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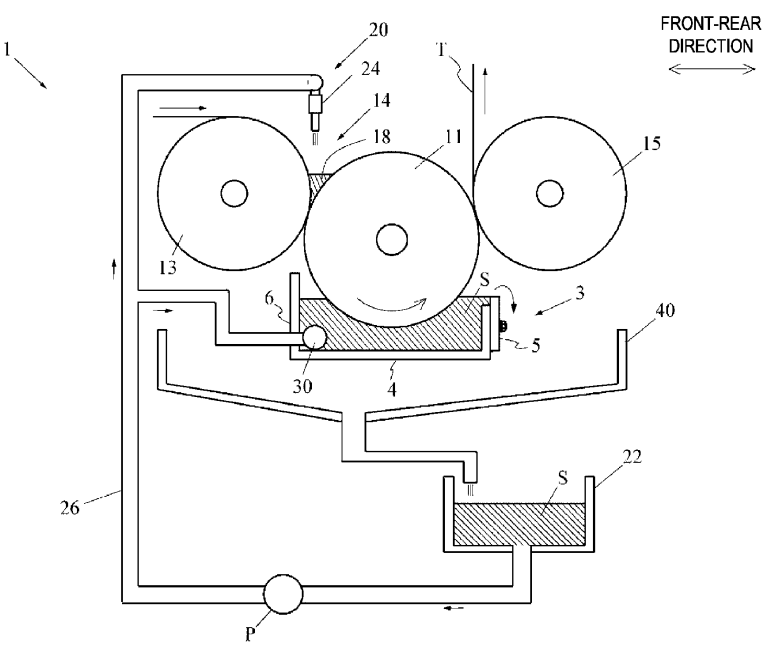
# (54) WARP SIZING APPARATUS

(57) Warp sizing apparatus (1) comprising a sizing tank (3) having a bottom plate (4), a first end wall (5), a second end wall (6) provided on the opposite side of said first end wall (5), a first side wall (7) and a second side wall (8) provided on the opposite side of said first side wall (7), whereby said sizing tank (3) is configured to store a sizing liquid (S); said warp sizing apparatus (1) further comprises a first roll (11) immersed in the sizing liquid in the sizing tank (3); and a second roll (13, 15) forming a nip with the first roll (11), so as to sandwich a warp sheet (T) between said second roll (13, 15) and said first roll (11), wherein a supply unit (30) configured to supply the sizing liquid (S) is provided on the second end wall (6) of the sizing tank (3), and the height of an upper edge of the first end wall (5) is lower than an upper edge of the second end wall (6), thereby allowing the liquid to overflow from said first end wall (5).

FIG.1




EP 4 063 549 A1

## Description

### TECHNICAL FIELD

**[0001]** The present invention relates to a warp sizing apparatus including a sizing tank having a bottom plate, front and rear end walls and left and right side walls and configured to store a sizing liquid; a first roll immersed in the sizing liquid in the sizing tank; and a second roll circumscribed around the first roll so as to sandwich a path of a warp sheet therebetween, wherein a supply unit configured to supply the sizing liquid is provided on one of the front and rear end walls of the sizing tank, and a height position of an upper edge of an overflow-side end wall on an opposite side to a supply-side end wall, which is the end wall on a side on which the supply unit is provided, is a position lower than a height position of an upper edge of the supply-side end wall, so that the sizing liquid overflows from the overflow-side end wall.

### BACKGROUND ART

**[0002]** For example, PTL 1 discloses a warp sizing apparatus as described above. The warp sizing apparatus disclosed in PTL 1 includes a sizing tank in which a sizing liquid is stored, a lower full squeeze roll (first roll) immersed in the sizing liquid in the sizing tank, and an upper full squeeze roll (second roll) circumscribed around the first roll. A warp sheet passes between the first roll and the second roll, so that extra sizing liquid is squeezed from the warp sheet.

**[0003]** Note that, foreign matters such as fluff and cotton fly of the warp, oil adhering to the warp, and air bubbles caused due to rotation of the sizing roll are floating on a liquid surface of the sizing liquid in the sizing tank. For this reason, in a general warp sizing apparatus, in order to remove foreign matters floating on the liquid surface, a new sizing liquid is continuously supplied into the sizing tank so that the foreign matters on the liquid surface are caused to overflow to an outside of the tank, together with the old sizing liquid in the sizing tank.

### CITATION LIST

### PATENT LITERATURE

**[0004]** PTL 1: JPH04-050357A

**[0005]** In the meantime, in the warp sizing apparatus of PTL 1, a new sizing liquid is supplied into the tank from one side (rear end wall) of the front and rear end walls of the sizing tank. The other end wall (front end wall) of the sizing tank is formed so that a height position of an upper edge thereof is a position lower than a height position of an upper edge of the rear end wall. Thereby, in the sizing tank, as the sizing liquid is supplied from the rear end wall-side, the sizing liquid overflows from the front end wall. Therefore, in the sizing tank, the rear end wall is a supply-side end wall referred to in the present invention, and the front end wall is an overflow-side end wall. The sizing liquid is caused to overflow from the front end wall, so that the sizing liquid near the liquid surface on which the above-described foreign matters are floating is discharged to the outside of the tank for preventing deterioration in state of the sizing liquid in the tank.

**[0006]** Note that, in a region on a front side of the first roll (a region between the first roll and the front end wall) in the tank, a forward flow of the sizing liquid is generated by rotation of the first roll in the tank. Therefore, the foreign matters floating on the sizing liquid in the region on the front side (anterior region) are discharged to the outside of the tank in a short time. However, in regions (lateral regions) on both sides of the first roll in the tank, the floating foreign matters may stay in the regions, and resultantly, the state of the sizing liquid in the tank may be deteriorated.

**[0007]** Specifically, in a conventional general warp sizing apparatus, including the warp sizing apparatus of PTL 1, intervals between the left and right sidewalls and the first roll in the sizing tank are narrow, and the lateral regions are very smaller than the region on the front side. Further, in the lateral regions, a degree of the forward flow of the sizing liquid generated by the rotation of the first roll is much smaller, as compared to the anterior region. For this reason, in the lateral regions, the flow of the sizing liquid is weak, so that the foreign matters floating near the liquid surface may stay in the regions for a certain period of time. On the other hand, the foreign matters are continuously generated during an operation of the warp sizing apparatus. Therefore, in some cases, the foreign matters may increase to such an extent that the foreign matters adversely affect the sizing to the warp sheet (the state of the sizing liquid in the tank may be deteriorated), such as a case where the foreign matters staying in the lateral regions flow to the anterior region and adhere to the warp sheet.

