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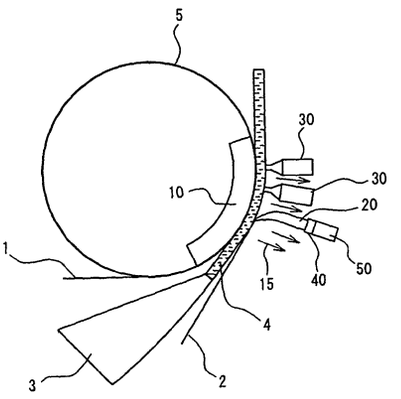
(54) TWIN-WIRE PAPER MACHINE

(57) In a twin wire former, white-water withdrawal means (20) for withdrawing white water (15) dewatered to the opposite side of a roll is arranged to the upstream side of a pressure element (30) to suppress the interference of the dewatered white water (15) with the pressure element (30). This renders it possible to prevent damage to the pressure element (30) that is caused by a collision with white water (15) during dewatering and to manufacture defect-free paper that has even dispersion of fibers.

FIG. 1



1, 2: WIRE
3: HEAD BOX
4: RAW MATERIAL LIQUID
5: SUCTION FORMING ROLL
10: SUCTION BOX
15: WHITE WATER
20: WHITE-WATER WITHDRAWAL BLADE
30: FLEXIBLE PRESS BLADE
40: PRESSURE SENSOR
50: DISPLACEMENT SENSOR & MOVING DEVICE

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Description

TECHNICAL FIELD

[0001] The present invention relates to a twin wire former that supplies a suspension of fibers between a pair of looped wires facing each other and dewaters the suspension of fibers held between the wires to form a web.

BACKGROUND ART

[0002] The first dewatering part of a twin wire former is equipped with two forming wires (hereinafter referred to as wires) that are in the form of a loop. A suspension of fibers (raw material liquid for paper) is supplied between the two wires from a head box. When the fiber suspension held between the wires is traveling, it receives dewatering pressure from a plurality of dewatering equipments. The dewatering pressure removes water from the fiber suspension. The dewatered fiber suspension is gradually formed into a mat of fibers, which grows into a web.

[0003] Thereafter, the web is further condensed by vacuum suction and is compressed and dewatered by a press part. After the web is dried with a drier, it is surface-treated by a calender part and is wound up into paper by a reel part. The thus-manufactured paper is required to have various qualities and properties, depending on uses. Many of the required qualities and properties are greatly influenced in the process of forming a mat of fibers that determines the basic structure of paper.

[0004] In the process of forming a mat of fibers, between the mat formed by the dewatering pressure applied with a dewatering equipment and a suspension of fibers, a difference in speed and the change occur in the directions of plane and thickness. Because of this, it is considered that the state of dispersion of fibers changes. Therefore, it may safely be said that the dispersed state of the fiber mat is influenced by the magnitude and operating time of the dewatering pressure, a fluctuation pattern in the dewatering pressure, etc.

[0005] Incidentally, one paper quality that is regarded as important is formation that represents the state of dispersion of fibers. In order to enhance the above-described formation, it is necessary to disperse fibers evenly. To obtain even dispersion of fibers, until a mat of fibers is formed as a web since a suspension of fibers was supplied from the head box, it is vital to suitably apply a change in the dewatering pressure to the fiber suspension. In conventional methods of dewatering, however, the fiber suspension held between two wires on a forming roll is dewatered to form a mat of fibers, but the maximum dewatering pressure is determined by the wire tension and the diameter of the forming roll, and there is a change in pressure that increases gradually to this maximum dewatering pressure as the amount of the fiber mat formed increases by the progress of dewatering. Because of this, the fibers in the suspension cannot be dispersed evenly and therefore there is a problem that the above-described paper formation is not good.

[0006] Hence, there have been proposed methods of dewatering such as those disclosed in Japanese Laid-Open Patent Publication Nos. SHO 55-137294 and HEI 6-235185. In these methods of dewatering, dewatering equipments 9, 10, 11, and 12 and a vacuum unit 13 are arranged along the traveling paths of wires 1 and 2, as shown in Fig. 4. The dewatering equipments 9, 10, 11, and 12 are used for applying dewatering pressure on suspension 4 held between the wires 1, 2. The dewatering equipment 9 is arranged opposite a forming roll 5. A blade member 8 provided on the tip end of the dewatering equipment 9 is pressed against the forming roll 5 to apply pulse-dewatering pressure on the forming roll 5. Note that the wires 1, 2 are both in the form of a loop and are guided by a plurality of rolls 6, 7. The suspension 4 is squirted from a head box 3 onto the forming roll 5 and is held in a wedge-shaped gap formed by the wires 1, 2.

[0007] Fig. 5 is a simplified diagram for explaining how dewatering is performed at the suction forming roll shown in Fig. 4, and Fig. 6 is a distribution diagram of a cumulative quantity to be dewatered to the opposite side of the suction forming roll of Fig. 4. The forming roll 5 is the first dewatering part of the former, so a quantity to be dewatered from the suspension 4 at the forming roll 5 is extremely great. Particularly, within a wire warp angle of 10 degrees, about 25% of the flow rate squirted from the head box 3 is dewatered to the opposite side of the forming roll 5, as shown in Fig. 6. White water dewatered to the forming roll side is suctioned by the suction box 10 of the forming roll 5, but white water 15 dewatered to the opposite side scatters along the traveling direction of the wires 1, 2, as shown by arrows in Fig. 6.

