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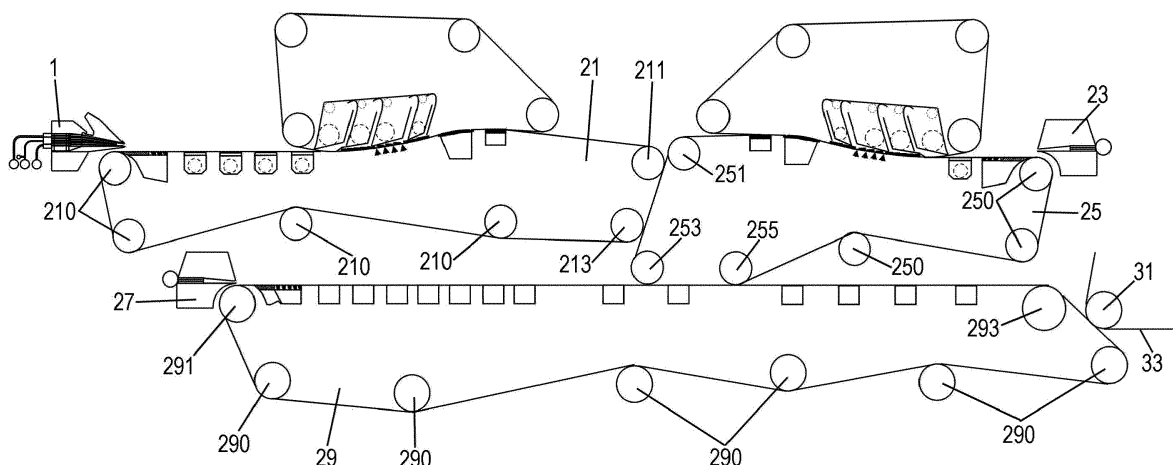
(54) **FIBER WEB MACHINE AND METHOD OF FORMING A MULTI-PLY WEB**

(57) A method of forming a multi-ply web in a fiber web machine, comprises the steps:

- feeding different pulp suspensions to diffusers of a multi-layer headbox,
- guiding the different pulp suspensions through the diffusers of the multi-layer headbox to eject them onto a wire of a forming section, the wire forming a closed loop,
- dewatering the liquid substances to form a filler ply in the form of an at least three-ply web,

- merging the at least three-ply web with a second web formed at a second head box ejecting pulp suspension on a wire of a second forming section, and
- merging the at least three-ply web with a third web formed at a third head box ejecting pulp suspension on a wire of a third forming section, wherein the third web is arranged on a side of the two-ply web opposite to that where the second web is arranged.

FIG. 1



Description

[0001] The invention pertains to a fiber web machine and to a method of forming a multi-ply web.

[0002] In order to produce FBB (Folding Box Board) it is known to form a filler ply (middle layer) in a forming section and to combine the filler ply with a top ply and a back ply. According to the prior art, the stocks forming these different plies have different properties. For example, a known filler plies have 20% to 30% BSW (Bleached Softwood), 50% to 70% BCTMP (Bleached Chemi Thermo Mechanical Pulp) and 20% to 30% Broke. Known top plies and back plies for example have 45% to 65% BSW and 35% to 55% BHW (Bleached Hardwood). Thus, bonding strength between the individual plies can be weak which might cause problems in a later processing stage or even in the final product.

[0003] Thus, there is need to provide a fiber web machine and a method of forming a multi-ply web having enhanced bonding strength between individual layers of ply.

[0004] According to the invention, a fiber web machine comprises at least three forming sections. Each of the forming sections has a wire guided about rolls in a closed loop and a headbox adapted to eject at least one layer of stock onto the respective wire. At least one of the headboxes is a multi-layer headbox adapted to eject at least three stock layers onto the respective wire. The closed loops of the wires are guided such that stock layers ejected on and conveyed by the wires are dewatered to form plies and then are merged such that the plies occurring from the stock layers ejected by the multi-layer headbox are sandwiched between the at least two other plies.

