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(71) Applicant: **Valmet Technologies, Inc.**
02150 Espoo (FI)

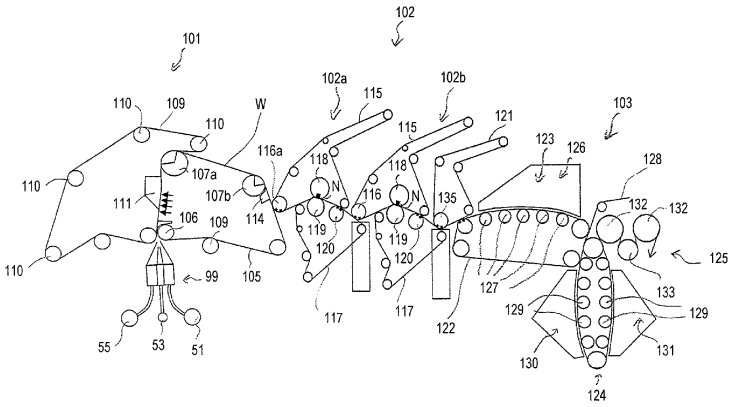
(72) Inventors:
- **Anttilainen, Sami**
  40740 Jyväskylä (FI)
- **Juppi Kari**
  40270 Palokka (FI)
- **Valkama, Timo**
  40630 Jyväskylä (FI)

(74) Representative: **TBK**
Bavariaring 4-6
80336 München (DE)

(54) **Paper or board making machine and method for manufacturing high filler content paper or board**

(57) The invention pertains to a paper or board making machine for manufacturing high filler content paper or board and to a corresponding method. The paper or board making machine comprises a forming section (101) in which at least one wire (105) arranged in a wire loop is provided for forming a web (W) from a fiber suspension, a closed draw press section (102) in which at least two press nips (N, N) being formed between two rolls (118, 119) each are provided for dewatering the web (W) transferred from the forming section (101), and a drying section (103) in which at least one drying cylinder (132) is provided for drying the web (W) transferred from the closed draw press section (102). The forming section (101) comprises a headbox (99) being capable of supplying liquids onto the wire (105, 109) in a layered manner and comprising a turbulence generator and a nozzle chamber having two converging walls (21, 22) forming a nozzle outlet (24). The turbulence generator has at least three diffusers (1, 3, 5, 7, 9) creating turbulence in liquids supplied into each respective diffuser (1, 3, 5, 7, 9) via feeding means (25, 27, 29) for feeding pulp suspension and/or water as the liquids. Each of the diffusers (1, 3, 5, 7, 9) has an outlet into the nozzle chamber. A central diffuser (1) of the at least three diffusers (1, 3, 5, 7, 9) has two blades (11, 13) arranged at its outlet and extending into the nozzle chamber in a converging manner. The blades (11, 13) separate a liquid flowing through the central diffuser (1) from liquids flowing through adjacent diffusers (3, 5, 7, 9). In the transporting direction of the web an impingement drying means (123, 124) is arranged before the at least one drying cylinder (132) in the drying section (103).

FIG. 3



EP 2 784 212 A1

Description

[0001] The invention pertains to a paper or board making machine for manufacturing high filler content paper or board and to a corresponding method.

[0002] When manufacturing paper it is a papermaker's goal to use as much filler as possible in order to maintain the required functional properties of the later paper. This is due to the fact that the fiber price is about six times higher than the filler (PCC) price. Filler GCC is even cheaper than PCC. However, using filler GCC leads to lower bulk in the paper. In addition to lower strength and bulk, a higher filler content in general also limits the runnability of the paper machine. Furthermore, a higher filler content makes paper weaker when it is wet, so the web run at the beginning of the drying section is comparatively challenging. Furthermore, a certain minimum strength is required in the size press so that the paper can bear free draw and other open space stress when it is moisturized. By known paper or board making machines, paper or board having filler contents of up to 30% can be realized.

[0003] Document WO 2008/034947 A1 discloses an example of a prior art paper or board making machine and of a method for manufacturing paper or board.

[0004] The inventors of the present invention have found that it is possible to improve the paper or board strength by adding starch or a larger amount of refined fiber, or some other chemicals, to a web middle layer. If it was possible to provide the mentioned reinforcing material into the middle of the web, but not into its boundary layers (i.e. at the surface of the paper or board web), the strength properties of the web could be remarkably improved. Thus, a larger amount of filler can be added to the paper, while the strength properties of the paper can be maintained in the required range.

[0005] In particular, it has been found that, in a case where starch or refined fibers have been added directly in the middle of the web, the paper strength exceeds that of a case where starch or refined fibers have been added in the machine chest, i.e. into the boundary layers of the paper as is currently done. When adding an increased amount of refined fibers into the middle layer, a similar result as that when using starch can be achieved.

[0006] Accordingly, there is need for a paper or board making machine and method for making a high filler content fiber web capable of providing a web having an increased filler content in a middle layer. This kind of paper or board making machine remarkably reduces production costs of paper or board.

