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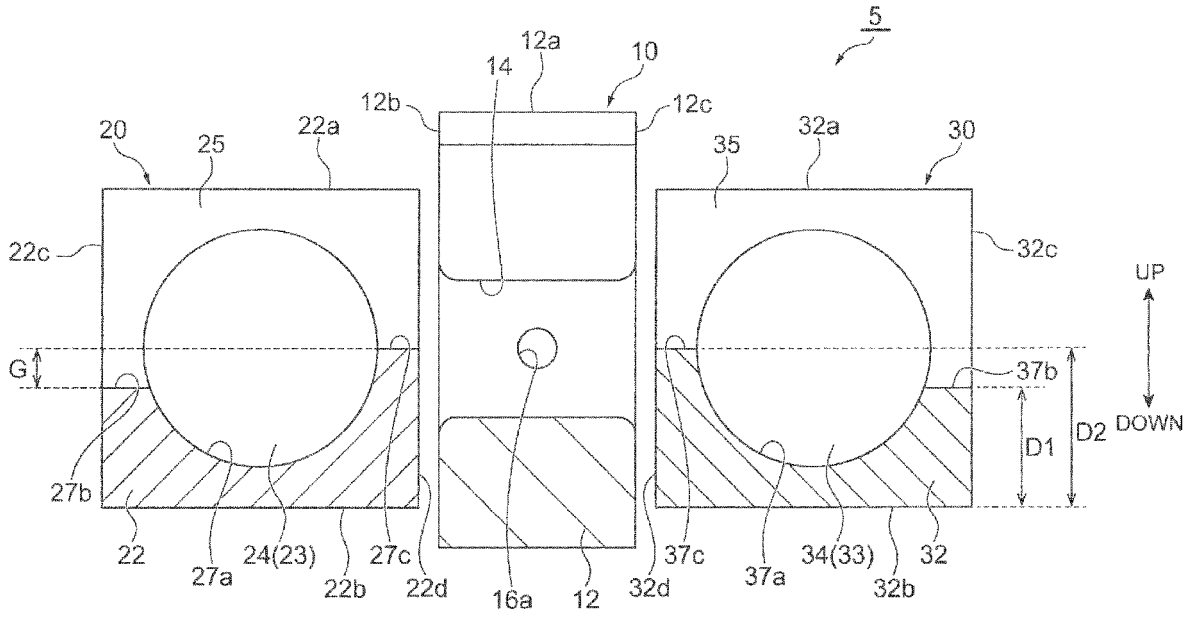
(54) SYNTHETIC YARN SPLICER

(57) A synthetic yarn splicer 1 includes a yarn splicing portion 10, a first clamping mechanism 20, and a second clamping mechanism 30. Each of the first clamping mechanism 20 and the second clamping mechanism 30 includes clamping portions 23 and 33 and support portions 22 and 32 that support the clamping portions 23 and 33, the support portions 22 and 32 include first contact surfaces 27b and 37b and second contact surfaces 27c and 37c which are disposed at a position interposing the clamping portions 23 and 33 in the facing direction of the first clamping mechanism 20 and the second clamping mechanism 30, and the second contact surfaces 27c and 37c are disposed between the yarn splicing portion 10 and the clamping portions 23 and 33 and are located above the first contact surfaces 27b and 37b.

Fig.5



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Description

TECHNICAL FIELD

[0001] The invention relates to a synthetic yarn splicer.

BACKGROUND

[0002] As a conventional synthetic yarn splicer, for example, one described in Patent Literature 1 (Japanese Unexamined Patent Publication No. H10-17214) is known. In the synthetic yarn splicer described in Patent Literature 1, a starting end and a terminating end of two synthetic yarns are aligned in the opposite directions to be drawn into an air nozzle, both side portions outside the air nozzle of the drawn yarn end are pressed down, the pressed both side portions are moved into the air nozzle, the aligned yarn end is loosened inside the air nozzle, and the yarns are spliced by an air flow inside the air nozzle.

SUMMARY

[0003] The synthetic yarn splicer is used to splice a terminating end of a yarn of one supply bobbin and a starting end of a yarn of the other supply bobbin in, for example, a yarn winding machine for winding synthetic fibers. In the yarn winding machine, the yarn is wound around a bobbin while applying a tension to the yarn to form a package. For that reason, an entangled portion obtained by splicing the yarns by the synthetic yarn splicer is pulled while a tension is applied thereto. In the yarn winding machine, when the entangled portion is unwound during the winding operation, the winding operation must be temporarily stopped and hence the production efficiency is lowered. For that reason, there is a demand for forming an entangled portion having a tensile elongation capable of withstanding a winding tension in the synthetic yarn splicer.

[0004] An aspect of the invention is to provide a synthetic yarn splicer capable of suppressing a decrease in tensile elongation of an entangled portion.

[0005] A synthetic yarn splicer according to an aspect of the invention is a synthetic yarn splicer that performs a splicing operation between one yarn and the other yarn formed of synthetic fibers, including: a yarn splicing portion that includes a passage through which one yarn and the other yarn are insertable and an injection hole which opens to the passage and injects a fluid; and a pair of clamping mechanisms that is located at a position interposing the passage of the yarn splicing portion and clamps each of one yarn and the other yarn inserted through the passage, in which each of the pair of clamping mechanisms includes a clamping portion that clamps each of one yarn and the other yarn and a support portion that supports the clamping portion, in which the support portion includes a first contact surface and a second contact surface which are disposed at a position interposing the clamping portion in the facing direction of the pair of clamping mechanisms, and in which the second contact surface is disposed between the yarn splicing portion and the clamping portion and is located above the first contact surface.

[0006] In the synthetic yarn splicer according to an aspect of the invention, one yarn and the other yarn formed of the synthetic fibers are swayed in the passage by using the clamping portion as a fixed point. In the synthetic yarn splicer, the second contact surface is disposed between the yarn splicing portion and the clamping portion and is located above the first contact surface. In this configuration, when one yarn and the other yarn are disposed, one yarn and the other yarn contact at least the second contact surface by the own weight of one yarn and the other yarn. In this state, when one yarn and the other yarn are clamped by the clamping portion and a fluid is injected to one yarn and the other yarn, one yarn and the other yarn are substantially swayed by using the second contact surface as a fixed point. For that reason, in the synthetic yarn splicer, a friction due to the contact with the support portion hardly occurs in one yarn and the other yarn to be swayed. Thus, the entangled portion can be appropriately formed in the synthetic yarn splicer. As a result, it is possible to suppress a decrease in tensile elongation of the entangled portion in the synthetic yarn splicer.

[0007] In one embodiment, the clamping portion may include a pair of clamping members facing each other and the first contact surface and the second contact surface may be provided at a position in which one clamping member and the other clamping member contact. In this configuration, one yarn and the other yarn clamped by the pair of clamping members can be reliably brought into contact with the second contact surface. For that reason, one yarn and the other yarn are reliably swayed by using the second contact surface as a fixed point. Thus, a friction due to the contact with the support portion hardly occurs in one yarn and the other yarn to be swayed. As a result, in the synthetic yarn splicer, the entangled portion can be appropriately formed and a decrease in tensile elongation of the entangled portion can be suppressed.

[0008] In one embodiment, the second contact surface may be a flat surface which extends in the facing direction of the pair of clamping mechanisms. In this configuration, it is possible to further avoid a friction due to the contact with the support portion in one yarn and the other yarn to be swayed.

[0009] In one embodiment, a dimension between the first contact surface and the second contact surface in a direction orthogonal to the first contact surface and the second contact surface may be equal to or larger than 0.5 mm and equal to or smaller than 1.5 mm. In this configuration, one yarn and the other yarn can be more reliably brought into contact with the second contact surface.

[0010] According to an aspect of the invention, it is pos-

sible to suppress a decrease in tensile elongation of an entangled portion.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

FIG. 1 is a perspective view illustrating a synthetic yarn splicer according to an embodiment.
FIG. 2 is a view illustrating a yarn splicing mechanism when viewed from above.
FIG. 3 is a side view of the yarn splicing mechanism.
FIG. 4 is a cross-sectional view of a yarn splicing portion.
FIG. 5 is a cross-sectional view taken along a line V-V of FIG. 2.
FIG. 6A is a diagram illustrating an operation of the yarn splicing mechanism.
FIG. 6B is a diagram illustrating an operation of the yarn splicing mechanism.
FIG. 7 is a diagram illustrating a state in which a yarn is held by the yarn splicing mechanism.
FIG. 8 is a diagram illustrating a yarn splicing mechanism according to Comparative Example.
FIG. 9A is a diagram showing Example and Comparative Example.
FIG. 9B is a diagram showing Example and Comparative Example.
FIG. 9C is a diagram showing Example and Comparative Example.
FIG. 9D is a diagram showing Example and Comparative Example.
FIG. 10A is a diagram showing a measurement result.
FIG. 10B is a diagram showing a measurement result.

DETAILED DESCRIPTION

[0012] Hereinafter, preferred embodiments of the invention will be described in detail with reference to the accompanying drawings. Furthermore, in the description of the drawings, the same reference numerals will be given to the same or equivalent components and the repetitive description will be omitted.

[0013] A synthetic yarn splicer 1 illustrated in FIG. 1 is a device which performs a splicing operation between a yarn end of a first yarn (one yarn) Y1 (see FIG. 7) formed of synthetic fibers and a yarn end of a second yarn (the other yarn) Y2 (see FIG. 7) formed of synthetic fibers. The synthetic yarn splicer 1 is used to perform a splicing operation between a terminating end of a yarn of one supply bobbin and a starting end of a yarn of the other supply bobbin, for example, in a yarn winding machine that winds a yarn from a supply bobbin to form a package. In the embodiment, the synthetic yarn splicer 1 is a so-called hand splicer.

[0014] The synthetic yarn splicer 1 includes a main body 3 and a yarn splicing mechanism 5. The main body 3 is a casing which accommodates the yarn splicing mechanism 5. The main body 3 includes a first main body portion 3a and a second main body portion 3b. The main body 3 is formed in, for example, a substantially L shape in the side view.

