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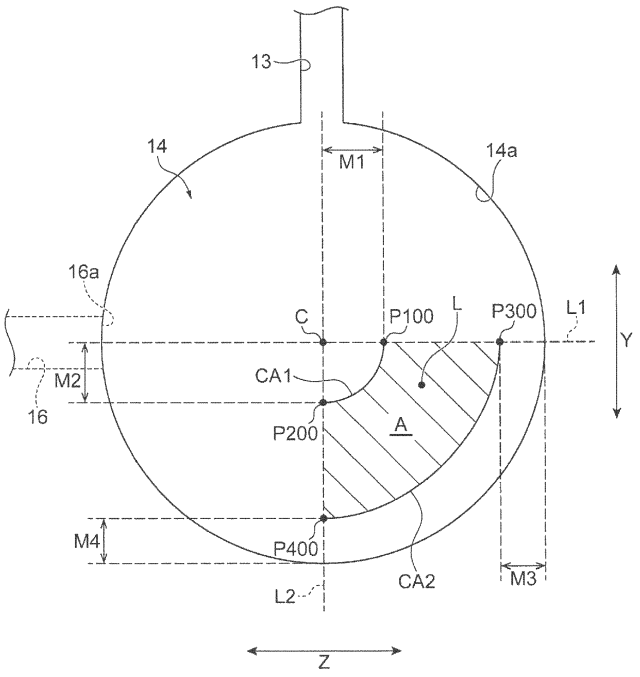
(54) SYNTHETIC YARN SPLICER

(57) A synthetic yarn splicer 1 includes a yarn splicing portion 10, a first clamping mechanism 20, and a second clamping mechanism 30, in which the first clamping mechanism 20 and the second clamping mechanism 30 clamp a first yarn Y1 and a second yarn Y2 so that a line L connecting a pair of clamping positions CP1 and CP2 of the first yarn Y1 and the second yarn Y2 is located in an area A of a chamber 14 and the area A is an area which is located at the side opposite to a slit 13 with respect to a first line L1 and is located at the side opposite to an injection hole 16a with respect to a second line L2 following a first direction Y and passing through a center C.

Fig.8



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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 splices one yarn and the other yarn formed of synthetic fibers, including: a yarn splicing portion that includes a passage which forms a space through which the one yarn and the other yarn are insertable, a slit which communicates with the passage and allows the one yarn and the other yarn to be insertable into the passage from an insertion direction orthogonal to a penetration direction of the passage, and an injection hole which opens to the passage and injects a fluid; and a pair of clamping mechanisms that is provided at a position interposing the passage of the yarn splicing portion in the penetration direction of the passage and clamps each of the one yarn and the other yarn inserted through the space, in which the passage has a circular shape when viewed from the penetration direction of the passage, in which the injection hole is disposed on a first line which is orthogonal to the penetration direction of the passage and the insertion direction and passes through a center of the passage, in which the pair of clamping mechanisms clamps the one yarn and the other yarn so that a line connecting a pair of clamping positions of the one yarn and the other yarn is located in a predetermined area of the passage when viewed from the penetration direction of the passage, and in which the predetermined area is an area which is located at the side opposite to the slit with respect to the first line and is located at the side opposite to the injection hole with respect to a second line following the insertion direction and passing through the center.

[0006] In the synthetic yarn splicer, a fluid which is injected from the injection hole collides with the inner peripheral surface of the passage at a position facing the injection hole and flows to the slit and to the side opposite to the slit along the inner peripheral surface. The fluid flowing to the slit can flow to the outside of the passage through the slit. For that reason, when the line connecting the clamping position is located in an area at the side of the slit with respect to the first line, a fluid does not effectively act on one yarn and the other yarn and one yarn and the other yarn are not appropriately swayed in the passage. Accordingly, there is a possibility that the entangled portion is not appropriately formed. Further, when the line connecting the clamping position is located in an area at the side of the injection hole with respect to the second line, there is a possibility that the fluid injected from the injection hole is directly sprayed to one yarn and the other yarn. Accordingly, since the fluid does not effectively act on one yarn and the other yarn and one yarn and the other yarn are not effectively swayed in the passage, there is a possibility that the entangled portion is not appropriately formed.

[0007] In the synthetic yarn splicer according to an aspect of the invention, the pair of clamping mechanisms clamps one yarn and the other yarn so that the line connecting the pair of clamping positions of one yarn and the other yarn is located in a predetermined area of the passage when viewed from the penetration direction of the passage. The predetermined area is an area which is located at the side opposite to the slit with respect to the first line and is located at the side opposite to the injection hole with respect to the second line following the insertion direction and passing through the center. In this configuration, since one yarn and the other yarn are entangled by a fluid which is injected from the injection hole, collides with the inner peripheral surface of the passage, and flows along the inner peripheral surface to the side opposite to the slit, the fluid effectively acts on one yarn and the other yarn. For that reason, in the synthetic yarn splicer, since one yarn and the other yarn are appropriately swayed in the passage, the entangled portion can be appropriately formed. As a result, in the synthetic yarn splicer, a decrease in tensile elongation of the entangled portion can be suppressed.

[0008] In one embodiment, the predetermined area may be an area between a first circular arc which is distant from the center by 0.5 mm and a second circular arc which is distant from the inner peripheral surface of the passage by 0.3 mm. In this configuration, since one yarn and the other yarn are more effectively entangled by a fluid flowing along the inner peripheral surface, the fluid more effectively acts on one yarn and the other yarn in the synthetic yarn splicer. Thus, in the synthetic yarn splicer, it is possible to further suppress a decrease in tensile elongation of the entangled portion.

[0009] In one embodiment, a diameter of the passage may be equal to or larger than ϕ3.5 mm and equal to or smaller than ϕ6.0 mm and a diameter of the injection hole may be equal to or larger than ϕ1.0 mm and equal to or smaller than ϕ1.3 mm. In this configuration, it is possible to more appropriately form the entangled portion. Accordingly, in the synthetic yarn splicer, it is possible to suppress a change in tensile elongation decrease amount while suppressing a decrease in tensile elongation of the entangled portion.

[0010] In one embodiment, each of the pair of clamping mechanism may include a clamping portion including a pair of clamping members clamping each of the one yarn and the other yarn. In this configuration, the clamping position of each of one yarn and the other yarn can be accurately set. Accordingly, in the synthetic yarn splicer, the line connecting the pair of clamping positions can be reliably located in a predetermined area.

[0011] In one embodiment, each of the pair of clamping mechanisms may include a support portion supporting the clamping portion and the support portion may be disposed between the yarn splicing portion and the clamping portion and may include a contact surface contacting the one yarn and the other yarn clamped by the clamping portion. In this configuration, one yarn and the other yarn can be supported by the contact surface. Thus, in the synthetic yarn splicer, the clamping position of each of one yarn and the other yarn can be more accurately set. As a result, in the synthetic yarn splicer, the line connecting the pair of clamping positions can be reliably located in a predetermined area.

[0012] According to an_aspect of the invention, it is possible to suppress a decrease in tensile elongation of an entangled portion.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

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 an area in a chamber.

FIG. 9 is a diagram illustrating each point in the chamber.

FIG. 10A is a diagram showing a measurement result.

FIG. 10B is a diagram showing a measurement result.

FIG. 10C is a diagram showing a measurement result.

FIG. 11A is a diagram showing a measurement result.

FIG. 11B is a diagram showing a measurement result.

FIG. 11C is a diagram showing a measurement result.

FIG. 12A is a diagram showing a measurement result.

FIG. 12B is a diagram showing a measurement result.

FIG. 12C is a diagram showing a measurement result.

FIG. 13A is a diagram showing a measurement result.

FIG. 13B is a diagram showing a measurement result.

FIG. 13C is a diagram showing a measurement result.

DETAILED DESCRIPTION

[0014] 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.

[0015] 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.

[0016] 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.

[0017] 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.

[0018] 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.

[0019] 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.

[0020] 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.

[0021] As illustrated in FIG 4, the yarn splicing portion 10 includes a yarn splicing nozzle 12, a slit 13, a chamber (passage) 14, and an air flow passage 16.