### SUMMARY

**[0008]** Therefore, an object of the present invention is to provide a warp sizing apparatus capable of preventing deterioration in state of a sizing liquid in a sizing tank due to an increase in foreign matters near a liquid surface, as much as possible.

**[0009]** In order to achieve the above object, the present invention has a preamble of the warp sizing apparatus as described above, and is characterized in that the left and right sidewalls each include an overflow part configured to allow overflow of the sizing liquid from an upper edge thereof.

**[0010]** Note that, as used herein, "an overflow part configured to allow overflow of the sizing liquid from an upper edge" refers to a part of the sidewall whose height position of an upper edge is determined so that the sizing liquid is allowed to overflow even from its upper edge while the sizing liquid overflows from the upper edge of the overflow-side end wall, as described above, due to

a relationship with the height position of the upper edge of the overflow-side end wall and a relationship with a type of the sizing liquid, an amount of supply of the sizing liquid into the tank and the like, in the sizing tank configured so that the sizing liquid overflows from the upper edge of the overflow-side end wall. Note that, the overflow part is not limited to a part of the sidewall and may also be the entire sidewall.

**[0011]** Further, in the present invention, both the sidewalls may each include a movable plate whose height position can be changed, and the above-described overflow part may be defined by the height position of the movable plate.

**[0012]** According to the warp sizing apparatus of the present invention, in the sizing tank where the sizing liquid overflows from the upper edge of the overflow-side end wall, the left and right sidewalls thereof include the overflow parts configured to allow overflow of the sizing liquid from the upper edges. That is, the sizing tank is configured so that the sizing liquid is allowed to overflow from the upper edge of the overflow-side end wall and is also allowed to overflow from the upper edges of at least parts of the left and right sidewalls. This makes it difficult for the above-described foreign matters to stay in the lateral regions. Therefore, according to the warp sizing apparatus of the present invention, it is possible to prevent the state of the sizing liquid in the tank from being deteriorated, as much as possible, as compared to a warp sizing apparatus including a sizing tank where the sizing liquid overflows only from the upper edge of the overflow-side end wall.

**[0013]** Further, when the left and right sidewalls are each configured to include the movable plate whose height position can be changed and the overflow part is defined by the height position of the movable plate, it is possible to appropriately adjust the overflow state of the sizing liquid to the outside of the tank, according to the type of the sizing liquid, the amount of supply of the sizing liquid, and the like.

## BRIEF DESCRIPTION OF DRAWINGS

**[0014]**

FIG. 1 is a side view of a warp sizing apparatus according to one embodiment of the present invention.
FIG. 2 is a plan view of FIG. 1.
FIG. 3 is a perspective view of a sizing tank shown in FIG. 1.

## DESCRIPTION OF EMBODIMENTS

**[0015]** Hereinafter, one embodiment of a warp sizing apparatus to which the present invention is applied will be described with reference to FIGS. 1 to 3. Note that, the present embodiment is an example where a warp sizing apparatus 1 includes a sizing roll 11 as a first roll immersed in a sizing liquid in a sizing tank and two squeeze rolls 13 and 15 as a second roll circumscribed around the first roll.

**[0016]** The warp sizing apparatus 1 includes a sizing tank 3 in which a sizing liquid S is stored, a sizing roll 11 having a warp sheet T wound thereon and immersed in the sizing liquid S, and a first squeeze roll 13 and a second squeeze roll 15 circumscribed around the sizing roll 11. The warp sizing apparatus 1 also includes a sizing liquid supply device 20 configured to supply, from above, the sizing liquid S to a circumscribed position of the sizing roll 11 and the first squeeze roll 13. The respective constitutional elements of the warp sizing apparatus 1 are described in detail, as follows.

**[0017]** The sizing tank 3 has a substantially rectangular shape, as seen from above, and is formed by a bottom plate 4 forming a bottom surface, and front and rear end walls 5 and 6 and left and right sidewalls 7 and 8 erected from four end edges of the bottom plate 4, respectively. Note that, a long side direction of the bottom surface forming a rectangular shape is a width direction of the sizing tank 3 (a direction in which the sidewalls 7 and 8 face each other), and a short side direction is a front-rear direction (a direction in which the end walls 5 and 6 face each other).

**[0018]** In addition, the end wall (rear end wall) 6 on the rear side of the sizing tank 3 is provided with a supply unit 30 connected to a supply source of the sizing liquid S, which will be described later. The sizing liquid S is supplied into the sizing tank 3 via the supply unit 30, so that the sizing liquid S is stored in the tank.

**[0019]** The sizing roll 11 is constituted by a roll portion 11a on which the warp sheet T is wound, and shaft portions 11b and 11b provided at both ends of the roll portion 11a. The sizing roll 11 is rotatably supported on both the shaft portions 11b and 11b by a frame (not shown) of the warp sizing apparatus 1. Note that, the sizing roll 11 is provided so that the roll portion 11a is located within an existence range of the sizing tank 3 as seen from above and an axis line direction thereof coincides with the width direction. In addition, the sizing roll 11 is provided so that a lower end of the roll portion 11a is located lower than an upper edge of the end wall (front end wall) 5 on the front side in a vertical direction. Thereby, the sizing roll 11 is in a state where the lower portion of the roll portion 11a is immersed in the sizing liquid S in a state where the sizing liquid S is stored in the sizing tank 3.

**[0020]** Note that, the warp sizing apparatus 1 is provided with a drive mechanism (not shown) for rotationally driving the sizing roll 11, and the sizing roll 11 is actively rotationally driven in accordance with a progress of the warp sheet T. The warp sheet T is guided in a form of being wound onto the roll portion 11a of the sizing roll 11, and is immersed in the sizing liquid S and is impregnated with the sizing liquid S in a process of passing through the roll portion 11a.

**[0021]** Further, the second squeeze roll 15 for squeezing the impregnated sizing liquid S in the sizing tank 3 from the warp sheet T is provided in arrangement of being

located on a front side with respect to the sizing roll 11. Like the sizing roll 11, the second squeeze roll 15 is constituted by a roll portion 15a and shaft portions 15b and 15b provided at both ends of the roll portion 15a.