[0008] In such a situation of dewatering, as shown in Fig. 4, if the blade 8 of the dewatering equipment 9 is pressed against the forming roll 5 from a position opposite the forming roll 5 for the purpose of improving the above-described formation, a great quantity of whit water 15 dewatered to the upstream side of the dewatering equipment 9 will collide violently with the blade 8. Because of this, deformation of the blade 8 due to a collision with the white water 15 occurs, or the bite of the blade 8 into the forming roll 5 due to the deformation occurs. As a result, the problem of a paper defect, uneven wear on the blade 8, damage to the wires 1 and 2, etc., is sometimes caused. Also, even when there is no deformation of the blade 8, white water 15 colliding with the tip end of the blade 8 sometimes enters between the blade 8 and the wire 2 and causes a defect in paper such as streaks. In such a case, paper with uneven dispersion of fibers is manufactured.

[0009] The present invention has been made in view

of the above-described problems. Accordingly, it is the object of the present invention to provide a twin wire former that is capable of manufacturing defect-free paper that has even dispersion of fibers, while preventing damage to blades that is caused by a collision with white water during dewatering.

DISCLOSURE OF THE INVENTION

[0010] In the present invention, the above-described problems are solved by preventing white water dewatered to the opposite side of aroll from interferingwith-pressure elements (blades, etc.). That is, a twin wire former according to the present invention is equipped with white-water withdrawal means for withdrawing white water dewatered to the opposite roll side, which is arranged to the upstream side of a pressure element. Note that the present invention is applied to twin wire formers in which (1) a suspension of fibers is supplied between first and second looped wires arranged opposite each other, (2) the looped interior surface of the first wire and the looped exterior surface of the second wire run around a roll, and (3) a pressure element for applying dewatering pressure on the looped interior surface of the secondwire is arranged on the looped interior surface side of the second wire and opposite the roll.

[0011] According to the twin wire former of the present invention, white water dewatered to the opposite roll side is withdrawn by white-water withdrawal means, whereby the interference of white water with the pressure element can be suppressed. This can avoid deformation of the pressure element and a bite into the roll due to the deformation. Also, even when there is no deformation of the pressure element, white water colliding with the tip end of the pressure element can be prevented from entering between the pressure element and the wire and causing a defect in paper such as streaks. As a result, damage to the pressure element can be prevented, defect-free and high-quality paper with uneven dispersion of fibers can be manufactured, and stable operation becomes possible.

[0012] In the case where a plurality of pressure elements are arranged along the direction in which the second wire travels, it is preferable that the white-water withdrawal means be provided in the forefront pressure element. The forefront pressure element is the most influenced by white water. Therefore, if the white-water withdrawal means is provided in the forefront pressure element, the interference between the forefront pressure element and white water is suppressed and problems due to the interference can be prevented. Of course, it is also possible to provide the white-water withdrawal means in each of the pressure elements.

[0013] A simple example of the white-water withdrawal means is a blade. That is, the blade is arranged inside the second wire and opposite the roll. This blade is not for the purpose of applying dewatering pressure on the looped interior surface of the second wire like the pressure element, but for the purpose of guiding and withdrawing white water in a direction away from the second wire along the blade surface and preventing white water from colliding with the pressure element. Therefore, the white-water withdrawal blade can be arranged at a position farther away from the second wire than the pressure element. It is also preferable that the withdrawal blade be higher in rigidity than the blade used as the pressure element (note that it is preferable that the pressure element have flexibility). It is also preferable that the white-water withdrawal blade have a tip end curved toward the upstream side to guide white water to the outside along the blade surface so that the white water colliding with the blade tip end does not collide with the wire surface again. The white-water withdrawal blade may be equipped with white-water suction means for forcibly suctioning white water withdrawn. By forcibly suctioning white water withdrawn, it can be withdrawn more effectively. Note that the white-water suction means can employ a vacuum box, etc.

[0014] Regarding the position of the white-water withdrawal blade in the roll direction, it is preferable that the tip end be arranged at a position about 15 mm away from the second wire. If the white-water withdrawal blade is too away from the first wire the efficiency of withdrawing white water declines, and if the white-water withdrawal blade is pressed into the first wire (that is, if distance becomes negative) there are cases where streaks due to the entry of white water occur and the white-water withdrawal blade itself is deformed. Preferably, there is provided position adjustment means so that the position of the white-water withdrawal blade in the roll direction can be freely adjusted to a position where white water is efficiently withdrawn. Note that white water dewatered to the opposite roll side applies pressure on the white-water withdrawal blade. This pressure varies with the position in the roll direction of the white-water withdrawal blade. Hence, if there is provided pressure detection means for detecting pressure that acts on the white-water withdrawal blade, and the white-water withdrawal blade is moved so that the detected pressure is proper, the white-water withdrawal blade can be readily adjusted to a proper position.

[0015] On the other hand, regarding the position of the pressure element in the roll direction, it is preferable that the tip end be about 1 mm pressed into the interior surface of the first wire toward the roll side so that fibers can be dispersed by the application of pressure. Preferably, there is provided position adjustment means so that the position of the pressure element in the roll direction can be freely adjusted to a position where proper fiber dispersion can be performed. More preferably, by providing pressure detection means for detecting pressure that acts on the pressure element, the position of the pressure element in the roll direction is adjusted and moved so that the detected pressure is proper pressure.