[0022] The yarn splicing nozzle 12 is a block body which is formed of metal or ceramic. The yarn splicing nozzle 12 includes an upper surface 12a, a pair of side surfaces 12b and 12c, and a lower surface 12d. A facing direction in which the upper surface 12a faces the lower surface 12d is a first direction Y (see FIG. 4). A facing direction in which a pair of side surfaces 12b and 12c faces each other is a second direction X (see FIG. 5). A direction orthogonal to the first direction Y and the second direction X is a third direction Z (see FIG. 4).

[0023] The slit 13 is provided in the yarn splicing nozzle 12. The slit 13 is a portion which communicates with the chamber 14 and introduces a yarn into the chamber 14. The slit 13 is formed over the upper surface 12a of the yarn splicing nozzle 12 and the chamber 14. The slit 13 is disposed on a second line L2 (see FIG. 8) to be described later and extends in the first direction Y. That is, the insertion direction of the first yarn Y1 and the second yarn Y2 with respect to the slit 13 is the first direction Y. 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 the upper surface 12a of the yarn splicing nozzle 12 toward the slit 13.

[0024] 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. That is, the penetration direction of the chamber 14 is a facing direction (a second direction X) of the pair of side surfaces 12b and 12c and is orthogonal to the insertion direction of the first yarn Y1 and the second yarn Y2 with respect to the slit 13. 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. In the embodiment, the chamber 14 has a true circular shape. The diameter of the chamber 14 is equal to or larger than, for example, ϕ3.5 mm and equal to or smaller than ϕ6.0 mm.

[0025] 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 diameter of the injection hole 16a is desirably equal to or larger than ϕ1.0 mm and equal to or smaller than ϕ1.3 mm. In the embodiment, the injection hole 16a is disposed on the first line L1 (see FIG. 8) in the chamber 14. 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.

[0026] 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.

[0027] 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 arid 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.

[0028] 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.

[0029] 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.

[0030] 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.

[0031] 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.

[0032] 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.

[0033] 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. The first contact surface 27b and the second contact surface 27c are located at the same height position in the facing direction of the pair of main surfaces 22a and 22b of the support portion 22.

[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 member 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. The first contact surface 37b and the second contact surface 37c are located at the same height position in the facing direction of the pair of main surfaces 32a and 32b of the support portion 32.

[0048] 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.

[0049] 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.

[0050] 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.

[0051] 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).

[0052] 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.

[0053] 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. Accordingly, 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.

[0054] As illustrated in FIGS. 7 and 8, the first clamping mechanism 20 and the second clamping mechanism 30 clamp the first yarn Y1 and the second yarn Y2 so that

the line L connecting the pair of clamping positions CP1 and CP2 of the first yarn Y1 and the second yarn Y2 is located at an area (a predetermined area) A in the chamber 14 at the second position P2.

[0055] As illustrated in FIG. 7, the clamping position CP1 is a position of each of the end portions of the first yarn Y1 and the second yarn Y2 (one end portion between the first clamping mechanism 20 and the second clamping mechanism 30) clamped by the first clamping member 24 and the second clamping member 26 and contacting the second contact surface 27c in the first clamping mechanism 20. Similarly, the clamping position CP2 is a position of each of the end portions of the first yarn Y1 and the second yarn Y2 (the other end portion between the first clamping mechanism 20 and the second clamping mechanism 30) clamped by the first clamping member 34 and the second clamping member 36 and contacting the second contact surface 37c in the second clamping mechanism 30.

[0056] As illustrated in FIG. 8, the area A is located at the side of the lower surface 12d (the side opposite to the slit 13) with respect to the first line L1 following the third direction Z of the yarn splicing nozzle 12 and passing through the center C of the chamber 14 and is located at the side opposite to the injection hole 16a with respect to the second line L2 following the first direction Y and passing through the center C. That is, the area A is located inside a fan-shaped area in which a center angle formed between the first line L1 and the second line L2 is 90°.

[0057] The area A is an annular area between a first circular arc CA1 which is distant from the center by 0.5 mm and a second circular arc CA2 which is distant from the inner peripheral surface 14a of the chamber 14 by 0.3 mm. That is, a distance M1 between the center C and an intersection point P100 between the first circular arc CA1 and the first line L1 is 0.5 mm. A distance M2 between the center C and an intersection point P200 between the first circular arc CA1 and the second line L2 is 0.5 mm. A distance M3 between the inner peripheral surface 14a and an intersection point P300 between the second circular arc CA2 and the first line L1 is 0.3 mm. A distance M4 between the inner peripheral surface 14a and an intersection point P400 between the second circular arc CA2 and the second line L2 is 0.3 mm. A distance between the first circular arc CA1 and the second circular arc CA2 in the radial direction of the chamber 14 is constant.

[0058] In the synthetic yarn splicer 1, the pair of clamping positions CP1 and CP2 of the first yarn Y1 and the second yarn Y2 in the first clamping mechanism 20 and the second clamping mechanism 30 can be adjusted by adjusting the positions of the yarn splicing portion 10 and/or the support portion 22 and the support portion 32. Specifically, for example, the positions of the pair of clamping positions CP1 and CP2 in the first direction Y can be adjusted by changing the positions of the support portion 22 and the support portion 32. For example, the positions of the pair of clamping positions CP1 and CP2 in the third direction Z can be adjusted by changing the position of the yarn splicing portion 10.

[0059] Subsequently, a method of forming an entangled portion using the synthetic yarn splicer 1 (a splicing method) will be described.

[0060] 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.

[0061] 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.

[0062] 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. At this time, the line L connecting the pair of clamping positions CP1 and CP2 of the first yarn Y1 and the second yarn Y2 is located at the area A of the chamber 14.

[0063] 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.

[0064] 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 mech-

anism 20 and the second clamping mechanism 30 are operated.

[0065] 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.

[0066] As described above, in the synthetic yarn splicer 1 according to the embodiment, the first clamping mechanism 20 and the second clamping mechanism 30 clamp the first yarn Y1 and the second yarn Y2 so that the line L connecting the pair of clamping positions CP1 and CP2 of the first yarn Y1 and the second yarn Y2 is located in an area A of the chamber 14 when viewed from the second direction X. The area A is, as illustrated in FIG. 8, an area which is defined by the first circular arc CA1 and the second circular arc CA2. In this configuration, since the first yarn Y1 and the second yarn Y2 are entangled with air which is injected from the injection hole 16a, collides with the inner peripheral surface 14a of the chamber 14, and flows to the side of the lower surface 12d of the yarn splicing nozzle 12 (the side opposite to the slit 13) along the inner peripheral surface 14a, the air effectively acts on the first yarn Y1 and the second yarn Y2. For that reason, in the synthetic yarn splicer 1, since the first yarn Y1 and the second yarn Y2 are appropriately swayed in the chamber 14, the entangled portion can be appropriately formed. As a result, in the synthetic yarn splicer 1, a decrease in tensile elongation of the entangled portion can be suppressed.

[0067] Specifically, an operation and an effect when the clamping positions CP1 and CP2 are set will be described with reference to FIGS. 9, 10A to 10C, 11A to 11C, 12A to 12C, and 13A to 13C.

[0068] As illustrated in FIG. 9, nine positions of the line L connecting the clamping positions CP1 and CP2 were set and the tensile elongation for each of them was measured. As illustrated in FIG. 9, a third line L3 is a line which is separated by a distance M11 from the first line L1 to the upper surface 12a of the yarn splicing nozzle 12 and extends in parallel to the first line L1. A fourth line L4 is a line which is separated by a distance M12 from the first line L1 to the lower surface 12d of the yarn splicing nozzle 12 and extends in parallel to the first line L1. A fifth line L5 is a line which is separated by a distance M13 from the second line L2 to the injection hole 16a and extends in parallel to the second line L2. A sixth line L6 is a line which is separated by a distance M14 from the second line L2 to the side opposite to the injection hole 16a and extends in parallel to the second line L2. The distances M11 to M14 are 1 mm.