[0005] Thereby, in an advantageous manner a web having a middle ply formed by the multi-layer headbox and top and back plies formed respectively formed by the other two headboxes can be provided. In particular, the properties of the stock layers forming the filler ply adjacent to the stock layers forming the top and back ply, respectively, can be made to resemble or even correspond to each other. Thus, bonding strength after merging within the produced web can be remarkably enhanced. With a multi-layer headbox, the middle layer stock differs from the top and bottom layers stocks. However, these surface layers will be mixed up due to natural mixing in the multi-layer headbox slice jet.

[0006] Advantageously, in the above described fiber web machine at least one inner diffuser of the multi-layer headbox can be connected with feeding means for feeding fresh water, dilution water and/or white water between the stock layers.

[0007] Thus, a water layer can be ejected between the individual stock layers forming the filler ply. Thereby, additives can be supplied with the water layers in order to enhance the properties of the individual stock layers.

[0008] Additionally or alternatively, even two inner diffusers being separated by at least one third inner diffuser of the multi-layer headbox can be connected with feeding

means for feeding fresh water, dilution water and/or white water.

[0009] Thereby, the above described advantage can be achieved between plural of the stock layers. Here, it is to be noted that the individual water layers can provide different additives, thus, the properties of the filler ply can be controlled locally via the filler ply's section.

[0010] According to the invention, a method of forming a multi-ply web in a fiber web machine, comprises the steps:

- feeding different pulp suspensions to diffusers of a multi-layer headbox,
- guiding the different pulp suspensions through the diffusers of the multi-layer headbox to eject them onto a wire of a forming section, the wire forming a closed loop,
- dewatering the liquid substances to form a filler ply in the form of an at least three-ply web,
- merging the at least three-ply web with a second web formed at a second head box ejecting pulp suspension on a wire of a second forming section, and
- merging the at least three-ply web with a third web formed at a third head box ejecting pulp suspension on a wire of a third forming section, wherein the third web is arranged on a side of the two-ply web opposite to that where the second web is arranged.

[0011] By applying the method according to the invention, similar advantages than those described above in context with the fiber web machine can be achieved.

[0012] The different pulp suspensions can have different compositions.

[0013] Thus, it is possible to change the properties of the filler ply over its thickness. In particular, in a case where the top and back plies have strongly different properties, the composition of the respective adjacent layers of the filler ply can be controlled such that their respective properties resembles or corresponds to those of the top ply and back ply, respectively.

[0014] According to the method the different pulp suspensions comprise 20% to 30% BSW, 50% to 70% BCTMP, and 20% to 30% Broke.

[0015] According to the method, through one of inner diffusers fresh water, dilution water and/or white water can be guided, such that on the wire a water layer is sandwiched between two adjacent ones of the pulp suspension layers.

[0016] By means of the water layer additives can be supplied to the web between the respective layer in a controlled manner to locally change the properties of the web via its height.

[0017] According to the method, through at least a second one of inner diffusers also fresh water, dilution water and/or white water is guided, wherein there is at least one diffuser arranged between the first one and the second one inner diffuser, such that on the wire there is at least a pulp suspension layer sandwiched between the

two water layers.

[0018] This improves the above described effect caused by the one water layer. Accordingly, it is possible to selectively change the properties of the individual stock layers.

[0019] According to the method, additives are added to the fresh water, dilution water and/or white water guided through the one or the second one of the inner diffusers.

[0020] According to the method, starch can be added as an additive to the fresh water, dilution water and/or white water.

[0021] Starch in an increased amount of for example 1 to 20 kg per ton of water is in particular suitable to increase the bonding strength between the individual layers and also to improve the bulk of the filler layer.

[0022] According to the method, an outer layer of the at least three-ply web can have a different composition than a central layer of the at least three-ply web.

[0023] According to the method, the outer layer of the at least three ply can comprises a mix of broke and BSW.

[0024] According to the method, one or both plies merged with the at least three-ply web can comprise 45% to 65% BSW and 35% to 55% BHW.

[0025] According to the method, the properties of the stock characteristics of at least at least one surface layer of the at least three-ply web and the properties of the stock characteristics of the second web correspond to each other.

