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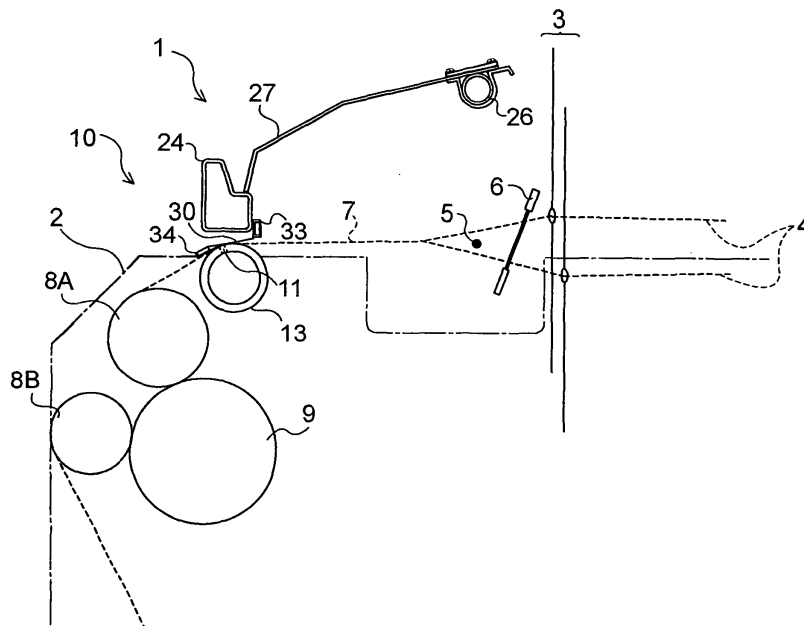
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(54) **Dewatering device for water jet loom and sheet used in dewatering device**

(57) A dewatering device for a water jet loom includes a dewatering pipe disposed on a take-up path of a woven cloth and having a suction hole that extends in a weaving width direction and that comes into contact with the woven cloth and an airtight sheet disposed so as to cover the suction hole from above the woven cloth and having

a sheet surface that comes into contact with the woven cloth. At least one of an outer peripheral portion of the dewatering pipe and the sheet surface of the airtight sheet has guide walls that are arranged along the weaving width direction with intervals therebetween and that extend in a direction that intersects the weaving width direction over a section that covers the suction hole.

FIG. 1



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a technique for efficiently dewatering a woven cloth that is wetted during weft insertion in a water jet loom that performs weft insertion by water jet.

2. Description of the Related Art

[0002] In water jet looms, a weft yarn is inserted into a warp shed with a water jet during weft insertion. At this time, the ejected water falls in the form of water drops and infiltrates through the surface of a woven cloth and into spaces between yarns in the woven cloth. As a technique for removing the water drops from the wet woven cloth in such a water jet loom, a device which includes a dewatering pipe having a suction hole and arranged on a take-up path of the woven cloth is known (see, for example, Japanese Unexamined Patent Application Publication No. 55-12878 (Fig. 1) and Japanese Unexamined Utility Model Registration Application Publication No. 61-33889 (Figs. 1 and 2)). In this device, an airflow toward the suction hole is generated by setting the pressure in the dewatering pipe to a negative pressure, and accordingly the woven cloth is dewatered. However, since an airflow that passes through the woven cloth is generated, even though the moisture on the surface of the woven cloth passes through the woven cloth and is removed therefrom in a region near the suction hole, the degree of vacuum in the dewatering pipe is considerably reduced due to the airflow. In addition, the moisture that soaks into the structure of the woven cloth, that is, into the spaces between the warp and weft yarns, cannot be sufficiently removed. Thus, sufficient dewatering cannot be performed.

[0003] Accordingly, as a technique for preventing a reduction in the degree of vacuum by reducing the amount of airflow that passes through the woven cloth, a structure in which an impervious sheet or a cover having an arc shape in cross section is arranged so as to cover the dewatering pipe from above the woven cloth that passes by the suction hole is known (see, for example, Japanese Unexamined Patent Application Publication No. 62-156345 (lines 1 to 11 in the upper right column on page 3 and Figs. 1 to 3) and Japanese Unexamined Utility Model Registration Application Publication No. 5-66084 (paragraphs [0009] to [0010] and Figs. 1 and 2)).

[0004] According to the techniques described in Japanese Unexamined Patent Application Publication No. 62-156345 and Japanese Unexamined Utility Model Registration Application Publication No. 5-66084, the degree of vacuum in the dewatering pipe is increased since the amount of airflow that passes through the woven cloth is reduced. Therefore, an amount of airflow that passes

through the structure of the woven cloth, that is, through the spaces between the warp and weft yarns, is somewhat increased. However, in practice, the overall degree of dewatering of the woven cloth cannot be increased as expected. Although the reason for this is uncertain, the present inventors suspect that this is because of the following reason. That is, the airflow must pass through the spaces between the yarns in the woven cloth, and this functions as a resistance to the airflow and reduces the amount of airflow. As a result, a region in which an airflow strong enough to suck in the water can be generated is limited to a small region around the suction hole. In addition, unlike the structures according to Japanese Unexamined Patent Application Publication No. 55-12878 and Japanese Unexamined Utility Model Registration Application Publication No. 61-33889, the water drops on the surface of the woven cloth are also caused to pass through the spaces in the woven cloth. Recently, the speed of operation of water jet looms has been increased and the time period in which the woven cloth passes by the suction hole has been reduced accordingly. Therefore, the present inventors suspect that moisture cannot be sufficiently sucked in in such a short time.

[0005] To achieve a desired degree of dewatering by the above-described device, the amount of airflow must be increased by increasing the degree of negative pressure. As a result, the woven cloth is strongly pulled by the suction hole when the woven cloth slides along the suction pipe, and therefore there is a risk that the woven cloth will be damaged. In addition, the capacity of a suction blower that functions as a negative-pressure source is increased. Accordingly, power consumption is increased and energy is wasted accordingly.

SUMMARY OF THE INVENTION

[0006] In light of the above-described situation, the present invention relates to a technique for dewatering a woven cloth that is wetted during weft insertion and an object of the present invention is to efficiently remove moisture from the woven cloth without increasing energy consumption of a negative-pressure source.

[0007] The present invention is applied to a dewatering device for a water jet loom including a dewatering pipe disposed on a take-up path of a woven cloth and having a suction hole that extends in a weaving width direction and that comes into contact with the woven cloth and a sheet disposed so as to externally cover the suction hole and having a sheet surface that comes into contact with the woven cloth, wherein the woven cloth is dewatered by causing the woven cloth to pass by the suction hole while the pressure in the dewatering pipe is set to a negative pressure. According to a first aspect of the present invention, guide walls are provided on at least one of an outer peripheral portion of the dewatering pipe and the sheet surface of the sheet, the guide walls being arranged in the weaving width direction with intervals therebetween and extending in a direction that intersects the

weaving width direction over a section that is included in a section where the dewatering pipe and the woven cloth come into contact with each other and that extends from a position on the upstream or downstream of the suction hole to at least a position in front of and near the suction hole. In addition, the outer peripheral portion of the dewatering pipe or the sheet on which the guide walls are provided is arranged such that top portions of the guide walls come into contact with the woven cloth and the guide walls are provided such that the pressure in flow-guiding passages defined by the adjacent guide walls is set to a negative pressure.

[0008] According to a second aspect of the present invention, a sheet for assisting a process of dewatering a woven cloth in a water jet loom is disposed such that the sheet extends in a weaving width direction and externally covers a suction hole formed in a dewatering pipe and extending in the weaving width direction. In addition, the sheet has a sheet surface which comes into contact with the woven cloth and on which guide walls are provided, the guide walls being arranged in the weaving width direction with intervals therebetween and extending in a direction that intersects the weaving width direction over a section that is included in a section where the dewatering pipe and the woven cloth come into contact with each other and that extends from a position on the upstream or downstream of the suction hole to at least a position in front of and near the suction hole.

[0009] According to the above-described first and second aspects, at least one of the outer peripheral portion of the dewatering pipe and the sheet surface of the sheet that comes into contact with the woven cloth is provided with multiple flow-guiding passages arranged in the weaving width direction and defined by the adjacent guide walls over the section from the position on the upstream or downstream of the suction hole to at least the position in front of and near the suction hole. In addition, the pressure in the dewatering pipe is set to a negative pressure, and accordingly an airflow that flows from the flow-guiding passages into the suction hole is generated. Since the flow-guiding passages are open toward the woven cloth, water drops on the surface of the woven cloth are discharged through the flow-guiding passages and the suction hole together with the generated airflow. Accordingly, compared to the conventional structure, the amount of dewatering from the woven cloth can be increased. Here, the range of "negative pressure" is broader than a so-called vacuum pressure, and refers to a pressure lower than the ambient or atmospheric pressure.