[0069] An intersection point between the third line L3 and the fifth line L5 is set as P11. An intersection point between the third line L3 and the second line L2 is set as P12. An intersection point between the third line L3 and the sixth line L6 is set as P13. An intersection point between the first line L1 and the fifth line L5 is set as P14. An intersection point between the first line L1 and the second line L2 is set as P15. The intersection point P15 corresponds to the center C of the chamber 14. An intersection point between the first line L1 and the sixth line L6 is set as P16. An intersection point between the fourth line L4 and the fifth line L5 is set as P17. An intersection point between the fourth line L4 and the second line L2 is set as P18. An intersection point between the fourth line L4 and the sixth line L6 is set as P19. The intersection point P16, the intersection point P18, and the intersection point P19 are located in the area A. Furthermore, in FIG. 9, a positional relationship between the area A and each of the intersection points P11 to P19 can be changed in response to the diameter of the chamber 14.

[0070] As shown in FIGS. 10A to 10C, 11A to 11C, 12A to 12C, and 13A to 13C, a measurement for three types of yarns (a yarn A to a yarn C) having different thicknesses or number of filaments was performed by using TENSORAPID4 (trade name) manufactured by USTER. Each yarn is a pre-oriented yarn (POY). FIGS. 10A to 10C show 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. FIGS. 11A to 11C show 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. FIGS. 12A to 12C show 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 ϕ1.0 mm. FIGS. 13A to 13C show 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 ϕ1.3 mm.

[0071] FIGS. 10A to 10C, 11A to 11C, 12A to 12C, and 13A to 13C show a tensile elongation decrease amount (%) from a reference value by using a tensile elongation measurement value of a synthetic fiber without an entangled portion as a reference value. In the result shown in

FIGS. 10A to 10C, 11A to 11C, 12A to 12C, and 13A to 13C, "-" illustrates a state in which the entangled portion is not formed. "Δ" illustrates a state in which the yarn is pulled out and the coupling cannot be maintained when a tension is applied to the yarn although the entangled portion is formed.

[0072] As shown in FIGS. 10A and 11A, a yarn A is a yarn of 40[dtex]-10[f] having a reference value of 63.0%. In the yarn A, it was found that the tensile elongation decrease amount (%) was relatively small at the intersection point P15, the intersection point P16, the intersection point P18, and the intersection point P19 as compared with the intersection points P11 to P14 and the intersection point P17.

[0073] As shown in FIGS. 10B and 11B, a yarn B is a yarn of 88[dtex]-72[f] having a reference value of 130.1%. In the yarn B, it was found that the tensile elongation decrease amount (%) was relatively small at the intersection point P15, the intersection point P16, the intersection point P18, and the intersection point P19 as compared with the intersection points P11 to P14 and the intersection point P17.

[0074] As shown in FIGS. 10C and 11C, a yarn C is a yarn of 135[dtex]-72[f] having a reference value of 127.1%. In the yarn C, it was found that the tensile elongation decrease amount (%) was small at the intersection point P16, the intersection point P18, and the intersection point P19 as compared with the intersection points P11 to P15 and the intersection point P17.

[0075] As shown in FIGS. 12A and 13A, a yarn A is a yarn of 40[dtex]-10[f] having a reference value of 63.1%. As shown in FIG. 12A, in the yarn A, it was found that the tensile elongation decrease amount (%) was relatively small at the intersection point P14, the intersection point P15, the intersection point P16, and the intersection point P19 as compared with the intersection points P11 to P13, the intersection point P17, and the intersection point P18. As shown in FIG. 13A, in the yarn A, it was found that the tensile elongation decrease amount (%) was relatively small at the intersection point P15, the intersection point P16, and the intersection point P19 as compared with the intersection points P11 to P14, the intersection point P17, and the intersection point P18.

[0076] As shown in FIGS. 12B and 13B, a yarn B is a yarn of 88[dtex]-72[f] having a reference value of 130.8%. As shown in FIG. 12B, in the yarn B, it was found that the tensile elongation decrease amount (%) was relatively small at the intersection points P15 to P19 as compared with the intersection points P11 to P14. As shown in FIG. 13B, in the yarn B, it was found that the tensile elongation decrease amount (%) was relatively small at the intersection point P15, the intersection point P16, the intersection point P18, and the intersection point P19 as compared with the intersection points P11 to P14 and the intersection point P17.

[0077] As shown in FIGS. 12C and 13C, a yarn C is a yarn of 135[dtex]-72[f] having a reference value of 130.0%. As shown in FIG. 12C, in the yarn C, it was found that the tensile elongation decrease amount (%) was relatively small at the intersection point P13, the intersection point P16, the intersection point P18, and the intersection point P19 as compared with the intersection point P11, the intersection point P12, the intersection point P14, the intersection point P15, and the intersection point P17. As shown in FIG. 13C, in the yarn C, it was found that the tensile elongation decrease amount (%) was relatively small at the intersection point P15, the intersection point P16, and the intersection point P19 as compared with the intersection points P11 to P14, the intersection point P17, and the intersection point P18.

[0078] As described above, in three types of yarns (the yarn A to the yarn C) having different thicknesses, when the line L connecting the clamping positions CP1 and CP2 is located at the area A, the tensile elongation decrease amount (%) is small in any case. For that reason, in the synthetic yarn splicer 1, it was found that a decrease in tensile elongation could be suppressed by locating the line L connecting the clamping positions CP1 and CP2 at the area A. Furthermore, since the tensile elongation value is generally different when the type of yarn (for example, a thickness or the number of filaments) is different, the allowed tensile elongation decrease amount (%) is also different.

[0079] In an area in which the intersection points P11 to P14 exist, air injected from the injection hole 16a and flowing to the slit 13 can flow to the outside of the chamber 14 through the slit 13. In particular, in an area in which the intersection points P11 to P13 exist, the outflow of air to the outside becomes noticeable. For that reason, when the line L connecting the clamping positions CP1 and CP2 is located at an area on the side of the upper surface 12a of the yarn splicing nozzle 12 with respect to the first line L1, air does not effectively act on the first yarn Y1 and the second yarn Y2 and the first yarn Y1 and the second yarn Y2 are not appropriately swayed in the chamber 14. For this reason, it is considered that the entangled portion is not appropriately formed. Further, since there is a possibility that air injected from the injection hole 16a may be directly sprayed to the first yarn Y1 and the second yarn Y2 at the intersection point P14 and a part of the intersection point P15, air does not effectively act on the first yarn Y1 and the second yarn Y2 and the first yarn Y1 and the second yarn Y2 are not appropriately swayed in the chamber 14. For this reason, it is considered that the entangled portion cannot be appropriately formed. Further, since the pressure of air injected from the injection hole 16a becomes weak at the intersection point P17 and a part of the intersection point P18, air does not effectively act on the first yarn Y1 and the second yarn Y2 and the first yarn Y1 and the second yarn Y2 are not appropriately swayed in the chamber 14. For this reason, it is considered that the entangled portion cannot be appropriately formed.

[0080] In the synthetic yarn splicer 1 according to the embodiment, the diameter of the chamber 14 is equal to or larger than ϕ3.5 mm and equal to or smaller than ϕ6.0

mm and the diameter of the injection hole 16a is equal to or larger than ϕ1.0 mm and equal to or smaller than ϕ1.3 mm. In this configuration, it is possible to more appropriately form the entangled portion. Accordingly, in the synthetic yarn splicer 1, it is possible to suppress a change in tensile elongation decrease amount while suppressing a decrease in tensile elongation of the entangled portion.

[0081] In the synthetic yarn splicer 1 according to the embodiment, the first clamping mechanism 20 includes the clamping portion 23 which includes the first clamping member 24 and the second clamping member 26 respectively clamping the first yarn Y1 and the second yarn Y2. The second clamping mechanism 30 includes the clamping portion 33 which includes the first clamping member 34 and the second clamping member 36 respectively clamping the first yarn Y1 and the second yarn Y2. In this configuration, the clamping positions CP1 and CP2 of the first yarn Y1 and the second yarn Y2 can be accurately set. Accordingly, in the synthetic yarn splicer 1, the line L connecting the pair of clamping positions CP1 and CP2 can be reliably located in the area A.

