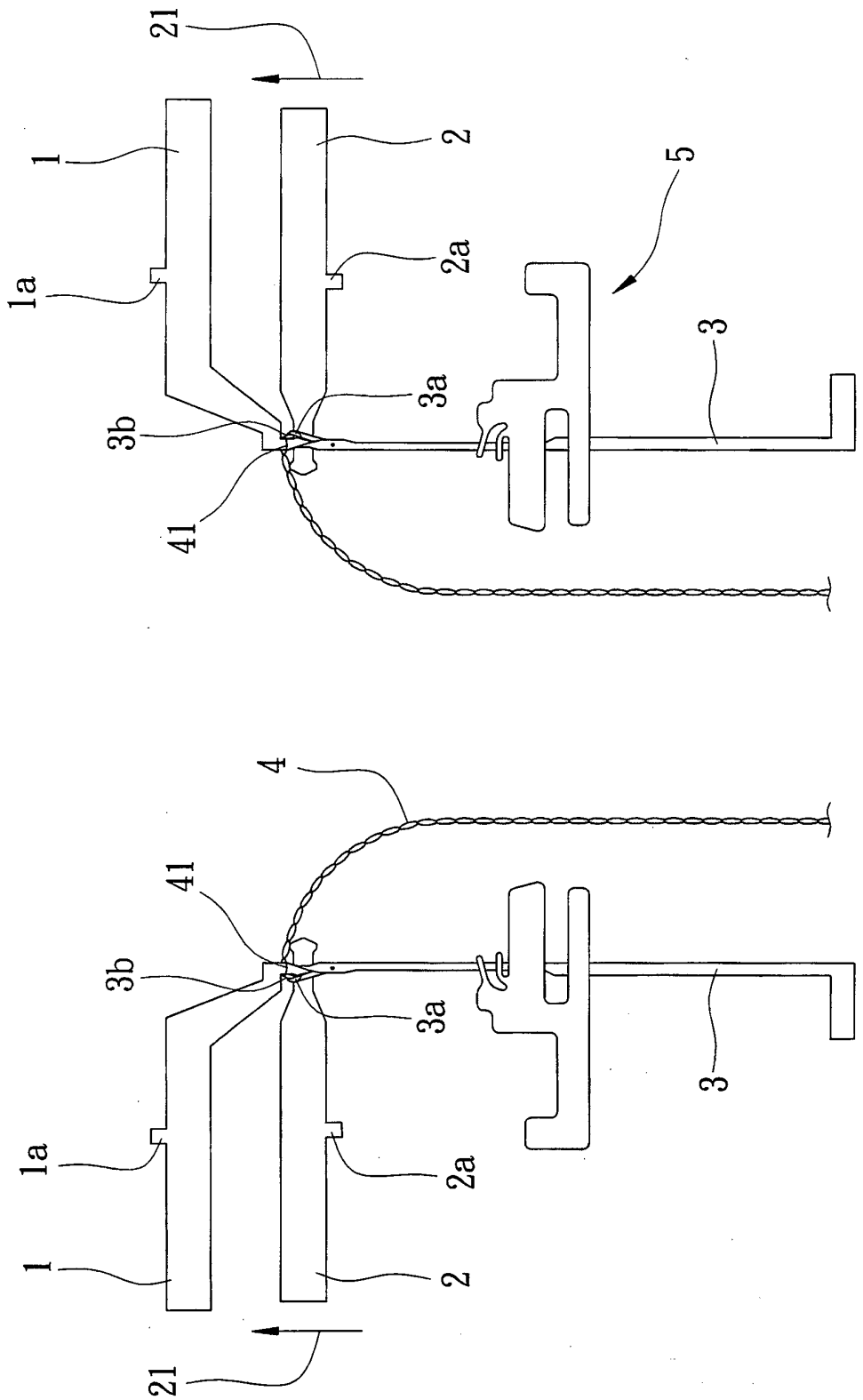



FIG. 9

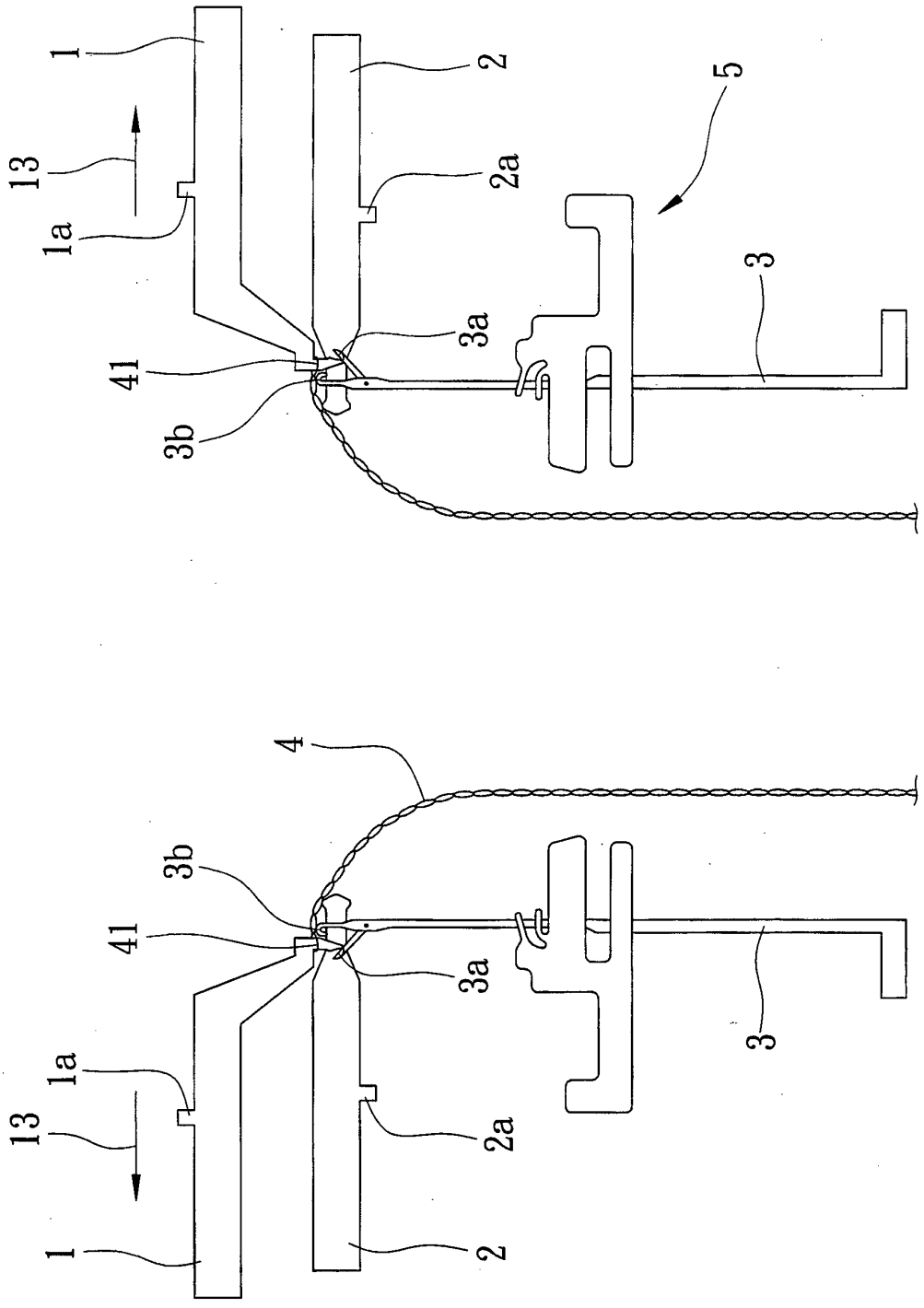



FIG. 10

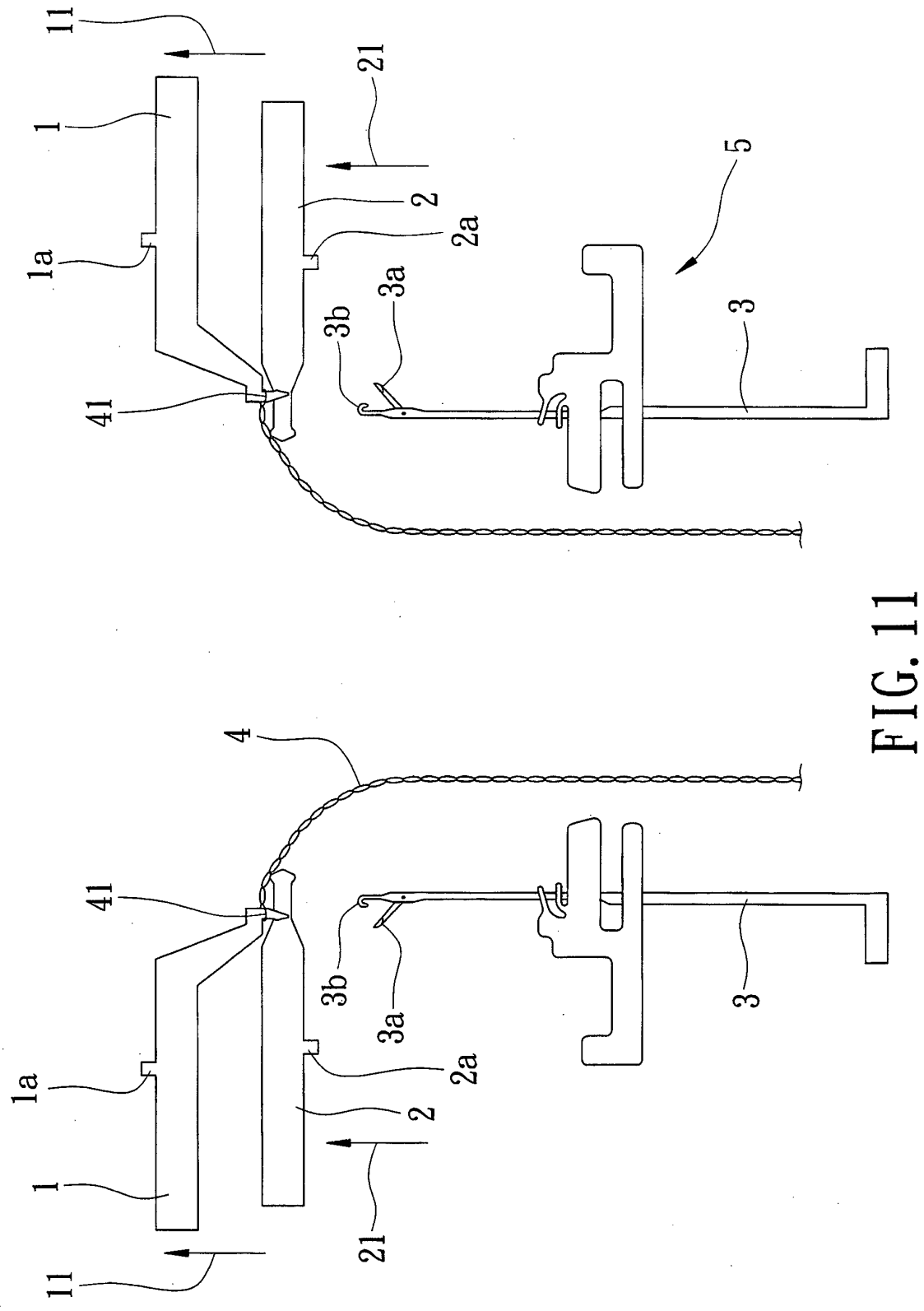



FIG. 11

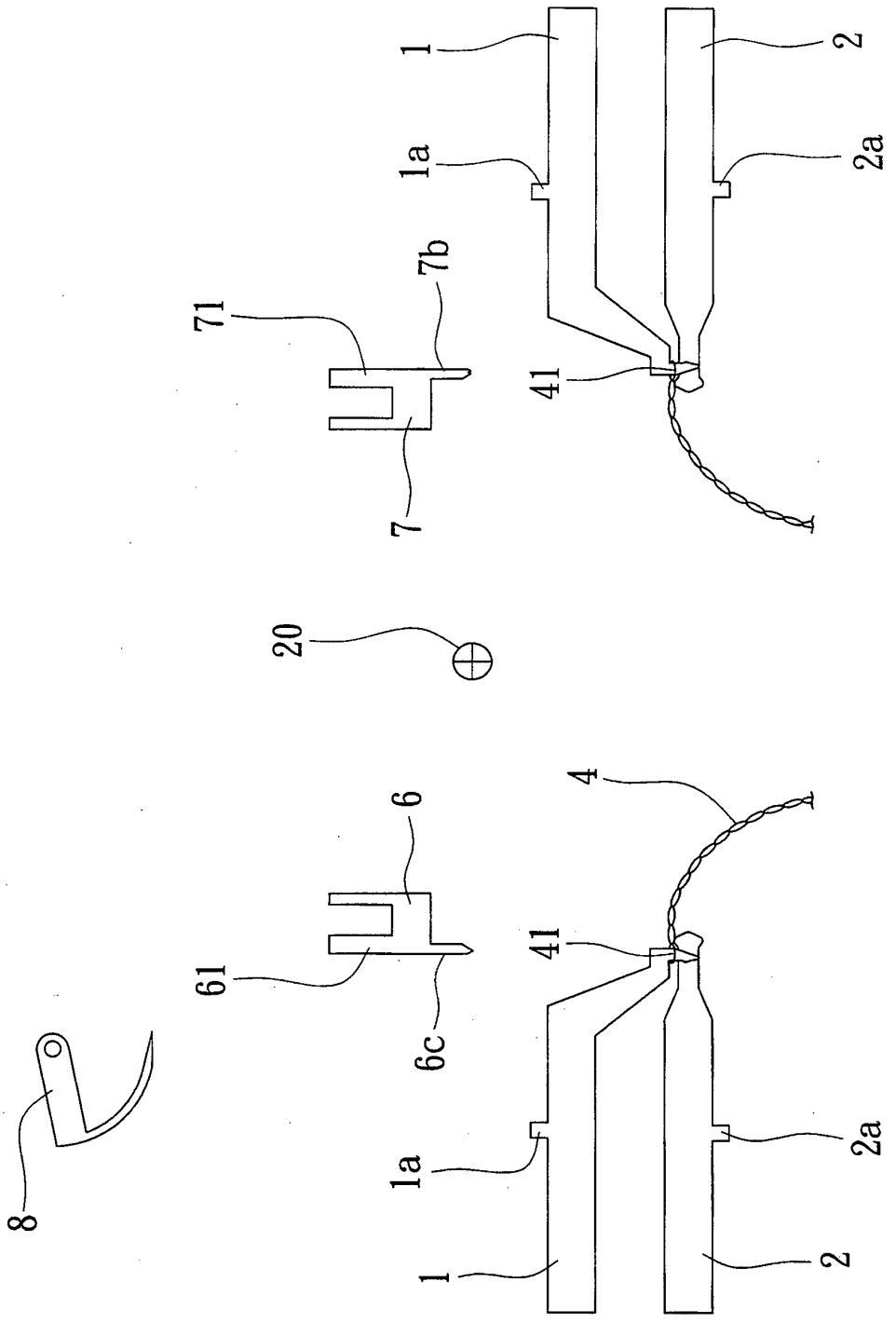



FIG. 12

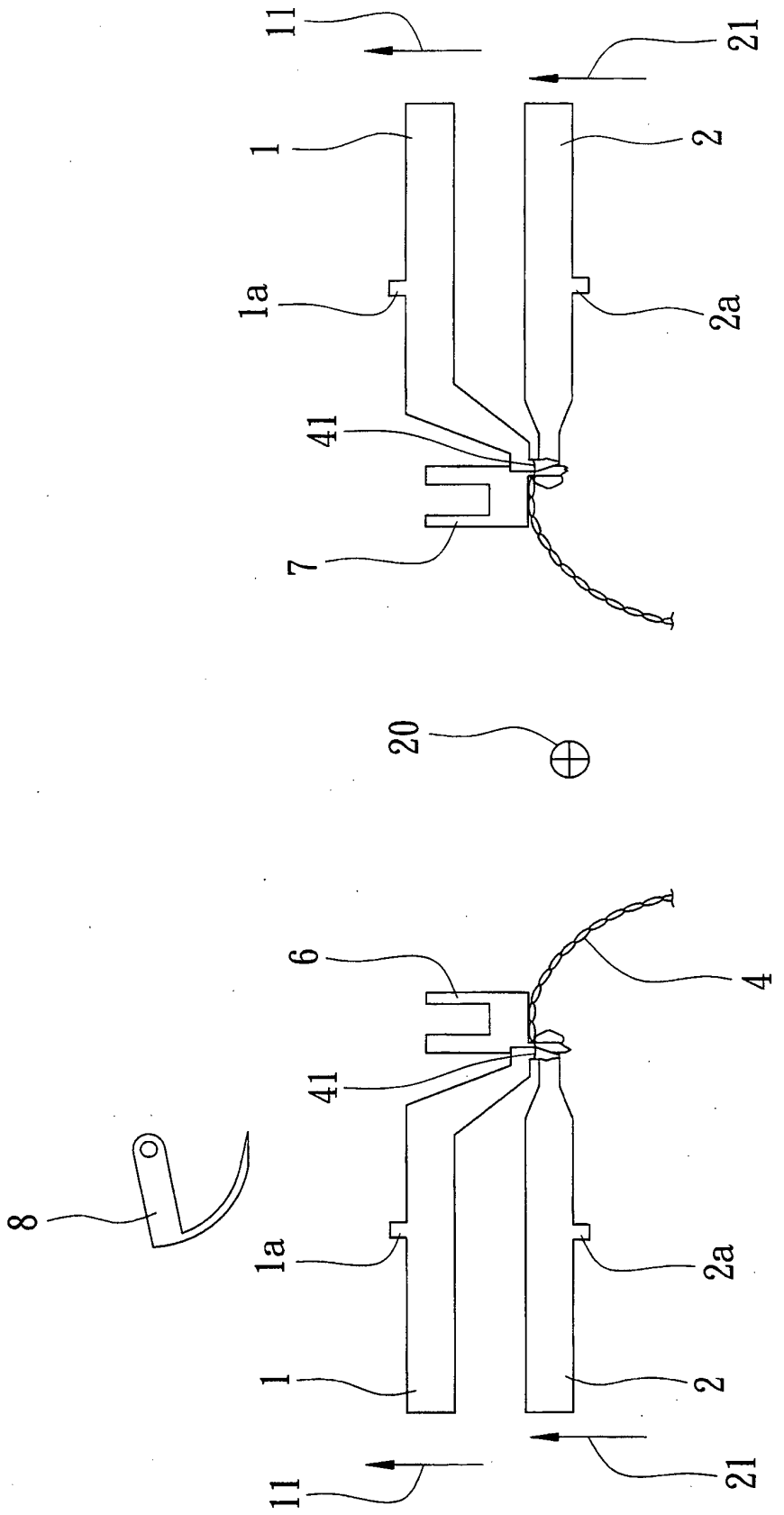



FIG. 13