[0026] According to the method, the properties of the stock characteristics of at least one surface layer of the at least three-ply web and the properties of the stock characteristics of the third web correspond to each other.

[0027] Accordingly, the invention enables that stocks existing in the filler ply (middle layers) will be layered so that a Broke/BSW mix is directed to the filler ply surfaces. This creates a remarkably good plybond between the actual surface layers, i.e. the top and back plies. Moreover, there is no clear stock difference. Moreover, since there is a multi-layer headbox used for forming the filler ply middle part (BCTMP or Broke/BSW layers) also a remarkably good plybond will be generated. This is caused since the multilayer-headbox causes natural mixing between the layers while they are still in the liquid stage. An additional water layer can be suitably applied in order to feed functional additives.

[0028] Further advantages of the invention will become apparent from a study of the enclosed drawings showing currently preferred embodiments of the invention.

Fig. 1 schematically shows an arrangement of forming sections of a fiber web machine according to the invention.

Fig. 2a to 2c schematically show section views of individual webs formed by means of the respective forming sections of Fig. 2.

Fig. 3 schematically shows a section view of a web achieved after merging the individual webs shown in Fig. 3a to 3c.

Fig. 4 schematically shows an example of a multi-layer headbox applicable in a forming section configured to form a middle ply.

Fig. 5 schematically shows another example of a multi-layer headbox applicable in a forming section configured to form a middle ply.

Fig. 6 schematically shows yet another example of a multi-layer headbox applicable in a forming section configured to form a middle ply.

[0029] Fig. 1 is a schematic view of a fiber web machine according to the invention. The fiber web machine has three forming sections 21, 25 and 29. A first forming section 21 of these three forming sections 21, 25 and 29 is provided with a multi-layer headbox 1. An examples of such a headbox is shown in Fig. 4. Figs. 5 and 6 show alternatives which are also applicable instead of the headbox 1. The individual headboxes will be described later.

[0030] The forming section 21 (also referred to as first forming section) comprises a wire guided in a closed loop via guiding rollers 210, 211 and 213. Other well-known forming means such as suction boxes, suction rolls etc. are provided with the forming section 21. Thus, the stock layers and central water layer ejected by the multi-layer headbox 1 become dewatered and are guided away from the headbox towards a merging section provided between guiding rollers 211 and 213.

[0031] In this merging section, the web formed in this first forming section 21 is merged with another web referred to a top web.

[0032] The top web is formed in a second forming section 25 which basically comprises a headbox 23 and a wire guided in a closed loop about guiding rollers 250, 251, 253 and 255. The headbox 23 is a single layer headbox and, thus, ejects a single stock layer onto the wire. The stock layer is also dewatered by means of well-known forming means to form the top web. In a merging section provided between the guiding rollers 251 and 253, the wire is guided in a manner contacting the wire of the first forming section 21 such that the web formed in the first forming section 21 is merged with the top web.

[0033] The web merged with the top web is then guided further by the wire of the second forming section 25 to a second merging section defined between guiding rollers 253 and 255. In the second merging section, the web merged with the top web is merged with a third web formed in a third forming section 29. The third web is also referred to as back web.

[0034] The back web is formed in the third forming section which basically comprises a headbox 27 and a wire guided in a closed loop about guiding rollers 291, 293,

and 290. The headbox 27 is also a single layer headbox ejecting a single stock layer onto the wire of the third forming section 29. As is the case with the web and the top web, the stock layer is also dewatered by well-known means to form the back web.

[0035] The wire of the third forming section 29 is guided such that it approaches the wire of the second forming section 25 and contacts the same in the section between the guiding rollers 253 and 255, thereby merging the back web with the web on a side opposite of the top web.

[0036] The web merged with the top and back webs is then guided further and handed over at a take-over roller 31 to a wire 33 of a press section for further treatment.

[0037] Thus, according to the invention an enhanced web can be produced in which a middle ply of the web (also referred to as filler ply (plies)) is then covered from both sides by a top ply occurring from the top web and a back ply occurring from the back web. Thus, the filler ply being provided in a layered manner (three in the embodiment), is merged with top and back plies, respectively.