[0082] In the synthetic yarn splicer 1 according to the embodiment, the first clamping mechanism 20 includes the support portion 22 which supports the clamping portion 23. The second clamping mechanism 30 includes the support portion 32 which supports the clamping portion 33. The support portion 22 is disposed between the yarn splicing portion 10 and the clamping portion 23 and includes the second contact surface 27c in which the first yarn Y1 and the second yarn Y2 clamped by the clamping portion 23 contact. Similarly, the support portion 32 is disposed between the yarn splicing portion 10 and the clamping portion 33 and includes the second contact surface 37c in which the first yarn Y1 and the second yarn Y2 clamped by the clamping portion 33 contact. In this configuration, the first yarn Y1 and the second yarn Y2 can be supported by the second contact surface 27c and the second contact surface 37c. Thus, in the synthetic yarn splicer 1, the clamping positions CP1 and CP2 of the first yarn Y1 and the second yarn Y2 can be more accurately set. As a result, in the synthetic yarn splicer 1, the line L connecting the pair of clamping positions CP1 and CP2 can be reliably located in the area A.

[0083] 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.

[0084] 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.

[0085] 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).

[0086] 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.

[0087] In the above-described embodiment, an example of an embodiment in which the slit 13 is disposed on the second line L2 has been described. However, the slit 13 may be disposed at the side of the upper surface 12a of the yarn splicing nozzle 12 in relation to the first line L1.

[0088] In the above-described embodiment, an example of an embodiment in which the area A is an annular area between the first circular arc CA1 which is distant from the center by 0.5 mm and the second circular arc CA2 which is distant from the inner peripheral surface 14a of the chamber 14 by 0.3 mm has been described. However, the area may be at least an area which is located at the side opposite to the slit 13 with respect to the first line L1 and is located at the side opposite to the injection hole 16a with respect to the second line L2. In this configuration, when the line L connecting the pair of clamping positions CP1 and CP2 of the first yarn Y1 and the second yarn Y2 is located in the area, a decrease in tensile elongation of the entangled portion can be suppressed.

[0089] 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.

[0090] 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.

[0091] In the above-described embodiment, the diameter of the chamber 14 and the diameter of the injection hole 16a are changeable by replacing the yarn splicing portion 10.

[0092] 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

[0093] 1...SYNTHETIC YARN SPLICER, 10...YARN SPLICING PORTION, 13...SLIT, 14...CHAMBER (PASSEGE), 14a...INNER PERIPHERAL SURFACE, 16a...INJECTION HOLE, 20...FIRST CLAMPING MECHANISM, 22... SUPPORT PORTION, 23...CLAMPING PORTION, 24... FIRST CLAMPING MEMBER, 26... SECOND CLAMPING MEMBER, 27c... SECOND CONTACT SURFACE, 30...SECOND CLAMPING MECHANISM, 32...SUPPORT PORTION, 33...CLAMPING PORTION, 34...FIRST CLAMPING MEMBER, 36...SECOND CLAMPING MEMBER, 37c...SECOND CONTACT SURFACE, A...AREA, C...CENTER, CA1...FIRST CIRCULAR ARC, CA2...SECOND CIRCULAR ARC, CP1,CP2...CLAMPING POSITION, L...LINE, L1...FIRST LINE, L2...SECOND LINE, Y1...FIRST YARN (ONE YARN), Y2...SECOND YARN (OTHER YARN).

Claims

1. A synthetic yarn splicer (1) that splices one yarn (Y1) and the other yarn (Y2) formed of synthetic fibers, comprising:

   a yarn splicing portion (10) that includes a passage (14) which forms a space through which the one yarn (Y1) and the other yarn (Y2) are insertable, a slit (13) which communicates with the passage (14) and allows the one yarn (Y1) and the other yarn (Y2) to be insertable into the passage (14) from an insertion direction orthogonal to a penetration direction of the passage (14), 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 provided at a position interposing the passage (14) of the yarn splicing portion (10) in the penetration direction of the passage (14) and clamps each of the one yarn (Y1) and the other yarn (Y2) inserted through the space,
   wherein the passage (14) has a circular shape when viewed from the penetration direction of the passage (14),
   wherein the injection hole (16a) is disposed on a first line (L1) which is orthogonal to the penetration direction of the passage (14) and the insertion direction and passes through a center (C) of the passage (14),
   wherein the pair of clamping mechanisms (20,30) clamps the one yarn (Y1) and the other yarn (Y2) so that a line (L) connecting a pair of clamping positions (CP1,CP2) of the one yarn (Y1) and the other yarn (Y2) is located in a predetermined area (A) of the passage (14) when viewed from the penetration direction of the passage (14), and
   wherein the predetermined area (A) is an area which is located at the side opposite to the slit (13) with respect to the first line (L1) and is located at the side opposite to the injection hole (16a) with respect to a second line (L2) following the insertion direction and passing through the center (C).

2. The synthetic yarn splicer (1) according to claim 1, wherein the predetermined area (A) is an area between a first circular arc (CA1) which is distant from the center (C) by 0.5 mm and a second circular arc (CA2) which is distant from the inner peripheral surface (14a) of the passage (14) by 0.3 mm.

3. The synthetic yarn splicer (1) according to claim 1 or 2,
   wherein a diameter of the passage (14) is equal to or larger than ϕ3.5 mm and equal to or smaller than ϕ6.0 mm, and
   wherein a diameter of the injection hole (16a) is equal to or larger than ϕ1.0 mm and equal to or smaller than ϕ1.3 mm.

4. The synthetic yarn splicer (1) according to any one of claims 1 to 3,
   wherein each of the pair of clamping mechanism (20,30) includes a clamping portion (23,33) including a pair of clamping members (24,26,34,36) clamping each of the one yarn (Y1) and the other yarn (Y2).

5. A synthetic yarn splicer (1) according to claim 4,
   wherein each of the pair of clamping mechanisms (20,30) includes a support portion (22,32) supporting the clamping portion (23,33), and
   wherein the support portion (22,32) is disposed between the yarn splicing portion (10) and the clamping portion (23,33) and includes a contact surface (27c,37c) contacting the one yarn (Y1) and the other yarn (Y2) clamped by the clamping portion (23,33).