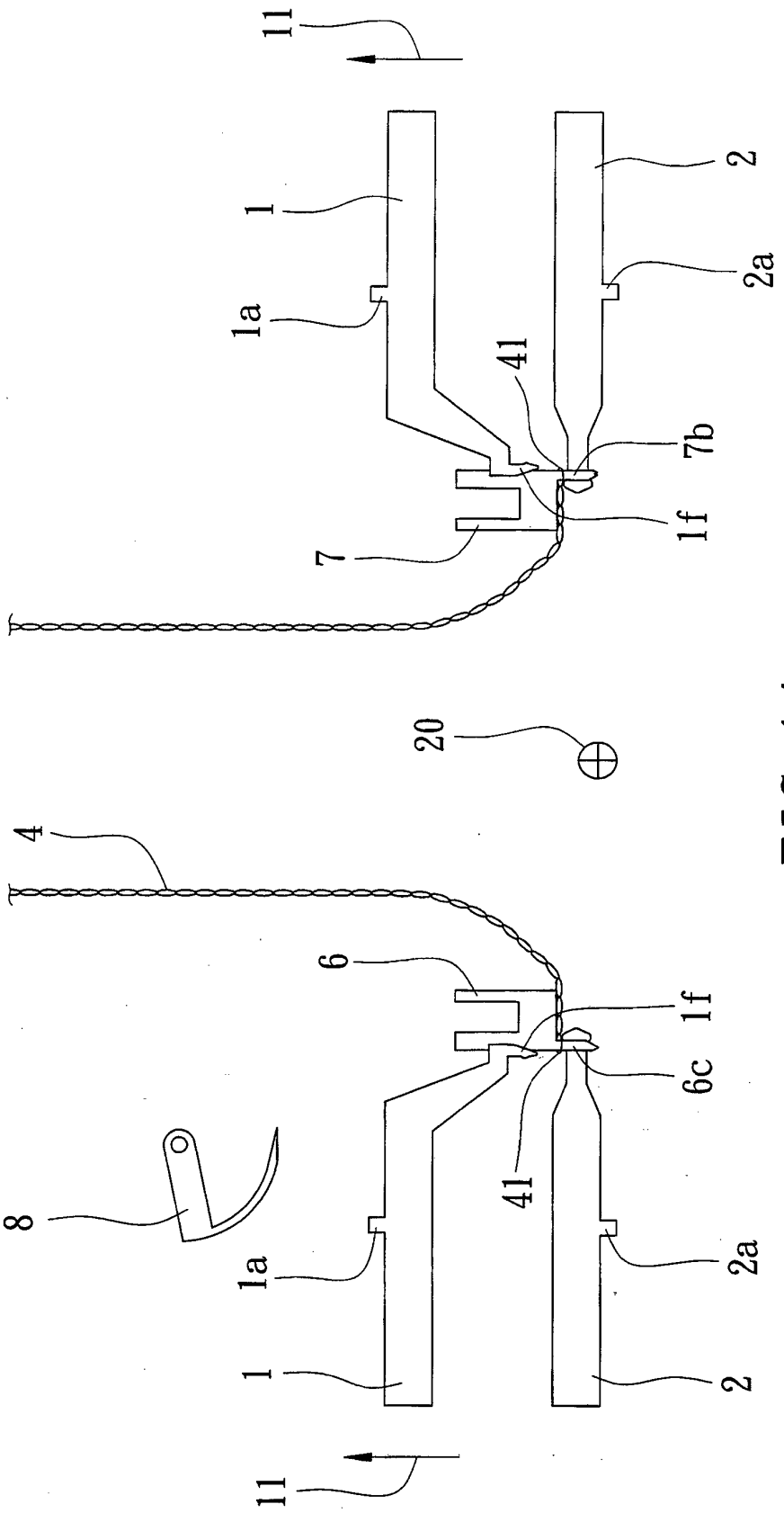



FIG. 14

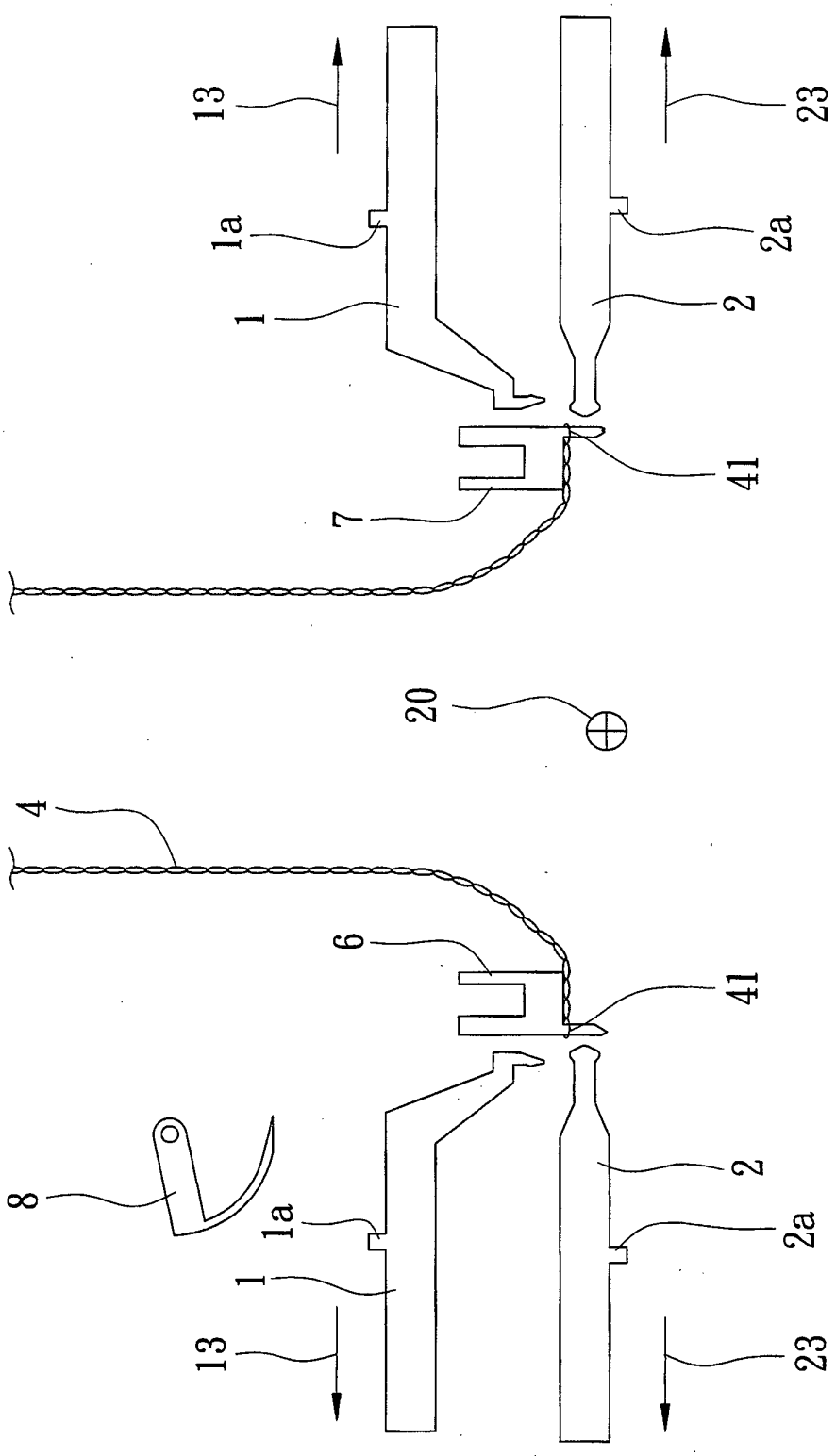



FIG. 15

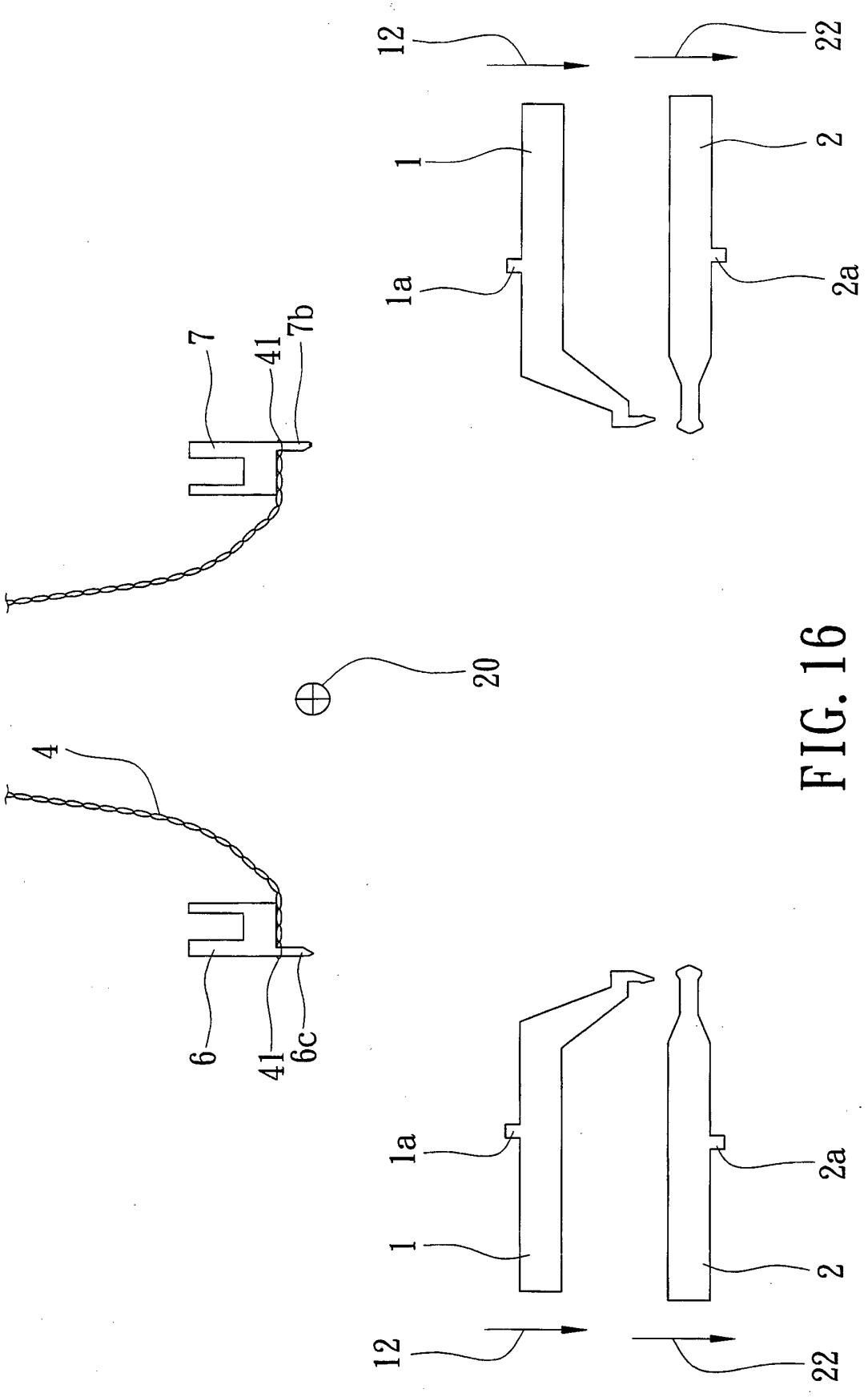



FIG. 16

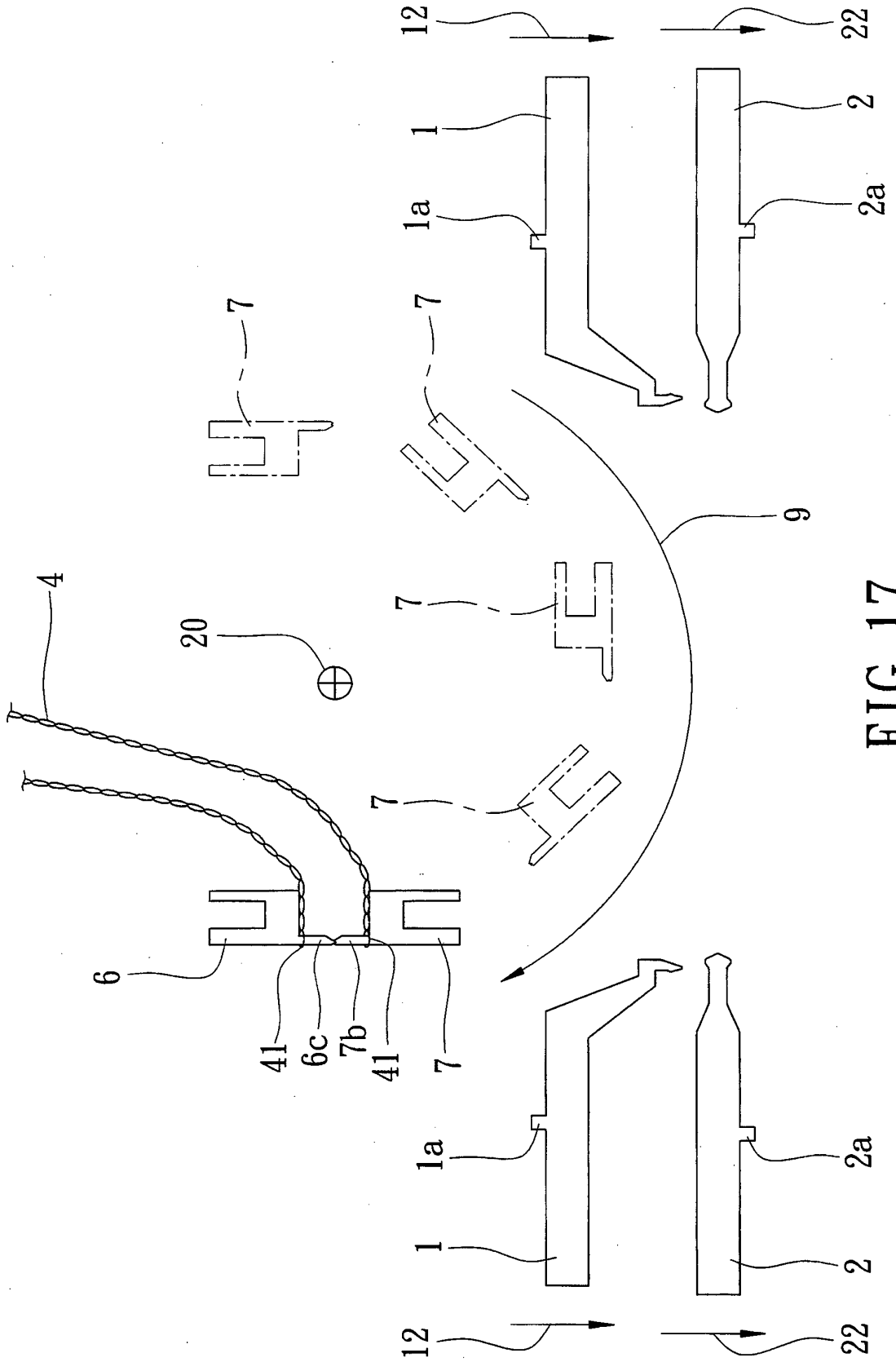



FIG. 17

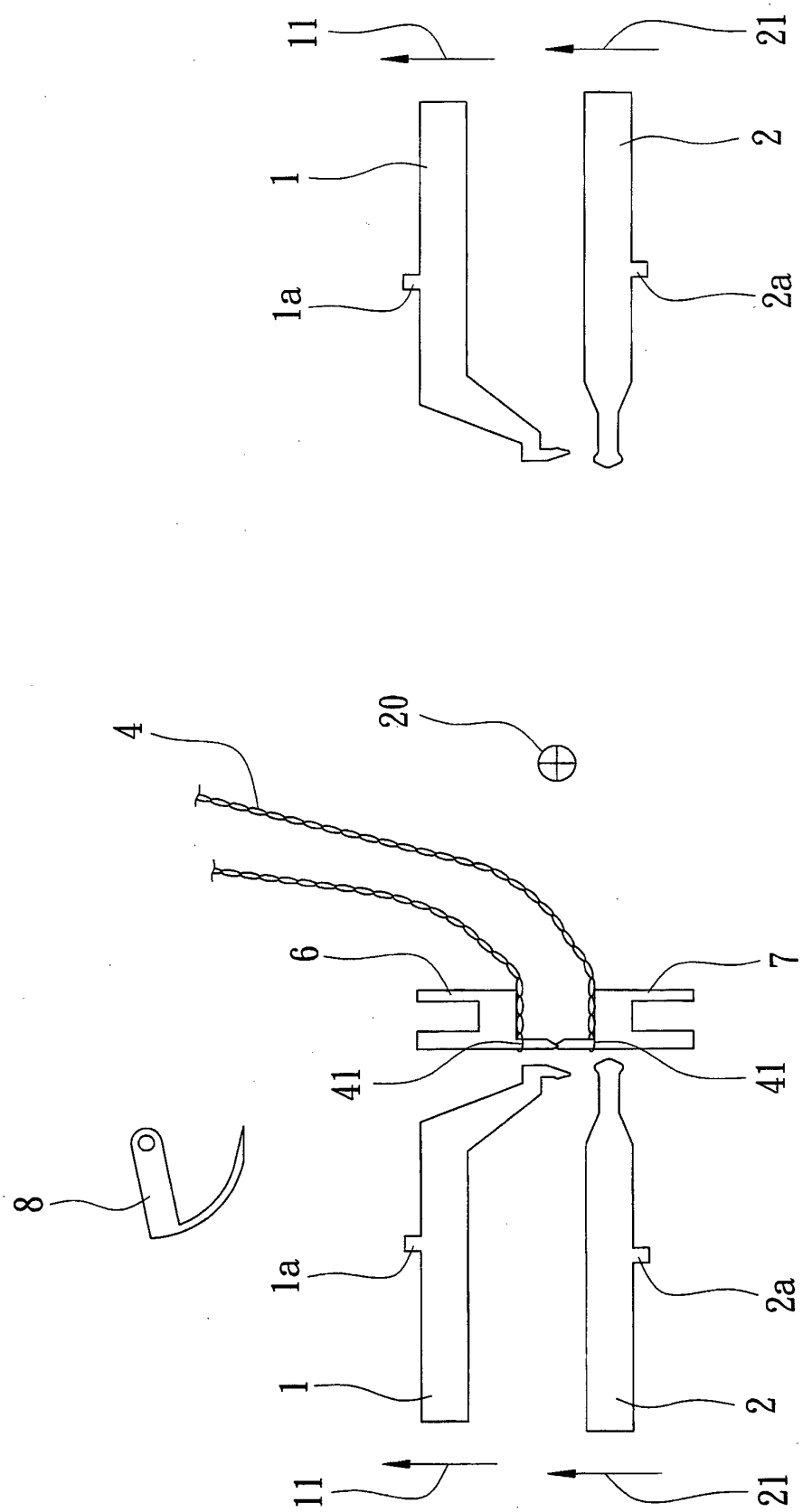



FIG. 18

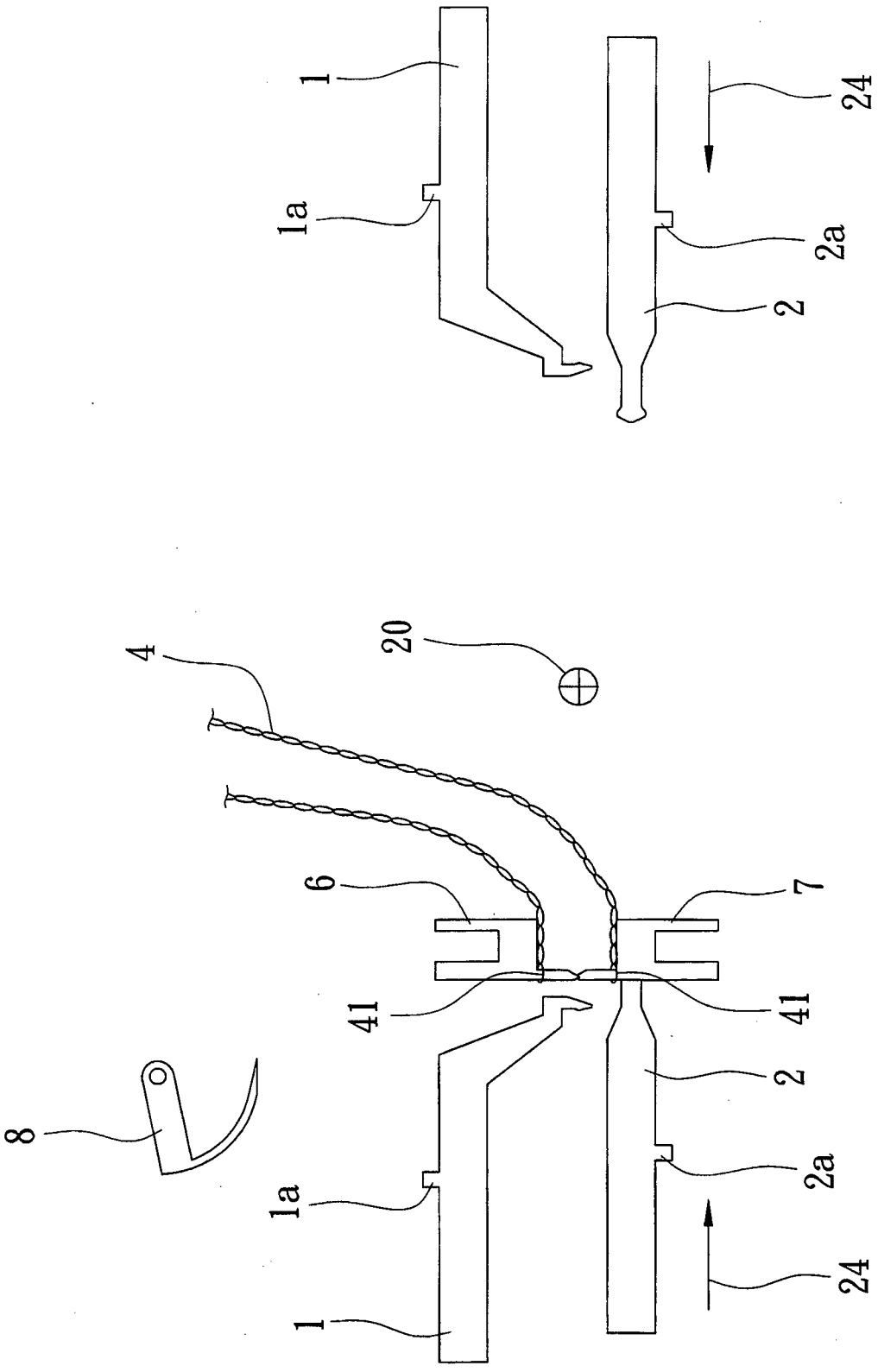



