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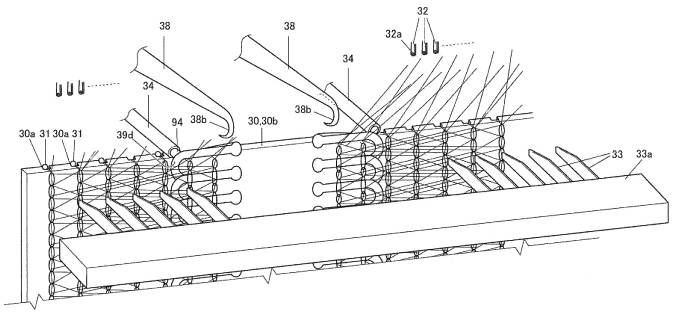
(54) PRODUCTION METHOD FOR STRINGER FOR WOVEN SLIDE FASTENERS AND PRODUCTION DEVICE

(57) [Problem] To more efficiently produce woven slide fasteners.

[Solution] A production method for a stringer (90) for woven slide fasteners in which a coil-shaped element row (95) is woven into one side edge of a fastener tape (91) for a knitted fabric. In this production method monofilaments are bent into a coil shape and formed into the element row as a result of the joint actions of a reciprocal action by a plurality of guides (34, 34) in the knitting width direction and a reciprocal action of a plurality of hooks (38, 38), when knitting an element row into the fastener tape by using the joint actions of a reciprocal action of a plurality of knitting needles (31) and the swing action and jogging action of a plurality of guide needles (32), said guides being arranged in the knitting width direction such that linear monofilaments (94, 94) are fed out and said hooks being arranged in the knitting width direction so as to move to a position separated from the position at which same are hooked around the monofilaments. A plurality of stringers, having the element row knitted into one side edge of the fastener tape as a result, are simultaneously produced, in a parallel state and in the knitting width direction.

FIG.9



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Description

Technical Field

[0001] The present invention relates to a method and device for producing a stringer for a knitted slide fastener, in which when a fastener tape is knitted, a linear monofilament is bent in a coil shape to form an element row, thereby producing a stringer having the element row knitted in one side edge portion of the fastener tape.

Background Art

[0002] The method of producing a stringer for a knitted slide fastener as described above is disclosed from Patent Documents 1 and 2 as described below.

Prior Art Document

Patent Document

[0003]

Patent Document 1: Japanese Patent Application Publication No. H10-042916A
Patent Document 2: WO 2015/097830

Summary of Invention

Problems to Be Solved by Invention

[0004] According to the methods described in the above patent documents, one stringer for a knitted slide fastener can be stably and efficiently produced. However, if only one stringer is continuously produced as described in the patent documents, the post processes are complicated. Therefore, there is a problem that a knitted slide fastener cannot be efficiently produced. That is, the knitted slide fastener, which is an actual product, has two stringers and a slider for engaging and disengaging the two stringers. Thus, in the case where only one stringer is produced, the knitted slide fastener cannot be efficiently produced. For example, the post processes, such as a process of conveying two stringers to the same site or a process of engaging element rows of the two stringers to form a chain, are complicated.

[0005] The present invention has been made keeping in mind the above problems, and an object thereof is to more efficiently produce a knitted slide fastener.

Means for Solving Problems

[0006] A method of producing a stringer for a knitted slide fastener according to the present invention is intended to produce a stringer having a coil-shaped element row knitted in one side edge portion of a knitted fastener tape and includes, when knitting element rows, respectively, into fastener tapes by cooperatively performing a swing operation and shogging operation of a plurality of guide needles and a reciprocating operation of a plurality of knitting needles, cooperatively performing a reciprocating operation, in a knitting width direction, of a plurality of guides, which are arranged in the knitting width direction to deliver linear monofilaments, and a reciprocating operation of a plurality of hooks, which are arranged in the knitting width direction to move between a position, at which the hooks are respectively wound with the monofilaments, and a position, at which the hooks are separated from the monofilaments, so that the monofilaments are bent in a coil shape to form the respective element rows, thereby simultaneously producing a plurality of stringers, which each have the element row knitted in the one side edge portion of the fastener tape, while being juxtaposed with each other in the knitting width direction.

[0007] Also, in the method of producing a stringer for a knitted slide fastener according to the present invention, the plurality of guides and the plurality of hooks may be asymmetrically arranged in the knitting width direction, and thus two stringers may be produced in a state where element rows thereof face one side in the knitting width direction. However, in order to easily engage the element rows with each other and thus to easily make two stringers into one chain, the following is preferable.

[0008] That is, the plurality of guides and the plurality of hooks are symmetrically arranged in pair in the knitting width direction, thereby producing two stringers, which each have the element row knitted therein, in a symmetric state where the element rows oppose each other.

[0009] Further, a means for reciprocating the hooks does not matter, but in order to efficiently produce the stringers or to reduce the number of components of the stringer production device, the following is preferable.

[0010] That is, a common arm extending from a common hook shaft, which extends in the knitting width direction, is swung by a swing operation of the hook shaft, and the hooks, which are juxtaposed with each other in the knitting width direction and fixed on the arm, are reciprocated in a reciprocating direction of the knitting needles.

[0011] Further, a means for reciprocating the guides does not matter, but in order to efficiently produce the stringers or to reduce the number of components of the stringer production device, the following is preferable.

[0012] That is, linkages connected to a common guide shaft, which extends in the knitting width direction, are operated by a swing operation of the guide shaft, and the guides, which are respectively fixed on the linkages, are reciprocated in the knitting width direction.

[0013] A device for producing a stringer for a knitted slide fastener according to the present invention includes stringer production parts for producing a stringer for a knitted slide fastener having a coil-shaped element row knitted in one side edge portion of a knitted fastener tape. Also, the stringer production parts include a needle bed having a plurality of needle grooves; a plurality of knitting

needles guided in the plurality of needle grooves; a plurality of guide needles for threading knitting yarns for the fastener tape; a guide allowing a linear monofilament to pass therethrough; a hook configured to be wound with the monofilament; a hook movement device for moving the hook between a position, at which the hook is wound with the monofilament, and a position, at which the hook is separated from the monofilament; and a guide movement device for reciprocating the guide in a knitting width direction, so that the monofilament is bent at the one side edge portion of the fastener tape to form the element row. Further, in the device according to the present invention, a plurality of stringer production parts are arranged to be juxtaposed with each other in the knitting width direction.

[0014] Also, in the device of producing a stringer for a knitted slide fastener according to the present invention, the stringer production parts may be asymmetrically arranged in the knitting width direction, and thus two stringers may be produced in a state where element rows thereof face one side in the knitting width direction. However, in order to easily engage the element rows with each other and thus to easily make two stringers into one chain, the following is preferable.

[0015] That is, the stringer production parts are symmetrically arranged in pair in the knitting width direction.

[0016] As an example of a specific configuration of the hook movement device, the following is preferable.

[0017] That is, the hook movement device includes a hook shaft extending in the knitting width direction and an arm extending radially outward from the hook shaft, and the arm has an attaching portion for the hook on a distal portion thereof.

[0018] Further, in order to efficiently produce the stringers or to reduce the number of components of the stringer production device, the hook movement device is preferably configured as follows.

[0019] That is, the hook movement devices include a common hook shaft extending in the knitting width direction and a common arm extending radially outward from the hook shaft, and the arm has attaching portions for the hooks at symmetric locations on both sides, in the knitting width direction, of a distal portion thereof.

[0020] Further, in order to efficiently produce the stringers or to reduce the number of components of the stringer production device, the guide movement device is preferably configured as follows.

[0021] That is, the guide movement devices include a common guide shaft extending in the knitting width direction and linkages for converting a swing motion of the guide shaft to a reciprocating motion, in the knitting width direction, of the guides, which are arranged to be spaced from each other in the knitting width direction.

Advantageous Effects of Invention

[0022] According to the present invention, it is possible to simultaneously produce a plurality of stringers and thus to efficiently produce a knitted slide fastener using two stringer.

[0023] Also, if the guides and the hooks are symmetrically arranged in pair in the knitting width direction, two stringers can be produced in a symmetric state where a pair of element rows oppose each other. Then, it is easy to make two stringers into one chain. The same effect can be obtained even if the stringer production parts are symmetrically arranged in pair in the knitting width direction.

[0024] Further, if the common arm is swung by a swing operation of the common hook shaft and thus a pair of hooks fixed on the arm is reciprocated, the pair of hooks can be reciprocated by a single hook shaft. Therefore, as compared with a case where each of hooks is reciprocated by separate hook shafts, it is possible to efficiently produce two stringers and also to reduce the number of components of the stringer production device.

[0025] Further, if a pair of linkages are operated by a swing operation of the common guide shaft and a pair of guides, which are respectively fixed on the pair of linkages and also symmetrically arranged in the knitting width direction, is reciprocated in the knitting width direction, the pair of guides can be reciprocated by a single guide shaft. Therefore, as compared with a case where each of guides is reciprocated by separate guide shafts, it is possible to efficiently produce two stringers and also to reduce the number of components of the stringer production device.

Brief Description of Drawings

[0026]

Fig. 1 is a block diagram showing an apparatus for producing a chain for a knitted slide fastener according to a first embodiment.

Fig. 2 is a plan view showing a stringer production device.

Fig. 3 is a side view showing the stringer production device.

Fig. 4 is a plan view of a guide movement device.

Fig. 5 is a side view of the guide movement device.

Fig. 6 is a plan view showing a part of a stringer.

Fig. 7 is a diagram showing a state where sinkers are separated from a needle bed.

Fig. 8 is a diagram showing a state where the sinkers are close to the needle bed.

Fig. 9 is a diagram showing a state where a hook is separated from an element portion and a guide is positioned on a folded-back portion side of the element portion.

Fig. 10 is a diagram showing a state where the hook is separated from the element portion and the guide is positioned on an engaging head portion side of the element portion.

Fig. 11 is a diagram showing a state where the hook presses a monofilament.

Fig. 12 is a diagram showing a state where the mono-

filament is wound around the hook and the guide is positioned on the folded-back portion side.

Fig. 13 is a diagram showing a state where knitting needles are lifted while the sinkers press one end of a stringer.

Fig. 14 is a front view of an engagement device.

Fig. 15 is a rear view of the engagement device.

Fig. 16 is a plan view of the engagement device.

Fig. 17 is a sectional view taken along a line XVII-XVII in Fig. 16 and a partially enlarged sectional view thereof.

Fig. 18 is a sectional view taken along a line XVIII-XVIII in Fig. 16.

Fig. 19 is a plan view showing a state where the engagement device is used.

Fig. 20 is a sectional view taken along a line XX-XX in Fig. 19.

Fig. 21 is a sectional view taken along a line XXI-XXI in Fig. 19.

Embodiments of Invention

[0027] An apparatus for producing a chain for a knitted slide fastener according to a first embodiment is configured to produce a plurality of sets of two stringers by a plurality of knitting yarns and a plurality of linear monofilaments and then to produce one chain from each set of two stringers.

[0028] As shown in Fig. 19, the stringer 90 has a knitted fastener tape 91 having a predetermined length and width and a coil-shaped element row 95 knitted in one side edge portion of the fastener tape 91 in a width direction thereof. Also, in the stringer 90, a part of the fastener tape 91 and the element row 95 exist on an element row side 90a of the entire widthwise length thereof, and the other part of the fastener tape 91 exists on a side of the entire widthwise length opposite to the element row side 90a, i.e., a non-element row side 90b thereof.

[0029] The element row 95 is made of resin and also has a coil shape having a plurality of turns. Also, one turn of the coil shape is referred to as an element portion 95a.

[0030] As shown in Fig. 6, the element portion 95a has an engaging head portion 95b configured to be engaged with an element portion 95a of another element row 95; a pair of leg portions 95c, 95c extending from both lengthwise ends of the engaging head portion 95b in a width direction of the fastener tape 91; and a folded-back portion 95d formed by folding back an end of one leg portion 95c opposite to the engaging head portion 95b to be connected to one leg portion 95c of the another element row 95.

[0031] The fastener tape 91, which is warp-knitted, has, as knitting yarns 92, chain stitch yarns 92a, tricot knitting yarns 92b and weft insertion yarns 92c and is formed by forming a plurality of juxtaposed wales by the chain stitch yarns 92a, knitting the tricot knitting yarns 92b into the adjacent wales and then knitting the weft insertion yarns 92c into a predetermined number of wales. Also, the element row 95 is fixed on the fastener tape 91 by causing chain stitch yarns 92a on both sides thereof in a thickness direction to sandwich the pair of leg portions 95c, 95c of the element portions 95a over the entire length of the element row 95.

[0032] As shown in Fig. 19, the chain 97 is formed by engaging two stringers 90, 90 with each other using engaging head portions 95b, 95b thereof.

[0033] As shown in Fig. 1, the apparatus for producing a chain for a knitted slide fastener according to the first embodiment includes a knitting yarn supply device 1 for supplying knitting yarns 92; a monofilament supply device 2 for supplying monofilaments 94; a stringer production device 3 for producing a plurality of (in the present embodiment, an even number of) stringers 90 using the knitting yarns 92 and the monofilaments 94 supplied from the knitting yarn supply device 1 and the monofilament supply device 2; a plurality of engagement devices 4, 4... for, respectively, engaging two stringers of the even number of stringers 90 produced by the stringer production device 3 and thus producing chains 97, of which the number corresponds to half of the even number; and a winding device 5 for winding a plurality of chains 97, 97... produced by the engagement devices 4, 4....

[0034] A main body of the stringer production device 3 is a knitting machine for warp knitting, such as a single raschel machine or a double raschel machine, and in the present embodiment, is configured as the single raschel machine. Further, the stringer production device 3 has a plurality of stringer production parts 3a for producing stringers 90 and a driving shaft 3b for synchronously driving all the stringer production parts 3a.

[0035] As shown in Fig. 2, all the stringer production parts 3a are juxtaposed with each other in a width direction of the stringer production device 3. Also, two stringer production parts 3a adjacent to each other in the width direction of the stringer production device 3 constitute one chain production unit and thus are configured to produce two stringers 90 to be used for producing one chain 97. In Fig. 2, the stringer production device 3 has ten stringer production parts 3a in total and thus the ten stringer production parts 3a constitute five chain production units. Two stringer production parts 3a, 3a of each of the chain production units are symmetrically arranged in the width direction of the stringer production device 3.