**[0022]** The second squeeze roll 15 is rotatably supported on both the shaft portions 15b and 15b by the frame in a direction in which an axis line direction thereof is made to coincide with the axis line direction of the sizing roll 11. Note that, the second squeeze roll 15 is supported by the frame via a pressing mechanism (not shown), and is provided so that the roll portion 15a is circumscribed in a state of being pressed against the roll portion 11a of the sizing roll 11. Therefore, the second squeeze roll 15 is configured to rotate as the sizing roll 11 is rotationally driven as described above.

**[0023]** Further, as for arrangement of the second squeeze roll 15 in the vertical direction, in the present embodiment, an axis center thereof is located slightly higher than an axis center of the sizing roll 11. Therefore, the circumscribed position of the second squeeze roll 15 with respect to the sizing roll 11 is located slightly above the shaft portion 11b in the vertical direction, on an outer peripheral surface of the roll portion 11a of the sizing roll 11.

**[0024]** Further, the warp sheet T wound on the sizing roll 11 as described above passes between the sizing roll 11 and the second squeeze roll 15 circumscribed as described above, and is then pulled out toward an outside. When passing between the sizing roll 11 and the second squeeze roll 15 in this way, the extra sizing liquid S is squeezed from the warp sheet T impregnated with the sizing liquid S as described above.

**[0025]** Further, on an upstream side of the sizing roll 11, a supply nozzle 24 for supplying the sizing liquid S so as to impregnate the warp sheet T with the sizing liquid S on the upstream side, and the first squeeze roll 13 for squeezing the sizing liquid S supplied by the supply nozzle 24 are provided.

**[0026]** These are specifically described. The first squeeze roll 13 is constituted by a roll portion 13a and shaft portions 13b and 13b provided at both ends of the roll portion 13a, like the second squeeze roll 15. The first squeeze roll 13 is rotatably supported on both the shaft portions 13b and 13b by the frame in a direction in which an axis line direction thereof is made to coincide with the axis line direction of the sizing roll 11. Note that, the first squeeze roll 13 is also rotatably supported by the frame via the pressing mechanism, like the second squeeze roll 15. Therefore, the first squeeze roll 13 is also circumscribed in a state of being pressed against the roll portion 11a of the sizing roll 11, and is configured to rotate as the sizing roll 11 is rotationally driven.

**[0027]** Further, in the present embodiment, the first squeeze roll 13 is provided at a position where a position of an axis center thereof substantially coincides with a position of the axis center of the second squeeze roll 15 in the vertical direction. That is, the first squeeze roll 13 is provided symmetrically with respect to the sizing roll 11 in the front-rear direction. Therefore, the circumscribed position of the first squeeze roll 13 with respect to the sizing roll 11 is substantially the same as the circumscribed position of the second squeeze roll 15 with respect to the sizing roll 11, on the outer peripheral surface of the roll portion 11a of the sizing roll 11.

**[0028]** Note that, the first squeeze roll 13 is circumscribed around the sizing roll 11 in this way, so that a wedge-shaped gap 14 is formed between the sizing roll 11 and the first squeeze roll 13. The supply nozzle 24 configured to supply the sizing liquid S toward the gap 14 is provided above the gap 14.

**[0029]** The supply nozzle 24 is provided in plural so as to be arranged at predetermined intervals in the width direction within the existence range of the roll portion 11a in the axis line direction of the sizing roll 11. The sizing liquid S is supplied from above to the gap 14 via each supply nozzle 24, so that a sizing liquid pool 18 in which the sizing liquid S is retained is formed in the gap 14.

**[0030]** In addition, the warp sheet T is guided in a form of being wound onto the roll portion 13a of the first squeeze roll 13, passes between the sizing roll 11 and the first squeeze roll 13 circumscribed as described above, and is then wound on the sizing roll 11 as described above. By passing through the sizing liquid pool 18 formed between the two rolls, the warp sheet T is in a state of being impregnated with the sizing liquid S. When the warp sheet T impregnated with the sizing liquid S passes between the sizing roll 11 and the first squeeze roll 13, the extra sizing liquid S is squeezed from the warp sheet T.

**[0031]** Note that, each supply nozzle 24 is a part of the sizing liquid supply device configured to supply, from above, the sizing liquid S to the gap 14 as described above, and the warp sizing apparatus 1 includes such sizing liquid supply device 20. In addition to the supply nozzles 24 described above, the sizing liquid supply device 20 includes a supply tank 22, which is a supply source of the sizing liquid S that is supplied to the supply nozzles 24. In the sizing liquid supply device 20, the supply tank 22 and each supply nozzle 24 are connected to each other by a pipeline 26, a pump P is provided in the pipeline 26, and the sizing liquid S is supplied to each nozzle 24 by the pump P. Further, in the present embodiment, the pipeline 26 is branched and also connected to the supply unit 30, and the sizing liquid supply device 20 is configured to supply the sizing liquid S even to the sizing tank 3.

**[0032]** Further, in the warp sizing apparatus 1, the sizing liquid S is supplied to the sizing tank 3, so that the stored sizing liquid S overflows to an outside of the tank. Therefore, the warp sizing apparatus 1 is provided with a recovery tank 40 for recovering the overflowed sizing liquid S, below the sizing tank 3.

**[0033]** The recovery tank 40 is formed in a housing shape opening upward, like the sizing tank 3, an interval between front and rear end walls 41 and 42 is greater than a dimension of the sizing tank 3 in the short side

direction (the front-rear direction), and an interval between left and right sidewalls 43 and 44 is greater than a dimension of the sizing tank 3 in the long side direction (the width direction). In addition, the sizing liquid S of the sizing liquid pool 18 in the gap 14 is also overflowed to both the roll portion 11a of the sizing roll 11 and the roll portion 13a of the first squeeze roll 13 by the supply of the sizing liquid S from the supply nozzles 24. The overflowed sizing liquid S is also recovered by the recovery tank 40. Further, the warp sizing apparatus 1 is configured so that the sizing liquid S recovered in the recovery tank 40 is sent to the above-described supply tank 22.

**[0034]** In the warp sizing apparatus 1 as described above, in the present invention, for the purpose of preventing deterioration in state of the sizing liquid in the sizing tank as much as possible, the sizing tank is configured so that the left and right sidewalls each include an overflow part configured to allow overflow of the sizing liquid from the upper edge thereof. One embodiment (the present embodiment) of the sizing tank 3 of the present invention is described in detail, as follows.