Fig.1

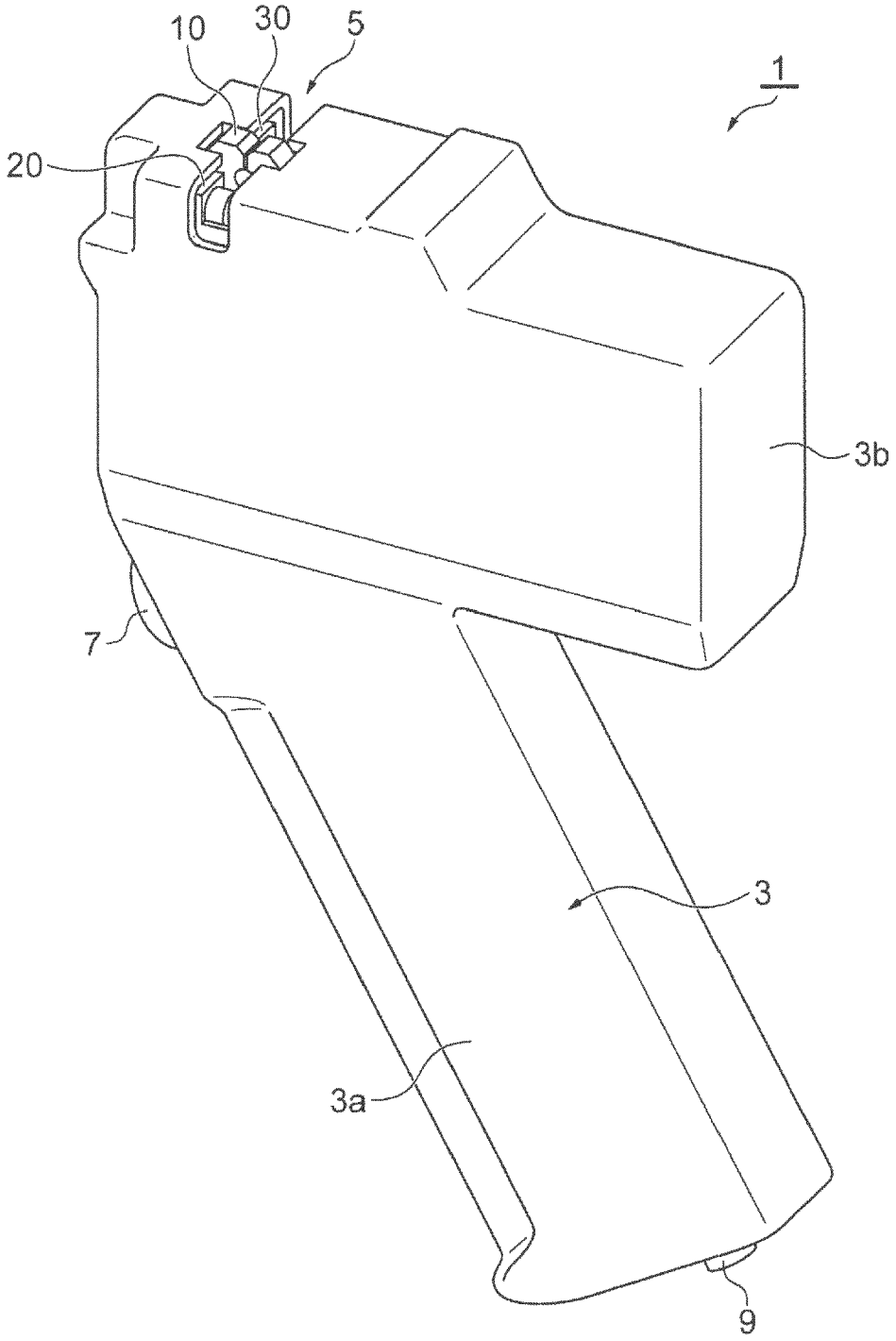
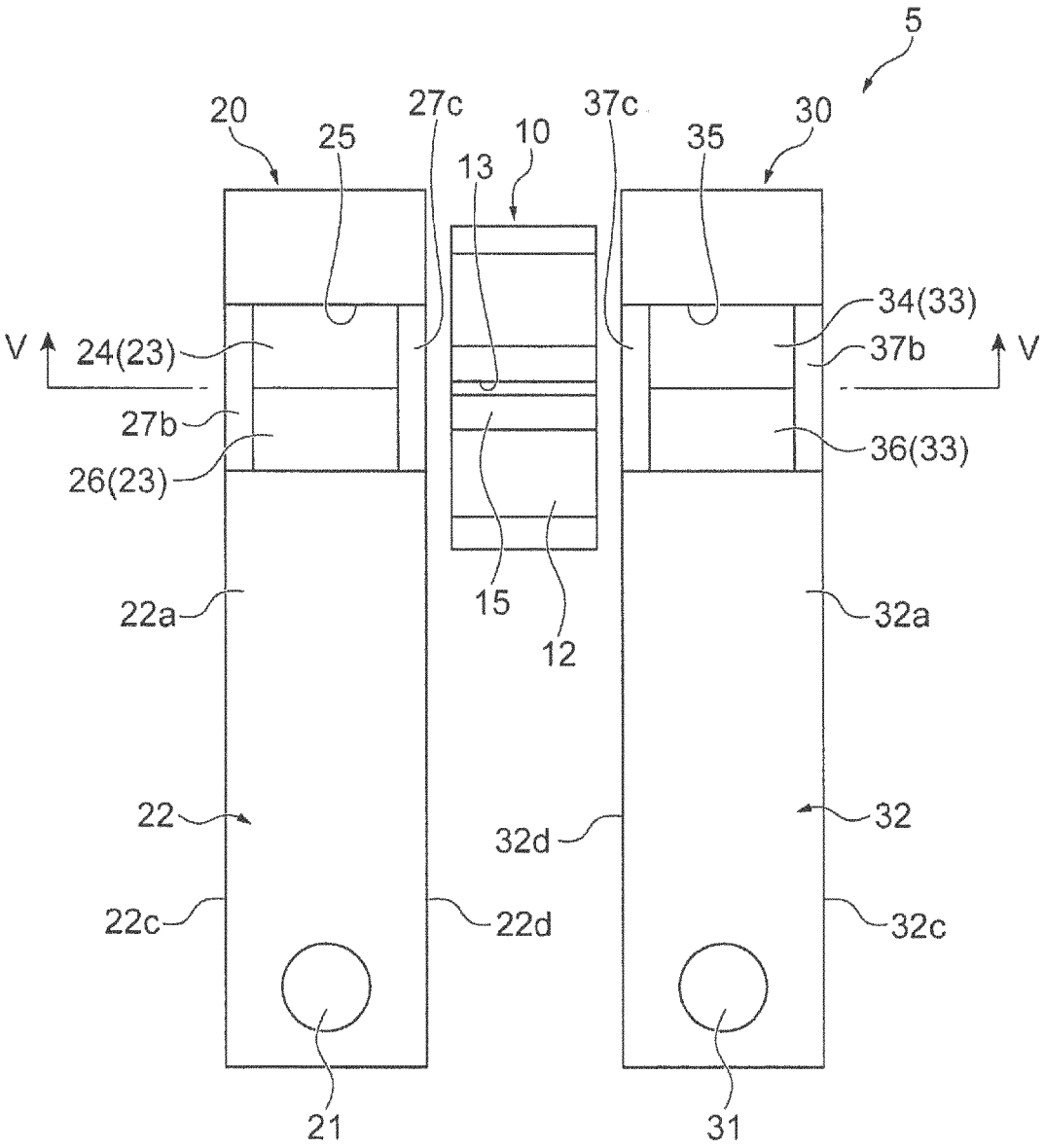


Fig.2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20
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27c
10
13
37c
35
30
34(33)
V
24(23)
37b
V
27b
36(33)
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32d
32
22c
22d
32c
21
31