[0036] As shown in Fig. 3 or 7, the stringer production parts 3a includes a needle bed 30 having a plurality of needle grooves 30a; a plurality of knitting needles configured to reciprocate along the plurality of needle grooves 30a and to emerge from and retract into the needle bed 30; a knitting needle movement device 31a for reciprocating the plurality of knitting needles 31; a guide needle 32 for threading a knitting yarn; a guide needle movement device 32a for causing the guide needle 32 to perform a predetermined operation; a plurality of sinkers 33 for pressing one end of a stringer; a sinker movement device 33a for reciprocating the sinkers 33; a guide 34 for guiding a linear monofilament; a guide movement

device 35 for guiding the guide 34 to bend the monofilament at one side edge portion of the fastener tape and thus to form a coil-shaped element row; a hook 38 configured to be wound with the monofilament; a hook movement device 39 for moving the hook 38 between a position, at which the hook 38 is wound with the monofilament, and a position, at which the hook 38 is separated from the monofilament; and a transmission mechanism (not shown) having cams, links and the like and configured to connect each of the movement devices 31a, 32a, 33a, 35, 38, 39 to a driving shaft.

[0037] Also, in the stringer production parts 3a, the guide 34, the hook 38, the knitting needle movement device 31a, the guide movement device 35 and the hook movement device 39 are arranged on one side of the needle bed 30 in a depth direction of the needle grooves 30a (in a thickness direction of the needle bed 30) (more specifically, to be oriented from an inner side of the needle grooves 30a toward an inlet thereof). Further, the sinkers 33 and the sinker movement device 33a are arranged on the other side of the needle bed 30 in the depth direction of the needle grooves 30a (more specifically, to be oriented from the inlet of the needle grooves 30a toward the inner side thereof). In addition, the guide needle movement device 32a is arranged on a side of the needle bed 30, at which the knitting needles 31 protrude through the needle grooves 30a, respectively.

[0038] In this way, arrangement of the guide 34, the hook 38, the knitting needle movement device 31a, the guide movement device 35, the hook movement device 39 and arrangement of the sinkers 33 and the sinker movement device 33a are divided on both sides of the needle bed 30 in the depth direction of the needle grooves 30a, thereby facilitating arrangement of them.

[0039] The needle bed 30 is a flat plate having a predetermined transversal width, longitudinal width and thickness, and on one surface thereof in a thickness direction, the plurality of needle grooves 30a extending in a longitudinal width direction thereof are formed at predetermined intervals in a transversal width direction. Also, the plurality of needle grooves 30a are configured to reciprocatingly guide the knitting needles 31, respectively, thereby causing the knitting needles 31 to protrude from one of both surfaces, in the longitudinal width direction, of the needle bed 30. One of both surfaces, in the longitudinal width direction, of the needle bed 30, on which the knitting needles 31 protrude, is referred to as a needle protruding surface 30b.

[0040] Hereinafter, directions with respect to the description of the stringer production device 3 are defined as in the following (1) to (3):

(1) A knitting width direction means the transversal width direction of the needle bed 30, i.e., a width direction of the main body (knitting machine) of the stringer production device 3 and corresponds to a right and left direction in Fig. 7.

(2) A height direction means the longitudinal width direction of the needle bed 30 and corresponds to a direction normal to the paper surface of Fig. 7. An upward direction is a direction toward the front side in the normal direction and a downward direction is a direction toward the back side in the normal direction.

(3) A front and rear direction means the thickness direction of the needle bed 30, i.e., the depth direction of the needle grooves 30a. A front direction is a direction toward an inlet side of the needle grooves 30a in the depth direction, and a rear direction is a direction toward a bottom side of the needle grooves 30a in the depth direction of the needle grooves 30a.

[0041] The knitting needles 31 are, for example, latch needles, and an opening direction thereof is set to the front direction.

[0042] As shown in Fig. 3, the guide needle 32 has a hole 32b, into which the knitting yarn 92 is to be threaded. Further, the guide needle 32 is divided into uses for chain stitching, tricot knitting and a weft insertion yarn. A plurality of guide needles 32 are juxtaposed with each other in the knitting width direction for each of the uses and are fixed on a guide needle bar 32c. On the guide needle bar 32c, the guide needle movement device 32a is fixed to form predetermined stitches.

[0043] For example, a guide needle movement device for chain stitching is configured to cause the guide needle 32 to perform a shogging operation (an operation in which the guide needle 32 moves in the knitting width direction) and a swing operation (an operation in which the guide needle 32 moves in the front and rear direction), thereby causing a chain stitch yarn to be wound one turn around the knitting needle 31. Also, a guide needle movement device for a weft insertion yarn is configured to cause the guide needle 32 to perform a shogging operation at the rear of the knitting needle 31, thereby knitting a weft insertion yarn into a predetermined number of wales formed by the chain stitch yarns.

[0044] The guide 34 is a cylinder and, as shown in Figs. 2 to 5, is arranged such that a direction, through which the cylinder extends, is oriented in the front and rear direction. Also, two guides 34, 34 of one chain production unit are symmetrically arranged in the knitting width direction with a space interposed therebetween. In addition, as shown in Fig. 9, the guide 34 is configured to allow the monofilament 94 to extend therethrough and thus to deliver the monofilament 94.

[0045] The guide movement device 35 has a guide shaft 35a extending in the knitting width direction and a linkage 35b connected to the guide shaft 35a and configured to fix the guide 34.

[0046] The guide shaft 35a is configured to drive at least two guide movement devices 35, 35 of the chain production unit in common. Also, the guide shaft 35a is swingably supported on a frame (not shown) of the stringer production device and connected to the driving shaft via the transmission mechanism.

[0047] The linkage 35b has a plurality of links and a plurality of connection portions, in order to convert a swing motion of the guide shaft 35a to a reciprocating motion, in the knitting width direction, of the guide 34. In the example of Figs. 4 and 5, the linkage 35b has three links 36a, 36b, 36c, two connection portions 37a, 37b each configured to connect two of the three links 36a, 36b, 36c with each other, and a support shaft 37j for swingably supporting one of the three links 36a, 36b, 36c. The three links 36a, 36b, 36c are referred to as first, second and third links 36a, 36b, 36c in the order from the guide shaft 35a toward the guide 34, and the two connection portions 37a, 37b are referred to as first and second connection portions 37a, 37b in the order from the guide shaft 35a toward the guide 34.

[0048] The first link 36a extends radially outward from the guide shaft 35a and is configured such that one end thereof in a length direction is fixed on the guide shaft 35a. Specifically, in the example of Figs. 4 and 5, the first link 36a is arranged such that the length direction thereof corresponds to the height direction and a lower end thereof is fixed on the guide shaft 35a. Also, the first link 36a is configured to convert a swing motion of the guide shaft 35a over a predetermined angular range to a swing motion (reciprocating motion), in the front and rear direction, of an upper end thereof, which is a distal portion of the first link 36a. Further, the first link 36a is common to two guide movement devices 35, 35 of the chain production unit. In addition, as shown from the height direction, two linkages 35b, 35b of the two guide movement devices 35, 35 are symmetrically arranged with respect to an imaginary center line L1 equally dividing the first link 36a in the knitting width direction and also extending in the front and rear direction.

[0049] The second link 36b is arranged such that a length direction thereof corresponds to the front and rear direction.

[0050] The first connection portion 37a is configured to connect a front end portion of the second link 36b with the upper end of the first link 36a. Also, the first connection portion 37a is a lower pair, such as turning pair or spherical pair, and is configured to transmit the reciprocating motion of the distal portion of the first link 36a in the front and rear direction to the second link 36b as a reciprocating motion thereof in the front and rear direction. Meanwhile, two first connection portions 37a, 37a of the chain production unit are respectively arranged on both outer sides, in the knitting width direction, of the first link 36a.

[0051] The third link 36c has an L-shape as viewed in the height direction. More specifically, the third link 36c has a fixing piece 36d extending in the front and rear direction and configured to fix the guide 34 and a connecting piece 36e extending in the knitting width direction and connected to the second connection portion 37b. The fixing piece 36d and the connecting piece 36e are jointed to each other at one end thereof in a right-angled bent shape. A portion, where the fixing piece 36d and the connecting piece 36e are jointed to each other, is referred to as a bent portion. Also, an end portion of both end portions of each of the fixing piece 36d and the connecting piece 36e away from the bent portion is referred as to a distal portion. In addition, the bent portion has a positional relationship that the bent portion is positioned closer to the imaginary center line L1 than is the distal portion of the connecting piece 36e.

[0052] The fixing piece 36d has a plate-shaped fixing piece main body 36h extending in the front and rear direction, and a stepped portion 36i protruding in a stepped shape from a distal portion of the fixing piece main body 36h in the upward direction, which is one side of the height direction. The stepped portion 36i is fixed while extending through the guide 34 in the front and rear direction.

[0053] The support shaft 37j extends through the bent portion of the third link 36c in the height direction and a part thereof in the height direction is fixed on the frame (not shown) of the stringer production device. Also, the support shaft 37j is configured to swingably support the third link 36c about the bent portion.

[0054] The second connection portion 37b is configured to connect a rear end portion of the second link 36b with the distal portion of the connecting piece 36e of the third link 36c. Also, the second connection portion 37b is a lower pair, such as turning pair or spherical pair, and is configured to transmit the reciprocating motion of the second link 36b in the front and rear direction to the connecting piece 36e of the third link 36c as a swing motion thereof in the front and rear direction. Meanwhile, the second connection portion 37b is arranged above the distal portion of the connecting piece 36e of the third link 36c.

[0055] The two linkages 35b, 35b of the chain production unit are configured to transmit movement of the guide shaft 35a to the guide 34 in the following manner:

(1) If the driving shaft is driven, the common guide shaft 35a is swung over the predetermined angular range via the transmission mechanism.

(2) As the guide shaft 35a is swung, an upper portion of the common first link 36a is swung in the front and rear direction about the guide shaft 35a.

(3) As the first link 36a is swung, two second links 36b, 36b are swung in the front and rear direction. Also, the two second links 36b, 36b are bilateral-symmetrically swung.

(4) As each second link 36b is swung, the third link 36c is swung about the support shaft 37j and also the distal portion of the fixing piece 36d together with the guide 34 is swung in the knitting width direction. At this time, the two third links 36c and the two guides 34, 34 are bilateral-symmetrically swung.

[0056] The two guide movement devices 35, 35 of the chain production unit can reciprocate the pair of guides 34, 34 by means of the common guide shaft 35a. Therefore, as compared with a case where each of guides 34

is reciprocated by separate guide shafts, the pair of element rows 95, 95 and hence the pair of stringers 90, 90 can be efficiently produced and also the number of components of the stringer production device 3 can be reduced. Also, since the two guide movement devices 35, 35 use the common first link 36a, the number of components of the stringer production device 3 can be reduced and also a dimension thereof in the knitting width direction can be shortened. Further, the fixing piece 36d of the third link 36c is positioned closer to the imaginary center line L1 than is the distal portion of the second connection portion 37b. Therefore, for example, as compared with a case where the fixing piece 36d of the third link 36c is positioned farther from the imaginary center line L1 than is the distal portion of the second connection portion 37b, the two guides 34, 34 of the chain production unit are positioned close to each other in the knitting width direction, so that a dimension, in the knitting width direction, of the two guide movement devices 35, 35 of the chain production unit can be shortened.

[0057] As shown in Figs. 7 and 8, the hook 38 has a rod-shaped portion 38a linearly extending in the front and rear direction and a hooking portion 38b connected to a distal portion of the rod-shaped portion 38a, which is a rear end portion thereof, and configured to hook the monofilament.

[0058] As viewed in the knitting width direction, the hooking portion 38b is configured to be bent from a distal end of the rod-shaped portion 38a toward the needle protruding surface 30b and also to be folded back toward a front end of the rod-shaped portion 38a.

[0059] As shown in Figs. 2 and 3, the hook movement device 39 is configured to drive at least two stringer production parts 3a, 3a of the chain production unit in common and has a hook shaft 39a extending in the knitting width direction and an arm 39b extending radially outward from the hook shaft 39a and also toward above the needle protruding surface 30b.

[0060] The hook shaft 39a is rotatably supported on the frame of the knitting machine and is positioned between the needle bed 30 and the guide shaft 35a in the front and rear direction and also positioned to be spaced upward from the linkage 35b in the height direction.

[0061] The arm 39b extends in the front and rear direction and is configured such that a front end portion thereof, which is a distal portion, is fixed on the hook shaft 39a and also both side surfaces thereof in the knitting width direction, which are a rear end portion, are formed as a pair of attaching portions 39c, 39c for attaching two hooks 38, 38 of the chain production unit.

[0062] Also, the center of the arm 39b and the center of two guide movement devices 35, 35 of the chain production unit are configured to be positioned on the imaginary center line L1 as viewed in the height direction. Further, if the hooks 38 are respectively fixed on the pair of attaching portions 39c, 39c of the arm 39b, the pair of hooks 38, 38 are symmetrically arranged in the knitting width direction, namely with respect to the imaginary center line L1. Further, the pair of hooks 38, 38 oppose each other to be close to each other in the knitting width direction, and a distance therebetween is narrower than a width of the fastener tape 91.

[0063] The common hook movement device 39 as described above is configured such that if the hook shaft 39a is swung, the distal portion of the arm 39b is swung in the height direction about the hook shaft 39a and also the pair of hooks 38, 38 is swung in the height direction above the needle protruding surface 30b. Also, the common hook movement device 39 can reciprocate the pair of hooks 38, 38 by means of the single hook shaft 39a. Therefore, as compared with a case where each of hooks is reciprocated by separate hook shafts, the pair of element rows 95, 95 and hence the pair of stringers 90, 90 can be efficiently produced and also the number of components of the stringer production device 3 can be reduced.

