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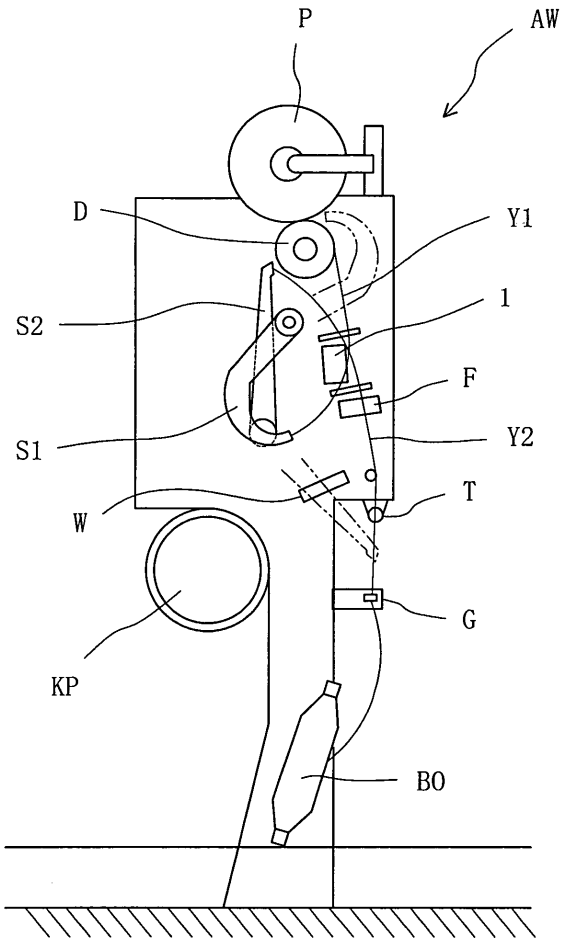
(54) Yarn splicer

(57) A yarn splicer according to the present invention ensures that yarn splicing can be carried out with elastic yarns being reliably caught and held, and prevents the absence of core yarns in a spliced portion. The splicer comprises: a pair of cutters 11 and 12 for cutting stretchable elastic yarns; a yarn splicing member 2 for applying compressed air to yarn ends of two elastic yarns Y1 and Y2 respectively cut by the cutters 11 and 12; and splicing holes 16 and 17 provided in the yarn splicing member 2 for guiding the yarn ends Y1 and Y2 so as to be placed together, and the splicer further includes a means for forming a catch-and-hold slit 21 for catching and holding the yarns Y1 and Y2 in the splicing holes 16 and 17, respectively, by utilizing length contraction and thickness expansion of each of the elastic yarn Y1 and Y2, which occurs when the elastic yarns are cut by the cutters 11 and 12.

Fig. 1



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a yarn splicer for splicing elastic yarns by applying compressed gas thereto.

Description of the Background Art

[0002] One type of yarn splicers mounted in automatic winders, spinning machines, etc., is an air splicer. In a yarn splicer of that type, two cut yarns are clamped, and guided to a yarn splicing member after placing the yarns together. Then, in this state, the yarns are cut by a pair of cutters, the end of each yarn is untwisted by an untwisting nozzle, and the untwisted yarn ends are twisted together by compressed gas from the yarn splicing member to instantly splice the two yarn ends together. In the case where the yarns that are to be spliced are elastic yarns having a stretchable core yarn, each yarn contracts in length at the time of cutting, so that the yarn ends slip off the yarn splicing member, resulting in failure of yarn splicing. In order to prevent the failure of yarn splicing, for example, the yarn splicer as described in Japanese Laid-Open Patent Publication No. 2001-199637 is provided with resisting members for providing resistance against length contraction of elastic yarn. In some cases, however, only the core yarns might contract in length when the elastic yarns are cut, so that no core yarns may be included in the yarn spliced portion, or the yarn ends may become inconsistent in length, leading to instability of the joint. Moreover, there is a difficulty in coping with various proportions of core yarns in elastic yarns.

SUMMARY OF THE INVENTION

[0003] Therefore, the problem to be solved by the present invention is to, in view of the above circumstances, provide a yarn splicer which ensures that yarn splicing can be carried out with elastic yarns being reliably caught and held, and prevents the absence of core yarns in the yarn spliced portion and the instability of the joint.

[0004] A yarn splicer according to the present invention comprises: a pair of cutters for separately cutting two stretchable elastic yarns; a yarn splicing member for applying compressed gas to yarn ends of the two elastic yarns cut by the cutters; and a splicing hole provided in the yarn splicing member for guiding the yarn ends so as to be placed together, and the splicer further includes a means for forming a catch-and-hold slit for catching and holding the yarn ends in the splicing hole by utilizing length contraction and thickness expansion of each elastic yarn, which occurs when the elastic yarns are cut by the cutters.

[0005] Preferably, the means for forming the catch-and-hold slit includes a plate member detachable from the yarn splicing member.

[0006] More preferably, the splicing hole has provided at opposite ends thereof a regulation plate for regulating the flow of the compressed gas.

[0007] The yarn splicer according to the present invention includes the means for forming the catch-and-hold slit for catching and holding yarns guided into a splicing hole. The catch-and-hold slit utilizes the nature of elastic yarns that contract in length and expand in thickness for catching and holding the yarns, thereby preventing the yarn ends from slipping off the yarn splicing member and significantly reducing failure of yarn splicing. Moreover, the core yarns can be prevented from being pulled away from the yarn splicing member, and therefore, the stretchability of the yarn spliced portion can be ensured. Also, the yarn ends placed in the splicing hole of the yarn splicing member become always consistent in length, leading to stability of the joint.

[0008] Further, the plate member is provided with a catch-and-hold slit, and the plate member is detachable from the yarn splicing member. Therefore, the plate member can be replaced with another plate member provided with a catch-and-hold slit having a suitable width in accordance with variation of the diameter of an elastic yarn or the proportion of a core yarn therein.

[0009] Furthermore, the splicing hole has provided at opposite ends thereof a regulation plate by which to regulate the flow of compressed gas and control the direction of each yarn guided into the splicing hole. Thus, it is possible to apply compressed gas suitable for yarn splicing to each yarn end, thereby achieving the stability of the joint and thus more satisfactory appearance and strength of the joint.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

FIG. 1 is a side view illustrating an automatic winder including a yarn splicer according to the present invention.