[0010] In addition, when the guide walls are provided such that the pressure in the flow-guiding passages are set to a negative pressure as in the above-described first aspect, the pressure in the flow-guiding passages is directly or indirectly set to a negative pressure by the airflow that flows into the suction hole. Accordingly, the water drops on the surface of the woven cloth and the water drops infiltrated in the structure of the woven cloth are sucked out into the flow-guiding passages due to the in-

fluence of the negative pressure, carried through the suction hole by the airflow, and are thus removed. In other words, the flow-guiding passages that are open toward the woven cloth and that have a negative pressure as described above serve a function of sucking out the infiltrated water drops from the woven cloth, similar to the suction hole. In addition, since the flow-guiding passages are formed so as to extend as described above, the suction section for the woven cloth is substantially increased and the period in which the negative pressure is applied to the woven cloth can be increased compared to the conventional structure. As a result, the amount of dewatering of the woven cloth can be increased.

[0011] The negative pressure in the flow-guiding passages is strong enough to suck out the water drops and the infiltrated water from the woven cloth. Therefore, unlike the conventional structure, the woven cloth can be dewatered to a desired extent without increasing the degree of vacuum in the dewatering pipe. Accordingly, the capacity of the suction blower that functions as a negative pressure source can be reduced. As a result, power consumption of the suction blower can be reduced and energy can be saved.

[0012] In the first aspect, the guide walls are provided on one or both of the outer peripheral portion of the dewatering pipe and the sheet surface of the sheet that comes into contact with the woven cloth.

[0013] In the above-described first and second aspects, according to the research performed by the present inventors, the intersecting angle $\theta 1$ between the direction in which the guide walls extend and the direction in which the suction hole extends is preferably set equal or close to 90° . More specifically, the intersecting angle $\theta 1$ is preferably set within several tens of degrees more or less than 90° .

[0014] Preferably, the guide walls are provided on the sheet, the sheet includes a first section and a second section arranged in the section in which the guide wall are formed continuously to each other in a direction in which the woven cloth is conveyed, the first section extending from a start point to an end point such that the position near the suction hole is located between the start point and the end point and the start point is separated from the suction hole and the second section extending to an end point that coincides with the start point of the first section from a start point at a position further away from the suction hole, and the sheet is disposed such that the top portions of the guide walls come into contact with the woven cloth in the first section and are separated from the woven cloth in the second section. Accordingly, since the flow-guiding passages are not covered by the woven cloth in the second section, the amount of airflow that flows from the uncovered space into the flow-guiding passages in the first section is increased and the water drops present in a region around the position at which the woven cloth comes into contact with the sheet can be more smoothly carried into the suction hole. According to the research performed by the present inventors, the

position at which the woven cloth is separated is preferably about 10 mm or more from the suction hole.

[0015] More preferably, the guide walls are provided on the sheet, the end point of the first section is positioned such that the suction hole is disposed between the start point and the end point, the sheet further includes a third section extending from a start point that coincides with the end point of the first section to an end point at a position further away from the suction hole, and the sheet surface of the sheet are in contact with the woven cloth in the third section. In such a case, since the third section in which the sheet surface and the woven cloth are in contact with each other is provided, the airflow concentrates in the first and second sections and accordingly the amount of dewatering from the woven cloth can be increased.

[0016] The sheet included in the dewatering device preferably includes of a flexible, airtight plate-shaped sheet member.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

Fig. 1 is a right side view of a water jet loom including a dewatering device provided with a sheet according to a first embodiment of the present invention;

Fig. 2 is an enlarged view of a portion around the dewatering device shown in Fig. 1;

Fig. 3 is an enlarged view illustrating the positional relationship between sections b, c, and g in the sheet and a suction pipe included in the dewatering device;

Fig. 4A is a diagram showing the dewatering device viewed from a direction shown by the arrow denoted by circled letter 'A' in Fig. 2 and Fig. 4B is a right side view of the sheet placed on an imaginary plane;

Fig. 5 is a diagram illustrating an example of guide walls included in the structure shown in Figs. 4A and 4B;

Fig. 6 is a diagram illustrating another example of guide walls;

Fig. 7 is a diagram illustrating another example of guide walls;

Fig. 8 is a diagram illustrating the experiment result obtained when the sheet according to the first embodiment of the present invention and a conventional sheet are evaluated;

Fig. 9 is a diagram illustrating another example of guide walls;

Fig. 10 is a diagram illustrating another example of guide walls;

Fig. 11 is a diagram illustrating another example of guide walls;

Fig. 12 is a diagram illustrating another example of guide walls; and

Fig. 13 is an enlarged view of a portion around a dewatering device according to a second embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] Embodiments of the present invention will be described below with reference to the accompanying drawings. First Embodiment

[0019] Fig. 1 is a right side view of a water jet loom including a dewatering device 10 according to a first embodiment of the present invention. The water jet loom 1 includes a warp beam (not shown) obtained by winding multiple warp yarns 4 in a sheet-like form, a warp shedding device (not shown) in which multiple healds 3 are arranged in a weaving width direction, a beating-up device (not shown) in which a reed 6 is mounted, a take-up device including a take-up roll 9 that is driven in association with the rotation of a loom main shaft so as to convey a woven cloth 7 downstream, and a cloth roll (not shown) that takes up the woven cloth 7, all of which are disposed between left and right frames 2.

[0020] The warp yarns 4 fed from the warp beam (not shown) extend through the healds 3 and the reed 6 to the woven cloth 7. The woven cloth 7 comes into contact with an outer peripheral portion of a suction pipe 13 that functions as a dewatering pipe included in the device according to the present invention, and is conveyed downward. Then, the woven cloth 7 is conveyed via a press roll 8A, the take-up roll 9, and a press roll 8B included in the take-up device while the conveying direction of the woven cloth 7 is successively changed, and finally reaches the cloth roll (not shown). The take-up device includes the press rolls 8A and 8B that function as rotatably supported driven rolls and a take-up roll 9 that is actively driven by a driving mechanism (not shown) having the loom main shaft as a drive source. The press rolls 8A and 8B are pressed against the take-up roll 9. When the loom is operated, water jets are ejected from weft insertion nozzles (not shown), and accordingly a weft yarn 5 is inserted into a warp shed formed by the healds 3. Then, the weft yarn 5 is beaten up by the reed 6 so that the woven cloth 7 is formed. The woven cloth 7 is wetted by the water jets and passes by a suction hole 11 formed in the suction pipe 13 for dewatering, which will be described below. Then, the woven cloth 7 is conveyed via the press roll 8A, the take-up roll 9, and the press roll 8B, and is wound around the cloth roll.

[0021] Fig. 2 shows a portion around the dewatering device 10 in more detail. The dewatering device 10 basically includes the suction pipe 13 that functions as a dewatering pipe and that has the suction hole 11 in the outer peripheral portion of the suction pipe 13 with which the woven cloth 7 comes into contact and a sheet 30 that is disposed so as to cover the suction hole 11 from above the woven cloth 7. More specifically, the suction pipe 13 includes a cylindrical member that extends in the weaving width direction and the suction hole 11 with a predetermined width that has a bottom is formed in the outer peripheral portion of the suction pipe 13 so as to extend in the weaving width direction. A plurality of through holes that communicate with a hollow section 12 and that have

the same width are formed in the bottom surface of the suction hole 11, and accordingly the hollow section 12 of the suction pipe 13 and the suction hole 11 communicate with each other.

[0022] A holder 14 is attached to the loom frames 2 with bolts 21 at a suitable position, and the suction pipe 13 is supported by the holder 14 at both ends thereof. The holder 14 is provided with holder caps 16 for holding the suction pipe 13 together with the holder 14. More specifically, the holder 14 and each holder cap 16 respectively include receiving portions 15 and 17 having semi-circular inner peripheries for receiving the suction pipe 13 and connecting portions provided at both ends of the receiving portions 15 and 17 in the radial direction and having screw holes for fixing the holder 14 and the holder cap 16 to each other. Each holder cap 16 is fixed to the holder 14 with hexagon socket head cap screws 22 that are fitted to the above-mentioned screw holes such that the suction pipe 13 is placed between the receiving portions 15 and 17 and the airtight or liquid-tight state of the hollow section 12 in the suction pipe 13 is maintained. The position at which the suction pipe 13 is attached to the loom frames 2 is determined such that the woven cloth 7 comes into contact with the outer peripheral portion of the suction pipe 13, in which the suction hole 11 is formed, over a section g extending from a start point k to an end point m, as shown in Fig. 3.

[0023] A space 19 that communicates with the hollow section 12 of the suction pipe 13 is provided at a deep (bottom) position of a region surrounded by the receiving portions 15 and 17, and this space 19 communicates with a passage of a pipe 20. An end of the pipe 20 is attached to a bottom portion of the holder 14 at an end of the holder 14. The other end of the pipe 20 is connected to a suction hole of a suction blower (not shown), which functions as a negative-pressure source, via a steam separator (not shown). When the loom is in operation, the suction blower is activated so that the pressure in the hollow section 12 of the suction pipe 13 is set to a negative pressure.

