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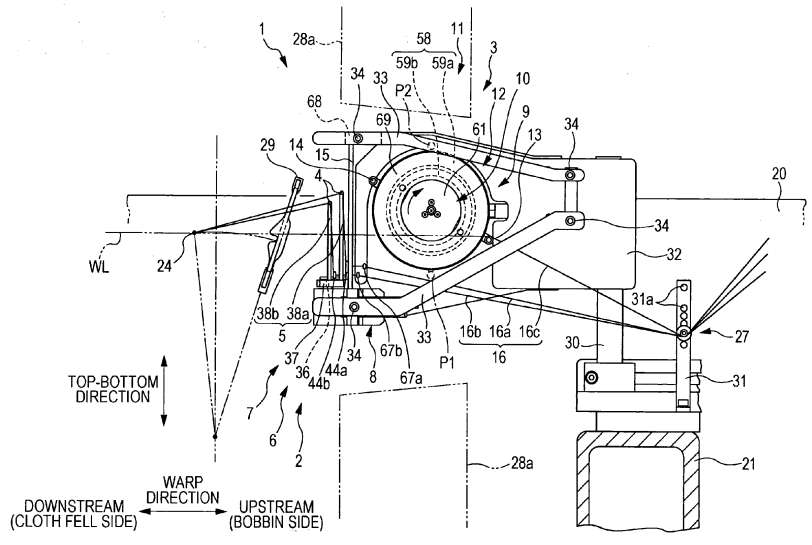
(54) Leno selvage forming apparatus for loom

(57) A selvage forming apparatus (1) forms a leno selvage construction by using a first selvage yarn (16a, 16b) and a second selvage yarn (16c). The selvage forming apparatus (1) includes a selvage-yarn-path switching device (2) that moves a path of the first selvage yarn (16a, 16b) in a weaving-width direction and a selvage shedding device (3) that moves a path of the second selvage yarn (16c) in a top-bottom direction. The selvage-yarn-path switching device (2) includes a selvage-yarn guide member (5) having an eyelet (4) through which the first selvage yarn (16a, 16b) is inserted and a first drive device (8) that switches a position of the eyelet (4) between two positions that are on the left and right sides of the second selvage yarn (16c). The selvage shedding device (3) includes an engagement portion (9) that engages with the second selvage yarn (16c) and moves so as to move the path of the second selvage yarn (16c) in the top-bottom direction. The engagement portion (9) moves along a revolution path including positions at which the second selvage yarn (16c) is closer to the first drive device (8) than the eyelet (4) and farther from the first drive device (8) than a tip end of the selvage-yarn guide member (5) in the top-bottom direction at a position of the selvage-yarn guide member (5).

FIG. 2



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a selvage forming apparatus for a loom, the selvage forming apparatus forming a selvage construction by using at least two selvage yarns pulled from respective bobbins.

2. Description of the Related Art

[0002] Japanese Unexamined Patent Application Publication (Translation of PCT Application) No. 11-505298 (hereinafter referred to as Patent Document 1) discloses an apparatus that forms a selvage construction by catching weft yarns with a plurality of selvage yarns at an edge of cloth woven by a loom.

[0003] This apparatus forms a so-called leno selvage construction by using three selvage yarns. The three selvage yarns include two twisting yarns and a single stationary yarn. A shed is formed by switching paths of the two twisting yarns and a path of the single stationary yarn in a top-down direction each time a weft insertion operation is performed. Positions of the two twisting yarns are switched in a left-right direction every other time the weft insertion operation is performed. Thus, the weft yarns are caught by the selvage yarns.

[0004] To move the selvage yarns in the above-described manner, the apparatus according to Patent Document 1 includes a first swing device and a second swing device. The first swing device swings a single tube-shaped guide needle, which guides the stationary yarn, in the top-bottom direction. The second swing device swings two tube-shaped guide needles, which guide the respective twisting yarns, in the top-bottom direction and includes a rotating mechanism for switching the positions of the two guide needles by rotating the two guide needles around an axis parallel to the guide needles at an intermediate position between the two guide needles.

[0005] In the apparatus according to Patent Document 1, the guide needle of the first swing device and the guide needles of the second swing device are swung in the top-bottom direction so that the guide needle of the first swing device is inserted between the two guide needles of the second swing device, thereby forming a first shed. After a weft yarn is inserted into the first shed, the guide needle of the first swing device is removed from between the two guide needles of the second swing device, so that a second shed is formed. The rotating mechanism rotates and switches the positions of the two guide needles of the second swing device at the position of the second shed, so that the paths of the two twisting yarns are switched in a weaving-width direction. Then, a weft yarn is inserted into the second shed. The apparatus according to Patent Document 1 forms the leno selvage construction by repeating the above-described processes.

[0006] In the apparatus according to Patent Document 1, the guide needle of the first swing device and the guide needles of the second swing device are both swung in the top-bottom direction to cause the selvage yarns to form a shed. In the case where the components are reciprocated in this manner, load is applied to the drive devices owing to the influence of inertia when the moving directions (swing directions) of the components are reversed.

[0007] The first swing device simply swings the guide needle thereof in the top-bottom direction, and the guide needle itself is light. Therefore, the load applied to the drive device is small when the amount by which the guide needle is swung is small. In contrast, the second swing device swings not only the two guide needles thereof but also the rotating mechanism in the top-bottom direction, and the influence of inertia of the rotating mechanism, which is heavy, is large. Therefore, a large load is applied to the drive device and there is a high possibility that the drive device for driving the second swing device will be damaged when the apparatus is driven continuously.

[0008] In particular, when the rotation speed of a main shaft of the loom is increased, the load applied to the drive device is also increased owing to the influence of inertia, and the drive device is more easily damaged. Therefore, the speed of the loom including the apparatus according to Patent Document 1 cannot be increased.

[0009] In the apparatus according to Patent Document 1, the above-described damage to the drive device owing to the inertia may be suppressed when the second swing device including the rotating mechanism is configured to not perform the swinging operation in the top-bottom direction. More specifically, the second swing device may be configured such that the guide needles thereof are only rotated by the rotating mechanism, and the shed may be formed mainly by swinging the guide needle of the first swing device.

[0010] However, to form the shed only by the swing movement of the guide needle of the first swing device, it is necessary to increase the swing angle of the first swing device in the top-bottom direction. To perform the shedding motion only by the swinging operation of the first swing device within a period required to perform the shedding motion when both the first and second swing devices perform the swinging operation, it is necessary to increase the swing speed of the first swing device. As a result, the above-described influence of the inertia on the drive device increases, and the load applied to the drive device that drives the first swing device increases accordingly. In this case, there is a high possibility that the drive device for driving the first swing device will be damaged. Therefore, also in this case, the speed of the loom including the apparatus cannot be used.

SUMMARY OF THE INVENTION

[0011] Accordingly, an object of the present invention is to provide a selvage forming apparatus that can be

used in a high-speed loom.

[0012] To achieve the above-described object, according to the present invention, a selvage forming apparatus for a loom, which forms a selvage construction by using at least two selvage yarns which are pulled from respective bobbins and include a first selvage yarn and a second selvage yarn, is configured as follows. That is, the selvage forming apparatus for the loom includes a selvage-yarn-path switching device disposed on a warp let-off side of a cloth fell in a warp direction and a selvage shedding device disposed on the warp let-off side of the selvage-yarn-path switching device in the warp direction. The selvage-yarn-path switching device includes a selvage-yarn guide member that is rod-shaped and extends at least in a top-bottom direction, the selvage-yarn guide member having an eyelet, through which the first selvage yarn is inserted, at a tip end thereof; a support member that is fixedly arranged with respect to a frame of the loom; a displacement member that supports the selvage-yarn guide member and that is supported by the support member so as to be movable with respect to the frame of the loom so that a position of the selvage-yarn guide member in a weaving-width direction is capable of being switched; and a first drive device that is fixedly arranged with respect to the frame of the loom and connected to the displacement member, the first drive device driving the displacement member so as to periodically switch a position of the eyelet between two positions that are on a warp row side of and a side opposite the warp row side of the second selvage yarn in the weaving-width direction. The selvage shedding device includes a rotary member that is fixedly arranged with respect to the frame of the loom so as to be rotatable around a rotation axis that extends in a direction that crosses the top-bottom direction, the rotary member including an engagement portion that is separated from the rotation axis and that engages with the second selvage yarn to move a path of the second selvage yarn; and a second drive device that rotationally drives the rotary member continuously in one direction around the rotation axis. The selvage shedding device is configured so that, when the second drive device rotationally drives the rotary member, the engagement portion is moved along a revolution path including a position at which the path of the second selvage yarn is closer to the first drive device than the eyelet in the top-bottom direction at least at a position of the selvage-yarn guide member in the warp direction, and a position at which the path of the second selvage yarn is farther from the first drive device than the tip end of the selvage-yarn guide member in the top-bottom direction at least at the position of the selvage-yarn guide member in the warp direction.

[0013] With regard to the "selvage-yarn guide member", "extends at least in a top-bottom direction" means that the extending direction of the selvage-yarn guide member is not limited to the top-bottom direction. As long as the extending direction includes a component in the top-bottom direction, as in the case where, for example, the extending direction is inclined or bent, the path of the first selvage yarn may be moved in the weaving-width direction and switched with respect to the path of the second selvage yarn that moves in the top-bottom direction. Therefore, all of such directions are included.

[0014] In addition, "fixedly arranged" means that the arrangement of the member is fixed, irrespective of whether the member is rotatable or non-rotatable in that arrangement.

[0015] With regard to the "displacement member", "supported by the support member so as to be movable with respect to the frame of the loom" means that both a case in which the displacement member is fixedly supported by the support member and is moved by a movement of the support member and a case in which the displacement member is movably supported by the support member are included.

[0016] With regard to the "rotary member", "rotation axis that extends in a direction that crosses the top-bottom direction" means that cases in which the rotation axis of the rotary member extends in all directions other than the vertical direction are included. As long as the direction of the rotation axis of the rotary member is not the vertical direction, the engagement portion can be moved in the top-bottom direction by rotationally driving the rotary member, so that the engagement portion can move and switch the path of the second selvage yarn with respect to the path of the first selvage yarn in the top-bottom direction. Therefore, the cases in which the rotation axis extends in all of these directions are included.

[0017] In the selvage forming apparatus according to the present invention, the rotary member may include a main body that is rotationally driven by the second drive device, and an engagement pin that serves as the engagement portion and projects from the main body toward the warp row side in the weaving-width direction, the engagement pin engaging with the second selvage yarn at one side of the second selvage yarn in the top-bottom direction and switching the path of the second selvage yarn by moving the path of the second selvage yarn from one side to the other side of a path of the first selvage yarn.

[0018] The rotary member may further include a balancer at a position symmetrical to the engagement pin about the rotation axis.

[0019] At least a part of the rotary member may be disposed at a position of a heald frame in the warp direction.

[0020] The selvage forming apparatus may further include a regulating member that is disposed at a position closer to the cloth fell than the selvage shedding device in the warp direction and that regulates the path of the second selvage yarn in the weaving-width direction.

[0021] The second drive device may rotationally drive the rotary member in a rotation direction such that, in a period in which the second selvage yarn is moved in a direction for forming a shed between the second selvage yarn and the first selvage yarn in the top-bottom direction,

that is, in a direction toward the first drive device in the top-bottom direction, the engagement portion is moved along a part of the revolution path that is closer to the cloth fell than a vertical line that passes though the rotation axis of the rotary member.

[0022] In the selvage forming apparatus for the loom according to the present invention, the selvage shedding device includes the rotary member including the engagement portion that is separated from the rotation axis in a radial direction and the second drive device that rotationally drives the rotary member continuously in one direction around the rotation axis. The second drive device rotationally drives the rotary member so that the engagement portion moves the path of the second selvage yarn in the top-bottom direction and switches the path of the second selvage yarn with respect to the path of the first selvage yarn. Therefore, compared to the structure according to the related art in which the shed is formed by the reciprocating motion of the swing devices, the load applied to the second drive device can be reduced by a large amount. Accordingly, the possibility that the second drive device will be damaged can be reduced. In addition, the second drive device can rotate a rotating shaft at a high speed, so that the selvage shedding apparatus can be operated at a high speed. Therefore, the selvage forming apparatus can be used in a high-speed loom.

[0023] In the case where the engagement portion of the rotary member is formed as the engagement pin that projects from the main body of the rotary member toward the warp row side in the weaving-width direction, the engagement pin can be caused to engage with the second selvage yarn at one side of the second selvage yarn in the top-bottom direction and move the path of the second selvage yarn toward the other side, thereby switching the path of the second selvage yarn in the top-bottom direction. Owing to the engagement pin, unlike the case in which, for example, the engagement portion has an eyelet that extends through the engagement portion in the weaving-width direction of the rotary member and the second selvage yarn is inserted through the eyelet, the path of the second selvage yarn is not bent by a large amount in the weaving-width direction. Therefore, excessive variation in the tension of the second selvage yarn can be suppressed and an appropriate selvage construction can be formed.

[0024] More specifically, when the engagement portion is moved along the revolution path, the engagement portion moves not only in the top-bottom direction but also in the warp direction, and the length of the path of the second selvage yarn from the cloth fell to the engagement portion varies accordingly. In this case, when, for example, the engagement portion has an eyelet that extends through the engagement portion in the weaving-width direction of the rotary member and the second selvage yarn is inserted through the eyelet, the second selvage yarn is bent by a large amount in the weaving-width direction at the eyelet. Therefore, when the length of the path varies as described above, the tension of the second selvage yarn significantly varies owing to frictional resistance (bending resistance) at the bent portion.

[0025] In the case where the engagement portion has the eyelet, the tension of the second selvage yarn may be reduced to suppress the excessive variation in the tension of the second selvage yarn. However, when the tension of the second selvage yarn is reduced, there may be a case in which an appropriate selvage construction cannot be formed.

[0026] In contrast, in the case where the engagement portion of the rotary member is formed of the engagement pin and the engagement pin is engaged with the second selvage yarn at one side of the second selvage yarn in the top-bottom direction, the second selvage yarn can be guided to the cloth fell without being bent by a large amount in the weaving-width direction. Therefore, the frictional resistance applied between the engagement portion and the second selvage yarn can be reduced. Accordingly, even when the length of the path of the second selvage yarn varies as described above, the pulling force generated by the movement of the engagement pin does not easily act on the second selvage yarn and the excess variation in the tension of the second selvage yarn can be suppressed. Since the excess variation in the tension of the second selvage yarn can be suppressed without reducing the tension of the second selvage yarn, an appropriate selvage construction can be reliably formed.

[0027] Since the variation in the tension of the second selvage yarn can be suppressed, the tension of the second selvage yarn can be easily adjusted. In addition, since the engagement pin engages with the second selvage yarn at one side of the second selvage yarn in the top-bottom direction, the operator can more easily connect the second selvage yarn to the engagement portion compared to the case in which the engagement portion has an eyelet that extends through the engagement portion in the weaving-width direction of the rotary member.

[0028] In the case where the rotary member includes the balancer at a position symmetrical to the engagement pin about the rotation axis, a vibratory force generated by the rotation of the engagement pin around the rotation axis may be canceled by a vibratory force generated by the rotation of the balancer around the rotation axis, and vibration of the rotary member can be suppressed. Thus, the load applied to the second drive device owing to the vibration can be reduced, and the rotary member can be rotated by the second drive device at a high speed. Accordingly, the selvage forming apparatus can be used in a loom operated at a higher speed.

[0029] In the case where at least a part of the rotary member is disposed at a position of the heald frame in the warp direction, the distance between the engagement portion and the cloth fell is reduced. Therefore, the swing angle of the path of the second selvage yarn (angle between the path of the second selvage yarn at the uppermost position and the path of the second selvage yarn at the lowermost position) can be increased without in-

creasing the size (diameter) of the revolution path, that is, without increasing the size of the rotary member. Accordingly, the selvage forming apparatus can be used in a loom operated at a higher speed.

[0030] More specifically, for example, when the size of the revolution path is constant, the angle between the line segment connecting the engagement portion to the cloth fell and the horizontal line decreases as the distance between the rotary member and the cloth fell increases. Therefore, the swing angle of the second selvage yarn is larger in the case where at least a part of the rotary member is disposed at a position of the heald frame in the warp direction than in the case where the rotary member is disposed at a position farther from the cloth fell than the position of the heald frame.

[0031] In other words, in the case where the rotary member is disposed at a position farther from the cloth fell than the position of the heald frame, the size of the revolution path (rotary member) needs to be increased to set the swing angle to the above-described swing angle. The swing angle affects the size of the selvage shed. Therefore, when a selvage shed having a desired size is to be formed, the rotary member may be arranged such that at least a part thereof is disposed at the position of the heald frame in the warp direction, so that the selvage shed having the desired size can be formed without increasing the size of the revolution path. In such a case, the size of the rotary member that causes the second selvage yarn to perform the shedding motion can be reduced and the inertia of rotation of the rotary member can be reduced accordingly. As a result, the load applied to the second drive device owing to the inertia can be reduced, so that the selvage forming apparatus can be used in a high-speed loom.

[0032] In the case where the selvage forming apparatus further includes the regulating member that is closer to the cloth fell than the selvage shedding device in the warp direction and that regulates the path of the second selvage yarn in the weaving-width direction, the position of the path of the second selvage yarn in the weaving-width direction can be maintained at a predetermined position at the position of the selvage-yarn guide member in the warp direction. Accordingly, the amount by which the displacement member is moved to periodically switch the path of the first selvage yarn between the two positions that are on the warp row side of and the side opposite the warp row side of the second selvage yarn in the weaving-width direction can be reduced. For example, the swing angle by which the selvage-yarn guide member is swung around the axis of a support shaft can be reduced. Thus, the time required to switch the path of the first selvage yarn can be reduced, so that the selvage forming apparatus can be used in a loom operated at a higher speed. In addition, since the swing angle of the selvage-yarn guide member can be reduced, the size of the first drive device can be reduced accordingly.

[0033] In the case where the selvage forming apparatus includes the regulating member, the second drive device may rotationally drive the rotary member in a rotation direction such that, in a period in which the second selvage yarn is moved in the direction for forming the shed between the second selvage yarn and the first selvage yarn in the top-bottom direction, the engagement portion is moved along a part of the revolution path that is closer to the cloth fell than a vertical line that passes though the rotation axis of the rotary member. In this case, the length of the path of the second selvage yarn between the engagement portion and the regulating member in the above-described period is relatively small, and therefore the path of the second selvage yarn is not easily bent. Accordingly, even when the second selvage yarn slides along the regulating member and receives a frictional resistance, the second selvage yarn reliably follows the movement of the engagement portion. As a result, the period in which the selvage shed formed by the movement of the second selvage yarn toward the first drive device has a desired size can be increased.

BRIEF DESCRIPTION OF THE DRAWINGS

[0034] Fig. 1 is an enlarged plan view of a part of a loom including a selvage forming apparatus according to an embodiment of the present invention.

[0035] Fig. 2 is a side view of the selvage forming apparatus according to the embodiment of the present invention.

[0036] Fig. 3 is a sectional side view of a selvage-yarn-path switching device.

[0037] Fig. 4 is a sectional view of Fig. 3 taken along line IV-IV.

[0038] Fig. 5 is a plan view of the selvage forming apparatus.

[0039] Fig. 6 is a side view illustrating an operation of a selvage shedding device in a state in which a shed that has been formed by selvage yarns is closed.

[0040] Fig. 7 is a side view illustrating the operation of the selvage shedding device in a state in which the shed is formed by the selvage yarns.

[0041] Figs. 8A and 8B are plan views illustrating the operation of the selvage-yarn-path switching device, wherein Fig. 8A shows the state in which first selvage yarns 16a and 16b are respectively on a side opposite a warp row side of and the warp row side of a second selvage yarn 16c and Fig. 8B shows the state in which the first selvage yarns 16a and 16b are respectively on the warp row side of and the side opposite the warp row side of the second selvage yarn 16c.

[0042] Fig. 9A to 9C are plan views illustrating examples of leno selvage constructions formed by a selvage forming apparatus according to the present invention, wherein Fig. 9A shows a two-yarn leno selvage construction and Figs. 9B and 9C show three-yarn leno selvage constructions.

[0043] Fig. 10 is a side view of a selvage forming apparatus.

[0044] Fig. 11 is a side view of a selvage forming ap-

paratus.

[0045] Figs. 12A, 12B, and 12C are a plan view, a side view, and a front view, respectively, of a selvage-yarn-path switching device included in a selvage forming apparatus.

[0046] Figs. 13A, 13B, and 13C are a plan view, a side view, and a front view, respectively, of a selvage-yarn-path switching device included in a selvage forming apparatus.

[0047] Figs. 14A and 14B are a front view and a side view, respectively, of a selvage-yarn-path switching device included in a selvage forming apparatus.

[0048] Figs. 15A and 15B are a front view and a side view, respectively, of a selvage-yarn-path switching device included in a selvage forming apparatus.

[0049] Fig. 16 is a side view of a selvage forming apparatus.

[0050] Fig. 17 is a side view of a selvage forming apparatus.

[0051] Fig. 18 is a side view of a selvage forming apparatus.

[0052] Fig. 19 is a side view of a selvage forming apparatus.

[0053] Fig. 20 is a side view of a selvage forming apparatus.

[0054] Fig. 21 is a side view of a selvage forming apparatus.

[0055] Figs. 22A and 22B are side views of a selvage forming apparatus, wherein Fig. 22A shows the state in which a shed is opened and Fig. 22B shows the state in which the shed is closed.

[0056] Fig. 23 is a side view of a selvage forming apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0057] A selvage forming apparatus according to an embodiment of the present invention will now be described with reference to Figs. 1 to 9. In the following description, a direction parallel to a direction in which warp yarns 18 are moved is defined as a "warp direction". A warp beam side, that is, a warp let-off side (not shown) from which the warp yarns 18 are fed and a cloth fell side in the warp direction are defined as an "upstream side" and a "downstream side", respectively. A direction in which a weft yarn 17 travels is defined as a "weaving-width direction". When a loom is viewed in a direction from the downstream side to the upstream side, the weaving-width direction is referred to also as a "left-right direction".

[0058] Fig. 1 is an enlarged plan view of a part of a loom including a selvage forming apparatus 1 according to the embodiment of the present invention. The selvage forming apparatus 1 is provided near each of cloth edges 19 at a weft insertion side and a weft arrival side in the weaving-width direction. The selvage forming apparatuses 1 at the weft insertion side and the weft arrival side have the same structure except that components thereof are arranged and shaped symmetrically in the weaving-width direction. Therefore, Fig. 1 illustrates only the selvage forming apparatus 1 at the weft insertion side and the structure of the loom therearound, and only the selvage forming apparatus 1 at the weft insertion side will be explained in the following description.

[0059] Bobbins 22 that feed selvage yarns 16 to the selvage forming apparatus 1 are disposed upstream of the selvage forming apparatus 1. The selvage forming apparatus 1 according to the present embodiment forms a three-yarn leno selvage construction by using three selvage yarns 16, which include two first selvage yarns 16a and 16b and a single second selvage yarn 16c. Accordingly, the bobbins 22 include two bobbins 22a and 22b for the first selvage yarns 16a and 16b, respectively, and a single bobbin 22c for the second selvage yarn 16c. Each of the three bobbins 22 is rotatably supported by a bobbin stand 23 that is fixedly arranged on a frame 20 of the loom.

[0060] In the present embodiment, the bobbins 22 are located upstream of the selvage forming apparatus 1 in the warp direction. However, when the selvage yarns 16 pulled from the respective bobbins 22 are appropriately routed, the bobbins 22 may instead be located downstream of the selvage forming apparatus 1, and even be located downstream of a cloth fell 24 if possible.

[0061] The selvage yarns 16 pulled from the bobbins 22 pass through a tenser device 25 that adjusts the tension applied to each selvage yarn 16, and are guided to the selvage forming apparatus 1 according to the embodiment of the present invention. Then, the selvage yarns 16 extend to the cloth fell 24 through between reed dents of a reed 29.

[0062] The selvage forming apparatus 1 is supported at a location upstream of a heald frame group 28 by the frame 20 at the weft insertion side of the loom with a stand 30 provided therebetween. The stand 30 stands on a cross beam member 21 that extends between the frame 20 at the weft insertion side of the loom and a frame (not shown) at the weft arrival side of the loom. Each heald frame 28a included in the heald frame group 28 has a space for receiving the selvage forming apparatus 1 between a heald 28b that is closest to the cloth edge and a side frame 28c of the heald frame 28a. A part of the selvage forming apparatus 1 is inserted through that space from the upstream side so that the selvage forming apparatus 1 is disposed between the heald 28b closest to the cloth edge and the side frame 28c of the heald frame 28a in the weaving-width direction.

[0063] The overall structure of the selvage forming apparatus 1 will now be described with reference to Fig. 2. The selvage forming apparatus 1 includes a selvage-yarn-path switching device 2 and a selvage shedding device 3. The selvage-yarn-path switching device 2 switches paths of the first selvage yarns 16a and 16b between two positions, which are on the warp row side of and the side opposite the warp row side of the second selvage yarn 16c in the weaving-width direction. The selvage

shedding device 3 moves a path of the second selvage yarn 16c between two positions, which are on the upper side of and the lower side of the first selvage yarns 16a and 16b in a top-bottom direction. The selvage forming apparatus 1 according to the present embodiment further includes a selvage yarn guide 27 and a regulating member 15. The selvage yarn guide 27 regulates the path of the second selvage yarn 16c in the top-bottom direction. The regulating member 15 regulates the path of the second selvage yarn 16c in the weaving-width direction.

[0064] Referring to Fig. 2, the selvage forming apparatus 1 includes a support frame 32 that is fixed to the stand 30. The selvage-yarn-path switching device 2 and the selvage shedding device 3 are attached to the support frame 32. The selvage-yarn-path switching device 2 is located upstream of the reed 29 in the warp direction. The selvage shedding device 3 is located upstream of the selvage-yarn-path switching device 2 and downstream of the selvage yarn guide 27 in the warp direction.

[0065] In the illustrated example, the selvage forming apparatus 1 includes plate-shaped guard members 33 that are provided on the support frame 32 at the side adjacent to the healds in order to prevent the selvage-yarn-path switching device 2 and the selvage shedding device 3 from contacting the heald 28b closest to the cloth edge (not shown). The guard members 33 are attached to the support frame 32 with respective stays (not shown) and bolts 34, and extend over a region in which the selvage-yarn-path switching device 2 and the selvage shedding device 3 are present in the warp direction.

[0066] The selvage-yarn-path switching device 2 will be described in detail with reference to Figs. 2 to 4. The selvage-yarn-path switching device 2 switches the paths of the two first selvage yarns 16a and 16b between positions on the left and right sides of the path of the second selvage yarn 16c in the weaving-width direction (see Figs. 8A and 8B). As illustrated in Figs. 3 and 4, the selvage-yarn-path switching device 2 mainly includes a main block 35 that is fixed to the frame 20 with the support frame 32 illustrated in Fig. 2 provided therebetween; a support shaft 36 that serves as a support member 6 and that is rotatably supported by the main block 35; a base member 37 that serves as a displacement member 7 and that is supported by the support shaft 36; two selvage-yarn guide rods 38a and 38b that serve as selvage-yarn guide members 5 and that stand on the base member 37; and a first drive device 8 that swings the base member 37 around an axis of the support shaft 36 by rotating the support shaft 36.