[0038] Figs. 2a to 2c schematically show a section view of the filler ply, top ply and back ply, respectively. As can be seen from Fig. 2a, the filler ply comprises three layers 51, 53 and 55. The top ply formed in the second forming section is referred to by 57 and the back ply formed in the third forming section is referred to by 59.

[0039] By supplying pulp suspensions of different compositions to the headbox 1 in order to form stock layers, the properties of the individual stock layers can be selectively adapted as desired. Thereby, it is possible to give the stock layer 51 properties similar or corresponding to those of the top layer 57, and in a similar manner to give the stock layer 53 properties similar or corresponding to those of the back layer 59. The middle stock layer 55 can be given properties different to those of the adjacent layers 51 and 53. Accordingly, when for instance manufacturing FBB, it is possible to design the central layer of the filler ply to be thick but have high bulk, while the layers sandwiching the central layer are selectively designed to fit to the top and back plies, respectively.

[0040] Fig. 4 schematically shows an example of a multi-layer headbox 1 for forming the filler ply in the forming section 21. The multi-layer headbox 1 has plural diffusers, one of them being a central diffuser 13 connected with stock header feeding means 5 feeding pulp suspension into the central diffuser 13. The adjacent diffusers 15 and 17 are also connected with the stock header feeding means 5. Thus, the later central layer of the filler ply corresponding to layer 55 in Figs. 3a-c and 4 is ejected from these three diffusers onto the wire in a layered manner.

[0041] Other stock feeding layers 3 and 7 are connected with diffusers 19 and 21 sandwiching the above mentioned diffusers 15, 13, and 17. Accordingly, pulp suspensions having different compositions than the central layer are used for forming the outer layers of the web to be formed. By selectively adapting the properties of these

outer layers to resemble or even correspond to the properties of the top and back plies formed in the forming sections 25 and 29, respectively, remarkable bond between the filler ply and the top and back plies is achieved.

[0042] Additional dilution water can be supplied from a dilution water feeding means 9 connectable via dilution water valves 11 with a pipe feeding stock header from stock header feeding means 5 to the central diffuser 13 for controlling the cross machine direction basis weight profile. Dilution water valves 11 are provided in a 30 - 150 mm interval in the headbox cross machine direction.

[0043] Figs. 5 and 6 show alternatives of headboxes which can be provided with the forming section 21 instead of the headbox 1. In Figs. 5 and 6 elements corresponding to the same or similar elements in Fig. 4 will be assigned the same reference signs and their description will be omitted.

[0044] The headbox shown in Fig. 5 has a higher number of diffusers. In particular, next to the already above described stock header feeding means 3, 5 and 7, an additional stock feeding means 8 as well as a water feeding means 6 is provided. From the water feeding means 6, fresh water, white water or dilution water is supplied to the central diffuser 13. Thereby, additional functional additives such as starch can be supplied with the water to form a layer between the stock layers.

[0045] Thereby, these functional additives cause advantageous effects between the respectively adjacent stock layers.

[0046] The headbox schematically shown in Fig. 6 has two water feeding means 6 and 10. In contrast to the headbox shown in Fig. 5, here the two water feeding means are connected with diffusers arranged out of the center. Thus, the functional additives can be selectively supplied between the outermost stock layers and the central stock layer, i.e. instead of a filler ply having two portions as the one formed with the headbox of Fig. 5, this filler ply has three portions.

[0047] Accordingly, the invention enables design of a web having a layered filler ply, where each of individual layers achieves certain required properties different from those of the other layers. The web is in particular suitable for FBB production, for WLC (White Lined Chipboard) production as well as for SBS (Solid Bleached Board) production.

[0048] The invention has been described by means of a preferred example, however, the scope of the invention is merely defined by the attached claims.

Claims

1. A fiber web machine comprising at least three forming sections, each of them having a wire guided about rolls in a closed loop, and a headbox adapted to eject at least one layer of stock onto the respective wire, wherein at least one of the headboxes is a multi-layer head-

box adapted to eject at least three stock layers onto the respective wire, and the closed loops of the wires are guided such that stock layers ejected on and conveyed by the wires are dewatered to form plies and then are merged such that the plies occurring from the stock layers ejected by the multi-layer headbox are sandwiched between the at least two other plies.