FIG. 2 is a perspective view illustrating the yarn splicer.

FIG. 3 is a front view illustrating principal parts of the yarn splicer.

FIG. 4 is a side view illustrating the yarn splicer for explaining the splicing operation of the yarn splicer.

FIG. 5 is a side view sequential to FIG. 4 illustrating the yarn splicer.

FIG. 6 is a side view sequential to FIG. 5 illustrating a yarn splicer FIG. 5.

FIG. 7 shows enlarged views of a yarn splicing member of a first embodiment, where (a) is a front view, and (b) is a view seen from the direction of arrow A in (a).

FIG. 8 shows enlarged views of a yarn splicing member of a second embodiment, where (a) is a front

view, and (b) is a view seen from the direction of arrow B in (a).

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0011] Hereinafter, a yarn splicer according to the present invention will be described in detail with reference to the accompanying drawings.

[0012] FIG. 1 is a side view illustrating an automatic winder including a yarn splicer according to the present invention. As shown in FIG. 1, an automatic winder AW includes: a take-up package P provided in an upper portion; a yarn supply bobbin BO provided in a lower portion; and a yarn splicer 1 provided between the yarn supply bobbin BO and the take-up package P. The "yarn" as described in the present embodiment is elastic yarn including a center thread, which is a stretchable core yarn composed of polyurethane or the like, and a cover yarn composed of cotton. A yarn Y, which is supplied from the yarn supply bobbin BO, is guided through a guide G, and suitably tensioned by a tenser T. Then, the yarn Y is caused by a traverse drum D to traverse the take-up package P so as to be wound therearound to a prescribed thickness. In order to prevent a yarn Y having a defect portion from being wound around the take-up package P, a yarn defect detection device F always detects any defective yarn portion, such as a thicker portion, a thinner portion, or a slub, of the yarn Y passing therethrough.

[0013] The detection device F detects a defect of the yarn Y passing therethrough by comparing the thickness of the yarn Y, which is supplied from the yarn supply bobbin BO and wound around the take-up package P, with preset thickness information about the yarn Y. When the detection device F detects any defect of the yarn, a cutter (not shown) provided in the detection device F cuts the yarn Y. Simultaneously with this, the rotation of the take-up package P ceases, and the winding of the yarn from the yarn supply bobbin BO is suspended. As a result, the yarn Y is separated into an upper yarn Y1 on the side of the take-up package P and a lower yarn Y2 on the side of the yarn supply bobbin BO. Accordingly, the upper yarn Y1 is held by the take-up package P, and the lower yarn Y2 is sucked by a yarn suction port (yarn trap) W.

[0014] Thereafter, an upper yarn suction arm S1 pivots upward on a rotation shaft provided at its end, and a lower yarn suction arm S2 pivots downward on a rotation shaft provided at its end. These suction arms S1 and S2 are each hollowed inside and connected to a suction duct KP, such that a tip portion of each of the suction arms S1 and S2 acts as a suction port because of suction from the suction duct KP. Accordingly, the upper yarn suction arm S1 having pivoted upward sucks and holds the upper yarn Y1, and the lower yarn suction arm S2 having pivoted downward sucks and holds the yarn Y2. Then, the suction arms S1 and S2 having held the yarns Y1 and Y2, respectively, return to their original positions, so that the yarns Y1 and Y2 are guided past the front side of the yarn splicer 1 to predetermined positions. The yarn splicing operation that is to be performed thereafter by the yarn splicer 1 will be described in detail later.

[0015] Next, the details of the yarn splicer 1 are described. FIG. 2 is a perspective view illustrating the yarn splicer. FIG. 3 is a front view illustrating principal parts of the yarn splicer. As shown in FIGS. 2 and 3, the yarn splicer 1 has a yarn splicing member 2 provided substantially in the center thereof. Provided above and below the yarn splicing member 2 are a pair of holding nozzles 5 and 6, a pair of yarn holding levers 7 and 8, a pair of yarn shifting levers 9 and 10, a pair of cutters 11 and 12, and a pair of clamping members 13 and 14. The clamping member 13, the holding nozzle 6 and the cutter 12 are provided for the upper yarn Y1, while the clamping member 14, the holding nozzle 5 and the cutter 11 are provided for the lower yarn Y2. The yarn splicing member 2, the pair of yarn holding levers 7 and 8 and the pair of yarn shifting levers 9 and 10 are provided for both the upper and lower yarns Y1 and Y2.

[0016] As shown in FIG. 3, the yarn splicing member 2 is provided with splicing holes 16 and 17 for placing the yarns Y1 and Y2 together. The splicing holes 16 and 17 have provided at their opposite ends a pair of regulation plates 19 and 20. The regulation plates 19 and 20 partially block the openings of the splicing holes 16 and 17 to regulate the flow of compressed air in the splicing holes 16 and 17, thereby controlling the position of each of the yarns Y1 and Y2 to satisfactorily tangle the yarn ends and thereby to ensure satisfactory appearance and strength of the joint of the yarns.

[0017] Next, the details of the splicing operation are described. FIG. 4 is a side view illustrating the yarn splicer for explaining the splicing operation of the yarn splicer. FIG. 5 is a side view sequential to FIG. 4 illustrating the yarn splicer. FIG. 6 is a side view sequential to FIG. 5 illustrating the yarn splicer.

[0018] First, as shown in FIG. 4, the upper yarn Y1 held by the upper yarn suction arm S1 is clamped by the clamping member 13, while the lower yarn Y2 held by the lower yarn suction arm S2 is clamped by the clamping member 14. Then, the yarn shifting levers 9 and 10 are moved to guide the yarns Y1 and Y2 into the splicing holes 16 and 17, respectively, provided in the yarn splicing member 2, as well as into the cutters 11 and 12, respectively. Thereafter, the yarns Y1 and Y2 are cut by the cutters 11 and 12, respectively, so as to form yarn ends to a prescribed length from where the yarns Y1 and Y2 are clamped by the clamping members 13 and 14, respectively.