Fig.3

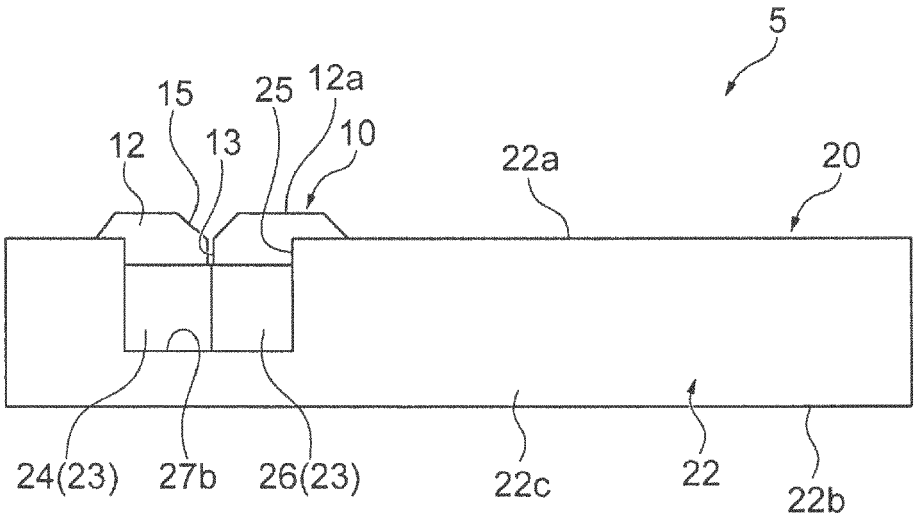
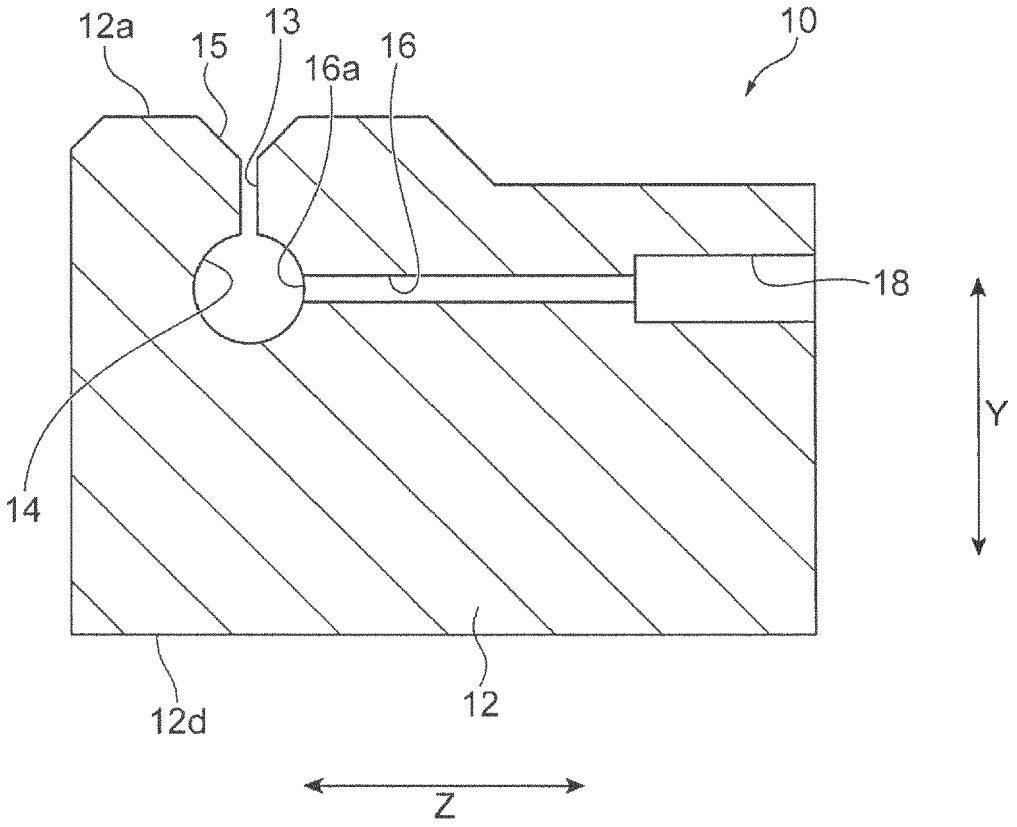
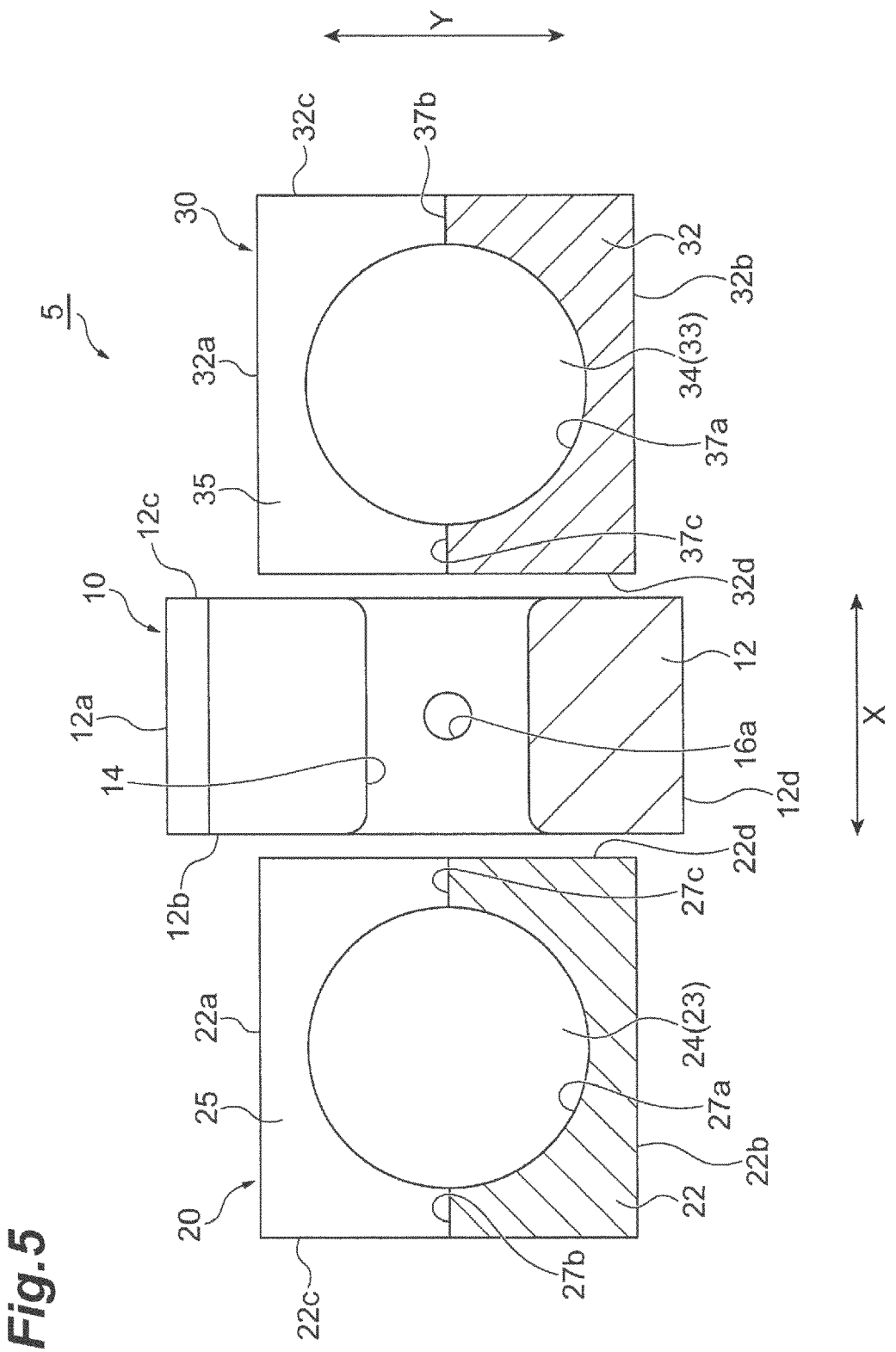


Fig.4




Y
X
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27c
22a
24(23)
25
27a
22b
20
22
27b
22c

Fig.5

Fig.6B

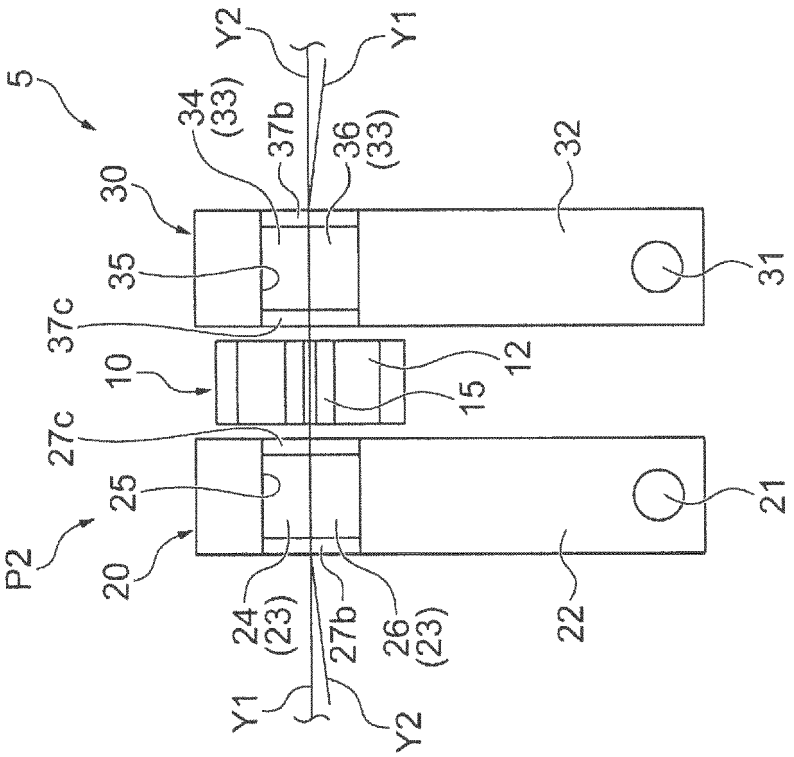
5
Y2
Y1
34
(33)
37b
36
(33)
32
30
35
31
37c
10
12
15
27c
25
21
P2
20
22
24
(23)
27b
26
(23)
Y1
Y2