[0015] The first main body portion 3a is a portion which is gripped by an operator when the synthetic yarn splicer 1 is used. The first main body portion 3a has, for example, a substantially rectangular parallelepiped shape. The first main body portion 3a is provided with an operation portion 7. The operation portion 7 is a button which is operated when performing a splicing operation in the synthetic yarn splicer 1. In the embodiment, the operation portion 7 is provided at a portion which is located within an operation range of an index finger when the first main body portion 3a is gripped by the operator at the side of one end portion (the side of the second main body portion 3b) of the first main body portion 3a in the longitudinal direction.

[0016] The lower end portion of the first main body portion 3a (the other end portion of the longitudinal direction) is provided with a connection portion 9. A tube (not illustrated) supplying compressed air (fluid) (hereinafter, simply referred to as "air") is connected to the connection portion 9. The first main body portion 3a may accommodate a switch which is operated in synchronization with the operation of the operation portion 7 and components branching compressed air supplied through the connection portion 9.

[0017] The second main body portion 3b is provided with the yarn splicing mechanism 5. The second main body portion 3b has, for example, a substantially rectangular parallelepiped shape. The second main body portion 3b is provided at one end portion of the first main body portion 3a. Specifically, the second main body portion 3b is integrally formed with the first main body portion 3a so that a predetermined angle (for example, 90° or less) is formed between the longitudinal direction of the second main body portion 3b and the longitudinal direction of the first main body portion 3a. The second main body portion 3b exposes the yarn splicing mechanism 5. The second main body portion 3b accommodates a driving portion or the like (for example, a cylinder or the like) which drives a first clamping mechanism 20 and a second clamping mechanism 30 to be described later.

[0018] As illustrated in FIG. 2 or 3, the yarn splicing mechanism 5 includes a yarn splicing portion 10, the first clamping mechanism 20, and the second clamping mechanism 30. The first clamping mechanism 20 and the second clamping mechanism 30 are provided at a position that interposes a chamber 14 of the yarn splicing portion 10.

[0019] As illustrated in FIG. 4, the yarn splicing portion 10 includes a yarn splicing nozzle 12, a chamber (a passage) 14, and an air flow path 16.

[0020] The yarn splicing nozzle 12 is a block body which is formed of metal or ceramic. The yarn splicing

nozzle 12 is provided with a slit 13. The slit 13 is a portion which introduces a yarn to the chamber 14. An upper portion of the slit 13 is provided with an inclined surface 15. The inclined surface 15 guides a yarn to the slit 13. The inclined surface 15 has a tapered shape which is narrowed from an upper surface 12a of the yarn splicing nozzle 12 toward the slit 13.

[0021] The chamber 14 is a passage through which a first yarn Y1 and a second yarn Y2 are inserted. As illustrated in FIG. 5, the chamber 14 penetrates one side surface 12b and the other side surface 12c of the yarn splicing nozzle 12. The chamber 14 forms a space through which the first yarn Y1 and the second yarn Y2 are insertable. As illustrated in FIG. 4, the chamber 14 has a circular shape when viewed from the side surfaces 12b and 12c. A circular shape includes a true circular shape, an oval shape, and the like. The diameter of the chamber 14 may be appropriately set in response to a design.

[0022] The air flow path 16 circulates air to be supplied to the chamber 14. The air flow path 16 includes an injection hole 16a which opens to the chamber 14. The injection hole 16a communicates the air flow path 16 with the chamber 14. Air is injected from the injection hole 16a to the chamber 14. The position and the diameter of the chamber 14 of the injection hole 16a may be appropriately set in response to a design. A connection portion 18 is provided at the upstream side of the air flow path 16 (the opposite side to the injection hole 16a). A supply pipe or the like which supplies air is connected to the connection portion 18.

[0023] As illustrated in FIGS. 2 and 3, the first clamping mechanism 20 includes a support portion 22 and a clamping portion 23. The first clamping mechanism 20 clamps a yarn inserted through the chamber 14 of the yarn splicing portion 10.

[0024] The support portion 22 has a rectangular parallelepiped shape (prismatic shape). As illustrated in FIG. 5, the support portion 22 includes a pair of facing main surfaces 22a and 22b and a pair of facing side surfaces 22c and 22d. The side surface 22d is a surface which faces the side surface 12b in the yarn splicing nozzle 12.

[0025] The support portion 22 holds the clamping portion 23. The support portion 22 is provided to be swingable. Specifically, as illustrated in FIG. 2, a base end portion of the support portion 22 (one end portion of the longitudinal direction) is provided with a shaft 21. The shaft 21 is fixed to a frame (not illustrated) or the like. The support portion 22 swings about the shaft 21. The support portion 22 moves between a second position P2 (see FIG. 6B) in which a front end portion (the other end portion of the longitudinal direction) moves close to the yarn splicing portion 10 and a first position P1 (see FIG. 6A) in which the front end portion moves away from the yarn splicing portion 10 in relation to the second position P2. That is, the first clamping mechanism 20 moves between the first position P1 and the second position P2. The support portion 22 moves by the driving of, for example, a driving portion (not illustrated) such as a cylinder. In the embodiment, as described above, one end portion of the longitudinal direction provided with the shaft 21 in the support portion 22 will be referred to as a base end portion and the other end portion of the longitudinal direction opposite to the one end portion will be referred to as a front end portion.

[0026] The support portion 22 is provided with a concave portion 25. The concave portion 25 is provided at the side of the front end portion of the support portion 22. The concave portion 25 opens to the main surface 22a and the pair of side surfaces 22c and 22d of the support portion 22. The concave portion 25 exposes a part of the clamping portion 23. As illustrated in FIG. 2, the concave portion 25 has a rectangular shape when viewed from the main surface 22a of the support portion 22. As illustrated in FIG. 3, the concave portion 25 has a rectangular shape when viewed from the side surface 22c of the support portion 22.

[0027] As illustrated in FIG. 5, the support portion 22 includes a support surface 27a which slidably supports a second clamping member 26 (a first clamping member 24) to be described later in the clamping portion 23. The support surface 27a is provided at a center portion in the facing direction of the pair of side surfaces 22c and 22d of the support portion 22. The support surface 27a has a shape (a semi-circular shape) which is curved in a convex shape downward in response to the shape of the outer peripheral surface of the second clamping member 26 (the first clamping member 24). The support surface 27a extends in the longitudinal direction of the support portion 22.

[0028] The support portion 22 includes a first contact surface 27b and a second contact surface 27c at a position interposing the support surface 27a in the facing direction of the pair of side surfaces 22c and 22d (the facing direction of the first clamping mechanism 20 and the second clamping mechanism 30). The first contact surface 27b and the second contact surface 27c constitute a bottom surface of the concave portion 25. The first contact surface 27b is a surface which is able to contact the first yarn Y1 and the second yarn Y2 clamped by the clamping portion 23. A contactable state includes a case in which the first contact surface 27b contacts the first yarn Y1 and the second yarn Y2 clamped by the clamping portion 23 and a case in which the first contact surface 27b does not contact the first yarn Y1 and the second yarn Y2. The second contact surface 27c is a surface which contacts the first yarn Y1 and the second yarn Y2 clamped by the clamping portion 23. As illustrated in FIG. 2, the first contact surface 27b and the second contact surface 27c are provided at a position in which at least the first clamping member 24 and the second clamping member 26 contact.

[0029] As illustrated in FIG. 5, the first contact surface 27b is a flat surface which is continuous to one end of the support surface 27a (an end at the side of the side surface 22c). The second contact surface 27c is a flat

surface which is continuous to the other end of the support surface 27a (an end at the side of the side surface 22d). That is, respective surfaces are provided in order of the second contact surface 27c, the support surface 27a, and the first contact surface 27b from the yarn splicing portion 10 when viewed from the facing direction of the pair of main surfaces 22a and 22b of the support portion 22. That is, the second contact surface 27c is disposed between the yarn splicing portion 10 and the clamping portion 23. The second contact surface 27c is located at the inside of the facing direction of the first clamping mechanism 20 and the second clamping mechanism 30 facing each other with the yarn splicing portion 10 interposed therebetween and the first contact surface 27b is located at the outside of the facing direction.

[0030] The first contact surface 27b is substantially parallel to the main surfaces 22a and 22b. The first contact surface 27b is provided over the support surface 27a and the side surface 22c. The second contact surface 27c is substantially parallel to the main surfaces 22a and 22b. The second contact surface 27c is provided over the support surface 27a and the side surface 22d.

[0031] In the embodiment, the first contact surface 27b and the second contact surface 27c are located at different positions in the facing direction of the pair of main surfaces 22a and 22b of the support portion 22. The second contact surface 27c is located above the first contact surface 27b. The above mentioned herein indicates a side from which the first yarn Y1 and the second yarn Y2 are introduced in a direction orthogonal to the facing direction (the clamping direction) of the first clamping member 24 and the second clamping member 26 and the facing direction of the first clamping mechanism 20 and the second clamping mechanism 30. That is, the above indicates the upside of the vertical direction illustrated in FIG. 5. The first contact surface 27b is located at the side of the main surface 22b in relation to the second contact surface 27c. The second contact surface 27c is located at the side of the main surface 22a in relation to the first contact surface 27b.

[0032] A distance D1 between the first contact surface 27b and the main surface 22b is shorter than a distance D2 between the second contact surface 27c and the main surface 22b. In other words, the distance D2 between the second contact surface 27c and the main surface 22b is longer than the distance D1 between the first contact surface 27b and the main surface 22b. When changing the viewpoint, the distance between the first contact surface 27b and the main surface 22a is longer than the distance between the second contact surface 27c and the main surface 22a. In other words, the distance between the second contact surface 27c and the main surface 22a is shorter than the distance between the first contact surface 27b and the main surface 22a.

[0033] A difference G in the facing direction of the pair of main surfaces 22a and 22b between the first contact surface 27b and the second contact surface 27c is, for example, equal to or larger than 0.5 mm and equal to or smaller than 1.5 mm. The difference G is a dimension between the first contact surface 27b and the second contact surface 27c in a direction orthogonal to the first contact surface 27b and the second contact surface 27c. The difference G may be appropriately set in response to the diameters or the like of the first clamping member 24 and the second clamping member 26. For example, when the distance D1 between the first contact surface 27b and the main surface 22b is shortened and the difference G is enlarged, the lengths of the first yarn Y1 and the second yarn Y2 clamped by the first clamping member 24 and the second clamping member 26 can be shortened. When the lengths of the first yarn Y1 and the second yarn Y2 clamped by the first clamping member 24 and the second clamping member 26 are shortened, there is concern that the first yarn Y1 and the second yarn Y2 may not be stably clamped by the clamping portion 23. For that reason, it is desirable to appropriately set the difference G on the basis of an experiment or the like to a degree that the first yarn Y1 and the second yarn Y2 are stably clamped by the clamping portion 23.