[0007] According to the invention, a paper or board making machine comprises a forming section in which at least one wire arranged in a wire loop is provided for forming a web from a fiber suspension, a closed draw press section in which at least two press nips being formed between two rolls each are provided for dewatering the web transferred from the forming section, and a drying section in which at least one drying cylinder is provided for drying the web transferred from the closed draw press section. The forming section comprises a headbox being capable of supplying liquids onto the wire in a layered manner and comprising a turbulence generator and a nozzle chamber having two converging walls forming a nozzle outlet.

[0008] The turbulence generator has at least three diffusers creating turbulence in liquids supplied into each respective diffuser via feeding means for feeding pulp suspension and/or water as liquids. Each of the diffusers has an outlet into the nozzle chamber. A central diffuser of the at least three diffusers has two blades arranged at its outlet and extending into the nozzle chamber in a converging manner. The blades separate a liquid flowing through the central diffuser from liquids flowing through the adjacent diffusers. Furthermore, in the transporting direction of the web an impingement drying means is arranged before the at least one drying cylinder in the drying section.

[0009] In a paper or board making machine having a headbox as described above, the position of the blade tips results in that the central layer consisting mainly of water at its boundaries does not get mixed with the adjacent pulp suspension layers. Thus, while in each of the diffusers a good distribution of the substances in the respective liquid takes place caused by the generated turbulences, the individual liquids stay separated from each other due to the blades. Furthermore, another effect of the blades is a slowing down of the turbulences in the boundary areas of each liquid layer. Accordingly, it is possible to supply the desired amounts of additives such as filler, starch or refined fibers in order to set the properties of the later paper or board web by supplying them to a centrally arranged water layer.

[0010] Accordingly, the different liquids can be supplied to a wire in a forming section in a layered manner, thus maintaining the purity of the individual liquid layers. Since mixing of the layers cannot take place at all, various additives such as filler materials, refined fibers, cationic starch, etc. in the water layer maintain their position in the center of the web to be formed, but are not distributed to the pulp suspension layers. Accordingly, a degradation of the additives caused by mixing and a subsequent interaction with materials from an adjacent liquid layer can be avoided. Thus, the desired properties of the additives are maintained. Accordingly, adjusting the required properties of the later paper or cardboard is easily enabled by supplying the respective materials with the respective layer, because a degradation of the individual material properties of the additives due to mixing with the respectively adjacent layer cannot take place.

[0011] In particular, it is possible to achieve an increased filler content in a central water layer with the filler ranging from 30% to 50% in the central layer. Such an increased filler content is preferred, since the filler material itself is comparably cheap.

[0012] Advantageously, according to the invention, one or more of the adjacent diffusers can have an additional blade arranged at the outlet, and the additional

blade has a shorter length than the adjacent blade of the central diffuser.

[0013] Thus, unifying the outer layers takes place before unifying them with the central water layer. Thereby, possible minor turbulences occurring in the boundaries of the outer layers caused by the unification of the layers do not affect the central water layer when later unifying the same with the outer layers.

[0014] Advantageously, according to the invention, the forming section can comprise a gap former or a hybrid former, the closed draw press section can comprise at least two subsequently arranged shoe press rolls, and the impingement drying means can be arranged next to the closed draw press section.

[0015] By the above described arrangement of formers, closed draw press section and impingement drying means, the drawbacks of the wet web caused by the increased filler amount can be overcome. Thus, problems caused by the reduced strength of the still wet web such as web breaks can be avoided.

[0016] Advantageously, according to the invention, the impingement drying means can comprise a horizontally and/or a vertically arranged impingement dryer. Thereby, an improved dry content of more than 60% can be achieved before the web enters the cylinder drying section.

[0017] Advantageously, according to the invention, the traveling path of the web can be curved in the impingement drying means. Thus, the runnability of the web can be improved and installation space for the paper or board making machine can be saved.

[0018] Advantageously, according to the invention, the number of drying cylinders can be less than 20 and a running speed in the drying section can be at least 1600 m/min. Due to the increased dry content of the web, the size of the drying section can be reduced, while the running speed in the drying section can be increased. Accordingly, while the machine can be downsized, the output can be increased.

[0019] Advantageously, according to the invention, the headbox can eject the liquids in an upwards direction into a gap formed between the at least one wire and a second wire, while both wires may run in a vertical upwards direction. Thereby, an interaction of the liquid layers caused by gravity force can be eliminated. Accordingly, the purity of the individual layers is not affected.

[0020] According to the invention, a method for making a high filler content fiber web comprises the step of supplying liquids in a layered manner onto a wire of a forming section of a paper or board making machine to form a web. The liquid layers supplied onto the wire comprise at least two pulp layers separated by a central water layer. The formed web is then transferred through a closed draw press section comprising at least two press nips being formed between two rolls each for dewatering the web in order to keep bulk in an acceptable range, and through a drying section in which at least one drying cylinder is provided for drying the web transferred from the closed draw press section.

[0021] Advantageously, according to the method of the invention, the filler content in the fiber web ranges from 30% to 50%.