FIG. 19

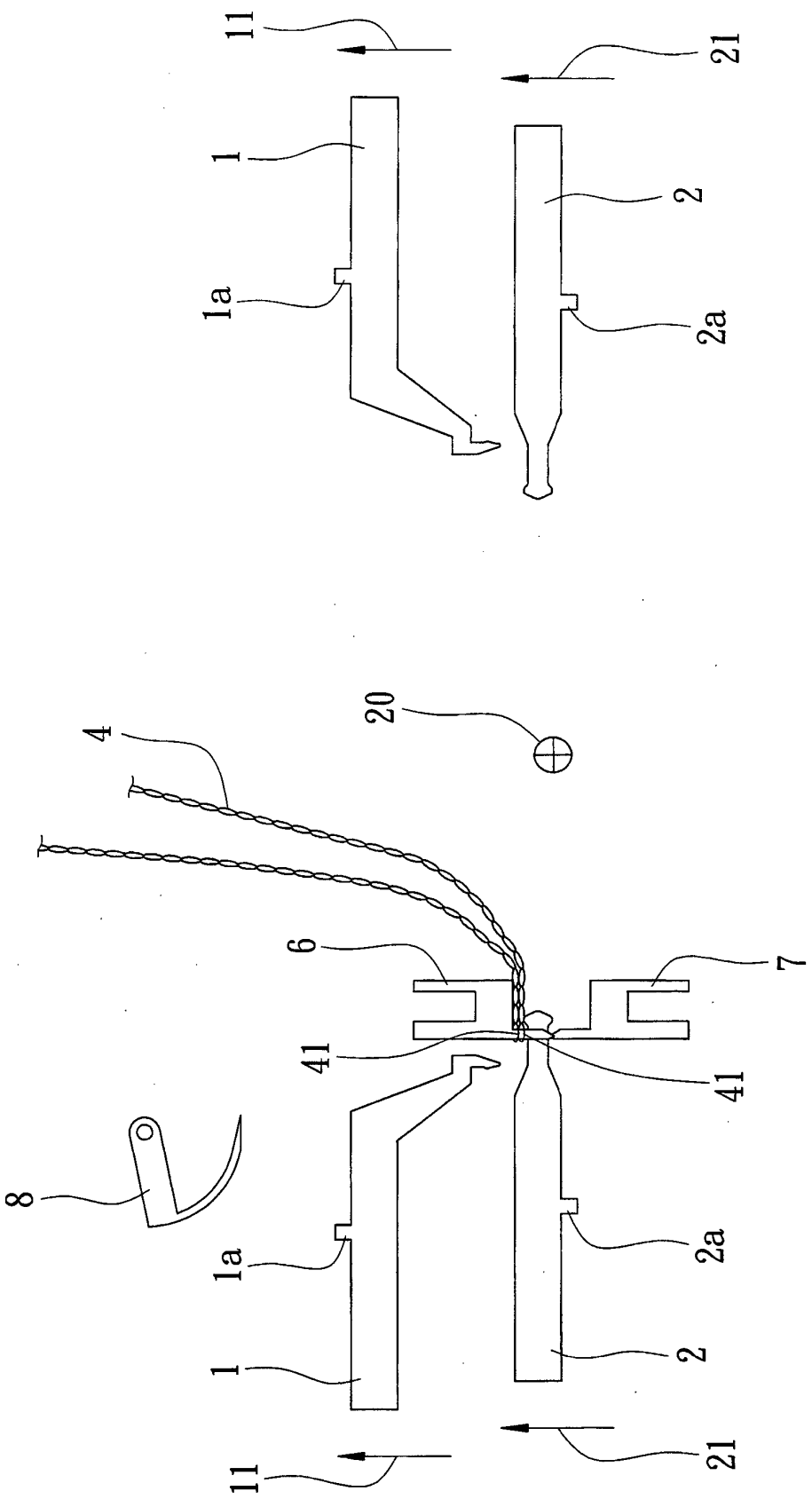



FIG. 20

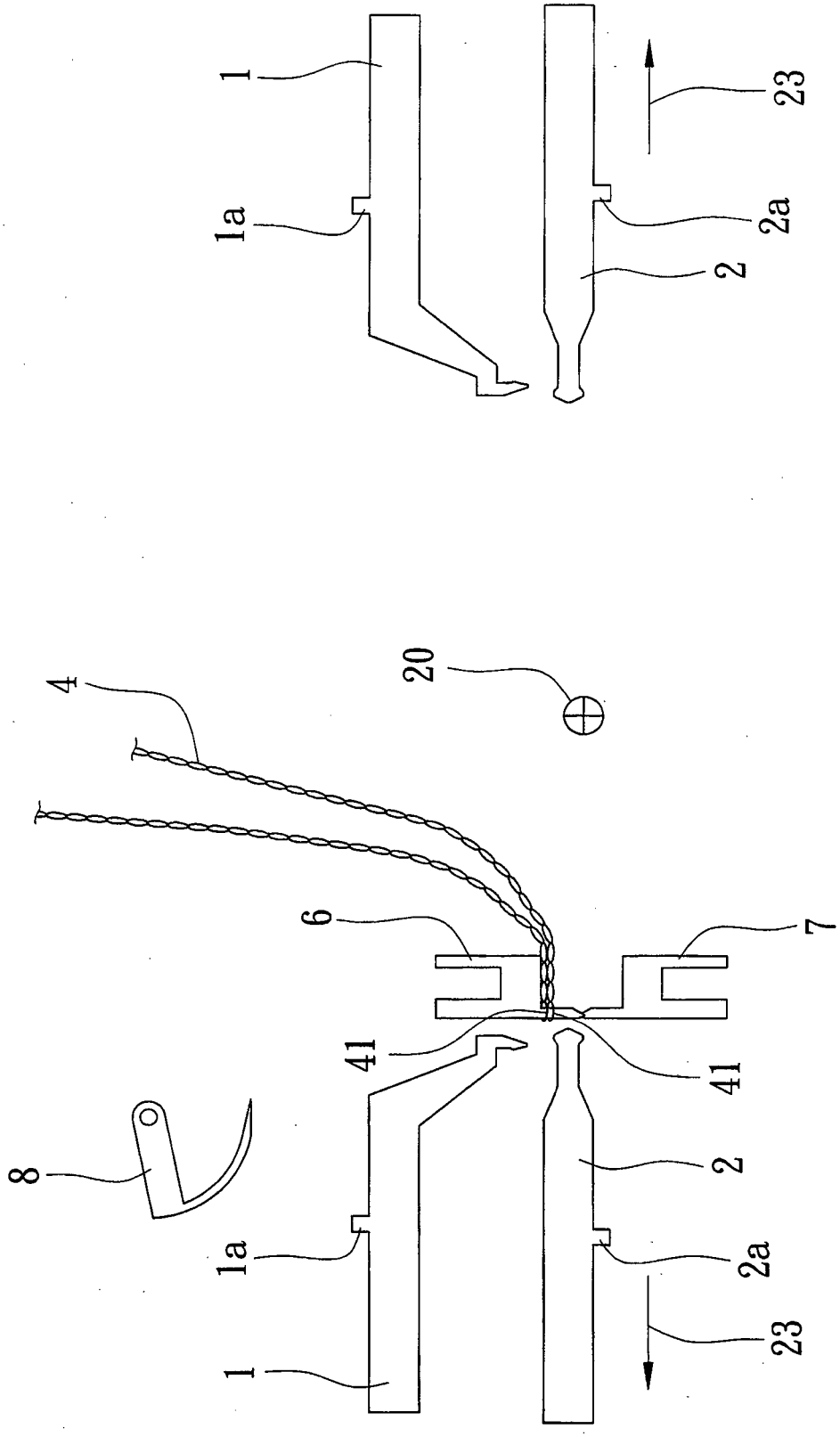



FIG. 21

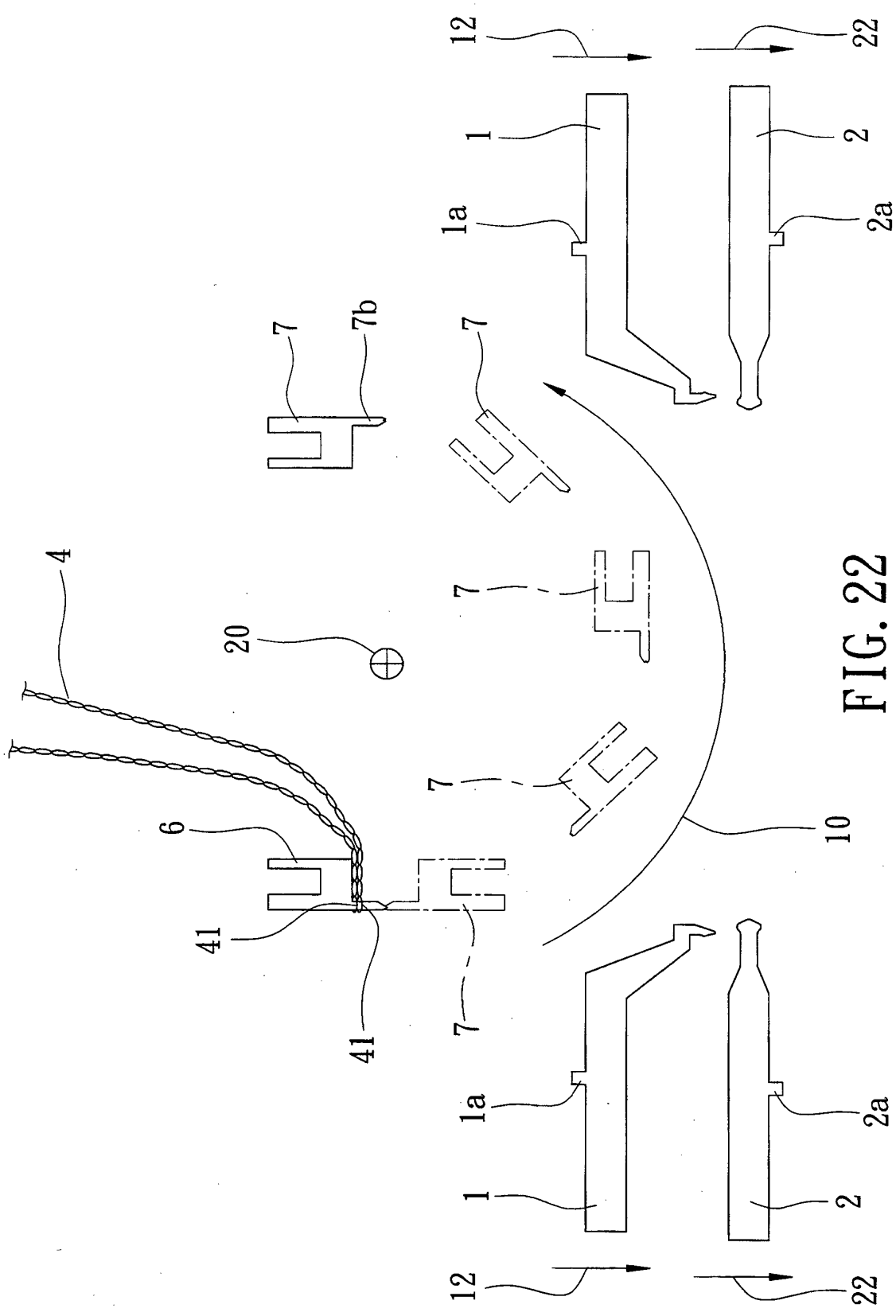



FIG. 22

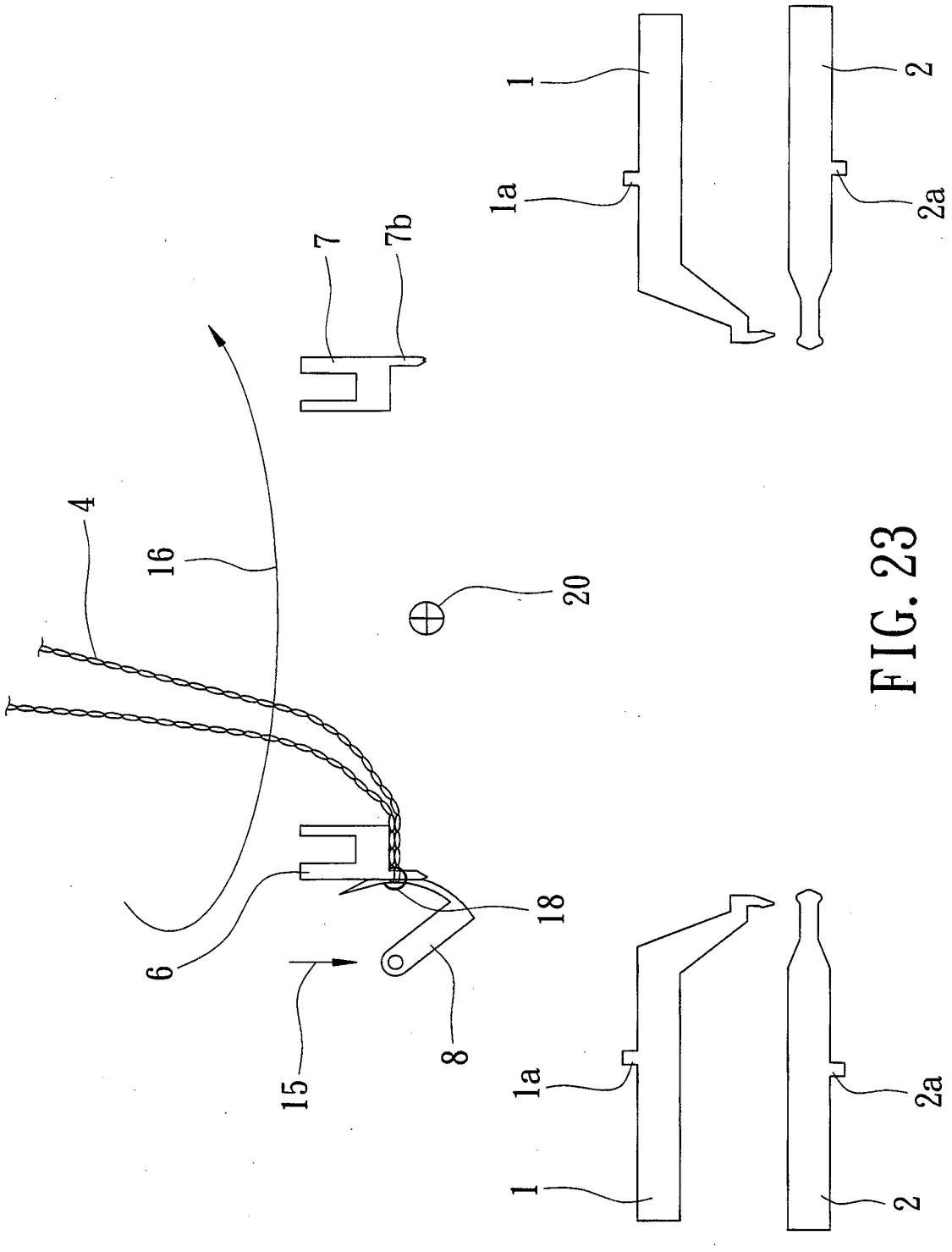



FIG. 23

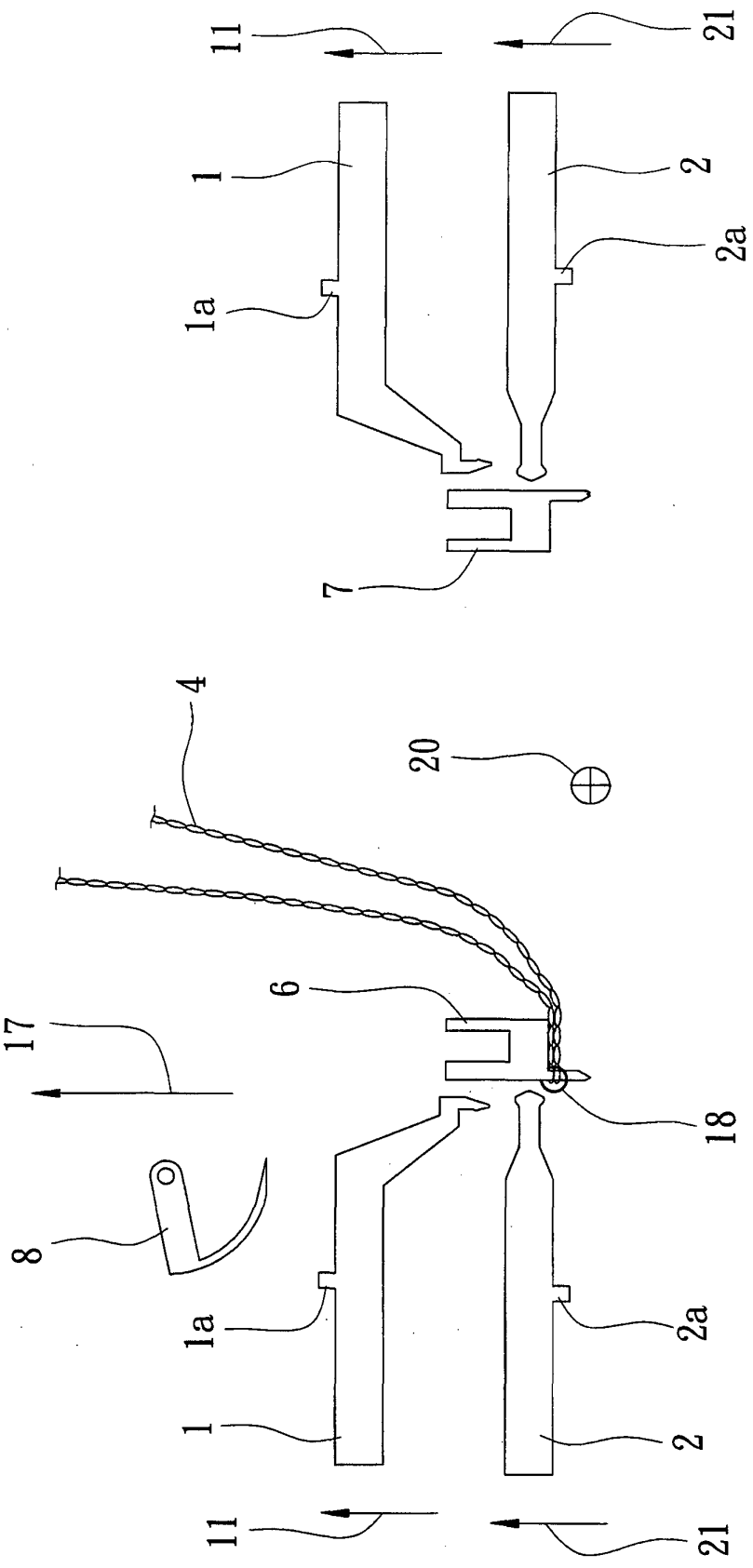