[0064] As shown in Figs. 3, 7 and 8, the sinkers 33 are a flat plate extending in the front and rear direction and arranged such that a thickness direction thereof coincides with the knitting width direction. Also, the plurality of sinkers 33 are juxtaposed with each other while being spaced from each other in the knitting width direction, and rear portions thereof are fixed on a sinker bar 33b. The plurality of sinkers 33 fixed on the sinker bar 33b is referred to as a sinker row. The sinker row is configured to reciprocate in the front and rear direction, and a range of reciprocating movement thereof is between a position, where the sinker row is spaced rearward from the needle protruding surface 30b, and a position, where the sinker row is positioned above the needle protruding surface 30b and also suppresses the stringer 90.

[0065] Also the stringer production part 3a is configured such that the plurality of sinkers 33, 33..., the plurality of knitting needles 31, 31..., the hook 38 and the guide 34 are arranged not to be in contact with each other. The more details are as follows. In a case where the sinker row is advanced as shown in Fig. 8, as viewed in the height direction, a front end portion of each sinker 33, which is a distal portion, is positioned above the needle protruding surface 30b and also between the adjacent knitting needles 31, 31, i.e., between the adjacent needle grooves 30a, 30a. Also, in the case where the sinker row is advanced, as viewed in the height direction, the hook 38 and the guide 34 are positioned between the adjacent knitting needles 31, 31 and also on both outer sides, in the knitting width direction, of a predetermined number of knitting needles (in the figure, two knitting needles 31, 31). The predetermined number of knitting needles 31 are intended to wind a knitting yarn for fixing the element row and thus hereinafter referred to as "fixing knitting needles". No knitting needles 31 are received in two needle grooves 30a, 30a respectively at both sides of two fixing knitting needles 31 in the knitting width direction. On the other hand, the needle grooves 30a are formed in the needle bed 30 at equal intervals in the knitting width direction, and the knitting needles 31 are received in the

remaining needle grooves 30a, except the above two needle grooves 30a, 30a. Further, the sinker 33 is arranged to move in and out between the two fixing knitting needles 31, 31, one side, in the knitting width direction, of the two fixing knitting needles 31, 31 (a side where the engaging head portion 95b of the element portion 95a is formed) is set as a position for the hook 38, and upper sides of the needle grooves 30a, 30a on both sides, in the knitting width direction, of the two fixing knitting needles 31, 31 and the hook 38 are set as limit positions of reciprocating movement of the guide. A solid line of the guide 34 in Fig. 7 is a left limit position and a one-dot chain line is a right limit position. In a case where the sinker row is retracted, the guide is reciprocated in the knitting width direction. Further, in the case where the sinker row is advanced as shown in Fig. 8, the guide 34 is positioned at the left limit position. Meanwhile, in the present embodiment, when the sinker row is advanced (when the sinker row presses one end of the stringer 90), two sinkers 33 of the sinker row are close to the hook 38 on both sides of the knitting width direction. Also, the sinker row is configured such that at locations other than a location thereon corresponding to the hook 38, sinkers 33 are arranged to be spaced from each other at equal intervals in the knitting width direction, and also a distance between sinkers 33, 33 respectively at both sides of the location corresponding to the hook 38 is set to two or more times the equal intervals, thereby preventing contact between the sinkers 33 and the hook 38.

[0066] As shown in Fig. 3, the sinker movement device 33a has a sinker shaft 33c extending in the knitting width direction and a sinker reed 33d configured to swing in the front and rear direction about the sinker shaft 33c.

[0067] The sinker shaft 33c is rotatably supported on the frame of the knitting machine.

[0068] The sinker reed 33d extends in the knitting width direction and also in the height direction. Also, as viewed in the knitting width direction, the sinker reed 33d is configured such that the sinker bar 33b is fixed on an upper end portion thereof in the height direction while protruding forward and also the sinker row is oriented toward above the needle protruding surface 30b.

[0069] The sinker movement device 33a of the above configuration can position the distal portion of the sinker row above or away from the needle protruding surface 30b by swing the sinker reed 33d over a predetermined angular range about the sinker shaft. Also, the sinker movement device 33a is arranged in the rear of the needle bed 30 and also the guide movement device 35 and the hook movement device 39 are arranged in front of the needle bed 30. Therefore, as compared with a case where installation sites of the guide movement device 35, the hook movement device 39 and the sinker movement device 33a are positioned on the same side in front or rear of the needle bed 30, it is easy to install each of the movement devices. Also, it is easy to arrange the sinkers 33 to prevent the sinkers 33 from coming in contact with the hook 38 or the guide 34.

[0070] The two stringer production parts 3a, 3a of the chain production unit as described above are operated in the following manner.

[0071] If a driving source is driven, the transmission mechanism is also operated so that each of the movement devices for the knitting needles, the guide needles, the sinkers, the hooks and the guides is operated. As a result, the knitting needles 31, the guide needles 32, the sinkers 33, the hook 38 and the guide 34 move in the order of (1) to (6) below. Meanwhile, in Figs. 9 to 13, sinkers 33 in the vicinity of the elements and also chain stitch yarns 92a and knitting needles for wales closest to the elements are omitted for easy viewing of the operation situation in the vicinity of the elements.

(1) As shown in Fig. 9, the knitting needles 31 are fully retracted in the respective needle groves 30a and the hooking portion 38b of each of the hooks 38 is stopped at a position above and farthest away from the needle protruding surface 30b. Also, the pair of guides 34, 34 are respectively positioned between the needle protruding surface 30b and the hooks 38 in the height direction and also are stopped at positions farthest away from each other in the knitting width direction. The stop position of each of the hooks 38 is a position is a position between the adjacent knitting needles 31, 31 and also corresponding to the folded-back portion 95d of the respective elements.

(2) As shown in Fig. 10, each guide 34 moves toward the engaging head portion 95b of the respective elements and then passes between the respective hooks 38 and the needle protruding surface 30b in the height direction. Due to the movement, one of the pair of leg portions 95c, 95c is formed in each of the stringer production parts 3a. Also, due to the movement, the pair of guides 34 are closest to each other in the knitting width direction.

(3) As shown in Fig. 11, the pair of hooks 38, 38 are lowered and thus moved toward the needle protruding surface 30b, and thus in each of the stringer production parts 3a, the hooking portion 38b presses the leg portion 95c in the vicinity of the guide 34. Also, in each of the stringer production parts 3a, the sinkers 33 start to move toward the needle protruding surface 30b.

(4) The guide 34 passes through the hooking portion 38b of the hook 38 and then moves toward the folded-back portion 95d. Then, as shown in Fig. 12, the guide 34 is stopped at the folded-back portion 95d. Due to the movement, the element portion 95a is wound around the hook 38, and thus the engaging head portion 95b and the other of the pair of leg portions 95c, 95c of the element portion 95a are formed in each of the stringer production parts 3a. Also, due to the movement, the pair of guides 34 are farthest away from each other in the knitting width direction.

(5) As shown in Fig. 13, the knitting needles 31 re-

ciprocate in the height direction to emerge from and retract into the needle protruding surface 30b by a predetermined number of times, and for each time, the guide needles 32 perform a predetermined swing operation or shogging operation. As a result, a knitted fabric for the fastener tape 91 is formed by a predetermined number of courses. In this example, it is assumed that two courses corresponding to Fig. 6 are formed. A knitted fabric corresponding to the two courses is a knitted fabric between the adjacent element portions 95a, 95a and is configured to knit the pair of leg portions 95c, 95c of the element portion 95a into the fastener tape 91. Further, for each time, while the knitting needles 31 are lifted relative to the needle protruding surface 30b, the sinkers 33 enter between the adjacent knitting needles 31, 31 so that the element row side 90a and the non-element row side 90b on one end of the stringer 90 in the length direction thereof are pressed by the sinkers 33. Thus, the knitted fabric is prevented from being lifted together with the knitting needles 31 as the knitting needles 31 are lifted. Also, after the knitting needles 31 reach a lifted position, the sinkers 33 start to move from above the needle protruding surface 30b rearward, thereby preventing the sinkers 33 from coming in contact with the knitting yarns while the knitting needles 31 are lowered.

(6) Then, the pair of hooks 38 moves upward and thus the element portions 95a are separated from the hooks 38. As a result, the operation returns to the state of (1).

[0072] As the operation of (1) to (6) as described above is repeated, two stringers 90 can be simultaneously symmetrically produced while being juxtaposed with each other in the knitting width direction.

[0073] According to the stringer production device 3 of the above configuration, each of the chain production units can knit two stringers 90 and thus a plurality of stringers 90 can be efficiently produced. Thus, sets of two stringers 90 can be produced by the number corresponding to the number of chain production units. Also, since one end of the stringers 90 in the length direction is pressed by the sinkers 33, the exterior appearance of the stringers 90 is enhanced. Further, when the sinker row presses one end of the stringers 90, two sinkers 33, 33 are respectively positioned on both sides of each hook 38. Therefore, as compared with a case where a sinker is positioned only on one of both sides of a hook, locations, at which the stringers 90 are pressed, are increased, thereby stabilizing knitting of the stringers 90. In addition, since two stringers 90 are knitted in a symmetric state, in which a pair of element rows 95, 85 oppose each other in the knitting width direction, it is easy to make two stringers 90 into one chain 91 thereafter. The stringers 90 produced by the stringer production device 3 having the above effects are lowered along a rear surface of the needle bed 30 and then are delivered to the engagement device 4.

[0074] As shown in Figs. 19 to 21, the engagement device 4 has a guide path 40 provided as a space portion therein and configured to allow a pair of stringers 90 to pass therethrough. The guide path 40 has two inlets 40a spaced from each other in a width direction thereof and one outlet 40b.

[0075] Hereinafter, directions with respect to the description of the engagement device 4 are defined as follows. A width direction means a width direction of the guide path 40 corresponding to a right and left direction in Fig. 19 and thus is also referred to as a right and left direction. A length direction means a length direction of the guide path 40 and corresponds to an upward and downward direction in Fig. 19. Also, an inlet direction means a direction from the outlet 40b toward the inlets 40a of the guide path 40 in the length direction and corresponds to a downward direction in the figure. An outlet direction means a direction from the inlets 40a toward the outlet 40b of the guide path 40 in the length direction and corresponds to an upward direction in the figure. A height direction means a height direction of the guide path 40 corresponding to a direction normal to the paper surface of Fig. 19 and thus is also referred to as an upward and downward direction. An upward direction means a direction toward the front side in the normal direction and a downward direction is a direction toward the back side relative to the pater surface in the normal direction. Meanwhile, in the present embodiment, it is assumed that the width direction corresponds to the knitting width direction with respect to the description of the stringer production device 3, the length direction corresponds to the front and rear direction with respect to the description of the stringer production device 3, and the height direction corresponds to the height direction with respect to the description of the stringer production device 3.

[0076] As shown in Figs. 14 to 21, the engagement device 4 is symmetric in the width direction and, as components for forming the guide path 40, includes first and second base plate portions 50, 60 opposing each other in the height direction with a space interposed therebetween so that a pair of stringers 90 juxtaposed with each other in the width direction can be guided on both sides in a thickness direction thereof; a partition portion 65 for partitioning the space between the first and second base plate portions 50, 60 at the middle thereof in the width direction, which is located on the side of the inlets 40a in the length direction, wherein partition portion 65 is configured to guide both inner sides, in the width direction, of a pair of element rows 95, 95 disengaged from each other; a pressing portion 70 for pressing a middle part, in the width direction, of the first base plate portion 50, which are divided into three parts in the width direction, toward the second base plate portion 60; a pair of outside protrusions 52, 52 protruding from the first base plate portion 50 to narrow a distance between the first and second base plate portions 50, 60 and configured to

guide both outer sides, in the width direction, of the pair of element rows 95, 95; first and second center protrusions 59, 61 configured to narrow the distance, in the height direction, between the first and second base plate portions 50, 60 at the middle thereof in the width direction, which is located on the side of the inlets in the length direction; and a pair of spacer portions 53, 53 respectively located on both outer sides of the guide path 40 in the width direction and sandwiched between the first and second base plate portions 50, 60.

[0077] The second base plate portion 60 is a rectangular flat plate and is arranged such that a thickness direction thereof coincides with the height direction. Also, the second base plate portion 60 has an upper surface formed as a flat surface in the right and left direction and the front and rear direction and is configured to guide lower surfaces, in the height direction, of the pair of stringers 90. Meanwhile, in the shown example, the second base plate portion 60 is fixed on a frame (not shown) by bolts.

[0078] The second center protrusion 61 is configured to protrude from the middle, in the width direction, of the upper surface of the second base plate portion 60 and also to extend over the entire length of an inlet side, in the length direction, of the second base plate portion 60. Also, the second center protrusion 61 has such a shape that a width thereof gradually narrows upward. Meanwhile, the second base plate portion 60 and the second center protrusion 61 constitute a single piece base member 62.

[0079] The first base plate portion 50 has a pair of side base plate portions 51, 51 arranged to be spaced from each other in the width direction, and a center base plate portion 56 arranged to be sandwiched between the pair of side base plate portions 51, 51. In the present embodiment, the pair of side base plate portions 51, 51 and the center base plate portion 56 are separate pieces, the center base plate portion 56, the partition portion 65 and the first center protrusion 59 constitute a single-piece center member 55, and the side base plate portions 51, the spacer portions 53 and the outside protrusions 52, which are located on the same side in the width direction, constitute single-piece blade members 54, respectively. Also, the pair of blade members 54, 54 are fixed on the second base plate portion 60 to be spaced from each other in a width direction of the second base plate portion 60, and the center member 55 is arranged on the second base plate portion 60 and also configured to be movably guided between the pair of blade members 54, 54 in the height direction.

[0080] The pair of side base plate portions 51, 51 has a pair of inner end surfaces 51a, 51a opposing each other in the width direction. The pair of inner end surfaces 51a, 51a extends in the length direction and has a pair of parallel surfaces 51b, 51b parallel to each other in the length direction on an outlet side thereof in the length direction and a pair of inclined surfaces 51c, 51c inclined with respect to the length direction on an inlet side thereof in the length direction. A distance between the pair of inner end surfaces 51a, 51a is constant on the pair of parallel surfaces 51b, 51b, but on the pair of inclined surfaces 51c, 51c, is gradually widened as it goes away from the pair of parallel surfaces 51b, 51b in the inlet direction. Meanwhile, one of both edge portions, in the width direction, of each side base plate portion 51, which is located on the side of the inner end surface 51a, is referred to as an inner edge portion, and the other edge portion opposite thereto is referred to as an outer edge portion.