[0019] In this state, the yarns Y1 and Y2 have their core yarns stretched and thus strained, and therefore, when the cutter 11 and 12 are operated, each of the yarns Y1 and Y2 is brought into contraction. Accordingly, as will be described in detail later, each of the yarns Y1 and Y2 contracts in length and expands in thickness, so that the yarns Y1 and Y2 are caught and held by a catch-and-hold slit 21 (see FIG. 7) formed in the yarn splicing member 2, and reliably secured in the splicing holes 16 and

17, respectively. As a result, the yarn end of each of the yarns Y1 and Y2 does not slip off the yarn splicing member 2, and therefore, it is possible to prevent failure of yarn splicing. Moreover, the core yarn of each of the yarns Y1 and Y2 can be prevented from being pulled away from the yarn splicing member 2, and therefore, the stretchability of the spliced portion of the yarns Y1 and Y2 can be ensured. Also, yarn ends of a uniform length can be placed in the splicing holes 16 and 17, leading to stability of the joint. Further, the yarns Y1 and Y2 are caught and held by a pair of resisting members 3 and 4, respectively, which ensures that the yarns are sucked by the holding nozzles 5 and 6 in the next step. The resisting members 3 and 4 are provided with a row of a number of comb-like blades, and fibers wrapped around the core yarn of each of the yarns Y1 and Y2 are caught by the comb-like blades, providing resistance against contraction.

[0020] Next, as shown in FIG. 5, simultaneously as the yarn shifting levers 9 and 10 return to their original positions, jets of compressed air are emitted to the back side from holding jet paths 50 and 60 provided in the holding nozzles 5 and 6. As a result, the yarn end of each of the yarns Y1 and Y2 is sucked and held, and the yarn ends of the yarns Y1 and Y2, which are uniform in length, are introduced into the splicing holes 16 and 17, respectively. The time for which the holding nozzles 5 and 6 suck and hold the yarns Y1 and Y2 is short, e.g., about 0.2 to 0.3 seconds, and the holding nozzles 5 and 6 suppress a swirling air flow. Therefore, each of the yarns Y1 and Y2 is not untwisted, and the core yarns can be prevented from contracting in length, making it possible to avoid the absence of core yarns in the spliced portion.

[0021] Then, as shown in FIG. 6, each of the holding nozzles 5 and 6 ceases its operation, and the yarn shifting levers 9 and 10 are activated to pull the ends of the yarns Y1 and Y2 out of the holding nozzles 5 and 6, respectively. Thereafter, the yarn holding levers 7 and 8 are activated to place the yarns Y1 and Y2 at their respective predetermined positions in the splicing holes 16 and 17. As a result, the yarn ends of the yarns Y1 and Y2 are placed together within the splicing holes 16 and 17. In this state, jets of compressed air are emitted from the splicing jet paths 22 and 23 into the splicing holes 16 and 17. The swirling streams of the compressed air twist and splice the yarn ends of the yarns Y1 and Y2 in the splicing holes 16 and 17. Then, the yarn splicing member 2 ceases emitting the compressed air, the yarn holding levers 7 and 8 and the yarn shifting levers 9 and 10 are placed back to their original positions, and each of the clamping members 13 and 14 is released to end the splicing operation.

[0022] Next, the yarn splicing member 2 is described in detail. FIG. 7 shows enlarged views of a yarn splicing member of a first embodiment, where (a) is a front view, and (b) is a view seen from the direction of arrow A in (a). FIG. 8 shows enlarged views of a yarn splicing member of a second embodiment, where (a) is a front view, and (b) is a view seen from the direction of arrow B in (a).

[0023] First, the yarn splicing member 2 of the first embodiment is described with reference to FIG. 7. The yarn splicing member 2 of the embodiment includes a first splicing hole 16 on the upper side and a second splicing hole 17 on the lower side (see FIG. 7(a)). The splicing holes 16 and 17 are provided in parallel with each other, such that the bottom surface of the first splicing hole 16 is substantially flush with the top surface of the second splicing hole 17. Upper portions in cross section of the splicing holes 16 and 17 are open to guiding slits 160 and 170 (see FIG. 7(b)). The guiding slits 160 and 170 are provided for guiding the yarns Y1 and Y2 into the splicing holes 16 and 17, respectively, and formed to be wider than the yarns Y1 and Y2. The first guiding slit 160 is connected with the right end side of the first splicing hole 16, and the second guiding slit 170 is connected with the left end side of the second splicing hole 17. The guiding slits 160 and 170 are provided continuously so as to penetrate with each other, thereby forming a V-shaped catch-and-hold slit 21 at the intersection of the guiding slits 160 and 170.

[0024] Thus, the upper yarn Y1 is guided through the first guiding slit 160 into the first splicing hole 16, and passes through the catch-and-hold slit 21, and thereafter the yarn Y is further guided through the second guiding slit 170 into the second splicing hole 17. Similarly, the lower yarn Y2 is guided through the second guiding slit 170 into the second splicing hole 17, and passes through the catch-and-hold slit 21, and thereafter the yarn Y2 is further guided through the first guiding slit 160 into the first splicing hole 16. Thereafter, when the upper yarn Y1 is cut by the cutter 12, the upper yarn Y1 placed in the second splicing hole 17 contracts in length and expands in thickness, and the length contraction and thickness expansion allows the upper yarn Y1 to be caught and held by the catch-and-hold slit 21. Also, when the lower yarn Y2 is cut by the cutter 11, the lower yarn Y2 placed in the first splicing hole 16 contracts in length and expands in thickness, and the length contraction and thickness expansion allows the lower yarn Y2 to be caught and held by the catch-and-hold slit 21. Since the yarns Y1 and Y2 are each elastic yarn including a stretchable core yarn, the length contraction and thickness expansion occurs due to the cutting, and the thickness of each of the yarns Y1 and Y2 having contracted in length and expanded in thickness becomes greater than the width of the narrow end of the catch-and-hold slit 21 (about 0.2 mm), so that each of the yarns Y1 and Y2 is caught and held thereby.

[0025] In this state, jets of compressed air are emitted from the first splicing jet path 22, which leads to the first splicing hole 16, and from the second splicing jet path 23, which leads to the second splicing hole 17, so that the yarns Y1 and Y2 are twisted and spliced together.

[0026] Next, the yarn splicing member 2 of the second embodiment is described with reference to FIG. 8. The yarn splicing member 2 of the embodiment has one splicing hole 16 continuously provided in the vertical direction.