FIG. 24

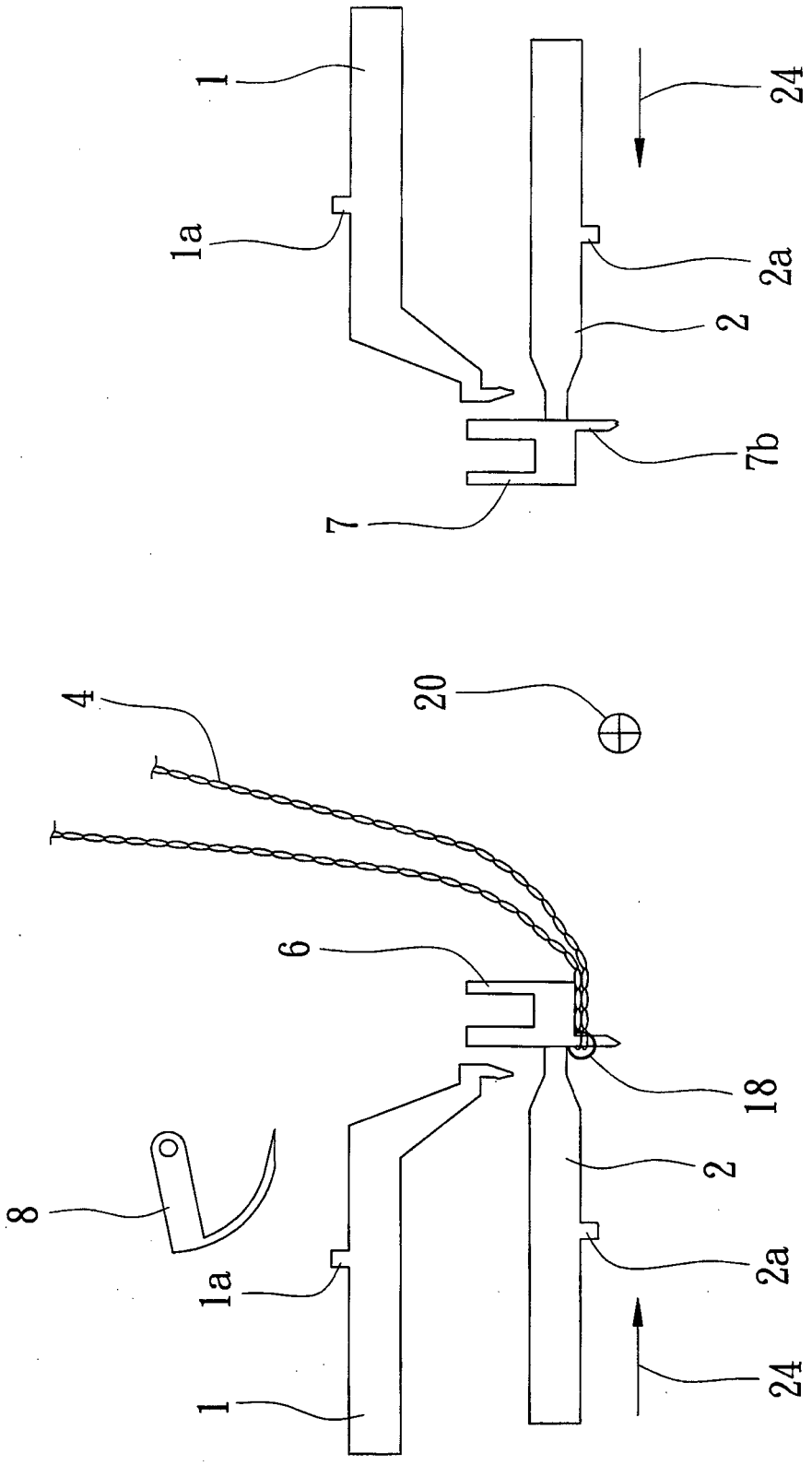



FIG. 25

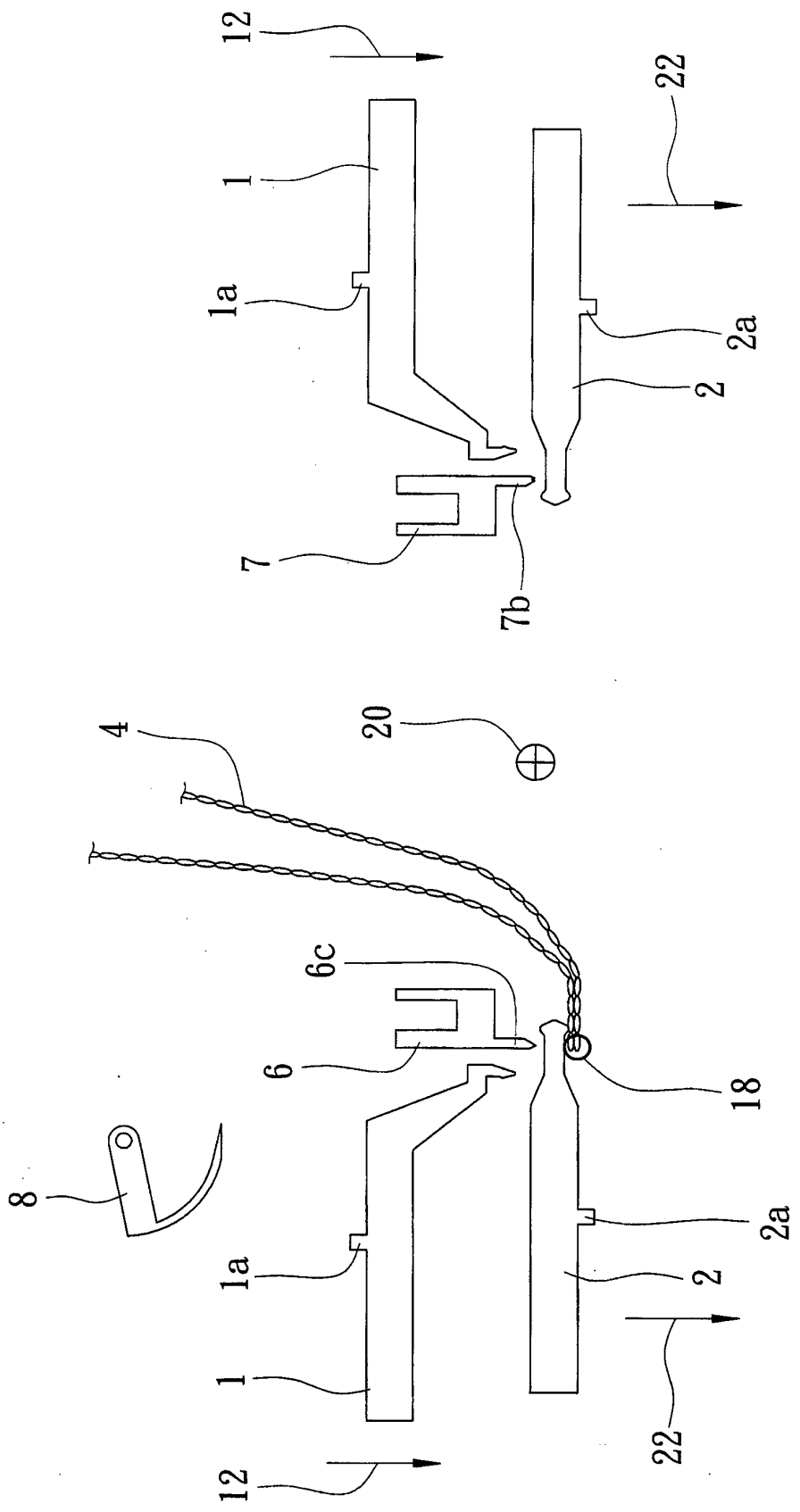



FIG. 26

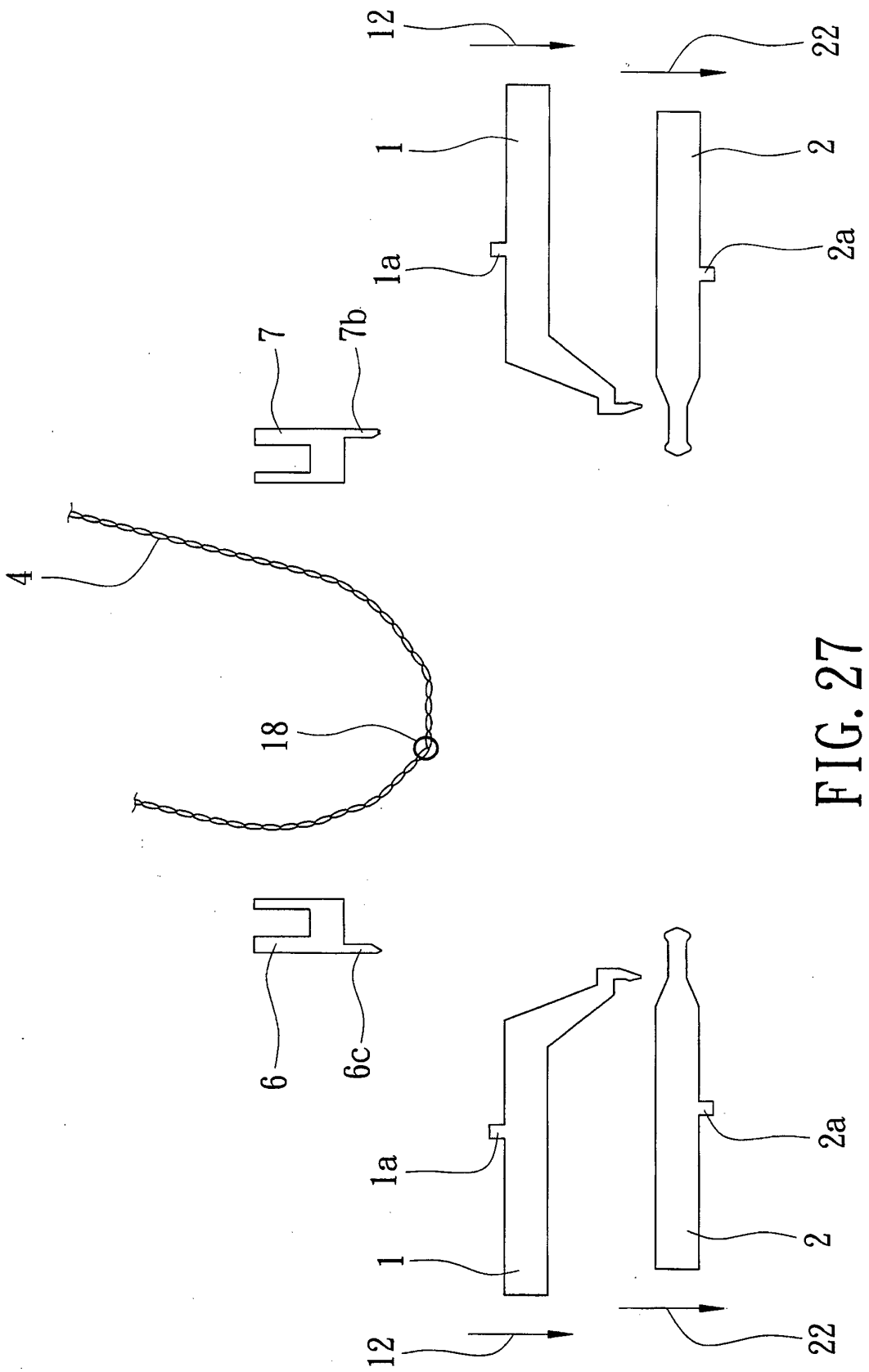



FIG. 27

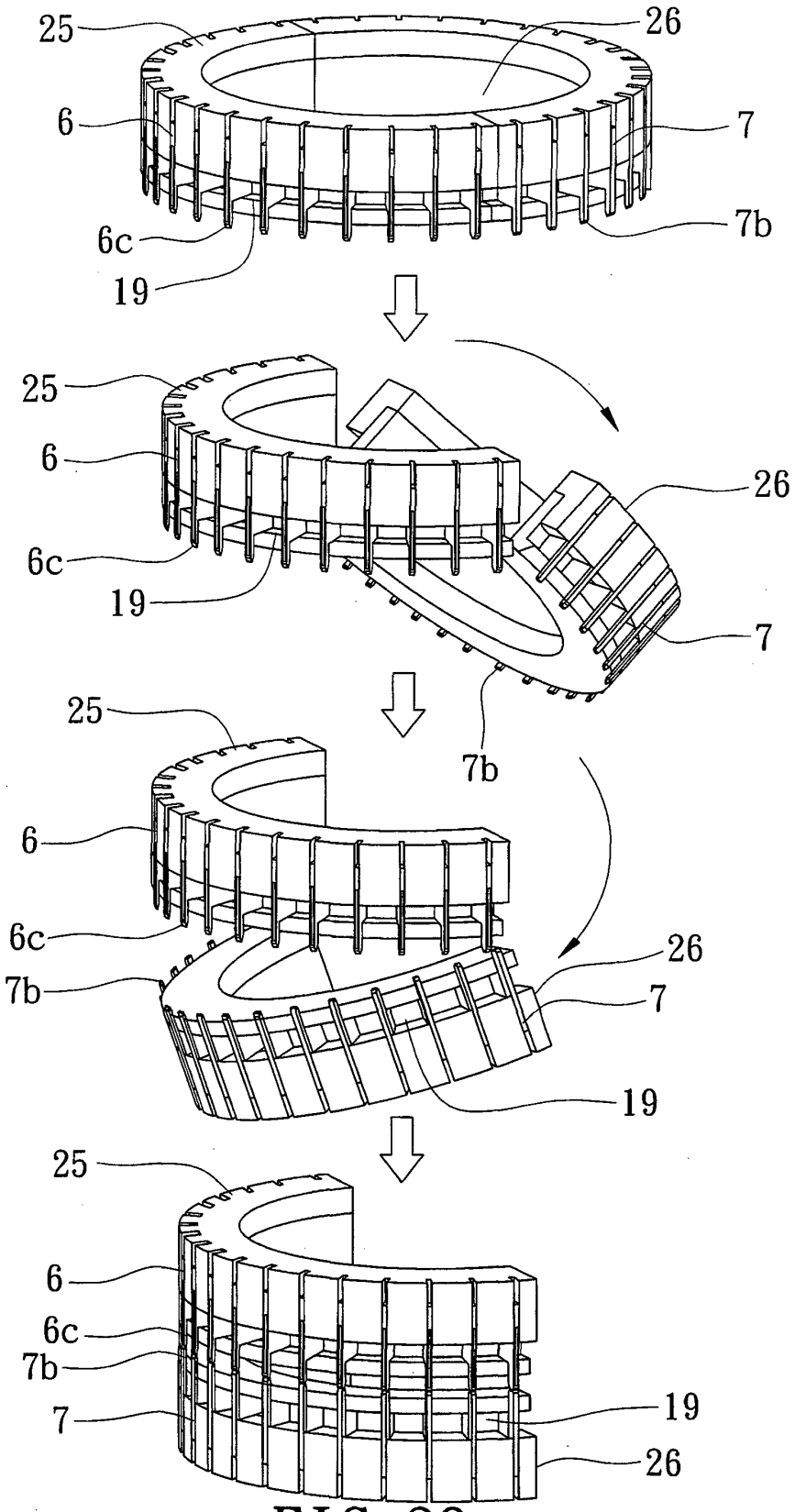



FIG. 28

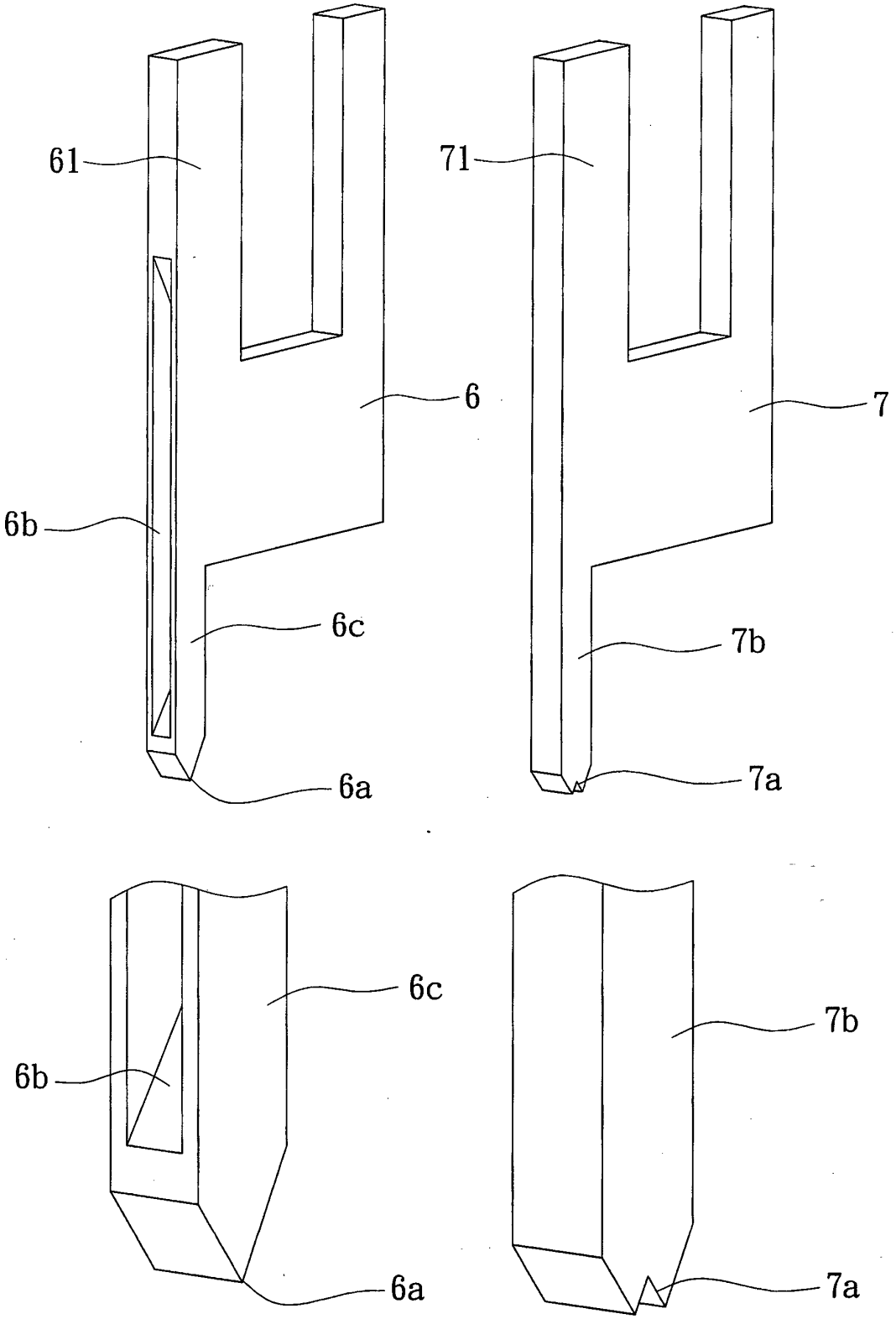



FIG. 29