[0024] The water jet loom has a water-blocking structure for preventing the water drops ejected during weft insertion from scattering. The water-blocking structure includes a shield plate 24 and a splash guard 27 that extend in the weaving width direction to prevent the water drops from splashing toward the front of the loom.

[0025] The shield plate 24 includes a base portion 24A having a rectangular tube shape, a protruding portion 25 that protrudes from the base portion 24A toward the rear of the loom so that a cushion member 29 can be mounted thereon, and an attachment portion 28 to which the sheet 30, which will be described below, is attached. All of the above-mentioned components of the shield plate 24 extend in the weaving width direction. In addition, each holder cap 16 has an attachment base 18 on the top, and the attachment base 18 extends horizontally in the front-rear direction of the loom to support the bottom surface of the shield plate 24. The shield plate 24 is fixed to the holder caps 16 at both ends thereof by fitting hexagon socket

head cap screws 21 to screw holes formed in the attachment bases 18 of the holder caps 16.

[0026] A pipe 26 is fixed to the frames 2 with components that are not shown in the figures, and the splash guard 27 is pivotally supported by the pipe 26 at the rear end thereof. Accordingly, the splash guard 27 can be pivoted about the pipe 26 such that the front edge thereof moves vertically to open or close the splash guard 27. When the splash guard 27 is closed, the front edge of the splash guard 27 is received by the cushion member 29 attached to the protruding portion 25 and functions as a part of the water-blocking structure for blocking the water drops ejected during weft insertion.

[0027] As shown in Fig. 2, end portions of the sheet 30 in a direction perpendicular to the longitudinal direction thereof, that is, in the vertical direction, are folded such that the folded portions have predetermined widths, and are adhered to the sheet surfaces at adhering portions 31A and 31B. The folded portions form bag-shaped portions 32A and 32B that extend in the weaving width direction and that are open at both ends thereof in the weaving width direction. Fig. 4A shows the dewatering device 10 viewed from a direction shown by the arrow denoted by circled letter 'A' in Fig. 2, and Fig. 4B shows a right side view of the sheet 30. The sheet 30 that extends in the weaving width direction is attached to the attachment portion 28 of the above-mentioned shield plate 24.

[0028] Bars 33 and 34 composed of plate-shaped members that extend in the weaving width direction are inserted and held by the bag-shaped portions 32A and 32B, respectively. The attachment portion 28 of the shield plate 24 has a plurality of screw holes arranged in the weaving width direction with intervals therebetween so that the sheet 30 can be attached with screws. The bar 33 is disposed in the bag-shaped portion 32A and is attached to the loom 1 by fitting screws 50 to through holes formed in the bar 33 at positions corresponding to the above-mentioned screw holes in the attachment portion 28. As described above, the sheet 30 is arranged so as to extend along the woven cloth 7 that comes into contact with the outer peripheral portion of the suction pipe 13 and is guided downward. The bar 34 that extends in the weaving width direction functions as a weight for causing the sheet 30, which is inclined as shown the figure, to come into contact with the woven cloth 7. In addition, referring to Fig. 4A, although the suction hole 11 in the suction pipe 13 extends beyond an edge of the woven cloth 7, a tape 42 is adhered to cover a region where the woven cloth 7 is not present, so that the airflow is prevented from flowing inward through this region.

[0029] The sheet 30 is made of a flexible resin material having a thickness of 0.2 to several millimeters. For example, the sheet 30 is formed of a transparent plastic sheet, and a heated mold that has an irregular surface (for example, a surface in which multiple irregularities having semicircular shapes in cross section are arranged along the width thereof) is pressed against the above-

mentioned adhering sections 31A and 31B for several seconds to several minutes so that portions of the sheet are thermally bonded together.

[0030] As shown in Fig. 3, the sheet 30 has multiple guide walls 36 arranged in the weaving width direction with intervals therebetween on a sheet surface 35 of the bag-shaped portion 32B that comes into contact with the woven cloth 7. Each guide wall 36 extends in a direction that intersects the weaving width direction over a section c defined by a start point w and an end point v and overlapping a contact section b in which the sheet surface 35 is in contact with the woven cloth 7. Referring to Figs. 4A, 4B, and 5, multiple grooves 39 that extend in a direction intersecting the weaving width direction at an angle θ_1 are formed in the sheet surface 35 of the sheet 30 that comes into contact with the woven cloth 7. The grooves 39 have a semicircular shape with a diameter P3 in cross section and are arranged in the weaving width direction at a pitch P1. Thus, wall surfaces 39a and 39b of the adjacent grooves 39 and top portions 35a of the sheet surface 35 that continue from the wall surfaces 39a and 39b form projections 37 that function as the guide walls 36, and the grooves 39 function as flow-guiding passages 38. In this case, the top portions 35a of the sheet surface 35 function as top portions 36a of the guide walls 36 and come into contact with the woven cloth 7, as described below.

[0031] When the sheet 30 is made of a plastic sheet, the grooves 39 may be formed by pressing a heated mold having projections (for example, multiple projections having a semicolumnar shape with the diameter P3 and arranged at the pitch P1) against the sheet surface 35 for several seconds to several minutes. However, the present invention is not limited to this, and the guide walls 36 or the flow-guiding passages 38 may also be formed by other known methods.

[0032] The guide walls 36 may also be formed as described below. As shown in Fig. 6, the projections 37 may also be semicolumnar portions that are made of the same material as the sheet 30 and that have a diameter P2, and be adhered to the sheet surface 35 of the sheet 30 such that the projections 37 are arranged on the sheet surface 35 at the pitch P1. Thus, the projections 37 that project from the sheet surface 35 function as the guide walls 36 and spaces between the adjacent projections 37 function as the flow-guiding passages 38. In this case, top portions 37a of the projections 37 function as the top portions 36a of the guide walls 36 and come into contact with the woven cloth 7, as described below.

[0033] Alternatively, the structures of Figs. 5 and 6 may be used in combination. More specifically, as shown in Fig. 7, the grooves 39 may be formed in the sheet surface 35 and the projections 37 having a semicolumnar shape with the diameter P2 may be respectively adhered to the top portions 35a of the sheet surface 35. Thus, the integrated guide walls 36 defined by the wall surfaces 39a and 39b of the adjacent grooves 39 and the projections 37 adhered to the top portions 35a that continue from the

wall surfaces 39a and 39b are formed so as to project from the bottom portions of the guide grooves 39. The spaces between the adjacent walls 36 function as the flow-guiding passages 38. Also in this case, the top portions 37a of the projections 37 function as the top portions 36a of the guide walls 36 and come into contact with the woven cloth 7, as described below.

[0034] The intersection angle θ_1 between the extending direction of the suction hole 11 and the guide walls 36 is not particularly limited as long as θ_1 is not equal to 0° or 180° so that the extending direction of the suction hole 11 intersects the guide walls 36. However, in view of flowability, θ_1 is preferably in the range of 40° to 140° . More preferably, θ_1 is equal or close to 90° (more specifically, in the range of 70° to 110°). In addition, parameters of the guide walls 36 for setting the pressure in the flow-guiding passages 38 to a negative pressure include the height t1 and thickness p2 of the guide walls 36, the arrangement pitch p1 of the guide walls 36, the extending length c, etc. From experience, the parameters t1, p2, and p1 may be set in the range of 0.2 mm to 2.0 mm and the extending length c may be set to 10 mm or less.

[0035] As shown in Fig. 3, the sheet 30 on which the guide walls 36 are provided comes into contact with the woven cloth 7 over a section b defined by a start point at a position y on the upstream of the suction hole 11 and an end point at a position z on the downstream thereof in the conveying direction of the woven cloth 7. When the sheet 30 is attached to the dewatering device 10, the top portions 36a of the guide walls 36 come into contact with the woven cloth 7 over a section c1 that extends from a position u on the downstream of the start point w of the section c to a position v. In other words, the section c defined by the start point w and the end point v in which the guide walls 36 are formed on the sheet 30 includes the section c1 defined by the start point u and the end point v in which the top portions 36a of the guide walls 36 are in contact with the woven cloth 7 and a section c2 defined by a start point that coincides with the start point w and an end point that coincides with the start point u of the section c1. The sheet 30 is disposed such that the top portions 36a of the guide walls 36 are in contact with the woven cloth 7 in the section c1, which corresponds to the first section, and are separated from the woven cloth 7 in the section c2, which corresponds to the second section. Accordingly, the flow-guiding passages 38 formed between the adjacent guide walls 36 are open toward the woven cloth 7 in the section c1 and toward a space between the woven cloth 7 and the sheet 30 in the section c2.