[0067] The main block 35 is a block-shaped member having a substantially rectangular parallelepiped shape, and has an opening 39 that opens in three side surfaces of the main block 35. The main block 35 has an angular U-shape with its open side facing rightward in side view. The main block 35 is fixed to a side surface of the support frame 32 illustrated in Fig. 2 at the warp row side in the weaving-width direction in such a manner that a flat surface 40, which is a side surface of the main block 35 that does not have the opening 39, is parallel to the weaving-width direction and is at the most downstream position in the warp direction.

[0068] The main block 35 has bearing-receiving holes 41 that extend therethrough in the top-bottom direction with the opening 39 provided between the bearing-receiving holes 41. Bearings 42 are fitted to the respective bearing-receiving holes 41 such that the bearings 42 are separated from each other in the top-bottom direction with the opening 39 provided therebetween and rotation axes thereof extend in the top-bottom direction. The support shaft 36 is supported by the bearings 42 in the bearing-receiving holes 41 formed in the main block 35. Thus, the support shaft 36 is fixedly arranged with respect to the frame of the loom by the bearings 42 and the main block.

[0069] The support shaft 36 is rotatably supported by the main block 35 such that the axis thereof extends in the top-bottom direction (in a direction that crosses the weaving-width direction). A part of the support shaft 36 is exposed to the outside at the opening 39 between the bearings 42. The support shaft 36 has a length that is greater than the height (dimension in the axial direction of the bearing-receiving holes 41) of the main block 35, and is assembled to the main block 35 so as to project from the top surface of the main block 35. The base member 37 is assembled to the portion of the support shaft 36 that projects from the main block 35 such that the base member 37 is not rotatable relative to the support shaft 36. Thus, the base member 37 is supported by the support shaft 36 such that the base member 37 is movable relative to the frame of the loom owing to the bearings 42.

[0070] The base member 37 is a flat block-shaped member. Through holes 43a and 43b and a through hole 43c for receiving the two selvage-yarn guide rods 38a and 38b and the support shaft 36, respectively, are formed in the base member 37 so as to extend through the base member 37 in the thickness direction. As illustrated in Fig. 4, the through holes 43a and 43b are formed so as to be equally spaced from the through hole 43c. The base member 37 is assembled to the support shaft 36 by fitting the support shaft 36 to the through hole 43c such that the through holes 43a and 43b are on the warp row side of the through hole 43c in the weaving-width direction.

[0071] As illustrated in Fig. 3, the selvage-yarn guide rods 38a and 38b are rod-shaped members having eyelets 4, through which the first selvage yarns 16a and 16b are inserted, at positions near the top ends thereof. The bottom ends of the selvage-yarn guide rods 38a and 38b are inserted through the through holes 43a and 43b, respectively, in the base member 37 so that the selvage-yarn guide rods 38a and 38b stand on the base member 37 in a direction parallel to the axis of the support shaft 36. In the present embodiment, the first selvage yarn 16a is inserted through the eyelet 4 in the selvage-yarn guide rod 38a, and the first selvage yarn 16b is inserted through

the eyelet 4 in the selvage-yarn guide rod 38b.

[0072] The two selvage-yarn guide rods 38a and 38b have different lengths (dimensions in the direction in which they extend). In the illustrated example, the selvage-yarn guide rod 38b is shorter than the selvage-yarn guide rod 38a. More specifically, the lengths of the selvage-yarn guide rods 38a and 38b are set so that, in the state in which the two selvage-yarn guide rods 38a and 38b are assembled to the base member 37, the tip end of the selvage-yarn guide rod 38b is below the straight line that connects the bottom end of the eyelet 4 in the selvage-yarn guide rod 38a and the cloth fell 24 in the top-bottom direction. Therefore, as illustrated in Fig. 2, the paths of the first selvage yarns 16a and 16b do not cross each other in the top-bottom direction in a region between the cloth fell 24 and the selvage-yarn guide rods 38a and 38b, and the first selvage yarn 16a is always above the first selvage yarn 16b.

[0073] Referring to Fig. 3, first selvage yarn guides 44a and 44b are attached to the base member 37. The first selvage yarn guides 44a and 44b serve to position the paths of the first selvage yarns 16a and 16b below the path of the second selvage yarn 16c in a region upstream of the selvage-yarn-path switching device 2. The first selvage yarn guides 44a and 44b are provided to prevent the second selvage yarn 16c from interfering with the first selvage yarns 16a and 16b when a shed is formed. This will be described in more detail below.

[0074] As illustrated in Figs. 3 and 4, the first drive device 8 includes a swing block 45, two permanent magnets 46 and 47, an electromagnet 48, an electromagnet housing 49, and a stopper member 50. As illustrated in Fig. 4, the swing block 45 is a block-shaped member having a pentagonal shape that is axially symmetrical in plan view. The swing block 45 has three side surfaces 45a, each adjacent pair of which are orthogonal to each other, two oblique surfaces 45b that continue from two of the three side surfaces 45a that are parallel to each other (side surfaces in the width direction), and top and bottom surfaces that are parallel to each other. The swing block 45 is axially symmetrical about an axis of symmetry 51 that extends through the boundary between the two oblique surfaces 45b and that is parallel to the side surfaces in the width direction.

[0075] A through hole 45c for receiving the support shaft 36 is formed in the swing block 45 so as to extend though the swing block 45 in the thickness direction. The center of the through hole 45c is positioned on the axis of symmetry 51. The portion of the support shaft 36 that is exposed at the opening 39 of the main block 35 is inserted through the through hole 45c, and the swing block 45 is fixed to the support shaft 36 such that the swing block 45 is not rotatable relative to the support shaft 36. Thus, the swing block 45 included in the first drive device 8 is connected to the base member 37 by the support shaft 36. Attachment holes 52 and 53 for the permanent magnets 46 and 47, respectively, are formed in the two oblique surfaces 45b of the swing block 45.

[0076] The permanent magnets 46 and 47 are inserted into the attachment holes 52 and 53, respectively, in the swing block 45 and are fixed to the swing block 45 by means of, for example, an adhesive. The permanent magnets 46 and 47 have the same cylindrical shape, and are attached to the attachment holes 52 and 53, respectively, in the swing block 45 such that the polarities thereof are opposite to each other.

[0077] The electromagnet 48 is housed in the electromagnet housing 49. The electromagnet housing 49 is fixed to an upstream side surface 54 of the main block 35 (among two side surfaces in a direction orthogonal to the width direction, the side surface in which the opening is formed). The electromagnet housing 49 has a substantially rectangular parallelepiped shape, and includes an attachment flange 55 at one end thereof in the longitudinal direction, as illustrated in Fig. 3. The electromagnet housing 49 is fixed to the main block 35 by using the flange 55 such that the longitudinal direction of the electromagnet housing 49 is parallel to the warp direction. Thus, the first drive device 8 is fixedly arranged with respect to the frame of the loom with the main block 35 provided therebetween.

[0078] A through hole 56 that receives the electromagnet 48 is formed in the electromagnet housing 49 so as to extend through the electromagnet housing 49 in the longitudinal direction, and the electromagnet 48 is fixedly arranged in the through hole 56. The polarity of the electromagnet 48 in an excited state is reversed when the direction in which current flows through a coil included in the electromagnet 48 is switched. When the polarity of the electromagnet 48 is reversed, the permanent magnets 46 and 47, which are arranged such that polarities thereof are opposite to each other, are alternately attracted to the electromagnet 48, so that the swing block 45 swings around the axis of the support shaft 36.

[0079] The stopper member 50 is plate-shaped and is fixed to the bottom surface (downstream surface) of the opening 39 in the main block 35. The thickness of the stopper member 50 is set so that a gap that allows the swing block 45 to swing is formed between the stopper member 50 and the swing block 45, and so that the swing block 45 comes into contact with the stopper member 50 when the amount of swing movement of the swing block 45 reaches a predetermined amount.

[0080] The swing motion of the swing block 45 based on the excitation of the electromagnet 48 is regulated by the stopper member 50 when the side surface 45a of the swing block 45 at the downstream side comes into contact with the stopper member 50. A swingable range of the swing block 45 is between a swing position (swing limit) at which a portion of the side surface 45a of the swing block 45 at the side opposite the warp row side comes into contact with the stopper member 50 and a swing position (swing limit) at which a portion of the side surface 45a of the swing block 45 at the warp row side comes into contact with the stopper member 50. The swing positions are determined by the above-described

gap and the width of the swing block.

[0081] In the selvage-yarn-path switching device 2 having the above-described structure, as illustrated in Fig. 4, the base member 37 and the swing block 45 are assembled to the support shaft 36 so that, when the axis of symmetry 51 of the swing block 45 is parallel to the warp direction, a line segment L that connects the centers of the through holes 43a and 43b in the base member 37 is at an angle α with respect to the warp direction. The angle α is set in association with the path of the second selvage yarn 16c, which will be described below. This will be described in more detail below.

[0082] When the swing block 45 swings between the above-described two swing positions (swing limits), the base member 37 swings around the axis of the support shaft 36 (center of the through holes 43c and 45c) such that the position where the line segment L is at the angle α relative to the warp direction serves as a neutral position. When the swing block 45 swings by a maximum amount toward the side opposite the warp row side, a portion of the base member 37 on the warp row side of the support shaft 36 is at a most upstream position (state illustrated in Fig. 8A). This position serves as the upstream swing limit of the base member 37. When the swing block 45 swings by a maximum amount toward the warp row side, the portion of the base member 37 on the warp row side of the support shaft 36 is at a most downstream position (state illustrated in Fig. 8B). This position serves as the downstream swing limit of the base member 37.

[0083] When the base member 37 is at the above-described upstream swing limit (in the state illustrated in Fig. 8A), the selvage-yarn guide rods 38a and 38b are at the most upstream positions in the warp direction. In the weaving-width direction, the selvage-yarn guide rod 38a is at a position farthest from the warp row and the selvage-yarn guide rod 38b is at a position closest to the warp row.

When the base member 37 is at the above-described downstream swing limit (in the state illustrated in Fig. 8B), the selvage-yarn guide rods 38a and 38b are at the most downstream positions in the warp direction. In the weaving-width direction, the selvage-yarn guide rod 38a is at a position closest to the warp row and the selvage-yarn guide rod 38b is at a position farthest from the warp row. Thus, the first drive device 8 drives the displacement member 7 so that the positions of the eyelets 4 in the selvage-yarn guide rods 38a and 38b are periodically switched between two positions which are on the warp row side of and the side opposite the warp row side of the second selvage yarn 16c in the weaving-width direction.

[0084] The selvage shedding device 3 will now be described in detail with reference to Figs. 2 and 5. The selvage shedding device 3 moves the path of the second selvage yarn 16c between positions above and below the paths of the first selvage yarns 16a and 16b in the top-bottom direction. The selvage shedding device 3 mainly includes a rotary member 10 including an engagement portion 9 that engages with the second selvage yarn 16c and a second drive device 11 that drives the rotary member 10 so that the rotary member 10 continuously rotates in one direction around a rotation axis.

[0085] The second drive device 11 according to the present embodiment is formed of a so-called direct-drive motor (hereinafter referred to as a DD motor). Referring to Fig. 2, a DD motor 58, which functions as the second drive device 11, is an inner-rotor motor including an annular stator 59a and a rotor 59b arranged such that the outer peripheral surface of the rotor 59b faces the inner peripheral surface of the stator 59a. The stator 59a is attached to the support frame 32 illustrated in Fig. 2 such that a rotation axis 60 (see Fig. 5) of the DD motor 58 extends in the weaving-width direction. In this manner, the DD motor 58 is fixed to a side surface of the support frame 32 at the warp row side in the weaving-width direction.

[0086] The rotary member 10 is assembled to the rotor 59b of the DD motor 58 such that the rotary member 10 is not rotatable relative to the rotor 59b. In the present embodiment, the rotary member 10 includes a main body 12 that is rotationally driven by the DD motor 58 and an engagement pin 13 that serves as the engagement portion 9 and that projects from the main body 12 toward the warp row side in the weaving-width direction.

[0087] As illustrated in Fig. 5, the main body 12 includes a rotating disc 61, which is a disc-shaped thin plate member, and a support stay 63 attached to the rotating disc 61. The main body 12 is fixed to the rotor 59b (not shown) of the DD motor 58 at the warp row side of the DD motor 58 in the weaving-width direction such that the center of the rotating disc 61 coincides with the rotation axis 60 of the DD motor 58. The main body 12 is rotatable around the rotation axis 60 that extends in the weaving-width direction. The main body 12 is fixedly arranged with respect to the frame 20 of the loom by the DD motor 58, and also by the support frame 32 and the stand 30 illustrated in Fig. 2.

[0088] The engagement pin 13 is attached to the support stay 63 of the rotating disc 61. The engagement pin 13 guides the path of the second selvage yarn 16c in the top-bottom direction by engaging with the second selvage yarn 16c, and moves the path of the second selvage yarn 16c in the top-bottom direction.

[0089] In the illustrated example, the engagement pin 13 is a round, rod-shaped member, and is provided with a flange portion 62 at the warp-row-side end thereof in the weaving-width direction to prevent the second selvage yarn 16c from being released. The engagement pin 13 is fixed to a side surface of the support stay 63 at the warp row side in the weaving-width direction such that an axis thereof extends in the weaving-width direction. When the main body 12 of the rotary member 10 is rotationally driven by the DD motor 58, the engagement pin 13 moves along a revolution path having the rotation axis 60 at the center.

[0090] In the present embodiment, the selvage yarn guide 27, which will be described below, is disposed between the selvage shedding device 3 and the tenser device 25. The position of the path of the second selvage yarn 16c in the top-bottom direction in the state in which the engagement
pin 13 is omitted (when it is assumed that the engagement pin 13 is not present) is determined by the vertical position of the selvage yarn guide 27 relative to the cloth fell 24 (straight line that extends through the guide position of the selvage yarn guide 27 and the cloth fell 24).

[0091] In the present embodiment, the path of the second selvage yarn 16c determined by the selvage yarn guide 27 and the cloth fell 24 is such that when the component of the revolution of the engagement pin 13 in the top-bottom direction is upward, the second selvage yarn 16c is pushed upward from below by the engagement pin 13. When the component of the revolution of the engagement pin 13 in the top-bottom direction is downward, the second selvage yarn 16c moves downward so as to follow the downward movement of the engagement pin 13 owing to the tension of the second selvage yarn 16c.

[0092] Therefore, as illustrated in Fig. 2, the vertical position of the second selvage yarn 16c at the position of the selvage shedding device 3 is determined by the vertical position (position in the top-bottom direction) of the engagement pin 13 that engages with the second selvage yarn 16c. Accordingly, the revolution path of the engagement pin 13 needs to satisfy the following two conditions, and the position of the engagement pin 13 in the radial direction of the rotary member 10 (distance from the center of the rotating disc 61) is determined so as to satisfy these conditions.

[0093] Condition 1: Referring to Fig. 7, the position of the engagement pin 13, which moves along the revolution path, at the time when the engagement pin 13 is at the lowermost position in the top-bottom direction is defined as a first position P1. At least when the engagement pin 13 is at the first position P1, the path of the second selvage yarn 16c, which engages with the engagement pin 13, is below (closer to the first drive device 8 than) the eyelet 4 in the selvage-yarn guide rod 38b in the top-bottom direction at the position of the selvage-yarn guide rod 38b in the warp direction. This condition needs to be satisfied to form a shed for the weft insertion operation. Here, "at least when the engagement pin 13 is at the first position P1" means that a case in which the path of the second selvage yarn 16c reaches a position below the eyelet 4 in the selvage-yarn guide member 5 before the engagement pin 13 reaches the first position P1 is included.

[0094] Condition 2: Referring to Fig. 6, the position of the engagement pin 13, which moves along the revolution path, at the time when the engagement pin 13 is at the uppermost position in the top-bottom direction is defined as a second position P2. At least when the engagement pin 13 is at the second position P2, the path of the second selvage yarn 16c, which engages with the engagement pin 13, is above (farther from the first drive device 8 than) the tip end of the selvage-yarn guide rod 38a in the top-bottom direction at the position of the selvage-yarn guide rod 38a in the warp direction. This condition needs to be satisfied to allow the selvage-yarn-path switching device 2 to switch the paths of the first selvage yarns 16a and 16b (to prevent the selvage-yarn guide rod 38a from interfering with the second selvage yarn 16c when the paths of the first selvage yarns 16a and 16b are switched). Here, "at least when the engagement pin 13 is at the second position P2" means that a case in which the path of the second selvage yarn 16c reaches a position above the tip end of the selvage-yarn guide member 5 before the engagement pin 13 reaches the second position P2 is included.

[0095] As illustrated in Fig. 5, in the present embodiment, a balancer 14 is provided on the rotary member 10 at a position symmetrical to the engagement pin 13 about the rotation axis 60. The balancer 14 includes a balancer stay 64 that is attached to the warp-row-side surface of the rotating disc 61 and a balancer pin 65 that is attached to the balancer stay 64 on the side opposite the warp row side of a region in which the engagement pin 13 extends in the weaving-width direction.

[0096] The balancer stay 64 is a plate-shaped member having substantially the same weight and shape as those of the support stay 63. The balancer pin 65 is a round, rod-shaped member having substantially the same weight and shape as those of the engagement pin 13. The balancer pin 65 is arranged at a position symmetrical to the engagement pin 13 about the center of the rotating disc 61 (rotation axis 60 of the DD motor).

[0097] The structure of the selvage shedding device 3 has been described. In the selvage shedding device 3, parts of the DD motor 58 and the rotary member 10 are disposed in a region in which the heald frames 28a are disposed in the warp direction. The reason for this is as follows.

[0098] As illustrated in Fig. 7, in the selvage forming apparatus 1 according to the embodiment of the present invention, a selvage shed is formed of the first selvage yarns 16a and 16b and the second selvage yarn 16c. Since the positions of the first selvage yarns 16a and 16b in the top-bottom direction are fixed, the size of the selvage shed is determined by a swing angle of the second selvage yarn 16c, that is, by an angle between the path of the second selvage yarn 16c at the uppermost position and the path of the second selvage yarn 16c at the lowermost position. In the present embodiment, the swing angle is determined by the diameter of the revolution path and the distance from the cloth fell 24 to the center of the revolution path.

[0099] When the diameter of the revolution path of the engagement pin 13 (rotary member 10) is constant and the vertical positions of the first and second positions P1 and P2 in the top-bottom direction are also constant, the swing angle of the second selvage yarn 16c is determined by the distance from the cloth fell 24 to the first position

P1 in the warp direction. Therefore, when the distance from the cloth fell 24 to the first and second positions P1 and P2 is large, the swing angle is small and a shed having a desired size for the weft insertion operation cannot be formed.

[0100] The size of the shed may be increased by moving the center of the revolution path (center of the rotary member 10) to a lower position to move the first position P1 to a lower position. However, when the center of the revolution path is moved to a lower position, the second position P2 is also moved to a lower position, and Condition 2 cannot be satisfied. The size of the shed may also be increased by increasing the size of the revolution path, more specifically, by increasing the distance from the center of the rotary member 10 to the engagement pin 13 or increasing the diameter of the rotor 59b of the DD motor 58 or the rotary member 10. However, when the size of the revolution path is increased, the inertia of rotation of the engagement pin 13, the rotor 59b of the DD motor 58, and the main body 12 increases, and it becomes difficult to increase the speed of the loom. In addition, the size of the selvage shedding device 3 increases and the arrangement of the selvage forming apparatus 1 in the loom is limited.

[0101] Accordingly, in the present embodiment, the selvage shedding device 3 is arranged such that a part thereof is positioned in a region in which the heald frames 28a are disposed, as illustrated in Figs. 1 and 2, to position the revolution path as close to the cloth fell 24 as possible in the warp direction. With regard to the arrangement of the selvage shedding device 3 in the warp direction, since the selvage-yarn-path switching device 2 is disposed downstream of the selvage shedding device 3, the position of the selvage shedding device 3 in the warp direction is set on the basis of the arrangement of the selvage-yarn-path switching device 2. The selvage-yarn-path switching device 2 is disposed upstream of the most retracted position of the reed 29 in the warp direction to avoid interference with the reed 29 (reed holder). In the present embodiment, the selvage shedding device 3 is disposed at a position closest to the cloth fell in consideration of the above-described factors, and is arranged such that a part thereof is disposed in the region in which the heald frames 28a are disposed. With this arrangement, in the present embodiment, the swing angle of the second selvage yarn 16c is made as large as possible without increasing the size of the revolution path, so that a selvage shed having a desired size is formed by the first selvage yarns 16a and 16b and the second selvage yarn 16c.

[0102] As described above, in the present embodiment, the selvage yarn guide 27 is provided between the selvage shedding device 3 and the tenser device 25. The second selvage yarn 16c engages with an upper portion of the engagement pin 13, and is guided to the cloth fell 24. The path of the second selvage yarn 16c is moved in the top-bottom direction by causing the second selvage yarn 16c to engage with the engagement pin 13, which moves in the top-bottom direction. Accordingly, the following condition needs to be satisfied to set the size of the shed formed by the second selvage yarn 16c at a maximum when the engagement pin 13 is at the first position P1. That is, the position of the path of the second selvage yarn 16c in the top-bottom direction in the state in which the engagement pin 13 is omitted (in the state in which the second selvage yarn 16c is directly guided from the selvage yarn guide 27 to the cloth fell 24) at the position of the selvage shedding device 3 needs to be below or at substantially the same level as the engagement pin 13 at the first position P1. In other words, the path of the second selvage yarn 16c needs to be below the selvage shedding device 3 in a region upstream of the selvage shedding device 3.

[0103] In the present embodiment, as illustrated in Fig. 1, the tenser device 25, which defines the path of the second selvage yarn 16c in the region upstream of the selvage shedding device 3, is arranged on the frame of the loom with a dropper device 26, which extends between the left and right frames of the loom, provided therebetween. The tenser device 25 guides the second selvage yarn 16c in a region above the selvage shedding device 3. Accordingly, in the present embodiment, the selvage yarn guide 27 is disposed below the selvage shedding device 3 in a region between the selvage shedding device 3 and the tenser device 25. The second selvage yarn 16c that has passed through the tenser device 25 is guided by the bottom surface of the selvage yarn guide 27, so that the path of the second selvage yarn 16c is positioned below the selvage shedding device 3.

[0104] The selvage yarn guide 27 is formed of a substantially cylindrical member, and is fixed to one of fixing holes 31a formed in a stay 31, which stands on the cross beam member 21, such that an axis thereof extends in the weaving-width direction. Thus, the selvage yarn guide 27 is fixedly arranged with respect to the frame of the loom. As illustrated in Fig. 5, the selvage yarn guide 27 has a guide groove 66c for guiding the second selvage yarn 16c in a peripheral surface thereof. The guide groove 66c extends in the circumferential direction of the selvage yarn guide 27. The guide groove 66c in the selvage yarn guide 27 regulates the path of the second selvage yarn 16c in the top-bottom direction and the weaving-width direction.

[0105] As illustrated in Fig. 5, the selvage yarn guide 27 is arranged such that the guide groove 66c that guides the second selvage yarn 16c is disposed in a region in which the engagement pin 13 of the selvage shedding device 3 extends in the weaving-width direction.

[0106] In the present embodiment, the selvage yarn guide 27 is also used to guide the first selvage yarns 16a and 16b. The selvage yarn guide 27 has not only the guide groove 66c but also guide grooves 66a and 66b for guiding the first selvage yarns 16a and 16b, respectively, in the peripheral surface thereof. The guide grooves 66a and 66b are on the side opposite the warp row side of the guide groove 66c in the axial direction of

the selvage yarn guide 27, and on the side opposite the warp row side of the region in which the engagement pin 13 extends in the weaving-width direction.

The three guide grooves 66b, 66a, and 66c for guiding the selvage yarns 16 are arranged in that order from the weft insertion side. The first selvage yarns 16b and 16a and the second selvage yarn 16c are guided by the respective three guide grooves in that order from the weft insertion side.

The guide grooves regulate the paths of the respective selvage yarns 16 in the top-bottom direction and the weaving-width direction.

[0107] In the present embodiment, the regulating member 15, which is disposed between the selvage shedding device 3 and the selvage-yarn-path switching device 2, regulates the path of the second selvage yarn 16c in the weaving-width direction. The regulating member 15 serves to maintain the path of the second selvage yarn 16c at a desired position in the weaving-width direction in a region near the selvage-yarn guide rods 38a and 38b included in the selvage-yarn-path switching device 2.

[0108] The regulating member 15 will be described in more detail. As illustrated in Fig. 1, in the present embodiment, the selvage shedding device 3 is disposed on the side opposite the warp row side of the cloth edge 19 in the weaving-width direction. The tip end of the engagement pin 13 is also arranged outside (on the side opposite the warp row side of) the cloth edge 19. Accordingly, the guide groove 66c formed in the above-described selvage yarn guide 27 is also located outside the cloth edge 19 in the weaving-width direction. When the regulating member 15 is omitted and the second selvage yarn 16c is directly guided from the selvage yarn guide 27 to the cloth edge 19 at the cloth fell 24 without being engaged with the engagement pin 13, the path of the second selvage yarn 16c is at an angle with respect to the warp direction (with respect to the cloth edge 19). The rotating disc 61 of the rotary member 10 included in the selvage shedding device 3 is parallel to the warp direction (cloth edge 19). Therefore, when the rotating disc 61 is rotated, the engagement pin 13 moves forward and backward in the warp direction while a distance from the cloth edge 19 in the weaving-width direction is maintained constant.

[0109] Therefore, when the regulating member 15 is omitted and the second selvage yarn 16c is engaged with the engagement pin 13 while the second selvage yarn 16c is directly guided from the selvage yarn guide 27 to the cloth edge 19 at the cloth fell 24, the position of the second selvage yarn 16c with respect to the engagement pin 13 in the weaving-width direction differs between the state in which the engagement pin 13 is at the most downstream position and the state in which the engagement pin 13 is at the most upstream position. Accordingly, the second selvage yarn 16c reciprocates along the engagement pin 13 in the weaving-width direction, and the engagement between the second selvage yarn 16c and the engagement pin 13 becomes unstable. Therefore, there is a possibility that the second selvage yarn 16c will be released from the engagement pin 13 when the rotary member 10 (engagement pin 13) is continuously rotated.

[0110] If the engagement pin 13 is configured so as to maintain the state in which the second selvage yarn 16c is engaged with the engagement pin 13, the second selvage yarn 16c can be prevented from being released from the engagement pin 13 as described above even when the regulating member 15 is not provided. Even in such a case, although the position of the cloth edge 19 at the cloth fell 24 is constant, the position of the engagement pin 13 moves forward and backward in the warp direction when the rotary member 10 (engagement pin 13) is continuously rotated. Therefore, the angle of the path of the second selvage yarn 16c between the engagement pin 13 and the cloth fell 24 with respect to the warp direction periodically changes, and the path of the second selvage yarn 16c between the engagement pin 13 and the cloth fell 24 vibrates (reciprocates) in the weaving-width direction. In this case, when, for example, the engagement pin 13 is moved from the second position P2 to the first position P1, the path of the second selvage yarn 16c varies while the engagement pin 13 is being moved, and there may be a case in which the second selvage yarn 16c cannot be properly guided into between the selvage-yarn guide rods 38a and 38b of the selvage-yarn-path switching device 2. Although this may be prevented by increasing the swing angle of the base member 37, there is a high possibility that the selvage forming apparatus cannot be used in a high-speed loom when the swing angle of the base member 37 is increased.