2. The fiber web machine according to claim 1, wherein at least one inner diffuser of the multi-layer headbox is connected with feeding means for feeding fresh water, dilution water and/or white water between the stock layers.
3. The fiber web machine according to any of claims 1 or 2, wherein two inner diffusers being separated by at least one third inner diffuser of the multi-layer headbox are connected with feeding means for feeding fresh water, dilution water and/or white water.
4. Method of forming a multi-ply web in a fiber web machine, comprising feeding different pulp suspensions to diffusers of a multi-layer headbox, guiding the different pulp suspensions through the diffusers of the multi-layer headbox to eject them onto a wire of a forming section, the wire forming a closed loop, dewatering the liquid substances to form a filler ply in the form of an at least three-ply web, merging the at least three-ply web with a second web formed at a second head box ejecting pulp suspension on a wire of a second forming section, and merging the at least three-ply web with a third web formed at a third head box ejecting pulp suspension on a wire of a third forming section, wherein the third web is arranged on a side of the two-ply web opposite to that where the second web is arranged.
5. Method according to claim 4, wherein the different pulp suspensions have different compositions.
6. Method according to claim 4 or 5, wherein the different pulp suspensions comprise 20% to 30% BSW, 50% to 70% BCTMP, and 20% to 30% Broke.
7. Method according to any of claims 4 to 6, wherein through one of inner diffusers fresh water, dilution water and/or white water is guided, such that on the wire a water layer is sandwiched between two adjacent ones of the pulp suspension layers.
8. Method according to claim 7, wherein through a second one of inner diffusers also fresh water, dilution water and/or white water is guided,

wherein there is at least one diffuser arranged between the one and the second one inner diffuser, such that on the wire there is at least a pulp suspension layer sandwiched between the two water layers.

9. Method according to any of claims 7 or 8, wherein additives are added to the fresh water, dilution water and/or white water guided through the one or the second one of the inner diffusers.
10. Method according to claim 9, wherein starch is added as an additive to the fresh water, dilution water and/or white water.
11. Method according to any of claims 4 to 9, wherein an outer layer of the at least three-ply web has a different composition than a central layer of the at least three-ply web.
12. Method according to claim 11, wherein the outer layer of the at least three ply comprises a mix of broke and BSW.
13. Method according to any of claims 4 to 11, wherein one or both plies merged with the at least three-ply web comprises 45% to 65% BSW and 35% to 55% BHW.
14. Method according to any of claims 4 to 12, wherein wherein the properties of the stock characteristics of at least at least one surface layer of the at least three-ply web and the properties of the stock characteristics of the second web correspond to each other.
15. Method according to any of claims 4 to 13, wherein wherein the properties of the stock characteristics of at least one surface layer of the at least three-ply web and the properties of the stock characteristics of the third web correspond to each other.