[0022] Advantageously, according to the method of the invention, the central water layer comprises fresh water, dilution water, and/or white water.

[0023] Advantageously, according to the method of the invention, starch and/or refined fibers are added to the central water layer before supplying the central water layer onto the wire.

[0024] Advantageously, according to the method of the invention, a drying content of the web is more than 60% before it is transferred to the cylinder drying section.

[0025] Advantageously, according to the method of the invention, a running speed of the web in the drying section is at least 1600 m/min.

[0026] According to the above described method and the advantageous alternatives, the advantages described above with regard to the paper or board making machine according to the invention can be achieved.

[0027] Thus, according to the invention a technology is provided by which it is possible to control the quality and strength of the web, although the filler content is largely increased when compared to prior art solutions. Adding filler causes losing of web strength. Thus, way tail threading as well as runnability at the beginning of the drying section requires a certain attention. However, these drawbacks are overcome in that the dry content before the cylinder drying section remarkably improves when the filler content is higher.

[0028] In order to keep bulk in an acceptable range, lower loads are required in the press section when the dry content decreases and problems with the runnability remain. Therefore, the impingement drying unit is arranged at the beginning of the drying section before the wet and cold web gets into contact with the hot drying cylinders. Accordingly, the web temperature increases and the web dry content rises. For instance, with a filler level of 40%, the web dry content exceeds 60%. Furthermore, downstream of the impingement drying unit, control of the web in tail threading and normal running is remarkable easy in the drying section.

[0029] Further advantages will be understood from the following description of presently preferred embodiments of the invention to be considered in context with the attached drawings.

Fig. 1 is a sectional view of a headbox structure installed at the wet end of a paper or board making machine according to an embodiment of the invention.

Fig. 2 is an enlarged view of a diffuser portion and a nozzle portion of the headbox structure shown in Fig. 1.

Fig. 3 is a schematic view of a paper or board making

machine according to the embodiment of the invention.

Fig. 4 is a diagram showing the effect of increasing starch content on the internal strength of a web.

[0030] In Fig. 1, from the left to the right, a headbox 99 comprises headers 39, 41, and 43, to which liquids such as pulp suspension and/or water are fed by headbox fan pumps (not shown), a manifold in which feeding pipes 25, 27, and 29 are provided, a diffuser chamber in which diffuser tubes 1, 3, 5, 7, and 9 are provided, and a nozzle chamber having converging walls 21, 22 forming a slice opening (nozzle outlet) 24. Manifold pipes 25, 27, and 29 establish communication from the headers 39, 41, and 43 to the diffuser tubes 1, 3, 5, 7, and 9. Blades 11, 13, 15, and 17 are respectively attached to outlets of the diffuser tubes 1, 3, 5, 7, and 9 via joints 31, 33, 35 and 37. Blades 11, 13, 15, and 17 have a wedge shaped cross-section, in which a thick end is attached to the respective diffuser tube while a thin end 11a, 13a, 15a, and 17a projects towards the slice opening. The blades are provided in a staggered manner, i.e. blades 11 and 13 as central blades lengthwise extend beyond blades 15 and 17.

[0031] From headers 39, 41, and 43 various liquids are pumped via the manifold pipes 25, 27, and 29 to the respective diffuser tubes 1, 3, 5, 7, and 9. According to the invention, water such as white water or fresh water is fed from header 41 to diffuser tube 1 via manifold pipe 29, while the other diffuser tubes 3, 5, 7, and 9 are supplied with a stock or pulp suspension. After having entered the respective diffuser tubes 1, 3, 5, 7 or 9, turbulence is generated in the respective liquids in order to achieve a desired distribution of the additives and materials present in the respective liquids. In particular, in the water supplied via manifold pipe 29 to diffuser tube 1, a high amount of filler and starch is present.

[0032] In the nozzle chamber, the blades 11, 13, 15, and 17 maintain the individual liquid layers separate before the liquids are ejected towards a forming section of a paper or board making machine. Each of the blades 11, 13, 15, and 17 is attached to a wall portion between the respective diffuser tubes 1, 3, 5, 7, and 9 via joints 31, 33, 35, and 37 in a freely pivotable manner. Thus, apart from the uppermost and lowermost diffuser tubes 5 and 9, each of the diffuser tubes 1, 3, and 7 is respectively continued by two of blades 11, 13, 15, and 17. The uppermost and lowermost diffuser tubes 5 and 9 are continued by blade 15 and nozzle chamber wall 22 and blade 17 and nozzle chamber wall 21, respectively. At the right side end of the diffuser tubes 1, 3, 5, 7 and 9 in Fig. 1, a transition from the diffuser tubes 1, 3, 5, 7, and 9 towards the nozzle chamber, i.e. the respective blades 11, 13, 15, and 17 and nozzle chamber walls 21 and 22, is formed in a uniform and smooth manner in order to avoid obstacles agitating the respective flow and liquid. This serves to avoid a further generation of turbulence and a corresponding agitation of the boundaries of the respective liquid layers emerging from the diffuser tubes 1, 3, 5, 7, and 9 in between the blades 11, 13, 15, and 17 and nozzle chamber walls 21 and 22, respectively.