[0016] The pressure detection means can employ an ordinary pressure sensor. In the case where a pressure

sensor is provided in the white-water withdrawal blade or pressure element, pressure acting on the white-water withdrawal blade or pressure element can be directly detected. Also, the reaction to the pressure acting on the white-water withdrawal blade and pressure element acts on the surface of the roll. Hence, by providing a pressure sensor on the roll surface, the pressure that acts on the white-water withdrawal blade and pressure element may be indirectly detected from the pressure acting on the roll surface through white water, wires, and a suspension of fibers.

[0017] Note that the above-described roll opposite which the pressure element and white-water withdrawal blade are arranged may be a solid roll, a roll with a porous band wrapped around the surface to withdraw surplus white water, or a roll with various grooves in the surface. However, it is preferable that the roll be a suction forming roll. In the case of a suction forming roll, white water dewatered to the roll side can be forcibly suctioned, and consequently, the quantity of white water to be dewatered to the opposite roll side because of the influence of centrifugal force can be reduced.

[0018] By employing the above-described twin wire former, papermaking can be performed by the following methods. That is, paper is manufactured by detecting pressure that acts on a white-water withdrawal blade by pressure detection means, and adjusting the position of the white-water withdrawal blade in the roll direction by position adjustment means so that the detected pressure is within a proper range. According to this papermaking method, the entry of white water to the tip end of the pressure element is surely prevented and defect-free and high-quality paper with even dispersion of fibers can be manufactured.

[0019] Paper can also be manufactured by detecting pressure that acts on the white-water withdrawal blade by first pressure detection means and also detecting pressure that acts on the pressure element by second pressure detection means, and adjusting the position of the white-water withdrawal blade in the roll direction by first position adjustment means so that the detected pressure is within a first proper range and also adjusting the position of the pressure element in the roll direction by second position adjustment means so that the detected pressure is within a second proper range. According to this method, dewatering pressure to be applied by the pressure element can be made proper and high-quality paper with even dispersion of fibers can be manufactured.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

FIG. 1 is a side view showing the principal part of a twin wire former constructed in accordance with a first embodiment of the present invention;

FIG. 2 is a side view showing the principal part of a twin wire former constructed in accordance with a second embodiment of the present invention;

FIG. 3A is a diagram showing the relationship between a distance d from a roll surface to each blade tip end and the roll surface pressure, for explaining a method of controlling proper positions of the white-water withdrawal blades and loadable blades;

FIG. 3B is a diagram for explaining the definition of the distance d shown in FIG. 3A;

FIG. 4 is a side view showing the construction of the dewatering part of a conventional twin wire former;

FIG. 5 is a simplified diagram for explaining how dewatering is performed at the suction forming roll shown in FIG. 4; and

FIG. 6 is a distribution diagram of a cumulative quantity to be dewatered to the opposite side of the suction forming roll of FIG. 4.

BEST MODE FOR CARRYING OUT THE INVENTION

[0021] Embodiments of the present invention will hereinafter be described in conjunction with the drawings.

(A) First Embodiment

[0022] Fig. 1 is a side view showing the principal part of a twin wire former constructed in accordance with a first embodiment of the present invention. Note in the figure that the same parts as the conventional twin wire former shown in Fig. 4 are represented by the same reference numerals.

[0023] As shown in Fig. 1, a pair of wires 1, 2 run around a forming roll 5 and are both in the form of a loop. The looped interior surface of one (first wire 1) of the two wires runs around the forming roll 5, while the looped exterior surface of the other wire (second wire 2) runs around the forming roll 5. Within the range that the wires 1, 2 run around the forming roll 5 (wire wrap range), there is provided a suction box 10. Inside the wire 2 and at positions opposite the suction box 10, a plurality of flexible loadable blades (pressure elements) 30 are arranged along the direction in which the wires 1, 2 travel. These loadable blades 30, 30 constitute a dewatering equipment, which disperses fibers evenly by applying pulse-dewatering pressure on a fiber suspension 4 which is a raw material liquid held between the wires 1 and 2.

[0024] In the first embodiment, a deflector blade (white-water withdrawal blade) 20 for withdrawing white water 15 is arranged upstream in close proximity to the forefront loadable blade 30. This white-water withdrawal blade 20 has a tip end gently curved toward the upstream side and is higher in rigidity than the loadable blade 30. Also, the position of the white-water withdrawal blade 20 in the roll direction (direction of the forming roll 5) is set so that the tip end is arranged in close prox-

imity to the interior surface of the wire 2 or contacts the interior surface to the degree of a kiss touch.

[0025] The white-water withdrawal blade 20 is provided with a pressure sensor 40 and a moving device 50 with a displacement sensor for position detection. The pressure sensor 40 is a sensor to detect pressure that acts on the white-water withdrawal blade and is primarily used for detecting pressure from white water that collides with the white-water withdrawal blade during dewatering. Also, the moving device 50 is a device to move and adjust the position in the roll direction of the white-water withdrawal blade 20 and is able to confirm the current position by the displacement sensor.

[0026] With such a construction, the fiber suspension 4 supplied between the wires 1 and 2 from a head box 3 is transferred onto the suction box 10 while being held between the wires 1 and 2. The fiber suspension 4 is dewatered by the surface pressure of the wires 1, 2 and the suction force of the suction box 10. On the opposite side of the suction forming roll 5, dewatering is also performed by the surface pressure of the wires 1, 2 and centrifugal force. The dewatered white water 15 is discharged inside the wire 2 along the direction in which the wires 1, 2 travel.