**[0035]** First, the front end wall 5 of the sizing tank 3 is a part erected from the bottom plate 4 and is constituted by a fixed end wall 5a, which is a part integrated with the bottom plate 4, and a front movable plate 5b attached to the fixed end wall 5a. Note that, the fixed end wall 5a forms a rectangular shape where a dimension in the width direction is the same as the bottom plate 4 and a side parallel to the width direction, as seen in a thickness direction, is a long side. In addition, the fixed end wall 5a has male screw portions 5a1 that each protrude in a shaft shape from an outer end surface (an end surface on an opposite side to an end surface facing the rear end wall 6) and have a male screw formed on an outer periphery thereof. Note that, the male screw portions 5a1 are provided in four on the fixed end wall 5a in a form of being aligned side by side at equal intervals in the width direction (a direction of the long side of the fixed end wall 5a).

**[0036]** The front movable plate 5b is a plate material having a rectangular shape, as seen in a plate thickness direction, and is a member whose dimension in the long side direction of an end surface thereof is substantially the same as the dimension in the long side direction of the fixed end wall 5a. Further, in the present embodiment, a dimension in the short side direction of the end surface of the front movable plate 5b is substantially the same as the dimension in the short side direction of the end surface of the fixed end wall 5a. Further, the front movable plate 5b has insertion holes 5b1 that are holes for inserting the male screw portions 5a1 of the fixed end wall 5a described above and are holes formed to penetrate in the plate thickness direction. Note that, the insertion holes 5b1 are formed in four so that positions thereof are matched with the respective male screw portions 5a1 in a state where the positions of the front movable plate 5b and the fixed end wall 5a are aligned in the width direction. Further, the front movable plate 5b is attached to the fixed end wall 5a in a form of sandwiching the front movable plate 5b by the outer end surface of the fixed end wall 5a and respective nuts screwed onto the respective male screw portions 5a1 by inserting the corresponding male screw portions 5a1 into the respective insertion holes 5b1 and tightening the nuts.

**[0037]** Note that, each of the insertion holes 5b1 of the front movable plate 5b is formed as a long hole that is long in the short side direction of the front movable plate 5b. This makes it possible to change the front movable plate 5b in the vertical direction in terms of an attaching position to the fixed end wall 5a. In addition, the fixed end wall 5a of the front end wall 5 is configured so that a height position of an upper edge thereof is a position lower than a height position of an upper edge of the rear end wall 6. In addition, each insertion hole 5b1 is formed so that the height position of the upper edge of the front movable plate 5b and the height position of the upper edge of the fixed end wall 5a match each other in a state where the front movable plate 5b is attached to the fixed end wall 5a at the lowest position.

**[0038]** Further, each insertion hole 5b1 is formed so that the height position of the upper edge of the front movable plate 5b becomes a position lower than the height position of the upper edge of the rear end wall 6 in a state where the front movable plate 5b is attached to the fixed end wall 5a at the highest position. In other words, the rear end wall 6 is formed to have such a height that the upper edge thereof is located higher than the front end wall 5 even when the front movable plate 5b of the front end wall 5 is located at the highest position. Therefore, the upper edge of the front end wall 5 is located at a position lower than the upper edge of the rear end wall 6, regardless of the position where the front movable plate 5b is attached to the fixed end wall 5a.

**[0039]** In addition, the sizing liquid S stored in the sizing tank 3 overflows at least from the upper edge of the front end wall 5 (front movable plate 5b) as the sizing liquid S is supplied into the tank, as described above. Therefore, in the present embodiment, the rear end wall 6 corresponds to the supply-side end wall referred to in the present invention, and the front end wall 5 (the fixed end wall 5a + the front movable plate 5b) corresponds to the overflow-side end wall referred to in the present invention.

**[0040]** In the sizing tank 3, each of the left and right sidewalls 7 and 8 is constituted by a fixed sidewall 7a; 8a, which is a part erected from the bottom plate 4, and a lateral movable plate 7b; 8b attached to the fixed sidewall 7a; 8a, similar to the front end wall 5. Therefore, both the fixed sidewalls 7a and 8a are formed integrally with the bottom plate 4, the fixed end wall 5a and the rear end wall 6 in a form of extending between the fixed end wall 5a of the front end wall 5 and the rear end wall 6. In addition, both the fixed sidewalls 7a and 8a are each formed as a wall having such a height that a height position of an upper edge thereof coincides with the height position of the upper edge of the fixed end wall 5a of the front end wall 5. As a result, the height positions of the

upper edges of both the fixed sidewalls 7a and 8a are also lower than the height position of the upper edge of the rear end wall 6.

**[0041]** Note that, both the fixed sidewalls 7a and 8a have male screw portions (only 7a1 is shown in FIG. 3) formed on outer surfaces thereof (end surfaces on an opposite side to end surfaces on a side facing the other side of both the sidewalls 7 and 8), in a similar manner to the male screw portions 5a1 of the fixed end wall 5a of the front end wall 5. Note that, the male screw portions are respectively provided in two on the outer surfaces of the respective fixed sidewalls 7a and 8a in a form of being aligned side by side in the front-rear direction.

**[0042]** In addition, each of the lateral movable plates 7b and 8b is a plate material having a rectangular shape, as seen in the plate thickness direction. A dimension in a short side direction of an end surface of each of the lateral movable plates 7b and 8b is substantially the same as the dimension in the short side direction of the end surface of the front movable plate 5b. However, a dimension in a long side direction of the end face of each of the lateral movable plates 7b and 8b is slightly greater than dimensions in the front-rear direction of the fixed sidewalls 7a and 8a. Specifically, the dimension in the long side direction of each of the lateral movable plates 7b and 8b substantially matches an interval between the outer end surface of the front end wall 5 and an outer end surface of the rear end wall 6 (an end surface on an opposite side to an end surface facing the front end wall 5) in the front-rear direction.

**[0043]** Further, each of the lateral movable plates 7b and 8b has insertion holes (only 7b1 is shown in FIG. 3) that are two holes for inserting the male screw portions of the fixed sidewall 7a; 8a and are holes formed to penetrate in the plate thickness direction. Note that, the insertion holes are formed in each of the lateral movable plates 7b and 8b so that positions of both side edges in the long side direction of the end surface of each of the lateral movable plates 7b and 8b substantially coincide with a position of the outer end surface of the front end wall 5 and a position of the outer end surface of the rear end wall 6 in a state where the male screw portions are inserted in the insertion holes. Further, the lateral movable plates 7b and 8b are attached to the fixed sidewalls 7a and 8a in a form of sandwiching the lateral movable plates 7b and 8b by the outer surfaces of the fixed sidewall 7a and 8a and respective nuts screwed onto the respective male screw portions by inserting the corresponding male screw portions into the respective insertion holes and tightening the nuts.