[0034] An angle of about 90° is formed between the second contact surface 27c and the side surface 22d. It is desirable to polish a surface of a top of a corner between the second contact surface 27c and the side surface 22d. In this configuration, it is possible to suppress the damage of the first yarn Y1 and the second yarn Y2 when the first yarn Y1 and the second yarn Y2 are separated from the top.

[0035] As illustrated in FIG. 2, the clamping portion 23 includes the first clamping member 24 and the second clamping member 26. Each of the first clamping member 24 and the second clamping member 26 is formed in a columnar shape. Each of the first clamping member 24 and the second clamping member 26 is formed of, for example, metal such as SUS having abrasion resistance. The diameter of each of the first clamping member 24 and the second clamping member 26 may be appropriately set.

[0036] The first clamping member 24 and the second clamping member 26 are disposed at the support portion 22 so that respective end surfaces face each other. Specifically, the first clamping member 24 is disposed at the side of the front end portion of the support portion 22 and the second clamping member 26 is disposed at the side of the base end portion of the support portion 22 in relation to the first clamping member 24. The first clamping mechanism 20 holds a yarn by clamping the yarn between the end surface of the first clamping member 24 and the end surface of the second clamping member 26 in the clamping portion 23.

[0037] A part of the first clamping member 24 is accommodated in the support portion 22 and a part of the first clamping member 24 is exposed in the concave portion 25 of the support portion 22. The first clamping member 24 may be fixed to the support portion 22 and may be provided to be movable (slidable on the support surface 27a) in the facing direction of the first clamping mem-

ber 24 and the second clamping member 26 (hereinafter, simply referred to as the "facing direction").

[0038] A part of the second clamping member 26 is accommodated in the support portion 22 and a part of the second clamping member 26 is exposed in the concave portion 25 of the support portion 22. The second clamping member 26 is movably provided in the support portion 22. The second clamping member 26 moves in the facing direction. The second clamping member 26 is biased toward the first clamping member 24 by a biasing member (not illustrated) such as a spring. That is, the end surfaces of the second clamping member 26 and the first clamping member 24 are in contact with each other by a biasing force of a biasing member in a state in which a force other than the biasing member is not applied to the second clamping member 26.

[0039] The second clamping member 26 moves in synchronization with the movement of the support portion 22. The second clamping member 26 moves in a direction moving away from the first clamping member 24 by the movement of the support portion 22 from the second position P2 (see FIG. 6B) to the first position P1 (see FIG. 6A). Specifically, the second clamping member 26 can be pressed down in a direction opposite to the biasing direction of the biasing member by a cam mechanism (not illustrated) or the like when the support portion 22 moves from the second position P2 to the first position P1. Accordingly, a gap (space) is formed between the first clamping member 24 and the second clamping member 26 in the clamping portion 23. Furthermore, the movement of the second clamping member 26 may not be synchronized with the movement of the support portion 22.

[0040] As illustrated in FIGS. 2 and 3, the second clamping mechanism 30 includes a support portion 32 and a clamping portion 33. The second clamping mechanism 30 clamps a yarn inserted through the chamber 14 of the yarn splicing portion 10.

[0041] The support portion 32 has a rectangular parallelepiped shape (prismatic shape). As illustrated in FIG. 5, the support portion 32 includes a pair of facing main surfaces 32a and 32b and a pair of facing side surfaces 32c and 32d. The side surface 32d is a surface which faces the side surface 12c of the yarn splicing nozzle 12.

[0042] The support portion 32 holds the clamping portion 33. The support portion 32 is provided to be swingable. Specifically, as illustrated in FIG. 2, a base end portion of the support portion 32 (one end portion of the longitudinal direction) is provided with a shaft 31. The shaft 31 is fixed to a frame (not illustrated) or the like. The support portion 32 swings about the shaft 31. The support portion 32 moves between a second position P2 (see FIG. 6B) in which a front end portion (the other end portion of the longitudinal direction) moves close to the yarn splicing portion 10 and a first position P1 (see FIG. 6A) in which the front end portion moves away from the yarn splicing portion 10 in relation to the second position P2. That is, the first clamping mechanism 20 moves between the first position P1 and the second position P2. The support portion 32 moves by the driving of, for example, a driving portion (not illustrated) such as a cylinder. The driving portion may be the same as the driving portion that drives the support portion 22 or may be separately provided. In the embodiment, as described above, one end portion of the longitudinal direction provided with the shaft 31 in the support portion 32 will be referred to as a base end portion and the other end portion of the longitudinal direction opposite to the one end portion will be referred to as a front end portion.

[0043] The support portion 32 is provided with a concave portion 35. The concave portion 35 is provided at the side of the front end portion of the support portion 32. The concave portion 35 opens to the main surface 32a and the pair of side surfaces 32c and 32d of the support portion 32. The concave portion 35 exposes a part of the clamping portion 33. As illustrated in FIG. 2, the concave portion 35 has a rectangular shape when viewed from the main surface 32a of the support portion 32. The concave portion 35 has a rectangular shape when viewed from the side surfaces 32c and 32d of the support portion 32.

[0044] As illustrated in FIG. 5, the support portion 32 includes a support surface 37a which slidably supports the second clamping member 36 (the first clamping member 34) to be described later in the clamping portion 33. The support surface 37a is provided at a center portion of the facing direction of the pair of side surfaces 32c and 32d of the support portion 32. The support surface 37a has a shape (a semi-circular shape) which is curved in a convex shape downward in response to the shape of the outer peripheral surface of the second clamping member 36 (the first clamping member 34). The support surface 37a extends in the longitudinal direction of the support portion 32.

[0045] The support portion 32 includes a first contact surface 37b and a second contact surface 37c at a position interposing the support surface 37a in the facing direction of the pair of side surfaces 32c and 32d. The first contact surface 37b and the second contact surface 37c constitute a bottom surface of the concave portion 35. The first contact surface 37b is a surface which is able to contact the first yarn Y1 and the second yarn Y2 clamped by the clamping portion 33. The second contact surface 37c is a surface which contacts the first yarn Y1 and the second yarn Y2 clamped by the clamping portion 33. As illustrated in FIG. 2, the first contact surface 37b and the second contact surface 37c are provided at a position in which at least the first clamping member 34 and the second clamping member 36 contact.

[0046] As illustrated in FIG. 5, the first contact surface 37b is a flat surface which is continuous to one end of the support surface 37a (an end at the side of the side surface 32c). The second contact surface 37c is a flat surface which is continuous to the other end of the support surface 37a (an end at the side of the side surface 32d). That is, respective surfaces are provided in order

of the second contact surface 37c, the support surface 37a, and the first contact surface 37b from the yarn splicing portion 10 when viewed from the facing direction of the pair of main surfaces 32a and 32b of the support portion 32. That is, the second contact surface 37c is disposed between the yarn splicing portion 10 and the clamping portion 33. The second contact surface 37c is located at the inside of the facing direction of the first clamping mechanism 20 and the second clamping mechanism 30 facing each other with the yarn splicing portion 10 interposed therebetween and the first contact surface 37b is located at the outside of the facing direction.

[0047] The first contact surface 37b is substantially parallel to the main surfaces 32a and 32b. The first contact surface 37b is provided over the support surface 37a and the side surface 32c. The second contact surface 37c is substantially parallel to the main surfaces 32a and 32b. The second contact surface 37c is provided over the support surface 37a and the side surface 32d.

[0048] In the embodiment, the first contact surface 37b and the second contact surface 37c are located at different positions in the facing direction of the pair of main surfaces 32a and 32b of the support portion 32. The second contact surface 37c is located above the first contact surface 37b. The first contact surface 37b is located at the side of the main surface 32b in relation to the second contact surface 37c. The second contact surface 37c is located at the side of the main surface 32a in relation to the first contact surface 37b.

[0049] A distance D1 between the first contact surface 37b and the main surface 32b is shorter than a distance D2 between the second contact surface 37c and the main surface 32b. In other words, the distance D2 between the second contact surface 37c and the main surface 32b is longer than the distance D1 between the first contact surface 37b and the main surface 32b. When changing the viewpoint, the distance between the first contact surface 37b and the main surface 32a is longer than the distance between the second contact surface 37c and the main surface 32a. In other words, the distance between the second contact surface 37c and the main surface 32a is shorter than the distance between the first contact surface 37b and the main surface 32a. The first contact surface 37b is located at the same position as that of the first contact surface 27b of the first clamping mechanism 20 and the second contact surface 37c is located at the same position as that of the second contact surface 27c of the first clamping mechanism 20.

[0050] A difference G in the facing direction of the pair of main surfaces 32a and 32b between the first contact surface 37b and the second contact surface 37c is, for example, equal to or larger than 0.5 mm and equal to or smaller than 1.5 mm. The difference G may be appropriately set in response to the diameters or the like of the first clamping member 34 and the second clamping member 36.

[0051] An angle of about 90° is formed between the second contact surface 37c and the side surface 32d. It is desirable to polish a surface of a top of a corner formed by the second contact surface 37c and the side surface 32d.

[0052] As illustrated in FIG. 2, the clamping portion 33 includes the first clamping member 34 and the second clamping member 36. Each of the first clamping member 34 and the second clamping member 36 is formed in a columnar shape. Each of the first clamping member 34 and the second clamping member 36 is formed of, for example, metal such as SUS having abrasion resistance. The diameter of each of the first clamping member 34 and the second clamping member 36 may be appropriately set.

[0053] The first clamping member 34 and the second clamping member 36 are disposed at the support portion 32 so that respective end surfaces face each other. Specifically, the first clamping member 34 is disposed at the side of the front end portion of the support portion 32 and the second clamping member 36 is disposed at the side of the base end portion of the support portion 32 in relation to the first clamping member 34. The second clamping mechanism 30 holds a yarn by clamping the yarn between the end surface of the first clamping member 34 and the end surface of the second clamping member 36 in the clamping portion 33.