[0036] When the loom is operated, the woven cloth 7 wetted by the water jets during weft insertion passes between the suction pipe 13 and the sheet 30. In addition, the pressure in the hollow section 12 of the suction pipe 13 is set to a negative pressure by a suction blower (not shown) that is activated in association with the operation of the loom. Accordingly, an airflow that flows into the suction hole 11 from the structure of the woven cloth 7

and the flow-guiding passages 38 is generated. The flow-guiding passages 38 formed by the adjacent guide walls 36 in the section c1 function as flow-guiding passages for the airflow that flows into the suction hole 11. Since the flow-guiding passages 38 are open toward the woven cloth 7, the water drops on the surface of the woven cloth 7 travel through the flow-guiding passages 38 together with the generated airflow, pass through the spaces between the yarns in the woven cloth 7 in a region near the suction hole 11, and are discharged through the suction hole 11 and the suction pipe 13.

[0037] Preferably, the guide walls 36 are structured such that the pressure in the flow-guiding passages 38 are set to a negative pressure at least in the section c1 in which the guide walls 36 are in contact with the woven cloth 7. Thus, the pressure in the flow-guiding passages 38 is directly or indirectly set to a negative pressure by the airflow that flows into the suction hole 11. Accordingly, the water drops on the surface of the woven cloth 7 or water drops infiltrated in the structure of the woven cloth 7 are sucked out into the flow-guiding passages 38 due to the influence of the negative pressure, carried through the suction hole 11 by the airflow, and are thus removed. In other words, the flow-guiding passages 38 that are open toward the woven cloth 7 and that have a negative pressure as described above serve a function of sucking out the infiltrated water drops from the woven cloth 7, similar to the suction hole 11. In addition, since the flow-guiding passages 38 are formed so as to extend as described above, the suction section for the woven cloth 7 is substantially increased and the period in which the negative pressure is applied to the woven cloth 7 can be increased compared to the conventional structure. As a result, the amount of dewatering of the woven cloth 7 can be increased.

[0038] In comparison, in section c2, the flow-guiding passages 38 are open toward the space between the woven cloth 7 and the sheet 30. Therefore, the amount of airflow that flows into the flow-guiding passages 38 from this space is increased. Since the amount of airflow is increased, the water drops in the woven cloth 7 are smoothly carried to the suction hole 11 and are sucked into the suction hole 11 thorough the spaces between the yarns in the structure of the woven cloth 7.

[0039] In the example shown in Fig. 3, the section b in which the sheet 30 is in contact with the woven cloth 7 includes a section e that continues from the section c1 and that corresponds to the third section in which the guide walls 36 are not provided. More specifically, in the sheet 30, the end point v of the section c1 in which the guide walls 36 are provided is positioned on the downstream of the suction hole 11 and the section e is provided in front of the section c1 on the downstream side thereof. The section e is defined by a start point that coincides with the end point v of the section c1 and an end point r at a position that is further away from the suction hole 11 and at which the outer peripheral portion of the suction pipe 13 is separated from the woven cloth 7. Thus, the

sheet 30 has the section e defined by the start point that coincides with the end point v of the section c1 and the end point r that is further away from the suction hole 11, and is disposed such that the woven cloth 7 is in contact with both the sheet surface 35 and the outer peripheral portion of the suction pipe 13 in this section e.

[0040] Since the woven cloth 7 is in contact with both the sheet surface 35 and the outer peripheral portion of the suction pipe 13 in this section e, airflow is not generated from this section e. For example, compared to the case in which the section e is not provided, the effect of the negative pressure in the suction hole 11 concentrates more in the sections c1 and c2 on the upstream of the section e. Therefore, the amount of airflow and the degree of negative pressure in the flow-guiding passages 38 are increased and the amount of dewatering of the woven cloth 7 is increased accordingly.

[0041] Experimental data obtained when the above-described dewatering device was applied to a water jet loom produced by Tsudakoma Corporation is shown in Fig. 8. The data was obtained as a result of experiment for evaluating the dewatering effect of the woven cloth 7 when the sheet 30 and the power of the suction blower were changed. The water jet loom used in the experiment was produced by Tsudakoma Corporation, and the product model of the loom was ZW408. The nominal reed space was 340 cm. The warp used in the experiment was polyester 75dtex/24f Z-twist 800 T/m and the weft was polyester 84dtex/36f Z-twist 800 T/m. The rotational speed of the loom was 450 rpm. In addition, a steam separator having so-called float in the mechanism for discharging the separated water was used.

[0042] A transparent plastic sheet with a thickness of 1 mm was used as the sheet. A conventional sheet corresponding to a comparative example (that is, a sheet with a flat surface having no guide walls) is called sheet A, and a sheet according to the present invention is called sheet B. The slit width of the suction hole 11 is about 5 mm. With regard to the parameters of the sheet 30 according to the present invention, the height t1 and the thickness p2 of the guide walls were set to 0.5 mm and the arrangement pitch p1 of the guide walls was set to 1.5 mm. The length of the section c was set to 40 mm and the intersection angle $\theta 1$ was set to 90°. In addition, commonly used suction blowers with powers of 750 W and 400 W were selectively attached. In Fig. 8, the column 'dewatering evaluation' shows the result obtained when an inspector objectively graded the amount of moisture that remained in the woven cloth 7 after leaving the suction pipe 13 into three levels. The column 'overall evaluation' shows the result of evaluation in which the overall performance is graded into three levels by taking the weave quality and power consumption of the suction blower into account in addition to the degree of dewatering.

[0043] According to the result shown in Fig. 8, the degree of dewatering was insufficient when the sheet A was used together with either of the commonly used suction

blowers. In comparison, the degree of dewatering satisfied the weaving factory criterion when the sheet B was used together with either of the suction blowers. Moreover, unlike the conventional sheet A, the degree of dewatering that satisfy the weaving factory criterion was obtained even when a small suction blower with the power of 400 W was used. In other words, unlike the conventional structure, an airflow strong enough to remove moisture from the woven cloth 7 can be generated in the flow-guiding passages without increasing the load. Therefore, the capacity of the suction blower that functions as a negative pressure source can be reduced. As a result, power consumption of the suction blower can be reduced and energy can be saved.

[0044] The above-described embodiment can be modified as described below. For example, with regard to the section c in which the guide walls 36 are provided, the end point v is positioned such that the suction hole 11 is positioned between the end point v and the start point u in the above-described embodiment. However, the present invention is not limited to this, and the end point v may also be positioned within the section corresponding to the suction hole 11 or in front of and near the suction hole 11 (position x shown in Fig. 3). The position x can be adequately set such that an airflow can be generated in the flow-guiding passages 38 due to the negative pressure in the hollow section 12. According to the research performed by the present inventors, the position x is limited to within several millimeters from the suction hole 11 by several millimeters, as shown in Fig. 3.

[0045] In addition, in the above-described embodiment, the section e in which the guide walls 36 are not formed is provided on the downstream of the section c1 and the section c2 in which the guide walls 36 are separated from the woven cloth 7. However, this section e may also be omitted depending on the kind of the woven cloth and the performance of the suction blower. In other words, the guide walls 36 may also be formed so as to extend beyond the section b in which the sheet surface 35 and the woven cloth 7 are in contact with each other.

[0046] The cross-sectional shape of the guide walls (flow-guiding passages) is not limited to the semicircular shape shown in Figs. 5 to 7, and may also be, for example, a polygonal (triangular, rectangular, etc.) shape or other shapes.

[0047] In addition, although the guide walls 36 are formed so as to extend linearly along an axial line corresponding to the intersection angle $\theta 1$ in Fig. 4, the guide walls 36 may also be formed so as to curve, that is, such that the intersection angle $\theta 1$ varies along the moving direction of the woven cloth, as shown in Fig. 9. In addition, although the guide walls 36 are formed continuously over the section c in Fig. 4, the guide walls 36 may also be formed intermittently in the moving direction of the woven cloth 7 so that multiple guide walls 36 are arranged with spaces 40 provided therebetween, as shown in Fig. 10. In addition, as shown in Fig. 11, shield portions 41 for blocking the airflow may be provided in some of the

flow-guiding passages to reduce the amount of airflow. Thus, various structures are included in the scope of the present invention as long as the guide walls 36 extend in the direction corresponding to the intersection angle $\theta 1$.

[0048] In addition, it is not necessary that the adjacent guide walls 36 have the same shape and the guide walls 36 may have different shapes, as shown in Fig. 12. In this case, each of the flow-guiding passages 38 formed between the adjacent guide walls 36 has a directionality different from that of the flow-guiding passage 38 adjacent thereto.

Second Embodiment

[0049] Instead of forming the guide walls 36 on the sheet 30 as in the above-described embodiment, the guide walls may also be formed on the outer peripheral portion of the suction pipe 13, as shown in Fig. 13. In the structure shown in Fig. 13, grooves 47 that intersect the extending direction of the suction hole 11 (i.e., direction perpendicular to the page) at the angle $\theta 1$ and that extend in a circumferential direction over the section c are formed such that the section c includes the suction hole 11. The grooves 47 are arranged in the weaving width direction. In this embodiment, similar to the structure shown in Fig. 5, the grooves 47 directly function as flow-guiding passages 46 and the separating wall portions between the adjacent grooves 47 function as guide walls 45.