**[0044]** In addition, each of the insertion holes of both the lateral movable plates 7b and 8b is also formed as a long hole that is long in the short side direction of each of the lateral movable plates 7b and 8b. This makes it possible to change the lateral movable plates 7b and 8b in the vertical direction in terms of attaching positions to the fixed sidewalls 7a and 8a. In addition, the insertion holes are respectively formed so that height positions of upper edges of the lateral movable plates 7b and 8b and height positions of upper edges of the fixed sidewalls 7a and 8a match each other in a state where the lateral movable plates 7b and 8b are attached to the fixed sidewalls 7a and 8a at the lowest position. Further, the insertion holes are respectively formed so that the height positions of the upper edges of the lateral movable plates 7b and 8b become positions lower than the height position of the upper edge of the rear end wall 6 in a state where the lateral movable plates 7b and 8b are attached to the fixed sidewalls 7a and 8a at the highest position.

**[0045]** In addition, the attaching positions of both the lateral movable plates 7b and 8b to the fixed sidewalls 7a and 8a are set so that the height positions of the upper edges of the lateral movable plates 7b and 8b become height positions at which the sizing liquid overflows not only from the upper edge of the front movable plate 5b but also from the upper edges thereof, considering a relationship with the height position of the upper edge of the front end wall 5 (front movable plate 5b), which is the overflow-side end wall, a type of the sizing liquid S and the like. In the present embodiment, both the lateral movable plates 7b and 8b are attached to the fixed sidewalls 7a and 8a as described above so that the height positions of the entire upper edges thereof are substantially the same as the height position of the upper edge of the front movable plate 5b.

**[0046]** Thereby, in the sizing tank 3, the stored sizing liquid S overflows from the entire upper edges of both the sidewalls 7 and 8 (both the lateral movable plates 7b and 8b), in addition to the entire upper edge of the front end wall 5 (front movable plate 5b), as the sizing liquid S is supplied into the tank, as described above. Therefore, in the present embodiment, the entire upper edges of both the sidewalls 7 and 8 (both the lateral movable plates 7b and 8b) correspond to the overflow part configured to allow overflow of the sizing liquid referred to in the present invention, respectively.

**[0047]** According to the warp sizing apparatus 1 of the present embodiment configured in this way, in the sizing tank 3 where the sizing liquid overflows from the upper edge of the overflow-side end wall (front end wall 5), foreign matters such as fluff of the warp floating near the liquid surface of the sizing liquid S in the tank and air bubbles caused due to rotation of the sizing roll 11 are discharged to the outside of the tank not only by the overflow of the sizing liquid S from the upper edge of the front end wall 5 but also by the overflow of the sizing liquid S from the upper edges of the left and right sidewalls 7 and 8. Thereby, as compared to a warp sizing apparatus where the sizing tank is configured so that the sizing liquid overflows only from the upper edge of the front end wall, it is more difficult for the foreign matters to stay in regions on both sides of the sizing roll 11 (regions between the sizing roll 11 and the left and right sidewalls 7 and 8) in the tank. Therefore, according to the warp sizing apparatus 1, the foreign matters are suppressed from increasing in the sizing tank 3, so that deterioration in state of

the sizing liquid S in the tank is prevented as much as possible.

**[0048]** In the above, one embodiment (hereinafter, referred to as 'above embodiment') of the warp sizing apparatus to which the present invention is applied has been described. However, the present invention is not limited to the configuration described in the above embodiment, and can also be implemented by other embodiments (modified embodiments) as described below.

**[0049]** (1) As for the sizing tank, in the above embodiment, the front end wall 5 that is the overflow-side end wall is constituted by the fixed end wall 5a and the front movable plate 5b attached to the fixed end wall 5a. In addition, both the sidewalls 7 and 8 are also constituted by the fixed sidewalls 7a and 8a and the lateral movable plates 7b and 8b attached to the fixed sidewalls 7a and 8a, respectively. However, in the present invention, the overflow-side end wall and both the sidewalls for constituting the sizing tank are not limited to being constituted by the fixed wall (the fixed end wall 5a, the fixed sidewalls 7a and 8a) and the movable plate (the front movable plate 5b, the lateral movable plates 7b and 8b) attached to the fixed wall, respectively, and one or both thereof may be constituted only by the fixed wall.

**[0050]** For example, in a case where a type of the warp to be sized and a type of the sizing liquid to be used in the warp sizing apparatus are fixed, the conditions do not change. Therefore, the overflow-side end wall and both the sidewalls may be constituted only by the fixed walls. However, from a standpoint of increasing the versatility of the warp sizing apparatus, one or both of the overflow-side end wall and both the sidewalls are preferably configured to include the movable plate so that the height position of the upper edge can be adjusted.

**[0051]** In addition, in the above embodiment, the lateral movable plates 7b and 8b of both the sidewalls 7 and 8 are attached to the fixed sidewalls 7a and 8a in conformity to the height position of the front movable plate 5b of the front end wall 5 so that the height positions of the upper edges of the front end wall 5 and both the sidewalls 7 and 8 are the same. That is, in the sizing tank, the height position of the upper edge of the overflow-side end wall and the height positions of the upper edges of both the sidewalls are substantially the same. However, in the present invention, the sizing tank is not limited to one where the height position of the upper edge of the overflow-side end wall and the height positions of the upper edges of both the sidewalls are substantially the same. For example, in a case where the overflow-side end wall and both the sidewalls are configured to include the movable plates as in the above embodiment, each movable plate may be attached to the fixed wall so that the height positions of the upper edges of the overflow-side end wall and both the sidewalls are different. Further, in a case where the overflow-side end wall and both the sidewalls are constituted only by the fixed walls, as described above, the overflow-side end wall and both the sidewalls (both the fixed walls) may be formed so that the height positions of the upper edges are different.

**[0052]** Note that, in the present invention, the overflow-side end wall is configured to have the height position of the upper edge from which the sizing liquid S overflows. In addition, both the sidewalls are configured so that the height positions of the upper edges thereof become the height positions at which the sizing liquid S overflows from the upper edges (overflow parts), in relation to the height position of the upper edge of the overflow-side end wall. However, it is also considered that, if the height positions of the upper edges of both the sidewalls are too lower than the height position of the upper edge of the overflow-side end wall (lower than the upper edge of the overflow-side end wall by 15 mm or greater), the sizing liquid does not overflow from the upper edge of the overflow-side end wall, depending on conditions such as a type of the sizing liquid to be used. For this reason, both the sidewalls are preferably configured so that, even when the height positions of the upper edges thereof are set lower than the height position of the upper edge of the overflow-side end wall, a difference in the height position is smaller than 15 mm. Further, both the sidewalls may also be configured so that the height positions of the upper edges thereof are slightly higher than the height position of the upper edge of the overflow-side end wall.