[0111] Accordingly, in the present embodiment, the regulating member 15 is provided between the selvage shedding device 3 and the selvage-yarn-path switching device 2 to reduce the variation in the positional relationship between the engagement pin 13 and the second selvage yarn 16c caused by the rotation of the rotary member 10 and the vibration of the path of the second selvage yarn 16c in the weaving-width direction in a region downstream of (on the cloth fell side of) the selvage shedding device 3.

[0112] As illustrated in Fig. 2, in the present embodiment, the regulating member 15 is a rod-shaped member. The regulating member 15 is arranged so as to extend in the top-bottom direction while the bottom end thereof is fitted to a hole formed in the top surface of the electromagnet housing 49 of the first drive device 8 and the top end thereof is supported by a guard stay 68 that supports the guard members 33. The dimension of the regulating member 15 in the top-bottom direction (longitudinal direction) is greater than the diameter of the revolution path of the engagement pin 13.

[0113] As illustrated in Fig. 5, the regulating member 15 guides the second selvage yarn 16c with the peripheral surface thereof at the side opposite the warp row side. The regulating member 15 is arranged such that the end thereof at the side opposite the warp row side is at the same position as the position of the guide groove

66c in the selvage yarn guide 27 in the weaving-width direction. Accordingly, the path of the second selvage yarn 16c is parallel to the warp yarns (cloth edge) in a region between the selvage yarn guide 27 and the regulating member 15, which are on both sides of the selvage shedding device 3.

In the selvage shedding device 3, the positional relationship between the engagement pin 13 and the path of the second selvage yarn 16c in the weaving-width direction is always constant while the rotary member 10 rotates, and the second selvage yarn 16c can be prevented from being released from the engagement pin 13 when the rotary member 10 continuously rotates.

[0114] As described above, the path of the second selvage yarn 16c is parallel to the rotating disc 61 of the rotary member 10. Therefore, when the engagement pin 13 is rotated by the rotation of the main body 12, the second selvage yarn 16c does not move in the weaving-width direction, and moves only in the top-bottom direction. As a result, the above-described vibration of the second selvage yarn 16c does not occur in the region downstream of the selvage shedding device 3.

[0115] Since the path of the second selvage yarn 16c between the selvage shedding device 3 and the selvage-yarn-path switching device 2 is regulated by the regulating member 15, the path of the second selvage yarn 16c between the regulating member 15 and the cloth fell 24 is at a constant position in the weaving-width direction. In the present embodiment, the path of the second selvage yarn 16c that is guided to the cloth fell 24 by the regulating member 15 is at the angle α (see Fig. 4) with respect to the warp yarns 18 in the weaving-width direction.

[0116] In the present embodiment, as illustrated in Fig. 5, a cover 69 for preventing the second selvage yarn 16c from interfering with the support stay 63 of the engagement pin 13 is attached to a side surface of the rotating disc 61 at the warp row side. The cover 69 is an annular disc-shaped member having an outer diameter that is substantially equal to that of the rotating disc 61, and is arranged such that the center thereof coincides with the center of the rotating disc 61.

[0117] The paths of the first selvage yarns 16a and 16b and the second selvage yarn 16c will now be described. In the weaving-width direction, the positional relationship between the paths of the selvage yarns 16 from the respective bobbins 22 to the selvage-yarn-path switching device 2 is constant, and the first selvage yarn 16b, the first selvage yarn 16a, and the second selvage yarn 16c are always arranged in that order from the side opposite the warp row side, as illustrated in Fig. 1. With regard to the positional relationship between the paths of the selvage yarns 16 from the selvage-yarn-path switching device 2 to the cloth fell 24, as illustrated in Figs. 8A and 8B, the path of the second selvage yarn 16c does not move. The path of the first selvage yarn 16a is on one of the left and right sides of the path of the second selvage yarn 16c, and the path of the first selvage yarn 16b is on the other of the left and right sides of the path of the second selvage yarn 16c. The paths of the first selvage yarns 16a and 16b are switched by the operation of the selvage-yarn-path switching device 2.

[0118] In the top-bottom direction, referring to Figs. 6 and 7, the positional relationship between the paths of the selvage yarns 16 from the selvage yarn guide 27 to the selvage-yarn-path switching device 2 is such that the second selvage yarn 16c, the first selvage yarn 16a, and the first selvage yarn 16b are arranged in that order from the top. With regard to the positional relationship between the paths of the selvage yarns 16 from the selvage-yarn-path switching device 2 to the cloth fell 24, the paths of the first selvage yarns 16a and 16b do not move. The path of the second selvage yarn 16c is above or below the paths of the first selvage yarns 16a and 16b, and is switched between the positions above and below the first selvage yarns 16a and 16b by the operation of the selvage shedding device 3.

[0119] Referring to Fig. 1, the second selvage yarn 16c is pulled from the bobbin 22c and is guided to the cloth fell 24 through the tenser device 25, the guide groove 66c of the selvage yarn guide 27, and the selvage shedding device 3 in that order from the upstream side. As illustrated in Fig. 2, the second selvage yarn 16c extends above the engagement pin 13 of the selvage shedding device 3 in the region between the selvage yarn guide 27 and the cloth fell 24. Therefore, when the rotary member 10 rotates, the second selvage yarn 16c is pushed upward in response to a movement of the engagement pin 13 from the first position P1 to the second position P2, and is moved downward while being placed on the engagement pin 13 in response to a movement of the engagement pin 13 from the second position P2 to the first position P1. Thus, the path of the second selvage yarn 16c is moved in the top-bottom direction by the operation of the selvage shedding device 3 in the region between the selvage yarn guide 27 and the cloth fell 24. As illustrated in Fig. 7, in the present embodiment, a shed is formed by the second selvage yarn 16c when the engagement pin 13 is at the first position P1.

[0120] As illustrated in Fig. 1, the first selvage yarn 16a is pulled from the bobbin 22a and is guided to the selvage-yarn-path switching device 2 through the tenser device 25 and the guide groove 66a of the selvage yarn guide 27 in that order from the upstream side.

[0121] As illustrated in Fig. 2, the first selvage yarn 16a that is guided from the selvage yarn guide 27 to the selvage forming apparatus 1 is guided through a first selvage yarn guide 67a that is fixed to the support frame 32, a first selvage yarn guide 44a that is attached to the base member 37 of the selvage-yarn-path switching device 2, and the eyelet 4 in the selvage-yarn guide rod 38a, and extends to the cloth fell 24.

[0122] Similarly, the first selvage yarn 16b is pulled from the bobbin 22b and is guided to the selvage-yarn-path switching device 2 through the tenser device 25 and the guide groove 66b of the selvage yarn guide 27 in that

order from the upstream side. The first selvage yarn 16b that is guided to the selvage-yarn-path switching device 2 is guided through a first selvage yarn guide 67b that is fixed to the support frame 32, a first selvage yarn guide 44b that is attached to the base member 37 of the selvage-yarn-path switching device 2, and the eyelet 4 in the selvage-yarn guide rod 38b, and extends to the cloth fell 24. In the illustrated example, the path of the first selvage yarn 16b is on the side opposite the warp row side of the path of the first selvage yarn 16a and is below the path of the first selvage yarn 16a.

[0123] The first selvage yarn guides 67a and 67b are provided so that the paths of the first selvage yarns 16a and 16b that are guided from the selvage yarn guide 27 to the eyelets 4 in the selvage-yarn guide rods 38a and 38b are regulated to positions below the rotary member 10. The first selvage yarn guides 67a and 67b are fixedly arranged in a region between the rotary member 10 and the selvage-yarn-path switching device 2 in the warp direction. The reason why the paths of the first selvage yarns 16a and 16b are positioned below the rotary member 10 is as follows.

[0124] That is, as illustrated in Figs. 2 and 5, in the present embodiment, the first selvage yarns 16a and 16b are guided by the selvage yarn guide 27, which is located below the selvage shedding device 3 in the top-bottom direction, in a region on the side opposite the warp row side of the engagement pin 13 in the weaving-width direction in a region upstream of the selvage shedding device 3. The eyelets 4 in the selvage-yarn guide rods 38a and 38b, which are located downstream of the selvage shedding device 3, are both located above the first position P1 (lowermost position) of the engagement pin 13.

[0125] In the structure of the present embodiment, when the first selvage yarns 16a and 16b are directly guided from the selvage yarn guide 27 to the eyelets 4 in the selvage-yarn guide rods 38a and 38b, respectively, the paths of the first selvage yarns 16a and 16b interfere with the selvage shedding device 3. To prevent this, in the present embodiment, the first selvage yarn guides 67a and 67b are provided to regulate the paths of the first selvage yarns 16a and 16b to positions below the rotary member 10.

[0126] In the present embodiment, the first selvage yarn guides 67a and 67b are disposed on the side opposite the warp row side of the engagement pin 13 of the selvage shedding device 3 in the weaving-width direction and at substantially the same vertical position as that of the first position P1 of the engagement pin 13 in the top-bottom direction. To prevent the path of the first selvage yarn 16b from crossing the path of the first selvage yarn 16a, the first selvage yarn guide 67b is disposed on the side opposite the warp row side of the first selvage yarn guide 67a in the weaving-width direction and on the downstream side of the first selvage yarn guide 67a in the warp direction. In addition, the first selvage yarn guide 67b is located below the first selvage yarn guide 67a in the top-bottom direction.

[0127] The first selvage yarn guides 44a and 44b are provided on the top surface of the base member 37 of the selvage-yarn-path switching device 2 to prevent the first selvage yarns 16a and 16b that are guided from the first selvage yarn guides 67a and 67b to the eyelets 4 in the selvage-yarn guide rods 38a and 38b, respectively, from interfering with the second selvage yarn 16c.

[0128] More specifically, the first selvage yarn guides 67a and 67b guide the first selvage yarns 16a and 16b, respectively, at fixed positions in a region upstream of the selvage-yarn-path switching device 2 (selvage-yarn guide rods 38a and 38b). The eyelets 4 in the selvage-yarn guide rods 38a and 38b are swung by the base member 37 in a region downstream of the first selvage yarn guides 67a and 67b. When the base member 37 is at an upstream or downstream swing limit, one or the other of the first selvage yarns 16a and 16b passes through a position where it crosses the path of the second selvage yarn 16c in the weaving-width direction in a region between the first selvage yarn guide 67a and the selvage-yarn guide rod 38a or between the first selvage yarn guide 67b and the selvage-yarn guide rod 38b.

[0129] Therefore, if the first selvage yarns 16a and 16b are directly guided from the first selvage yarn guides 67a and 67b to the eyelets 4 in the selvage-yarn guide rods 38a and 38b, respectively, the paths from the first selvage yarn guides 67a and 67b to the eyelets 4 in the selvage-yarn guide rods 38a and 38b, respectively, pass through positions where they cross the path of the second selvage yarn 16c at the lowermost position (path of the second selvage yarn 16c in the state in which the engagement pin 13 is at the first position P1) also in the top-bottom direction.

[0130] In such a case, when the second selvage yarn 16c is moved downward in response to the movement of the engagement pin 13, the second selvage yarn 16c interferes with one of the first selvage yarns 16a and 16b and cannot be moved to an intended position. As a result, a selvage shed having the desired size cannot be formed. To prevent this, the first selvage yarn guides 44a and 44b are arranged near the selvage-yarn guide rods 38a and 38b, respectively, on the base member 37 in the present embodiment. The first selvage yarn guides 44a and 44b regulate the paths of the first selvage yarns 16a and 16b from the first selvage yarn guides 67a and 67b to positions near the bottom ends of the selvage-yarn guide rods 38a and 38b, respectively, to positions below the path of the second selvage yarn 16c at the lowermost position.

[0131] As illustrated in Figs. 8A and 8B, the first selvage yarn guides 44a and 44b are fixed to the base member 37 and swing together with the base member 37 (the selvage-yarn guide rods 38a and 38b). Therefore, both when the base member 37 is at the upstream swing limit and the downstream swing limit, the paths of the first selvage yarns 16a and 16b are below the lowermost position of the second selvage yarn 16c in the regions from the first selvage yarn guides 67a and 67b to the first sel-

vage yarn guides 44a and 44b, respectively. One of the first selvage yarns 16a and 16b that travels along the path that crosses the path of the second selvage yarn 16c in the weaving-width direction is caused to extend under the second selvage yarn 16c and is bent upward by the first selvage yarn guide 44a or the first selvage yarn guide 44b. Thus, the first selvage yarns 16a and 16b are guided to the eyelets 4 in the selvage-yarn guide rods 38a and 38b without interfering with the path of the second selvage yarn 16c at the lowermost position.

[0132] As illustrated in Fig. 4, in the present embodiment, the base member 37 is assembled to the support shaft 36 in the following manner. That is, when the axis of symmetry 51 of the swing block 45 is parallel to the warp direction (when the base member 37 is at the neutral position in the swingable range thereof), the line segment L that connects the centers of the through holes 43a and 43b in the base member 37 is parallel to the path of the second selvage yarn 16c from the regulating member 15 to the cloth fell 24. In the present embodiment, when the base member 37 is at the neutral position, the line segment L is on the warp row side of the path of the second selvage yarn 16c in the weaving-width direction.

[0133] With the above-described structure, the amount by which the swing block 45 swings may be adjusted so that the middle position of the line segment L is located on the path of the second selvage yarn 16c in top view when the base member 37 is at the upstream or downstream swing limit. Accordingly, as illustrated in Figs. 8A and 8B, the selvage-yarn guide rods 38a and 38b may be equally separated from the second selvage yarn 16c in top view when the base member 37 is at the upstream and downstream swing limits. As a result, the second selvage yarn 16c can be prevented from interfering with the selvage-yarn guide rods 38a and 38b, and reliably moved in the top-bottom direction to form a selvage shed having the desired size.

[0134] The selvage yarn guide 27 according to the present embodiment illustrated in Fig. 5 has the guide grooves 66 that guide the respective selvage yarns 16. However, the selvage yarn guide is not limited to this. For example, selvage yarn guides having eyelets for receiving the selvage yarns 16 may be provided for the respective selvage yarns 16 in place of the selvage yarn guide 27 having the guide grooves 66, and the selvage yarns 16 may be guided by inserting the selvage yarns 16 through the eyelets in the respective selvage yarn guides.

[0135] The operation of the selvage forming apparatus 1 will now be described with reference to Figs. 6, 7, 8A, and 8B.

[0136] In the weaving operation of the loom, the DD motor 58 (not shown) included in the selvage shedding device 3 is driven so that the rotary member 10 (engagement pin 13) rotates through one revolution clockwise when viewed from the warp row side in the weaving-width direction each time the loom main shaft rotates through one revolution. In the present embodiment, the phase relationship between the rotation angle of the loom main shaft and that of the engagement pin 13 that moves along the revolution path is set so that the engagement pin 13 is at a middle position of a movement path from the second position P2 to the first position P1 when the main shaft angle is 0°, at which beating-up motion for the weft yarn is performed. The phase relationship between the rotation angle of the loom main shaft and that of the engagement pin 13 that moves along the revolution path is not limited to this, and the phase of the rotary member 10 with respect to the main shaft of the loom may be changed as necessary.

[0137] In the selvage-yarn-path switching device 2, the time at which the base member 37 is swung from one of the upstream and downstream swing limits to the other (time at which the polarity of the electromagnet is switched in the first drive device 8, that is, the time at which the paths of the first selvage yarns 16a and 16b are switched) is set to the time at which the engagement pin 13 reaches the second position in the selvage shedding device 3.

[0138] (1) Referring to Fig. 7, when the rotary member 10 included in the selvage shedding device 3 is rotated so that the engagement pin 13 is moved from the second position P2 to the first position P1 on the revolution path thereof in the weaving operation, the path of the second selvage yarn 16c from the engagement pin 13 to the cloth fell 24 (hereinafter referred to as a "partial path") moves downward from the uppermost position in the top-bottom direction. The positions of the paths of the first selvage yarns 16a and 16b are fixed in the top-bottom direction. Therefore, the above-described partial path of the second selvage yarn 16c moves to a position below the first selvage yarns 16a and 16b, and the selvage shed is formed between the second selvage yarn 16c and the first selvage yarns 16a and 16b. The size of the selvage shed is at a maximum at the time when the engagement pin 13 reaches the first position P1.

At this time, the second selvage yarn 16c extends through a space between the selvage-yarn guide rods 38a and 38b in the warp direction.

[0139] (2) While the partial path of the second selvage yarn 16c is being moved upward after the selvage shed is formed in step (1), the weft insertion operation is started when the rotation angle of the loom main shaft reaches the weft insertion start angle. Accordingly, the weft yarn is inserted into the selvage shed. The leading end of the inserted weft yarn passes through the selvage shed at the weft insertion side immediately after the start of the weft insertion operation, travels through the warp shed, and reaches the selvage shed at the weft arrival side (not shown) after passing the position of the cloth edge at the weft arrival side. Therefore, the driving operation of the DD motor 58 included in the selvage forming apparatus 1 at the weft insertion side is controlled so that the size of the selvage shed is greater than or equal to the size large enough for the weft insertion operation (required size) at least over the entire weft insertion period. The

driving operation of the DD motor 58 included in the selvage forming apparatus 1 at the weft arrival side (not shown) is controlled so that the size of the selvage shed is greater than or equal to the required size at least at the end of the weft insertion operation.

[0140] (3) As illustrated in Fig. 6, when the rotary member 10 is further rotated after the weft insertion operation, the engagement pin 13 moves to the second position along the revolution path, and the partial path of the second selvage yarn 16c moves upward toward the uppermost position. Accordingly, the partial path of the second selvage yarn 16c moves to a position above the first selvage yarns 16a and 16b, and the inserted weft yarn is held by the first selvage yarns 16a and 16b and the second selvage yarn 16c.

[0141] (4) Subsequently, when the engagement pin 13 reaches the second position P2, the partial path of the second selvage yarn 16c reaches the uppermost position at which the partial path is above the tip end of the selvage-yarn guide rod 38a. At this time, the first drive device 8 of the selvage-yarn-path switching device 2 swings the base member 37 around the axis of the support shaft 36 from one of the swing limits to the other. Accordingly, the paths of the first selvage yarns 16a and 16b at the side opposite the warp row side of and the warp row side of the path of the second selvage yarn 16c in the weaving-width direction when viewed from above are switched in the weaving-width direction (see Figs. 8A and 8B). As a result, the first selvage yarns 16a and 16b are caused to cross (be twisted with) the second selvage yarn 16c in the weaving-width direction.

[0142] (5) Next, when the rotary member 10 is further rotated and the engagement pin 13 is moved downward from the second position P2, the partial path of the second selvage yarn 16c is also moved downward from the uppermost position. When the main shaft angle of the loom reaches 0°, the partial path of the second selvage yarn 16c reaches the above-described middle position. At this time, the beating-up motion for the inserted weft yarn is performed. When the partial path of the second selvage yarn 16c is moved downward from the uppermost position, the partial path of the second selvage yarn 16c is moved in a direction for opening the selvage shed in which the weft yarn is held. However, as described above, the first selvage yarns 16a and 16b are caused to cross the second selvage yarn 16c in the weaving-width direction. Therefore, even when the partial path of the second selvage yarn 16c is moved downward to a position below the first selvage yarns 16a and 16b, the weft yarn is not released from the selvage shed and the state in which the weft yarn is held by the first selvage yarns 16a and 16b and the second selvage yarn 16c is maintained.

[0143] The above-described steps (1) to (5) are repeated each time the main shaft of the loom rotates through one revolution, so that a three-yarn leno selvage construction illustrated in Fig. 9B is formed at the edge of the woven cloth.

[0144] Although an embodiment of the present invention has been described, the present invention is not limited to the above-described embodiment, and various embodiments are possible within the technical scope of the present invention. Other embodiments will now be described.

[0145] Although the selvage forming apparatus according to the above-described embodiment forms a three-yarn leno selvage construction by using the two first selvage yarns 16a and 16b and one second selvage yarn 16c, the number of selvage yarns are not limited to three. For example, the number of first selvage yarns 16a and 16b may be reduced to one, and a two-yarn leno selvage construction illustrated in Fig. 9A may be formed by using a single first selvage yarn 16a and a single second selvage yarn 16c. In this case, the selvage-yarn-path switching device 2 may include a single selvage-yarn guide member 5.

[0146] In the above-described embodiment, the selvage-yarn-path switching device 2 forms the leno selvage construction illustrated in Fig. 9A or 9B by switching the positions of the eyelets 4 in the selvage-yarn guide members 5 each time the loom main shaft rotates through one revolution, that is, each time the weft insertion operation is performed once. However, the frequency at which the positions of the eyelets 4 are switched is not limited to once every time the weft insertion operation is performed once. For example, the selvage-yarn-path switching device 2 may form a leno selvage construction illustrated in Fig. 9C by switching the positions of the eyelets 4 in the selvage-yarn guide members 5 each time the loom main shaft rotates through two revolutions, that is, each time the weft insertion operation is performed twice. Alternatively, the selvage-yarn-path switching device 2 may switch the positions of the eyelets 4 in the selvage-yarn guide members 5 each time the loom main shaft rotates through three or more revolutions.

[0147] In the above-described embodiment, the selvage-yarn guide rods 38a and 38b are arranged so as to stand on the top surface of the base member 37 and extend upward in the vertical direction, and the first drive device 8 is disposed below the base member 37. However, for example, the selvage-yarn-path switching device 2 according to the above-described embodiment may be vertically inverted, as illustrated in Fig. 11. More specifically, the selvage-yarn guide rods 38a and 38b may be arranged so as to extend downward in the vertical direction from the bottom surface of the base member 37, and the first drive device 8 may be disposed above the base member 37. In Fig. 11, components corresponding to those in the above-described embodiment are denoted by the same reference numerals as those in the above-described embodiment.

[0148] In the structure illustrated in Fig. 11, opposite to the above-described embodiment, the size of the shed formed by the selvage yarns 16 is at a maximum when the engagement pin 13 included in the selvage shedding device 3 is at the uppermost position on the revolution

path. Therefore, in this example, the uppermost position and the lowermost position of the revolution path of the engagement pin 13 correspond to the first position P1 and the second position P2, respectively, in the above-described embodiment.

[0149] In the illustrated example, unlike the above-described embodiment, the selvage yarn guide 27 is disposed above the selvage shedding device 3, and the path of the second selvage yarn 16c in the state in which the engagement pin 13 is omitted is above or at substantially the same level as the engagement pin 13 at the uppermost position in the top-bottom direction. Therefore, opposite to the above-described embodiment, when the component of the revolution of the engagement pin 13 in the top-bottom direction is upward, the second selvage yarn 16c moves upward so as to follow the engagement pin 13 owing to the tension of the second selvage yarn 16c, and the path of the second selvage yarn 16c is moved upward to a position where the weft insertion operation can be performed (a shed is formed). When the component of the revolution of the engagement pin 13 in the top-bottom direction is downward, the second selvage yarn 16c is pushed downward from above by the engagement pin 13, and the path of the second selvage yarn 16c is moved downward to a position where the paths of the first selvage yarns 16a and 16b can be switched by the selvage-yarn-path switching device 2.

[0150] The direction in which the selvage-yarn guide members 5 extend is not limited to the vertical direction as described above, and may be at an angle relative to the vertical direction and inclined toward the warp direction and/or the weaving-width direction as long as the paths of the first selvage yarns 16a and 16b can be switched without a problem. In this case, the entire body of the selvage-yarn-path switching device 2 may be inclined (the support member 6 may be inclined with respect to the top-bottom direction (vertical direction) toward the warp direction and/or the weaving-width direction). Alternatively, the support member 6 may be oriented in the vertical direction and the selvage-yarn guide members 5 may be inclined with respect to the displacement member 7.

[0151] In the above-described embodiment, the positions of the selvage-yarn guide members 5 (eyelets 4) are switched in the weaving-width direction by swinging the base member 37, which functions as the displacement member 7 to which the selvage-yarn guide members 5 are fixed, around the rotation axis that extends in the vertical direction. However, the structures illustrated in Figs. 12A to 12C to 15A and 15B, for example, may instead be used. The structures will be described in more detail.

[0152] In the example illustrated in Figs. 12A to 12C, displacement members 7 are linearly reciprocated to switch the positions of selvage-yarn guide members 5 in the weaving-width direction. In Figs. 12A to 12C, components similar to those in the above-described embodiment, for example, components of the selvage shedding device 3, are denoted by the same reference numerals as those in the above-described embodiment.

[0153] A selvage-yarn-path switching device 2 of this example includes actuators 73 that function as first drive devices 8; a groove member 71 in which grooves 70 are formed so as to extend in the weaving-width direction and that functions as a support member 6; and slide bases 72 that support the respective selvage-yarn guide members 5, that are movable in the weaving-width direction along the grooves 70 in the groove member 71, and that function as the displacement members 7. First selvage yarn guides 74 are fixed to the groove member 71. The actuators 73 linearly move the slide bases 72 in the weaving-width direction along the grooves 70 in the groove member 71 so that the positions of eyelets 4 in the selvage-yarn guide members 5 are switched in the weaving-width direction.

[0154] In the example illustrated in Figs. 12A to 12C, two first selvage yarns (first selvage yarns 16a and 16b) are provided, that is, two selvage-yarn guide members 5 are provided (a three-yarn leno selvage construction is formed). The number of grooves 70 in the groove member 71, slide bases 72, and actuators 73 is two so as to correspond to the number of selvage-yarn guide members 5. In the case where the number of first selvage yarns is one (when a two-yarn leno selvage construction is formed), the number of grooves 70, slide bases 72, and actuators 73 may be one. In the illustrated example, to regulate the paths of the first selvage yarns 16a and 16b to positions below a rotary member 10, first selvage yarn guides 75 are provided in addition to first selvage yarn guides 74 and 67. The first selvage yarn guides 75 are arranged below the rotary member 10.

[0155] Figs. 13A to 13C illustrate an example in which a single first selvage yarn is used (a two-yarn leno selvage construction is formed). A displacement member 7 is rotationally driven around a rotation axis in one direction to switch the position of a selvage-yarn guide member 5 (eyelet 4) in the weaving-width direction. In Figs. 13A to 13C, components similar to those in the embodiment illustrated in Figs. 12A to 12C are denoted by the same reference numerals as those in the embodiment illustrated in Figs. 12A to 12C.

[0156] A selvage-yarn-path switching device 2 of this example illustrated in Figs. 13A to 13C includes a servo motor 76 that serves as a first drive device 8; a support shaft 77 that extends in the vertical direction, that is directly connected to an output shaft of the servo motor 76, and that serves as a support member 6; and a disc-shaped base member 78 that is fixed to the support shaft 77, that supports the selvage-yarn guide member 5 with a bearing 80 provided therebetween at a position shifted from the rotation center of the support shaft 77, and that serves as the displacement member 7. The servo motor 76 is contained in a main block 81. A first selvage yarn guide 79 is fixed to the main block 81.