The splicing hole 16 is open at the upper center, which leads to the guiding slit 160 (see FIG. 8(b)). Provided in upper and lower portions of the yarn splicing member 2 are a pair of plate members 210 and 210'. The plate members 210 and 210' have catch-and-hold slits 21 and 21' formed at their respective centers, and the catch-and-hold slits 21 and 21' have their narrow ends placed in the splicing hole 16.

[0027] Therefore, the yarns Y1 and Y2 are guided through the catch-and-hold slits 21 and 21', respectively, into the splicing hole 16. Thereafter, when the upper yarn Y1 is cut by the cutter 12, the upper yarn Y1 placed in the bottom side of the splicing hole 16 contracts in length and expands in thickness, and the length contraction and thickness expansion allows the upper yarn Y1 to be caught and held by the catch-and-hold slit 21' . Also, when the lower yarn Y2 is cut by the cutter 11, the lower yarn Y2 placed in the bottom side of the splicing hole 16 contracts in length and expands in thickness, and thus is caught and held by the catch-and-hold slit 21. Thereafter, in this state, a jet of compressed air is emitted from the splicing jet path 22, which leads to the center of the splicing hole 16, so that the yarns Y1 and Y2 in a stretched state are twisted and spliced together. In the yarn splicing member 2 of the embodiment, the plate members 210 can be replaced with other plate members 210 with a catch-and-hold slit 21 of a different width in accordance with the thickness of the yarns that are to be spliced.

[0028] The above-described yarn splicer 1 according to the present invention can be installed in automatic winders, spinning machines, and various other textile machines equipped with a yarn splicer. Also, the effect of the present invention can be achieved so long as the yarns that are to be spliced are spun yarns having relatively great stretchability.

Claims

1. A yarn splicer comprising:

   a pair of cutters for separately cutting two stretchable elastic yarns; a yarn splicing member for applying compressed gas to yarn ends of the two elastic yarns cut by the cutters; and a splicing hole provided in the yarn splicing member for guiding the yarn ends so as to be placed together,
   characterized by including means for forming a catch-and-hold slit for catching and holding the yarn ends in the splicing hole by utilizing length contraction and thickness expansion of each elastic yarn, which occurs when the elastic yarns are cut by the cutters.

2. The yarn splicer according to claim 1, **characterized in that** the means for forming the catch-and-hold slit includes a plate member detachable from the yarn splicing member.

3. The yarn splicer according to claim 1 or 2, **characterized in that** the splicing hole has provided at opposite ends thereof a regulation plate for regulating the flow of the compressed gas.