[0054] A part of the first clamping member 34 is accommodated in the support portion 32 and a part of the first clamping member 34 is exposed in the concave portion 35 of the support portion 32. The first clamping member 34 may be fixed to the support portion 32 and may be provided to be movable in the facing direction of the first clamping member 34 and the second clamping member 36 (to be slidable on the support surface 37a).

[0055] A part of the second clamping member 36 is accommodated in the support portion 32 and a part of the second clamping member 36 is exposed in the concave portion 35 of the support portion 32. The second clamping member 36 is movably provided in the support portion 32. The second clamping member 36 moves in the facing direction. The second clamping member 36 is biased toward the first clamping member 34 by a biasing member (not illustrated) such as a spring. That is, the end surfaces of the second clamping member 36 and the first clamping member 34 contact each other by a biasing force of a biasing member in a state in which a force other than the biasing member is not applied to the second clamping member 36.

[0056] The second clamping member 36 moves in synchronization with the movement of the support portion 32. The second clamping member 36 moves in a direction moving away from the first clamping member 34 by the movement of the support portion 32 from a second position P2 (see FIG. 6B) to a first position P1 (see FIG. 6A). Specifically, the second clamping member 36 is pressed down in a direction opposite to the biasing direction of the biasing member by a cam mechanism (not illustrated) or the like when the support portion 32 moves from the second position P2 to the first position P1. Ac-

cordingly, a gap (space) is formed between the first clamping member 34 and the second clamping member 36 in the clamping portion 33. Furthermore, the movement of the second clamping member 36 may not be synchronized with the movement of the support portion 32.

[0057] Subsequently, a method of forming an entangled portion using the synthetic yarn splicer 1 (a splicing method) will be described.

[0058] First, as illustrated in FIG. 6A, the first yarn Y1 and the second yarn Y2 are set on the synthetic yarn splicer 1. Specifically, the first yarn Y1 and the second yarn Y2 are located in the chamber 14 through the slit 13 of the yarn splicing portion 10 and are disposed on the first clamping mechanism 20 and the second clamping mechanism 30 located at the first position P1. More specifically, the first yarn Y1 and the second yarn Y2 are disposed between the first clamping member 24 and the second clamping member 26 of the first clamping mechanism 20 and are disposed between the first clamping member 34 and the second clamping member 36 of the second clamping mechanism 30. Accordingly, the first yarn Y1 and the second yarn Y2 are placed on the first contact surface 27b and the second contact surface 27c of the first clamping mechanism 20 and are placed on the first contact surface 37b and the second contact surface 37c of the second clamping mechanism 30.

[0059] When the first yarn Y1 and the second yarn Y2 are set on the synthetic yarn splicer 1, the operation portion 7 is operated (pressed down). Accordingly, in the synthetic yarn splicer 1, the driving portion is operated so that the first clamping mechanism 20 and the second clamping mechanism 30 are operated.

[0060] Specifically, the first yarn Y1 and the second yarn Y2 are clamped by the first clamping member 24 and the second clamping member 26 of the first clamping mechanism 20. Further, the first yarn Y1 and the second yarn Y2 are clamped by the first clamping member 34 and the second clamping member 36 of the second clamping mechanism 30. Then, as illustrated in FIG. 6B, the first clamping mechanism 20 and the second clamping mechanism 30 move from the first position P1 to the second position P2. Accordingly, as illustrated in FIG. 7, the first yarn Y1 and the second yarn Y2 are held between the clamping portion 23 and the clamping portion 33 in a loosened state. Further, the first yarn Y1 and the second yarn Y2 are held while contacting at least the second contact surface 27c and the second contact surface 37c.

[0061] Further, when the operation portion 7 is operated, air is injected from the injection hole 16a to the chamber 14 through the air flow path 16. Accordingly, the first yarn Y1 and the second yarn Y2 located inside the chamber 14 are spliced by the action of air to form an entangled portion.

[0062] Subsequently, the operation of the operation portion 7 is cancelled. Accordingly, in the synthetic yarn splicer 1, the injection of air from the injection hole 16a to the chamber 14 is stopped and the first clamping mechanism 20 and the second clamping mechanism 30 are operated.

[0063] Specifically, as illustrated in FIG. 6A, the first clamping mechanism 20 and the second clamping mechanism 30 move from the second position P2 to the first position P1. In accordance with this operation, the second clamping member 26 of the first clamping mechanism 20 moves in a direction moving away from the first clamping member 24 and the clamping of the first yarn Y1 and the second yarn Y2 by the first clamping member 24 and the second clamping member 26 is cancelled. Also similarly to the second clamping mechanism 30, the second clamping member 36 moves in a direction moving away from the first clamping member 34 and the clamping of the first yarn Y1 and the second yarn Y2 by the first clamping member 34 and the second clamping member 36 is cancelled. Furthermore, the clamping of the first yarn Y1 and the second yarn Y2 by the first clamping member 24 and the second clamping member 26 may be cancelled after the first clamping mechanism 20 moves from the second position P2 to the first position P1. Similarly, the clamping of the first yarn Y1 and the second yarn Y2 by the first clamping member 34 and the second clamping member 36 may be cancelled after the second clamping mechanism 30 moves from the second position P2 to the first position P1. With the above-described configuration, the splicing of the first yarn Y1 and the second yarn Y2 by the synthetic yarn splicer 1 is completed. Accordingly, the first yarn Y1 and the second yarn Y2 become one yarn.

[0064] Subsequently, an operation and an effect of the synthetic yarn splicer 1 according to the embodiment will be described.

[0065] As illustrated in FIG. 8, in a first clamping mechanism 20A of a yarn splicing mechanism 5A according to Comparative Example, a positional relationship between a first contact surface 27b and a second contact surface 27c of a support portion 22A is opposite to that of the first contact surface 27b and the second contact surface 27c of the support portion 22 of the first clamping mechanism 20 according to the embodiment. That is, the second contact surface 27c is located below the first contact surface 27b. A support portion 32A of a second clamping mechanism 30A also has the same configuration.

[0066] In this configuration, if the first yarn Y1 and the second yarn Y2 are swayed in the chamber 14 by using the clamping portions 23 and 33 as fixed points when air is injected, the yarns may contact the second contact surfaces 27c and 37c. In this way, when the first yarn Y1 and the second yarn Y2 contact the second contact surfaces 27c and 37c, a friction occurs due to the contact. Accordingly, since the first yarn Y1 and the second yarn Y2 are damaged, there is concern that an entangled portion is not appropriately formed. As a result, in a configuration according to Comparative Example, there is a possibility that the tensile elongation of the entangled portion may decrease.

[0067] In contrast, in the synthetic yarn splicer 1 according to the embodiment illustrated in FIG. 7, the second contact surfaces 27c and 37c are located above the first contact surfaces 27b and 37b. In this configuration, the first yarn Y1 and the second yarn Y2 are swayed inside the chamber 14 by using the clamping portions 23 and 33 as fixed points. Here, since the second contact surfaces 27c and 37c are located above the first contact surfaces 27b and 37b, the first yarn Y1 and the second yarn Y2 contact at least the second contact surfaces 27c and 37c due to the own weight of the first yarn Y1 and the second yarn Y2 when the first yarn Y1 and the second yarn Y2 are disposed. In this state, when the first yarn Y1 and the second yarn Y2 are clamped by the clamping portion 23 and the clamping portion 33 and air is injected to the first yarn Y1 and the second yarn Y2, the first yarn Y1 and the second yarn Y2 are substantially swayed by using the second contact surfaces 27c and 37c as fixed points. For that reason, in the synthetic yarn splicer 1, a friction due to the contact with the support portions 22 and 32 hardly occurs in the first yarn Y1 and the second yarn Y2 which are swayed. Thus, an entangled portion can be appropriately formed in the synthetic yarn splicer 1. As a result, it is possible to suppress a decrease in tensile elongation of the entangled portion in the synthetic yarn splicer 1.

[0068] Specifically, an effect of the synthetic yarn splicer 1 will be described on the basis of Examples and Comparative Examples. FIGS. 9A to 9D show a tensile elongation decrease amount (%) from a reference value in Examples and Comparative Examples by using a tensile elongation measurement value of a synthetic fiber without an entangled portion as a reference value. Examples show a result of a yarn provided with an entangled portion formed by the synthetic yarn splicer 1 according to the embodiment. Comparative Examples show a result of a yarn provided with an entangled portion formed by the synthetic yarn splicer including the yarn splicing mechanism 5A illustrated in FIG 8. The measurement for four types of yarns (a yarn A to a yarn D) having different thicknesses or molecular structures was performed by TENSORAPID 4 (trade name) manufactured by USTER. Each yarn is a pre-oriented yarn (POY).

(Comparative Example 1 and Example 1)

[0069] A yarn A is a yarn of 135[dtex]-72[f]. In Comparative Example 1, a result was obtained such that a measurement value of the yarn A with respect to a reference value (129.2%) was 115.4% and a tensile elongation decrease amount from the reference value was "-13.8%". In Example 1, a result was obtained such that a measurement value of the yarn A with respect to the reference value was 120.3% and a tensile elongation decrease amount from the reference value was "-8.9%".

(Comparative Example 2 and Example 2)

[0070] A yarn B is a yarn (cationic dyeable yarn) of 88[dtex]-48[f]-CD. In Comparative Example 2, a result was obtained such that a measurement value of the yarn B with respect to a reference value (137.3%) was 120.0% and a tensile elongation decrease amount from the reference value was "-17.3%". In Example 2, a result was obtained such that a measurement value of the yarn B with respect to the reference value was 124.5% and a tensile elongation decrease amount from the reference value was "-12.8%".

(Comparative Example 3 and Example 3)

[0071] A yarn C is a yarn of 84[dtex]-36[f]. In Comparative Example 3, a result was obtained such that a measurement value of the yarn C with respect to a reference value (119.7%) was 107.6% and a tensile elongation decrease amount from the reference value was "-12.1%". In Example 3, a result was obtained such that a measurement value of the yarn C with respect to the reference value was 109.8% and a tensile elongation decrease amount from the reference value was "-9.9%".