[0081] The side base plate portion 51 is a skewed hexagonal plate as viewed in the height direction and is configured such that a lengthwise dimension thereof is the same as that of the second base plate portion 60 and a widthwise dimension thereof is shorter than a half of a width of the second base plate portion 60. More specifically, the hexagon of the side base plate portion 51 has such a shape that two corner portions on an inlet side of a rectangle having two sides parallel to the length direction and the width direction are obliquely cut off.

[0082] The center base plate portion 56 is a flat plate thicker than a thickness of the pair of side base plate portions 51, 51 and has a center parallel portion 57 arranged between the pair of parallel surfaces 51b, 51b and a center inclined portion 58 extending from the center parallel portion 57 toward the inlets 40a and arranged between the pair of inclined surfaces 51c, 51c.

[0083] The center parallel portion 57 has a rectangular shape linearly extending in the length direction as viewed in the height direction. The first center protrusion 59 protrudes from the middle, in the width direction, of a lower surface of the center parallel portion 57, toward the second base plate portion 60 and extends over the entire length of the center parallel portion 57 in the length direction. Also, the center parallel portion 57 and the first center protrusion 59 have lower surfaces formed as a flat surface in the front and direction and the right and left direction and are configured to guide a pair of leg portions 95c, 95c of the pair of element rows 95, 95 in an engaged state on an upper side thereof in the height direction. Also, the lower surfaces of the center parallel portion 57 and the first center protrusion 59 oppose upper surfaces of the second base plate portion 60 and the second center protrusion 61. Further, the first and second center protrusions 59, 61 are configured to narrow a distance between the first and second base plate portions 50, 60 in the height direction and also to guide a pair of engaging head portions 95b, 95b of the pair of element rows 95, 95 in the engaged state.

[0084] The center inclined portion 58 has a triangular shape as viewed in the height direction and thus is configured such that a width thereof gradually narrows toward the inlet direction. Also, the center inclined portion 58 has a lower surface (a surface thereof opposing the second base plate portion 60) formed as a flat surface in the right and left direction and the front and rear direction, and the partition portion 65 protrudes downward from the middle, in the width direction, of the flat surface. Thus,

the lower surface of the center inclined portion 58 is exposed to both sides of the partition portion 65 in the width direction and is configured to guide the engaging head portions 95b of the pair of element rows 95, 95 in the disengaged state on an upper side thereof in the height direction.

[0085] The partition portion 65 has a triangular shape smaller than the center inclined portion 58 as viewed in the height direction and is configured such that a width thereof gradually narrows toward the inlet direction. Also, both surfaces of the partition portion 65 in the width direction are configured to guide the pair of engaging head portions 95b of the pair of element rows 95, 95 in the disengaged state on both inner sides thereof in the width direction.

[0086] The outside protrusion 52 protrudes downward from the inner edge portion of the lower surface of the side base plate portion 51 and is configured to narrow a distance between the side base plate portion 51 and the second base plate portion 60. A protrusion length of the outside protrusion 52 is set such that a distance between the outside protrusion 52 and the second base plate portion 60 in the height direction has substantially the same dimension as a thickness of the fastener tape 91 and the fastener tape 91 is allowed to pass between the outside protrusion 52 and the second base plate portion 60.

[0087] Also, the outside protrusion 52 extends along a part of the inner edge portion of the side base plate portion 51, which corresponds to the inclined surface 51c, and one end thereof in the extending direction is located at one inlet 40a of the guide path 40 and the other end in the extending direction is located on the parallel surface 51b of the inner edge portion of the side base plate portion 51. Thus, a distance between the pair of outside protrusions 52, 52 in the width direction gradually narrows as it goes from the inlets 40a toward the outlet 40b. Also, the partition portion 65 exists between the pair of outside protrusions 52, 52 on the inlet side of the guide path 40, and a distance between each of the outside protrusions 52 and the partition portion 65 is set to be slightly larger than a width of the element row 95. On the other hand, on the outlet side relative to the partition portion 65, no partition portion 65 exists between the pair of outside protrusions 52, 52, and thus a distance between the pair of outside protrusions 52, 52 is set to have a dimension suitable for allowing the pair of element rows 95, 95 to be engaged with each other.

[0088] Also, the outside protrusion 52 is arranged more outside than the inclined surface 51c of the inner end surface 51a in the width direction and is spaced therefrom in the outlet direction. Therefore, the lower surfaces of the pair of side base plate portions 51, 51 are provided in a state where parts thereof located more inside than the pair of outside protrusions 52, 52 in the width direction oppose the second base plate portion 60 and thus is configured to guide an outer surface, in the width direction, of the folded-back portion 95d of the pair of leg portions 95c, 95c of the element rows 95. Meanwhile, according to the present embodiment, as shown in an enlarged portion of Fig. 7, the parts of the lower surfaces of the pair of side base plate portions 51, 51, which are located more inside than the pair of outside protrusions 52, 52 in the width direction, are positioned at a location higher than a lower surface of the center inclined portion 58 of the center base plate portion 56.

[0089] The spacer portion 53 protrudes downward from the outer edge portion, in the width direction, of the lower surface of the side base plate portion 51. The inner end surface 51a, in the width direction, of the spacer portion 53 is inclined inward in the width direction toward the outlet 40b side, in the length direction, of the side base plate portion 51. Thus, a distance between the pair of spacer portions 53, 53 in the width direction gradually narrows toward the outlet direction. Also, the blade member 54 is fixed on the second base plate portion 60 by a bolt B1 extending through the spacer portion 53 and the side base plate portion 60 in the height direction.

[0090] The pressing portion 70 has a rod 71 extending through the center member 55 in the height direction; a fixing portion for fixing one end portion (lower end portion) of the rod 71 on the second base plate portion 60; a compressive coil spring 73 as a spring for pressing the center member 55 against the second base plate portion 60 while surrounding an outer circumference of the rod 71; and a pushing member 74 fixed on the other end portion (upper end portion) of the rod 71 and configured to push the compressive coil spring 73.

[0091] The rod 71 is a round rod. Also, a through-hole 55a, which allow the rod 71 to extend therethrough, is formed to penetrate the center inclined portion 58 and the partition portion 65 of the center member 55. The through-hole 55a is formed to be slightly larger than a diameter of the rod 71, and thus the center member 55 can move along the rod 71 in the height direction.

[0092] The fixing portion 72 has a fixing hole 60 penetrating a part of the second base plate portion 60, which comes in contact with the partition portion 65, in the height direction and also allowing the rod 71 to pass therethrough; a retaining hole 71a penetrating a part of the rod 71, which is located below the second base plate portion 60, in a direction perpendicular to the height direction; and a retaining pin 71p inserted in the retaining hole 71 in such a manner that both end portions thereof protrude from the retaining hole 71a. Also, the fixing portion 72 has a groove portion 60s extending over the entire height of an end surface on the inlet 40a side of the second base plate portion 60 and thus communicated with the fixing hole 60h. The entire length of the groove portion 60s in the width direction is set to be larger than a diameter of the retaining pin 71p. Thus, it is possible to insert or remove the rod 71 in or from the fixing hole 60h while inserting only one end of the retaining pin 71p in the rod 71.

[0093] The pushing member 74 has a pushing body 75, through which the rod 71 passes in such a shape that the pushing body 75 protrudes from the rod 71 in a collar

shape, and a male screw 76 for fixing the pushing body 75 to the rod 71.

[0094] The pushing body 75 is of a circular disk shape and has a through-hole 75a formed on the center portion thereof to allow the rod 71 to pass therethrough, and female screw holes 75b formed at a plurality of sites on an outer circumferential surface thereof and configured to be communicated with the through-hole 75a and also to allow the male screw 76 to be screwed therein.

[0095] In the engagement device 4 of the above configuration, the pushing member 74 and the fixing portion 72 are respectively fixed on both end portions of the rod 71, the center member 55 and the compressive coil spring 73 are arranged between the fixing portion 72 and the pushing member 74 with the rod 71 passing through them, and the compressive coil spring 73 is in a compressed state. Thus, a restoring force acts on the compressive coil spring 73 so that the partition portion 65 of the center member 55 is pressed against the second base plate portion 60.

[0096] As shown in Figs. 19 to 21, the engagement device 4 as described above is configured to engage a pair of element rows 95, 95 of two stringers 90, 90 in the order of (1) to (5) below.

(1) Two stringers 90, 90 delivered from the stringer production device 3 are introduced into the two inlets 40a, 40a of the guide path 40 in a state where a pair of element rows 90 thereof oppose each other and also are spaced from each other in the width direction.

(2) The pair of element rows 95 are advanced along the guide path 40 as a pair of engaging head portions 95b, 95b are guided by both sides, in the width direction, of the partition portion 65 and also folded-back portions 95d are guided by the pair of outside protrusions 52, 52. In addition, both sides of pair of element row sides 90a, 90a of two stringers 90, 90 in the height direction are guided by the lower surfaces of the center base plate portion 56 and the pair of side base plate portions 51, 51 and the upper surface of the second base plate portion 60 between the pair of outside protrusions 52, 52 and the partition portion 65.

(3) Since the partition portion 65 has a width gradually narrowing toward the outlet direction and also the pair of outside protrusions 52, 52 gradually approach each other toward the outlet direction, engaging head portions 95b, 95b of the pair of element rows 95, 95 gradually approach each other as the pair of element rows 95, 95 goes toward the outlet direction.

(4) Once the pair of element rows 95, 95 passes by the partition portion 65, a pair of folded-back portions 95d of the pair of passed element rows 95, 95 is guided by the pair of outside protrusions 52, 52. Therefore, the pair of engaging head portions 95b, 95b are engaged with each other, and as a result, one chain 97 is produced from two stringers 90, 90. Also, at this time, the pair of leg portions 95c, 95c are guided by the center base plate portion 56 and the second base plate portion 60 in the height direction and also the engaging head portion side of the pair of leg portions 95c, 95c is guided by the pair of first center protrusions 59, 61 while being sandwiched therebetween in the height direction, thereby facilitating engagement of the pair of engaging head portions 95b, 95b.

[0097] Meanwhile, when the chain 97 is produced, the center member 55 and the second base plate portion 60 are in contact with each other due to the restoring force of the pressing portion 70 (compressive coil spring 73). Further, at this time, a height of the element row sides 90a of the stringers 90 passing through the guide path 40 is smaller than a height of the guide path 40 (more specifically, a distance between the lower surfaces of the center base plate portion 56 and the pair of side base plate portions 51, 51 and the upper surface of the second base plate portion 60 between the pair of outside protrusions 52, 52 and the partition portion 65).

[0098] But, in some cases, a height of the element row side 90a is likely to be partially higher than the height of the guide path 40, namely the stringer are likely to be defective. In the case, the element row side 90a lift the center member 55 against the restoring force of the compressive coil spring 73, so that the compressive coil spring 73 is further compressed and thus a dimension of the guide path 40 in the height direction is widened, thereby preventing the element row side 90a from being jammed in the guide path 40.

[0099] Further, once the defective part of the element row side 90a passes through the guide path 40, the center member 55 and the second base plate portion 60 come in contact with each other again due to the restoring force of the compressive coil spring 73, so that the pair of engaging head portions 95b, 95b are engaged with each other and thus two stringers 90, 90 become one chain 97.

(5) Thereafter, the chain 97 is discharged from the outlet 40b of the guide path 40 while the pair of engaging head portions 95b, 95b are engaged with each other.

[0100] Chains 97 produced by all the engagement devices 4 are wound by the winding device 5.

[0101] According to the engagement device 4 as described above, two stringers 90, 90 can be made into one chain 97. Thus, when producing slide fasteners thereafter, there is no need for separately preparing two stringers 90, thereby facilitating production of the slide fasteners. The engagement device 4 is particularly suitable for using in a production line for a knitted slide fastener, but may be used as an engagement device for fasteners of coil types other than the knitted slide fastener.

[0102] Meanwhile, the apparatus for producing a chain

for a knitted slide fastener is not limited to the foregoing embodiments, but may be properly changed without departing from the spirit thereof. For example, the following changes may be made.

[0103] Although in the foregoing embodiments, the stringer production device 3 is configured such that all of stringers 90 are produced in a state where a pair of element rows 95, 95 of two stringers oppose each other in the knitting width direction, the present invention is not limited thereto. Alternatively, all of stringers 90 may be produced in a state where element rows 95 thereof face one side in the knitting width direction, or some of the stringers 90 may be produced in a state where a pair of element rows 95, 95 of two stringers oppose each other in the knitting width direction and the other stringers 90 may be produced in a state where element rows 95 thereof face one side in the knitting width direction.

[0104] Also, although in the foregoing embodiments, the stringer production device 3 is configured such that the guide shaft 35a and the first link 36a of the guide movement device 35 and the hook shaft 39a and the arm 39b of the hook movement device 39 are common to two stringer production parts 3a, 3a of each of the chain production units, the present invention is not limited thereto. Alternatively, the guide movement device 35 and the hook movement device 39 may be equipped in each of the stringer production parts 3a, or only the guide shaft 35a of the guide movement device 35 and the hook shaft 39a of the hook movement device 39 may be common to a plurality of stringer production parts 3a.

[0105] In the foregoing embodiments, the engagement device 4 has the pair of spacer portions 53, 53, but the engagement device 4 may have no pair of spacer portions 53, 53. In this case, the first base plate portion 50 has the pair of side base plate portions 51, 51 and the center base plate portions 56, which are integrated with each other, and the center base plate portion 56 is fixed on the second base plate portion 60 via the partition portion 65.

[0106] Although in the foregoing embodiments, the engagement device 4 has the pressing portion 70, the present invention is not limited thereto. In this case, it is sufficient if the center member 55 is immovable relative to the second base plate portion 60 in the height direction. For example, the center member 55 may be fixed on the second base plate portion 60 or may be fixed on at least one of the side base plate portions 51.

[0107] Further, although in the foregoing embodiments, the engagement device 4 is configured such that the first base plate portion 50 is divided into three parts, i.e., the pair of side base plate portions 51, 51 and the center base plate portion 56, the present invention is not limited thereto. The first base plate portion 50 may be configured such that the pair of side base plate portions 51, 51 and the center base plate portion 56 are integrated with each other.