[0027] At this time, the white water 15 dewatered to the opposite side of the forming roll 5 is guided and withdrawn in a direction away from the wire 2 along the surface of the white-water withdrawal blade 20. This withdrawal suppresses the amount that the white water 15 collides with the loadable blade 30. As a result, deformation of the loadable blade 30 due to a collision with a large quantity of white water 15, and the occurrence of streaks due to the entry of the white water 15 into the space between the loadable blade 30 and wire 2, can be prevented. That is, the twin-wire former of the first embodiment is capable of manufacturing paper of even fiber dispersion that is free from a paper defect such as streaks, while preventing damage to the loadable blades 30 due to a collision with white water 15.

[0028] Note that the white-water withdrawal blade 20 can be adjusted to a proper position by detecting pressure that acts on the white-water withdrawal blade 20 with the pressure sensor 40, and then performing position adjustment with the moving device 50 so that the detected pressure is proper pressure. Since the white-water withdrawal blade 20 has no purpose of enhancing dispersion of fibers, there is no need to generate high dewatering pressure in the fiber suspension 4. The proper position of the white-water withdrawal blade 20 and position control method will be described later (in a second embodiment). However, as at least described above, if the position of the white-water withdrawal blade 20 is adjusted so that it is arranged very close to the wire 2 or contacts the wire 2 to the degree of a kiss touch, there is no possibility that the white-water withdrawal blade 20 will be pressed against the wire 2. As a result, the problem of the occurrence of streaks due to the entry of the white water 15 into the space between the loadable blade 30 and wire 2, bite of the white-water withdrawal blade 20 into the wire 2 due to deformation of the white-water withdrawal blade 20, etc., can be avoided.

(B) Second Embodiment

[0029] Fig. 2 is a side view showing the principal part of a twin wire former constructed in accordance with a second embodiment of the present invention. Note in the figure that the same parts as the first embodiment are represented by the same reference numerals.

[0030] In the second embodiment, flexible loadable blades 35, 36, and 37 arranged in the traveling direction of a wire 2 are respectively provided with white-water withdrawal blades 25, 26, and 27, as shown in Fig. 2. The white-water withdrawal blades 25, 26, and 27 are arranged upstream in close proximity to the corresponding loadable blades 35, 36, and 37 and are fixed to moving devices 55, 56, and 57 along with the corresponding loadable blades 35, 36, and 37. Each of the moving devices 55, 56, and 57 has a displacement sensor. In Fig. 2, three units 65, 66, and 67, which consist of the loadable blade, white-water withdrawal blade, and moving device, are arranged along the traveling direction of the wire 2.

[0031] With such a constitution, white water 15 dewatered to the opposite side of the forming roll 5 is withdrawn by the units 65, 66, and 67. The cumulative amount of white water 15 dewatered is maximum at the forefront loadable blade 35, but dewatering of white water 15 is also performed between the loadable blades 35 and 36 and between the loadable blades 36 and 37. Therefore, since the units 65, 66, and 67 are provided with white-water withdrawal blades 25, 26, and 27 for withdrawing white water 15, the white water 15 dewatered between the loadable blades 35 and 36 and between the loadable blades 36 and 37 can be prevented from colliding with the loadable blades 36, 37. This makes it possible to prevent damage to these loadable blades 36, 37 and to manufacture paper that has even dispersion of fibers.

[0032] In the second embodiment, a pressure sensor 60 is arranged inside the forming roll 5 to detect roll-surface pressure. The pressure sensor 60 rotates integrally with the forming roll 5 and serially detects pressure that acts at each position in the circumferential direction. The reaction to the pressure acting on the white-water withdrawal blades 25, 26, 27 and loadable blades 35, 36, 37 acts on the surface of the forming roll 5. Hence, if a change in the pressure applied on the roll surface is detected with the pressure sensor 60, the pressure that acts on the white-water withdrawal blades 25, 26, 27 and loadable blades 35, 36, 37 can be indirectly detected.

[0033] Fig. 3 is an explanatory diagram for explaining a method of controlling positions of the white-water withdrawal blades 25, 26, 27 and loadable blades 35, 36,

37. Fig. 3A is a diagram showing the relationship between a distance d from the roll surface to each blade tip end and the roll surface pressure, and Fig. 3B is a simplified diagram for explaining the definition of the distance d shown in Fig. 3A. Note that the position control method hereinafter described can also be applied to the position control of the white-water withdrawal blade 20 of the first embodiment.

[0034] First, regarding the positions of the white-water withdrawal blades 25, 26, and 27, if the white-water withdrawal blades 25, 26, and 27 are too away from the wire 2 the efficiency of withdrawing white water 15 declines, and if the white-water withdrawal blades 25, 26, and 27 are pressed into the wire 2 there is a need to take into account the occurrence of streaks due to the entry of white water 15, and deformation of the white-water withdrawal blades 25, 26, and 27. Therefore, proper positions of the white-water withdrawal blades 25, 26, and 27 are within a white-water collision pressure region from a reference position, as shown by a black bar in Fig. 3A. The reference position is away from the surface of the forming roll 5 by the sum of the thickness of the two wires 1, 2 and the thickness of the fiber suspension 4 held between the wires 1, 2. More specifically, the proper positions are in a range of 0 to 15 mm from the reference position (interior surface of the wire 2).

[0035] On the other hand, proper positions of the loadable blades 35, 36, and 37 are within an inter wire deformation region from the above-described reference position as shown by a white bar in Fig. 3A, because they must compress the fiber suspension 4 held between the wires 1 and 2 to disperse fibers. More specifically, the proper positions are in a range of 1 to 3 mm from the reference position toward the forming roll 5.