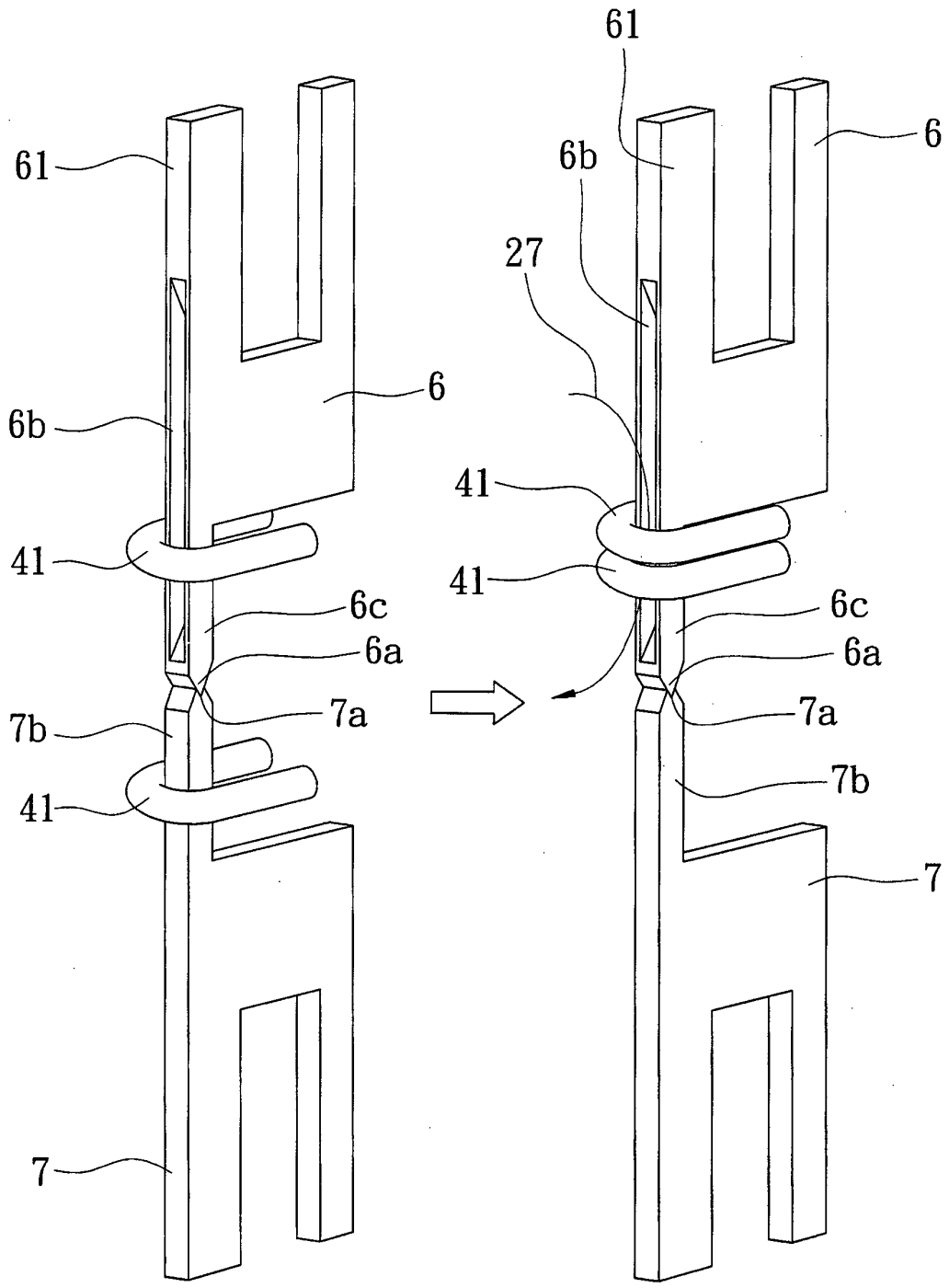



FIG. 30

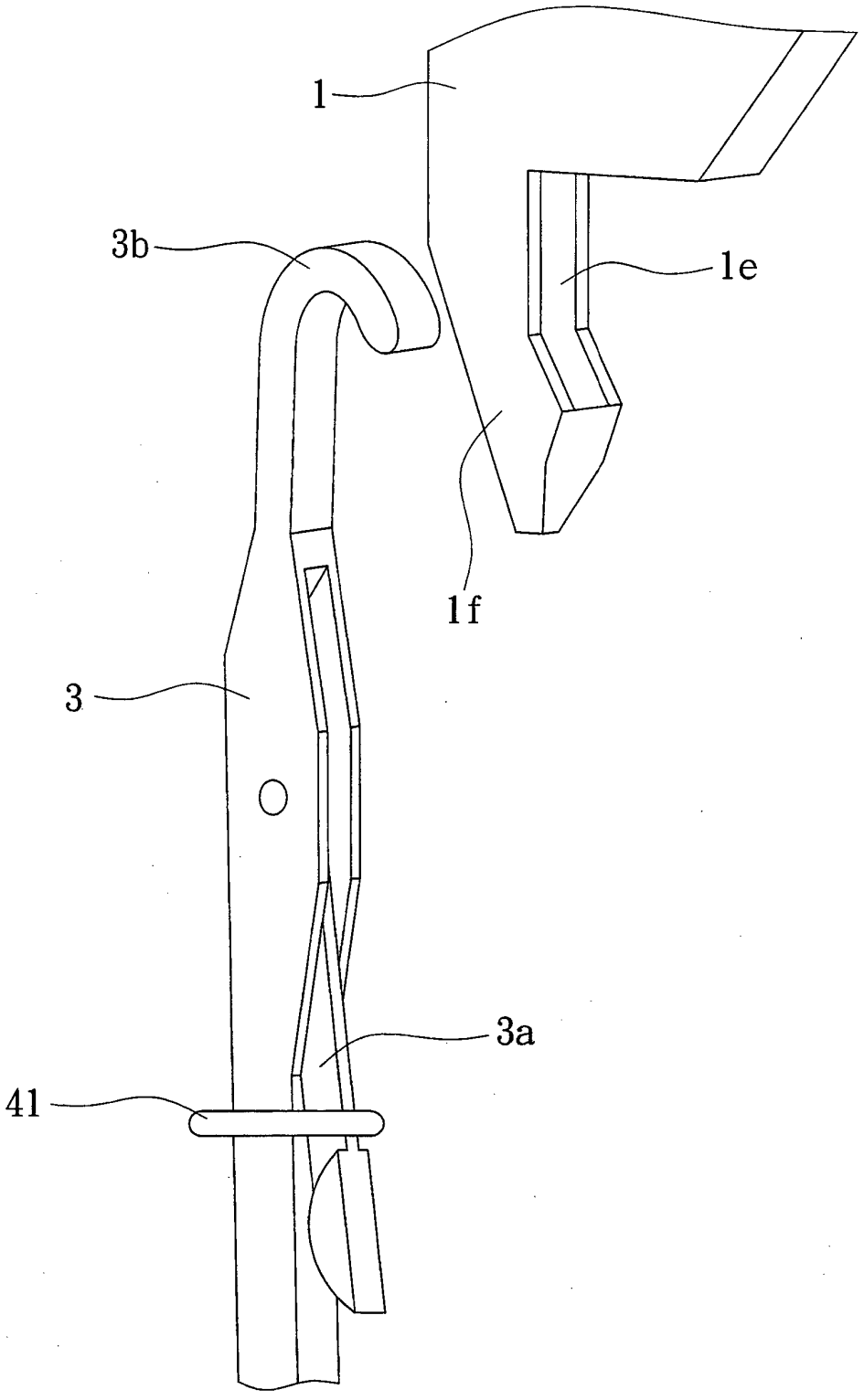



FIG. 31

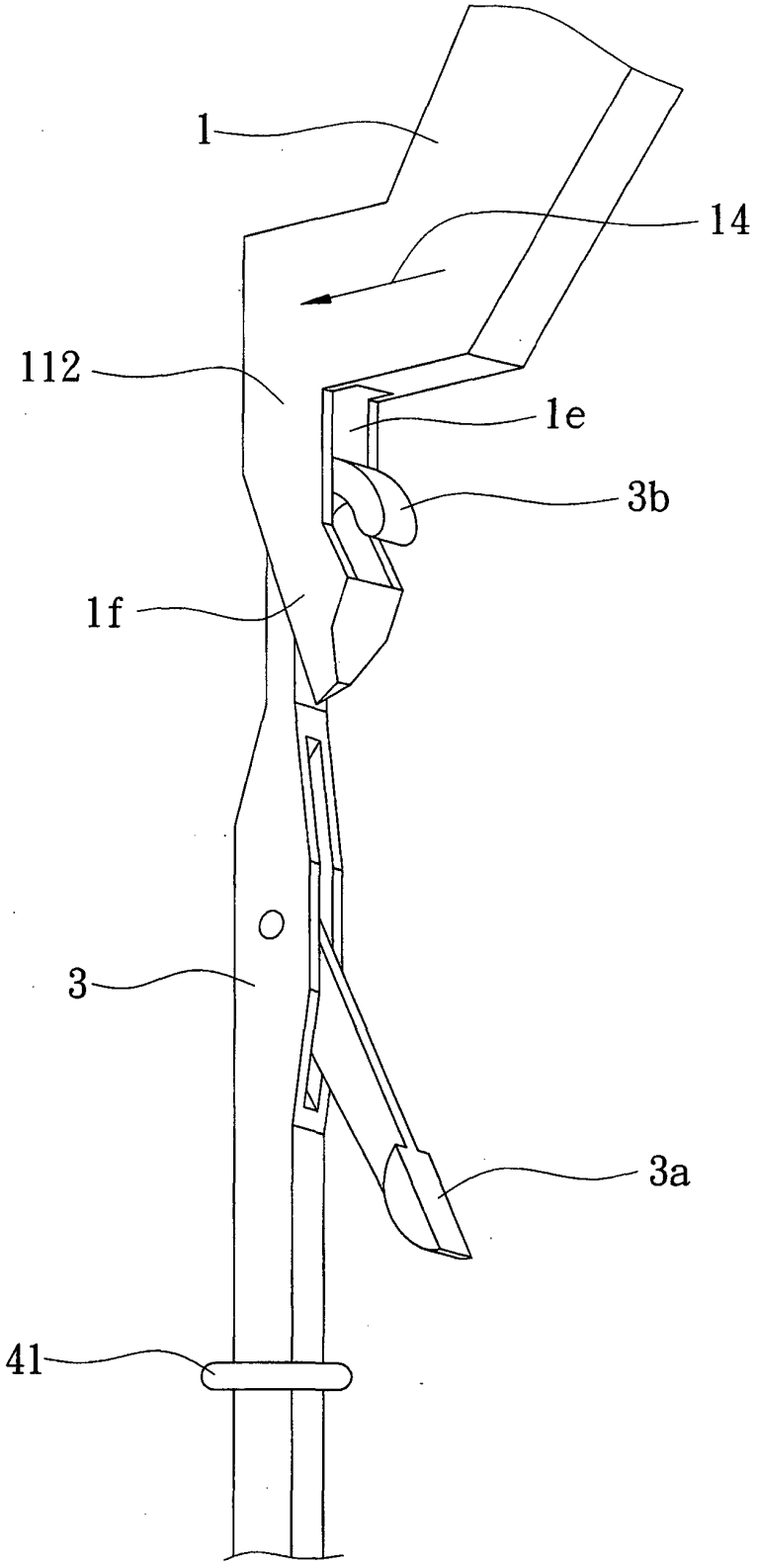



FIG. 32

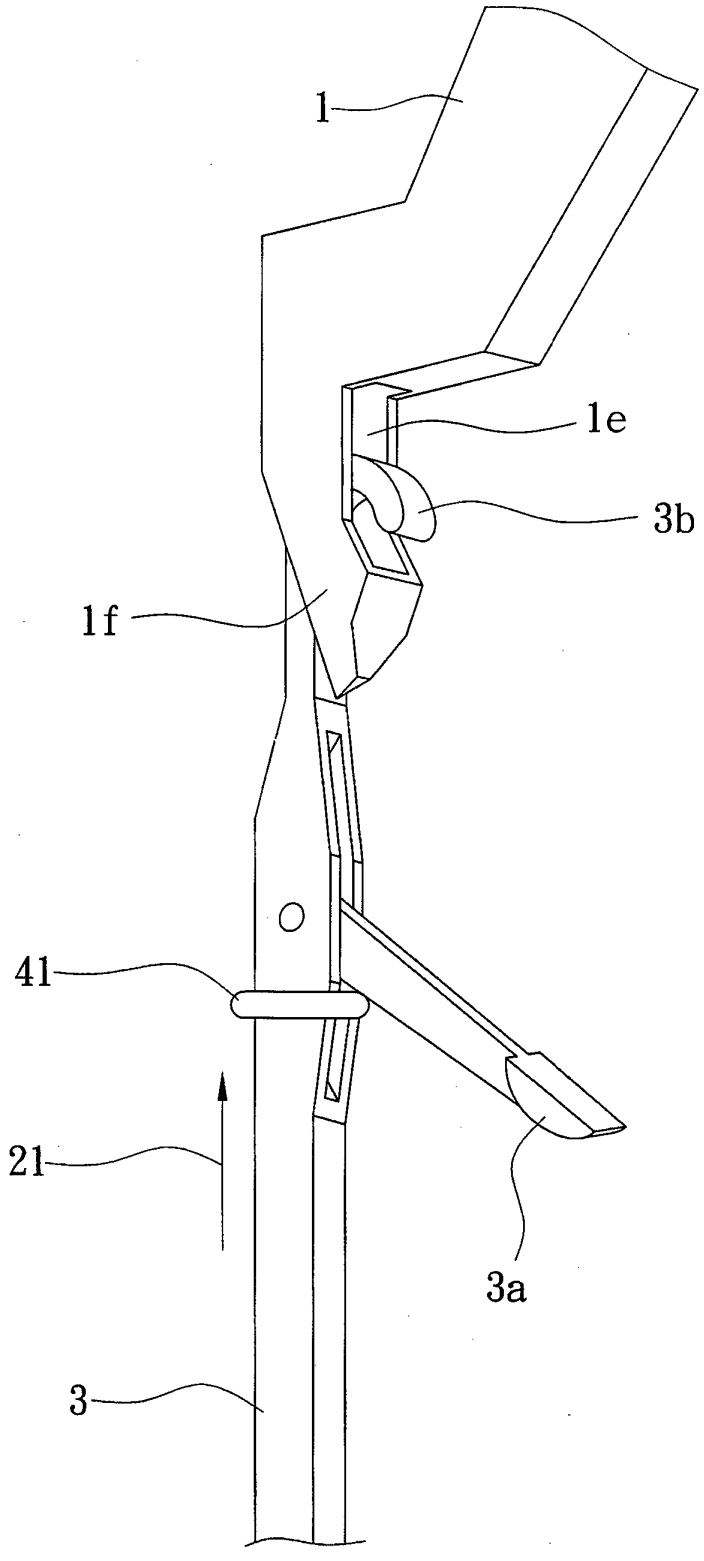



FIG. 33

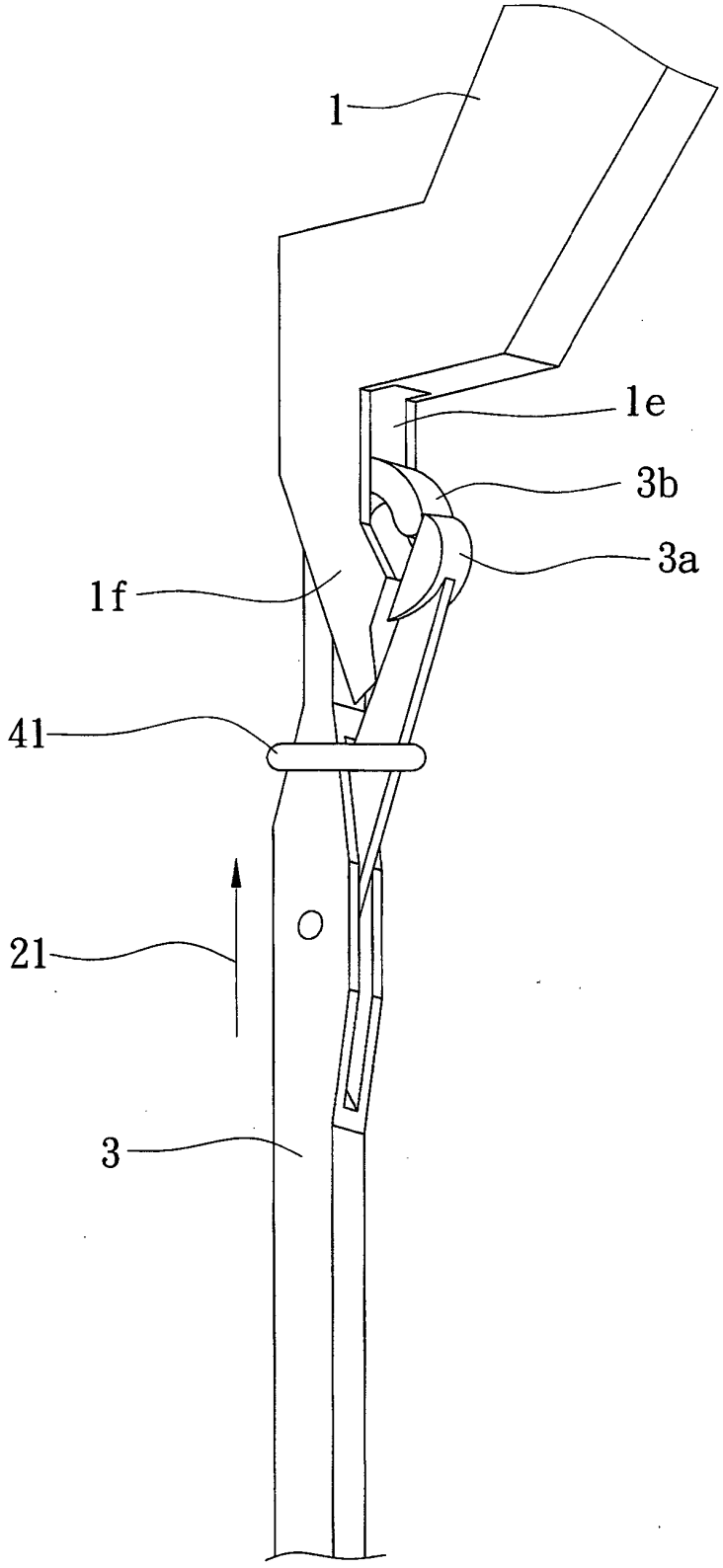



FIG. 34

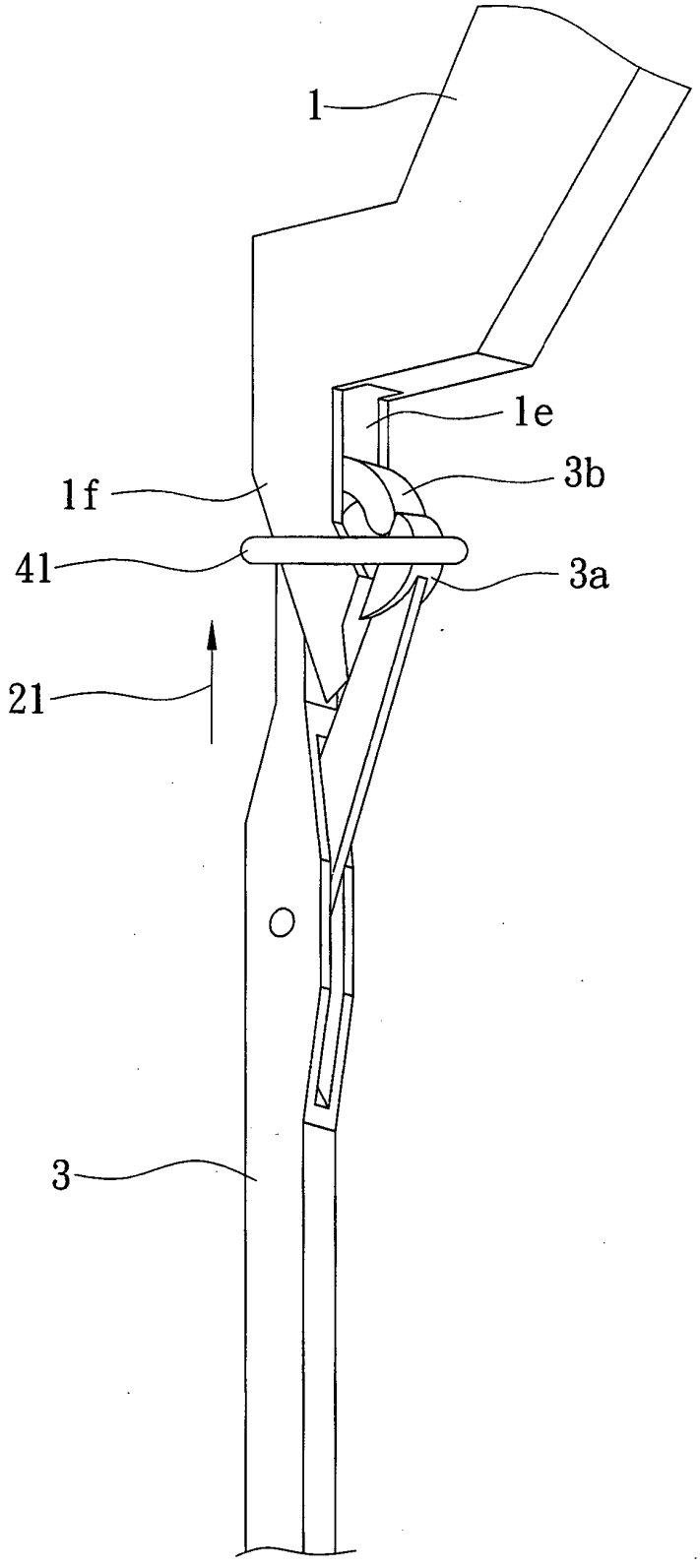