[0108] Further, although in the foregoing embodiments, the engagement device 4 is configured such that the partition portion 65 is a part of the center member 55 and the center member 55 including the partition portion 65 is movable relative to the pair of side base plate portions 51, 51 in the height direction, the present invention is not limited thereto. The partition portion 65 may be provided as a separate member from the center member 55 and the partition portion 65 may be integrated with the second base plate portion 60.

[0109] Further, although in the foregoing embodiments, the engagement device 4 is configured such that the fixing portion 72 uses the retaining pin 71p, the present invention is not limited thereto. The fixing portion 72 may use other fixing means, such as a screw pair, which allows the second base plate portion 60 and the rod 71 to be screwed to each other.

[0110] Further, in the foregoing embodiments, the engagement device 4 has the first and second center protrusions 59, 61, but the engagement device 4 may have no first and second center protrusions 59, 61.

Description of Reference Numerals

[0111]

1:	Knitting Yarn Supply Device
2:	Monofilament Supply Device
3:	Stringer Production Device
3a:	Stringer Production Parts
3b:	Driving Shaft
4:	Engagement Device
5:	Winding Device
30:	Needle Bed
30a:	Needle Groove
30b:	Needle Protruding Surface
31:	Knitting Needle
31a:	Knitting Needle Movement Device
32:	Guide Needle
32a:	Guide Needle Movement Device
32b:	Hole
32c:	Guide Needle Bar
33:	Sinker
33a:	Sinker Movement Device
33b:	Sinker Bar
33c:	Sinker Shaft
33d:	Sinker Reed
34:	Guide
35:	Guide Movement Device
35a:	Guide Shaft
35b:	Linkage
36a:	First Link
36b:	Second Link
36c:	Third Link
36d:	Fixing Piece
36e:	Connecting Piece
36h:	Fixing Piece Main Body
36i:	Stepped Portion
L1:	Imaginary Center Line
37a:	First Connection Portion

37b: Second Connection Portion
37j: Support Shaft
38: Hook
38a: Rod-Shaped Portion
38b: Hooking Portion
39: Hook Movement Device
39a: Hook Shaft
39b: Arm
39c: Attaching Portion
40: Guide Path
40a: Inlet
40b: Outlet
50: First Base Plate Portion
51: Side Base Plate Portion
51a: Inner End Surface
51b: Parallel Surface
51c: Inclined Surface
52: Outside Protrusion
53: Spacer Portion
B1: Bolt
54: Blade Member
55: Center Member
55a: Through-Hole
56: Center Base Plate Portion
57: Center Parallel Portion
59: First Center Protrusion
58: Center Inclined Portion
60: Second Base Plate Portion
60h: Fixing Hole
60s: Groove Portion
61: Second Center Protrusion
62: Base Member
65: Partition Portion
70: Pressing Portion
71: Rod
71a: Retaining Hole
71p: Retaining Pin
72: Fixing Portion
73: Compressive Coil Spring
74: Pushing Member
75: Pushing Body
75a: Through-Hole
75b: Female Screw Hole
76: Male Screw
90: Stringer
90a: Element Row Side
90b: Non-Element Row Side
91: Fastener Tape
92: Knitting Yarn
92a: Chain Stitch Yarn
92b: Tricot Knitting Yarn
92c: Weft Insertion Yarn
94: Monofilament
95: Element Row
95a: Element Portion
95b: Engaging Head Portion
95c: Leg Portion
95d: Folded-Back Portion
97: Chain

Claims

1. A method of producing a stringer (90) for a knitted slide fastener having a coil-shaped element row (95) knitted in one side edge portion of a knitted fastener tape (91), comprising:

when knitting element rows (95, 95) into fastener tapes (91, 91), respectively, by cooperatively performing a swing operation and shogging operation of a plurality of guide needles (32) and a reciprocating operation of a plurality of knitting needles (31),
cooperatively performing a reciprocating operation, in a knitting width direction, of a plurality of guides (34, 34), which are arranged in the knitting width direction to deliver linear monofilaments (94, 94), and a reciprocating operation of a plurality of hooks (38, 38), which are arranged in the knitting width direction to move between a position, at which the hooks (38, 38) are respectively wound with the monofilaments (94, 94), and a position, at which the hooks (38, 38) are separated from the monofilaments (94, 94), so that the monofilaments (94) are bent in a coil shape to form the respective element rows (95), thereby simultaneously producing a plurality of stringers (90), which each have the element row (95) knitted in the one side edge portion of the fastener tape (91), while being juxtaposed with each other in the knitting width direction.

2. The method according to claim 1, wherein the plurality of guides (34, 34) and the plurality of hooks (38, 38) are symmetrically arranged in pair in the knitting width direction, thereby producing two stringers (90), which each have the element row (95) knitted therein, in a symmetric state where the element rows (95, 95) oppose each other.

3. The method according to claim 1, further comprising:

swing a common arm (39b) extending from a common hook shaft (39a), which extends in the knitting width direction, by a swing operation of the hook shaft (39a); and
reciprocating the hooks (38, 38), which are juxtaposed with each other in the knitting width direction and fixed on the arm (39b), in a reciprocating direction of the knitting needles (31).

4. The method according to claim 1 or 2, further comprising:

operating linkages (35b, 35b) connected to a common guide shaft (35a), which extends in the knitting width direction, by a swing operation of the guide shaft (35a); and
reciprocating the guides (34, 34), which are respectively fixed on the linkages (35a, 35a), in the knitting width direction.

5. A device for producing a stringer for a knitted slide fastener, comprising stringer production parts (3a, 3a) for producing a stringer (90) for a knitted slide fastener having a coil-shaped element row (95) knitted in one side edge portion of a knitted fastener tape (91),
wherein the stringer production parts (3a) comprise:

a needle bed (30) having a plurality of needle grooves (30a);
a plurality of knitting needles (31) guided in the plurality of needle grooves (30a);
a plurality of guide needles (32) for threading knitting yarns (92) for the fastener tape;
a guide (34) allowing a linear monofilament (94) to pass therethrough;
a hook (38) configured to be wound with the monofilament (94);
a hook movement device (39) for moving the hook (38) between a position, at which the hook (38) is wound with the monofilament (94), and a position, at which the hook (38) is separated from the monofilament (94); and
a guide movement device (35) for reciprocating the guide (34) in a knitting width direction, so that the monofilament (94) is bent at the one side edge portion of the fastener tape (91) to form the element row (95);

wherein a plurality of stringer production parts (3a) are arranged to be juxtaposed with each other in the knitting width direction.

6. The device according to claim 5, wherein the stringer production parts (3a) are symmetrically arranged in pair in the knitting width direction.

7. The device according to claim 5, wherein the hook movement device (39) comprises a hook shaft (39a) extending in the knitting width direction and an arm (39b) extending radially outward from the hook shaft (39a),
wherein the arm (39b) has an attaching portion (39c) for the hook (38) on a distal portion thereof.

8. The device according to claim 7, wherein the hook movement devices (39, 39) comprise a common hook shaft (39a) extending in the knitting width direction and a common arm (39b) extending radially outward from the hook shaft (39a),
wherein the arm (39b) has attaching portions (39c, 39c) for the hooks (38, 38) at symmetric locations on both sides, in the knitting width direction, of a distal portion thereof.

9. The device according to claim 5, wherein the guide movement devices (35, 35) comprise a common guide shaft (35a) extending in the knitting width direction, and linkages (35b, 35b) for converting a swing motion of the guide shaft (35a) to a reciprocating motion, in the knitting width direction, of the guides (34, 34), which are arranged to be spaced from each other in the knitting width direction.

FIG.1

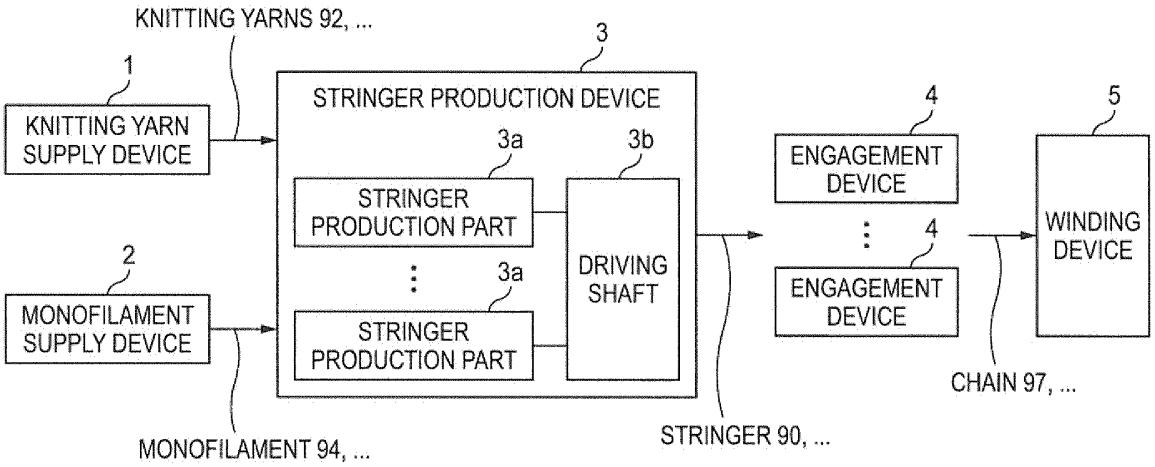

KNITTING YARNS 92, ...
1
KNITTING YARN SUPPLY DEVICE
2
MONOFILAMENT SUPPLY DEVICE
MONOFILAMENT 94, ...
3
STRINGER PRODUCTION DEVICE
3a
STRINGER PRODUCTION PART
3a
STRINGER PRODUCTION PART
3b
DRIVING SHAFT
STRINGER 90, ...
4
ENGAGEMENT DEVICE
4
ENGAGEMENT DEVICE
5
WINDING DEVICE
CHAIN 97, ...

FIG.2

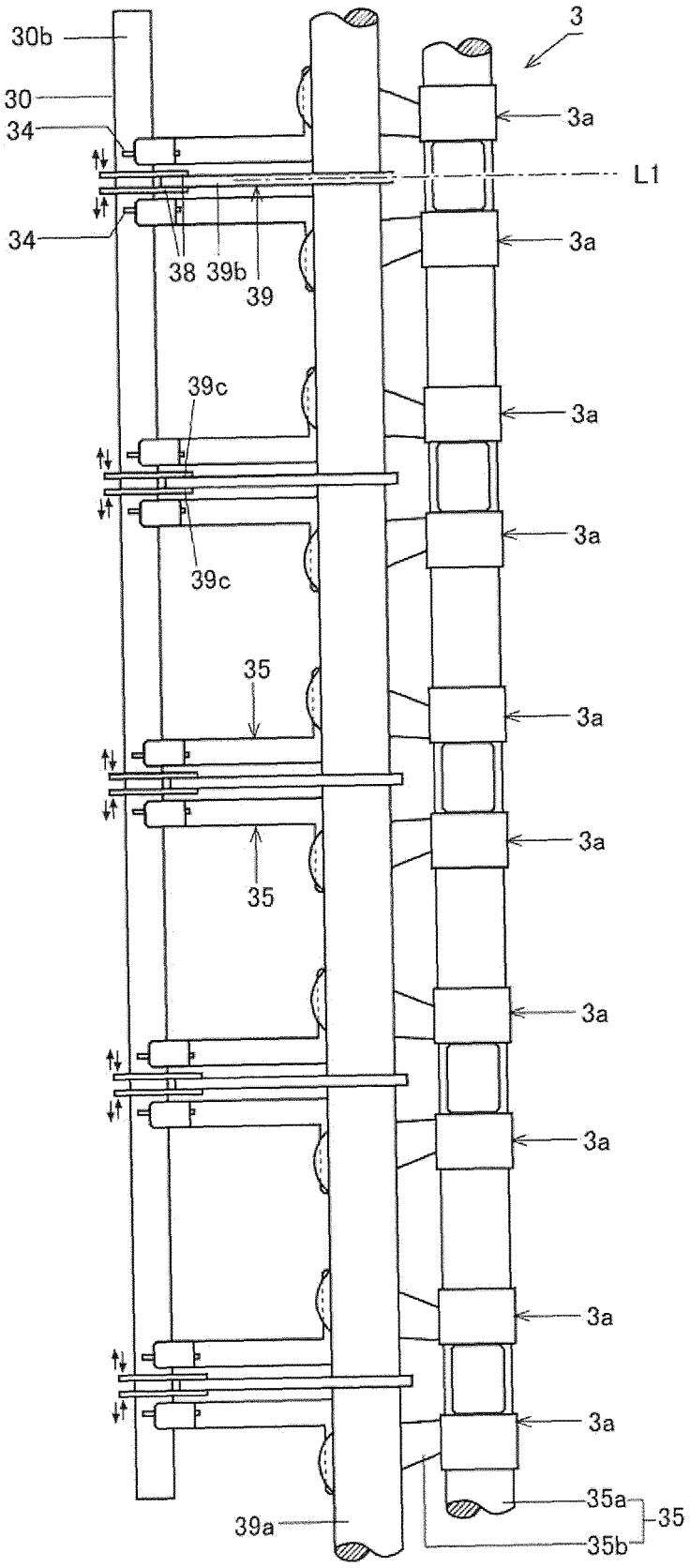
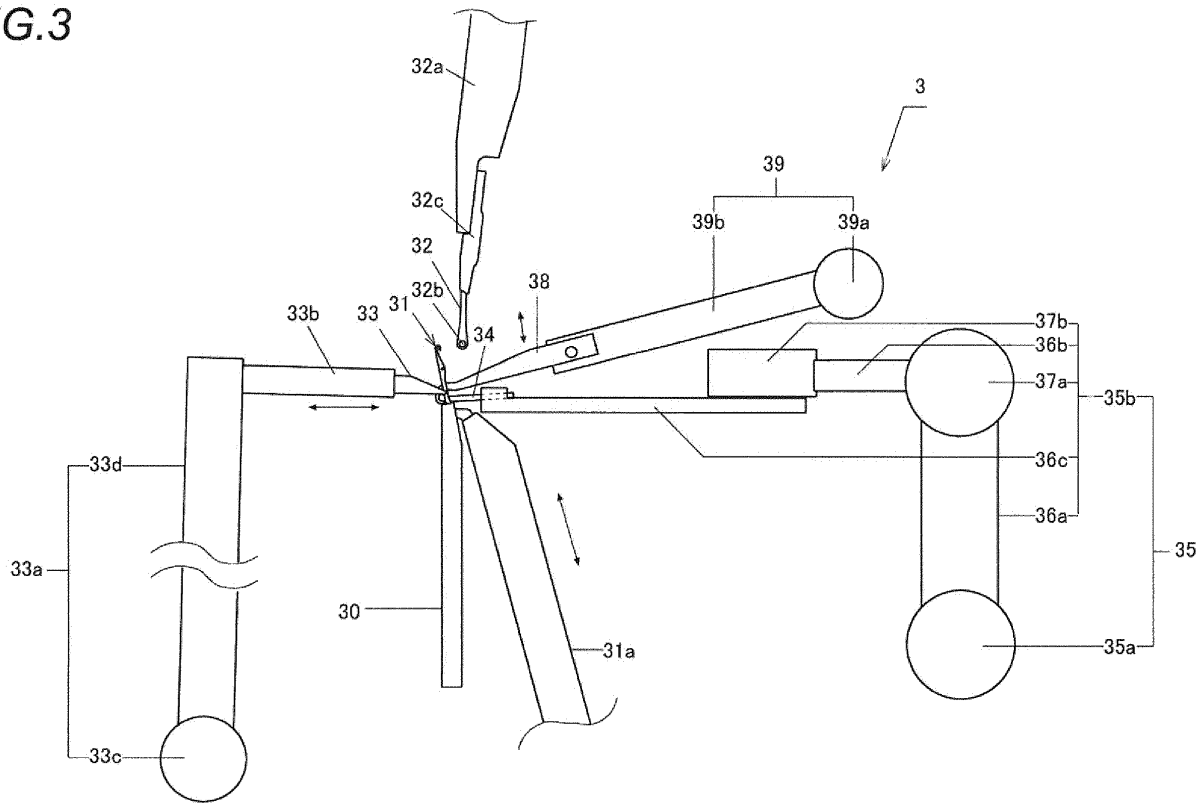