[0036] The position control of the white-water withdrawal blades 25, 26, 27 and loadable blades 35, 36, 37 is performed based on values detected by the pressure sensor 60 provided in the forming roll 5. That is, a pressure diagram such as that shown by a solid line in Fig. 3A is previously prepared and a proper pressure range corresponding to proper positions is computed. And by controlling the moving devices 55, 56, and 57 so that values detected by the pressure sensor 60 are within the proper pressure range, the positions of the white-water withdrawal blades 25, 26, 27 and loadable blades 35, 36, 37 are adjusted. The above-described position control can be performed automatically, or it can be performed manually by an operator. In the case of automatic control, the pressure diagram is previously stored in a controller, and signals from the moving devices 55, 56, and 57 are fed back to the controller so that values detected by the pressure sensor 60 are within the proper pressure range.

[0037] If papermaking is performed while performing the position control of the white-water withdrawal blades 25, 26, 27 and loadable blades 35, 36, 37 in the above-described manner, the dewatering pressure to be applied by the loadable blades 35, 36, 37 can be made optimum. In addition, the occurrence of streaks due to the entry of white water into the space between the loadable blade (35, 36, or 37) and the wire 2 can be surely prevented. As a result, it becomes possible to manufacture high-quality paper that has even dispersion of fibers.

[0038] Note that since the fiber suspension 4 becomes thinner in thickness as dewatering moves, the reference position shown in Fig. 3A (which is away from the surface of the forming roll 5 by the sum of the thickness of the two wires 1, 2 and the thickness of the fiber suspension 4 between the wires 1, 2) moves closer to the surface of the forming roll 5 toward the downstream side. Therefore, the pressure diagram shown in Fig. 3A varies with blade positions. Hence, to perform accurate position control, it is preferable to previously input a pressure diagram corresponding to each blade to a controller.

(C) Others

[0039] While the present invention has been described with reference to two embodiments, the invention is not to be limited to the details given herein, but may be modified within the scope of the invention hereinafter claimed.

[0040] For instance, in the second embodiment, while the white-water withdrawal blades 25, 26, 27 are formed integrally with the loadable blades 35, 36, 37, the white-water withdrawal blades 25, 26, 27 may be formed separately from the loadable blades 35, 36, 37, and the moving devices may be provided in the blades 25, 26, 27, 35, 36, and 37, respectively. Also, in the second embodiment, each of the blades 25, 26, 27, 35, 36, and 37 may be provided with a pressure sensor so that optimum position control can be performed based on values detected by the pressure sensor.

[0041] In the first and second embodiments, while one white-water withdrawal blade is arranged to the upstream side of each loadable blade (second embodiment) or to the upstream side of the loadable blade group (first embodiment), a plurality of white-water withdrawal blades may be arranged to the upstream side of each blade or blade group.

[0042] Also, each white-water withdrawal blade may be provided with suction means (such as a suction box, etc.) so that the white water withdrawn by the blade can be forcibly suctioned. Withdrawn white water can be continuously removed to the outside, so it becomes possible to withdraw white water more efficiently.

[0043] In addition, the white-water withdrawal means of the present invention is not to be limited to the blades constructed in accordance with the above-described embodiments. The white-water withdrawal means may have any shape if it can prevent the white water withdrawn to the opposite side of the forming roll 5 from colliding with loadable blades. Therefore, for example, it may have a shape that becomes thicker in the traveling

direction of the wire, or it may have a guide plate shape if rigidity is assured. Also, the pressure elements are not to be limited to the blades constructed in accordance with the above-described embodiments. They may be roll members or rod members , if they can applypulse-dewatering pressure on the fiber suspension held between the wires. In the case of blades, they may be not a flexible type like the embodiments, but a fixed type.

Claims

1. A twin wire former for supplying a suspension of fibers between first and second looped wires arranged opposite each other, and dewatering said suspension of fibers held between said first and second wires, running a looped interior surface of said first wire and a looped exterior surface of said second wire around a roll, said former comprising:

   a pressure element, arranged on the looped interior surface side of said second wire and opposite said roll, for applying dewatering pressure on the looped interior surface of said second wire; and
   white-water withdrawal means arranged to the upstream side of said pressure element for withdrawing white water dewatered to the looped interior surface side of said second wire.

2. The twin wire former as set forth in claim 1, wherein:

   said pressure element comprises a plurality of pressure elements arranged along a direction in which said second wire travels; and
   said white-water withdrawal means is provided in the forefront pressure element of said pressure element group.

3. The twin wire former as set forth in claim 1 or 2, wherein said white-water withdrawal means comprises a white-water withdrawal blade arranged on the looped interior surface side of said second wire and opposite arranged said roll.

4. The twin wire former as set forth in claim 3, wherein said white-water withdrawal blade has a tip end curved toward an upstream side.

5. The twin wire former as set forth in claim 3 or 4, further comprising white-water suction means for suctioning white water withdrawn by said white-water withdrawal blade.

6. The twin wire former as set forth in any one of claims 3 through 5, further comprising first position adjustment means for adjusting the position of said white-water withdrawal blade in the direction of said roll.

7. The twin wire former as set forth in claim 6, further comprising first pressure detection means for detecting pressure that acts on said white-water withdrawal blade.

8. The twin wire former as set forth in claim 6 or 7, further comprising second position adjustment means for adjusting the position of said pressure element in said roll direction.

9. The twin wire former as set forth in claim 8, further comprising second pressure detection means for detecting pressure that acts on said pressure element.

10. The twin wire former as set forth in any one of claims 1 through 9, wherein said roll comprises a suction forming roll.