[0033] Accordingly, the individual liquids flowing towards the slice opening 24 through the nozzle chamber are still separated by the respective blades 11, 13, 15, and 17. Surface friction of blades 11, 13, 15 and 17 maintains turbulence in the boundary areas of the individual liquid layers. Therefore, when unifying the stock or pulp suspension liquid flows which are separated by blade 15 at its tip end 15a or when unifying the stock and pulp liquid flows separated by blade 17 at its tip end 17a, an interaction between the individual liquid layers does not take place, since the turbulence in the respective boundary regions is still small-scale. Thus, stock or pulp suspension liquid flows will then merge together downstream of the tip ends 15a, 17a, of blades 15, 17. The length of blades 15 and 17 can be chosen such that there is sufficient distance to the tip ends 11a, 13a of blades 11, 13 for ensuring that individual stock or pulp suspension will merge together. The blades 11, 13 and the nozzle chamber walls 21 and 22 maintain turbulence in the stock or pulp suspension liquid flows.

[0034] The same effect as described above occurs when unifying the above described liquid layers consisting of stock or pulp suspension liquid with the water layer flowing between blades 11 and 13 at their tip ends 11a and 13a, respectively. As already mentioned above, the tip ends 11a and 13a of the blades 11 and 13, respectively, are arranged closer towards the slice opening 24 than tip ends 15a and 17a. That is, the lengths of blades 11 and 13 separating the water layer from the stock or pulp suspension liquid layers exceed the lengths of blades 15 and 17, respectively. In this regard, it also has to be noted that, although the lengths of blades 11 and 13 correspond to each other in the drawings, blades 11 and 13 can have different lengths, but it is important that their lengths exceed the respective lengths of the other blades 15 and 17.

[0035] After unifying the water layer with the stock or pulp suspension liquid layers, the liquids are ejected via slice opening 24 in a layered manner onto a wire or fabric of a forming section for further treatment, such as dewatering, pressing and drying. The distance from the tip ends 11a, 13a of blades 11, 13 to the forming section is short for ensuring the layered structure. Since thin blade tip ends 11a, 13a improve a layered structure of the web to a greater extent, the thickness of the blade tip end is less than 0.5 mm, preferably less than 0.3 mm. Thus, in the forming section a web W is formed.

[0036] For adjusting the ejected liquid flow, a slice lip 23 is provided at the upper nozzle chamber wall 22. Slice lip 23 can be adjusted in its position, i.e. in particular its reach can be adjusted by known means such as horizontal or vertical slice positioners, micro adjusters, etc. To simplify matters, these are not shown in the drawing. It has to be noted that, due to the layered structure of the

liquids ejected, a slice reach R (see Fig. 2) is preferably 1 to 10 mm, thereby advantageously acting on the ejected liquid flow (also referred to as "free jet") without affecting the purity of the individual liquid layers. Accordingly, by means of the headbox structure according to the invention, it is possible to influence the ejected liquid flow to a much higher degree than is known from the prior art.

[0037] Furthermore, due to the layered structure of the liquids, i.e. the water layer being sandwiched between the stock or pulp suspension liquid layers, the additives and other substances present in the respective liquid layers do not interact with each other, because a mixing of the individual liquid layers can be surely excluded. Thus, adjusting the properties of the later paper or board by introducing additives or other substances into the stock or pulp suspension liquids/water is facilitated. Furthermore, particularly the amount of filler in the water layer can be increased, thereby achieving a remarkable cost reduction compared to paper or board having a comparably high filler content.

[0038] Fig. 3 shows a paper machine in accordance with the invention. The paper machine comprises a forming section 101, a press section 102 and a drying section 103. The forming section 101 comprises a gap former. The press section 102 has two press portions 102a and 102b, each of which comprises a press nip formed between respective two press rolls 118 and 119. The drying section 103 has impingement dryers 123, 124 arranged before a first cylinder group 125.

[0039] The forming section 101 of Fig. 3 comprises the headbox 99, a bottom wire 105 forming an endless loop while guided by a breast roll 106, suction rolls 107a and 107b and guide rolls 108, and a top wire 109 forming a second endless loop while guided by a breast roll 106 and guide rolls 110. It is to be noted that, according to the embodiment, the forming section is arranged in a vertical manner. Thus, in Fig. 3, the bottom wire loop is arranged on the right side and above headbox 99, while the top wire loop is arranged on the left side and above headbox 99. The bottom wire 105 and the top wire 109 define a twin-wire portion between themselves. A fiber suspension is fed from the headbox 99 into a gap formed between the bottom wire 105 and the top wire 109. At the twin-wire portion, within the top wire loop 109 there is a dewatering box arrangement 111 provided with a curved deck and guiding the top wire 109 onto the surface of the fiber suspension layer present between the bottom wire 105 and the top wire 109.