[0157] The servo motor 76 rotationally drives the disc-shaped base member 78 in one direction so that the sel-

vage-yarn guide member 5 revolves around the rotation axis of the support shaft 77 and the position of the eyelet 4 in the selvage-yarn guide member 5 is switched in the weaving-width direction. In this case, the servo motor 76 is preferably controlled so as to rotate intermittently. However, the servo motor 76 may instead be controlled so as to rotate continuously.

[0158] In the case where the servo motor 76 is intermittently rotated, two specific positions may be set on both sides (the warp row side and the side opposite the warp row side) of a path of a second selvage yarn 16c in the weaving-width direction. The servo motor 76 may be controlled so that the output shaft of the servo motor 76 (the support shaft 77) is rotated through half a revolution to move the selvage-yarn guide member 5 between the two positions each time the main shaft is rotated through one revolution and so that the selvage-yarn guide member 5 is at one of the two positions in a predetermined period during each revolution of the loom main shaft. The selvage-yarn guide member 5 may be moved between the two positions while the second selvage yarn 16c is positioned above the top end of the selvage-yarn guide member 5 in the top-bottom direction.

[0159] In the case where the servo motor 76 is continuously rotated, the output shaft of the servo motor 76 (support shaft 77) is rotated through a single revolution so that the selvage-yarn guide member 5 is rotated through a single revolution around the axis of the support shaft 77 each time the main shaft of the loom rotates through two revolutions. The servo motor 76 is controlled so that the time at which the selvage-yarn guide member 5 crosses the path of the second selvage yarn 16c in the weaving-width direction is within the period in which the second selvage yarn 16c is above the top end of the selvage-yarn guide member 5 in the top-bottom direction.

[0160] In this example, the selvage-yarn guide member 5 is supported by the disc-shaped base member 78 with the bearing 80 interposed therebetween. Therefore, the selvage-yarn guide member 5 revolves around the axis of the support shaft 77 while rotating so that the eyelet 4 is always oriented in the warp direction owing to the tension of a first selvage yarn 16a. Thus, the first selvage yarn 16a is prevented from being coiled (wound) around the selvage-yarn guide member 5 as a result of the revolution of the selvage-yarn guide member 5.

[0161] Figs. 14A and 14B illustrate an example in which the positions of selvage-yarn guide members 5 (eyelets 4) are switched in the weaving-width direction by swinging the selvage-yarn guide members 5 around a rotation axis that extends in the warp direction. In Figs. 14A and 14B, components similar to those in the embodiment illustrated in Figs. 12A to 12C are denoted by the same reference numerals as those in the embodiment illustrated in Figs. 12A to 12C.

[0162] A selvage-yarn-path switching device 2 of the present embodiment includes a support shaft 82 that is fixedly arranged on a main-body bracket 83 so as to extend in the warp direction and that functions as a support member 6. Swing rods 85, which function as the selvage-yarn guide members 5, are supported by respective end portions of the support shaft 82 in a swingable manner. The swing rods 85 have through holes 84 at intermediate positions in the direction in which the swing rods 85 extend, and the support shaft 82 are fitted to the through holes 84 so that the swing rods 85 are supported in a swingable manner. The swing rods 85 have elongate holes 86 at the bottom ends (ends opposite to the ends at which the eyelets 4 are formed) thereof. The elongate holes 86 are long in the direction in which the swing rods 85 extend and extend through the swing rods 85 in the thickness direction. First selvage yarn guides 92 are fixed to the main-body bracket 83.

[0163] In the illustrated example, a first drive device 8 includes a rotating shaft 87 that is fixedly arranged so as to extend in the warp direction; two crank discs 88 that are integrated with respective end portions of the rotating shaft 87 such that rotation centers thereof are on the axis of the rotating shaft 87 and such that the crank discs 88 are not rotatable relative to each other; swing pins 89 attached to the respective crank discs 88 at positions shifted from the rotation centers of the crank discs 88; a pinion gear 91 that meshes with gear teeth formed on the outer periphery of one of the two crank discs 88 (the upstream crank disc 88 in the illustrated example); and a servo motor 90 that is attached to an output shaft of the pinion gear 91. The swing pins 89 are inserted through the elongate holes 86 in the respective swing rods 85, so that the first drive device 8 is connected to the swing rods 85. Thus, the swing rods 85 (in particular, portions of the swing rods 85 below the through holes 84), the crank discs 88, and the swing pins 89 form a crank mechanism.

[0164] When the servo motor 90 rotationally drives the crank discs 88, the swing pins 89 move in the weaving-width direction so that the swing rods 85 swing in a reciprocating manner around the support shaft 82. As a result, portions of the swing rods 85 above the support shaft 82 move symmetrically to the respective swing pins 89 about the support shaft 82, and the positions of the eyelets 4 are moved in the weaving-width direction. Since the swing pins 89 are inserted through the elongate holes 86 formed in the swing rods 85, the swing rods 85 are not influenced by the movement of the swing pins 89 in the top-bottom direction due to the rotation of the crank discs 88.

[0165] In the example illustrated in Figs. 14A and 14B, the support shaft 82 that supports the swing rods 85 in a swingable manner corresponds to the support member 6, the portions of the swing rods 85 above the support shaft 82 correspond to the selvage-yarn guide members 5, and the lower portions of the swing rods 85 including the portions supported by the support shaft 82 correspond to displacement members 7. In the illustrated example, the selvage-yarn guide members 5 and the displacement members 7 are integrated together as the swing rods 85. However, the portions of the swing rods

85 corresponding to the displacement members 7 may instead be formed separately from the portions corresponding to the selvage-yarn guide members 5, and the swing rods 85 may be fixed to the displacement members 7 that are formed separately therefrom.

[0166] Figs. 15A and 15B illustrate an example in which selvage-yarn guide members 5 are swung around a support shaft that extends in the warp direction, similar to the example illustrated in Figs. 14A and 14B. In this example, the support shaft is directly rotated. In Figs. 15A and 15B, components similar to those in the structure illustrated in Figs. 14A and 14B are denoted by the same reference numerals as those in the structure illustrated in Figs. 14A and 14B.

[0167] In a selvage-yarn-path switching device 2 of this example, a first drive device 8 includes two servo motors 94 for respective swing rods 93 that serve as the selvage-yarn guide members 5. The servo motors 94 are fixedly arranged on a main block 95 such that rotation axes of output shafts 94a thereof extend in the warp direction. Drive discs 96 are attached to the output shafts 94a of the respective servo motors 94, and the swing rods 93 are arranged so as to stand on the respective drive discs 96. First selvage yarn guides 97 are fixed to the main block 95.

[0168] When the servo motors 94 periodically (intermittently) rotate the respective drive discs 96 in a reciprocating manner, the swing rods 93 are driven so as to swing in a reciprocating manner, so that the positions of eyelets 4 formed in the swing rods 93 are switched between two positions that are on the warp row side of and the side opposite the warp row side of a second selvage yarn 16c in the weaving-width direction. In this case, the output shafts 94a of the servo motors 94 correspond to support members 6, and the drive discs 96 correspond to displacement members 7.

[0169] In the above-described embodiment, the selvage shedding device 3 is configured such that the main body 12 of the rotary member 10 included in the selvage shedding device 3 includes the rotating disc 61, which is a disc-shaped thin plate member, and the support stay 63 attached to the rotating disc 61. However, the structure of the rotary member 10 is not limited to this, and the structures illustrated in Figs. 16 and 17 may instead be used.

[0170] Fig. 16 illustrates an example in which a main body 12 does not include the disc-shaped member according to the above-described embodiment, and includes only a stay 99 that is attached to an output shaft of a servo motor 98, which is provided as a second drive device 11, such that the stay 99 is not rotatable relative to the output shaft. In Fig. 16, components similar to those in the embodiment illustrated in Figs. 12A to 12C are denoted by the same reference numerals as those in the embodiment illustrated in Figs. 12A to 12C.

[0171] Fig. 17 illustrates an example in which a main body 12 is a belt member 103 that is wound around a drive pulley 101 attached to a drive shaft 100 of a second drive device 11 (not shown) and a driven pulley 102 having a rotation axis that is parallel to the drive shaft 100. In Fig. 17, components similar to those in the example illustrated in Fig. 16 are denoted by the same reference numerals as those in the example illustrated in Fig. 16.

[0172] In this example, the drive pulley 101 and the driven pulley 102 are attached to a support frame 32 such that a part of the path of the belt member 103 wound around the drive pulley 101 and the driven pulley 102 is perpendicular to the top-bottom direction and parallel to the warp direction. In this example, similar to the above-described embodiment, an engagement portion 9 is formed of an engagement pin 13. The engagement pin 13 is fixed to the outer peripheral surface of the belt member 103 such that an axis thereof is parallel to an axis of the drive shaft 100, and is arranged so as to partially project from the belt member 103 in the weaving-width direction. The drive pulley 101 is rotationally driven so that the belt member 103 is continuously rotated in one direction. Accordingly, the engagement pin 13 is moved along a revolution path that extends along the outer peripheral surface of the belt member 103.

[0173] In the above-described embodiment, the selvage shedding device is configured such that the engagement portion 9, which engages with the second selvage yarn 16c,
is formed of the engagement pin 13 that engages with the second selvage yarn 16c at the outer peripheral surface thereof. However, the structure of the engagement portion 9 is not limited to this. For example, as illustrated in Figs. 18 and 19, a member having an eyelet 105, which serves as an engagement portion 9, may be attached to a main body 12 of a rotary member 10 instead of the engagement pin 13, and a second selvage yarn 16c may be inserted through the eyelet 105 so that the second selvage yarn 16c is moved in the top-bottom direction. According to this example, unlike the above-described embodiment, the second selvage yarn 16c is positively (forcedly) moved by the engagement portion 9 in both the upward and downward directions. Fig. 18 is a side view of a selvage shedding device 3 viewed from the warp row side, and Fig. 19 is a side view of the selvage shedding device 3 viewed from the side opposite the warp row side. Although the shape of a selvage-yarn-path switching device 2 illustrated in Figs. 18 and 19 somewhat differs from that of the selvage-yarn-path switching device 2 of the above-described embodiment, the same reference numeral is used since the function and operation of the selvage-yarn-path switching device 2 are similar to those of the selvage-yarn-passage switching device 2 of the above-described embodiment.

[0174] In the illustrated example, the selvage shedding device 3 includes a second drive device 11 that is composed of an inner-rotor DD motor (not shown), as in the above-described embodiment. The DD motor is attached to a support frame 108 in such a manner that the rotation axis of the DD motor extends in the weaving-width direction. A rotating disc 106, which serves as the main body

12 of the rotary member 10, is attached to a warp-row-side surface of a rotor of the DD motor such that the rotating disc 106 is not rotatable relative to the rotor. A first stay 107 is fixed to a warp-row-side surface of the rotating disc 106.

[0175] The first stay 107 includes an end portion having a side surface that is parallel to the warp direction. A through hole is formed in the end portion of the first stay 107 so as to extend through the end portion in the weaving-width direction, and a first eyelet member 110 in which the eyelet 105 is formed is attached to the through hole. The first eyelet member 110 is a cylindrical member through which the eyelet 105 extends in the axial direction, and has a flange portion for guiding the second selvage yarn 16c at an end thereof in the axial direction. The first eyelet member 110 is fitted to the through hole in the first stay 107 such that the flange portion thereof projects from a warp-row-side surface of the first stay 107.

[0176] The second selvage yarn 16c is inserted through the eyelet 105 from the rotating-disc-106 side, is engaged with and bent at the inner peripheral edge of the flange portion of the first eyelet member 110, and is guided toward the cloth fell 24. Therefore, in this example, the eyelet 105 in the first eyelet member 110 corresponds to the engagement portion 9 of the rotary member 10. The dimension of the first stay 107, that is, the dimension from an attachment portion of the first stay 107 that is attached to the rotating disc 106 to the tip end, is set so that the revolution path of the eyelet 105 around the rotation axis satisfies conditions 1 and 2 as in the above-described embodiment.

[0177] In the case where the second selvage yarn 16c is inserted through the eyelet 105 as in the illustrated example, it is necessary that the path of the second selvage yarn 16c do not interfere with the rotary member 10 in a region upstream of (on the bobbin side of) the eyelet 105. More specifically, it is necessary that there is no component that crosses the path of the second selvage yarn 16c in the weaving-width direction (the first stay 107 in this example) in a region upstream of the eyelet 105. Accordingly, in the present embodiment, a tubular path 111 is provided so as to extend through the selvage shedding device 3 in the weaving-width direction, and the second selvage yarn 16c is inserted through the tubular path 111 from the side opposite the warp row side. The second selvage yarn 16c is constantly guided from a position of the rotation axis at the warp row side of the tubular path 111 to the eyelet 105. Accordingly, irrespective of the position of the eyelet 105 on the revolution path, no component crosses the path of the second selvage yarn 16c in the region upstream of the eyelet 105 in the selvage shedding device 3.

[0178] More specifically, the tubular path 111 includes a cylindrical member (not shown) through which a through hole extends in the axial direction and two second eyelet members 112 that are fitted to the through hole in the cylindrical member at both ends of the through hole. The cylindrical member (not shown) is long enough to extend through the rotating disc 106, the DD motor (not shown), and the support frame 108 in the weaving-width direction, and is fixed to the rotating disc 106 so as to extend through the rotating disc 106, the DD motor (not shown), and the support frame 108 such that the axis thereof coincides with the rotation axis of the rotary member 10.

[0179] With this structure, the second selvage yarn 16c is inserted into the eyelet member 112 at the end of the tubular path 111 on the side opposite the warp row side (back side of the support frame 108), as illustrated in Fig. 19, and is pulled out from the eyelet member 112 at the end of the tubular path 111 on the warp row side (front side of the support frame 108), as illustrated in Fig. 18. Accordingly, the second selvage yarn 16c is constantly guided from a position of the rotation axis of the DD motor to the eyelet 105, and no component crosses the path of the second selvage yarn 16c in the region upstream of the eyelet 105. In other words, irrespective of the position of the eyelet 105 on the revolution path, the second selvage yarn 16c does not contact the first stay 107 in regions other than the eyelet 105.

[0180] In this example, as illustrated in Fig. 19, the selvage shedding device 3 includes a second stay 113 arranged on the side opposite the warp row side of the rotating disc 106. The second stay 113 is provided to absorb the variation in the length of the partial path of the second selvage yarn 16c from the cloth fell 24 to the first eyelet member 110 due to the rotation of the rotary member 10 (first stay 107).

[0181] The second stay 113 is attached to a side surface of the rotating disc 106 on the side opposite the warp row side, and a through hole is formed in an end portion of the second stay 113 so as to extend though the end portion in the weaving-width direction. A third eyelet member 114 having an eyelet is fitted to the through hole. The second stay 113 is attached to the rotating disc 106 so that the eyelet in the eyelet member 114 is at the same position as the eyelet in the first eyelet member 110 in the weaving-width direction.

[0182] In the illustrated example, the path of the second selvage yarn 16c extends through the eyelet in the third eyelet member 114 in a region upstream of the second eyelet members 112 (tubular path 111). With this structure, the variation in the length of the partial path of the second selvage yarn 16c from the cloth fell 24 to the first eyelet member 110 due to the rotation of the rotary member 10 (first stay 107) is absorbed and reduced by the variation in the length of the path of the second selvage yarn 16c in the region upstream of the second eyelet members 112.

[0183] As in the illustrated example, in the case where the second selvage yarn 16c is positively moved in the top-bottom direction by the eyelet 105, which serves as the engagement portion 9, the selvage yarn guide 27 according to the above-described embodiment that determines the path of the second selvage yarn 16c in the

state in which the shed is opened is not necessary. More specifically, in the above-described embodiment, the second selvage yarn 16c is passively moved downward by using the tension of the second selvage yarn 16c itself. Therefore, the selvage yarn guide 27 is required to regulate the position of the path of the second selvage yarn 16c in the top-bottom direction in the state in which the shed is opened to a position where the size of the selvage shed is at a maximum. In contrast, in the illustrated example, the second selvage yarn 16c is inserted through the eyelet 105 and is positively moved in the top-bottom direction. Therefore, the selvage yarn guide 27 according to the above-described embodiment is not necessary. Only a selvage yarn guide having a function of simply guiding the second selvage yarn 16c from the corresponding bobbin to the eyelet 105 is required, and the freedom of arrangement of the selvage yarn guide is increased compared to that in the above-described embodiment.

[0184] Instead of the engagement pin 13 that serves as the engagement portion 9 of the selvage shedding device 3 in the above-described embodiment, an eyelet pin 123 having an eyelet 122 may be provided as the engagement portion 9. The structure illustrated in Fig. 21 is similar to that of the above-described embodiment except for the engagement portion 9, and components similar to those of the above-described embodiment are denoted by the same reference numerals.

[0185] In this example, the eyelet pin 123 is supported by a support stay 124 of a rotary member 10 such that the axis thereof extends in the weaving-width direction. The eyelet pin 123 has an eyelet 122 that extends through the eyelet pin 123 in a direction orthogonal to the axis of the eyelet pin 123 (weaving-width direction) at a position on the warp row side of the position at which the eyelet pin 123 is supported by the support stay 124. The eyelet pin 123 is supported by the support stay 124 with a bearing 125 interposed therebetween, and is rotatable around the axis thereof.

[0186] The reason why the eyelet pin 123 is attached to the support stay 124 with the bearing 125 interposed therebetween will now be described. If the bearing 125 is omitted, the eyelet pin 123 itself serves as a component that crosses the path of the second selvage yarn 16c in the region upstream of the eyelet 122 depending on the orientation of the eyelet 122. Therefore, the second selvage yarn 16c becomes wound around the eyelet pin 123 when the rotary member 10 is rotated. In contrast, in the case where the eyelet pin 123 is supported by the support stay 124 with the bearing 125 interposed therebetween, when the rotary member 10 is rotated, the eyelet pin 123 moves along the revolution path while rotating so that the eyelet 122 is always oriented toward the cloth fell owing to the tension of the second selvage yarn 16c. Owing to the rotation of the eyelet pin 123, there is no component that crosses the path of the second selvage yarn 16c in the region upstream of the eyelet 122. In other words, irrespective of the position of the eyelet pin 123 on the revolution path, the eyelet pin 123 does not contact the second selvage yarn 16c in regions other than the eyelet 122. As a result, the second selvage yarn 16c is prevented from being wound around the eyelet pin 123.

[0187] In the above-described embodiment, the engagement pin 13 having a circular cross section is used as the engagement portion 9. However, in the case where the engagement portion 9 is formed of an engagement pin, the cross-sectional shape of the engagement pin is not limited to a circular shape, and may instead be flat as illustrated in Figs. 22A and 22B. Figs. 22A and 22B illustrate a selvage forming apparatus 1 having a structure similar to that of the above-described embodiment except for the engagement portion 9, and components similar to those of the above-described embodiment are denoted by the same reference numerals.

[0188] In the case where an engagement pin 126 having a flat cross section illustrated in Figs. 22A and 22B is used as the engagement portion 9, unlike the above-described embodiment, a dwell period in which the position of the second selvage yarn 16c does not move in the top-bottom direction can be provided when the engagement portion 9 is at the first position (lowermost position) and the second position (uppermost position) on the revolution path of the engagement portion 9. As a result, the weft insertion operation and the process of switching the paths of first selvage yarns 16a and 16b are facilitated.

[0189] In the above-described embodiment, the engagement portion 9 is provided on the support stay 63 that is fixed to the main body 12. However, the support stay 63 may be omitted in the above-described embodiment, and the engagement pin 13 may be attached to the rotating disc 61 that serves as the main body 12. Alternatively, as illustrated in Fig. 20, the engagement portion 9 may be provided directly on the main body 12. In Fig. 20, an eyelet member 116, which serves as the engagement portion 9, is provided directly on a rotary ring 115 that serves as the main body 12. In Fig. 20, components similar to those in Figs. 18 and 19 are denoted by the same reference numerals as those in Figs. 18 and 19.

[0190] In the example illustrated in Fig. 20, the main body 12 of the rotary member 10 is formed of an annular rotary ring 115. The rotary ring 115 is supported by an inner peripheral surface of an annular bracket (not shown) that is fixed to a support frame 121, and is rotatable relative to the support frame 121. The rotary ring 115, which serves as the main body 12, has a through hole that extends through the rotary ring 115 in the weaving-width direction. Eyelet members 116 for guiding the path of the second selvage yarn 16c that is inserted through the through hole are provided at both ends of the through hole.

[0191] The eyelet members 116 are similar to the eyelet member 110 in the example illustrated in Figs. 18 and 19, and are fitted to both ends of the through hole in the rotary ring 115 such that flange portions thereof project

from the side surfaces of the rotary ring 115 in the weaving-width direction. Therefore, similar to the example illustrated in Figs. 18 and 19, the eyelets in the eyelet members 116 correspond to the engagement portion 9 of the rotary member 10. The inner and outer diameters of the rotary ring 115 are set so that the revolution path of the eyelets in the eyelet members 116, which are fitted to the through hole in the rotary ring 115, around the rotation axis satisfies conditions 1 and 2 as in the above-described embodiment.

[0192] The second selvage yarn 16c is inserted into the eyelet member 116 at the side opposite the warp row side (back side of the support frame 121) (not shown) and is pulled out from the eyelet member 116 at the warp row side (front side of the support frame 121), so that the second selvage yarn 16c extends through the rotary ring 115 and is guided toward the cloth fell 24. No component that extends in the weaving-width direction is attached to the side surface of the rotary ring 115 on the warp row side or the side surface of the rotary ring 115 on the side opposite the warp row side. Therefore, there is no component that crosses the path of the second selvage yarn 16c in the weaving-width direction in the region upstream of the eyelet members 116, and the rotary member 10 does not interfere with the second selvage yarn 16c when the rotary member 10 is rotated.

[0193] In the example illustrated in Fig. 20, the rotary member 10 is connected to a second drive device 11 (drive shaft 117) through drive pulleys 118 and 119 and a belt 120. Although the rotary member 10 of the selvage shedding device 3 is directly connected to the DD motor 58 that serves as the second drive device 11 in the above-described embodiment, the rotary member 10 may instead be driven by the second drive device 11 through a transmitting member.

[0194] More specifically, in the example illustrated in Fig. 20, the rotary ring 115 has a width (dimension in the weaving-width direction) that is larger than that of the above-described bracket. The drive pulley 118 is fixed to the outer periphery of a portion of the rotary ring 115 that is on the warp row side of the bracket in the weaving-width direction. The drive pulley 118 is connected to the drive pulley 119, which is fixed to the drive shaft 117 of a servo motor (not shown), with the belt 120. The driving force of the drive shaft 117 is transmitted to the rotary ring 115 through the drive pulley 119, the belt 120, and the drive pulley 118. In this example, the servo motor (not shown), the drive shaft 117, the drive pulleys 118 and 119, and the belt 120 correspond to the second drive device 11.

[0195] In the examples illustrated in Figs. 18, 19, 20, and 21, the eyelets that serve as the engagement portion 9 are not limited to circular holes, and may instead be elongate holes.

[0196] In the above-described embodiment, the engagement portion 9 is moved along the revolution path by rotating the rotary member 10 around the rotation axis that extends parallel to the weaving-width direction. However, the rotary member 10 may instead be rotated around a rotation axis that is inclined from the weaving-width direction toward the top-bottom direction and the warp direction within a range in which the movement of the path of the second selvage yarn 16c in the top-bottom direction is not adversely affected.

[0197] In the above-described embodiment, the second drive device 11 used to rotate the rotary member 10 is the DD motor 58 of an inner rotor type. However, the second drive device 11 is not limited to this, and may instead be a DD motor of an outer rotor type. Alternatively, a servo motor may be used in place of the DD motor, and the rotary member 10 may be directly attached to a rotating shaft of the servo motor. Alternatively, as illustrated in Fig. 20, the second drive device may be formed of a servo motor and a belt transmission mechanism, and the servo motor may rotate the rotary member 10 through the belt transmission mechanism.

[0198] In the selvage forming apparatus 1 at the weft insertion side according to the above-described embodiment, the rotary member 10 is rotated clockwise when the selvage forming apparatus 1 is viewed from the warp row side in the weaving-width direction. However, the rotary member 10 may instead be rotated counterclockwise.

[0199] When the rotary member 10 is rotated counterclockwise in the structure including the regulating member 15 according to the above-described embodiment, there is an advantage that the period in which the shed that allows the weft insertion operation is formed is longer than that in the case where the rotary member 10 is rotated clockwise. This will be described in more detail. In the following description, it is assumed that the revolution path along which the engagement pin is moved is divided into an upstream section and a downstream section by a vertical line that passes through the rotation center of the rotary member 10. The upstream section of the revolution path is referred so as an upstream revolution path section, and the downstream section of the revolution path is referred to as a downstream revolution path section.

[0200] In the case where the regulating member 15 is disposed downstream of the selvage shedding device 3 as in the above-described embodiment, the second selvage yarn 16c is bent toward the warp row side in the weaving-width direction at the position of the regulating member 15, and is then guided to the cloth fell 24. In this case, when the second selvage yarn 16c is moved in the top-bottom direction, the second selvage yarn 16c slides along the regulating member 15 and receives a frictional resistance.

[0201] When the rotary member 10 is rotated counterclockwise to rotate the engagement portion 9 from the second position P2 to the first position P1, the engagement portion 9 is moved along the downstream revolution path section. When the rotary member 10 is rotated clockwise, the engagement portion 9 is moved along the upstream revolution path section. Thus, the distance be-

tween the engagement portion 9 and the regulating member 15, that is, the length of the path of the second selvage yarn 16c between the engagement portion 9 and the regulating member 15, differs between the case in which the rotary member 10 is rotated counterclockwise and the case in which the rotary member 10 is rotated clockwise. In the former case, the second selvage yarn 16c is moved downward while the length of the above-described path is smaller than that in the state in which the engagement portion 9 is at the second position P2. In the latter case, the second selvage yarn 16c is moved downward while the length of the above-described path is larger than that in the state in which the engagement portion 9 is at the second position P2.

[0202] When the rotary member 10 is rotated counterclockwise, the length of the above-described path is smaller than that in the case where the rotary member 10 is rotated clockwise, and therefore the partial path of the second selvage yarn 16c is not easily bent. Even though the second selvage yarn 16c slides along the regulating member 15 and receives a frictional resistance, the second selvage yarn 16c reliably follows the movement of the engagement portion 9 and moves downward. As a result, the selvage shed is quickly formed in response to the movement of the engagement portion 9 when the rotary member 10 is rotated counterclockwise.