Fig. 1

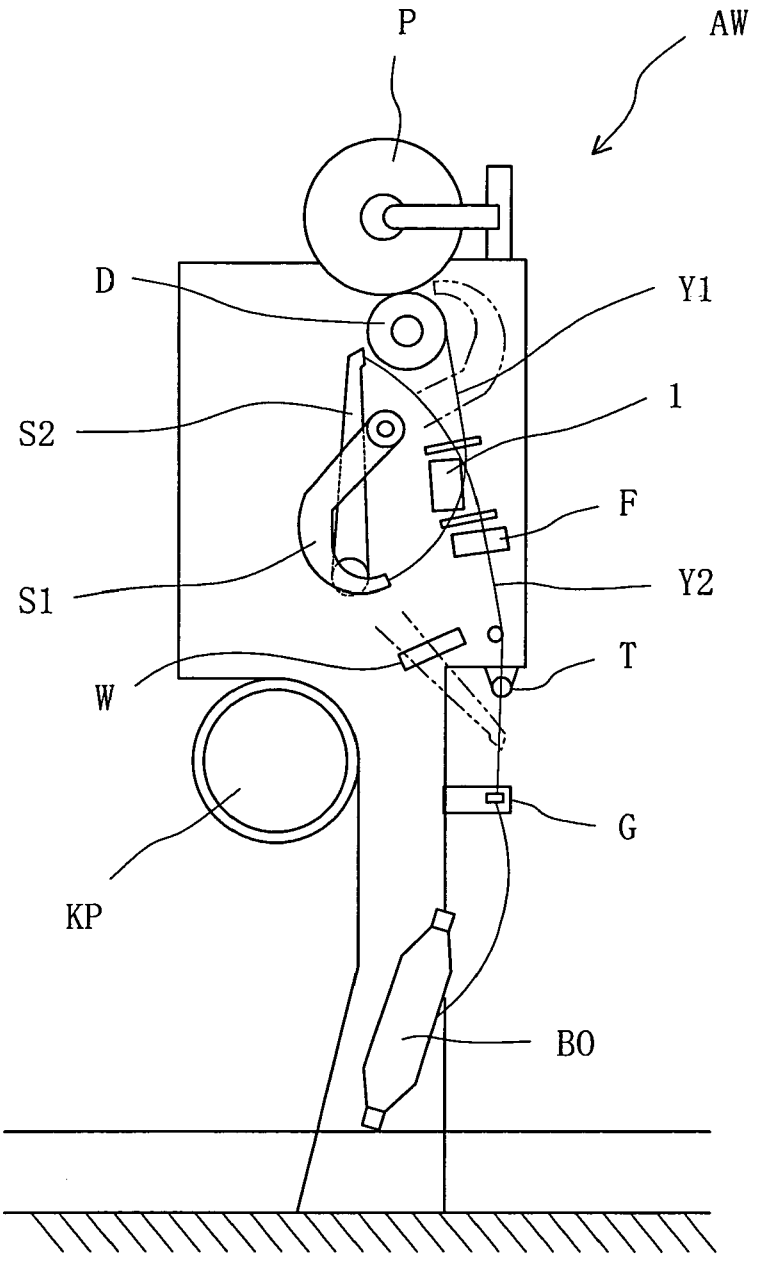


Fig. 2

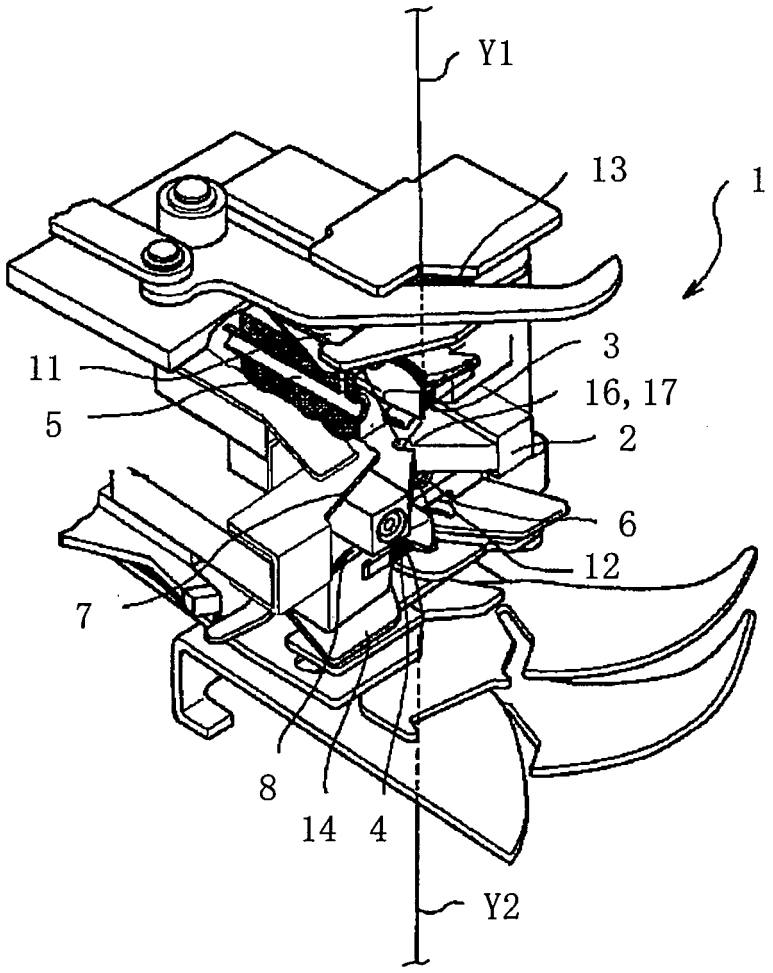


Fig. 3

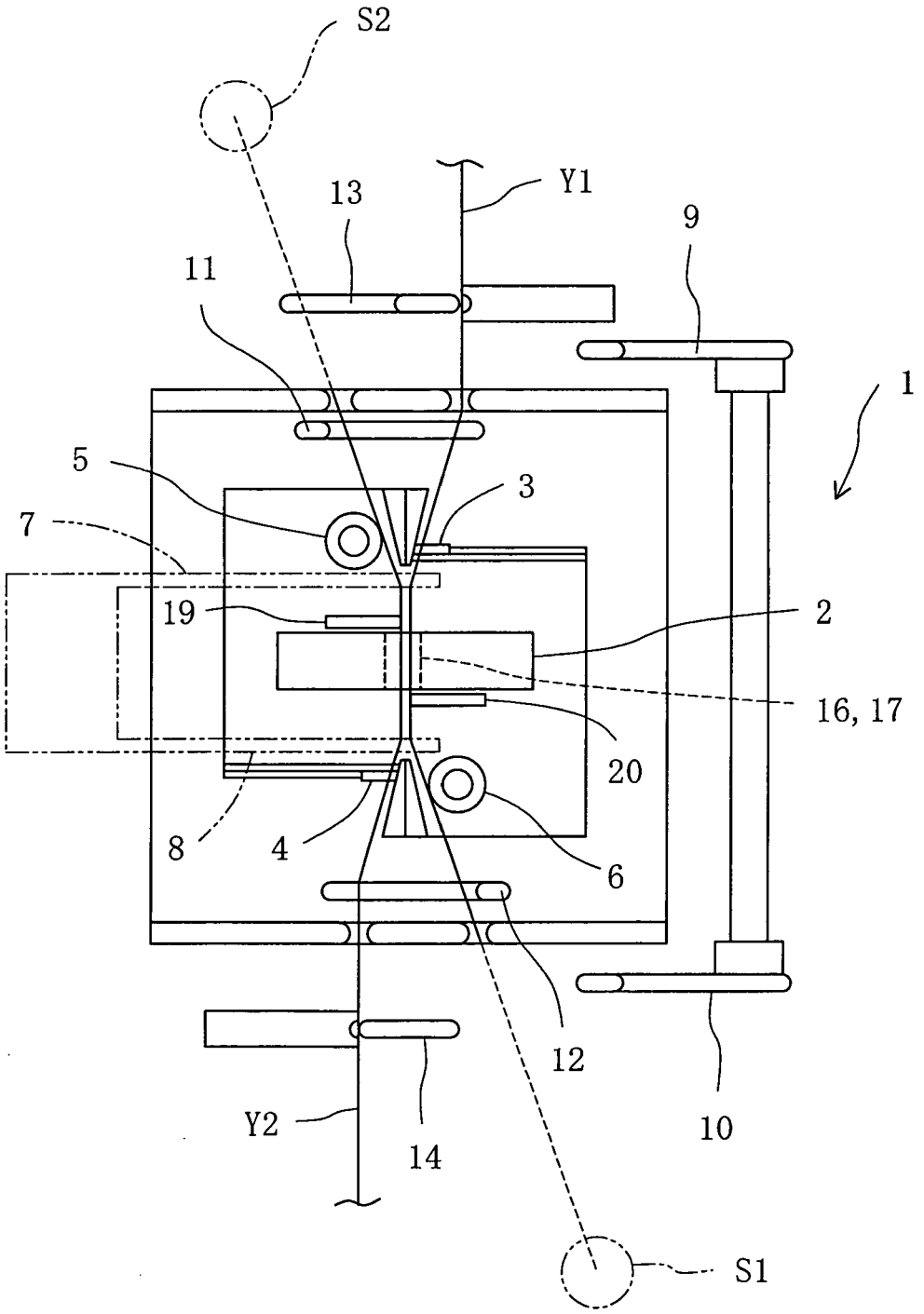


Fig. 4