(Comparative Example 4 and Example 4)

[0072] A yarn D is a yarn of 90[dtex]-36[f]. In Comparative Example 4, a result was obtained such that a measurement value of the yarn D with respect to a reference value (103.4%) was 97.1% and a tensile elongation decrease amount from the reference value was "-6.3%". In Example 4, a result was obtained such that a measurement value of the yarn D with respect to the reference value was 101.9% and a tensile elongation decrease amount from the reference value was "-1.5%".

[0073] As described above, when the entangled portion is formed by the synthetic yarn splicer 1 according to the embodiment in four types of yarns (the yarn A to the yarn D) having different thicknesses or molecular structures, the tensile elongation decrease amount for any case is smaller than those of Comparative Examples. For that reason, it was found that a decrease in tensile elongation was suppressed when the entangled portion was formed by the synthetic yarn splicer 1. Furthermore, since a tensile elongation value is generally different when the type of yarn (for example, the thickness or the number of filaments) is different, an allowable tensile elongation decrease rate is also different.

[0074] In the synthetic yarn splicer 1 according to the embodiment, the clamping portions 23 and 33 include the first clamping members 24 and 34 and the second clamping members 26 and 36 facing each other. The first contact surfaces 27b and 37b and the second contact surfaces 27c and 37c are provided at a position in which the first clamping members 24 and 34 and the second clamping members 26 and 36 contact. In this configuration, the first yarn Y1 and the second yarn Y2 which are

clamped by the first clamping members 24 and 34 and the second clamping members 26 and 36 can be reliably brought into contact with the second contact surfaces 27c and 37c. For that reason, the first yarn Y1 and the second yarn Y2 are reliably swayed by using the second contact surfaces 27c and 37c as fixed points. Thus, a friction due to the contact with the support portions 22 and 32 does not occur in the first yarn Y1 and the second yarn Y2 which are swayed. As a result, in the synthetic yarn splicer 1, the entangled portion can be appropriately formed and a decrease in tensile elongation of the entangled portion can be suppressed.

[0075] In the synthetic yarn splicer 1 according to the embodiment, the second contact surfaces 27c and 37c are flat surfaces which extend in the facing direction of the first clamping mechanism 20 and the second clamping mechanism 30. In this configuration, it is possible to more avoid a friction due to the contact with the support portions 22 and 32 in the first yarn Y1 and the second yarn Y2 which are swayed.

[0076] In the synthetic yarn splicer 1 according to the embodiment, the difference G between the first contact surfaces 27b and 37b and the second contact surfaces 27c and 37c is equal to or larger than 0.5 mm and equal to or smaller than 1.5 mm. In this configuration, the first yarn Y1 and the second yarn Y2 can be more reliably brought into contact with the second contact surfaces 27c and 37c. Thus, in the synthetic yarn splicer 1, the entangled portion can be appropriately formed and a decrease in tensile elongation of the entangled portion can be suppressed.

[0077] Specifically, an effect of the first contact surfaces 27b and 37b and the second contact surfaces 27c and 37c will be described on the basis of the measurement result. FIGS. 10A and 10B illustrate a measurement result in a case in which the difference G is 0 mm, 0.5 mm, 1.0 mm, and 1.5 mm. FIGS. 10A and 10B illustrate a tensile elongation decrease amount (%) from the reference value for each difference G by using the tensile elongation measurement value of the synthetic fiber without the entangled portion as the reference value. In the measurement, TENSORAPID 4 (trade name) manufactured by USTER was used. FIG. 10A shows a result of a configuration in which the diameter of the chamber 14 is ϕ6.0 mm and the diameter of the injection hole 16a is ϕ1.3 mm in the synthetic yarn splicer 1. FIG. 10B shows a result of a configuration in which the diameter of the chamber 14 is ϕ3.5 mm and the diameter of the injection hole 16a is ϕ1.0 mm in the synthetic yarn splicer 1. In FIGS. 10A and 10B, a measurement was performed six times for each of cases in which the difference G is 0 mm, 0.5 mm, 1.0 mm, and 1.5 mm.

[0078] As illustrated in FIGS. 10A and 10B, when the difference G is 0 mm, that is, height positions of the first contact surfaces 27b and 37b and the second contact surfaces 27c and 37c do not change (the contact surfaces are located at the same height positions), a change in tensile elongation decrease amount occurs. Specifically, when the difference G is 0 mm, a difference between a maximum value and a minimum value of the decrease amount is 7.0% in the measurement result shown in FIG. 10A and a difference between a maximum value and a minimum value of the decrease amount is 10.1% in the measurement result shown in FIG. 10B. In contrast, when the difference G is 0.5 mm, 1.0 mm, and 1.5 mm, a change in decrease amount is small as compared with a case in which the difference G is 0 mm. Further, when the difference G is 0.5 mm, 1.0 mm, and 1.5 mm, an average tensile elongation decrease amount is small as compared with a case in which the difference G is 0 mm. For that reason, when the entangled portion is formed by the synthetic yarn splicer 1, it is found that a change in tensile elongation decrease amount can be suppressed and a decrease in tensile elongation can be suppressed.

[0079] Although the embodiment of the invention has been described, the invention is not essentially limited to the above-described embodiment and can be modified into various forms without departing from the gist thereof.

[0080] In the above-described embodiment, a shape illustrated in FIG. 1 has been described as the shape of the main body 3. However, the shape of the main body 3 is not limited to the shape illustrated in FIG. 1.

[0081] In the above-described embodiment, an example of an embodiment in which the first clamping members 24 and 34 and the second clamping members 26 and 36 are formed in a columnar shape, that is, the cross-sections of the first clamping members 24 and 34 and the second clamping members 26 and 36 are formed in a circular shape has been described. However, the first clamping member and the second clamping member are not limited to the columnar shape as long as the yarn can be clamped, but may be formed in various shapes (for example, prismatic shapes or the like).

[0082] In the above-described embodiment, an example of an embodiment in which the support portions 22 and 32 swing about the shafts 21 and 31 to move to the first position P1 and the second position P2 has been described. However, the support portions 22 and 32 may move in a direction moving close to each other and moving away from each other, for example, in a substantially parallel state.

[0083] In the above-described embodiment, an example of an embodiment in which the first yarn Y1 and the second yarn Y2 are disposed on the first clamping mechanism 20 and the second clamping mechanism 30 located at the first position P1, the first clamping mechanism 20 and the second clamping mechanism 30 are moved from the first position P1 to the second position P2, and air is injected from the injection hole 16a to the chamber 14 to form an entangled portion has been described. However, a method of forming the entangled portion by using the synthetic yarn splicer 1 is not limited thereto.

[0084] For example, the first yarn Y1 and the second yarn Y2 are disposed on the first clamping mechanism 20 and the second clamping mechanism 30 located at

the second position P2, the first clamping mechanism 20 and the second clamping mechanism 30 are moved from the second position P2 to the first position P1, the first clamping mechanism 20 and the second clamping mechanism 30 are moved from the first position P1 to the second position P2, and air is injected from the injection hole 16a to the chamber 14 to form an entangled portion.

[0085] In the above-described embodiment, an example of an embodiment in which the synthetic yarn splicer 1 is a hand splicer used while being gripped by an operator has been described. However, the synthetic yarn splicer may be provided in an apparatus or the like.

REFERENCE SIGNS LIST

[0086] 1... SYNTHETIC YARN SPLICER, 10...YARN SPLICING PORTION, 14...CHAMBER (PASSEGE), 16a...INJECTION HOLE. 20...FIRST CLAMPING MECHANISM, 22...SUPPORTING PORTION, 23...CLAMPING PORTION, 24...FIRST CLAMPING MEMBER, 26...SECOND CLAMPING MEMBER, 27b...FIRST CONTACT SURFACE, 27c...SECOND CONTACT SURFACE, 30...SECOND CLAMPING MECHANISM, 32...SUPPORT PORTION, 33...CLAMPING PORTION, 34...FIRST CLAMPING MEMBER, 36...SECOND CLAMPING MEMBER, 37b...FIRST CONTACT SURFACE, 37c...SECOND CONTACT SURFACE, Y1...FIRST YARN (ONE YARN), Y2...SECOND YARN (OTHER YARN).

Claims

1. A synthetic yarn splicer (1) that performs a splicing operation between one yarn (Y1) and the other yarn (Y2) formed of synthetic fibers, comprising:

   a yarn splicing portion (10) that includes a passage (14) through which one yarn (Y1) and the other yarn (Y2) are insertable and an injection hole (16a) which opens to the passage (14) and injects a fluid; and
   a pair of clamping mechanisms (20,30) that is located at a position interposing the passage (14) of the yarn splicing portion (10) and clamps each of one yarn (Y1) and the other yarn (Y2) inserted through the passage (14),
   wherein each of the pair of clamping mechanisms (20,30) includes a clamping portion (23,33) that clamps each of one yarn (Y1) and the other yarn (Y2) and a support portion (22,32) that supports the clamping portion (23,33),
   wherein the support portion (22,32) includes a first contact surface (27b,37b) and a second contact surface (27c,37c) which are disposed at a position interposing the clamping portion (23,33) in the facing direction of the pair of clamping mechanisms (20,30), and
   wherein the second contact surface (27c,37c) is disposed between the yarn splicing portion (10) and the clamping portion (23,33) and is located above the first contact surface (27b,37b).

2. The synthetic yarn splicer (1) according to claim 1,
   wherein the clamping portion (23,33) includes a pair of clamping members (24,26,34,36) facing each other, and
   wherein the first contact surface (27b,37b) and the second contact surface (27c,37c) are provided at a position in which one clamping member (24,34) and the other clamping member (26,36) contact.

3. The synthetic yarn splicer (1) according to claim 1 or 2,
   wherein the second contact surface (27c,37c) is a flat surface which extends in the facing direction of the pair of clamping mechanisms (20,30).

4. The synthetic yarn splicer (1) according to any one of claims 1 to 3,
   wherein a dimension between the first contact surface (27b,37b) and the second contact surface (27c,37c) in a direction orthogonal to the first contact surface (27b,37b) and the second contact surface (27c,37c) is equal to or larger than 0.5 mm and equal to or smaller than 1.5 mm.