[0203] When the rotary member 10 is rotated counterclockwise to rotate the engagement portion 9 from the first position P1 to the second position P2, the engagement portion 9 is moved along the upstream revolution path section. When the rotary member 10 is rotated clockwise, the engagement portion 9 is moved along the downstream revolution path section. Thus, the length of the path of the second selvage yarn 16c between the engagement portion 9 and the regulating member 15 differs between the case in which the rotary member 10 is rotated counterclockwise and the case in which the rotary member 10 is rotated clockwise. In the former case, the second selvage yarn 16c is moved upward while the length of the above-described path is larger than that in the state in which the engagement portion 9 is at the first position P1. In the latter case, the second selvage yarn 16c is moved upward while the length of the above-described path is smaller than that in the state in which the engagement portion 9 is at the first position P1.

[0204] When the rotary member 10 is rotated counterclockwise, the length of the above-described path is larger than that in the case where the rotary member 10 is rotated clockwise, and therefore the partial path of the second selvage yarn 16c is easily bent. When the second selvage yarn 16c slides along the regulating member 15 and receives a frictional resistance, followability of the second selvage yarn 16c to the movement of the engagement portion 9 is reduced. Accordingly, the upward movement of the second selvage yarn 16c is slower than the movement of the engagement portion 9. As a result, the selvage shed is slowly closed in response to the movement of the engagement portion 9 when the rotary member 10 is rotated counterclockwise.

[0205] As described above, in the case where the selvage forming apparatus 1 includes the regulating member 15 and the rotary member 10 is rotated counterclockwise, the selvage shed is quickly formed and slowly closed in response to the movement of the engagement portion 9. Therefore, there is an advantage that the selvage-shed opening period in which the weft insertion operation can be performed can be made longer than that in the case where the rotary member 10 is rotated clockwise.

[0206] However, in the case where the rotary member 10 is rotated clockwise as in the above-described embodiment, there is an advantage that the time at which the paths of the first selvage yarns 16a and 16b are switched can be made earlier than that in the case where the rotary member 10 is rotated counterclockwise. This will be described in more detail.

[0207] When the rotary member 10 is rotated clockwise, the engagement pin 13 that is rotated from the first position P1 to the second position P2 is moved upward along the downstream revolution path section that is on the downstream side from the rotation axis of the rotary member 10. The length of the path of the second selvage yarn 16c between the engagement portion 9 and the regulating member 15 is small, and the partial path of the second selvage yarn 16c is not easily bent. Accordingly, the second selvage yarn 16c reliably follows the movement of the engagement pin 13.

[0208] If the selvage-yarn-path switching device 2 starts switching the paths of the first selvage yarns 16a and 16b while the vertical position of the partial path of the second selvage yarn 16c at the positions of the selvage-yarn guide members 5 in the warp direction is below the top ends of the selvage-yarn guide members 5, the selvage-yarn guide members 5 may interfere with the second selvage yarn 16c. Even in such a case, since the partial path of the second selvage yarn 16c is not easily bent, the second selvage yarn 16c is not easily caught as a result of receiving a frictional resistance or being bent when the selvage-yarn guide members 5 interfere with the second selvage yarn 16c, and can be forcedly moved upward and released from between the selvage-yarn guide members 5. Therefore, the time at which the paths of the first selvage yarns 16a and 16b are switched can be made earlier, and the selvage forming apparatus can be used in a loom operated at a higher speed.

[0209] Similar to the selvage forming apparatus at the weft insertion side, also in the selvage forming apparatus at the weft arrival side (not shown), the rotary member may be rotated either clockwise or counterclockwise. In the selvage forming apparatus at the weft arrival side, the relationship between the rotation direction of the rotary member 10 and the shed forming and closing operations is similar to that in the selvage forming apparatus 1 at the weft insertion side described above, except "counterclockwise" is to be read as "clockwise" and "clockwise" is to be read as "counterclockwise" in the

above description.

[0210] In the above-described embodiment, a part of the selvage shedding device 3 (rotary member 10) is disposed in a region in which the heald frames 28a are present. However, it is not necessary to dispose the selvage shedding device 3 (rotary member 10) in the region in which the heald frames 28a are present. For example, if the size of the selvage shed is larger than that required for the weft insertion operation, the rotary member 10 may be disposed upstream of the heald frames 28a in the warp direction within a range in which the weft insertion operation can be performed without a problem. In the case where the rotation speed of the main shaft of the loom in the weaving operation is relatively low, the rotation speed of the DD motor 58 and the rotary member 10 of the selvage shedding device 3 may also be relatively low. Therefore, the load applied to the second drive device 11 owing to the inertia of the DD motor 58 and the rotary member 10 is also small. In such a case, the diameter of the revolution path of the engagement portion 9 may be increased by increasing the diameter of the rotary member 10 within a range in which the load applied to the second drive device 11 owing to the inertia is allowable, and the amount of movement of the second selvage yarn 16c in the top-bottom direction may be increased accordingly. Then, the rotary member 10 may be disposed upstream of the heald frames 28a in the warp direction while the size of the shed formed by the selvage yarns 16 is maintained at the size required for the weft insertion operation.

[0211] In the above-described embodiment, the regulating member 15 is provided between the selvage shedding device 3 and the selvage-yarn-path switching device 2 in the warp direction. The regulating member 15 is provided to prevent the path of the second selvage yarn 16c from vibrating in the weaving-width direction in a region closer to the cloth fell 24 than the selvage shedding device 3 when the rotary member 10 is rotated. However, the regulating member 15 may be omitted. In such a case, the selvage shedding device 3
is preferably configured such that a plane including the revolution path of the engagement portion 9 is parallel to the path of the second selvage yarn 16c from the selvage yarn guide 27 to the cloth fell 24, that is, such that the path of the second selvage yarn 16c is orthogonal to the rotation axis of the rotary member 10. However, the regulating member 15 may be simply omitted when the arrangement of the selvage shedding device 3, the size of the revolution path of the rotary member 10, etc., are such that the above-described vibration is allowable or when the selvage-yarn-path switching device 2 is configured to tolerate the above-described vibration.

[0212] In the above-described embodiment, the selvage yarn guide 27 is disposed below the selvage shedding device 3 so that, in the state in which the engagement pin 13 is omitted, the position of the path of the second selvage yarn 16c in the top-bottom direction at the position of the selvage shedding device 3 is below or at substantially the same level as the engagement pin 13 at the first position P1, which is the lowermost position on the revolution path. However, as illustrated in Figs. 10 and 11, a selvage yarn guide may instead be disposed above the selvage shedding device 3 so that the path of the second selvage yarn 16c at the position of the selvage shedding device 3 is above or at substantially the same level as the engagement pin 13 at the uppermost position on the revolution path.

[0213] According to the above-described embodiment, the selvage forming apparatus 1 is provided at each of the weft insertion side and the weft arrival side of the loom that weaves a single strip of cloth, that is, at each side of the woven cloth. However, the present invention may also be applied to a center selvage forming apparatus of a double-width loom that simultaneously weaves a plurality of strips of cloth. In this case, in addition to the selvage forming apparatuses provided at the weft insertion side and the weft arrival side of the loom, two selvage forming apparatuses 1 for forming center selvages are provided between the adjacent strips of woven cloth (for example, between first and second strips formed in a two-strip weaving operation) so as to correspond to the cloth edges of the respective strips. In this case, similar to the above-described embodiment, each of the two selvage forming apparatuses 1 disposed between the adjacent strips of woven cloth may include a dedicated selvage-yarn-path switching device 2. Alternatively, however, a single selvage-yarn-path switching device 2 may be provided for the two selvage forming apparatuses 1.

[0214] For example, Fig. 23 illustrates an example in which two selvage shedding devices 3 (not illustrated) and a single selvage-yarn-path switching device 2 are used to form a selvage on each of first woven cloth 127 and second woven cloth 128. In this example, a three-yarn leno selvage construction is formed on each woven cloth by using three selvage yarns 16 (first selvage yarns 16a and 16b and a second selvage yarn 16c). Similar to the above-described embodiment, the second selvage yarn 16c for the first woven cloth 127 and the second selvage yarn 16c for the second woven cloth 128 are moved in the top-bottom direction by the respective selvage shedding devices (not illustrated) to form sheds.

[0215] Switching of the paths of the first selvage yarns 16a and 16b for the first woven cloth 127 and switching of the paths of the first selvage yarns 16a and 16b for the second woven cloth 128 are both performed by the selvage-yarn-path switching device 2. The selvage-yarn-path switching device 2 in this example includes a base member 129 that serves as a displacement member 7. Selvage-yarn guide rods 130a and 130b for the first woven cloth 127 and selvage-yarn guide rods 131a and 131b for the second woven cloth 128 are provided on the base member 129 as selvage-yarn guide members 5. The base member 129 is fixed to a support shaft 132 that serves as a support member 6. Similar to the above-described embodiment, a first drive device 8 (not shown) causes the base member 129 to swing with the support

shaft 132 interposed therebetween, thereby switching the paths of the first selvage yarns 16a and 16b.

[0216] In the illustrated example, first selvage yarn guides 133a, 133b, 134a, and 134b correspond to the first selvage yarn guides 44a and 44b according to the above-described embodiment, and regulating members 135 and 136 correspond to the regulating member 15 according to the above-described embodiment.

[0217] The selvage forming apparatus according to the present invention may be used as a catch-cord selvage forming apparatus. In this case, the selvage yarns of the selvage forming apparatus according to the present invention that is disposed near a cloth edge and serves as a catch-cord selvage forming apparatus catch an end of the inserted weft yarn to form a selvage construction. The selvage construction is cut by a cutter after beating-up motion, and is released from the woven cloth as a catch-cord selvage. The catch-cord selvage that has been cut off, the catch-cord selvage being formed of the end of the weft yarn and the selvage yarns, is discarded.

Claims

1. A selvage forming apparatus (1) for a loom, the selvage forming apparatus (1) forming a selvage construction by using at least two selvage yarns (16) which are pulled from respective bobbins (22) and include a first selvage yarn (16a, 16b) and a second selvage yarn (16c), the selvage forming apparatus (1) comprising:

a selvage-yarn-path switching device (2) disposed on a warp let-off side of a cloth fell (24) in a warp direction; and
a selvage shedding device (3) disposed on the warp let-off side of the selvage-yarn-path switching device (2) in the warp direction,
wherein the selvage-yarn-path switching device (2) includes
a selvage-yarn guide member (5) that is rod-shaped and extends at least in a top-bottom direction, the selvage-yarn guide member (5) having an eyelet (4), through which the first selvage yarn (16a, 16b) is inserted, at a tip end thereof (5),
a support member (6) that is fixedly arranged with respect to a frame of the loom,
a displacement member (7) that supports the selvage-yarn guide member (5) and that is supported by the support member (6) so as to be movable with respect to the frame of the loom so that a position of the selvage-yarn guide member (5) in a weaving-width direction is capable of being switched, and
a first drive device (8) that is fixedly arranged with respect to the frame of the loom and connected to the displacement member (7), the first drive device (8) driving the displacement member (7) so as to periodically switch a position of the eyelet (4) between two positions that are on a warp row side of and a side opposite the warp row side of the second selvage yarn (16c) in the weaving-width direction,
wherein the selvage shedding device (3) includes
a rotary member (10) that is fixedly arranged with respect to the frame of the loom so as to be rotatable around a rotation axis that extends in a direction that crosses the top-bottom direction, the rotary member (10) including an engagement portion (9) that is separated from the rotation axis and that engages with the second selvage yarn (16c) to move a path of the second selvage yarn (16c), and
a second drive device (11) that rotationally drives the rotary member (10) continuously in one direction around the rotation axis, and
wherein the selvage shedding device (3) is configured so that, when the second drive device (11) rotationally drives the rotary member (10), the engagement portion (9) is moved along a revolution path including a position at which the path of the second selvage yarn (16c) is closer to the first drive device (8) than the eyelet (4) in the top-bottom direction at least at a position of the selvage-yarn guide member (5) in the warp direction, and a position at which the path of the second selvage yarn (16c) is farther from the first drive device (8) than the tip end of the selvage-yarn guide member (5) in the top-bottom direction at least at the position of the selvage-yarn guide member (5) in the warp direction.

2. The selvage forming apparatus (1) according to Claim 1,
wherein the rotary member (10) includes
a main body (12) that is rotationally driven by the second drive device (11), and
an engagement pin (13) that serves as the engagement portion (9) and projects from the main body (12) toward the warp row side in the weaving-width direction, the engagement pin (13) engaging with the second selvage yarn (16c) at one side of the second selvage yarn (16c) in the top-bottom direction and switching the path of the second selvage yarn (16c) by moving the path of the second selvage yarn (16c) from one side to the other side of a path of the first selvage yarn (16a, 16b).

3. The selvage forming apparatus (1) according to Claim 2,
wherein the rotary member (10) further includes a balancer (14) at a position symmetrical to the engagement pin (13) about the rotation axis.

4. The selvage forming apparatus (1) according to Claim 1, 2, or 3,
wherein at least a part of the rotary member (10) is disposed at a position of a heald frame (28a) in the warp direction.

5. The selvage forming apparatus (1) according to Claim 1, 2, 3, or 4, further comprising:

a regulating member (15) that is disposed at a position closer to the cloth fell (24) than the selvage shedding device (3) in the warp direction and that regulates the path of the second selvage yarn (16c) in the weaving-width direction.

6. The selvage forming apparatus (1) according to Claim 5,
wherein the second drive device (11) rotationally drives the rotary member (10) in a rotation direction such that, in a period in which the second selvage yarn (16c) is moved in a direction for forming a shed between the second selvage yarn (16c) and the first selvage yarn (16a, 16b) in the top-bottom direction, the engagement portion (9) is moved along a part of the revolution path that is closer to the cloth fell (24) than a vertical line that passes though the rotation axis of the rotary member (10).

FIG. 1

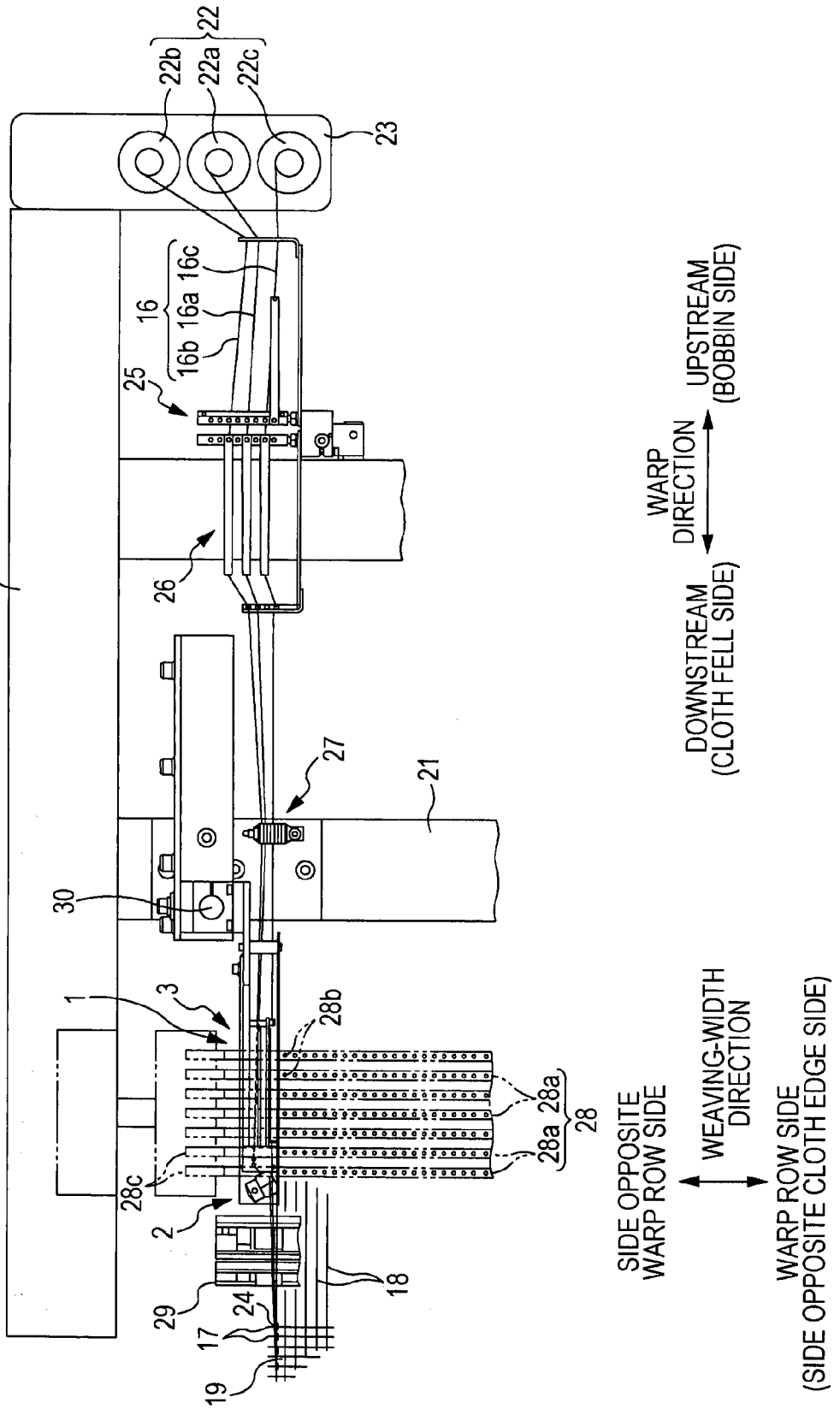

20
22
22b
22a
22c
23
16
16c
16a
16b
25
26
27
21
30
1
3
28b
28a
28
28c
2
29
24
17
19
18
WARP DIRECTION
UPSTREAM (BOBBIN SIDE)
DOWNSTREAM (CLOTH FELL SIDE)
SIDE OPPOSITE WARP ROW SIDE
WEAVING-WIDTH DIRECTION
WARP ROW SIDE (SIDE OPPOSITE CLOTH EDGE SIDE)

FIG. 2

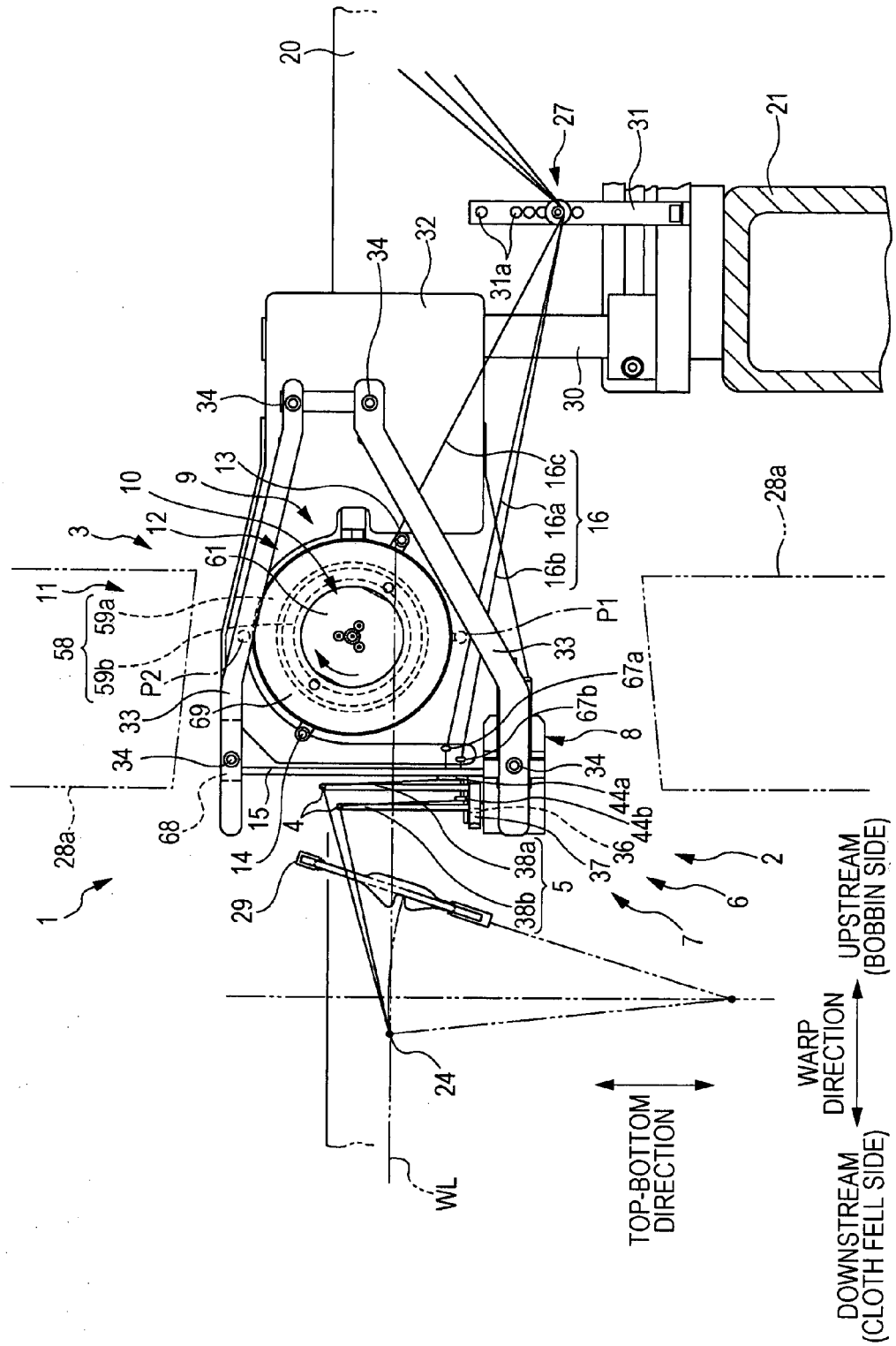

20
27
31
21
32
34
31a
30
34
16c
16a
16
16b
28a
10
9
13
12
3
61
11
59a
58
59b
P2
33
69
34
68
28a
1
15
4
14
29
24
WL
P1
33
67a
67b
8
34
44a
44b
36
37
38a
38b
5
2
6
7
TOP-BOTTOM DIRECTION
WARP DIRECTION
UPSTREAM (BOBBIN SIDE)
DOWNSTREAM (CLOTH FELL SIDE)

FIG. 3

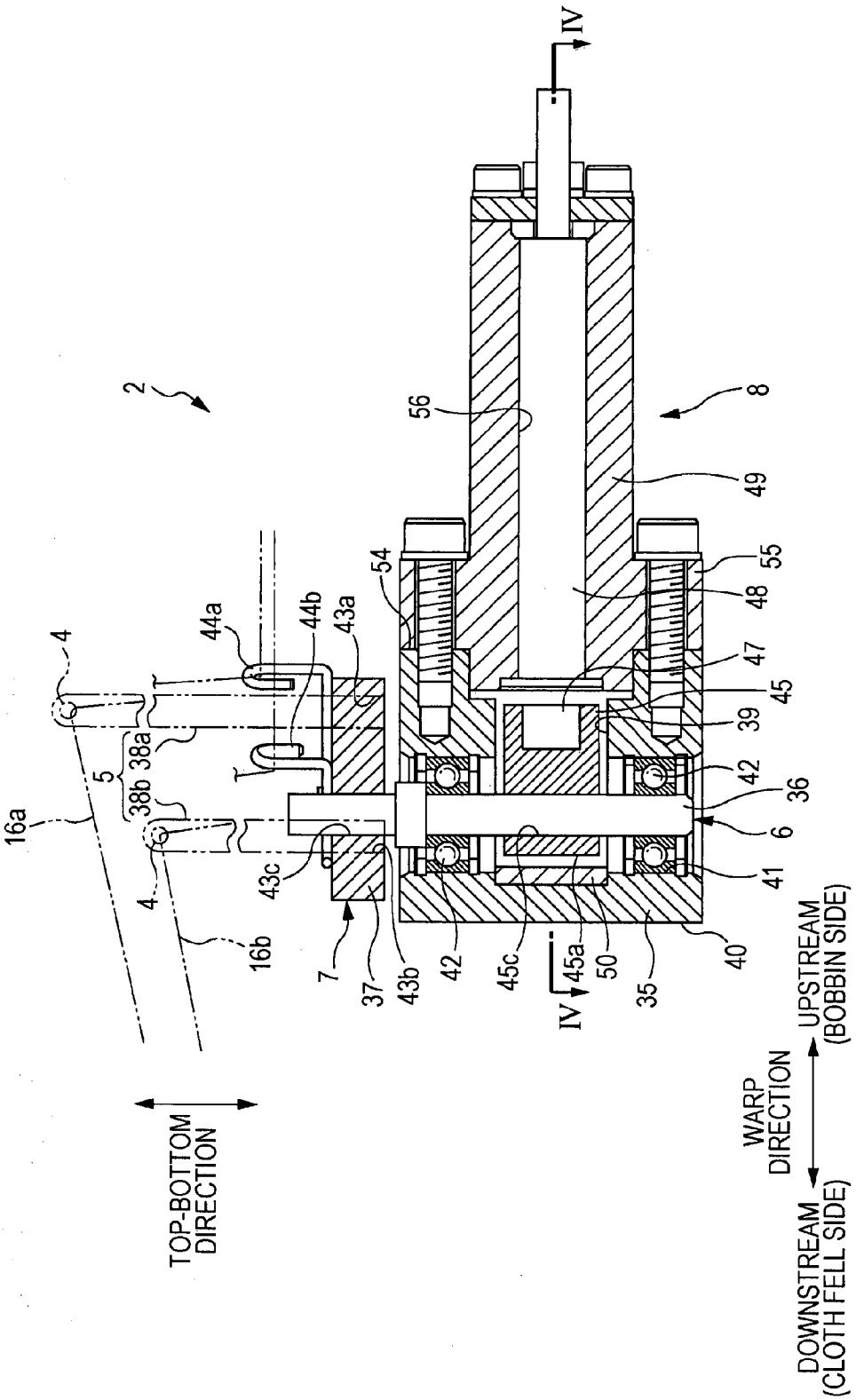

IV
2
8
56
49
54
55
48
47
45
39
42
36
6
41
40
35
50
45a
45c
42
43b
37
7
43c
16b
4
16a
5
38b
38a
4
44b
44a
43a
TOP-BOTTOM DIRECTION
WARP DIRECTION
UPSTREAM (BOBBIN SIDE)
DOWNSTREAM (CLOTH FELL SIDE)