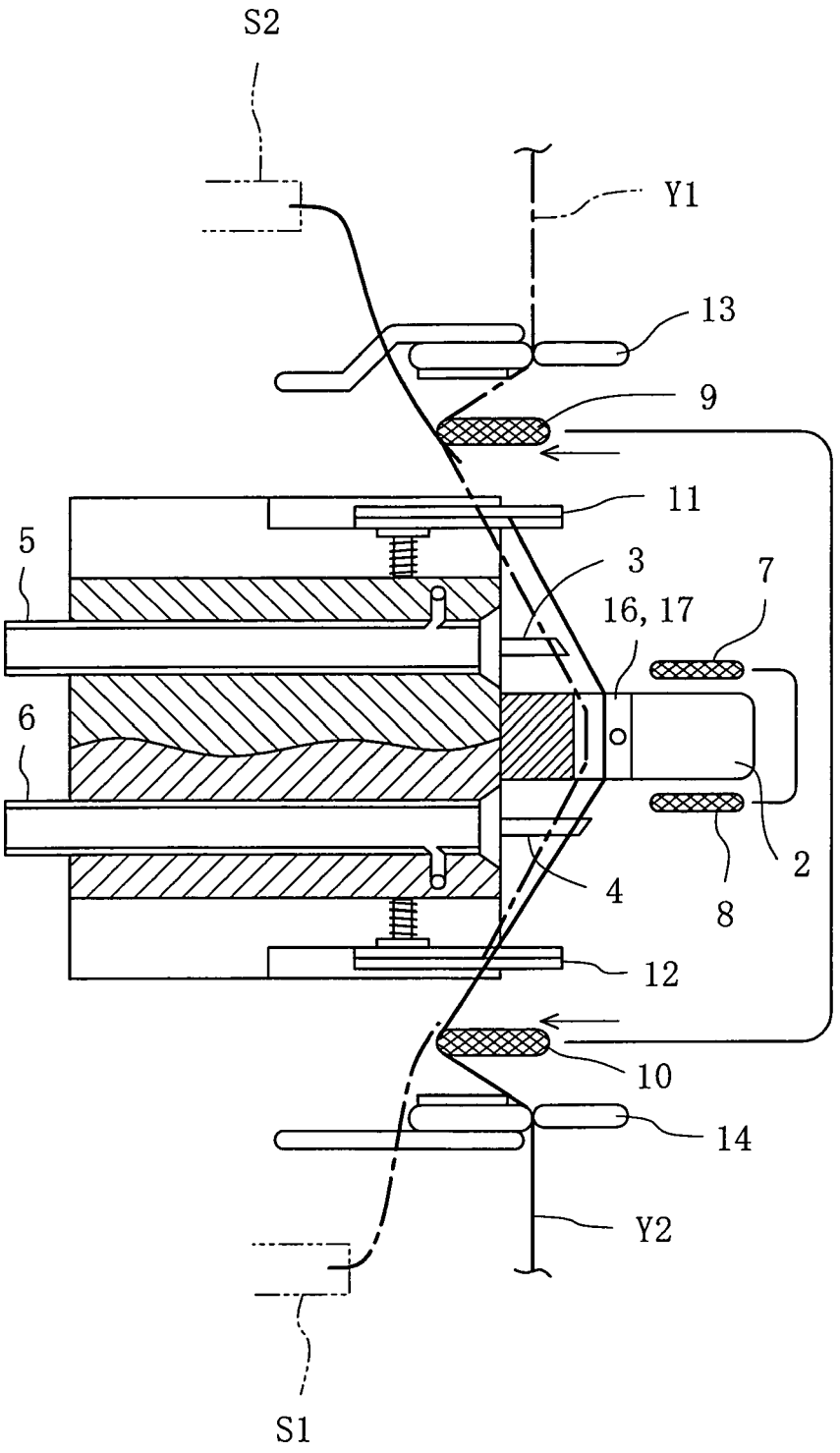


Fig. 5

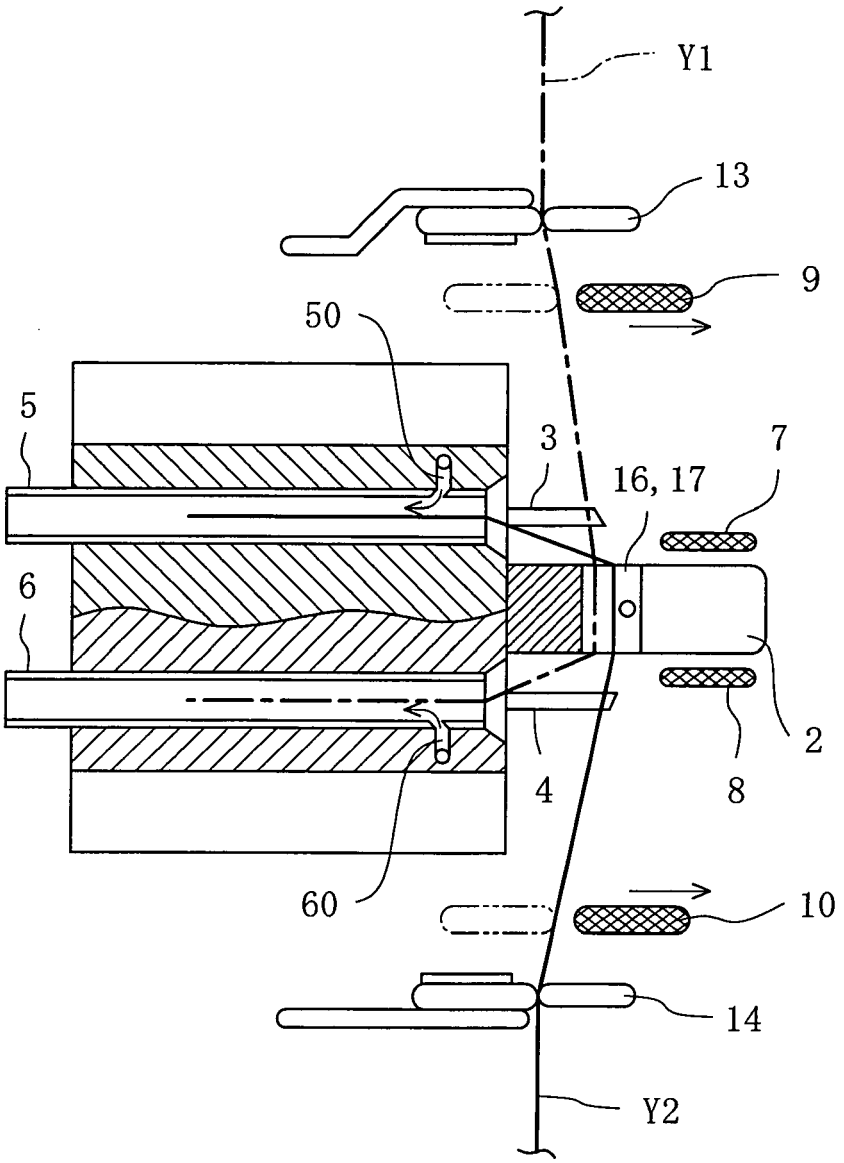


Fig. 6

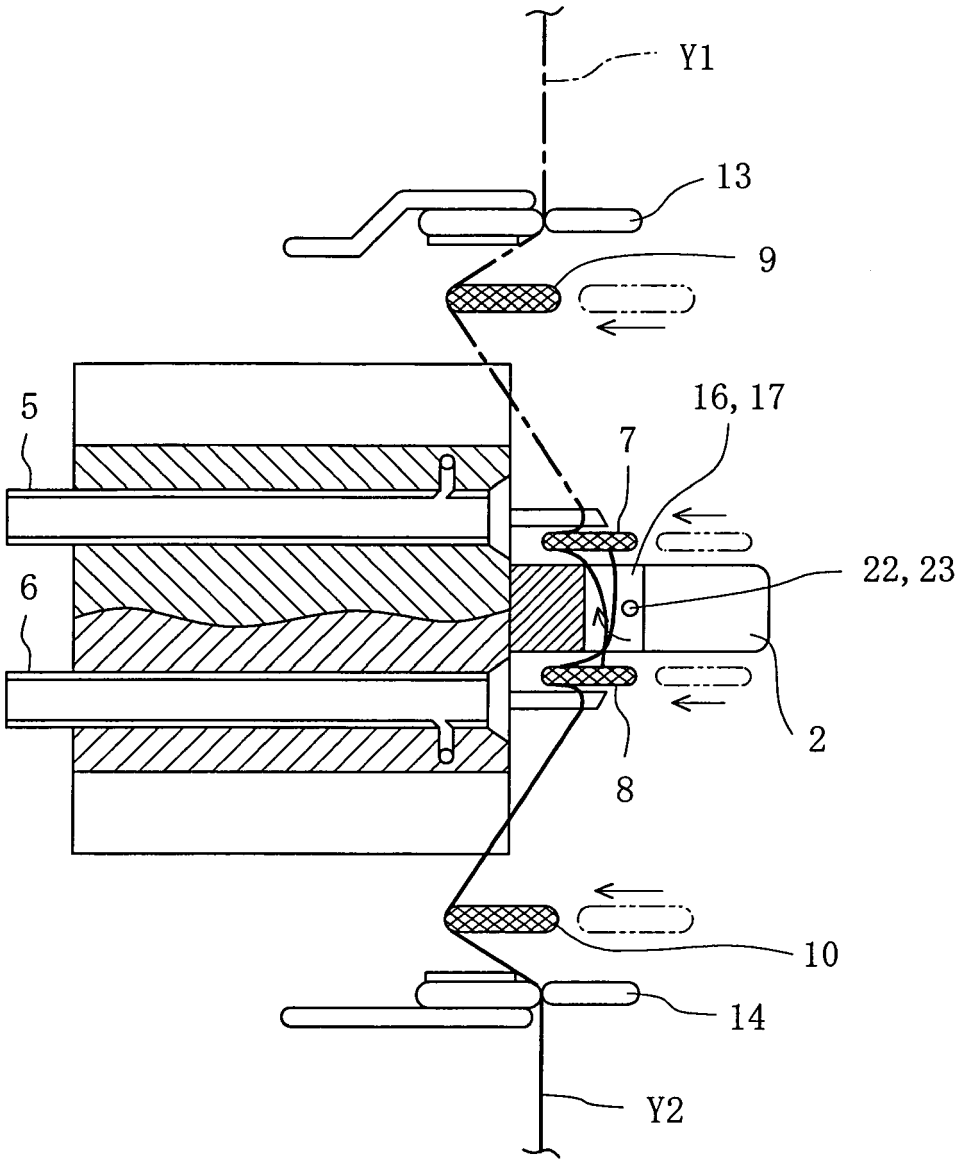


Fig. 7

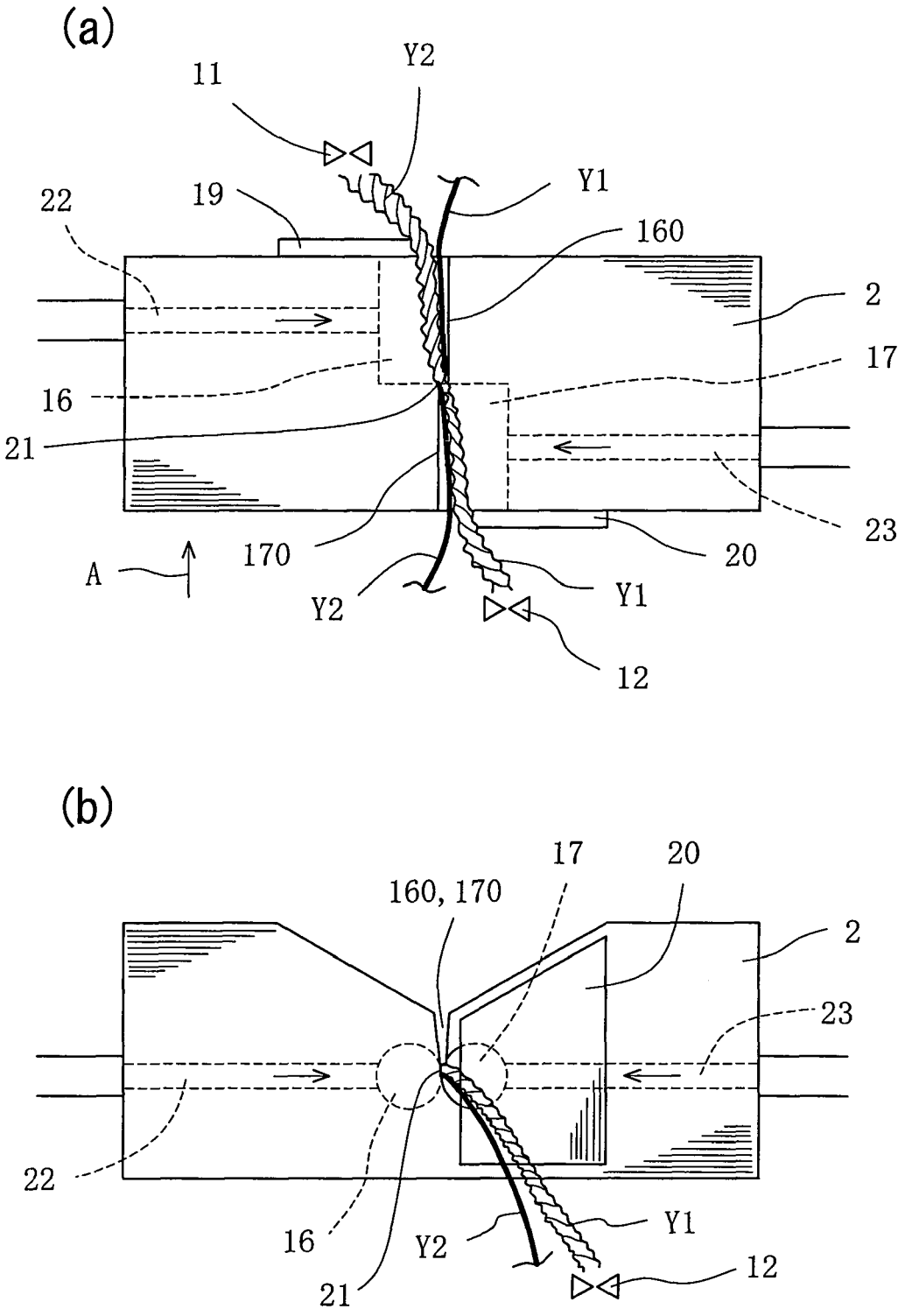