Fig.6A

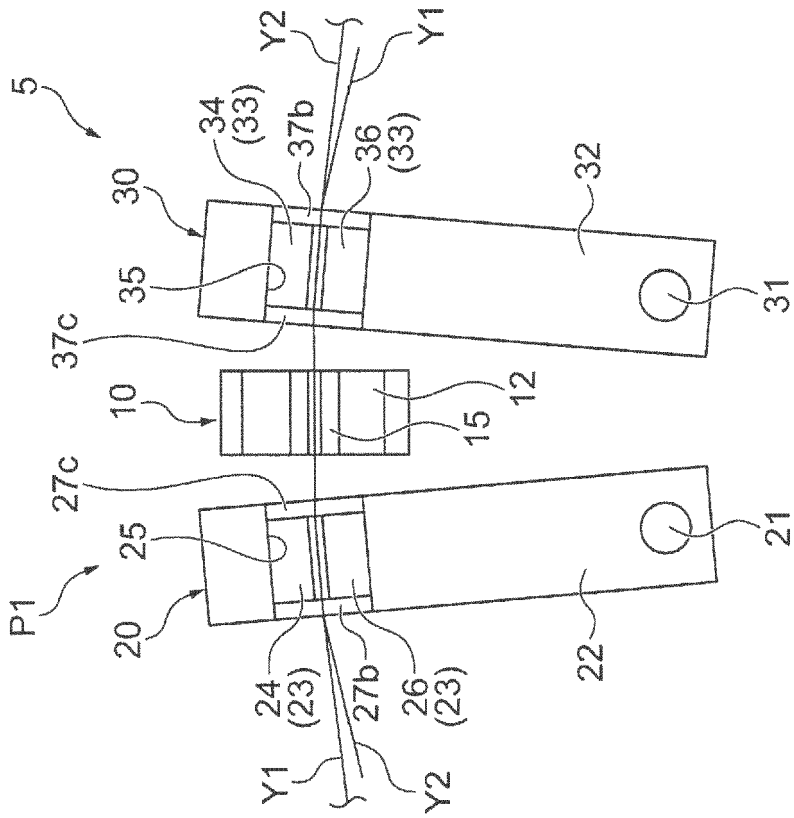
5
Y2
Y1
34
(33)
37b
36
(33)
32
30
35
31
37c
10
12
15
27c
25
21
P1
20
22
24
(23)
27b
26
(23)
Y1
Y2

Fig.7

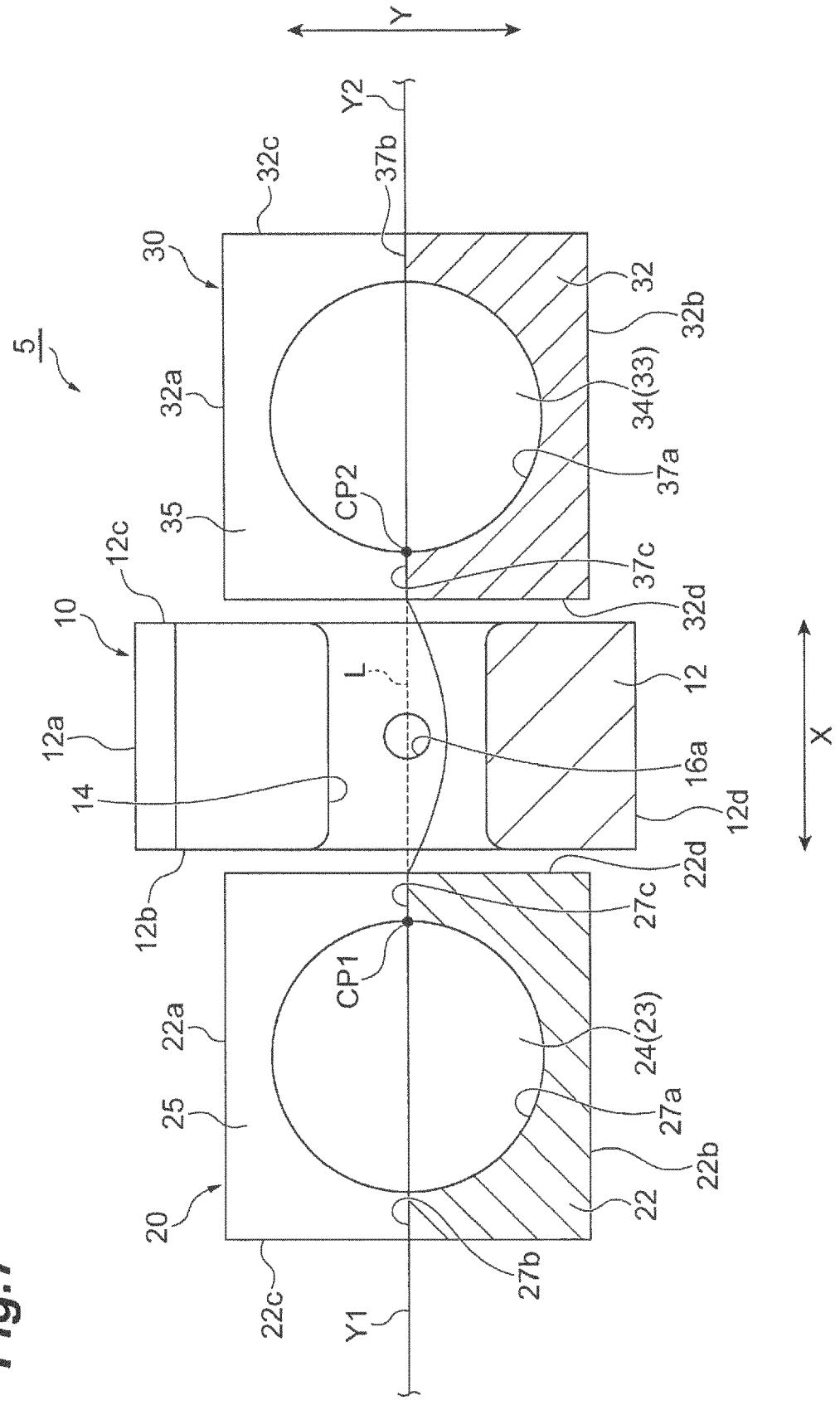
5
10
12
12a
12b
12c
12d
14
16a
20
22
22a
22b
22c
22d
24(23)
25
27a
27b
27c
30
32
32a
32b
32c
32d
34(33)
35
37a
37b
37c
CP1
CP2
L
X
Y
Y1
Y2

Fig.8

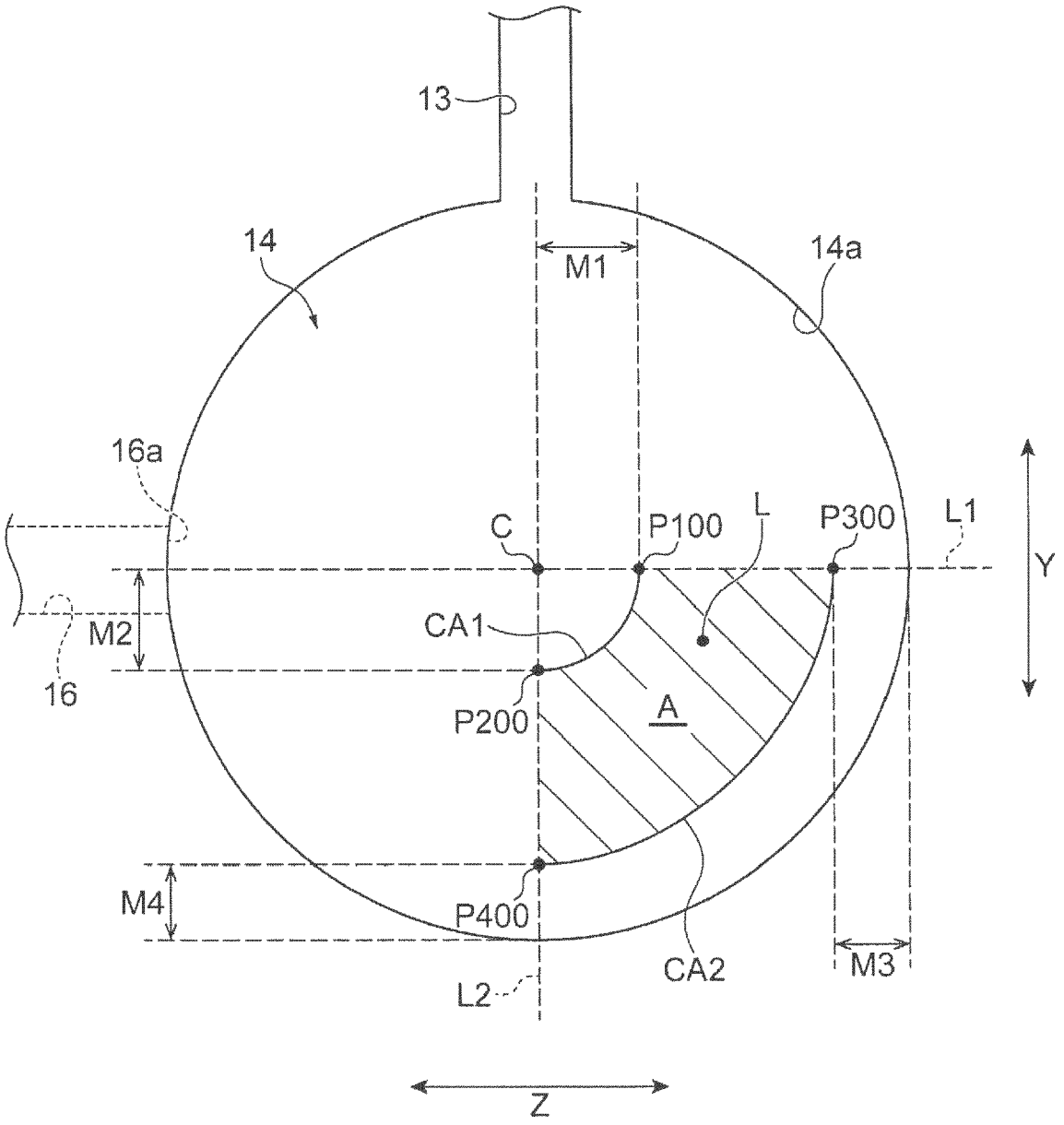
13
14
14a
M1
16a
C
P100
L
P300
L1
Y
M2
CA1
16
P200
A
M4
P400
CA2
M3
L2
Z