FIG. 4

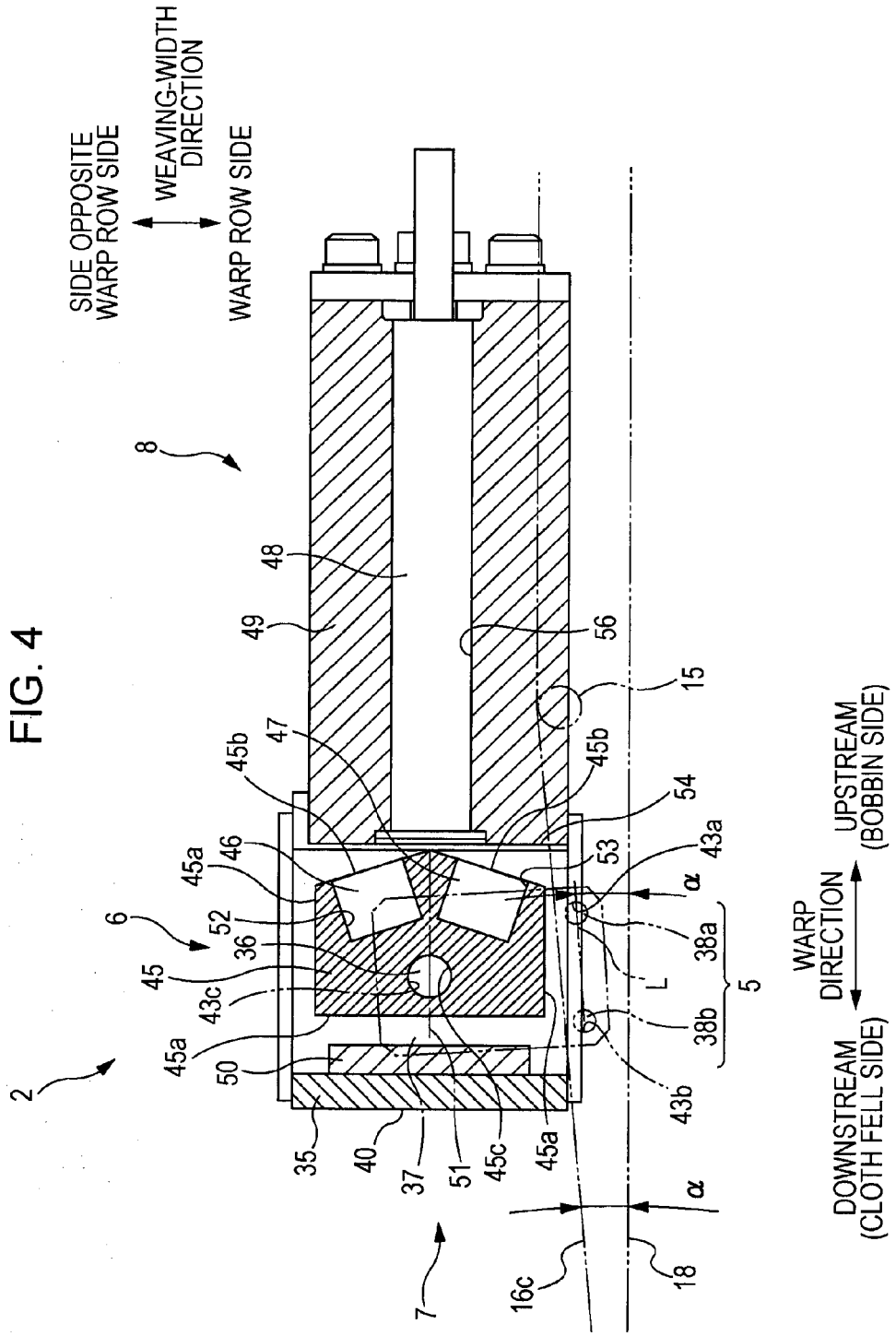

SIDE OPPOSITE WARP ROW SIDE
WEAVING-WIDTH DIRECTION
WARP ROW SIDE
8
48
49
56
15
47
45b
45b
54
46
45a
53
43a
α
6
52
36
38a
45
43c
L
5
45a
50
38b
43b
35
40
37
51
45c
45a
α
7
16c
18
WARP DIRECTION
UPSTREAM (BOBBIN SIDE)
DOWNSTREAM (CLOTH FELL SIDE)
2

FIG. 5

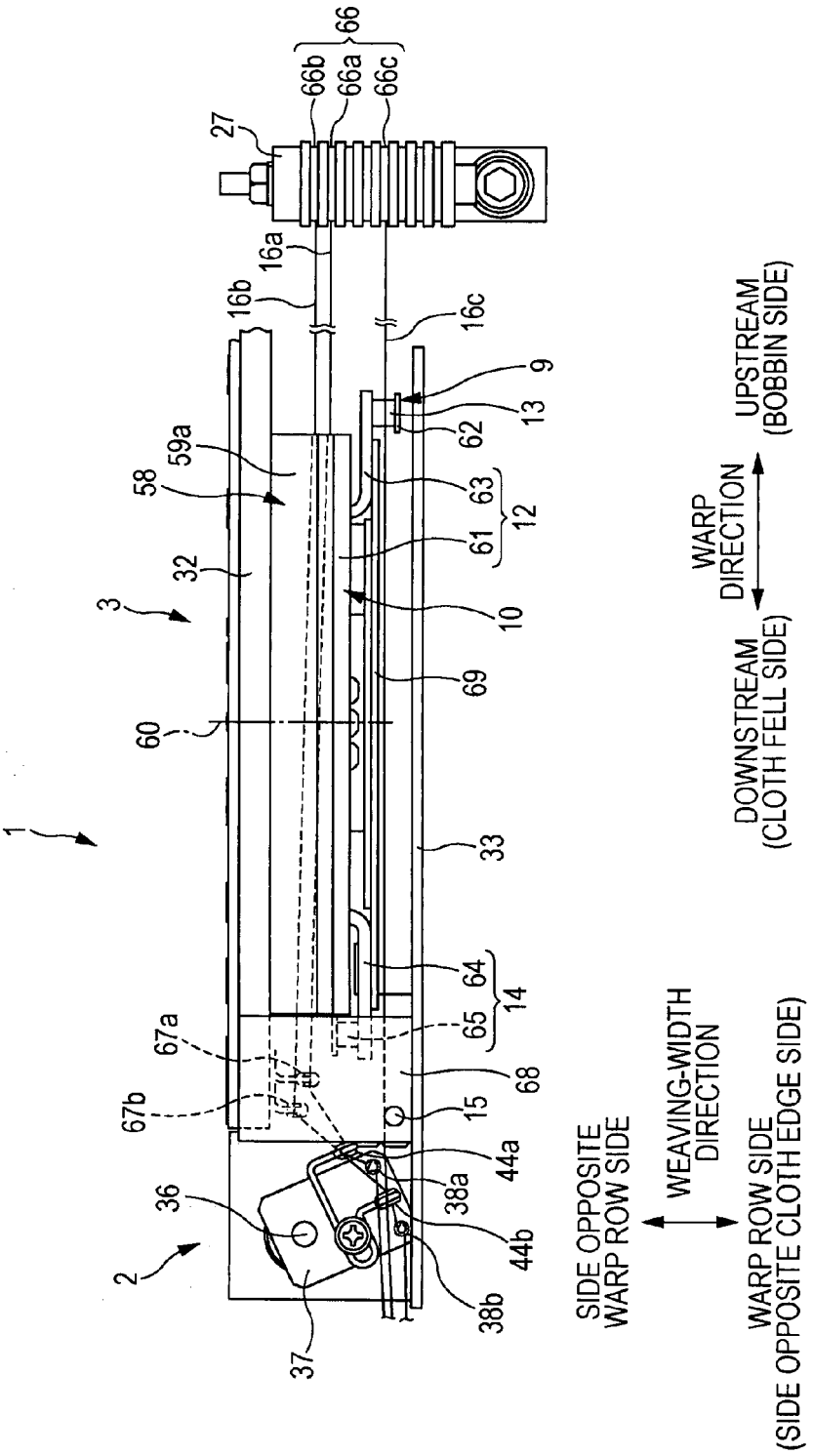

1
2
3
9
10
12
13
14
15
16a
16b
16c
27
32
33
36
37
38a
38b
44a
44b
58
59a
60
61
62
63
64
65
66
66a
66b
66c
67a
67b
68
69
WARP DIRECTION
UPSTREAM (BOBBIN SIDE)
DOWNSTREAM (CLOTH FELL SIDE)
WEAVING-WIDTH DIRECTION
SIDE OPPOSITE WARP ROW SIDE
WARP ROW SIDE (SIDE OPPOSITE CLOTH EDGE SIDE)

FIG. 6

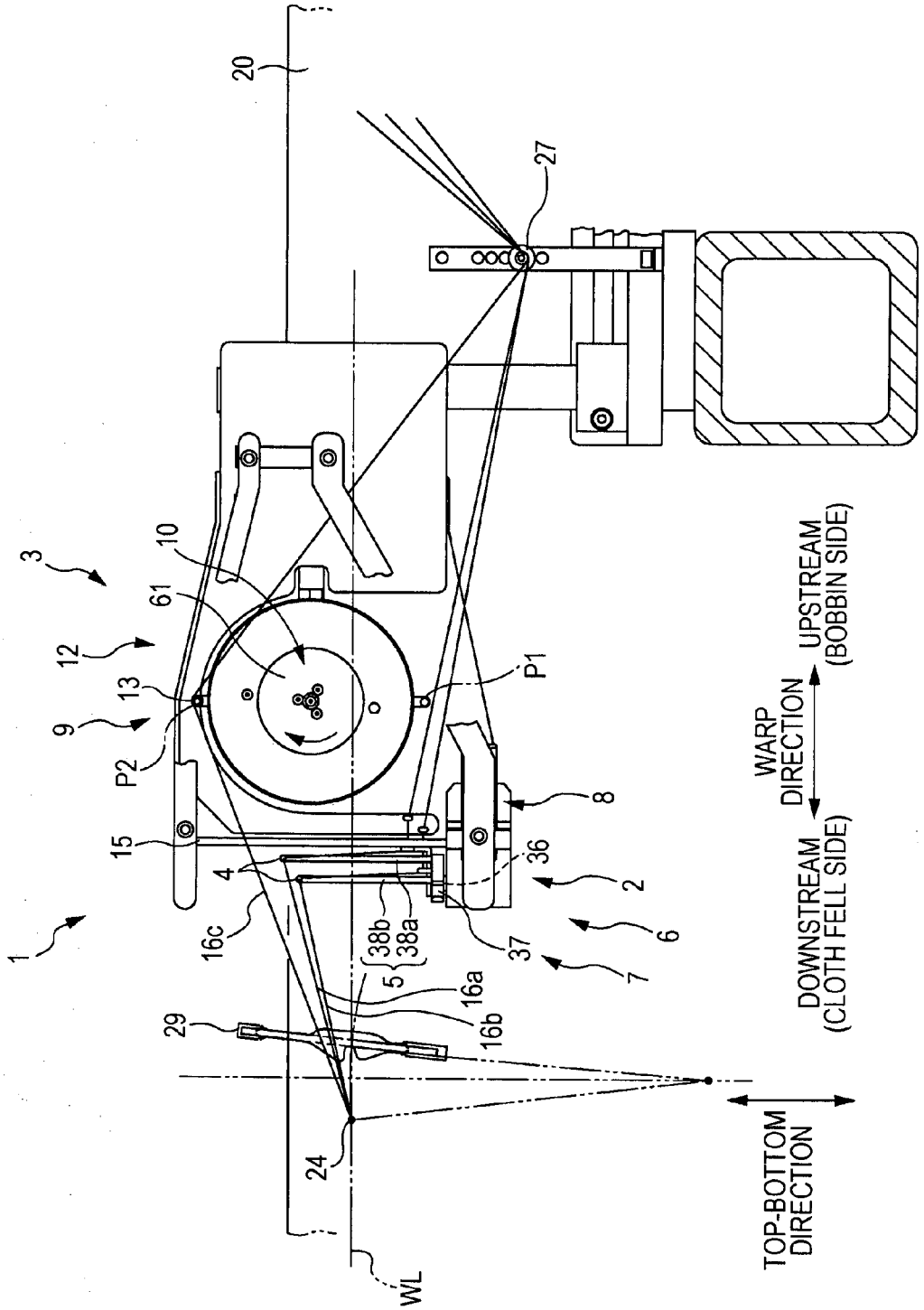
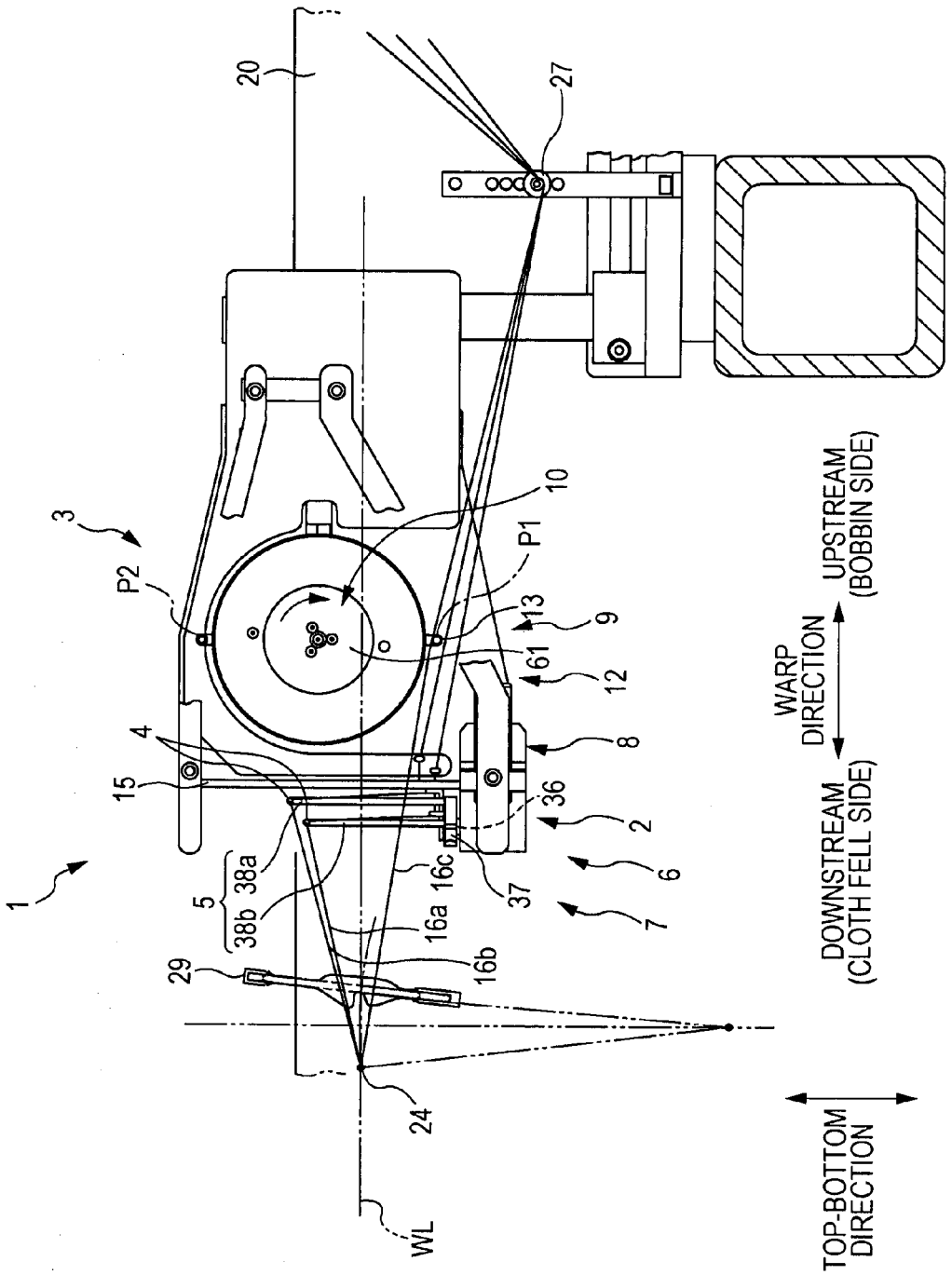

20
27
3
10
61
12
13
9
P2
P1
8
15
4
36
2
16c
38b
38a
37
6
7
1
5
16a
16b
29
24
WL
WARP DIRECTION
UPSTREAM (BOBBIN SIDE)
DOWNSTREAM (CLOTH FELL SIDE)
TOP-BOTTOM DIRECTION

FIG. 7


20
27
3
P2
10
P1
13
9
61
12
8
4
15
36
2
6
7
1
5
38a
38b
16c
37
16a
16b
29
24
WL
WARP DIRECTION
UPSTREAM (BOBBIN SIDE)
DOWNSTREAM (CLOTH FELL SIDE)
TOP-BOTTOM DIRECTION

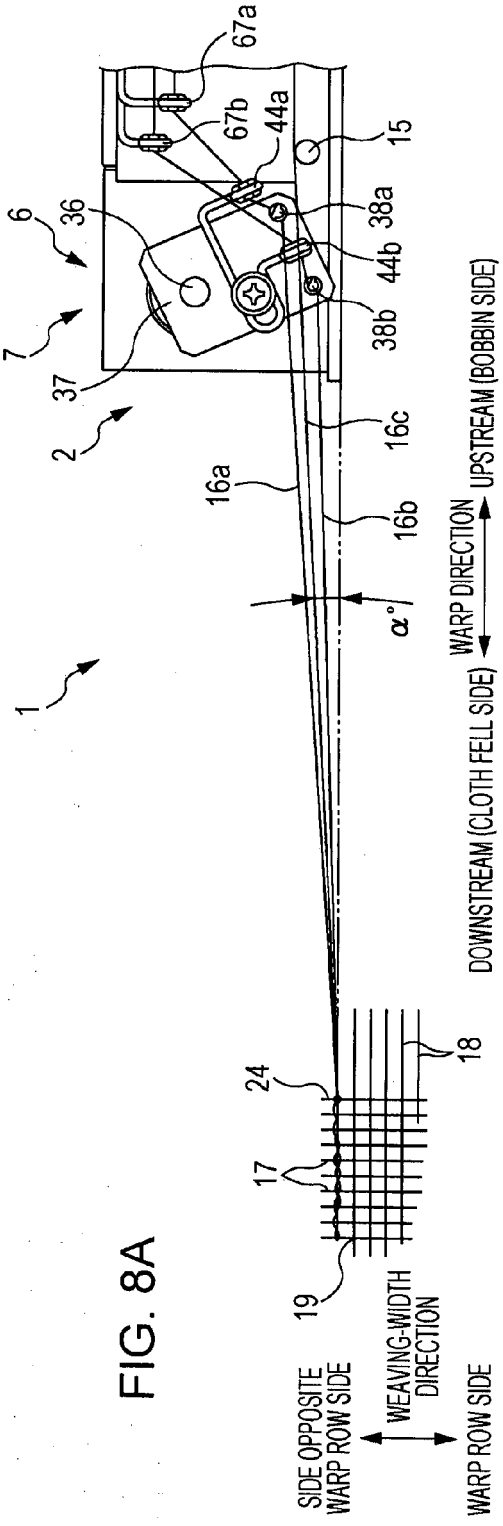

67a
67b
44a
15
6
36
38a
44b
7
38b
37
2
16c
16a
16b
1
α°
WARP DIRECTION
UPSTREAM (BOBBIN SIDE)
DOWNSTREAM (CLOTH FELL SIDE)
24
18
17
19
SIDE OPPOSITE WARP ROW SIDE
WEAVING-WIDTH DIRECTION
WARP ROW SIDE

FIG. 8A

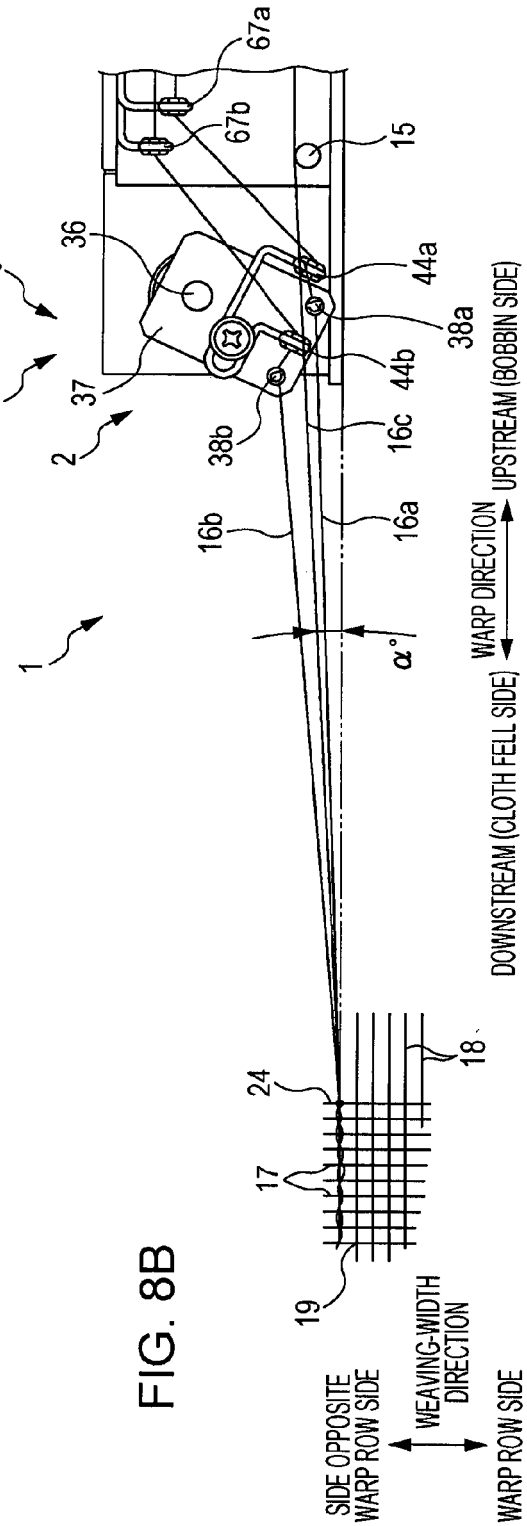

67a
67b
15
6
36
44a
38a
7
44b
38b
37
2
16c
16b
16a
1
α°
WARP DIRECTION
UPSTREAM (BOBBIN SIDE)
DOWNSTREAM (CLOTH FELL SIDE)
24
18
17
19
SIDE OPPOSITE WARP ROW SIDE
WEAVING-WIDTH DIRECTION
WARP ROW SIDE

FIG. 8B

FIG. 9A

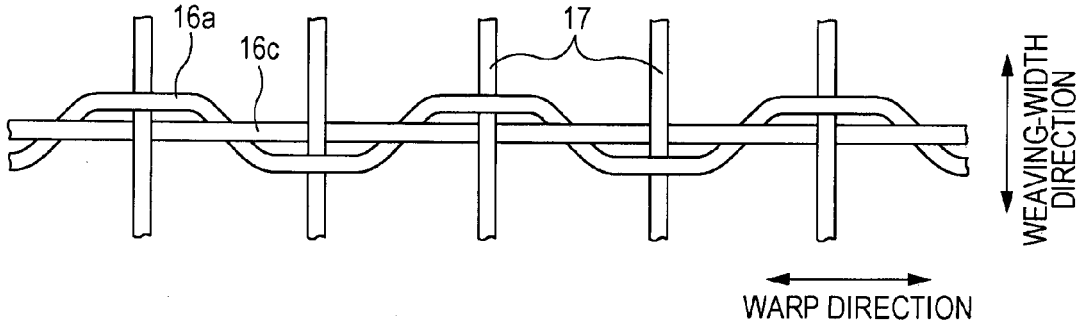


FIG. 9B

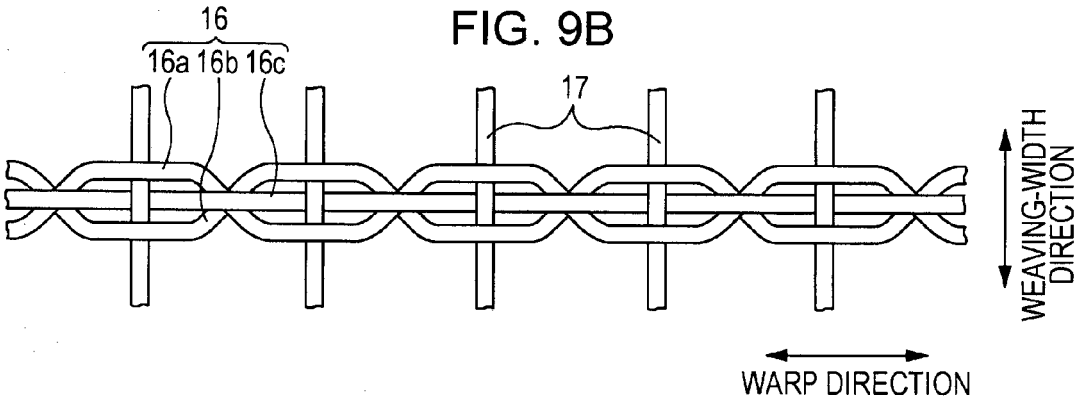


FIG. 9C

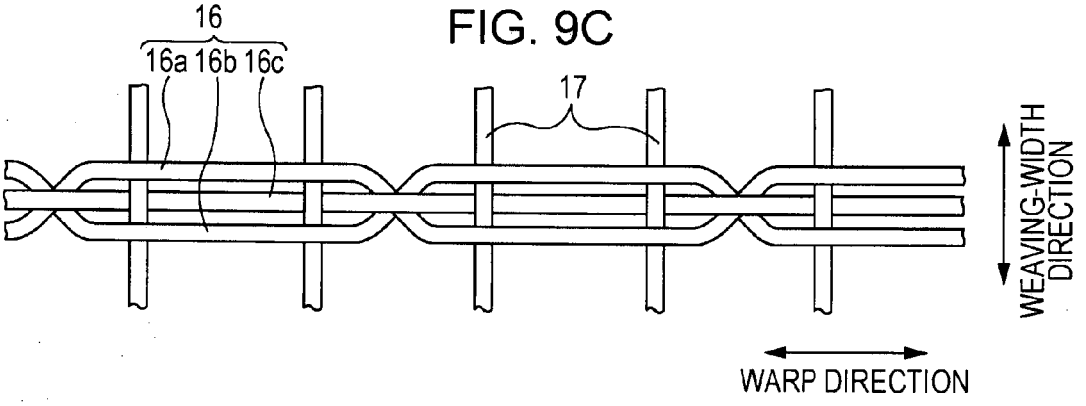


FIG. 10

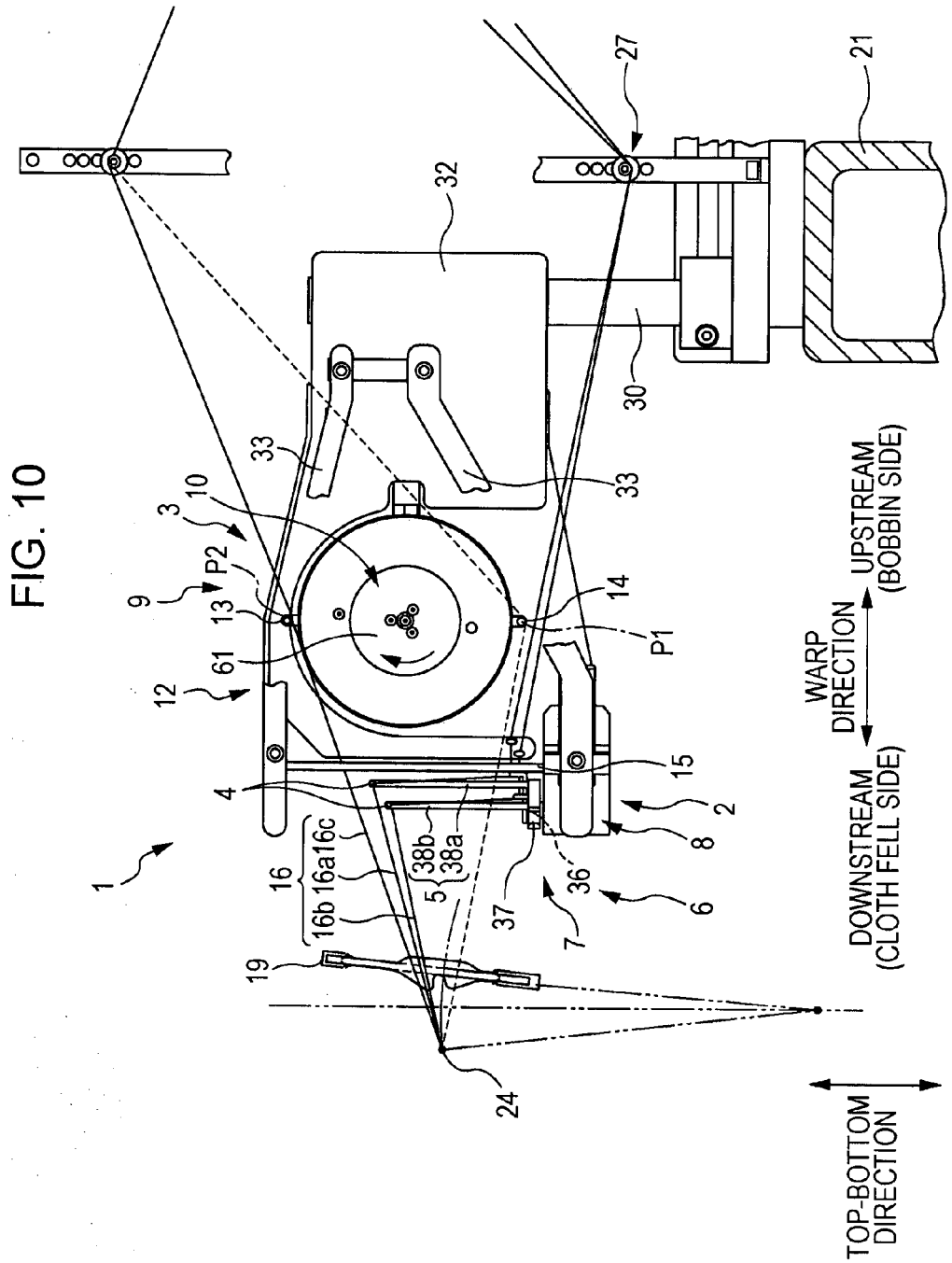

1
2
3
4
5
6
7
8
9
10
12
13
14
15
16
16a
16b
16c
19
21
24
27
30
32
33
36
37
38a
38b
61
P1
P2
WARP DIRECTION
UPSTREAM (BOBBIN SIDE)
DOWNSTREAM (CLOTH FELL SIDE)
TOP-BOTTOM DIRECTION