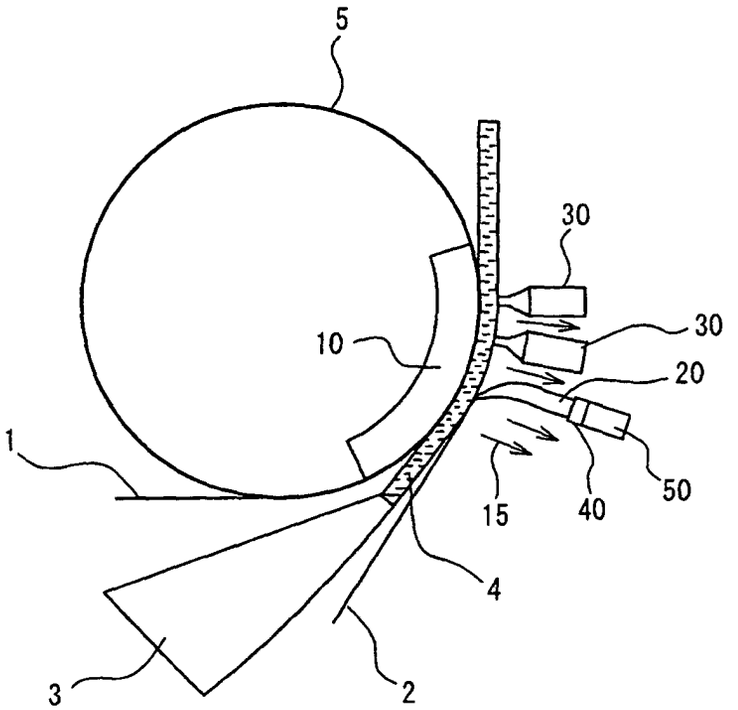
11. A method of manufacturing paper by employing the twin wire former as set forth in claim 7, comprising the steps of:

    detecting pressure that acts on saidwhite-water withdrawal blade by said first pressure detection means; and
    adjusting the position of said white-water withdrawal blade in said roll direction by said first position adjustment means so that the detected pressure is within a proper range.

12. A method of manufacturing paper by employing the twin wire former as set forth in claim 9, comprising the steps of:

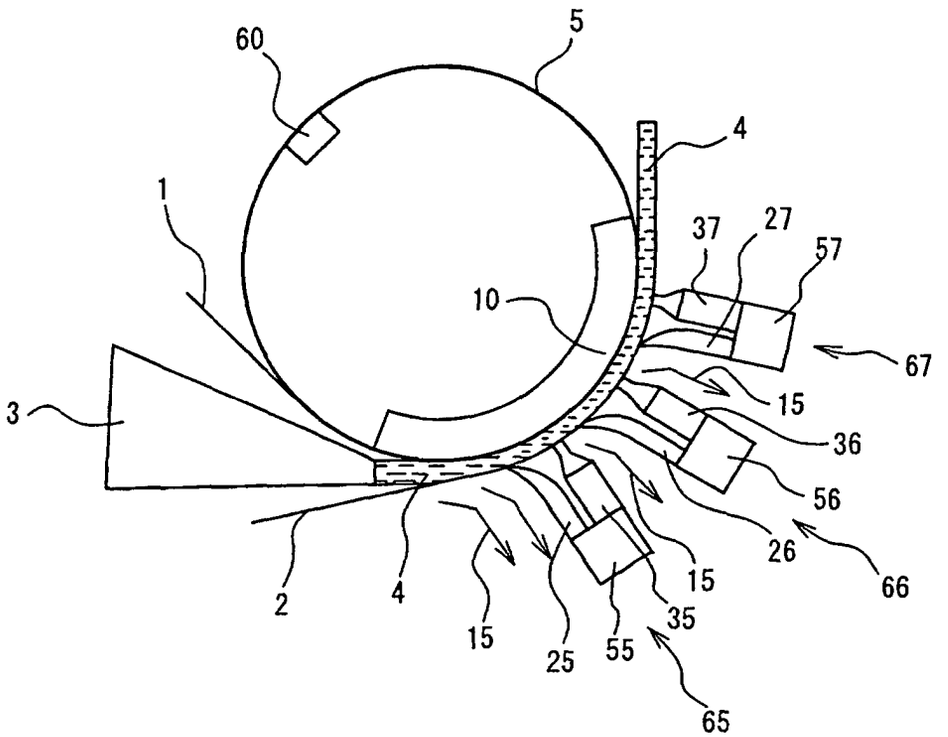
    detecting pressure that acts on saidwhite-water withdrawal blade by said first pressure detection means and also detecting pressure that acts on said pressure element by said second pressure detection means; and
    adjusting the position of said white-water withdrawal blade in said roll direction by said first position adjustment means so that the detected pressure is within a first proper range, and also adjusting the position of said pressure element in said roll direction by said second position adjustment means so that the detected pressure is within a second proper range.