FIG. 35

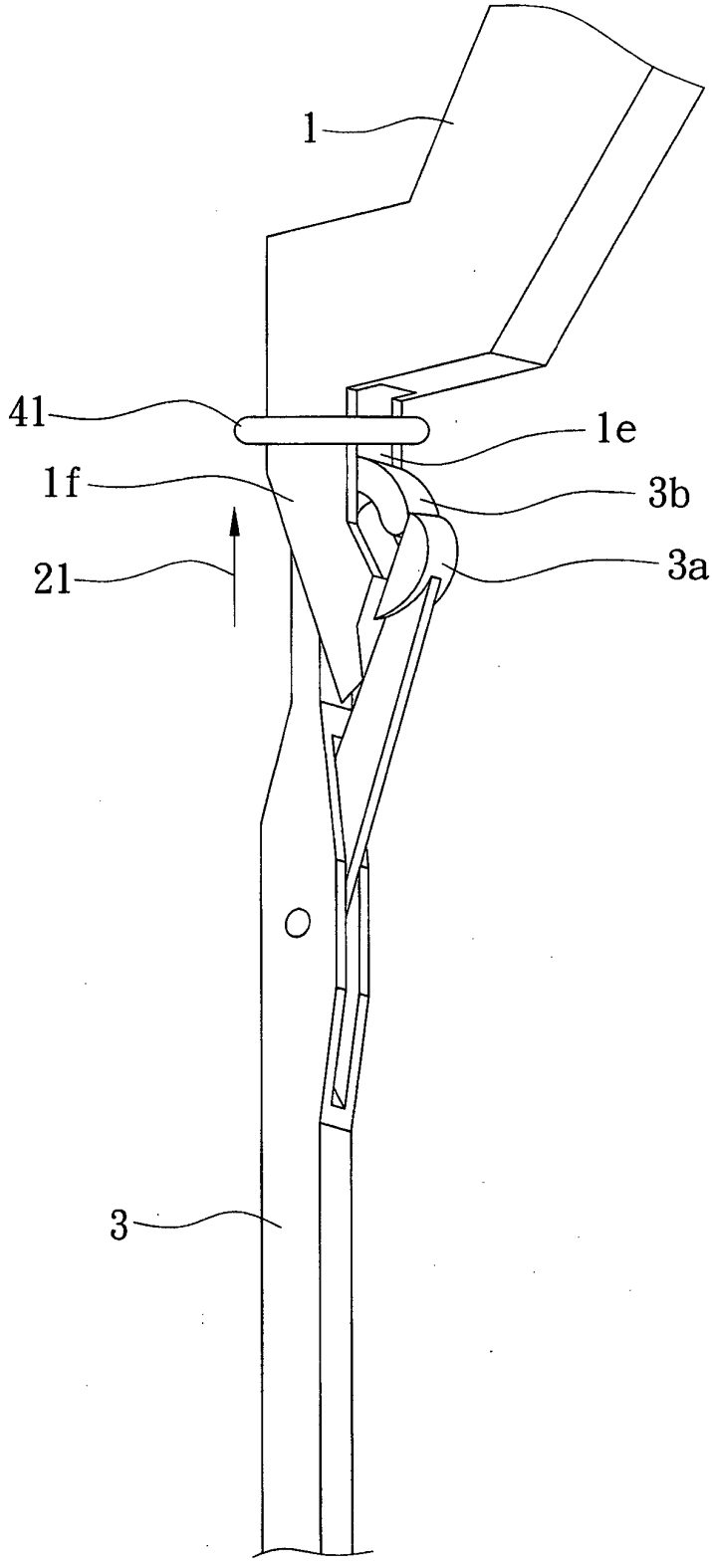



FIG. 36

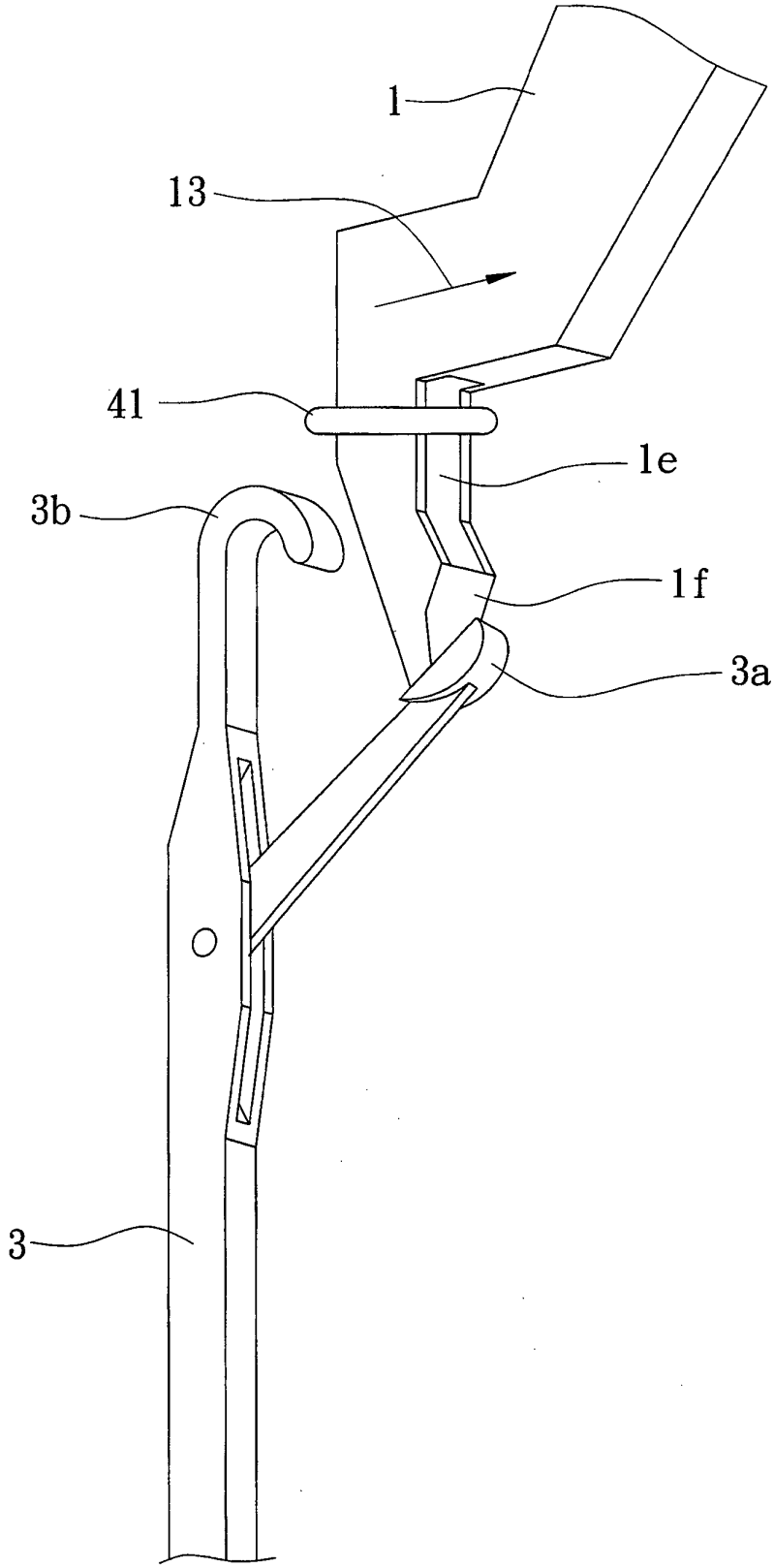



FIG. 37

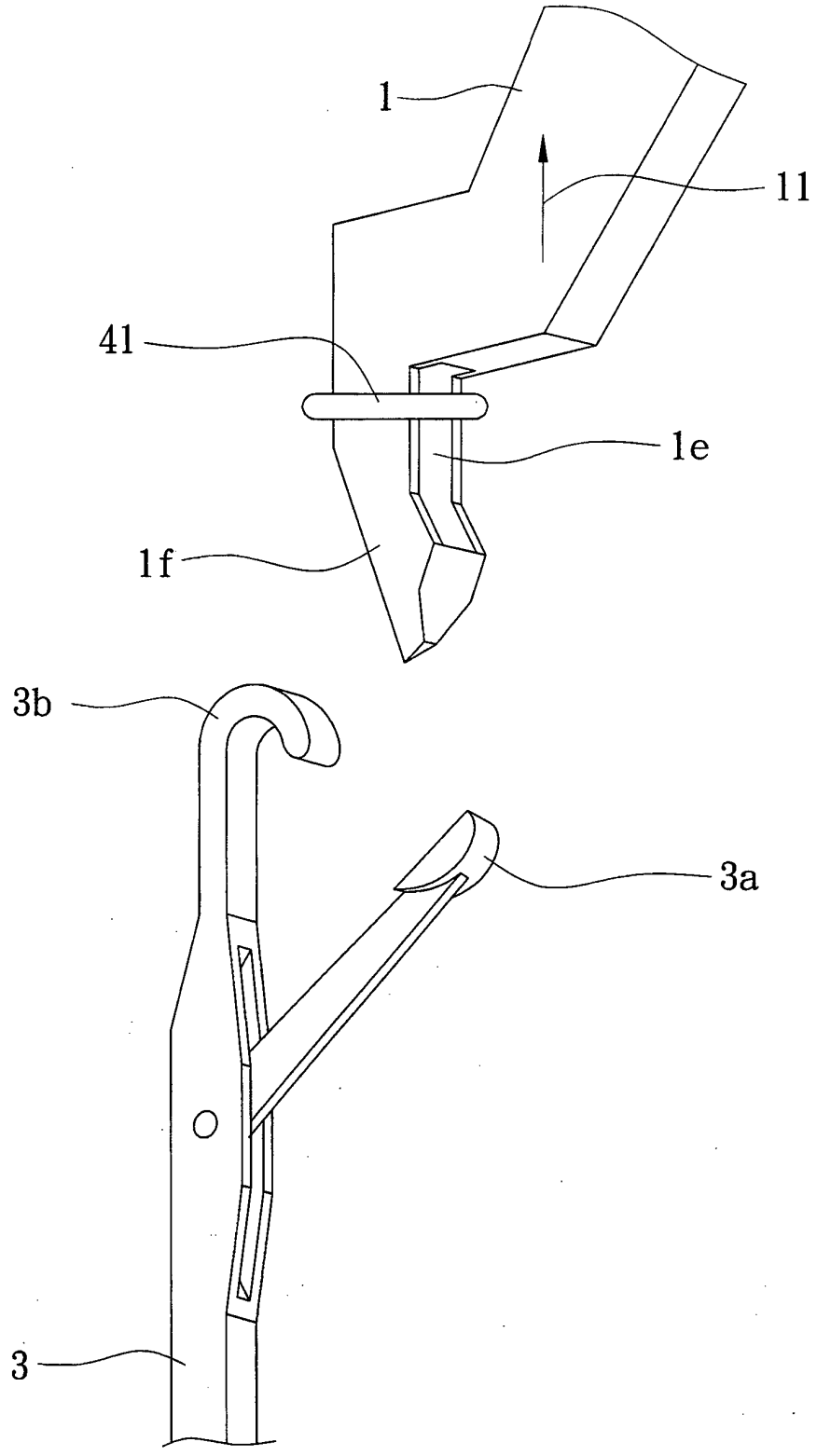



FIG. 38

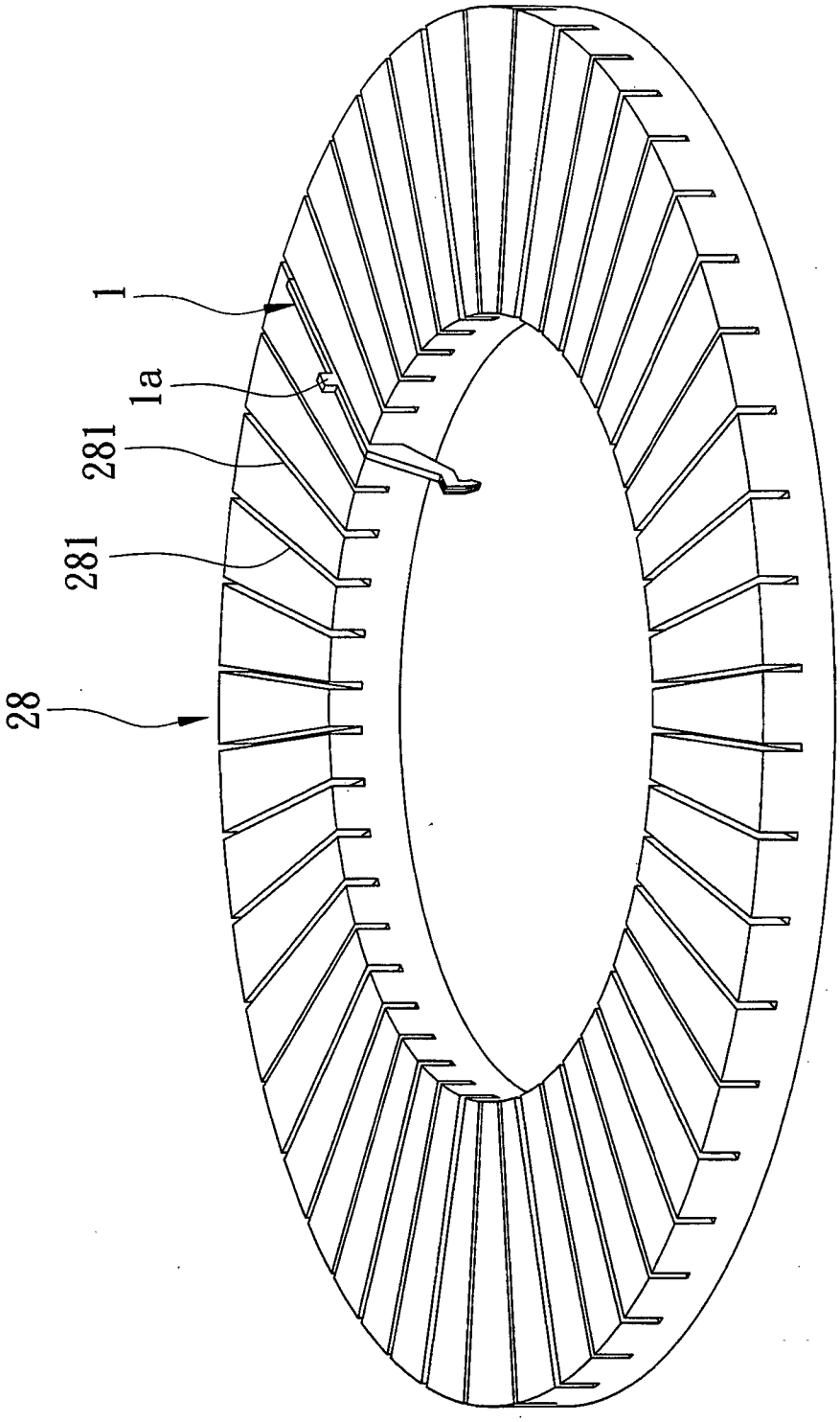



FIG. 39

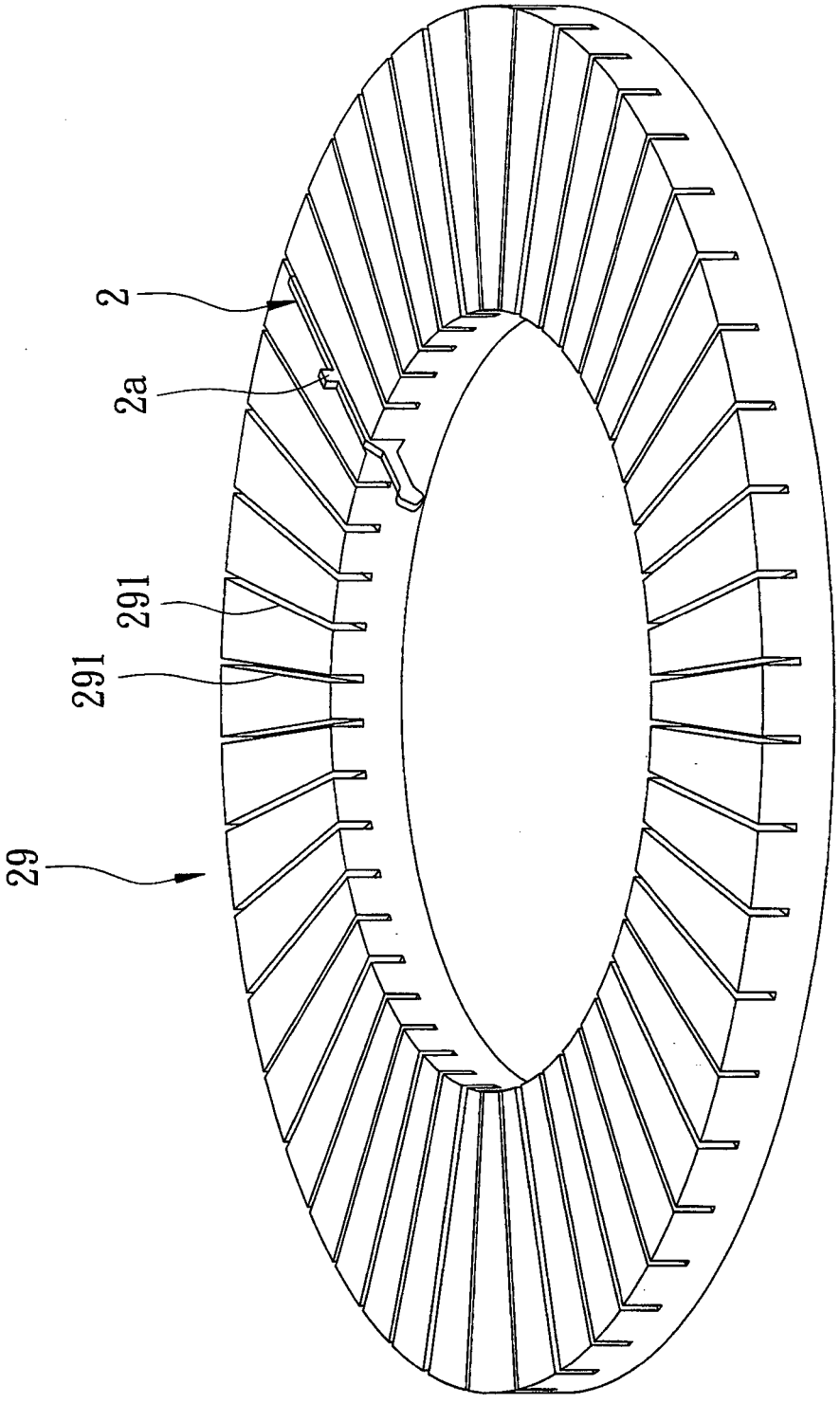