[0050] When the guide walls 45 are formed on the outer peripheral portion of the dewatering pipe as described above, the flow-guiding passages 46 communicate with the suction hole 11 at one end thereof. Therefore, the pressure in the flow-guiding passages 46 is directly set to a negative pressure due to the airflow that flows into the suction hole 11, and the flow-guiding passages 46 that are open toward the woven cloth 7 function similarly to the suction hole 11. Therefore, the area of the suction section for the woven cloth 7 is substantially increased and the amount of dewatering of the woven cloth 7 is increased. The modifications of the guide walls described in the first embodiment may also be applied to the structure of the second embodiment.

[0051] The above-described first and second embodiments may also be modified as below. For example, although the guide walls and the flow-guiding passages formed therebetween are provided in only one of the sheet 30 and the outer peripheral portion of the suction pipe 13 in the above-described embodiments, they may also be provided in both of the sheet 30 and the outer peripheral portion of the suction pipe 13.

[0052] In addition, in the guide walls (flow-guiding passages) according to either of the above-described first and second embodiments, a portion of the section c on the upstream of the suction hole 11 is longer than a portion of the section c on the downstream of the suction hole 11. However, the portion on the downstream may also be longer than the portion on the upstream. In ad-

dition, in the first embodiment, the positions of the sections c2 and e with respect to the section c1 may also be reversed in the front-rear direction. In such a case, the sheet 30 is separated from the woven cloth 7 in the section c2 located on the downstream of the suction hole 11 and the top portions 35a are in contact with the woven cloth 7 in the section e located on the upstream of the suction hole 11.

[0053] In the case in which the guide walls (flow-guiding passages) are provided on the sheet as in the first embodiment, the shape of the suction pipe 13 is not limited to the cylindrical shape as described in the above two embodiments. For example, the present invention can also be applied to a dewatering device including a suction pipe having recesses or projections on the outer peripheral surface thereof to increase the efficiency in dewatering the woven cloth along the outer peripheral surface of the suction pipe. In other words, a dewatering device according to the present invention may also be obtained by attaching the sheet 30 according to the first embodiment to such a device.

[0054] In addition, a plurality of kinds of sheets 30 or suction pipes 13 having guide walls (flow-guiding passages) of which the above-described parameters differ from each other may be prepared and selectively attached in accordance with the weave specification.

[0055] The present invention may be applied to water jet looms in which weft insertion is performed by inserting a weft yarn into a warp shed with water jets and which include dewatering devices for removing water drops from a woven cloth which is wetted during weft insertion.

Claims

1. A dewatering device (10) for a water jet loom, comprising:

a dewatering pipe (13) disposed on a take-up path of a woven cloth (7) and having a suction hole (11) that extends in a weaving width direction and that comes into contact with the woven cloth (7); and

a sheet (30) disposed so as to externally cover the suction hole (11) and having a sheet surface (35) that comes into contact with the woven cloth (7),

wherein the woven cloth (7) is dewatered by causing the woven cloth (7) to pass by the suction hole (11) while the pressure in the dewatering pipe (13) is set to a negative pressure, and wherein the dewatering device (10) is **characterized in that** guide walls (36, 45) are provided on at least one of an outer peripheral portion of the dewatering pipe (13) and the sheet surface (35) of the sheet (30), the guide walls (36, 45) being arranged in the weaving width direction with intervals therebetween and extending in a

direction that intersects the weaving width direction over a section (c) that is included in a section (g) where the dewatering pipe (13) and the woven cloth (7) come into contact with each other and that extends from a position on the upstream or downstream of the suction hole (11) to at least a position (x) in front of and near the suction hole (11), and

the outer peripheral portion of the dewatering pipe (13) or the sheet (30) on which the guide walls (36, 45) are provided is arranged such that top portions (36a, 45a) of the guide walls (36, 45) come into contact with the woven cloth (7) and the guide walls (36, 45) are provided such that the pressure in flow-guiding passages (38, 46) defined by the adjacent guide walls (36, 45) is set to a negative pressure.

2. The dewatering device (10) according to claim 1, wherein an intersecting angle θ_1 between the direction in which the guide walls (36, 45) provided on the outer peripheral portion of the dewatering pipe (13) or the sheet (30) extend and the direction in which the suction hole (11) extends is set equal or close to 90° .
3. The dewatering device (10) according to one of claims 1 and 2, wherein the guide walls (36) are provided on the sheet (30), and wherein the sheet (30) includes a first section (c1) and a second section (c2) arranged in the section (c) continuously to each other in a direction in which the woven cloth (7) is conveyed, the first section (c1) extending from a start point (u) to an end point (v) such that the position (x) near the suction hole (11) is located between the start point (u) and the end point (v) and the start point (u) is separated from the suction hole (11), the second section (c2) extending to an end point that coincides with the start point (u) of the first section (c1) from a start point (w) at a position further away from the suction hole (11), and wherein the sheet (30) is disposed such that the top portions (36a) of the guide walls (36) come into contact with the woven cloth (7) in the first section (c1) and are separated from the woven cloth (7) in the second section (c2).
4. The dewatering device (10) according to claim 3, wherein the guide walls (36) are provided on the sheet (30), wherein the end point (v) of the first section (c1) is positioned such that the suction hole (11) is disposed between the start point (u) and the end point (v) and the sheet (30) further includes a third section (e) extending from a start point that coincides with the end point (v) of the first section (c1) to an end point at a position (r) further away from the suction hole (11), and

wherein the sheet surface (35) of the sheet (30) are in contact with the woven cloth (7) in the third section (e).

5. A sheet (30) for assisting a process of dewatering a woven cloth (7) in a water jet loom, **characterized in that:** 5

the sheet (30) is disposed such that the sheet (30) extends in a weaving width direction and externally covers a suction hole (11) formed in a dewatering pipe (13) and extending in the weaving width direction, and 10
the sheet (30) has a sheet surface (35) which comes into contact with the woven cloth (7) and on which guide walls (36) are provided, the guide walls (36) being arranged in the weaving width direction with intervals therebetween and extending in a direction that intersects the weaving width direction over a section that is included in a section (g) where the dewatering pipe (13) and the woven cloth (7) come into contact with each other and that extends from a position on the upstream or downstream of the suction hole (11) to at least a position (x) in front of and near the suction hole (11). 15 20 25

6. The dewatering device (10) or the sheet (30) according to one of claims 1 to 5, wherein the sheet includes a flexible, airtight plate-shaped sheet member. 30