FIG. 1



1, 2:WIRE
3:HEAD BOX
4:RAW MATERIAL LIQUID
5:SUCTION FORMING ROLL
10:SUCTION BOX
15:WHITE WATER
20:WHITE-WATER WITHDRAWAL BLADE
30:FLEXIBLE PRESS BLADE
40:PRESSURE SENSOR
50:DISPLACEMENT SENSOR & MOVING DEVICE

FIG. 2



1, 2: WIRE
3: HEAD BOX
4: RAW MATERIAL LIQUID
5: SUCTION FORMING ROLL
10: SUCTION BOX
15: WHITE WATER
25, 26, 27: WHITE-WATER WITHDRAWAL BLADE
35, 36, 37: PRESS BLADE
55, 56, 57: DISPLACEMENT SENSOR & MOVING DEVICE
65, 66, 67: UNIT

FIG. 3A

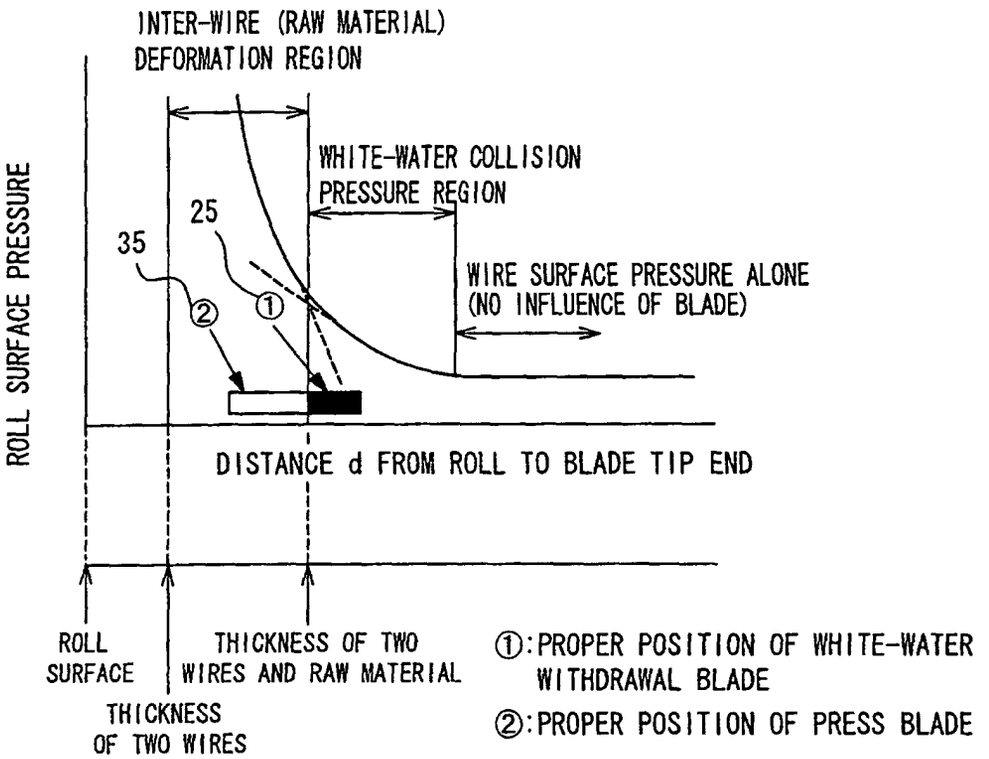
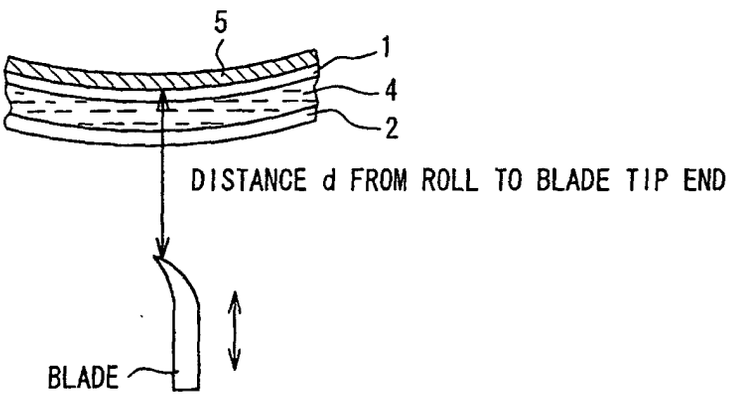
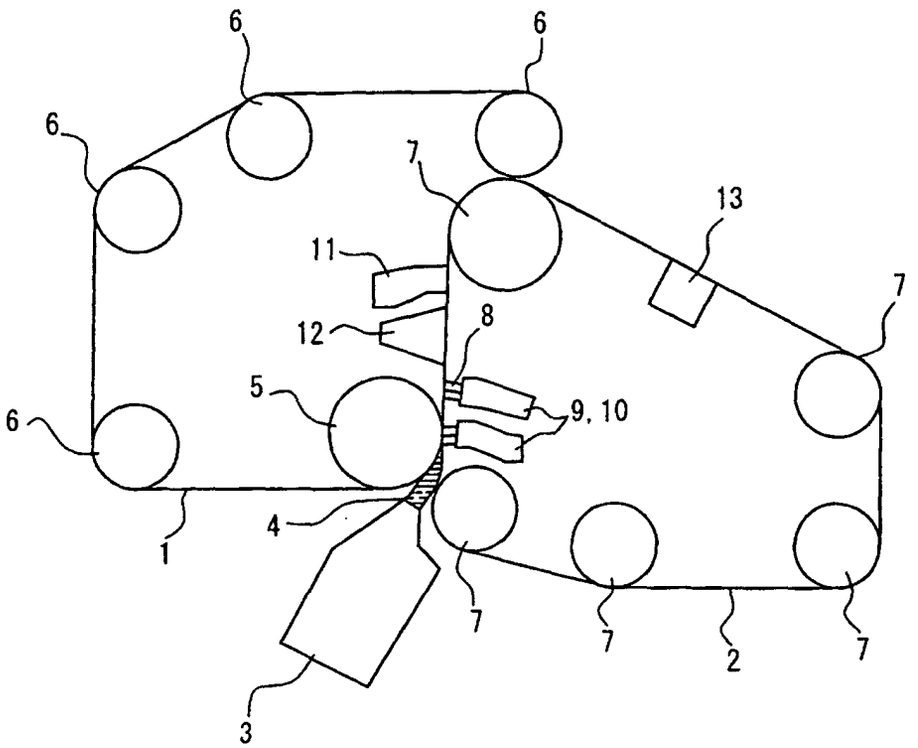