FIG. 40

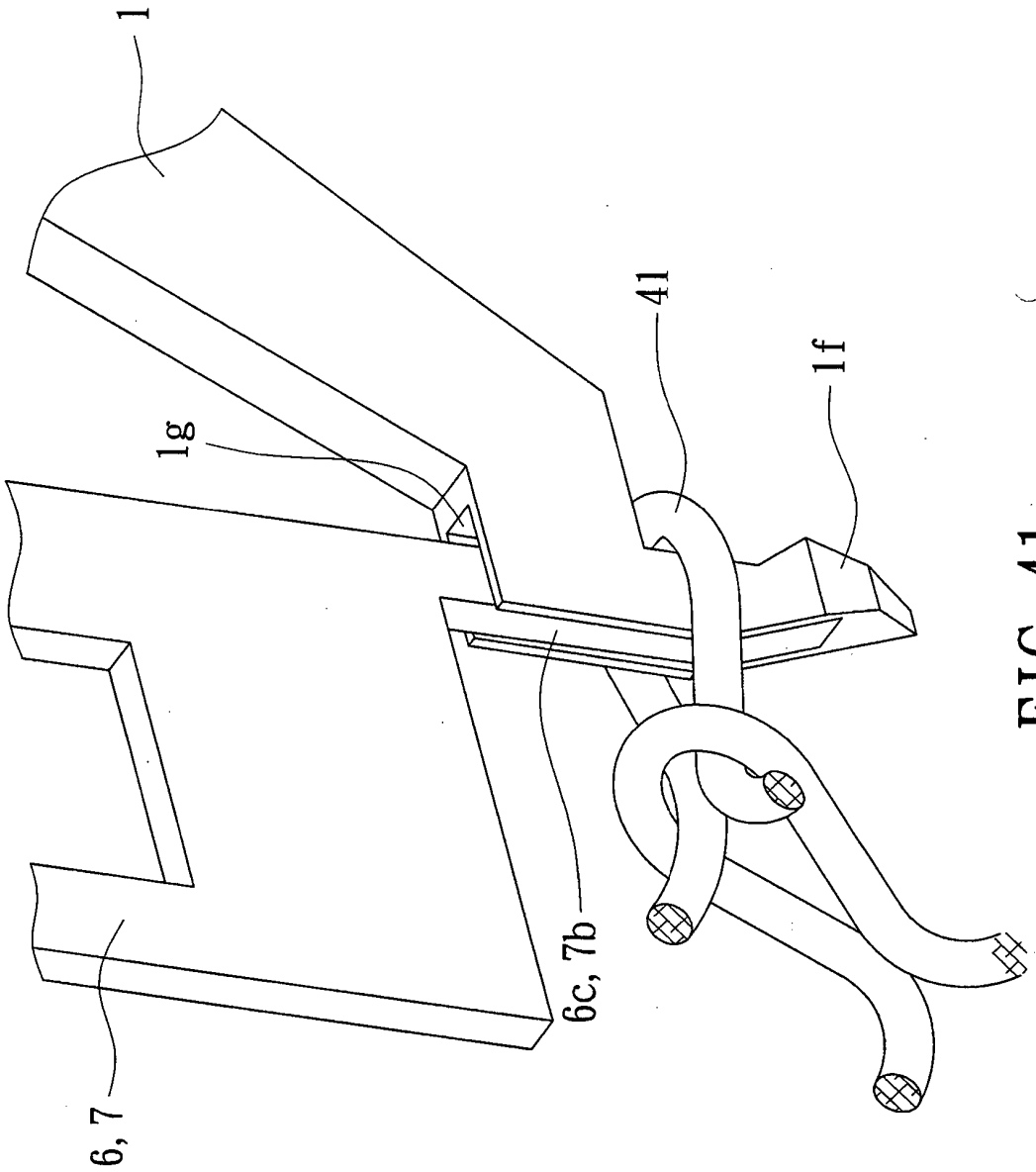



FIG. 41

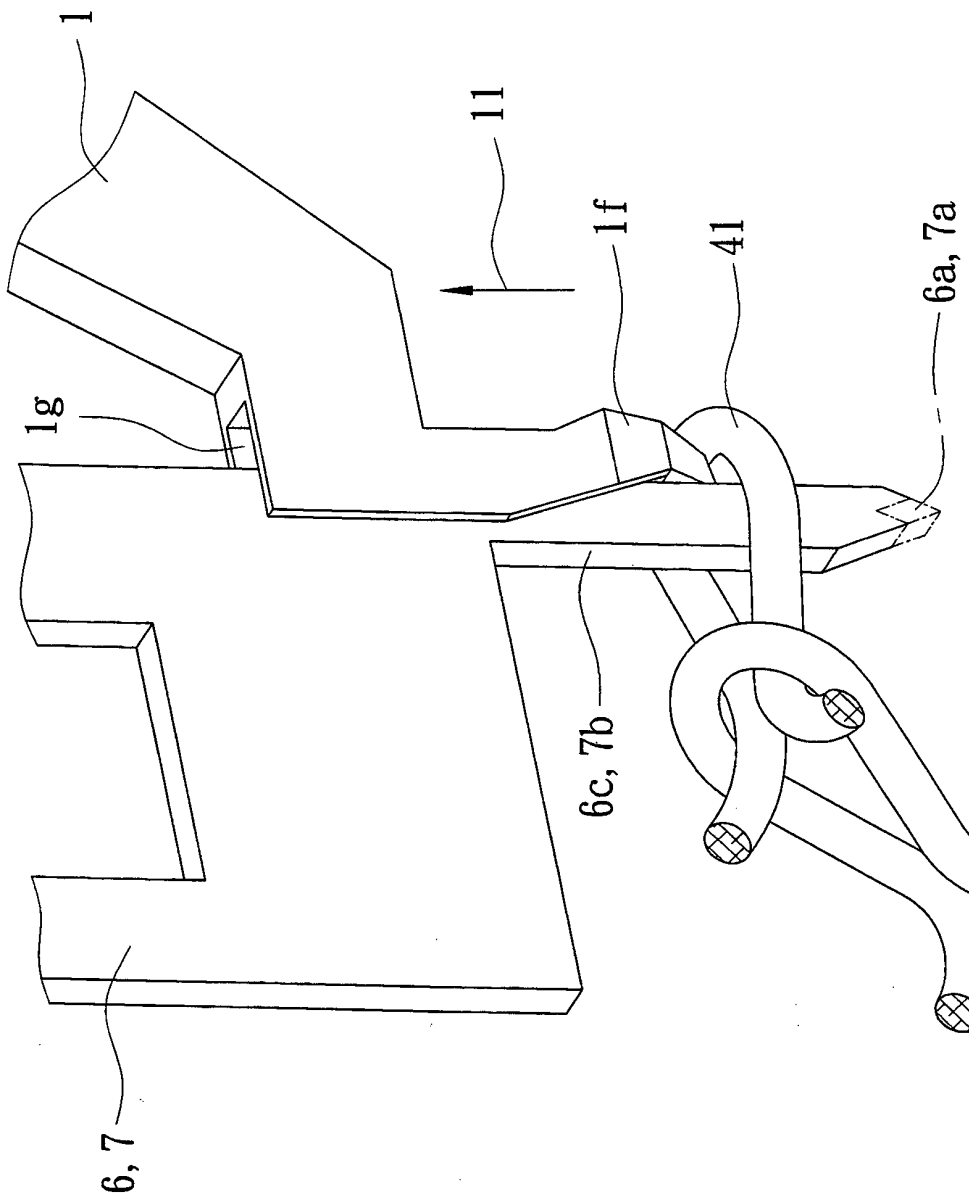



FIG. 42

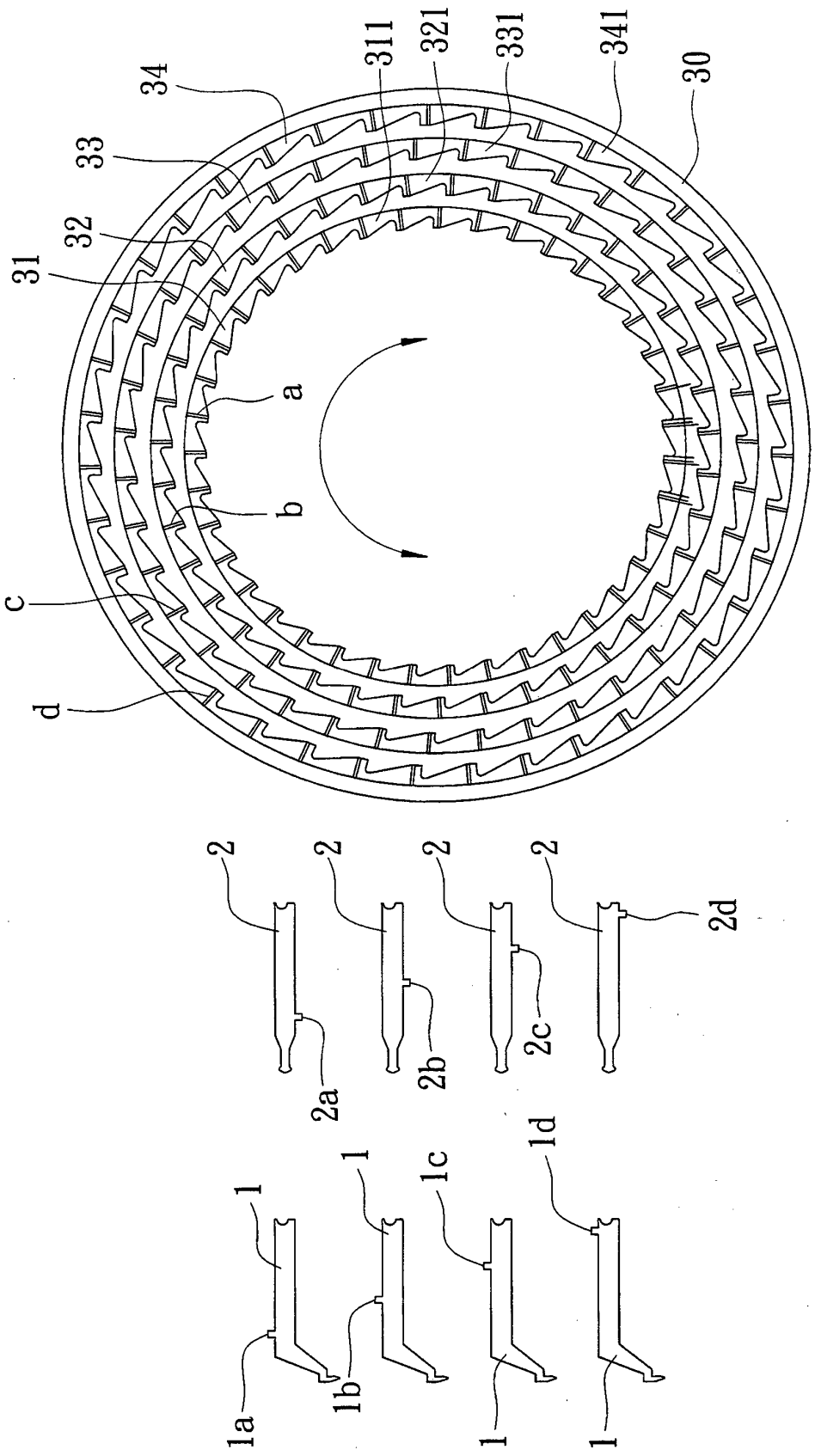



FIG. 43

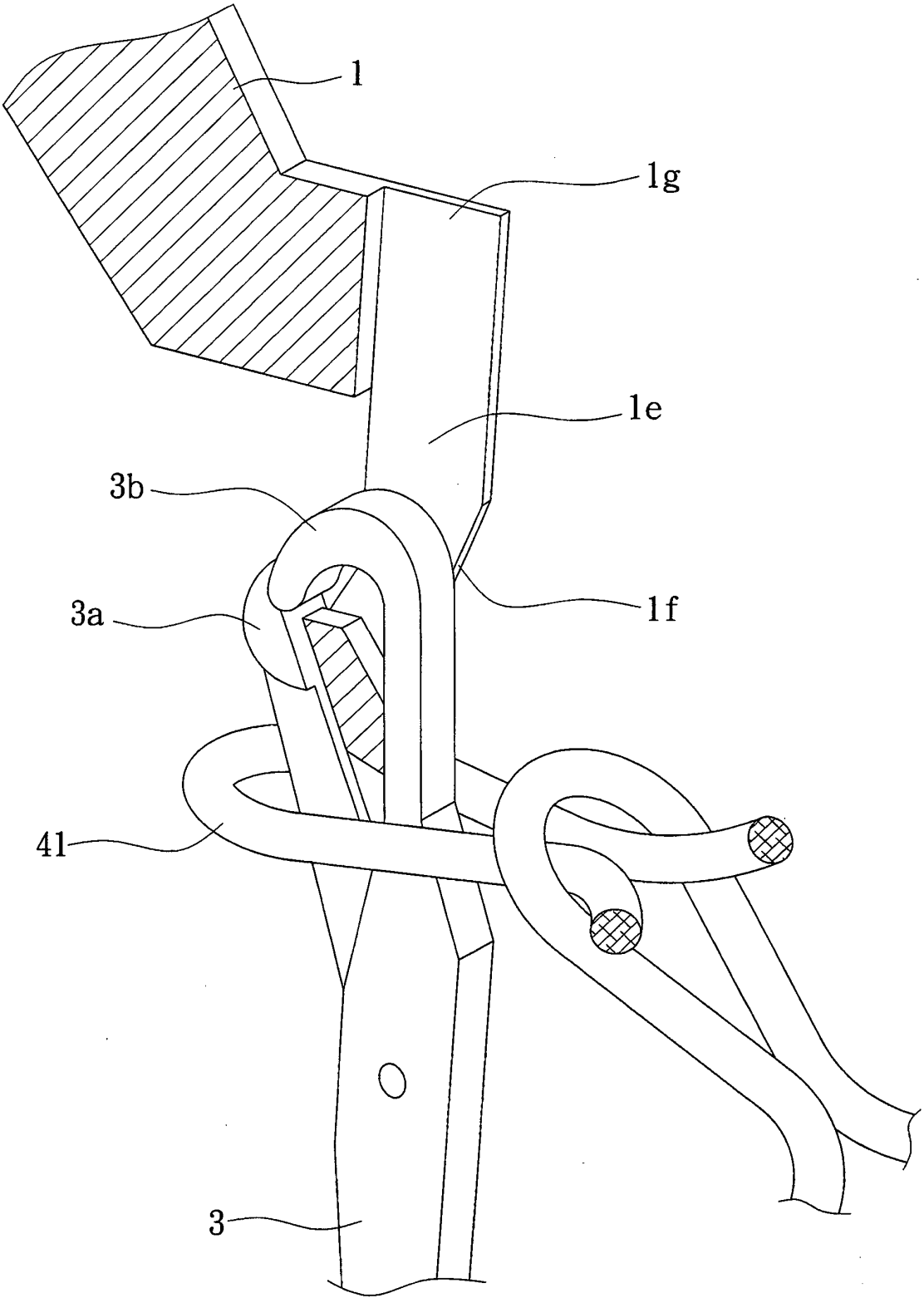



FIG. 44

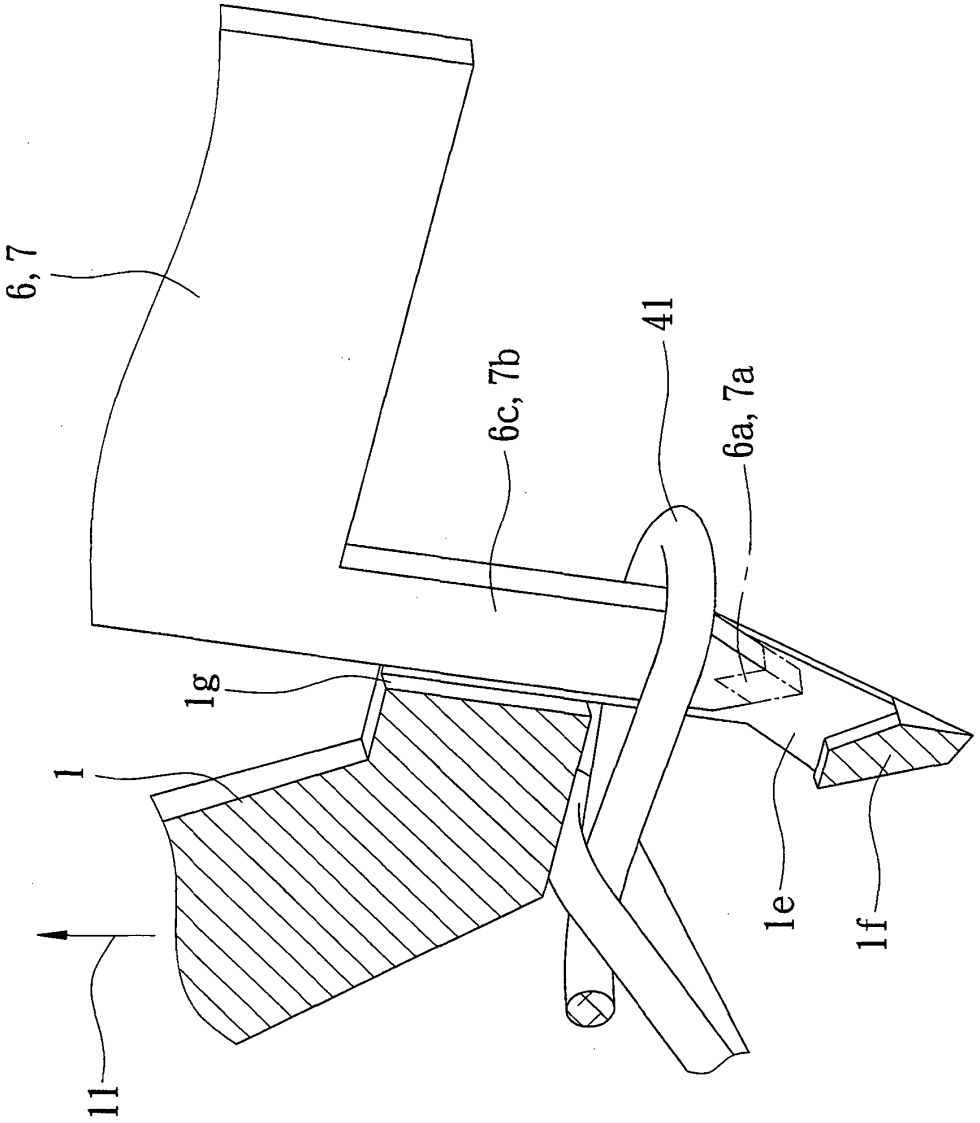



FIG. 45