FIG.3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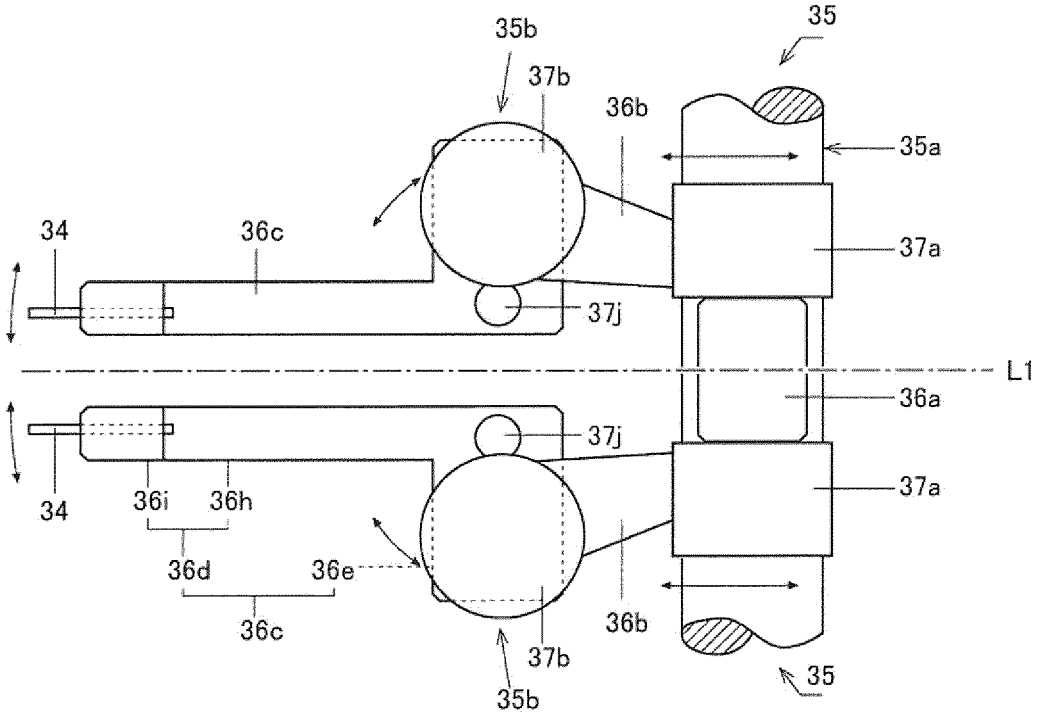
3
39
32c
39b
39a
32
38
32b
33b
33
31
34
37b
36b
37a
35b
33d
36c
36a
35
33a
30
31a
35a
33c

FIG.4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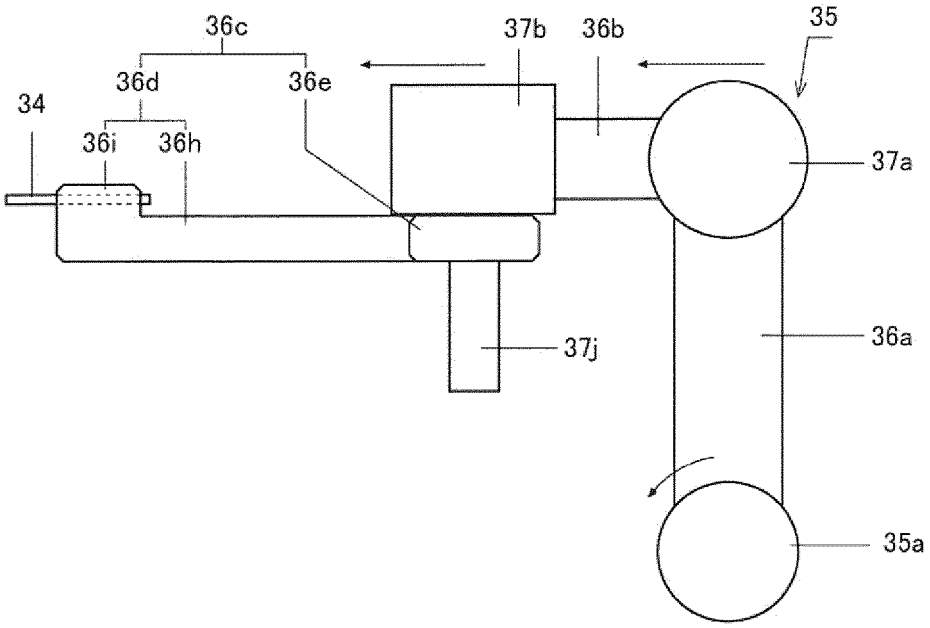
37b
35
36b
35a
34
36c
37a
37j
L1
36a
37j
34
36i
36h
37a
36d
36e
36c
36b
37b
35
35b

FIG.5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35
36d
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34
36i
36h
37a
37j
36a
35a