FIG. 3B



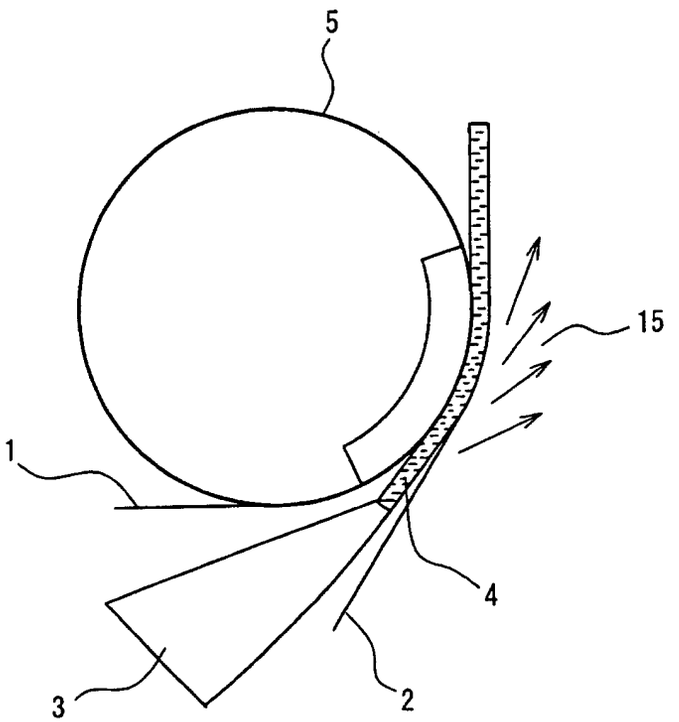
1, 2:WIRE
4:RAW MATERIAL LIQUID
5:SUCTION FORMING ROLL

FIG. 4



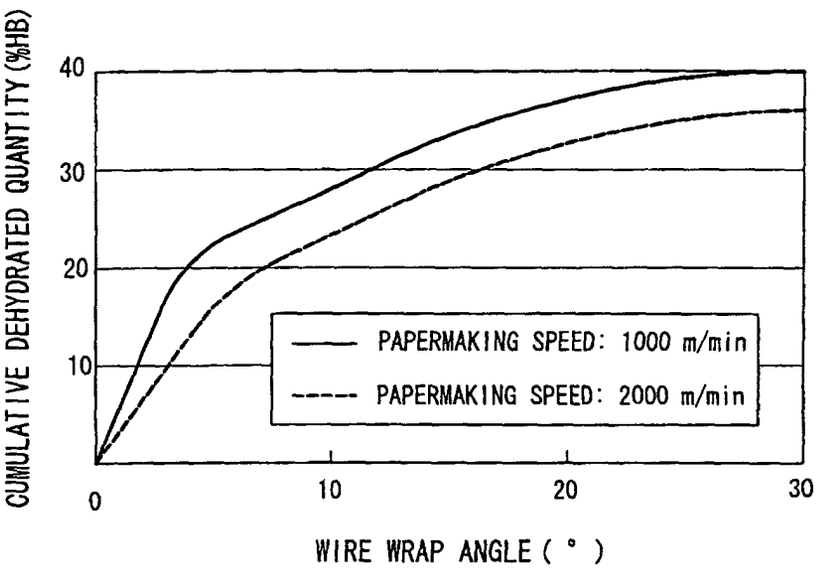
1, 2:WIRE
3:HEAD BOX
4:RAW MATERIAL LIQUID
5:SUCTION FORMING ROL
8:BLADE
9, 10, 11, 12, 13:DEHYDRATOR

FIG. 5



1, 2:WIRE
3:HEAD BOX
4:RAW MATERIAL LIQUID
5:SUCTION FORMING ROLL
10:SUCTION BOX
15:WHITE WATER

FIG. 6


CUMULATIVE DEHYDRATED QUANTITY (%HB)
40
30
20
10
0
10
20
30
WIRE WRAP ANGLE (°)
PAPERMAKING SPEED: 1000 m/min
PAPERMAKING SPEED: 2000 m/min

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP03/01386

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] D21F9/02

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] D21F9/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1926-1996	Toroku Jitsuyo Shinan Koho	1994-2003
Kokai Jitsuyo Shinan Koho	1971-2003	Jitsuyo Shinan Toroku Koho	1996-2003

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5480520 A (J.M.Voith GmbH), 02 December, 1996 (02.12.96), Full text & FI 9400155 A & CA 2113673 A & CA 2113673 C & DE 4301103 C & EP 607549 A1 & EP 607549 B1 & DE 4301103 C & DE 59309760 G & JP 6-235185 A	1-12
Y	GB 2063948 A (Beloit Corp.), 12 November, 1980 (12.11.80), Full text & JP 56-85493 A & ES 496929 A & IT 1134337 A & IT 1134337 B	1-12

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

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

Date of the actual completion of the international search	Date of mailing of the international search report
12 May, 2003 (12.05.03)	27 May, 2003 (27.05.03)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP03/01386

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 6-341090 A (Mitsubishi Heavy Industries, Ltd.), 13 December, 1994 (13.12.94), Full text (Family: none)	7,9,11,12

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