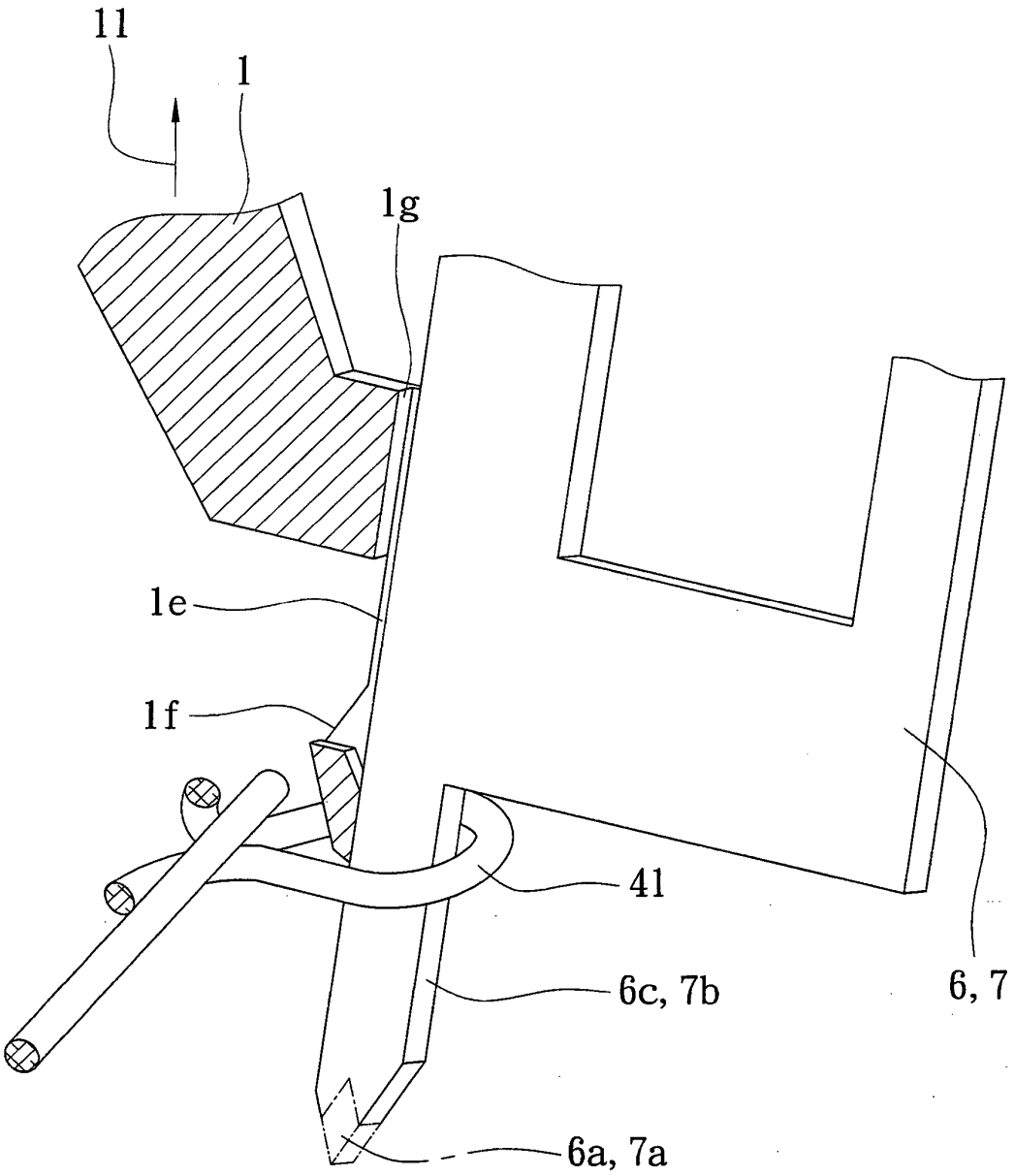



FIG. 46

## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description


- US 2004211226 A **[0008]**
- EP 2080827 A **[0009]**
- JP 2004143614 B **[0010]**
- JP 2001316959 B **[0010]**
- US 5487281 A **[0011]**
- US 5586453 A **[0012]**