Fig.9

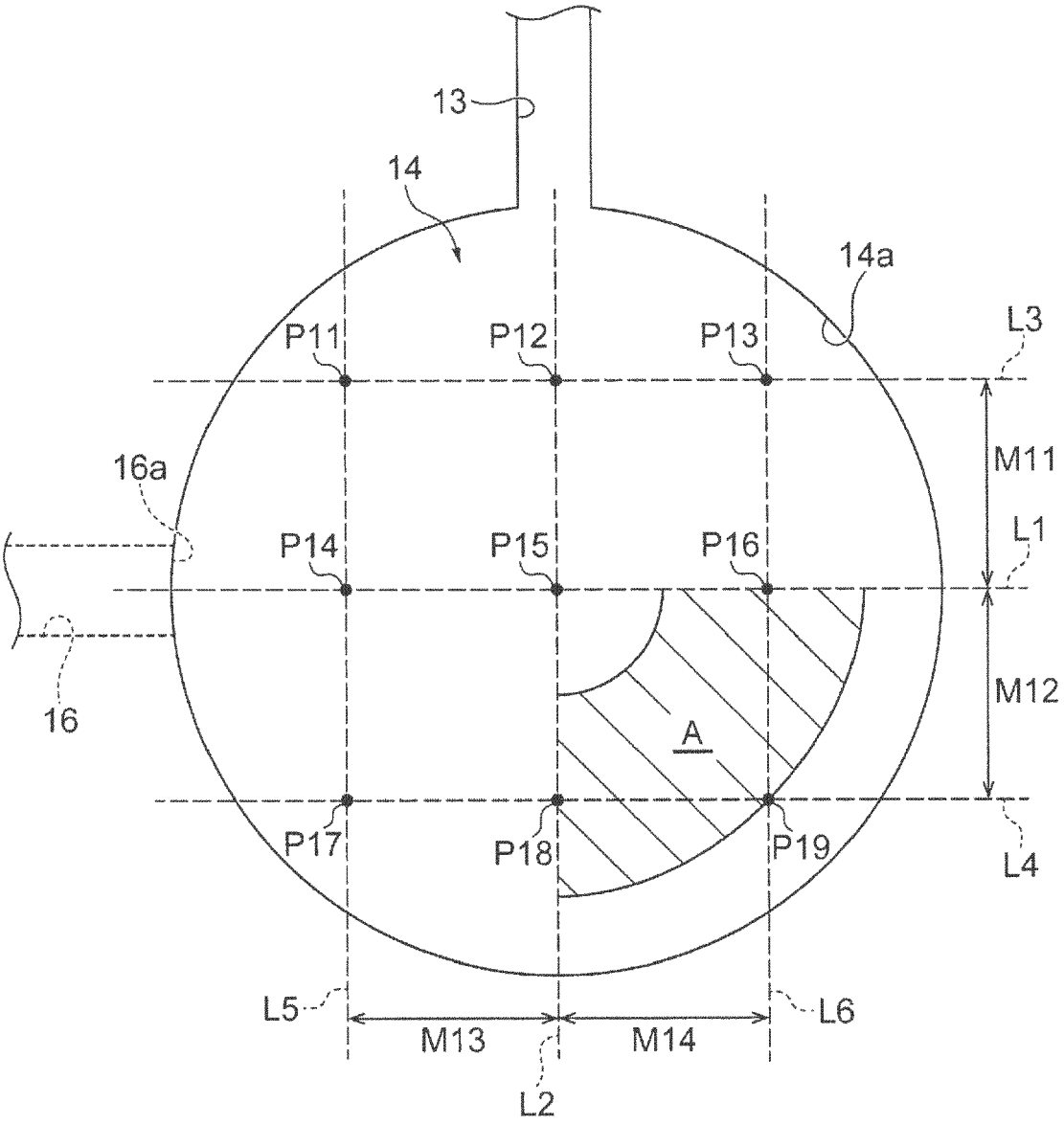
13
14
14a
P11
P12
P13
L3
M11
16a
P14
P15
P16
L1
M12
16
A
P17
P18
P19
L4
L5
L6
M13
M14
L2

Fig.10A

A : 40[dtex] - 10[f]

P11	P12	P13
—	—	-30.5
P14	P15	P16
-24.2	-21.0	-16.3
P17	P18	P19
-38.3	-27.1	-8.8

Fig.10B

B : 88[dtex] - 72[f]

P11	P12	P13
—	△	-4.8
P14	P15	P16
-6.8	-6.4	-6.4
P17	P18	P19
△	-2.5	-6.0

Fig.10C

C : 135[dtex] - 72[f]

P11	P12	P13
—	—	-42.1
P14	P15	P16
△	△	-11.1
P17	P18	P19
—	-12.5	-12.1

Fig.11A

A : 40[dtex] - 10[f]

P11	P12	P13
—	—	-31.8
P14	P15	P16
-35.2	-21.3	-9.1
P17	P18	P19
△	-20.9	-8.2

Fig.11B

B : 88[dtex] - 72[f]

P11	P12	P13
—	—	△
P14	P15	P16
-7.9	-6.6	-6.2
P17	P18	P19
-4.0	-5.9	-4.0

Fig.11C

C : 135[dtex] - 72[f]

P11	P12	P13
△	△	-25.7
P14	P15	P16
-21.8	-29.5	-10.2
P17	P18	P19
-21.7	-21.2	-9.2

Fig.12A

A : 40[dtex] - 10[f]

P11	P12	P13
—	△	-16.3
P14	P15	P16
-11.2	-10.8	-11.2
P17	P18	P19
-18.6	-22.1	-12.3

Fig.12B

B : 88[dtex] - 72[f]

P11	P12	P13
—	-14.0	-12.4
P14	P15	P16
-19.5	-11.1	-10.3
P17	P18	P19
-10.4	-11.6	-10.0

Fig.12C

C : 135[dtex] - 72[f]

P11	P12	P13
—	—	-16.4
P14	P15	P16
-34.7	-57.7	-18.3
P17	P18	P19
-51.3	-14.8	-15.3

Fig.13A

A : 40[dtex] - 10[f]

P11	P12	P13
—	—	—
P14	P15	P16
-15.7	-13.0	-10.6
P17	P18	P19
-23.0	-14.8	-11.5

Fig.13B

B : 88[dtex] - 72[f]

P11	P12	P13
—	—	—
P14	P15	P16
-39.6	-11.4	-10.0
P17	P18	P19
-15.7	-13.1	-11.0

Fig.13C

C : 135[dtex] - 72[f]

P11	P12	P13
—	—	—
P14	P15	P16
—	-23.4	-12.3
P17	P18	P19
-37.8	-30.3	-14.4

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
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