[0040] In the example of Fig. 3, in the dewatering box arrangement 111 after a first dewatering box, there is a second dewatering box arranged on the top wire 109 side and opposite to that second dewatering box there are adjustable loading elements arranged on the bottom wire 105 side. It is to be noted that reference sign 111 is assigned to this whole dewatering box arrangement. Accordingly, the individual elements such as the first or second dewatering boxes or the adjustable loading elements are not shown in the drawing in detail.

[0041] After the dewatering box arrangement 111 on the side of the bottom wire 105, there is a first suction roll 107a, which turns the web W still sandwiched between the bottom wire 105 to run to the right. Furthermore, the top wire 109 is guided such that, in the area of suction roll 107a, the top wire 109 is separated from the bottom wire 105 and the web is kept with the bottom wire 105 by means of suction roll 107a. Suction roll 107a is further followed by a suction roll 107b. Suction roll 107b is arranged at a lower level than suction roll 107a. Accordingly, the web W is transported in an oblique and downward manner towards suction roll 107b. Suction roll 107b is then followed by a suction box 114, on which the dry solids content of the web W is raised before it is transferred to the first press loop 102a of the press section 102.

[0042] After the suction box 114, the web W is passed from the downward oblique portion of the bottom wire 105 to a pick-up felt 115 of the first press portion 102a of press section 102 by means of a pickup roll 116. It is to be noted here that the press section 102 has two corresponding press portions 102a and 102b being subsequently arranged. Furthermore, since press portion 102b more or less corresponds to press portion 102a, corresponding elements have been provided with the same reference signs, and a repetition of their description will be omitted.

[0043] The press nip N is formed between two press rolls 118, 119, the upper one of which is a shoe roll 118 and the lower is a counter roll 119. The shoe roll 118 is provided with a static concave surface, around which a flexible shell is rotating. The web W is passed through the nip N sandwiched between the pickup felt 115 also functioning as a top felt and a bottom felt 117, which both receive water being pressed out of the web. At the press nip N the counter roll 119 presses the felts (fabrics) 115, 117 and the web W against the concave surface of the shoe roll 118, thereby forming a so called extended nip, the length of said nip being greater than that of a nip formed by two hard-surfaced rolls. Downstream of the nip N on the side of the bottom felt 117 there is a suction roll 120, one function of which is to ensure that the web W follows the bottom felt 117 at the stage when the top felt 115 is separated from the web W. After that, the web W is transferred from the bottom felt 117 by means of a pickup roll 116 arranged in the second press loop 102b onto the pick-up felt 115 of the second press portion 102b.

[0044] Thereafter, the treatment of the web i.e. pressing is performed in an identical manner as in the first press portion 102a. Downstream of the press nip N when the top felt 115 is separated from the web W in the second press portion 102b, the web W is transferred from the bottom felt 117 by means of a transfer fabric 121 to a first drying fabric 122 of the drying section 103. Transfer to the transfer fabric is effected by means of another pickup roll 135 arranged in the loop formed by the transfer fabric 121.

[0045] The drying section 103 first comprises a horizontal impingement dryer 123, which is followed by a

vertical impingement dryer 124 and at least one drying cylinder group 125. The horizontal impingement dryer 123 comprises a blow unit 126 and the drying fabric 122 forming an endless loop while guided by support rolls 127. The support rolls are arranged in a convex manner, i.e. while passing the impingement dryer 123, the traveling path of the web is curved towards the blow unit 126. Heated air is blown from the blow unit 126 towards the web W when it travels under the blow unit 126 while being supported by the drying fabric 122 and the support rolls 127, so that the web W is heated and water evaporates from its surface. Thereafter, the web W is transferred from the first drying fabric 122 to a second drying fabric 128, which conveys the web W through both the vertical impingement dryer 124 and the first drying cylinder group 125. While being guided by support rolls 129, the drying fabric 128 first forms, a vertical loop, blow units 130 and 131 being disposed on two opposing vertical portions of the vertical loop. The first blow unit 130 blows heated air to the surface of the web W while it runs vertically in a downward direction and the second blow unit 131 blows heated air against the web W while it runs back in an upward direction. In a manner similar to that of the horizontal impingement dryer 123, the support rolls 129 are also arranged in a convex manner such that the traveling path of the web is curved towards the blow units 130 and 131, respectively.

[0046] After having passed the vertical impingement dryer 124, the web W is passed, while supported by the drying fabric 128, along a meandering path through the first drying group 125 comprising a number of steam-heated drying cylinders 132 in an upper row and a number of reversing rolls 133 in a lower row. It is to be noted that, after the first drying cylinder group 125 there can be one or more other drying cylinder groups, which can comprise one or two wires.

[0047] The web is passed as a closed draw the whole distance from the forming section 101 through the press section 102 to the beginning of the drying section 103. Thus, the web is not stretched unnecessarily and the number of breaks advantageously can be minimized.

[0048] Fig. 4 is a schematic diagram showing the internal strength increase of the web when increasing the amount of starch in the web. The dashed line represents a case where the starch is added according to the prior art technology, i.e. the starch is added to the machine chest. The solid line represents a case where the starch is added to water (white water or fresh water) supplied via the headbox 99 and forming a central pure water layer between two or more pulp suspension layers when being ejected into the gap between the two forming wires 105 and 109.