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FIG. 1

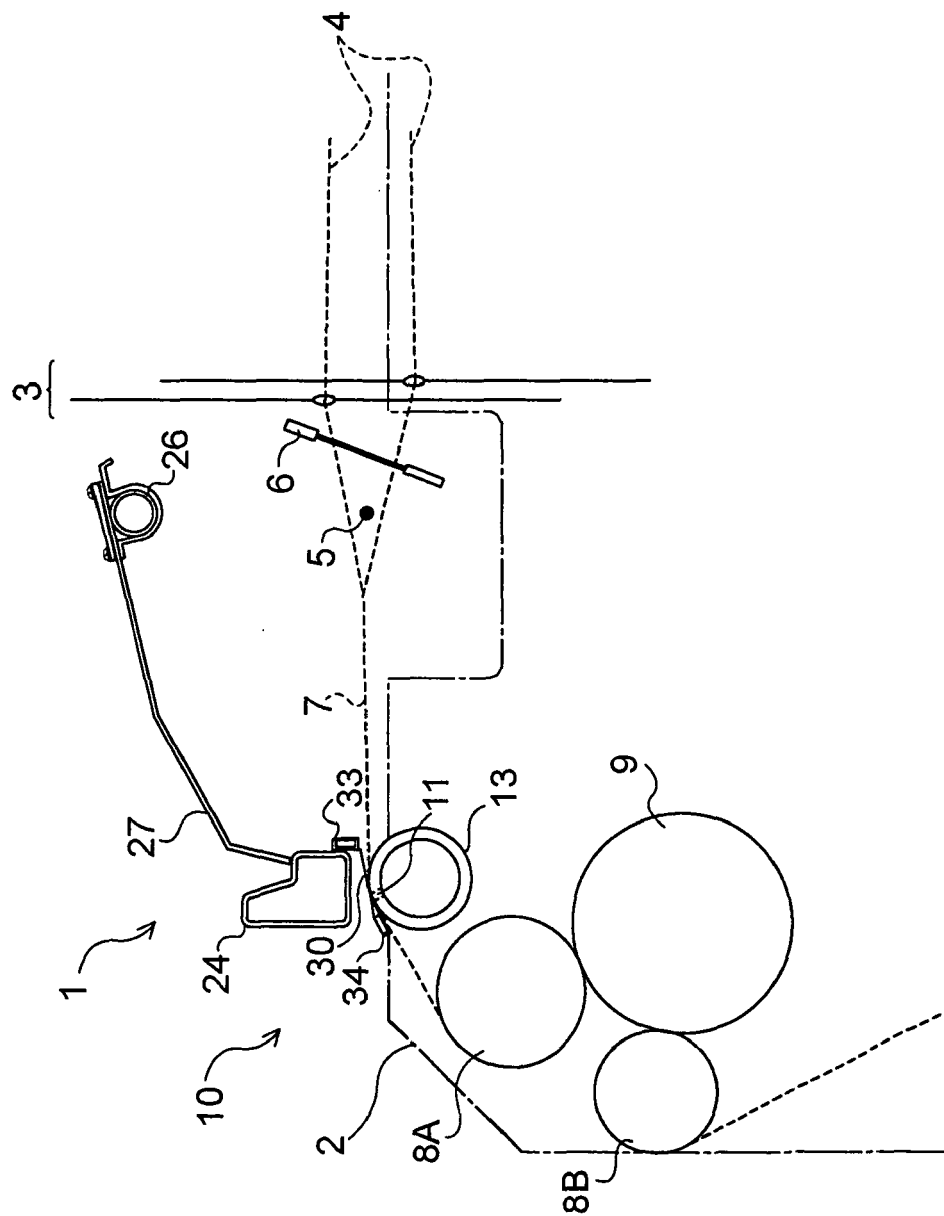


FIG. 2

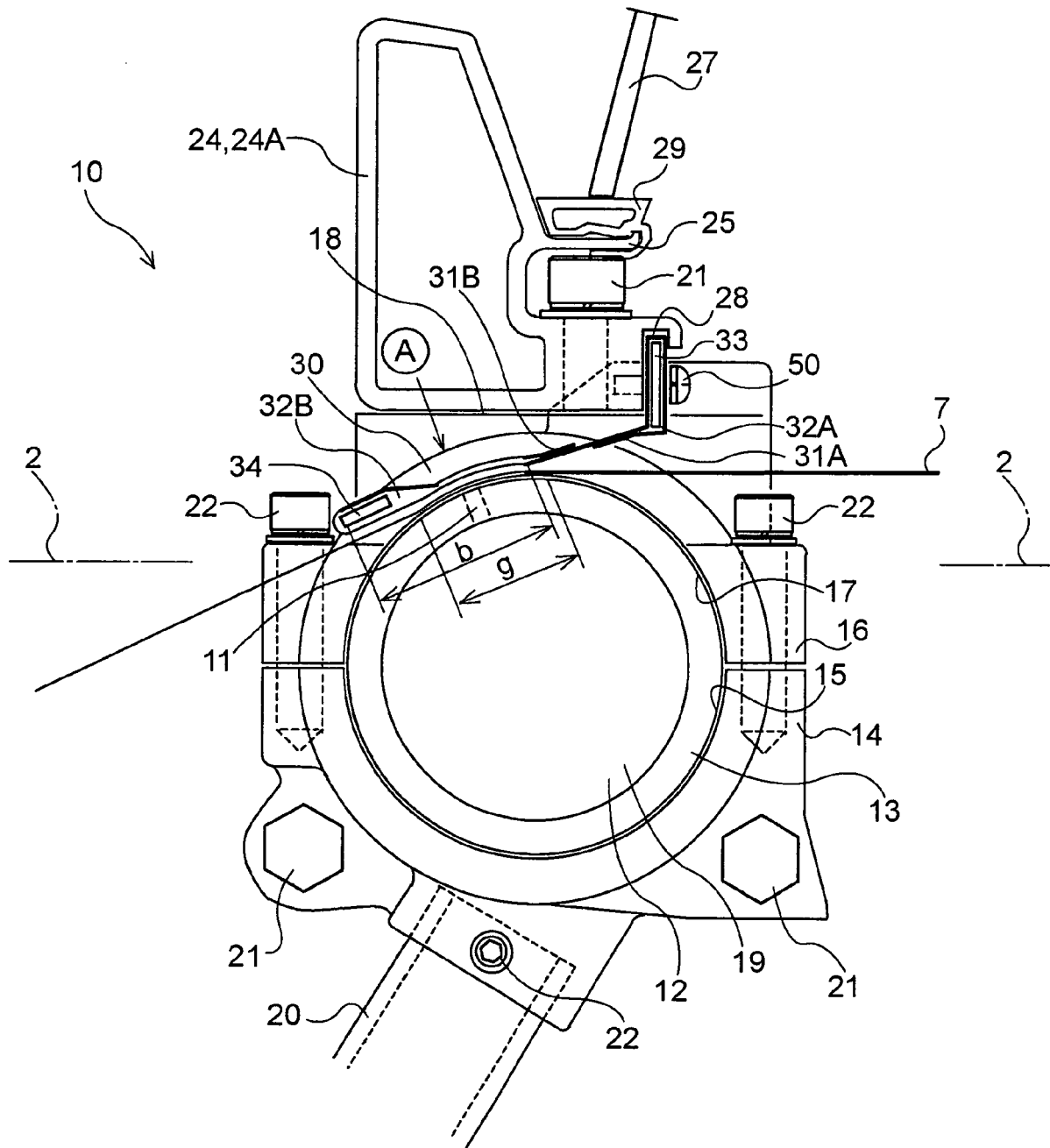


FIG. 3

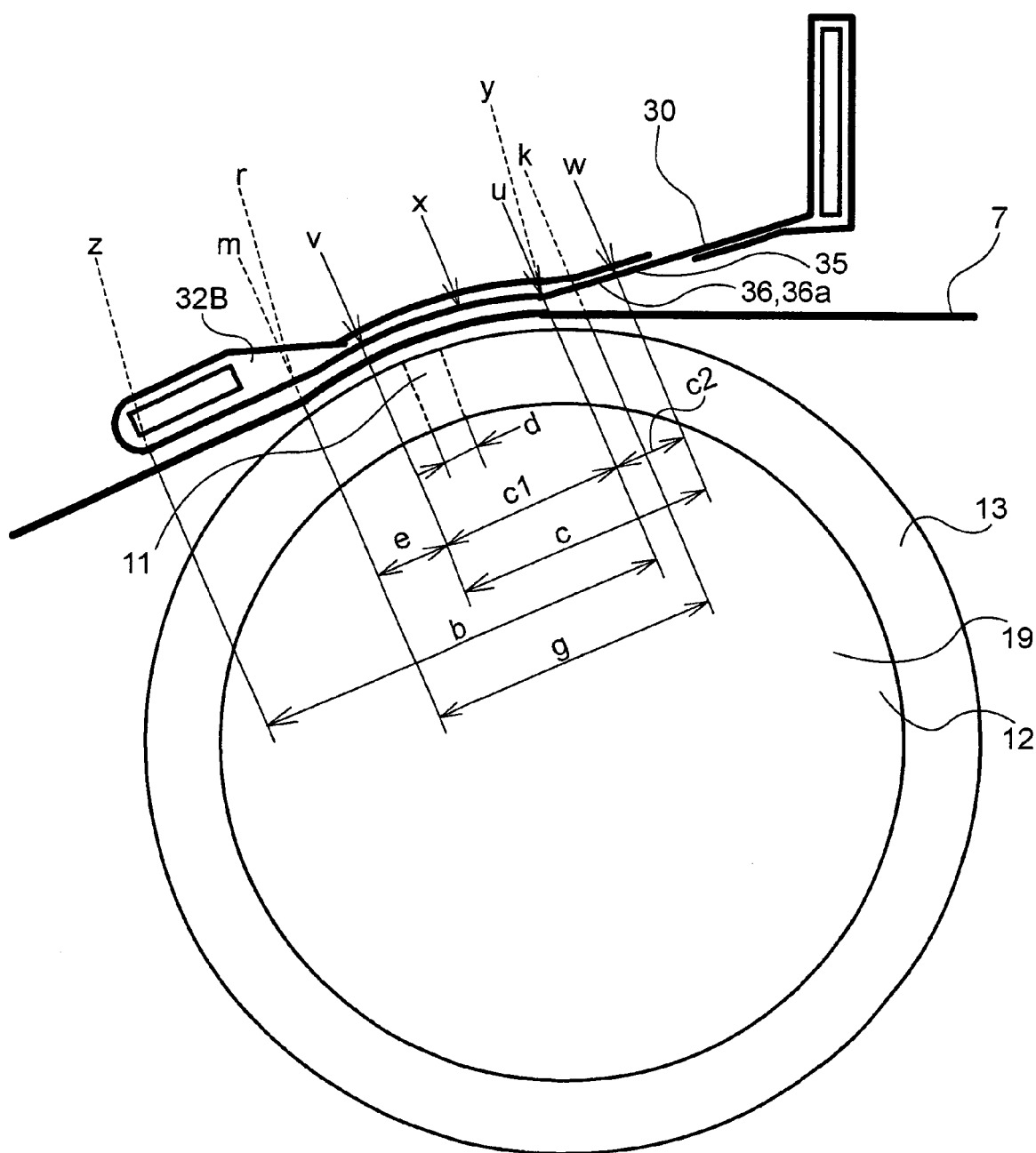


FIG. 5

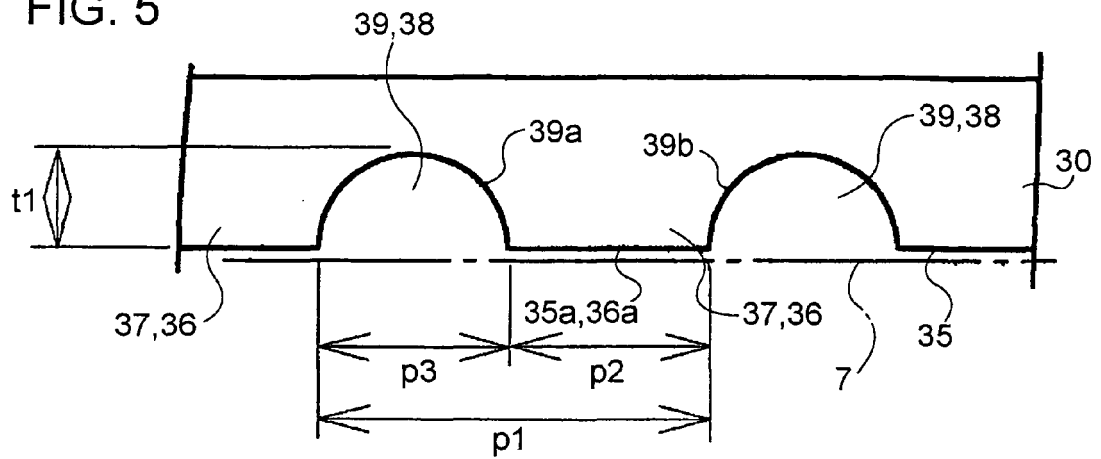


FIG. 6

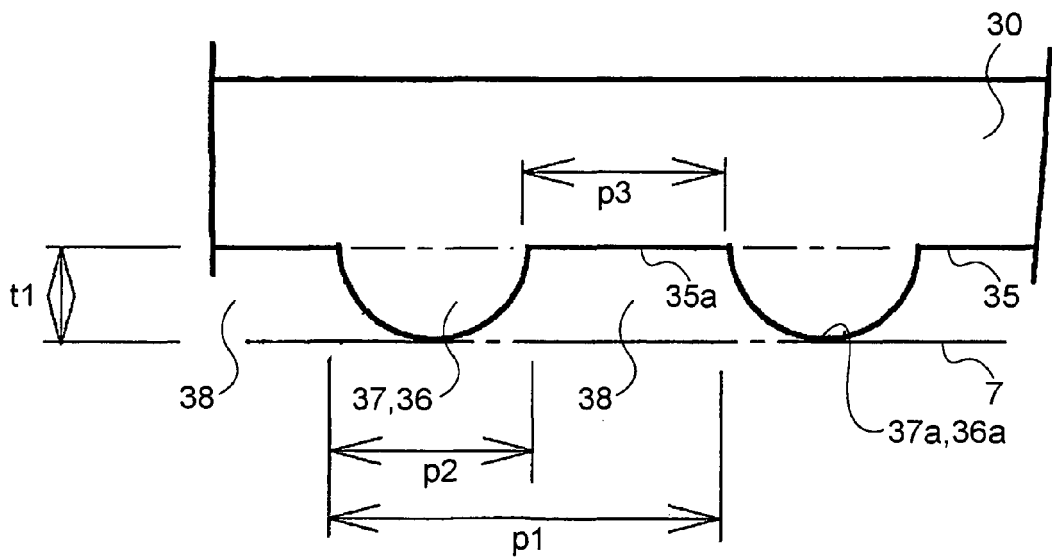


FIG. 7

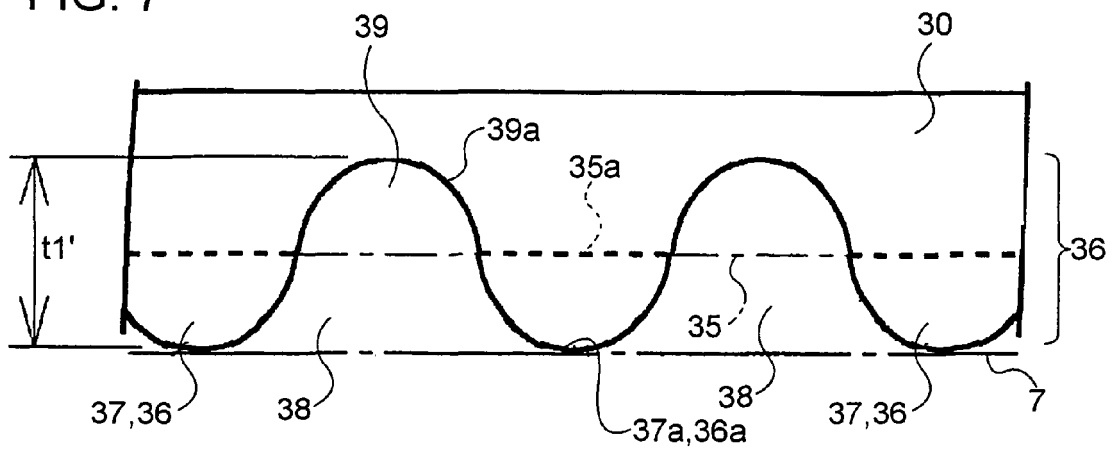


FIG. 8

EXPERIMENTAL CONDITION		EVALUATION RESULT		
KIND OF AIRTIGHT SHEET	POWER OF SUCTION BLOWER	DEWATERING EVALUATION	DETAILS	OVERALL EVALUATION
1) SHEET A (COMPARATIVE EXAMPLE)	750W	×	IMPERFECT DEWATERING	×
2) SHEET A (COMPARATIVE EXAMPLE)	400W	×	IMPERFECT DEWATERING	×
3) SHEET B (EXAMPLE)	750W	○	DESIRABLE (ALMOST PERFECT) DEWATERING	○
4) SHEET B (EXAMPLE)	400W	○	DESIRABLE DEWATERING CRITERION IS SATISFIED ALTHOUGH REMAINING MOISTURE IS SLIGHTLY MORE THAN ABOVE EXAMPLE 3	◎