**[0053]** Further, in the above embodiment, both the sidewalls 7 and 8 are configured so that the entire upper edges of both the sidewalls 7 and 8 (both the lateral movable plates 7b and 8b) become the overflow parts. However, in the present invention, both the sidewalls may be configured so that at least parts of the upper edges thereof are formed as the overflow parts, and is not limited to the configuration where the entire upper edges are formed as the overflow parts. Therefore, both the sidewalls may be each configured so that a part thereof is lower than the other part in terms of the height position of the upper edge so that the sizing liquid S overflows only from an upper edge of the part.

**[0054]** For example, both the sidewalls may be configured so that the upper edges thereof form a stepped shape or a concave shape, as seen in the width direction, or may be configured so that the upper edges thereof are inclined so as to be gradually lower from the supply-side end wall toward the overflow-side end wall in the front-rear direction. Note that, as for the latter, in a case where both the sidewalls are each constituted by the fixed wall and the movable plate as in the above embodiment, the movable plate may be attached to the fixed wall in such a form that the upper edge thereof forms an angle with respect to the upper edge of the fixed wall.

**[0055]** In addition, in the above embodiment, both the sidewalls 7 and 8 are configured such that one lateral movable plate 7b; 8b is attached to the fixed sidewall 7a; 8a. However, in the present invention, the sidewall may be configured such that a part corresponding to the lateral movable plate of the above embodiment attached to the fixed sidewall is formed by combining a plurality of plate materials. In this case, each plate material becomes a

lateral movable plate, and each is independently attached to the fixed sidewall. In a case where the sidewall is configured in this way, the height position of the upper edge can be changed in a unit of the lateral movable plate. Therefore, some lateral movable plates can be attached to the fixed sidewall so that the height positions of the upper edges thereof are lower than the other lateral movable plates, thereby causing the corresponding part to be as an overflow part. Note that, in a case where the sidewall is constituted by the fixed sidewall and the lateral movable plate, the numbers of the lateral movable plates on both the sidewalls are not necessarily required to be the same.

**[0056]** Further, in a case where a sidewall is configured to include a plurality of lateral movable plates, the sidewall is not limited to the configuration where the lateral movable plates exist over the existence range of the fixed sidewall in the front-rear direction. Specifically, a plurality of lateral movable plates whose side dimensions parallel to the front-rear direction at the time of being attached to the fixed sidewall are smaller than a half of the dimension in the front-rear direction of the fixed sidewall is prepared, and the sidewall may be configured in such a form that the lateral movable plates are attached to the fixed sidewall at intervals in the front-rear direction. In this case, the upper edge of the fixed sidewall of at least a part where the lateral movable plates are not attached in the front-rear direction becomes the overflow part.

**[0057]** (2) As for the warp sizing apparatus, the warp sizing apparatus 1 of the above embodiment has such a configuration that the supply unit 30 is provided on the rear end wall 6 of the front and rear end walls 5 and 6 of the sizing tank 3 and the sizing liquid S is supplied from the rear side. That is, the rear end wall 6 is the supply-side end wall, and accordingly, the front end wall 5 is the overflow-side end wall. However, in the present invention, the warp sizing apparatus may also be configured such that the supply unit is provided on the front end wall and the sizing liquid S is supplied from the front side. In this case, the front end wall becomes the supply-side end wall, and the rear end wall becomes the overflow-side end wall.

**[0058]** Further, in the warp sizing apparatus 1 of the above embodiment, the device for supplying the sizing liquid S to the supply nozzles 24 and the sizing tank 3 (supply unit 30) is a common device (sizing liquid supply device 20). However, in the present invention, the warp sizing apparatus may also be configured so that a device for supplying the sizing liquid S to the sizing tank (supply unit) is provided separately from a device for supplying the sizing liquid S to the supply nozzles.

**[0059]** However, the warp sizing apparatus of the preamble of the present invention is not limited to the configuration where the sizing liquid S is supplied to the wedge-shaped gap between the sizing roll and the first squeeze roll circumscribed around the sizing roll on the rear side. Therefore, the warp sizing apparatus may also be configured not to include the supply nozzles for supplying the sizing liquid S to the gap. In this case, the warp sizing apparatus may be configured in a form of omitting even the first squeeze roll.

**[0060]** (3) As for the first roll and the second roll, in the above embodiment, the warp sizing apparatus 1 is configured in such a form that the sizing roll 11 is immersed in the sizing liquid S in the sizing tank 3 and the first and second squeeze rolls 13 and 15 are circumscribed around the sizing roll 11 so as to sandwich the path of the warp sheet T therebetween. That is, in the warp sizing apparatus 1 of the above embodiment, the sizing roll 11 is the first roll, and the two squeeze rolls 13 and 15 circumscribed around the sizing roll 11 are the second roll.

**[0061]** However, in the present invention, the warp sizing apparatus may also be configured so that the second squeeze roll is immersed in the sizing liquid S in the sizing tank. More specifically, the warp sizing apparatus may also be configured in such a form that the sizing tank is arranged below the second squeeze roll in the front-rear direction and the second squeeze roll is arranged below the sizing roll so as to be immersed in the sizing liquid S in the sizing tank. In this case, the second squeeze roll becomes the first roll, and the sizing roll circumscribed around the second squeeze roll becomes the second roll.

**[0062]** The present invention is not limited to the above embodiment, and can be variously changed without departing from the gist of the present invention.