[0049] It is also to be noted that the bulk of the later paper or board reduces with an increased filler content. Thus, in order to benefit from the advantages resulting from the increased filler content, drawbacks such as a worsened runnability must be met, e.g. by provision of the impingement dryers before the drying section.

[0050] While the above description was given on the basis of presently preferred embodiments, it is to be understood that the scope of the invention is not limited to the above, but is merely defined by the appending claims.

Claims

1. A paper or board making machine comprising:

a forming section (101) in which at least one wire (105) arranged in a wire loop is provided for forming a web (W) from a fiber suspension,
a closed draw press section (102) in which at least two press nips (N, N) being formed between two rolls (118, 119) each are provided for dewatering the web (W) transferred from the forming section (101),
a drying section (103) in which at least one drying cylinder (132) is provided for drying the web (W) transferred from the closed draw press section (102), wherein
the forming section (101) comprises a headbox (99) being capable of supplying liquids onto the wire (105, 109) in a layered manner and comprising a turbulence generator and a nozzle chamber having two converging walls (21, 22) forming a nozzle outlet (24),
the turbulence generator having at least three diffusers (1, 3, 5, 7, 9) creating turbulence in liquids supplied into each respective diffuser (1, 3, 5, 7, 9) via feeding means (25, 27, 29) for feeding pulp suspension and/or water as the liquids, each of the diffusers (1, 3, 5, 7, 9) having an outlet into the nozzle chamber,
a central diffuser (1) of the at least three diffusers (1, 3, 5, 7, 9) having two blades (11, 13) arranged at its outlet and extending into the nozzle chamber in a converging manner, the blades (11, 13) separating a liquid flowing through the central diffuser (1) from liquids flowing through adjacent diffusers (3, 5, 7, 9), and wherein
in the transporting direction of the web an impingement drying means (123, 124) is arranged before the at least one drying cylinder (132) in the drying section (103).

2. The paper or board making machine according to claim 1, wherein one or more of the adjacent diffusers (3, 5, 7, 9) has an additional blade (15, 17) arranged at the outlet, and the additional blade (15, 17) has a shorter length than the adjacent blade (11, 13) of the central diffuser (1).

3. The paper or board making machine according to claim 1 or 2, wherein the forming section (101) comprises a gap former or a hybrid former (105, 109).

4. The paper or board making machine according to any of the preceding claims, wherein the closed draw press section (102) comprises at least two subsequently arranged shoe press rolls (118, 118).

5. The paper or board making machine according to any of the preceding claims, wherein said impingement drying means (123, 124) is arranged next to the closed draw press section (102).

6. The paper or board making machine according to claim 5, wherein the impingement drying means (123, 124) comprises a horizontally and/or a vertically arranged impingement dryer (126, 130, 131).

7. The paper or board making machine according to any of the preceding claims, wherein the traveling path of the web (W) is curved when passing the impingement drying means (123, 124).

8. The paper or board making machine according to any of the preceding claims, wherein the number of drying cylinders (132) is less than 20 and a running speed in the drying section (103) is at least 1600 m/min.

9. The paper or board making machine according to any of the preceding claims, wherein the headbox (99) ejects the liquids in an upwards direction into a gap formed between the at least one wire (105) and a second wire (109), both wires (105, 109) running in a vertical upwards direction.

10. A method for making a high filler content fiber web comprising:

supplying liquids in a layered manner onto a wire (105) of a forming section (101) of a paper or board making machine to form a fiber web (W), the liquid layers supplied onto the wire (105) comprising at least two pulp layers separated by a central water layer,
the formed fiber web (W) being then transferred through a closed draw press section (102) comprising at least two press nips (N) being formed between two rolls (118, 119) each for dewatering the fiber web (W),
through an impingement drying means (123, 124) being arranged before an at least one drying cylinder (132) in a drying section (103), and through the drying section (103) in which the at least one drying cylinder (132) is provided for drying the web (W) transferred from the closed draw press section (102).

11. The method for making a high filler content fiber web according to claim 10, wherein the filler content in the fiber web (W) ranges from 35% to 50%.

12. The method for making a high filler content fiber web according to claim 10 or 11, wherein the central water layer comprises fresh water, dilution water, and/or white water.

13. The method for making a high filler content fiber web according to any of claims 10 to 12, wherein starch and/or refined fibers are/is added to the central water layer before supplying the central water layer onto the wire (105).

14. The method for making a high filler content fiber web according to any of claims 10 to 13, wherein a drying content of the fiber web (W) is more than 60% before it is transferred to the drying section (103).

15. The method for making a high filler content fiber web according to any of claims 10 to 14, wherein a running speed of the fiber web (W) in the drying section is at least 1600 m/min.