NOTE 1) DEWATERING EVALUATION

○: GOOD △: NOT GOOD ×: BAD

NOTE 2) OVERALL EVALUATION

◎: VERY GOOD ○: USABLE ×: UNUSABLE

FIG. 9

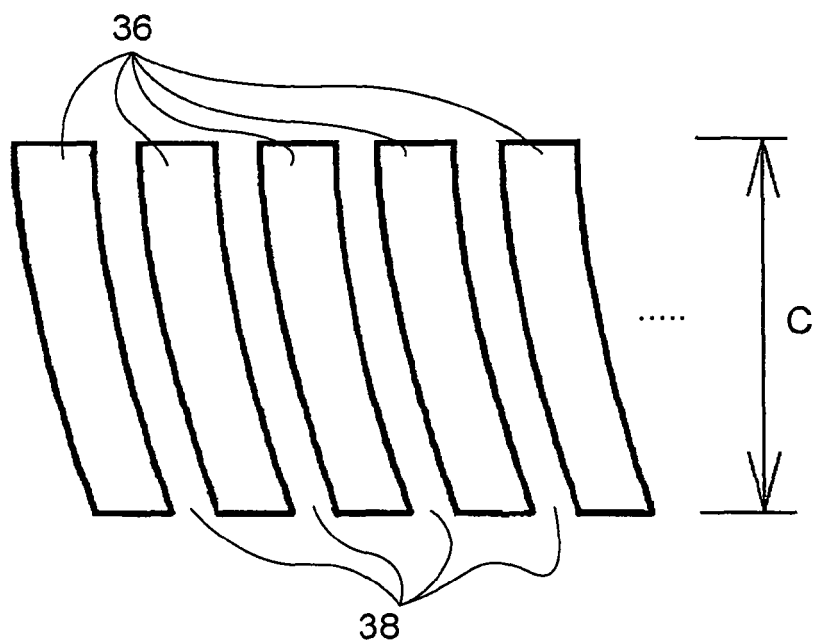


FIG. 10

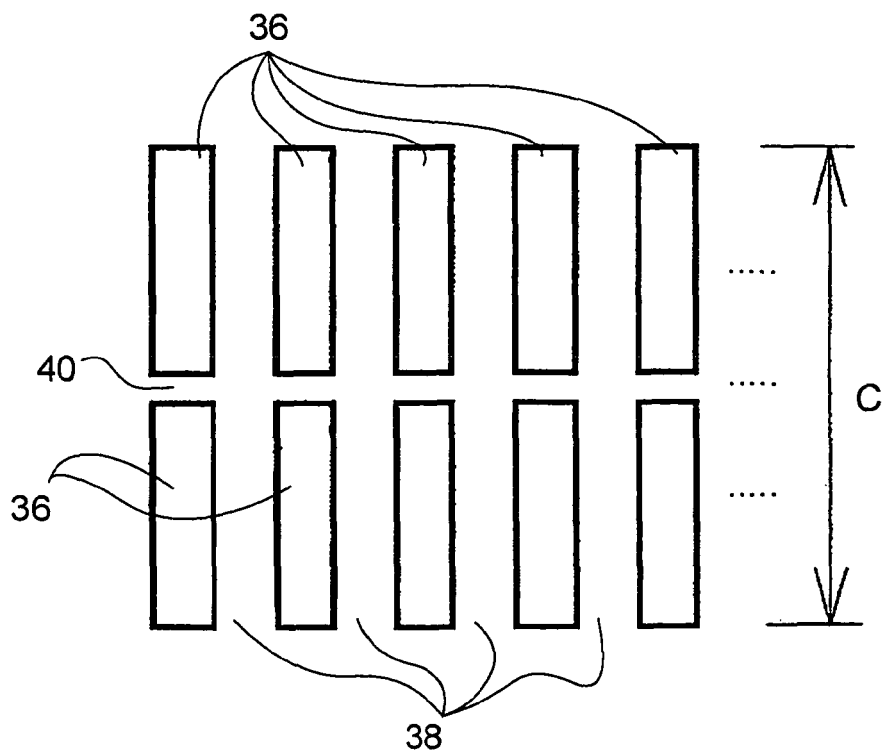


FIG. 11

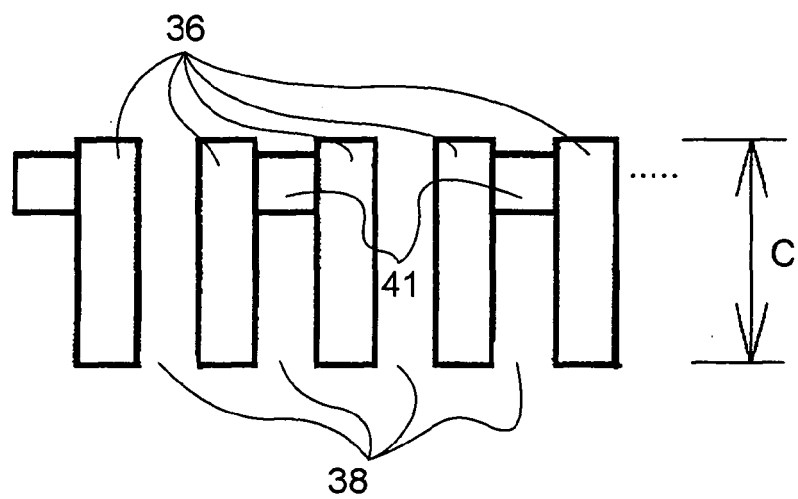


FIG. 12

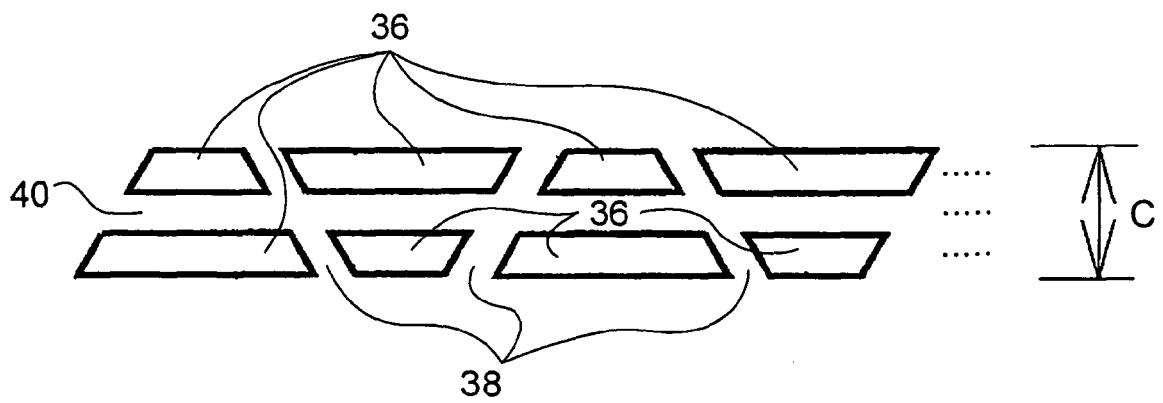
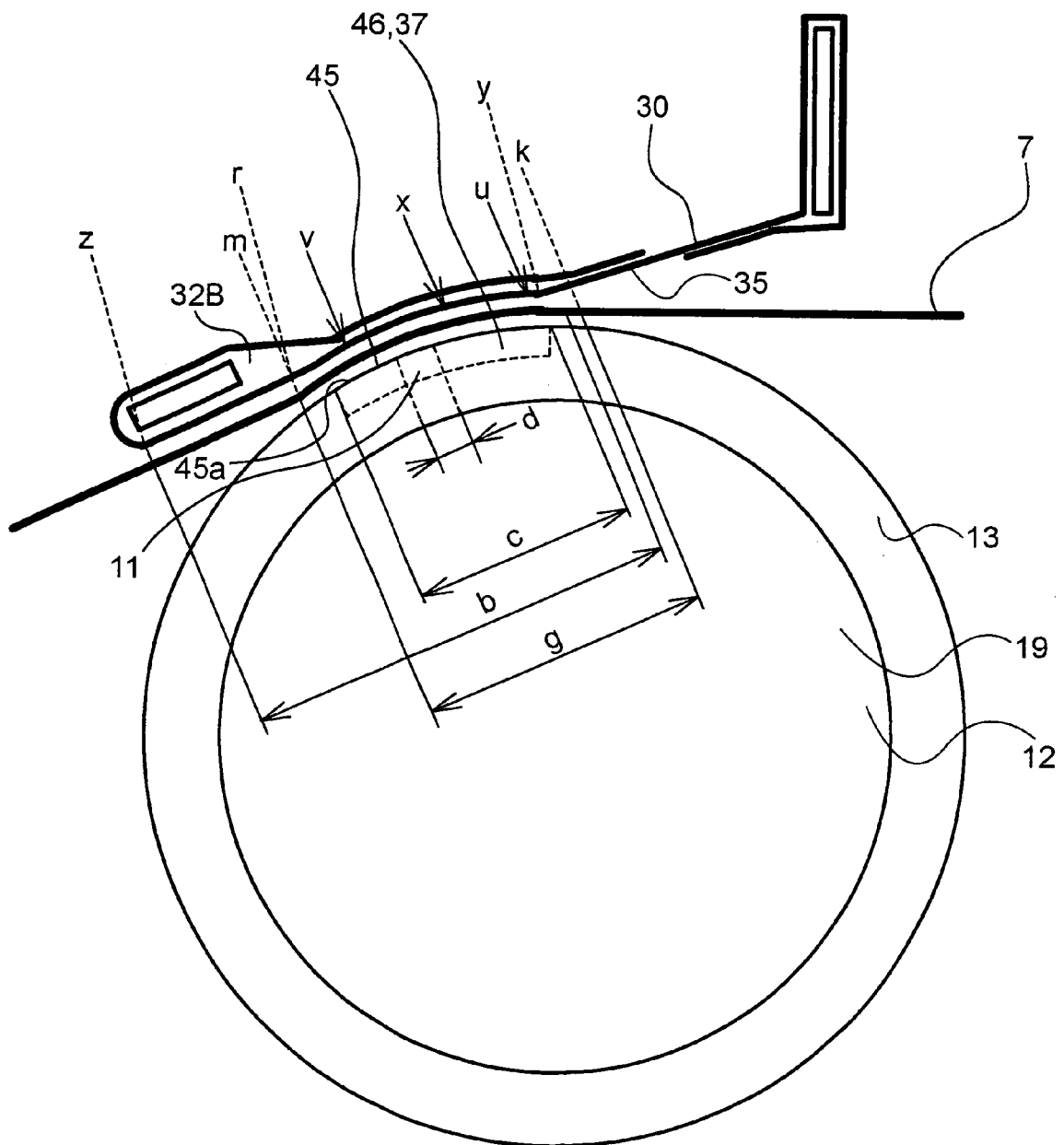


FIG. 13





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 01 0386

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Place of search Munich		Date of completion of the search 12 September 2006	Examiner Iamandi, Daniela
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 06 01 0386

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12-09-2006

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