Fig.1

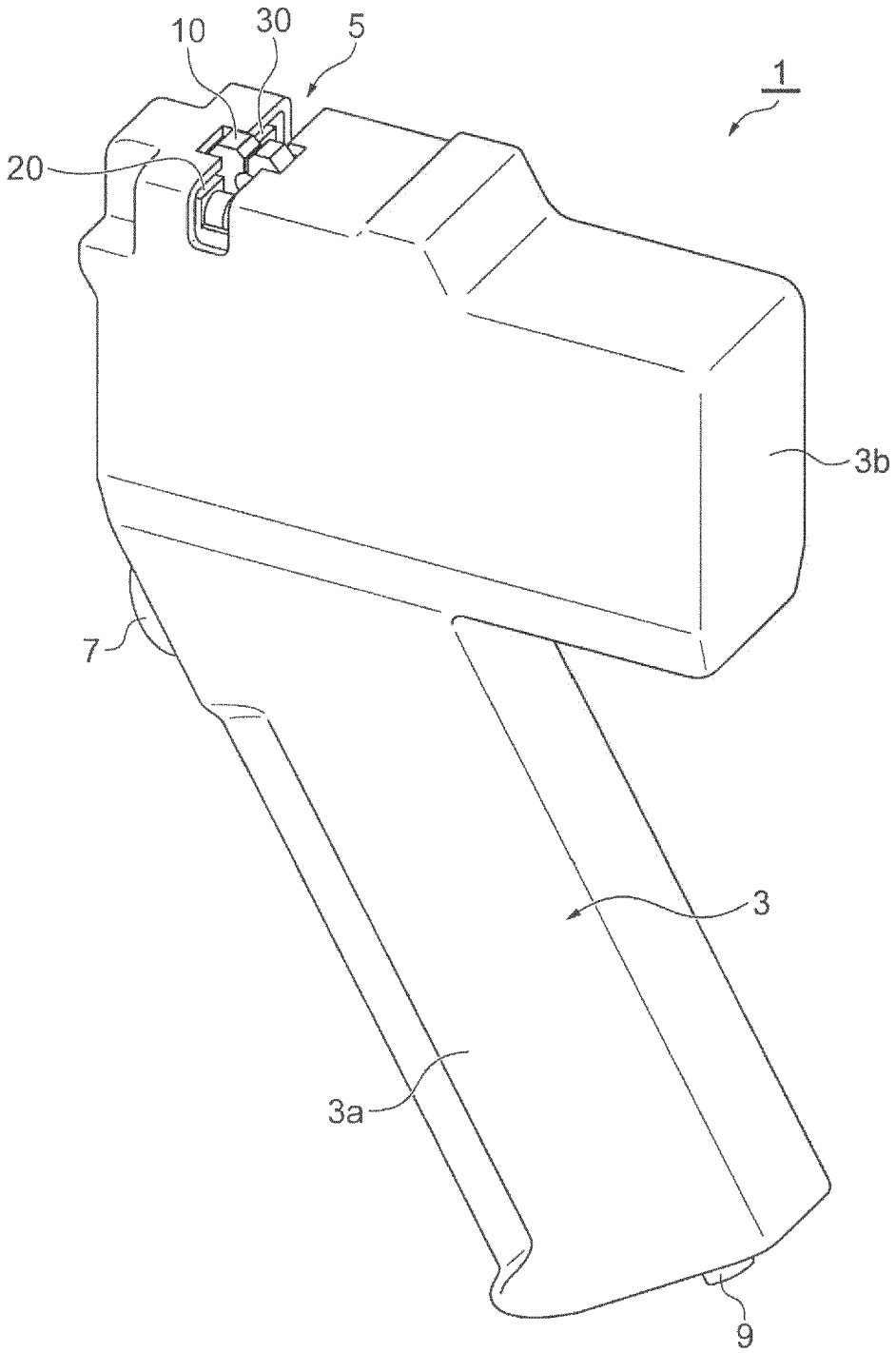


Fig.2

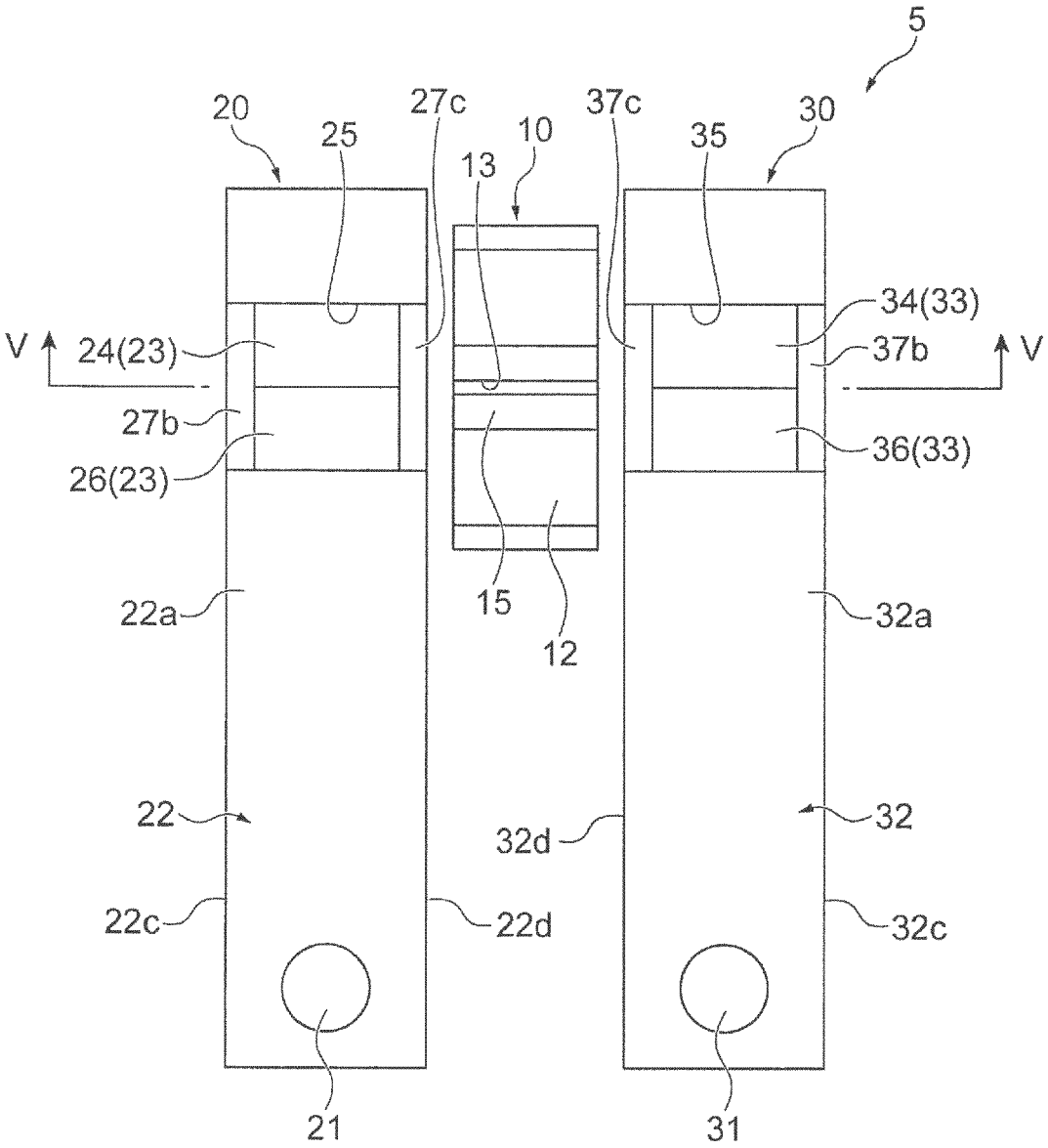

5
20
25
27c
10
13
37c
35
30
34(33)
V
24(23)
37b
V
27b
36(33)
26(23)
22a
15
12
32a
22
32d
32
22c
22d
32c
21
31

Fig.3

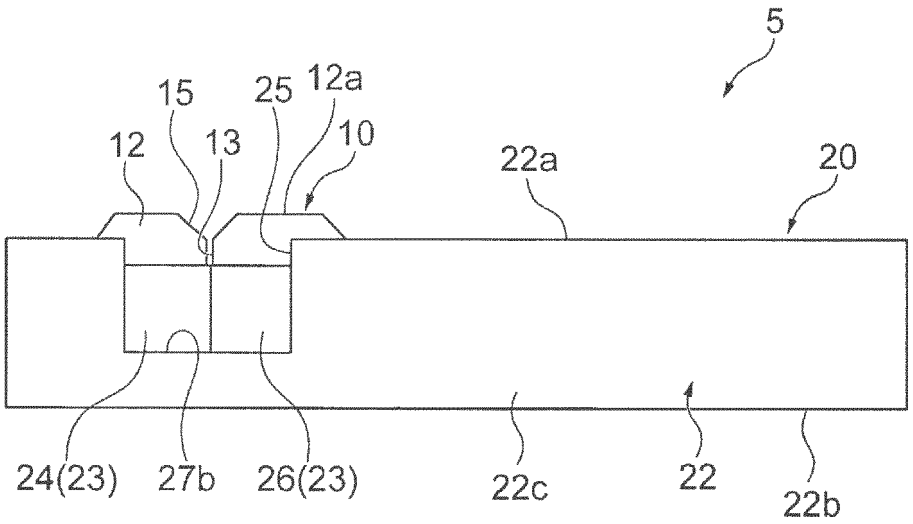
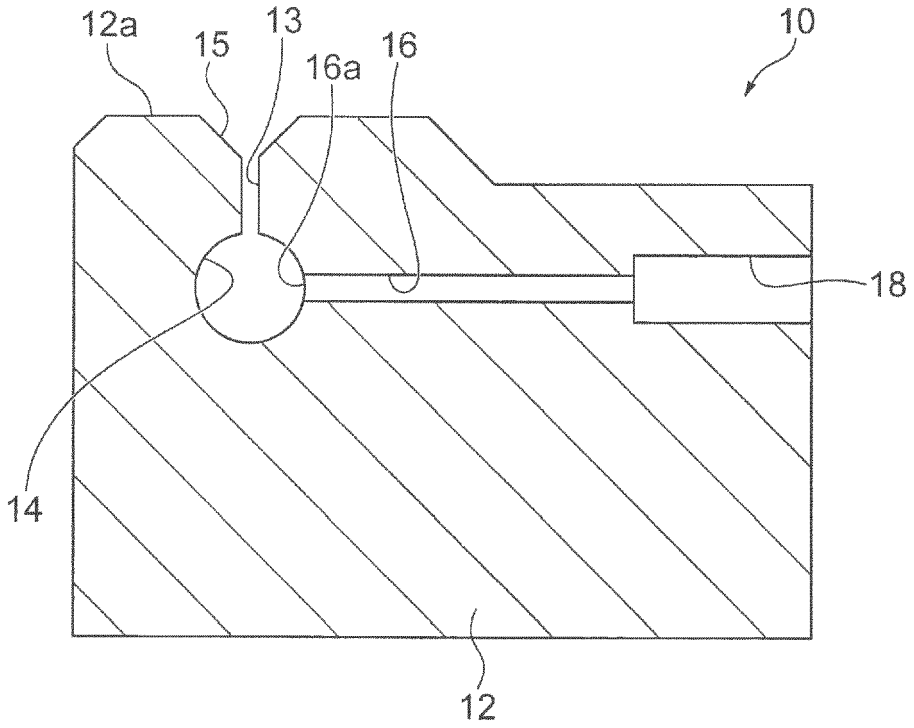