FIG. 11

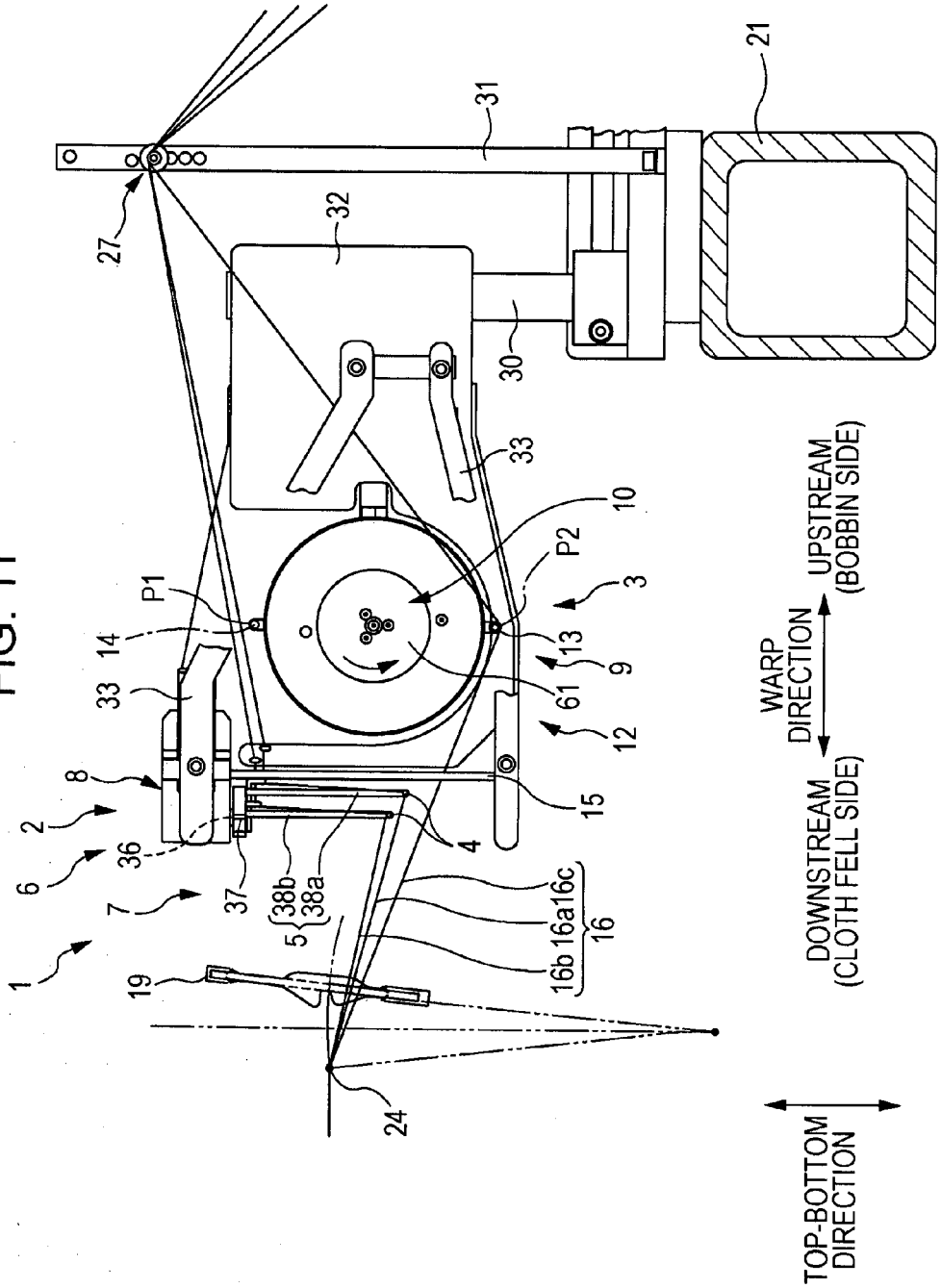

21
31
32
27
30
33
10
P2
3
P1
14
13
9
61
12
33
15
8
2
4
36
6
37
38b
38a
5
7
16c
16a
16
16b
1
19
24
UPSTREAM
(BOBBIN SIDE)
WARP
DIRECTION
DOWNSTREAM
(CLOTH FELL SIDE)
TOP-BOTTOM
DIRECTION

FIG. 12A

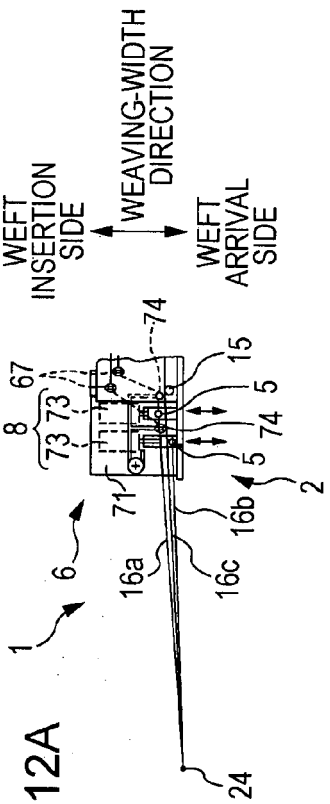


FIG. 12B

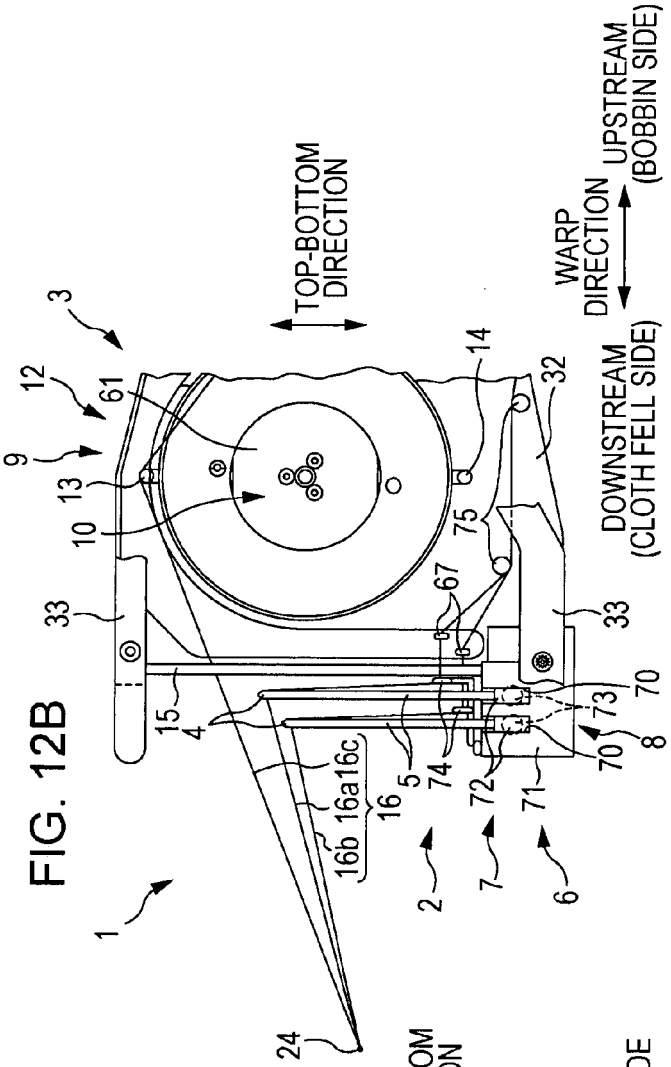
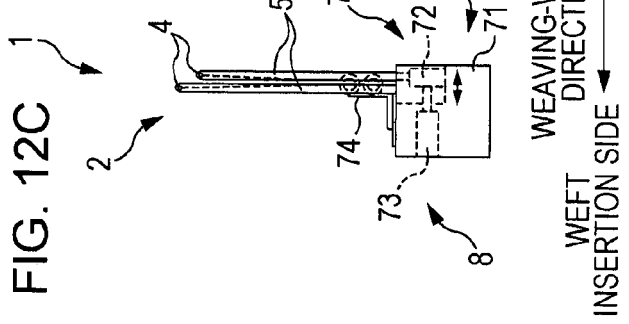


FIG. 12C



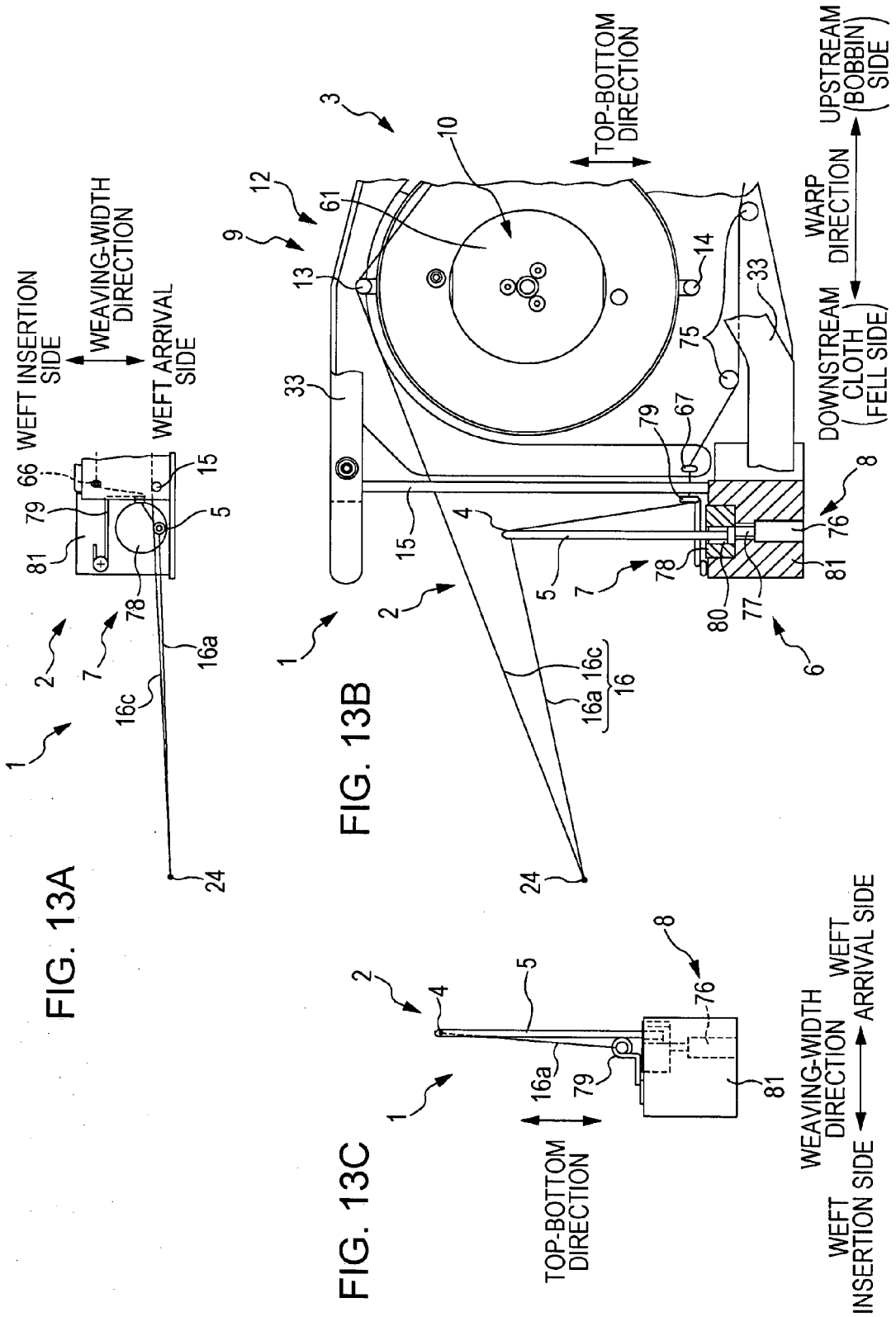


FIG. 13A

FIG. 13B

FIG. 13C

FIG. 14A

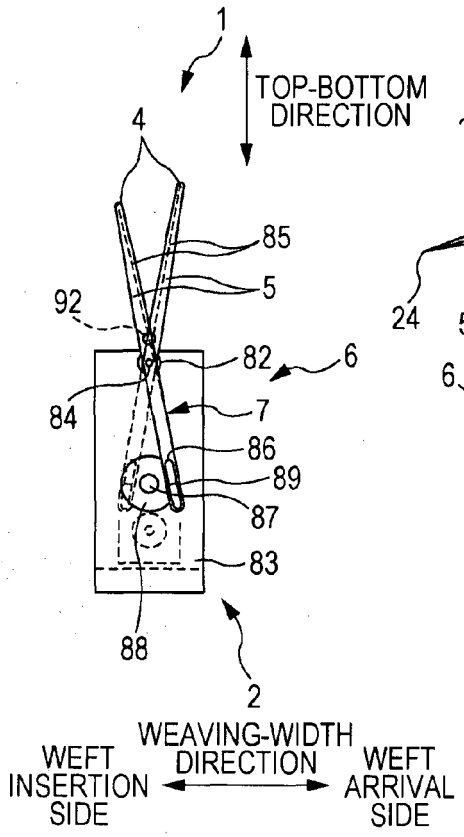


FIG. 14B

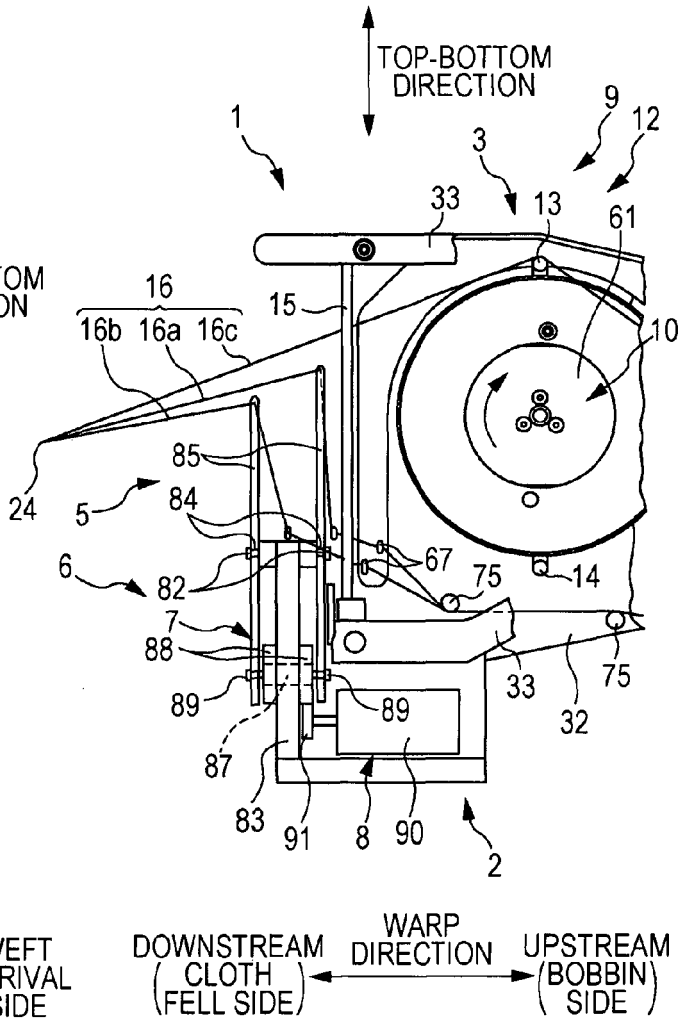


FIG. 15A

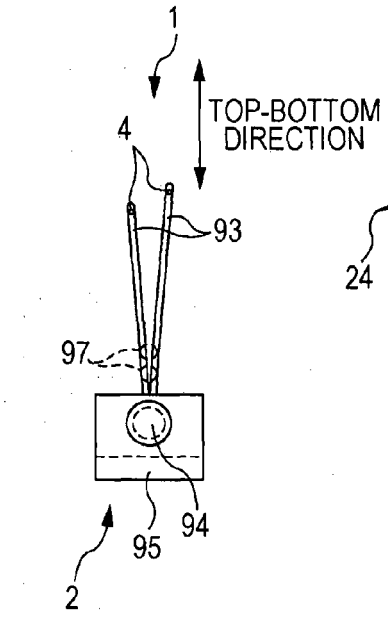


FIG. 15B

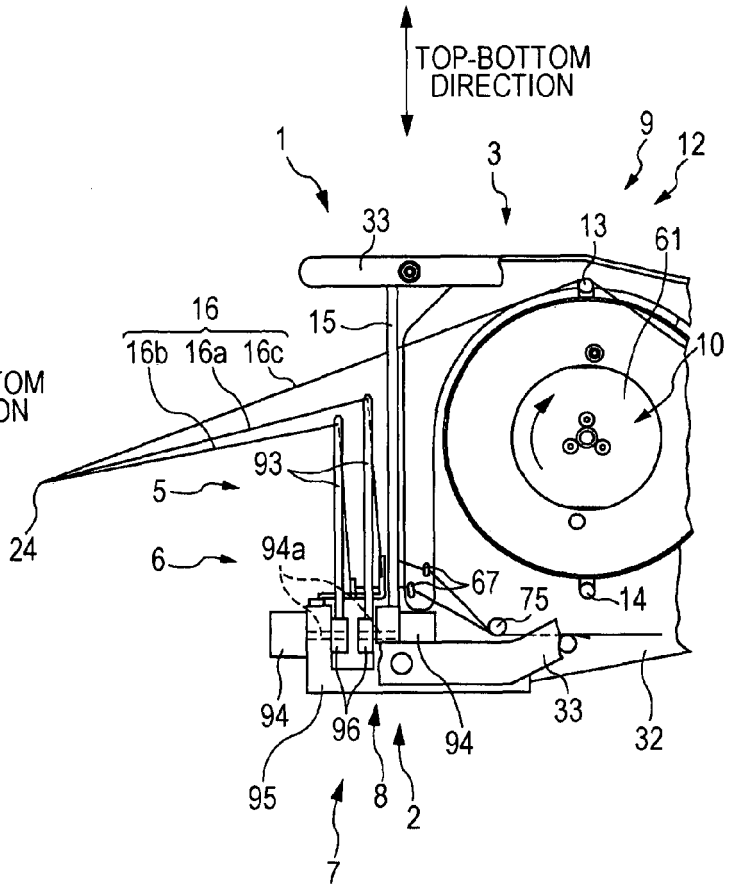
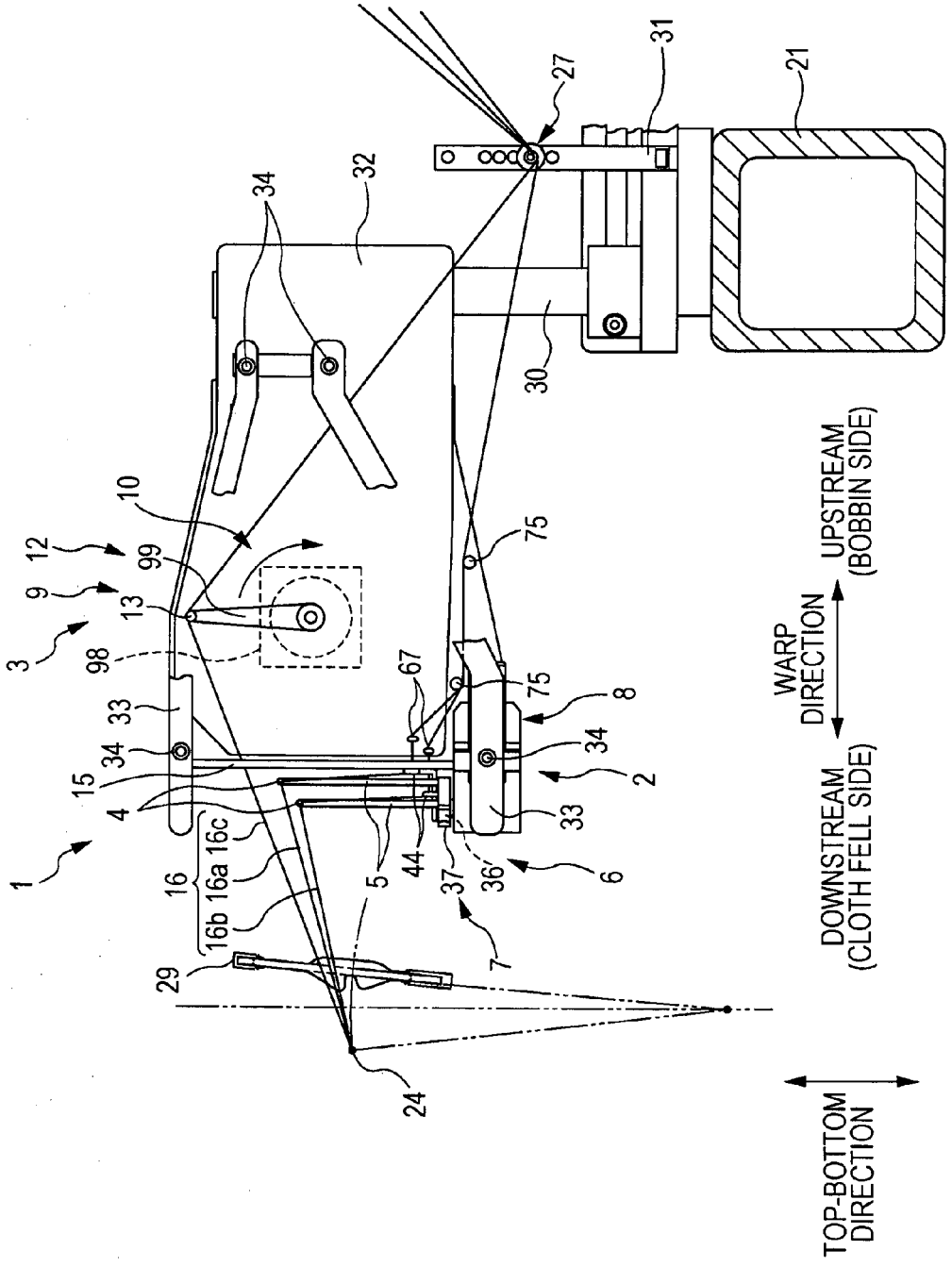


FIG. 16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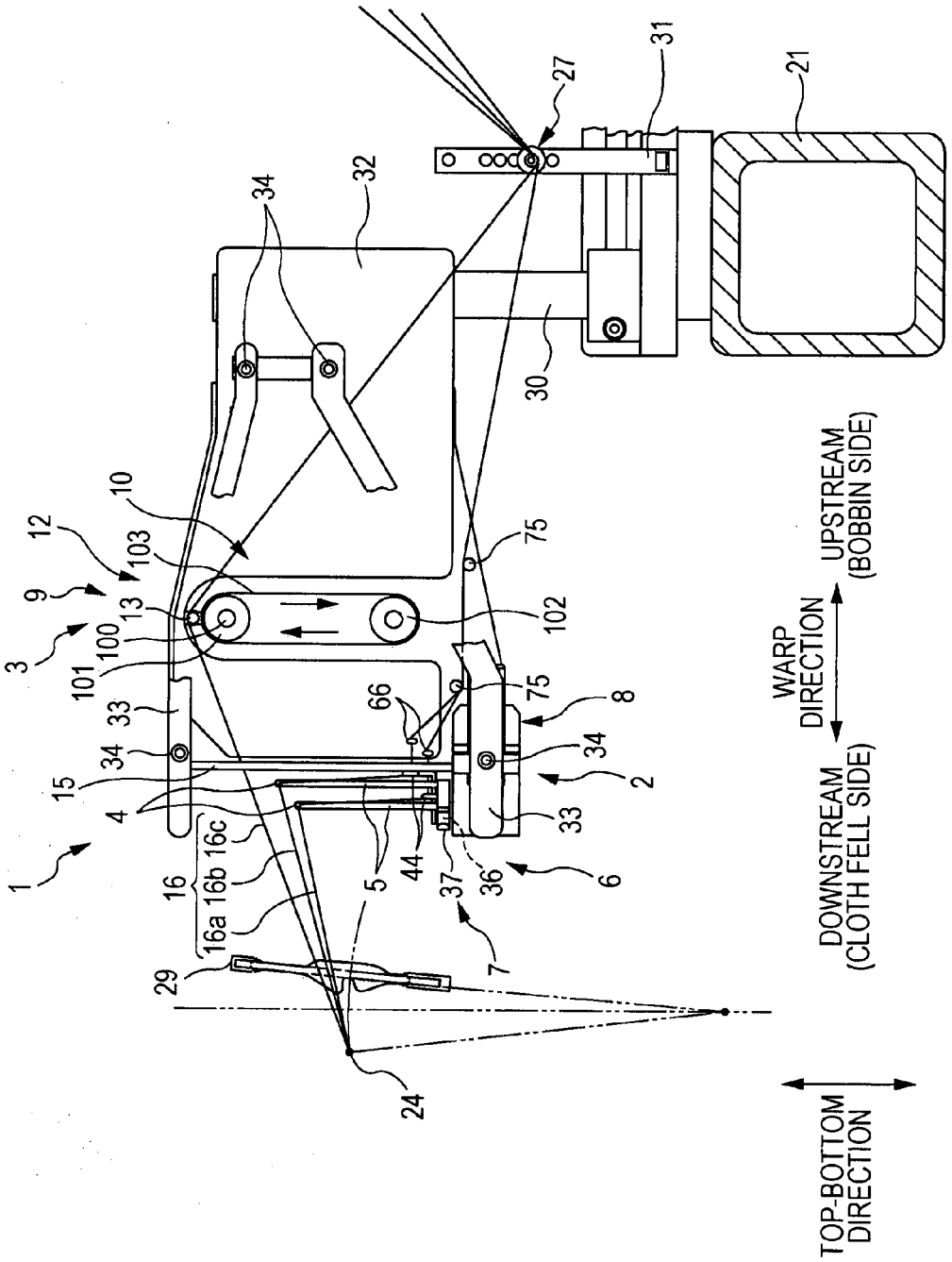
75
98
99
UPSTREAM (BOBBIN SIDE)
WARP DIRECTION
DOWNSTREAM (CLOTH FELL SIDE)
TOP-BOTTOM DIRECTION