FIG.6

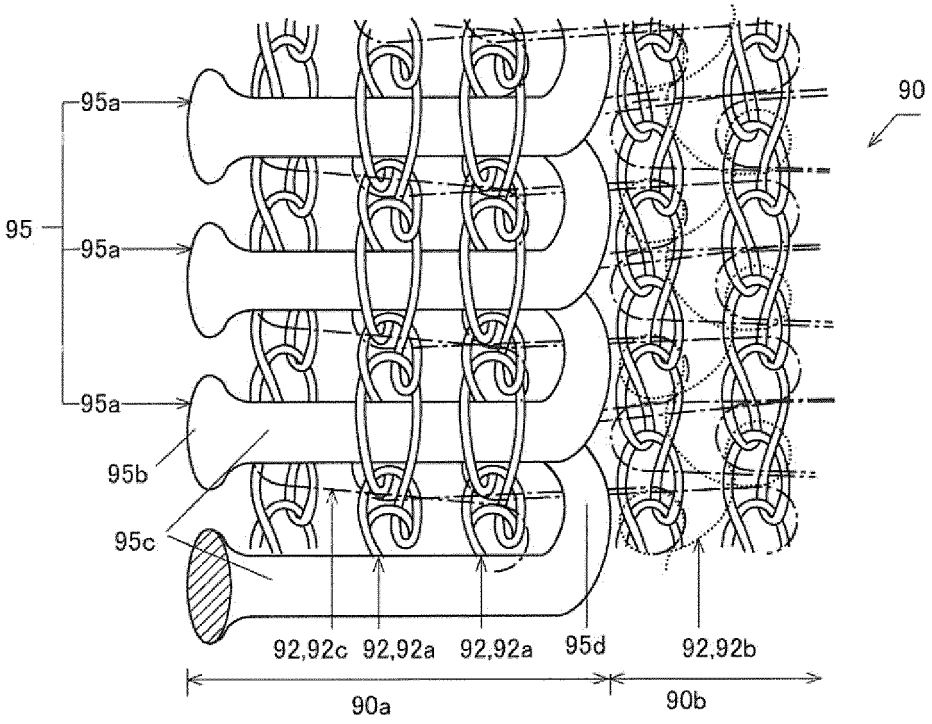


FIG.7

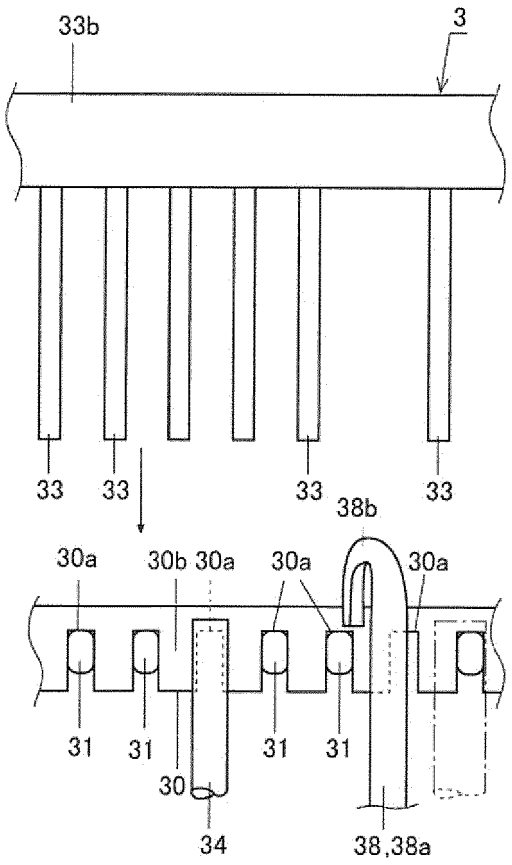

33b
3
33
33
33
33
38b
30a
30b
30a
30a
30a
31
31
31
31
30
34
38,38a

FIG.8

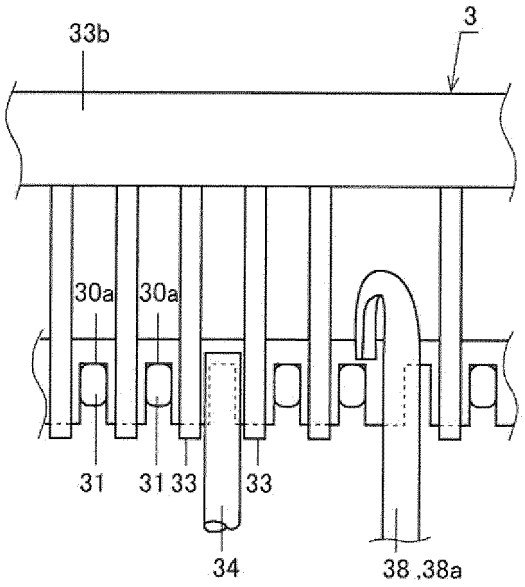

33b
3
30a
30a
31
31
33
33
34
38 ,38a

FIG.9

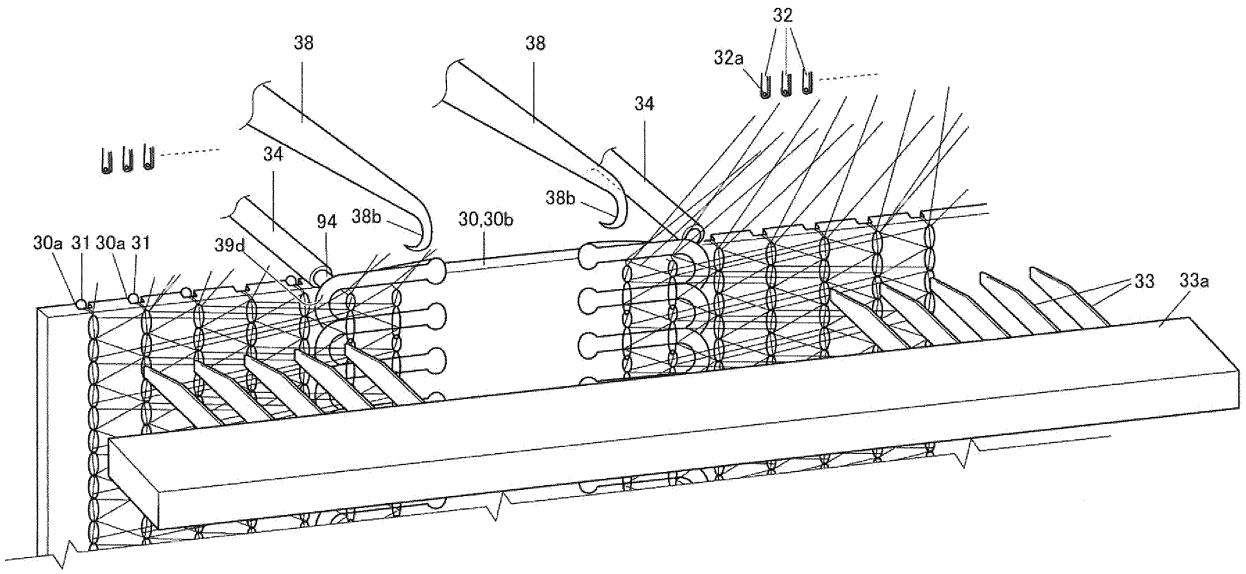


FIG.10

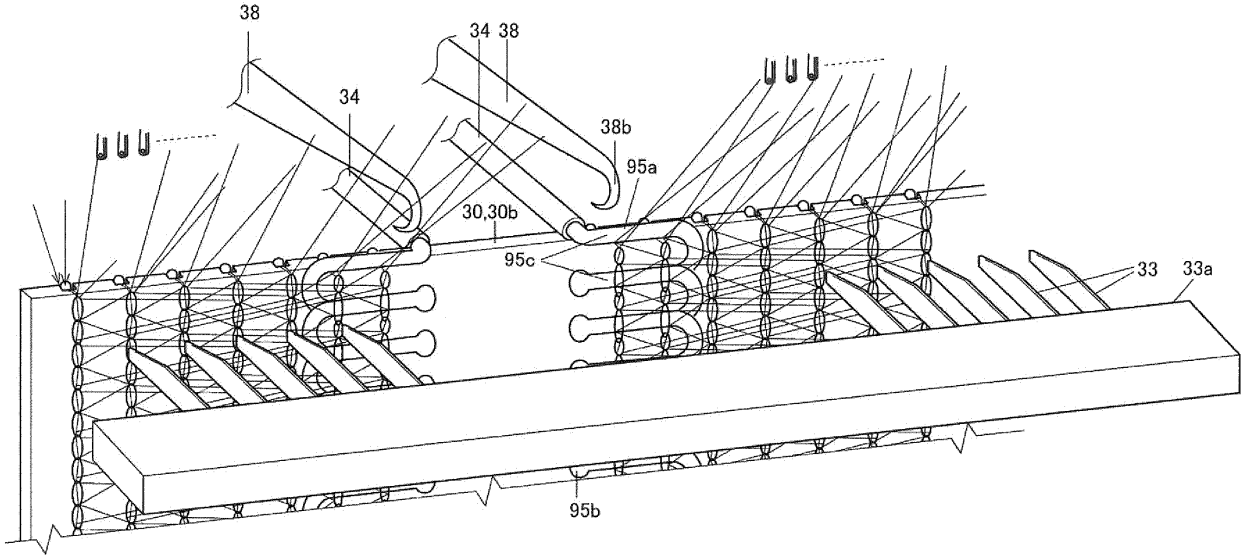


FIG.11

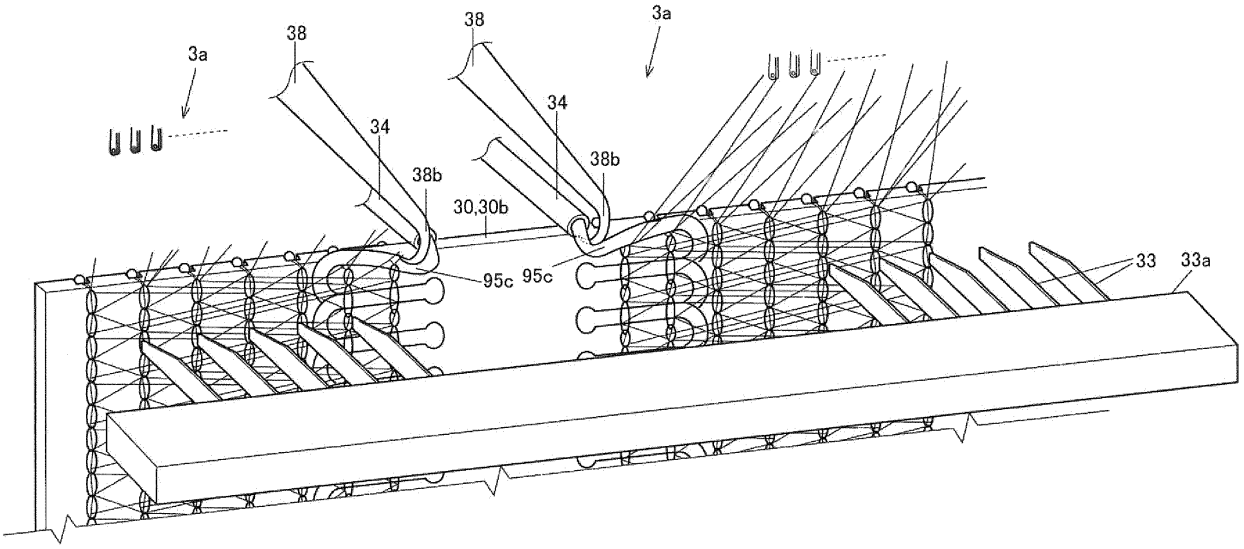


FIG.12

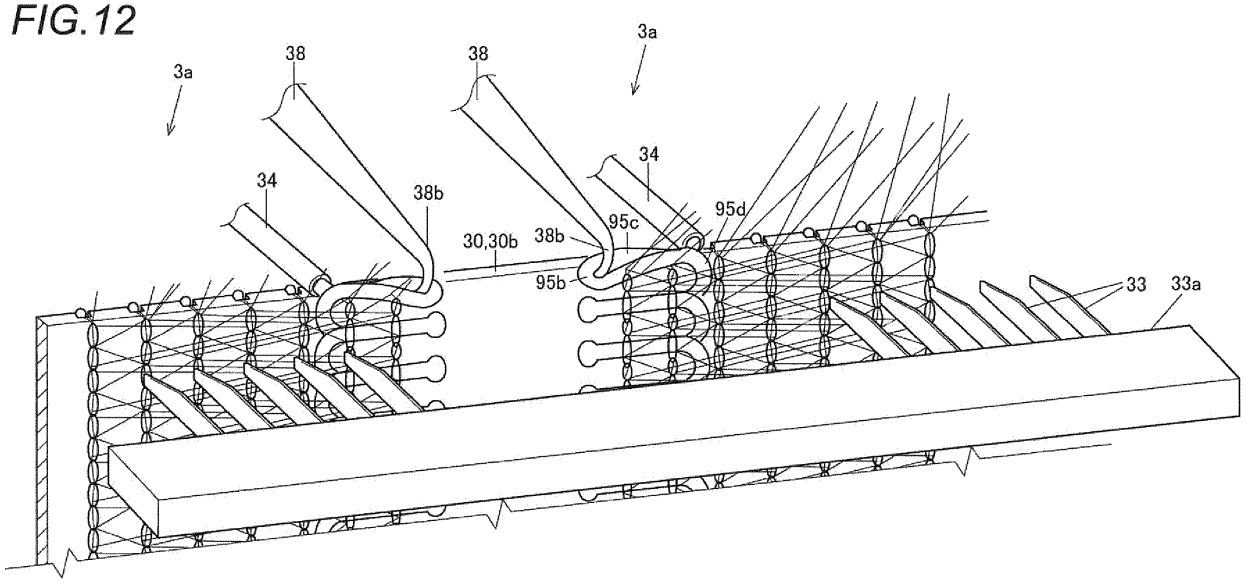


FIG.13

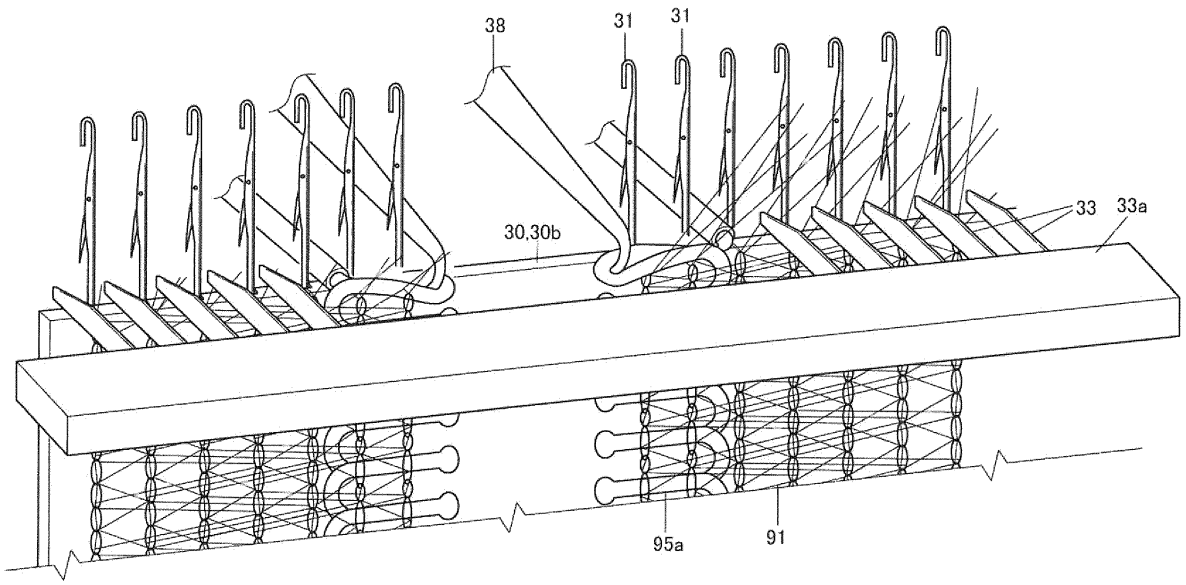
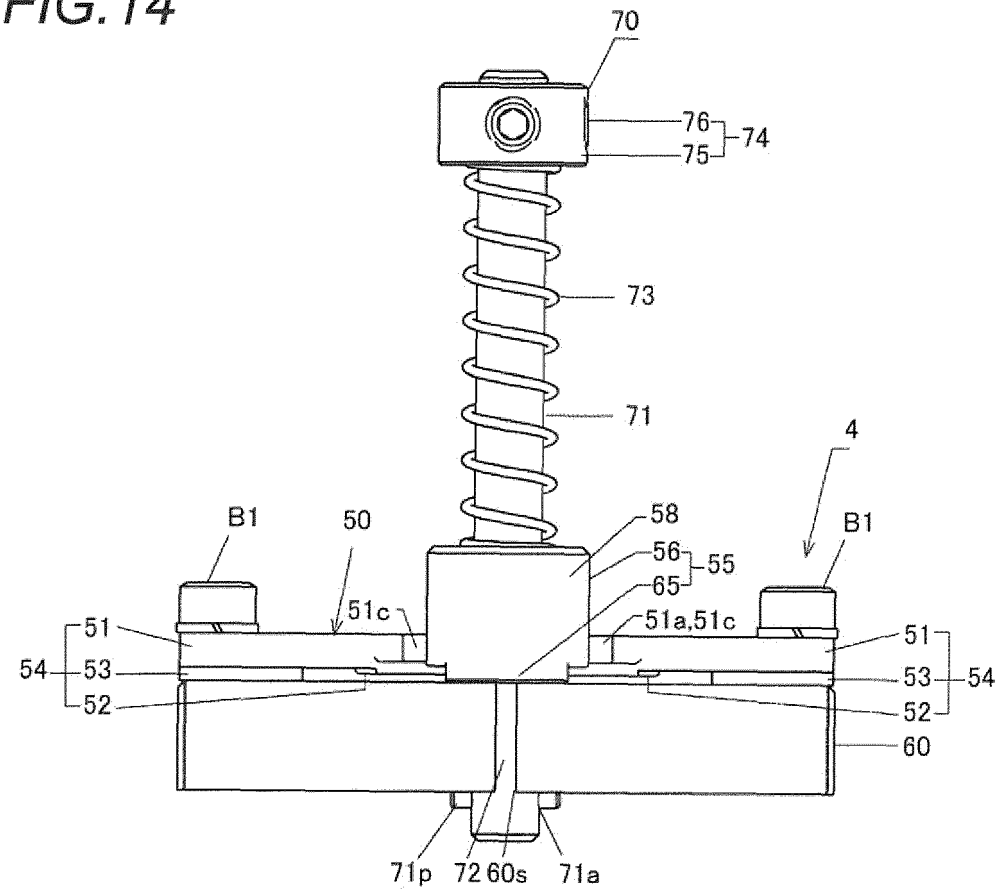


FIG.14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73
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B1
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B1
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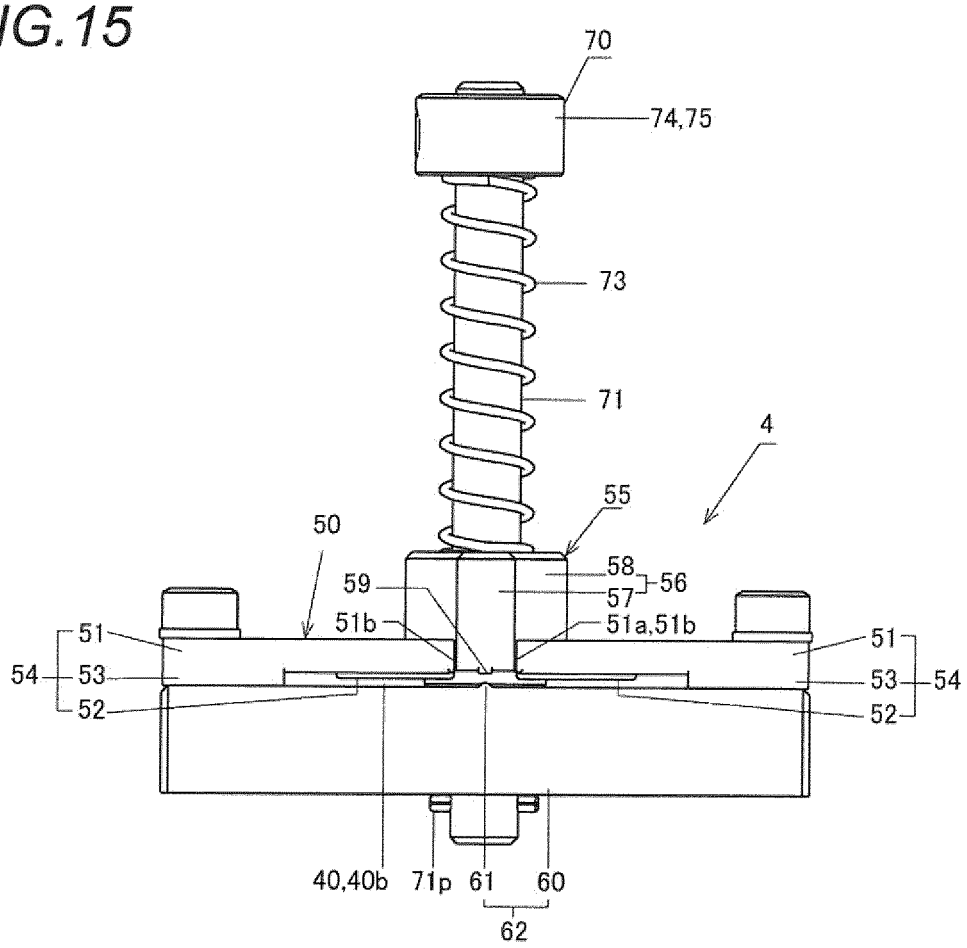
71p
72
60s
71a