REFERENCE SIGNS LIST

**[0063]**

1: warp sizing apparatus
3: sizing tank
4: bottom plate
5: front end wall
6: rear end wall
7: left sidewall
8: right sidewall
11: sizing roll
11a: roll portion
11b: shaft portion
13: first squeeze roll
13a: roll portion
13b: shaft portion
14: gap
15: second squeeze roll
15a: roll portion
15b: shaft portion
18: sizing liquid poo
20: sizing liquid supply device
22: supply tank
24: supply nozzle
26: pipeline
30: supply unit
40: recovery tank
S: sizing liquid
T: warp sheet

## Claims

1. A warp sizing apparatus (1) comprising a sizing tank (3) having a bottom plate (4), front and rear end walls (5 and 6) and left and right side walls (7 and 8) and configured to store a sizing liquid (S); a first roll (11) immersed in the sizing liquid (S) in the sizing tank (3); and a second roll (13; 15) circumscribed around the first roll (11) so as to sandwich a path of a warp sheet (T) therebetween, wherein a supply unit (30) configured to supply the sizing liquid is provided on one of the front and rear end walls (5 and 6) of the sizing tank (3), and a height position of an upper edge of an overflow-side end wall on an opposite side to a supply-side end wall, which is the end wall on a side on which the supply unit (30) is provided, is a position lower than a height position of an upper edge of the supply-side end wall, so that the sizing liquid (S) overflows from the overflow-side end wall, **characterized in that**
both the sidewalls (7 and 8) each include an overflow part configured to allow overflow of the sizing liquid (S) from an upper edge thereof.

2. The warp sizing apparatus (1) according to Claim 1, **characterized in that**
both the sidewalls (7 and 8) each include a movable plate (7b; 8b) whose height position can be changed, and the overflow part is defined by the height position of the movable plate.

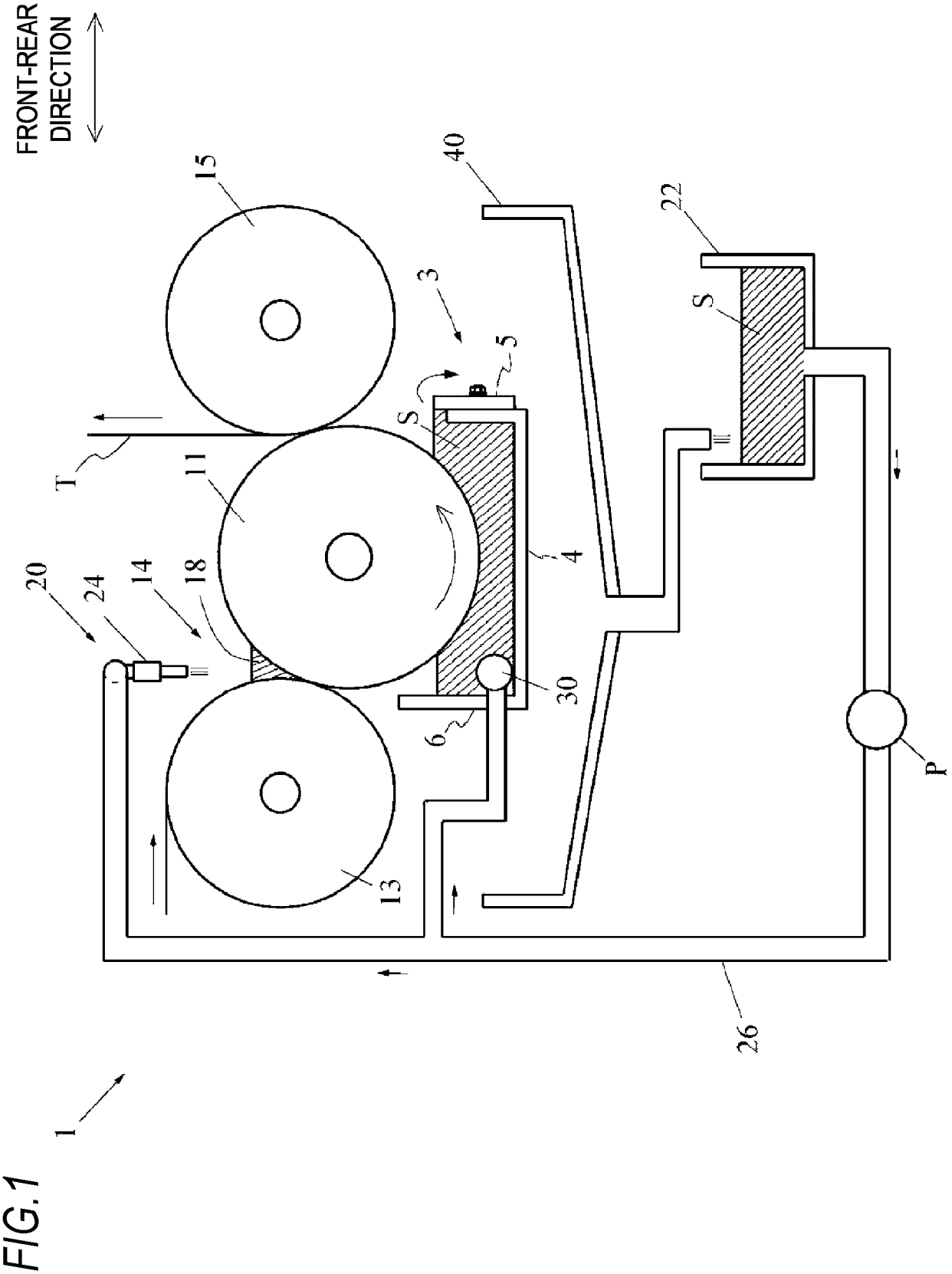
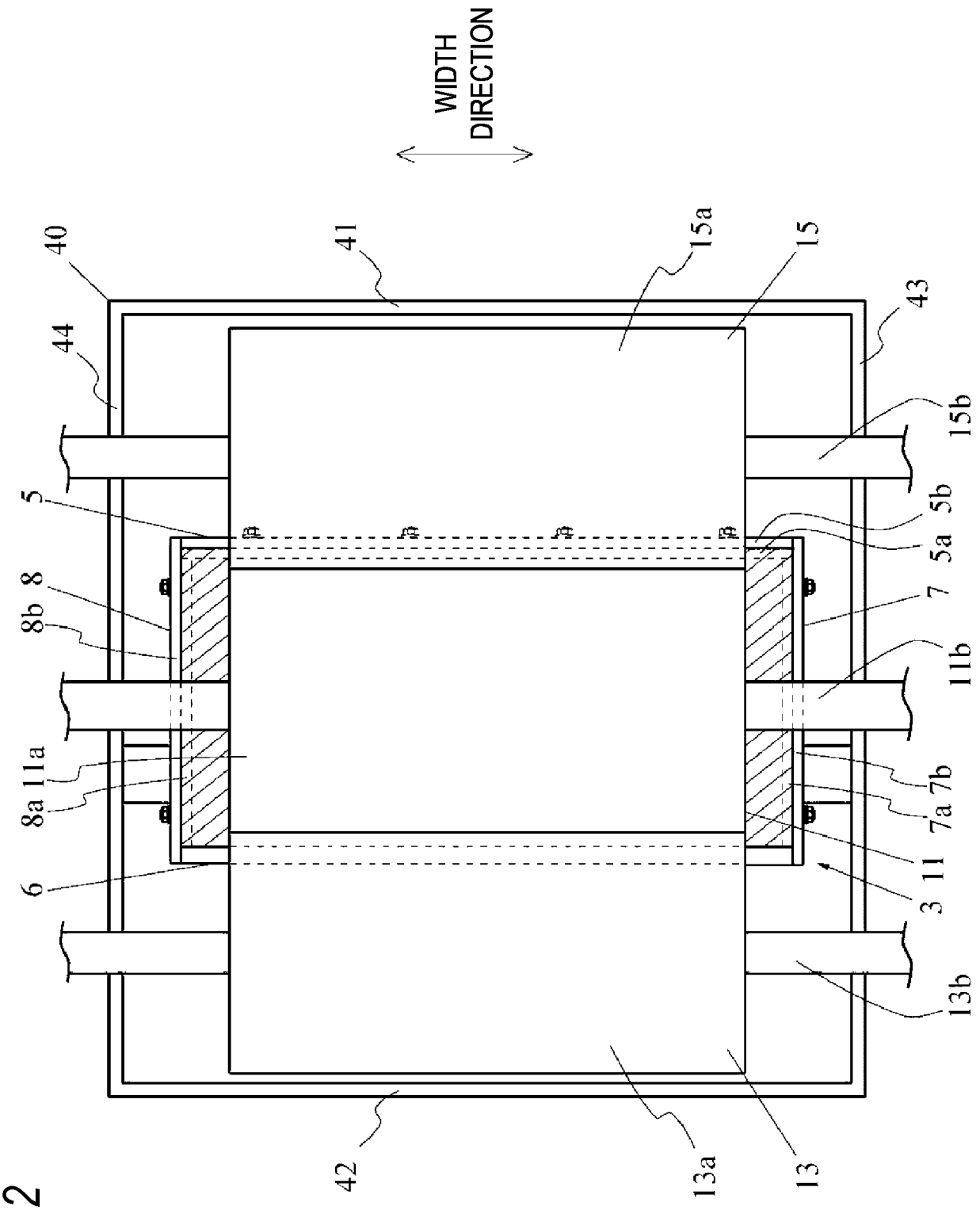