Fig.4



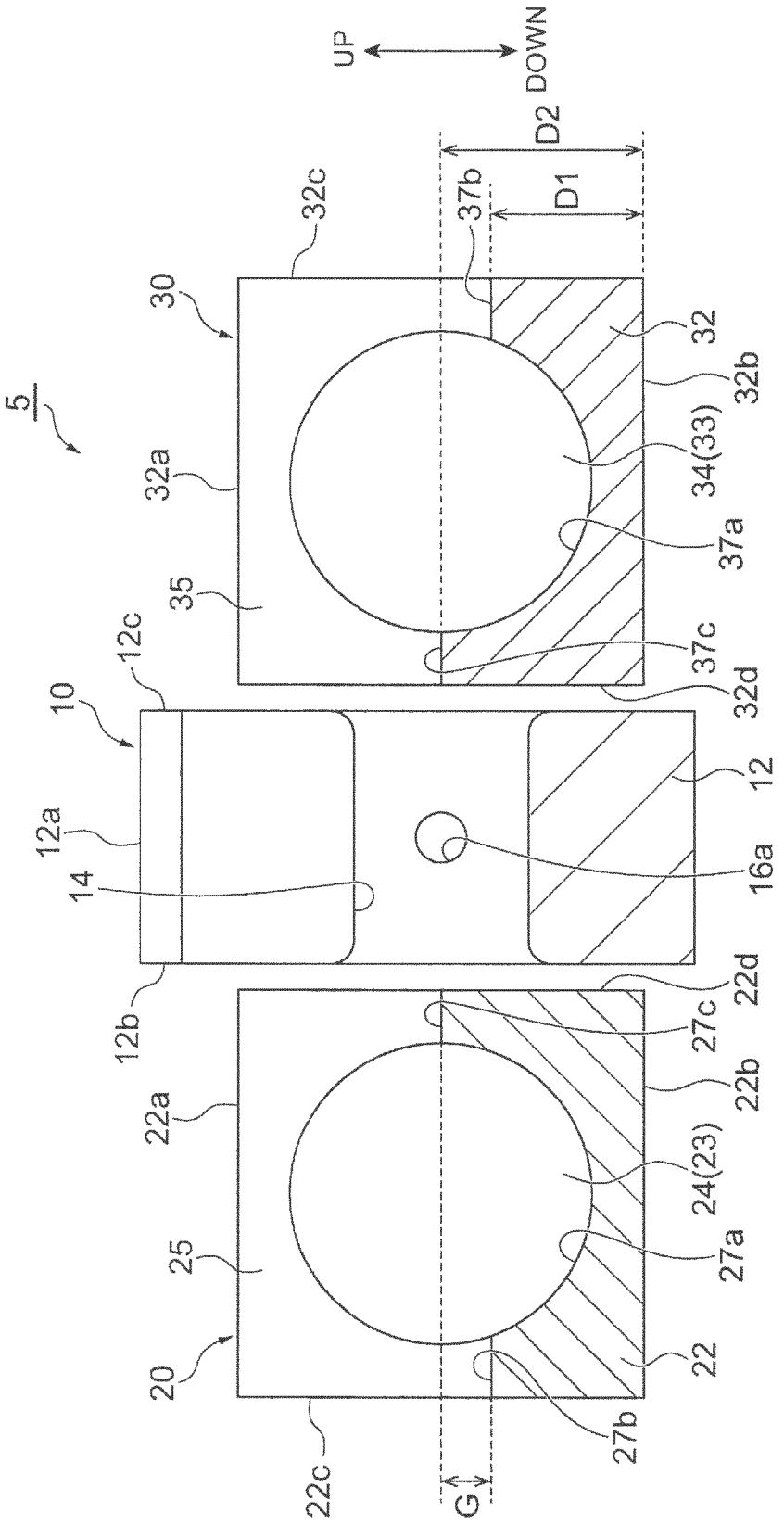
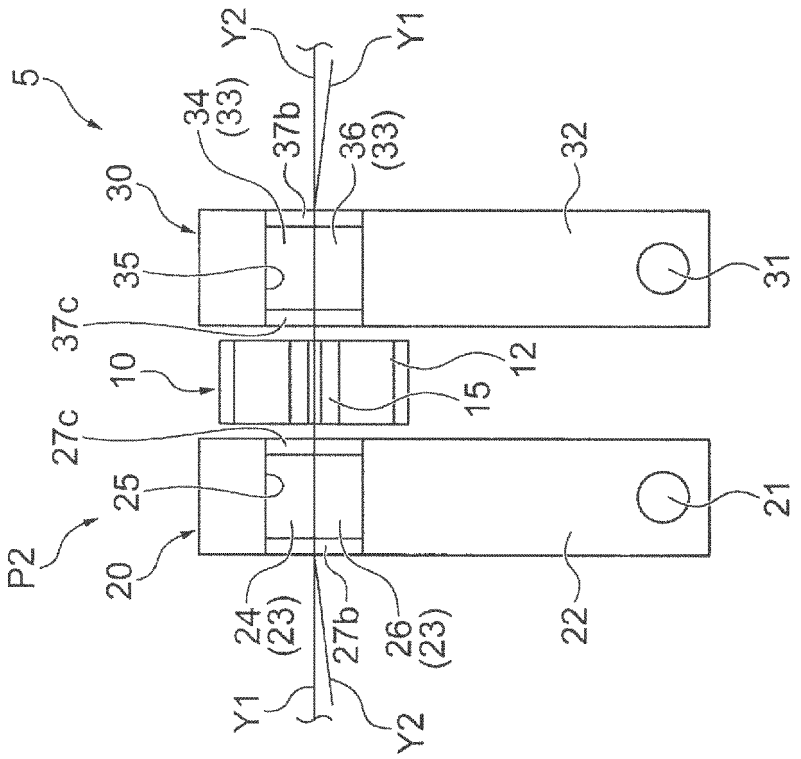

UP
DOWN
D2
D1
5
30
32c
37b
32
32b
32a
34(33)
37a
35
37c
32d
12c
10
12
12a
16a
14
12b
22d
27c
22b
22a
24(23)
25
27a
20
22
27b
22c
G

Fig.5

Fig.6B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Y2
Y1
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(33)
37b
36
(33)
30
32
35
31
37c
10
12
15
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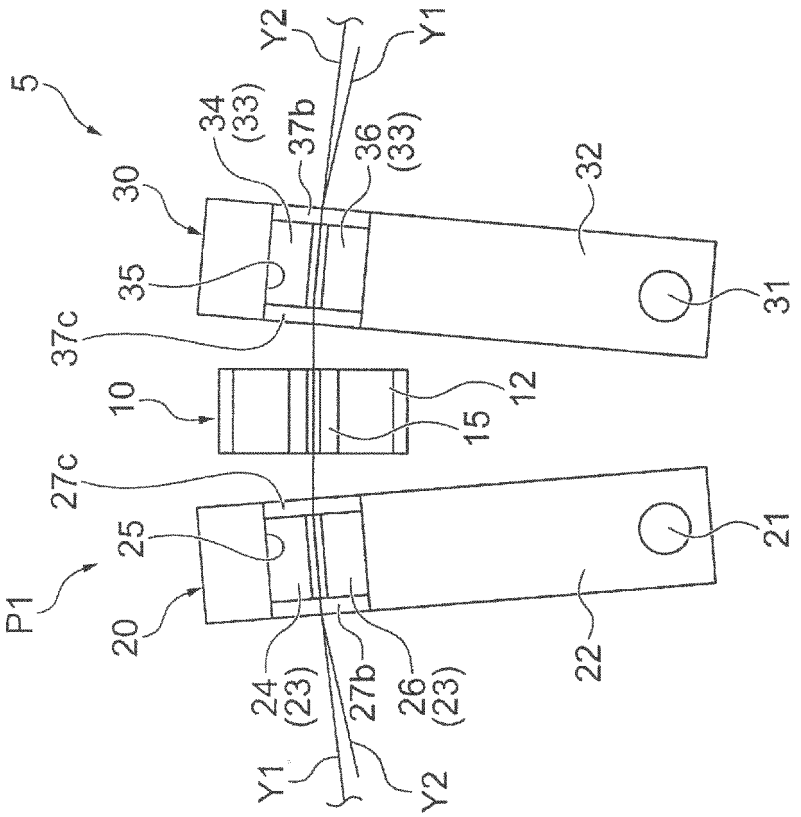
20
22
24
(23)
27b
26
(23)
Y1
Y2

Fig.6A


5
Y2
Y1
34
(33)
37b
36
(33)
30
32
35
31
37c
10
12
15
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22
24
(23)
27b
26
(23)
Y1
Y2