FIG. 1

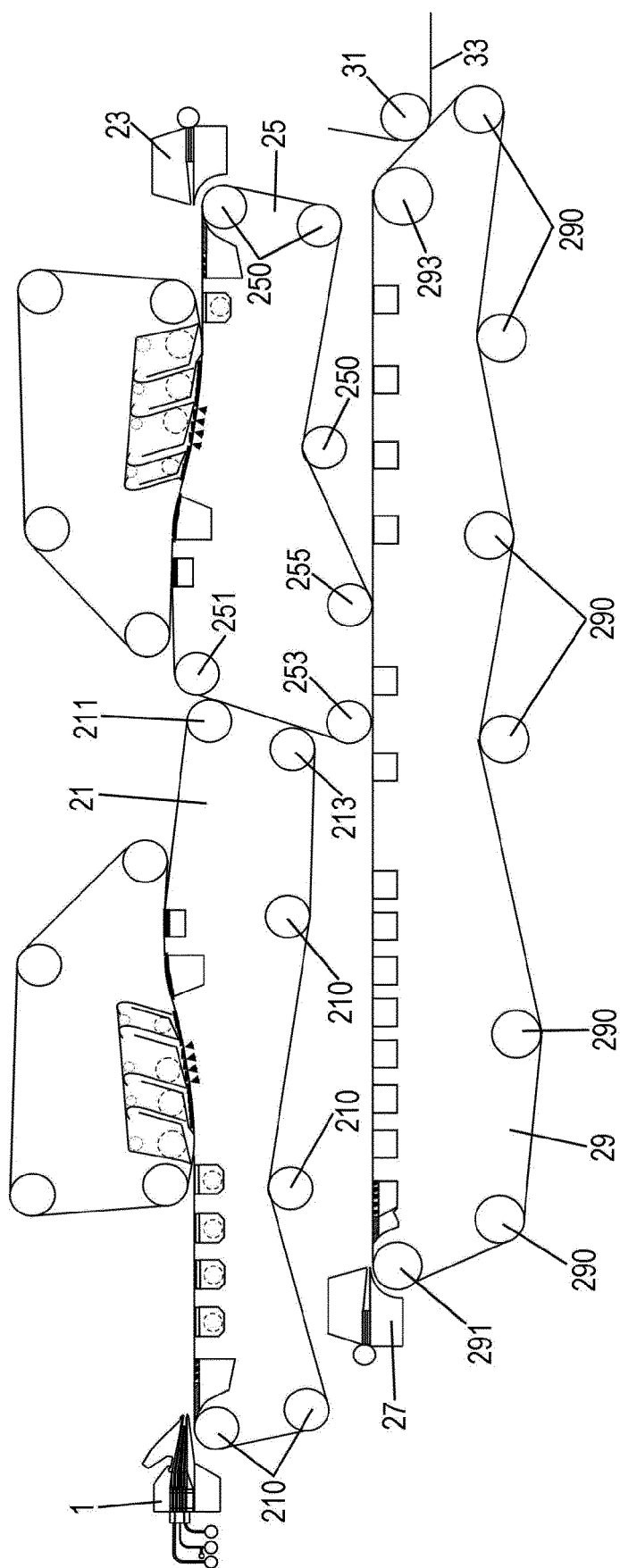


FIG. 2A

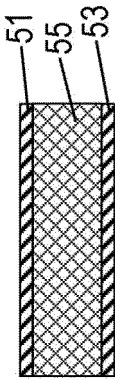


FIG. 2B



FIG. 2C



FIG. 3

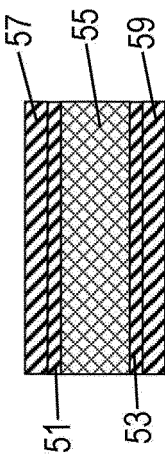


FIG. 4

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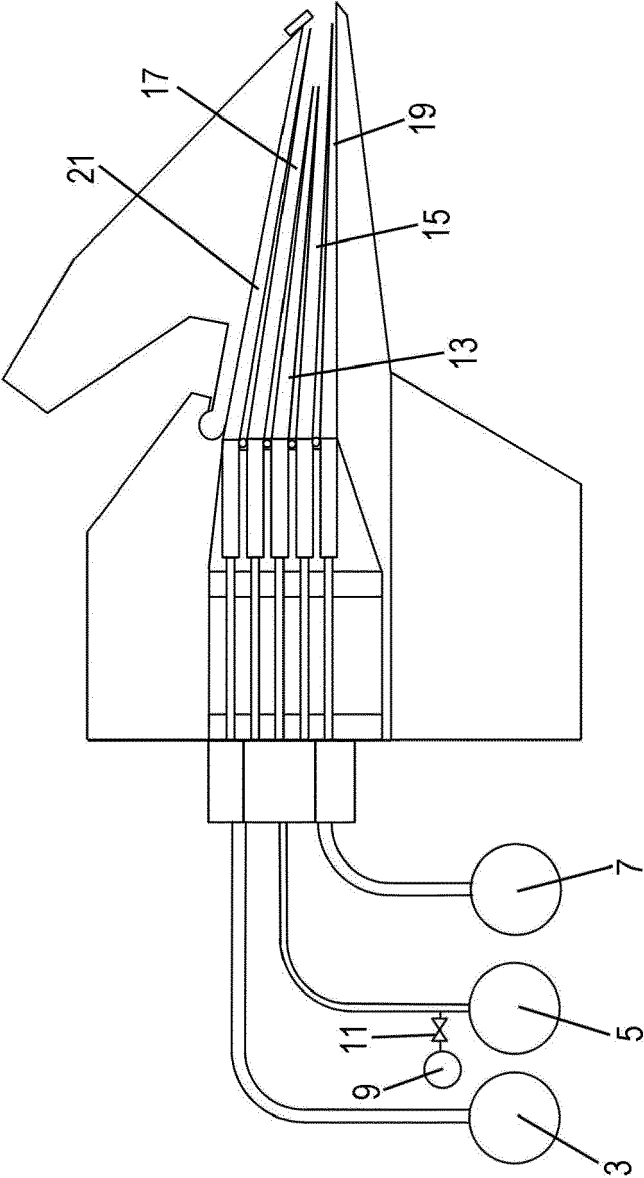