FIG. 1

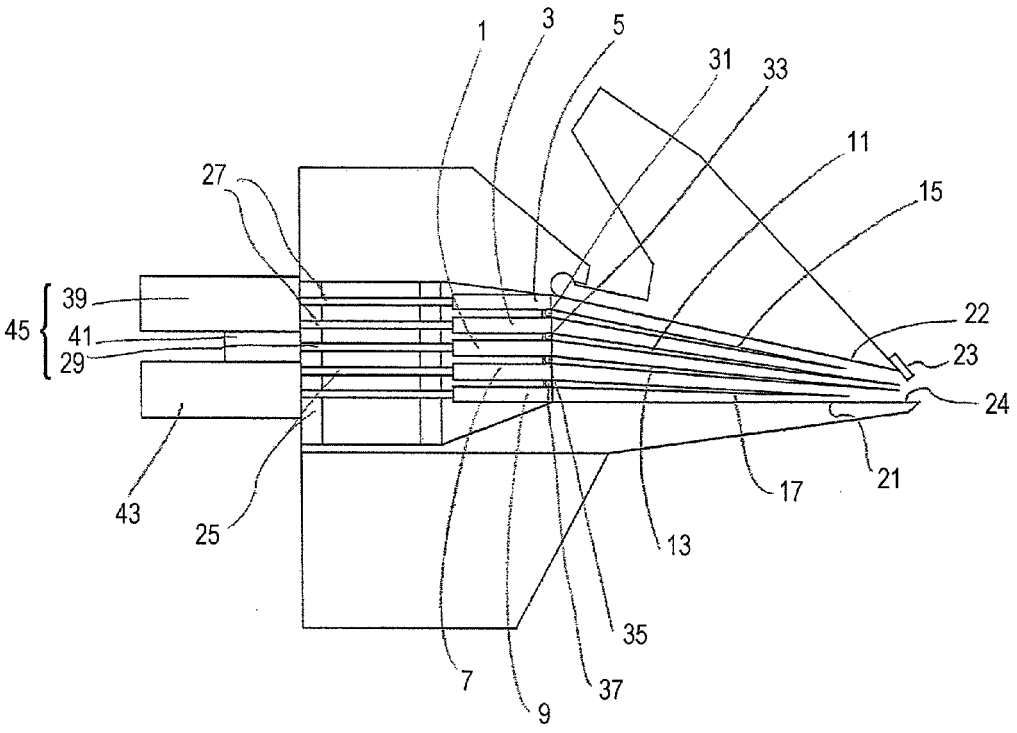


FIG. 2

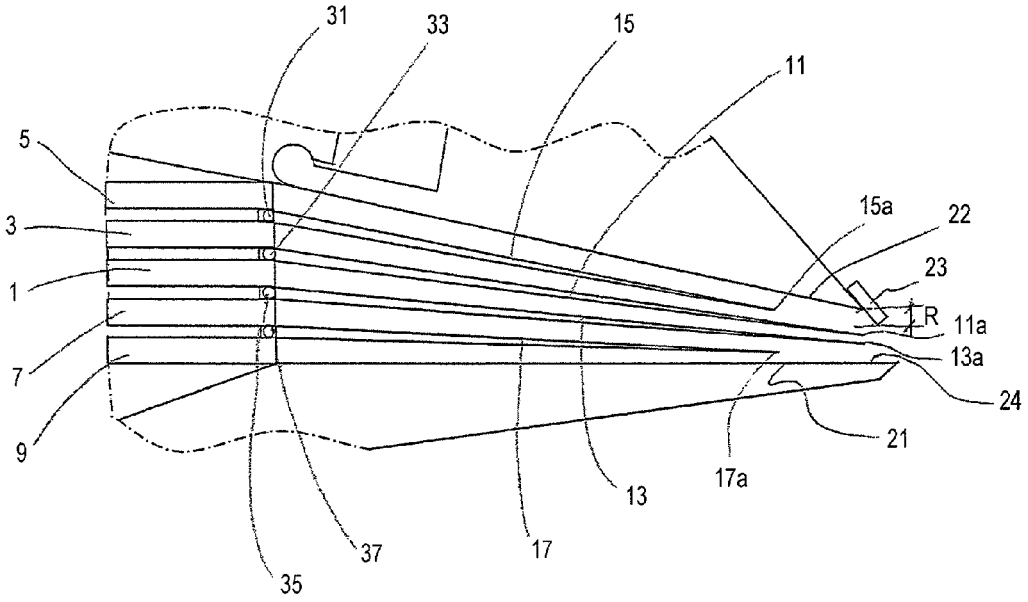


FIG. 3

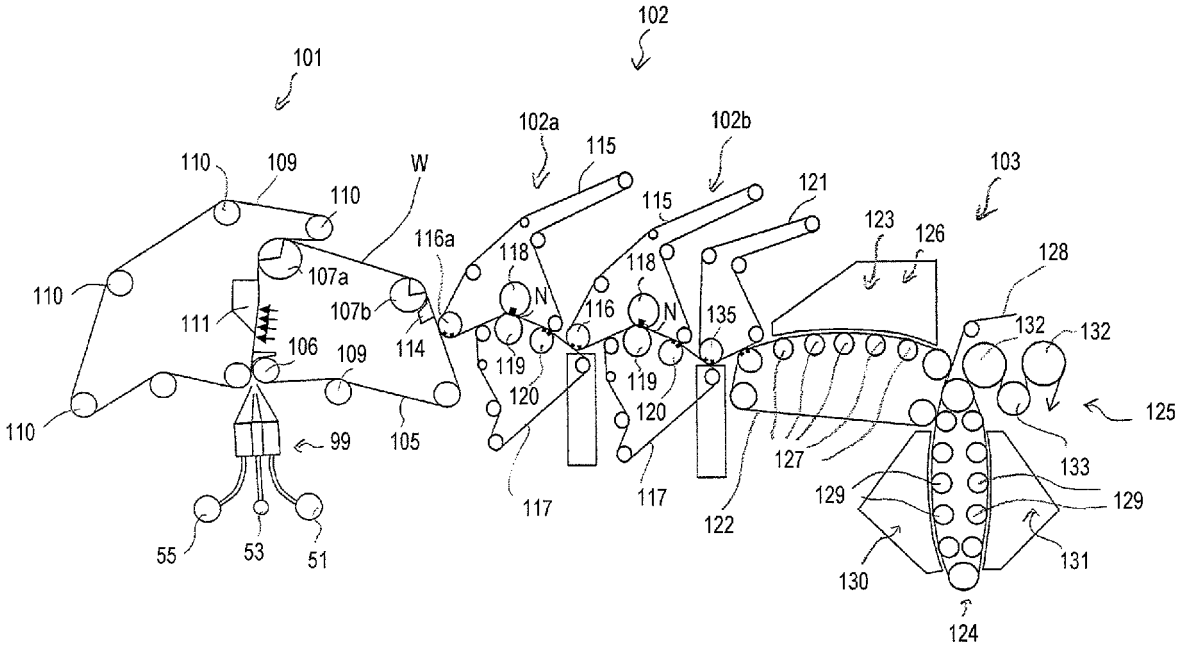
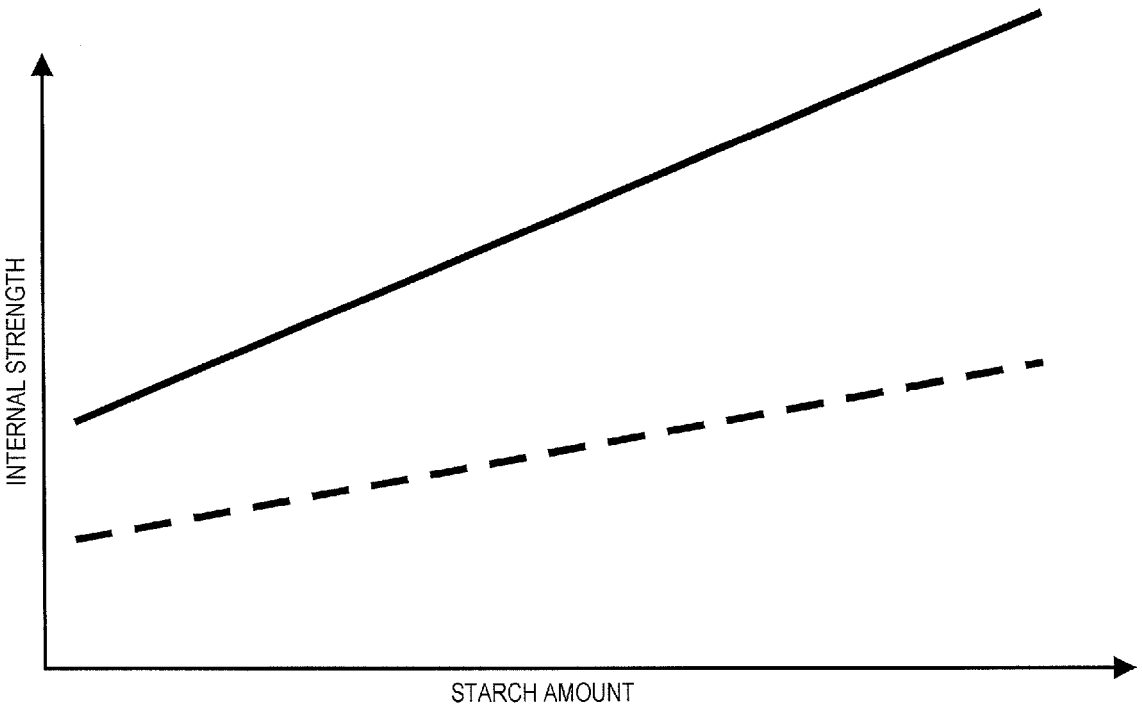

101
102
102a
102b
103
110
109
W
115
121
123
126
128
116a
107a
107b
118
N
116
135
132
111
106
114
119
120
125
99
105
117
122
127
133
129
55
53
51
130
131
124

FIG. 4



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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	14 May 2013	Maisonnier, Claire

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The present search report has been drawn up for all claims

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