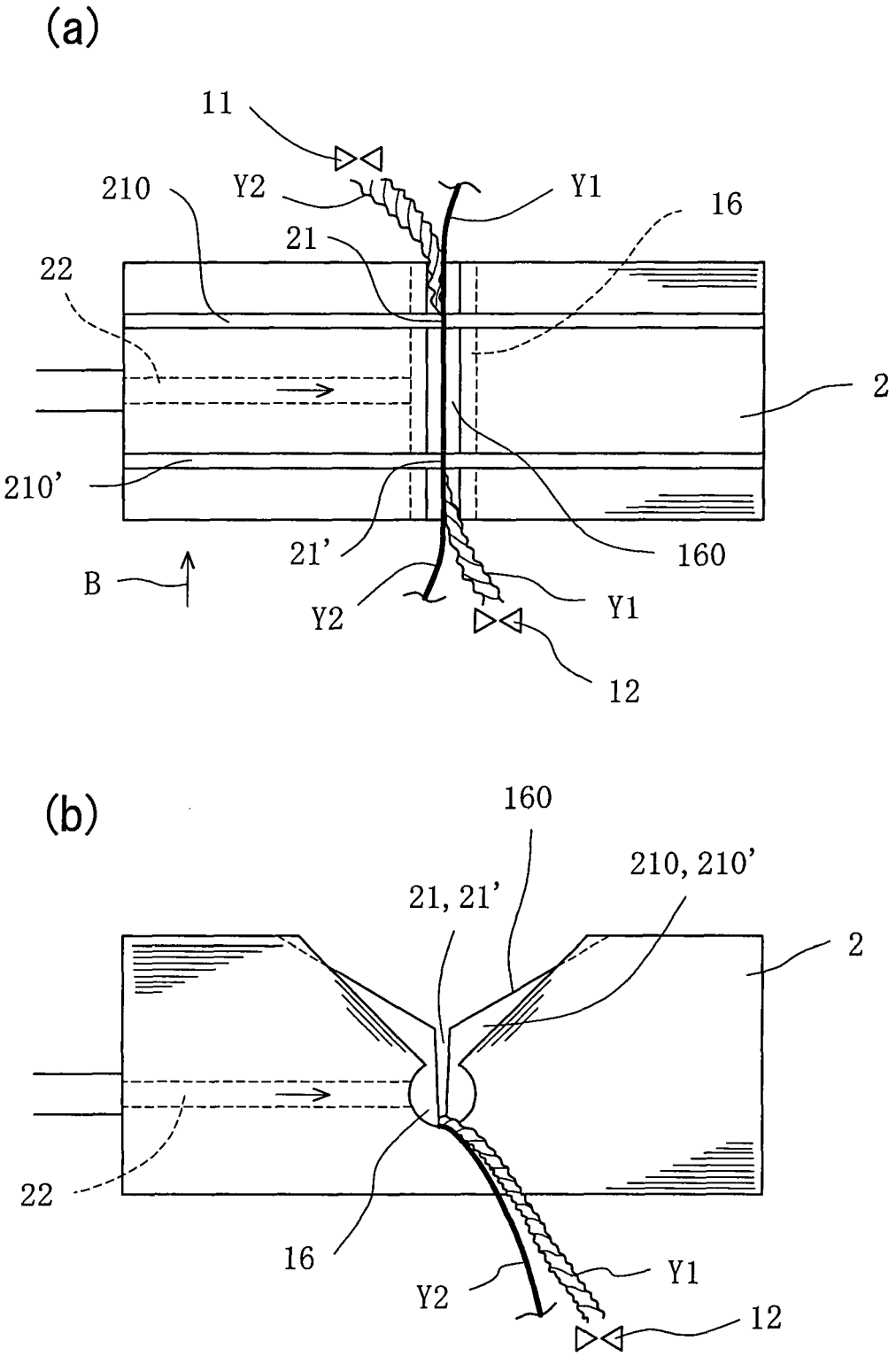

(a)
11
Y2
Y1
22
19
160
2
17
16
21
23
A
170
20
Y2
Y1
12
(b)
17
20
160, 170
2
23
22
16
Y2
Y1
21
12

Fig. 8


(a)
11
210
Y2
Y1
16
21
22
2
210'
21'
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B
Y2
Y1
12
(b)
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210, 210'
21, 21'
2
22
16
Y2
Y1
12