FIG. 5

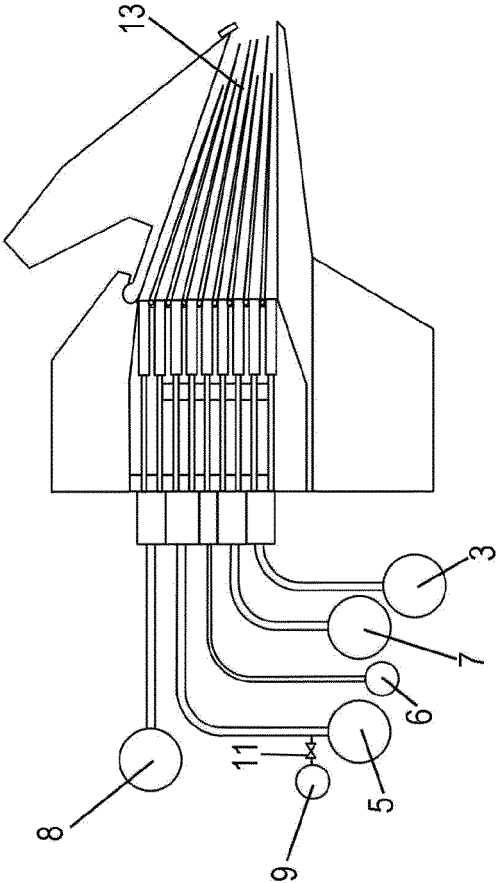
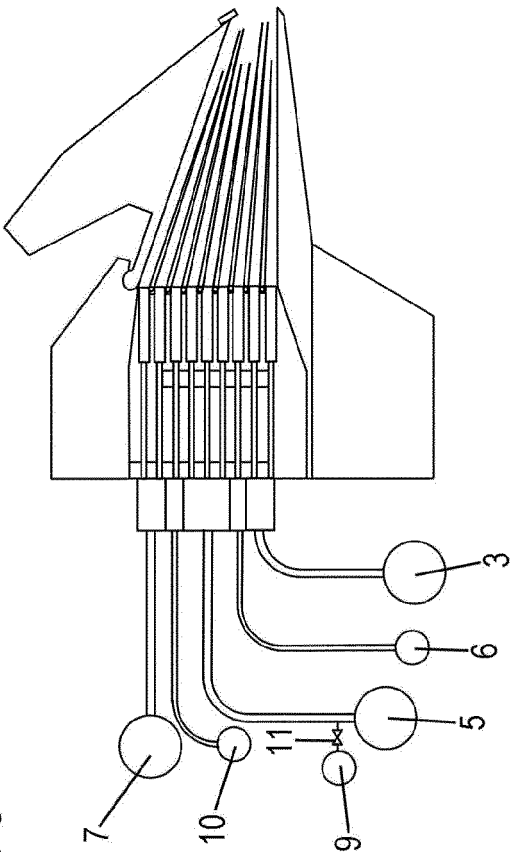


FIG. 6





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Application Number
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 4 September 2018	Examiner Pregetter, Mario
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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