FIG.1

FIG.2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11
13b
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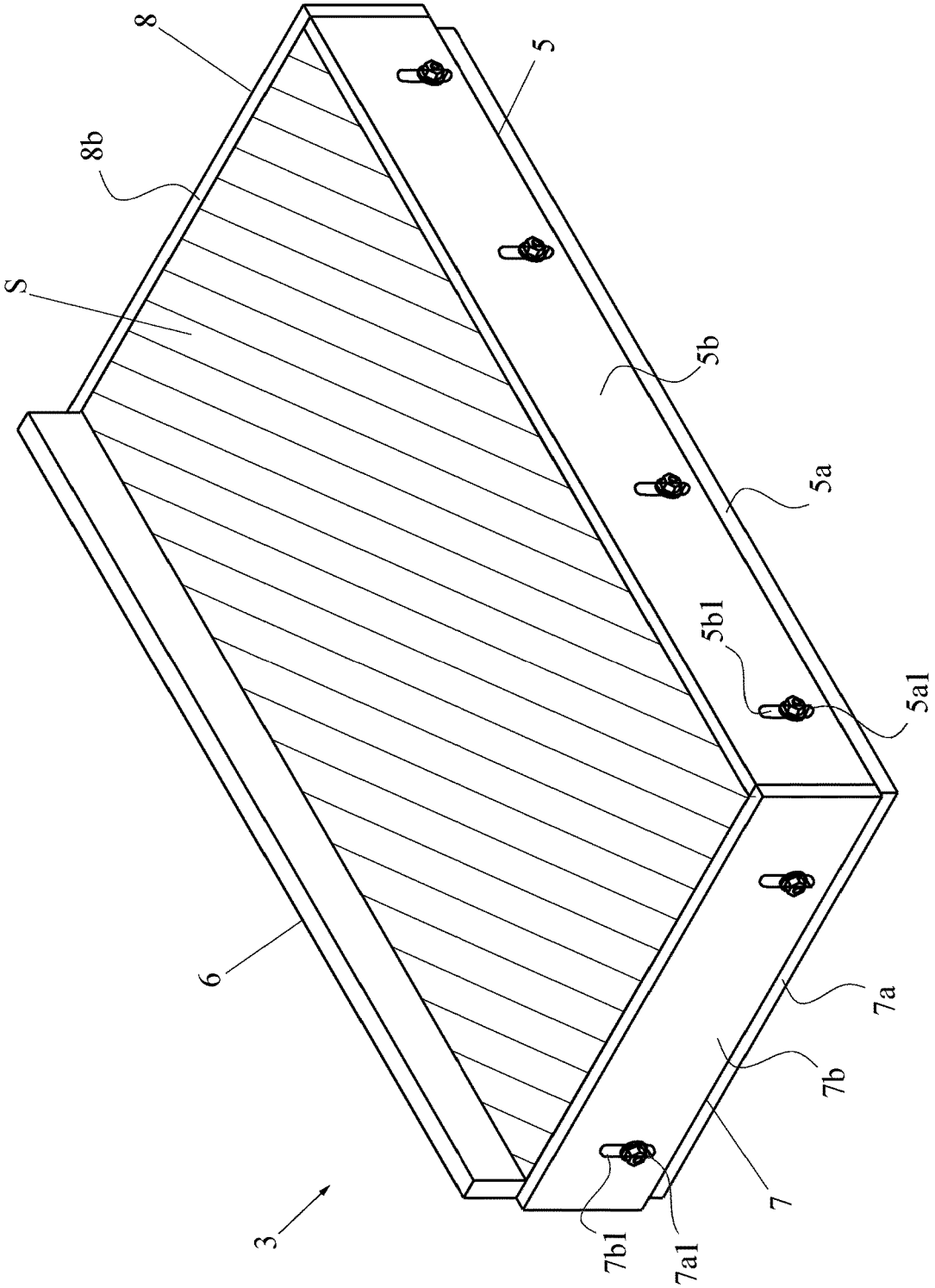
13a
13

FIG.3



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# EUROPEAN SEARCH REPORT

Application Number
EP 22 15 8549

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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 | 21 July 2022 | Clivio, Eugenio |

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