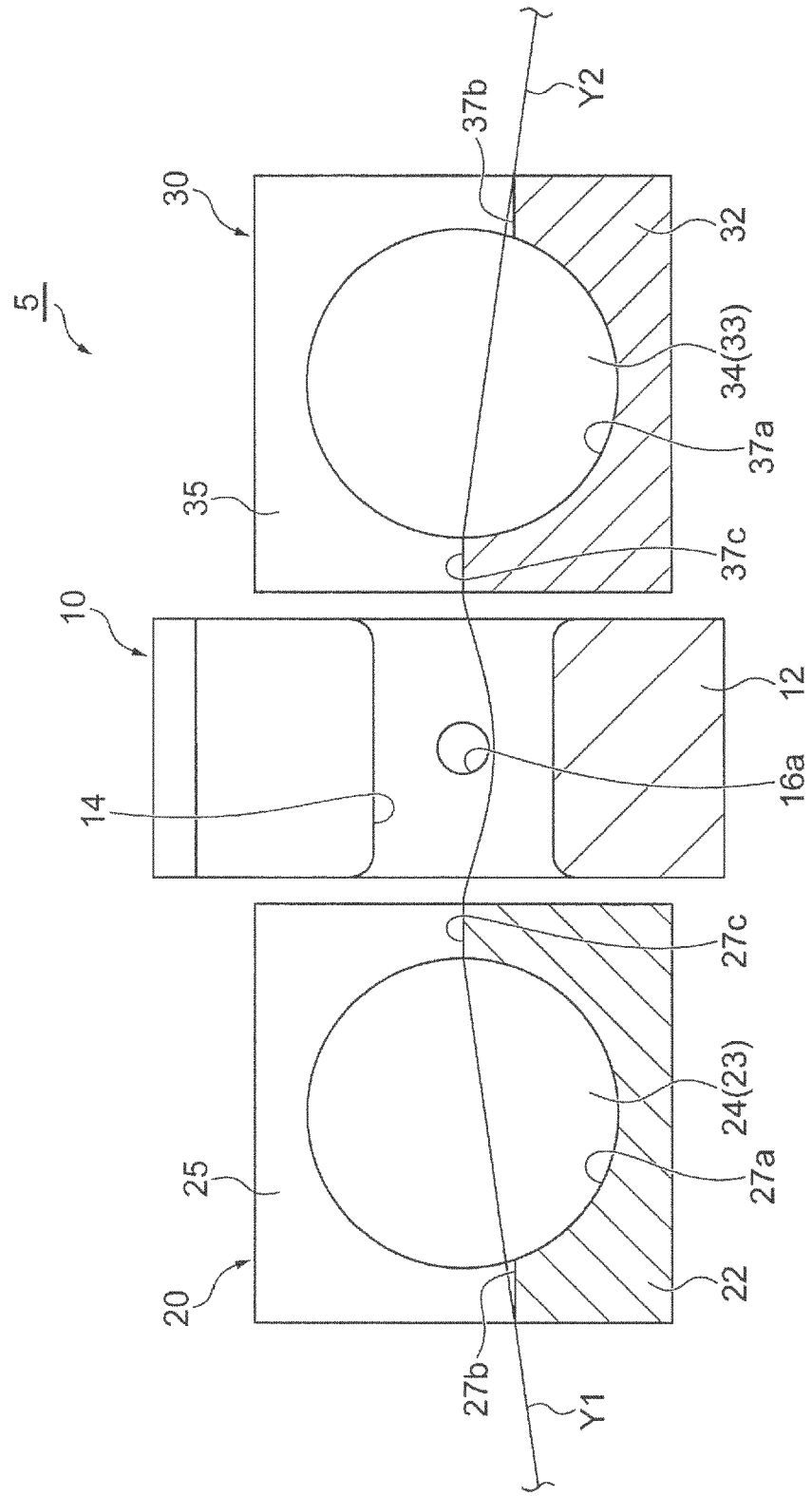
5
30
37b
Y2
32
34(33)
37a
35
37c
10
12
16a
14
27c
24(23)
27a
25
22
20
27b
Y1

Fig.7

Fig.8

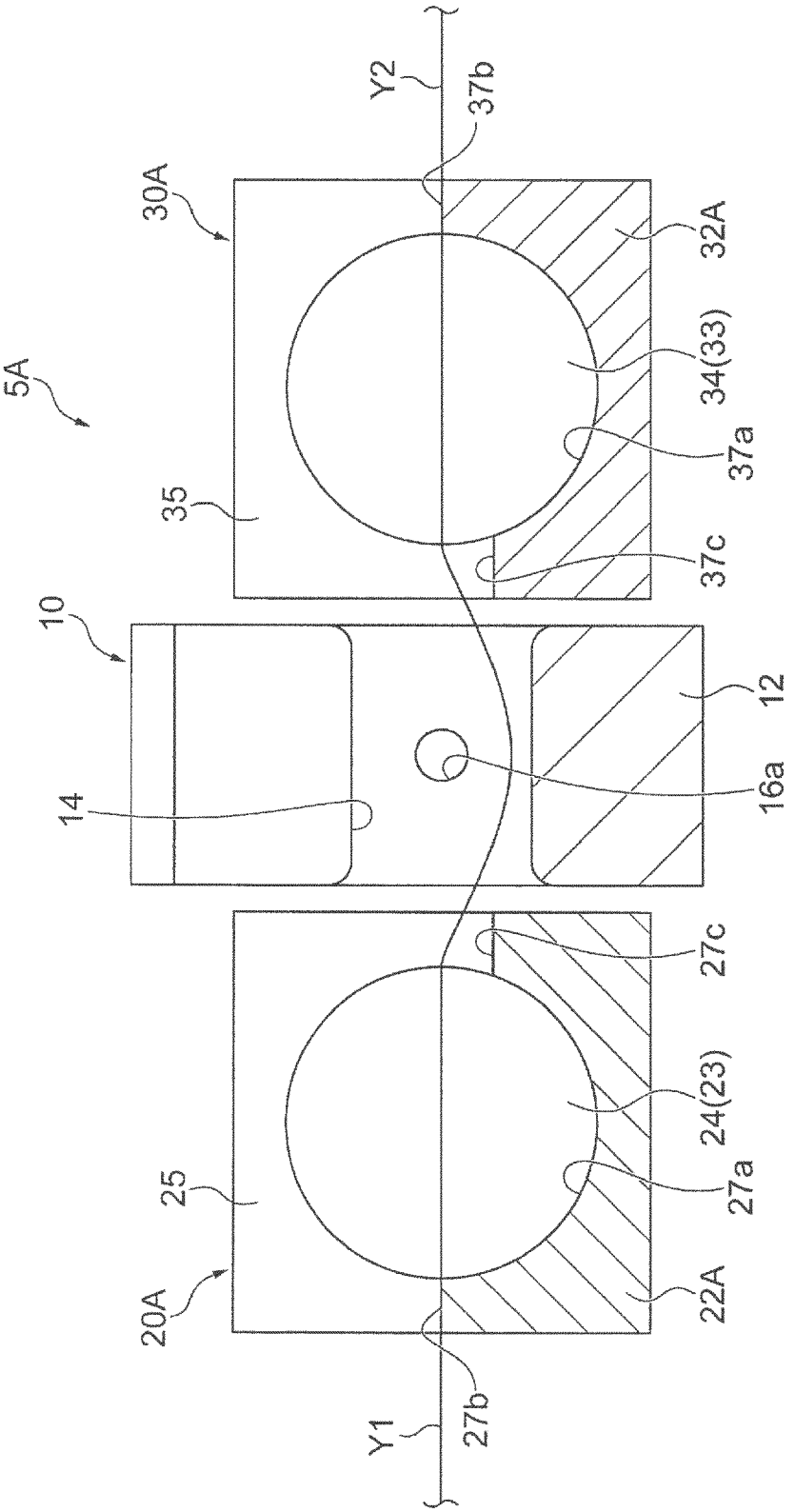
5A
10
14
16a
12
20A
25
27b
27a
24(23)
27c
22A
Y1
30A
35
37b
37a
34(33)
37c
32A
Y2

Fig.9A

YARN A : 135[dtex]-72[f]

	REFERENCE	COMPARATIVE EXAMPLE	EXAMPLE
TENSILE ELONGATION[%]	129.2	115.4	120.3
DECREASE AMOUNT[%]	—	-13.8	-8.9

Fig.9B

YARN B : 88[dtex]-48[f]-CD

	REFERENCE	COMPARATIVE EXAMPLE	EXAMPLE
TENSILE ELONGATION[%]	137.3	120.0	124.5
DECREASE AMOUNT[%]	—	-17.3	-12.8

Fig.9C

YARN C : 84[dtex]-36[f]

	REFERENCE	COMPARATIVE EXAMPLE	EXAMPLE
TENSILE ELONGATION[%]	119.7	107.6	109.8
DECREASE AMOUNT[%]	—	-12.1	-9.9

Fig.9D

YARN D : 90[dtex]-36[f]

	REFERENCE	COMPARATIVE EXAMPLE	EXAMPLE
TENSILE ELONGATION[%]	103.4	97.1	101.9
DECREASE AMOUNT[%]	—	-6.3	-1.5

Fig.10A

	G : 0[mm]	G : 0.5[mm]	G : 1.0[mm]	G : 1.5[mm]
1	-2.7%	-4.1%	-3.7%	-4.5%
2	-4.4%	-4.4%	-4.8%	-3.1%
3	-7.3%	-3.5%	-3.1%	-2.0%
4	-9.7%	-5.5%	-2.5%	-2.5%
5	-3.5%	-5.0%	-1.8%	-4.5%
6	-3.0%	-3.6%	-3.9%	-3.2%
AVERAGE	-5.1%	-4.3%	-3.3%	-3.3%
DIFFERENCE BETWEEN MAXIMUM VALUE AND MINIMUM VALUE OF DECREASE AMOUNT	7.0%	1.9%	3.0%	2.5%

Fig.10B

	G : 0[mm]	G : 0.5[mm]	G : 1.0[mm]	G : 1.5[mm]
1	-7.5%	-9.0%	-6.6%	-9.6%
2	-17.6%	-4.8%	-5.9%	-7.4%
3	-8.7%	-7.0%	-8.0%	-7.1%
4	-11.2%	-9.0%	-6.0%	-7.2%
5	-9.0%	-8.8%	-4.0%	-5.8%
6	-7.9%	-6.9%	-3.7%	-10.9%
AVERAGE	-10.3%	-7.6%	-5.7%	-8.0%
DIFFERENCE BETWEEN MAXIMUM VALUE AND MINIMUM VALUE OF DECREASE AMOUNT	10.1%	4.2%	4.3%	5.1%

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 19 16 7460

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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