FIG. 17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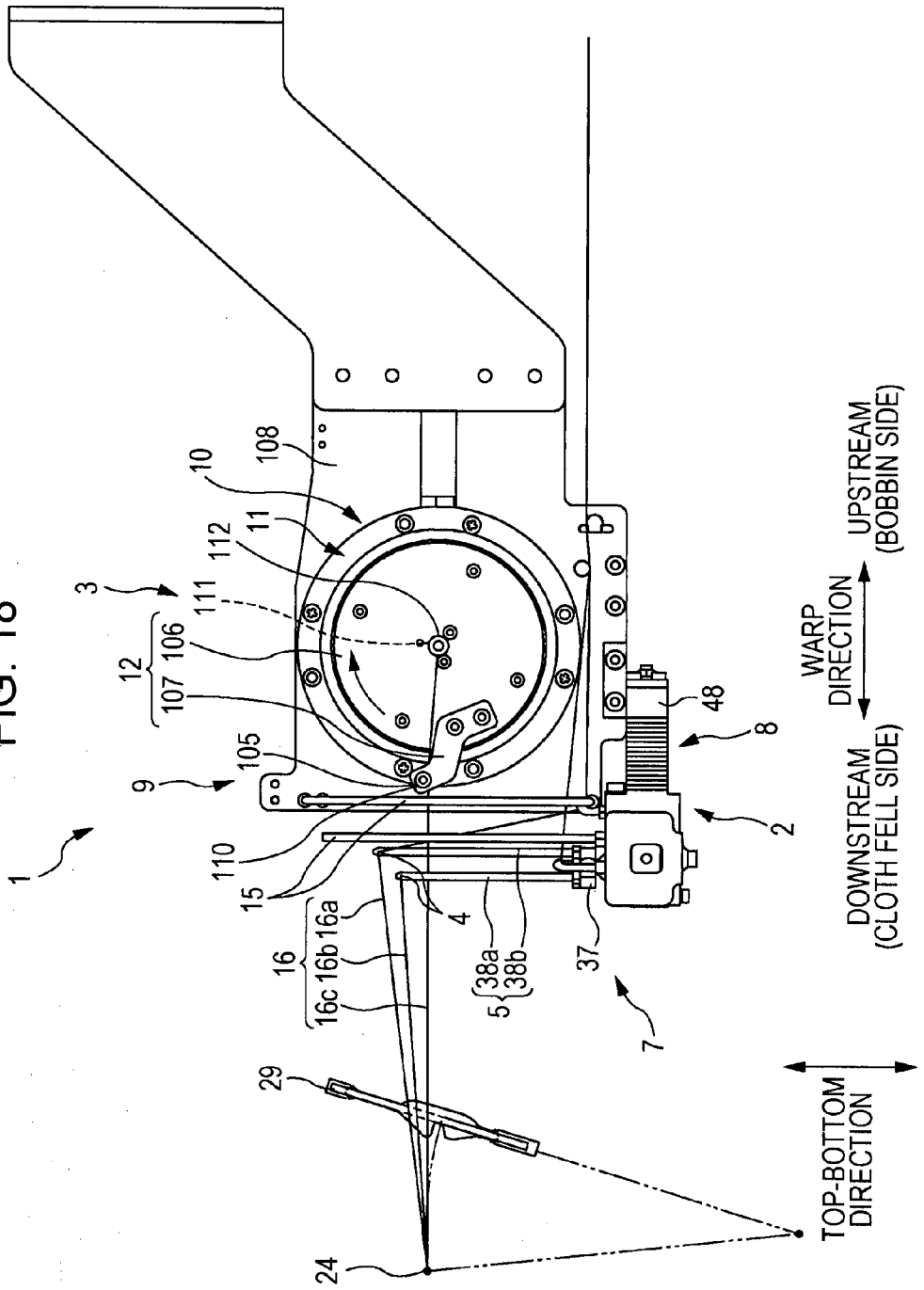
75
100
101
102
103
UPSTREAM (BOBBIN SIDE)
WARP DIRECTION
DOWNSTREAM (CLOTH FELL SIDE)
TOP-BOTTOM DIRECTION

FIG. 18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16a
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16c
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38a
38b
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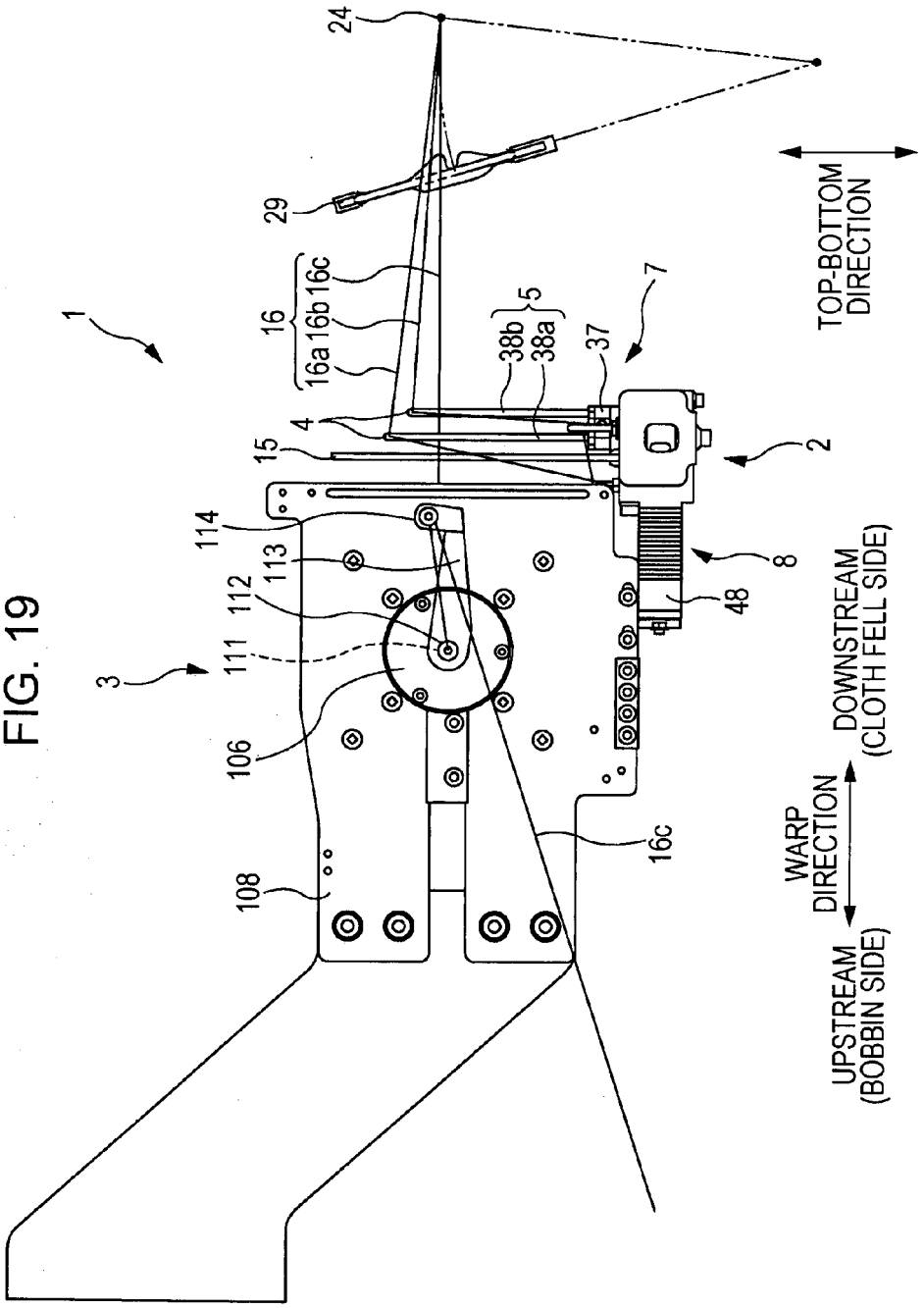
UPSTREAM (BOBBIN SIDE)
WARP DIRECTION
DOWNSTREAM (CLOTH FELL SIDE)
TOP-BOTTOM DIRECTION

FIG. 19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16a
16b
16c
24
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37
38a
38b
48
106
108
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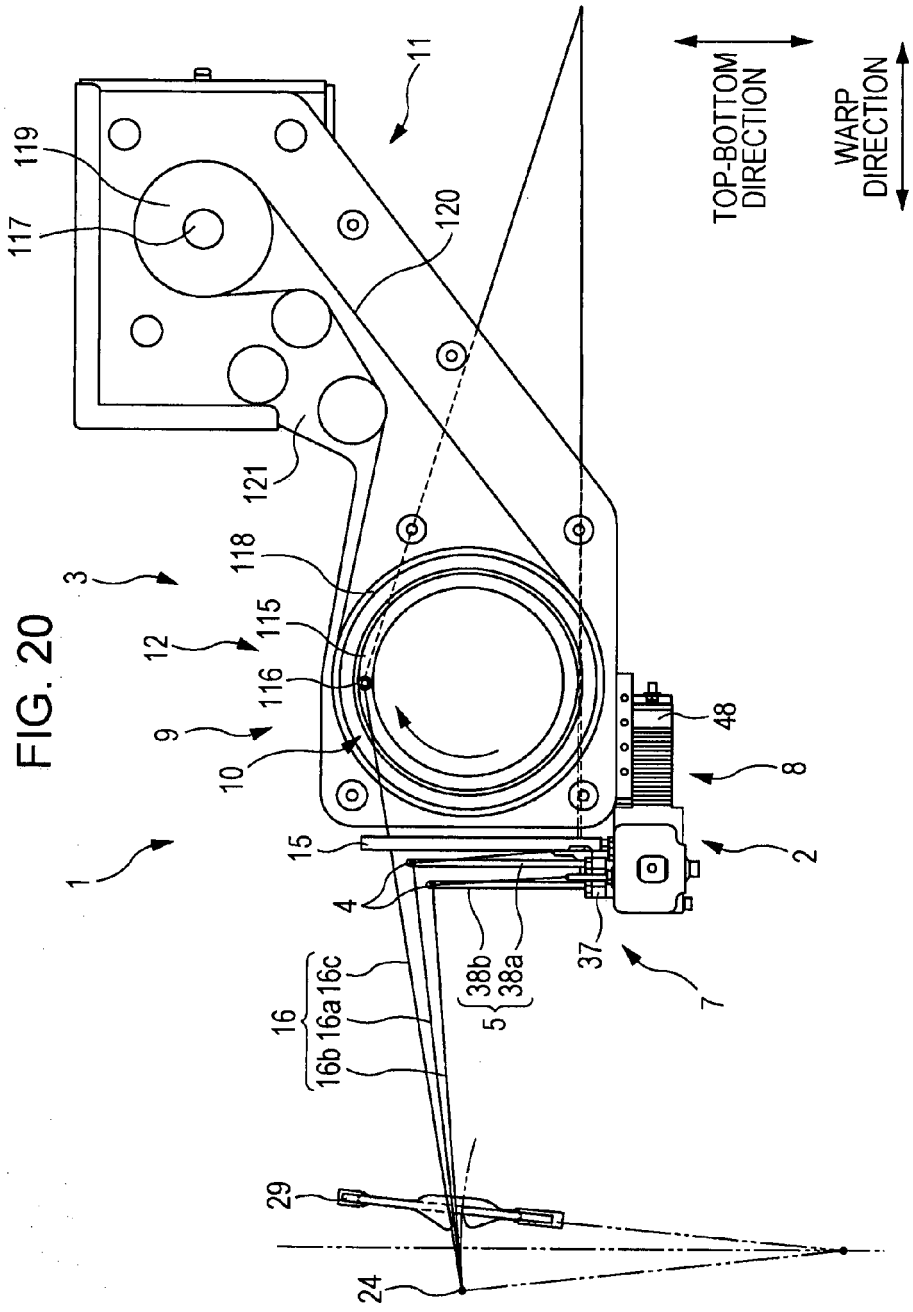
113
114
TOP-BOTTOM DIRECTION
DOWNSTREAM (CLOTH FELL SIDE)
WARP DIRECTION
UPSTREAM (BOBBIN SIDE)

FIG. 20


TOP-BOTTOM DIRECTION
WARP DIRECTION
11
119
117
120
121
118
3
12
115
116
9
10
1
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4
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38b
38a
5
16
16a
16c
16b
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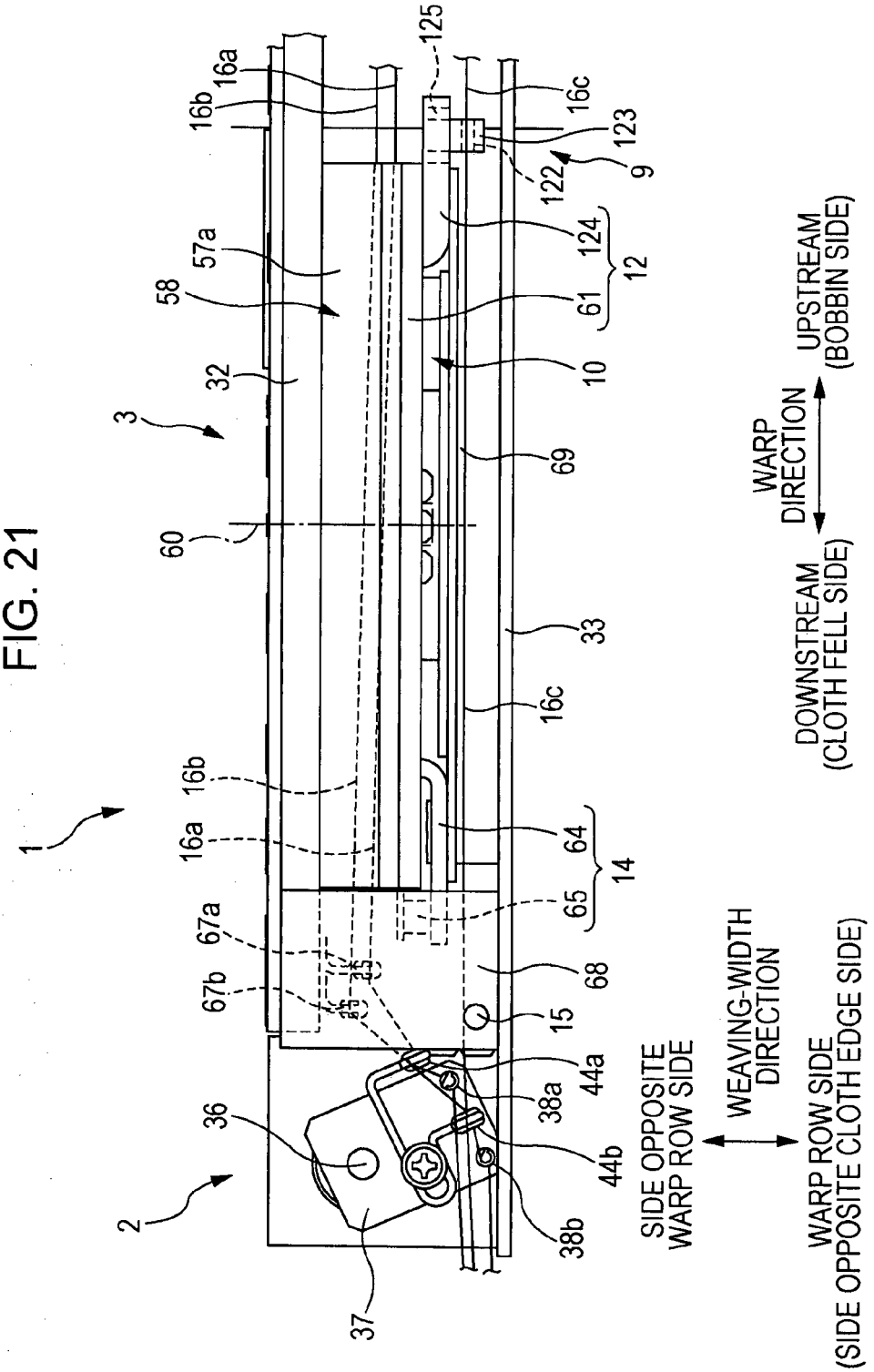
FIG. 21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16b
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38a
38b
44a
44b
57a
58
60
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64
65
67a
67b
68
69
122
123
124
125
WARP DIRECTION
UPSTREAM (BOBBIN SIDE)
DOWNSTREAM (CLOTH FELL SIDE)
WEAVING-WIDTH DIRECTION
SIDE OPPOSITE WARP ROW SIDE
WARP ROW SIDE (SIDE OPPOSITE CLOTH EDGE SIDE)

FIG. 22A

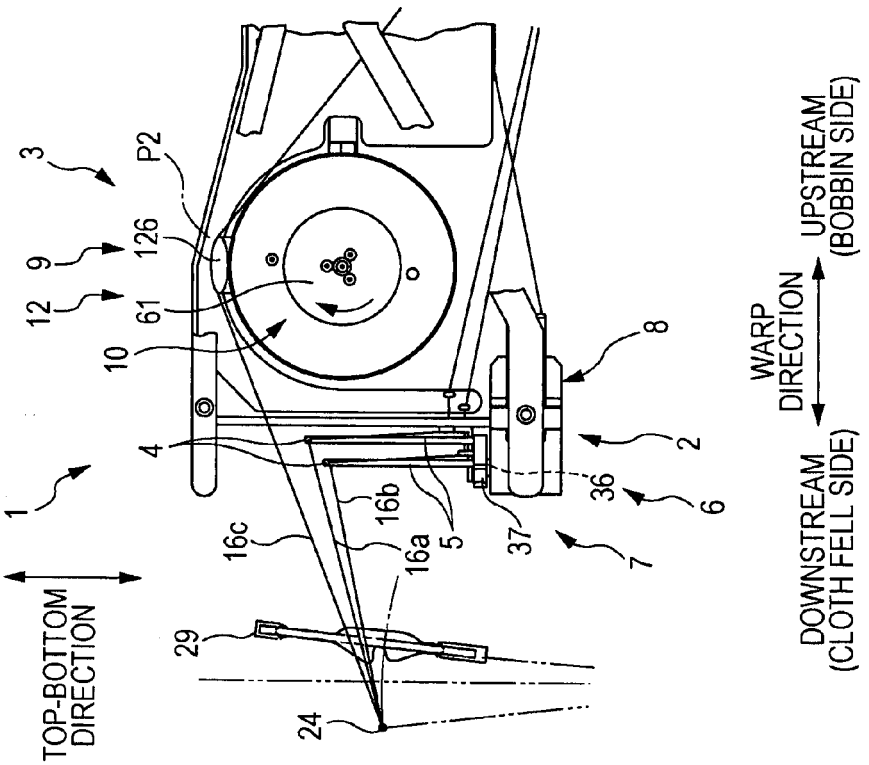


FIG. 22B

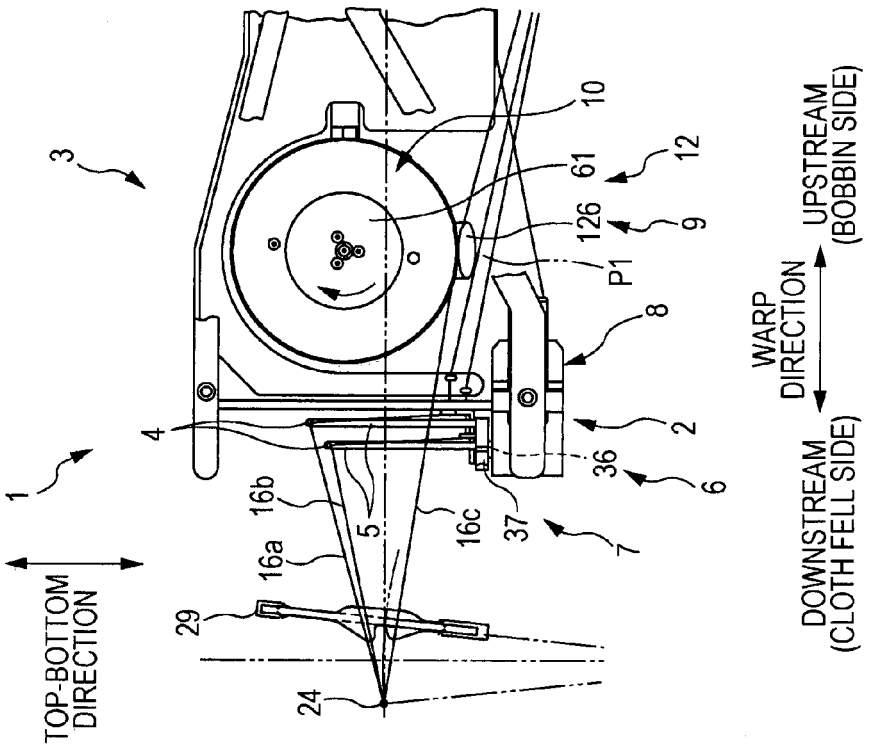
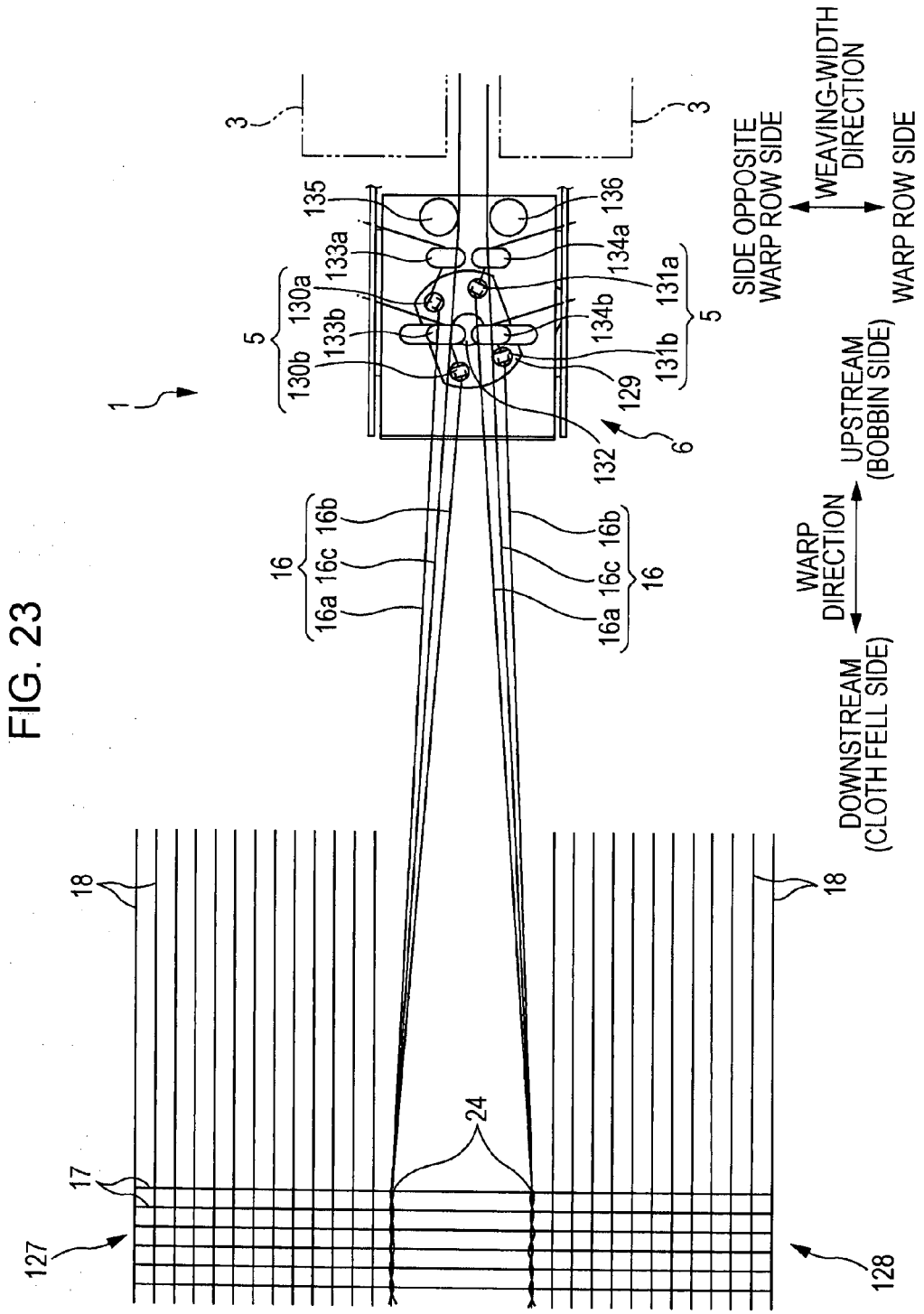


FIG. 23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134a
134b
131a
131b
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129
132
6
16
16a
16c
16b
16
16a
16c
16b
18
18
17
24
127
128
WEAVING-WIDTH DIRECTION
SIDE OPPOSITE WARP ROW SIDE
WARP ROW SIDE
UPSTREAM (BOBBIN SIDE)
WARP DIRECTION
DOWNSTREAM (CLOTH FELL SIDE)

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EUROPEAN SEARCH REPORT

Application Number
EP 13 00 2916

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 96/36751 A1 (KLOECKER ENTWICKLUNGS GMBH [DE]; WANNING WERNER [DE]; SEIFER KARL HEIN) 21 November 1996 (1996-11-21) * page 2 - page 7 * * figures 4-6 *	1-6	INV. D03C7/04 D03C7/06
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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
Munich	27 August 2013	Hausding, Jan

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