FIG.15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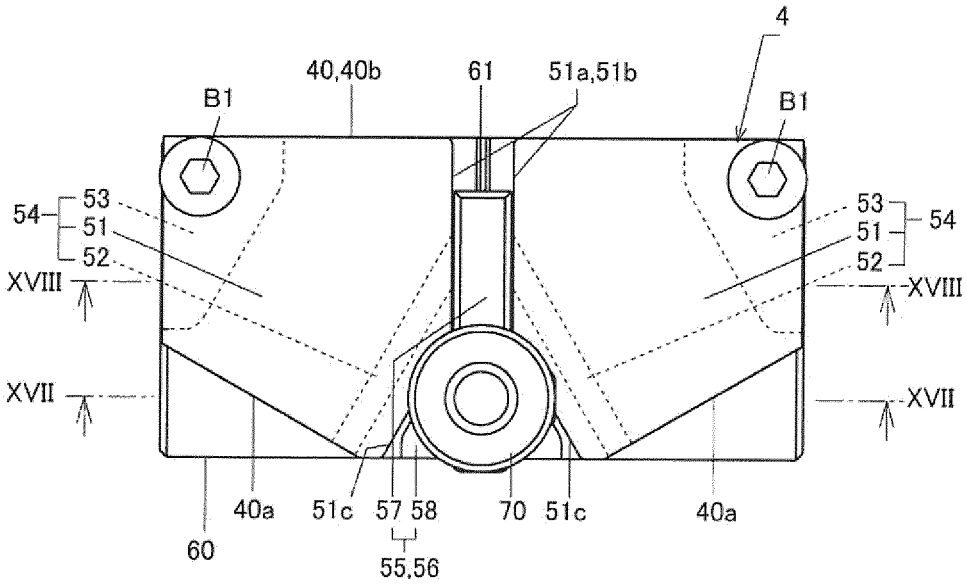
71p
61
60
62

FIG.16


4
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51a,51b
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B1
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52
XVIII
XVII
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51c
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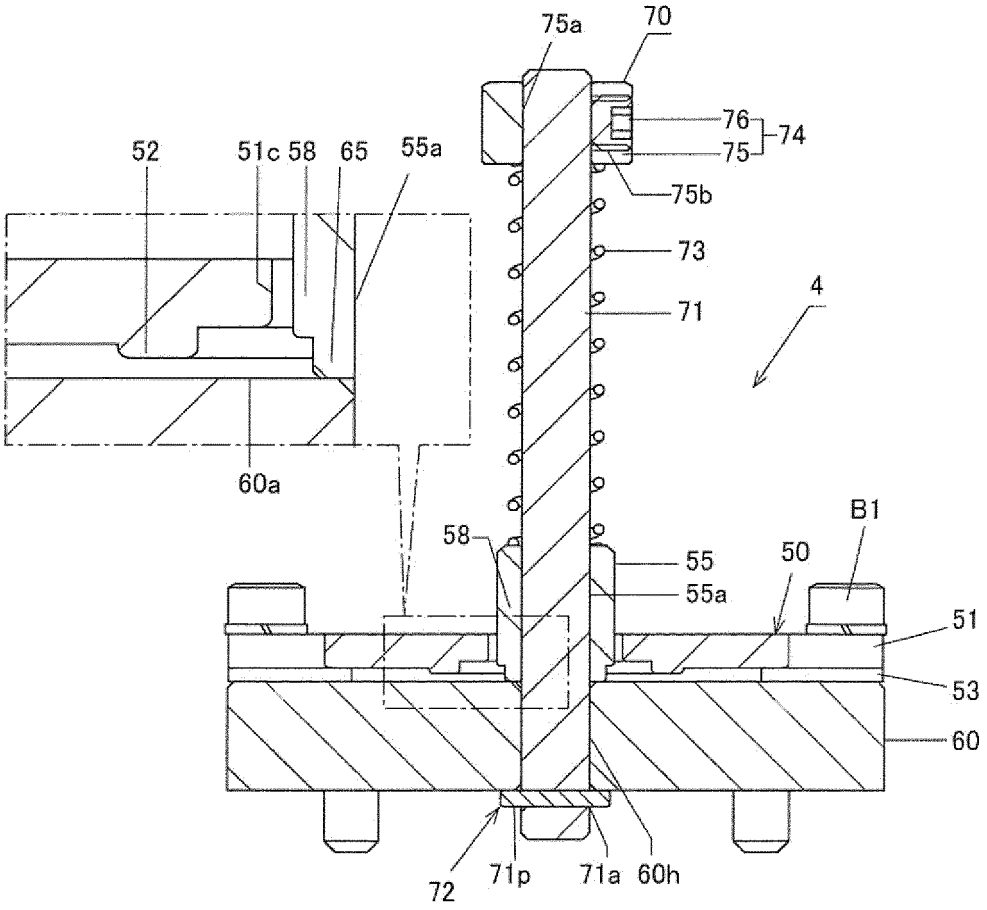
70
60

FIG.17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B1
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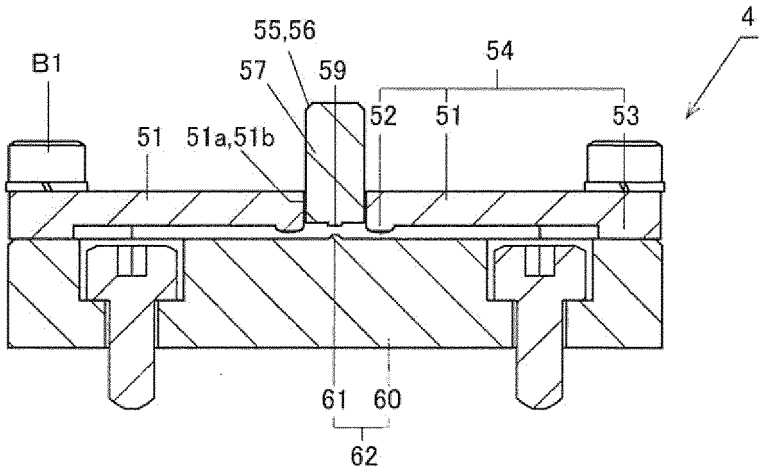
55a
51
53
60
72
71p
71a
60h

FIG.18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B1
57
59
52
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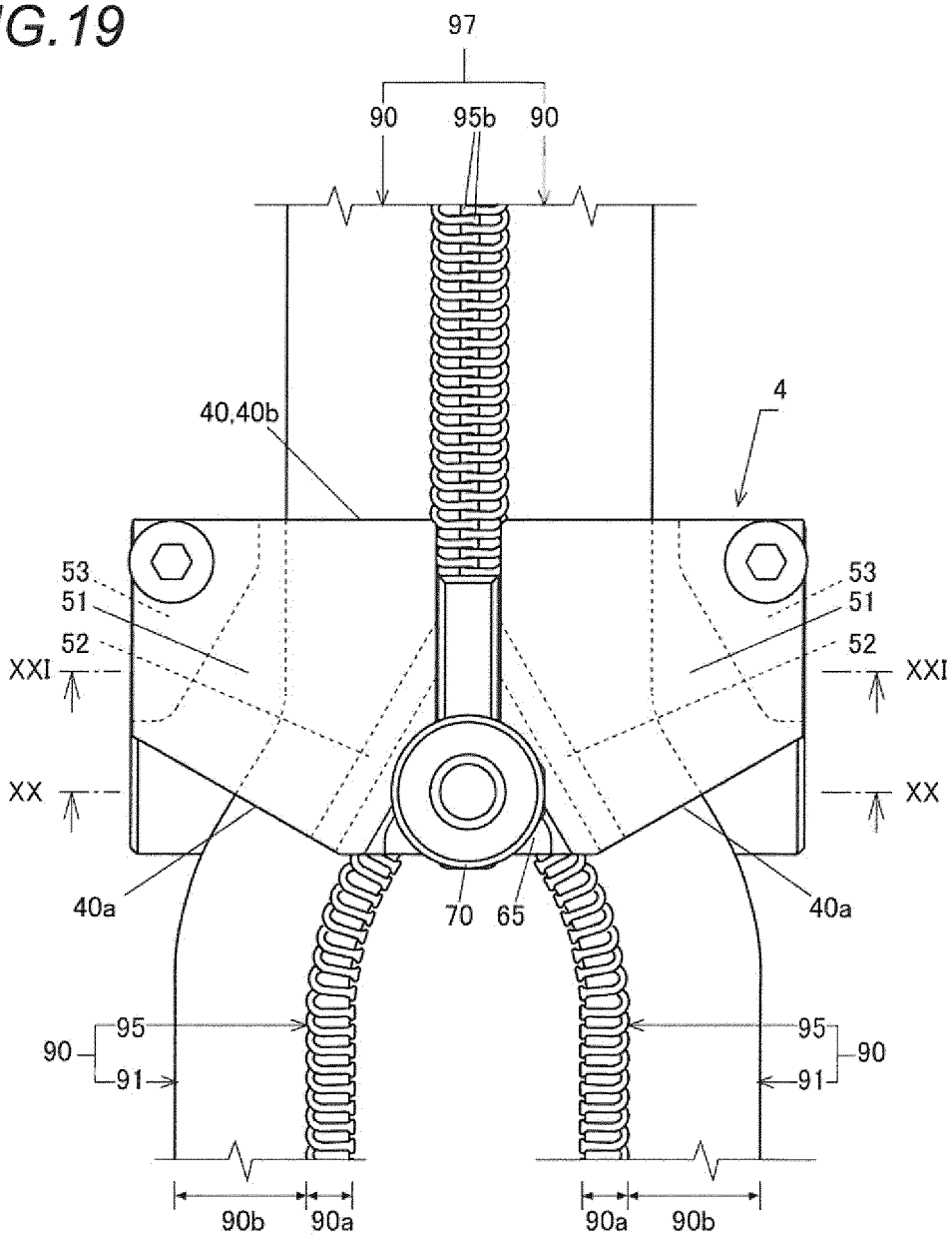
53
51
51a,51b
61
60
62

FIG.19


97
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40,40b
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51
52
XXI
XX
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51
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XXI
XX
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91
90b
90a
90a
90b

FIG.20

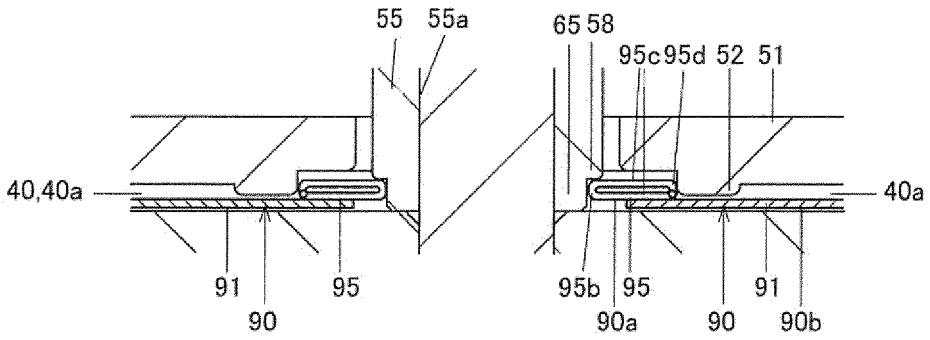
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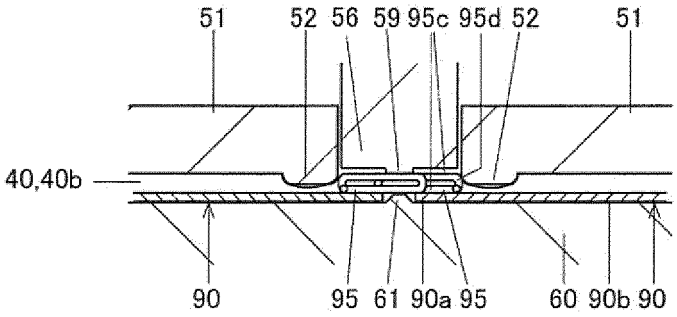
FIG.21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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2015/084679

A. CLASSIFICATION OF SUBJECT MATTER
A44B19/56(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A44B19/56

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2016
Kokai Jitsuyo Shinan Koho 1971-2016 Toroku Jitsuyo Shinan Koho 1994-2016

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 10-042916 A (YKK Corp.), 17 February 1998 (17.02.1998), paragraphs [0012] to [0045]; fig. 1 to 6 & US 5924311 A column 4, line 4 to column 9; fig. 1 to 6 & EP 823225 A2 & CN 1173562 A & KR 10-0265387 B	1,2,5-7 3,4,8,9
Y A	JP 2005-230040 A (YKK Corp.), 02 September 2005 (02.09.2005), paragraphs [0019] to [0039]; fig. 1 to 7 & US 2005/0178161 A1 paragraphs [0030] to [0063]; fig. 1 to 8 & EP 1563753 A1 & CN 1656965 A & KR 10-2006-0045324 A	1,2,5-7 3,4,8,9

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
09 March 2016 (09.03.16)	22 March 2016 (22.03.16)
Name and mailing address of the ISA/ Japan Patent Office 3-4-3,Kasumigaseki,Chiyoda-ku, Tokyo 100-8915,Japan	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2015/084679

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2015/097830 A1 (YKK Corp.), 02 July 2015 (02.07.2015), (Family: none)	1-9
A	JP 2007-002367 A (YKK Corp.), 11 January 2007 (11.01.2007), & CN 1883330 A	1-9
A	JP 55-063605 A (Yoshida Kogyo Co., Ltd.), 13 May 1980 (13.05.1980), & US 4290194 A	1-9

Form PCT/ISA/210 (continuation of second sheet) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP H10042916A B **[0003]**
- WO 2015097830 A **[0003]**